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* Shown with two BT-LH2550 monitors, sold separately. HS450 rack-mount chassis (standard) not shown.

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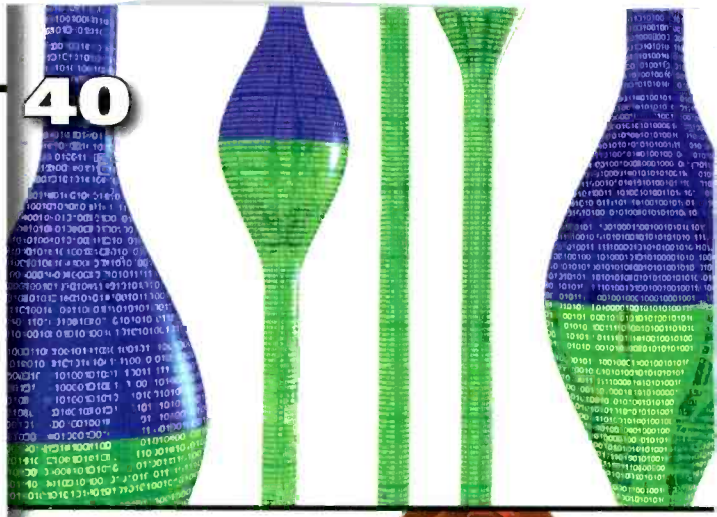
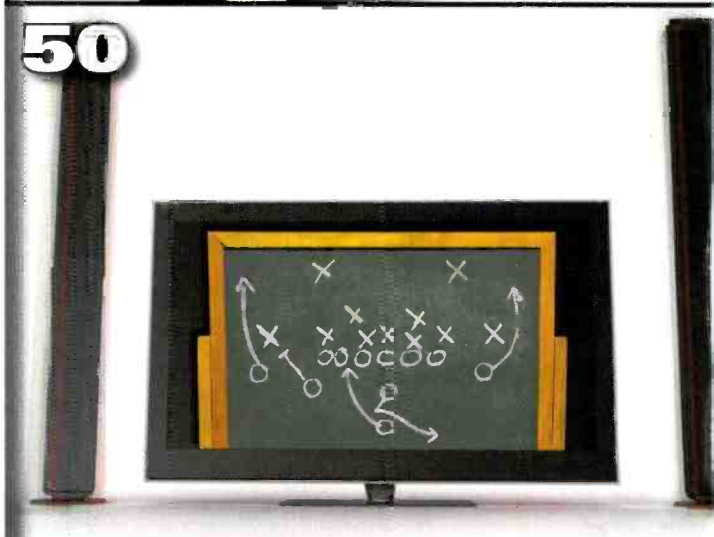
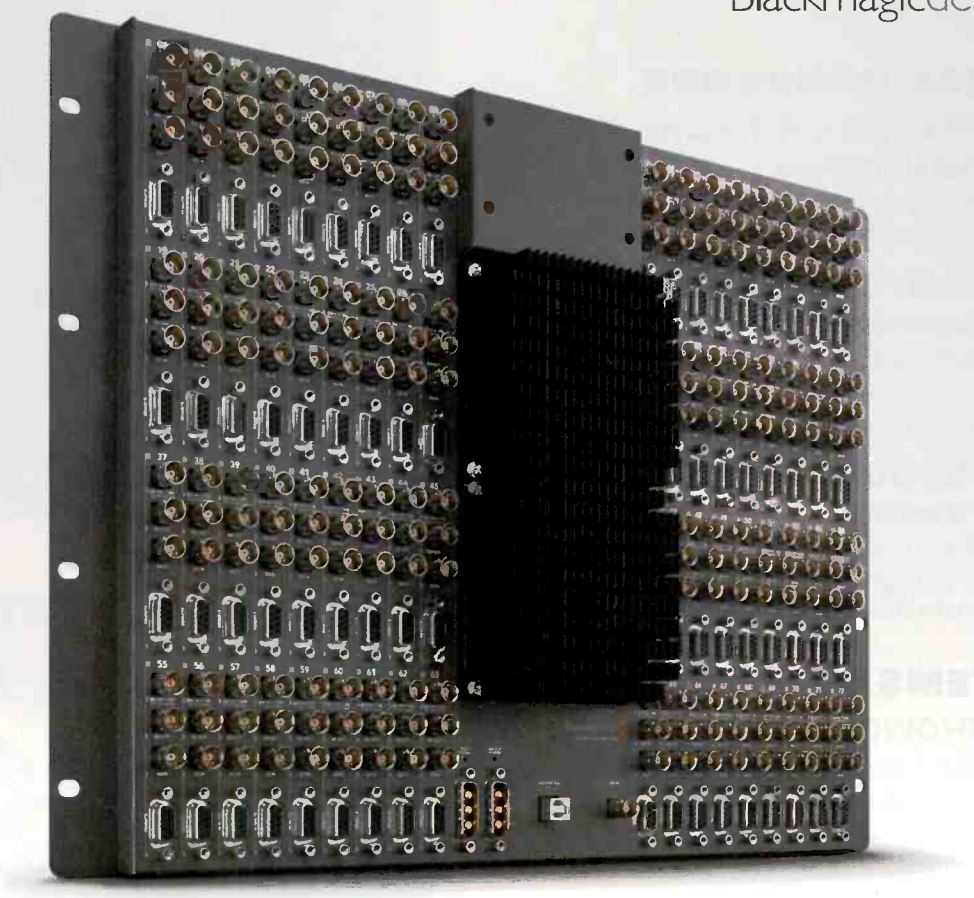




Blackmagicdesign



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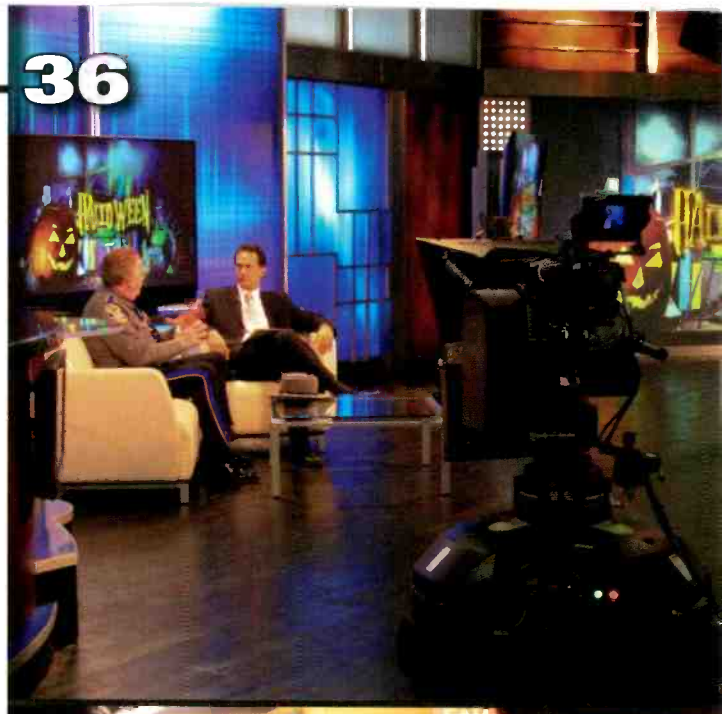

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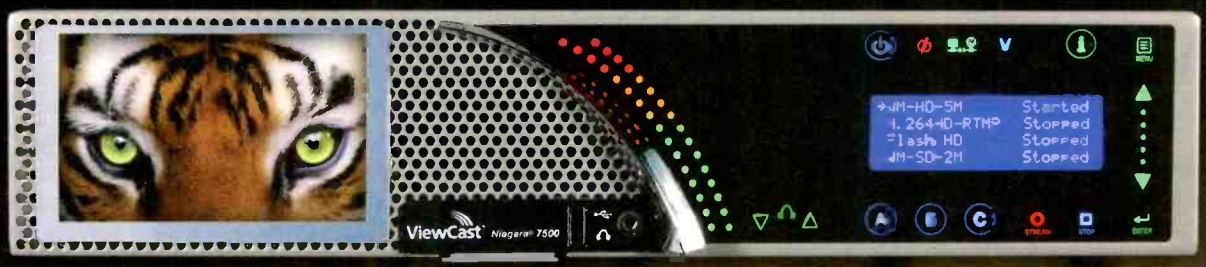

It's easy to be enticed by the alluring good looks of the Niagara® 7500 – the newest HD streaming solution from ViewCast. On the outside, its sleek, innovative design and responsive touch-control interface will excite you. Its brilliant high-resolution HD display will dazzle you. But on the inside, it's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

The Niagara 7500 devours your HD video and easily transforms it into high-quality streams for delivery to IP and mobile networks. Its powerful video pre-processing features streamline and simplify your workflow. Inverse telecine, closed caption extraction and rendering, de-interlacing, scaling, cropping and bitmap overlay are just a few of its standard features.

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Top 10 suggestions for success at NAB

You can spot an NAB Show newbie a mile away. These are people either walking around in a complete daze, or as hyped as a new puppy.

To help prevent overload, here are 10 recommendations for NAB newcomers:

10. Coffee. Starbucks always has a line. Unless you really need a $7 frappacino-mocha-latte-half-caf-decaf, then buy your coffee in the cafeteria or from a kiosk. Because Starbucks has the Las Vegas Convention Center franchise, it's the same coffee! Grab your joe elsewhere and get back to the show floor.

9. LVCC pastries. Just don't. First, they are little more than caloric stomach bombs. Second, the last time I bought one, it cost $3.50. They are poison to both your waistline and pocketbook.

8. Restrooms. I can't give you women any personal advice, but men, listen up. Don't use the restroom next to Banners cafeteria, which is under the stairs. Also avoid the restrooms next to meeting rooms N101/N201. Even worse, don't use any of the restrooms on the convention floor. They are crowded and smelly, to say the least.

My advice is to try the restrooms on the second level of the North Hall or South Hall. Facilities near session rooms are sometimes busy, but you can stop by during lulls in traffic, and they seem cleaner than others.

7. Clothes. Wear comfortable clothes and shoes, and carry a shoulder bag or briefcase. Please do not drag around a roller bag; they are a pedestrian hazard.

6. Meal time. Don't expect to eat at regular times. If you try to eat lunch at, well, lunch time, you'll waste two hours, and you'll end up paying $12 for a sandwich. Instead, either beat the crowd by going early, or wait until 2 p.m. Better yet, save those calories for a great off-site evening dinner.

5. Where to eat. The food at the convention center rates average. Breakfast selections are often better than lunch, and it's less busy. I prefer the International Food Market in the South Hall to Banners. If the weather is nice, you might try the outside barbecue.

4. Product literature. You can pick up literature as you tour the hall, but then you end up dragging around tons of paper all day. Besides, you know it'll all be thrown away in the hotel room. Ask vendors to mail it to you.

3. Transportation. Take the buses; they're free. At show closing time, the cab lines are huge. And, depending on your particular bus route, it might even be faster than by cab.

2. Session selection. This is a tough one. Balance the need for training with the need to see real products. Both are necessary to have an informed opinion about new technologies.

1. Badges. My final advice to newcomers: Be sure your show badge is prominently displayed on your chest and turned facing forward. The LVCC door Nazis will double-team smackdown anyone trying to enter without proper credentials. While sometimes unassuming, don't be fooled. These folks won't think twice before a full body tackle, taking you to the floor and ripping your eyeballs out if you attempt to enter the show floor without a badge. I would imagine stun guns to be slightly more humane.

With this knowledge in hand, the NAB Show should be nothing to fear. Good luck, and let me know how you fared. BE

Brad Dick

EDITORIAL DIRECTOR

Send comments to: editor@broadcastengineering.com

Rethink automatic loudness control

Excessive loudness variation is probably the most common viewer complaint, and it's now something you can eliminate entirely. Our Automatic Loudness Control for our Densité interfaces is designed to address all typical loudness problems, including audio jumps between programs and commercials. To ensure effective loudness control without adversely impacting program content, we've incorporated the latest proven technologies from our partners, **Linear Acoustic** and **Jünger Audio**. It's time to rethink what's possible.

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Spectrum crisis

Dear editor:

Thank you to Mark Hyman for his great letter in the February issue. (You can read the letter online at *http://broadcastengineering.com/viewpoint/feedback-0210.*) The looming spectrum crisis causes one to wonder about the hundreds of megahertz of frequencies set aside for government use. If there's a spectrum crisis, why isn't this spectrum available?

Don't be silly, you say? Precisely.

Tom Norman, CPBE
Sr. engineer
Burst
Centennial, CO

Mobile DTV wake-up call

Dear editor:

There is an opportunity for content providers, networks, studios and others that may be fading away. For those who wish to partner with local broadcasters and take advantage of broader reaching audiences, the capacity to provide mobile DTV is shrinking. While it occurs to most that local station mobile DTV simulcasting makes sense, it has not yet come to pass.

The last 10 years of cultivating mobile and portable capabilities may well pass some by. That's right; the ability to provide mobile DTV may be DOA for some because broadcasters are partnering to provide access across all available platforms with all of their available bits.

Where does local mobile DTV reside in your plans for the future? For broadcasters, this is not just about "doing" mobile DTV if the answer is "Let's do it!" Rather, it's about making sure the bandwidth to do so is available. Content providers, networks, studios and others might lack clear understanding as to the bit bandwidth required to make mobile DTV possible. Consider this wake-up call an invitation to come to the table for discussion so that the local broadcaster bit capacity required is accounted for in the decisions broadcasters are making today. Think of it this way:

19.4Mb/s available (total stream capacity)
18Mb/s for HD + PSIP/overhead = 19.4Mb/s (network HD)
15Mb/s for HD + 3.5Mb/s for SD + PSIP/overhead = 19.4Mb/s (network HD and one SD subchannel)

Many may have noticed broadcasters are looking at and taking advantage of multicast opportunities. One example: Sinclair just did a deal with THECOOLTV for a subchannel in all but one market. In markets where we already have a subchannel, the bit allocation might look like:

12Mb/s for HDTV + 3Mb/s for SDTV + 3Mb/s for SDTV + PSIP/overhead = 19.4Mb/s (network HD and two SD subchannels)

Bits are valuable. With the required overhead of mobile DTV, we are looking at ~25 percent efficiency for mobile bits. That means that if we want a reasonable mobile DTV service (350kb/s video + 48kb/s audio + 2kb/s signaling = 400kb/s per service), we require 400kb/s x 4 or 1.6Mb/s per mobile DTV service.

Where will those additional bits come from? For the HDTV plus two SDTV case, maybe we upgrade encoders and squeeze another 10 percent across the three MPEG-2 video services and gain bandwidth for a single mobile DTV service. But if we are "doing" Network HD + "THIS" SD + "THECOOLTV" SD plus "some other" (just for example), we have long run out of bits. Where is the play for mobile DTV without local bits to offer? Broadcasters are looking at Sezmi and other possibilities, opportunities that may represent good economics for broadcasters. More bits are required for that! The question clearly becomes: Where do we put mobile DTV?

Here's the point: We can squeeze and squeeze and squeeze, but at some point (very nearly now!) the bits run out. If the content providers, networks, studios and others don't speak up now, broadcasters may have deals in place that preclude "doing" mobile DTV.

We need answers to the question: Where does local mobile DTV reside in your plans for the future? The time to speak up is now!

Mark A. Aitken
Director, Advanced Technology
Sinclair Broadcast Group

Generator search

Dear editor:

In your many travels and experiences, have you ever heard of the now discontinued Litton InstaGas Nitrogen generator? We purchased one in 1996, and it has failed. Litton got out of this business years ago. We want to try to fix the generator but do not have any schematics.

Maybe you could ask your readers if they know of a source for repairs or more information. Thanks!

Tom Bondurant
Director of engineering
WAPT-TV

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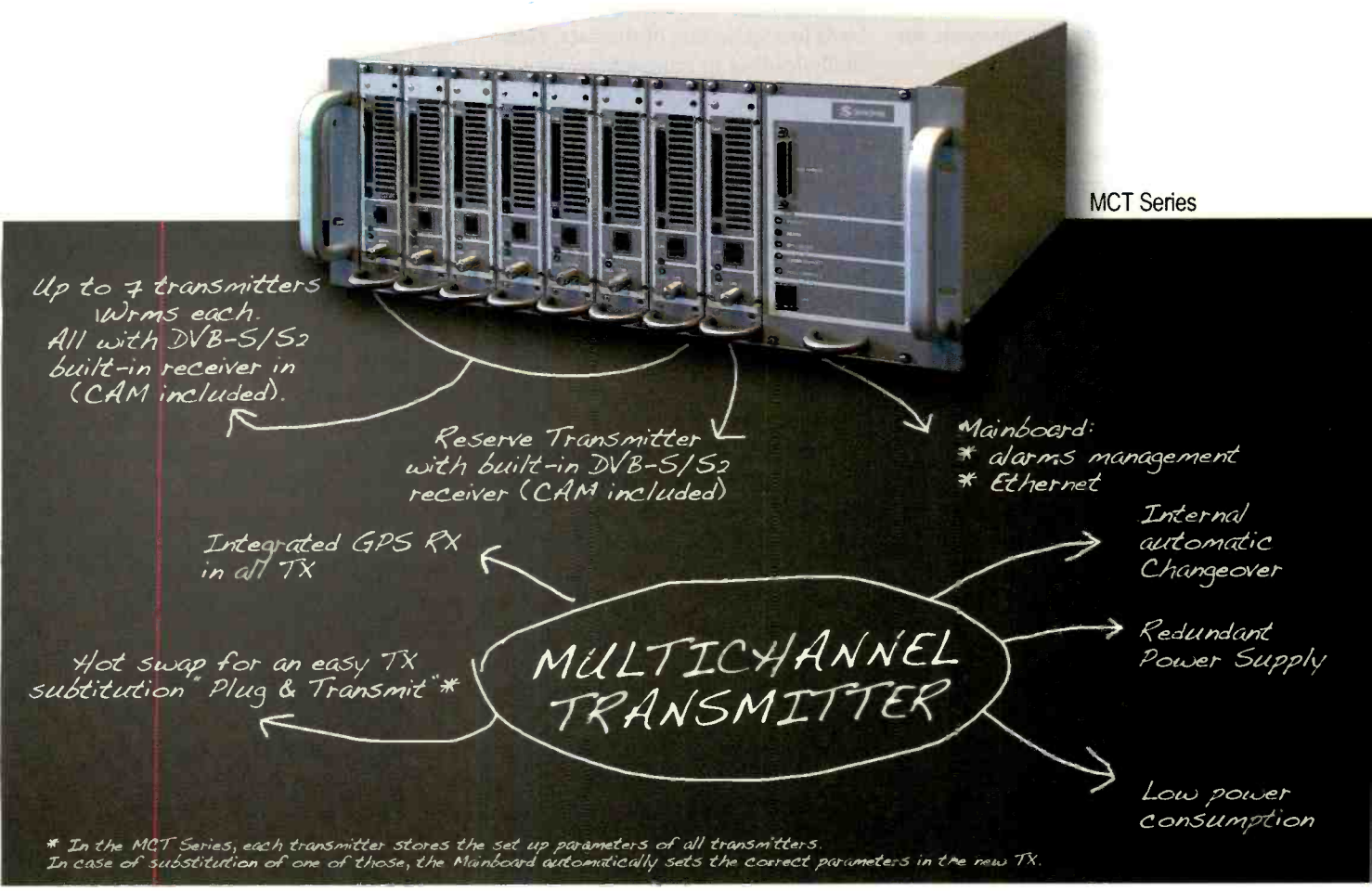

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Beyond HD 1080p

Switch to 3G-SDI seamlessly using existing HD cabling.

NIGEL SETH-SMITH

The SMPTE and ITU-R 3Gb/s SDI standards have launched a new generation of interface and processing equipment. We all like the higher data rate, but there is a natural nervousness as to whether it will work reliably, particularly over infrastructure installed for 1.5 Gb/s HD-SDI.

This article shows how 3G products can operate with existing HD cabling, and how users can ensure an error-free system.

To guarantee reliable performance over long cable runs, the system designer needs to know:

- when to equalize to compensate for high-frequency loss;
- when to reclock to compensate for jitter buildup; and
- when to use copper and when to use fiber.

The rules are backed up by analysis of the sources of errors in a high-speed data system and descriptions of how to avoid errors using techniques for budgeting loss and jitter in the system.

Characteristics of coaxial cable and optical fiber

Signals travelling over cables suffer losses. In the case of coaxial copper cables, these losses are caused by a combination of the resistance of the conductors and absorption by the insulating dielectric. Both of these effects are worse at high frequencies. The resistive losses are influenced by the "skin effect," which makes the losses increase in proportion to the square root of the transmitted frequency. Dielectric losses are directly proportional to frequency. Cables should be selected such that the dielectric loss is not a significant factor over the frequency range to be transported. For HD and 3G-SDI, this means the use of foam dielectrics. Both resistive loss and dielectric loss are directly proportional to cable length.

Fiber-optic cables are made of glass that is almost perfectly transparent, at least at the wavelengths of light used for data carriage. There is, however, some absorption loss over long distances. This absorption is not particularly dependent on the data rate of the link, because the bandwidth of the data is tiny compared with the carrier frequency. There is a second way in which the accurate carriage of information over fiber-optic cables is distorted: dispersion. The light travelling through the cable may take a number of different paths, all of slightly different lengths. Over some distance, this leads to a spreading of the data, eventually leading to complete mixing of adjacent bits. This effect is worse for high data rates, because the bits are closer together. Dispersion is much less of an issue with single-mode fiber, in which the data-carrying part of the fiber has such a small radius that the light can effectively only take a single path. Both absorption loss and dispersion are directly proportional to cable length.

Standards

One area of difficulty for system builders is the lack of a standard for the performance of digital video transport interfaces. The data protocols, voltages, impedances, etc., are all standardized, but the standards bodies, SMPTE and ITU-R, do not dictate the cable length for reliable operation. This is a deliberate decision, so as technology improves, the performance can improve with it rather than being frozen at any particular value. It also recognizes that different applications require different performance, and it makes sense to allow a mix of equipment with different performance and pricing.

There are, however, informative statements in the SDI standards for the coaxial copper interface, which are as follows:

- *SMPTE 259M, SD-SDI standard.* This standard describes a serial digital interface for 525/60 and 625/50 DTV equipment operating with either 4:2:2 component signals or 4fSC composite digital signals. This standard has application in the TV studio over lengths of coaxial cable where the signal loss does not exceed an amount specified by the receiver manufacturer. Typical loss amounts would be in the range of 20dB to 30dB at one-half the clock frequency with appropriate receiver equalization. Receivers designed to work with lesser signal attenuation are acceptable.
- *SMPTE 292, HD-SDI standard.* Receivers operating with input cable losses in the range of up to 20dB at one-half the clock frequency are nominal; however, receivers designed to work with greater or lesser signal attenuation are acceptable.
- *SMPTE 424M, 3G-SDI standard.* This standard is a transport defining a bit-serial data structure for 3Gb/s (nominal) component digital signals or packetized data. This standard specifies a coaxial cable interface suitable for applications where the signal loss does not exceed an amount specified by the receiver manufacturer. Typical loss amounts would be in the range of up to 20dB at one-half the clock frequency.

Note that the reference to "typical" cable losses is included within the scope of the document. This is the part of the document that sets the scene for the standard, but does not include any actual standard requirements. However, a quick reading of the standard can easily lead to the mistaken conclusion that a loss of 20dB at a frequency equal to

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half of the data rate should used for systems budgeting.

Actual copper performance

Copper cables require special driver chips at the send end to generate the waveforms defined in the SMPTE specifications and dedicated equalizer chips at the receive end to compensate for the frequency-dependent losses in the cable. SDI equalizers contain feedback loops, so they automatically work with any cable length up to their particular limit. This limit is defined by the maximum gain available in the chip.

The equalizers are designed to compensate for skin effect loss, which is proportional to the square root of the frequency. This is why it is important to use cables with minimal dielectric loss, because the equalizer does not have the correct characteristic to compensate for this kind of loss. If the equalizer is a poor match to the loss, the overall frequency response is not flat, and the data symbols become distorted (intersymbol interference), causing a reduction in the eye height and eye width and leading to bit errors. When the 3G equalizers were being designed, one of the specifications was for them to work with the same family of cables that are used for HD signals, so they are compatible with the installed base.

Some of the latest generation of 3G equalizers provide a maximum gain of more than 40dB, so they can achieve error-free operation on up to 140m of the appropriate cable. (See Figure 1.)

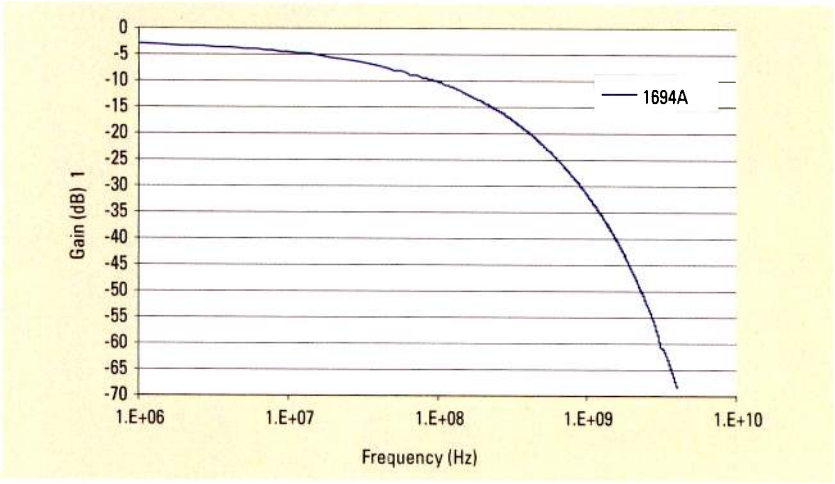

Figure 1. Insertion loss of Belden 1694A cable

Implementation guidelines for copper links

As has been shown, the use of high-quality transmit and receive components with adequate gain and a correctly defined frequency response allow cable lengths of up to 140m to be compensated for reliably.

Jitter

In addition to signal distortion due to high-frequency loss, digital errors can also be induced if the data eye closes horizontally, because the times of the transitions become distorted. There are several causes of this eye closure:

- *Intersymbol interference (ISI)*, caused by imperfect equalization of the attenuated signal from the long cable. Reflections due to suboptimum transmitter and receiver return loss may also contribute to ISI.
- *Duty cycle distortion (DCD)*, caused by differences in timing for rising and falling edges of the signal. ISI and DCD combine to make up deterministic jitter.
- *Noise generated in the receive electronics*, because it amplifies the attenuated signals from the cable, also known as random jitter.
- *Crosstalk* from adjacent signals in the sensitive equalizer's input.

These jitter effects are not corrected by the equalizers. The *absolute* value of these jitter effects, measured in picoseconds, is largely independent of the data stream. But as the data eye becomes narrower with higher data rates, the *relative* value, measured in data periods (referred to as Unit Intervals [UI]), increases. A 3G UI is half the width of an HD UI, and so is twice as vulnerable to jitter.

Jitter budgeting

SMPTE 424M, the 3G standard, has a looser specification for transmit jitter than SMPTE 292, the HD specification. It specifies .3UI at the transmitter compared with .2UI for HD. This recognizes the difficulty of achieving the .2UI figure at 3G, where 1UI is only 330ps. While this makes things easier for the transmitter, it means there is less jitter budget left for the remaining elements in the link. SMPTE 424M does make a strong recommendation for .2UI transmit jitter, and modern 3G capable SDI transmitters and receivers do achieve this figure. So when calculating a jitter budget, it is recommended to check the actual specification of 3G equipment and not just that it is SMPTE-compliant.

In practice, this means that, to be safe, jitter needs to be removed from the signal each time a long cable has been traversed or a significant piece of signal processing has taken place, e.g., signal selection in a crosspoint. Jitter is removed using a reclocker, which regenerates the serial clock using a phase-locked loop (PLL) locked to the incoming data. The outgoing data are resampled using the regenerated clock, and the jitter budget is thus reset. Alternatively, if the signal has been transformed from the serial to the parallel domain for processing, the deserializer should have good tolerance to incoming jitter and be able to generate error-free data from the incoming stream. Similarly, the serializer should include a serial clock generator with low jitter, so the new serial data stream is clean as it is launched.

Reclockers

In a reclocker, the specifications to look for are input jitter tolerance (IJT), which specifies the amount of jitter on the incoming signal that can be tolerated without data errors, and output intrinsic jitter (OIJ), which specifies the amount of jitter remaining on the signal at the reclocker's output. A good

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reclocker has an IJT of .7-.8UI and OIJ of less than .1UI.

Deserializing receivers and serializing transmitters

In the receiving deserializer, the important specification to look for is IJT. In the transmitting serializer, it is OIJ. For 3G signals, IJT should be at least .7UI, and OIJ should be an absolute maximum of .2UI. This allows for a further .1UI to creep in between the serializer and the equipment output without jeopardizing SMPTE compliance. If a lower OIJ can be achieved, then the output can better the SMPTE specification and has the potential for longer cable lengths. To achieve low OIJ, the system designer must ensure that the clock used by the serializer has low jitter, either by using a serializer with a built-in clock cleaner or by cleaning up the clock used with an FPGA serializer by using a dedicated clock cleaner. The clock-cleaning process is performed in both cases by using a clock generator with low intrinsic jitter, combined with a low loop-bandwidth PLL to reject jitter from the parallel reference clock.

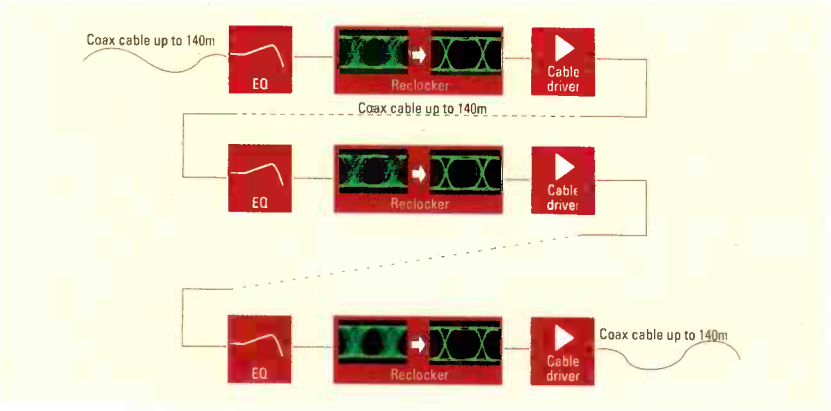

Figure 2. A multipass 3G-SDI system

Multipass and jitter

Jitter removal using reclockers is effective for jitter at frequencies above the loop bandwidth of the reclocker's PLL. This is almost all of the jitter and is effective for many passes. At the 2009 NAB Show, one vendor showed 101 passes through a cable, equalizer and reclocker combination, with no measured errors.

Low-frequency jitter reduction

The loop bandwidth is a compromise between the need to track the dynamic characteristics of the incoming data stream and the need for low output jitter. In practice, a loop bandwidth of around 1MHz is used. This rejects jitter at frequencies above 1MHz, but

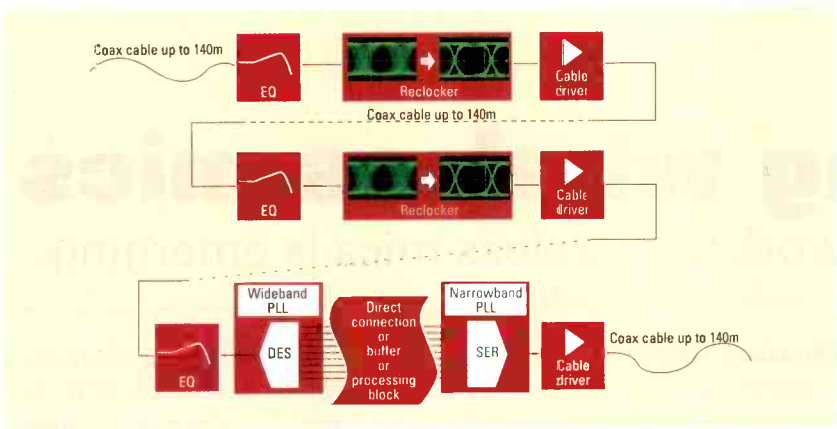

Figure 3 A multipass 3G-SDI system with low-frequency jitter budget reset

passes on lower-frequency jitter. It is possible in a high-complexity system, where the signal remains in the serial domain for many cable runs, that low-frequency jitter accumulates to a point where it approaches the SMPTE 424M specification of .2UI at 10Hz. In this case, the signal should be deserialized and reserialized. The deserializing process transfers the data to the parallel domain, in which the .2UI at 3Gb/s represents only .15UI at the 148.5MHz parallel clock rate. The parallel data are then reserialized using a PLL with a very low loop bandwidth, and the jitter budget is reset over the complete spectrum. (See Figures 2 and 3.)

Conclusion

3G systems can be safely implemented using coaxial cable runs of up to 140m. It is important that:

- The transmitted signals meet or exceed the SMPTE specification;
- The cable equalizers are of high quality;
- The signals are equalized and reclocked after every cable run;
- The connectors are 3G-qualified; and
- The appropriate foam dielectric cable is used.

For longer links, fiber-optic cables are recommended. For these:

- It is important to use send and receive interfaces with video capability;
- Single-mode fiber is required for links longer than 400m;
- For long links, ensure that the send power and the receive sensitivity are correct for the fiber loss;
- For short links, ensure that the receiver is able to accept the input power without overload; and
- The signals should be reclocked after every fiber run. BE

Nigel Seth-Smith is a member of the Strategic New Product Definition and Business Development team at Gennum.

Operating wireless mics

Regulatory framework for wireless mics is emerging.

BY HARRY C. MARTIN

The FCC is clearing the 700MHz band (TV Channels 52-69) of wireless microphones in order to make room for new uses. At the same time, it has grandfathered previously-illegal use of these Part 74 devices on Channels 51 and below subject to a power limitation of 50mW. None of this comes as a surprise. The FCC has been saying for more than a decade that Channels 52-69 must be vacated.

Dateline

- For noncommercial TV stations in Texas, the biennial ownership report deadline is April 1. The biennial ownership reporting date for commercial TV, Class A and LPTV stations has been suspended pending a further redesign of FCC Form 323.
- April 1 is the deadline for TV stations in Texas to electronically file their broadcast EEO midterm reports (Form 397) with the FCC.
- April 1 is the deadline for TV stations licensed in the following states to place their annual EEO reports in their public files: Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas.
- April 12 is the deadline for all commercial TV and Class A stations to submit first-quarter Children's Television Programming Reports to the FCC.
- April 12 is the deadline by which commercial TV stations must place children's TV-related commercial compliance certifications and Web site compliance information in their public files.
- April 12 is the deadline by which all stations, commercial and noncommercial, must place their first-quarter issues and programs lists in their public files.

Wireless rules

Wireless microphones are used in live and televised musical presentations, and in most TV news and sports broadcasts. They are also used for live theater, opera, churches, lecture halls and anywhere else someone speaks to a crowd. Even the FCC's meeting room uses them.

Most professional wireless microphones use unoccupied channels in the TV bands. These do not cause interference to TV reception because the large users, and the companies that sell to small users, are careful about avoiding TV channels in use. Even organizations devoted to protecting broadcast spectrum have accepted wireless microphones.

Until now, the use of wireless microphones required an FCC license. Eligibility was strictly limited to radio, TV, cable, movie production and a few other groups. All other users have been operating illegally. Such users were supposed to occupy non-TV frequencies, but the TV band microphones work better and are the most popular. But, because the unlicensed use of wireless microphones caused no trouble, the FCC left things alone.

This changed due to the DTV transition, which involved the repacking of channels to free up the 700MHz band (the channels formerly known as TV Channels 52-69) for other uses. But some wireless microphones left over from before the transition still operate in that part of the band. These may cause problems for the new users of 700MHz, primarily public safety and commercial wireless users.

The FCC has now issued a Report and Order and Further Notice of Proposed Rulemaking that attempts both to clear the 700MHz band and, in the process, grandfather nonlicensed users. Under the R&O, as of June 12, 2010, and sooner in cases where there is a potential for interference, wireless microphones on Channels 52-69 may no longer be imported, manufactured, sold, leased or operated in the United States.

But until the FCC decides on permanent rules, both old and new users who are currently ineligible for Part 74 licenses may nonetheless operate legally on an unlicensed basis, at up to 50mW power, provided the frequencies used are below TV Channel 52. In its rulemaking, the FCC is likely to adopt final power limits for wireless microphones, decide whether new units must be digital-only, determine which TV channels should be available and determine the details of user registrations. The rules are likely to forbid data transmission, interconnection with the telephone network, wireless telephone headsets and aftermarket RF amplifiers.

Under the R&O, wireless mics on Channels 52-69 may no longer be imported, manufactured, sold, leased or operated.

Current licenses that authorize 700MHz band operation will automatically be modified to delete those frequencies effective June 12, 2010, but will remain valid for lower frequencies. A few licenses that are only for the 700MHz band will be voided. BE

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

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

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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Digital interfaces

High-speed data connections for production environments are continuing to evolve.

BY ALDO CUGNINI

A video processing pipeline encompasses end-to-end audio and video processing, commencing with A/V capture and culminating at a video display. As shown in Figure 1, this pipeline typically includes A/V capture, post processing, storage, distribution and playback. These fundamental steps, in existence since the early days of video processing, form the backbone of this pipeline. On the other hand, the media, methods and interfaces associated with each step have changed over the years.

Digital video interfaces

Digital formats have now all but replaced analog, and hard disk drives and other digital storage media have replaced analog videotapes. Most video post processing can be handled on a standard PC, and the ubiquitous Internet has become as important a video distribution medium as traditional off-the-air, cable and satellite broadcasting.

Along with their numerous benefits, digital TV and digital cinema also present new challenges throughout

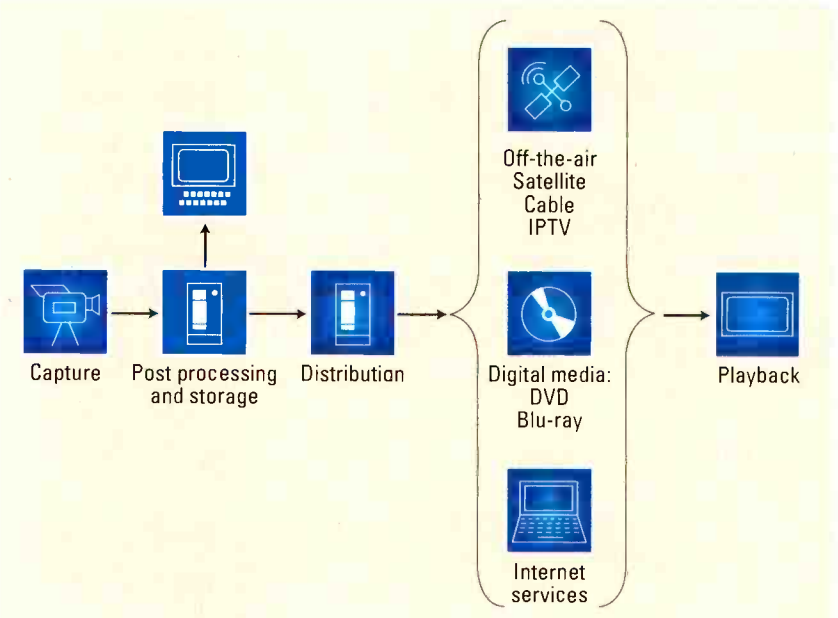

Figure 1. Digital video processing pipeline

the video processing pipeline, and increased video resolution dictates higher bit-rate requirements. Digital rights management (DRM) intentionally imposes limitations on digital content usage via copy protection or access control at all stages of the processing pipeline. Modern video equipment needs to support both the new digital, as well as legacy analog, interfaces. Professional and consumer digital audio and video formats afford higher resolutions, wide acceptance and convenience. It is only natural to see the underlying digital interfaces evolve in parallel with these formats. Table 1 on page 22 summarizes the key features of some of the common digital audio and digital video interfaces used in professional or consumer equipment.

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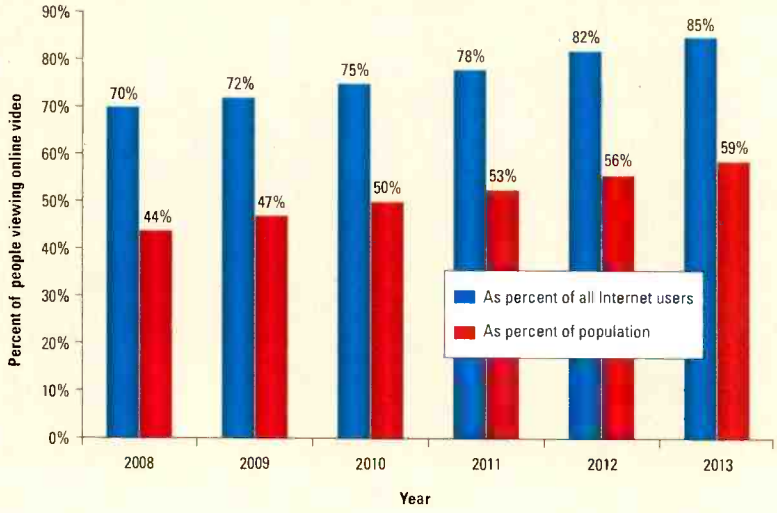

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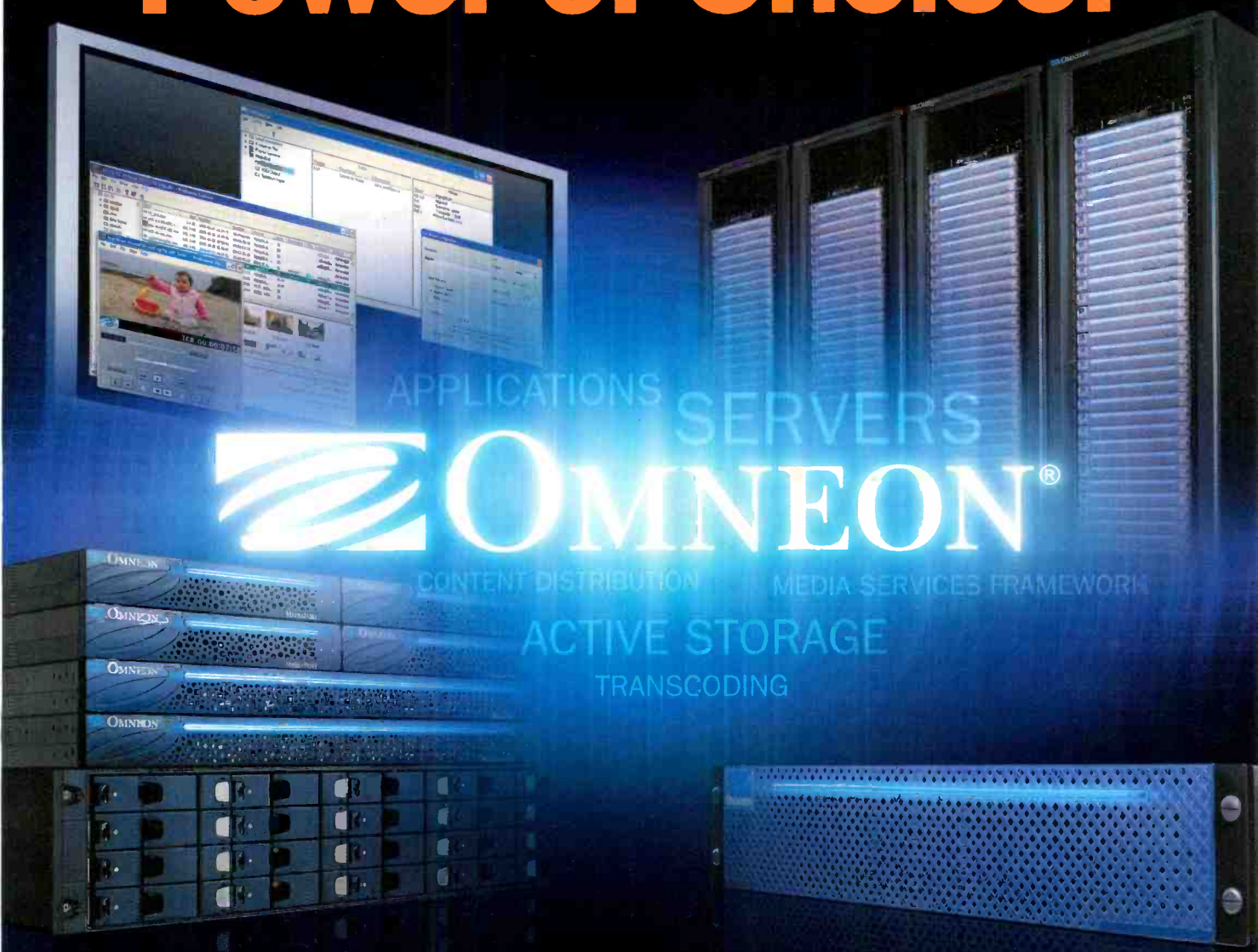

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SD-SDI is a serial link specified by the ITU-R BT.656 and SMPTE 259M standards. It can be used to transmit uncompressed digital video or audio (usually up to eight channels) over 75Ω coaxial cable. Without repeaters, rates of up to 270Mb/s over 300m are serviceable. Defined by the European Community standard EN50083-9, DVB-ASI (Digital Video Broadcasting, Asynchronous Serial Interface) was defined for the transmission of MPEG transport streams and is electrically similar to SDI, with a data rate of 270Mb/s.

HD-SDI is the second-generation version of SDI and allows the transmission of HD (1080i and 720p) signals over the same 75Ω cables as SD-SDI. It can handle rates up to 1.485Gb/s and is defined by SMPTE 292M. A dual-link HD-SDI (defined by SMPTE 372M) provides up to 2.97Gb/s and supports 1080p resolutions, but is expected to be replaced by the single-link 3G-SDI. 3G-SDI is the third-generation version of SDI and allows the transmission of HD 1080p signals over a 75Ω coax cable. It is defined by SMPTE 424M and can reach a maximum bit rate of 2.97Gb/s.

Consumer electronics equipment continues to push the envelope of data rates and usability as well. Traditional USB 2.0 (High Speed) is already enjoying widespread use on most computer peripherals, including storage media, and supports a maximum transfer rate of 480Mb/s. The new USB 3.0 (Super Speed) specification supports transfer rates up to 4.8Gb/s; products using the interface to carry video to PC monitors are expected this year.

HDMI is becoming the de-facto standard in consumer electronics and seems to be replacing legacy digital interfaces for short-distance interconnects. HDMI supports, on a single cable, both an SD or HD uncompressed video stream (up to 4K x 2K resolutions with version 1.4), up to eight channels of audio, and consumer electronics control (CEC). High bandwidth Digital Content Protection (HDCP) provides a robust mechanism for authentication and copy protection over the interface.

Starting with version 1.3, HDMI supports two other important features in digital video processing: the *xvYCC* color space and Deep Color. Above this, HDMI 1.4 brings the theoretical total upper bandwidth to nominally 10.2Gbs/s, with a maximum video bandwidth of 8.16Gb/s and maximum audio bandwidth of 36.86Mb/s. HDMI 1.4 supports the resolutions and features used in digital cinema, such as a 4K x 2K (3840 x 2160p) video resolution at 24/25/30Hz, or 4096 x 2160p at 24Hz. A 100Mb/s Ethernet link, an audio return channel (similar to S/PDIF) and 3-D video are also supported in version 1.4.

The DisplayPort interface, defined by VESA and incompatible with both DVI and HDMI, supports up to 17.2Gb/s. Security for the interface is provided by DisplayPort Content Protection (DPCP), based on 128-bit AES (Advanced Encryption Standard) encryption. While it has been adopted by Apple, Dell and other PC manufacturers for high-end monitors, the interface seems to be struggling to gain major acceptance in the marketplace when compared to HDMI.

Interface	Standard	Max bit rate (Mb/s)	Examples
SD-SDI	SMPTE 259M	360	480i video, two-channel audio
	SMPTE 344 M	540	480p video, two-channel audio
HD-SDI	SMPTE 292 M	1485	720p video, 16-channel audio
3G-SDI	SMPTE 424M	2970	1080p video
AES/EBU	AES3	1.5 (two channel)	Eight-channel audio
S/PDIF	IEC 60958 type II	1.5 (two channel)	Four-channel PCM
DVB-ASI	EN50083-9	270	MPEG 480p TS
ADAT optical		9.2	Eight-channel PCM
MADI	AES10-2003	100	64-channel PCM
USB	USB 2.0	480	480p video or compressed ATSC
	USB 3.0	4800	1080p video
HDMI	HDMI v1.4	10,200	1080p video, 7.1 DTS-HD master audio
DisplayPort	VESA	17200 (v 1.2)	1080p video

Table 1. Digital A/V interfaces

Digital audio interfaces

In a broadcast plant, increasing flexibility while minimizing wiring, complexity and maintenance are strong drivers to adopting new standards

and technologies, including the associated physical interfaces required to support those technologies. Audio distribution over data networks, such as Ethernet, is one example of such an emerging technology.

Mature point-to-point digital audio interconnects within the video processing pipeline include AES3, MADI and SDI. First published in 1985, the AES/EBU interface, AES3, was primarily designed to carry 44.1kHz or 48kHz PCM audio. It supports a variety of cabling and connectors, including 75Ω coax with BNC or DB25 connectors; AES3 can easily support eight channels of uncompressed PCM audio. The Sony/Philips Digital Interconnect Format (S/PDIF), essentially a consumer derivative of the AES/EBU specification, supports both uncompressed PCM (up to four channels) and compressed audio, such as 5.1 Dolby Digital. S/PDIF uses RCA, BNC and TOSLINK connectors, the latter commonly used for consumer audio applications using a digital optical interface. The ADAT Optical Interface uses cabling similar to the optical S/PDIF. Unlike S/PDIF, ADAT was developed for the pro-market and can support up to eight 24-bit, 48kHz uncompressed audio channels. MADI is a further enhancement to the AES/EBU interface that supports transmission of digital audio using both coax and fiber-optic lines, and up to 64 uncompressed audio channels (up to 96kHz and 24 bits each). MADI uses a basic data rate of about 100Mb/s, and enables audio transmission using cables over 100m long and up to 3000m, making it desirable to the professional audio sector.

The ever-evolving video processing pipeline

Over the past few years, video has transitioned from SD, 480i video and 2-channel audio, to 1080p video with multichannel audio. New display technologies allow for wider color gamuts. 3-D video is transitioning from the movie theater to the home, and may force the development of new interfaces, especially on graphics cards. As standards bodies continue to upgrade existing audio and video interfaces and develop new ones, video production studios need to merge traditional video capturing and editing equipment with powerful PC and video servers and use a combination of Gigabit Ethernet, HDMI, and legacy audio and video interfaces, such as SDI and HD-SDI. Count on continuing evolution as the norm! BE

Aldo Cugnini is a consultant in the digital television industry.

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

Networking software

Understanding networking software fundamentals helps quickly identify problems in the broadcast facility.

BY BRAD GILMER

Almost all the network traffic in the world these days is Transmission Control Protocol/Internet Protocol (TCP/IP) over Ethernet. From a practical standpoint, this means that if you are just starting to learn about networking, you should focus on this technology. However, broadcasters may also encounter User Datagram Protocol (UDP)/IP over Ethernet. This introductory tutorial on networking software will focus on must know items for broadcast engineers.

Fundamental principles

It is important to understand the fundamental principles that affect the behavior of networks within and between broadcast facilities:

- *Ethernet is a packetized network.* All Ethernet data, whether it is an automation log file, a video clip or a live video stream, is sent in packets. This means that the data (sometimes called the payload) is cut up into pieces and loaded into packets for transport across the network. For example, think of packets as tractor-trailer rigs; the payload is loaded into the trailer. At the receiver, the chunks are reassembled in the order in which they were sent.
- *Packets have a source address and a destination address.* Address information is contained in a header, which can be quickly read by anyone who needs to know where the packet came from or where it is going. Imagine that the tractor-trailer has two large, easily-read labels on the cab, which say where it started from and where it is headed. (See Figure 1.)
- *Packets are self-routing.* Switches and routers read the addresses in each packet to figure out where it needs to go. This is contrary to the routed video model where input from an external control system (a router control panel) determines the A/V path through the router.
- *Packets travel independently.* Once a packet is launched onto the network, there is no way to know what path it will take to get to the destination (unless the network is small). The specific route may change for a number of reasons, including equipment fault, congestion or maintenance. Each packet is routed independently of all other packets. This can lead to unexpected behavior. For instance, packets launched in succession may arrive at the destination out of order; that is, if you launch two packets, the second packet may arrive before the first packet since it may be routed across a shorter path. Also, the transit time across the network may vary from packet to packet.
- *Networks lose information.* Networks drop packets. In fact, in some cases, networks drop packets on purpose! Packets may be lost because of equipment failures, but they may also be intentionally dropped when the network becomes congested.
- *IP over Ethernet is not a guaranteed transfer mechanism.* Underlying network mechanisms do not guarantee that a launched packet will reach its destination. At the lower level, Ethernet is designed as a "launch and forget" proposition. It is up to higher software systems to deal with delivery issues. UDP does not make any attempt to recognize and correct for lost packets. TCP attempts to resend lost packets, but if the errors are too great, TCP will give up entirely.
- *Network file transfers are an "all or nothing" affair.* When a file is transferred over a network, the transfer either succeeds or it fails. If a single bit is corrupted during the transfer (and TCP is unable to correct it by resending the data), then the entire transfer will be aborted. Network protocols are designed in this way to ensure that errors are not propagated across the network.
- *Networks are designed using layered protocols.* A long time ago, network designers figured out that writing one huge networking application was a bad idea. What if the hardware changed from wire to fiber? What if people needed more error protection? What if chip technology changed to allow faster network speeds? In one huge application, the entire thing would have to be rewritten every time one of these things changed.

Instead, network designers came up with a plan for a layered system; thus, you may hear that a router operates at Layer 3, etc. Different technologies

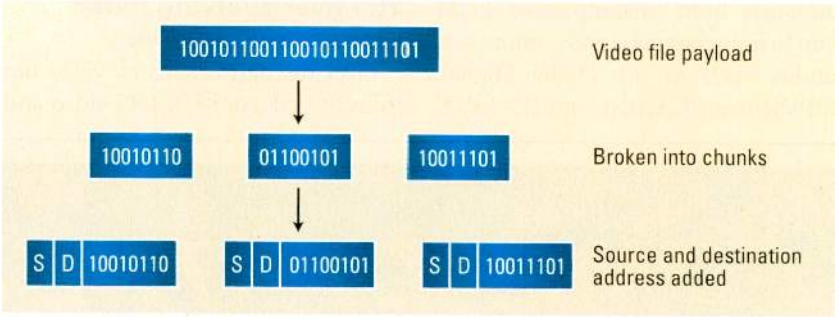

Figure 1. Packetized networks break the payload into chunks and add source and destination addresses in the packet headers.

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may be substituted within a specific layer. You can have TCP/IP over Ethernet, or you can have UDP/IP over Ethernet. TCP and UDP operate at the same layer, so you can change between TCP and UDP without having to make changes to IP or Ethernet.

• *Broadcasters have complex networking needs.* On the one hand, broadcasters are just like any other business — they need networking technology to move files, pay bills, send e-mail, print documents and do all the other things businesses do day in and day out.

On the other hand, broadcasters have a tendency to stress their networks, particularly technical networks. Increasingly, broadcasters are moving large video files and transmitting professional quality streams across their networks both within and between facilities. Broadcasters need to realize that core networking technology was never designed with these applications in mind. If you are working with a network used to support operations, normal business networking rules apply. If you are working with a video production network where users are exchanging A/V files and high-resolution streams, then things may not work as expected, and you may have to employ some tricks to get your network to behave reliably. In some cases, you may have to move away from TCP/IP over Ethernet entirely.

• *QoS is important for broadcasters.* As you can imagine, some of the fundamental characteristics of networks mentioned above do not work out well for broadcasters in a professional video environment. Fortunately, the needs of the broadcaster are lining up well with the consumer market where being able to handle video is becoming a priority. This means that QoS capabilities are being built into more equipment over time. Using QoS, you can guarantee the level of performance across a network. But you should know that QoS is not a thing; you cannot buy QoS. You also cannot set the QoS switch on your router and get guaranteed delivery.

Instead, QoS is a framework of policies and technologies that can be used to control the quality of service to be delivered by your network. At a high level, QoS works by controlling traffic admitted to the network, marking traffic by type (voice, video, data, etc.), and establishing priorities for traffic types so that lower priority traffic gets dropped first when the network gets busy. (See Figure 2.) QoS can establish guaranteed routes for particular flows so that all packets in a stream flow from source to destination via the same path, no matter what. This avoids out-of-order packets and packets with wildly varying arrival times at the destination.

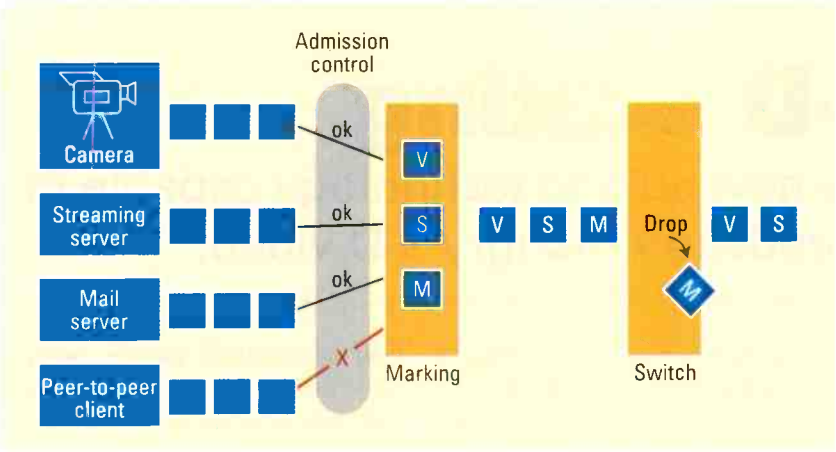

Figure 2. In this illustration of QoS, policy blocks peer-to-peer traffic. Video, streaming and mail traffic are marked. Later, a switch may decide to dump mail traffic if congestion occurs.

• *All networks are not the same.* There are several broad classifications of networks, and it is important to know the differences between them. There are local area networks (LANs) and wide area networks (WANs). A LAN is usually confined to a single facility. There are WANs that run between facilities over a wide geographical area. There is the public Internet, and there are private managed networks. Both the public Internet and private managed networks are WANs. (They may be comprised of several WANS.) However, in the case of private managed networks, QoS is carefully controlled to give users predictable performance. There is no guarantee on the public Internet.

There are virtual private networks (VPNs) as well. VPNs connect more than one facility together so that all computers look like they are in the same facility, even if they are physically located miles apart.

Finally, there are virtual LANs (VLANs), which segment network traffic on the same physical network. You might put all of the traffic on one VLAN, all of the news department on another one and the sales department on a third. All three VLANs are physically connected to the same routers and switches in the facility. To the clients on the network, these computers appear to be running on three physically separate networks. BE

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

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

3-D editing

Here's a look at the new editing technology capable of handling bandwidth-hungry 3-D video.

BY L.T. MARTIN

With so many predicting that 3-D productions will soon move from fad to mainstream, editors are going to need to get ready to tackle the requirements for telling stories in Z-space. Yet with less than 40 films produced during the modern era of 3-D, until now only a small cadre of editors have experienced the challenge of cutting in 3-D. But that is all about to change.

Somewhat buried under the hoopla surrounding 3-D theatrical features such as "Avatar," with the arrival of 3-D TVs, the delivery of 3-D content to the home is starting to attract growing interest and, more importantly, financial investment. Last December, the Blu-ray Disc Association announced the finalization and release of its Blu-ray 3-D specification.

Then at January 2010's CES Show, several entities, including ESPN and Discovery Communications, unveiled plans to start generating and delivering 3-D to the home over satellite and cable later this year. In addition, Next3-D announced it would start a Web-based 1080p VOD service this month. While 3-D in the cinema has been fed mostly by CG-dominated material, new programming for home viewing will be based on live production, which means editors ought to start sharpening their chops to get ready for the onslaught.

A new way of thinking

Having spoken with editors who worked on most of the recent 3-D film productions, I can tell you that cutting for the third dimension requires new thinking in both technology and aesthetics. At first blush, the technology seems fairly familiar. Ever since "The Power of Love" was premiered on Sept. 27, 1922, at the Ambassador Hotel Theater in Los Angeles using the dual projector Fairhall-Elder stereoscopic 3-D process, 3-D filmmakers have realized that the trick of creating depth perception relies on somehow getting two different images to the viewers' left and right eyes and letting the brain assimilate them into the perception of depth.

But even though today's 3-D productions are usually shot with two HD or higher resolution digicam rigs shooting through a beam splitter instead of the old side-by-side film cameras, almost all editors on 3-D productions cut only the "left eye" images on 2-D NLEs. That's because using two camera rigs shooting through a beam splitter, the "right eye" has to be flipped either vertically or horizontally in the lab (depending on camera configuration) to be properly oriented. Although some very high-end systems such as Quantel's Pablo can accomplish real-time stereoscopic 3-D editing and mastering in a single system, their operational costs have relegated them mostly to 3-D finishing.

Cutting for the third dimension requires new thinking in both technology and aesthetics.

For the rest of us involved with creative cutting, what we used to call "offline," only the Avid systems equipped with version 3.5 software or later can edit true stereo timelines and play them out directly to a full color 3-D monitor. That means editors first see the images without Z-space depth on their conventional picture monitor while making cutting decisions, and then have to either turn to an ancillary 3-D monitor after they have been played out to evaluate the depth effect, or wait until a post facility can composite the two eyes together for projection in a 3-D theater.

However, a factor found to be crucial to the improvement of today's 3-D presentations is controlling the convergence of the lenses of the two recording cameras, thanks to the innovative research conducted by DP Vince Pace, a key collaborator with James Cameron on his underwater documentaries and, of course, "Avatar." Pace is credited with developing the convergence-adjusting FUSION 3-D camera used on almost all live action film, TV and sporting events. As a result, 3-D editors will have to learn to deal with controlling the "toe in" or "toe out" of the eyes to match the desired position of an object in Z-space, and even the Avid systems cannot manipulate the convergence of the left and right eye images.

Nor can any of the other laptop edit systems currently available make those convergence adjustments by themselves. To the rescue comes a third-party software called Neo3-D from CineForm, a company known for its intermediate file codecs. In its latest incarnation, Neo3-D provides full-resolution left and right eye images within a single AVI/MOV wrapper on Apple's Final Cut Pro, Adobe's Premier Pro, and Sony's Vegas Pro 9 NLEs. Because Neo3-D can output in any of a number of anaglyph formats such as red/cyan, green/magenta or amber/blue, that means the editor can use inexpensive colored glasses looking at an edit room's conventional 2-D monitor to evaluate and

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adjust the left/right convergence. This can save significant post-production lab costs during editing, and once the picture is locked, it can subsequently be output in either the RealD or Dolby 3-D polarized, full spectrum stereo presentation formats.

A viable alternative

But this brings up another current in today's 3-D that is bubbling beneath the surface. While major proponents of 3-D insist that some form of full color stereoscopic 3-D is the only way to go, great advances have been made in single-image stream 3-D that can be viewed on any normal TV or computer screen. Starting off with anaglyph approaches such as those mentioned above, this has been significantly improved by companies like ColorCode 3-D, which has developed an encoding process matched to inexpensive glasses through which the color information is conveyed through a specially-designed amber filter, and the depth component is perceived through a unique blue filter.

Insisting loudly that this is not traditional anaglyph, ColorCode 3-D provided the supporting technology behind "3-D Week" on Channel 4 in the UK last November and was used for the 3-D ads during the 2009 Super Bowl. Editors should be aware of this kind of technology because it doesn't require a special high-cost presentation system or relatively expensive polarized or active-shutter glasses, and its images can simultaneously be fully appreciated by most people even without the special lenses.

With Panasonic having presented a prototype of the first cost-effective 3-D camera for mainstream use at CES 2010, and the new content delivery organizations hungry for 3-D content that doesn't yet exist, there may come a call for home 3-D systems that don't require pricey screens and lenses and whose images can be viewed in a pinch by people in the room who aren't wearing those funny glasses. These are, after all, still early days, and there is also going to be a lot of editing needed for nonbroadcast productions. Single-image stream 3-D may become a viable alternative.

A great challenge

But however it is presented, the aesthetics defining the new grammar of 3-D will afford the greatest challenge to editors trying to tell visual stories in this new medium, and by now there are enough editors with sufficient experience wrestling with Z-space to harvest some of their lessons learned.

The most important is that without proper convergence control, 3-D images rapidly become tiring to the eye. This is exacerbated by rapidly cut sequences if the editor requires the audience's eyes to shift their convergence from shot to shot. So 3-D editors will have to learn not to confuse the viewers' minds by scatter-gunning the convergence points all over the screen.

Another rule of 3-D aesthetics that has emerged is that foreground objects can be much more distracting when floating past the screen than they were in 2-D. This was immediately apparent during the experimental 3-D broadcast of the BCS College Football Championship on Jan. 8, 2009, during which the ubiquitous sideline shots did not work at all. Even the overheads of the field, a mainstay of football broadcasting, appeared disturbingly flat.

Finally, editors will have to learn to cope with the fact they are dealing with a proscenium stage in 3-D. Deciding whether objects should come out of its volume toward the audience, or recede into its depths away from the viewers, will be a fundamental consideration for editors to keep in mind. It will also be just one of the new creative tools they have at their command when cutting 3-D. BE

L.T. Martin is a freelance writer and post-production consultant.

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For a recent series of promotional spots for NBC's American Gladiators, Kertesz created on-set pre-visualization compositing taking a feed from a Vision Research Phantom HD Camera. "Because of the tight turnaround time, and the talent involved, it was essential that we were working with equipment that was reliable and fast. The camera didn't genlock, so we had to have an on-set solution to feed its footage into the HD Ultimatte 11. The FS1 was essential for that purpose."

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File format conversion

Maintaining signal quality during transfer is of prime importance.

BY RUSSELL BROWN

File format conversion has become increasingly important in today's file-based workflow environment. In the past, file format conversion was accomplished with dedicated services that provided their own software and/or hardware to accept the file transfer and convert it to what the station needed.

Today, a TV station may require many different types of file conversions to produce media for on-air playback, content for its Web site and files for archival storage. While the actual file type may be different, the requirements are the same: high-quality video and the smallest file size.

Video quality

Whenever a video file is converted from one type to another, the issue of video quality must be addressed. Assuming there is no data loss, the parameters of how the video was encoded is the main factor in determining video quality and, thus, its ability to be converted to another file format. Starting with acquisition, files differ in both quality and size.

Much of the future media to be converted will come from analog media, either film or videotape, and the quality of that initial transfer will determine the subsequent quality of future file conversions.

Video file formats are called either "lossless" or "lossy" — any file that uses compression on the video is considered lossy, because it must throw away some picture information to perform the compression and, thus, reduces the file size. You always want to move from lossless toward lossy with as little degradation to the picture as possible.

Files and wrappers

When a video file is created, the raw essence file is made up of the actual data from the codec used to encode the audio and video signals. This could be an MPEG-2 file or one of the many DV formats, but when input to a server or other device, the software that accepts it needs to know certain parameters about the actual audio and video data to be able to play it back. This is where the container comes in, which holds the separate audio and video essence data together and provides the necessary data, including codec used, frame rate, data rate, number of channels, etc., needed to be able to play them back.

One function of the container is to be an interchange format. When this type of container is used with professional video systems, it is called a wrapper. Wrappers have been developed to make it easier to exchange video files and the information associated with them between various systems such as nonlinear editing systems, video servers and some digital VTRs. Wrappers are data files that contain within them the essence, or audio and video files, and the metadata, which is data about or related to the audio and video files. The need for wrappers came about due to the lack of information exchanged during file transfers from one storage system to another. Without wrappers and metadata, the receiving system lacks any information about the content of the files.

The best-known professional wrapper is Material eXchange Format (MXF), developed by SMPTE (377M-2004). MXF was designed for use within broadcast and post-production facilities, making it the first choice for many stations. Although MXF has been widely adopted, it has not been fully implemented in many

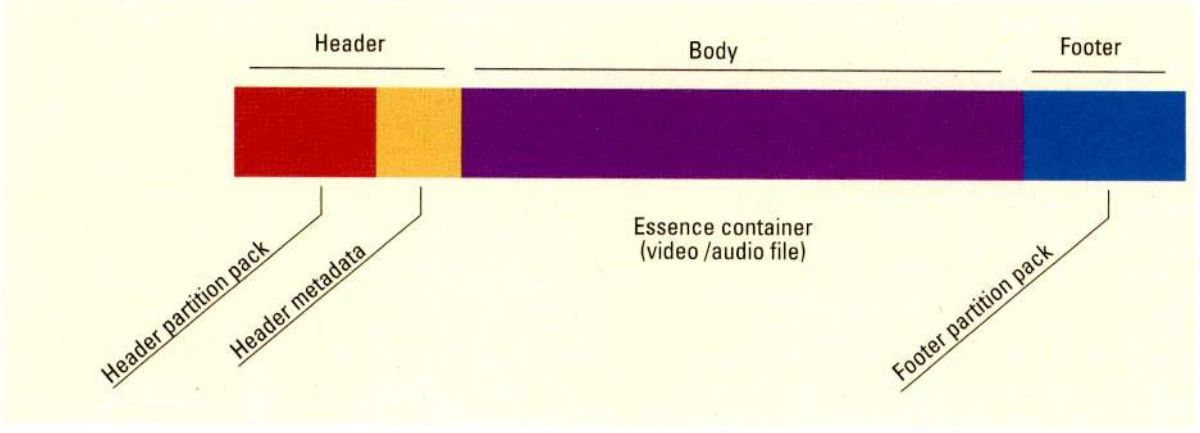

Figure 1. MXF data structure

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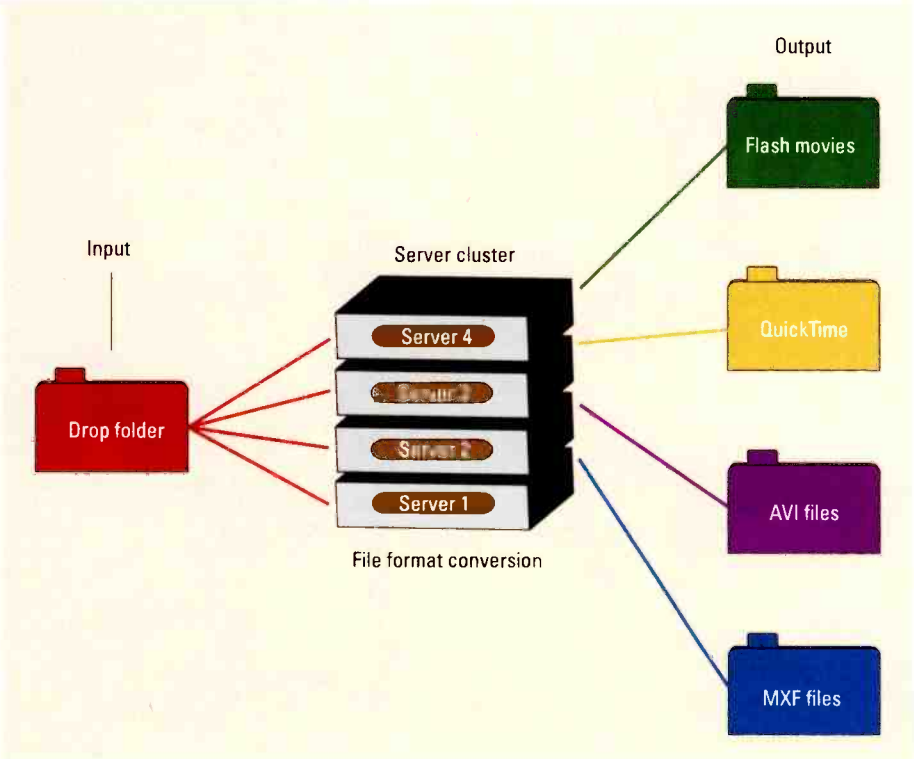

Figure 2. Using server clusters for file conversion

cases, so its full capabilities have not been used by many broadcasters. (See Figure 1 on page 32.)

Other containers and wrappers include QT (QuickTime), AAF (Advanced Authoring Format), GXF (General eXchange Format, SMPTE 360M), OMF (Open Media Framework) and AVI (Audio Video Interleaved).

The two most common video files in professional use for SD include:

- D10 (SMPTE 356M): Also known as Sony's IMX, this is an MPEG-2 format using only I-frames and eight channels of AES audio.
- DV/DIF (Digital Video/Digital Interface Format): Also known as DV, it is used in AVI-DV, QT-DV, MXF GC DV-DIF.

To apply a new wrapper, the program strips off the original wrapper and creates the new wrapper around the essence data, with all the appropriate data and metadata included. To

convert the actual essence file type, or codec, the original encoded data must be unwrapped and examined, and then an algorithm is applied to convert the data to the new codec. How well this is done will determine the quality of the conversion and the quality of the video.

As of today, there is no common file format for HD, because most facilities use the format created during acquisition. Conversion programs can either change the essence file type or the wrapper the essence data is contained within. The latter technique is much easier than the former.

Conversion

Conversion of the essence data takes time, because it uses a lot of a computer's processor power to perform the complex equations needed to convert from one codec to another. One way to speed up the process is to use multiple computers to distribute the load. A cluster of servers is used to reduce the amount of time required to convert a file and/or to convert multiple files at once. Quicker-than-real-time conversion is possible when using dedicated servers in clusters.

A typical setup would have a hot folder, which resides on a server or a storage device attached to the server. Via the network, any video file that requires conversion would be transferred to this hot folder. When a file appears in the folder, it is read by the conversion software, and the process begins. If the file is corrupt and can't be read, it is transferred to another folder that contains problem files.

Once the conversions are complete, the multiple output files are transferred to their respective folders, which can be seen on the network and transferred to the appropriate devices. Creating multiple types of files at the same time increases efficiencies by delivering copies for the various workflows within the station, including proxies for viewing on the desktop, MXF files for distribution, QuickTime for the video servers and so on. (See Figure 2.)

Metadata

An important point to keep in mind with any file conversion is to make sure the metadata makes it. Metadata consists of information such as time code, I/O markers, closed-captioning and other VBI data. Different wrappers can hold this data in different forms and will need to be converted during the conversion process as well. BE

Russell Brown is chief engineer at KMTP-TV in San Francisco and writer of Broadcast Engineering's *"Transition to Digital" e-newsletter.*

The NBC station's new digital media center features an open work and production environment in which everyone can literally see one another, communicate freely and collaborate on projects in an unencumbered way.

NBC Connecticut builds digital media center

BY MICHAEL GROTTICELLI

NBC Connecticut, the NBC O&O in Hartford, CT, has taken the concept of a streamlined workflow and literally put it into play in all aspects — physically and technologically — in its new state-of-the-art digital media center.

Last July, the station moved into a new facility — built behind its existing station and on the site of a former parking lot — and became the first station in the state to broadcast its local newscasts in 1080i HD. It's still the only station in Connecticut offering viewers local news in HD.

Working with Union City, NJ-based system integrator KMH Audio-Video Integration, Keith Barbaria, director of technology and engineering at NBC Connecticut, developed a blueprint for an innovative facility that provides easy access to all departments and staff. The 42,000sq-ft building looks large from the outside; however, inside there is only 25,000sq-ft of usable space, which is tight but efficiently utilized. KMH provided systems programming and commissioning for all production and broadcast systems in the building, as well as voice and data, and cable TV. Various existing systems were relocated, with a series of transitions planned and coordinated between NBC engineering and KMH in order to keep the station on the air throughout the entire construction and installation process.

Truly open workflow

The goal in the design of the digital media center was to create a workplace in which everyone can literally see one other, communicate freely and collaborate on projects in an unencumbered way.

The entire facility features an open design. The first floor newsroom is open to the second floor, and features a mezzanine that looks down to the lower level. It's also open to the studio (which includes four Sony HDC-1400 cameras), so the staff has a clear view of live newscasts in progress. The assignment desk is the focus of the newsroom, opposite the studio, which is situated on a 22in riser, making it easier to see where the staff is and support them if necessary. Even the offices throughout the facility have glass front walls and doors.

The new facility is a marked departure from the old building, where the staff felt confined by numerous walls, making it difficult to find people. During late-breaking situations, this often made it difficult to communicate. The new building alleviates that by opening up the entire space.

Fast-paced news editing at the station is accomplished with four Grass Valley EDIUS workstations, located right off the newsroom. The editing stations are open so anyone can see what's going on. NBC Connecticut's

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newsgathering process was completely tape-based until 2007, when the NBC Stations Group (now called NBC Local Media) standardized on the EDIUS nonlinear editing system and Grass Valley ADVC conversion units for their field editing operations. The station purchased 21 EDIUS licenses and a variety of the ADVC converters.

Photographers come in from the field with their laptops and plug into any available network connection at the station. This environment is complemented by three Apple Final Cut Pro workstations, which are used for longer form pieces and promotional elements that can be created over time.

Fast-paced editing in the field

In the field, NBC Connecticut photographers shoot with Panasonic P2 cameras. Once footage is captured, the P2 cards from the cameras are inserted into a laptop in the field and edited on the spot with EDIUS software. This saves time and enables the person closest to the story to develop what will eventually be broadcast on that evening's newscast. The workflow is fast and efficient, according to Barbaria, who said that although there are often several cards floating around the newsroom at any one time — the station has been using P2 since January and bar-coded the cards for organizational purposes — it has never lost one or had one fail.

Once the edit is complete, most pieces are delivered through the Internet and into a BitCentral Oasis server at the station. From there, that piece is folded into a Grass Valley Aurora Playout workstation in the station operations control room, or it can be sent to the news editing room, where it is worked on further on another EDIUS system. This gets content to air faster than was possible with videotape.

Editors at the station share clips stored on a Grass Valley K2 media server-based HD storage area network (SAN) with 5TB, which serves as the central point for all news content. Four channels of K2 client servers ingest and store satellite and other feeds for editing and storage on the K2 SAN. The Final Cut Pro editors also share the SAN, via K2 FCP Connect software. Finished stories are then transferred to a four-channel stand-alone K2 client, with local storage, for play-to-air under Aurora Playout and Avid iNEWS control. An additional four channels on the K2 SAN clients serve as backup to the play-to-air stand-alone K2 clients. After they have aired, finished segments are transferred to DVD for archiving.

Next to the production studio is a new HD control room, complete with a Ross Video Vision production switcher and four 50in Sony flat-screen monitors running Miranda KaleidoX multiviewer software. Avid Deko SD graphics systems brought over from the old facility are used here, with graphic elements upconverted to widescreen HD before going to air. A Wheatstone D10 digital audio console is also used for stereo audio to accompany most locally produced content, while true surround sound (5.1) is passed through during broadcasts of NBC network HD programming. Large windows in the control room look out onto the set, providing line of site for the control room staff and an additional set background for the studio.

The entire facility is a production set

The facility also includes 13 broadcast service panels (BSP) with fiber-optic, video, audio and data connections. They are fully integrated into the control room and allow reporters to plug in and go live on camera from almost anywhere in the building. It provides the staff the ability to present news in new and creative ways, as opposed to the old facility, which limited them to a single studio and a constant on-air look.

For example, the station's morning and evening cooking segments are shot in the staff kitchen. Both of the lobbies in the building are used for interview segments. There's even a BSP on the roof for weather and any type of outdoor shots. News production often takes advantage of

Design team

NBC Connecticut
David Doebler, president and general manager
Keith Barbaria, director of technology and engineering
Joe Dimaggio, engineer
Mark Chase, engineer
Ed Rankin, engineer
Karen Bradshaw, IT manager

KMH Audio-Video Integration
Kevin M. Henneman, president
Adam Semcken, lead design engineer

Technology at work

Apple Final Cut Pro workstations
Avid
- Deko CG
- iNEWS newsroom computer system

BitCentral Oasis servers
Grass Valley
- Aurora playout software
- EDIUS editing workstations
- K2 SAN

Miranda
- Densité signal processing modules
- KaleidoX multiviewer software

NVISION 3Gb/s HD routing switcher
Panasonic AG-170 P2 camcorders
Ross Video Vision 3M/E HD video production switcher
Sony
- 50in flat-screen LCD monitors
- HDC-1400 studio cameras

Wheatstone D10 digital audio console

of the landscaped grounds to produce outdoor cooking and other outdoor segments for the 11 a.m. news.

The facility is brand-agnostic, meaning there are no fixed NBC logos on the set or in the facility. All logos are generated from the control room and fed to facility and set monitors, allowing NBC Connecticut to customize the look of its broadcast or provide customized content to other O&Os and outside clients.

Connecticut's digital media center

The staff and station management refers to its new building as Connecticut's digital media center because it was designed to be a content provider for not only TV but for the station's Internet site, digital channels and the mobile devices it plans to broadcast to in the near future.

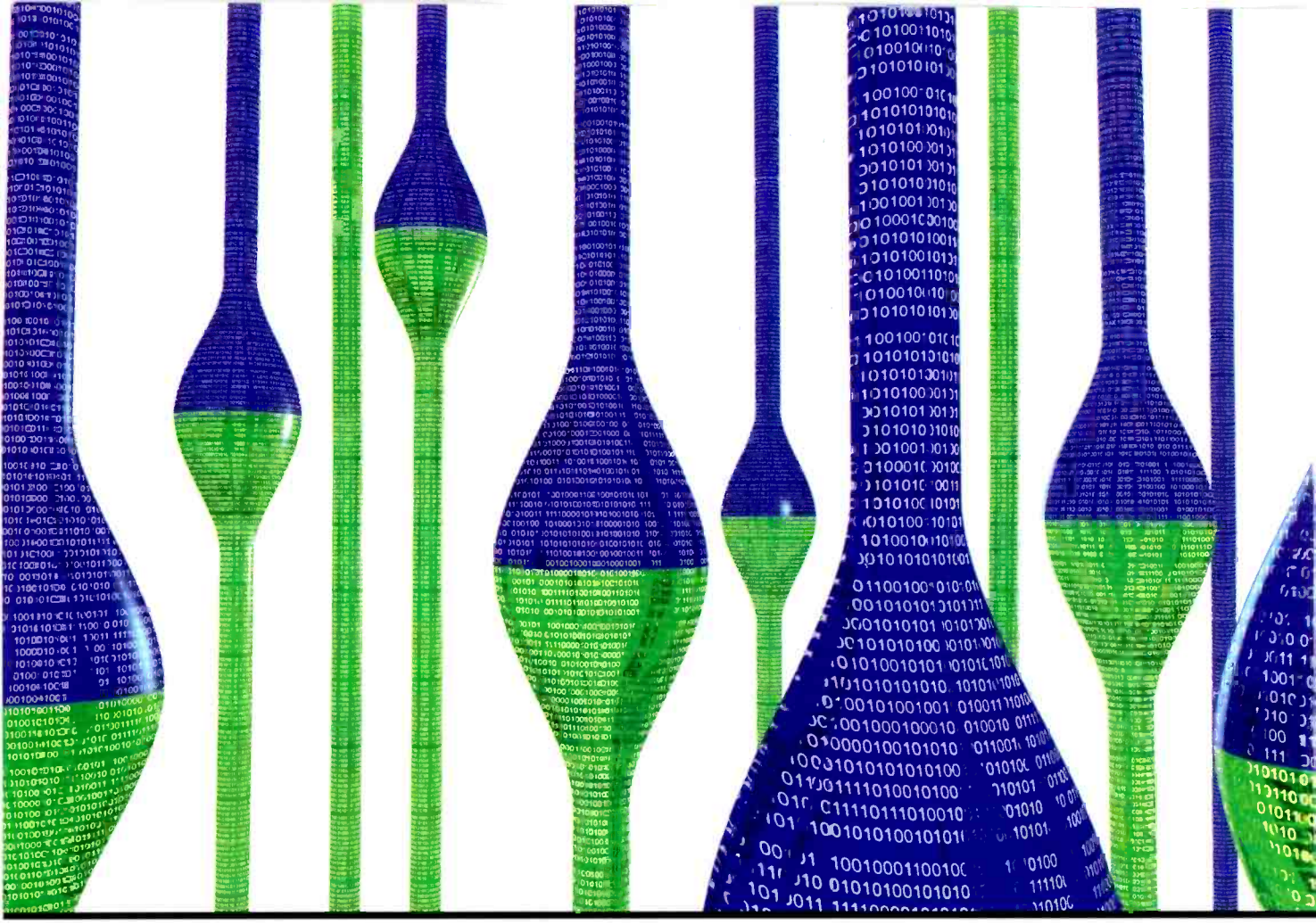
The new facility was nearly two years in the making. NBC Connecticut broke ground on Oct. 29, 2007, and moved into the new space in July 2009. This multiphase process gave the station time to choose the most flexible HD technology and build a facility that reflects the changing television business. This building is not just a broadcast facility; it's a multiuse facility.

Overseeing a facility that now produces more than 40 hours of local news per week, Barbaria and his engineering team have achieved their goals of a truly integrated workflow environment.

"It was almost magical to stare at a set of drawings one day, and then walk into the facility you envisioned months later," he said. "The TV business is changing, and we wanted to build a facility that is flexible, that can serve us now and can change with the times."

From all appearances, the team has deployed a unified setting that the staff enjoys, and the increased productivity it is now seeing is proof that the original "future-proof" concept is working — in more ways than one. BE

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



Building IP-centric media centers

Priority flow control-enabled storage clusters eliminate traffic interference and support 100-percent efficiency.

BY LUC ANDRIES

As broadcasters transition to file-based media production, large disk-based storage systems are becoming the fundamental media service of the production architecture. However, media traffic presents much more rigorous throughput requirements than classical IT solutions. Storage components must handle gigabyte-size files, large chunks of data in one I/O (typically up to 4MB) and continuous streams of traffic bursts over the storage network.

To increase throughput, media storage solutions distribute, or stripe, data over several distinct storage systems. Because every server needs parallel access to every storage system, media storage often relies on storage cluster concepts typically used in high-performance computing (HPC). These clusters employ a large number of devices, leading to complex storage network architectures. However, while HPC clusters typically exchange mostly small messages, media networks are continuously loaded to full capacity, leading to network congestion and sustained oversubscription of the switch ports.

These circumstances present a significant challenge: How can network engineers design a scalable storage network that can sustain the continuous throughput required by file-based media production while maintaining high efficiency and network use? As this article describes, the most significant barrier is traffic interference. Previously, VRT-medialab demonstrated that a storage cluster architecture employing Cisco's Data Center Bridging (DCB) technology and the PAUSE frame mechanism defined in the IEEE 802.3x standard can achieve higher link bandwidth use and scalability than traditional InfiniBand (IB) solutions. (See *Broadcast*

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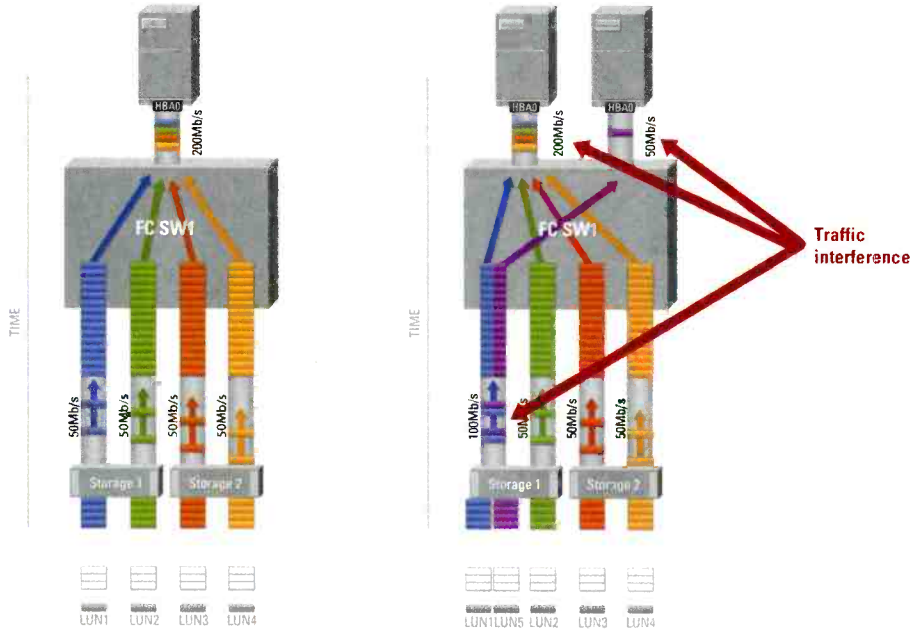


Figure 1. Oversubscription in a media storage environment

Engineering, January 2010.) However, the fundamental impediment of traffic interference remains for both 802.3x- and IB-based clusters.

Our laboratory sought to address this with priority flow control (PFC). We performed a series of comparative tests between 802.3x- and PFC-enabled storage clusters. Ultimately, we found that PFC eliminates traffic interference and supports a highly scalable storage network that sustains 100-percent efficiency.

Media storage architectures

Because media storage systems stripe data over several storage systems, every server needs parallel access to every storage system. Like classical IT storage area networks (SANs), most first-generation media file systems use a single Fibre Channel (FC) storage network to connect every file server node with every storage controller. This leads to a complex network topology that is ill-suited for media environments. VRT-medialab demonstrated that under sustained media storage traffic loads, the long traffic bursts interfere with each other in the switch buffers and create severe efficiency loss. (See Figure 1.)

As shown, when multiple sources deliver long bursts of traffic to the same destination, throughput of the source links is limited by the bandwidth of the aggregating link. However, when a second destination requests data from the same source storage controller (see purple traffic flow in Figure 1), the second destination server does not receive the full bandwidth available at the shared source link. Because the switch port buffers are filled with "blue" traffic, the purple flow can only pass a data frame every time a blue packet is read by the left destination server — a problem exacerbated by the fact that the left destination is reading from four sources simultaneously. Traffic interference occurs, and traffic flow to the second destination slows. Extrapolating this effect to larger media storage network topologies, efficiency severely deteriorates, limiting the scalability of any FC-based media storage environment.

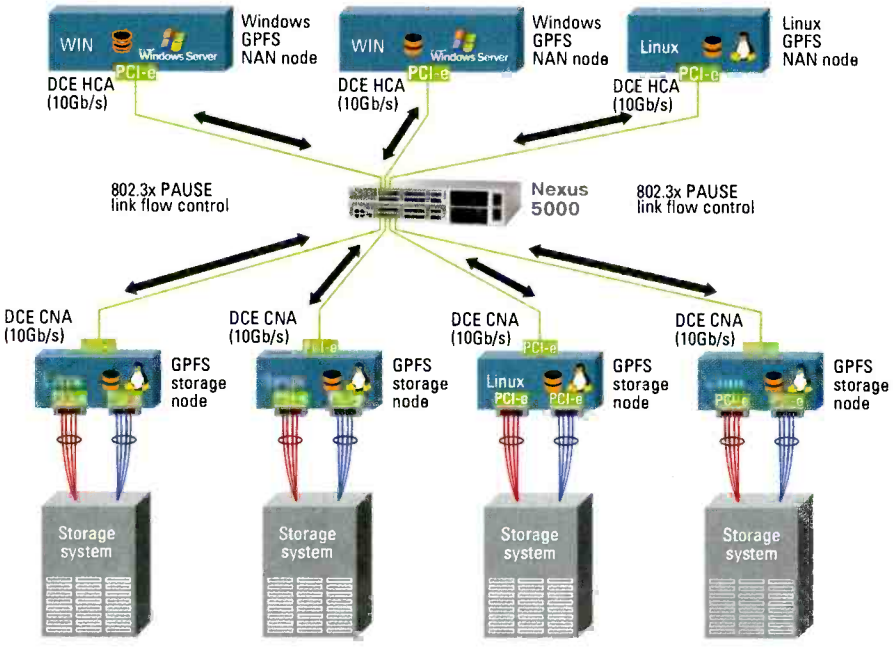


Figure 2. 802.3x DCB-based WARP cluster architecture

DCB-based WARP cluster network

These limitations can be partially overcome by splitting the storage network into two separate networks. (See Figure 2.) This can be accomplished using IBM's General Parallel File System (GPFS) and a Workhorse Application Raw Power (WARP) media storage cluster consisting of storage cluster nodes and network-attached cluster nodes (NAN). This architecture has a much simpler topology.

DCB transport is well-suited as the cluster network for this type of media storage architecture. DCB allows flows to be tightly controlled and load-balanced over the links and uses the 802.3x PAUSE mechanism to provide link-level flow control similar to FC, creating a "lossless" environment. The result is a notable improvement in scalability and link bandwidth use

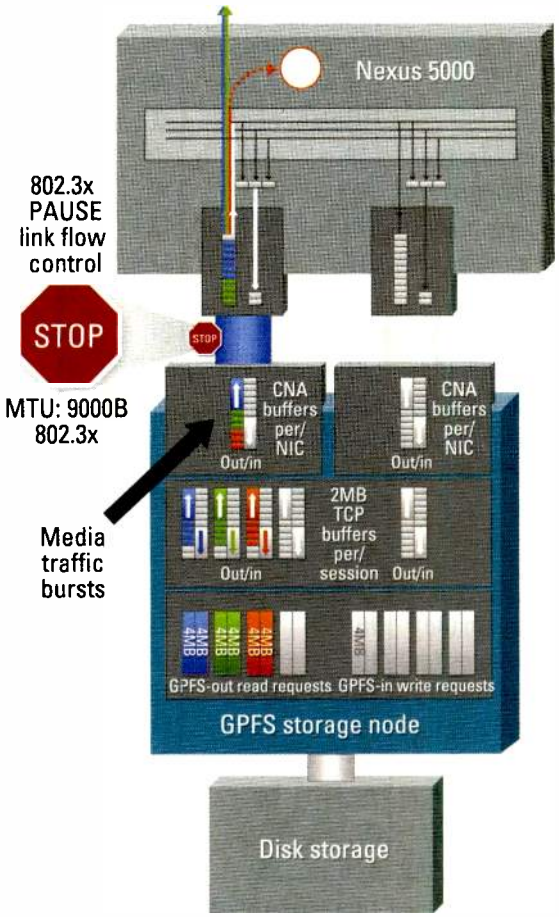


Figure 3. Oversubscription in the 802.3x DCB-based WARP cluster

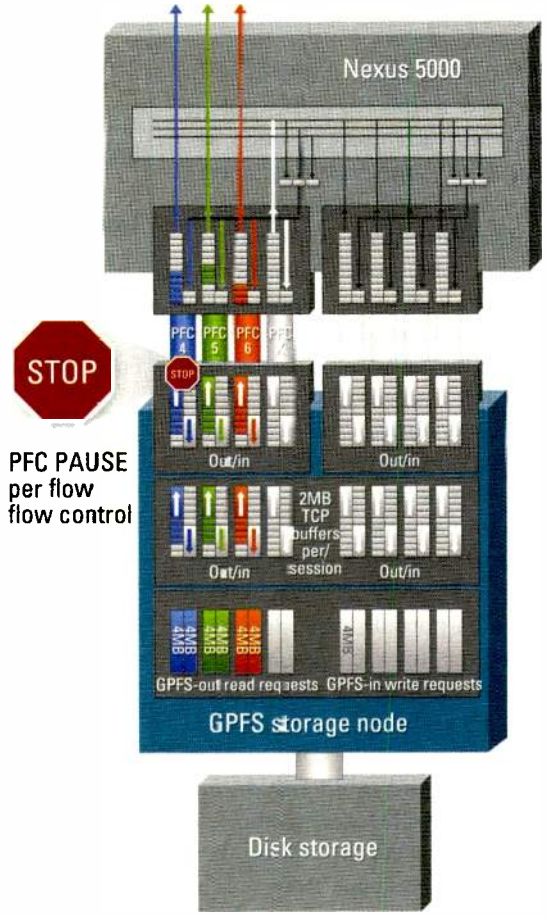


Figure 4. PFC implemented in the DCB-based WARP cluster

compared with FC or even IB; however, the fundamental effects of traffic interference remain. (See Figure 3.)

As shown, when multiple NAN nodes read traffic from the storage nodes, each storage node responds with large bursts of media traffic toward each requesting NAN node (depicted as different colors). At the converged network adapter (CNA) network interface of the storage node, the bursts are queued in the network interface buffer. These frames are sent to the switch (shown here as a Cisco Nexus 5000), where they end up in a single ingress queue buffer. Because 802.3x PAUSE link flow control is configured, the link sends a PAUSE frame to the storage node once the high threshold of the buffer is reached, thereby avoiding frame loss.

In this example, three different NAN nodes are reading frames out of this buffer and also from the other storage nodes. This limits the total reading bandwidth on this port to only 75 percent of the incoming traffic throughput. Hence, the buffer fills up, and the PAUSE mechanism kicks in. If, because of the bursty nature of the traffic per flow, the filling of the switch port buffer is not equally distributed over the three different "colors," one of the colors (or traffic flows) can be depleted by the simultaneously reading NAN nodes before the buffer reaches its low threshold and unpauses the link. When this happens, no frame from the depleted color is available, resulting in a "read-miss" of the NAN node and a drop in efficiency. The issue continues until the link is unpaused and frames of the missing color are again provided out of the network interface queue of the storage node. This efficiency loss can cause significant performance degradation in the network. Fortunately, there is a solution to this dilemma.

Priority flow control

DCB provides another, more advanced flow control mechanism: PFC. IEEE 802.1Q defines a tag that contains a three-bit priority field, allowing engineers to assign priorities to different Layer 2 traffic flows. With PFC, the network can be configured to pause traffic labeled with a specific priority (or "p-value") independent of the other traffic. The mechanism works the same way as 802.3x PAUSE but selectively, per traffic class, instead of pausing the whole link at once. Effectively, each traffic class gains its own independent buffers and pause mechanism.

Whereas an 802.3x DCB WARP cluster will have traffic interference at oversubscribed ports, PFC can link different priorities to the traffic flows between two specific nodes of the storage cluster, allowing engineers to implement flow control for each distinctive traffic flow. (See Figure 4.) Ultimately, this solution eliminates traffic interference.

Consider again the situation shown

in Figure 3, in which multiple NAN nodes read traffic from the storage nodes and each storage node responds with large bursts of media traffic toward each requesting NAN node (again depicted as different colors). This time, however, each flow between a distinctive source-destination pair is labeled with a different priority value.

With PFC activated on the CNA, each p-value-labeled flow has a separate buffer in the network interface, and the bursts are queued into the dedicated network interface buffer for each respective color. On the other side of the link, the Nexus 5000 DCB switch port also uses dedicated queue buffers for each p-value, providing for separate sending and receiving queue buffers at both ends of the link for each color. Frames are picked in a round-robin fashion out of the different CNA queues and sent over the link, where they fill up their respective ingress queue buffers of the switch port.

In Figure 4, three different NAN nodes read frames out of the buffers for their respective colors, and also from the other storage nodes, once again filling the buffers. This time, the PFC PAUSE mechanism kicks in. Now, because each flow fills its own buffer independently, the switch can send a selective pause-frame to the server when necessary, pausing only one traffic flow without interfering with others. At the same time, the independent flow control mechanisms for each flow keep enough frames available in the independent receiving switch port buffers for each color.

Hence, none of the streams are depleted by the simultaneously reading NAN nodes, and the reading links continuously operate at maximum efficiency. As long as each storage-NAN server pair has an independent priority value and queue, no traffic interference occurs. Throughput scales linearly as the cluster is scaled, and the storage cluster network achieves 100-percent efficiency.

		Linux 802.3x DCB-based cluster			
		Read (Gb/s)	Percent single node	Write (Gb/s)	Percent single node
One NAN node	One stream (dd)	10	100	10	100
	Four streams (dd)	9.9	100	10	100
Two NAN nodes	One stream (dd)	16.3	82	17.1	86
	Four streams (dd)	16.3	82	17.8	89
Three NAN nodes	One stream (dd)	20.3	68	23.3	78
	Four streams (dd)	20.3	68	21	70
Four NAN nodes	One stream (dd)	24.2	61	24.2	61
	Four streams (dd)	24.3	61	24	60

Table 1. Test results for Linux 802.3x-enabled, DCB-based WARP cluster

		Linux PFC DCB-based cluster			
		Read (Gb/s)	Percent single node	Write (Gb/s)	Percent single node
One NAN node	One stream (dd)	10	100	9.9	100
	Four streams (dd)	10	100	10	100
Two NAN nodes	One stream (dd)	19.9	100	19.9	100
	Four streams (dd)	19.9	100	19.9	100
Three NAN nodes	One stream (dd)	29.9	100	29.8	100
	Four streams (dd)	29.9	100	29.8	100
Four NAN nodes	One stream (dd)	36.1	91	39.5	99
	Four streams (dd)	37.6	94	39.9	100

Table 2. Test results for Linux PFC-enabled, DCB-based WARP cluster

		Windows 802.3x DCB-based cluster			
		Read (Gb/s)	Percent single node	Write (Gb/s)	Percent single node
One NAN node	One stream (dd)	10	100	9.9	100
	Four streams (dd)	10	100	9.9	100
Two NAN nodes	One stream (dd)	16.2	81	17.3	87
	Four streams (dd)	16.2	81	16.5	83
Three NAN nodes	One stream (dd)	19.6	65	20.8	70
	Four streams (dd)	19.9	66	20.6	69
Four NAN nodes	One stream (dd)	22.6	57	23.5	59
	Four streams (dd)	23.1	58	23.4	59

Table 3. Test results for Windows 802.3x-enabled, DCB-based WARP cluster

Testing PFC

Our laboratory performed comparative tests between 802.3x- and PFC-enabled WARP clusters for both Linux and Windows NAN nodes. The tests included single-stream throughput to/from one to four NAN nodes and multiple (four) streams to/from one to four NAN nodes (for a more even saturation of the link bandwidth), independently verifying the efficiency for both reading and writing.

Tables 1 and 2 provide the results for the Linux cluster. The "percent single node" column compares the throughput per NAN node with the throughput obtained when using a single NAN node only. Tables 3 and 4 provide the results for the Windows cluster.

Conclusion

These results clearly demonstrate both the substantial impact of traffic interference on media storage networks and the extraordinary

		Windows PFC DCB-based cluster			
		Read (Gb/s)	Percent single node	Write (Gb/s)	Percent single node
One NAN node	One stream (dd)	10	100	9.7	100
	Four streams (dd)	10	100	9.8	100
Two NAN nodes	One stream (dd)	19.9	100	19.4	100
	Four streams (dd)	20	100	19.5	100
Three NAN nodes	One stream (dd)	29.9	100	28.7	99
	Four streams (dd)	29.9	100	28.8	98
Four NAN nodes	One stream (dd)	36.3	91	37.3	96
	Four streams (dd)	37.1	93	37.7	97

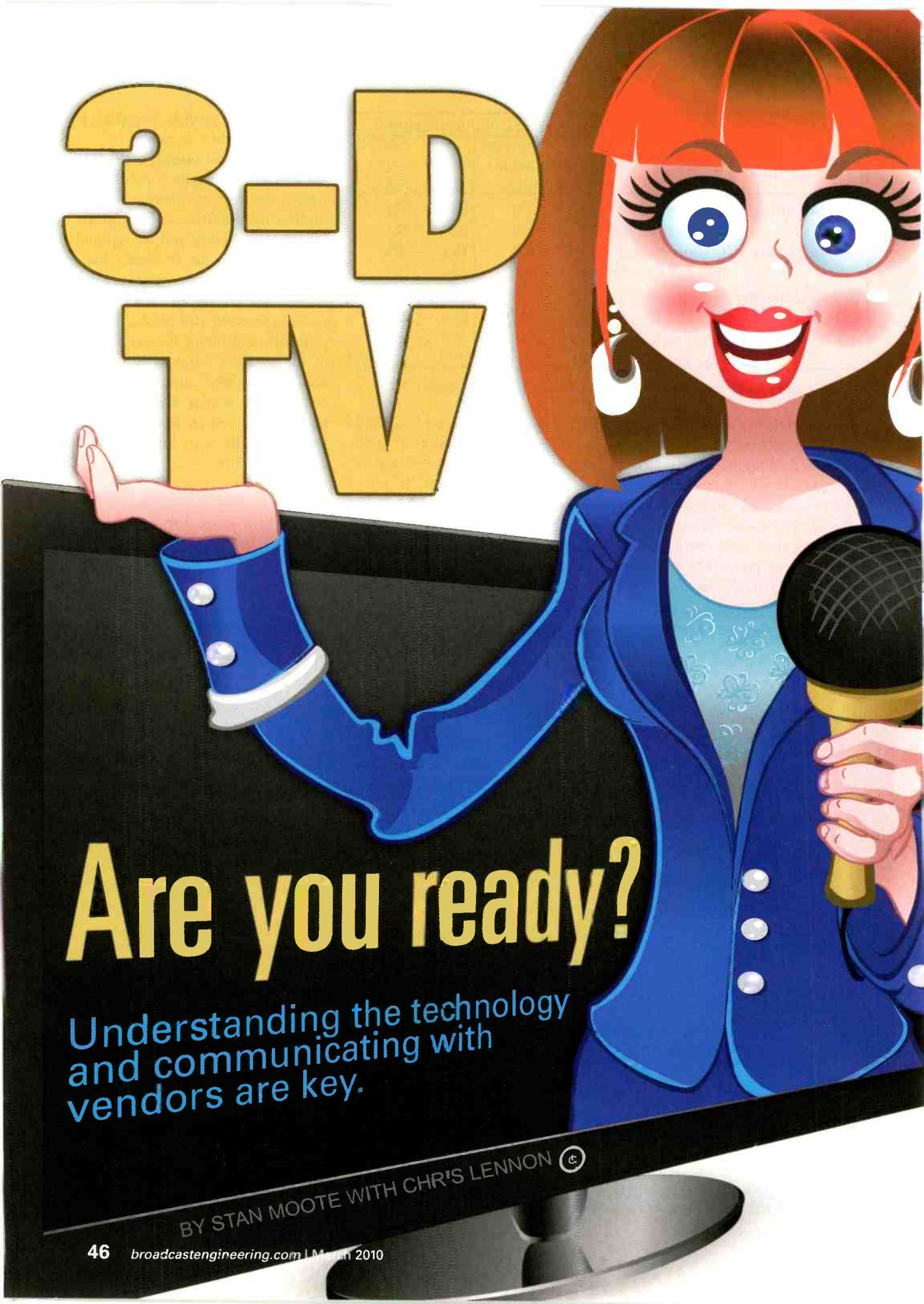
Table 4. Test results for Windows PFC-enabled, DCB-based WARP cluster

improvements in scalability and network bandwidth use when using PFC. In the 802.3x clusters, traffic interference causes a performance drop of up to 40 percent when using four NAN nodes simultaneously. The same traffic interference and performance drop has been previously measured in IB-based WARP clusters. When PFC is enabled, however, no traffic interference is observed at all. (The small performance drop when reading from four NAN nodes is caused by the fact that the file system can't launch prefetches for reading requests aggressively enough to overcome the statistical response fluctuation of the storage system when running continuously at full throttle. This effect is not observed when writing.)

The test proved unequivocally that the PFC-enabled cluster network can sustain 100-percent efficiency at continuous full throttle — demonstrating ideal scalability and an optimal storage solution for IP media environments. Windows performance is only marginally less than Linux performance but still displays linear scalability and almost 100-percent use of the available bandwidth. Clearly, the PFC-enabled cluster network outperforms similar IB-based cluster architectures in both throughput (especially for Windows) and linear scalability. BE

Luc Andries is a senior infrastructure architect and storage and network expert with VRT-medialab, the research and development arm of Flemish public radio and TV broadcaster VRT.

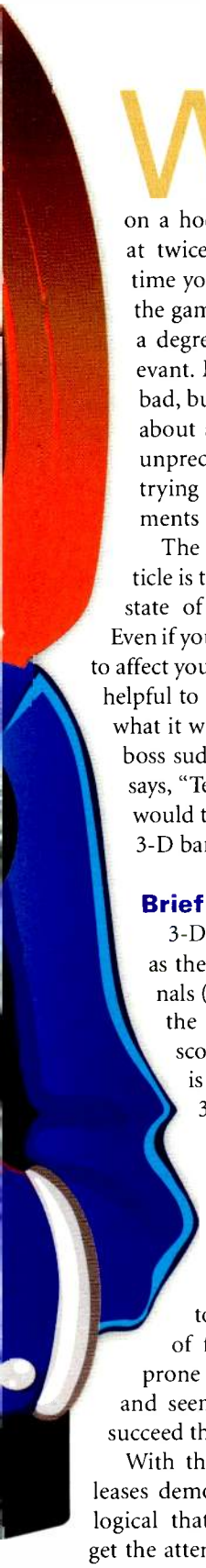
3-D TV



Are you ready?

Understanding the technology and communicating with vendors are key.

BY STAN MOOTE WITH CHRIS LENNON



Writing about 3-D is a bit like trying to do play-by-play commentary on a hockey game being played at twice normal speed. By the time you comment on one play, the game has moved on to such a degree that it's already irrelevant. Maybe it's not quite that bad, but it is a challenge to talk about a topic that's moving at unprecedented speed, while trying to ensure your comments remain relevant.

The main purpose of this article is to help you consider your state of readiness for 3-D TV. Even if you don't think this is going to affect you any time soon, it will be helpful to have an appreciation for what it will take if and when your boss suddenly comes to you and says, "Tell me right now what it would take for us to hop on this 3-D bandwagon!"

Brief background

3-D TV can be characterized as the distribution of two signals (left eye and right eye) to the viewer, so that a stereoscopic view of the content is achieved. The current 3-D movement comes, naturally, out of cinema. The reason it's different from previous, abandoned attempts at 3-D is largely due to cinema's (and TV's) move to digital. Today's 3-D is of far superior quality, less prone to audience discomfort and seems much more likely to succeed than previous attempts.

With the clear ROI for 3-D releases demonstrated by studios, it's logical that this movement would get the attention of those producing and distributing content to TV viewers. Add to that the release of 3-D Blu-ray players and titles to consumers, upcoming cable and satellite 3-D offerings, and the onslaught of 3-D TVs — many at relatively low incremental cost to consumers over traditional HDTVs — and you have something that seems to have many of the ingredients for success.

Content drivers

Those in the TV business who specialize in sports and movie content are the first to embrace 3-D TV. Big sporting events and feature films have appeal in 3-D that goes well beyond other TV fare. For viewers, donning glasses to watch special events like these seems reasonable, but expecting them to put on and take off glasses for everything under the sun may be unrealistic. So, if you specialize in news and typical TV series, you may not have to worry as much about 3-D content today as others will, but never say never.

Let's clear up some confusion

One of the areas of frustration for broadcasters at this point is the confusion surrounding the various 3-D technologies. A quick survey of that landscape shows why 3-D can be bewildering.

The 2-D + Difference approach, which has enjoyed success in gaming and other areas, involves taking a traditional 2-D picture and adding metadata describing the difference (or depth) between the left eye and right eye view to allow TVs to render the second eye view. Blu-ray is going with MPEG's MVC (Multiview Video Coding) extension of H.264/MPEG-4 AVC, which supplements a traditional 2-D view with metadata, enabling the construction of the second eye view. This provides full-resolution pictures for each eye. Of course, bandwidth isn't as much of a consideration for Blu-ray as it is for other distribution media.

Frame-compatible approaches, such as over-under and side-by-side are favored by cable and satellite providers. There are others, such as line interleave, column-interleave and checkerboard, but those don't seem to be enjoying the uptake of the other two. Frame-compatible approaches make sense for distribution media with limited bandwidth (our current HD distribution pipes).

Frame-sequential approaches, which are based on every other frame being targeted at a different eye, offer full HD resolution — but at a cost. This is the format of choice for lower-cost displays, utilizing active shutter glasses, but doesn't make sense for early distribution of broadcast material.

Today's 3-D is of far superior quality and seems much more likely to succeed than previous attempts.

An easy trap to find yourself in if you're a TV person trying to sort through all of this is a tendency to confuse the transmission and display formats with the formats used to handle 3-D internally in the plant. The format used in production, post production and processing in your facility need not match that used in transmission or viewing.

Here's an example. The viewer may watch the content with a frame-sequential display running at 120Hz (or faster) with active shutter glasses. The signal may reach him via satellite in a frame-compatible, side-by-side format. However, the program may have been recorded as two distinct full HD streams and handled internally in the broadcast plant as two streams. Decoding one 3-D format and encoding it into another is just as routine as moving from any 2-D format to another, so be careful to decouple the emission and display format used from that applied in the production and transmission facilities.

Since many are still reeling from a recent investment in a digital infrastructure, expecting them to undergo another plant upgrade — replacing all the associated gear with special 3-D gear — is unrealistic in many cases. It is for this same reason that cable and satellite operators currently favor frame-compatible 3-D TV approaches. They may not be full HD for each eye (as they must drop half the resolution, either vertically or horizontally, to fit two views into a single frame), but these approaches allow stereoscopic content to be handled by existing infrastructure with mostly minor upgrades. And reduced resolution or not, it looks pretty darned good.

However, these frame-compatible approaches seem unlikely to be adopted internally by broadcasters, as lost resolution in the plants is something most will try to avoid. Alternatives, such as 2-D + Difference, which is now touted as requiring only a 35 percent increase in bandwidth and MVC, seem to be interesting approaches to dealing with identical 2-D and 3-D content (since 2-D + Difference and MVC are 2-D- and 3-D-compatible in a single stream and full resolution for each eye). At the moment, however, it would seem more likely that they'll instead use two full HD streams internally.

Practically, we should think about 3-D TV in a similar fashion to SD and HD signals — with just a few exceptions. Figure 1 shows a typical 3-D workflow.

What action is the standards world taking?

Just as it is across the media industry in general, 3-D is a big deal these days in virtually every related standards development organization. Different organizations have different perspectives and plays in the world of 3-D, and this is reflected in their current activities.

A few of interest include:

- *3D@Home Consortium.* This organization has several steering teams, focusing on everything from creation, all the way to display of 3-D content.
- *ATSC.* Although 3-D initially fell within the scope of future work, at least one ATSC country is expecting to hold trials of 3-D over-the-air broadcasting later this year.
- *CEA.* As consumer electronics manufacturers roll out a wide array of 3-D TV equipment (including Blu-ray players), the CEA has been a leader in this area. It has led several consumer surveys and has a 3D Task Force under way.
- *DVB.* With a new group recently formed, DVB is looking at 3-D potential for its constituent countries. We can expect more news here very soon.
- *ITU.* This organization is looking far beyond the stereoscopic 3-D that much of the industry is now focused on. It considers the current work to be only the first of a three-phased implementation of 3-D TV, culminating in holographic television.
- *MPEG IF.* Its new 3DTV Working Group is studying some interesting topics, including support of 2-D/3-D ad insertion.
- *SCTE.* SCTE formed a 3D Working Group that has been quite active for some time already, and is working closely with CableLabs on cable-specific considerations in the area of 3-D.
- *SMPTE.* Following publication of its 3D Task Force report, SMPTE has working groups studying issues in the following areas: 3-D image format, graphics, subtitles and metadata. Output from these groups is anticipated in mid-2010.

Post production

There is no question that preserving the two streams in the highest quality possible is most important — mezzanine I-frame compression only. As for monitoring the use of 3-D TV content, active shutter glasses should be used with full-bandwidth video into the monitor.

In plant

Ideally, 3-D TV video within a broadcast facility will match up with the HD plant format. The left eye and right eye streams will be 1080i or 720p on a single 3Gb/s or two 1.5Gb/s coax. Certainly running on a single 3Gb/s coax has several advantages, similar to the change from mono into stereo audio (matched timing, switching and processing).

Compression for storage is a touchy subject. Longer GOP compression is being used more and more for HD quite successfully. There are always compression artifacts; however, in 3-D TV, we need to ensure that the artifacts are the same on both the left and right channels. Practically speaking, the only way to ensure this is to use higher compression bit rates than typically used for HD.

Usually, several channels are run together within a facility, and this makes keeping an eye on several monitors on the same wall difficult

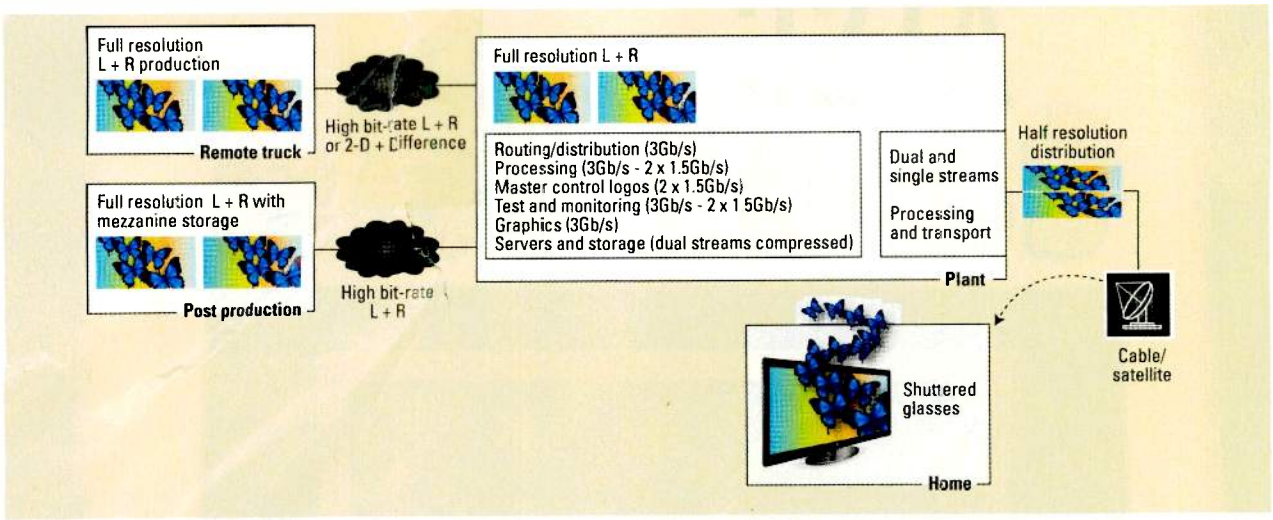


Figure 1. A typical 3-D workflow shows how involved the process must be for 3-D to reach home televisions.

to impossible using active shuttered glasses. Monitor walls and multiviewers are best suited for passive polarized glasses.

Contribution

Whether the 3-D TV content is backhauled from an event or being sent out to affiliates, preserving the left and right eye channel is of prime importance. Naturally, dark fiber is the best option, running at 3Gb/s. The next best options are using two streams with a synchronized MPEG higher bit rate encoding process or the higher bit 2-D + Difference approach mentioned earlier.

Distribution

Ultimately, we will see 2-D + Difference or some other full-resolution approach to 3-D for distribution in the long term. As long as the bandwidth concerns can be dealt with, it would seem logical that most broadcasters and consumers would, given a choice, prefer full HD for each eye.

For now, however, that isn't going to happen, as current cable and satellite paths and STBs will be used. The best approach is squeezing the video by half and putting left and right channel adjacent within the same stream.

A 3Gb/s infrastructure will be a great investment for your future ability to handle 3-D video.

This is most commonly done either side by side, or one above the other. As this preserves the frame (and field) nature of the video, it can go through today's compression engines and links generating the same artifacts on both channels. The aforementioned details are summarized in Table 1.

Are you ready now?

We hope this article increased your awareness of some of the technologies being used for 3-D today, as well as into the future. We also hope it cleared up some misconceptions and confusion about 3-D, and its potential impact on your plant.

The main lesson here is that a 3Gb/s infrastructure will be a great investment for your future ability to handle 3-D video. Talk with your primary vendors and inquire about the readiness of the products you use to handle 3-D. In some cases, they may be ready now. In others, an upgrade may be needed. Replacement of equipment won't be required in many cases.

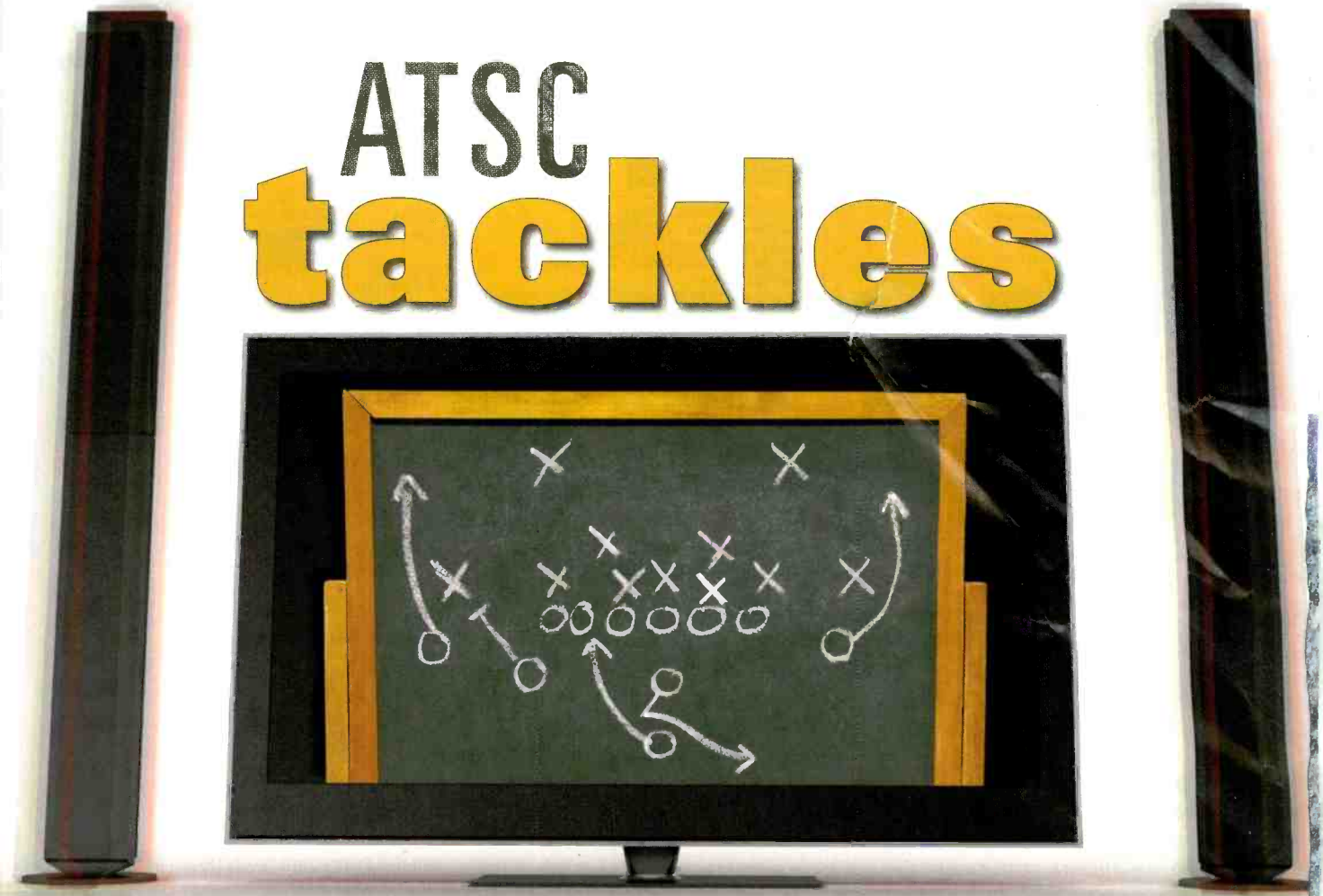
Key takeaways on 3-D TV? Understand the technology, talk to your vendors, and be ready for that day when the boss walks in and asks the dreaded 3-D question ... ! BE

Stan Moote is vice president of corporate development and Chris Lennon, CTO Group, for Harris Broadcast Communications.

	Production	In plant	Contribution	Distribution
Format	Dual stream	Dual stream	Dual stream or 2-D + Difference	Half resolution (adjacent)
Compression	Mezzanine	Mid-high bit rates	Higher backhaul rates	Today's HD to the home bit rates
Display types	Active shutter glasses	Passive polarized glasses		Active shutter glasses (home)

Table 1. Format, compression and display types vary at different stages in 3-D workflow.

ATSC tackles audio loudness



BY JIM STARZYNSKI AND J. PATRICK WADDELL

The ATSC has published a new Recommended Practice (RP) that addresses the large variation in loudness among programs, commercials and other interstitial elements. The new document is A/85, "Techniques for establishing and maintaining audio loudness for digital television." A/85 covers all facets of the audio delivery system, from implementation of the key ATSC standards to mix room monitoring and the consumer experience. It also includes "Quick Reference Guides" to get operators and content creators up to speed on critical information, as well as links to audio test signals that can be used for monitoring environment setup.

Loudness variations

Despite the conclusion of the DTV transition, many broadcasters and the production community have been slow to effectively adapt to the changes required to transition from analog NTSC audio techniques to contemporary digital audio practices. With digital television's expanded aural dynamic range (over 100dB) comes the opportunity for excessive variation in content when DTV loudness is not managed properly.

Consumers do not expect large changes in audio loudness from program to interstitials and from channel to channel. Inappropriate use of the available wide dynamic range has led to consumer complaints, which eventually reached Congress.

The NTSC analog TV system uses conventional audio dynamic range processing at various stages of the signal path to manage audio loudness for broadcasts. This practice compensates for limitations in the dynamic range of analog equipment and controls the various loudness levels of audio received from suppliers. It also helps smooth the loudness of program-to-interstitial transitions. Though simple and effective, this practice permanently reduces dynamic range and changes the audio before it reaches the audience. It modifies the characteristics of the original sound, altering it from what the program provider intended to fit within the limitations of the analog system.

The AC-3 audio system defined in the ATSC digital television standard uses metadata, or data about the data, to control loudness and other audio

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parameters more effectively without permanently altering the dynamic range of the content. The content provider or DTV operator encodes metadata along with the audio. From the audience's perspective, the dialog normalization (dialnorm) metadata parameter sets different content to a uniform loudness transparently. It achieves results similar to a viewer using a remote control to set a comfortable volume between disparate TV programs, commercials and channel-changing transitions. The dialnorm and other metadata parameters are integral to the AC-3 audio bit stream.

It is important for the digital television system to provide uniform subjective loudness for all audio content. Consumers find it annoying when audio levels vary between channels and on a single channel. Dialog, the spoken word, has been identified as the element that audiences typically adjust their volume to. Achieving an approximate match for average dialog level from all content is a desirable goal. While the AC-3 audio specifications in ATSC Standard A/52, "Digital Audio Compression (AC-3, E-AC3) Standard," provide syntax that makes this goal achievable, system implementation in the real world has proven more difficult than expected.

Addressing the loudness issue encompasses several elements, which include mixing; monitoring; and proper encoding of local and network programs, commercials, promos and other content. The S6-3 study group explored all facets of DTV loudness, with a goal to identify problem areas and recommend practical solutions.

The industry has recognized that a new proficiency in loudness measurement, production monitoring, metadata usage and contemporary dynamic range practices is critical for meeting the expectations of the content supplier, the broadcaster, the audience and governing bodies.

The AC-3 audio system

The ATSC AC-3 audio system intends to deliver a reproduction of the original (unprocessed) content at the output of the AC-3 decoder in a receiver, normalized to a uniform loudness. It provides the ability for broadcasters to allow each listener the freedom to exert some control over the degree of dynamic range reduction, if any, that best suits his or her listening conditions.

The metadata parameter dialnorm is transmitted to the AC-3 decoder along with the encoded audio. The value of the dialnorm parameter indicates the loudness of the anchor element of the content. The dialnorm value of a very loud program might be 15, and of a soft one, 27. There is an attenuator at the output of the AC-3 decoder that applies appropriate attenuation to normalize the content loudness so all content is normalized to the same level without compromising dynamic range.

If the dialnorm metadata parameter accurately reflects the overall loudness of the content, then listeners will be able to set their volume controls to their preferred listening (loudness) level and will not have to change the volume when the audio changes from program to advertisement and back again. If all broadcasters use the system properly, the loudness will also be consistent across channels.

There are three methods of using audio metadata: fixed, preset and agile. Any one of these approaches will deliver consistent loudness to the listeners. A broadcaster should use the method that best suits its operational practices. Whichever approach is selected, the system depends on transmitting a value of dialnorm that correctly represents the loudness of the content, which depends in turn on accurate measurements.

Loudness measurement

Because loudness is a subjective phenomenon, human hearing is the best judge of loudness. When combined with a known mixing environment, experienced audio mixers using their sense of hearing can produce a program with remarkably consistent loudness. If all programs and commercials are produced with consistent loudness — and if the loudness of the mix is preserved through the production, distribution and delivery chain — listeners will not be subjected to annoying changes in loudness within and between programs.

When measuring audio signals, there are two key parameters of interest: the true peak level of the signal and its loudness. The true peak measurement enables the mixer to protect the program from clipping, and the loudness measurement allows the mixer to protect the listener from annoying variations in loudness. Although the mixer balances a mix using his or her hearing, an objective loudness measurement helps to maintain consistent loudness within and between programs.

The familiar VU and PPM meters measure neither the loudness nor the true peak levels of the signal. The characteristics of many of the common electronic meters available are unknown, and contribute to the inconsistent and confusing situation found in practice today.

The A/85 RP provides guidance that, if followed, will result in consistency in loudness and avoidance of signal clipping. The specified measurement techniques are based on the loudness and true peak measurements defined by ITU-R Recommendation BS.1770, "Algorithms to measure audio program loudness and true peak audio level."

Loudness is measured by integrating the weighted power of the audio signals in all channels over the duration of the content. The general structure of the algorithm is shown in Figure 1.

The BS.1770 method was validated in listening tests by comparing its results to the relative subjective loudness of mono, stereo and multichannel program material. Measured loudness is reported as Loudness K-weighted Full Scale (LKFS). A unit of LKFS is the same measure as a decibel. A -15 LKFS program can

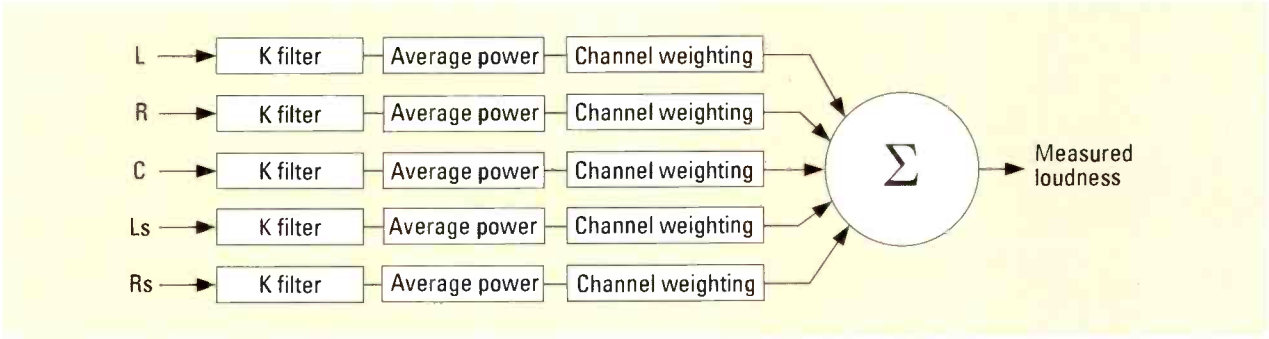

Figure 1. ITU-R BS.1770 loudness algorithm

be made to match the loudness of a quieter -22 LKFS program by attenuating it by 7dB.

The loudness of the anchor element (often dialog, for long-form programs, a global measure for short-form content, e.g. commercials) of the mix is used as the proxy for the overall loudness of the content. Accurate measurement of the loudness of the anchor element is necessary to allow operators to deliver content to listeners at consistent loudness levels.

Target loudness

With input from members representing various disciplines and following considerable discussion by the S6-3 committee, it was decided that for delivery or exchange of content without metadata (and where there is no prior arrangement by the parties regarding loudness), the target loudness value should be -24 LKFS. Minor measurement variations of up to approximately ±2 dB of this value are anticipated due to measurement uncertainty and are acceptable. Content loudness should not be targeted to the high or low side of this range.

Metadata management considerations

An AC-3 encoder allows users to set up to 28 metadata parameters concerning the characteristics of the accompanying audio in the bit stream. The parameters can be classified in three groups:

- *Informational metadata.* This

For operators using a fixed dialnorm system	a) Ensure that all content meets the target loudness and that long-term loudness matches the dialnorm value; and/or b) Employ a file-based scaling device to match long-term loudness of nonconformant file-based content to the target value; and/or c) Employ a real-time loudness-processing device to match the loudness of nonconformant real-time content to the target value.
For operators using an agile dialnorm system	a) Ensure that during program production, post production or ingest content is measured and labeled with the correct dialnorm value matching the actual loudness of the specific content; and/or b) Employ a file-based measurement and authoring device to set dialnorm to the average loudness of the specific content; and/or c) Employ a real-time processing device to match content to a specific loudness. Apply a dialnorm value, matching the loudness of all content processed by this device.

Table 1. Large loudness variation during transitions can be effectively managed by ensuring dialnorm properly reflects the dialog level of all content.

includes seven optional parameters that can be used to describe the encoded audio. These parameters do not affect encoding or the decoded listening experience in the home.

- *Basic control metadata.* This includes 19 parameters that determine the dynamic range compression, downmixing, matrix decoding and filtering used in certain operating modes of the professional encoder and consumer decoder. Optimizing the setting of these parameters for each program may enhance the listening experience under varying listening conditions and with certain content types. However, default values may be used without detriment to the listening experience.
- *Critical control metadata.* This includes two parameters that are critical for proper encoding and decoding. The first is channel mode (acmod), which should be chosen correctly to engage proper channel formatting in the decoder to match the content. Improper use of this parameter may alter a transmission and cause the loss of dialog when encoding a 5.1 program, for example, encoding a 5.1 channel soundtrack with 2/0 metadata. The second is dialog level (dialnorm), which the DTV Standard (A/53) requires to be set correctly to prevent potentially severe loudness variation during content transitions on a channel and when channel changing across the DTV dial. Incorrect dialnorm values can lead to a variation in loudness as large as 30dB.

The requirement for accurate dialnorm, channel mode (acmod) and other metadata can be met in three different ways, at the discretion of the operator:

- *Fixed metadata.* The AC-3 encoder dialog level is fixed to a single value, and the content dialog levels are conformed to that setting.
- *Preset metadata.* AC-3 encoder presets are programmed, each with different dialnorm values and engaged via a general purpose interface (GPI) or other control interface.
- *Agile metadata.* The AC-3 encoder is configured to receive external metadata. An upstream agile dialnorm metadata system may be used to deliver dynamically changing dialnorm values to the encoder, corresponding to the changing loudness at the content boundaries.

When managed properly, all three methods provide a compliant and acceptable end result for the consumer. It is also possible for the operator to apply a hybrid approach, choosing one of the methods for loudness management and a different method for the remainder of the metadata. For example, the user might maintain a fixed dialnorm value but switch the channel mode as required.

Controlling program-to-interstitial loudness

The AC-3 audio system incorporates the necessary technology to mitigate variations in loudness during program-to-interstitial transitions. Effective solutions are listed in Table 1.

There are notable conditions that may adversely impact program-to-interstitial transitions at content boundaries, such as when:

- Content suppliers often increase dramatic impact by using program dynamics and manipulating loudness to achieve a desired audience effect. This is sometimes done at the end of program segments going into a commercial break.
- An extreme variation outside of the comfort zone may cause a listener to adjust the volume to compensate for the large, temporary change in loudness. When a scheduled commercial or promo plays going into or out of breaks, the listener may need to readjust the volume yet again to achieve an acceptable setting for the short-form content. This has proven to be an annoyance to the audience.

Dynamic range management

The DTV audio system is capable of delivering wide dynamic range (the range between the softest and loudest sounds.) Content producers often take advantage of dynamic range as one of the methods to convey artistic intent.

However, there could be a conflict between the desire of the content producer to deliver content with wide

dynamic range and the audience who cannot, or chooses not to, enjoy the wider dynamic range. This could be caused by the inability of the viewer's equipment to reproduce the desired range of sounds, or the lack of an environment suitable to the enjoyment of the wide dynamic range. Thus, the goals of preserving the original dynamic range of the content and satisfying viewers can often be at odds.

A goal of the AC-3 system is to provide content producers with the greatest freedom and flexibility in the choice of dynamic range control (DRC) when producing content. The AC-3 system conveys these DRC options to the viewer, where the DRC system will interact with the viewer's input in a known and repeatable fashion.

There are several methods for controlling dynamic range. Some methods apply prior to audio encoding, some apply after decoding, and some span both domains. One approach is traditional compression and/or limiting, where gain control is applied to the audio prior to encoding. Another approach is to use the AC-3 coding system, which generates gain control words during encoding but does not apply the gain control to the audio until after decoding. This allows a user to optionally choose how much dynamic range they desire.

The primary difference between the two approaches is that the AC-3 approach is reversible, and the other approach is not. A hybrid of the two methods is also possible, allowing for some permanent and some reversible processing to be combined in a balance determined by the broadcaster.

Awareness and education

The ATSC recognized that developing the Recommended Practice on audio loudness is an important step, but that ongoing education on the recommendations contained in the document will be critical to effectively addressing the loudness problem. Accordingly, the ATSC has embarked on an aggressive educational effort. This article is one element of this work; educational seminars are another. The ATSC has held two events so far, one on Nov. 4 in Washington, D.C., and another on Feb. 16 in Rancho Mirage, CA. The February seminar was timed to be adjacent to the 2010 Hollywood Post Alliance Technology Retreat. At the NAB convention next month, the ATSC will set up a demonstration area where loudness control techniques can be observed. BE

Jim Starzynski is principal engineer and audio architect at NBC Universal, and J. Patrick Waddell is the technical marketing manager, Standards & Regulatory, Harmonic.

PREVIEW

A winning combination!

Each year, the *Broadcast Engineering* staff provides a guide full of comprehensive coverage to help you make the most of the NAB Show. This manual is meant to serve as your ultimate resource for hitting the NAB jackpot! First, we announce the winners of our Excellence Awards competition. We'll recognize these facilities at the NAB Show for their achievement in each of eight categories. Next, our exhibit hall map will help you find your way through the maze of booths. And finally, browse through more than 25 pages of product descriptions and photos to build your ultimate shopping list. Whatever you're looking for at this year's show, we wish you the best of luck in finding it!

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

The BroadcastEngineering 9th annual Excellence Awards

Note from the editor

This year there were 40 entries in *Broadcast Engineering's* Excellence Awards contest.

The winning entries were selected based on more than 30,000 votes we received from our readers on the Web site.

Congratulations to all the entrants in this year's contest. You represent the highest quality in television, production and network technology. To see firsthand the equipment and solutions used by these leading facilities, visit the NAB booths of the vendors described in the stories. For directions to each vendor's booth, check out our extensive NAB map, which begins on page 67.

Brad Dick

Brad Dick
Editorial Director

New studio or RF technology – station

WINNER: TV Globo TVDR..... 60

Submitted by GLOBO Comunicação e Participações SA

Runners-up: Oklahoma Educational TV Authority
Submitted by Axcera

WLII-TV and WSUR-TV
Submitted by AZCAR

New studio technology – network

WINNER: CBS..... 60

Submitted by Pilat Media

Runner-up: Trans Video Communications Studios' NET
Submitted by Broadcast Integration Services

New studio technology – HD

WINNER: WDSE-TV 62

Submitted by Heartland Video Systems

Runner-up: HSN
Submitted by Sony Electronics

New studio technology – nonbroadcast

WINNER: Rensselaer Polytechnic..... 62

Submitted by Ross Video

Runners-up:
Transportation Security Administration
Submitted by Professional Products Inc.

Oriole Park at Camden Yards
Submitted by Communications Engineering Inc.

Station automation

WINNER: Jewish Life TV..... 64

Submitted by Compix Media

Network automation

WINNER: Comcast Media Center..... 64

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Runner-up: Red Bee Media
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Newsroom technology

WINNER: NY1 News..... 66

Submitted by Azzurro Systems Integration

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Submitted by Grass Valley

Post & network production facilities

WINNER: Dome Productions 66

Submitted by AZCAR

Runners-up:
Adtext, The Mill
Submitted by Softel

Golf Channel
Submitted by Solid State Logic

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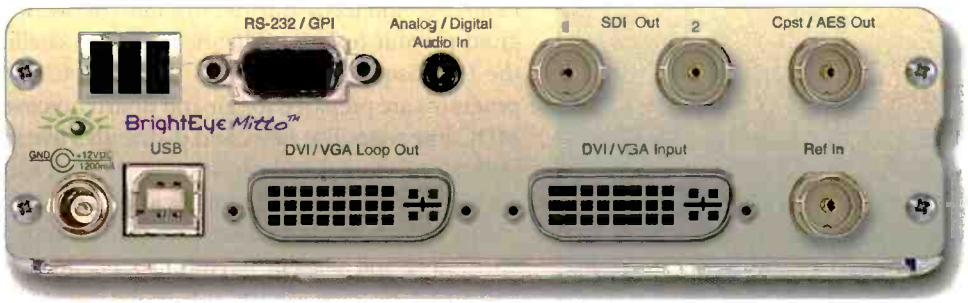

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Simply use your mouse to click and drag over the specific portion of computer video that you want to output. Whether you output the entire screen or just a selected portion, you'll be able to see exactly what you are doing. And timing the video output into your system is easy, too.

See you at NAB Booth N1929

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* *Mitto* - the Latin root word for *Transmit* and *Uncompromising*

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TV Globo

Winner of new studio or RF technology – station

Submitted by

GLOBO Comunicação e Participações SA

Runners-up:

Oklahoma Educational TV Authority
Submitted by Axcera

WLII-TV and WSUR-TV
Submitted by AZCAR

Digital terrestrial TV is being launched in Brazil with great success, reaching more than 65 million people in less than two years. However, Brazil is a huge country, and there are rural areas that will never be covered by terrestrial TV. Aiming to better serve the rural communities and digitize the analog satellite signal before analog technology becomes obsolete, TV Globo decided to develop a system targeted for rural areas based on GPS.

Project planning for TV Globo's Digital Television for Rural Areas (TVDR) began in 2005. Checking its location through a GPS module, the set-top box will only yield TV GLOBO's satellite signals in rural areas of Brazil.

In November 2009, this system launched in the Rio de Janeiro rural area and will subsequently be expanded throughout Brazil. TVDR will feature only one satellite national feed, but regional feeds will replace the national feed, region by region. A conditional-access system was developed for this project, linking geo-referenced maps to each regional feed. As each regional feed becomes available, the receivers located in the corresponding region will automatically choose it. If the location is outside Brazil, no signal will be decrypted.

To ensure the launch of the first signal in Rio de Janeiro, the technical team designed, integrated and tested the whole system in detail. The operational team was involved and trained throughout the process to facilitate the start of this new operation. The key components of the system are a conditional-access system from Nagravision, encoders and multiplexers from Cisco, a set-top box from Thomson, and a GPS module from Prime.

TVDR's project team developed a system that will benefit the population of rural areas with digital quality and lend to satellite transmissions the regional aspects of terrestrial TV, while helping to eliminate rights issues and preserve TV GLOBO's business model.

CBS

Winner of new studio technology – network

Submitted by

Pilat Media

Runner-up:

Trans Video Communications Studios' NET
Submitted by Broadcast Integration Services

CBS' new Media Distribution Center (MDC) in New York City replaces aging, tape-based legacy equipment in the current Broadcast Origination Center (BOC) with HD digital file server-based scheduling and playout technologies. The MDC handles up to 80 inbound feeds and 18 outbound network feeds for program playout to U.S. affiliates. Fiber and satellite links connect the 19,735sq-ft facility to CBS Television City in Los Angeles, where scripted programs are prepared for air and disaster recovery operations are located. The MDC integrates live news and distributes live sports programs with regionalization as required and can support content for new media platforms such as CBS Sportsline, mobile TV applications and VOD services.

Key objectives focused on automating and streamlining the workflow for scheduling and playout operations and minimizing the potential for errors. CBS turned to Pilat Media's Integrated Broadcast Management System (IBMS) for media management, program content scheduling and in-house technical facility scheduling.

By integrating its centralized, TV network enterprise-wide database and exploiting its integration capabilities with other systems, IBMS helps the MDC run at peak efficiency. Support for CBS' legacy systems enabled IBMS to provide a smooth, progressive migration path to MDC functionality. Broadcast-relevant data flows into the IBMS system from a wide variety of interfaces. Commercial and promo information are received from the CBS sales system. Program format and timing information are entered into IBMS. The system also takes in data from a separate sales traffic system for The CW Network.

Media management is helping CBS migrate to a tapeless environment. The system processes acquisitions, logging the details of material received into the system and manages ingest of that material to servers. It also manages the MDC tape libraries within a single integrated environment.

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WDSE-TV

Winner of new studio technology – HD

Submitted by

Heartland Video Systems

Runner-up:

HSN
Submitted by Sony Electronics

WDSE-TV, the PBS affiliate in Duluth, MN, and Heartland Video Systems started planning the rebuild of the WDSE master control room in 2008. At that time, WDSE's digital broadcast stream consisted of an HD rebroadcast from PBS, an SD rebroadcast of PBS Create, an SD channel that also fed the analog transmitter and the MN Channel. The primary goal of the project was to provide a functional master control switcher for all four services, as well as to make all of WDSE's content available on all services.

All content is ingested into the server in 1080i, switched through all the master control channels as 1080i and then cross- or downconverted just prior to encoding and transmission using Miranda XVP-1801 cards. While this approach could have increased the cost of the project, it actually reduced the overall cost. Because a majority of the equipment already in the facility allowed for the output format to be set as HD regardless of the source material, the need for format conversion was greatly reduced. The Bitlink IRDs for PBS were all reconfigured at no cost, and the TANDBERG RX1290 receivers were licensed for upconversion. The remainder of the SD equipment uses a small pool of AJA FS1s for upconversion. This concept also provided a natural level of redundancy for bypass switching because everything is in one format.

The existing Omneon server was upgraded with new HD media ports and a modest amount of additional storage. NVerzion's TeraStore provided 72TB of nearline storage to handle all the HD content. An Omneon ProBrowse proxy server allows remote monitoring of content, and Utah Scientific's MC-400 switchers are fully SD/HD configurable and were set up to switch in HD. All of WDSE's local programming is now being done in HD. The Snell Kahuna allowed for reconfiguration of its output to feed HD to WDSE. At the input side, it accepts SD or HD sources and transitions between the two.

Rensselaer Polytechnic

Winner of new studio technology – nonbroadcast

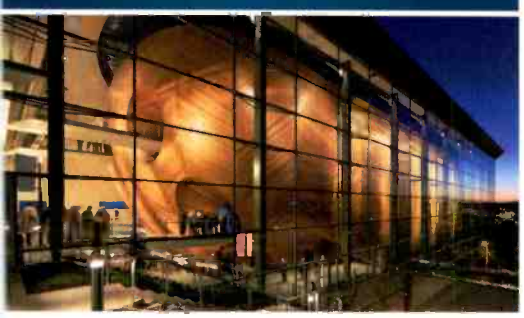
Submitted by

Ross Video

Runners-up:

Transportation Security Administration
Submitted by Professional Products Inc.

Oriole Park at Camden Yards
Submitted by Communications Engineering Inc.



Rensselaer Polytechnic Institute in Troy, NY, is one of the nation's oldest technological universities. Rensselaer founded the Curtis R. Priem Experimental Media and Performing Arts Center (EMPAC), a facility with next-generation presentation and production capabilities for art and science.

Rensselaer faced its biggest challenge by starting from a blank page in designing and implementing EMPAC. EMPAC's engineers, in concert with other EMPAC staff and representatives from Rensselaer, worked with team members from AZCAR, Audio-Video and product vendors.

EMPAC's space, equipment and workflow needed to be reconfigurable. With little turnaround, the concert hall may be used for a live orchestral concert for an audience of 1200, a lecture series, recording solo piano work, architectural acoustic research or hosting an independent film festival. Physically, all spaces are also designed with NC15 noise floor criteria, making them ideal for live performance, recording and research platforms.

There were many vendors involved in the building of EMPAC, and flexibility was key when it came to choosing every detail. This is the main reason Rensselaer chose Ross for the switcher. The Ross Video Vision 3 QMD-X multidefinition production switcher fit the budget while leaving room for features such as VTR control, aux keys and smart conversion.

EMPAC's A/V infrastructure embraces the very latest in broadcast, live performance, post-production and research technologies. It installed an extensive cable plant of single-mode fiber, Cat 6A F/UTP and other traditional and nontraditional cable technologies to tie all the building's venues together. By doing this, any activity can be easily centralized or decentralized.

Since opening its doors in 2008, EMPAC continues to impact students, researchers, artists and audiences with opportunities fostered by leading-edge science and engineering performance technology.

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Jewish Life TV

Winner of station automation

Submitted by

Compix Media

Jewish Life TV (JLTV) is a Los Angeles-based broadcast channel that reaches nearly 25 million viewers in the United States. In delivering high-quality programming to this audience, JLTV faces two challenges: producing professional presentations for viewers and offering attractive advertising opportunities and a high level of visibility for program sponsors. To meet these challenges, JLTV worked with systems integrator and consultant Jonathan Landman of Newcast to design and implement a facility with an emphasis on reliability and functionality at an affordable cost. One of the key requirements was the ability to display information from the Web as a live ticker on the screen plus the simultaneous integration of viewer and sponsor messages into these tickers.

The installation features the ProTrack TV scheduling traffic system and NVerzion automation system. The ProTrack system feeds the JLTV schedule to the automation software, which then automates the control of the 360 Systems Maxx video server for continuous spot, interstitial and program playback. NVerzion also controls Compix Media's branding, logo, ticker and text overlay system, which employs template-based branding and automates data entry to provide current, targeted graphical messaging.

When the system went live in October 2009, it gave JLTV a powerful tool for boosting ad sales and attracting new viewers. The Compix CynerG2 enables the JLTV staff to insert sponsor branding along with continuously updated news crawls at the bottom of the screen during regular programming, thereby bypassing the growing issue of viewers using DVR recording to skip interstitial, spot-based advertising. The facility is also using the CG system to insert custom messages from viewers in a secondary crawl, and this personalization of on-screen content along with programming and sponsor-driven content helps to engage and build JLTV viewership.

Comcast Media Center

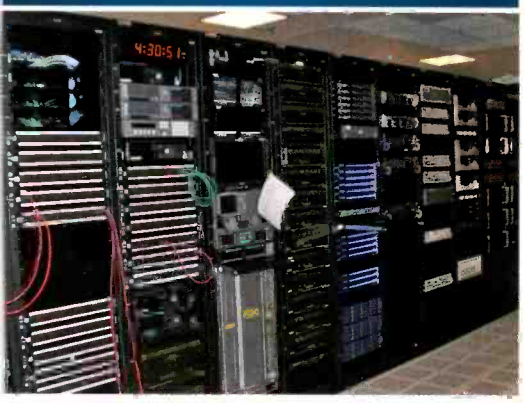
Winner of network automation

Submitted by

Diversified Systems

Runner-up:

Red Bee Media
Submitted by TSL



Versus has become one of the fastest-growing sports cable networks in the country. It is the exclusive cable TV home of the NHL, IndyCar Series, Tour de France, World Extreme Cagefighting andProfessional Bull Riders. It also airs college football from top conferences. Growing demands pushed the legacy system to the limits. The broadcaster launched a shared HD channel with sister network Golf Channel in December 2007, known as Versus/Golf HD. To accommodate its own dedicated HD Channel launched in December 2008, Versus needed its own network operations facilities.The broadcaster built its new network operations center within the Comcast Media Center (CMC) in Denver. With the amount of live events rapidly increasing, it needed a network operations and transmission facility to accommodate both HD and SD playout, as well as provide for the blackout requirements of the sports franchises.

The project had an aggressive schedule with only a few short months to design, build and cut over the master control and transmission systems within a greenfield space at CMC. After a thorough, competitive bid process, Diversified Systems was selected as the integrator for the project. Diversified was up to the challenge and brought the project in on time and on budget.

The system had to tie in seamlessly with the Versus Stamford, CT, file-based production facility. Using server technology from Omneon along with automation and asset management from Avid's Sundance Digital, Diversified and the team from the CMC created an efficient and highly reliable system that leverages the workflow established in production. The flow of the space and the adjacencies of the various functions such as master control, feed coordination, ingest and media prep were primary concerns in laying out the floor plan. After several revisions, the team created an environment where the operations staff could visually monitor the aforementioned functional areas from a centralized work area without unnecessarily disrupting the operators.

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Las Vegas Convention Center

BROADCAST SOLUTIONS • SERVICE PROVIDER SOLUTIONS • ROUTING • CONTROL & MANAGEMENT

NY1 News

Winner of newsroom technology

Submitted by

Azzurro Systems Integration

Runner-up:

WFTV-DT
Submitted by Grass Valley

NY1 News, Time Warner Cable's 24-hour news channel in New York City, is one of the most advanced newsgathering operations in the world. The station recently worked with Azzurro Systems Integration to upgrade and consolidate its master control environment. The consolidation allows the broadcaster to provide multiple distribution streams from a single master control area using three master switcher systems. All feeds are distributed in both HD and analog. HD feeds are converted to ASI streams and analog video and audio in the final stage prior to transmission. One feed carries normal NY1 News programming and is distributed to Manhattan, Bronx, Staten Island, Brooklyn and Bergen County, NJ. A second master switcher feeds a local insert to Queens, and the third system provides Spanish programming. Local ad insertion capability has been built into the system. Internal routing and distribution is accomplished via HD-SDI with embedded audio channels.

Programming for each feed is switched with an Evertz QMC-2 HD-SDI master switcher. The master switchers each control an Evertz Topaz 16 x 16 routing switcher, which provides subswitching for the program, preset, bypass and key feeds to the master switcher. Sources feeding the Topaz switchers include Omneon server ports providing inputs and outputs to and from a central storage system. The system has 16 bidirectional channels, 32 playout channels, and storage for 1250 hours of DV50 material and four audio channels. Additionally, an Omneon MediaDeck provides backup, central routing switcher outputs and additional sources. The MediaGrid active storage system provides 126TB of raw capacity using high-bandwidth content servers, 57TB of available storage with a replication factor of 2:2, and storage for 2035 hours of DV50 material and four audio channels. A Dalet Enterprise Edition automation system controls the server systems and switching.

Dome Productions

Winner of post & network production facilities

Submitted by

AZCAR

Runners-up:

Adtext, The Mill
Submitted by Softel

Golf Channel
Submitted by Solid State Logic

Today, for the sports entertainment world, customer demand is for HD. With the commissioning of Thunder, its fifth HD truck, Dome Productions wanted to select the proper mix of equipment to yield the greatest functionality, while keeping the vehicle's gross weight under control. To achieve the right mix, Thunder used fiber optics to not only carry multiple signals on a single cable but also to reduce the weight. Dome worked with AZCAR, a leader in HD broadcast system integration and production, because it brought complementary management, experience and engineering expertise to the project.

With a 3-D eye to the future, Dome invested in the technologies that could take it to 1080p60, the format necessary for live stereoscopic 3-D productions when its clients see the need. This included the installation of an Evertz EQX 3Gb/s router and a cable infrastructure capable of handling the bandwidth and return loss characteristics of a 4.25GHz signal parameter. Ten switchable Sony HDC-1500R cameras allow for addressing the flexibility that sports and entertainment venue operations require. Sixteen channels provided by an EVS XT[2] LSM server complement Sony HDCAM and Sony SR high-bandwidth digital video recorders. Sound is managed with numerous Dolby E and surround encoder/decoder products, with surround mixing on a Calrec Sigma mixing deck with Bluefin, a 320-channel processor system capable of 8 x 5.1 surround, stereo or mono audio groups. The Grass Valley Kalypso HD 4M/E production switcher, Abekas Dveous/MX dual-channel DVE and Chyron HyperX2 SD/HD graphics CG make up video production. Audio support equipment includes an RTS Adam intercom, Wohler AMP2 audio monitors, Ward Beck AMS8-1AM monitors, Crown CTs-4200 amplifiers and JBL speakers.

The 53ft trailer features a 41ft by 5ft expando section that provides room for the three-deck production center and the 25ft-long transmission and video support area. Thunder's first production, for MLB, aired May 12, 2009.

NAB SHOW | April 12-15, 2010 | Las Vegas, Nevada

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ExhibitHall Map

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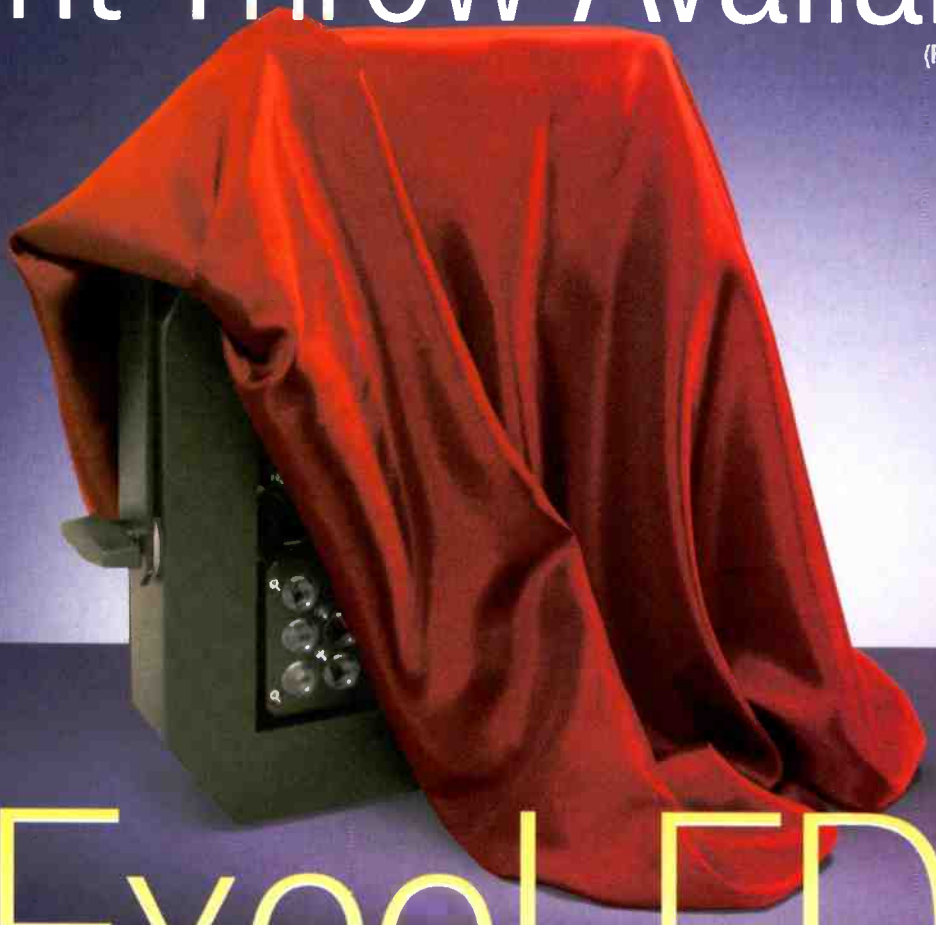

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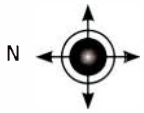
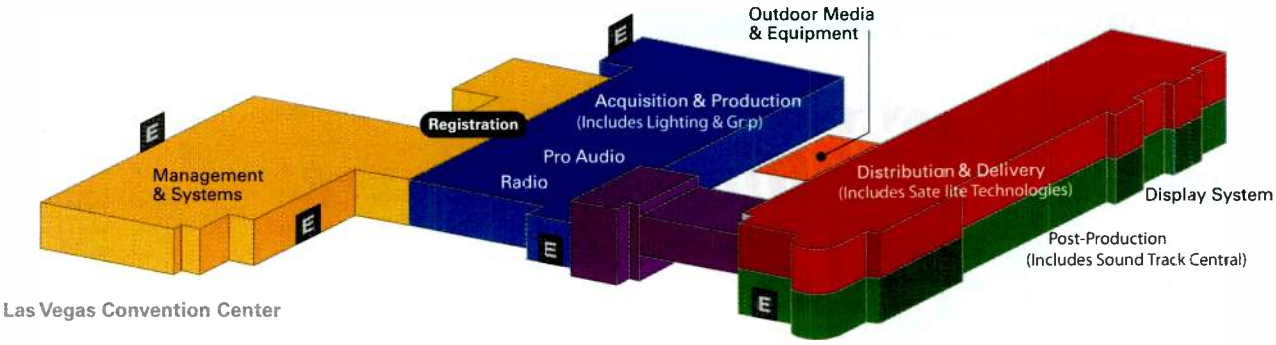


EXHIBIT HALL HOURS

Monday, April 12-Wednesday, April 14
9 a.m.-6 p.m.

Thursday, April 15
9 a.m.-2 p.m.



Map information current as of Feb. 22, 2010

MAP INFORMATION

The following is a brief description of what you will find in this year's NAB map from *Broadcast Engineering*.

To the right, you will see a listing of the NAB categories and what products can be found in each. Next to each listing you will find a color square that indicates the convention hall each category is located in. On the overview map (above) you will see each hall with its product categories.

Our table of contents lists each hall and the pages they are found on. On each of these pages you will notice some booths are highlighted with different colors. The ■ highlighted booths are our magazine advertisers, while the □ highlighted booths are our map advertisers.

We thank all of our advertisers for their support of our NAB coverage and exhibit hall map.

TABLE OF CONTENTS

PRODUCT CATEGORIES

■ **Acquisition & Production** — Cameras, lenses, lighting and grip and ingest technologies.

■ **Post-Production** — Video editing, graphics, animation, special effects software and hardware, audio editing and music/sound libraries.

■ **Management & Systems** — Video servers, systems integration, database technologies and digital asset management.

■ **Distribution & Delivery** — Transmitters and towers for TV, radio broadcasting, satellite technologies, cable, fiber, IPTV, mobile video and streaming products.

■ **Display Systems** — Projection equipment, LCD and plasma displays and digital signage.

■ **Pro Audio** — Audio recording and mixing equipment, encoding and compression technologies.

■ **Radio** — The entire spectrum of products and services for analog, digital and streaming radio.

■■ **Outdoor Media & Equipment** — ENG vehicles, outdoor signage, satellite services, power products and production equipment.

■ **Content** — Owners, aggregators and producers showcase their digital content to align with broadcasters, distributors and delivery technologies.

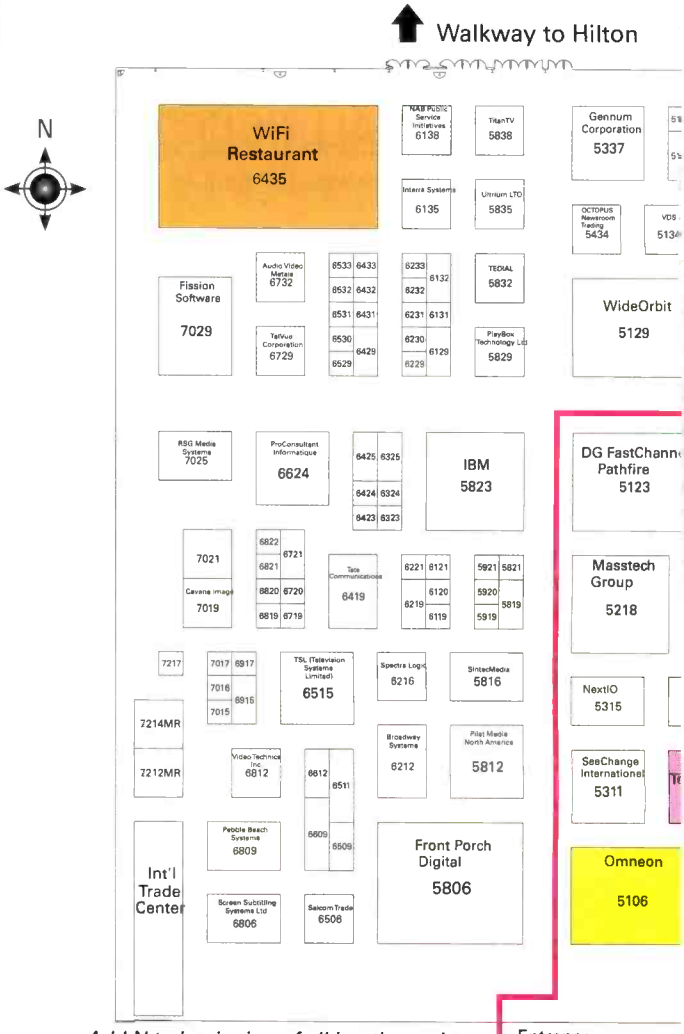
■ **Broadband** — Broadband-enabled TVs, online video, mobile broadband networks, platforms, set-top boxes, gaming, IP, streaming and advertising technologies.

Front cover: See Clear-Com at booth #SC6025 on page 6

See Videssence at booth #C3144 on page 6

NORTH HALL

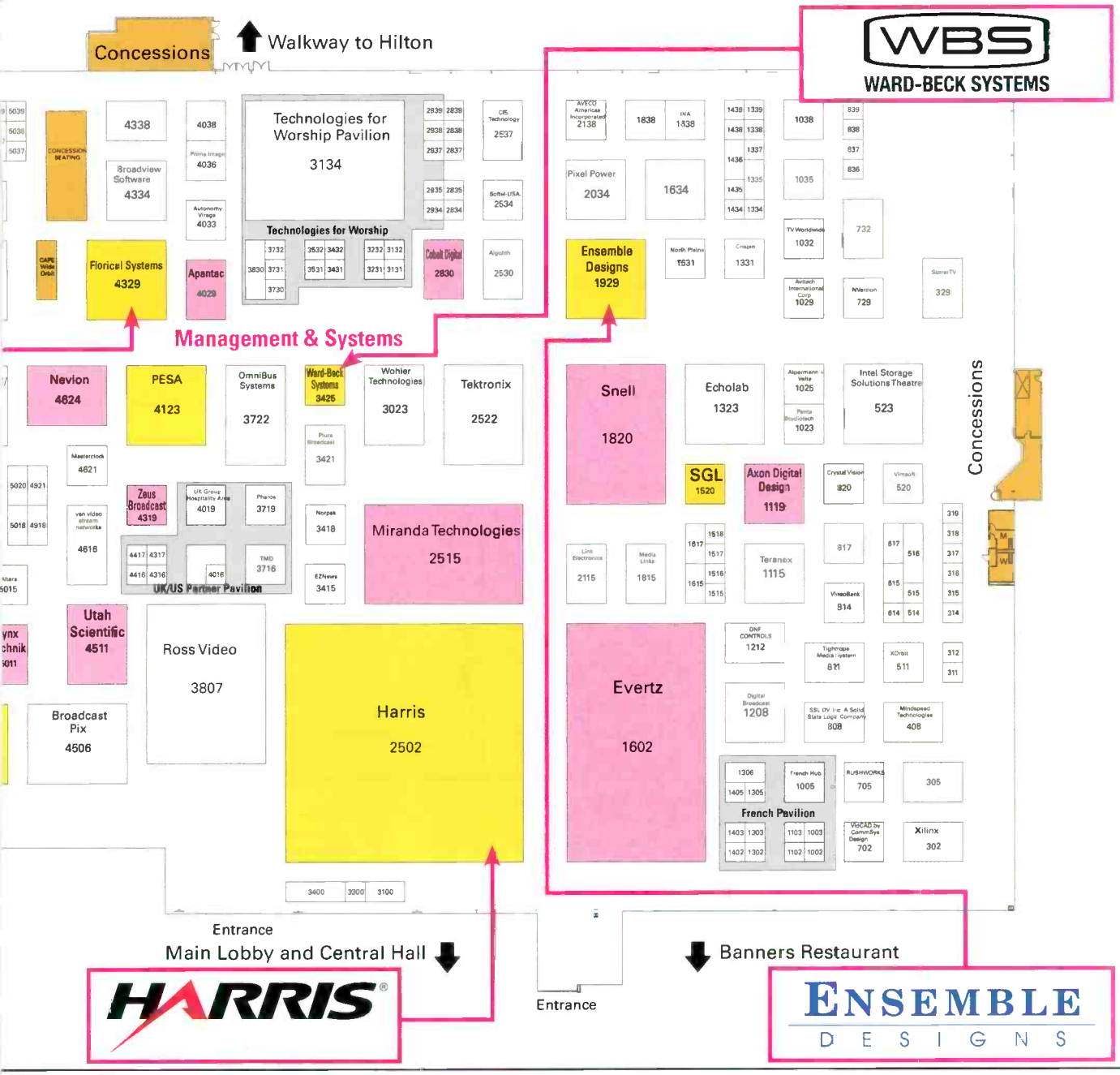
Advertisers | Map advertisers | Points of convenience



See Ensemble at booth #N1929 on page 5

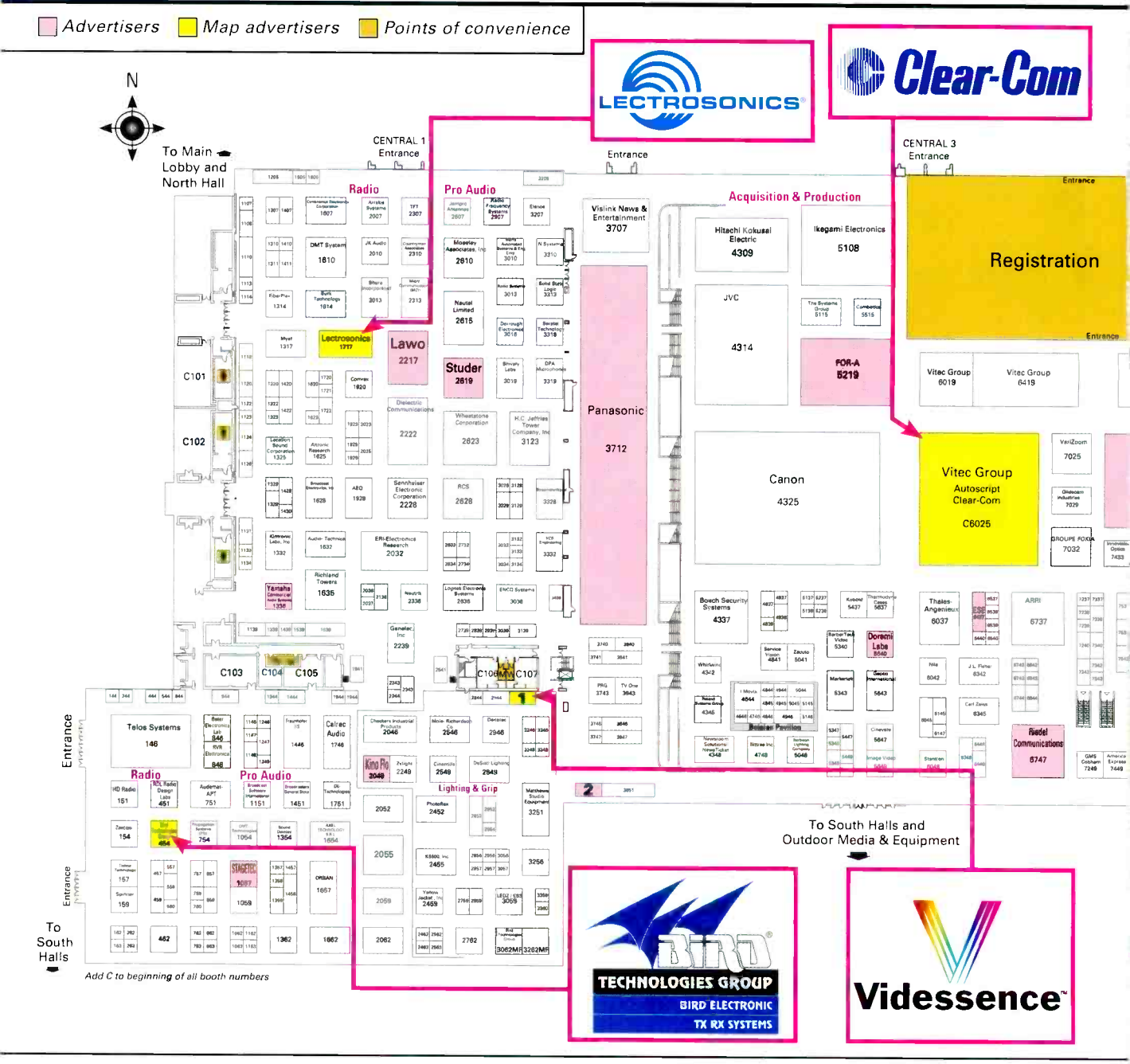
See Harris at booth #N2502 on page 5

NAB Exhibit Hours, April 12-15, 2010
Mon.-Wed.....9 a.m.-6 p.m.
Thurs.....9 a.m.-2 p.m.



CENTRAL HALL

Advertisers | Map advertisers | Points of convenience



See SGL at booth #N1520 on page 5

NAB Exhibit Hours, April 12-15, 2010
Mon.-Wed. .....9 a.m.-6 p.m.
Thurs. .....9 a.m.-2 p.m.

To South Halls and
Outdoor Media & Equipment

MAP #	COMPANY	BOOTH
1	Videssence	C3144
2	Digital Alert System	C3651
3	MultiDyne	C7637
4	Fischer Connectors	C11724

See Lectrosonics at booth #C1717 on page 6

See Autoscript at booth #C6025 on page 7

SOUTH HALL, upper level

Advertisers | Map advertisers | Points of convenience

Add SU to beginning of all booth numbers

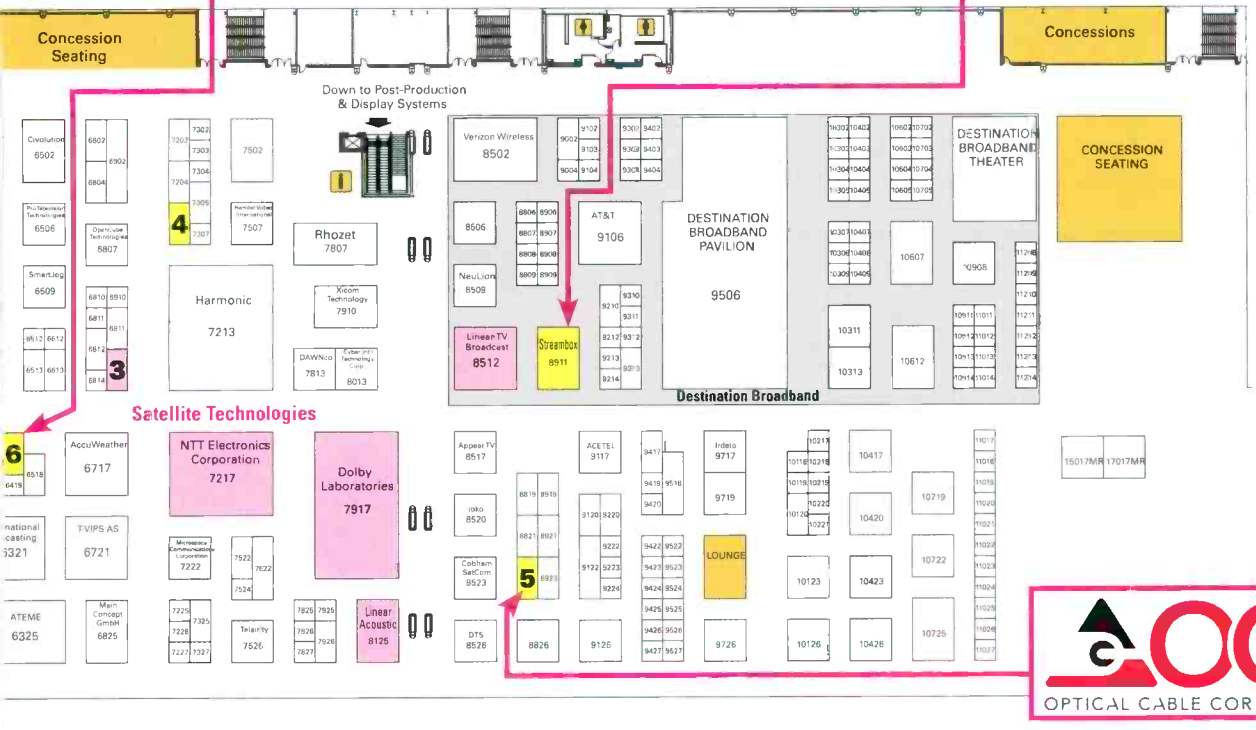
See Broadcast Engineering at booth #SL9123 on page 12

MAP #	COMPANY	BOOTH
1	DVEO	SU2709
2	Triveni Digital	SU3202 & SU5217A
3	NPR	SU6913
4	Jünger Audio	SU7206
5	Optical Cable	SU8823
6	White Sands	SU6417

NAB Exhibit Hours, April 12-15, 2010
Mon.-Wed.....9 a.m.-6 p.m.
Thurs.....9 a.m.-2 p.m.

White Sands Engineering
A Division Of TVC

Streambox



OCC
OPTICAL CABLE CORPORATION

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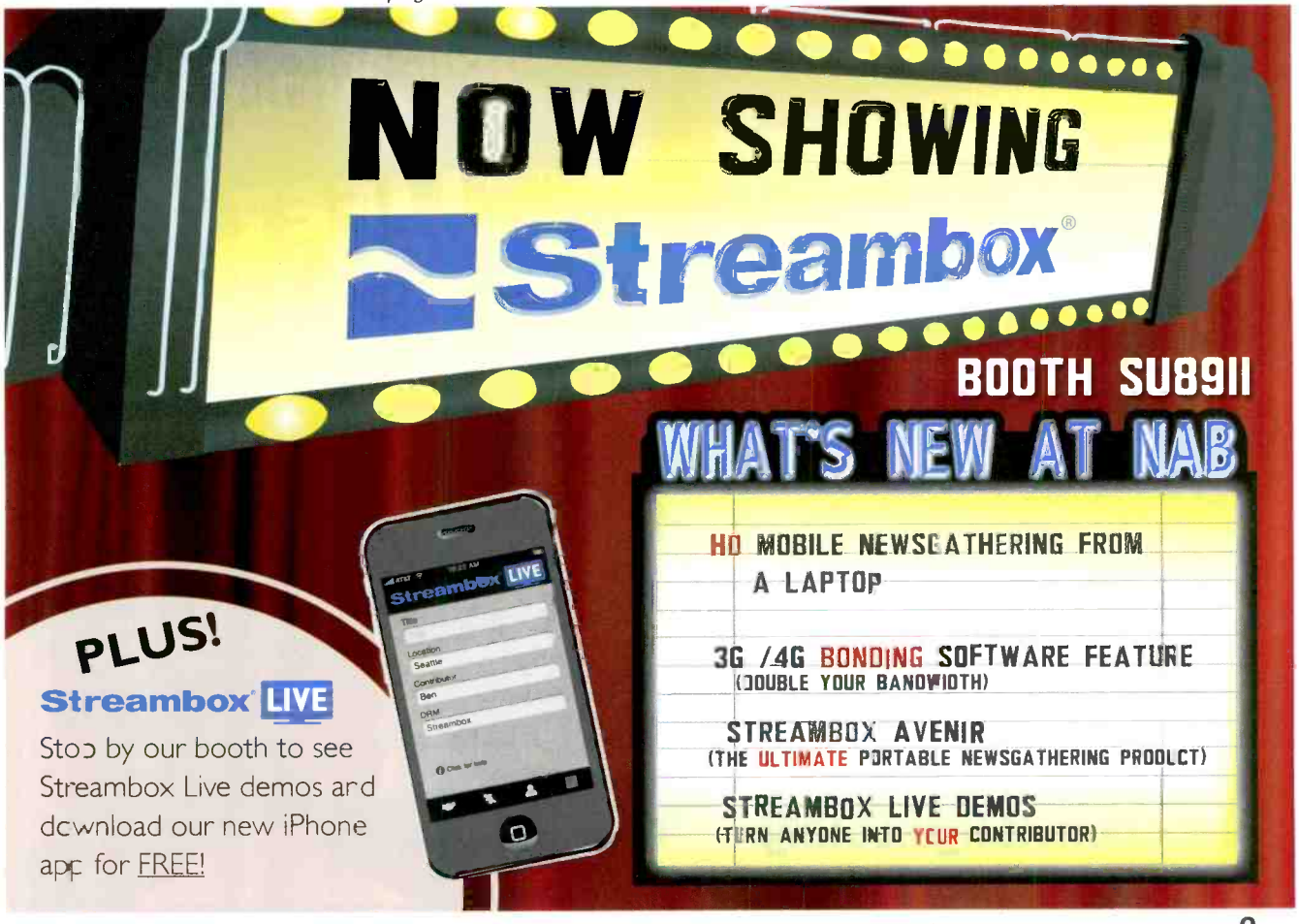

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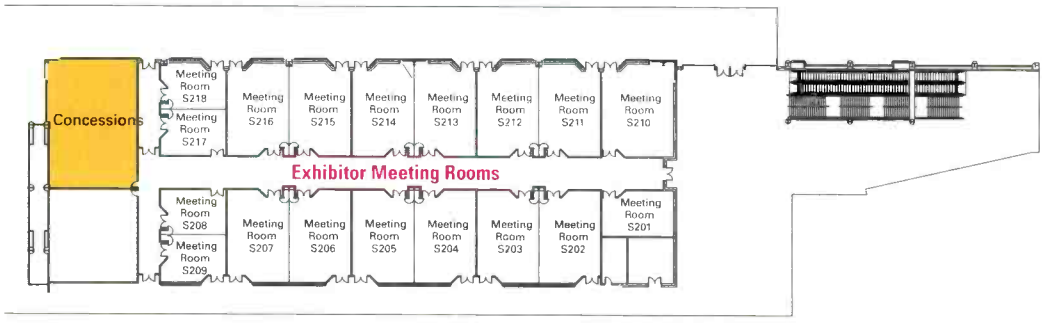

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NAB Exhibit Hours, April 12-15, 2010
Mon.-Wed.....9 a.m.-6 p.m.
Thurs.....9 a.m.-2 p.m.

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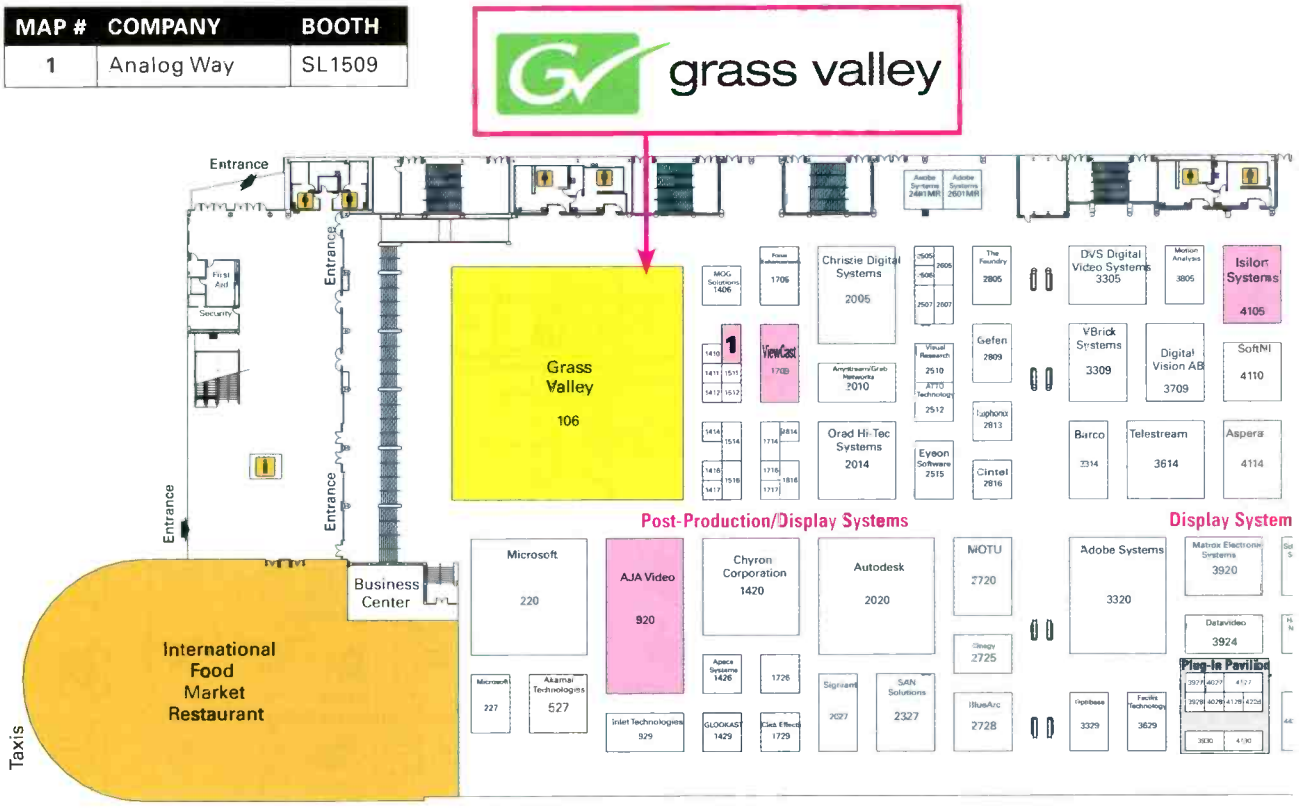
1	Analog Way	SL1509



Add SL to beginning of all booth numbers

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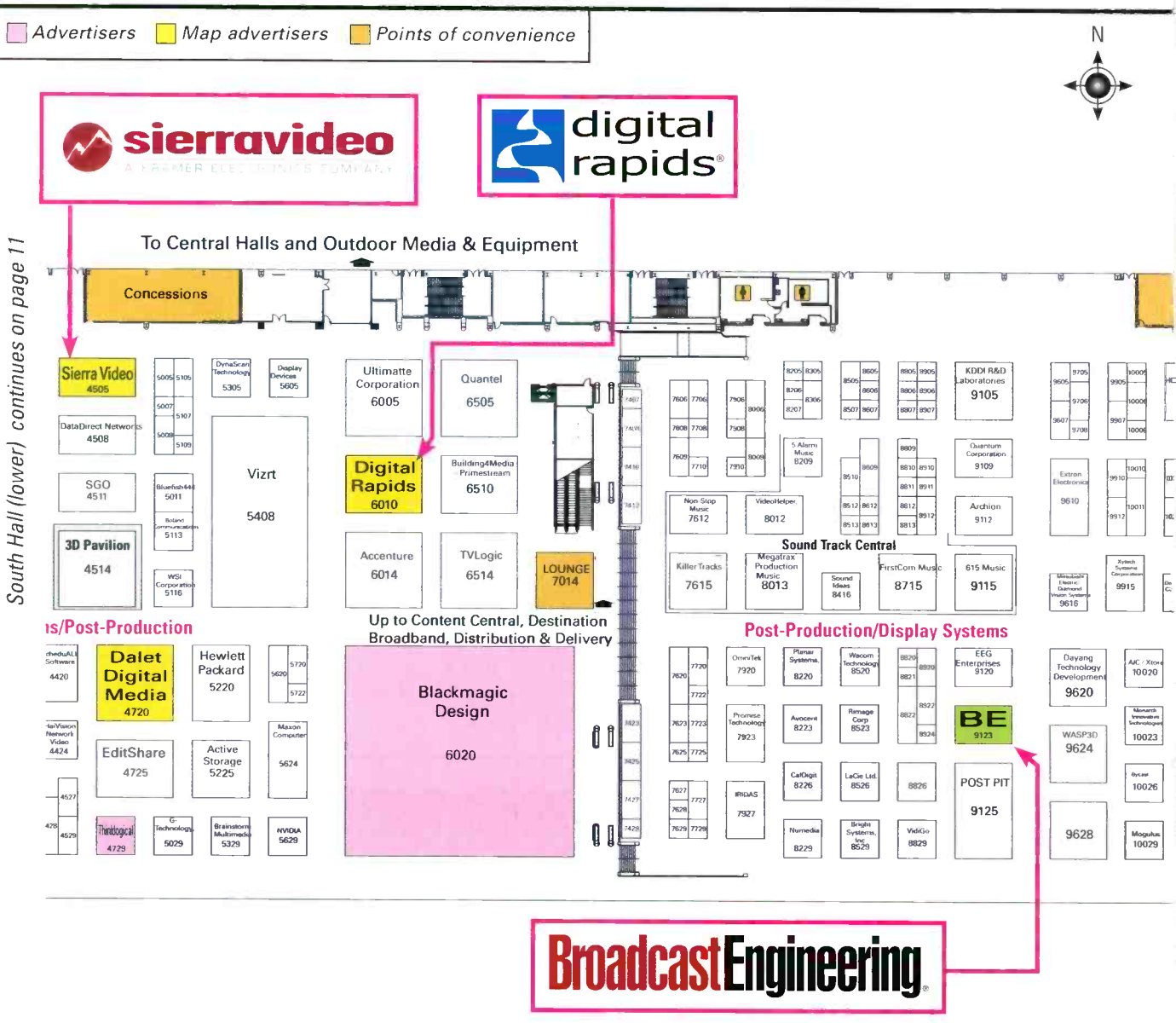

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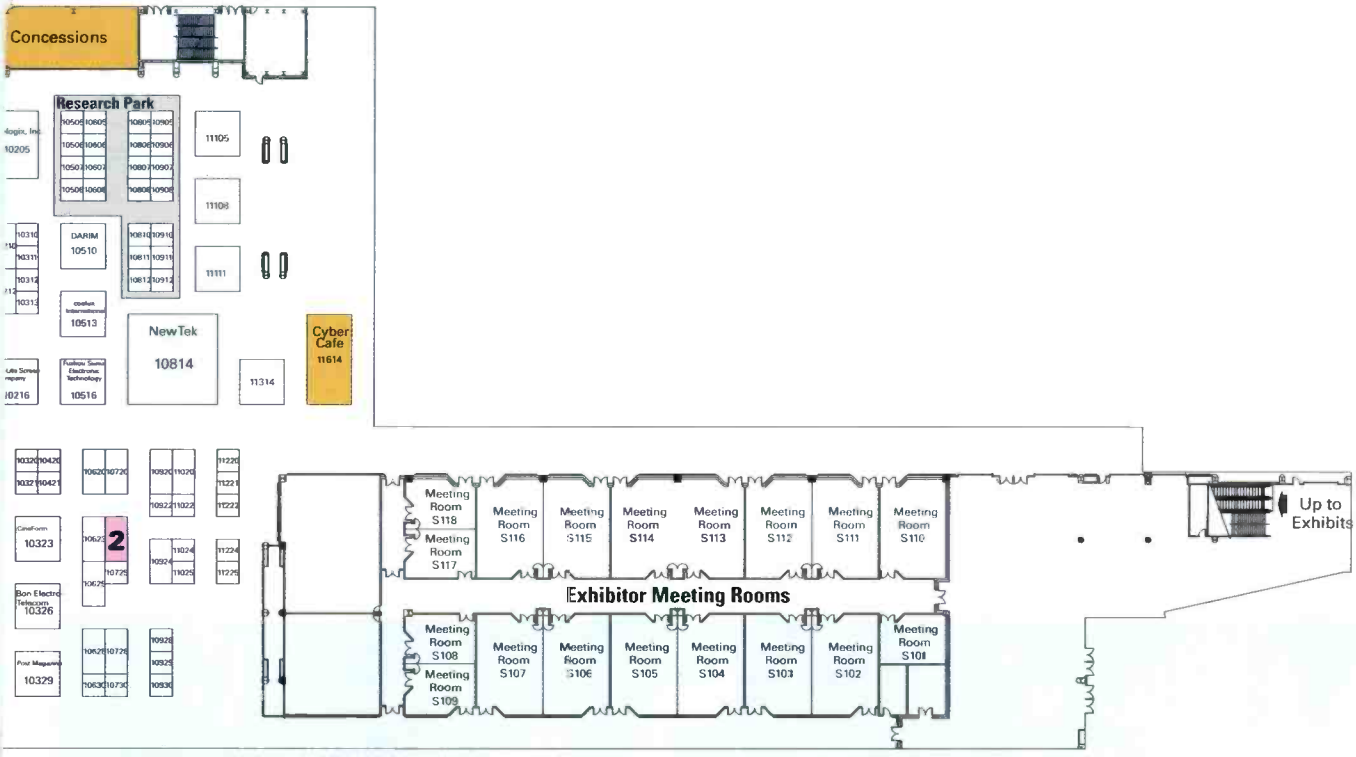

MAP #	COMPANY	BOOTH
2	Daitron (i-Chips)	SL10723

OUTDOOR MEDIA & EQUIPMENT

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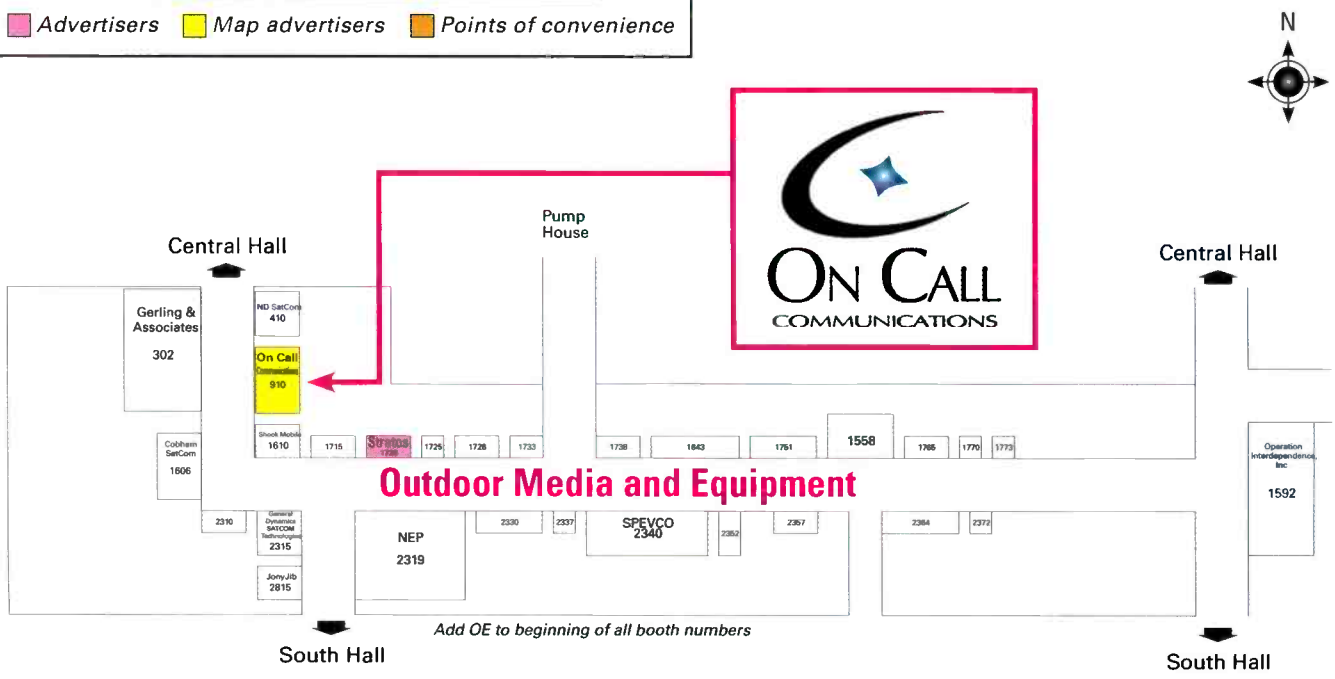

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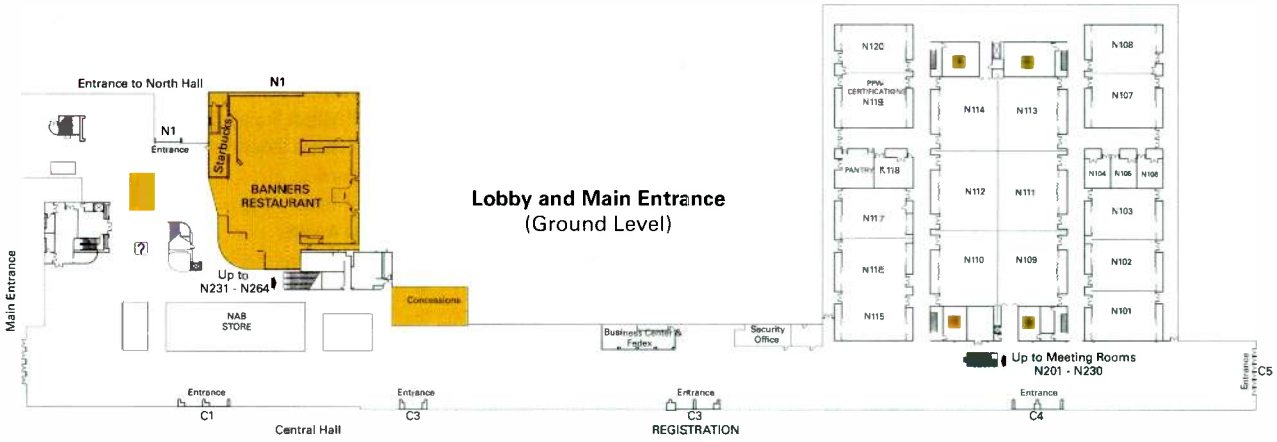
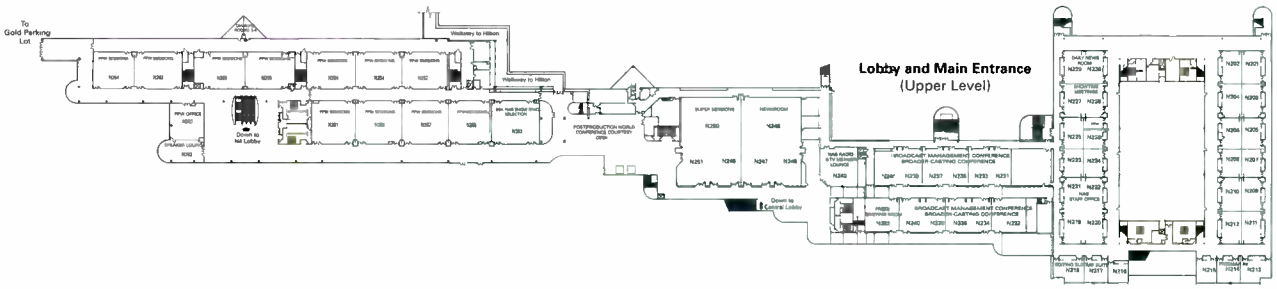
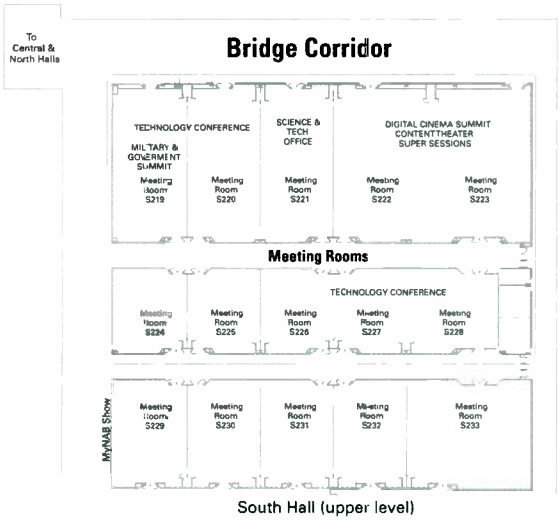
Mon.-Wed.....9 a.m.-6 p.m.
Thurs.....9 a.m.-2 p.m.







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2009

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Do You Need to Broadcast Video Content from the Web?

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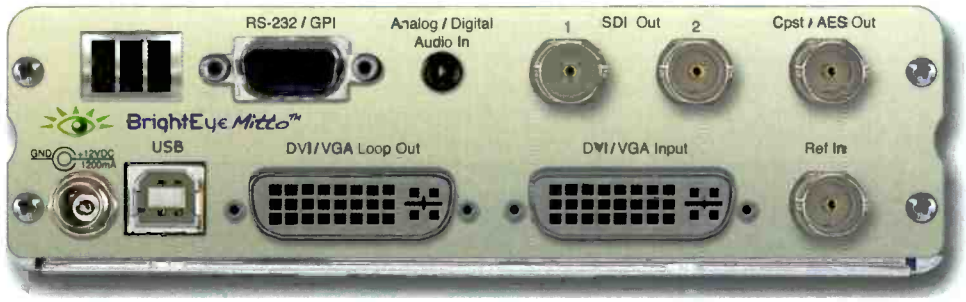
A broadcaster came to us and asked that we build an HD scan converter for them. When we brought the prototype to them for testing, they were ecstatic at how good the output looked.



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Simply use your mouse to click and drag over the specific portion of computer video that you want to output. Whether you output the entire screen or just a selected portion, you'll be able to see exactly what you are doing. And timing the video output into your system is easy, too.

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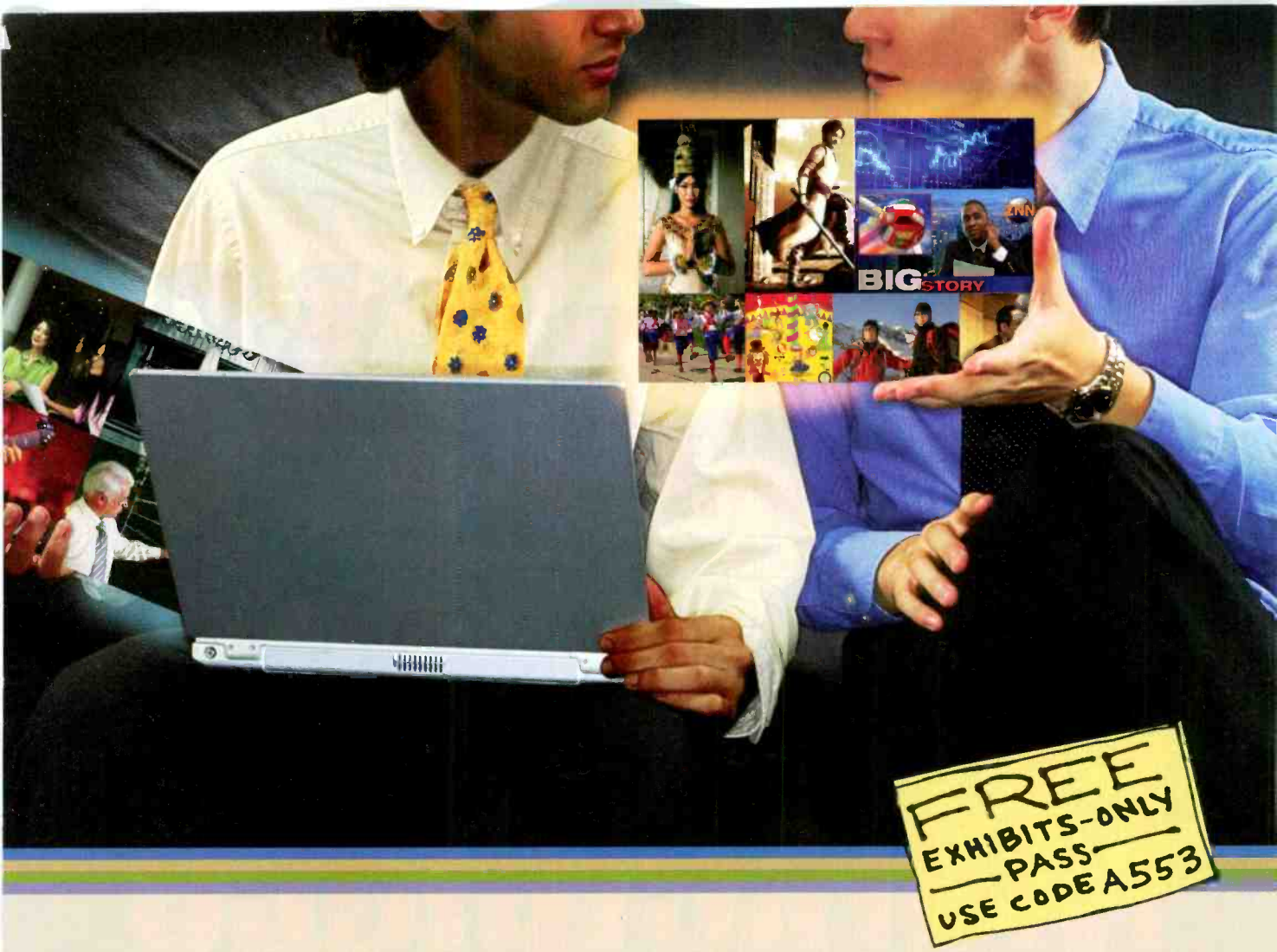

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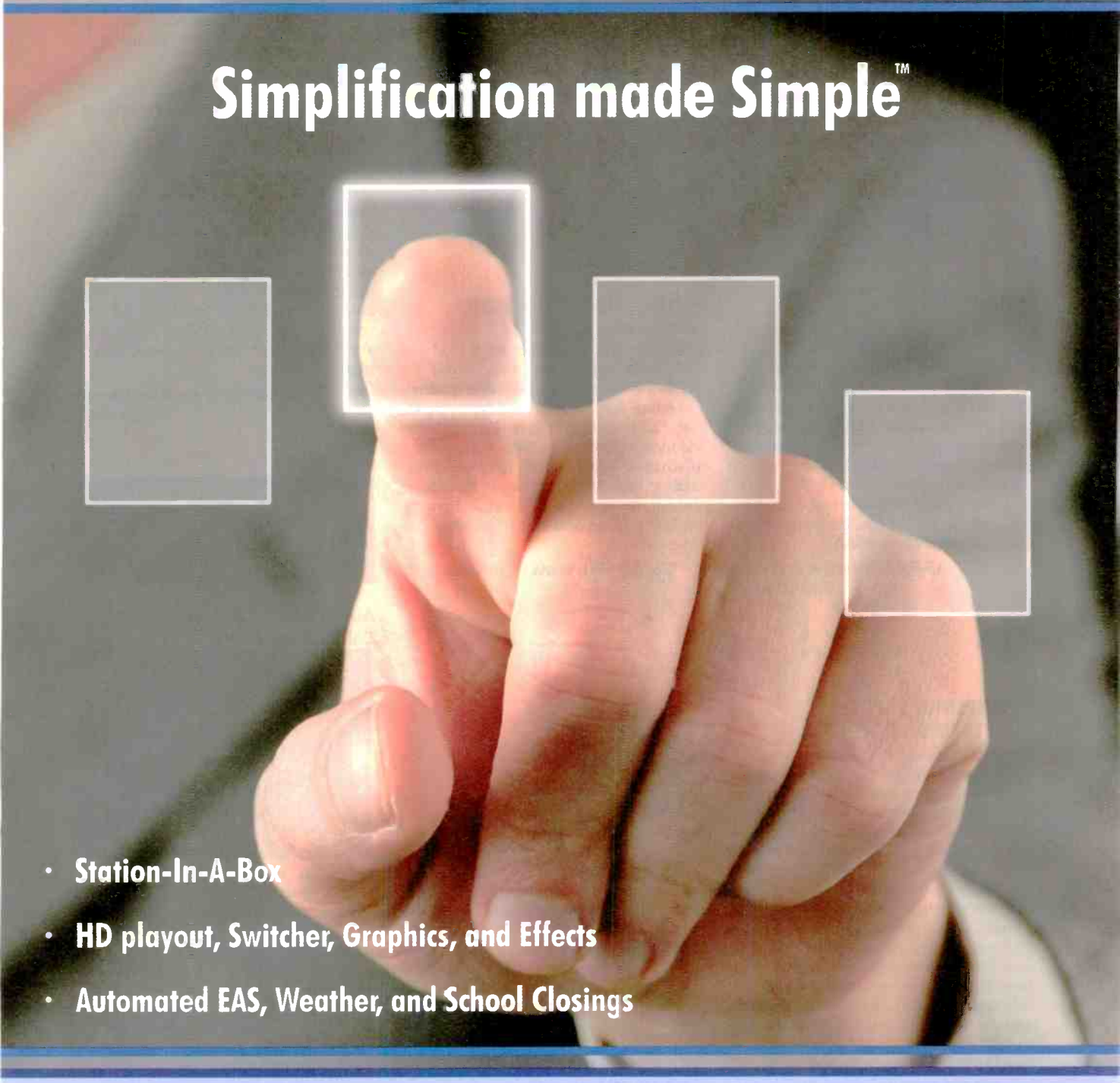

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800-231-7350; http://ap.com/
Booth: C2023

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Provides a file-based workflow solution for loudness correction, audio creation, conversion and upmixing; version 1.4 software provides support for Dolby Pulse; version 1.5 software supports the LXF file container format (used with Harris/Leitch servers) and the MP4 media container format (used in online applications).

415-558-0200; www.dolby.com
Booth: SU7917

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508-652-0900; www.genelecusa.com
Booth: C2239

AUDIO LOUDNESS CONTROL
Junger Audio Level Magic

The automated audio loudness control system for production and broadcast features new additions that offer an integrated workflow solution for managing Dolby coded 5.1 audio signals in production, ingest and playout; adjusts the level from any source at any time, with no pumping, breathing or distortion; based on a simultaneous combination of an AGC, a transient processor for fast changes and a peak limiter for continuous unattended control of any program material, regardless of its original source.

+49 30 677 7210; www.junger-audio.com
Booth: SU7205

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DSP matrix mixers; Ethernet, RS232 and USB offer connection for control; the 1Gb/s port connects units over a single Cat 6 line; feature unlimited input expansion, addressable TCP/IP Ethernet and seamless auto-mixing with PGA; offer a 48-channel mix bus with full output matrixing; include simultaneous multipoint third-party and native control; have ultra-low 1.33 ms near-side latency for real-time audio.

505-892-4501; www.lectrosonics.com
Booth: C1717

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Linear Acoustic AERO.air

Now supports internal Dolby E/Dolby Digital/Dolby Digital Plus decoding as well as insertion of Nielsen audience measurement information; utility confidence decoding of the output signal ensures continuous insertion of audience measurement data and produces GPO alarms to alert station personnel of issues; accepts any Dolby encoded or PCM audio that provides upmixing, loudness control, and audience measurement, and outputs both PCM and Dolby encoding for transmission.

717-735-3611; www.linearacoustic.com
Booth: SU8125

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416-335-5999; www.ward-beck.com
Booth: N3425

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510-870-0891; www.wohler.com
Booth: N3023

Audio mixers, on-air, portable, studio, playback

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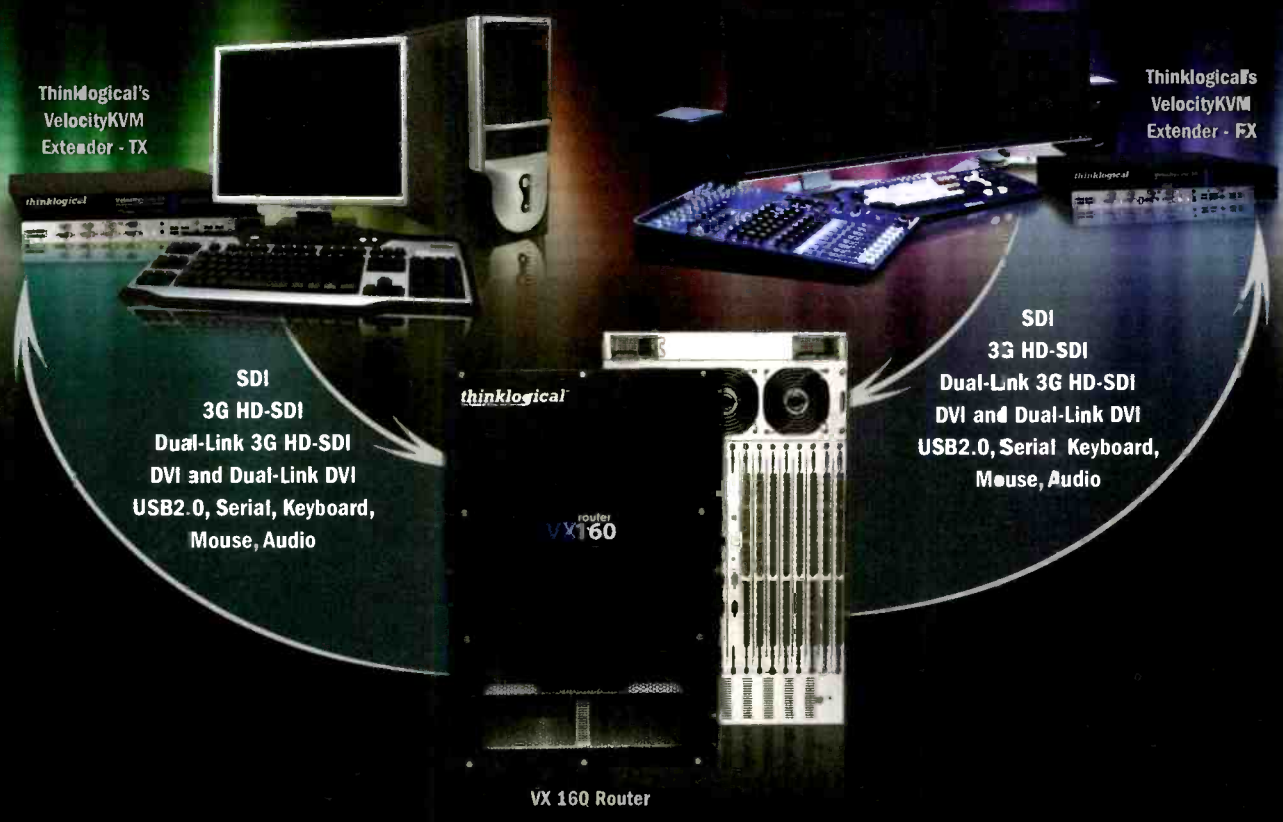
Calrec Audio Apollo

Relies on Bluefin2 for processing; at 48kHz, Bluefin2 gives Apollo up to 1020 channel processing paths, 128 program busses, 96 IFB/track outputs and 48 auxiliaries; at 96kHz, Apollo affords 510 channel processing paths, 64 program busses, 48 IFB/track outputs and 24 auxiliaries; features a second dynamics section in each channel, more than 70 minutes of assignable delay and three independent APFL systems for multiple operator use.

+44 1422 841310; www.calrec.com
Booth: C1746

Extend. Distribute. Innovate.

Unparalled resolution with secure and reliable media distribution over fiber. Access the equipment you need to get the job done - whether you are in the editing suite, machine room, broadcast studio, or traffic center.



VX 160 Router

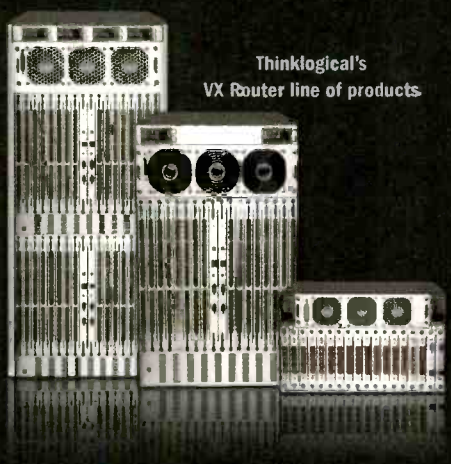
Route and switch virtually any desktop cevice up to 40 kilometers away from the controlling computer.

Transport every frame of a video stream with unprecedentec bandwidth - **6.25 Gbps** - with NO compression or frame dropping.

Whether your infrastructure requirements are three floors apart or three blocks apart, Thinklogical provides innovative media distribution.

Find out more about our VelocityKVM extension line and our series of VX Routers at **www.thinklogical.com** or **800-291-3211**.

Visit Us at NAB 2010 - Booth SL4729



Thinklogical's VX Router line of products

thinklogical™

Inspired technology for the broadcast and post production industry

Color indicates advertisers

AUDIO AUTOMATIC GAIN CONTROL DECODER
Ensemble Designs LevelTrack

Corrects mismatched audio levels between different program sources or segments within a program, addressing the latest audio compliance requirements for broadcasters; based upon the history in each channel, gradual changes are applied to prevent the audio level from dropping below or exceeding user-programmable thresholds.

530-478-1830
www.ensembledesigns.com
Booth: N1929

COMPACT DIGITAL BROADCAST CONSOLE
Studer Vista 5

The 32-fader unit consists of 20 channel strips and 12 additional versatile strips for operating output and input channels.; up to 240 channels can be accessed from the desk, and the total I/O capacity may exceed 1700 inputs and outputs, depending on the additional cards and configurations.

818-895-3496; www.studer.ch
Booth: C2619

DIGITAL AUDIO MIXER
Lawo V4.8 software

A new interface for the mc² series and the Nova73 HD systems; the new channel display features additional color and textural information for the VCA and link displays; now it is possible to interconnect any number of channels, even with an almost unlimited number of link groups; each link group can be linked with different modules, such as fader, mute or EQ; a color and name can be assigned to each group, which guarantees the ability to differentiate the various link groups in a channel with absolute certainty; each channel can even meter one of the first eight linked channels, comparable to a VCA master.

+49 7222 1002 0; www.lawo.de
Booth: C2217

DIGITAL CONSOLE
Salzbrenner StageTec Mediagroup CRESCENDO

Targets the needs of users in broadcast and live venues; has a depth of 530mm and supports up to 300 audio channels, 128 summing busses and 48 channel strips; allows users to configure the number of mono, stereo and 5.1 sums, as well as stereo and 5.1 input channel-linking.

888-782-4391; www.stagetec.com
Booth: C1057

Audio recording

AUDIO RECORDING, STORAGE, PLAYBACK
Zaxcom QRX100

Inputs four channels of audio from up to two Zaxcom stereo or mono digital transmitters to capitalize on cameras that record four or more discrete audio channels; the QRX100 will then output these received audio channels as both analog and AES digital formats; allows broadcasters to record all channels from four-channel ENG cameras quickly and easily; doubles as a time code receiver, with an optional video sync/SMPTE time code output and an optional integrated IFB transmitter.

973-835-5000; www.zaxcom.com
Booth: C154

Audio routing, distribution

MULTIFORMAT MODULAR ROUTER
Evertz EMR

Provides a unified platform for routing digital audio, analog audio, MADI audio, data and time code; 6RU frame can accommodate 288 x 288 AES, 288 data ports, 288 x 288 time code signals or a mix; expansion to 4608 x 4608 can be accomplished with multiple frames.

905-335-3700; www.evertz.com
Booth: N1602

AUDIO ROUTER
Miranda Technologies NVISION 8500

Features integrated audio processing, including de-embedding, shuffling, break-away and re-embedding capabilities; uses new hybrid switching technology, which allows every frame in the router family to de-embed, route and re-embed up to 16 channels of mono audio per video input, and output in a completely nonblocking audio/video switch.

514-333-1772; www.miranda.com
Booth: N2515

FIBER-OPTIC SIGNAL TRANSPORT
Riedel MediorNet

For uncompressed multichannel HD/SD video, audio, intercom and data; now available in new MADI and RockNet MediorNet cards as well as the software-based Framestore feature for U.S. markets; combines signal transport, routing, signal processing and conversion into one integrated real-time network; includes signal routing, allowing users to send any incoming signal to any output or even to multiple outputs by just a mouse click or by a router control system; each mainframe provides a router for 32 x 32 720p/1080i signals, 160 x 160 SD-SDI signals, 27,000 x 27,000 AES signals or any combination of these.

914-819-0495; www.riedel.net
Booth: C6747

BROADCAST INTERFACE CARD
Yamaha Commercial Audio Systems MY8-SDI-ED

Offers from eight to 64 I/O channels, depending on the number of consoles and cards used; provides I/O of HD-SDI embedded audio signals; features one HD/SD-SDI input, two HD/SD-SDI outputs (same signal) and one reclocked through-output; can de-embed up to two of the four audio groups (four channels per group for a total of eight channels), multiplexed in an HD-SDI signal, and can embed two audio groups into an HD/SD-SDI signal for output.

714-522-9011; www.yamahaca.com
Booth: C1336

Color indicates advertisers

Automation, including news and master control

NEWS PRODUCTION
Bitcentral Precis

Open and nonproprietary news production solution; integrates with newsroom computer systems, nonlinear editors, storage devices and video codecs; offers a cost-effective way to migrate to a file-based, easily scalable and HD-upgradable play-to-air system.

800-214-2828; www.bitcentral.com
Booth: SU2312

DIGITAL CONTENT MANAGEMENT SYSTEM
Florical Systems AssetCollector

Uses Rhozet's Carbon Coder to provide a complete automated solution for all digitally delivered content; loads with S.M.A.R.T. Central workflow management tool, accessed from any networked computer through the Internet; enables user to manage digital content from anywhere.

352-372-8326; www.florical.com
Booth: N4329

REPLAY SYSTEM
Grass Valley K2 Dyno 1.5

Adds an enhanced user interface with updated audio meters and intuitive remaining storage time and remaining time indicators; offers improved (2X faster) highlight and playlist creation and cue-up functions; fine-tuned operational control allows users to streamline production workflows and boost productivity; fully compatible with Grass Valley K2 Summit software release v7.1.14, I-Frame MPEG and AVC-Intra options now available for K2 Summit servers, and the company's K2 Solo server, representing a low-cost single input/single output channel system.

503-526-8100; www.grassvalley.com
Booth: SL106

AUTOMATION AND PLAYOUT PLATFORM
OmniBus iTX

Includes more than 130 new features, such as advanced aspect ratio control with AFD insertion, BXF schedule import, enhanced CG capability and closed-captioning functionality, support for copy guard data insertion, additional bit rate support for Dolby D, and schedule preview control; allows broadcasters to mix both media formats and resolutions in the same schedule; broadcast HD, SD and lower bit rates can be mixed within a single schedule and are automatically up- or downconverted by iTX; can be used for Internet TV and streaming delivery applications.

303-237-4868; www.omnibus.tv
Booth: N3722

MASTER CONTROL SWITCHER
Utah Scientific MC-4000

Integrated system is designed to handle the most demanding on-air operations in live, automated or automation-assisted operating environments; features new internal squeeze and graphics capabilities, as well as a new control panel option.

801-575-3770; www.utahscientific.com
Booth: N4511

AUTOMATION SYSTEM

Pebble Beach Systems Marina

Flexible and scalable up to hundreds of channels; distributed architecture is able to use resources over multiple servers; designed to allow broadcasters to select the best underlying technology to suit their specific needs, enabling them to tackling complex, changing workflows while retaining the ability to mix basic passthrough-style channels with labor-intensive channels within a single system.

917-832-4372; www.pebble.tv
Booth: N6809

AUTOMATION SYSTEM

Snell Morpheus

Version 2 expands the system's feature set and offers full ratification for running on a Virtual Machine environment; includes intelligent synchronization of time-delayed channels, support for triggering scripted, complex operations via simple manual intervention and implementation of the spot-checking capability; allows users to evolve the look, feel and content of their channels simply and quickly, in house.

818-556-2616; www.snellgroup.com
Booth: N1820

AUTOMATION NEWSROOM SOLUTIONS

VSN vsnmacnews

The latest versions of vsnnews terminal, vsnnetsharer/macsharer and vsnarchive now run on MacOS and/or Windows platforms even within a single network; features like drag and drop between different modules, specific plug-ins to assign editing projects to a playlist, and new attractive user interfaces provide users with an enhanced level of flexibility to design their production architecture.

305-331-4889; www.vsn-tv.com
Booth: N4616

Cameras, lenses, accessories

PL MOUNT ZOOM LENS

Fujinon 75mm-400mm HK5.3x75

Offers large telephone focal range, fast T-stops and high optical performance; designed to maximize performance on either film or digital cinematography cameras; features 136mm front-barrel diameter, consistent gear position and production-friendly size and mass.

973-686-2405; www.fujinon.com
Booth: C7425

1080P CAMERAS

Grass Valley LDK 8000 Elite WorldCam

Offer the capability for 1080p50 and 59.94 bandwidth; with a single fiber adaptor users can switch between 720p50/60, 1080i50/60 and now 1080p50/60; 1080p has been added without compromising any other functionality of the fiber interconnection, including an HD return video path and the ability to run up to 4000m (13,100ft) on SMPTE-standard hybrid fiber.

503-526-8100; www.grassvalley.com
Booth: SL106

Color indicates advertisers

CAMERA
Panasonic AW-HE50

Available in two versions: the AW-HE50H with an HDMI output and AW-HE50S with an HD/SD-SDI output and genlock; will be a key component in the company's first complete IP and Serial-control capable system; up to 100 units located in remote locations can be operated by a new remote camera controller, the AW-RP50.

201-392-6141
www.panasonic.com/broadcast
Booth: C3712

CGs, prompters, captioning

CHARACTER GENERATOR
Compix CompactCG HD

Offers both HD-SDI and SD-SDI functionality, as well as the specs and feature set of a full-size system in a rugged 1RU chassis; ideal for channel-branding applications, with software options including NewsScroll with RSS, which provides the power of multiple crawls, logos, a real-time clock, live weather updates, ratings, and live RSS feeds.

949-585-0055; www.compix.tv
Booth: C9515

CAPTION/SUBTITLE ENCODING SOFTWARE
Softel Swift vTX

Enables broadcasters to repurpose content regardless of file format and switch between SD and HD formats easily to facilitate multiplatform, worldwide distribution; supports a large array of file, wrapper and playout formats.

203-354-4602; www.softelgroup.com
Booth: N2534

Consulting services

SYSTEMS INTEGRATIONS
Burst

Designs, engineers and installs integrated systems for video broadcast technologies; specializes in bundled solutions to complex projects, from hardware and software, to installation and training.

303-858-9848; www.burstvideo.com
Booth: C11126

Graphics, animation products

BRANDING SWITCHER
Pixel Power BrandMaster

Combines master control and high-end branding graphics in a single integrated system to enable channels to be efficiently branded without the need to maintain an external pool of graphics resources; puts graphics capability at the transmission point, reduces the complexity of the signal path, streamlines the channel branding process and lowers the total cost of channel branding; features a new master control panel, designed to deliver a control surface that is familiar to master control operators; a new version of the Router Control System adds the power of single-button channel assignment, with full router salvo control.

818-276-4515; www.pixelpower.com
Booth: N2034

GRAPHICS SYSTEM
Harris G5

All-in-one broadcast graphics system; can be easily incorporated into any automated, live sports broadcast environment via the industry-standard Intelligent Interface, MOS protocols, or the new Harris Direct Control 2 interface; the 3RU system delivers flawless 2-D and 3-D real-time graphics on a single channel in SD or HD, as well as 3-D scene playback capability.

800-231-9673; www.broadcast.harris.com
Booth: N2502

Intercom, IFB products

INTERCOM SOFTWARE
Clear-Com Communication Systems

Interfaces with external audio systems including party line systems, paging systems, program feeds and other matrix systems using a four-wire interface over a standard IP network; allows authorized users with Internet access to easily communicate with other crew members using hard-wired panels and wireless belt packs on the party line and/or matrix intercom circuit who are using hard-wired panels and wireless belt packs; can accept and send audio through a facility's public announcement system, program feed and other four-wire audio devices via most commercially available audio interface boxes.

510-337-6600; www.clearcom.com
Booth: C6025

INTERCOM VIRTUAL KEY SOFTWARE
Riedel Artist VCP-1004 Virtual Panel

Virtual key panel software allows a regular computer to be used as an intercom control panel in combination with any Artist digital matrix intercom system; computers running the software can be integrated via a wired or a wireless Ethernet connection into the matrix; the communication between matrix and virtual panel is realized via the VoIP-108 G2 client card; features four talk-keys and a shift-key to double the number of available keys.

914-819-0495; www.riedel.net
Booth: C6747

Color indicates advertisers

Lighting equipment

LED LIGHT
Videssence ExceLED 100

100W LED fixture provides an adjustable beam-spread without lenses using only one set of LEDs; an adjustment knob at the back of the fixture easily rotates to move from spot through flood mode and locks in place; can produce light levels at a distance of 25ft and more.

412-384-3515; www.videssence.tv
Booth: C3144

LIGHTING FIXTURES
Kino Flo VistaBeam 600 and VistaBeam 300

The pole yoke accessory gives the studio DMX fixtures a welded alloy yoke bale offering 360 degrees of fixture movement to focus the soft beam lighting from a studio grid; the pole/yoke system saves time and money eliminating the need for ladder access or costly automated rigging and hoist systems; VistaBeam 600 delivers the equivalent of a 4000W Softlight, but uses only nine amps of power; both fixtures have a DMX control system and the ability to produce daylight or tungsten balanced light from the same fixture.

818-767-6528; www.kinoflo.com
Booth: C2049

Media storage, archive systems, asset management

MAM SYSTEM
Alteran Technologies
ViTaDi Database

Works directly with pre-existing database infrastructures; accepts .csv and .xml files; data is put directly into the file as it is ingesting to further streamline the process; controls multiple capture solutions simultaneously; organizes metadata and allows for automated metadata creation; manages and tracks videotape status throughout the capture process; organizes captured files and the transcoding engine; monitors and reports on the final capture results.

818-998-9100
www.alterantechnologies.com
Booth: C9733

PRODUCTION ASSET MANAGEMENT SYSTEM
Avid Interplay 2.1

Supports enhanced media access and control via Interplay support for Mac-based Avid editing systems and streamlined asset ingest and metadata management capabilities; lets users manage content creation projects by centralizing media assets and extending access to remote users; offers Web 2.0 services, further extending third-party interoperability.

978-640-6789; www.avid.com
Booth: SU902

ARCHIVE SYSTEM
Cache-A Prime-Cache

Network-attached archive appliance enables users to create source masters in acquisition workflows when using the new memory card or disk-based cameras; provides long-term archival storage with easy access at every stage of production.

866-931-5560, ext. 1; www.cache-a.com
Booth: SL7906

MAM APPLICATION
Dalet Digital Enterprise Edition WebSpace

Advanced, portable Web-based MAM and news production application uses latest Web 2.0 technologies; features professional video and audio production tools, an enterprise search engine and user-friendly interface; streams media in H.264 or MPEG-4, making remote access to the main archives simple and fast.

212-269-6700; www.dalet.com
Booth: SL4720

DATA STORAGE
Isilon IQ

Scale-out NAS storage solutions speed access to critical business information, offering an efficient, easy-to-manage storage infrastructure that reduces capital and operational expenditures while allowing users to seamlessly grow their storage as they grow their business.

206-315-7537; www.isilon.com
Booth: SL4105

CONTENT DELIVERY SYSTEM
Digital Rapids MediaMesh

Designed to provide efficient transfer of digital media between content providers; optimizes delivery of HD, SD and digital cinema content over terrestrial IP networks and satellite; lowers the costs of delivery for content, from ad spots to syndicated series and long-form features; provides integrated review, inventory management, transcoding, repackaging and playout.

905-946-9666; www.digital-rapids.com
Booth: SL6010

SERVER
EVS XT[2]+

Available in two-, four- or six-channel configurations; available in SD/HD ready or full HD/SD mode with dual networking capabilities; features include SAS disk controllers, increased internal storage of up to 12 disks with compact 2.5in form factor, increased storage with external array (hot-swappable disks) with a total capacity of up to 20TB per server, 30 percent more bandwidth and a clear upgrade path to AVC-Intra and 1080p support, expanded codec support, and improved monitoring capabilities and SNMP communications.

973-575-7811; www.evs.tv
Booth: C9508

CONTENT REPLICATION
Front Porch Digital DIVAnet V6.3

Optional addition to DIVArchive system; automates intelligent replications and distribution of content between any number of independent DIVArchive systems; new features include intelligent load balancing between DIVArchive sites, inclusion of a central distribution plan manager to implement global content distribution plans, end-to-end tracking of content replication commands and global object-delete to support smooth resumption of operation in the event of connectivity loss.

303-440-7930; www.fpdigital.com
Booth: N5806

Color indicates advertisers

STORAGE SYSTEM
Omneon MediaGrid

Integrated with a high-performance production server to enable fast access to incoming media used in live and near-live broadcast production; supports production tools from Adobe, Apple, Avid and EVS; provides the processing power for Omneon ProXchange to repackage edited content for rapid delivery to other media distribution outlets.

408-585-5000; www.omneon.com
Booth: N5106

DIRECT-ATTACHED STORAGE SYSTEM
Small Tree GraniteSTOR ST-RAID

Offers real-time editing for Final Cut users while supporting 12 streams of ProRes 422HQ with no dropped frames; 2TB system is available in eight-, 12- or 16-drive configurations; provides consistent performance over Ethernet networks.

866-782-4622; www.small-tree.com
Booth: SL7425

VIDEO SERVER
LEIGHTRONIX MINENCE-HD

Multichannel, HD video server features H.264 encode/decode hardware that delivers digital video images at extremely low data rates; four digital video channels operate as either encode or decode, offering flexibility for demanding record or playback applications; standard features include a built-in TV automation interface and HD-SDI video inputs/outputs.

800-243-5589; www.leightronix.com
Booth: C9015

MAM SYSTEM
NETIA Manreo 2

Adds features to streamline workflow and allow users to simply and efficiently repurpose and broadcast content assets to multiple platforms; incorporates new NETIA Workflow Engine as well as NETIA's Hypercast Warehouse set of archiving tools, a platform dedicated to media asset management.

888-207-2480; www.netia.com
Booth: SU3502

MEDIA ASSET MANAGEMENT SYSTEM
PlayBox Technology PlayBox Metus

Allows users to manage and organize media files located on computers or storage devices in a network, analyze them, retrieve and edit the metadata, create subitems and archive them with security; features fast-forward playback in asset viewer with speech intelligible up to two times.

404-424-9283; www.playbox.tv
Booth: N5829

ARCHIVE MANAGEMENT SOFTWARE

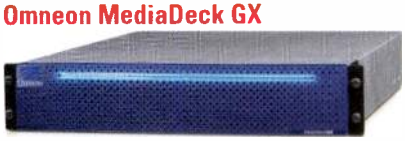
SGL FlashNet

Seamlessly integrates with Avid Interplay 2.1; supports latest version of Apple's Final Cut Server; provides an XML-based API that allows every major broadcast vendor to create integrated applications that can instantly access the SGL content storage management system; scales to a cluster with a theoretically infinite number of identical nodes, each of which provides high-speed access into and out of the archive; clustered architecture provides high level of reliability.

+44 1489 889930; www.sgluk.com
Booth: N1520

CHANNEL PLAYOUT SOLUTION

Omneon MediaDeck GX



Combines video server playout, graphics and audio processing, all of which can operate under the control of the user's preferred automation system; offers rich branding, real-time graphics and master control functionality; simplifies workflows and makes it easier and more affordable for broadcasters to launch new services or to make incremental additions to their existing channel lineup.

408-585-5000; www.omneon.com
Booth: N5106

ASSET MANAGEMENT

ViewCast Media Platform (VMp)

A unified framework that helps organizations manage the full lifecycle of their digital media content, including IP video; supports online video, including content acquisition, transformation, indexing, workflow and distribution; combining ViewCast's Osprey and Niagara IP video encoding solutions with the capabilities of VMp — live scheduling and event management, VOD, digital asset management and enterprise content management infrastructure from IBM — has created a comprehensive solution for driving value with digital media.

800-250-6622; www.viewcast.com
Booth: SL1709

SATA STORAGE SYSTEM

Sonnet Technologies Fusion DX800RAID

Expandable eight-drive RAID direct-attached storage system includes PCIe RAID controller card; designed to provide video editors the speed required for working with uncompressed 10-bit 1080 HD video streams.

949-587-3500; www.sonnettech.com
Booth: SL7727

INGEST

Video Technics VT HotFolder

Software application imports SD/HD file-based media content from a wide variety of sources into the VT database for immediate playout on any Apella or OASYS video server; supports multiple codecs, video standards and file containers.

404-327-8300; www.videotechnics.com
Booth: N6812

Color indicates advertisers

New media, streaming products, multimedia/Internet

HD/SD LIVE STREAMING ENCODER
Brick House Video MiniCaster

Designed to offer a cost-effective solution for live streaming, complete with HD-SDI, SD-SDI and analog video inputs, and embedded and discrete audio processing with GigE output; comes in a compact, 2RU half-rack enclosure; can record live streams via built-in RAID storage.

203-376-3372
www.brickhousevideo.com
Booth: N4019

ENCODING SYSTEM
Digital Rapids StreamZHD 3.2

Supports three-screen live and on-demand experiences and file-based workflows by offering simultaneous encoding to multiple formats and devices; new features include integrated segmenting for Apple iPhone delivery, JPEG 2000 encoding and workflow integration, YouTube Content ID fingerprinting support, Microsoft PlayReady digital rights management support and enhanced Microsoft IIS Smooth Streaming.

905-946-9666; www.digital-rapids.com
Booth: SL6010

TRANSCODING SYSTEM
Harmonic Rhozet Carbon Server 4.0

Designed to manage a network of Carbon Coder transcoders as well as Carbon QC 1.0 quality control modules; provides complete file-based workflow management including transcoding, quality control and delivery; brings automated compliance and quality testing into the transcoding workflow; features dynamic load-balancing and failover protection.

408-542-2500; www.harmonicinc.com
Booth: SU7213

ENCODER/DECODER
NTT Electronics HV9100 series

Supports both HD (1080i/720p) and SD (480i/576i); additionally supports, optionally, up to 16 channels of audio input capability and an IP interface; compatible with the 4:2:2 profile.

201-556-1770; http://nel-america.com
Booth: SU7217

ENCODER
Streambox SBT3-5300

Ideal for live news broadcasts, distribution of video to cable headends, SNG/ENG vehicles and other video delivery applications that require high reliability and performance with minimal power consumption; delivers SD video quality and compression at data rates ranging from 64Kb/s to 15Mb/s; forward error correction and burst error protection help to mitigate packet loss and network jitter; Web interface enables seamless local or remote system management.

206-956-0544; www.streambox.com

Booth: SU8911

ENCODER
ViewCast Niagara 2120

A compact, low-cost streaming solution; allows even nontechnical personnel to stream high-quality live video in H.264 Adobe Flash format; its built-in Web interface simplifies system setup and operation, allowing complete system control from anywhere on the network; users can set streaming parameters from the intuitive Web interface and can begin streaming in multiple resolutions and bit rates with a single push of the front-panel stream button.

800-250-6622; www.viewcast.com

Booth: SL1709

Production switchers, video effects, keyers

HD/SD LOGO KEYER
Crystal Vision MultiLogo

Provides three layers of keying from a variety of internal and external sources, including a 4GB or 8GB multiport, nonvolatile video store that can read six images and write two images simultaneously; new features include easy trimming of recorded clips, text labeling of presets and GPI functionality; allows three logos to be faded up and down independently and makes it easy to put together a sequence of changes using all three key levels.

407-405-8644; www.crystalvision.tv

Booth: N820

Color indicates advertisers

SEAMLESS SWITCHER
Analog Way Quattro Value
Performs fast and smooth transitions between any video or computer sources; allows seamless switching between one computer input and any other video or computer input; is fitted with four universal A/V inputs, including one DVI and three outputs — one analog, one DVI for the main and one analog for the preview.

212-269-1902; www.analogway.com
Booth: SL1509

PRODUCTION SWITCHER
Brick House Video
Callisto Micro-HD
Features four asynchronous HD inputs, multiple program/preview and monitoring outputs, 12V operation and a small footprint; designed for mobile crews, helicopter operators and other users for whom space, weight and ease of use are at a premium.

203-376-3372
www.brickhousevideo.com
Booth: N4019

MULTILEVEL EFFECTS SWITCHER
Ross Video Vision Octane
Features 35 full-screen HD animation stores, 24 channels of 3D DVE with WARP capability, 96 inputs, 48 outputs and 56 keyers; can be loaded with any number of multilevel effects from one to eight, match any application and be combined with up to nine different control panels; ships with new 3G infrastructure as standard.

613-652-4886; www.rossvideo.com
Booth: N3807

Recording media

CAPTURE CARD
AJA Video KONA 3 v7.5
KONA 3 card running Version 7.5 software enables double-speed transfer from supported VTRs, including the Sony SRW-5800; supports Apple ProRes 4444 RGB; new features include support for time lapse and VPID as part of KONA 3 SDI output for support of select dual-link monitors.

530-274-2048; www.aja.com
Booth: SL920

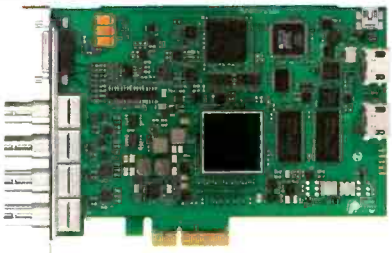
TRANSMISSION RECORDING SYSTEM
Axon Digital Design TRACS
Transmission recording and compliance system/video logger now features an HD input, which enables compliance recording or video logging without the need for an additional external device for downconversion; input is available as an option on all single-channel TRACS recorders and does not affect the maximum storage capability.

301-854-6557; www.axon.tv
Booth: N1119

MPEG-2 CODEC
Canon
Enables high-quality imaging and audio performance with up to 50Mb/s data recording and twice the color data of the HDV profile format as well as the recording of 1920 x 1080-pixel HD video; supports higher resolution and increased color data for high-quality video.

201-807-3300; www.usa.canon.com
Booth: C4325

VIDEO CAPTURE CARD
Blackmagic Design
DeckLink HD Extreme



Now includes dual link and 3Gb/s SDI for 4:4:4 quality, and a new hardware down-converter for simultaneous HD and SD playback; connects to SDI, HDMI, component analog, NTSC/PAL and S-video equipment for capture and playback, while instantly switching between SD, HD and 2K.

630-307-2400
www.blackmagic-design.com
Booth: SL6020

HD VIDEO DISK RECORDER
Doremi Labs V1-UHD

Provides instant access to video, uncompressed recording and networkable operation; is 3RU high and available with fixed or hot-swappable internal drives; records HD-SDI and SDI video; includes an external video storage chassis for feature-length recording; features frame-accurate control.

818-562-1101; www.doremilabs.com
Booth: C5640

DVR
Fast Forward Video HD3

Designed for on-set motion picture and TV production; features JPEG 2000 compression for optimal HD and SD image quality, as well as a high-quality, third-party monitor; available in single- or dual-channel configurations; uses removable, hot-swappable 2.5in SATA drives that are compatible with the company's complete HD line of products.

949-852-8404; www.ffv.com
Booth: C8016

ADAPTER
Maxell iVDR VC102

Direct-to-disk adapter provides reliability and ruggedness; has a current capacity of 250GB, enough space to record 19 hours of digital video, 110 hours of DVD-quality video or 20 hours of MPEG HD video.

800-533-2836; www.maxell-usa.com
Booth: C8737

Satellite equipment, services

SATELLITE COMMUNICATIONS SOLUTIONS
NPR Satellite Services

Provides the satellite capacity for building, servicing or expanding a satellite network; offers nationwide coverage to meet the video, audio and data distribution needs of broadcasters and network operators.

202-513-2604; www.nprss.org
Booth: SU6913

Color indicates advertisers

SATELLITE SERVICE
On Call Communications
QuickSPOT On Demand

Within minutes of deploying a QuickSPOT antenna, the system is ready to begin transmitting HD/SD video feeds along with providing IFB-compatible phone lines and Internet access; pay-for-what-you-use billing system offers flexibility to access satellite time per minute without prescheduling or purchasing discounted prescheduled blocks of time.

949-707-4729; www.occsat.com
Booth: OE910

MOBILE BROADBAND SATELLITE SERVICE
Stratos BGAN X-Stream

Allows a guaranteed minimum symmetrical video streaming rate of 384kb/s, with up to 450kb/s expected under optimal conditions; is supported only by Class 1 BGAN terminals; access to BGAN X-Stream does not require an additional external antenna or any other supplementary hardware.

709-748-4226; www.stratosglobal.com
Booth: OE1720

MODULATOR
Sencore TX 3453

Delivers multiple channels of transcoding in a reliable, high-density 1RU chassis; features a configurable engine and multichannel architecture, bidirectional video transcoding from MPEG-2 to MPEG-4-/H.264 and/or H.264 to MPEG-2 in all common HD or SD formats, as well as ASI and IP transport stream and optional RF interfaces; offers up to 16 channels.

605-339-0100; www.sencore.com
Booth: SU4310

Studio and support products, multi-image displays

MULTI-IMAGE DISPLAY
Harris Predator II-GX

HD control and monitoring solution; available in a 1RF or 2RU frame, making it ideally suited to outside broadcast vans, production centers, monitoring facilities or master control rooms that require a flexible, scalable architecture; allows for the expansion of inputs to match growing monitoring needs, including optional computer graphic input cards, which allow DVI-I or VGA sources to be monitored alongside video; features low system latency and easy reconfigurability; offers built-in autosensing support for multiple input video and audio standards, embedded and discrete audio monitoring, SNMP-based alarms and aspect ratio management.

800-231-9673
www.broadcast.harris.com
Booth: N2502

VIDEO PLAYBACK DEVICE MULTIVIEWERS

Apantac Tahoma-LI

3G-ready family with looping inputs autodetects four to 32 video inputs (HD/SD-SDI/composite); supports DVI, HDMI and VGA outputs up to 2048 x 1080; includes built-in video and audio alarm detection; incorporates a built-in CATx extender, which allows digital 1080p signals to be extended up to 115ft.

503-616-3711; www.apantac.com
Booth: N4029

FLAT SCREENS

Autoscript LED TFT-Plus

Range includes 8-, 12-, 15- and 17in versions; feature an illuminated control panel for easy visibility in dark studio conditions; feature LED technology, which offers advantages for display longevity, performance, reliability and "green" energy savings.

203-926-2400; www.autoscript.tv
Booth: C6025

LCD MONITORS

JVC G series

Features 3G and dual-link HD/SD-SDI (1080p/60 4:4:4) inputs; the 17in DT-V17G1Z and the 24in DT-V24G1Z are designed for broadcast, studio, mobile and field applications that demand accurate color reproduction for critical image evaluation; feature a built-in waveform monitor with over-level function, vectorscope with selectable size and position, advanced audio level meter and LTC/VITC time code support.

800-582-5825; http://pro.jvc.com
Booth: C4314

AMOLED MONITOR

TVLogic LEM-150L1

Uses a 15in AMOLED screen at native 1366 x 768 resolution; features include 100,000:1 contrast ratio, two 3G/HD/SD-SDI inputs and outputs, one DVI input, one HDMI input with HDCP, analog/component/composite/S-video/RGB inputs, 1:1 pixel mapping modes for SD/HD audio disembedder and built-in speaker.

818-567-4900; www.tvlogicusa.com
Booth: SL6514

MONITORS

Marshall Electronics Quad-Viewer

Full-resolution monitors with IMD; available in different sizes; allows viewing of four different inputs at once with three different layouts to choose from; does not require external under monitor display; supports the following protocols: Image Video, NVISION, TSL and MEI; offers a full-resolution 1920 x 1200 display; new unique RotoMenu feature enables fast, direct and easy menu navigation.

800-800-6608; www.lcdracks.com
Booth: C8931

Color indicates advertisers

TECHNICAL FURNITURE SYSTEM
TBC Consoles IntelliTrac

Front and rear device tracks allow unlimited lateral positioning of critical monitors; rack bay turrets may be easily upgraded or relocated, allowing quick, user-friendly modifications; full range of articulating arms for distance, height and tilt control may be used for mounting flat-panel monitors, speakers, phones and task lighting.

631-293-4068; www.tbcconsoles.com
Booth: C12626

KVM EXTENDER
Thinklogical VelocityKVM

Extends KVM, DVI and analog video, USB, audio and serial signals up to 350m using standard 50um multimode fiber, 1000m using eSX+ multimode fiber and 40km using single-mode fiber; allows for full-frame-rate transmission of uncompressed DVI with no frame dropping; features USB 1.1, USB 2.0 and DDC2B/EDID compliancy as well as local KVM ports; supports single- and dual-link DVI signals.

203-647-8725; www.thinklogical.com
Booth: SL4729

LCD MONITOR
TVLogic XVM-245W

Uses 24in 1920 x 1080 color-critical monitor featuring 10-bit LCD, RGB LED backlight, HD/SD input support including 2K; includes two auto-sensing HD/SD-SDI, component, composite, S-video, RGB, DVI-I and HDMI with HDCP inputs, fully automated calibration with integrated 3D LUT, SMPTE-C, REC 709, DCI-P3 and EBU color-space support, internal waveform/vectorscope, interlaced field mode and 3G dual-link 4:4:4 option.

818-567-4900; www.tvlogicusa.com
Booth: SL6514

MONITORS
Marshall Electronics ORCHID

Fully-featured broadcast LCD rack-mount monitors; available in different sizes; include a real-time waveform monitor, real-time color vectorscope, 16 64-segment tricolor audio meters and a tricolor tally indicator; offer on-screen time code, seven assignable GPI inputs and adjustable color temperature, as well as an auto-sensing front-panel headphone jack and auto-sensing rear unbalanced stereo output.

800-800-6608; www.lcdracks.com
Booth: C8931

3-D

PRODUCTION AND INFRASTRUCTURE PORTFOLIO
Evertz

Designed to assist broadcasters with transition to 3-D broadcasting; products range from contribution and acquisition to distribution and multiviewing.

905-335-3700; www.evertz.com
Booth: N1602

3-D FIELD FIBER TRANSPORT
MultiDyne LiGHTBoX

A 3-D field fiber transport system; features more signal paths for HD video, audio and data; fully customizable and offers virtually any signal configuration; can also be linked via tactical fiber cable to the MultiDyne DVM-2500, HD-1500, HD-3000 and HEMC-4000; provides a high-quality signal throughput and the opportunity to integrate almost any solution from the MultiDyne product line, including the new DVI-6000 and COMMS-2000 products; equipped with a rugged case, making it highly weatherproof for outdoor and remote location broadcasting.

516-671-7278; www.multidyne.com
Booth: C7637

3-D LCD MONITOR
Panasonic BT-3DL2550

A 25.5in 3-D LCD production monitor with full 1920 x 1200 resolution; features professional connectivity, including dual HD-SDI and DVI interfaces, exceptional color performance and a ruggedized frame; includes two HD/SD-SDI inputs, component and RGB, as well as standard RS-232C (nine-pin) and GPI (nine-pin) remote inputs, headphone jack and green and red tally lamps on the front panel; has an embedded audio decoder onboard (through its headphone jack), time code display, closed-captioning (through video input only) and audio level meter display of up to eight channels.

201-392-6141
www.panasonic.com/broadcast
Booth: C3712

TBCs, frame syncs, conversion equipment

DUAL DE-INTERLACER/SCALER
Daitron i-Chips IP00C811

Features a built-in video decoder, ADC, CPU and LVDS Tx; supports PiP, PoP with inputs and output up to 1080p/WUXGA/2K1K progressive or 1080i; additional features include MPEG noise reduction, edge enhancement, xvYCC deep color processing, high-color bitmap OSD, 90-degree image rotation, mirror image, keystone correction and edge blending; suited for video walls applications.

503-682-7560; www.daitron.com
Booth: SL10723

Color indicates advertisers

UP/DOWN/ CROSSCONVERSION CARD
Cobalt Digital Fusion-3G 9900 Series UDX

Supports 3G/HD/SD-SDI, fiber and analog I/O and AES and analog I/O; takes the input video and performs high-quality deinterlacing and video scaling; AFD processing engine performs reliable, accurate ARC changes with no user input; features advanced audio-processing options allowing routing, gain, delay and mixing as standard features; video options include color correction, wings keying, general-purpose keying and test signal generation; audio options include Dolby E and AC-3 decoding/encoding, Linear Acoustic UPMAX upmixing and AEROMAX loudness processing.

217-344-1243; www.cobaltdigital.com
Booth: N2830

SHORT-DELAY DOWNCONVERTER
Crystal Vision Q-Down 3G

Downconverts 1080p 3Gb/s, 720p HD and 1080i HD at 50Hz and 59.94Hz, with the downconverter bypassed if the input is SD; provides input loop-throughs and three downconverted feeds; HD video inputs can be configured as mixtures of digital HD, RGB and YUV, while SD outputs can be configured as mixtures of SDI, composite, Y/C, YUV and RGB; features fixed video delay settings including minimum (16 or 52 SD lines), fixed (52 SD lines) and frame; can deal with any 3Gb/s or HD or SD aspect ratio conversion requirements.

407-405-8644; www.crystalvision.tv
Booth: N820

SCAN CONVERTER
Ensemble Designs BrightEye Mitto

Makes it easy to choose the desired video output format, 1.5Gb/s and 3Gb/s HD-SDI or SD-SDI; possesses proprietary scaling technology and exclusive multitap filtering; the region selected for output determines if the scan converter acts as an upconverter or downconverter; the filters automatically adjust in accordance with the conversion being performed; the included software allows users to simply use a mouse to select which part of the computer video they want to output to HD or SD video.

530-478-1830
www.ensembledesigns.com
Booth: N1929

CONVERTERS
PESA QuadBox series

Fiber media converters with three new product offerings — a 4 x 4 coax switch box, a 4 x 4 fiber switch box and a two-channel bidirectional fiber/coax extender; supports video formats from 143Mb/s to 3Gb/s; provide equalized and reclocked video signals for SMPTE 259M, 292M and 424M or can be set to by-pass mode if needed.

800-323-7372; www.pesa.com
Booth: N4123

SDI-TO-HDMI CONVERTER
LYNX Technik yellobrik CDH 1811

Ideal for converting any SDI video signal (up to 3Gb/s 1080p60) into a standard HDMI signal for monitoring and display; also ideal as an integrated SDI fiber transmission system with HDMI confidence monitoring; an optional fiber interface allows the module to be used for monitoring fiber connections and also function as a fiber converter; the HDMI output displays the native input resolution, so no scaling artifacts are introduced.

661-251-8600; www.lynx-usa.com
Booth: N5011

STANDARDS AND FORMAT CONVERTERS
Snell CVR800 and TBS800

CVR800 frame rate and format converter and TBS800 format converter and synchronizer both offer a range of features and functionality, including support for 3Gb/s operations and composite video I/O; offer user-controllable enhancement tools to enable users to obtain their preferred visual effect.

818-556-2616; www.snellgroup.com
Booth: N1820

LOUDNESS CONTROL
Miranda Technologies Automatic Loudness Control (ALC)

Prevents excessive jumps in program-to-program and channel-to-channel loudness levels; available for multiple Densité interfaces; three ALC solutions are available: ALC with Linear Acoustic AEROMAX processing, ALC with Junger Level Magic processing and ALC with Miranda's low-cost, high-performance wideband audio processing; operation can be based on either set-and-forget or actively managed processing modes.

514-333-1772; www.miranda.com
Booth: N2515

Telco, IPTV and mobile video equipment

MPEG-2 TO H.264 TRANSCODERS/MPEG-2 TO MPEG-2 SCALERS
DVEO MPEG Gearbox

Available in ASI-to-IP, ASI-to-ASI and IP-to-IP systems; transcodes one HD (720p) stream or two SD streams into H.264 and outputs the streams over ASI or IP; receives uncompressed HD-SDI at up to 1.485Gb/s; I/O format can be MPEG-2 or H.264; will work as a PAL to NTSC converter; transcodes at bit rates of 64kb/s to 12Mb/s; supports SNMP, SD/HD input, up to 720p HD output, AAC or MPEG/AC-3 transcoding or pass-through audio and resolutions of SQVGA, QCIF, QVGA, SIF, VGA or any custom size up to 720p.

858-613-1818; www.dveo.com
Booth: SU2709

MULTI-IMAGE DISPLAY/MONITORING SOLUTION
Evertz MViP

Targeted at applications where simple, efficient monitoring of audio and video from an IP transport stream is required; developed for digital headends, IPTV networks and sites using IP for distribution with a requirement to monitor and display audio and video along with fault information and transport details on a DVI-based monitor.

905-335-3700; www.evertz.com
Booth: N1602

Color indicates advertisers

IP VIDEO TRANSPORT
Nevion VS901-Ix-GE

Provides high-quality JPEG2000 compressed SD/HD video and transport over IP; its low latency and high visual quality is the ideal solution for interactive or any delay-sensitive applications; guarantees the highest possible visual quality with absolute minimal degradation through multiple encode/decode cycles; provides optimum source content for final encoding via MPEG-2/H.264 and distribution to the home.

805-247-8560; www.nevion.com
Booth: N4624

IPTV DISTRIBUTION
Intelsat IPTV Service

A wholesale MPEG-4 content aggregation and delivery service for distributors and integrators operating in the United States; supports delivery of a prepackaged TV programming lineup in a highly-efficient MPEG-4 IP format to cable and telecom service providers.

202-944-7515; www.intelsat.com
Booth: SU1417

IP VIDEO PRODUCTION SYSTEM
Panasonic 50 series

An IP and Serial-controlled video production system; includes the AW-RP50 remote camera controller, the AW-HE50 multiformat HD/SD camera with an integrated pan-tilt-zoom mechanism, and the AW-HS50 sub-compact live switcher with built-in multiviewer.

201-392-6141
www.panasonic.com/broadcast
Booth: C3712

Test & measurement equipment

H.264 VIDEO-OVER-IP DISTRIBUTION SOLUTION
HaiVision Network Video Video Furnace System 5.5

Supports MAKITO H.264 encoder to manage and distribute live video to computers and set-top boxes, to create scheduled playback channels for enterprise TV and signage, and to record content and deliver VOD; controls direct, secure distribution of SD and HD video to InStream player and STINGRAY set-top box; Playback Manager supports scheduled channels for IP video broadcast and signage; Media Server leverages H.264 to enable HD VOD; enhanced with network video recording functionalities, including API-enabled management by third-party systems, ad hoc and pause/resume recording, bookmark insertion with annotations and publishing.

514-334-5445; www.haivision.com
Booth: SL4424

PSIP GENERATOR
Triveni Digital GuideBuilder

Now offers new mobile services features; provides mission-critical operational capabilities for both content providers and network operators by generating accurate PSIP data; enables unified fixed and mobile DTV metadata management and generation capabilities in a single platform; includes the addition of electronic service guide functionality to ensure up-to-date scheduling and tuning, managed through the operator's existing workflow components.

609-716-3500; www.trivenidigital.com
Booth: SU3202

SCOPE
Blackmagic Design Ultrascope

A 3Gb/s SDI and optical fiber SDI scope designed for editors and colorists; plugs into any compatible Windows computer with a 24in monitor; can display six live scope views simultaneously; includes 3Gb/s SDI plus 3Gb/s optical fiber SDI; auto detects SD, HD and 3Gb/s SDI inputs.

630-307-2400
www.blackmagic-design.com
Booth: SL6020

SPECTRUM ANALYZERS
Bird Technologies SignalHawk series

Now includes a dedicated rack-mounted version, built using the same analysis engine but with no display or keypad; the SH-36S-RM includes Ethernet and USB connections for local and remote communication; users can remotely analyze the radio frequency spectrum; measure intended and interfering signals; remotely display signal amplitude versus frequency, and save traces to your PC; eliminate trips to difficult remote locations; manage multiple sites from one centralized location; verify FCC compliance via built-in emissions masks.

866-695-4569
www.bird-technologies.com
Booth: C454

TS MONITOR
Triveni Digital StreamScope RM-40 2.0

New features include Live Services Manager and thumbnail views of the RM-40 real-time stream monitoring appliance that enable users to confirm with a quick glance that video is present; also decodes closed-captioning data with rules-based alerts if data should fall out of compliance, reducing the manual workload necessary to maintain required closed-captioning information.

609-716-3500; www.trivenidigital.com
Booth: SU3202

TEST & MEASUREMENT EQUIPMENT
Cobalt Digital Audio Loudness Meter

Provides a flexible, comprehensive solution for ingest or on-air loudness metering and assessment; features true peak-level detection, error tracking and logging, and an intuitive interface with touch-screen control; ensures thorough audio level and LFKS assessment information; option is available on a number of Cobalt 9000 Series cards and is ATSC A/85 and ITU BS.1770 compliant.

217-344-1243; www.cobaltdigital.com
Booth: N2830

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DTV Marketplace

TV ANALYZER
Rohde & Schwarz R&S ETL

Enables users to perform all required measurements on TV transmitters or cable headends; options available to measure ATSC and ATSC Mobile DTV single-frequency networks and support U.S. J.83/B cable standard and Japanese ISDB-T standard; automated software that simplifies compliance testing of ATSC transmitters is available free of charge.

410-910-7800
www.rsa.rohde-schwarz.com
Booth: SU3717

WAVEFORM MONITORS
Tektronix WFM8200 and WFM8300

Provide high-quality, real-time, automated 3Gb/s SDI eye pattern display and jitter measurements; feature advances in color grading with new patented Luma Qualified Vector and Spearhead Gamut displays; WFM8300 also provides multirate HD/SD-SDI and 3G-SDI color bar and pathological signal generation capabilities.

800-833-9200; www.tek.com
Booth: N2522

TV transmitters, feedline, antennas, towers, services

ATSC MOBILE DTV TRANSMITTER
Axcera ATSC Mobile DTV system

Combines fixed and mobile content into a single transport stream feeding an ATSC broadcast transmitter; using the company's field-tested ATSC Mobile DTV Multiplexer and Axciter ATSC Modulator, an existing digital transmitter can be easily upgraded to carry mobile DTV service.

800-215-2614; www.axcera.com
Booth: SU2908

DISTRIBUTION AMPLIFIER
ESE DV-212

A 1 x 12 3G/HD/SD SDI distribution amplifier with a loop through input; provides cable equalization, reclocking and distribution; distributes one 3G, HD or SD-SDI input signal to 12 outputs; the video signal can be reclocked before distribution or distributed without retiming the input signal; in reclocking mode, it automatically detects and reclocks the 270Mb/s, 1.5Gb/s, or 3Gb/s signal.

310-322-2136; www.ese-web.com
Booth: C6437

SIX-WAY DIVERSITY RECEIVER
RF Central RMR X6-II-D4

Features on-screen display of stream data, Ethernet monitoring for remote access and IP encapsulation for Internet broadcast; available as a stand-alone COFDM receiver with ASI output, with an MPEG-2 internal SD/HD or integral MPEG-4 SD/HD decoder; includes compact chassis and OLED display.

980-852-3700; www.rfcentral.com
Booth: C6419

RECEIVER/DECODER
Screen Service Broadcasting Technologies XBT 704

In analog operation, receives an RF input signal and delivers it through its output connectors; acts as a bypass for the RF analog signal; in digital operation, receives an RF digital input signal and decodes the contents; extracts a program from the bouquet and delivers it into an ASI output signal; signal feeds a transposer; features two-channel balanced analog audio output and doubled SDI interface for digital video with embedded audio.

888-522-0012; www.screen.it
Booth: SU4908

MICROWAVE LINK SYSTEM
Nucomm ChannelMaster Lite

Available in single-, dual- or tri-band configurations, using frequency bands from 1.5GHz to 15.4GHz; features adjustable long-GOP encoding — including I, P and B frames — improving video quality as well as offering a low delay mode; the encoder can be purchased as HD/SD or SD only; for increased flexibility, a wide array of inputs are provided, including composite video/audio, SDI (with de-embedded audio), ASI and 70MHz.

800-968-2666; www.nucomm.com
Booth: C6419

VHF TRANSMITTERS
Harris Platinum VHF transmitter

Available in both liquid-cooled, high-power and air-cooled low-power models; feature PowerSmart technology for efficiency and reliable operation; both of these solid-state transmitters incorporate the Harris Apex M2X multimedia exciter to support a wide range of global digital standards — including ATSC, ATSC M/H, DVB-T/H, ISDB-TB, FLO, DMB, DAB, CMMB and CTTB; software upgrades allow easy migration to different modulation requirements.

800-231-9673
www.broadcast.harris.com
Booth: N2502

UHF/VHF LOW-POWER TRANSMITTER
Rohde & Schwarz R&S SCx8000

Supports ATSC, ATSC Mobile DTV, DVB-T/H and MediaFLO as well as analog TV standards; implements a module-based, air-cooling concept; integrates an RF splitter and combiner solution in the amplifier modules; can be switched from analog to digital transmission at any time by remote or manually; power output stage comes equipped with broadband precorrection; features power output of up to 450W or 300W with one amplifier in UHF range, or up to 900W with second amplifier; amplifiers come equipped with two power supplies.

410-910-7800
www.rsa.rohde-schwarz.com
Booth: SU3717

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Color indicates advertisers

Video editing systems

PCI EXPRESS EDITING SOLUTION
Blackmagic Design Multibridge Eclipse

External PCI Express capture and playback solution instantly switches between SD, HD and 2K, in 4:2:2 or 4:4:4 video quality; connects to PC or Mac with high-speed 10Gb/s PCI Express for editing system, or use independently as a bidirectional SDI video converter; features 3Gb/s SDI, HDMI and analog editing with 16 channels of audio.

630-307-2400; www.blackmagic-design.com
Booth: SL6020

EDITING SYSTEM
Grass Valley EDIUS 5.5

PC-based nonlinear editing software; now includes real-time, full-resolution AVCHD editing already released for the EDIUS Neo 2 Booster package; ideal for professional and prosumer videographers who shoot and edit AVCHD video and need native real-time performance when editing material compressed with the AVCHD format; is now Windows 7 compatible.

503-526-8100; www.grassvalley.com
Booth: SL106

Video routing

PORTABLE VIDEO SWITCHER
FOR-A HVS300HS series

The newest addition to the company's Hanabi series; the small,1RU main frame is packed with features including frame synchronizing and resizing engine on every channel, which allow any SD equipment to be used in full HD mode; has plenty of wipe patterns, including 2-D and 3-D DVE transitions; features a keyer with chroma key, DSK, dual picture in picture, 16-channel multiviewer and still stores.

352-371-1505; www.for-a.com
Booth: C5219

VIDEO PRODUCTION SYSTEM
Broadcast Pix Slate V8

Features a powerful and efficient new user interface, as well as enhancements to its Fluent Multi-View, Clip Store and Macros workflow tools; new options extend control to ViewCast streamers and Telemetrics camera control systems; will run on upcoming 3G systems, enabling a smooth transition to a 1080p future; Fluent Multi-View has an updated look that is easier to read and customize; any element can now be resized; colors can be changed for window borders and backgrounds; new alignment tools make it easy to optimize across as many as four monitors.

978-600-1100; www.broadcastpix.com
Booth: N4506

SWITCH
Nevion VS7700

ASI/SDI intelligent slipless switch provides full transport stream protection for digital television networks; with comprehensive TR 101 290 real-time analysis, it can base switching decisions not only on disrupted signals but also on the quality of both the primary and backup transport streams; by performing feed-forward switching, TS packet alignment is guaranteed throughout the switching process.

805-247-8560; www.nevion.com
Booth: N4624

SWITCHER
Panasonic AW-HS50

The IP-capable HD/SD live, portable switcher offers four HD/SD-SDI inputs and one DVI-D input, as well as a built-in multiviewer display; features a built-in frame-synchronizer for each input, two HD/SD-SDI outputs and one scalable DVI-D output; provides IP links to the new AW-RP50 remote camera controller, enabling automatic selection of the currently controlled P/T/Z camera video on the switcher's aux bus.

201-392-6141
www.panasonic.com/broadcast
Booth: C3712

I/O BOARDS
Utah Scientific

Designed for the UTAH-400 router; allow users to choose MADI audio and IP video input and output options in addition to the existing analog and digital video (up to 3G) and analog and digital audio options.

801-575-3770; www.utahscientific.com
Booth: N4511

3G HD/SDI ROUTING SWITCHER

Sierra Video openGear routing switcher

Passes 19Mb/s SDI to 3G/s HD-SDI video; available in 8 x 4, 8 x 2, 4 x 4 and 4 x 2 I/O configurations; features include reclocking, automatic input equalization and dual reference inputs; compatible with Dashboard control software; can be controlled via RS-232/422 or with a remote-control panel.

530-478-1000; www.sierravideo.com
Booth: SL4505

Weather/data services

EMERGENCY ALERT MANAGEMENT SYSTEM

Digital Alert Sysmtems DASDEC-II

Includes integrated support for MPEG-2 or MPEG-4 outputs, a browser-based interface for remote monitoring, up to four Ethernet ports for multiple access points within a station and automatic FCC-compliance logging within the system's non-volatile memory bank; can be used as a drop-in replacement for any existing EAS encoder/decoder set; supports a broad range of physical connection and interface protocols; engineered to handle future emergency alert requirements with software; flexible packaging allows for various model configurations.

585-765-2254
www.digitalalertsystems.com
Booth: C3651

WEATHER GRAPHICS

Weather Central 3D:LIVE

A real-time broadcast weather platform for HD and SD; integrates up-to-the-second data, 3D effects, animations, high-resolution maps, and comprehensive storytelling tools that ensure a continuous supply of fresh content; new tools enable meteorologists to quickly and easily personalize forecasts, graphics and alerts for distribution to their audience across the complete spectrum of broadcast, online and mobile communications mediums, including social media platforms such as Twitter and Facebook.

608-274-5789; www.weathercentral.tv
Booth: SU912

Wire, cable, connectors

SMALL-DIAMETER CABLE

Optical Cable High-Density Bend-Tolerant Cable

Designed for use in truck, LAN, data center, 40/100GigE and other applications where small size, light weight and small bend radii are needed; increases capacity in tray systems, improves cable management, increases cooling efficiency and reduces cost for under-raised-floor cabling systems; offers superior performance with negligible loss; exceeds ITU-T-G.657.A2 standards for bending performance; has a tighter bend performance than many similar products.

540-265-0690; www.occfiber.com
Booth: SU8823

CONNECTORS

Fischer Connectors AluLite series

Aluminium engineered metal connectors; 50 percent lighter than typical metal connectors; the ultra light, compact connectors offer excellent strength-to-weight ratio; ideal for handheld material, mobile equipment, batteries and power supplies, trollies, rack-mounted units or auxilary equipment; easily integrate with high-profile product designs, while also offering a flexible color-coding system; rugged, sealed up to IP68 and operational from -50°C to +150°C; can withstand the harsh field conditions of outside broadcasting.

800-551-0121
www.fischerconnectors.com
Booth: C11724

Note: Booth numbers are provided by NAB and are current as of press time. Every effort has been made by Broadcast Engineering *to ensure the accuracy of these listings.*

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Media Application Server

Omneon's server takes on cross-platform, file-based workflow integration.

BY SIMON ELDRIDGE

For years, broadcast professionals have been challenged with the idea that a "generic" IT platform could eliminate the integration woes and format wars that complicate plant design. Despite the promise of such platforms, the fact is that things have not gotten much simpler.

The ongoing complexity of plant design stems from two issues. The first of these is file format interoperability, which receives the most attention and is partly addressed by useful yet imperfect standards such as MXF. The second issue, that of cross-platform, file-based workflow integration, is in some respects a thornier problem. Though this issue has received substantially less consideration than the first, it raises a critical question: Within new file-based infrastructures that do not rely on the video router, how can media be moved effectively through the broadcast workflow?

Omneon has addressed the workflow issue with its Media Application Server, which is built on the generic application servers that the IT world uses to provide core software services and infrastructure. This platform, in turn, supports better and faster integration — and more efficient operation — of applications and services that exchange metadata and transaction data within complex systems. As a result, back-end applications can be written so that data persistence, application control and system status all can be centralized and distributed to applications across the network.

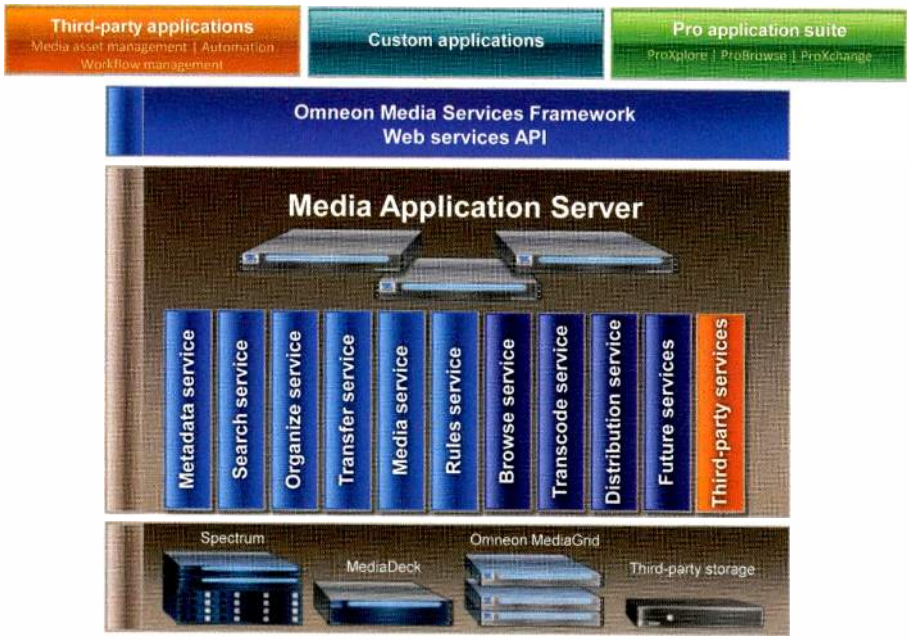

Figure 1. Omneon's Media Application Server is designed around service-oriented architecture principles.

Applying media awareness to the application server, Omneon has addressed challenges specific to broadcast and production workflows. The resulting integration platform supports all applications that manage, process and use the media in the underlying systems. In media-centric environments, the application server brings greater efficiency to fundamental processes by supporting a growing range of automated and simultaneous operations. One example is the movement of files from device to device with concurrent transcoding or generation of low-resolution proxies performed as needed.

The ability to control and manage video servers, storage, transcoders and other devices is key to broadcasters' realization of straightforward, streamlined file-based operations. To this end, the server is designed around service-oriented architecture (SOA) principles. This approach provides a single enterprise platform for the control and management of these devices. It also simplifies the movement of content — delivering the right format at the right time to the right location.

A collection of Web services — APIs collectively dubbed the Media Services Framework (MSF) — within the application server provides tools for controlling how content is moved, wrapped, formatted and converted. (See Figure 1.) The Omneon ProXplore interface, or any other media management system compatible with the MSF Web service APIs, may be tailored to serve as a custom user interface and media asset management system.

Automation is essential to effective file-based workflows. Built-in rules and notifications engines can guide automated events and notify other systems or users about system activity and job status. A rules engine within the Omneon platform automates the transfer of incoming encoded video feeds directly from in-

gest servers to central storage as soon as the feeds begin, giving editors rapid access to centrally stored content. As each new encode session begins, a notification is sent to the third-party proxy subsystem. The subsystem can in turn use MSF calls to start reading and transferring the growing file, making low-resolution video available to everyone in the enterprise.

Rules also can automate conversion of files, whether from external sources or from archives, into the "house" file format. As a result, all available content can be used in the same way. To enable very fast conversions, the application server directs the ProXchange system to perform parallel transcoding across all available processors within the MediaGrid active storage system.

Working with a simple GUI, users select content using low-res proxy versions of media. The media asset management system uses MSF API calls to identify physical storage locations of high-resolution content. These calls also ensure that the media is automatically moved to the right place for editor access. When edited files are saved to a particular directory, additional rules ensure that those files are immediately transferred to on-air servers, making them available for transmission even as the transfer completes. If the central production and remote transmission centers are not co-located, the platform automatically calls on ProCast to enable bandwidth-optimized WAN transfer of content to the remote node, wherever in the world it may be.

The transfer mechanism used depends largely on file wrapper format, environment and use case. The Media Application Server supports standard FTP transfers and tail-mode FTP for left-to-right content, when moving growing files is critical. The server also supports the Active Transfer mechanism, which allows any growing ingest format to be moved and written coherently to the destination device as recording continues. Such transfer capabilities speed user and device access to content, regardless of where it is stored. Dynamic rewrapping of content — the conversion from one media type (e.g., QuickTime or MXF) to another as part of the transfer process — not only allows broadcasters to overcome compatibility issues, but also eases integration of best-of-breed broadcast systems.

This technology addresses the complexities of cross-platform, file-based media workflows in two ways. First, it serves as a single enterprise platform for the control and management of broadcast devices. Second, it guides and automates the movement of content. The server thus represents a significant step forward in simplifying broadcasters' deployment of advanced multiplatform systems. BE

Simon Eldridge is Omneon product manager, software and applications.

Camera crossover

Now that consumer digital SLR cameras include video capability, will news crews start using them?

BY JOHN LUFF

Cameras can be thought of as optical analog-to-digital (A/D) converters these days. Photons respond in the lens as waves, and the sensor converts photons (arguably acting like particles) into stored electrical charge. That is a sampling process pure and simple. To make it more specific, it is a three-dimensional sampling technology, with spatial samples taken at the frame (or field) rate in a succession of samples that only represent the original scene.

Unlike compression, the goal of this kind of sampling is to reproduce the most accurate rendition of the scene as possible. MPEG is generally coded at 8 bits per sample, but cameras commonly sample at 10 to 14 bits per sample. This has a clear and direct effect on the capture range and noise floor of the camera. More is better — better contrast, detail in the light and dark areas, less noise sensitivity, more accurate color rendition, and more natural looking pictures. Though a camera cannot reproduce the full range of light values possible (think starlight to nuclear explosion), partly because the display cannot accomplish the other end of the acquisition/display process, a camera with more potential range goes a long way to making natural images look, well, natural.

In a way, many modern camera sensors are similar to oversampling audio A/D converters. They use more pixels in the sensor than the image format requires. Individual pixels are formed by combinations of pixels, either at the time of A/D conversion or in post processing. This allows a camera with more pixels to create a multitude of scan standards. For instance, one manufacturer's sensor is 4320 x 1920 pixels. By combining six samples vertically into one, a 720-line format is created. Combining four vertical samples into one makes a 1080-line format. The same is true in the horizontal direction, with 1920 samples natively, or by combining three samples into two output samples, a 1280-sample structure is achieved to create a 1280 x 720 native image.

Cameras intended for digital cinema production do the same thing, with the result that varying resolutions and aspect ratios can be created without building purpose-specific cameras. It would be prohibitively expensive to create a multitude of chips for each output format, and from a practical standpoint, an agile camera is a much smarter approach. From a manufacturer's perspective, it may be the only way to make cost-effective cameras. From a user's viewpoint, it allows some future flexibility in how the camera is used.

It is important to realize that we have begun to approach the limits of physics in the design of practical HD cameras. A 2/3in sensor is actually about 11mm diagonal, or roughly 5.4mm x 9.6mm. On that chip, each pixel is about a .005mm square. To achieve full resolution, an HD camera system, lens and camera, must produce about 81 lines a pair per mm. Now consider the future standard for UHDTV, developed by NHK in the last decade and standardized by SMPTE recently. The picture is a whopping 7680 x 4320 pixels! A 2/3in sensor would now have pixels only a little over .001mm, one-quarter of the size we have today. And the lens/camera performance must produce nearly 400 line pairs per mm to achieve the same performance. That would be a stunning optical system indeed, or the imager must become much larger to allow practical optics to be used.

Consumer crossover

But let's look at the other end of the scale. Consumer camcorders have many different sensor sizes, from 1/2in on high-end crossover cameras to as small as 1/6in, with many in the range of 1/3in. Extrapolating the numbers above means that on a 1/3in sensor, the pixels for 1080 images are about .0025mm square, and the lens system performance would also have to double to achieve the same per results. But the truth is that inexpensive cameras use inexpensive optics. Performance has to suffer. The pictures are demonstrably better than SD cameras, but cannot equal the quality of a studio camera and lens.

In order to produce higher volumes of HD content, the natural order of economics moves people to less expensive hardware.

This gives rise to an interesting dynamic. In order to produce higher volumes of HD content, the natural order of economics moves people to less expensive hardware. The resulting content cannot be the same quality as that shot with more expensive hardware. So in the rush to get more HD content to air, we are in fact choosing often to produce less

than HD performance. News cameras might be high quality, or they might be consumer crossover cameras. One network recently announced it was giving reporters HD consumer cameras that are barely bigger than a cell phone so they can capture images when a crew is not present. The images might be 720p or 1080i technically, but the resolution will clearly suffer a dramatic degradation. That is acceptable because of the possibility that the content is more impactful and therefore worth the trade-off. Intercutting HD and pseudo-HD images creates a change in quality discernable to average viewers. The key is that consumers understand not to expect the same production approach as taken for the Super Bowl. Thus, this is readily accepted.

The new season of NBC's "Saturday Night Live" debuted with a new look for the opening title sequence. The entire opening montage was shot using the Canon EOS 5D Mark II and the new EOS 7D digital SLR cameras.

Nonetheless, the importance of the rise of consumer crossover products is important to understanding the camera marketplace. It is clear that DVCPRO, which is based on the research done for the consumer DV camcorder marketplace, changed the way camera technology is developed and deployed worldwide. The technology arises in the professional market in no small measure because it can leverage the research paid for by a high-bandwidth consumer product delivery chain.

Conclusion

In the last year, we have seen the advent of digital SLRs with video capture capability, extending the range of options to a new class of cameras. Most are oversampled, with some having up to 21 million pixels (single chip, not three as many video cameras have). But the range of optical choices is an interesting dynamic. I wonder how we will fit a 7in viewfinder to a 1.8lb camera? Will it work on a steadycam? Production professionals have already found innovative ways to use this interesting possibility and will continue to do so. NBC's "Saturday Night Live" shot a recent segment entirely with SLRs. Can news crews be far behind? BE

John Luff is a broadcast technology consultant.

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What's a stereographer?

You'll need one to create 3-D content.

BY ANTHONY R. GARGANO

Let the hype begin! The International CES Show has come and gone, and the 3-D juggernaut has now left the station. 3-D technology seemed to permeate every nook and cranny at the show in any vision-related consumer electronics booth. From still cameras to displays and from computer gaming to Blu-ray disks, eye-popping content abounded. The industry has sown the seeds of must-have technology, and the Consumer Electronics Association — the industry's official trade organization — is already predicting sales of 4 million 3-D television sets in 2010.

Reigning in such unabashed enthusiasm and promotion are flipside comments such as that by blogger and freelance copywriter Otis Maxwell, who, when discussing 3-D TV said, "My prediction is this is like the hot girl you're never going to bring home to meet mom."

3-D content

As with any new visual media technology, it is always all about content. 3-D content today is essentially limited to 3-D film libraries. While there are technologies being advertised and companies offering services, 2-D to 3-D upconversion is a mixed bag. To do it effectively, it's a very expensive process. Unless money is spent to do it well, consumers will not be compelled to invest in a new display whose 3-D images look like the cardboard cutouts in a child's paper popup book, and that's what a lot of today's 2-D to 3-D upconversions look like. Compare that to the 3-D IMAX experience presented by the movie "Avatar," and you will quickly conclude that there is no comparison. It's like T-ball vs. the World Series, or school soccer vs. the World Cup.

That brings up the question of whether 3-D is a theater experience where the revenue return can support high production value content and its attendant high production cost. George Lucas has recently been quoted as considering rereleasing the "Star Wars" franchise in 3-D. You can bet that if he does, there will be untold millions spent on delivering a viewing experience that technically will be as memorable as that of "Avatar."

But even in a large-screen venue, 3-D still has problems. A small percentage of viewers of "Avatar" in 3-D IMAX complained of headaches and nausea. And then there is the recent debacle of 3-D football on the giant screen at Cowboys Stadium, where it had to be turned off after just 10 minutes because of the headache and nausea complaints and the boos of the fans watching it.

From still cameras to displays and from computer gaming to Blu-ray disks, eye-popping content abounded.

But back to content; the transition to HD had a federally mandated transition to digital transmission facilitating its widespread adoption. Movies and existing television series' archives also provide a wealth of content for respectable SD-to-HD conversion. Series originally shot on film can readily be remastered to HD. This is not the case going from 2-D to 3-D, at least not for a discernibly acceptable product.

For new content, 3-D production has its unique challenges. In a recent discussion with producer Ted Kenney, whose credits among others include the movie "U2 3-D" and NBC's "Chuck" episode in 3-D, he shared some of the unique 3-D production challenges. For example, because 3-D uses twin capture lenses, his production company, 3ality Digital, found it necessary to develop software to measure the lenses' optical centers and make sure that they matched. Also, when doing cuts between cameras during a shoot, he needed to ensure that the depth planes matched one another to preclude a nausea-inducing artifact in the program material. For 3-D production, he has found it necessary to create a new position — what he calls a stereographer. The role of the stereographer, whose main function is the proper use of depth, includes everything from making sure there is no mismatch between the zoom ratios in twin lenses to measuring on-set depth levels. 3-D production requires major changes in the creative process.

What's next?

So, where does all this leave the broadcaster? Well, there are no standards, and every standards body from SMPTE to MPEG to the EBU all have active working groups and subcommittees, but they are not close to adopting anything soon. While neither the polar opposite views of the CEA nor Otis Maxwell may prove to be prescient, with all the elements behind this current 3-D push, we are bound to land somewhere in between. And even that "somewhere" is a long way off. In the meantime, enjoy that odd 3-D movie or PC game, and don't worry about it until the advent of what we know the real market driver will be: 3-D porn. BE

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

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