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AUGUST 2005

Broadcast Engineering®

THE JOURNAL OF DIGITAL TELEVISION

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Getting your station online

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Computers & Networks
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A PRIMEDIA PUBLICATION

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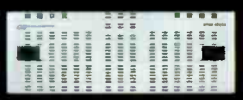

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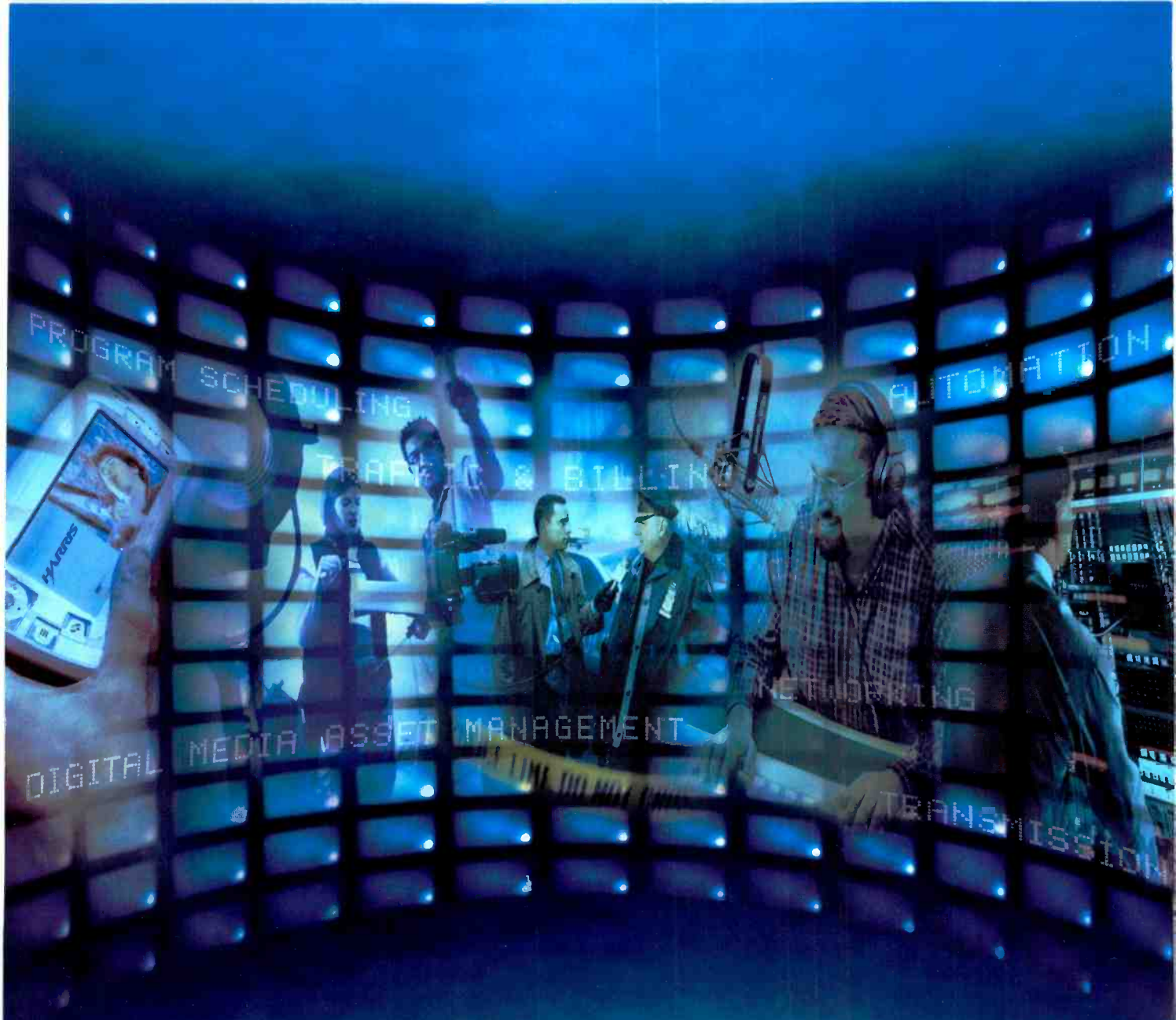

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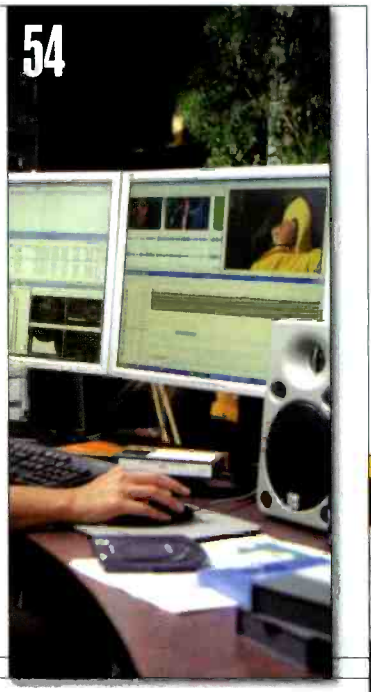


ON THE COVER:

Because today's NLEs come equipped with built-in video effects, audio mixing capability and MPEG editing, editors can now become a one-man-band. Photo courtesy Apple Computer.

BEYOND THE HEADLINES

DIGITAL HANDBOOK

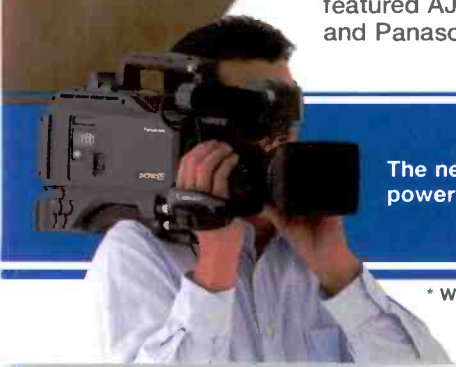
(continued on page 8)

all the news fits

Shoot more news more efficiently with Panasonic's new P2 Store drive. The AJ-PCS060 stores 60GB of DVCPRO footage on a one-pound*, ultra-rugged hard drive that simplifies ENG workflow. Plug in a P2 card, push the Start button and your DVCPRO content transfers to the P2 Store at faster-than-real time.

Crews need fewer reusable P2 cards in the field since the P2 Store holds the contents of up to 15 (4GB) P2 cards. P2-compatible edit systems connect to the P2 Store's USB 2.0 port for instant access to content.

The P2 line-up also includes the new, low-power AJ-SPC700 (pictured below) and the fully featured AJ-SPX800 DVCPRO50/25 P2 camcorders. To learn more about the new AJ-PCS060 and Panasonic's entire P2 family, visit www.panasonic.com/p2 or call 1-800-528-8601.



The new AJ-SPC700 DVCPRO50/25 P2 camcorder offers low power consumption and high cost efficiency for newsgathering.

Panasonic
ideas for life

* Weight of AJ-PCS060 is 1.4 pounds

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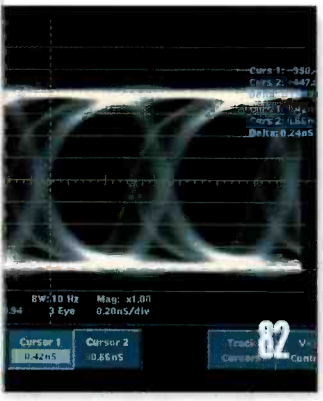
SYSTEMS DESIGN & INTEGRATION



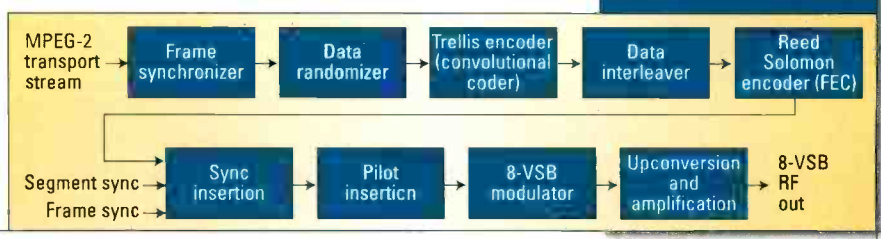
NEW PRODUCTS & REVIEWS

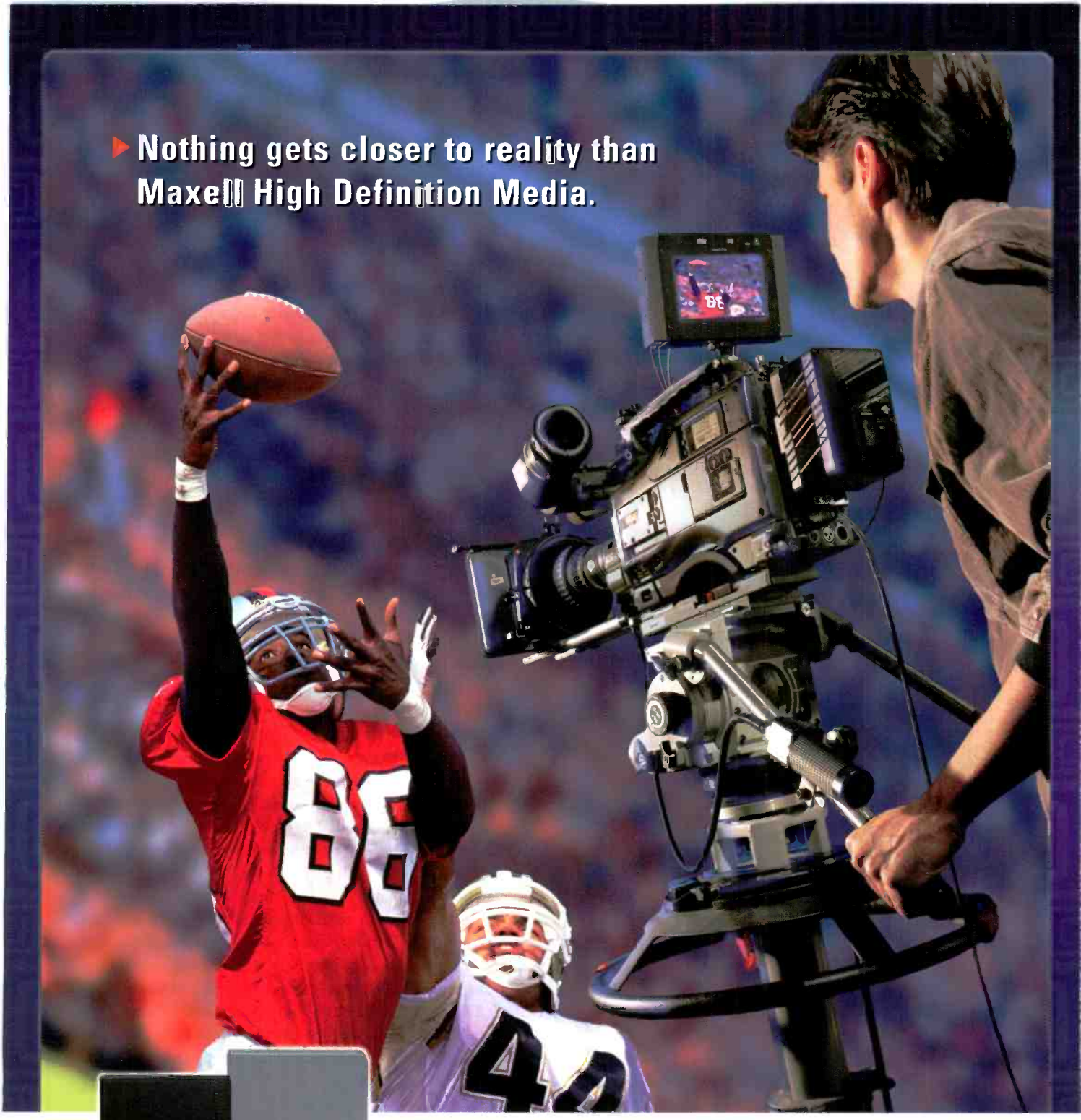
DEPARTMENTS

Freezeframe

Find the error in the block diagram (below) of a representative VSB terrestrial broadcast transmitter. Hint: DTV standard A53/C.

Readers submitting winning entries will be entered into a drawing for *Broadcast Engineering* t-shirts. Enter by e-mail. Title your entry "Freezeframe-August" in the subject field and send it to: editor@primediabusiness.com. Correct answers received by Oct. 1st, 2005, are eligible to win.





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Get the lead out

Is your video library system near the end of its life? Could it ever need replacement boards or parts? Do you have replacement devices on hand, or are you assuming the manufacturer will be able to supply them? What about those studio cameras? Are you expecting the manufacturer to have boards in a few years when you need them? Maybe install that upgrade they promised when you bought it?

I've got bad news, fella. These products and practically everything in your facility is about to become obsolete and perhaps unrepairable! Soon you may not be able to get the replacement boards, components, transistors, ICs, resistors, pots or switches — items that today are off-the-shelf. It's possible you could end up having to replace an entire system simply because you can't get a $10 part.

Want to know why? Because the European Union's (EU) environmental bureaucrats have decided that any company wanting to sell products in Europe must get the lead out of their equipment.

I recently visited with Will Wohler, president of Wohler Technologies, about this issue. It seems he's become the de facto broadcast industry spokesman about these ridiculous new EU regulations.

Here's what I've learned: The EU's new requirements are contained in two documents, commonly known as WEEE and RoHS, or the Waste Electrical and Electronic Equipment directive and Reduction of Hazardous Substances, respectively. Together they require recycling targets for electronic devices and the elimination of the use of such heavy metals as lead, mercury, cadmium, hexavalent chromium and two brominated flame retardants (i.e., PBB and PBDE) from all electronics sold in the EU beginning. Remember what's in solder? Lead. All electronics sold into Europe after July 1, 2006, can't have any lead in them.

"So what?" you ask. "I'm based in the United States. Why should I care?"

Ask yourself why any manufacturer would continue to build (or support) a product that could only be sold in the United States but not Europe because it contains lead? And no manufacturer in his right mind is going to retool a factory to make replacement components for devices already nearing the end of their lives. This goes for cameras, production switchers, routers, you name it. I hate to tell you, buddy, but your supply chain is about to dry up.

It's true that if the manufacturer is U.S.-based, it isn't subject to Brussels' ridiculous rules. However, if that U.S. company wants to sell even one device in Europe, you guessed it: The device must be completely lead-free. Gotcha! You're screwed.

It would be worth a call to your key vendors to see what their support policies are going to be with regard to lead-based components. Remember, it's not just your vendor's policy that's important here. If the vendor can't get a certain IC or transistor because it's not available in a lead-free version, you're still screwed.

Of course, once everything electronic is made with lead-free solder, we'll be over this bump. It's just that it's an awfully big bump, and it's going to hit you where it hurts most. BE

Brad Dick
editorial director

Editor's note: More information is available at http://europa.eu.int/comm/environment/waste/weee_index.htm *and* www.technosteria.com, *where you can sign a petition asking to block the regulations.*

HDV to HD-SDI made simple

Miranda's award-winning **HD-Bridge DEC** offers high quality HDV to HD-SDI interfacing. With integral 1080i/720p cross conversion, it can really simplify signal processing when you're working across multiple HD formats. It's ideal for lossless HD-SDI editing of HDV files, with rapid batch capture using RS422 VTR control. HDV editing workflow is also improved with its Graticule markers and multiple monitoring outputs, including analog HD, digital/analog audio, and time code. And naturally, HD-Bridge DEC is also perfect for on-air playout of HDV using an HD-SDI infrastructure. So for smarter HDV interfacing, contact Miranda.

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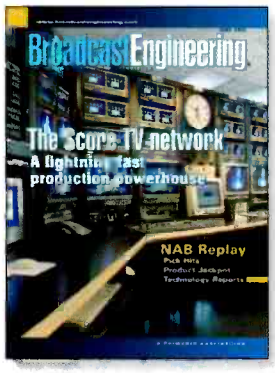
HDTV: MAKING IT HAPPEN



The photo on the June cover of Broadcast Engineering *is courtesy of Andy Washnik, CORPRICOM.*

Back me up

Brad Gilmer:

If you back up your data to the same physical hard drive and the drive fails, won't everything be lost?

DON RIMA

Brad Gilmer responds:

Backing up a drive onto itself is never a good strategy. If the drive or controller fails, the backup is no good.

I recommend that you create at least two logical partitions on the physical hard drive (or install two separate drives if you have room). The first partition stores the operating system (OS) and any other applications that can be easily reloaded from their distribution CDs. The second partition stores application-specific data.

This is a good idea because the performance of some operating systems degrades over time. The only way to get the OS back to normal is to reformat the drive and reinstall the OS. But, not all operating systems suffer from this problem.

If you have the OS on a separate partition from the data, you can reformat and reinstall it without having to restore all of your data. In many cases, you can also reinstall your applications to the first partition and simply relink to the data drive.

I only back up the second partition on the belief that I can reload everything on the first partition from CDs.

RAID is a good technology to protect critical systems from data loss, but it can be costly, and some applications, like laptops, can't use it due to hardware constraints.

T2D correction

Phil Cianci:

In the May 16 *Transition to Digital* e-newsletter, the "ATSC transports streams" article says: "In the ATSC system, in order to facilitate channel acquisition in less than a half second, there is a defined relationship between video and audio PIDs for a given program."

This was present in the original version of the standard (ATSC A/53) and was known as the program paradigm. The program paradigm was dropped from the standard in later versions. The video and audio PIDs for each program are listed in the program map table for that program and referenced in the service location descriptor of the virtual channel table.

ROBERT GROSS
WPIX
NEW YORK, NY

CAT5

Brad Gilmer:

CAT5 cable is most commonly a four-pair cable. It is possible to get hundreds of pairs of CATx cable under a single sheath. (Behind four-pair, 25-pair seems to be the most common for CAT5.) CATx ratings do not necessarily specify twist density or direction. I hear that a cable must simply meet the performance specifications and how those specifications are met is up to the cable manufacturer.

LINCOLN KING-CLIBY

Brad Gilmer responds:

You are correct. CAT5 cable is available in different configurations. Multi-pair cables are commonly used to run between floors and patch bays or where multiple Ethernet connections are required. Four-pair cable is used frequently in point-to-point Ethernet wiring.

All the cable manufacturer must do is meet the specifications. That said, they meet those specifications by using a consistent twist-per-inch to create a transmission line with the appropriate characteristics to reliably transfer the data on the cable with acceptable return loss. How they do that is left to the manufacturer.

Editor's note: Broadcast Engineering *will begin a three-part series on wiring and cable by Steve Lampen in September. Cable specifications, selection and usage for audio, video and Ethernet applications will be covered in this series. Don't miss it!* BE

May Freezeframe:

Q. Provide the introduction years for the following SD digital tape formats: D1, D2, D3, Digital Betacam, D5, DV and MiniDV, DVCPRO, DVCPRO50, D9 Digital-S, DVCAM, Betacam SX, Digital8 and IMX.

A. The correct answers are from Graham Jones' book, *A Broadcast Engineering Tutorial for Non-engineers*; pages 147-149:

D1	1987
D2	1989
D3	1991
Digital Betacam	1993
D5	1994
DV and MiniDV	1995
DVCPRO	1995
DVCPRO50	1998
D9 Digital-S	1995
DVCAM	1996
Betacam SX	1996
Digital8	1999
IMX	2000

Winner:

John Steinhardt

Test Your Knowledge!

See the Freezeframe question of the month on page 8 and enter to win a *Broadcast Engineering* T-shirt.

Send answers to bdick@primediabusiness.com

WAKE UP

TO NON-LINEAR PERFORMANCE

TO REMOVABLE CONVENIENCE

TO AN AFFORDABLE SOLUTION

It's not a dream. Watch for it.

grass valley

A THOMSON BRAND

Looking high and wide for news

BY CRAIG BIRKMAIER

As reported in this column in May, affordable HD was one of the big news stories at NAB2005. (For more, see "Web links" on page 16.) The reality that the new tools of digital media production are scaling up to meet the requirements for HD post production has been growing for several years. Computer-based tools for editing and managing HD content are now available from a variety of vendors with little — if any — premium over their SD counterparts. You may need more disk storage for HD, as well as monitors that are up to the task, but these components are being driven by the relentless cost reduction benefits of Moore's Law.

As the broadcast industry comes to grips with the impending migration to digital television, including HDTV, we are beginning to understand where the real costs and challenges of moving to HD, with its widescreen format, will be revealed. For example, it has been reported that the management at one Little Rock network affiliate received a request from the on-air staff to include a budget for plastic surgery and dermabrasion along with the cash for HD cameras.

Unlike other technical innovations that have changed the look of television over the decades, HD is not creating a bandwagon effect at the local level, forcing other stations in the market to upgrade to remain competitive. Only a handful of stations in the United States have hitched their fortunes to the HD bandwagon; to date, their local competitors have not followed.

One can understand the reluctance to be a pioneer in the face of tough local competition, especially in the broadcast news business. And then there is the reality that there are still only about 10 million HD-capable homes in the United States, and most of these do not receive off-air DTV broadcasts. It was to be expected that local broadcasters would find little to be excited about when looking at first-generation HD products and the total costs of converting station operations for HD program origination.

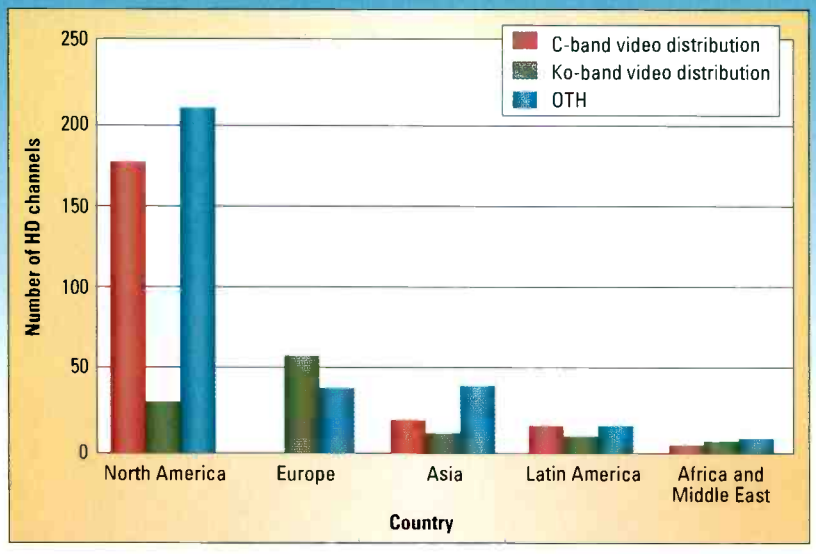
At NAB, the PR hype was thick with the buzzword *affordable HD* filling the air. JVC introduced an HD ENG camera and demonstrated an end-to-end solution for live remote broadcasts in HD. Panasonic's first HD P2 camcorder also seems optimized for ENG and other local HD origination tasks. And Sony seems anxious to push its HDV bandwagon into the industry's newsrooms. Affordable HD camcorders are now finding their way into many hands, including some broadcast facilities, if only to learn more about the technology.

Local broadcasters can no longer hide behind the high cost of HD acquisition and production. Although to be fair, you get what you pay for. A good HD lens for a studio camera will generally cost more than the HD camera to which it is attached. The new affordable HD camcorders can make outstanding pictures, but it is obvious that they must employ some compromises to reach these breakthrough price points.

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

Global HD channels by region, 2010

HDTV over satellite to grow over next five years



Source: Northern Sky Research *www.northernskyresearch.com*

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Today's HDTV viewers expect surround sound with their programming, and Dolby® E makes it happen. With Dolby E you can easily deliver surround sound from the remote truck to the network, from the network to the local station, and within cable and satellite operations. Dolby E converts your two-channel broadcast plant to a multichannel audio facility.

Dolby E carries audio metadata to ensure the integrity of your program's original sound. It automatically controls the complete audio delivery path—from production to the viewer's home. And with all the other broadcast products now incorporating Dolby E, you can deliver surround sound more easily than ever. Join the hundreds of broadcast and postproduction facilities that already know how well Dolby E delivers. It's the right call to make.

www.dolby.com/tvaudio

DOLBY®

So what's the real problem with local HD production and HD ENG?

Like being there

Those hooked on HD like to say that the HD viewing experience is almost like being there. There is no question that the higher levels of detail make it possible to see things that have been carefully masked by the limitations of NTSC and the expert work of those who often turn local news into a beauty contest.

Sets that worked fine in SD don't cut it for HD. Every imperfection can be seen, including those in instances where station engineers have learned to use the lack of definition in traditional broadcasts as a mask. Plastic surgery has even been cited as a requirement for those seeking to make the transition to HD.

And then there is the $64,000 question: How does HD actually enhance the ability to cover the news? Do we really need to see what passes for news in more detail?

Some see the trend moving in the opposite direction. Competitive pressures are causing news organizations to deliver breaking news using technologies that offer significantly less resolution than NTSC. For example, camera phones provided some of the most compelling images in the aftermath of the July 7 terrorist bombings in London.

And then there's competition from the Internet. When a major story breaks, many people — especially those at work — turn to Internet news portals for the story. A recent announcement by the CBS television network suggests that the very landscape of television news is changing as viewer options for information proliferate.

On July 12, CBS News and its digital content partner, CBS Digital Media, announced plans for a major expansion of CBSNews.com, creating a 24-hour, multiplatform digital news network, bypassing cable television in favor of the nation's fastest-growing distribution system — broadband. (See "Web links" below.)

The very definition of how news is delivered is changing before our eyes. And the enhanced clarity of HDTV may not be a critical factor.

Catch 16:9

One factor, possibly the most significant barrier to the migration of news to HDTV, is that the wider screen allows some viewers to see more than others.

This may well be the Catch-22 to the quick adoption of HD, not just in the United States, but worldwide. While the United States flirts with HDTV, Europe welcomes widescreen TV. Even there, however, compromise is the watchword. Many DTV broadcasts in Europe are using a 14:9 aspect ratio. On legacy 4:3 sets, the 14:9 content is displayed in a letterbox format that nearly fills the screen. On 16:9 sets, the 14:9 programming does not fill the full screen width.

The easy way to deal with the aspect ratio mismatch is to keep all of the critical information within a 4:3 safe area so that the entire audience can see what is important. This is the technique that the "Tonight Show with Jay Leno" uses. Nothing important happens in the extra side panel areas that only the HD audience can see.

For TV news, the situation grows even more complex because of the extensive use of graphics. Some stations have experimented with adding information that can be seen only by the HD audience in the side panels, while the standard 4:3 broadcast fills the center. Others simply restrict important graphic information to the 4:3 safe area.

Even if a station does make the commitment to move to HD news broadcasts, it is likely that much of the content will remain in SD. Most stations use contributing news services that do not currently feed in HD. Plus, it is still expensive to re-equip the entire news department for HD, even with affordable HD products. So for now, HD news will remain a compromise, with a mixture of stories that may be delivered at almost any resolution and multiple aspect ratios.

There is one aspect of affordable HDTV, however, that cannot be ignored. There is nothing to keep broadcasters from playing and learning. The cost to acquire an HD camcorder and an NLE system to produce HD content is now at a level where it can be written off as a learning experience. And these tools can also be used to create SD programming, including widescreen shows at SD resolution.

In such a competitive world, broadcasters cannot afford to ignore this opportunity. BE

Web links

Download May 2005: "Affordable HD at NAB"
http://bg.broadcastengineering.com/ar/broadcasting_affordable_hd_nab/

WUSA HDTV FAQ: "What's the big deal about HDTV? For starters, it's big..."
www.wusatv9.com/special/hdtv.aspx

"CBS News revamps online presence"
http://broadcastengineering.com/newsletters/bth/20050717/cbs-news-online-20050717/index.html

"ABC News to re-launch ABC News Now service"
http://broadcastengineering.com/newsletters/news_tech/20050414/abc-news-now-20050414/index.html

Craig Birkmaier is a technology consultant at Pcube Labs, and he hosts and moderates the OpenDTV forum.

SEND Send questions and comments to:
craig_birkmaier@primediabusiness.com

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DeckLink HD Pro Features: HDTV and standard definition support in 4:2:2 or Dual Link 4:4:4 • All HDTV formats including 1080/24p, 50i, 59.94i, 60i, 720/59.94p, 60p • Standard definition SDI format support for NTSC and PAL • Precision 14 bit analog monitoring output. Switches between HD or SD • True 10 bit RGB 4:4:4 or YUV 4:2:2 HDTV capture • Instantly switch between SMPTE-259M SDI and SMPTE-292M HD-SDI • Dual HD-SDI input and output for Dual Link 4:4:4 and 12 bit support • AES-S/PDIF output, AES-S/PDIF input and AES word-clock output • Sony™ compatible RS-422 serial deck control port included • Black burst & HD Tri-Sync compatible genlock input.

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Includes drivers for Microsoft Windows XP™ and Premiere Pro 1.5™ and Sony Vegas 6™, and on Mac OS X™, QuickTime™ and Final Cut Pro™.

Support for all leading broadcast applications. Apple Final Cut Pro™ • Adobe Premiere Pro 1.5™ • Sony Vegas 6™ • Adobe After Effects™ • Discreet Combustion™ • DVD Studio Pro • iDVD™ • Discreet Cleaner™ • Color Finesse™ • Microcosm™ • Apple Shake™ • Motion™. And most other QuickTime™ and DirectShow™ based applications.

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DeckLink HD Pro

Introducing the world's highest quality video card with amazing Dual Link HDTV 4:4:4 SDI for 10/12 bit RGB workflow. DeckLink HD Pro instantly switches between HD and standard definition. Now you can afford the best quality HDTV card available, even if most of your work is in standard definition. DeckLink HD Pro does both!

DeckLink HD Pro features an unprecedented 14 bit 4:4:4 analog monitoring output, retaining the subtle detail of film originated video. Combined with high speed converters adds up to the world's best HDTV monitoring. Monitoring instantly switches between HD and SD. Great features like AES-S/PDIF audio, and black burst & HD Tri-Sync input helped DeckLink HD Pro win 4 leading industry awards at NAB 2004.

New Single Link 4:2:2 model of DeckLink HD Pro available! Only RRP US$1,495

Workgroup Videohub

Workgroup Videohub eliminates manual cable patching by connecting everyone together into a fully featured professional routing switcher. Also includes independent monitoring outputs so you can instantly see any deck or editing system in your facility. Workgroup Videohub has 12 fully independent dual rate SDI inputs and 24 independent SDI outputs that auto switch between HD-SDI and Standard Definition SDI.

RRP US$4,995

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RRP US$695

DeckLink HD

This world leading 10 bit HDTV SDI card has changed the broadcast industry. It instantly switches between HDTV or NTSC/PAL SD eliminating your upgrade risk to HDTV.

RRP US$595

DeckLink Extreme

This amazing video card features 10 and 8 bit SD-SDI, HD-SDI down conversion, analog composite and component I/O, balanced analog audio I/O, DV, JPEG, internal keyer, genlock and so much more.

RRP US$895

Blackmagicdesign

Visit our website **www.blackmagic-design.com** or call your local DeckLink dealer for more information

BEYOND THE HEADLINES

DTV
status update

BY HARRY C. MARTIN

In June, the FCC moved towards completion of Round One of the DTV channel election process by approving 25 negotiated channel agreements, rejecting 12 and sending more than 150 letters to stations whose channel elections would result in impermissible interference. The recipients of those letters were given 60 days to notify the FCC on how the interference conflict will be resolved.

The FCC also issued tentative DTV channel designations for 1554 stations participating in the first round of channel elections. The commission currently expects to wrap up Round One this summer, clearing the way for Round Two elections in the fall, possibly as early as September. The FCC's ultimate goal is to issue a new DTV Table of Allotments by August 2006.

On July 1, DTV station identification requirements took effect. DTV stations must now comply with the longstanding station ID rules. DTV station IDs must include the station's call letters followed by the community or communities specified in the station's license. Stations can insert the frequency, channel number, name of the licensee and/or name of the network between the call letters and community of license. Also, stations that are multicasting may include additional information identifying each program stream.

Meanwhile, use-it-or-lose-it deadlines for replication/maximization of DTV service areas are already upon some stations and fast approaching others. By July 1, affiliates of the top-four commercial networks (i.e., ABC, CBS, Fox and NBC) in markets 1 to 100 were required to be operating with full facilities, meaning that:

- Where the station is currently operating on its tentative DTV channel designation, the station must construct full authorized facilities.
- Where the tentative DTV channel designation is *not* the station's current DTV channel, the station must serve at least the number of viewers served by the 1997 facility on which their replication coverage was based. The same use-it-or-lose-it obligations will apply to all other commercial and noncommercial TV stations as of July 1, 2006.

The penalty for falling short of the use-it-or-lose-it requirement is loss of interference protection to the portion of the relevant service area that is unused as of the applicable deadline. Moreover, a station falling short of the full build-out requirement will not be able to carry over interference protection on its post-transition channel to DTV service areas not served. While these deadlines may be waived, the commission has cautioned that waivers will be granted only in "unusual and limited circumstances."

DTV receiver deadlines moved up

In June, the commission refused to eliminate its deadlines for manufacturers of TV receivers to include DTV tuners. Those deadlines were:

- July 1, 2005: 50 percent of the television sets manufactured and imported into the United States with screen sizes of 25in to 26in must include a digital television tuner.
- July 1, 2006: 100 percent of such TV sets must have a DTV tuner.

The FCC retained the 50 percent deadline of July 1 and advanced the 100 percent deadline for 25in to 36in TV sets from July 1, 2006, to March 1, 2006. In addition, the FCC issued a further request for comment on whether the deadline for all television sets with screen sizes 13in or larger should be moved forward from July 1, 2007, to no later than December 31, 2006. At the same time, there is movement in both houses of Congress to advance the July 1, 2007, deadline.

The Consumer Electronics Association (CEA) and the Consumer Electronics Retailers Association (CERA) filed a request to delay these deadlines. According to CEA and CERA, the FCC's requirement has resulted in the hoarding of non-DTV sets by retailers and has served to impede the rollout of digital service. To resolve this problem, CEA and CERA suggested that the commission eliminate the 50 percent requirement and establish March 1, 2006, as the deadline for 100 percent of these TV sets to have a DTV tuner. The FCC rejected these pleas. BE

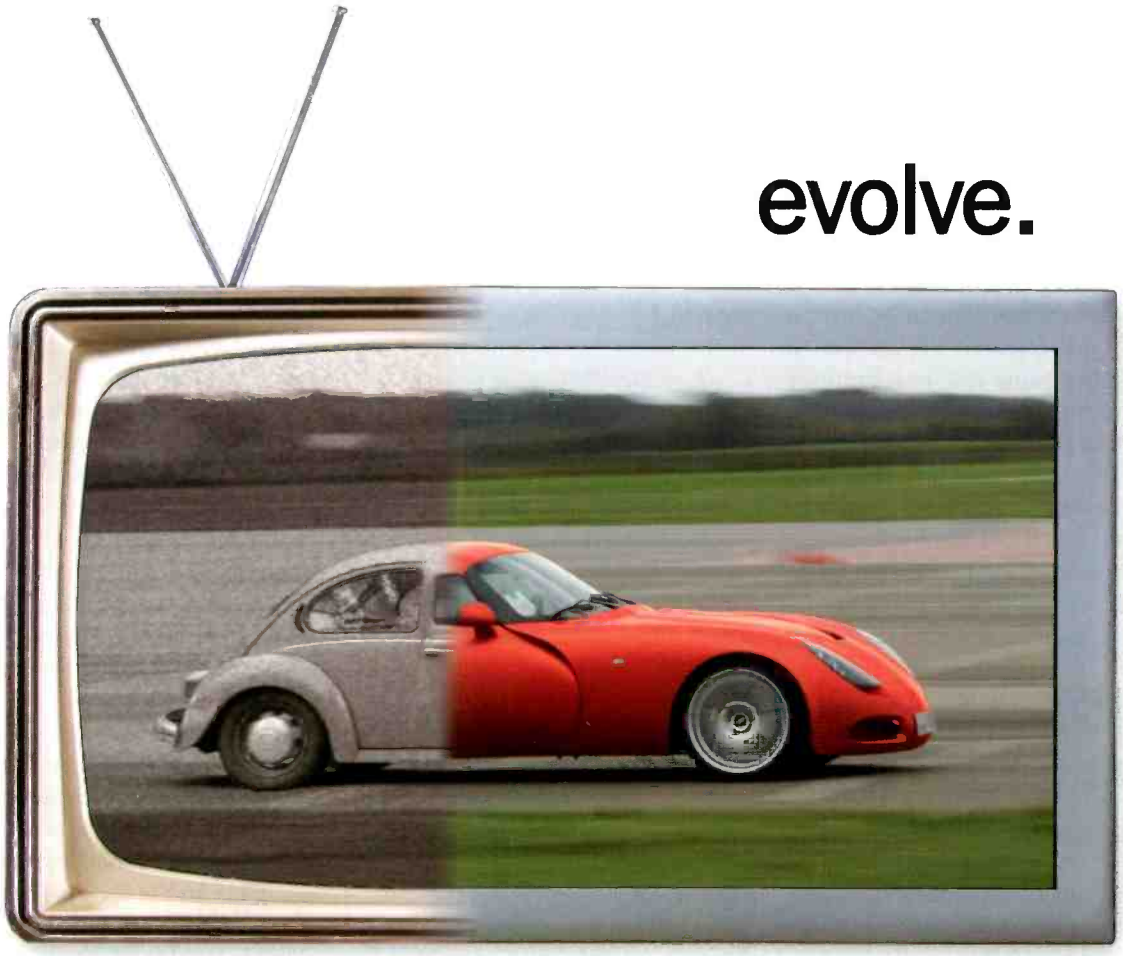
Harry C. Martin is the immediate-past president of the Federal Communications Bar Association and a member of Fletcher, Heald and Hildreth.

SEND Send questions and comments to: harry_martin@primediabusiness.com

Dateline

October 1 is the filing deadline for renewal applications for TV, LPTV, Class A TV and TV translator stations in Iowa and Missouri. The renewal applications (Forms 303-S) must be accompanied by biennial ownership reports (Forms 323) and EEO program reports (Forms 396).

October 1 is also the start date for renewal pre-filing announcements for TV stations (not LPTV, Class A or translators) in Colorado, Minnesota, Montana, North Dakota and South Dakota, in anticipation of a renewal application filing date of December 1.



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Analog audio noise

BY MICHAEL ROBIN

Analog audio signals are affected by noise. Noise is best defined as an unwanted disturbance superimposed on a useful signal. The noise level is usually expressed in dB relative to a reference value and is commonly referred to as signal-to-noise-ratio (SNR). In professional studio equipment, the reference level for SNR measurements is the maximum output level (MOL) or 10dB above standard operating level (SOL). In a studio environment, there are two types of noise: random noise and coherent noise (hum and crosstalk). In this article, we will discuss random audio noise and its effects.

Random noise

The main source of random noise is the thermal agitation of electrons. Given *R*, the resistive component of an impedance *Z*, the mean square value of the thermal noise voltage is given by $E_n^2 = 4kTBR$, where

E_n = The RMS noise voltage
k = Boltzmann's constant (1.38×10^{-23} joules/kelvin)
T = The absolute temperature in kelvin
B = The bandwidth in Hz

T is usually assigned a value such that 1.38T = 400, corresponding to about 17° C. So $E_n^2 = 1.6 \times 10^{-20}$ BR.

The SNR at the output of a system depends on the noise generated by the resistive component of the signal source.

The SNR at the output of a system depends on the noise generated by the resistive component of the signal source — for example, the microphone. Assuming B = 20kHz and a microphone with a resistive component R = 150Ω, then $E_n = 0.219\mu V$. This is the theoretical thermal noise of the microphone input circuit. The microphone preamplifier contributes its own random noise, which considerably reduces the SNR of the system. The situation can be visualized as having an ideal noiseless amplifier whose input is fed by a noise generator. This fictitious noise is called the equivalent input noise (EIN) of the amplifier. The difference between the EIN and the calculated theoretical thermal noise level of the audio signal source is called the noise factor of the amplifier.

The measurement of SNR begins with a rather involved procedure, and the accuracy of the results depends on a strict adherence to a set of rules. The following routine test procedure is suitable for the SNR measurements of an audio mixer:

Step 1: Disable all inputs except the one in the measurement path. Disable all compressors and equalizers. Feed a 1kHz audio signal at the rated input level (e.g., -70dBu) at the microphone input and adjust input sensitivity, channel gain and master gain for SOL at the output (+8dBu or +4dBu).

Step 2: Remove the input signal source and substitute with a low-noise 150Ω resistor. Measure the noise at the output with the audio analyzer in dBu in a 20kHz bandwidth. An optional noise-weighting network may be used to simulate the ear frequency response.

The actual SNR is given by the difference, in dB, between MOL in dBu and the measured noise in dBu. The use of a weighting network may produce SNR values that differ by 10dB or more from flat 20kHz bandwidth measurements.

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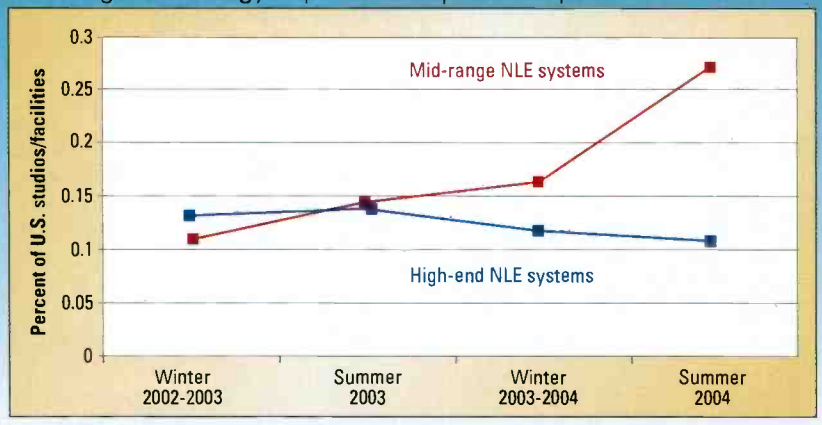

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The concept of dynamic range

The overload level, also called MOL, is usually defined in terms of acceptable total harmonic distortion (THD). Although there is no universal agreement on the maximum accepted value for THD, the figure of 1 percent is generally quoted for audio consoles and distribution amplifiers. Analog audio equipment is adjusted such that the MOL is higher than the SOL or line-up level. The difference between MOL and SOL, expressed in dB, is called headroom.

The MOL of an audio console or audio distribution amplifier is usually specified as 10dB or more above the SOL. Higher values of headroom may be needed when VU meters are used for audio signal level monitoring due to the meter masking effects.

Audio mixing consoles are also specified in terms of maximum input level (MIL). The MIL of an audio mixing console is the microphone input level at which the THD, due to the microphone input preamplifier, is 1 percent. The input headroom of an audio mixing console is the difference between the MIL and the rated input level (e.g., -60dBu). Input headroom specifications for audio consoles are between 20dB and 35dB.

The minimum acceptable signal level in a system is closely related to the acceptable SNR at low signal levels. This is clearly an operational decision. Ideally, the SNR at the lowest acceptable signal level should not be lower than 40dB. Microphone sensitivity ratings, measured at 74dB sound pressure level (SPL), are commonly expressed in open-load microvolts or dBV (decibels with respect to 1V). Impedances of professional-quality microphones are standardized at 150Ω, but other values are also encountered in practice.

SPL (dB)	Microphone output voltage (μV)	SNR (dB)
120	20,000.00	99.21
74	100.00	53.19
61	22.40	40.19
34	1.00	13.19

Table 1. Open load SNR at dynamic microphone output

A typical moving-coil microphone,

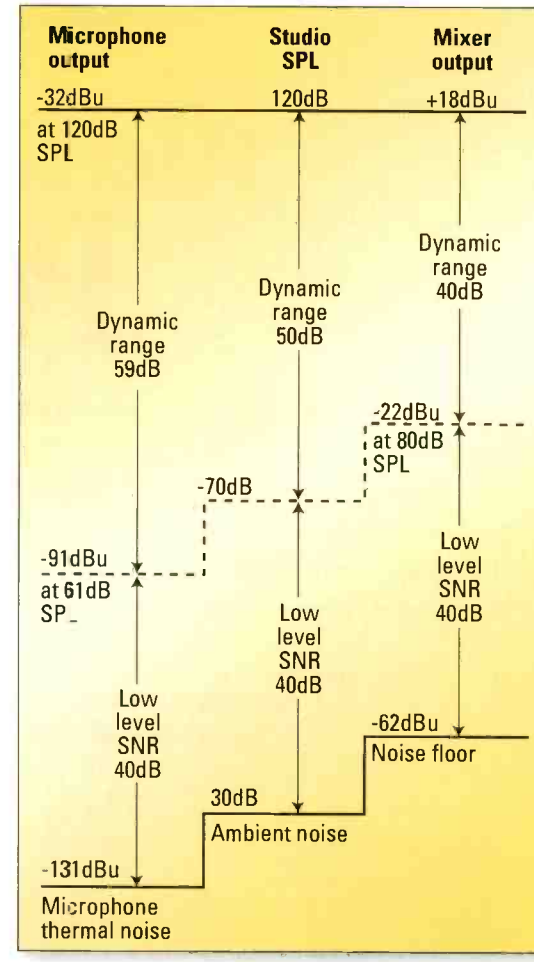

Figure 1. Factors contributing to the dynamic range in a studio environment

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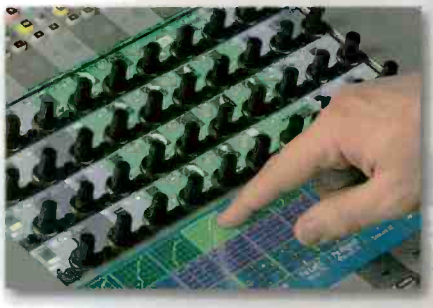

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with a source impedance of 150Ω, generates an open-load voltage of 100μV (-80dBV) at 74 SPL. The input impedance of the microphone preamplifier bridges the microphone output — that is, it has a value of 1500Ω or higher, to avoid microphone damping and input signal-to-noise degradation due to excessive signal loss.

Table 1 on page 22 lists the theoretical SNR at a standard dynamic microphone output for several SPLs under open load conditions. This table shows that 40dB SNR can be achieved at an SPL of 61dB, assuming that the ambient noise in the studio is 0dB SPL. A higher level of ambient noise will raise the minimum acceptable signal level.

The dynamic range is defined as the difference, expressed in dB, between MOL and the minimum acceptable signal level. Figure 1 on page 22 shows how three basic elements, namely the microphone, the studio and the analog audio mixer, each contribute to a reduced dynamic range in a studio. There are a number of assumptions made here as follows:

- The microphone source resistance is 150Ω.
- The microphone sensitivity is -80dbV at 74 SPL.
- The recording studio ambient noise is 30dB SPL.
- The peak SPL is 120dB.
- The studio operates in a voltage-matching mode.
- The SOL is +8dBu.
- The audio mixer MOL at 1 percent THD is +18dBu.
- The audio mixer SNR is 80dB with respect to MOL.
- The audio mixer is lined up such that an SPL of 120dB produces MOL at the output.

The assumptions made above reflect the expected single-pass performance of typical equipment available on the market. These are ideal operating conditions. In actual practice, the results may be different and, possibly, worse.

The dynamic range is defined as the difference, expressed in dB, between MOL and the minimum acceptable signal level.

Given SPL peaks of 120db, an ambient acoustical studio noise level of 0dB SPL and a standard dynamic microphone as defined above, the theoretical dynamic range at the microphone output is 59dB. It is limited mostly by the thermal noise of its

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resistive component of the mic.

The ambient noise in a broadcast studio is of the order of 30dB SPL. This limits the dynamic range of the studio to 50dB. Unlike the random noise generated by the resistive component of the microphone, the studio acoustical ambient noise has mostly low-frequency spectral noise components. Top-of-the-line analog audio mixers have an SNR on the order of 80dB with respect to the reference MOL. If the mixer is adjusted such that SPL peaks of 120dB generate output-level peaks (MOL) of +18dBu (10dB above an SOL of +8dBu) at 1 percent THD with an SNR of 80dB, the mixer background noise level is -62dBu as measured at its output. This limits the dynamic range of the audio mixer to 40dB.

Operational approaches

In order to avoid mixer input and output overloading at high SPL levels and a reduced SNR at low SPL levels, the operator must ride the gain, meaning manually adjusting input signal levels, channel gains and the master faders to achieve optimum operating conditions. Some mixing audio consoles with a large number of microphone inputs feature individual input channel compressors to ease the task of the operator. BE

The ambient noise in a broadcast studio is of the order of 30dB SPL.

Michael Robin, fellow of the SMPTE and former engineer with the Canadian Broadcasting Corp.'s engineering headquarters, is an independent broadcast consultant located in Montreal. He is co-author of Digital Television Fundamentals, *published by McGraw-Hill and translated into Chinese and Japanese.*

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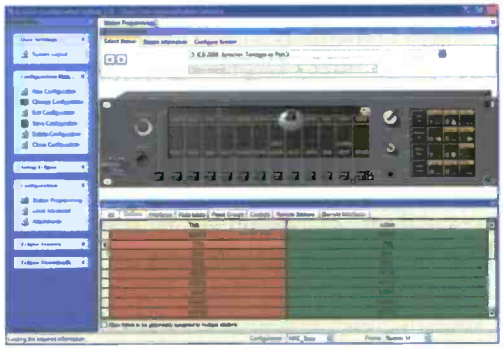

Drag-and-drop system configuration changes are fast and easy with Eclipse's intuitive software.

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Remote monitoring and control

BY BRAD GILMER

Remote monitoring and control of broadcast facilities is nothing new. Does anyone remember transmitter remote control systems based on telephone stepper relays? As the years have passed, remote monitoring capabilities have increased, driven by the consolidation of facilities, economies of scale and perhaps the engineer's natural propensity to do cool things with equipment that is far away.

Traditionally, broadcasters have focused on remote monitoring and control of transmitters. But now it is possible to remotely monitor and control all sorts of equipment.

As broadcasters have deployed more computer infrastructure in remote facilities, the need for monitoring and control of this infrastructure has grown. Let's take a look at the options available.

Remote command-line access

All computer access was remote at one point. The mainframe sat in a computer room, and terminals were located somewhere else. The terminals were usually Digital Equipment model VT-100s, and they were connected to the mainframe by RS-232. (See Figure 1.) It wasn't until the early '80s that Apple, Tandy, IBM and others introduced consumers to small systems with the terminal and computer all in one box. This all-in-one construction eliminated the need for a separate terminal.

Fast-forward about 10 years, and ironically, the need for remote terminals to be connected to central servers reappears. Internet servers are typically located where they can have access to high-speed network connections, but people who maintain these servers could be anywhere.

What people needed was an application that could be run on their local computer that would turn it into a remote terminal on their Internet server. This is exactly what telnet does. Telnet is an application that emulates a computer terminal (usually a VT-100).

To connect to a remote computer, you type "telnet hostname [port]" at a command line. From that point on, your computer acts as if it is a terminal connected by a serial cable to a mainframe. The port command is optional and defaults to port 22 for telnet. Many administrators disable telnet on computers that have Internet connections because of security concerns; telnet sends everything you type (including user names and passwords) in the clear.

Many, if not all, UNIX system administrators still use telnet-type connections because they prefer to work with command line utilities. They find that with experience, they can do many jobs more quickly from the command line than they can when using a graphical user interface (GUI). Telnet would be the perfect tool to use in this case because it provides remote command line access to a server. However, system administration commandfrequently contain information that administrators would prefer to keep secret — for example, the root password for the server. A more secure version of telnet was required.

Secure shell (SSH) was developed to provide remote, *secure* terminal access to computer systems. Functionally, SSH is almost identical to telnet, with the notable exception that all communication across an SSH connection is encrypted. It provides an authentication layer with advanced capabilities. To learn more about SSH and authentication, visit *www.openssh.org*.

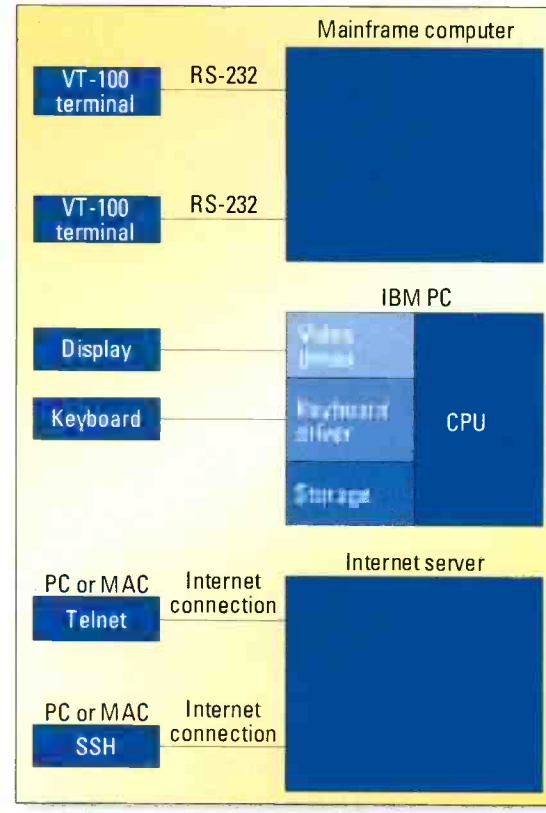

Figure 1. VT-100 terminals used to be connected to mainframes using RS-232 connections. In the '80s, the IBM PC and Apple IIe combined the computer, display drivers and keyboard I/O into one box. Now, PCs and Macs use telnet and SSH over the Internet to create a virtual terminal session.

Remote GUI access

While command-line access addresses the needs of many server administrators, there are other times

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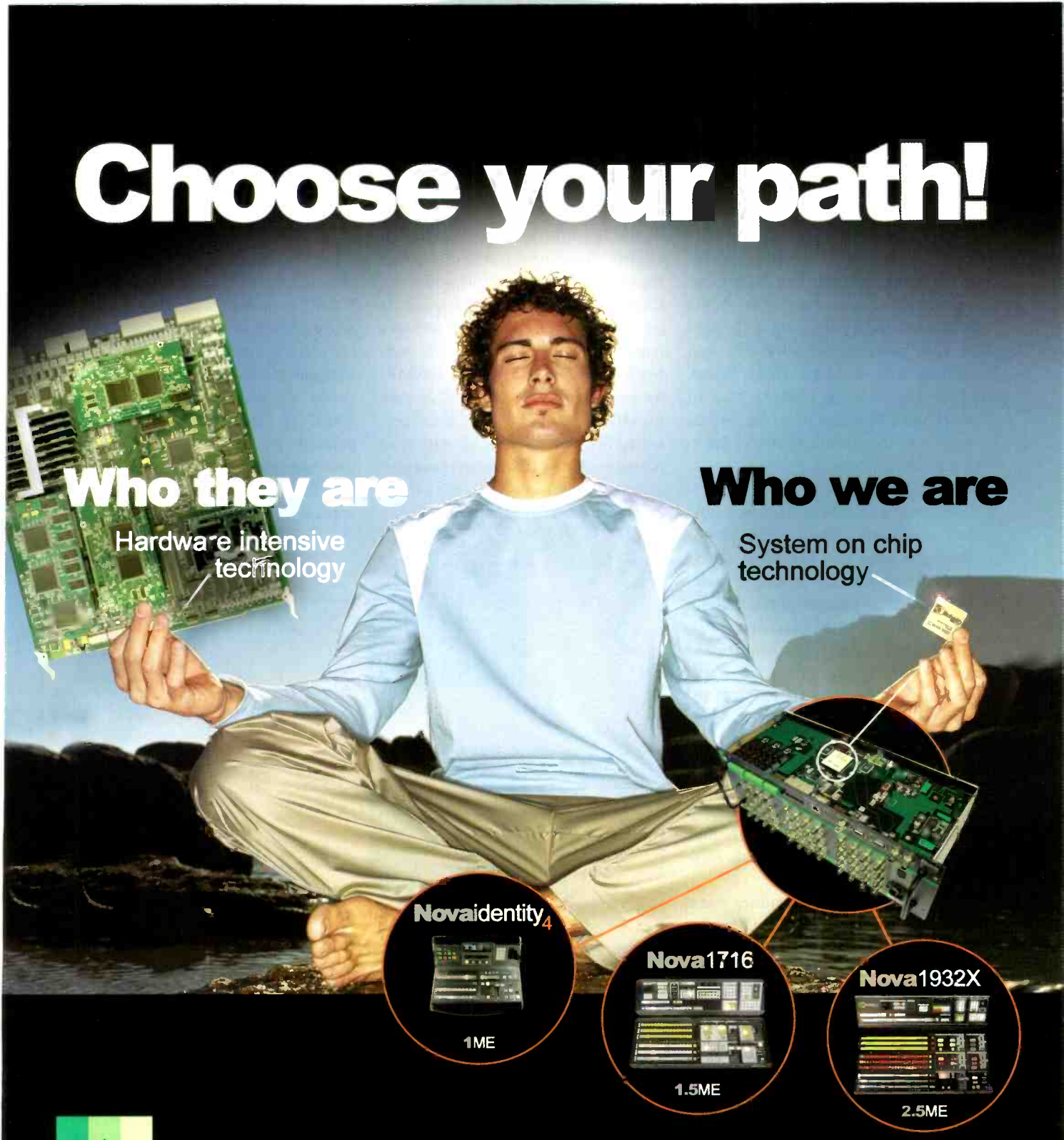

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when administrators and users need access to a GUI.

GUI-based remote control applications have existed for many years. LapLink was developed in the mid-'80s to provide command-line remote access to PCs. Timbuktu provided similar functionality for Apple machines. By connecting a modem to your computer at work and then calling that modem from home, these applications allowed you to work with files and print, as well as perform other common chores. from a remote location.

The performance of these applications over a telephone line was slow but acceptable. When Apple developed the Mac, and Microsoft developed Windows, this created a problem for users who required remote access. The GUIs required that much more information be transmitted across the telephone line. While it was possible to operate a GUI system remotely, performance was a problem, and interactivity was difficult.

Fast-forward to today, and several things have changed. First, most installations are now interconnected with modems that run at much higher speeds (56Kb/s compared with 1200 baud in the mid-'80s).

Second, most critical facilities and a majority of homes are served by Internet connectivity that operates at 512Kb/s or higher.

Third, computer engineers have figured out how to dramatically reduce the amount of bandwidth needed for remote control of a GUI system. Now, instead of sending the entire screen, the data on the link represents only what has changed in the image. Not only does this cut the bandwidth required, but also it reduces the processing time required in the server and client so that delay is minimized. If you run a firewall, you will probably have to change its configuration for these remote control applications to work properly.

Remote control and monitoring

While telnet, SSH and various GUI remote applications take care of one area of interest for broadcasters, they omit another. Namely, they do not provide a view of what is happening on the network. An SSH session might tell you that your server is experiencing an unusual load, but it would not tell you where the traffic is originating on your network. Computer network engineers have used the Simple Network Monitoring Protocol (SNMP) for years to provide them with a view of what is happening on their network. SNMP provides an easy way for network devices (agents) to report various parameters back to a central monitoring system (manager).

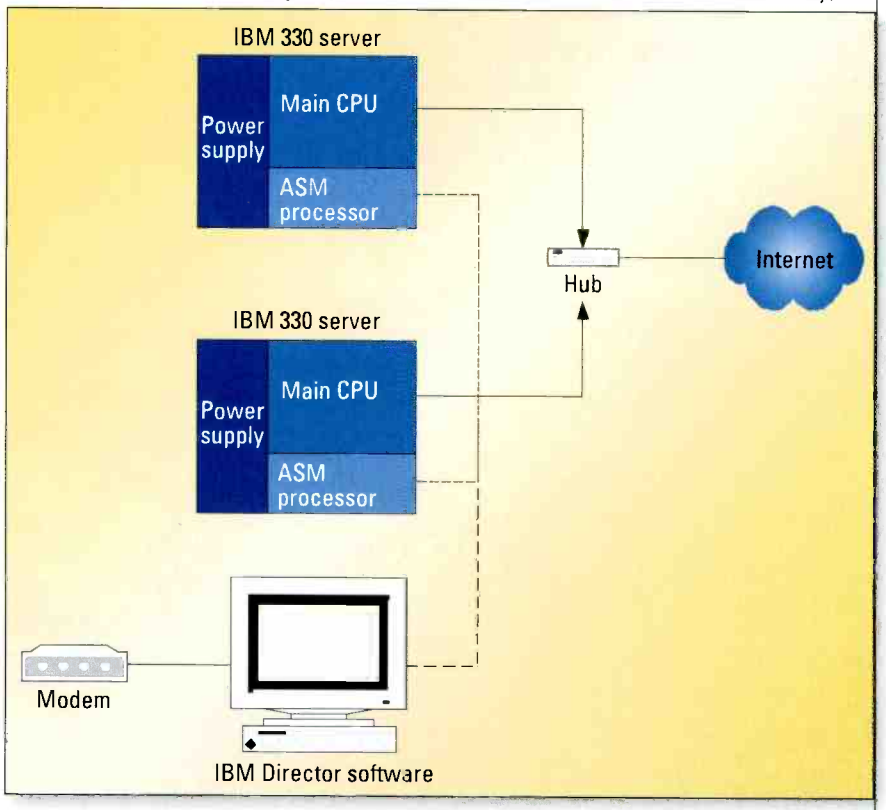

Figure 2. IBM 330 servers contain an advanced system management (ASM) processor, in addition to the main CPU. The independent ASM processor can communicate with Director software. Director is responsible for monitoring the output of the ASM and notifying a system administrator via pager or e-mail message if server parameters are out of limits.

SNMP-enabled systems may provide information on port traffic, power supply voltages, fan speeds and so on. In addition, SNMP supports commands and traps. Commands allow a remote user to change the configuration of a device. Traps provide a way to remotely monitor a system and to be notified when some parameter goes out of tolerance.

One of the great benefits of SNMP is that it provides a standardized way to monitor computer networks. In many cases, you can use SNMP agents from various manufacturers with a single SNMP manager. This allows you to mix equipment from different manufacturers in your network and still manage it from a central location.

One of the good things about SNMP is that the core can be expanded to support functionality that was not originally anticipated. SNMP is beginning to be accepted within the broadcast community, and some standardized SNMP extensions are being incorporated into shipping equipment. As computer-based broadcast facilities become more common, it will become more common to find SNMP agents in broadcast equipment.

A word of warning about SNMP

control: SNMP control was never intended for real-time control of broadcast equipment. It was to be used to do things such as change the configuration of a particular port on an Ethernet router. SNMP control is completely non-deterministic, meaning that, within reason, there is no way to know when the command will be executed. In some broadcast applications, this type of control works well. Turning on studio lighting is an application where it does not really matter if the command is executed in 200ms or 2s. But this sort of variability would be completely unacceptable in most broadcast applications.

Advanced system monitoring

You may have heard about computer systems that have the capability to call your pager or send an e-mail when something goes wrong. Let's look at one implementation to see how these systems work.

I have two IBM 330 e-Series single rack unit servers. I monitor the health of both of these servers using IBM Director, a software package written expressly for this purpose.

The e-Series servers are a little unusual in that they have a completely separate processor (called the advanced system management, or ASM processor) dedicated to monitoring and reporting on the server itself. (See Figure 2.) The ASM runs whether the computer is turned on or not, allowing you to send commands to start, stop, reboot and perform other system maintenance commands, even if the main processor is locked up.

The ASM processors communicate with the Director. As administrator, I can configure IBM Director to monitor numerous parameters on multiple servers and send me notification when these parameters fall out of preset limits. I can connect to the ASM over the Internet (through a VPN for security purposes) to send control commands to the servers as required.

I have found remote reporting and management capability invaluable. If you have never worked with hardware and software that has this capability, I suggest you give it a try.

A long time ago, sharp broadcast engineers developed various remote control technologies so that they could do their jobs quickly and more efficiently. That trend continues today as broadcasters move to computer-based technologies. Fortunately, telnet, SSH, remote GUIs, SNMP and advanced management tools are available to the broadcast computer engineer. BE

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

SEND Send questions and comments to: brad_gilmer@primediabusiness.com

Setting up audio

BY BOB HODAS

In the past, not much attention has been paid to audio in smaller broadcast rooms. With the advent of HDTV, 5.1 surround sound and the computerization of audio, more facilities are starting to take a harder look at how they might make some sound improvements. Proper speaker and equipment positioning make a significant impact on a room's audio performance.

Speaker positioning

You can make huge improvements simply by putting the listener and the speaker into the proper position in the room. Take a good look at your speaker manufacturer's frequency response charts.

Remember that these are anechoic measurements. As soon as you put your speaker in a room, the bass response will start to change significantly. Bass response will build up even more when you place the speaker against the wall or in a corner. But the response charts are useful for knowing what the speaker's limitations are.

For example, Yamaha NS-10s can roll off dramatically after 100Hz, so you don't have to be too concerned about deep bass problems when positioning them. Using a wall or corner may even be to your benefit.

You also want to pay close attention to the recommended position for proper phase alignment. You want to make sure when you position your speakers and listening position that this alignment point intersects your ear position.

I'm going to make a couple of assumptions here. One is that your room is already up and running, and two is that the room is a rectangle. Normally I would put you through a process of finding which wall the sound system wants to be on (short or long), but if you're already up and running, we can only hope that you got the orientation correct.

To help you in the above speaker placement endeavor, I recommend a $100 program called Room Optimizer by RPG (*www.rpginc.com*). I want to be very clear that while these calculations work quite well in theory, they are neither perfect nor foolproof. There are times when, due to construction and other factors, the program doesn't get the job done, and an analyzer and your ears are needed.

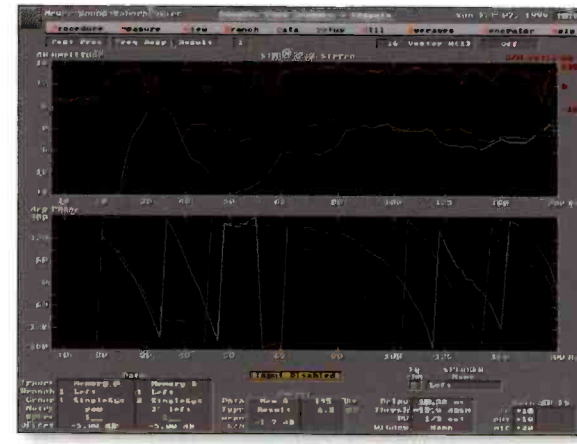

Figure 1. Nonsymmetrical speaker placement — L/R speaker traces overlaid with phase, 8Hz to 200Hz

I can't stress the idea of symmetry enough. If your speakers are not placed symmetrically in the room, they will have different frequency responses. This means that your music will sound different in the left and right speakers, your center image will be off-center, and your depth of field will collapse. So make sure that the left and right speakers are equidistant from the side walls. The same applies to the speakers in regards to the front wall.

You can make huge improvements simply by putting the listener and the speaker into the proper position in the room.

Why is the above true? Below 200Hz, your speakers are fairly omnidirectional. The signals that bounce off the walls and ceiling are going to mix in with the direct speaker signal. This delayed bounce will cause comb filtering. The time delay and, therefore, frequency of interaction is dependent on the speaker distance from the walls. If the left and right speakers are at different distances from the walls, the cancellations will occur at different frequencies.

This is also true for first-order reflections above 400Hz, but the high frequencies are much more directional. First-order reflections are the initial signal reflections that bounce off the walls, floor and ceiling and mix in with the direct speaker signal. In most rooms, the reflections will be short enough that your brain cannot separate them out from the direct signal. These destructive reflections cause holes in the frequency response, so you miss parts of the music. They also affect the phase response, so it creates problems in the soundstage and imaging, both side-to-side and front-to-back.

Figure 1 gives you a demonstration of what happens to the bass when speakers are placed asymmetrically in a room. One speaker looks great, but the other is in bad shape. If you try to treat the above bass problem acoustically, you will find that a treatment that works for one speaker will not

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work for the other and perhaps make it even worse. So symmetrical placement is critical.

Equipment placement

You should also pay attention to the placement of your equipment in the room. Most people don't consider this factor, but a bunch of gear on the right side of the room and nothing on the left is going to change the way the speakers behave. Try to design a layout that is balanced side-to-side as much as possible.

The rules of first-order signal reflections also apply to the reflection off the console if your speakers are sitting on the meter bridge or too close to the back of the desk. (See Figure 2.) Your high end will be much smoother and more coherent if you put the speakers on stands and move them back from the console to a distance where the tweeter doesn't interact. (See Figure 3.)

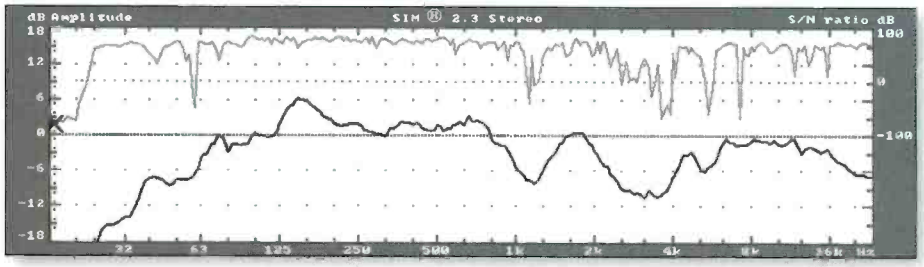

Figure 2. Response with speaker on meter bridge

As for the console, many of you probably have no real console, perhaps just a desk with a controller or keyboard. The flat surface of a desk can be worse for reflections than the raked surface of a console, so you should be especially aware of speaker placement.

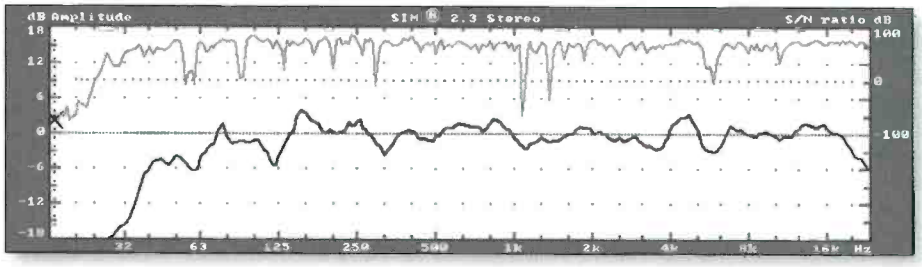

Figure 3. Response with speaker on stand 8in behind console

You also must consider the positions of your computer monitors and how they interact with the speakers. If the monitors are right in between the speakers, you could get low-frequency loading into the surface of the monitor. You will also experience a loss of front-to-back depth imaging.

I suggest placing the monitors below the speaker level. If possible, build them into the desk and place them at an angle so they are easy to view, but don't interact with the speakers.

Sound and light act a lot alike above 400Hz, so you can use a mirror and simple geometry to find these unwanted reflections. Invest about $30 in a frameless 2ft-by-2ft plastic mirror. (You can get one at a plastics store.) Have someone sit in the listening position while you hold the mirror absolutely flat against the side walls and ceiling. Slide the mirror along the walls to see where the listener can see the speaker components (not the side or top of the speakers) reflected in the mirror.

Each time the speaker components are seen in the mirror, that is a first-order reflection point. (See Figure 4.) Remember that you must keep the mirror perfectly flat against the boundary surface while doing this test. It's just like billiards; the geometry needs to be exact. You will probably be able to outline one large area on the side walls that shows the reflection of both speakers.

You will want to put a treatment in that place. But please be judicious with the absorption. (There is nothing worse to my ears than an overly damped room.) Just treat the areas that need it, and leave the rest alone.

Figure 4. Use mirrors to check for first-order reflection points

I like to absorb the ceiling and side reflections rather than diffuse them because this increases the coherence of the system. I also like to diffuse the rear wall reflections because it adds space to the room. The diffusion gets rid of the discrete reflections but leaves most of the energy intact. The energy is just spread out over time.

Don't let anyone try to equalize first-order reflections. They are completely dependent on your position and will change at different seating positions throughout the room. Equalization will not fix a high-frequency reflection problem. BE

Bob Hodas is an acoustic consultant and owns Bob Hodas Acoustic Analysis.

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HD background B

Wipe bar provided by Utility Bus

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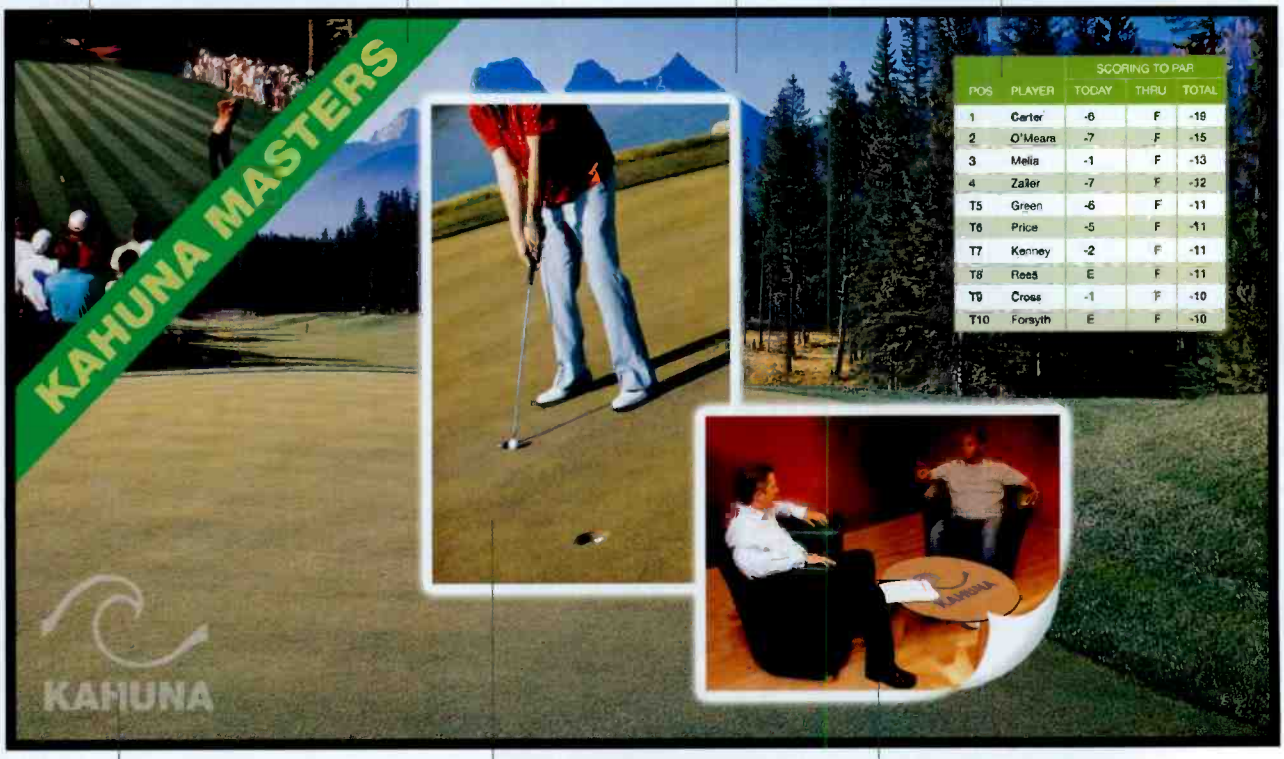
SD character generator output using FormatFusion and resize engine



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The broadcast control room of the Grand Ole Opry was upgraded with a 104-channel, 48kHZ Euphonix System 5 console.

The Grand Ole Opry's new sound

BY DAN DALEY

The Grand Ole Opry in Nashville, TN, turns 80 this year and has spent most of those 80 years as the sonic signature of country music. Television broadcasts have been carried on select weekends for the past two years on the Great American Country (GAC) cable network. Before that, Viacom's Country Music Television (CMT) broadcast the shows on most weekends for two years. CMT, the successor to the Nashville Network (TNN), was founded by Gaylord Broadcasting before it was sold to CBS cable, then a division of Westinghouse in 1997. Gaylord Entertainment owns the Opry House and the adjacent Gaylord Opryland Resort, where WSM-AM — the long-time radio broadcaster of the Opry — has a glass-walled booth in the lobby from which several on-air shows are done.

The Opry hired Steve Gibson, a music industry veteran, well-known session guitarist and studio owner in Nashville for the last 30 years, as a music and creative consultant to help plan its audio systems upgrades. Given the importance of the Opry's sound to the business of country music, was surprised at the relative complacency he found at its broadcast operations.

They established a novel and ultimately effective strategy: repairing the broadcast sound by starting at the stage.

Ole systems

Problems included an older AMS Neve V3 console, the maintenance of which Gibson described as lacking, with broken channel strips and a general reliance on outdated technology. For example, the broadcasts were being archived to ADAT decks.

There were also lax operational modalities. An example: The Opry signal path was routed through unnecessary copper and transformers. It then passed through several other switching and console variables before arriving at the transmitter.

Grand solutions

Opry general manager Pete Fisher invited Gibson and George Massenburg, a well-known mixing and mastering engineer and audio systems developer, in as consultants in March 2002. They established a novel and ultimately effective strategy: repairing the broadcast sound by starting at the stage. The concept was to improve the broadcast sound by first improving the live sound

the audience heard.

Working on the notion that country music is essentially acoustic music, Gibson advised that many of the direct-insertion inputs, such as guitar amplifiers, be amplified using microphones instead. A new FOH console was installed, a 64-input ATI Paragon II with recall faders and assignable soft keys feeding a flown JBL Vertech PA system.

Massenburg discovered that the Opry House's meager acoustical treatments had deteriorated, with missing acoustical tiles or tiles that had been painted over. Additions made were primarily absorptive foam on walls and additional heavy curtains on the rear and side walls to minimize reflections. This allows shows to be played louder in the hall, generating increased excitement, which translates to better performances.

Consulting analyst Sam Berkow identified acoustical nodes as a major problem. His analysis revealed frequency masking in the room from resonance areas under the main balcony. These received additional acoustical treatments.

Once the house sound had been upgraded, the consultants redid the broadcast control room, located midlevel against the Opry House's rear wall. A 104-channel, 48kHz Euphonix System 5 console replaced the aging V Series desk. King Williams and Steve Marcantonio mix the show for TV and radio from there, recording it to an AMD

FOH engineer Tommy Hensley works the Opry House's ATI Paragon II console, which can generate any combination of up to 32 mono or 16 stereo monitor mixes.

Design Team

Jon Mire, technical services manager
Steve Gibson, music director and audio consultant
George Massenburg, audio consultant
Steve Marcantonio, television and audio broadcast engineer
King Williams, audio broadcast engineer
Kevin Reinen, chief technology engineer
Sam Berkow, acoustics consultant

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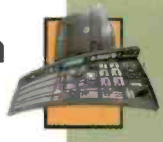

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Opteron 264 (3.65GB of RAM, 1TB local hard drive) running Steinberg Nuendo 3.02 recording software (timecode locked) with a redundant backup system. Reference monitors are Genelec 8050As with Genelec 7070A subs.

The television audio is routed to an AMS Neve Capricorn digital music console in a room behind the stage. Radio goes directly to the transmitter from the System 5 audio console. The digital music console takes various audio elements, including live OB interview inserts, theme and bumper music and house applause microphones, and mixes them with the stereo music mix sent from the audio console.

Williams splits the output of the Euphonix into two stereo feeds. Stereo 1 feeds everything except television. Stereo 2 goes to the Capricorn for broadcast. Stereo 1 has a Smart Research C2 compressor applied. A slaved unit is applied to Stereo 2.

One of the operational changes to the broadcast is that the audio console sends an audience-minus mix to the digital music console, where Johnson adds his own ambience in. This avoids the comb filtering previously experienced as a byproduct of the latency engendered by the two digital consoles doing A/D conversions at different points in the signal path.

This AMD Opteron computer screen at the Opry runs Steinberg Nuendo 3.02 software.

Another change was the implementation of an RTS PL-type IC system. The two-channel system runs over the same line. And a multipin connector beneath the stage allows the audio crew to give the Opry intercoms their own instantly recallable configurations. This is needed because the studios are used for other programs during the week.

Choosing the audio console was based on a combination of performance and price. The onboard snapshot automation meshes nicely with the high volume of artists and musicians who perform during the show. Regular performers, such as Little Jimmy Dickens and Porter Wagoner, have their level and EQ setting stored and ready to be recalled instantly.

The Opry House plans to purchase a RAID-type storage system to migrate the current FireWire drives for archiving.

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Opry changes

The changes in the house sound rippled back to the broadcasts with some unexpected challenges. The improved stage monitoring system, mixed by an 80-input Harrison LPC, was louder and was bleeding into the larger number of open microphones onstage. This was rectified to a degree by varying the microphone placements.

Mixing techniques also had to change. Gibson says low-frequency information, which increased significantly as the stage sound amplified mechanical coupling with the stage itself, is attenuated to broadcast. Broadcast mixes that once relied heavily on artificial reverb and were often overly compressed now use organic ambience from more audience microphones, with a lighter touch on compression overall. The result is what Gibson says is a more realistic acoustical sound that translates well to broadcast when it leaves the Opry House and travels via Vyvx to GAC's earth station uplink in Denver.

Music on television is proliferating, and Gibson is convinced that all efforts to send a good signal out of a venue are still at the mercy of transmission formats, cable in particular. The audio department has multiple real-time monitoring options to toggle between during shows, including the AM radio, DirecTV satellite and local Comcast cable returns, all periodically compared with the live signal to the control room.

The bottom line, though, is that the Grand Ole Opry has reasserted its position as the sonic signature of country music and now has broadcast audio that can back that up. BE

Dan Daley is a journalist and author who covers business and pro audio technology.

Equipment List

Allen Smart C2 stereo compressor
AMD Opteron main recording system
AMS Neve Capricorn
ATI Paragon II recall console
EMT 140 Plate Reverb
Euphonix
- System 5 audio console
- 64 remote mic pre amps
- Converters A/D D/A

Genelec
- 8050A reference monitor
- 7070A sub

Harrison LPC console
JBL Vertech PA system
Lexicon dual 480L
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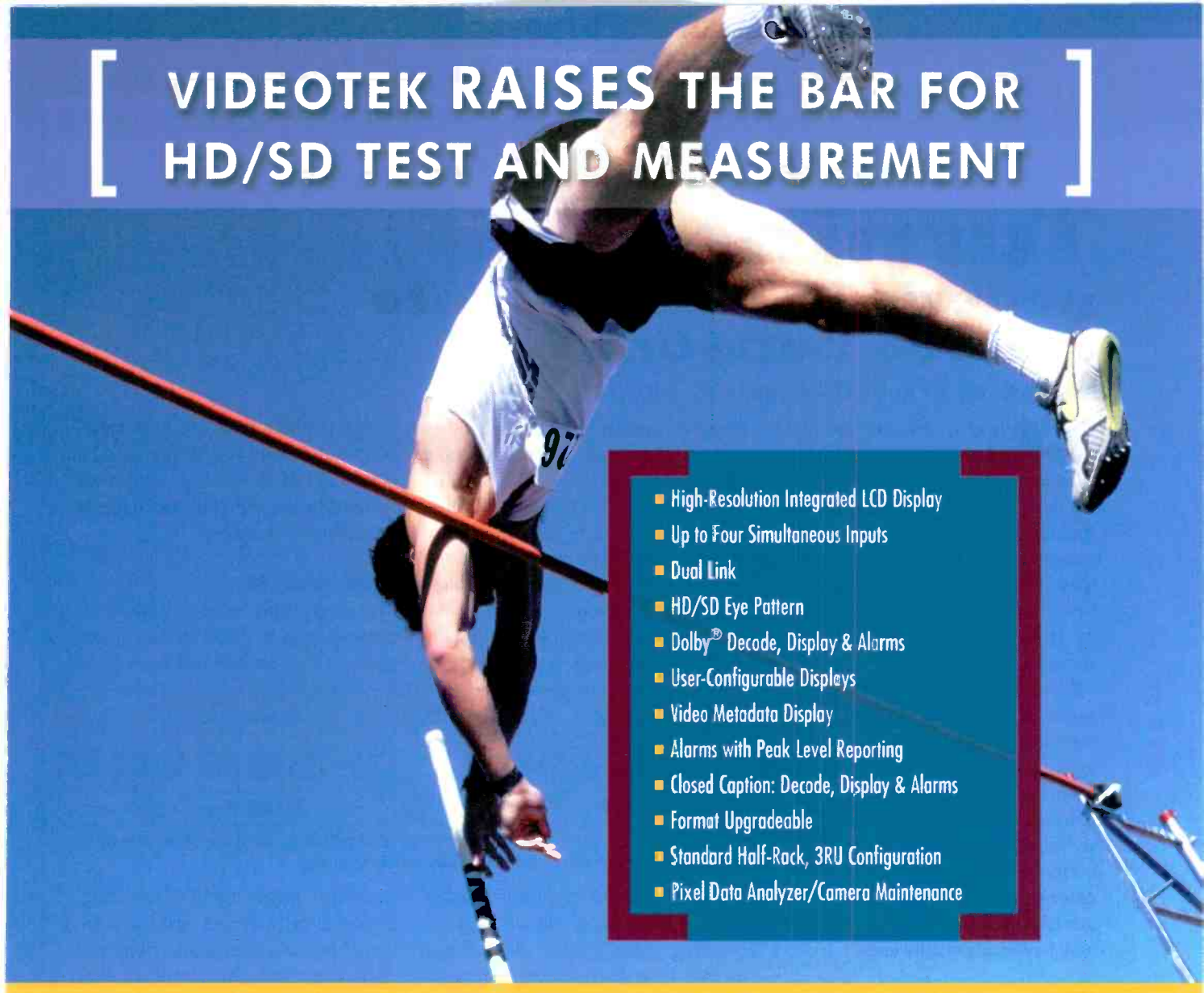

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Turning a generic IP network into a video network

BY DAN MCCRARY AND HENRY SARIOWAN, PHD

Broadcasters may have a lot of experience with generic IP WAN networks for moving data. However, if the goal is to use these same networks to deliver TV signals, especially live HDTV programs, then these IP networks must first be enhanced to support high-quality video. The key is controlling the variables.

Reliability and quality of service (QoS) have to be tracked, measured and managed differently. Throwing more bandwidth at the problem is not the solution. Such techniques as forward error correction (FEC), clock synchronization and buffer control are essential tools in maintaining a persistent and predictable quality level.

Quality and QoS

Although it's common to see video files exchanged over IP networks in production and broadcast LAN environments, real-time transmission of broadcast-quality SD and HD video over WANs is just starting to take off. The combination of DTV and IP technologies now offers broadcasters a fresh opportunity to significantly improve their core business by enhancing their television transmission services while simultaneously lowering the program transmission costs.

While IP networks provide distinct cost advantages in transporting video content from source to destination, ensuring video quality and reliability over long distances requires more than just a network with a specified QoS. It requires an IP video gateway capable of preserving the important characteristics of the broadcast video signal, such as clock accuracy and data integrity. While QoS can help minimize impairments in IP networks, a well-designed IP video gateway must also handle the intrinsic impairments of packet networks.

Video over IP

To successfully turn a generic IP network into a video network, one needs to first understand the unique challenges posed by IP networking. Fundamentally, IP networks are designed for data communications and operate in a best effort mode, i.e. they do not guarantee the delivery or the correct sequence of every packet.

Traditional packet networks do not have a priority mechanism to control the amount of traffic injected into the network. Traffic is only throttled after congestion is detected in the network, by which time a large number of packets may have been dropped at the routers.

In best-effort IP networks, all user packets are treated equally, meaning time-critical video traffic receives the same priority as delay-tolerant e-mail traffic. In such an environment, video packets may be queued at a router behind a long line of delay-tolerant packets. The result can be packet loss or long delays for the video packets before they arrive at the receiver. (See Figure 1.)

A common but flawed approach to solving these issues is to allocate more bandwidth for the video traffic.

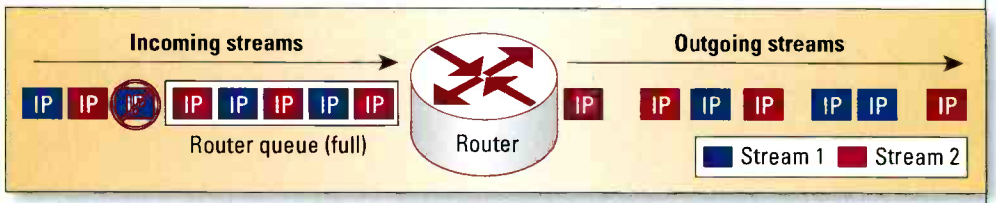

Figure 1. Packet loss and variable delay caused by router queuing

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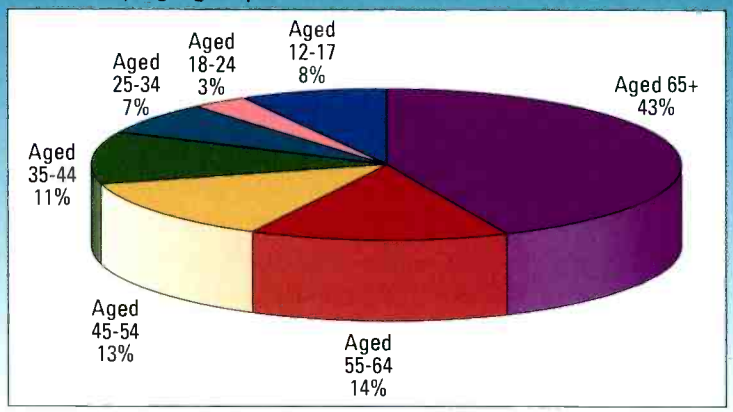

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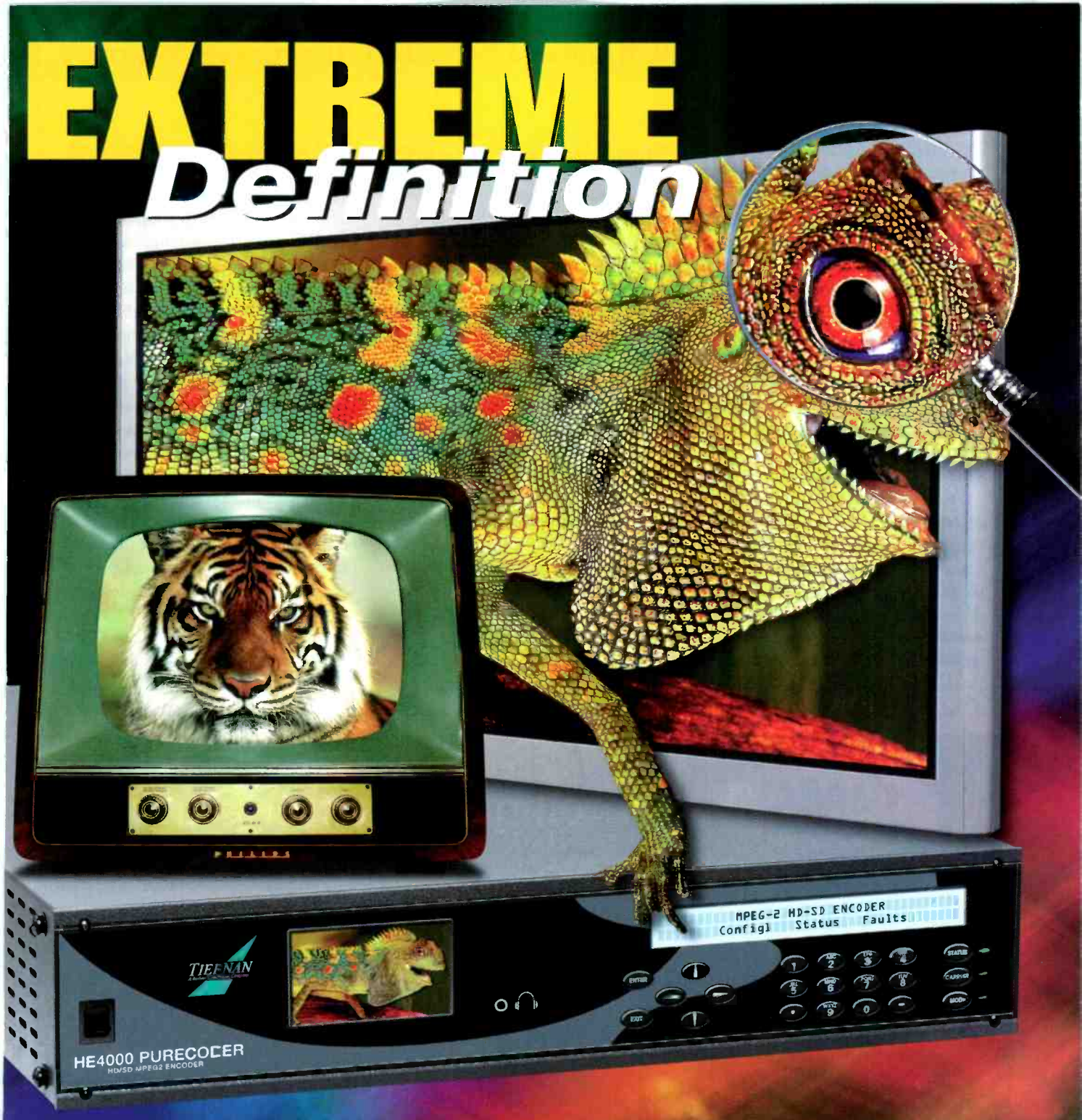

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However, over-provisioning alone cannot guarantee uninterrupted video transmission. In over-provisioned networks, there may still be an errant sender that suddenly injects a large burst of traffic into the networks, exceeding the network capacity and causing catastrophic congestion.

To guarantee consistent, perfect video transmission, an IP-based video network has to be architected with the essential building blocks: QoS and a broadcast-quality IP video gateway.

Quality of service

QoS is essential to transporting SD or HD video over an IP network. It consists of various network techniques and protocols that enable IP networks to guarantee each user a unique set of measurable network performance parameters, such as minimum bandwidth, packet loss ratio and maximum jitter. Such guarantees are especially required by real-time multimedia applications that have minimal tolerance for such network impairments as packet loss and delay variation.

QoS is typically handled by routers and switches in the network. Several important components of these QoS techniques are described below: multiprotocol label switching (MPLS) and traffic classification, metering, shaping, and admission control policies.

MPLS enables the creation of virtual connection-oriented paths within a network. Bandwidth can be reserved for each virtual path. Network performance parameters, such as loss and jitter, can be guaranteed throughout the traffic flow. MPLS can, therefore, be used to provide bandwidth guarantees for video traffic by separating these flows from other best-effort paths assigned to Web or e-mail traffic.

Traffic metering, shaping and admission control policies are other forms of QoS techniques that limit the amount of traffic entering the network. By controlling the ingress traffic, network congestion can be avoided and such conditions as packet loss and jitter become minimized.

Other QoS techniques, such as differentiated services, traffic classifications and priority queuing mechanisms, also allow critical broadcast video traffic to be treated with higher priority than standard voice or data traffic.

While these QoS techniques described above greatly improve the performance of IP networks, they do not completely eliminate certain fundamental characteristics of packet networks, such as jitter due to queuing in the routers, occasional packet loss or out-of-sequence delivery caused by network outages.

Despite the many benefits of QoS, impairments like these may still cause video distortion, such as image

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macroblocking, frame dropouts and temporary interruption of services, beyond the tolerance level of most broadcasters and content owners. The most effective way to mask these residual network impairments and ensure a perfect video transmission is to use an IP video gateway.

IP video gateways

The second critical building block of a video network is an IP video gateway specifically designed to transport broadcast video signals. A video gateway, also called a video network adapter, performs conversion from one type of interface to another type.

Most equipment used in studios or broadcast stations use non-IP, bit-serial interfaces, such as ASIs or SDIs. An IP video gateway is required to convert those interfaces to IP interfaces, such as fast Ethernet or gigabit Ethernet. (See Figure 2.) The functions of an IP video gateway include:

- Conversion from bit-serial interfaces to packet-based IP interfaces.
- Clock recovery and synchronization.
- Recovery from packet loss and out-of-order packets.
- Network monitoring and reporting.

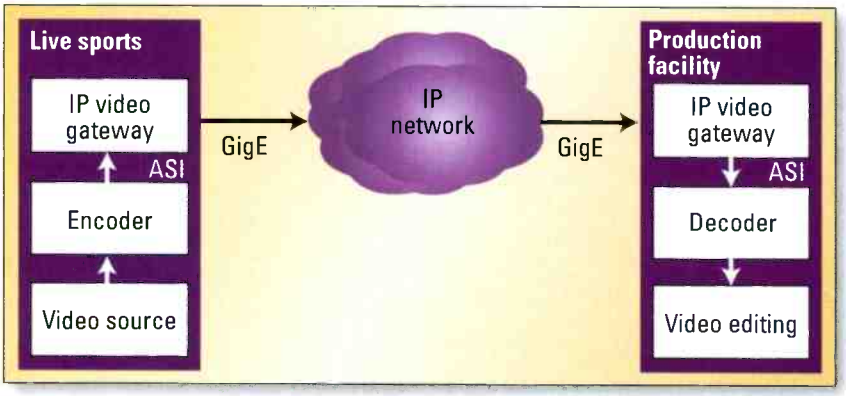


Figure 2. IP video gateways in contribution networks

One of the most important functions of an IP video gateway is to accurately reproduce the original timing (clock) information of the video signal at the receiver. This task becomes extremely challenging in IP environments because the large packet jitter (the variance in interpacket arrival times) caused by the IP networks makes it extremely difficult to estimate and track minuscule clock differences between the sender and the receiver.

In addition, due to the high bit-rate nature of broadcast contribution video, even a slight inaccuracy in clock recovery may quickly cause buffer overflow or underflow, disrupting the video signal. If not accurately corrected, the clock skew at the receiver may cause a host of problems, ranging from loss of colors to complete loss of picture.

A video over IP gateway also has to cope with potential packet loss or reordering of packets, which may cause significant picture degradation. FEC techniques, such as the one defined by the SMPTE Pro-MPEG Code of Practice #3, represent a powerful tool to combat this problem by sending repaired packets together with the original stream of packets containing the video data. When packets are lost and never make it to the receiver, the repaired packets, combined with the non-missing packets, are used to reconstruct the lost packets. (See Figure 3.)

When evaluating IP video gateways, it's important to use gateways that implement a smart buffer scheme, combining the synchronization, jitter, reorder and FEC buffers so latency at

the receiver is minimized. Minimizing latency is particularly critical in an environment where large delays can be problematic, such as in live interviews and interactive TV applications.

These statistics also enable users to optimize the operations of the IP network, video codec and video gateways. If such operations are tuned correctly, both private and public IP networks should be capable of carrying perfect, broadcast-quality video.

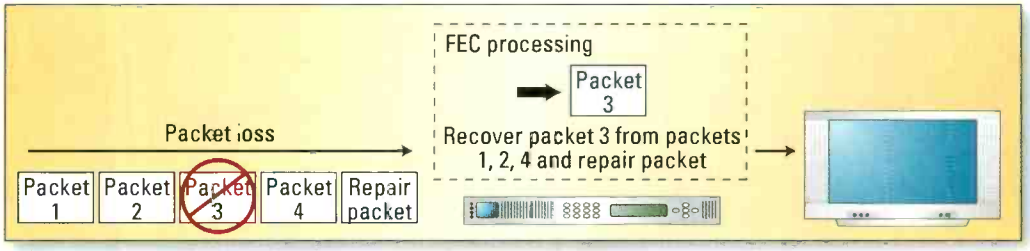


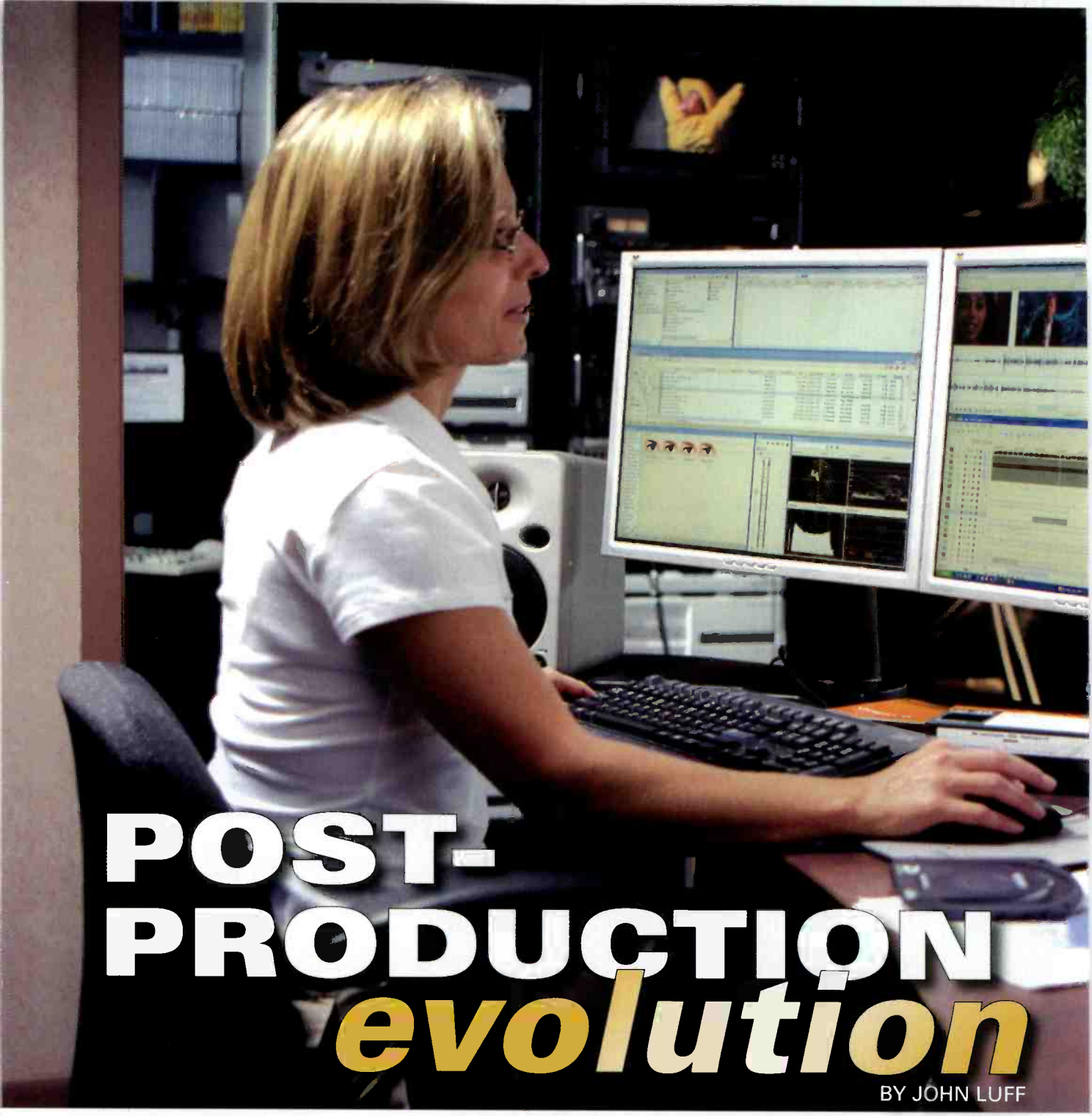
Figure 3. Forward error correction

IP video gateways should provide real-time network statistics so that appropriate actions can be taken as soon as a problem is detected. By capturing statistics such as packet loss ratio, maximum burst loss and network jitter, users can be alerted to immediate or pending problems and correct them before the conditions worsen.

The benefits

IP networks offer many technical and financial benefits to broadcasters who need to transport SD and HD video content in real-time to remote studios, affiliates and distribution partners. Ensuring content quality and stream reliability depends on deploying the critical architectural components that enable this. The first critical step is to provide networks with the right QoS components in order to minimize various impairments associated with packet networks. The next important step is to select the right IP video gateway solutions that will overcome any remaining impairments. FEC is designed specifically for this purpose. By implementing both of these measures, broadcasters can enable an IP network for real-time SD and HD video transport. BE

Dan McCrary is vice president of marketing and Henry Sariowan, PhD, is vice president of strategic technology planning for Path 1 Network Technologies.



POST-PRODUCTION evolution

BY JOHN LUFF

For those of you younger than 40, it may come as a bit of a shock, but editing has not always been an electronic process. Computers are relatively new to the scene and especially new to the editing process.

A look back

We often talk about the transition to digital technology in our industry. Seldom is such a thread more valid than in the case of post-production tools. TV post production began when skilled editors physically spliced program segments together using Editall splicing blocks and a special Scotch-brand type of adhesive tape. The technique was not unlike film editing; often segments were hung in bins as a film editor might do.

Practical electronic editing began with the Ampex Editec in 1963. It used cue tones recorded on tape to electronically control the splice timing. Synchronization of the edit points required great reflexes and a significant degree of luck.

Time-code-based editing began in 1971. Surprisingly, this was about the same time NLEs began to appear. The first was the CMX-600. It used computer disks to record monochrome images, which could be conformed with the original videotape recordings using an auto-assembly system called the CMX-200. Only six CMX-600s were ever sold, perhaps because each one cost $250,000 in 1971. That

Beth Logan builds tracks for an HD project using Sony's Vegas 6. Photo courtesy Logan Productions.

would be $1.2 million dollars in today's money! And you thought today's equipment was expensive.

Despite stratospheric costs, from those roots came the first widely used electronic computer editing system, the CMX-300, which was also released in 1971. For about two decades, the CMX-300 dominated the industry. However, other entrants, including Calaway Engineering, ISC, Accom and Editware, brought important improvements to the technology and moved the industry from the clunky minicomputers of the time to microprocessor-based systems that later became a major force in the post-production process.

The entry of NLE technology

Younger readers may think that computer-based NLE has always been with us. Not so. NLE technology was only a marginally-successful part of the industry for its first decade. During the late '70s and early '80s, Lucas Films' EditDroid, Editing Machines' EMC2 and the Montage Picture Processor all pioneered the concept of random-access NLE by following in the footsteps of the CMX-600.

However, it was not until 1989 that an unknown startup company really moved editing from editing controlled *by* computers to editing *in* computers. It was this aspect that moved video editing into the mainstream of the post-production process.

It was not until 1989 that an unknown startup company really moved editing from editing controlled *by* computers to editing *in* computers.

That company sold a whopping five systems on the show floor at NAB1989. Despite this meager beginning, it's name became synonymous with NLE and entered the lexicon reserved for few other manufacturers. That company was Avid.

New editing paradigm

The entire post-production industry has been uprooted by the revolution in hardware. High-end edit rooms used to cost upwards of $1 million and required VTRs, switchers, audio consoles, monitoring, effects systems, character generators, graphics cameras, routing switchers and lots of training. Today, the same horsepower can be provided in full-bandwidth HD in a desktop processor for a single-digit percentage of what it cost only a decade ago.

This revolution has changed the post industry from one highly leveraged in capital hardware cost to one focused around highly-skilled, creative (and mobile) individuals. It has become hard for large post companies to compete with a sole practitioner

who has an entire editing system in the trunk of his car or on his laptop. The most successful production companies have rebuilt their businesses to focus on human resources and workflow engineering.

The newsroom revolution

Every TV newsroom has used editors since the introduction of news film in the '40s. It was the job of these talented folks to process content acquired from the field into discrete and cohesive segments for newscasts.

Electronic editing began with the introduction of Umatic 3/4in tape in the '70s. CBS coined the term electronic newsgathering (ENG), and the use of film for news quickly disappeared. Arguably, Umatic lowered the quality of the product put on-air. However, as better equipment became available, notably with the introduction of the first Betacam professional VTRs, news moved to an all-electronic workflow, including simple linear editing with VTRs.

Avid's Adrenaline HD features 10-bit video capture and playback and real-time HD and SD multicamera editing.

The next step was to move from a linear workflow to an NLE workflow. Avid introduced the first nonlinear computer-based news editing system in 1993. As a plethora of vendors released new products, workflow further improved. Today, it would be foolish to implement a news editing system based only on linear editing techniques. Now it's all about workflow, with linkage between newsroom computer systems, production workflow solutions and network-based editing.

Today, it is easy to say there is virtually nothing that cannot be done with computer post-production techniques. Each year, the improvement in software and hardware tools is astounding. The computer on which I am writing this article was delivered for $900, and it included a FireWire interface and editing software, which is remarkably full-featured. It can ingest and edit at full resolution and even output WM9

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and MPEG-2 with software codecs. Having spent a decade of my career as a video editor using razor blades and later an Ampex RA-4000, one of the first computer editing systems that used time code, I can truly say that I would have killed for even today's low-end software.

Storage issues

There are several other issues that impact current editing technology, but storage is at the forefront. One of the limitations of editing and compositing applications has been the high cost of storing images at full resolution. Fortunately, the tremendous drop in the cost of storage follows the increasing processor speeds. Also, as the cost of CPUs have dropped, so, too, has storage.

With early editing systems, manufacturers discouraged users from selecting any disk storage they did not sanction. Sanction typically meant: "Buy it from us."

However, the tables have turned, and some vendors have welcomed, or perhaps accepted might be more appropriate, the need for users to seek high-speed storage solutions and networking hardware for editing applications. This is particularly important in editing where large amounts of content are produced.

Management of that content with workflow processes, which include media asset, archive and rights management, is increasingly a part of post production. An important part of modern shared production environments is the ability to browse a library of content available to be edited. Managing the linkage of browse and online libraries and keeping them in perfect sync is critical. A card catalog is pretty clumsy when the

Today's NLE technology empowers editors by providing a seamless real-time workflow supporting all video acquisition formats with real-time, multi-track, mixed format HD/SD editing, compositing, chroma keying, titling and timeline output capabilities. Photo courtesy Canopus.

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Leitch's VelocityHD NLE features full-quality HD playback of two video streams, two dynamic graphic streams, and dual-stream real-time HD transitions and effects.

assets are not on removable media like videotape.

HDV solutions

HDV recording in cameras has been around for a couple of years. Until recently, however, editing HDV was challenging. The reason was that long GOP files are created in the HDV compression process, and for a long time it was assumed that long GOP MPEG editing was either impossible or impractical. However, recent developments in encoders and decoders from several manufacturers have shown that's not the case.

At NAB2005, HDV editors were shown, and most are robust and versatile. Even so, not all editing solutions use the same processing. Some require the video to be decoded to baseband, edited and then recomposed. That takes time. Other software systems decode only the video around the desired transition, which means faster total throughput.

Now producers have the option of using short and long GOP MPEG, DV, uncompressed and other formats for both acquisition and editing. Some current HDV editing products include: Adobe Premiere Pro 1.5, Apple Final Cut Studio, Avid Xpress ProHD and StudioHD, Canopus Edius NX for HDV, Leitch Velocity HD, Pinnacle Liquid 6, and Sony Vegas 6.

Innovation

Innovation doesn't just come from large companies with the assets and resources to invest in research and development. It also comes from startups anxious to prove prowess to a skeptical marketplace. Nowhere is that more true than in post production. One only needs to remember that Avid was once David seeking to slew a much bigger Goliath. It is wise to investigate the small and struggling innovators, for sometimes their desire and lack of preconceived notions leads to highly successful new solutions, not unlike those we enjoy today.

Innovation has become an intensive software business with hardware that is nearly off the shelf. This has been the root of tremendous change. Once the province of traditional television post production, electronic editing has become the norm for film and video, with features moving increasingly to electronic capture in HD, fulfilling the promise first recognized in the late '80s by Francis Ford Coppola and George Lucas. Digital intermediate work, a highly specialized form of electronic editing, completes the spectrum that begins with DV editing in home PCs.

One only needs to remember that Avid was once David seeking to slew a much bigger Goliath.

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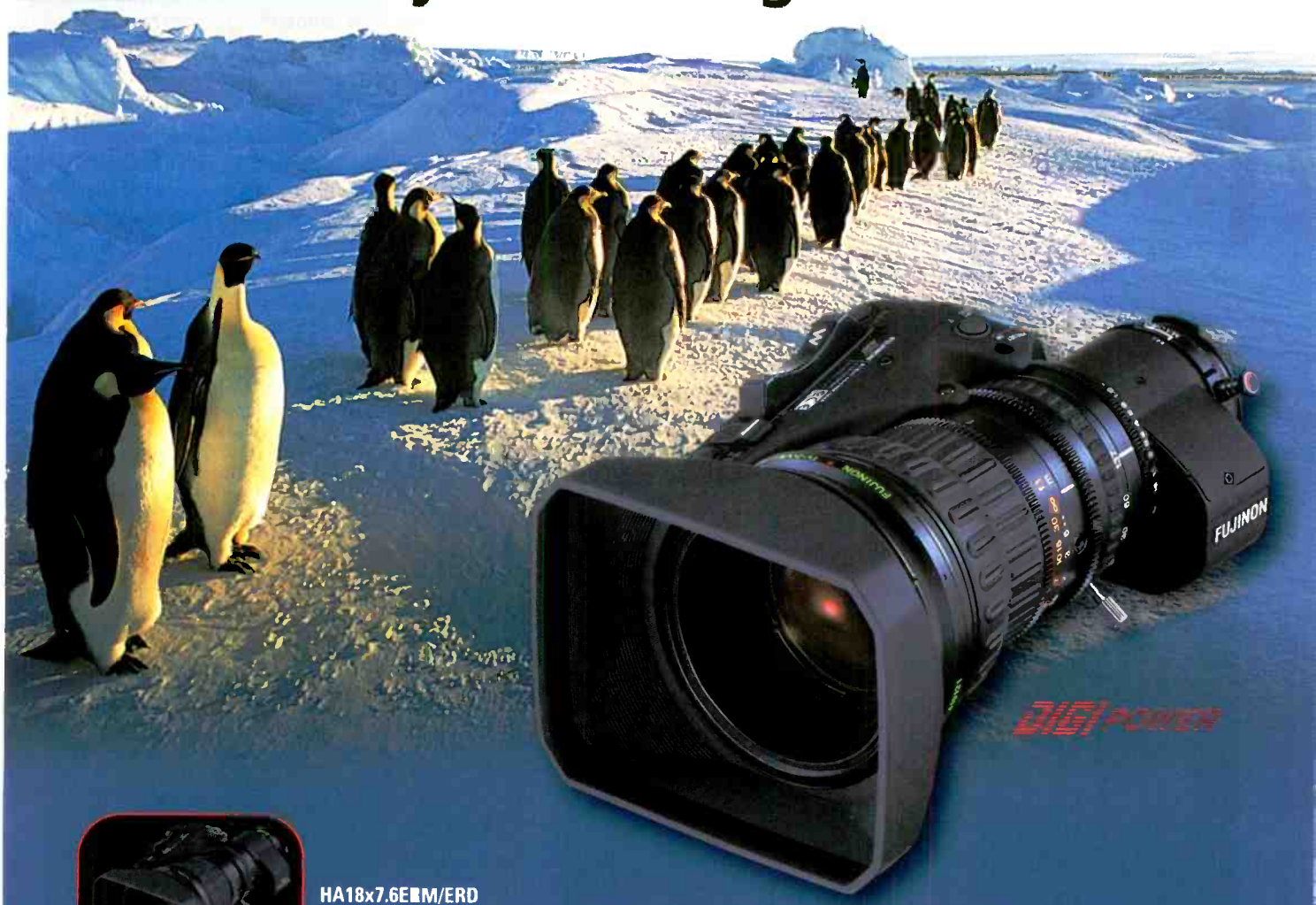

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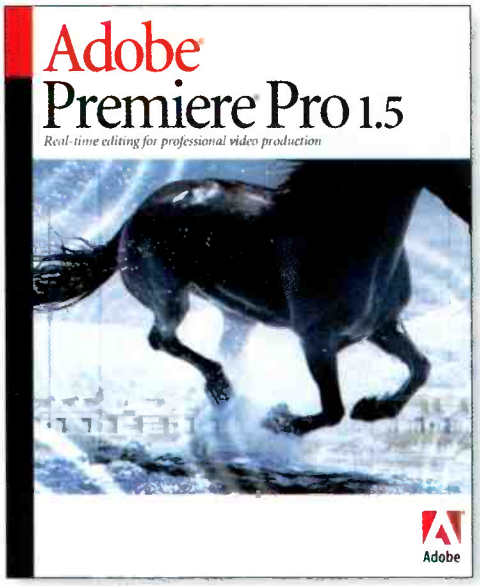


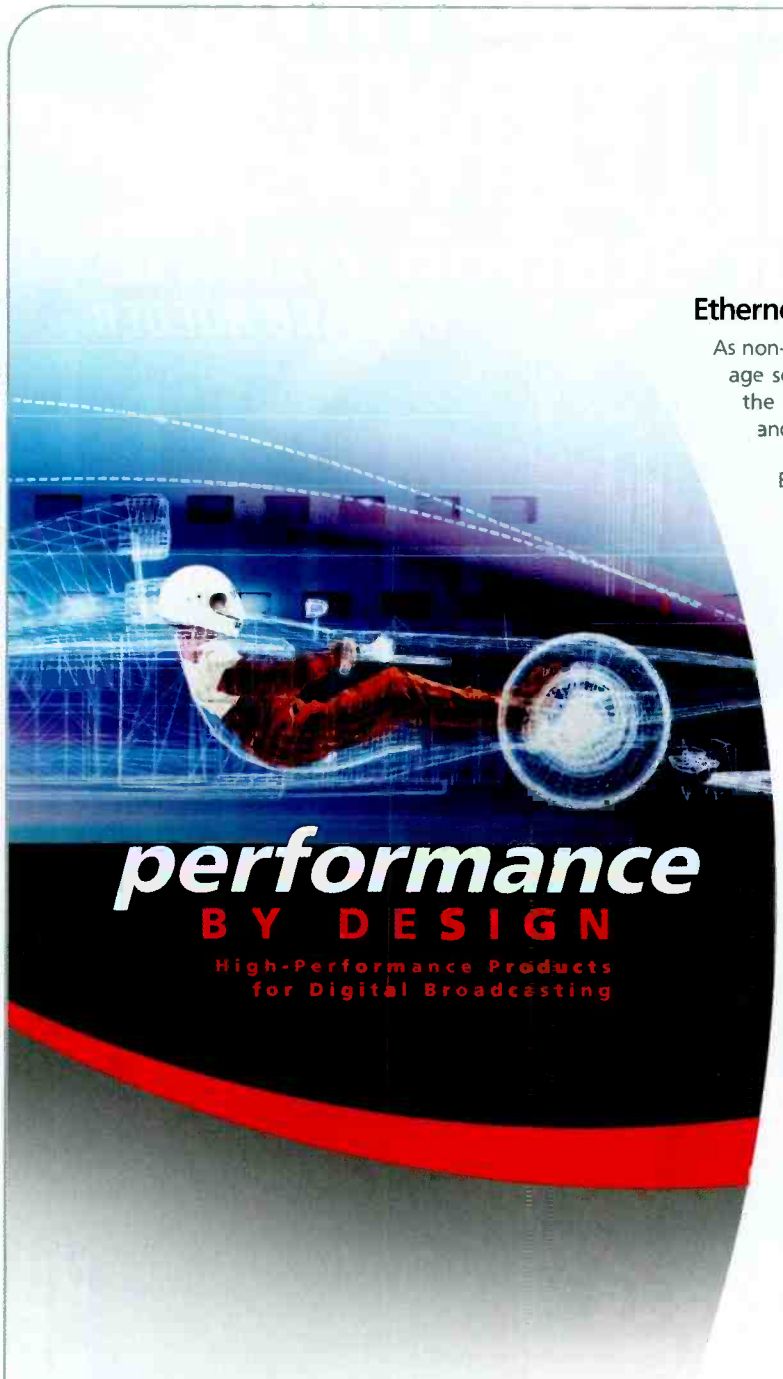
Adobe Premiere Pro 1.5 offers an expanded set of editing tools for correcting, enhancing and managing projects.

The future holds advances that will seem remarkable when they happen and unremarkable with historical perspective. One can assume that faster processors and cheaper storage will make worries about computer limitations an issue that is easy to overcome. The latest dual core processors from Intel, the Pentium Processor Extreme Edition, will have a major effect on the future of editing and graphics. These processors include hyper-threading technology, allowing four threads to be processed at the same time. Combined with a 64-bit operating system, the improvement in processing power is huge and should enable sophistication in media applications on a scale that was previously impossible. For instance, encoding HDTV to MPEG-2 or H.264 should be significantly faster, perhaps approaching real time with optimized code.

Gordon Moore from Intel, the author of "Moore's Law" said, "[The] first microprocessor only had 2200 transistors. We are looking at something a million times that complex in the next generations — a billion transistors. What that gives us in the way of flexibility to design products is phenomenal." Large-scale production of products using this technology will move computer-intensive graphics applications, like TV editing, to even less expensive platforms with significant improvements in performance.

The ability of such hardware to run applications that require huge amounts of memory are also facilitated by 64-bit addressing, which raises the amount of memory addressed to 1Pb (1000Tb). Initial testing by Intel reportedly shows typical gains of 1 percent to 50 percent in speed with 64-bit processors. Using hyper threading and accessing significantly more memory gains for TV and media applications will become critical factors in improving software performance. **BE**

John Luff is senior vice president of business development for AZCAR.



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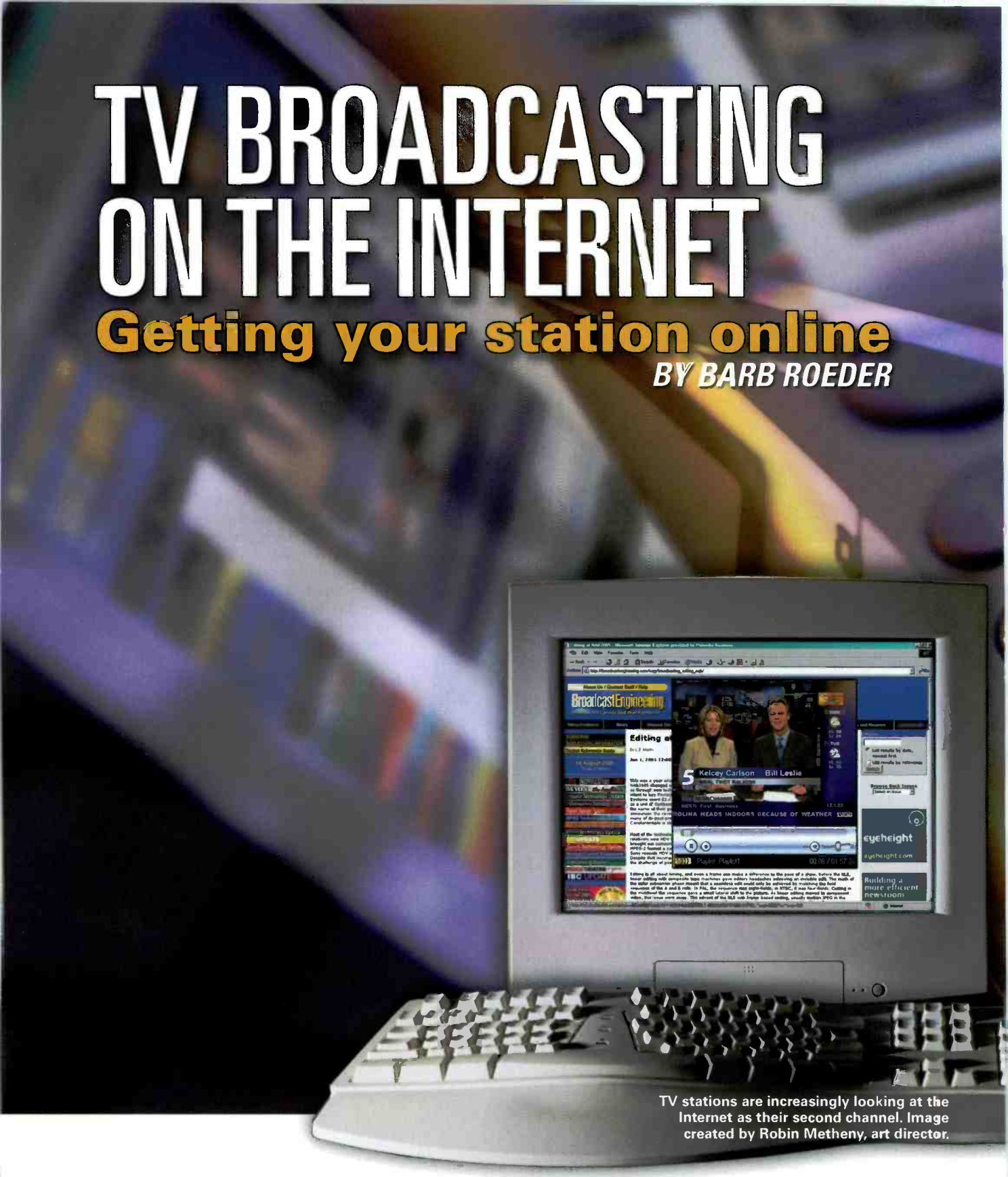

TV stations are increasingly looking at the Internet as their second channel. Image created by Robin Metheny, art director.

Technology for Internet delivery of audio and video channels has evolved, allowing broadcasters to create a full range of content 24/7 and cater to niche markets worldwide. In addition to the infrastructure needed for encoding and delivery, a large-scale effort to deliver content to a diverse audience will require automation, content management strategies and methods for tracking usage. The key is to cater to an audience that looks for personalization in all aspects of its viewing experience, including interactivity,

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Encoding

Most Internet television stations will offer their content in multiple formats and multiple bit rates to reach the widest audience. Today's delivery formats include Windows Media, Real, Flash Video, Quicktime and MPEG-4. In general, a format consists of its own set of codecs, a proprietary player and specialized server technology to achieve optimum delivery. Many computers support more than one format, but users often have their preferred player. PDAs and video phones are often designed around one format. Supporting multiple formats creates complexity in the production of Internet television channels, but automated encoding systems and application service providers with experience in delivery and management can ease the burden on a station's resources.

The basic infrastructure for ingesting content for Internet delivery is shown in Figure 1. Signal conditioning should include color correction, time-base correction, noise reduction, and audio EQ and normalization. These will smooth out inconsistencies, making the encoding process easier. Your goal for input to the encoder should be to achieve the highest possibly quality, using signals routed via SDI or in a component analog format. DV is a possibility, though keep in mind that its limited color bandwidth may introduce artifacts in high-motion scenes, complex computer-generated graphics or blue-screening.

Encoding parameters will include frame size, frame rate and bit rate and often require some tradeoffs in terms of quality and efficiency for delivery. While it's possible to deliver television-quality signals, at least in the eyes of the viewer, it may not be practical or desirable. For many codecs, a full-screen video image (640 x 480) still requires between 700Kb/s and 1Mb/s to achieve decent quality. While this is possible in a large corporate environment, delivering this level of bandwidth will not be appreciated by the IT departments and may be blocked by firewall technology. In addition, consider the viewer at home or on the road who has access to DSL or a cable modem broadband network, which generally maxes out at 768Kb/s.

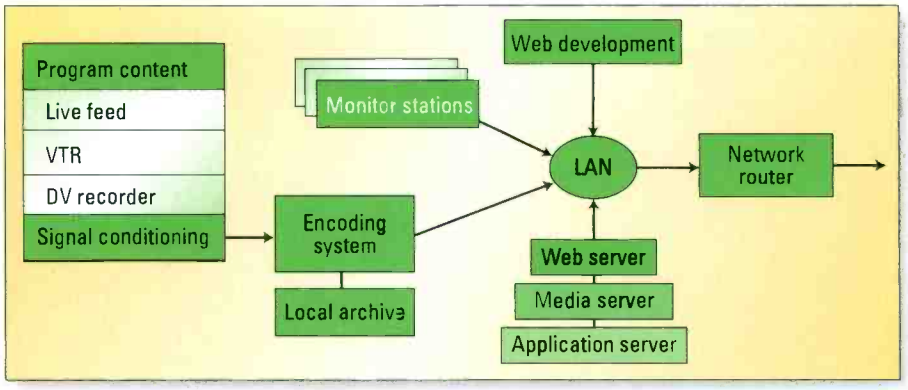

Figure 1. Signal acquisition, encoding and delivery system for an Internet television station

PDAs and video phones are often designed around one format.

The broadband market is growing steadily, but network inconsistencies still necessitate a scaled approach. Streams that contain multiple bit rates, known as MBRs, can be encoded

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in both Windows Media and Real. Therefore, a server can negotiate the best bit rate to deliver across any given network, as requested by the receiving client computer or device. Most MBR streams work most effectively if the bit rates are grouped for certain types of connections, for instance a 100Kb/s, 200Kb/s and 300Kb/s stream for broadband delivery or a 24Kb/s, 32Kb/s and 40Kb/s stream for dial-up and new wireless devices. Other formats offer only a static negotiation of bandwidth between server and client. Therefore, separate files need to be created for each bit rate, adding a good deal of complexity to the production and management of your content.

Because today's systems are capable of real-time encoding to multiple formats, you can deliver any programming destined for broadcast on the Internet as well. Unlike a broadcast, however, you can encode and store video-on-demand files so your audience can choose their own playlists.

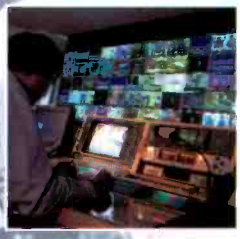
Always keep in mind the audience you want to reach. Some will have limited time and want their content in short clips. Others may be on mobile devices with limited viewing screens, so additional interactive elements are not as useful to them. In order to develop a cost-effective business model, interstitial advertising should be considered, but may need to be designed for specific markets and devices during production.

Encode and store video-on-demand files so your audience can choose their own playlists.

Delivery

Once encoded, the streams must be pushed out to a delivery network. A broadcaster can maintain its own servers, or it can rely on a content distribution network (CDN) to reach the broadest audience in the most effective manner. Maintaining server farms is not for the faint of heart, but if your audience is small (below

Managed monitoring for broadcast and distribution



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1000 simultaneous viewers), it is possible to co-locate your own server at any ISP hosting center. Delivering 1000 streams is easily achievable using a dedicated media server for any format, but will also require up to 300Mb/s of constant network bandwidth, the equivalent of more than 20 T1 connections.

CDNs have the advantage of sophisticated technology for load balancing and edge caching, so the end user's viewing experience is more likely to be free of buffering and interruptions due to traffic congestion over the Internet. Many CDNs offer all of the common formats, but be aware of added costs for delivering any that might require proprietary servers.

On the viewer side, you can enhance the user's experience by customizing a Web interface that takes advantage of the content you want to deliver and offers viewers a different experience than just watching a television program. Customized player interfaces can be developed for any format. And by segmenting a browser page, other relevant materials can be offered to the viewer as well. For instance, links to related news stories and background material relevant to the content or advertising can be embedded alongside the video window.

Links to related news stories and background material relevant to the content or advertiser can be embedded alongside the video window.

Organizing

Managing such a large-scale operation will require some type of content publishing platform that can track all of the clips stored on your servers, metadata associated with those clips and any other relevant materials you are offering your viewers. Key words can be associated with any piece of content, whether it is a video or audio clip, images or text, so users can search for information to gain a better understanding of the message you are delivering. Coordinating this effort requires a hefty Web development team, or you can use applications that have been developed by vendors in the streaming media sector, including some CDN providers.

With the growing broadband market and the maturing technology for encoding and delivery, putting a television station on the Internet is viable now more than ever. Some of the production steps will come naturally to broadcasters and can be accomplished within the existing studio infrastructure. But some steps may be better left to outside vendors specializing in network delivery and complex Web development tools. BE

Barb Roeder is a consultant and president of BarbWired (www.barbwired.com).

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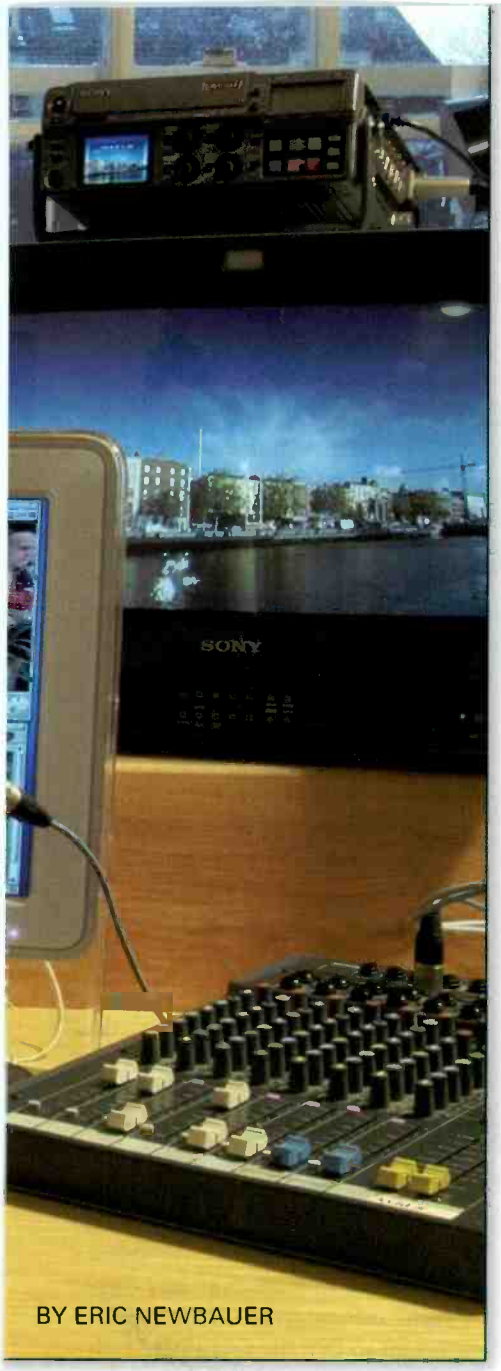
There has been much discussion (and a good dose of confusion) about the term "iSCSI" over the last year. This relatively new protocol for storage technology offers many compelling benefits, including solid performance and the ability to inexpensively create a storage area network (SAN) using standard Ethernet components.

But what exactly is iSCSI? Perhaps it is helpful to first touch briefly on what iSCSI is *not*. It is not networked attached storage (NAS). It does not require Small Computer Systems Interface (SCSI) disks. It is not a file-sharing protocol like those used by Mac and Windows servers. It is not Internet Fibre Channel Protocol (iFCP), a protocol used to connect Fibre Channel (FC) SAN islands across long distances. Nor is it Fibre Channel Over Internet Protocol (FCIP), a tunneling protocol used to extend or connect FC networks.

iSCSI *is* extremely close to the FC Protocol, which is designed for large data transfers with low overhead and low latency. For those already familiar with FC, iSCSI can be loosely



BY ERIC NEWBAUER

generalized as "Fibre Channel over Ethernet."

By definition, iSCSI (Internet SCSI or "SCSI over IP") is a storage networking standard that enables the transport of block I/O data over an IP network. iSCSI replaces SCSI's direct-attached cabling architecture with a network fabric. Essentially, the protocol works by encapsulating SCSI commands into packets and transporting them via TCP/IP. In other words, an Ethernet network now has the potential to become a SAN. And as a direct result of this ubiquitous, standardized Ethernet infrastructure come many interesting features and benefits that would otherwise be impossible.

Some might argue that simplicity is a key advantage of using iSCSI over FC to deploy a SAN. The reason: An iSCSI SAN doesn't necessarily require the specialized hardware knowledge that is perceived to be a prerequisite with FC. There is already an inherent level of familiarity with the various Ethernet networking components. Therefore, a company lacking a dedicated staff of storage network technicians should feel more adept at maintaining and troubleshooting an iSCSI SAN.

Where does it fit?

Although iSCSI can certainly be complementary to many other storage technologies, it is especially well-suited for a large portion of the middle market — that is, the mass of users who:

- Need considerably more throughput than NAS or client/server can provide.
- Desire the benefits of a SAN.
- Have determined FC is somewhat excessive for their needs.

An iSCSI SAN can be the solution here in that it provides comparatively excellent throughput, delivers the benefits of consolidated storage and requires fewer resources overall than FC in terms of people and cost.

The price and performance of iSCSI implementations for audio and video applications can vary widely. In a comparison of similar FC components, one can expect to save between 40 percent to 60 percent with iSCSI. It may be possible to use existing network interface cards (NICs), switches, etc., which would result in additional savings.

Performance is of highest importance when the storage network is expected to stream large amounts of audio or video — i.e., production or post using applications such as Digidesign's Pro Tools or Apple's Final Cut Pro. iSCSI can excel here, whereas the extreme throughput demands would usually relegate NAS and client/server to push/pull.

Benefits of iSCSI

The throughput levels achieved over a well-tuned Gigabit Ethernet (GbE) iSCSI SAN are surprising. This is especially apparent when compared to the performance of common file-sharing protocols over a similar network. The client/server and NAS protocols used for basic file sharing rarely match the efficiency of a block-level protocol such as iSCSI or FC. It is important to understand that those file-level protocols are better for users or applications that need to access a particular file, whereas block-level protocols are optimal for users or applications that constantly need the fastest access to data.

In general, the protocol is a key reason pure "wire speed" is almost never achieved. The constraint is not the available bandwidth (1Gb/s in this case). It is the overhead of the protocol being used. By employing a more efficient protocol, one can more fully use the bandwidth of the pipe. Conversely, if the pipe is the bottleneck, then a more efficient protocol won't help much.

Another significant benefit over FC is that an iSCSI SAN is capable of natively spanning great distances. It is common for networked storage to be located a fair distance from its consumers. It could be located down the hall or locked away in some data center. iSCSI is certainly comfortable within the local network.

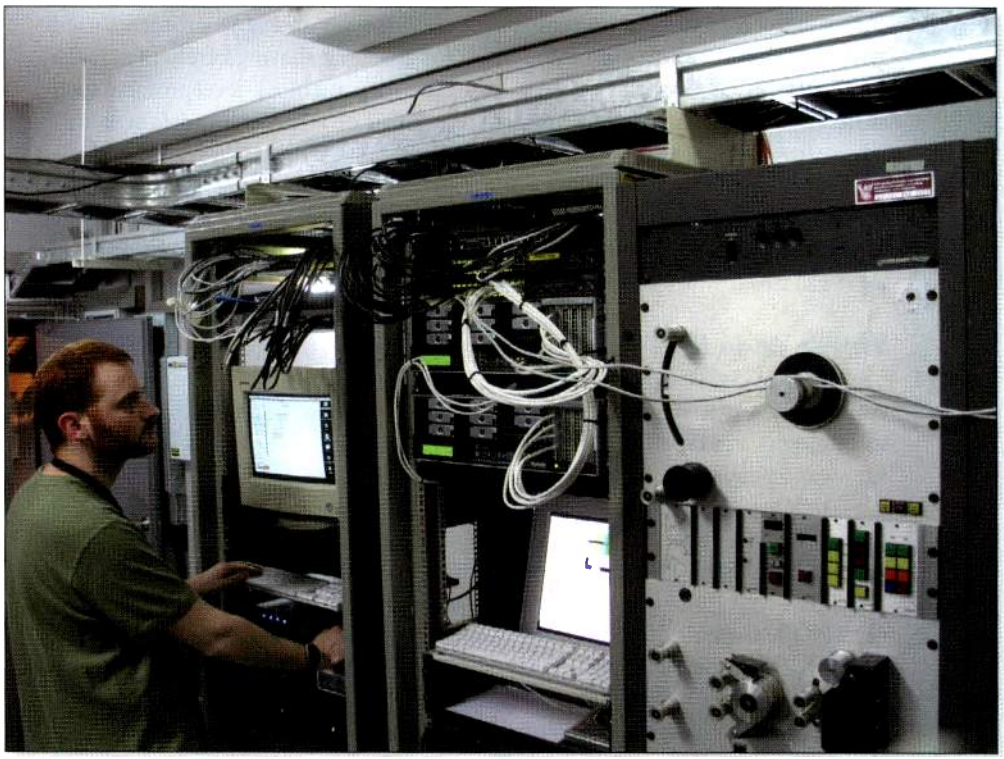
But the task of securely extending storage — particularly SAN storage — can become complicated outside the immediate confines of a campus. iSCSI makes this much easier. Not only can a virtual private network (VPN) be used to securely extend an iSCSI SAN over a WAN, but also iSCSI supports the Challenge/Handshake Authentication Protocol (CHAP). CHAP is an advanced authentication mechanism that can help ensure that a user or server has the valid credentials to connect to a particular resource on a SAN.

VPN and CHAP can be used together or independently, depending on the desired level of security. A few applications for an iSCSI Storage WAN

(SWAN) are:

- Remote mirroring.
- Offsite archive/backup.
- Disaster recovery.
- Content delivery.

iSCSI's compatibility with existing software applications is practically guaranteed. This is because iSCSI storage is presented to the OS as though it is attached locally, rather than presenting it as a network share. And because iSCSI storage is seen at the block-level, it is possible to use an operating system's native file system on those devices. Some applications simply will not run on storage that is presented as a network share. This is not a problem in an iSCSI environment.



Studio Network Solutions' systems engineer Loring Weinkauf installs a globalSAN iSCSI initiator at Technicolor's Bangkok, Thailand, location.

Hardware requirements

At the basic hardware level, there are no special networking components required. (See Figure 1.) However, it is doubtful that much will be gained by using anything less than high-quality GbE components.

Beginning from within the computer itself and working towards the physical storage, the first component to consider is the network interface. The integrated GbE NIC found in most computers is usually sufficient for SAN connectivity. If performance becomes a problem, consider upgrading the NIC. The alternative is to use a TCP/IP offload engine (TOE) on the NIC or host bus adaptor (HBA). This deals with the additional TCP flow, thus reducing the possibility of the host's CPU becoming an I/O bottleneck. There is heated debate as to the optimum solution. One side favors the concept of the TOE; the other believes the cost of a TOE should simply be applied towards a faster CPU.

Special cabling is not required other than that which is necessary for GbE. High-quality Category 5e cable is recommended. Although it is usually more expensive, plenum-rated cable should be used when safety regulations or compliance codes dictate.

A managed Layer 3 Ethernet switch is sufficient for the majority of iSCSI SANs. The configuration of the switch itself is of paramount importance. There can be thousands of settings in a high-quality GbE switch. As with most things, reading the manual and learning the "ins and outs" of the device can be the difference between unparalleled success and miserable failure.

iSCSI details

iSCSI works by encapsulating SCSI commands and transporting them via TCP/IP. On opposing ends of the network are the pillars of iSCSI: the initiator and the target. The initiator, which can be in the form of hardware or software, is installed on the host. The most basic responsibilities of the initiator are to establish a connection to an iSCSI target and start the transfer of information to and from it. (See Figure 2 on page 76.)

Configuring the initiator so that it is capable of connecting to a given target is quite simple. (An example is shown in the screen shot on page 76.) Connection information can be made persistent so that the setup need only be done once per target.

The iSCSI target's primary function is to respond to the requests started by the initiator. This task is accomplished

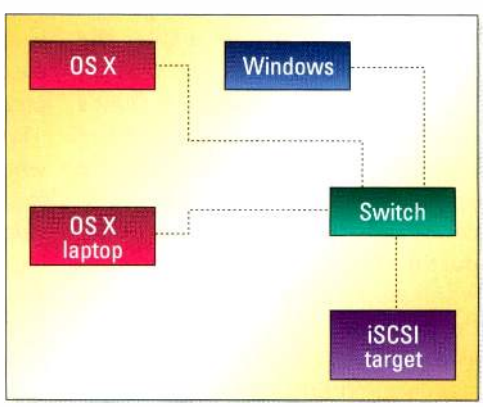


Figure 1. A typical iSCSI SAN

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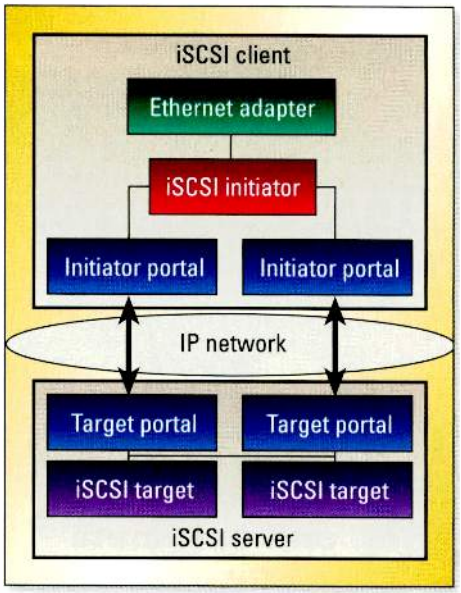

Figure 2. Typical iSCSI architecture

by brokering the requests of the initiator to the physical storage. The iSCSI target most often takes the physical form of a storage appliance, although there are software-only products available as well. Regardless of the format, the iSCSI target acts as the bridge between the network and the disks — usually a RAID of Serial ATA drives.

A common question is whether a separate network should be implemented for the iSCSI traffic. The correct answer to this question requires close examination of the intended purpose and expected throughput of the iSCSI SAN.

In small installations constrained by budget, there often is no choice but to use the existing infrastructure. If this is the case, it must be accepted that any IP-based solution could possibly suffer due to the existing traffic on the network. Therefore, an iSCSI SAN will still perform better than the available alternatives simply because of the efficiency of the iSCSI protocol.

To guarantee the highest performance and stability, it is recommended to implement a dedicated IP infrastructure for the iSCSI SAN. A compromise between these two approaches is to implement a virtual LAN (VLAN) to isolate the iSCSI traffic on an existing infrastructure.

Implementation

It is probable that a broadcaster already has an assortment of storage and networking technologies in place. Some may be for back-office functions and some for media networks. When deployed correctly, iSCSI can be complementary to existing storage/networking systems.

iSCSI need not be viewed as an either/or solution. Nowhere is this truer than with FC. Consider, for example, a FC/iSCSI hybrid SAN. This opens the door to tiered storage networking. (See Figure 3.) Here, it is possible to extend FC only to those that need the highest performance, while routing the FC SAN over iSCSI to the remainder of users or servers. There are several bridging and routing devices available that are capable of extending iSCSI connectivity to various protocols.

The demand for iSCSI is predicted to accelerate steadily over the next several years. It is hard to ignore the benefits of SAN, let alone one that is implemented on common network components. The fact is that iSCSI is firmly situated on top of the two most ubiquitous network standards: TCP/IP and Ethernet. Its value proposition becomes even more apparent with the realization that Ethernet economics now can be applied to an organization's SAN strategy.

Some have even predicted that iSCSI signals the demise of FC. The more likely outcome (near-term at least) is that iSCSI will find its way alongside many FC implementations. But perhaps nothing stands to solidify the position of iSCSI more than the mass adoption of 10GbE. With five times the bandwidth of most FC products sold today, 10GbE currently sits quietly in the background — an inevitable giant in waiting. BE

An iSCSI initiator setting up the first connection to an iSCSI target

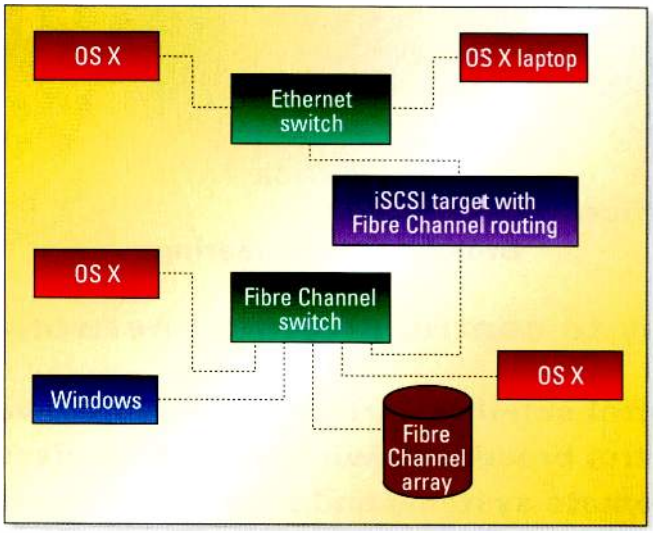

Figure 3. An example of tiered storage networking

Eric Newbauer is director of operations for Studio Network Solutions.

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KPIX-TV animates with Curious World Maps

BY JOHN SCHROEDER

In the competitive world of broadcasting, it is important to find new ways of informing a demanding public. This is particularly relevant when it comes to delivering information and news content, as this is one area where viewers have no qualms about voting with their remotes.

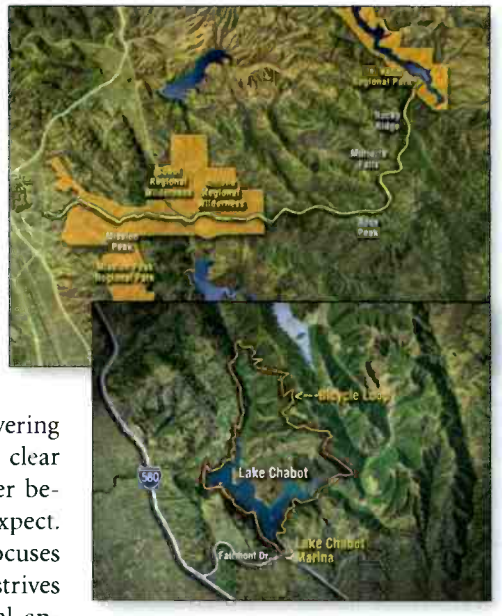
KPIX-TV CBS 5/UPN Bay Area Television understands the importance of serving its viewers. The station covers the San Francisco, Oakland and San Jose tri-city area, broadcasting to the country's sixth largest market with more than two million television households.

The station emphasizes delivering comprehensive, succinct and clear information in a timely manner because that's what viewers expect. But that's not all the station focuses on. The design department strives to subliminally create a visceral appeal through relevant, interesting packaging, which is where the need for good graphics software comes into the equation.

One way to bring content to life is by using map graphics. Whether it's a news story, a documentary or a commercial, viewers like to visualize the location so they can identify where the story is happening. However, creating map graphics, especially for breaking news where the situation is constantly changing, can be time-consuming without the appropriate tool.

This was the problem KPIX faced. We wanted to create visually stunning maps that carried the station's identity and brand, but we also wanted the ability to update them for breaking news. We also hoped to animate our maps and incorporate satellite imagery and 3-D in an effort to compel viewers and add relevance to the storytelling.

Prior to acquiring suitable software, our graphics staff would create maps by scanning supplied materials from producers or acquiring digital maps from the Web. The next step involved tracing the entire area, including specific details, into a paint program and manually filling in the styles to match the station's look. The time involved in this process was tremendous, and if the story changed or the information needed to be altered, show deadlines could easily be jeopardized.



With Curious World Maps, KPIX is able to add satellite imagery, 3-D and natural earth options to location graphics.

The only other solution was trying to anticipate potential need by building a library of pre-built maps. These libraries became cumbersome, and the station never seemed to have exactly the right map — or if it did, the area of interest would be jammed up in the corner, and there would be no time to build it again.

We found a solution to the problem in 2001, when Curious Software launched Curious World Maps Version 1.0. KPIX was one of the first stations to acquire the software, and since then, we have regularly upgraded to each new version. We also added satellite imagery, 3-D and natural earth options to enhance the overall presentation of the maps.

Installation was straightforward. The software is CD-based and works on both Macs and PCs, depending on the format required. It comes with a comprehensive manual that our design department found easy to follow. The design team had telephone access to the company's software experts in case of any teething problems.

The software works by allowing designers to create a master style sheet that can be used as a template to create still or animated maps. Users can tap into built-in vector databases comprised of detailed outline data for countries, regions, states and

The software works by allowing designers to create a master style sheet that can be used as a template to create still or animated maps.

counties. The program also includes more than 150,000 place names covering towns, mountains and other physical features such as rivers, lakes and roads. Imported local data or satellite images can be incorporated, making it simple to create an animation that zooms in from a spinning globe right down to a single building, all within a few minutes.

The designers at KPIX use Curious World Maps to create a master style sheet that can be used as a template to create still or animated maps.

Once the preformatted style sheet was set up, we had full autonomy. The program has proved to be powerful and has given us total creative control of map graphic production. Where once it took a designer several hours or more to build a detailed information graphic with animation, it is now possible to achieve the same task in half the time or less and still have the ability to change with the story.

Recently, we started using the software on an internally produced show called "The Great Outdoors with Tom Stienstra," which highlights local areas of interest in the tri-city region. This weekly program averages four to eight maps per show, including animation and 3-D. The first graphic highlights the point of interest in a wide-angle map in relation to the tri-city area in order to establish a quick frame of reference.

The maps that follow vary depending on the region and geography. If illustrating mountainous areas, we might show a 3-D model; if highlighting multiple locations, we will fly around with an animation while maintaining elegant movement. Sometimes our design department likes to use 3-D maps mixed with imagery as a scene setter, as this is a captivating and compelling way to add relevant and interesting packaging to the story. Curious World Maps allows us to achieve great results without a lot of overhead and long rendering times, especially when using a properly equipped PC.

Another advantage of the software is its compositing capabilities. Users can import graphics files such as highway symbols or client logos directly from Adobe Photoshop and maintain all the functionality of the art files as though they originated from within the application. It is also possible to import or export 3-D topographical files and geo-referenced image documents in some of the more established formats.

The software's open architecture gives us the flexibility to pick and choose what we want to do within each program and what we want to handle with other tools. It is straightforward to use. All of our designers can operate and build maps using the program. Curious World Maps has transformed the landscape of location graphic creation for KPIX CBS 5/UPN Bay Area Television. BE

John Schroeder is the design director at KPIX-TV CBS 5/UPN Bay Area Television.

WTTW-TV archives HD with JVC's VTRs

BY FRED ENGEL

WTTW-TV Channel 11 has been Chicago's home for public television for 50 years and has been instrumental in developing stereo audio for TV production and broadcast.

On Jan. 1, 2004, WTTW made its HD broadcast service debut. It focused on the revival of the music show "Soundstage." A staple on the PBS network in the 1970s, "Soundstage" has returned and is being produced in HD video and Dolby 5.1 surround audio.

The station was using an HD MPEG server with limited capacity and a schedule that included six hours of unique programming repeated four times daily and not repeated again that week. It became clear that we needed a way to archive HD and upconverted widescreen material.

Professional HD videotape recorders are expensive to own and maintain, especially when a two-hour tape exceeds $150. Working with a limited budget, the station was looking for a less expensive solution.

The audio and video capabilities of JVC's ProHD D-VHS tapes better suit WTTW-TV's needs than more expensive professional VTRs because the original ASI signal from the satellite is never decoded.

Professional HD videotape recorders are expensive to own and maintain, especially when a two-hour tape exceeds $150.

While researching other possible professional HD products, WTTW discovered the JVC ProHD D-VHS series. The inexpensive VTRs' use of low-priced tapes (less than $15 for a three-hour tape) motivated the station to look further at these products. After extensive research, the station decided that JVC's SR-VDA300U VTRs were the perfect solution.

PBS provides two 19.3Mb SMPTE 310-compatible program streams to its member stations. One is a multicast of four SD programs; the other is a full-time HD program service. WTTW uses this HD service along with locally produced HD and upconverted widescreen programs, as well as HD programming acquired from other sources. The satellite receiver used for the HD service provides an ASI output that carries the SMPTE 310 stream. This ASI output is fully compatible with the ProHD D-VHS system, allowing us to record PBS satellite feeds directly to the SR-VDA300U ASI mastering recorder.

The JVC machines provide HD analog component video outputs. Audio is available as either stereo analog or optical. The JVC SR-VD400U ProHD D-VHS player also has an IEEE-1394 Firewire connection. We have successfully tested this output using the new Miranda ASI Bridge, a device that converts the 1394 output to an ASI signal that is compatible with our HD MPEG server. Using the Miranda 1394/ASI Bridge allows the PBS program stream to be directly transferred to the server from the ProHD D-VHS tape, including Dolby AC3 surround sound audio and closed captioning.

Implementation of the new system at the station has been a big success. The high-quality video is maintained through the system, as it is dependent on the quality of the external MPEG encoders. The products have saved a tremendous amount of money without compromising video quality.

The audio and video capabilities of the JVC machines are as good or even better than more expensive professional VTRs, and the tape cost savings are staggering. JVC's ProHD D-VHS format is ideal for any station looking to capture HD less expensively.

Miranda Technologies is working with JVC to modify the ASI Bridge, so our ProHD system can handle basic archive time-shift tasks, something many DTV broadcasters face. BE

Fred Engel is director of engineering at WTTW-TV Channel 11 in Chicago.

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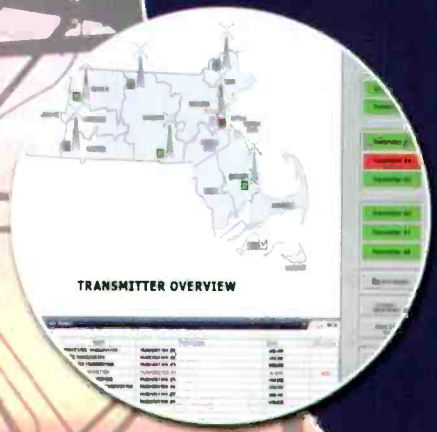

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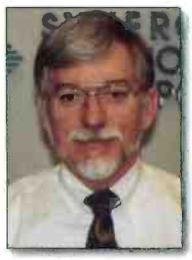
Monitoring
the SDI stream

BY JOHN LUFF



For decades, we have all been used to looking at a single test instrument to decipher almost anything about a composite video signal. You can see frequency response issues, differential gain, video levels, signal timing and many other parameters that identify the health of the signal and a lot about the quality of the picture itself. In many cases, the same scope can be used to look at 625-line signals. With slightly different models, you can look at component analog video and HD signals with the same clarity and simplicity.

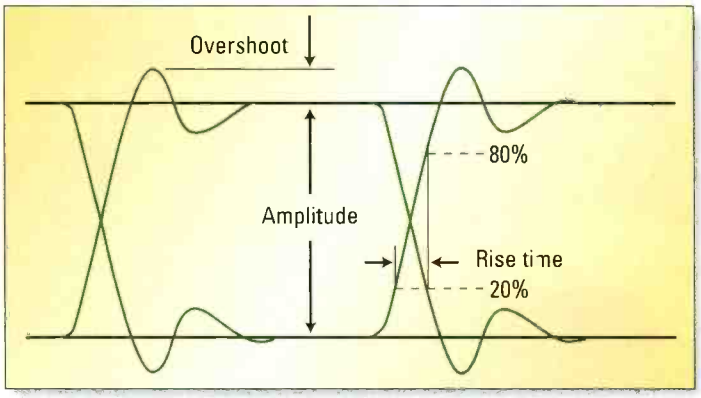


Figure 1. As the signal degrades in long cables, noise distorts the waveform. Figure from SMPTE 259M-1997.

When video is digitally sampled and then transmitted, things get a bit murkier. First, it is impossible to look at a digital signal on a simple analog waveform monitor. The digital signal (SMPTE 259M for SD and SMPTE 292M for HD) must be deserialized, decoded and converted to analog. After that, you can return to looking at the same familiar, albeit component, signal.

But what if the digital signal doesn't seem to be working? Bit errors and complete loss of picture can happen, yet you might still have a signal on the cable. Underneath, what makes SDI so different?

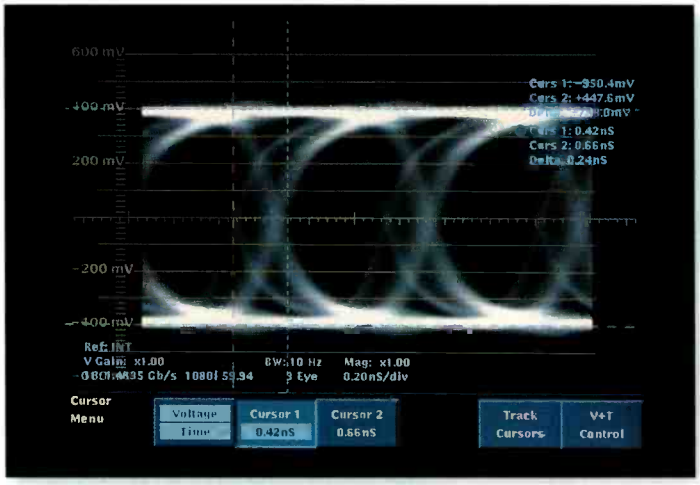


Figure 2. This Tektronix WFM-700A display illustrates jitter added to the decoded data. The zero crossing is no longer easy to identify.

First, SMPTE 259 and 292 are really analog signals representing digits. Think about it. SMPTE 259M is a pseudo square wave at a center frequency of 270MHz. SMPTE 292M is the same structure at 1.485GHz. An analog signal would be unusable at just a short distance in coax at those frequencies. The SMPTE standards set the launch conditions for the signal with known characteristics in the coaxial cable medium it is transported. If the characteristics of the cable are known, you can work out the signal loss in the cable with simple math. It turns out the SD standard was reverse-engineered to achieve acceptable bit error rates at a distance of about 1000ft in precision coax. Beyond that, anything would be a gift. At about 1200ft, almost all signals would be lost.

The standard established a launch signal of 800mV amplitude with tightly specified rise times.

As the signal degrades in long cables, due to frequency response and loss issues, the noise on the signal begins to distort the waveform, and eventually the data transitions can no longer be recovered. (See Figure 1.) Noise added to the signal has the effect of adding jitter to the decoded data since the zero crossing is no longer as easy to identify precisely. (See Figure 2.)

It is important to note that all this kind of display is showing you is the likelihood that the bits can be decoded successfully. There are plenty of other parameters that one must keep track of with digital video. It is vital to think of the digital signal as a sort of unidirectional network carrying a multiplex of signals in a tightly controlled structure. Both 259 and 292 define ancillary data, which resides in the time slices that would carry vertical and horizontal blanking in an analog signal.

Because digital signals can represent sync with a small number of bytes,

lots of space is left over. Plenty of uses have been standardized, with the most commonly used one being embedded audio (up to 16 mono tracks, eight AES pairs in four groups of two channel pairs). Also common are the carriage of closed-caption data and the use of SMPTE 259 as a data transport called serial data transport interface (SDTI). SDTI generally carries either multiple compressed streams on one wire or one signal transported at up to four times real time.

When SDI is used for such purposes, a simple matrix or spreadsheet is often the best way to show the data being transported in a tabular fashion. This allows the syntax to be reviewed to ensure that the data is present, has properly announced its presence and is behaving appropriately. One can identify the number of channels transmitted (the presence of bit activity) by looking at the channel status bits in the AES stream, whether the content is data (for instance Dolby E) or linear audio. This can be highly useful. Such tabular display of the SDI data can also be used to look at the picture data. One might find stuck bits or gamut errors out of range for the standard.

Clearly, a waveform monitor type of display is still useful, and some products include these advanced alternate displays in waveform monitor products to increase their usefulness for troubleshooting purposes. To the video signal displays, one might add audio level, phase metering and picture confidence monitoring. It is still useful to know the content after all!

But just as a waveform monitor is still important, measurement tools that do not show waveforms as a primary display are also important. There are SDI monitoring systems on the market intended to measure jitter in the data and display tabular data for in-depth analysis without providing convention waveform or vector displays. This can be useful when checking for bit errors.

If you are testing a system for conformance to the standard and tracking the quality of the data itself, it is useful to have a display that shows checksum errors in picture or ANC data, as well as the status of the EDH check words specified in SMPTE RP-165. While these displays might be combined with a waveform monitor, measurements can be done by instruments intended for much more specialized testing and monitoring of signals for transient errors. This can be helpful in locating subtle problems in a system, such as illegal signal levels associated with one input picture source or intermittent bit errors.

If you think of the SDI (or HD-SDI) signals as both video and data and pick monitoring strategies appropriate to your system, the monitoring equipment you choose may well be unconventional. **BE**

It turns out the SD standard was reverse-engineered to achieve acceptable bit error rates at a distance of about 1000ft in precision coax. Beyond that, anything would be a gift.

John Luff is senior vice president of business development for AZCAR.

SEND Send questions and comments to: john_luff@primediabusiness.com

MULTICHANNEL AUDIO ENCODER/DECODER

Dolby Laboratories Dolby E DP571/DP572: Encodes up to eight channels of digital audio and metadata for use in DTV program production and broadcast distribution; decodes Dolby E bitstreams for use in DTV program production and broadcast distribution infrastructure.

415-645-5293; *www.dolby.com*

700MHZ ANTENNAS

Dielectric 7C, 7P and 7S Series: Antennas can be horizontally, vertically or circularly polarized; 7C Series consists of slotted coaxial antennas designed for applications requiring a lightweight, 6MHz or 10MHz solution in the 700MHz band; the 7P Series meets both omnidirectional and unique pattern requirements with either horizontal or vertical polarization; the 7S Series is designed for applications requiring a horizontally polarized, omnidirectional broadband solution.

207-655-4555; *www.dielectric.com*

HD/SDI FOUR-CHANNEL AUDIO EMBEDDER/DISEMBEDDER

AJA HD10AMA: Disembedder provides four analog audio outputs; embedder is user-selectable, on a channel pair basis, to either pass SDI input audio or to embed input analog audio; analog audio levels are selectable.

530-274-2048; *www.aja.com*

BIDIRECTIONAL ANALOG CONVERTER

Blackmagic Design Multibridge: Simultaneously converts from digital to analog, and analog to digital; supports 12 channels of SDI-embedded audio and converts to and from eight channels of AES and four channels of pro analog balanced audio.

+31 20 616 9424; *www.blackmagic-design.com*

5.1 SOURCE INPUT HANDLING

Calrec Audio System Plus: Allows for comprehensive adjustment of individual discrete elements via a custom-designed spill panel; using one fader per surround channel, an operator uses the resources of 2x stereo channels for L/R and LS/RS, and 2x mono channels for center and LFE.

+44 1422 842159; *www.calrec.com*

DIGITAL WIRELESS INTERCOM

Clear-Com FreeSpeak: Features complete programmability with up to six communications routes per beltpack; users can remote and customize coverage areas, as well as connect with two wired party-line and four digital matrix channels.

+44 1223 815000; *www.clearcom.com*

TRANSMITTERS AND REPEATERS

DMT: Range includes digital and "digital-ready" analog models in VHF and UHF bands, with air or liquid cooling; offer 0.1W to 40kW output power; compatible with all types of digital terrestrial TV networks.

+44 118 986 6123; *www.dmtonline.com*

MULTI-DISPLAY AND SIGNAL MONITORING SYSTEM

Evertz MVP: Allows users to resize and relocate up to 72 auto-detected HD-SDI, SD-SDI or composite analog video inputs on one or more displays; each input is resizable more than once and shown on the same or multiple displays.

+44 1895 458 444; *www.evertz.com*

BI-AMPLIFIED MONITORING SYSTEM

Genelec 8120A: The company's smallest speaker system (height with Iso-Pod is 242mm, width is 151mm and depth is 142mm); designed for monitoring in difficult listening environments, particularly those compromised by lack of space; has a die-cast aluminum minimum diffraction enclosure.

508-652-0900; *www.genelec.com*

VTR

Grass Valley Turbo iDDR: Leverages the digital storage, networking and media-management capabilities of the company's Profile video servers; fits into any existing environment; users can load content as audio or video, or as files from removable media.

+33 1 34 20 70 00; *www.grassvalley.com*

CONTENT DELIVERY PLATFORM

Harris H-Class: Provides broadcasters and content providers with the means to integrate disparate processes into a single, modular system; handles all content management and delivery enterprise-wide from creation to consumption; based on open standards.

217-221-7180; *www.broadcast.harris.com*

SD/HD EDITOR

Leitch VelocityNX: A full-featured HD/SD craft editor for NEXIO environments; based on the Velocity user interface; integrated into the NEXIO SAN; features the ability to edit Leitch native SD and HD files directly from the NEXIO shared storage architecture.

+44 1344 446 000; *www.leitch.com*

DUAL HD MONITOR SET

Marshall Electronics V-R72P-2HDA: Features high-resolution, 1.2 million pixel screens with completely digital signal processing; designed specifically for analog applications; accepts DVI and HDMI computer or video signals plus all SD and HD analog video standards and signal types.

800-800-6608; *www.lcdracks.com*

MODULAR ROUTER

Network Electronics VikinX: Consists of a 128 x 128 AES router and a 64 x 64 analog audio router; features dual hot-swappable and load-sharing power supplies; supports dual and redundant system control and monitoring tools.

+44 29 2067 1760; *www.network-electronics.com*

FIBER-OPTIC CONNECTORS

Neutrik OpticalCon: Consists of an all-metal and dirt-protected chassis and cable connector; increases the reliability and maximizes the uptime; offers the choice of using a cost-effective LC connector as a permanent connection.

+423 2325393; *www.neutrik.com*

DYNAMIC AUTOMATION

Salzbrenner STAGETEC AURUS SnapMix: Allows for storing complex mixes or effects as SnapMixes; SnapMixes can be recalled regardless of the presence of external time code, with the internal clock of the AURUS used as a sync reference; allows for asymmetrical fades between two stored snapshots for precisely reproducing complex panning effects.

+49 9545 440 0; *www.stagetec.com*

DIGITAL/ANALOG RECEIVER

Nucomm CR6D: Comes with an internal MPEG-2 decoder and COFDM demodulator; compatible with most remote controls; capable of multiband operation when used with block downconverters.

908-852-3700; *www.nucomm.com*

NEWSROOM WORKFLOW SYSTEM

OCTOPUS Newsroom Octopus 5: Improved comprehensive search tool now looks for locally stored data, as well as indexes Web content gained from RSS feeds; new feature allows users to store defined filters and create their own piece of main menu.

+420 221 181 511; *www.octopus-news.com*

HD MEDIA SERVER

Omneon Spectrum HD: Features integrated capability for the simultaneous playback of SD and HD content on either the same channel or independent channel; HD MediaPort playout modules can support one or two channels of HD MPEG playout of 4:2:0 and 4:2:2 material at bit rates up to 78Mb/s.

+44 1256 884 450; *www.omneon.com*

HD CAMCORDER

Panasonic AG-HVX200 P2 Palmcorder: Switchable between SD and HD and between interlaced and progressive; uses P2 solid-state storage of MXF files; supports all 1080, 720 and 480 signals at 24p and 30p frame rates.

201-348-5300; *www.panasonic.com*

PLAYOUT SYSTEM

Telenor Satellite Broadcasting SBc Playout: You provide Telenor with the programming and a schedule; Telenor stores the programming and later broadcasts it according to the specified times; ideal for smaller operators that do not have their own production facilities.

+44 207 923 6500; *www.telenorsbc.com*

DIGITAL VIDEO PROCESSING

Terayon DM 6400 Network CherryPicker: Applications include grooming of custom channel line-ups, rate shaping and statistical multiplexing; designed to deliver superior picture quality for both SD and HD digital video services; now features support for the H.264/AVC advanced codec.

408-235-5500; *www.terayon.com*

WAVELENGTH MANAGER

Telecast Fiber Systems Teleport: Coarse wavelength division multiplexing wavelength manager; provides high-bandwidth multiplexing for 32 digital signals on two single-mode fibers; features 1300nm and 1550nm inputs.

508-754-4858; *www.telecast-fiber.com*

AUDIO MONITOR

ATG Broadcast SAM-E: New SDI audio extractor option provides push-button, front-panel access to each of the eight audio channel pairs; is ideal for multichannel or multi-language applications; has eight stereo inputs, digital carrier auto-sensing and amplified stereo outputs; designed for desktop or rack-based installation.

+44 1462 485 4444; *www.atgbroadcast.co.uk*

ARCHIVE MANAGEMENT

Front Porch Digital DIVArchive 5.9: Key enhancements include broader interoperability with MXF devices, multi-site archive distribution, archive partitioning, enhanced Unicode support, expanded format support for partial restore, and stronger integration with leading nonlinear editing platforms.

+33 4 50 88 37 70; *www.fpdigital.com*

MULTI-DEFINITION MODULES

Ross Video RossGear MD: Multi-definition modules for distribution, monitoring, format conversion, frame synchronization, audio embedding and processing; handles all SD-SDI and HD-SDI signals; has a 2RU modular MD frame; designed to complement the Synergy MD line of switchers.

613-652-4886; *www.rossvideo.com*

HDTV DIGITAL WIRELESS CAMERA SYSTEM

Link Research LinkHD: Maintains full detail and resolution of HD format TV pictures throughout transmission; uses MPEG compression and modulation techniques; low transmission delay, low-power requirement and a robust diversity signal; has bit rate between 18Mb/s and 50Mb/s and will operate in HQ mode or rugged mode, with bandwidth of 20MHz or 10MHz.

+44 1923 200900; *www.linkres.co.uk*

HD-SDI TEST SIGNAL GENERATOR

Wohler Technologies Penpal-HD: Produces 32 video test patterns in 18 HD formats, each of which can be combined with three different audio tone settings; capabilities include three moving test patterns, pathologicals and four stereo pairs of AES audio embedded in the HD-SDI signal.

650-589-5676; *www.wohler.com*

BROWSING SYSTEM

Omneon ProBrowse: Create and view low-resolution versions (proxies) of full-resolution material contained within an Omneon Spectrum system; monitors content directories within an Omneon Spectrum server and automatically generates low-resolution versions of all material, including any new material being ingested or copied into the Omneon Spectrum system over FTP.

+44 1256 884 450; *www.omneon.com*

BATTERY

Anton/Bauer HyTron 140: Employs a special nickel metal hydride cell technology developed for low emission vehicles and e-bikes; capable of loads up to 12A; provides a capacity improvement greater than 16 percent compared to the current HyTron 120.

203-929-1100
www.antonbauer.com

VIDEO DISK ARRAY SERIES

Proavio editBOX: Has five removable SATA II disks and an eSATA interface; accommodates multistream 10-bit video; features an eSATA PCI-X host adapter for Macintosh or Windows operating systems; supplies sustained throughputs of more than 160MB/s; has a RAID-0 architecture.

562-777-3488; *www.proavio.com*

MULTICHANNEL AUDIO-SPLITTERS

Lawo alphaton MPV-43P: Is a 19in 1RU device; offers four channels with one input split into three outputs; inputs and outputs as XLR connectors are provided on the shot-blasted and anodized front panel; offers an individually switchable 48V-phantom power for each of the four channels.

416-292-0078; *www.lawo.de*

PRO PATCH

ADC Optical Normal Through Panel: Fiber source and destination connections are on the rear of the panel, with a normal through connection between the source and destination ports; 3RU chassis houses six modules to provide 24 fiber terminations; 4RU chassis houses six modules to provide 48 fiber terminations; modules are available with or without monitor ports on the front.

952-938-8080; *www.adc.com*

LCD MONITOR

Marshall Electronics V-R70P-HDSDI: Features a high resolution, TFT-Megapixel screen with 1.2 million pixels and digital signal processing; is constructed with a durable enclosure featuring an optical-grade polycarbonate protective cover and anti-glare/anti-reflective screen; includes an AV-mount battery adapter; runs four to six hours on optional 50WH battery; analog signals can be converted to 10-bit digital.

800-800-6608; *www.lcdracks.com*

VOLTAGE REGULATOR

Furman Sound: AR-15 – Series II: Delivers a stable 120 ±5 VAC whenever the input AC line voltage is between 97V and 141V; features Linear Filtering Technology (LiFT) with zero ground contamination; has Series Multi-Stage Protection Plus (SMP+) with Extreme Voltage Shutdown (EVS); output capacity is 15A; features eight outlets on the back panel and one on the front.

707-763-1010; *www.furmansound.com*

FLUID HEADS

Sachtler SPEEDBALANCE: Includes seven new fluid heads; offers payloads ranging from 1kg to 16kg and 25kg for Video 20 SB; features either 10 or 12 step counterbalance, resulting in extremely fine graduation and an increased payload range; uses Sachtler's step switching, which allows camera operators to balance the fluid head and camera quickly.

516-867-4900; *www.sachtler.com*

2-D/3-D BROADCAST GRAPHICS PLATFORM

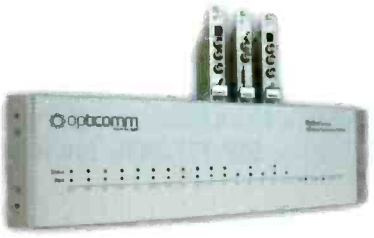
Leitch Technology, Inscriber Inca RTX HD: Supports HD and SD graphic solutions, including real-time animations and audio transitions; develop custom graphic applications; provides up-to-the-minute data, dynamic graphics and effects within interactive programs.

519-570-9111; *www.inscriber.com*

MASTER CONTROL PROCESSOR

Utah Scientific HD/SD-2020: Provides digital audio and video processing for master control switching applications; can hold two independent signal processing channels; offers a full range of mixing and keying functionality.

801-575-8801; *www.utahscientific.com*



FIBER OPTIC VIDEO/AUDIO/DATA TRANSMISSION PLATFORM

Opticomm Optiva: Build a transmission platform based on user-specific needs; online product configurator selects the exact video, audio and data signals needed to transport optics and connectors and the most suitable housing unit; receive an automatically generated quotation with a diagram of the system.

858-450-0143; *www.opticomm.com*

MULTIFORMAT ROUTER

Quartz Xenon: New developments include audio and signal processing technology (SPT) modules; SPTs include a multiviewer, multilevel keyer, animated logo inserter and base-level master control switcher.

+44 118 935 0200; *www.quartzuk.com*

CATALOG

Bird Electronic RF and Microwave Components catalog: Offers several product groups, including attenuators, terminators, loads, couplers, signal samplers, dividers/combiners and filters; features Bird Electronic's Design to Order capabilities; new product additions include terminations, signal samplers, 600W tunable harmonic filters, mobile duplexers, 350W directional couplers and 800W power dividers; users can configure their own signal distribution systems.

440-248-1200; *www.bird-electronic.com*

UNINTERRUPTIBLE POWER SYSTEM

Eaton Powerware 9355: Is available in 10kVA and 15kVA models; is 91-percent efficient, which reduces utility costs, extends battery runtimes and produces cooler operating conditions; has a tower design half the size of comparable three-phase UPSs.

216-523-5000l; *www.eaton.com*

PORTABLE DVR

Fast Forward Video FieldPro: Is powered by an external 12VDC power adapter; features video capture and playback at 60fps, resolution greater than 550 lines at 4:1 compression, user-selectable compression ratios ranging from 4:1 to 20:1, and recording times averaging from four to 20 minutes per gigabyte.

949-852-8404; *www.ffv.com*

DUAL-CHANNEL ON-CAMERA UHF RECEIVER

Azden 200UPR: The 63 frequency UHF receiver operates in the 794MHz-806MHz band; records the sound from two subjects simultaneously; is available in three pre-packaged systems, which includes the receiver and two mic/transmitters; features a crystal-controlled PLL synthesis and a two-channel, 3.mm, -58dB balanced mic-level jack; each channel has on/off switches, LEDs, group frequency selectors and dual high-gain antennas.

516-328-7500; *www.azdencorp.com*

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MULTI-SYSTEM CONTROLLER

Video Technics Director 4.0: Enhances and optimizes large network performance, multi-system Apella playout and record network channel control; connects available Apella channels for network remote control; play, stop and recue events quickly from any VT Director client; search and browse the database; create and execute multichannel play lists.

404-327-8300; *www.videotechnics.com*

HD MONITOR

Cine-tal Philo: Features Cine-tal's Intelligent Display Server Technology in a 24in LCD monitor; is comprised of two models offering a variety of configurations for HD-SDI inputs and outputs; can be configured for up to four HD-SDI inputs; includes two levels of waveform monitor and vectorscope technology, a test signal generator and a rack-mount kit; features OmniTek's waveform monitor and vectorscope.

317-576-0091; *www.cine-tal.com*

SHOULDER-MOUNTED CAMCORDER SUPPORT SYSTEM

PAG Orbitor: Provides a balanced and stable shooting platform for handheld camcorders; camcorder's weight is supported and counterbalanced, enabling hours of shooting without fatigue; freedom of movement is achieved by a three-axis mechanism that enables the user to pan, tilt and roll smoothly.

+44 20 8540 4797; *www.paguk.com*

DIGITAL BELTPACK/HEADSET INTERCOM STATION

Riedel Performer: Offers an integrated two-channel solution for combined digital matrix and party-line intercoms; can be used stand-alone or in conjunction with matrix systems; is comprised of the C3 two-channel Digital Beltpack, the C44 System Interface and the C31 1x3 Split Box.

+49 2 02 292 90; *www.riedel.net*

SIGNAL ANALYZER

Leader Electronics LV5700A: New addition of delta and bar-graph display modes; enables operators to spot chroma gamut errors at a glance and identify the source colors; displayed on a high-resolution TFT color screen.

+31 40 2 645 345; *www.elquip.com*

For Sale

For Sale

Help Wanted

ASSISTANT CHIEF ENGINEER

Crown Media International, LLC is searching for an Assistant Chief Engineer to coordinate installation of production and broadcast equipment and perform new product evaluation in our Denver Network Operations Center. Requires degree in Electrical Engineering or equivalent work experience, ability to perform maintenance and repair of broadcast equipment to the component level, experience with TV signal measurement equipment and electronic test equipment, as well as ability to perform broadcast system design utilizing CAD systems.

To apply, forward resume to:
carlamccabe@hallmarkchannel.com
or fax to (303) 224-0879

BROADCAST ENGINEERING TECHNICIAN
MTV Networks

Fast-paced 24/7 environment seeks candidates to maintain the technical integrity of a Network Operations Center. Candidates should have 5 to 7 years experience in broadcast TV with extensive maintenance experience with VTRs (DigiBeta, HD-Cam, and Beta SP) and Server based video playout platforms (Pinnacle & Grass Valley), Master control video switchers (Miranda & Saturn), Video/audio routers, and Digital tape archives. A comprehensive component level background in Baseband Video/Audio is required, knowledge of RF infrastructures a plus. Additional industry knowledge with satellite compression equipment and distribution methods, data networks & servers is desired. Certificates in Harris/Louth Automation, Sony VTR maintenance on DigiBeta VTRs, MCSE, A+ Certification, or SBE preferred.

Please email all resumes to
nocstaffing@mtvstaff.com
or fax to 631-300-3259

Help Wanted

MAINTENANCE ENGINEER

ABC affiliate in Cleveland, OH needs an experienced Maintenance Engineer to troubleshoot electronic equipment to a system level; repairing, aligning, installing, maintaining and relocating equipment. Must be able to lift 50 lbs, work on ladders and on rooftops. Must be competent in the use of electronic testing equipment and able to work independently. Requires five years experience in television station as an Engineer. Prefer experience in live truck, DVC Pro cameras and VTR maintenance. See full job posting on **www.scripps.com.**

Send cover letter, resume and salary requirements to:
HR, WEWS
3001 Euclid Avenue
Cleveland, OH 44115
fax: 216-431-4287
or email to jobs@wews.com
EOE

Maintenance Engineer

Qualifications: The successful candidate must have a minimum of 3-4 years experience. Ability to troubleshoot and repair to the component level, video switchers, audio consoles, tape machines, cameras and all support equipment. Must be familiar with LAN systems. TCP/IP, computer configuration & software installation. RF knowledge a plus. This is an IBEW Union Position.

Salary: Dependent on Experience

KCRA-TV/KQCA-TV
Attn: Stefan Hadl Director of Engineering 3
Television Circle
Sacramento, CA 95814
No phone calls please
KCRA-TV/KQCA-TV is an EOE

Help Wanted

BROADCAST DESIGN ENGINEER

A full service broadcast systems integrator currently has a position open for a Broadcast Design Engineer in the Southeast Region. If you are looking for a challenging position working with some of the most innovative clients in the industry, you should contact us.

Job Responsibilities Include: Interfacing with clients to determine project goals and expectations; determine equipment requirements for new systems; developing complex broadcast design and detailed documentation; adhering to timelines; interaction with installation, testing, and training teams; and new technology evaluation.

Qualifications & Requirements: 5 years design experience in a television broadcasting environment required. Excellent interpersonal skills a must. Experience with HD conversion, Dolby digital, Dolby E preferred. Working knowledge of a variety of software packages, including ACAD, Microsoft Word and Excel and Microsoft Project Is desired.

Salary: Commensurate with experience; Excellent Benefits available.

Confidential

Please email resume to:
jobs@tech-engineers.com

MOBILE UNIT ENGINEERS

TRIO VIDEO, the leading mobile television production company in the Midwest, is seeking Mobile Unit Engineers to operate and maintain its standard and high definition mobile unit fleet from its base of operations in Chicago. Responsibilities include coordinating, troubleshooting and maintaining on-site mobile unit operations and equipment. All experience levels considered with: engineering degree, technical training, multiple years of hands-on broadcast experience or any combination.

Qualified candidates should send their resume to:
Trio Video
2132 West Hubbard
Chicago, IL 60612
resumes@triovideo.com
fax 312-421-0361

CHIEF ENGINEER

Chief Engineer KVRR-TV; FOX: Exp. with UHF and VHF full power transmitters. Duties include repair and maintenance of all broadcast equipment including DVC Pro, Avid, Ross, microwave and translators.

Send Resume to:
P.O. Box 9115
Fargo, ND 58106
EOE

Help Wanted

Engineer 2
Iowa Public Television
6450 Corporate Drive
Johnston, IA 50131

Iowa Public Television is seeking applicants for an Engineer 2 position to work primarily in the Master Control area. This position will operate master control and transmitter control system for all IPTV transmitters; complete the FCC logs, and record satellite programs for delayed playback or library storage. Other duties include operating servers, flexicart, still stores, digicart, character generator and the weather warning system, along with reporting errors or technical difficulties to the appropriate departments. Work hours are primarily 5:00 p.m. to 1:00 a.m. Tuesday through Saturday with changes as needed.

- **Requirements:** Must have experience in operating master control equipment.
- **Salary range:** $33,425 to $47,964/annual, plus full benefit package.

You may request an application form by:

- **Mail:** Human Resources
  Iowa Public Television
  P.O. Box 6450
  Johnston, IA 50131
- **Telephone:** (515)242-3117
- **Fax:** (515)242-4113
- **Email:** Humanresources@iptv.org

Or complete and print an application form from our Web site, www.iptv.org

EOE/AAE

WTTG/FOX5 & WDCA/UPN20
Washington DC
ENGINEERING MANAGER

Experienced hands-on technical manager to assist the VP Engineering with overseeing the day-to-day technical operations of this fast-paced duopoly, news station. Requires minimum 6 years experience providing Engineering and IT support to broadcast News and Master Control / On-Air operations at a major market television station. Managerial responsibilities include employee supervision. Must be knowledgeable in complex digital video, digital audio and LAN systems, with proven ability to quickly and accurately diagnose and resolve problems. Must be knowledgeable in users' workflow requirements and provide training on new systems. Requires excellent communication skills. Must be able to effectively work with others in challenging situations. Strong background in video, audio, RF and IT components and systems. Project management experience required. Experience working with collective bargaining agreements in a union represented facility preferred.

Forward resume and letter of interest to:
Human Resources,
FOX 5/WTTG & WDCA/UPN20
5151 Wisconsin Avenue, NW
Washington, D.C. 20016.
Fax:202-895-3286
email:WTTG-HR@foxtv.com
Web site: www.fox5dc.com
EOE/M/F/D/V

Help Wanted

TURNER STUDIOS

Engineering Managers and Production Engineers- Turner Studios is seeking motivated, experienced, client-oriented Engineering professionals to join our team.

We're currently accepting resumes for Engineering Managers and Production Engineers to design, install and maintain our SD and HD production and post facilities.

Current openings include:

- **Engineering Mgr, Studios Projects**
  38182BR
- **Engineering Mgr, Data Systems**
  28993BR
- **Technical Supervisor, Live Events**
  39494BR
- **Production Engineers, Edit & Studio**
  34993BR
  38562BR
- **Network Specialists**
  (posting soon)

For more details about each opening, please see our job postings at www.turnerjobs.com, using these Requisition #'s in your search.

Please send resumes to:
Jeff Sharpe - Director of Engineering
Fax - 404-878-4014
Email - jeff.sharpe@turner.com

MANAGER, BROADCAST MEDIA INFORMATION SYSTEMS

WorldSpace Corporation provides digital satellite audio, data, and multimedia broadcasting coverage to Africa, Asia, The Middle East and Western Europe. We are seeking a manager to be primarily responsible for the technical support of the WorldSpace Broadcast and Production Computer Automation System (Dalet Digital Media System). You will provide primary hardware and network support for Dalet Digital Media System (DDMS), assist Software Application support department, be the primary System Administrator of DDMS network, support communication systems including FTP servers, VPN, and UDP/TCPIP file transfers over Internet—includes routers, switches, and firewall configurations. You will also maintain documentation of Dalet systems, bug lists, trouble tickets and track vendor bug fixes and workarounds, plus Sybase databases. You will be part of Engineering team responsible for design and deployment of new systems. Education includes a BS degree in Computer Science or Information Technology and MSCE certification. Experience: at least 7 years experience in the field of IT, design and maintenance of Internet and WAN communication systems, Dalet Digital Media System Software (preferred), Sybase, Internet and WAN based communications security.

Send resumes to:
Ms. Cari Ciuba at
careers@worldspace.com

Help Wanted

DIRECTOR OF TECHNICAL SERVICES

Mississippi Public Broadcasting seeks a Director of Technical Services to oversee the operation, maintenance, and continued development of its various networks including its statewide radio and television networks. MPB operates 8 radio and 8 television analogue transmitters, 8 digital television transmitters, an interactive video network, and major television and radio production facilities. The director of technical services reports to the Executive Director and supervises a staff of approximately thirty-five (35). MPB operates a state of the art High Definition mobile unit. MPB strives to be at the forefront of the technical development of digital television, radio, and High Definition production. Special Qualifications: The required Master's degree or Bachelor's degree must be in Engineering. The five (5) years of experience required at the Master's degree level, or six (6) years at the Bachelor's level, or the ten (10) years at the high school level, must have been in broadcast television with some experience in digital television and microwave systems. Must have experience with project planning and design and have experience in management of technical staff. This position is classified as Non-State Service, Exempt. See Web Site for compete description (www.mpbonline.org).

SUBMIT: State of Mississippi application (obtained via State Personnel Board and Mississippi Employment Service) to:
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Revisiting broadcasting, by default

BY PAUL MCGOLDRICK

We know from current statistics that a growing number of viewers in the United States are using cable and satellite through triple-play services (TV, high-speed Internet access and telephone). These bundled packages are becoming more and more financially attractive, especially when, in the larger cities at least, the telephone services include price-limited long-distance.

Consequently, off-air TV reception is for the financially strapped and for those — and I know at least one such family — who think having too many channels to choose from will make them addicted to the box.

With the current political attempt to marginalize public broadcasting — reducing public funding or placing people in a position to change the direction of both the TV and radio services — the last local offering of information is threatened. Member stations, often with unique programming, will be the heaviest hit by political games, while the network affiliates continue to offer only less-than-acceptable local news.

TV station ownership limits are only a cover story for a few individuals whose real interest is in trying to control the media. They already own the content channels they want to, and limiting the number of their terrestrial operations is no skin off the nose of their profits. Those who want the FOX News approach to the world can tune in all day (just as they do in the ready room of my local police department). Those who want something different know that Comedy Central's "The Daily Show with Jon Stewart" is probably the most serious approach they can get to fake news.

Just as TiVo has tried to change the world of TV reception by allowing us to skip commercials, there are other changes on the horizon, which, I believe, have far more monumental implications for the broadcast industry.

The first of these changes is happening in the radio arena, but it will be copied for video as technology catches up. The move to podcasting in the last year has been spectacular. Users can find aggregators, such as RadioTime.com, to put together the content they want to hear and have it all downloaded to their MP3 devices. Podcasting helps users personalize their own radio stations, whether their taste is in music, talk radio or news. Although podcasting was coined by combining Apple's iPod with the word broadcasting, an Apple device or software is not required — just RSS 2.0 software. In its latest version, RSS now stands for Really Simple Syndication. Some of the aggregators have a free level of service, but for real content, you have to be willing to pay — and people are.

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Whether podcasting will challenge satellite radio is an unknown, but I am hearing smaller terrestrial radio station owners talking beyond their current formats and trying to address a type of listener rather than a type of music. This philosophy seems smart because the latter is going to be covered completely by podcasting and satellite. Drive time may continue to be a feature of the big city, but it is not going to pay the electric bill for 24/7 broadcasting.

The same thing has to happen with TV broadcasting. TiVo isn't for everyone because the sources available are limited to the package size being subscribed to on cable or satellite. Much more creative material is available. The success of Netflix (king of pop-up ads) in getting people to walk to their mailbox for rented DVDs instead of driving 10 minutes to the video store shows it. As the pipe to homes gets fatter and fatter — with some form of VDSL being realistic for most of the country within a year or two — there will be a place for aggregators of video as well as audio.

As long as they get the price model right — and they have only Netflix to beat — with no physical disk or mailing complications, the aggregator cannot lose. But the broadcasters will lose, unless they become an early part of it, as many radio stations are trying to be with podcasting. Any ideas for a catchy name for these video services? BE

Paul McGoldrick is an industry consultant based on the West Coast.

SEND Send questions and comments to: paul_mcgoldrick@primediabusiness.com

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