

# Broadcast Engineering

THE JOURNAL OF DIGITAL TELEVISION

## DIGITAL newsrooms

The need for change

**Digital asset  
management**

Where IT meets video

**Surround sound**

You've got to hear it right

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Audio Control



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Engineering

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# Broadcast Engineering

THE JOURNAL OF DIGITAL TELEVISION

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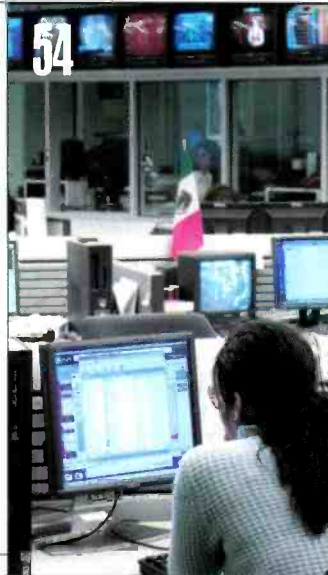
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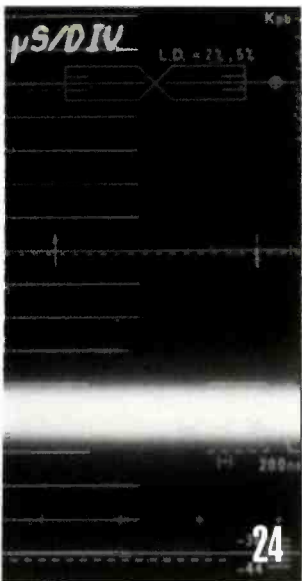
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### ON THE COVER:

Time Warner Cable's NY1 24-hour cable news channel recently installed a new Avid tapeless digital news production system. Shown here is an NY1 producer working on the daily rundown of the news from the control room.

(Continued on page 8)



# The Shortest Route from Inspiration to Air

10:30 - 10:31 - 10:32 - 10:33 - 10:34 - 10:35 - 10:36



LIVE PRODUCTION



EDITING



CONTENT DELIVERY



NEWS PRODUCTION



SPORTS ANALYSIS



OEM DEVELOPER

Streamline your workflow. Pinnacle automates and eliminates the time consuming, mundane and repetitive. Let us empower you with the tools to edit, create graphics, prepare news and playout your best.



## Graphics

From local news to the Olympics, Deko is the only name you need to know for highly automated, creatively flexible solutions. Featuring Deko3000 with powerful Inflexion engine and true 3ds max 3D graphics, DekoCast traffic and automation, and Deko3000 HD.

## Editing

Pinnacle Liquid 6 is the only NLE with built-in, native support for HD editing with real-time effects. HDV straight to the timeline -- no transcoding, no wasted time. MXF adds support for Pinnacle MediaStream servers, Sony XDCAM, Panasonic P2 and more.

## News

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## Playout

From small production facilities to multi-channel broadcast networks, MediaStream 8000 scales easily from small channel counts with independent storage to massive systems offering more than 100 channels with shared storage. It's the most advanced MediaStream ever.



Image Courtesy of Eurosport

connecting  
creativity

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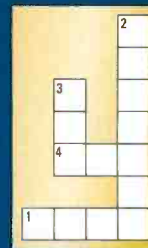
82 Doremi Labs' portable video test generator, plus other new products



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## FreezeFrame



What broadcast product company's name was fun and chief product's name resides in the Matrix? Readers submitting winning entries will be entered into a drawing for *Broadcast Engineering* T-shirts. Enter by e-mail. Title your entry "FreezeFrame-February" in the subject field, and send it to: [editor@primediabusiness.com](mailto:editor@primediabusiness.com). Correct answers received by April 1, 2005, are eligible to win.





To The Power of Maxell

## ▶ Tom Duff



"Work hard, play hard, and we do them both better than anyone." These are the guiding words that Tom Duff and his partners live by at Optimus - a full service commercial post-production house. Tom's a stickler for quality with an eye for creativity, and he's blown away by the power and performance of Maxell Professional Media. "Maxell offers the superior technologies we need to do our best work." That's why Tom and his people use Maxell Digital Betacam, D-5, HDCAM and DVD. You can email Tom at [tduff@optimus.com](mailto:tduff@optimus.com). To learn more about Maxell Professional Media, call 1.800.533.2836 or visit [maxell.com](http://maxell.com).

OPTIMUS |   
editorial

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## Mr. Copp's neighborhood

It's a beautiful day in the neighborhood. Would you be mine? Could you be mine?

Good afternoon, children. Welcome to my neighborhood, where all TV broadcasts and programs are children-friendly.

Come on, children! It's time to watch television. Jamie, can you say, "remote control?" That's right, you need to ask Uncle Cops if it's okay to turn on the set.



"Is it okay, Uncle Cops? Can we watch TV?"

Sure you can, children, because I'm making it safe for all of you to watch television.

Your mommies and daddies know that we at the Federal Censorship Commission (FCC) are here to make sure that all those evil broadcasters and mega corporations don't pollute your little heads with unapproved programs.

Why, just the other day, that big wicked network from Disneyland wanted to run a disgusting history program on the anniversary of WWII.

A man named Steven Spielberg made this award-winning movie that shows what it was really like in the war.

Fortunately, we at the FCC scared broadcasters so much that many stations refused to air it. And that's how we at the FCC like to work — by intimidation. As long as we're on duty here, you children won't have to worry about seeing any other violent Spielberg-directed shows.

By the way, has your mommy or daddy ever mentioned a man named Bono? He's the leader of a band called U2. Now, I don't know what U2 means, but maybe he got the name from the spy plane piloted by Gary Powers that the Russians shot down way back on May 1, 1960.

Anyway, Bono — he goes by Bono, not Mr. Bono — said a bad word on a television show. He said something like "f-ing brilliant." Now, we, the Federal Censorship Commission, have said that you can't say the f-word on television, so we tried to punish those naughty broadcasters for letting that word hit the airwaves.

Unfortunately, we had to retract our actions because someone pointed out that Bono had used the f-word as an adjective. And, as all good children know, that means the word was a descriptor, not an action. So, we at the FCC decided that it's okay to use the f-word on television as long as you're using it as an adjective. Remember, children, the FCC says it's okay to use the f-word as an adjective or adverb, but not as a noun or verb.

The FCC is also protecting you from vile commercials. Fox canceled this year's Super Bowl commercial for Airborne because it showed Mickey Rooney's butt. The network "deemed [it] inappropriate for broadcast." Yeah! The federal censors have won again. Now you children won't have to cover your eyes to avoid seeing the actor's 84-year old butt.

My friend Jonathan Adelstein and I should really be working with the other members of the FCC to provide solutions and leadership. But fortunately, our boss, Chairman Powell, is looking for another job, so he's not paying much attention to things. That leaves Mr. Adelstein and me free to keep TV safe for all of America's little children.

Well, the clock says it time to go, so turn off the television, and start your homework. I'll be back tomorrow to tell you another story about how your friendly FCC will continue to ruin broadcasting and protect all of us from those evil mega corporations.

As told to your editor ...

*Brod Dick*  
editorial director

Send comments to: • [editor@primediabusiness.com](mailto:editor@primediabusiness.com) • [www.broadcastengineering.com](http://www.broadcastengineering.com)



**SELECT TV**

Wed June 2nd

10:34 ET

20° C

**Weather: Amsterdam**

Mon	15	
Tue	16	
Wed	23	

**Weather: London**

Mon	17	
Tue	20	
Wed	18	

signed

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**BREAKING NEWS:** Talks w

**SPORTS:** Des



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Full



# Dazzling branding, amazing control

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## PAL-compatible

I work as an engineer at Sun Television Network in India. For post-production, we are using an AVID NLE and Symphony. We were concerned about the colour gamut, so I used the legalizer that comes with the Symphony. After editing, the finished material is dumped into JVC Digital-S format VTRs. We use our own DVB uplink and Harmonic MV50 Divicom encoders. We would like the Luma and colour gamut of the finished material from our NLE to be within specification for PAL broadcast. Kindly suggest levels available in AVID NLE that we can fix in the legalizer.

The options available are:

Composite :

low ( ) mv high ( ) mv

Luma :

low ( ) mv high ( ) mv

Colour gamut RGB :

8 bit/10 bit low ( )0 high ( )255  
bracket value indicates lower & higher values.

REGARDS,

ASHLEY SAMUEL

LEBANON, NH

*Editor responds:*

The default values for PAL projects in Symphony are:

Composite:

low (-140) mv high (770) mv

Luma:

low (0) mv high (700) mv

Colour gamut RGB :

8 bit/10 bit low (0) high (255)

## The FIRST automation system

Brad,

John Luff has an error in his December article about automation on page 50. The first automation system



installed in a TV station was WTMJ-TV in 1965. It was built by Sarkes Tarzian Company and was designed by Jim Moneyhun, who now heads his own company in Florida. It was a punched card system, and I remember the meeting

with the IBM rep who told us after several hours of discussion that we could punch cards for all 24 hours and not make enough to make the system work. So we never had a connection to the traffic office. We just entered the next few events manually.

Our second system was from CDL, and I don't remember the date, but I believe it was before the 1974 date that WTCN-TV installed its CDL system.

JIM

*Jim,*

Thanks for the clarification and correction. Working from punch cards would certainly be a bit harder than from the GUIs today's systems employ! If anyone has other early implementation stories, it would be fun to hear them.

JOHN

## Limitations in Canada

A couple of articles in the October issue referred to HDTV transmissions in Canada. I've owned an HDTV set for four years and have yet to see any free-to-air HD programming. The article should refer to cable and satellite delivery as "limited."

NEIL MOUSSEAU

TECHNICAL MANAGER

CTV OTTAWA NEWS BUREAU

## FCC vs. NASCAR

Brad :

After reading your October editorial

regarding the new regulations for children's programming, let me get something straight: It's okay for the government to tell the consumers what's best for them (ie: cutting off analog TV), but it's not okay for the government to set standards for the broadcasters? The FCC is similar in a way to NASCAR: If you want to be a part of the race, you gotta accept their rules. However, unlike the government, NASCAR is not owned and operated by special interest groups.

Keep up the good work, and kindest regards,

CHARLIE FARR

UNDEREMPLOYED TECH. WORKER

VIRGINIA BEACH, VA

## October FreezeFrame:

Q. What is the name of the company and product of the first videodisk recorder for ENG applications?

A. NEC Diskcam

## Winner:

Tom Alderson



## November FreezeFrame:

Q. Name the product shown above. What year was it introduced?

A. Ampex DCT 700s production switcher, November, 1992

## Winner:

No correct entries were received.

## 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](mailto:bdick@primediabusiness.com)



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Just one system that handles everything.

Profile 6G server products feature the same familiar, highly intuitive user interface found on all Profile XP Media Platform systems, but go a step further by providing simplified media management and built-in HD encoders and decoders and built-in SD/HD up-and down-conversion. They also feature a 2 Gb Fibre Channel storage system that is 40 percent less expensive than previous generations. The new Profile 6G line also supports a



new Grass Valley™ Universal Interface Module (UIM) that supports high-speed Fibre Channel and Gigabit Ethernet connectivity and industry-standard streaming file formats such as the Material eXchange Format (MXF) and SMPTE 360M to transfer files in and out of standalone Profile servers and Grass Valley Open Storage Area Network (SAN) systems.

In fact, whatever the topology—standalone, distributed, or centralized—Profile 6G servers are a perfect fit. Need to upgrade an existing Profile XP Media Platform system to a Profile 6G server? We can do that, too.

To learn more about the Profile 6G line, please visit:  
[www.thomsongrassvalley.com/Profile6G](http://www.thomsongrassvalley.com/Profile6G)



## Lead; follow — Get out of the way!

BY CRAIG BIRKMAIER

It was the summer of 1997, and the prodigal son had just returned from exile. The company that he and Steve Wozniak had created in a Silicon Valley garage was thought to be dead ... again.

Apple Computer was caught in a downward spiral, another apparent victim of Bill Gates' relentless efforts to dominate the future of personal and home entertainment computing. With a virtual monopoly on the PC business, Gates had set his eyes on a new target — the TV. The TV was the exclusive turf of the consumer electronics (CE) industry — an industry now dominated by Japanese and European companies.

Early in 1997, the FCC adopted the Advanced Television Systems Committee (ATSC) standard for terrestrial digital television broadcasts. That same year Microsoft went to NAB telling broadcasters that it had a better idea for digital television. The com-

pany announced the acquisition of Web TV and the formation of the DTV Team, with several PC industry partners, including Intel.

Broadcasters were not impressed with either the FCC decision or the DTV Team approach. By the summer of 1997, they were putting pressure on Congress to take the teeth out of the DTV transition timetable, which was advanced by the FCC.

By early that fall, Congress would render the timetable meaningless as it attached the now infamous 85 percent rule to the 1997 Balanced Budget Act.

Steve Jobs stood below a massive standard definition screen as he delivered his Macworld keynote in the summer of 1997, trying to reassure the Mac faithful that all was not lost. The PowerPoint presentation on the screen was replaced with a larger-than-life image of Bill Gates, looking very much like Big Brother, as portrayed in the classic Apple 1984 Super Bowl commercial that

launched the Macintosh. Gates glared down at Jobs; the crowd groaned.

Jobs announced that Microsoft was making a \$700 million investment in



**At MacWorld 1997 Bill Gates appears to broker a deal to let Apple survive. At MacWorld 2005, Jobs announces a deal with Sony President Kunitake Ando to make 2005 the year of HDTV.**

Apple and a commitment to keep supporting the Mac platform. The investment would help Apple turn the corner and would assure the world that Microsoft would not pull the rug out from what was left of the company.

Gates built his empire by following the lead of Apple and gobbling up virtually every competitor. But could he lead the PC industry in an all-out assault on a turf dominated by the CE industry?

### 2005: The year of HDTV

Bill Gates has appeared at CES every year since Microsoft announced its intentions to put a PC in the family room.

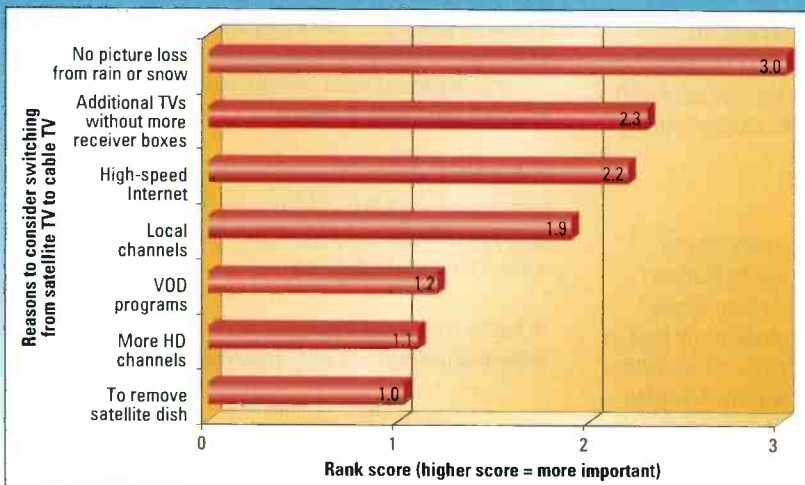
Each year, Gates updates Microsoft's latest vision of the emerging digital lifestyle. Last year, he announced the software underpinnings for the Microsoft Media Center; this year, Media Center PCs were vying for the attention of other CES exhibitors and attendees.

The concept of a PC as a media hub, PVR and DTV tuner was heavily promoted at this year's CES, but it took a back seat to the big star of the show — HDTV.

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

### Weather affects choice over satellite or cable TV

#### Cable TV promises better reception



Source: Lyra Research

www.lyra.com



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During the past year, HDTV sales in the United States passed an important tipping point. According to the Consumer Electronics Association (CEA), more than 7 percent of U.S. homes now have an HD-capable display. Seven percent penetration for any CE product has typically been used as a benchmark to indicate that sales are about to take off. CEA Market Research projected that 6.97 million DTV units would be sold in 2004. (A final sales figure for the year was not available at the time when this was written.) This research projects that 10.77 million HD displays will be sold in 2005, 16.77 million in 2006, 23.25 million in 2007 and 27.05 million in 2008.

HDTV dominated the exhibits at CES as the traditional consumer electronics (CE) vendors tried to upstage one another with the biggest LCD or plasma panels. Meanwhile, virtually unknown manufacturers in China and other emerging nations introduced

low-cost LCD panels. Competition from these low-cost competitors has been a significant factor in the rush to develop HD-DVD, as profit margins for the current generation of SD-DVD players have vaporized.

DIRECTV used the CES platform to announce that it will use MPEG-4 part 10 video compression (H.264) to launch local-into-local HDTV service in the nation's top 12 markets later this year. Several weeks later, EchoStar, which operates the Dish Network DBS service, bought the rights to a satellite and additional orbital slots owned by Cablevision's ill-fated VOOM HDTV satellite service. It is likely that some of these assets will be used to deliver local HDTV signals to Dish subscribers. DIRECTV also announced that it would begin to offer a homegrown PVR service to subscribers; the company will continue to support the TiVo PVR service, which it has offered for several years, but this move is likely to

undermine the largest deployment of TiVo PVRs to date.

At CES, TiVo announced a major change in direction, seeking to compete head-to-head with the set-top boxes and PVRs being deployed by

## Web links

2005 HDTV Winter Guide

[www.ce.org/publications/books\\_references/dtv\\_guide/HDTV\\_Guide\\_Winter\\_05.pdf](http://www.ce.org/publications/books_references/dtv_guide/HDTV_Guide_Winter_05.pdf)

CEA/STARZ! Brochure

[www.ce.org/shared\\_files/resources/HDTV\\_Brochure\\_2005final.pdf](http://www.ce.org/shared_files/resources/HDTV_Brochure_2005final.pdf)

December 2004 Download: "Will your next PC be an affordable DTV?"  
[http://broadcastengineering.com/magbroadcasting\\_next\\_pc\\_affordable/index.html](http://broadcastengineering.com/magbroadcasting_next_pc_affordable/index.html)

Robert X. Cringley: "Is the Mini about Movies?"

[www.pbs.org/cringely/pulpit/pulpit20050120.html](http://www.pbs.org/cringely/pulpit/pulpit20050120.html)

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cable systems nationwide. TiVo is planning to offer a digital cable-ready set-top box with multiple tuners, capable of recording HDTV programming. Several weeks after CES, TiVo decided to compete with Comcast, rather than working with it.

How to get HDTV content into the homes of consumers continues to be the subject of intense debate and inter-industry squabbling. It is becoming increasingly clear that DTV broadcasts are not very high on the list of alternatives, at least from the perspective of the CEA and its members. The CEA released a new HDTV Buyers Guide, which provides a good overview of what the marketplace is really doing. (See the Web links on page 16.) It also announced a new HDTV brochure co-produced with STARZ!

#### The "other" CE show

Even as CES was drawing more than 140,000 attendees to Las Vegas, there

was an interesting undercurrent at work. Many analysts noted the absence of one company at CES — Apple. Analysts were casting a nervous eye to the west, where Steve Jobs was preparing to deliver his next MacWorld keynote. Jobs opened the keynote with an interesting comment: This would be the first MacWorld keynote delivered using HDTV projection. Later he claimed that 2005 will be "the year of HDTV," as he announced a variety of initiatives by Apple to bring HDTV to the masses.

One of those initiatives is support for H.264, the new video compression codec from MPEG and the ITU. OS-X 10.4 and QuickTime 7.0, which are likely to be released in time for this year's NAB, will support H.264 for applications that span the range from creating and delivering video to cell phones, to that big HDTV plasma panel hanging on the wall.

To illustrate one of these new ini-

tiatives, Jobs invited the president of Sony, Kunitake Ando to the stage. Jobs announced that Apple was working with Sony to support Sony's consumer HDV format.

The iLife application suite ships with every Macintosh. Along with iMovie, it includes iTunes, iPhoto, iDVD and Garage Band. These applications turn a Mac into a digital media hub, supporting the sharing of your digital media content between computers and portable media players.

As Ando spoke, Jobs was recording his comments with the Sony HDV camcorder that Apple will sell in its online and brick and mortar stores. The scene spoke volumes — just as the image of Gates glaring down upon Jobs had done some seven years earlier. This time the role reversal was not lost on the analysts. Apple now dominates the music player market that Sony created.

But it was not just the delivery

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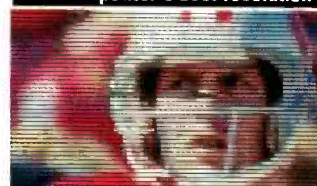
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devices that Ando was seemingly in awe of. Ando praised Apple's software and the way that it integrates a variety of devices and services to create a new infrastructure for selling and enjoying music. And he hinted at future opportunities for the companies to work together, as they will do with HDV. In return, Jobs expressed enthusiasm for the Blue-Ray DVD format, which he wants to integrate with the Apple product line.

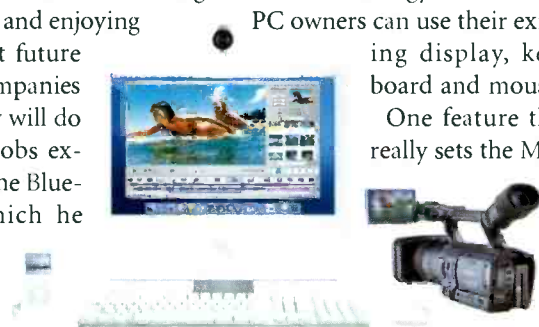
Then Jobs introduced the Mac Mini. This computer is the size of an external

drive enclosure, yet the tiny box is large enough to include a 40GB or 80GB hard drive and optional wireless networking, Bluetooth for local peripherals and WiFi for network connections. It also includes a modem, 10/100Mb/s Ethernet, USB 2.0 and Firewire (IEEE-1394). But the Mac Mini is missing three traditional PC components: the display, keyboard

and mouse. Apple aims the Mini at traditional PC users who have resisted buying a Mac because of the perceived higher cost. The strategy assumes that

PC owners can use their existing display, keyboard and mouse.

One feature that really sets the Mini



Apple and Sony are joining forces through products like the Sony HDV camcorder and Apple iMac.

apart from the low-cost PCs is video and graphics support. The mini includes an ATI Radion 9200 graphics chip with 32MB of dedicated graphics RAM. And it offers both VGA and DVI outputs that can drive displays with more than 2 million pixels, like the Apple 23in Cinema Display — or your new HDTV or LCD panel.

The DVD playback capabilities rival

current DVD players that scale the output up to HD resolution.

Could Jobs be thinking about more than just inducing a few PC enthusiasts to switch to the Mac? He claims not to be interested in the Media Center concept, noting that the cable industry is a monopoly. However, he is also famous for misleading analysts.

Robert X. Cringley, the technology guru at PBS, speculates that the Mac Mini is all about movies. (See the Web links on page 16.)

I agree with Jobs that 2005 will be the year of HDTV, at least for Apple. Will it also be the year that broadcasters wake up and smell the bits? Producing HDTV content can no longer be used as an excuse now that viewers can acquire and edit HD for less than \$10,000. **BE**

*Craig Birkmaier is a technology consultant at Pcube labs, and he hosts and moderates the OpenDTV Forum.*



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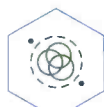
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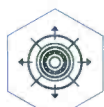
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# DTV transition marches into 2005



BY HARRY C. MARTIN

This year the FCC will continue its push towards a full DTV transition. The most immediate concerns for TV broadcasters are as follows:

## Buildout and PSIP deadlines

While already widely publicized, it bears repeating that network affiliates in the top 100 markets are required to build out their full DTV facilities by July 1, 2005, and that all operating DTV stations must implement PSIP technology by Feb. 1, 2005.

## Round One channel elections

On December 21, 2004, the commission released the revised DTV Table and established Feb. 10, 2005, as

the deadline for those licensees with at least one in-core DTV channel (2 to 51) to file FCC Form 382, electing a channel for permanent DTV operation. Licensees with two "low" VHF channels (2 to 6), and licensees with only one in-core channel, could elect instead to take a pass on this "Round One," relinquishing their in-core DTV channels and rolling the dice for a better channel in "Round Two" elections.

The commission will now review the elections made in Round One. Where it determines that a Round One channel election will result in an interference conflict, the commission will notify the licensees involved in the conflict and will require them to file an FCC Form 383 to inform the commission whether:

- (i) they have resolved the interference by agreement or technical amendments;
- (ii) they have decided to switch from using their respective NTSC in-core channel to their in-core DTV channel, if they have one (by the terms of the DTV Table of Allotments, such channels have been protected since 1997); or
- (iii) they have elected to abandon their Round One channel election and have chosen to participate in Round Two elections instead.

## Petitions for reconsideration of DTV order

Ten parties filed petitions for reconsideration or clarification of the new DTV transition rules. While the filing of the petitions does not automatically postpone or stay the transition schedule, such petitions could affect the rules and/or timetable governing the

transition, and it is expected the FCC will act on them expeditiously.

Three of the petitioners seek redress from the commission's decision to dismiss all pending petitions for rule-making for new or different analog television channels. Those rulemaking petitions had been filed by parties who did not have a paired DTV channel.

Two engineering consulting firms also weighed in with petitions. They questioned the interference protection standards adopted by the commission and suggested certain modifications to the interference prediction software.

## Digital TV translator and LPTV rules

In September, the commission adopted new rules to permit TV translators and low-power television stations to convert to digital. These rules became effective on Jan. 28, 2005. However, the information collection aspects of the new rules (i.e., the forms that LPTV operators may need to file) will not be available until OMB approves the new forms.

## City-grade service requirements

As of Dec. 31, 2004, DTV city-grade service requirements have changed such that, for Channels 2 to 6, the field strength of the principal community signal must be 35dBu; for Channels 7 to 13, the field strength must be 43dBu; and for Channels 14 to 69, the field strength must be 48dBu. **BE**

## Dateline

In addition to the DTV deadlines discussed above, TV broadcasters in the following states must meet these renewal application and related deadlines:

*Indiana, Kentucky and Tennessee:*  
Renewal applications, EEO program reports and biennial ownership reports must be filed on or before April 1. Post-filing renewal announcements must begin on April 1.

*Michigan and Ohio:*  
Renewal pre-filing announcements must begin to be broadcast on April 1 and continue on April 16, May 1 and May 16. Renewal applications, EEO program reports and biennial ownership reports then must be filed on or before June 1.

Harry C. Martin is president of the Federal Communications Bar Association and a member of Fletcher, Heald and Hildreth PLC, Arlington, VA.



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## Analog video noise



BY MICHAEL ROBIN

**N**oise is defined as an unwanted parasitic signal superimposed on the wanted signal. The effect of the noise on the reproduced picture is expressed as signal-to-noise ratio (SNR). As a signal passes through a cascade of amplifier stages or devices, the SNR decreases after each stage because noise is added in each stage. Two types of noise will be considered in this article: random noise and coherent noise.

### Random noise

Random noise is generated by circuit elements. It is the consequence of the granular structure of matter and, thus, it can be reduced but cannot be completely eliminated. A given circuit will have a specific SNR, which cannot be improved.

Figure 1 outlines the spectral dis-

tribution of the types of random noise encountered in practice. Flat frequency response amplifying devices generate white noise, whose power density is constant with frequency. Devices that emphasize the higher frequencies with respect to the lower frequencies of the spectrum exhibit triangular noise, whose power density is proportional to the square of the frequency. The noise spectrum is modified by the characteristics of the discrete elements that constitute a system. As a consequence, white and triangular noise are seldom encountered in pure form. Equaliz-

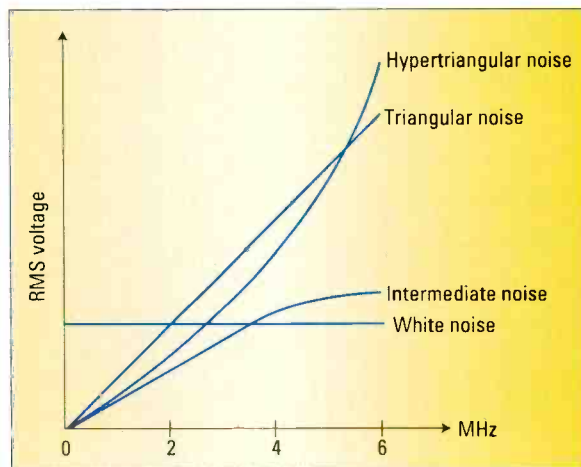


Figure 1. Various types of random noise spectra

ing distribution amplifiers are characterized by hypertriangular noise, where the distribution is approximately triangular at low frequencies and approaches a parabola at higher frequencies.

Figure 2 on page 26 shows the conceptual equipment setup for the measurement of video noise. The bandwidth of the random noise accompanying the video signal may be considerably greater than that of the video signal. This is due to the fact that the noise bandwidth is determined by equipment and circuits handling the signal, whereas the video bandwidth is primarily determined by the picture reproducing equipment with limited resolution capability. Eventually, the noise and the signal bandwidth are made equal by the transmitter and the receiver.

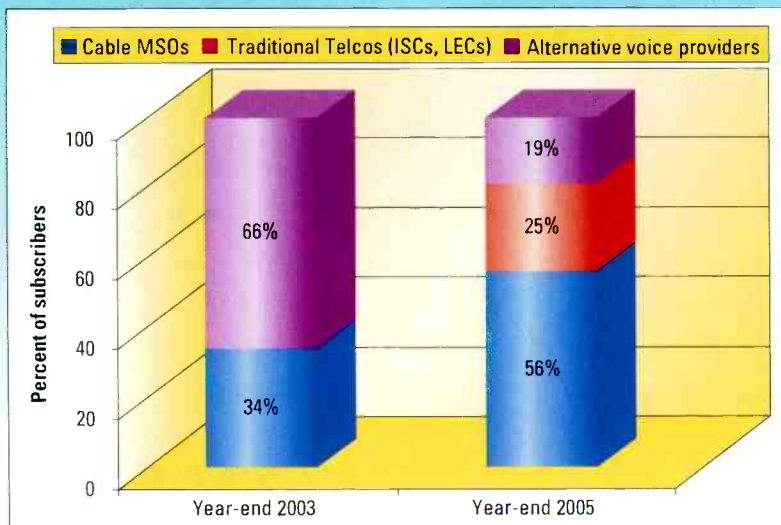
It is evident that a serious error is possible in the measurement of the SNR unless arrangements are made to make the noise and the signal bandwidth equal at the point of measurement. For this reason, the noise is

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measured in a frequency band extending from 10kHz to the upper limit of the video band (4.2MHz in

NTSC; 5MHz, 5.5MHz or 6MHz in PAL). The lower frequency limit ensures that hum is not measured as random noise. The upper limit ensures that irrelevant high frequency noise is removed from the measured signal. Certain authorities also use a weighting filter approximating the eye response. To measure random noise, the timebase of the oscilloscope is set to display one TV line.

### Luminance random noise

The effect of random noise on the luminance component of the picture is seen as a fluctuating pattern of black and white specks. The pattern is relatively coarse in the case of white noise and fine-grained in the case of triangular noise. Given the low sensitivity of the

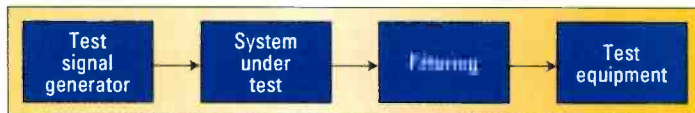


Figure 2. Equipment setup for noise measurements

eye for fine luminance details, moderate amounts of triangular noise affecting the luminance are quite tolerable.

The typical test signal for the measurement of noise is a flat field at the black level (i.e a luminance level of 0 IRE). The luminance random SNR is defined as:

$$SNR(dB) = 20 \log_{10} (p-p \text{ video signal voltage} / RMS \text{ noise voltage})$$

where the p-p amplitude (reference) of the video signal is 714mV for the 525/60 system and 700mV for the 625/50 system.

Specialized equipment gives a direct reading as per the formula above. Oscilloscope measurements of luminance SNR necessitate a conversion from peak-to-peak noise voltage, as displayed on the oscilloscope screen, to

RMS noise voltage. To measure the SNR, the "quasi" peak-to-peak amplitude of the noise is carefully estimated, and a

conversion factor is added to obtain the RMS noise value. Various organizations use conversion factors between 14dB and 18dB. 15dB is the commonly used value. The SNR is consequently calculated as per the formula:

$$SNR(dB) = 20 \log_{10} (p-p \text{ video signal voltage} / p-p \text{ noise voltage}) + 15$$

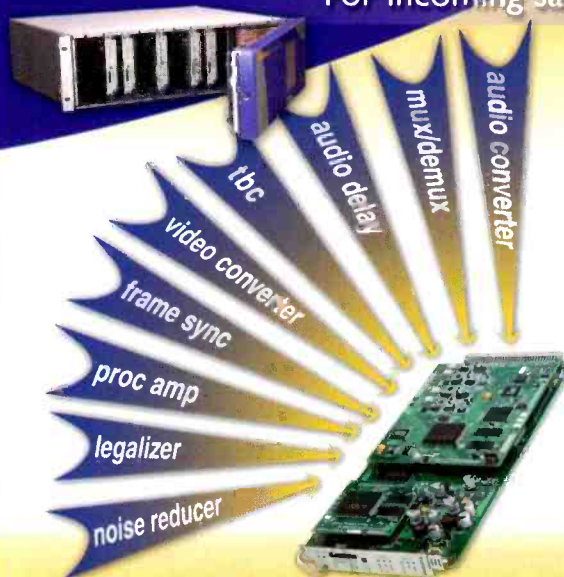
Figure 3 on page 28 shows the display of random noise on a wideband oscilloscope, with a sensitivity of 20mV/cm and a spectral response extending up to 20MHz. In this example, the p-p amplitude of the random noise is about 140mV, and the calculated SNR is:

$$SNR(dB) = 20 \log_{10} (714/140) + 15 \approx 29dB$$

Figure 4 shows the display of the same random noise on a video waveform

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monitor, with the bandwidth limited to 4.2 MHz. In this example the p-p of noise is about 20 IRE or about 14mV, and the calculated SNR is:

$$SNR(dB) = 20 \log_{10} (714/14) + 15 \approx 49dB$$

A significant difference! It is evidently essential to specify the bandwidth of noise measurements when quoting SNR figures.

### Chrominance random noise

The effect of random noise on the chrominance component of the picture is rather different. Noise components that have comparatively little impact on the luminance assume a greater importance in a color signal.

Essentially, the chrominance information is transmitted as amplitude and phase modulation of a suppressed subcarrier in NTSC and PAL, hence as double sideband components in the spectrum centered around 3.58MHz (NTSC) or 4.43MHz (PAL).

White and triangular noise components in the spectrum around the color subcarrier are demodulated in the receiver or monitor as comparatively low-frequency signal amplitude fluctuations (<500kHz) and are seen as a coarse pattern of colored specks. The SECAM system is relatively immune to chrominance noise due to the frequency modulation of the chromi-

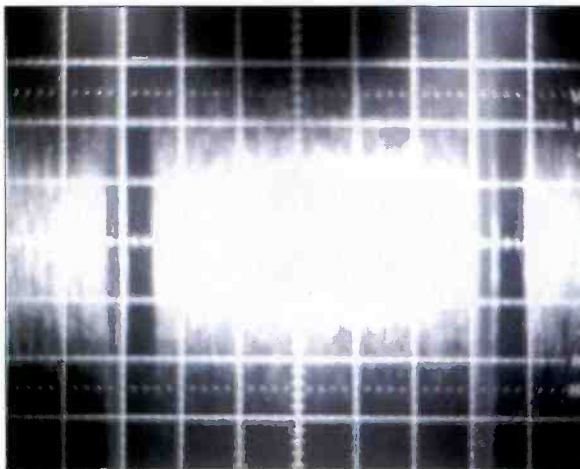


Figure 3. Random noise displayed on a wideband oscilloscope, with a vertical sensitivity of 20mV/cm and bandpass of 20MHz

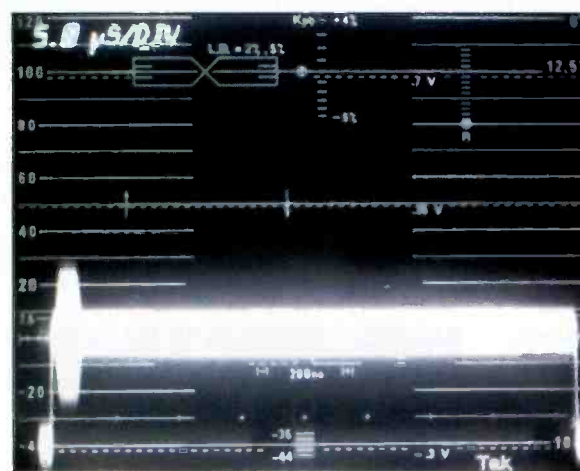


Figure 4. Random noise displayed on a video waveform monitor, with a vertical sensitivity of 10 IRE/division and bandpass of 4.2MHz

field signal with a set chrominance level and phase is used a test signal. The noisy signal at the output of the equipment under test is band-pass filtered to extract the chrominance information. The chrominance information is demodulated, and its random variations of amplitude and phase, with respect to a standard ref-

above.

Note that in NTSC, the hum (60Hz) is not coherent with the field frequency of 59.94Hz. As a consequence, with the oscilloscope synchronized to the video field rate, the 60Hz hum will be displayed as a movable waveform. Higher frequency periodic noise measurements use a 10kHz high-pass filter. It may be convenient to use a spectrum analyzer to identify the interfering periodic noise.

Type of noise	Distribution amplifier	Routing switcher	Production switcher	1" VTR
Random	≥70dB	≥65dB	≥65dB	≥48dB
Hum	≥60dB	≥60dB	≥60dB	≥60dB
Periodic	Non-measurable	Non-measurable	Non-measurable	≥60dB

Table 1: Single-pass performance of studio-type equipment in terms of noise

nance subcarriers. The measurement of chrominance SNR has not been internationally standardized. Several manufacturers have developed "de facto" measurements methods. A full-

erence, are measured as amplitude noise and phase noise.

### Coherent noise

The coherent noise is generated

outside the equipment and coupled in some manner into it. This type of noise does not possess the statistical properties of random noise. It usually consists of one or more spurious signals of a periodic or quasi-periodic nature. The coherent noise can be avoided by good engineering practice, unlike the random noise. The picture impairment it causes is measurable as peak-to-peak noise. The signal to coherent noise ratio is defined as:

$$SNR(dB) = 20 \log_{10} (p-p \text{ video signal voltage} / p-p \text{ coherent noise voltage})$$

The coherent noise may be hum or other periodic frequencies. (See Table 1). The measurement of hum uses a low-pass 10kHz filter. To measure the hum, the time-base of the oscilloscope is set to display one field. The oscilloscope gain is increased as convenient, and the p-p amplitude of the displayed waveform, a 60Hz sinewave, is measured. The SNR is calculated using the formula

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



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# Networking tutorial, part 2

BY BRAD GILMER

This month we will look at several things that I wish someone had told me before I became heavily involved in computers and networks. The first topic is bandwidth and throughput.

A 10Base-T system does not deliver 10Mb/s, and a gigabit Ethernet system does not deliver 1Gb/s. Because of overhead, collision resolution algorithms and other factors, the actual data rate across a network will always be less than the data rate specified by the nomenclature (10Mb/s for 10Base-T, etc.). A good rule of thumb is to load the network to about 70 percent of its total capacity. Some would argue that even this is too high, and that 60 percent or 50 percent is more realistic.

## Backplane bandwidth

While we are on the topic of throughput, let's talk about routers and switches. It is common to find Ethernet switches that are labeled as 10/100 compatible or even 10/100/Gig-E. What the manufacturer is telling you is that the switch will automatically adjust its transmission rate to match whatever you plug into that port. If you plug two 10Base-T equipped computers and two Gig-E computers into the same switch, they will all be able to communicate. Furthermore, if the two Gig-E computers exchange data, they will do it at Gig-E speeds. In other words, having mixed rate computers on the switch will not lower the overall speed of the switch. The link between any two ports will operate at the lowest rate between the two ports.

If you have a station full of older computers with 10Base-T cards, the

switch will automatically adjust its rate to 10Mb/s so that it is able to link to the Network Interface Cards (NICs) in these computers. When you buy a new server with a 100Base-T card, you can plug this server into the switch, and the link between the server and the switch will operate at 100Mb/s. In Figure 1, the server is connected to two workstations through a multi-speed switch. Each of the workstations is configured with 10Base-T NICs.

Given the configuration shown in Figure 1, what is the actual throughput between the server and each workstation? Assuming that the server has lots of internal bandwidth and keeping in mind our 70 percent figure above, the server should be able to

should be able to deal with the load on the network without any problem.

What if we slightly change the scenario? Let's say we move to a 10/100/Gig-E switch, the majority of workstations are equipped with 100Base-T cards, and there are a few graphics station clients with Gig-E cards. Will the system still work at full bandwidth? You might look at the front of the switch and assume that the number of ports times the maximum bandwidth of each port would give you the total bandwidth available on the backplane of the switch. Let's say you are using a 10 port 10/100/Gig-E switch, and that this switch cost a few hundred dollars. You calculate that the switch should have a total backplane bandwidth of

10Gb/s (10Gb/s x 1Gb/s per port). At this price, it is unlikely that this is the case. The switch may have a backplane bandwidth on the order of 2Gb/s to 3Gb/s at best. Of course, if you have spent several thousand dollars on your switch, then it is probably non-blocking.

When designing networks for professional teleproduction, there is

one important question to ask: What is the non-blocking bandwidth of the switch? In other words, what is the total bandwidth of the switch backplane? A completely non-blocking 10 port 10/100 Ethernet switch would have to be able to switch a maximum of 10 streams of data, with all of those streams running at their theoretical maximum of 100Mb/s. The switch must have a total bandwidth capacity of 10Mb/s x 100Mb/s, or 1Gb/s. If someone argued that in this example a switch might still be con-

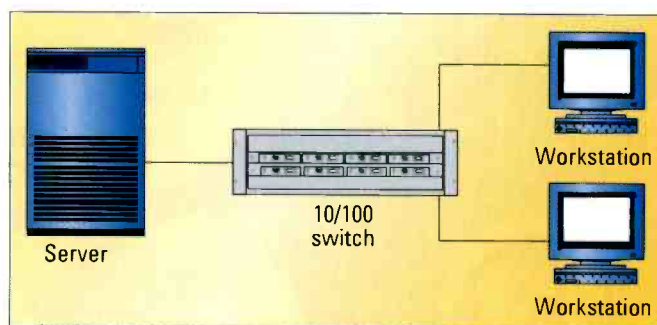
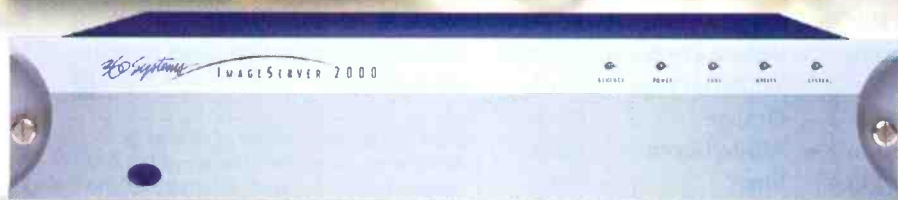


Figure 1. Depending upon the switch bandwidth, a server may or may not deliver full performance to workstations.

source somewhere around 70Mb/s of data. (I am going to use "source" and "sink" terminology here, even though the conversation is actually two-way.) Presuming that each workstation contains a 10Base-T NIC, and that there are no internal bottlenecks inside the workstations (this may be a faulty supposition), and continuing to keep in mind our 70 percent figure, each workstation is capable of sinking about 7Mb/s of data. The aggregate sink bandwidth is then approximately 14Mb/s—so it appears that the server



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sidered non-blocking if it has 700Mb/s of backplane capacity, he or she might be right. However, if the switch only has 200Mb/s of backplane capacity, network speeds will certainly suffer.

If the switch is a blocking switch, what will happen as the switch runs out of bandwidth? Depending upon the protocols and application software, things may still function normally, although the network will be slower than if you had a non-blocking switch.

The moral of the story is: If you really need high throughput, you may have to do more than upgrade your NIC cards to 100Base-T or Gig-E. You may have to replace your network switch, even if it is labeled 10/100/Gig-E.

### On cabling

Readers continue to write me regarding the August 2004 column on network cabling. The article had an error, so I would like to cover this again just to be sure we set the record straight. To build your own Ethernet cable, first things first — get some cable — and not just any cable. Be sure to get CAT-5 cable. Use CAT-5E if you want to use the cable for gigabit Ethernet now or in the future. Cable that is not specifically made for Ethernet Unshielded

Twisted Pair applications *will not work*. You will also need two RJ-45 connectors and an RJ-45 crimp tool.

The pin out for a normal Ethernet cable that you would use between a computer and a switch is as follows:

- Pin 1 – White/Orange – Pin 1
- Pin 2 – Orange – Pin 2
- Pin 3 – White/Green – Pin 3
- Pin 4 – Blue – Pin 4
- Pin 5 – White/Blue – Pin 5
- Pin 6 – Green – Pin 6
- Pin 7 – White/Brown – Pin 7
- Pin 8 – Brown – Pin 8

The pin out for a crossover Ethernet cable that you would use between two computers *without* a switch is as follows:

- Pin 1 – White/Orange – Pin 3
- Pin 2 – Orange – Pin 6
- Pin 3 – White/Green – Pin 1
- Pin 4 – Blue – Pin 4
- Pin 5 – White/Blue – Pin 5
- Pin 6 – Green – Pin 2
- Pin 7 – White/Brown – Pin 7
- Pin 8 – Brown – Pin 8

To determine which pin is Pin 1, hold the connector in your hand with the opening of the cable facing you and with the metal contacts facing up. Pin 1 is the far left pin.

### Out with the old

Many of us have drawers full of old networking hardware. When a new

project comes up, it is tempting to dig into the drawer to see if you have the hardware you need. This is fine if you are dealing with equipment that will be used to feed non-critical systems.


However, network technology and protocols are being constantly improved, especially in areas of network security and quality of service. Therefore, if you are dealing with equipment that is being used for mission-critical applications at the core of a network, or you are working with firewall systems that will protect your network from intrusions, you will be much better off buying new equipment rather than recycling old hardware.

BE

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



Send questions and comments to:  
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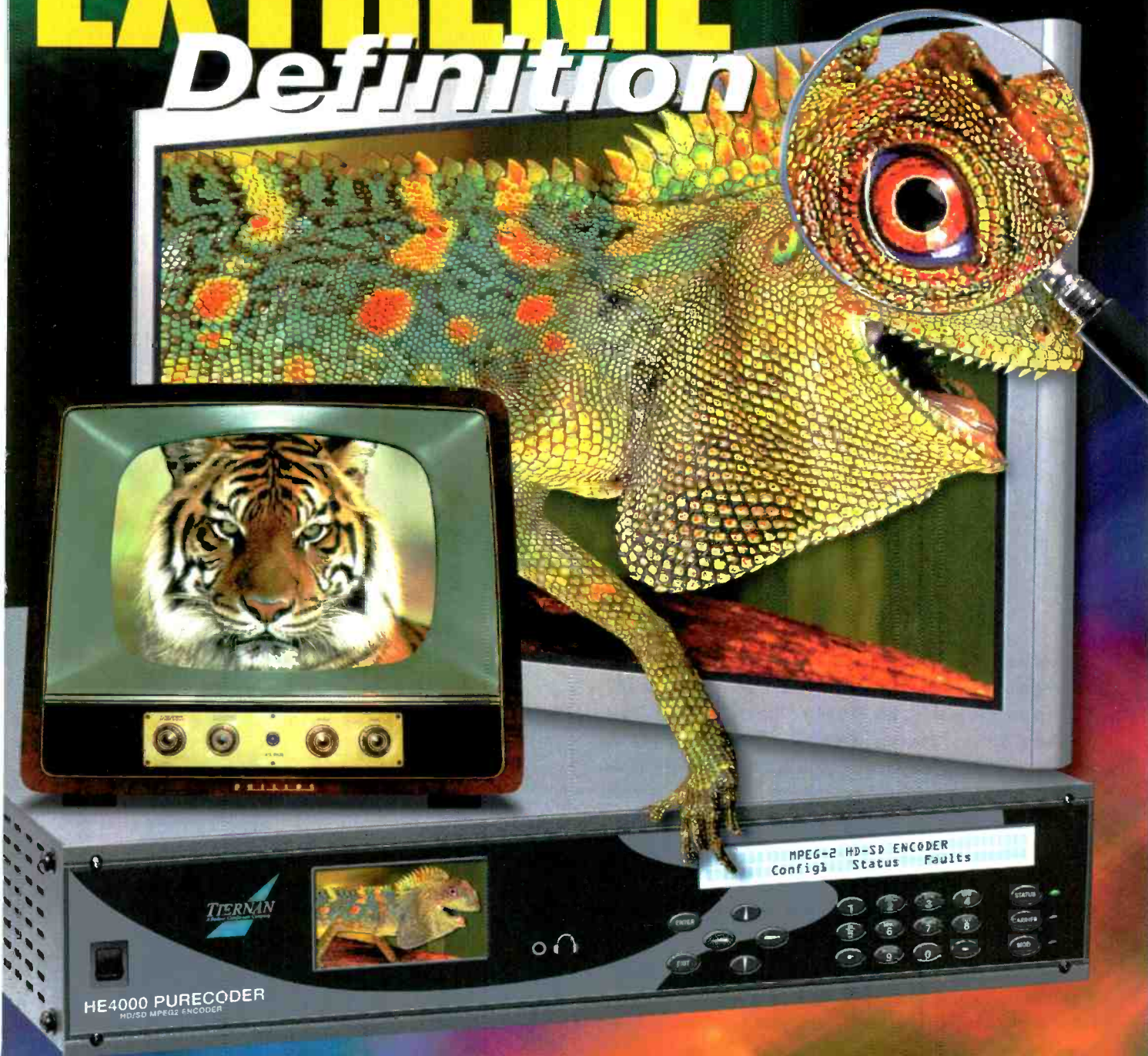
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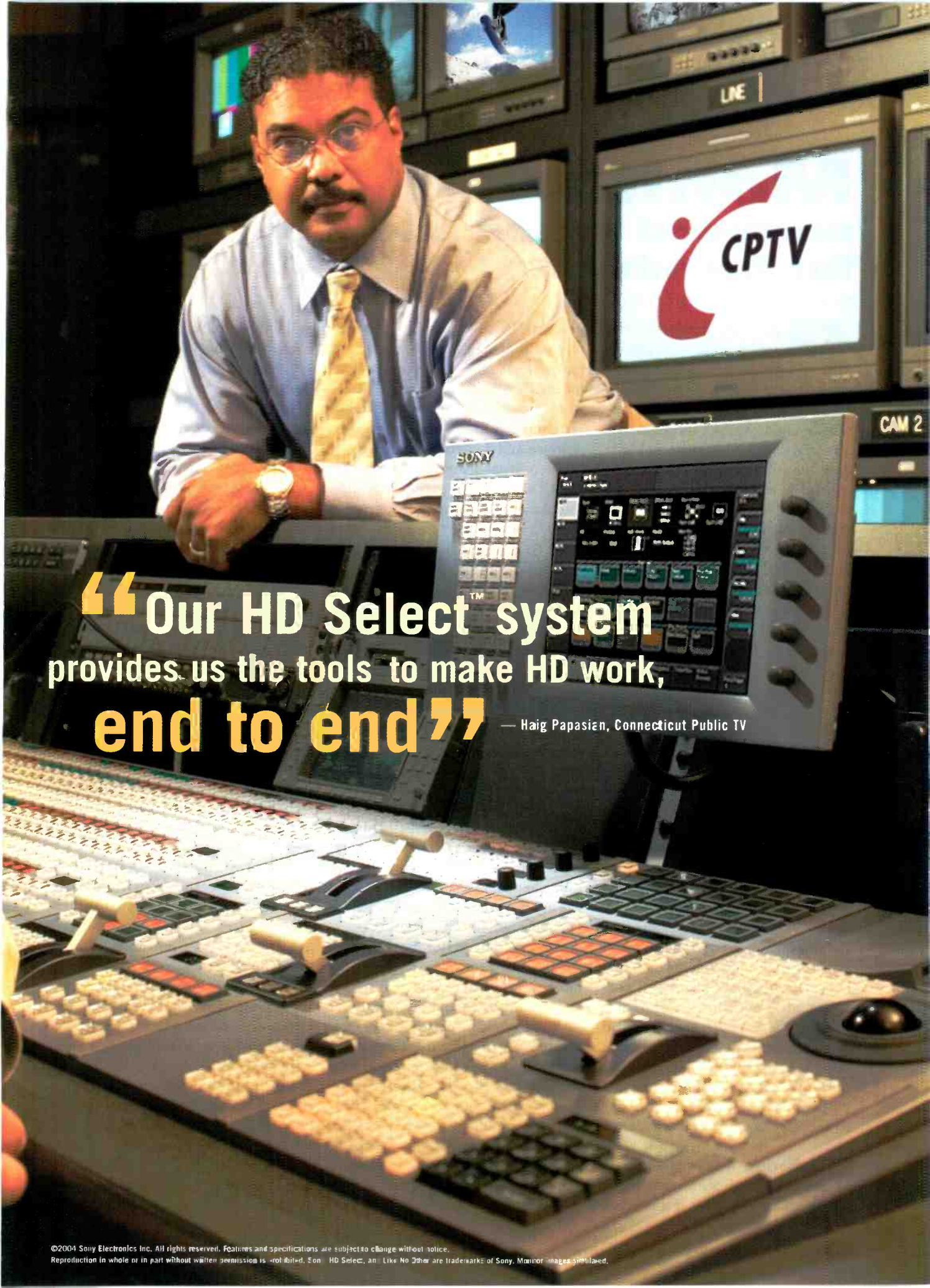
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# Monitoring surround sound audio for broadcast

BY MIKE SOKOL AND HECTOR LA TORRE

**P**roducing surround audio for broadcast is a process we all are either already facing or soon going to have to face. All HDTV broadcasts will be surround-sound capable, and most satellite and digital cable carriers already have the infrastructure in place to regularly transmit 5.1 surround sound. Further, all digital cable carriers use Dolby Digital to transmit both stereo and surround audio. The table-top channel box will either output this as an AC-3 data stream from its S/PDIF connector, or downmix the 5.1 channels into a stereo mix and send it out the analog stereo outputs.

With that said, even with broadcasts moving to 5.1 surround, most viewers will continue to hear your surround mix in stereo for many years to come. And maintaining the “do no harm” promise to the stereo listeners is difficult. It is a fairly straightforward process to create a surround mix that sounds good on the majority of surround playback systems; however, making surround mixes play back in stereo or even mono is more of a challenge. Producing a successful surround mix is not quite as easy as putting up three more speakers and throwing some ambient crowd noise into the back channels. The most important elements you’ll need are a proper monitoring system and a way to check for downmix cancellations.

### Deciphering downmixing

Let’s discuss downmixing first. Here’s what a downmix is and when

it occurs. Every surround mix needs to go through a codec of some kind for transmission. Codec is an acronym for enCODE-DECode. It is the process where six or more channels of audio are squeezed into the space of two channels and then reconstructed back to the original channels. Both Dolby Digital and DTS are examples of surround codecs in common use, but you

patibility and mixes that cancelled out when something was flipped in polarity, all surround mixes have to be checked for stereo (and mono) playability. To understand the potential pitfalls, let’s check out exactly how a downmix works.

The default downmix ratios for Dolby Digital are as follows. The left rear channel is put into the front left speaker at -3dB down from its original level. The right rear channel is put into the front right speaker at -3dB down, the center channel is put into both the left and right front speakers at -3dB down, and the LFE (Low Frequency Effects) channel is eliminated from the downmix. These downmix ratios can be changed to values such as -4.5dB or -6dB within the Dolby Digital Metadata, but most broadcasters will use the Dolby defaults of -3dB all around. (See Figure 1.)

What this implies is that phase problems between each left front/rear and right front/rear channels will only be heard when those channels are combined in a downmix situation. The same thing goes for the center channel because it gets mixed to the left and right front speakers. For instance, if you introduce a static delay of some 30 or 40 milliseconds between the signal feeding the front channels and the rear channels, say to make the sound really big, those listeners hearing a downmix will have to contend with a comb filter altering the sound. This sort of sounds like a Wah-Wah pedal with echo (for those of us who are Old School).

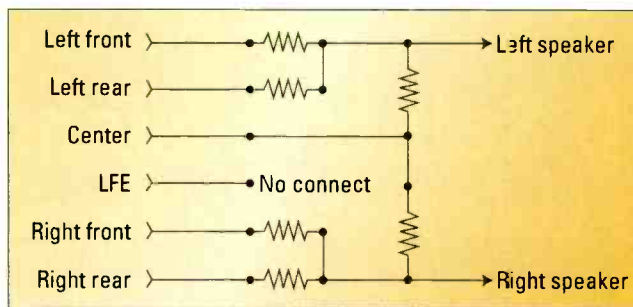
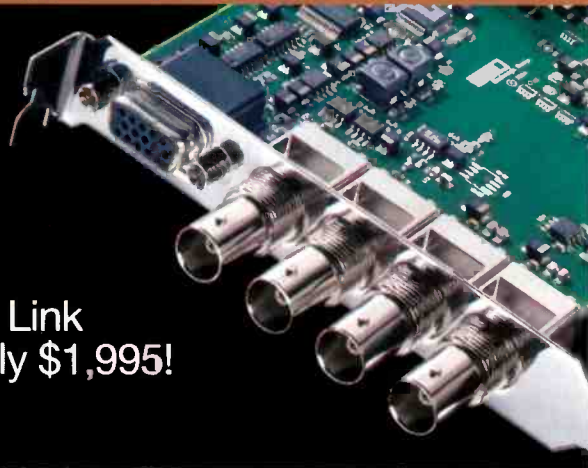


Figure 1. Typical 5.1 surround to stereo downmix diagram

will only run into Dolby Digital (aka AC-3) for television broadcasting. These digital codecs really don’t change the quality of your sound very much because they are totally discrete from channel to channel. That is, unlike matrix encoders such as Dolby Pro Logic and SRS Circle Surround, there’s no steering interaction between the channels, so your mix will sound almost exactly like the original tracks after transmission and decoding.

All this would be perfect except that the majority of home listeners will be listening on a stereo or mono television. There is a backwards-compatible process where your six original channels are combined (downmixed) to stereo, and that is where most broadcast surround audio gets into trouble. Just like back in the day when we had to worry about stereo-to-mono com-





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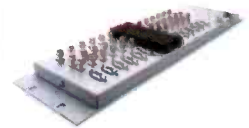
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Another thing that can cause cancellation failure during downmix is microphone placement during record-

ers, they will cancel as a comb filter during downmix to mono. Either way sounds bad to the millions of listen-

surround mix into stereo, using the downmix ratios originally set within the Dolby AC-3 Metadata. Monitor your surround broadcast using a home-theater receiver both in surround and stereo (downmix) modes. Now you can hear what your final broadcast will sound like for both audiences. If the surround mix sounds big and full, while the stereo mix sounds out of phase or thin, then you have a downmix comb-filter issue. Moreover, note that a channel polarity can be accidentally flipped in broadcast, which can do things like completely cancel out your announcer's voice in the stereo downmix but still sound fine in surround. The only way to know if you have a polarity flip or comb-filter issue is to monitor both in surround and downmixed stereo. Anything less than that is asking for trouble. Remember, "Murphy was an optimist."

## The only way to know if you have a polarity flip or comb-filter issue is to monitor both in surround and downmixed stereo.

ing. For example, if you place your audience response microphones 40 feet apart from each other to cover the crowd, note that you essentially have introduced a 35-millisecond delay between them. If these mics are used for the front and rear speakers, then they will cancel as a comb filter during a downmix to stereo. And if they are used for the left and right rear speak-

ers hearing your broadcast on a stereo or mono television.

### Remember Mr. Murphy

How to hear if you are successfully transmitting your surround/stereo broadcast? You need to monitor for the bad effects. On every surround receiver on the planet, there's a little "stereo" button that will turn your 5.1 (or 6.1)

Keep in mind that most of the surround speaker controllers from companies such as Martinsound, Studio Technologies and Blue Sky (among others) offer a downmix monitor switch as part of their controls. This downmix switch allows you to simulate the 5.1-to-stereo downmix in your monitor speakers while still broadcasting or mixing in surround. It is a great way to test your mixes for downmixing compatibility before they go to air.

Equally important in surround monitoring for broadcast are the proper implementation and setup of bass management techniques and subwoofers. We look forward to grappling with those topics in a future issue of *Broadcast Engineering*. **BE**

## Basic mic techniques to avoid downmix problems

**A**void spacing microphones far apart for ambience pickup. Try a simple ORTF (Office de Radiodiffusion Television Francais) coincident microphone technique, or X-Y stereo pair to pickup crowd response. (See Figures 1 and 2.)

The ORTF stereo is a common stereo recording mic array, so it is easy to purchase a simple spreader bar from, for instance, Atlas (among others) that will hold two cardioid mics and mount them in the proper position. The X-Y stereo pair technique is a little less common in the USA, and, as you can see, is simply a pair of cardioid mics crossed in a V pattern at 130 degrees. (Our UK counterparts use the X-Y technique more often.) This offers a bit less spaciousness in stereo when compared to ORTF, but does downmix to mono a little better since the capsules are spaced closer together.

If your budget permits, you can also use a dedicated surround microphone — such as a Holophone ([www.holophone.com](http://www.holophone.com)) — for crowd response, remembering to always fly your mics high enough above the crowd to avoid having any single person in the crowd stand out in the mix.

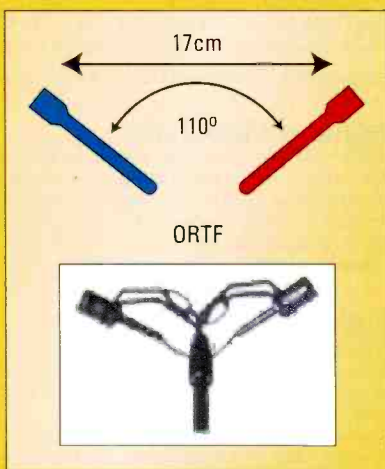


Figure 1. The ORTF coincident microphone technique

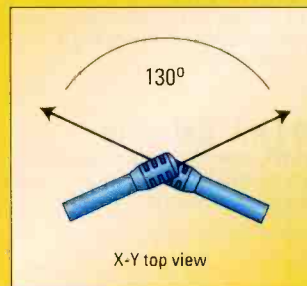


Figure 2. The X-Y stereo technique

Mike Sokol and Hector La Torre conduct more than 30 surround sound workshops each year at universities, AES and Grammy sections across the USA for Fits & Starts Productions. More surround information and a tour itinerary can be found at [www.hovtosound.com](http://www.hovtosound.com).

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# Crawford Communications encompasses video and IT

By Jack Verner

In their transition to digital television, broadcasters are absorbing IT into their video infrastructures. Increasingly, they are shutting down legacy operations or merging them with computer-based systems to reduce their vast videotape libraries. Meanwhile, they continue to become more comfortable with automation and its associated workflow benefits. Crawford Communications, based in Atlanta, merged video and IT and created a roadmap to a completely tapeless, file-based facility.

Crawford's initial foray into the project was a response to physical stor-

age limitations. The company currently provides satellite origination for 34 networks and turnaround services for more than 30 additional networks from this site. Years of long-term videotape storage created a severe lack of space in its network library storage room, the central point for receiving and logging clients' videotapes. The influx of new content finally reached the point where the facility was nearing the limit of new business it could accommodate.

Rather than expand the facility's square footage, the company opted for a completely automated, server-based, multichannel master control facility

supported by a data-based, hierarchical, storage-management system. From this strategy grew a digital library system called ENCOMPASS, which stands for ENCode, Manage and Protect your ASSETS. The facility called on Digital System Technology (DST) to design and integrate the system.

ENCOMPASS is generally divided into three areas: an expandable 40-channel master control playout center, a multiple ingest station and a terminal-gear room with separate IT and video infrastructures. Tie lines from these new areas interface with the





The master control playout pod uses OmniBus automation to trigger network feeds and send them through their dedicated air chains. The pod can support up to 20 in-house networks.

facility's existing operations, including its technical operations center (TOC) (for incoming/outgoing feeds), Avid editing suites and traffic systems. The team also built entirely new air chains to establish an automated digital workflow from the network origination rooms to the playout center and TOC.

### The design

The systems integrator consolidated drawings and data delivered by the principal vendors (Masstech, SGI and OmniBus). It used these technical drawings as guidelines for building the master control console space, router

integration, and associated wiring and cabling. Later, the integrator created drawings for the other aspects of the project, including:

- Audio and video signal flows.
- Time code.
- Closed captioning and other metadata.
- Control.
- Routing.
- Synchronization.
- Timing.
- Networking.
- Proxy servers and gateways.
- Test and measurement.
- Professional time-base generators and clocks.
- Signal-reference ground.
- Cable management.

The facility designated a central area of the 135,000sq ft building for the system. The integration phase focused on incorporating the IT into a functional serial digital facility. The design team selected proven information technologies to connect the facility's back-end storage infrastructure with new and existing off-the-shelf video servers and equipment.

### Playout pod

The system's centerpiece is the master control playout center or playout pod. The pod can support up to 20 in-house networks. Each network has a redundant stream with a seamless, automatic switchover to the backup if the main stream fails. The facility has room to build an additional playout pod of the same size for another 20 networks as business warrants.

The playout pod resembles a half-circle, with four Barco display screens for signal monitoring. Each screen accommodates five networks. A vertical layout of the primary server, backup server, air chain and IRD provide the feed's history. Alarms and other warnings indicate the point of failure if signal problems arise.

Large SVGA monitors are spread across the length of the playout pod for signal monitoring of all servers, asset management devices, graphics playout devices, automation components such

as playlists, and other IT devices. A large KVM router with nearly 15 monitoring and control stations allows operators and engineers to select sources to monitor from multiple servers and automation devices. Two operators, one at each side of the playout pod, monitor sources and access automation playlists from multiple networks through the facility's OmniBus Colossus multichannel automation system. Playlists for 10 networks are available on each automated PC. A supervisor seated in the middle can make playlist changes and fix problems reported by a network monitoring operator.

The playout pod requires very little equipment at the console due to the scope of the automation system. Most devices that would normally be featured at the console are positioned in the air chain in the terminal-gear room. The automation system triggers the network feeds and sends them through their designated air chains. It feeds each network through a Pinnacle DekoCast graphics playout device or an Evertz logo inserter to add bugs, graphics and squeeze credits. Ensemble Design backup switches provide automatic bypass functions so the signal reaches its final destination regardless of signal failure at any point in the air chain.

### IT routing

The facility has transitioned mostly to an IT routing environment for moving files instead of video into servers and storage systems. Hewlett Packard and Cisco provide several layers of IT routing over Ethernet to transfer files throughout the facility. A Leitch Integrator router built to 96x64 (capable of 128x128) is responsible for video and audio routing, although this is generally used only for live events. Rather than playing video out of the editing systems and ingesting it into the server as video, the facility now saves content from the editing systems to a storage array. That storage array links to playout servers for broadcast to air.

The new ingest and playout processes have ushered in operational

changes that dramatically alter the facility's workflow. The old tape-based workflow required operators to physically retrieve tapes and load VTRs for playout and duplication in various network origination areas. The computer-based system streamlines the process by moving files between servers through FTP and automatically recalling files from archival storage.

Although these changes are steering the facility toward a tapeless operation, most clients still ship their air material on videotape. Operators in the network library storage room enter new videotape information into the facility's database and send the tapes directly to the ingest area, which accommodates 12 channels of simultaneous videotape ingestion. A PESA ingest router transfers material to storage and playout servers. Six VTRs installed in an adjacent equipment rack serve QC purposes prior to ingestion. Operators use

rate. The cache servers use three sources to obtain program material: legacy Avid nonlinear editing systems and their associated Unity network and storage system, FTP transfer from various servers, and SGI ingest servers.

**MAM**

The 34 network-originated channels rely heavily on the Masstech Mass-Store, a software-based A/V asset- and archive-management system. DST installed a main and a backup system to integrate program material into playout streams for satellite delivery through the facility's teleport. Mass-Store tracks the content stored on the servers, intermediary caches and a Spectralogic data-tape library. It also tracks videotape storage with the network library storage room.

The data-tape robot is responsible for the archive portion of the facility's hierarchical storage-management system. The data-tape robot retrieves stored material for playout to air, along with its accompanying metadata. The robot features Python drives that use the Sony Advanced Intelligent Tape (SAIT) format. This format provides a tape-to-cache speed of 120Mb/s and provides high storage density for the facility.

**Gear**

The new terminal-gear room houses all electronics solutions and the data tape robot as well as video and audio routers, terminal gear, graphic devices and QC stations. Roughly 30 equipment racks are divided among three rows. The team built the rows to separate IT and video gear for bandwidth and security reasons. On the security side, access to the public Internet is not allowed. This avoids any possibility of file corruption caused by an outside source.

Two of the three rows are dedicated to IT equipment. OmniBus, Omneon and



**The video row houses equipment for adding graphical elements to network feeds within the air chain.**

SGI gear occupy one row; the other row holds Masstech gear, proxy servers and the Spectralogic robotics. The third row houses video terminal gear. This includes Leitch distribution amplifiers and converters, as well as Ensemble Design bypass switchers, frame synchronizers, processing gear and embedders. A PESA Cougar router transfers satellite feeds from IRDs into loggers for recording to servers. The Leitch Integrator router, Leitch Panacea ingest router, Pinnacle DekoCast and Evertz logo inserters are also housed in the video racks. Synchronizers and other traditional terminal-gear products are not needed on the IT side, provided the staff quality-checks and synchronizes everything at the ingest point.



**At the pod console, a supervisor can make changes to the air playlist and correct problems reported by a network monitoring operator.**

overhead speaker domes to contain their audio sources while keeping other sources out.

**Servers**

Omneon, Pinnacle and SGI ingest and air playout servers are key to building the new workflow process. The cache servers use MPEG-2 compression to deliver air material to playout servers at 15Mb/s and to the facility's existing editing suites at 50Mb/s. The facility can ingest long-form programming such as movies using either data

**Design team**

**Crawford:**

- Jim Schuster, sr. vp, satellite op.
- Michael Connell, dir., adv. tech. (ENCOMPASS)
- Don Rodd, CE, satellite op.
- Bill Elsholz, lead broadcast eng., satellite op.
- Jay Pound, database admin.
- Carol Burton, traffic mgr., network op.

**DST:**

- Cindy Hutter, eng./sr. project mgr.
- Chris Spacone, IT eng.
- Mickey Kroll, broadcast eng.
- Brian Kincheloe, installation sup.



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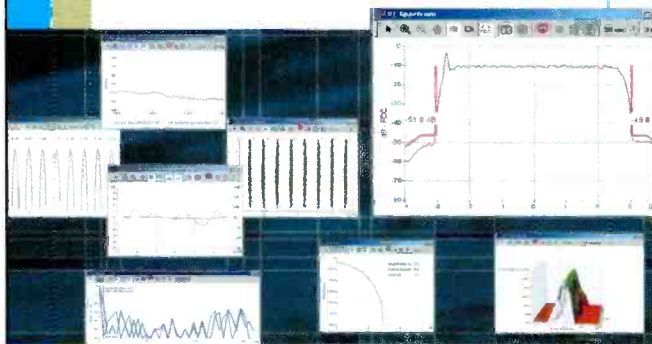
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## Crawford Communications encompasses video and IT

Engineers in the terminal-gear room can use the QC station to monitor feeds and waveforms for three facility routing systems: the video/audio router, the ingest router and the Cougar router. Patch panels and terminal gear (DAs, converters) are positioned at both sides of the QC station so engineers can patch into equipment connected to any of the routing system while trying to pinpoint problems.

Each equipment rack connects to two power strips, each on a separate breaker, to ensure redundancy. Similarly, all devices within the racks connect to redundant power supplies. The failure of any power device will trigger a seamless transition to the backup source. The facility also provides full-facility electrical redundancy through backup generators and UPS systems.

### New opportunities

The facility estimates that it can easily accommodate up to 120 networks simply by adding more digital storage. The transition to a new IT-based workflow and a digitized, completely scalable automated system creates new business opportunities and opens the way for a completely tapeless environment in the future.

**BE**

*Jack Verner is vice president of engineering and technology at Digital System Technology.*

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- Evertz 9625LG+DCP logo generators
- Leitch
  - Integrator 96x64 a/v router
  - Panacea ingest routing switcher
  - VDA6800 analog video DAs
- Masstech Group
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  - MassStore 4/V MAM
- Omneon ingest/payout servers
- OmniBus Colossus multichannel automation
- PESA
  - Cougar satellite/IRD feed router
  - LN82DV1 8x2 switchers
- Pinnacle DekoCast graphics
- SGL ingest/payout servers
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- Teranex noise reducers
- Wohler ARS-21B and ARS-11 audio routers





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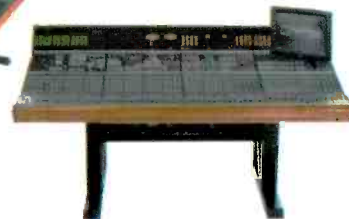
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The Sigma 100 medium format digital production console



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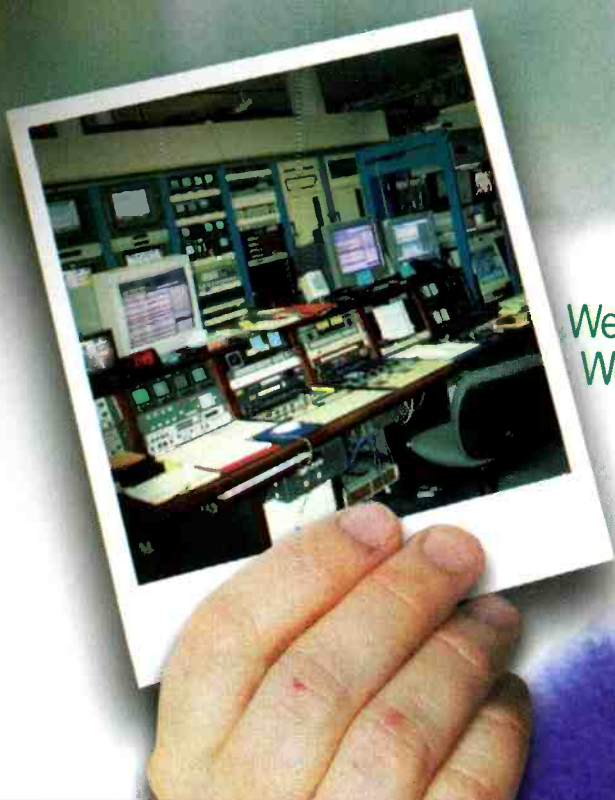
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## Mobile TV and data

BY MARTIN JACKLIN

The promise of mobile TV has brought the worlds of public wireless telecom and broadcasting into close collaboration and imminent competition.

Since the late 1990s when digital terrestrial TV entered public life, mobile TV has been an application area of interest. It has been associated with an increasing variety of new advanced transmission and compression technologies, business models and service concepts.

In this article, mobile TV refers to AV transmission or signal distribution, point-to-point and point-to-multipoint, and moving receivers. Mobile TV in its general form also appears to be rolling out in three distinct, if converging, areas: telecom, as an extension of phones

(smart-phones); the IT industry, notebook receivers and rich media PDAs; and as an extension of television, out of the home.

Figure 1 illustrates the different technologies that offer potential of mobile multimedia, and gives a rough sense of bit rate versus mobility.

The history of modern, digital mobile TV effectively began in 1996 and 1997, when German broadcaster RTL conducted trials of a DVB-T service on slow moving trams in downtown Cologne and on the German autobahn in a yellow Bugatti at speeds up to 300km/h.

In 1998, the Japanese Digital Broadcast Experts Group approved ISDB-T, a digital terrestrial standard that supports mobile terminals accessing more rugged segments of the transmitted signal to receive video, radio and other data services. Pilots and trial services are already up and running.

In 1999, the Singapore Broadcast Corporation (SBC) introduced TV Mobile—the world's first public transport broadcast TV service—on buses and trams and mass transit services. Mercedes

is introducing DVB-T reception as an option in its cars sold in Europe.

The power consumption of DVB-T front ends, however, is too high to support handheld devices for one to several days on a single charge. Since 1999, DVB has been working on how to complement UMTS, the European 3G standard, with broadcast services. The pieces of the technical puzzle are basically a power-efficient tuner-demodulator design, the use of IP-datacasting as a video and data delivery layer and a more efficient video compression solution than MPEG-2. This standard came to be called DVB-H (for handheld). And the basic reason why it exists is power consumption.

Last November, the European Telecommunications Standards Institute

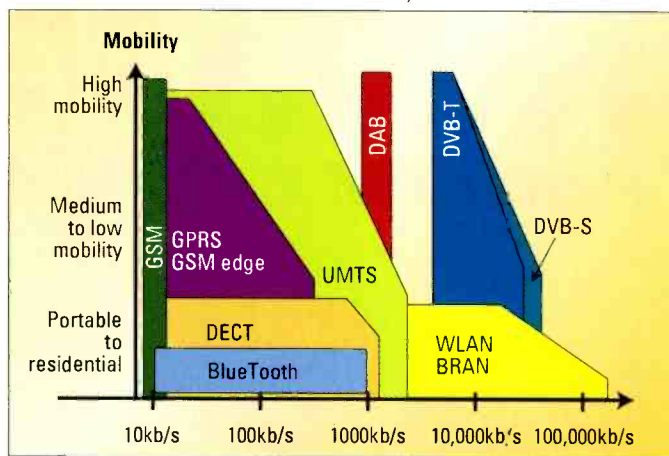
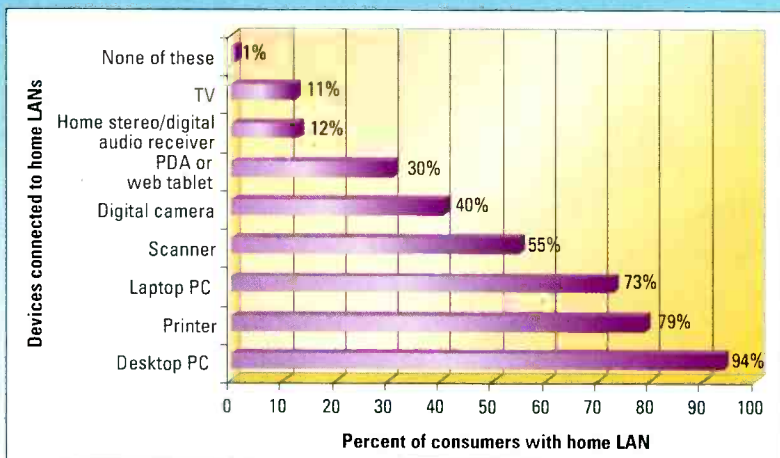


Figure 1. Technology bit rates and mobility. Source: "The Convergence of Broadcast & Telecommunications Platforms," ad hoc Group DVB-UMTS, Report No. 1 (Full), 6.2.2002 Editor: Rainer Lueder.

## FRAME GRAB A look at the consumer side of DTV

### Devices connected to home networks

By end of 2006, 125 million devices will be networked in U.S. homes



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(ETSI) approved DVB-H for delivery of mobile television to handheld devices like cell phones.

The commercial appeal of digital television could be summarized as having a choice between improved picture and sound, or more rugged signals. Having more rugged signals means worse

images; better images means less robust signals. New advanced video coding systems promise to make low bit rates achievable. However, new codecs require more hardware and memory resources, and eat power, and thus, battery life. With the new systems, a new trade-off is introduced: video coding

efficiency versus complexity.

All of the more robust transmission and reception methods, for DVB-T and DVB-H, and even enhanced VSB from the ATSC, find the available data rate reduces as robustness increases. Next-generation video and audio codecs such as MPEG-4 AVC (H.264) and Microsoft Windows Media Video (VC-1) appear to solve this problem.

The 3G partnership project (3GPP) has standardized on MPEG-4 (Part 2: simple visual profile) coding. Late last November, DVB approved new guidelines for low bit-rate applications (such as DVB-H) adopting MPEG-4 AVC Video.

Does a new codec really help? In compression, the most efficient coding scheme takes the most amount of work — the decode needs more muscle to do more tasks in less or the same amount of time. So, we are back to Moore's law: Soon, we will have the processing power, BUT now there is more work to be done. Anyone who has ever really used an advanced mobile communication device that is video-capable will know the impact these features have on battery life.

In South Korea, a novel strategy has been attempted, where mobile broadcast TV services are offered using the Korean Digital Multimedia Broadcasting (DMB) standard. DMB comes in flavors: T-DMB, using terrestrial airwaves, and S-DMB, which provides a direct satellite-to-mobile phone feed.

South Korea is also forging ahead with a new Broadband Wireless Access standard called "WiBro," an example of the new "4G" Wireless LAN-based system, specified in the IEEE as 802.16. Based on the same physical layer (OFDM) as 16d, 802.16e is tailored for the high mobility environment, including handover and roaming.

WiMax is integrated and IP-based, and potentially goes beyond the hybrid DVB-T/UMTS approach. Many people believe this direction is the most promising way to implement broadband connectivity with mobility. With IPTV and voice over IP, this can complement (or compete) with 3G telephone systems.

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It is clear that a hybrid broadcast/cellular approach, even if that is 3G, is an interim phase. WiMax may hold the promise of being a unifying generation of converged technology, supporting as it does full duplex IP.

DVB-H trials in Berlin and Helsinki are using existing terrestrial TV masts to broadcast compressed signals to handsets with add-on receivers.

In the UK, the mobile network O2 will start using DVB-H in 2005. The UK's NTL, a clear competitor to U.S.-owned transmission services company Crown Castle, is active in TV network operation in the UK. Crown Castle will broadcast 16 channels on a spare TV frequency. O2 plans to give 500 Nokia TV phones to subscribers to test a service, which could cost around \$22 per month for a bouquet of news and entertainment channels.

Last October, Crown Castle began operating pilot DVB-H services from



**The Nokia DTB-T Mediascreen (left) has a battery life of 20 minutes, while the Nokia 7700 DVB-H Mediaterminal (right) has a battery life of two hours.**

three transmitters near Pittsburgh, PA, viewed on prototype Nokia mobile TV phones and DIBcom mobile receivers.

Whether it is a mobile phone with AV capability or a PDA-based mini video jukebox, or some other kind of

mobile TV device, the "killer" device of choice for consumers is not entirely clear, as lifestyles still evolve.

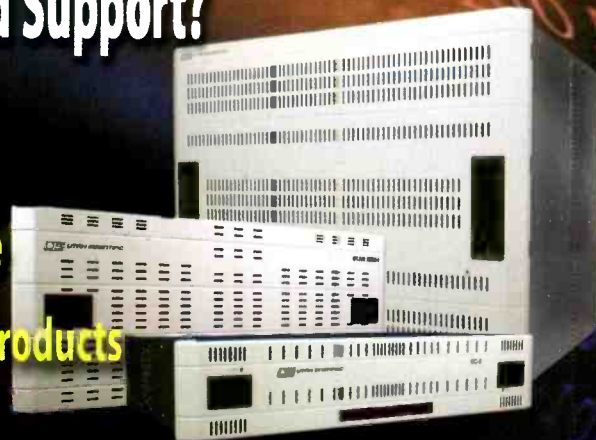
Whatever technology is used, it is clear broadcasters will need to drop some of the precepts of traditional programming. The Singapore TV mobile service found programs could not be longer than 10 minutes, the length of an average Singapore bus ride.

People are free to watch TV on their mobiles only in a certain rhythm. Broadcasters need to think differently about making the right kind of programs and making sure people can afford the time to watch them. That is a subject for another article. **BE**

*Martin Jacklin is a technical author and consultant based in Geneva, and is a member of Broadcast Projects, (www.broadcastprojects.com) an alliance of independent consultants working in the digital media industry.*

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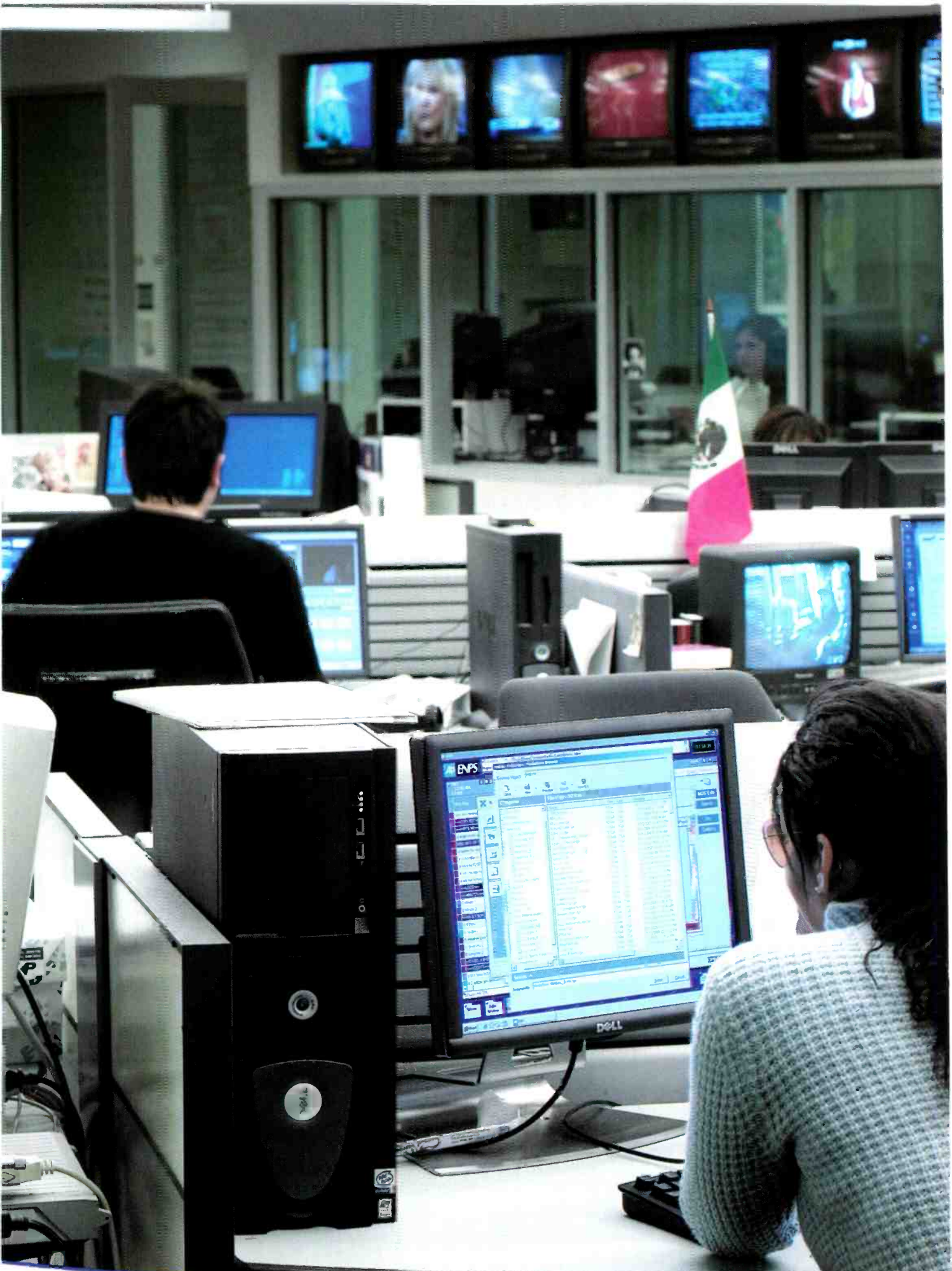


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# DIGITAL

## newsrooms: Why change in 2005?

BY JONATHAN MARKS

I have taken part in several newsroom conferences recently. The most interesting was one organized by *Broadcast Engineering* in Chicago last October. Coming from Europe, I was amazed at how many regional TV stations in the USA were still analog. Only in the last six months has digital really become worth a second look.

Having been involved in, or reported on, several digital transitions, I'd like to share the results of several newsroom battles that I have witnessed on both sides of the Atlantic. It is often difficult to filter out the "essence" of the arguments to go digital from the sales pitches. I've even started some of those battles by saying "no" to projects that were purely driven by technology — solving problems the station didn't know it even had. Hopefully, the points made here will save you time and trouble.

I'm speaking from an independent broadcast journalist's perspective as someone who writes for TV, radio and new media. I act as a communications bridge between the creative professionals and the technical support, for it is vital that both sides of the process share a common vision. It is also essential that they don't confuse others with their own specific jargon. It is important to spend time and effort interpreting technical goals

in terms of journalistic ones, and vice-versa.

### Basic assumptions

Here is what is essential in 2005:

- *Relevant content:* Any broadcast newsroom that isn't implementing an integrated IT approach to its news production is going to rapidly lose the battle for scoops. Because, more and more, those scoops are being broken by newsrooms supplying content for TV, mobile phones, PDAs, portable music jukeboxes and pagers — usually at the same time.

- *Public involvement:* With five Mega-pixel cameras already appearing on Korean mobiles, it's becoming obvious that the audience now has the capability to create content. All the early shots of 9/11 were "amateur video." A lot more news will involve contributions from the public, but it will take the skills of journalists to craft and check the story.

- *Context:* The environment in which you read or see something is as important as relevant, reliable content. After all, any kid in his bedroom writing a Weblog is creating content.

### New era of production

We're entering a new phase of news production for TV, thanks to several crucial developments all coming together. First, the cost of storage continues to drop, now less than \$1 per GB.



Time Warner Cable's NY1 24-hour cable news channel recently installed a new Avid tapeless digital news production system.

In November 2004, home computers began shipping with a TB of storage.

Second, standard PC servers are now fast enough to de-compress broadcast quality video in real time. Third, networking costs have crossed some crucial thresholds. The technology is reliable and affordable.

And finally, but perhaps most important, we're now in the open-standards era where journalists expect to be able to drag and drop material as it flows through the building, not cut and paste it. Thanks to standards like Media Object Server (MOS), different bits of the equipment are getting better at talking to each other. There is still work to do, but things are going in the right direction.

### Different priorities

Depending on your function at your station, you will have a certain set of priorities. You might be the head of IT, charged with reducing costs, improving performance and getting a maximum return on any technological development. Your list of priorities may look something like this:

- Improve return on investment.
- Reduce costs.
- Simplify workflow.
- Simplify maintenance.
- Manage security.
- Output more with less.

But, remember most of your newsroom users are journalists or designers, who need to be persuaded by other arguments than just the old "more-for-less" story. In order to gain acceptance in the newsroom, those on the IT implementation team have to convince users that the introduction of IT technology means faster turnaround times, beating the competition, being able to find relevant material from a multitude of sources, and being accurate as well as first.

Let's face it: In many cases, the introduction of IT has been used as a thin disguise for downsizing. Management always wants the same quality output for less — much less. And, if automation can reduce costs in the supermarket business, why doesn't it work in the

same way in for broadcast news?

While some jobs do indeed disappear, others are created. People who combine the knowledge of IT solutions/workarounds with an appreciation for a journalist's deadline will find they are in demand. IT people who can think out of the box, as well as journalists who can define what they really need, are worth investing in.

### The need for speed

Analog news production people have done a great job. Production teams, both in the field and in the newsroom, have developed ingenious routines to get news stories on the air as fast and as accurately as possible, despite the many tape formats that have come and gone over the last decade.

But little can be done to make a tape-based system faster. Plus, the cost of VTR maintenance and media costs continue to rise. Journalists are being faced with increasingly complex situ-

ations that require them to find and verify information from multiple sources. They cannot do that if they are forced to write in one place, edit in another and research in yet another. Broadcasters who have made the digital transition can now outpace the analog news-gatherers. In digital newsrooms, the increase in speed is often between 20 percent and 30 percent for operations of 30 to 50 people. That's because the fundamentals of the workflow have been changed.

Efficient digital newsrooms use technology to allow systems and journalists to share the workload, especially when it comes to metadata. Now journalists can find key material again after the deadline is over. No one can afford to start each news day with a blank sheet and reshoot all the footage. But if the newsroom workflow prevents the staff from locating

archive material fast enough, then you are basically requiring the staff to redo what they've already done.

### Never outsource the workflow analysis

If you're planning to make changes in your newsroom, start by taking a couple of paces back and asking: What's the common thread flowing through our production system?

It should be an idea, not a production number on a sticky label. No one remembers numbers. You and third-party clients remember the great stories by name. Why not let technology help shape ideas that flow in from the outside world, to be edited, put on the air and possibly filed away for future reference — all with common titles, names and metadata?

Consider whether a new production workflow will require processes such as cutting and pasting because applications won't talk to each other. Or will

**Never make journalists slave to a workflow developed by someone who has never made a TV show. That's asking for staff rebellion.**

the news staff be able to edit by drag and drop, with format conversions happening in the background?

Avoid simply digitizing a current analog process. Start by rethinking how news is created. Importantly, as an organization, you have to do this yourself. Consultants and IT specialists can help interpret the results into what equipment is needed. But never farm out the way you do your core business activities to outsiders. Your way of working will depend on a variety of critical factors — legacy systems, the size of the market, journalistic goals and capabilities, and audience expectations. While you can learn from a larger or smaller station, each facility needs to develop its own solution. Finally, never make journalists slave to a workflow developed by someone who has never made a TV show. That's asking for staff rebellion.



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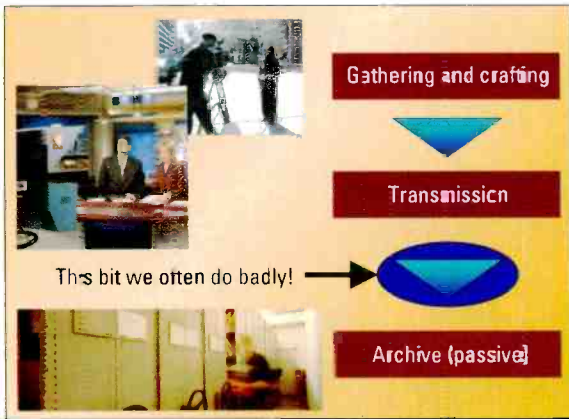
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# DIGITAL newsrooms:

Why change in 2005?



Start by picking three or four respected reporters/journalists in your operation and involve them in your quest to get stories to

**Figure 1. In the traditional workflow model, archiving is at the end of the chain. This makes the archive accessible to only a few.**

air faster than the competition. The devil is in the details. At one regional newsroom, the staff identified more than a dozen problems that were slowing down the creative process, from technical incompatibilities to an unclear chain of command. When things went wrong, it wasn't obvious who was responsible for getting it right the next time. The staff had had a case of BSE — "blame somebody else."

Select people who are actively out there in the real world beyond the studio and who are using current equipment to make stories to real deadlines. Ideally, they are people who have three to four years of hands-on experience. Go out with them and follow how they get the news, from in the field to the moment of playout. Collect horror stories about why stories nearly didn't get to air on time or why stories failed altogether.

You will quickly see that deadline pressures often mean that people cannot find stuff fast enough. Sometimes its reporters looking for archive material — perhaps something they have shot themselves, a tape incorrectly labeled, wrong captions, spelling errors or a playout editor who grabbed the wrong version of the story.

Often, you'll find that time is lost because of logistics, when material is being manually transported, copied or played out. During this time, it cannot be edited or manipulated by editors/journalists. Graphic artists cannot see what they need to illustrate. There are probably parts in the chain where work is being duplicated because systems don't talk to each other.

Figure 1 shows the traditional way of creating content, capturing content, shaping it, transmitting it and then moving the story to an archive.

Consider this: Instead of putting the archives at the end of the chain, why not put it in further up the production change, say in the middle? By doing so, you have changed the archive process from passive, only accessible to the few, to an active archive accessible to everyone. (See Figure 2.) This allows journalists to access material

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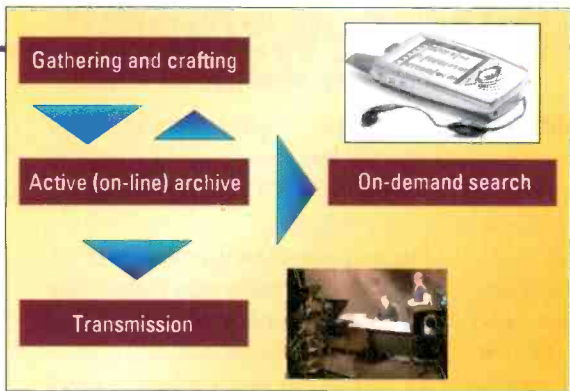
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**Figure 2. In the IT approach to workflow, the archives are put in the middle of the production chain. This results in an active archive that is accessible to everyone.**

for transmission in the normal way. The archive now can contain material that is only seconds old.

### Think sideways

Changing the workflow like this often provides several advantages. Material now has a shelf life of content separate from its transmission date. Stations spend millions creating content that is only accessible to the public while it is being aired. Moving the archive forward provides the opportunity to repurpose the same material for other venues.

In addition, almost 20 percent of the U.S. population now receives their news from IT devices (PCs, PDAs and, increasingly, Smartphones). Having an active archive puts you in a strong position to supply content that has been adapted to the needs of mobile providers. As a creator of local content, stations are the ideal partner for a mobile phone company or Web portal. (Editor's note: See the article "WRAL-TV delivers news, weather to Sprint PCS Vision customers" in our Dec. 24th News Technology Update newsletter.)

Newsroom systems that use open architecture technology are ready for the days when having findable content is valuable not only to the newsroom staff, but also for third parties. Any station that covers regional news, sports, weather and traffic has content that can be repackaged for mobile phone networks, PDA platforms or Weblogs. That content is valuable to another set of consumers — and to new advertisers.

### Training: The main key to acceptance

Traditionally, training is mentioned at the end of technical papers. Vendors will tell you that training is no problem and that you'll be surprised how fast it all goes. It can work

that way, but only if you bring your thinking about training right up to the front.

If you have built a logical workflow, those trained on it will be your biggest fans. You have eased their fears about the logistics surrounding news production. In theory, at least, they have more time to be journalists/editors.

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But with an increase in staff churn in newsrooms, consider how you'll train those newcomers? The training scheme needs thought to give people an initial overview, job-specific training and simple ways they can remind themselves of procedures when they forget. Few people like to show their ignorance. Those who make mistakes because they are afraid to ask are often the ones who make unjustified complaints about anything "new."

Anyone waiting for the single all-singing, all-dancing newsroom sys-

tem will have a long wait; it will never come.

And, newsroom IT systems should always allow for their own evolution. For instance, with storage costs continuing to drop, does it make sense to buy a huge amount of storage now when you may not need it for five years? Ask tough questions. How much news footage is created each year? How much is kept and what percent of that is ever used again? If the recycle rate is low, could it be because it is faster to create new material than for the staff

to locate the original material? How much will you save on media costs and maintenance of VTRs? Those funds can be used elsewhere.

Efficient, functional newsrooms are based around leaders who continually check with the users on features that they need to be faster and more accurate. Evolution and change is good because they can help make a news staff faster and more accurate. **BE**

*Jonathan Marks is the director of Critical Distance.*

## NY1's expands editing

BY MICHAEL GROTTICELLI

Time Warner Cable's NY1 is expanding its news coverage throughout the tri-state area, with a mindful eye on maximizing its technology and human resources to get the best news on the air. Pioneering a "one-man-band" philosophy that has reporters shoot, write and edit their stories, the company has redefined local news gathering. Due to its success, Time Warner has replicated the model in other parts of the country as well.

Continuing its groundbreaking ways, the 24-hour cable news channel has installed a new Avid tapeless digital news production system to work in tandem with, but independently from, its existing Pinnacle Systems Vortex News system. The result is a fully networked production environment in which NY1's staff can accomplish more, in less time and with better results in an environment that is more cost-effective to run than a traditional newsroom.

In November, NY1 launched two new news bureaus, one in Palisades Park, NJ, and the other in Staten Island. It set up a dedicated network based on Avid Technology products and systems that allows reporters to write, shoot and edit their stories and then send them

back to NY1's main facility in New York City for insertion into the network's daily news offering at 15 minutes past every hour.

Together, the Avid and Pinnacle Vortex digital news production systems provide NY1 with two separate, yet comprehensive, networked editing environments that support its main NY1 News channel as well as NY1 Noticias, a Spanish-language version.

Joe Truncale, director of technical operations and engineering for NY1, has seen the company's editing/production workflow transition over the years, from standalone Panasonic NewsBYTE systems to the current networked environment — incorporating both Avid and the Pinnacle Systems Vortex — where everyone involved in the news creation process has access to clips that can be directly downloaded from an archival server to the timeline on their individual editing workstations.

For each news bureau, NY1 has installed an Avid Unity LANshare EX for News systems as well as an Avid NewsCutter XP workstation and local storage arrays (about 100 hours capacity in Staten Island and 25 hours in Palisades Park).

The Avid system selected by NY1 also includes Avid MediaManager

for asset management and browse/logging, TransferManager for moving media from one network location to another, and Avid's new AirSpeed video server for multiple channels of playout. NY1 currently uses Avid AirSpace playout servers with 100 hours of storage in its main NYC location.

This file-based workflow, in which the news bureaus are connected to the NYC facility via a dedicated Gigabit Ethernet fiber line and IP delivery, enables the network's news staff to work efficiently when preparing elements for the news rundowns. Stories completed at each bureau are sent back to NY1 as a digital file or baseband video.

The network connections established between the bureaus and NYC is not fully bi-directional, according to Truncale. A producer in Staten Island can feed material back to NY1 but cannot fully access the network in NYC. When they want a particular clip, they make a phone call, and the required video clip is sent via baseband video to them for editing. **BE**

### Editor's Note:

Don't miss an expanded version of this article, available at:

[www.broadcastengineering.com](http://www.broadcastengineering.com)





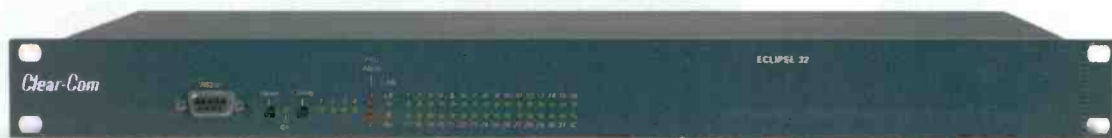
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# Digital asset management

BY DAVID AUSTERBERRY **IT meets video**

**D**igital asset management (DAM) is a popular topic on the conference and seminar circuit. Why should it be of interest to broadcasters, and what ben-

efits does it deliver? The proponents of DAM suggest it offers many advantages for the handling of media files throughout the processes of production and distribution.

DAM has been readily adopted by many corporate sectors for managing their document and image archives. The print and publishing community makes extensive use of DAM.





Installed at Viasat is both Harris' D-series automation playout and its Landmark and Broadcast-Master systems for air-time sales and program scheduling.

image? As existing users of the latest digital technologies throughout the production chain, broadcasters have much to gain from the implementation of DAM. This article looks at the challenges facing broadcasters who are looking to use DAM as part of the migration to file-based workflows.

### A definition

The vendors of DAM systems offer a wide range of products. Their facility and feature sets run from basic to

Television broadcasters have traditionally maintained assets in the form of film or videotape. This physical media can be managed just like a book. Each reel is allocated a unique number and stored on shelves in a library. A card index or computer database maintains a set of records for the reels. There are tried and trusted practices for viewing and withdrawing tapes (or films) from the vault.

In 1998, when the joint SMPTE/EBU Task Force looked at harmonizing

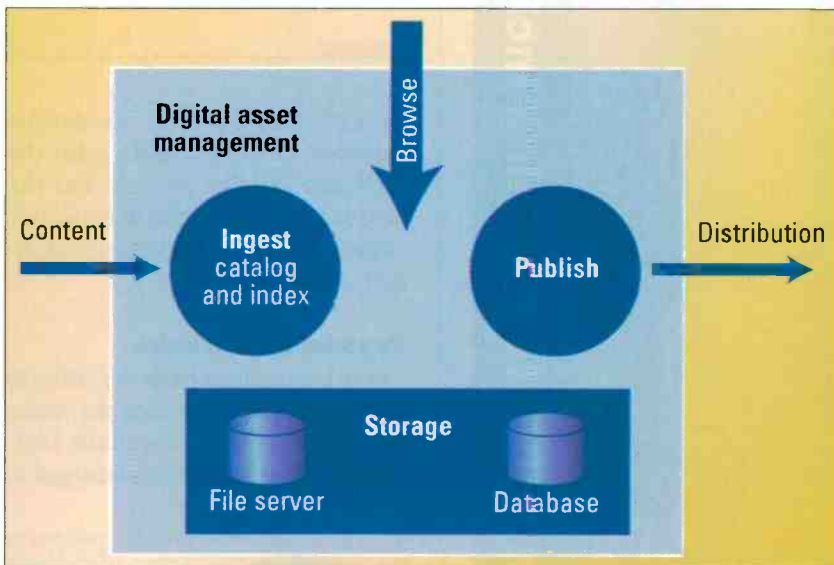


Figure 1. When ingested, assets are indexed and cataloged. Then the files are held on a storage network, where they can be browsed. The final step is publishing, where assets can be turned into revenue by distribution over many channels.

complex enterprise-scale systems. By definition, DAM manages digital assets. Lawyers speak of an asset as an item of property. Digital assets are a sub-set, property that exists in digital form. Generally, this means a computer file.

Electronic documents form one large and important group of assets. These are the conventional files of any business: word processor documents, spreadsheets, presentations, white papers, contracts, quotes and invoices.

Media businesses use a further group of files that includes images, Web content and audio-visual files. Other sectors also use image files — CAD files, seismic surveys — and these can be just as large as a video file.

standards for program interchange, it introduced the idea of an asset being defined as content plus rights (to use). In the context of broadcasting, the management of digital assets also includes rights management.

### DAM systems

The components of a DAM system depend somewhat upon the application, but there are common elements. Assets are ingested, along rights information. At the ingest stage, the asset is indexed and then cataloged. The files are held on a storage network, possibly a mix of disks and data tapes. Control information and metadata is held in a conventional database. (See Figure 1.)

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## Digital asset management IT meets video

Once the assets have been cataloged and stored, then provision is made to browse the content using the catalog and index. In many systems, access control provides security to ensure assets can be viewed only by those with relevant permission.

The final, and perhaps most important, stage is publishing. Here, the assets can be turned into revenue

cataloging, ordered storage, indexes, and check-in and check-out procedures. In any library, it is essential that content can be found easily and with the minimum of information. A traditional card index stores a range of metadata: program title, producer, editor, dates for shooting or transmission, etc. The list is endless. Such data has been formalized in documents

**In any library, it is essential that content can be found easily and with the minimum of information.**

by distribution over numerous channels: broadcast, cable, print, the Web and cellular phones. For the broadcaster, publishing may include editing, finishing, packaging and, finally, transmission.

### Broadcast systems

Broadcasters have been migrating to file-based workflows since the introduction of the nonlinear editor. Digital processing islands have emerged in

such as the SMPTE metadata dictionary for use with computer databases and DAM.

In the file-based world, this same metadata can be carried over from the card index. There are more sophisticated systems that automatically log material. They can analyze the video and segment it into shots tagged with time code. With speech-to-text conversion, it is possible to provide automated transcripts. These are typically used for continuous agency feeds in news operations. Within the closed world of program production, the team may have no need for such systems; it has the shooting notes and the scripts.

In the tape-based world, viewing copies are made to avoid damage to the master tape. These can be clones in the same tape format, or copies on VHS or DVD. DAM uses low-resolution proxies for viewing. This is not to avoid damage to the master, but to save network

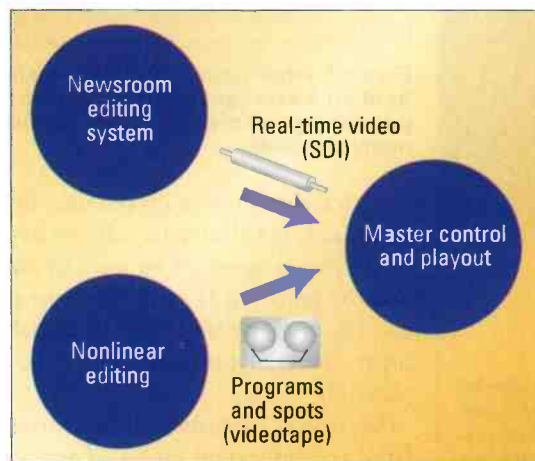


Figure 2. Digital processing islands in post-production, newsroom and master control

post-production, in the newsroom and in master control. Elsewhere, programs and commercials are still moved around as tape or live video streams. (See Figure 2.)

A DAM system has to replicate the processes used for handling videotape:

loading. An uncompressed HD file (1.5Gb/s) can be viewed using a streaming media codec at perhaps 300kb/s. This concept is not new to television. The offline NLE uses a highly compressed copy of the original media — a proxy — for the rough



cut. The original uncompressed files are then used for the online conform.

Just as the NLE uses proxies, in common with DAM, they also make extensive use of small images grabbed from the video track (thumbnails) to represent each scene. The automatic logging systems perform a similar task of creating the thumbnails for the DAM.

### Shooting

The latest generation of camcorders is offering alternatives to tape, with recordable optical disks and solid-state flash memory cards. The disks can be captured by an NLE over Ethernet or IEEE1394. The memory cards plug into a regular PC card slot in a laptop editor, or they can use a card reader with a desktop workstation. Because the media files are wrapped in the MXF format, it becomes easier to offer cross-vendor compatibility. These camcorders create a low-resolution MPEG-4 proxy, and some create a thumbnail for each scene as they record.

The camcorders incorporate many of the functions of a conventional ingest station, enabling direct ingest from the camera to the DAM system. The advantage to the broadcaster is twofold: lower costs, plus faster than real time ingest rates. For news operations, these are a real bonus.

### Transmission

Over the last 10 years, since the inception of reliable video servers, television channel layout has changed from tape to using files. The first change was to spots and interstitials. As disk capacity increased and the price dropped, it became viable to play long-form programs from disk. A number of DAM systems have evolved for this specialist application and meet network demands for 99.9999 percent reliability. A missed spot is lost revenue.

### Adopting DAM

There are many reasons that broadcasters are wary of DAM. First, there

is the old saying, "If it's not broken, don't fix it." Workflows have evolved over many decades that deliver programs. In an arena of rapidly changing technology, that saying cannot hold. Other more specific reasons include lack of buy-in from the financial officer, a perceived lack of metadata standards and an unproven price

or cost benefit.

The first two are partly an issue of education. DAM systems are complex. They are a blend of IT and media technologies, often including sophisticated cataloging engines. Major changes may have to be made to working practices before real cost benefits are realized. There is risk attached to

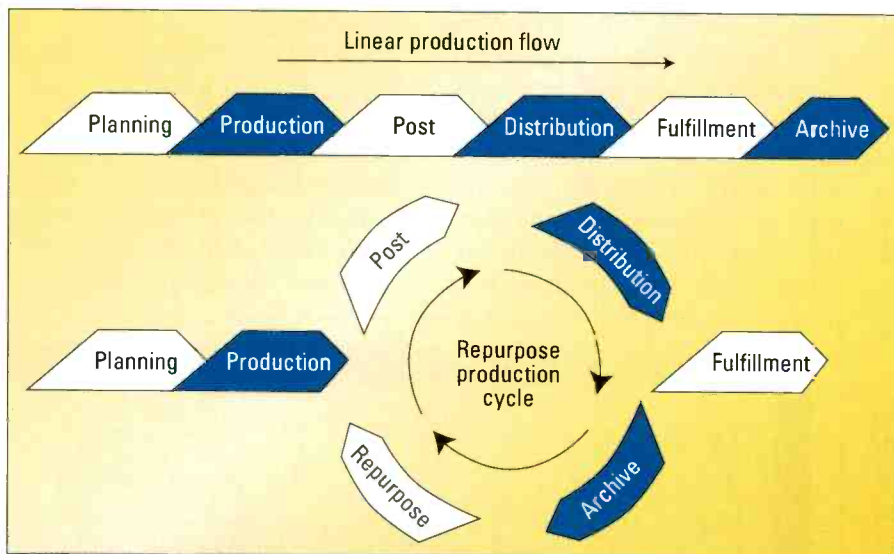
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**Figure 3. A repurposing production cycle is replacing the traditional linear workflow of television production.**

these major changes, and that risk has to be balanced against the possible benefits.

If DAM is trusted to handle the revenue generation in ployout, then why not roll it out across other areas of program creation and publishing?

balization of the media providers adds the administrative complexity of managing multiple language soundtracks, subtitles and closed captions. (See Figure 3.)

The consolidation of call-letter stations into groups has led to a centralization of creative and technical resources. At group headquarters, finished media radiates to the local stations. The local stations are often solely an injection point

## Benefits of DAM

The business of television is in the middle of a step change in technology. Files are replacing tapes. Digital delivery includes IPTV, DVD, Web streaming and third-generation cell-phones. Real-time delivery via the STL to a tower is no longer the sole delivery channel for content. DAM has been designed from the ground up for this new environment.

The developments in delivery channels are creating demand for content that has been repurposed to suit the demands of the channel. For content publishers, a repurposing cycle is replacing the traditional linear workflow of television production. The glo-

## Perhaps the biggest impediment to the adoption of DAM is the fear of the new.

for local news. Fiber networks act as spokes to deliver content as files. DAM can efficiently manage this server-to-server file exchange. The local stations can browse low-resolution proxies of media stored at group headquarters. Metadata exposes useful information about programs, commercials, interstitials and PSAs. To provide this same service in a tape-based world, we would need a full-time dubbing provision, plus the cost and delays of couriers.

With DAM, the media repository can be made available at the desktop to anyone within the group, even when separated by hundreds of miles.

Perhaps the biggest impediment to the adoption of DAM is fear of the new. Meanwhile, file-based workflows are being rapidly adopted. DAM delivers sensible management of the ephemeral media file. The familiar tape cassette is headed for the sole task of being a capture and archive medium.

**BE**

*David Austerberry is the editor of Broadcast Engineering's world edition, as well as a technical writer and consultant on video technologies. He is author of "Digital Asset Management: How to Realize the Value of Video and Image Libraries," published by Focal Press.*

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# Stratos Lightwave video media converters

BY MARK BENTON

In the broadcast video world, 75Ω coax is used virtually everywhere to carry signals between routers, tape decks, cameras, distribution amps, etc. While this coax provides good performance for SDTV signals, the 1485Mb/s bandwidth of HDTV signals limits coax runs to approximately 200ft to 500ft. This distance can be insufficient for many on-location venues where HDTV is being used, including sports arenas, concert halls and stadiums. In addition, these runs often aren't long enough for permanent installations in TV studios or video production houses. And, besides the distance concerns, there are many situations where existing coax cable tray space is at a premium, and adding more coax is expensive.

Fiber-optic cables can easily overcome this distance limitation because their attenuation at high frequencies is significantly lower than coax. Fiber also overcomes the concerns of limited space and weight in crowded existing coax cable trays. Unfortunately, most of the video hardware in use today — even equipment designed specifically for HDTV — is still equipped with only BNC connectors for coax cable. Most of it has no built-in provision for fiber-optic cable.

The solution to the distance limitation of coax and the lack of native fiber connectivity is coax-to-fiber and fiber-to-coax media converters. While the marketplace does offer several devices to provide these functions, historically they have suffered from two types of problems.

The first problem is size and packaging. Many converters are line cards that must be installed in equipment racks. This precludes their use in the field, or in temporary applications

where installation in a rack is not possible. Even "throw-down" box converters can be too large and bulky for many applications.

Smaller, "in-line" converters often exhibit the second problem — insufficient video performance. Some of these units cannot meet the specifications for the SMPTE optical and electrical protocols for HDTV. The result is compromised or intermittent video quality, insufficient optical link dis-

high and 0.75in wide, and they are equipped with a 75Ω BNC connector on one end and an ST simplex fiber-optic connector on the other end. Using nine-micron, single-mode fiber-optic cable, they provide a typical link distance of 15mi at 1485Mb/s.

The devices fully meet or exceed all SMPTE specs at distances of 3mi at 1.485Gb/s and 6mi at 270Mb/s. The converters use custom optics, mechanical engineering and controlled

**The small size of the units allows their use virtually anywhere — directly on cameras and equipment, in the middle of a cable run ...**

tance or, in the worst cases, the inability to even establish a link over the fiber-optic cable run.

Stratos Lightwave converters meet SMPTE protocols 259M, 292M,

impedance circuit design technologies for high-end telecom and datacom optical transceivers that operate at speeds of 2.5Gb/s or greater. The units are cost-competitive with other, larger converters while providing high reliability and high-quality video performance.

The small size of the units allows their use virtually anywhere — directly on cameras and equipment, in the middle of a cable run or in rack-mount panels. They are contained in rugged, die-cast metal housings overmolded with a compliant, non-conductive elastomer. This packaging can withstand rugged handling and provides high reliability in the field.

Simplex transmitters and simplex receivers are available. The transmitter (in a red-colored housing) features built-in line equalization for signal integrity with various lengths of attached coax. The receiver (in a blue-colored housing) features signal re-clocking for all SMPTE 259M and 292M rates and 75Ω line-driven



**The differing red and blue colors of the transmitter and receiver reduce the chance of installation errors.**

305M and 310M and will operate correctly and reliably from 19.4Mb/s to 1485Mb/s. They also support DVB-ASI operation. These converters are approximately 4in long by 0.75in

electrical outputs to support significant coax cable runs. Re-clocking provides random jitter control and allows broadcasters to use the receiver remotely in the field.

The different housing colors of the transmitter and the receiver reduce the chance of installation errors caused by personnel with minimal technical

significant technical knowledge.

These devices include a digital-diagnostics interface (DDI) for high-reliability applications such as live video feeds or uplinks. DDI-monitored parameters include device temperature, device power-supply voltage, received optical power (receiver only), laser bias current (transmitter only) and transmit-

ate over a wide power supply voltage range of 4.5VDC to 16VDC.

Other devices and equipment that support these video media converters include universal 110V/220V wall-plug power adapters, a single unit in-line DDI interface box and a 1RU shelf, which holds 18 converters for rack-mount installations.

These video media converters facilitate the transport, processing and display of HDTV signals over significant distances, without loss of signal quality. They allow an existing infrastructure of coax-based video equipment to interface easily with fiber-optic cable. Because the units are small and self-contained, they eliminate the need for installation in equipment racks, providing flexibility in deployment. **BE**

## Re-clocking provides random jitter control and allows broadcasters to use the receiver remotely in the field.

background or by knowledgeable personnel in a fast-paced, on-location event. A multi-color LED performance indicator, visible on the outside of the unit, provides a clear indication of go/marginal/no-go link status. This helps ensure reliable in-field monitoring, whether or not the user has any

ted optical power (transmitter only). DDI also offers alarm flags to warn when specific operating conditions exceed the device's parameters. An LED on each unit indicates these data, which can be accessed through the four-pin connector. The connector also provides DC power to the device, which can oper-

*Mark Benton is director of product development at Stratos Lightwave.*

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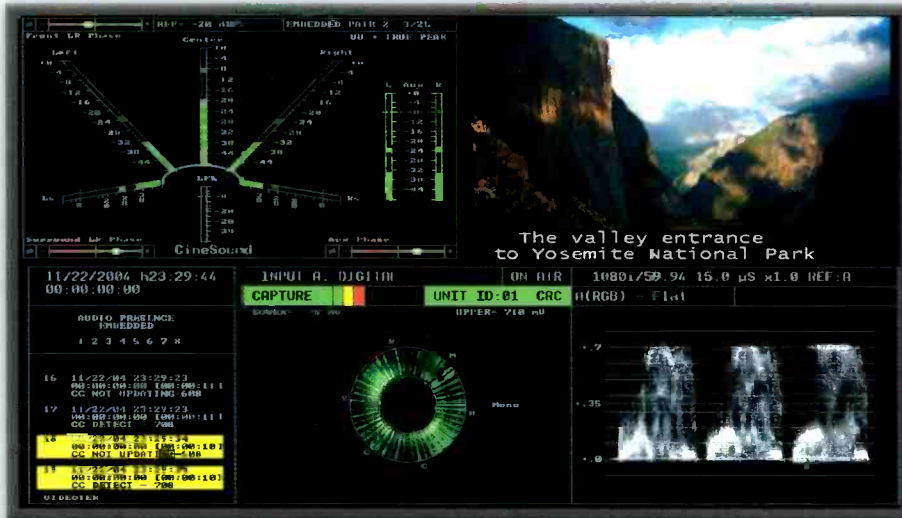
*Emmy* - The Academy of Television Arts and Sciences, *Vanguard Award* - Video Systems Magazine, *Pick Hit* - Broadcast Engineering Magazine, *Editor's Pick Award* - NAB, *TV Star Award* - TV Technology Magazine, and *Technology Award* - The Society of Broadcast Engineers. Not only are Videotek's products the most technologically advanced, they are the industry's first choice!



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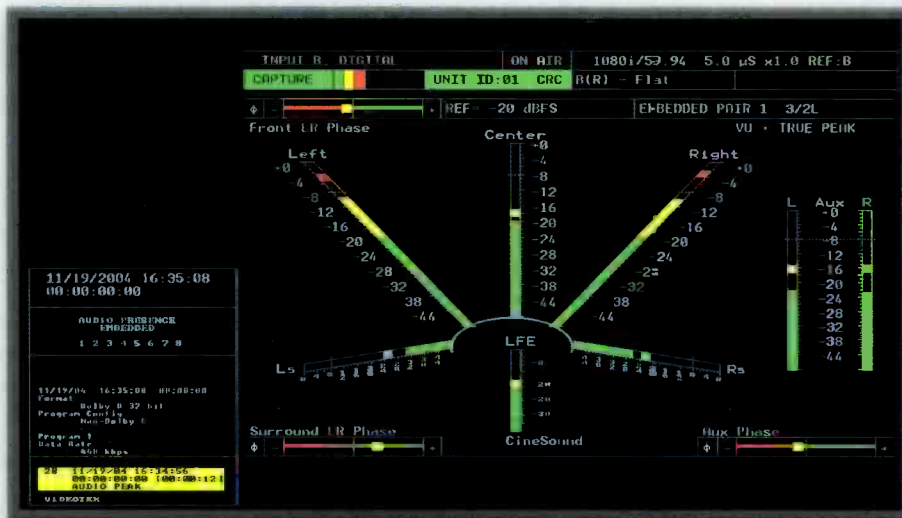
### Closed Caption Monitoring, Verification, and Alarms



Videotek's VTM Series is the industry's standard in monitoring High Definition 708 closed captions, and is used as a reference instrument by industry leading closed caption service providers. EIA-608 and 708 closed captions (including XDS) are completely verified using the on screen display and alarms.

- EIA 608 Closed Captions
- EIA 708 Closed Captions
- Customizable XDS Display
- Selectable Caption Size
- Simultaneous Picture and Waveform Display of Closed Captions

### CineSound®, The Industry Reference for Surround Sound Monitoring



The Videotek patented CineSound® display provides an intuitive view of multi-channel audio sources. Dolby® Digital, Dolby® Surround EX™, Dolby® E technologies, and Pro Logic I formatted audio are decoded and displayed on screen in a full range of meter ballistics and scales. Additional on screen indications include: audio presence, Metadata table display, signal format, and a comprehensive set of audio alarms.

- Dolby® E, Dolby® Digital, Surround EX™, and Pro Logic I Monitoring
- CineSound Display Indicates Exact Level of Each Channel
- Metadata Display
- Simultaneous Lt/Rt, Lo/Ro, or Auxiliary Level Monitoring
- Phase Monitoring of L/R, Ls/Rs, and Stereo Pair
- Analog Output of Decoded Source

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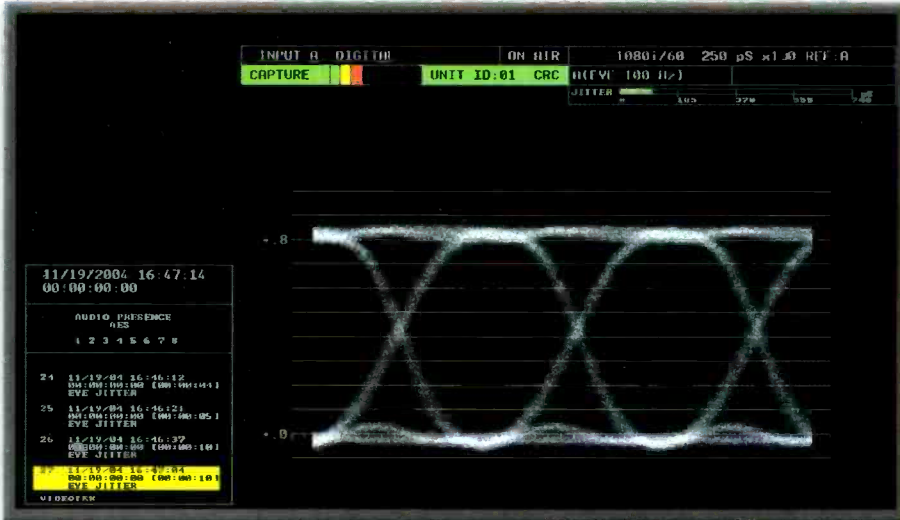
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ISO-9001 Certified



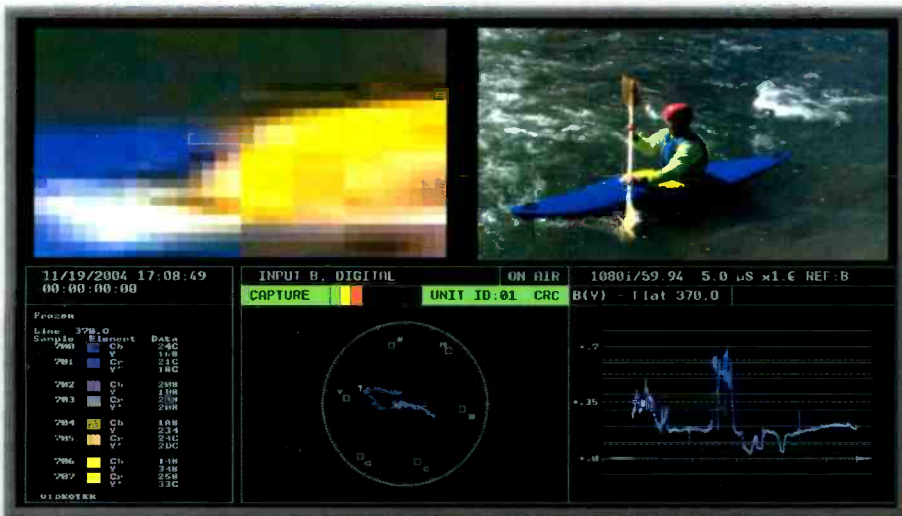
## Eye Pattern for Exact SDI Signal Compliance Measurements



Videotek's linear, high speed input amplifier provides the most accurate high definition digital signal display available. The eye pattern display is used to analyze the serial bit stream amplitude, rise time, jitter and signal irregularities. Overlay, 10 eye (SD) and 20 eye (HD) sweep modes are available for evaluating peak jitter (correlated and un-correlated).

- HD/SD Eye Pattern
- Jitter Meter
- 10Hz, 100Hz, and 1KHz Filters

## Exclusive High Definition Pixel Analysis



Videotek's data capture/pixel analyzer is the most powerful image evaluation tool on the market today. This display and analysis mode provides all the information needed to analyze pixel data values of the high definition image. The upper left portion of the display provides a magnified view of the area surrounding the pixel cursor. The waveform/vector displays show the pertinent information of the selected pixel's video line.

- Pixel by Pixel Analysis
- Magnified View On Screen
- Analyze a Stored Frame of HD or SD Video
- Alarm Trigger with Frame Store
- Automatic Cursor Positioner Locates Alarmed Pixels
- 8H, 8V, or 2H Pixel Cursors

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# Advanced Features and Functions for All Environments

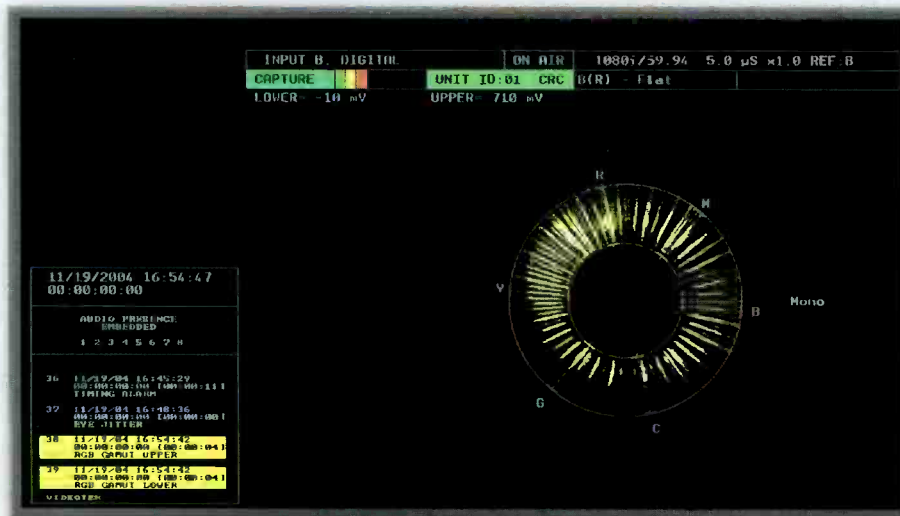
## Precision Relative Timing Display and Measurement



Videotek's precise relative timing display and measurement resolves system timing differences to within a digital video sample period. The instrument's accurate and calibrated timing display offers an innovative and simple way to determine and adjust relative timing differences between any two inputs. Videotek's On Screen Monitors are the first in the industry to provide an intuitive display designed specifically for system timing.

- Analog vs. Digital
- Digital vs. Digital
- Any Source vs. Any Source
- Any Source vs. Reference
- Digital Readout Provides Exact Measurement
- Color Coded Cursors Depict Timing Status

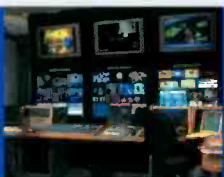
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Videotek's patented gamut display is used for pinpointing color space errors. A familiar vector presentation uses two concentric variable rings to indicate the upper and lower range limits set by the user. The color of the graticule ring represents gamut status. This display takes the guess work out of determining the cause of a gamut alarm by mapping the exact vector position (color) of the illegal video data.

- RGB Gamut
- Composite Gamut
- Separate Luma Indicator

**Worldwide Applications in Broadcast, Cable, Industrial, and Production Environments**



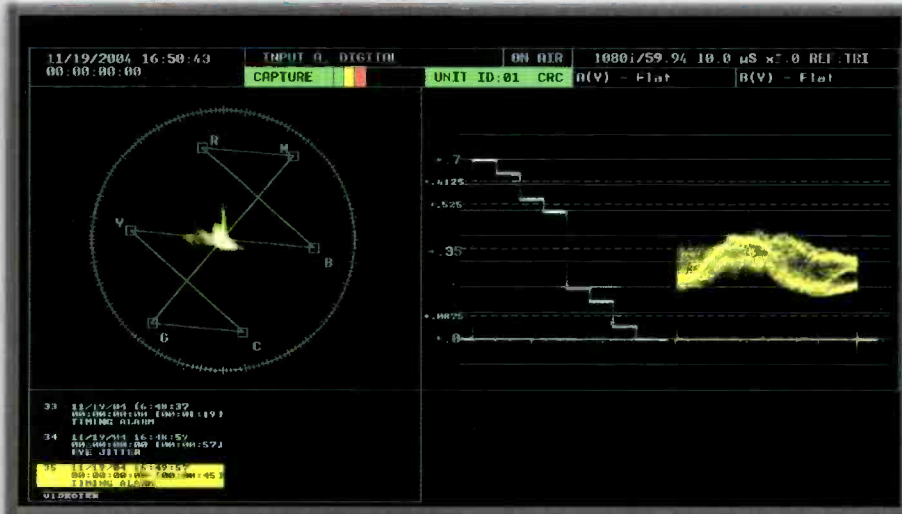


## Full Range of Audio Options



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- 2, 4, 6, 8 Bar Graphs
- Channel Mapping

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- Telecine Applications
- Waveform/Vector
- A/B Parade and Overlay
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## Control and System Integration

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- Optional Remote Control Panel
- PS-2 Mouse Control
- Keyboard Control
- GPI Inputs and Outputs
- XGA/DVI Inputs and Outputs
- Embedded SNMP Agent
- Serial, Ethernet, TCP/IP Communications



For more information on Videotek's advanced VTM family and other state-of-the-art offerings, please visit our web site at: [www.videotek.com](http://www.videotek.com)



# About Leitch's Videotek Division

Videotek, a division of Leitch Technology Corporation, is a leading manufacturer of high definition test and measurement equipment, 8VSB demodulators, routing switchers, legalizers, color correctors, and related equipment for the professional video and television broadcast markets. Videotek is committed to zero defects and is ISO-9001 certified. As a part of Leitch Technology Corporation, Videotek plays a significant role in enabling operations of any size to achieve a truly Integrated Content Environment. Leitch is the most trusted name for increasing performance and productivity through solutions that streamline workflow of content production, processing, transmission and management. With a sole focus on and commitment to the television industry, Leitch provides unparalleled customer support.

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US Patents 6,069,607, 6,532,024 and 6,828,981

UK Patent 2,330,475 - Other US and International Patents Pending



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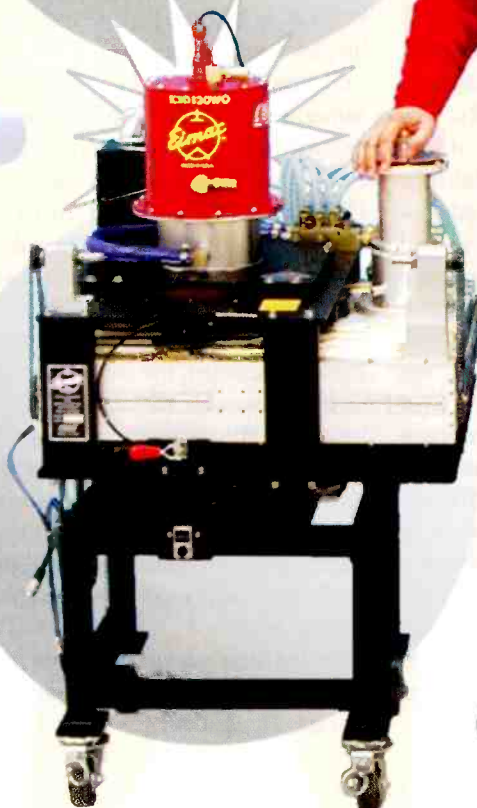
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## Video servers

BY JOHN LUFF

**M**y dictionary tells me that a server is “Computer science: A file server.” That’s not very illuminating, unless you think about it a bit deeper. Video servers erupted onto the media landscape as computers whose function was to playback video on command (not on demand — that’s a different context for another time). They were simple beasts, with puny disk drives we once thought were huge. They produced acceptable pictures using motion JPEG at something like a whopping 24Mb/s. Yikes! A 2GB disk and 24Mb/s? Not only that, they were pretty simple devices responding to commands intended for VTRs. The dialect included no selection of clip name, nor trick mode playback initially.

As in all things, the bleeding edge of technology rapidly gives way to real products when the market thinks the engineers and marketers were onto something important. Ghandi said, “Imitation is the sincerest flattery.” We certainly had lots of flattery, and quickly. Servers sprang up faster than spring flowers. Many used the same components and simply different hosts. Some tweaked the codecs to achieve better performance. Within a few years, MPEG-2 codecs allowed significant improvements in storage density, and over time the standard record rate dropped by 50 percent, and more, for good quality.

But in the age of TiVo, what is a server for professional use? After all, I can record a couple hundred hours of HD and SD content and browse the metadata using a remote from my couch. And like it or not, the line between a “video server” and home recording technology is exceedingly thin. What separates these tools, and where are we going?

As in all things, it is not simple. Though consumer electronics are remarkably reliable and sophisticated, the line between these different genres is pretty long. Professional servers in general have intelligent remote control capability these days, and they usually respond to complex command sets that allow an automation system (newsroom or play to air automation) to send the name of a clip and a command to cue, park and play on command, with frame accuracy. Consumer boxes don’t need frame-accurate results. The operative rule might be, “Just do it before I get perturbed and hit play a second time.”

Quality is important in both, but consumer boxes are not perceived as bastions of quality maximization. When recording is integrated into a receiver for DBS services, the quality of the recording has precisely nothing to do with the local codec because the bit stream is simply parked on a disk and later played back verbatim. When a local broadcast signal is recorded, the codec need only exceed reasonable consumer standards long accepted, hopefully of quality higher than VHS. The consumer box must function reliably. The professional box must function precisely on cue, meet rigid interconnection signal standards, have high quality and be able to be upgraded.

Storage density is less important in the professional box than total quantity of storage. Though early servers held a few hours, today servers routinely have 200 hours or more and are much smaller in size than units of a few years ago, especially if storage time is equivalent.

Another distinguishing factor is the number of I/O channels. Simple servers and consumer boxes are generally one or two inputs and perhaps as many as two outputs. Commercial server solutions must be adaptable to

tens of outputs for many applications in a seamless whole that shares a common pool of storage, often in the hundreds or thousands of hours.

Consumer boxes don’t need to interface to archives, nearline storage subsystems, asset management software, newsroom automation systems and the like. Though likely to change in the near future, consumer boxes do



Equipment racks at WCPO-TV house the Omneon Spectrum media server system.

not need to take files in from other servers (compute and video servers) and handle playback. Professional applications must deal with commercial and content delivery systems that drop content on intermediate storage locally, including the movement of that content to playout systems.

And so it seems there are plenty of defining differences. Upon closer examination, however, we find the types of professional video servers growing and the differences becoming more of a continuum with consumer applications on one end, and large-scale playout systems on the other. In between, we find systems designed for point of sale applications, edge servers for broadcast networks, production



# Competitive Television Through Technology Summit

For Stations, Groups & Networks

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## A letter from the publishers

Implementing new technologies brings both solutions and challenges. The key for television executives is to maximize the former while minimizing the latter. Whether it is implementing DTV transmission, improving workflow or moving to an IT-based infrastructure, the challenges sometimes overshadow the hoped-for benefits. All the while, the competition gets tougher, the marketplace tighter and regulations more confusing.

*B&C* and *Broadcast Engineering* magazines have developed a series of exclusive seminars to help television executives cut through the clutter of noise and hype that so often surrounds new developments. The goal is to help these executives focus on identifying the unique solutions that may benefit their stations while at the same time reduce the risk of making incorrect technology choices.

This year's Competitive Television Summit is supported by leading equipment providers and attended by more than 100 television executives from leading facilities across the country. Attendees encounter a series of fast-paced and intensive sessions covering a variety of topics from IT conversion to strategies for implementing HD. Between the sessions, they have an ample opportunity to meet fellow executives so they can share ideas and thoughts on how our industry will meet the challenges that face us.

We hope this glimpse of the technology issues provides the information and encouragement you need to help make your enterprise more competitive.

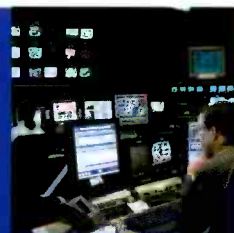
Regards,

Dennis Triola  
Group Publisher  
*Broadcast Engineering*

Chuck Bolckom  
Group Publisher  
*B&C*

## On the Cover

Producers at Time Warner Cable's NY1 24-hour cable news channel work on the daily rundown of the news from the producer pod. Photo courtesy of Avid Technology.



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# IT conversion: Real-world lessons to make the transition easier

**C**hange is never easy. Established ways of thinking, working and living are hard to release. Like a four-year-old clinging to a security blanket, we all take comfort in the soft, warm embrace of familiarity.

Yet, that familiarity comes with a price. It's impossible to grow, improve and respond to our changing circumstances if we cling too tightly to the things that are comfortable.

Signs are everywhere. Station groups and networks are fulfilling the graphics needs of all owned stations from a central graphics hub. News footage isn't footage at all. It consists of files that can be sent in real-time or at a snail's pace depending on the speed of an Internet connection, or files that reside on memory cards, optical disks and hard drives fed into a newsroom's

change does not have to be painful, and once it's complete, the rewards will far exceed the natural discomfort associated with giving up legacy work habits and obsolete technologies.

## Where to begin

Al Kovalick, Strategist with Pinnacle Systems, has some simple advice for stations as they begin their

conversion from traditional video production and distribution to building an IT infrastructure: "Don't boil the ocean."

According to Kovalick, stations should convert one workflow at a time and learn from the experience they gain from the effort. Start with ingest, playout, news or promo editing. Pay attention to "functionality and workflow from the perspective of the user and management needs, interoperability with legacy systems, reliability, IT network QoS (quality of service) and security," he said.

However, before replacing any video-based equipment and methods with an IT infrastructure, station executives should consider how the new approach will impact workflow. Omneon Video Networks VP of marketing Geoff Stedman said stations "should start by looking at their workflow and identifying areas of opportunity that would benefit most from moving content around as a file rather than video. Graphics is a natural



**Stations making the transition from traditional video operations to an IT-centric workflow should seek guidance from a certified IT consultant, according to David Schleifer, Avid Technology VP of broadcast and workgroups.**

The television industry today finds itself in an accelerated period of change. The touchstones used to give stations a sense of direction and comfort are crumbling. Unprecedented change is upon the business, and there's no turning back.

At networks, station groups and large market stations the conversion of a video-based work environment to an IT infrastructure and workflow is well advanced. The

digital workflow with the click of a mouse. Shot logs aren't logs, and tape labels aren't labels. Now it's metadata that sticks with the content forever so everyone in the station can find that content when it's needed.

As medium and small market stations contemplate the sweeping nature of this change, they must realize that change is necessary to remain competitive. Fortunately, that

place to start because it lends itself to file-based workflows.”

Omneon Video Networks VP of product marketing Paul Turner added, “Graphics offer a well-bounded file size where customers can step in first with an island of technology. It’s the place many users focus first because it does not need to accommodate the large file sizes of moving video.”

The concept of where to start the IT conversion seems a little strange to Thomson director of strategic accounts Bruce Lane because as he sees it, most stations have already begun. “Fifteen or 20 years ago, TV stations had typewriters and computers and then networked their

start? A capital budget is based on equipment that needs to be replaced where you can get return on investment,” said Lane.

Glen Sakata, senior director of sales broadcast, satellite, telco and government at Harmonic agreed. Knowledge, training and expertise in IT are keys to a successful start. But don’t think it has to come from in-house.

“Based on our customers’ experiences, the number one place to start is either hiring expertise in-house or consultative services before embarking in the IT space,” he said.

“Typically, creating an island like news, or go-to-air, or the back office is a natural first step phase, but

well worth the effort,” he said. “The benefits are huge and it delivers a better system in the end.”

## How to proceed

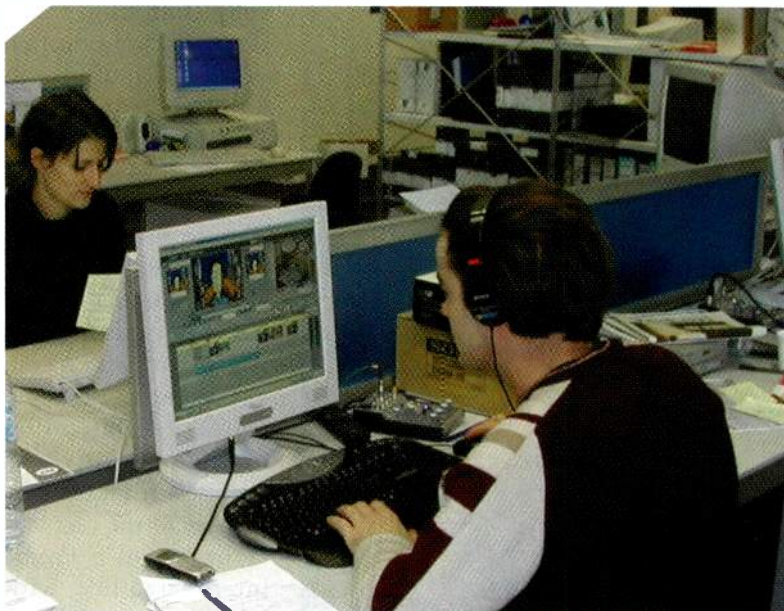
The next step on the road to a station or group-wide IT infrastructure is tying these IT islands together. “That’s a big job after the fact,” said Omneon’s Stedman. “It’s really smart to think about how they (stations) are going to want to interconnect these parts and even share information between stations from the beginning.”

Start by focusing on the core network, advised Thomson’s Lane. “You need to think about purchasing the best and fastest IT infrastructure you can. Lay in the best cables you can because the delta in price between the best and second (best) might not be significant, especially if you consider manpower and labor. The same is true for switches and routers.”

He continued, saying “What I’ve found and done in working with customers is to take a look at their immediate needs and also look at what their future desires would be and sometimes help them with (shaping their) future desire because we are exposed to what they might not see.”

However, there’s a danger in planning too far out, cautioned Harmonic’s Sakata. “One important point is planning for the near term versus the long term,” he said. “You want to buy and build something that is affordable but extensible. If you aim too high or hire a consultant who brings in a team of people from Cisco, you end up underutilizing the system for years. And by time you do use it to capacity, the same system would have dropped in price considerably.”

“Make sure you have what you need with short-term room for growth. To expand substantially in the long run will require a new system,” added Sakata.



**A properly configured IT infrastructure gives a station’s reporters all the tools needed to write a story, edit video and audio, and create voiceovers from their desktops.**

computers,” he said. “They built an infrastructure in the television station. They need to expand on that infrastructure. What they really need is IT training or to hire someone with IT expertise. That is what they need at the core because (they need someone who knows that) Gigabit Ethernet is not more costly than 10Base-T. It’s not going to hurt you, but only protect you in the future,” he said.

“And where exactly should they

tying it all together is another thing,” according to Avid Technology VP of broadcast and workgroups David Schleifer. The worst thing to do is to start building IT islands without the expertise to understand how it all will combine itself eventually. “Taking the time to contemplate the conversion with guidance from a certified IT consultant and cautiously converting a single workflow to learn from that experience are keys to ultimate success, which is



## Fear and loathing

Resistance to converting to an IT infrastructure appears to come from two sources: the urge to cast a wary eye at new technology that's not video at its heart, and the fear that relying on computers, networks and files for the bread and butter is an imprudent business decision in a world filled with viruses, worms and hackers.

"What's the most feared part?" asked Thomson's Lane. "Just the word 'IT.' To a broadcast person who may not have a networking background, IT is like that old movie 'It,'" he said.

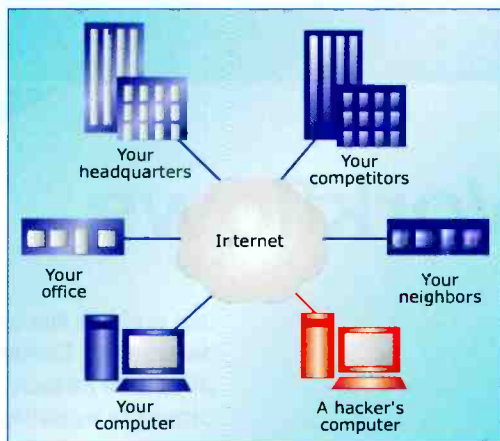
"You overcome fear with education, magazines, books, courses, new technology in trade magazines presented in a non-scary way. Or, through vendor publications," said Lane.

"There is a SMPTE, SBE or IEEE organization within their (broadcast engineers') town, and the attendance is much smaller than you would have hoped for.... I highly recommend they take advantage of those opportunities, and check out local colleges and nighttime educational opportunities. There is a plethora of IT courses all the way up to network certification," he said.

At larger market stations, station groups and networks, acceptance of IT has occurred, said Pinnacle Systems' Kovalick. "It's harder for small market stations to do it because they don't have the experience," he said. "They're not as comfortable on making a buying decision because they don't have experience. Smaller stations don't have that collective in-

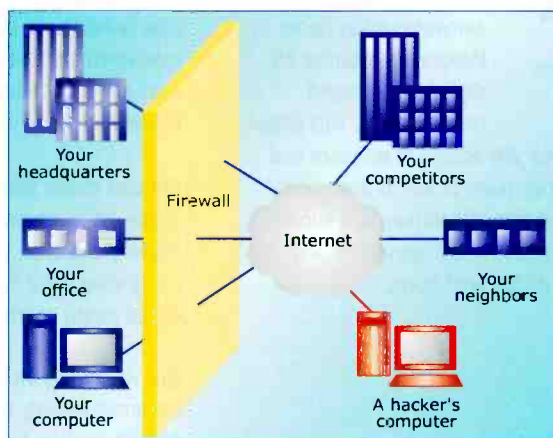
telligence (about IT), yet."

But at larger broadcast operations, "there's always an IT person there," he said. "Many stations have savvy IT people, and some are in



**Some broadcasters fear the conversion to IT because they believe it will make mission-critical systems vulnerable to Internet nastiness like viruses and hackers. (Diagrams courtesy of Omneon Video Networks.)**

charge of broadcasting operations," said Kovalick. "Smart people understand they must be retrained, and not treat IT with fear and loathing. It's an opportunity. Change requires managing it. How do you educate the workforce so they fit into a new organization and



**The first level of defense from Internet troublemakers is a properly-configured firewall.**

feel comfortable?" he asked.

Education can go along way towards allaying fears about viruses and hackers. "The number one topic is network security and virus pro-

tection," said Omneon's Turner. "That is a very reasonable question. Immediately, it's the objection that people articulate for not moving to IT. And the reality is that a well-provisioned and properly set-up and maintained network can be as safe as any operation in the television station," he said.

Broadcasters often fail to appreciate that concern over network security is not unique to the television industry. Hospitals, banks, large corporations and even Wall Street have successfully taken measures to protect mission-critical operations from cyber attacks. "This is not an issue that is new to the world," said Turner.

Omneon's Stedman said, "Networking and networking security are top of mind. There are two items on the things-to-fear list: losing assets, that is content disappearing or degrading, and people breaking in. Standard IT practices — protected storage and anti virus and Internet security — are well-honed for dealing with many of the network concerns."

Part of learning to live with new IT threats and coming to appreciate that they can be dealt with comes from recognizing that the traditional video-based workflow is also vulnerable to security issues and that industry best practices and work rules have diminished them to the point that few in the industry are aware of their potential exposure.

"I mean physical security in terms of ... putting something on air that shouldn't be there," said Turner. "Every broadcaster has a master control center, and there is an emergency VTR or disc player. If ev-

erything else fails, the master control operator can slam a tape in and play out something to keep the station on the air. And we rely on that

*(Continued on page S8)*



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Making the media content management process intuitive and highly affordable is a key component of the dMAX Initiative. In fact, we've already deployed Grass Valley asset-management technology at nearly 30 sites worldwide for a variety of workflows from news environments to large-scale asset management systems. And later this year we'll launch a powerful new Grass Valley platform of software-based workflow-management applications that will give you the most cost-effective means available to carefully manage digital audio and video clips.

### **We can make your workflows work better.**

Today, no company touches more points of today's digital production workflows or has more experience integrating them than Thomson. And that includes digital news, sports, and feature production.

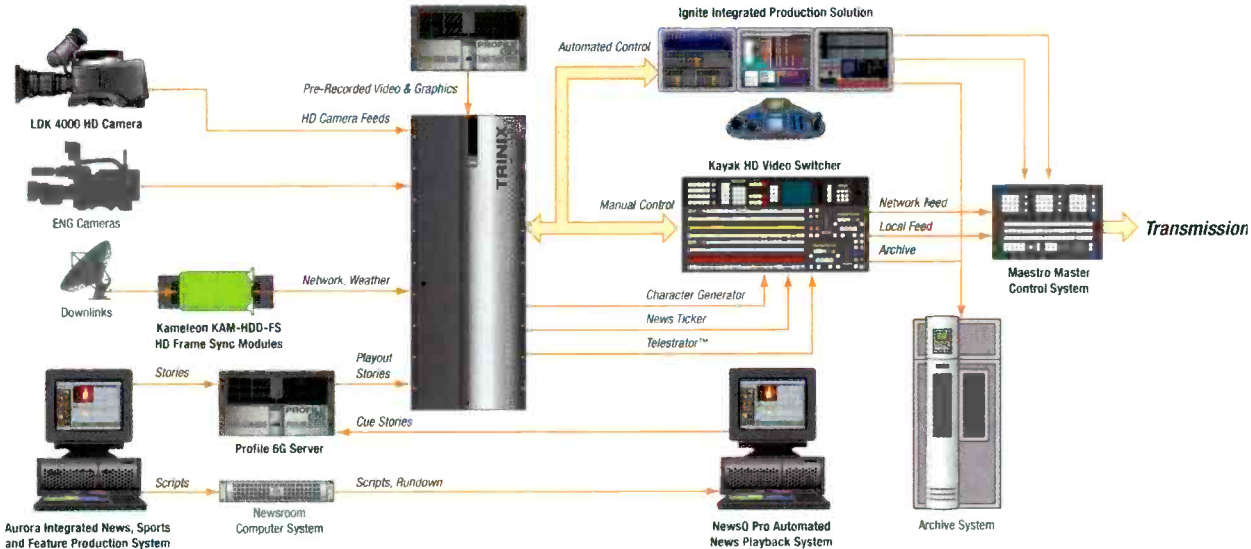
Our workflows include applications for ingest, browse, nonlinear editing, media storage, and content playback, as well as links to integrated production solutions.

In fact, our new Aurora™ software suite is perfectly tuned to support news, sports, and feature production. You can configure it with ingest, nonlinear editing, and/or playlist management modules. And you can





**Grass Valley News, Sports, and Feature Production Workflow**



We offer a workflow that scale from news, sports, and feature production to high-end, multi-format mobile production including event/sports coverage. In addition to our new Aurora software suite and Ignite integrated production solutions, it features Grass Valley cameras, switchers, routers, servers, modular products, and archive systems.

specify floating licenses for each module to match your workflow requirements and available labor pools.

The scalable design of the Aurora suite supports everything from MPEG-1 and Windows Media 9 formats for low-resolution proxy files to SD and HD video. It's also integrated with our new Grass Valley Ignite™ integrated production solutions, which offer the first and most complete link between the newsroom and the control room.

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- Radio Nord, Quebec
- RAI, Italy
- France 3, France
- European parliament, Belgium
- EBU, Geneva
- SBS, Korea
- TV Asahi, Japan
- 9 Network Adelaide, Australia
- Globosat, Brazil

(Continued from page S5)  
operator to not put in something that should not go to air," he said. "In other words, there is a workflow we have currently that from the outside looks to be a massive security issue. But we put mea-

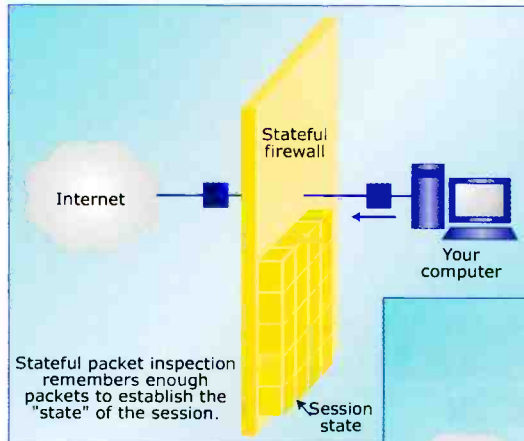
that things available to the facility LAN will also be available to the equipment LAN. In this case, I think of www standing for the Wild, Wild West."

Lane went on to say, "We don't want that getting into our Kalypso (production switcher), but journalists need access to the Internet to research stories, and they need access to the production rundown list, and that drives our playout server. So, we need to put the proper protection be-

Think of a VPN as a way to establish secure communications via public telecommunications means, such as the Internet, between a remote location and the station's equipment LAN. Perhaps the remote location is the home of a station engineer or IT manager. It could also be the offices of the IT vendor that installed the station's infrastructure. The vendor can use the VPN to diagnose problems and update software without sending a technician to the station.

Security is maintained through certain protocols that allow only encrypted data, which the network recognizes as being properly encrypted for that specific VPN, to pass between the remote location and the station's LAN.

"Diagnostics does not need to be a weak point," said Thomson's Lane. "Through

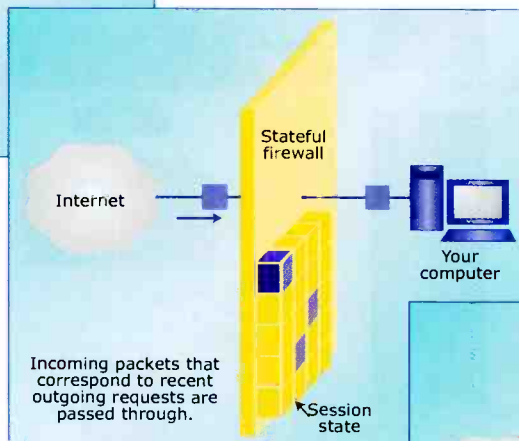


**Stateful firewalls remember the "state" of the session to block unsolicited packets from a station's equipment LAN.**

asures in place, such as hiring practices, to protect against that."

An IT infrastructure can also have specific measures put in place to protect a station from virus attacks and hackers. "Develop a security policy for the entire A/V facility," said Pinnacle System's Kovalick. "Follow the lead of the IT department. Ask any supplying vendors about the security features of their products."

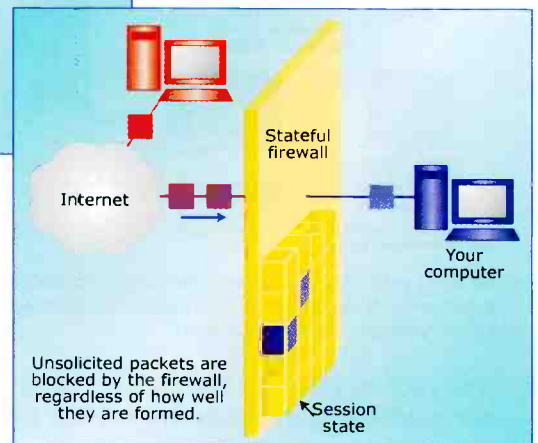
Take advantage of standard practices and tools, such as using firewalls, virus protection, filtering software and intrusion detection software. Additionally, keep the station's general purpose local area network (LAN), which is used for tasks like e-mail, as separate as possible from the equipment LAN. "The equipment LAN should not have access to all that's on the facility LAN," explained Thomson's Lane. "Connection can be limited by port access, directional access and communication-type access, and that will limit the possibility



tween the equipment LAN and the facility LAN to eliminate the type of communication that goes down from the facility LAN to the equipment LAN and vice versa."

IT infrastructure vulnerability from remote diagnostics frequently raises concerns as stations contemplate modernizing their workflow, but measures are available to limit or even eliminate exposure to unwanted access.

"Remote diagnostics are a necessary evil," said Pinnacle Systems' Kovalick. "If the proper virtual private network (VPN) and blocking is established between a remote vendor or monitoring entity, there should be no security risk. Pinnacle supports remote diagnostics on many of our products, either via VPN or dial up modem."



VPNs and secure access ports, diagnostics can be done internally in a facility. In our case, that's NetCentral diagnostics to all of our equipment and to other equipment and other devices. That can be internal to the facility and through secure access give the opportunity for remote diagnosis and monitoring across a secure network. To further ensure that network and that remote access remains secure, that port can be opened and closed or disconnected when customers don't want to provide us or anyone else



access. It's open only when required, limiting the opportunity and time for unwanted access."

## Surprise party

While consultants, vendors and station IT managers and engineers attempt to have a thorough understanding of their IT infrastructure, stations inevitably experience a few surprises when transforming their operations to an IT-based workflow.

"There are two kinds of products that are purchased," explained Avid Technology's Schleifer. "One is where you know everything about the product before you buy. You bought a brick and brought it home. You knew it would be rectangular because it's a brick. The other kind of purchase is where you get the product home and start learning about it. Everyone who has bought our system has discovered more about it when they begin using it."

Stations that haven't fully considered the ramifications of converting to an IT infrastructure may experience a few surprises along the way. According to Pinnacle Systems' Kovalick, software upgrades can be troublesome surprises. "At times, this needs to be done as soon

station's equipment network will require. Reworking a network after the fact can be costly because of duplicating some expenditures that would have been unnecessary the second time around with the proper planning.

A trap that stations often fall into leading to rework is the failure to recognize up front the benefit of extending the reach of the IT in-

and the bandwidth needed to move high bit rate files around in a production or enterprise environment. You don't want 50Mb/s files flying up and down a network."

## Fade to black

Revolutionary changes in the workflow at larger stations, groups and networks are ushering in an era of greater efficiency and in-

*"There are the benefits of riding a much larger market, the prices of components are down and Moore's Law is up..."*

*- David Schleifer, Avid Technology*



frastructure to the organization's back office. While doing so offers the station greater productivity at all levels of its operation, doing so after the fact means capital resources were spent inappropriately to begin with — a surprise that could have been avoided with proper initial planning.

"The classic workflow is anyone with a business need should have access to assets, graphics or whatever," said Omneon's Turner. "There are sound business reasons for a lot of people to look at these assets. They may not all need to change or playout the content, but a lot of people need to look at it. When you do that, the size of the network grows."

Turner went on to say, "There are generally two networks at a television station: the enterprise-wide network for e-mail and Internet, and there is the broadcast side. There are gateways between the two. The hidden costs are how large that network will grow

creased productivity. However, those changes are requiring almost everyone from the chief engineer to the maintenance tech, the news director to the master control room operator, to leave their comfort zone and dive headlong into IT.

At small- and medium-sized stations, where there may be fewer resources to spend on consultants and less in-house expertise, workflow transformation and IT technology may seem better left alone.

However, given the competitive realities of today's business climate, over-the-air television is one of a growing number of content providers, where clinging to such short-term comforts could lead to long-term disaster.

The one thing separating local television stations from the vast majority of these emerging distribution channels is the ability to originate local programming that's relevant to home viewers on a consistent, timely basis.

Seen in this light, the IT infrastructure can free underused talent still trapped in the morass of videotape, to do what TV stations do best: serve their communities with local content. ■



**Convert one operation, such as news, to an IT infrastructure to gain experience, advises Pinnacle Fellow Al Kovalick.**

as possible, and this is not easy when running a 24/7 facility."

Another potential pitfall is underestimating the bandwidth a



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# New distribution opportunities for TV stations: What's the payoff?



**J**ust for a moment, forget programming. Think content. For just a few seconds, ignore your main broadcast channel. Think distribution. Leave TVs behind; focus on flat panel monitors — from the big plasmas hanging on the wall to the tiny color LCD on cell phone displays.

Give yourself a moment to contemplate all of the new display and delivery options bubbling up in the consumer marketplace, and you begin to catch a glimpse of the challenges and opportunities facing television broadcasters at the beginning of the 21<sup>st</sup> century.

Consider a few facts:

- **USDTV:** In September 2004, USDTV, an over-the-air digital programming distributor, announced it had gained its 10,000<sup>th</sup> customer. The service allows broadcasters in select cities to pool their unused DTV spectrum to offer cable channels via broadcast to subscribers with special set-top boxes.

- **WRAL:** In December 2004, WRAL in Raleigh, NC, teamed up with Sprint PCS to become the first local television station in the country to offer up-to-the-minute news, traffic and weather to cell phone customers.

- **DVB-H:** In October 2004, Crown Castle and Nokia began a pilot test in Pittsburgh, PA, of the Digital Video Broadcasting-Handheld (DVB-H) standard for delivery of programming to special handsets.

- **MPEG-4 AVC H.264 and Windows Media 9 Video:** These advance compression techniques are gaining momentum in a variety of applications,

offering two-times the improvement in compression of SD material and three-times the improvement in HD compression when compared to MPEG-2.

- **SK Telecom's TU Media in South Korea:** In January, the telecommunications company announced the launch of a trial implementation of

use their existing distribution resources, it will be impossible to cash in unless the right workflow and infrastructure are in place.

"Distribution opens an exciting area ...," said David Schleifer, Avid Technology VP of broadcast and workgroups. "What are they? I can't tell you for sure. 3G phone is likely

*"You can't afford the 200 people CNN needs to do a Web site, and neither could they."*

*- David Schleifer, Avid Technology*



the Digital Multimedia Broadcasting (DMB) standard with the delivery of three video channels via satellite to special cell phones. The number of video channels will grow to more than a dozen by spring.

These developments and many others illustrate the radical changes in technological development and implementation that are transforming the business of local television broadcasting. Never before have so many distribution alternatives been available to broadcasters, and never before have local broadcasters faced the prospect of using their scarce capital resources to produce and package content for so many diverse distribution channels.

While the situation presents broadcasters with unprecedented opportunities to better brand themselves in a cluttered media world, generate added revenue and better

to be one. The Web is coming back. Web advertising is going up, and there are mobile devices, wireless PDAs. All of these are avenues and channels to deliver content. Our challenge is to allow our customers to chase these affordably, quickly and nimbly, and I think we have done that. Take the Web. In the past it would have taken a team of people do a Web site. You can't afford the 200 people CNN needs to do a Web site, and neither could they."

Schleifer continued, "Gannett's KUSA in Denver is a good example. We have gone in and worked with them to streamline their Web site, and I can watch it formatted for my phone. They are basically running that with one-and-a-half people per shift to get out content for the Web. There's integration with the computer system and the editing system. They have a lot of video out there



and are refreshing it. If they want to add this broadband or other distribution channel, they have a method to do so.”

## New approaches

At the core of many of the new distribution alternatives facing broadcasters is the fact that programming is quickly becoming digital files rather than video. That transformation is ushering in drastic changes in areas like news production and content playout at the station. But beyond what goes on inside the station, this change means broadcasters are no longer solely tied to offering a constant stream of programming from their antenna and to their cable headend. They can distribute files as if they were some giant repository of news, entertainment and information.

“In the past, with a real-time distribution network, it’s a real-time stream, and there has to be a sender and receiver for that distribution to have done any good,” said Geoff Stedman, Omneon Video Networks VP of marketing. “There’s no value if there is no receiver there.

“One of the things the IT environment does is change content from a stream into a file. Files can be sent unattended and wait to be retrieved. You can trickle a file, send it faster or slower than real time — for instance, using a file-based distribution network and the extra spectrum (in a DTV signal) to do datacasting. In other words, broadcasting a real-time stream and using the extra bandwidth to do datacasting to edge servers to build content so when a viewer needs it, it is there ready for local viewing. That is an interesting change with trickling versus sending in real time.”

Datacasting offers broadcasters a high degree of flexibility in serving up specialized content to niche markets. However, as of now it’s not achieved broad national success because such applications require those

who are interested in content to invest in special datacast receivers. That isn’t to say datacasting hasn’t succeeded in serving the needs of special constituencies. Since early 2004, KLCS has been doing just that for teachers and students in the Los Angeles County School District. (For in-depth coverage of this application, see last year’s Competitive Technology Supplement or visit [www.broadcastengineering.com](http://www.broadcastengineering.com) or [http://broadcastengineering.com/systems\\_design\\_integration/klcs-dtv/index.html](http://broadcastengineering.com/systems_design_integration/klcs-dtv/index.html).) But that just scratches the surface of the impact video as digital content is having.

“Stations make bottom line revenue from advertising to a local audience,” said Glen Sakata, Harmonic senior director of sales - broadcast, satellite, telco and government. In the end, it’s about reaching the widest audience they can. The widest audience is reached through multiple tier one providers like MSOs and DBS. Today, it’s cable and DBS, and tomorrow it’s telcos and new wireless technologies, such as DVB-H.”

He added, “All of these delivery systems have created segment wars

between competing architectures. There are different segments, wireless, telco and cable, and all are going after each other any way they can and pursuing any niche they can to deliver services to the consumer, whether it’s video, voice or data. While national content is available to virtually all providers, the competition is about greater access to persuasive local content, especially in HD.

The opportunity for broadcasters resides in packaging their content for traditional transmission use and these tier one service providers coming to market with next-generation delivery platforms.

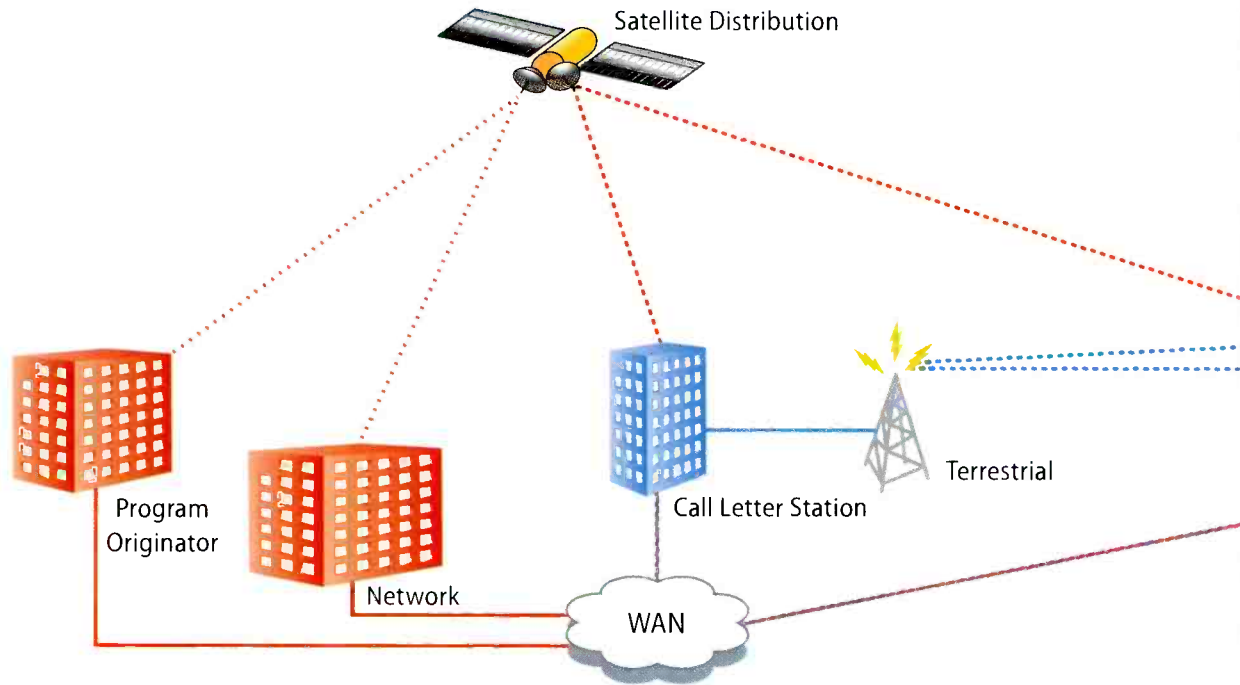
“Tier one service providers often are proclaimed by broadcasters as the enemy,” Sakata explained. “Regardless of how one views this relationship, they are not going away, nor are they reducing their service footprint. The service providers want content, though not necessarily packaged in the traditional broadcast television way. We believe that television stations may be best served by not looking at the service providers as a foe but rather a partner that wants and needs to sell their

*(Continued on page S16)*



**New delivery systems have created segment wars among wireless, telco and cable. Fortunately for broadcasters, they all want local content.**

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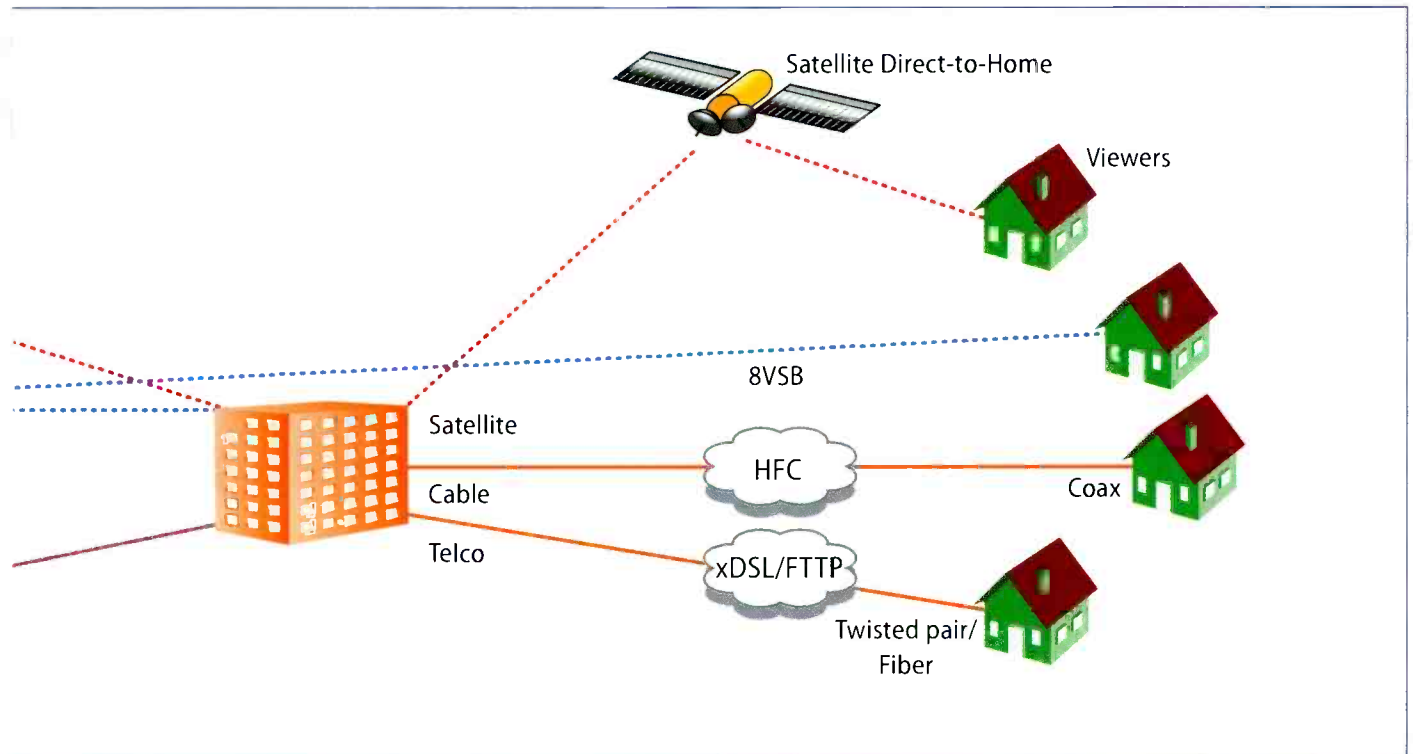
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(Continued from page S13)  
(the station's signals) product. Make it persuasive and package it as necessary for both to win."

## Riding the wave

Riding the wave of change in content distribution isn't simple. It requires forging new business relationships, potentially hard negotiations over how revenue will be divided, creative thinking and a willingness to experiment, adjust and move forward. In the view of Harmonic's Sakata, it requires another key element: the right people.

"Hire people who understand what works with alternative delivery methods from a production perspective as well as others who have business development expertise for those markets," he said.



**Powerful IT-centric workflow allows broadcasters to repackage content for alternate distribution while maintaining a lean workforce.**

"Sometimes it's an employee; sometimes it's a consultant.

"Many stations have their sales department do business development. But that's not the most effective way of doing it. Many times you need the experience of someone who comes from the target distri-

last year with GlobeCast and Scientific-Atlanta as an example," said Mike Antonovich, PanAmSat executive VP, global sales and marketing. "We provide the customer with the entire production chain for HD contribution of news, sports and event coverage all the way from en-

**"We provide the customer with the entire production chain for HD contribution of news, sports and event coverage ..."**

**— Mike Antonovich, PanAmSat**



bution market to help your management understand what works and what doesn't."

Technology and technology partnerships play an important role as well. Taking advantage of new IT infrastructures in news production is an important component of tailoring existing station content to the packaging requirements of new distribution avenues.

"Specifically about KUSA," said Avid's Schleifer, "they put in a Unity for News and infrastructure around it. All content are files. Taking DV files and getting them to the Web is a matter of converting files and metadata and fitting into the newsroom computer system. Directly from their system, they can publish to the Web. They make Web-ready-resolution without human intervention. They use INews and extra data not on-air. All of that flows out very, very easily. Their infrastructure investment allowed them to take that next step at a lower incremental cost."

The reach of technology partners can extend beyond the studio and into the field to help broadcasters take advantage of emerging distribution options, especially when it comes to areas like HD, where acquisition, backhaul and distribution resources are fledgling at stations.

"Look at the end-to-end special events HD service we put together

coding, production management, content aggregation, teleport facilities and distribution of the content on our HD neighborhood."

Technology partnerships can take some unexpected twists for broadcasters as well. U.S. Digital Television (USDTV) demonstrates that new business models can flourish with a little out-of-the-box thinking.

In March 2004, the company launched its low-priced alternative to cable in Salt Lake City, UT; Albuquerque, NM; and Las Vegas. The system is based on the idea that consumers want a less costly way of receiving cable programming than cable TV and that broadcasters would be willing to pool their excess digital channel transmission resources — those outside their flagship channel offering — to transmit pay programming and share in the revenue.

"The great thing about this effort is it exhibits a thoughtful, alternative use of utilizing existing spectrum to expand a local station's channel line-up and offers a second tier of multi-channel access," said Harmonic's Sakata. "This could be especially effective in with MDU and MTU — multiple dwelling units and multiple tenant units — where viewers have limited access to cable or DBS."

He continued, "The shortcoming has two sides. First is limited content



availability. One of DIRECTV's commercial successes is the Sunday Ticket. Also, cable MSOs such as Comcast have been trying to add to the amount of content they own, again with the potential of locking out USDTV's partners and viewers of attractive content.

"The second issue is the growth of HD from the networks through to the local stations. The remaining available bandwidth may push these ancillary channel lineups even further. Cable is not ignoring these new terrestrial services, using its drive to provide all-digital services. In some cases, the base set-top box is only \$5 a month, or even free. But it allows you to use the in-home coax system for additional TV sets and adds PPV capabilities. All digital reclaims enough bandwidth to add more HD and VOD without using more spectrum.

"Timing is everything, however, and USDTV has the potential to carve out a solid grassroots following if it can sign up the right partners soon. Mobile access is going to make this interesting. Sirius has announced its plans to deliver video and DVB-H trials are underway to deliver a wide suite of services to handheld devices. Service providers are not going to go away and people are going to have more and more ways to access entertainment and information."

## Positioning and competition

Emerging distribution alternatives offer stations new ways to build their brands and cement their presence in the local community. According to Avid Technology's Schleifer, the idea of using any of these means to augment a station's position in the market is so new that the field is wide open.

"Positioning, I think this is where there is no fixed formula," he said. "Gannett stations are interesting for us to look at. Cox and others have an opportunity to leverage print, broadcast, radio and the Web and move customers



**KESQ-TV in Palm Desert, CA, is transforming its existing facility into an all-digital environment with help from Avid's end-to-end digital broadcast production solutions.**

around. I think Gannett has done a very good job of that."

He added, "They are doing that by making it (their stations' content, which is being packaged for these new distribution alternatives) compelling. To win any of these distribution channels, you have to put effort in there. For a Web site to succeed, it can't be a late reflection of the newscast that people gloss over. Stations that exert editorial control over their Web site content as much as they do with their newscast generate more interest and eyeballs to the site."

The wide-open landscape that these new distribution alternatives present adds new dimensions to the competitive marketplace. The ramifications are so great that it's difficult to fathom in their entity, but one thing seems certain: Competition among companies providing new distribution services will spawn numerous opportunities for stations to repack their content.

"Stations compete against each other and a growing number of service providers," said Harmonic's Sakata. "We do know for a fact that the service providers we work with, like EchoStar and Comcast, all say the same thing: They need more local content. Service providers tell us all the time they want local content. We're hearing it from

all sorts of levels — from the CTO, CEO and business development level.

"People have downplayed the battle between cable, DBS and teleco carriers. But it's a very serious, billion dollar battle for the consumer's entertainment, communication and information revenue, and local content factors prominently in their basic business models."

As the relatively simple business model of a bygone era of television broadcasting recedes into a faded memory, station executives must grapple with how best to capitalize on new ways news, entertainment and information can reach their audience.

New technology that enhances work-flow so existing news and local programming can be repackaged to capture a slice of these new distribution opportunities is only a piece of the puzzle. To succeed fully in this transitory time, stations must begin rethinking their fundamental business model and seek out the expertise to win in areas they target.

"There are always different ways to achieve success when one fully understands and appreciates the end goals," said Harmonic's Sakata. "Today's television station, group or network needs to reassess those goals before developing the strategy to achieve them. The game has changed." ■

# IT: The promise versus the reality

Local television stations traditionally have required lots of people — some with highly specialized technical knowledge — to operate and maintain equipment, shoot, edit and produce content and control playback to air of network and locally originated news and entertainment programming.

The promise of an information technology (IT) infrastructure at TV stations is straightforward. When compared to business as usual, an IT-centric workflow will improve efficiencies, raise productivity, reduce maintenance and operating expenses and deliver a greater return on investment for station owners.

That broad brush characterization addresses the highlights of IT in TV, but what about the nitty-gritty benefits? How exactly do stations benefit? Where will they see the greatest rewards? Where are the roadblocks, and what would the ideal IT-centric workflow look like?

Those and similar questions motivate — and in some cases even haunt — station managers as they contemplate abandoning their existing video-based workflow in favor of an IT-infrastructure. The questions also provide a bit of a reality check for station management as it wrestles with a conversion that's underway.

## Productivity gains

An IT infrastructure lets stations put a new workflow in place that reduces redundant tasks. For instance, imagine that a remote crew shoots footage that has to make it to air as part of the 5 p.m. report. It's entirely possible that five or

more people, including the reporter, news editor, a producer, a promo editor and the news director, may all need that footage at the same time, long before the telecast. Rather than making multiple dubs of the master, an IT infrastructure can make that footage into a digital file that is available to everyone who needs it simultaneously — a tremendous boon to productivity.

“Productivity enhancements will occur with savings realized by faster than real-time movement of content, simultaneous multi-user access to content, and automated content processing,” said Pathfire product manager Jamie Meyer. “Enabling hands-free content-management solutions frees the workflow processes from the normal bottlenecks associated with operator-centric tasks.”

While certainly not all of those bottlenecks relate to news production, a good portion does. “Dalet believes the television newsroom is one of the biggest cost centers in modern communications that has yet to fully benefit from integrated IT workflows,” said company director of business development Tom McDonald. “Dalet News Suite brings newsroom computer (NCS), video production and studio playout control functions together into one enterprise-wide system. Underlying this is a single common database and content-agnostic asset manager. Users can

log-on anywhere on the network as a video editor, journalist, producer or tape operator and get the controls required to do their jobs.”

Additionally, maintenance is more efficient with an IT infrastructure. Costly VTR repair should dwindle as use of legacy tape machines steadily declines. Time, effort and expense spent on other video equipment can be eliminated or re-directed as extensive diagnostics run automatically in the background to detect and warn of problems before they occur.

“Maintenance certainly is one



**An IT-centric workflow will enhance productivity, freeing personnel for value-added tasks.**

(area),” explained Thomson director strategic accounts Bruce Lane. “The diagnostic capability into the video server, production switcher, routing switcher, news product all will give you a faster response time. The pro-active notification will reduce on-air errors. It will simplify the response. The diagnostics also give you a better view into what is going wrong.”

Pinnacle Systems strategist Al





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Kovalick summed up the benefits: “(They’ll be found in) networked workflow efficiencies, content tracking and usage, little pure video to test and maintain. General maintenance will be simplified and not A/V-specific for at least part of the A/V chain. Use of automated templates to simplify graphics creation and tighter integration between graphics, playout, traffic and automation will create a better end product.”

“The other thing is workflow in news, syndicated (program) and commercial playback. But by moving to an IT infrastructure and automation, you can get the news stories through the process faster,” said Kovalick.

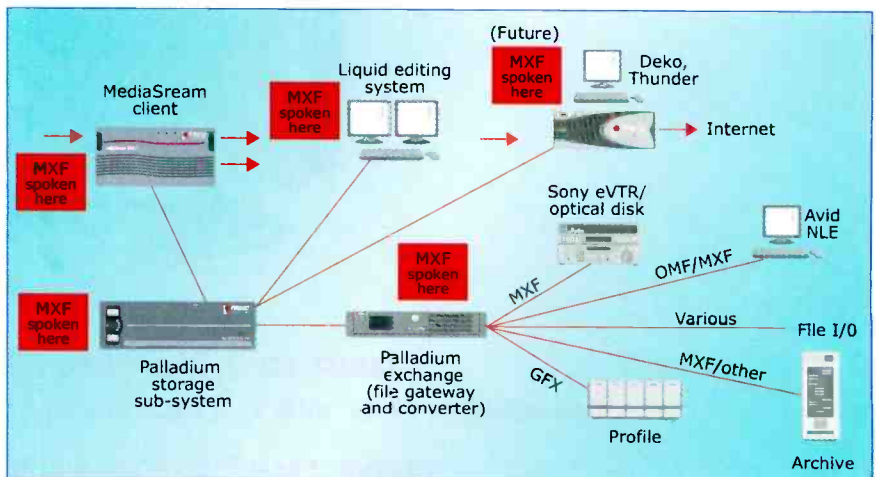
Stations that have established a few IT islands, such as a graphics production area to take advantage of file-based workflow efficiencies, can enjoy further benefits through well-planned and implemented expansion into other production and operations centers.

According to John Wadle, VP for technology at OmniBus Systems, the major benefits of increasing how much of broadcast operations rely on IT instead of traditional broadcast technology can be significant. In his words, “leveraging available IT technology for storage, distribution, monitoring and dis-

he said.

Another significant benefit is the availability of experienced personnel for IT-based operations, which “far exceeds the availability

accept? Are there compromises they can’t or shouldn’t make when converting a video-based operation to one that relies on IT technology? According to Pathfire’s



**IT-centric workflow improves productivity through seamless file exchange. This Pinnacle Systems illustration depicts one approach.**

of experienced broadcast engineers,” he added.

### Too much of a good thing

It isn’t surprising that television stations can benefit from IT-technology. After all, what major U.S. industry hasn’t? In the words of Pinnacle’s Kovalick, “Metcalf’s Law says the usefulness of a network goes up at the square of the num-

Meyer, there are.

Enabling IP-based infrastructures for data and content exchange is critical to the success of the station, he said. “However, implementation of this infrastructure without an adequate security plan will render the station useless. The move from video routing to data routing introduces new challenges that the station staff must proactively prepare for.”

Broadcasters will not accept an IT infrastructure design without adequate redundancy. “Any IT solution must allow for and plan for potential failure scenarios,” said Meyer. “Just like there was always a workaround if a tape deck jammed, a good IT solution must provide an easy-to-implement, ready-to-roll-out, workaround to ensure the ultimate product makes it to air. Redundancy and elimination of single points of failure are still extremely important design requirements.”

Compromise on the quality of IT components, such as routers, switches and cabling, is also unac-

**“Not all IT-based components are suitable for broadcast”**

**- Tom McDonald, Dalet**



tributed operations” allows stations to more widely take advantage of “a broad selection of proven tools in all of these areas.” Stations will benefit as IT technology continues to improve “independent of the market constraints on advances in broadcast-specific products,”

ber of nodes. This applies to internal A/V networks just as it does to the Web. So, internal IT/AV systems will benefit from this law as more devices are networked on a common system.”

Still, are there some changes broadcasters just aren’t willing to



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ceptable to broadcasters, explained Dalet's McDonald. "Not all IT-based components are suitable for broadcast," he said. "Broadcasters tempted by the ever-plunging costs of IT components must choose only components that meet the highest levels of performance and mission critical standards. Further, the last part of the production and delivery chain — video playout — still requires specialized video servers that provide ultimate reliability and quality of service."

Being mindful of their boundaries isn't a rationale for broadcasters to postpone what is sure to happen, according to OmniBus' Wadle. "The answer to this question (what's acceptable and unacceptable) is changing rapidly as stations realize the benefits and inevitability of IT-based broadcast solutions," he said. "Movement to IT technology on a broad scale is a question of 'when,' not 'if.' Late adopters of IT-based solutions will incur increasing costs to adapt conventional broadcast technology as IT-based content storage and distribution becomes widespread."

## Return on investment

The growing use of file-based, IT-infrastructure at stations and its resulting gains in efficiency and productivity present management with attractive opportunities to improve station profits and maximize return on investment.

Should they wield the ax, slashing staff and cutting costs? Should they redirect station personnel who have been under-used into more productive tasks that can generate additional revenue for the station?

"You have an option," explained Avid Technology VP of broadcast and workgroups David Schleifer. "You could put in a system and run with less staff, or you could put out better product or more product. The latter is the one most often chosen. People are trying to add a show and improve quality."

Schleifer continued, saying, "When we see the former (used), you usually see it with lean and mean startups. They (management) couldn't get on air with a certain (level of) staff, and they use technology to do that."

Thomson's Lane agreed. "The ultimate goal for broadcasters is obviously to get a return on invest-

stories with the least amount of staffing is the ultimate goal."

On a broader scale, IT enables systems within the station to be connected, which ultimately streamlines workflows. "This will shift operational staffing by system operators to support staffing needs by IT professionals," explained Pathfire's Meyer. "The operations



**News production can benefit from an IT infrastructure that makes video clips, audio and metadata available throughout the newsroom.**

ment to lower their capital and operational budgets, to get more profitable, or get to profitability," he said.

"To that end, the more efficient a facility is — be that through not having to QA several times, to be able ingest one time and play many or in the graphics department where they are used by everyone in the group — I see people moving to or desiring to get to that in a news environment where there are repositories or sharing of assets across a group of broadcasters."

Lane said, "I also see within a facility, a desire to be highly efficient with the workflow of producing news from ingest to edit to review to playout, doing that as efficiently as possible. Doing the most news

personnel can then be redeployed within the facility for other tasks. Overall, this represents significant savings to the station."

## Importance of standards

Whether it's a green-field installation at a new operation or an existing station that's taking an incremental approach to installing an IT infrastructure, central to success and benefiting from a digital file-based workflow is the interchange of files between various servers and devices on the network. Industry standards, such as MOS, AAF and MXF, grease the skids of the IT infrastructure. "In a mature industry, they (standards) are the lingua franca," said Avid's Schleifer. "At the earlier stages, they don't exist and



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companies have to innovate without them.”

Without them, broadcasters would be left with islands of proprietary IT technology requiring the anathema of efficiency — poorly used manpower — to transcode and physically move data or video from one island to another.

“In all cases,” said Pathfire’s Meyer “the protocols enable connectivity of dissimilar systems. In some cases, notably MOS, the systems use this as the core mechanism of interface. MOS is in a separate category from AAF and MXF. AAF and MXF are gaining traction to enable both existing and emerging solutions the ability to communicate. In addition, they are responsible for reducing barriers in the workflow of the stations, which, in the absence of these standards, would necessitate different interfaces that are contrary to the needs of the station.”

Meyer continued, saying, “For example, paper exchange for data entry and baseband video for the exchange of content. Clearly, these types of antiquated interfaces are counter to the productivity needs of the broadcast environment.”

According to OmniBus’ Wadle, the IT industry has been quick to seize upon these tools to facilitate growth. “The rapid evolution and acceptance of IT-based broadcast standards have been driven by the ease of implementation of these standards within broadcast products based on IT technology,” he said.

“For example, the wide acceptance of XML as a platform-independent data encoding method has resulted in an extensive availability of XML tools in virtually every computer operating system and development language. This in turn facilitates the support for XML-based broadcast protocols like MOS,” he continued.

“Likewise, the inevitability of packaged digital content distribu-

tion has accelerated the need for standards like AAF and MXF, while the IT tools available have enabled broad implementation of support for these standards.”

MXF had a remarkable year in 2004 with broad acceptance on the part of major IT vendors and major manufacturers of IT-based field acquisition solutions. Think of MXF as a digital wrapper that’s put around video, audio and graphics files as well as metadata. It allows files from one system to be recognized by another and facilitates interchange. However, it does not transcode, or convert file formats.

“The industry needs a standard methodology for transferring files between servers and different devices,” said Thomson’s Lane. “MXF does that, and we support it wholeheartedly.”

system may not be able use all that metadata, and may filter it out, but it is an industry standard,” said Lane.

As Dalet’s McDonald observed, “The reality is that systems need to perform many wrapper and media conversions for the foreseeable future and that should be built into the product. Having a solid integration platform for the many flavors of files and protocols that work today is still going to be a requirement.”

Regardless, the lack of transcoding won’t slow down the MXF train or the growth of IT stations, according to OmniBus Systems’ Wadle.

“Seamless file interchange (via standards like MXF) is certainly essential to the rapid acceptance and deployment of IT infrastructures at broadcast facilities,” he said. “While



### Standards grease the skids of the IT infrastructure at television stations by allowing file interchange and control.

“It can tell what is contained in a file and whether what it contains is useless on the far end and doesn’t get used. It doesn’t do file conversion. But it is an industry standard, so it is something all manufacturers can point to knowing this is MXF and know what to look for — how many video and audio tracks and where metadata are stored. A

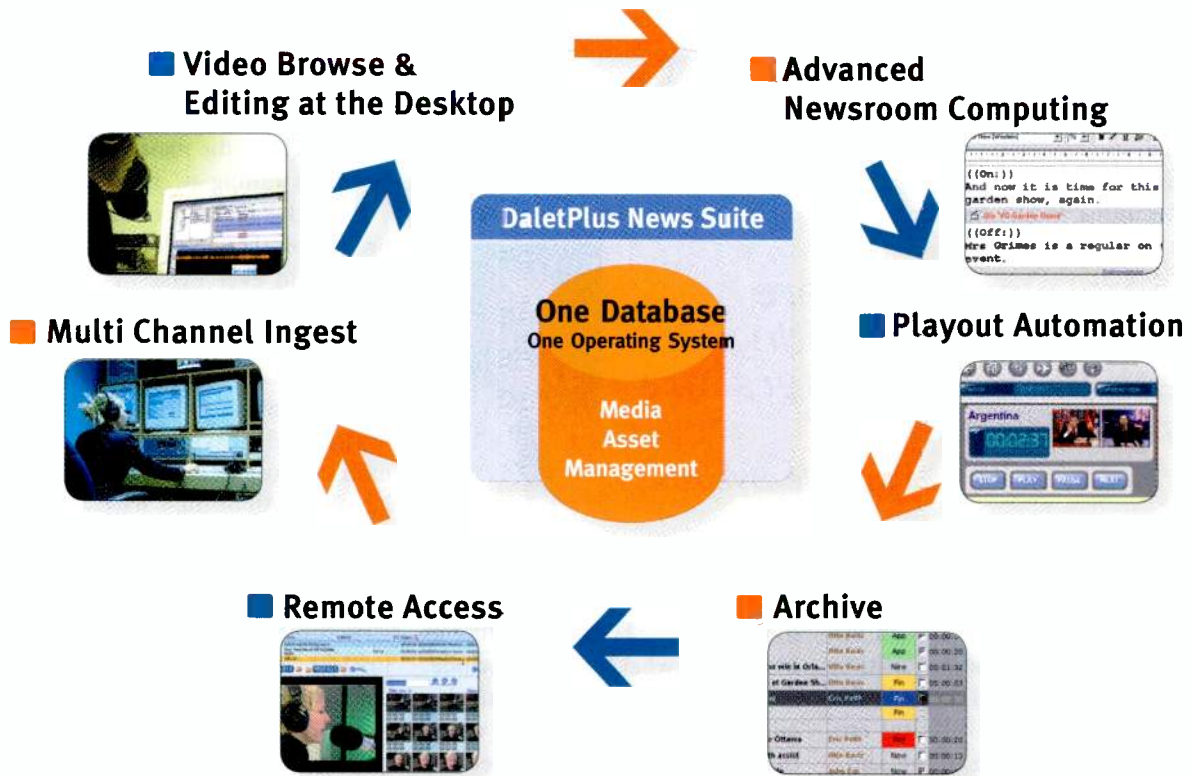
the dominance of IT in broadcasting is inevitable, the rate of acceptance and deployment of IT is greatly enhanced by these standards because they reduce the number of incompatible systems that must be integrated.”

Omneon Video Networks VP marketing Geoff Stedman put it simply: “(Standards and MXF are)



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absolutely essential. It's hard to imagine getting to the benefit of an IT workflow without the ability to seamlessly move material between systems."

### The ultimate workflow

Today, IT technology offers many advantages to stations, but what about tomorrow? What will the ultimate implementation of IT at television stations look like?

OmniBus' Wadle has some spe-

functions entirely in software to produce an IP-based channel stream," he said. "As a final step in the origination (playout) process, the channel stream would be converted to digital video (601) via a card in the mix server."

As for transmission, he sees a system in which digital video streams from the playout would be encoded and multiplexed for DTV as required and sent to the digital transmitter, cable system or

about numbers — actually a single number: one. "A workflow with ingest once and play many, that is a fundamental change to a TV station. Material comes in via some means, then it's stored on a central library system where all of the media assets exist and are simultaneously accessed as a production task -the idea of the media vault as it were. That's the major target everyone is aiming at," he said.

Pinnacle's Kovalick rejects the entire notion that an ultimate IT system could ever exist. "However, business needs should dictate the architecture needed to meet the required specs," he said.

"Non-real-time file transfer focus or streamed focus or real-time common storage focus or some hybrid?" he asked. "All of these have a sweet spot depending on workflow and business needs."

Whatever the ultimate IT infrastructure will be in the future is unclear. But one thing is certain: the use of IT technology to improve the workflow at television stations is taking hold. "IT plus AV is maturing," said Pinnacle's Kovalick. "It is still experiencing growing pains. Some workflows are very mature like news, editing and ingest-playout. Others are taking baby steps like live IP streaming."

Regardless, IT is a proven technology and early adopter of IT-centric broadcast operations can rely on the new workflow to gain competitive advantage. Unlike so many technologies that came before for television, IT technology is not something unique to broadcast. As such, stations managers can take advantage of economies of scale unlike anything that ever determined the price of video equipment. IT also offers another advantage.

"Unlike brand new technologies," said Omnibus' Wadle, "the leading edge of IT for broadcast need not be at the leading edge of IT overall. In other words, for broadcasters IT is not the 'bleeding edge.'" ■

*"Some workflows are very mature like news, editing and ingest-playout. Others are taking baby steps..."*

*- Al Kovalick, Pinnacle Systems*



cific ideas about that. "The ultimate digital workflow would be based on the elimination of all traditional broadcast technology between the point of initial content acquisition (ingest) and the final steps in the transmission chain (digital encoder/mux/transmitter)," he said.

"Most content would arrive via digital packages with embedded metadata. All content would be encoded via hardware or transcoded via software, as required, to content files in a compression format such as Windows Media or MPEG-4 and placed in a clip server based on IT mass storage (e.g. NAS). Associated metadata would be placed in an IT server-based database, such as SQL Server," said Wadle.

For playback, Wadle envisions a system based entirely on IT servers and clients connected via gigabit Ethernet that would manage digital content files and associated metadata, communicate with traffic via Web services and originate (play) scheduled content from IT storage.

"One or more 'play servers' would decode and stream scheduled content files as IP to a 'mix server' for each channel providing graphics overlays and video mix

DBS provider.

Dalet's McDonald is as clear about what he doesn't want to see in the ultimate IT infrastructure as he is about what it should include. "No tapes," he said. It should include fast retrieval of any video from today's footage and feeds to yesterday's archives. There should also be few, if any, file transfers from one system to another, "especially in the minutes right before air time," he said.

McDonald said, "Much of the locally originated content that aired (would be) sent via wireless Internet to the newsroom where editing started before the upload was complete. The package is finished on a simple, enterprise-based editing software at the desktop where voiceovers and graphics can be added if need be. The content could be aired even while it is being finished. Web versions of the video are automatically created and put on the news Web site. Once broadcast, it is automatically archived where it can be retrieved anytime using a simple search."

To Omneon Video Networks VP product marketing Paul Turner, the ultimate system of the future is all



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# Maximizing value and longevity of media assets

**W**alk into nearly any television station, and somewhere behind a locked door will reside a videotape archive with shelf after shelf of cassettes, 1in Type C reels and even 2in Quad tape — all containing programs or source material of special interest to the station.

To broadcasters, such rooms were their tape libraries. Footage was programming or raw material. Finding what was required involved searching labels and hoping any previous library visitor re-shelved the tape.

To those with an IT bent, those rooms are the forerunners of digital archive systems, asset manage-

upon a station that seem as far removed from transmitting a single main channel to a captive audience as tape libraries are from digital asset management (DAM). Multicasting, new non-broadcast distribution opportunities and the growing need for more news production are demanding that recently produced shows and stories, including raw video, audio and metadata, be retained in a searchable, convenient way.

If stations are to take advantage of emerging opportunities that will allow them to repackage existing material for new audiences, they

offset by the cost of repurposing. Effective media asset management can make repurposing both possible and cost-effective."

While having the ability to quickly find and repackage content for new outlets like cell phones is interesting, broadcasting is still the primary concern of television broadcasters. Transmitting both an NTSC service and a DTV service, which likely includes a main HDTV channel and several SD DTV channels, means the need to find and manage recorded content for both services will grow in importance until the ultimate conclusion of the analog switchoff.

Helping to resolve the management of mixed HD and SD environments will be media asset management systems, said Paul Turner, Omneon Video Networks VP of product marketing.

"That is a pretty important point," Turner said. "In the middle of the migration of traditional workflows — even in terms of HD — the reality is a large number of producers (even local to fully syndicated producers) are looking at libraries and realizing a significant portion of their library will have diminished value unless they can play it out as HD. At the same time, producers purely in HD are losing the SD market. So, the whole idea of managing these assets means now you have two media with exactly the same information being portrayed."

He added, "You have two versions of 'Star Wars,' one in SD and the other in HD. How do you track the two? How do you track the rights? Do you have different kill dates on both of them? The idea of managing that asset gets more complex,



**Television news operations like Time Warner's NY1 News generate hundreds of assets, including video, audio and graphics, on a daily basis.**

ment systems, and media asset management (MAM) systems. Sure, they weren't digital; they weren't easily searched; nor were they resolution independent — a U-matic is a U-matic, after all. But they did serve as repositories of video, audio and graphics from which old material could be retrieved and reused.

The evolving business model of broadcast television places demands

must recognize their local content has value to purveyors of new distribution avenues and the fact that they better be able to find what they're looking for.

"The revenue benefits of repurposing depend on the efficiency of the repurposing process," said John Wadle, OmniBus Systems VP for technology. "In other words, the benefit of alternate distribution is



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but having both versions drives the business model. Many people prefer to have one version of the asset in HD and have up- and down-conversion taken care of at a point right before the playout. That way, the asset management, the kill date, relates to one asset.” However, where dual versions of the same asset are needed, DAM can help to track number of playbacks and kill dates.

## Asset management vs. archive

There’s a difference between a DAM system and an archive. From the perspective of OmniBus’ Wadle, archiving is a part of a digital media asset management system.

“Digital archiving is one component of a media (digital) asset management system,” he said. “While many MAM systems include the equipment and functionality to maintain a digital archive, only some applications of MAM also require ‘archivist’ capabilities as are often found in enterprise DAM systems. In this respect, a broadcast MAM system that includes a digital archive is normally not a true archive system, nor are such capabilities required in many broadcast MAM applications.”

David Schleifer, Avid Technology VP of broadcast and workgroups, explained, “Digital asset management and archiving are two different things tied together.” Confusion between the two is understandable, he said, because of the way vendors describe their products.

He continued, “I was on a panel with others from the industry and said, ‘We all say we are asset management systems. That’s not going to work.’ The reality is asset management and archiving systems are used differently. Digital asset management represents customers’ desire to find and manage their assets at a high level. Part of that is archiving.”

According to Omneon’s Turner, a little visualization clears up any confusion.

“A digital archive, in general, is some collection of tape machines with a robot of some form that feeds tape to them and tracks where material is — a massive thing with a pipe out of it,” Turner said. “It’s your bank or library of material. An asset management system tracks that media throughout your facility wherever it exists and tracks rights management — who may look at it, when it has to be deleted. A movie channel has the rights to a movie at a certain time, for a certain number of times. After that, it has to go. It would also move new material from the ingest server to playout or an archiving system.”

According to OmniBus’ Wadle, the functional subsystems of a

tions of the MAM subsystems. It should support device control for a wide variety of broadcast equipment, archives, encoders and transcoders needed by the subsystems, he said.

A MAM’s metadata exchange must provide a framework for sharing content metadata among the MAM and adjacent systems through a shared database or messaging technologies, Wadle said. Additionally, content acquisition should support ad-hoc ingest of tape content, scheduled record from tape, line or satellite feed, unscheduled record from line or satellite feed and receipt of packaged digital content, such as MXF, from remote locations.

NewsBrowse from Thomson is an



**Proxies, in the form of low-resolution video clips and thumbnails, are the index tool that reporters, producers and others use to find the asset they seek with a DAM system.**

MAM system should include integration with the MAM infrastructure, metadata exchange, content acquisition, content transfer, transcoding and wrapping, key frame recognition, indexing and searching, workflow management, proxy services, logging and editing, rights management, desktop integration, and content protection.

The MAM infrastructure creates and maintains a database of content metadata with sufficient scope and flexibility to support the func-

example of an asset management system targeted at a specific application. “It provides linking the high-res and low-res assets, tracking the high-res assets, which could include multiple copies,” said Bruce Lane, Thomson director of strategic accounts. “It includes metadata to search and edit, the ability to edit at the desktop, to browse and schedule records and to conform to the playout server if you wish directly or link to an edit suite directly to add features and other components to the store. Compo-



nents could also include a digital library. But that is not always the case. Many have NewsBrowse, and those assets stay in the system until after they've aired and then are moved to digital tape. Very few news operations have a digital library, so they archive back to master tape, and we can track that as it moves off to tape, and maintain metadata and low-res, even though high-res has been offlined."

According to OmniBus' Wadle, implementing a MAM system should be done "at a measured pace" so the benefits and detriments of the system can be evaluated each step of the way.

"Decide what MAM functions are relevant and potentially beneficial

least one remote site if applicable. Add the remaining MAM capabilities desired in one or more phases and verify their compatibility and operation at the primary site after each phase."

Finally, extend the full MAM system to all remote sites, Wadle said.

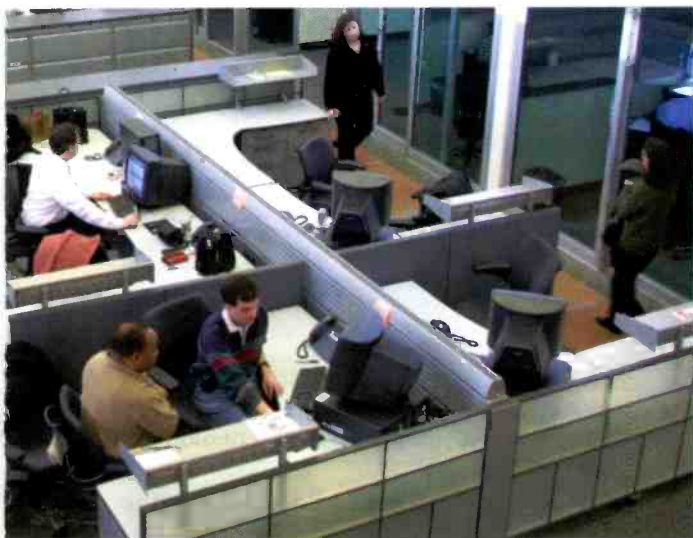
According to Thomson's Lane, it's not necessary to add a DAM system when installing a digital newsroom production system, although it would be acceptable.

"The big thing is understanding the workflow of the facility bringing in the asset management system," he said, "and the appropriate level of training so all of the people in the facility understand how workflow will change and improve integrating

search for clips without needlessly tying up valuable network bandwidth.

"The golden egg is a large centralized system," said Omneon's Turner. "When you do that, as this library grows in size, so does the number of people wanting to access material. If they are going to access it, they want to look at it."

"Proxies are mandatory for managing assets on any central storage library. We are talking elephant files here. An HDCAM clip is 140Mb/s sustained. That is not possible, so you have to go to low-bandwidth proxies, which are a fundamental part of an asset management system. They (those using the system) need to be able to look at clips to



**One benefit of DAM is the ability to serve up multiple clients with the same source material for a variety of simultaneous uses.**



**Metadata is key to an asset management system so that video, audio and graphic assets can be searched by key words.**

to your operation," he said. "Upgrade the current content acquisition or ingest system to an acquisition system based on a MAM infrastructure. Verify the acceptability and compatibility of the new system with the rest of your operation. Add a non-destructive subsystem, such as Indexing and Searching (i.e. one that does not change data) to operate on the content and metadata collected by the acquisition system."

He added, "Extend access to this limited MAM system to include at

the new system. The key to success here is training, training, training."

### **Proxies management**

In an asset management system, think of proxies as thumbnails or low-res video clips with associated metadata that provide an index browsing capability to the high resolution footage stored on servers, data tape archives or even in legacy video libraries. Proxies are great stand-ins for the high-res source because they allow multiple users to

find the right one. This opens interesting managing intricacies. When do you delete the real-time video and proxy? What if it went off central storage to tape storage? Don't you still want the proxy? So the persistence of the proxy may have different business rules compared to the asset," said Turner.

Thomson's Lane advised, "Keep these proxies forever. You can choose to reduce the storage required as material ages by eliminating proxies. If you do, you may choose moving

clips at low-res to just having thumbnails. But you always want to keep the thumbnail and metadata. Think forever. The cost of low-res storage is so low compared to the benefit that it pays to expand your low-res storage."

Whether proxies will be necessary in the long run is open to debate. OmniBus' Wadle said, "It is important to note that the rapid expansion of bandwidth on standard LANs, coupled with the improving quality at lower bit rates for proxies, will soon begin to blur the line between proxies and 'broadcast quality' content."

For the moment, however, they serve a useful function. "Proxies are the enabling technology for the wide deployment of MAM access," he said. "Because of their relatively small size and low bit-rate compression, proxies can be distributed easily via traditional office LANs or WANs to provide MAM access to office desktops with standard PC hardware and operating software."

### The tape library

Countless hours of old programs and source material stored on the shelves of station tape libraries are a poor choice for archiving digitally. Demand for those clips will be rare, the time it takes to ingest decades of tapes is staggering, and there are just better, more productive things to do with station personnel and resources.

"To digitize all of the material in an analog tape library would take years," said Omneon's Turner.

However, a portion of historic footage is used regularly, and that suggests a useful strategy for dealing with an analog tape library, according to Thomson's Lane.

"You will find an 80/20 rule," he said. "In this case, to get the media you might use in a library, you might use 20 percent of the assets but use them 80 percent of the time. The remaining 80 percent is used 20 percent of the time."

Start by digitizing the 20 percent

that is used most often. To get the high-use material into the digital library happens quickly but represents a small percentage of the entire library. It's a waste of time and money transferring material that's never used," Lane said.

### Mixed up world

As broadcasters contemplate developing content for alternate distribution avenues, such as video-enabled cell phones and video-on-demand services offered by telcos, as well as already existing in a mixed SD and HD world, managing assets to serve various resolution require-

ment in each step of the process and where necessary down-converting or transcoding for distribution. That is the highest possible video format that is cost effective."

OmniBus' Wadle said, "With realization of the (ultimate) IT-based station (see: "IT: The promise versus the reality" in this supplement), the issues brought on by concurrent transmission of HD, SD, narrowband streaming and datacasting will disappear. A 'mix server' as described could handle a mixed schedule of SD and HD content on a single channel. A second



**Implementing a DAM system should be done "at a measured pace," according to John Waddle, OmniBus Systems VP for technology.**

ments becomes a concern.

Avoiding multiple copies and up- or down-converting in real-time is a solid approach to asset management, according to Omneon's Turner. "For managing of the actual asset, it is easier to deal with if there is only one instance of that media," he said. "You could argue that for business reasons, you may want two copies, but it is certainly easier to have one copy that can be up-converted or down-converted in real time."

Thomson's Lane said, "We're always going to have different formats and resolutions. They are not necessarily going to go away. I stress capturing material in the highest possible format and maintaining

mix server could originate the narrowband stream for cell phones, also from SD and HD content. Both servers would use the same clips regardless of their resolution, doing the equivalent of up or down conversion in the software decoding to IP as needed."

Wadle concluded, "As long as the origination process includes the ploy-out, routing and mixing of traditional video signals, the problems associated with handling multiple resolutions will require complex and expensive up- and down-converters, multiple-format or multiple routers and mixers, and associated complexity in the automation process." ■



# Strategies for HD operation



**D**uring this time of transition from NTSC analog service to full-power DTV transmission, local stations have employed a handful of strategies to deliver HDTV to a relatively small but growing number of viewers with HD receivers and monitors.

As of the end of 2004, there were more than 12 million DTV households, according to a Jan. 13 FCC report. There were also more than 1400 television stations broadcast-

Bruce Lane, Thomson director of strategic accounts. "In a passthrough sense, you are minimizing up- and down-conversion. This approach minimizes the equipment required at local station level. There is also a bit of compromise in what you can do with that at the local level."

A small cadre of local stations augment the network's HD line up with locally originated HDTV programming, mostly news. Few of that small band do any field acquisition in HD, with some notable exceptions like KUSA in Denver, which shoots HD from its news chopper.

There are many reasons why more local stations don't originate HD, but most boil down to two factors: the expense of producing in HD and the relatively small number of consumers who own the products necessary to receive and enjoy an HD signal.

However, those impediments are beginning to fade as new, lower cost HD acquisition tools enter the market and the high-definition audience grows. A recent study from Leichtman Research Group found that 7 percent of U.S. television households owned HDTV sets as of the end of the third quarter in 2004, about twice the number that reported owning HDTVs the previous year.

While it's unclear when the tipping point will be reached that swings most stations into local HD origination, the trend appears obvious, begging the question of the best ways to grow local origination to coincide with the growing HD audience.

"Technology has advanced to the point of being less of an obstacle for any station to deliver HD to their audience," observed Glen Sakata,

Harmonic senior director of sales - broadcast, satellite, telco and government. "Doing so ranges from simple passthrough of an MPEG-2 stream to adding HD routing, switching and production equipment to a facility. The practical issue of overlaying HD over what was SD is no longer an ugly science project. It's less a technical question and based more on the station and network goals. Some stations implement HD production and services but never seem to have a clear business model that they are trying to fulfill. Going HD is not tactical; it's strategic."

## Double duty

While the digital conversion continues, one way to help soften the sting of costly HD equipment is to look for devices that can operate in an SD mode today, but be upgraded to HD operation in the future.

"When do you make purchases, and how do you make purchases?" asked Thomson's Lane. "If you are looking to preserve, you can buy something that is upgradeable. Our LDK5000 is fully upgradeable to the LDK6000 HD camera, which does HD and SD. Our Kalypso Duo is SD and can be upgradeable to HD switchable, thus saving money today by buying an upgradeable product."

Another potential alternative is use of new HDV format camcorders for field acquisition. While its 27Mb/s bit rate pales in comparison to full-on HDTV, its low price and convenient size make it a serious contender for early local field acquisition of HD.

"I personally think HDV will be a powerful force in newsgathering,"



**The Thomson Grass Valley Kalypso Duo is an SD production switcher that can be upgraded to HD when required.**

ing DTV signals and more than 90 million cable households passed by HDTV service.

Managing this transition on the local level most often takes the form of passing through network HD feeds on a station's main DTV channel. There are definite advantages to this strategy. "HD passthrough preserves as much as possible the quality of the origination capability," said

said Paul Turner, Omneon Video Networks vice president of marketing. "I've seen one clip, and it's looked darn good. The video holds up to scrutiny. It seems like HDV is the DVCAM of the 2000s. DVCAM offers high-quality capture of local events and a size of camera that all of a sudden you're more worried about the size of tape and not camera. HDV uses a tiny DV25 cassette holding HD material. Fundamental is the cost benefit equation. You can get \$3500 HD video out of them. That's impressive. It's now stored on tape. It's basically HD MPEG, a standard MPEG file, so there's no reason that couldn't be stored on a P2 memory stick or optical disk. No reason why these work-flows won't work in lower station market budgets."

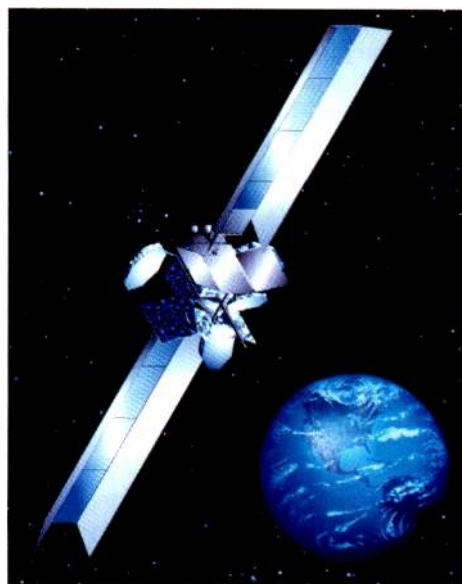
Said Harmonic's Sakata, "Anything that can save production or acquisition cost while providing picture and audio will go a long way in creating that ubiquitous HD viewing model. One caution about HDV. The average viewer is savvier about what is acceptable. There's a polarization that wasn't there three years ago. Just read the AV Forum sometime. See what cable and DBS customers say."

Asked Thomson's Lane, "Could it (field acquisition for news) be some other format? I personally think we will see a large amount of HD acquisition products at NAB. Once acquisition moves to HD, that is going to drive news editing to move to HD. The servers already exist, and the rest of the workflow is already there. It's just a matter of supporting the higher bandwidth product."

Added Harmonic's Sakata, "We expect affordability will come in the form of production tools from Apple and Microsoft products both on a di-

rect basis and from partners."

Said Omneon's Turner, "Fundamental to being cost-effective (with HD production at local stations) is largely based on acquisition, getting HDV in and editing it. And Apple is editing HDV — HDV in and out. Now you have cost-effective tools coming into play. It's a cost-effective acquisition format. There's the ability to edit that material and relatively soon machines with the ability to play it out from



**PanAmSat's Galaxy 13 is opening up the "HD neighborhood" in the sky for MSOs, according to the company.**

disk-based storage. (It's) not a big leap from editing to playout."

He continued, "I think HDV is a fundamental change in the cost barrier to produce in HD locally. For \$1000, the cost of a Mac mini and Firewire disks, you have HD editing. The Apple Mac mini is man enough to run Final Cut Pro, so for \$2500, you have editing for HD."

Partnering with the right service providers is critical as well for stations trying to find their way on the shifting sands of HD distribution.

"Ultimately, we are focused on getting our customers' HD programming viewed by as large a swath of the TV viewing audience

as possible," said Mike Antonovich, PanAmSat executive VP, global sales and marketing. "To achieve this, we have dedicated our Galaxy 13 satellite to establishing the strongest neighborhood of HDTV programming anywhere, making it the 'go-to' HDTV destination for cable MSOs. The more HDTV networks on one dedicated HD neighborhood, the easier it will be for MSOs to pass those services to consumers. We will be supplementing the success of the Galaxy 13 neighborhood by launching two additional high-powered satellites, Galaxy 14 and 15 in the next year."

### **Advanced compression**

Progress in compression technology may also change the HDTV calculus for broadcasters, offering them new ways to reduce costs and potentially increase revenue. For example, newer technology such as MPEG-4 AVC (H.264) and Windows Media 9 deliver significant improvements in file size reduction when compared to MPEG-2. MPEG-4 AVC (H.264) can offer a 2X to 3X compression advantage over MPEG-2 for HDTV. Where MPEG-2 files required 18.5Mb/s for video, the newer compression technology can achieve 9Mb/s.

Broadcasters applying the technology to backhaul links could, for example, complete transmission in half the time, transmit up to twice as much or combine the two to reduce the time and expense of leasing satellite time or telco capacity. Essentially, they could get twice the content moved for a given amount of time or reduce usage by half.

Additional efficiencies are available for satellite transmission, thanks to a separate set of channel codes called Turbo codes DVB-S2 (Digital Video Broadcasting-Satellite version 2) that can increase coding efficiency by more than 30 percent. When combined with advanced compression algorithms, the two can offer broadcasters siz-



able savings in backhaul and satellite newsgathering links.

Advanced compression algorithms also impact revenue opportunities. While FCC Report and Orders require that a station's main DTV video service is MPEG-2, broadcasters have more latitude with their unused digital bandwidth. For example, some broadcasters in Salt Lake City, UT; Albuquerque, NM; and Las Vegas, NV, are working with United States DTV (USDTV) to offer a low-cost alternative cable TV to customers with a special set-top box. In exchange for allocating their unused DTV channel bandwidth for transmission of the USDTV service, participating stations share in the revenue.

In such applications, advanced compression technologies allow broadcasters to offer more channels and possibly attract more viewers to the over-the-air pay TV service. The MPEG-4 AVC (H.264) encoded channels can piggyback on the MPEG-2 transport stream the stations transmit.

The MPEG-2 receiver can look at the incoming transport stream, find what it needs for the main TV channel and ignore the rest, making it available to a separate decoder that could look for the pay service programs that were compressed with an advanced compression algorithm like MPEG-4 AVC (H.264).

In other words, the normal HD receiver used to tune and decode a station's main digital channel would examine the incoming MPEG-2 transport stream, check to see if it was an ATSC service that it understands, and ignore the rest.

## Dual service

Given the importance of new IT-centric workflows and the efficiencies they offer, how best can they support the mix resolution and aspect ratio requirements of a television station transmitting both HD and its regular NTSC signal?

According to Thomson's Lane,

the key is the aspect ratio. "Produce your newscast in 16:9 and down-convert, crop and chop or squeeze," he said. "Four-by-three aspect ratio conversion can be done in a production switcher. That's just a matter of designing your newscast."

Harmonic's Sakata disagreed: "Changing the aspect ratio, stretch or zoom in for 16:9 in most every case creates an unpleasant experience for consumers. Our DBS cus-

tomers have described how critical their customers have become about nuances in image and audio quality. When you watch video edited by non-professionals, you can tell because room tone goes away. Professional movie makers and TV makers, however, have known this for years and now have to apply the same consideration to HD for television."

tomers have described how critical their customers have become about nuances in image and audio quality. When you watch video edited by non-professionals, you can tell because room tone goes away. Professional movie makers and TV makers, however, have known this for years and now have to apply the same consideration to HD for television."

According to Turner, the great movie sound viewers experience when they plug DVDs into their players has retrained the ears of viewers and raised expectations. Ignoring this heightened auditory awareness can be perilous.

"(One) thing that drives people's (HD) viewing experience is surround sound. It's not just the domain of home theater. People are buying a surround sound decoder pre-amp for \$200, keeping their old speakers and adding new speakers for front. It's fairly common," Turner said. "Psychology is all over the TV industry," he said. "We rely on psycho-perceptual factors for video to work at all. I mean, we all just look at a series of still images presented very quickly to trick our

## The last hurrah

Station managers and engineers must grapple with numerous issues as the industry transitions from the known into the uncharted area of HD. As long as stations take a conservative approach and limit their HDTV offerings to programming

*"Ultimately, we are focused on getting our customers' HD programming viewed by as large a swath of TV viewing audience as possible"*

*- Mike Antonovich, PanAmSat*



that's passed through from the network, they risk little.

However, the decision to begin local origination of HD programs, such as news, adds a significant layer of complexity and expense. Confining new HD signal origination to the studio is demanding, but field acquisition of HD footage as part of a station's ENG activities seems beyond the reach of most.

The good news for managers and engineers weighing the possibility is that technologies have and will emerge to drive down the cost of HD field acquisition. New low-cost formats, such as HDV, may hold part of the answer. If Thomson's Lane is correct, expect to see significant introductions of other low-cost professional means this spring.

Another bright spot on the horizon for field acquisition is advanced compression algorithms, such as MPEG-4 AVC (H.264) and Windows Media 9. Significant improvements from these algorithms will give stations a way to cut satellite backhaul costs. Such algorithms also present ways to get more out of secondary DTV channels and mean more revenue. ■

BroadcastEngineering and



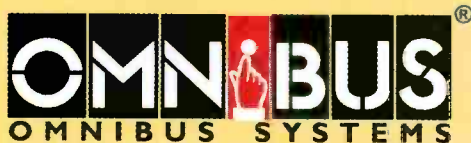
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**Apple Xsan:** Is a 64-bit cluster file system for Mac OS X; share files and volumes up to 16TB on a high-speed Fibre Channel network; up to 64 users can simultaneously access a single storage volume that supports multiple high-bandwidth video streams; users can theoretically achieve throughput of up to 400Mb/s.

800-767-2775; [www.apple.com](http://www.apple.com)

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Includes closed captioning verification and status reporting, LAN-based API control of content for asset management functions and full implementation of Omneon media servers into Floralica's broadcast system configuration; real-time playback is still required to create the proxy, but adding the captioning data to the video file in the Omneon server can now be done at nearly four times real time.

Floralica: 352-372-8326; [www.floralica.com](http://www.floralica.com)

Omneon: 408-585-5000; [www.omneon.com](http://www.omneon.com)

Evertz: 877-995-3700; [www.evertz.com](http://www.evertz.com)

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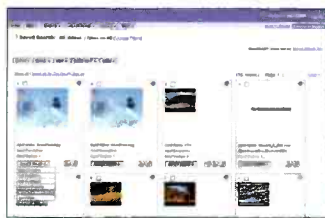
**Panasonic AJ-HDX400:** Features three 2/3in one-million pixel IT progressive CCDs to produce a high sensitivity of F10 at 2000 lux, low-light shooting down to 0.008 lux (at +68dB) and ultra-sensitive recording up to 74dB in digital super gain mode; is equipped with 12-bit A/D DSP circuits; uses DVCPRO HD-LP 9-micron recording to record 33 minutes on a DVCPRO medium-size cassette; records 48kHz/16-bit digital audio on all four channels.

201-392-4127; [www.panasonic.com/broadcast](http://www.panasonic.com/broadcast)

## TRIPOD

**Sachtler ENG 75/2 D:** Is combined with the DV 4 II or DV 2 II fluid heads; features the Touch & Go camera plate that lets operators change between tripod and shoulder shooting in seconds; use with MiniDV camcorders 2.2lb or more; DV 4 II has a maximum payload of 16.3lb; DV 2 II has a maximum payload of 7.9lb.

516-867-4900; [www.sachtler.com](http://www.sachtler.com)



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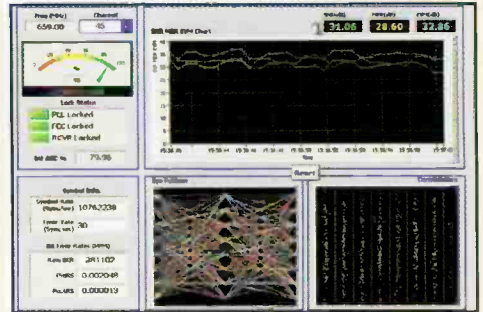
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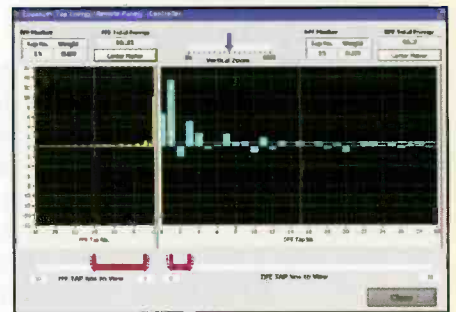
All reports and controls are available locally on a rack-mount PC or a laptop computer, or from a remote location through the Internet.

The **msi-4400** Analyzer is covered by MSI's three-year warranty.

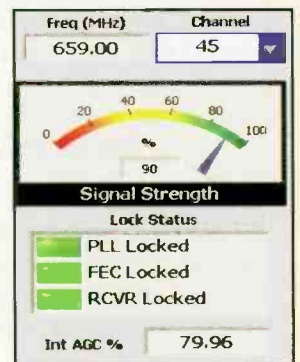
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caches in video switchers, and quite literally dozens of other applications that did not exist 15 years ago, or in many cases even five years ago.

The low end of the professional market is populated with many systems costing less than \$15,000. They perform the function of VTR replacement admirably. Some systems are used for playout servers in small stations with "challenged" budgets. Some of these servers use commercially available codecs, which can be bought for less than \$1000, and combine them with industrial computers and unmodified off-the-shelf operating systems. They fit a niche in the market that is important. Many production control rooms include such systems for playback of repeating backgrounds, bumper clips and transitional elements.

As you move up the price range, you find a crop of general-purpose servers used in broadcast and ancillary uses.

The available storage options are likely to include networked storage systems (NAS, for instance). They range of options for expansion of I/O, storage, and archive and network connections is enlarged from the low-end systems, as is the quality of the I/O in general due to more engineering dollars available to optimize performance. Reliability is arguably better as you move into this market segment (\$15,000 to \$45,000).

At the high end of the market, one finds rugged, complex systems with high throughput to allow high bit-rate operations, including HDTV record and playback. Until recently, only a couple of manufacturers had HD codecs internally (SMPTE 292M). Others relied upon "best in breed" solutions from codec manufacturers and used ASI as the I/O. This year, one manufacturer introduced a line of servers that uses fast processors to allow software codecs to handle the input

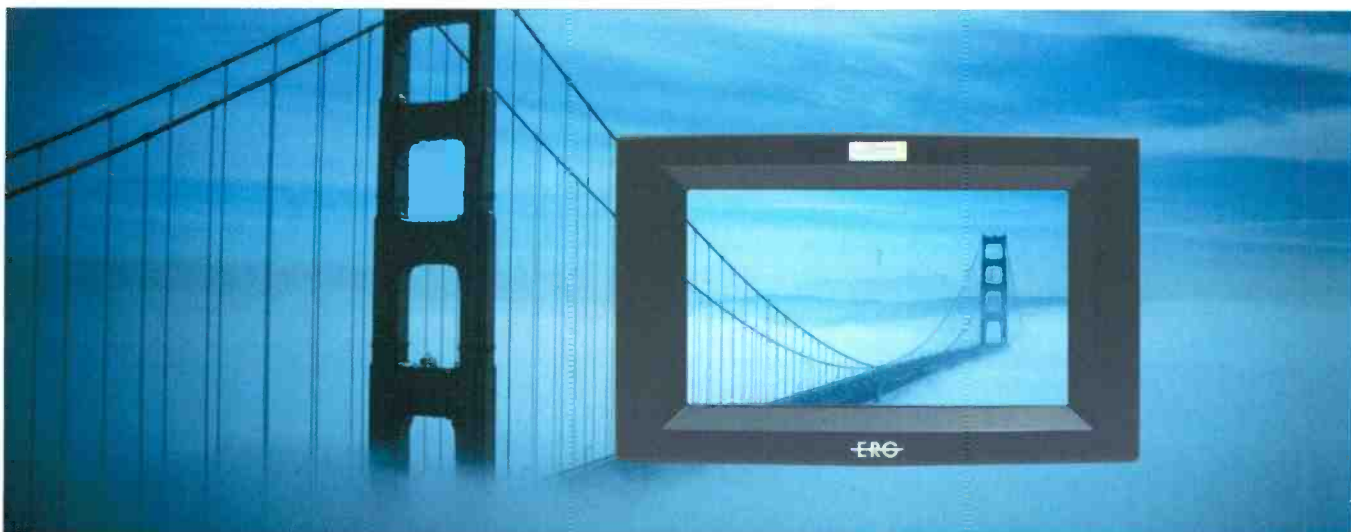
side, with more traditional hardware decoders. Bandwidth on the backplane is increasingly important in this market segment because the number of I/O channels may require more than 500Mb to permit simultaneous record and playback of multiple channels.

Where are we headed? The upper end of the market will likely remain complex and relatively expensive. The bottom end of the market will improve with more reliability and better performance as H.264 codecs become commercially available at reasonable prices in the future. And the consumer market will grow in capability to look even more like the big brothers we traditionally call video servers. **BE**

*John Luff is senior vice president of business development at AZCAR.*



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## HD SOURCE SWITCHER

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# Fixing it in post

BY PAUL MCGOLDRICK

The ultimate excuse, escapism, crutch or stupidity in our industry is to “fix it in post.” Once uttered by a director or producer during a shoot, the problem, however big, goes away for the production crew and falls smack into the lap of the often forgotten editing few. These brave professionals, who spend their careers in windowless existences, rely on their knowledge and skill in repairing the mistakes that should have been thought about and evaluated during all of the pre-production lunches.

The ultimate post-operation I sat in on was in the Los Angeles area at a house that was colorizing early movies. The frame-by-frame color setting and recording was perhaps the most tedious thing I have seen in the broadcast industry and required enormous skill at an extraordinary expense.

Whereas all editors can color-correct, remove scratches, and get rid of most of the rain that wasn't supposed to be there on the shoot, it is time-consuming work, which most producers or directors don't want to sit in on. But when it comes to actually fixing the flow of video or audio, the lack of a director's presence — which happens only too often — usually means that the work has to be redone at a later session to suit a vision that the editor had no knowledge of.

But there is another “fix(ing) it in post” that most broadcasters and studio staff are unaware of. That work — as you read this issue of the magazine — is in the pre-production process now. It will be in production in March, and the first raw edit will be seen at NAB in April. What am I talking about? Every new product that is on the floor of the Las Vegas Convention Center, April 18 to 21.

You have to have been in the business of making equipment for our industry to understand that some companies are better than others in the organized, or disorganized, manner in which they turn up for trade shows like NAB. I have worked for companies where:

- Some of the new products on display were totally non-operational, but were in pretty boxes.

## There's nothing inherently wrong or immoral about showing a product at a trade show that isn't 100 percent ready for prime time ...

- The product was not functional but the result could be “simulated” for participant viewing.
- The product was functional (sometimes with design engineers, soldering iron in hand, working at the booth well after midnight before the show opening), but there were still missing functions or features, or the product just didn't meet the expected specifications.

Rarely have I seen a fully-functional new product at NAB, but that could usually be remedied by the time IBC rolled around.

Once there was interest in the product, which meant that customers wanted on-site demonstrations, the post-show fixes would have to be rapidly played out. On occasion, the product would go no further towards reality, with multiple lots of “I told you so” passing back and forth on post-mortem flights out of the city. (It's remarkable how much people will talk about their business on flights from Las Vegas, even though they should obviously be aware that the airplane is full of both potential customers and

competitors. I've learned extraordinary things just by keeping my ears open in the gate areas at McCarran International Airport.) There was a classic example in this regard at one of the final Dallas NABs, when a Florida transmitter manufacturer just completely walked away from its booth. All the equipment was left, as was the booth and its promotional materials, until, finally, the conven-

tion center staff scooped the entire contents of the 20ft by 10ft space into a dumpster.

There's nothing inherently wrong or immoral about showing a product at a trade show that isn't 100 percent ready for prime time — unless, of course, it isn't but the vendor tells you that it is. And most savvy customers should expect that there will be kinks that need to be ironed out before any delivery can be made. The vendors will also be listening closely to your inputs, seeing either the benefits of adding (or removing) features that are desired (or will never be used) before finalizing the design — or thinking about changes in the next version to come.

This kind of fixing it in post is not nearly as expensive as in a shot production, but be aware that it happens and will continue to happen. Now, about those pre-production lunches ...

BE

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



Send questions and comments to:  
[paul\\_mcgoldrick@primediabusiness.com](mailto:paul_mcgoldrick@primediabusiness.com)







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the 1990s, the number of people in the UK who are employed in the public sector has increased from 10.5 to 13.5 million (1990–1999).

There are a number of reasons why the public sector has expanded. One reason is that the public sector has become a more important part of the economy. The public sector has become a major employer, and its growth has been a key factor in the overall growth of the economy. Another reason is that the public sector has become a more important part of the welfare state. The public sector has become a major provider of social services, and its growth has been a key factor in the overall growth of the welfare state.

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# Broadcast Engineering

THE JOURNAL OF DIGITAL TELEVISION

## BROADCAST TRUCKS

Technology behind the beauty

**Special Report:**  
**Building IT video systems**

Six-part series  
for video engineers

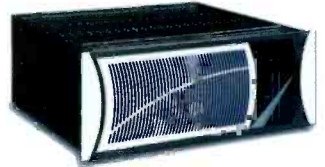
**Digital audio workstations**

New features and performance

Digital Audio Network Router

# The Bridge

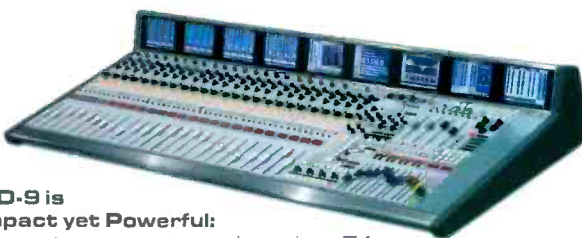
**The Bridge Router** can hold all the electronics you'll need for a small console: I/O cards, mix engines, and DSP processors. Naturally it can also have automatic fail-over DSP and CPU cards to keep you on-air. You can expand the system with a simple cage-to-cage interconnect.



## It's not just a Digital Console, IT'S AN ENTIRE AUDIO INFRASTRUCTURE

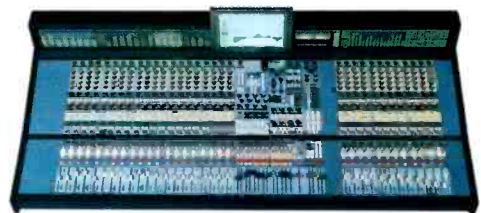
**YOU CAN START** with a simple AES router with analog and digital inputs and outputs. From there you can add logic I/O cards and scheduling software; you can link multiple master bridge cages together to achieve thousands and thousands of I/O ports; you can create a custom system that includes multiple smaller remote satellite cages— with everything interconnected via CAT5 or fiberoptic links.

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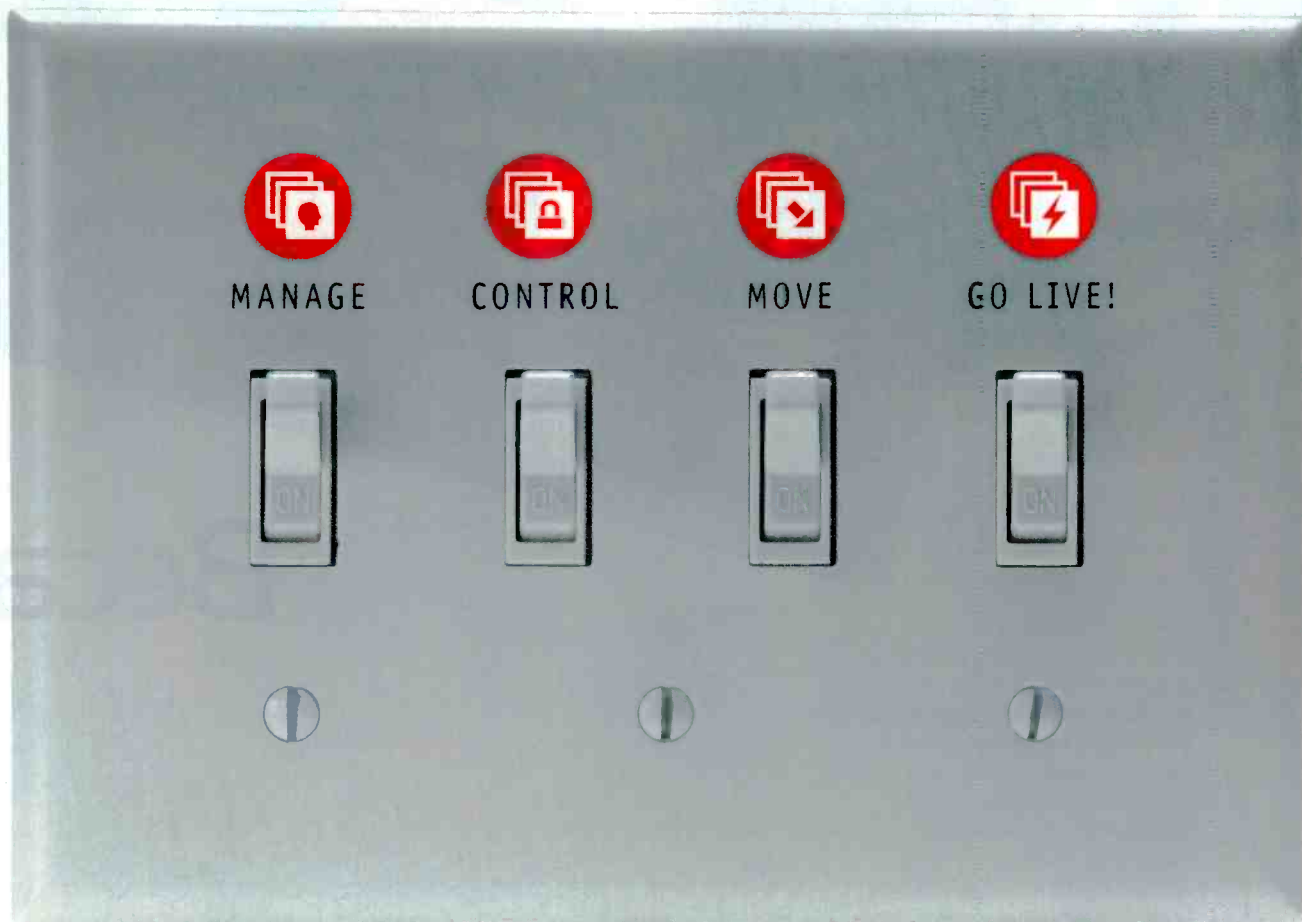
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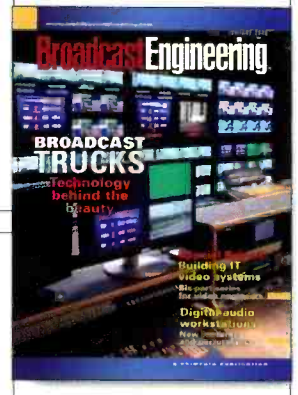
By Fred Huffman

If you can build a broadcast facility, you can build an IT system to work with it.

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By Larry Thorpe and Gordon Tubbs

Find out why the modulation transfer function is the best predictor of an HDTV lens' performance.



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### ON THE COVER:

For mobile system integrators, 2004 was an exciting year. Vendors carefully tested out HD for several months. Today, many have fully embraced it.

(Continued on page 8)



HJ21ex7.5B  
21x EFP

HJ22ex7.6B  
22x TELE

HJ40x10B/HJ40x14B  
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# creativity

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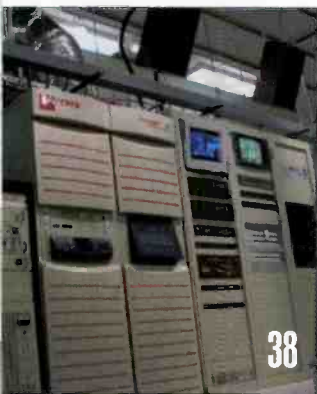
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## FreezeFrame



By what date must stations have fully implemented the ATSC A/65B PSIP standard? Readers submitting winning entries will be entered into a drawing for *Broadcast Engineering* T-shirts. Enter by email. Title your entry "FreezeFrame-January" in the subject field, and send it to: [editor@primediabusiness.com](mailto:editor@primediabusiness.com). Correct answers received by March 1, 2005, are eligible to win.





# ▶ Tim McGuire To The Power of Maxell



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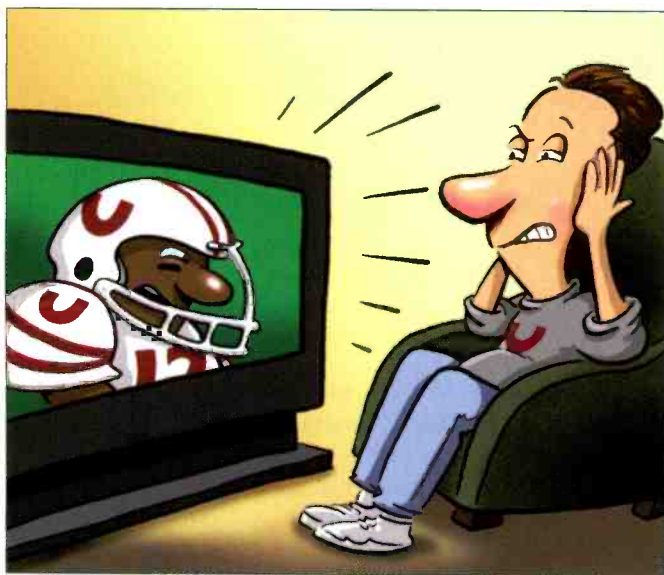
Recordable Media   Data Storage   Portable Energy   Technological Partnerships



## Wanted: Good HD audio engineer

**W**hile I'm not a regular sports fan, I've found myself surfing by the last few weeks of football games. What I've heard literally hurts my ears.

The one caveat to the following comment is that I'm getting reception via Time Warner Cable. So, it's possible (likely) its equipment could affect some aspects of the problem. However, because the results have been so across-the-board in terms of various HD programs and networks, I'm beginning to question the audio expertise of my fellow broadcast engineers.



As a regular *Broadcast Engineering* reader, you've probably seen photos and read the stories about some of the audio technology being installed in today's HD broadcast trucks. These trucks have about every audio goodie an engineer could want. There is probably a quarter-million dollars in just the audio console! Given all this technology, wouldn't you think it's possible to be able to deliver a consistent level of quality in the audio feed of the typical HD football game?

Granted, today's audio feeds are a whole lot better than what we had two years ago. Back then, the audio in HD trucks was really just an afterthought. But come on! How hard is it to get the surround mics fed into the proper channels? Or, why hasn't the mixer done a

mono check? If he had, perhaps someone would have noticed that the color man's mic is out of phase.

Although not all HD sporting events suffer from these types of problems, many still do. And, I'll admit that it is possible for downstream problems to occur that can ruin even the best mix — but a mic phase reversal isn't caused at the cable headend.

Another issue is the amount of surround sound used in the broadcasts. CBS typically has more surround than does FOX. While I like the sound of the CBS mix better, I'll leave the decision on the amount of surround to the creatives. However, one piece of free advice to FOX: If you won't decrease the amount of trashy graphics and the annoying noise used as you fly them in, please drop the audio level a bit. These A/V effects obscure and detract from both seeing the game and hearing the announcers. What's next? Adding an extra "swish" every time you switch between cameras?

The worst problem with today's HD audio feeds is inconsistent levels between the live feed and network or local station breaks. On the CBS and FOX feeds I examined last Sunday, both exhibited easily noticeable audio level shifts when the program switched between the game site back to network origination or between remote sites.

Granted, this is armchair quarterbacking, but it looks to me like the network MCR guys are improperly matching audio levels between the remotes and network commercial playout. The result is that we home viewers set our volume controls to enjoy the game, but then get blasted when the first monaural commercial comes along. How about adjusting dial norm on those encoders to help level out the differences? You've got the technology, so use it.

Next month: Is it my glasses or is that HD image fuzzy? Why can't HD camera operators FOCUS?!

*Broad Dick*

editorial director

Send comments to: • [editor@primediabusiness.com](mailto:editor@primediabusiness.com) • [www.broadcastengineering.com](http://www.broadcastengineering.com)





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## Selected file-sharing

Brad,

Our post-production facility has many networked computer-based editing and media management systems. In the administration of these bread-and-butter production systems, I have one hard-and-fast rule — no Internet connections. Oh, sure, we have lots of “connected” workstations, separated from the production workstations with physical space. Only “sneakernet” is used to transfer files between these two worlds. I had an Internet-connected DVD workstation that was destroyed by an e-mail virus a few years ago, which confirmed my policy. And, our office network has been attacked on numerous occasions, requiring us to implement some of the firewall and anti-virus techniques described in October’s issue.

I would like to see an article on ways to enable isolated networks to still share files with Internet-enabled networks, on a selective basis. As an example, a client sends us a logo graphic file to use in a spot. We download it on the office network, dump it to a disk (or jump-drive or firewire drive or whatever) and connect that to the production network. How about a separate connection to that office

network, with a way to temporarily enable a file-transfer connection, just for the amount of time needed to transfer the info? This, effectively, isolates the production system from the Internet, while still enabling us to be “connected” to the outside world.

ED FRATICELLI

## Brad Gilmer responds:

There are several things you can do to “cautiously connect” your broadcast network to the Internet. At a high level, one approach would be to build two independent networks, one for the broadcast network and one for the business/Internet. You can then control what crosses over between the two networks based upon things like protocol, MAC address of the source or destination computer, or some other parameters.

Another thing you can do is use dual-homed hosts — servers with two NIC cards. You plug one NIC card into the broadcast network and one NIC card into the business/Internet network. The server can be configured to make its data available on both networks. Also, most servers can be configured to be a router, routing permitted traffic between the two networks. While you can use the server to do both jobs, I suggest you use the server to deliver its content to both networks, but use a separate router to control the traffic moving between the two networks.

## Pixels

Dear Michael Robin,

I bought both of your books, but I’m struggling against the pixels. Are the pixels that you sample really displayable pixels, or just samples?

If they are samples, can you never reach more real display pixels than half the samples (Nyquist)?

PETER TAVENIER

HOLLAND RAILCONSULT

## Michael Robin responds:

If you are sampling an analog video signal, the horizontal resolution, (expressed in LPH) is equal to the maximum video frequency multiplied by the resolution factor. You can’t do better! The CCIR 601 maximum allowable frequency is 5.75MHz (lower than the 6.75 Nyquist frequency) so the resulting resolution, at best, is approximately 455LPH. If, on the other hand, you have a concatenation of conversions back and forth between analog and digital, as in a broadcasting studio, the end result cannot be better than what the resulting analog frequency response allows. This will definitely be lower than 5.75MHz.

If you are talking about samples, CCIR 601, 720 active horizontal samples equals 360 sinewaves during an active line, or a resulting frequency of 6.75MHz. So, because the maximum video frequency is 5.75MHz, we have no hope of ever displaying so many pixels on an active line. What we can hope to see is about 613 pixels per active line.

Bear in mind that we live in a mixed analog/digital world!

BE

## October FreezeFrame:

- Q. Name the company and product name of the first videodisk recorder for ENG applications.
- A. NEC Diskcam

## Winner:

Tom Alderson


## 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](mailto:bdick@primediabusiness.com)



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# The sense of Congress

BY CRAIG BIRKMAIER

**D**on't you just love the way Congress fixes things? Listening to the politicians, the pundits and the mass media, you'd think that our elected representatives have the unique ability to gather a sense of what best serves the public interest and then to codify this into legislation that will fix any problem. Of course, you'd be wrong.

Take campaign finance reform, for example. This legislation was supposed to close the door on soft money, which was being funneled through the political parties. We were told that it would help curtail the dramatic growth in spending on political campaigns. Just a few election cycles back, we crossed the billion-dollar threshold on spending for congressional and presidential races. In 2000, we passed the \$2 billion milestone. In 2004, according to *USA Today* (see Web links), we passed the \$3 billion milestone — actually \$4 billion when all election

costs are counted. This includes more than \$400 million in soft money funneled through the 527 loophole. Guess it's back to the drawing board for campaign finance reform.

Ditto for telecommunications reform. Congress "fixed" it in 1996 with the most comprehensive overhaul of telecommunications regulations since the original Telecommunications Act was written in 1939. The 1996 act authorized the FCC to loan broadcasters a second channel for the transition

safety communications and to be auctioned for new telecommunications services when broadcasters are forced to give it back.

## A resolution with no definition

It should come as no surprise that things did not work out as planned when Congress overhauled the Telecommunications Act in 1996. We've got tons of dark fiber in the ground, but the last mile is still copper. The

**The politicians are no closer to getting the analog TV spectrum back from broadcasters than they were in 1996.**

to digital television. It also instructed the FCC to establish regulations for the DTV transition, including a schedule to assure the timely return of the analog spectrum — valuable spectrum that is to be used to enhance public-

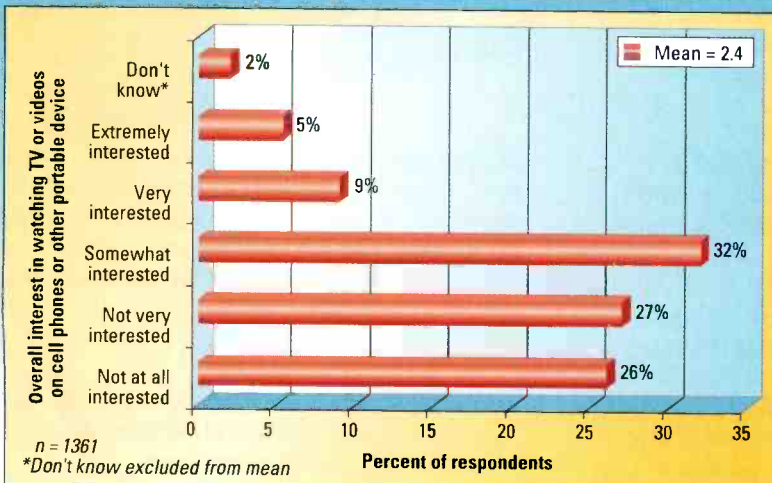
attempt to open up local exchanges to create more local competition for traditional telephone and new high-speed data services failed. The cable industry has resisted attempts to unbundle the set-top boxes needed to access new digital TV services, and cable rates keep climbing faster than inflation rates. The politicians are no closer to getting the analog TV spectrum back from broadcasters than they were in 1996.

As expected, the cries to get the spectrum back are growing louder now that the election is over. The FCC has been working on a revised plan, acknowledging the reality that the analog spectrum will not be returned on Dec. 31, 2006 — the deadline they set in 1997 when they launched the DTV transition plan. It now appears, however, that the FCC is going to dump this one back in the lap of Congress, which has announced its intentions to look at telecommunications reform, again, during the next session. Just for dramatic effect, Congress attached a "Sense of Congress" resolution to the

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

### Lack of interest in TV on cell phones

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intelligence reform bill passed by the lame duck Congress in December. The resolution calls on broadcasters to meet the Dec. 31, 2006, deadline set by the FCC. Unfortunately, this resolution provides no definition as to how this is to happen; it does not enjoy the same force of law as the little rider they put on the Balanced Budget Act of 1997.

Just months after the FCC set the DTV transition schedule, those sensible folks in Congress "fixed" it. No broadcaster would be forced to return the analog channel until 85 percent of the homes in their market were capable of receiving the DTV signals of every broadcaster in the market. To be included in that 85 percent, the home would need to have at least one set with an off-air DTV tuner, or a digital multichannel service that carries the DTV signals of all of the broadcasters in that market.

Have our elected representatives lost their senses? Do they understand that they have the power to put the teeth

back into the 2006 deadline by simply repealing the 85 percent rule that Congress passed in 1997? Of course they do. Do they have the resolve to do it? No way. They have another expensive election to pay for in 2006.

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**Just months after the FCC set the DTV transition schedule, those sensible folks in Congress "fixed" it.**

about DTV reform. Mark your calendars: Congress will pass another major telecommunications reform bill in the summer or fall of 2006. The next year-and-a-half will be marked by numerous Congressional hearings, while the FCC continues to interpret the divergent views of Congress and federal appeals courts on issues too numerous to enumerate here. For broadcasters, the top issues are:

spect to indecency limits.

Implementing the Broadcast Flag and limits on consumer video recording rights.

The FCC may try to move on some of the issues listed above this year. A federal appeals court just ordered the FCC to explain why it has not issued its final rules on DTV carriage by cable systems. It is likely that whatever the FCC decides, it will face immediate

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legal challenges. Any move by the FCC will frame the key issues. But, ultimately, Congress will need to legislate a solution to address the issues raised by the courts.

legal despite their ability to copy TV shows and movies. That decision set out rough guidelines under which devices used to make illegal copies of copyrighted material could be distrib-

decision. Or the court could decide that file-sharing networks must block the sharing of copyrighted files in a manner that parallels the Broadcast Flag, which limits the ability of consumers to make and share copies of free-to-air digital TV broadcasts.

In December, Senator Daniel K. Inouye (D-Hawaii) told the Honolulu *Star-Bulletin* that he and Ted Stevens (R-Alaska) will hold six meetings across the country to let the public weigh in on possible changes to the Telecommunications Act. As the

## Lower courts have ruled in favor of new consumer digital technologies ranging from CD burners to portable MP3 players.

In March, the Supreme Court will hear a controversial case to determine whether file-sharing software companies can be held legally responsible for copyright infringement on their networks. The case focuses on Morpheus and Grokster, each of which are popular peer-to-peer, file-swapping applications that are widely used to trade movies, music and software.

At the core of the case is an interpretation of the 20-year-old Sony-Betamax decision that made VCRs

uted without the manufacturer being responsible for the resulting piracy, as long as the product was also capable of "substantial non-infringing uses."

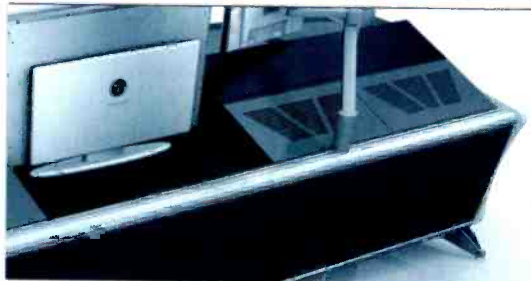
Based on this precedent, the lower courts have ruled in favor of new consumer digital technologies ranging from CD burners to portable MP3 players. In choosing to hear this case, the Supreme Court has opened the door to speculation that it might modify the personal recording rights established by the Sony-Betamax

## Web links

**USA Today on 2004 election costs:**  
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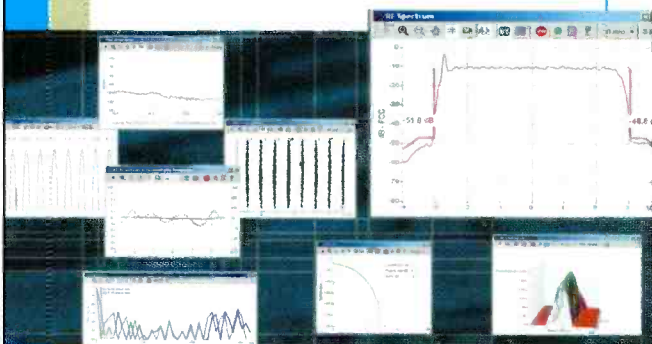
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ranking democrat and chairman, respectively, of the Senate Commerce Committee, they will preside over the planned rewrite of the act.

Also in December, President Bush told the Commerce Department to create a spectrum task force that will have one year to produce a report on how to improve the management of the nation's airwaves.

Meanwhile, the real DTV transition will continue. Cable will push customers into digital services as they attempt to limit the loss of subscribers to DBS. HDTV programming will continue to proliferate on cable, DBS and HD-DVD. Consumers will continue to buy new HD-capable



**In December, FREEVIEW, the free digital service that provides more than 30 free digital TV channels, broke into the top 10 of all DTV deployments in the world.**

displays and will continue to show little interest in receiving HDTV off air. And broadcasters will continue to protect the NTSC "sacred cow" while they look for a business model that can survive the DTV transition. That business model should be obvious. It's called free TV.

In December, FREEVIEW, the free multichannel successor to the failed On Digital subscription DTV broadcast service, broke into the top 10 of all DTV deployments in the world. The other nine are paid multichannel services including large cable systems in the U.S. and DBS systems around the world. About 25 percent of the FREEVIEW set-top receivers being sold are for second sets.

Unfortunately, the notion of free-to-air digital multichannel services has gained little traction with U.S. broadcasters. USDTV recently announced that it has 10,000 subscribers in three U.S. markets for its multichannel DTV subscription service, which costs \$20/mo. At NAB2004, Emmis Communications announced that a coalition of 12 broadcast groups would work together to pool DTV spectrum to deliver a \$25/mo. subscription service package to compete with USDTV. The coalition has invited other broadcasters to join, but the initiative has failed to gain traction with broadcast networks and groups.

**BE**

*Craig Birkmaier is a technology consultant at Pcube labs, and he hosts and moderates the OpenDTV Forum.*



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# À la carte gets negative response



BY HARRY C. MARTIN

In late November the Media Bureau released its report detailing the (few) pros and (numerous) cons of an à la carte pricing model for cable and satellite (multichannel video program distribution, or MVPD) programming. Last May, members of the House and the Senate requested that the FCC weigh in on the potential for à la carte pricing in MVPD markets to reduce rates and increase viewer control over channel and content selection. In response, the bureau conducted a symposium and solicited public comments on the positives and negatives. As a result of its research, the bureau gave the model a less-than-warm reception.

According to the bureau, an à la carte model would *not* lower subscription costs or promote viewer choice. It concluded that the outcome of such a model would be an increase in the subscribers' monthly bills, in addition to a dwindling supply of channels from which to choose.

The bureau's thinking goes like this: Under an à la carte system, MVPD providers would have to implement

a complicated new system for tracking and billing for millions of individualized, household-by-household program selections. This would cost more than continuing to offer the tiered programming bundles currently available, and the additional costs would be passed on to subscribers. Only those customers purchasing fewer than nine networks would actually see their cable or satellite bills reduced. The average MVPD subscriber, who regularly watches 17 channels, would get hit with a rate increase somewhere between 14 percent and 30 percent.

The bureau also concluded that the model would have a detrimental impact on the diversity of programming options. Under the system, networks would no longer be assured of inclusion in a basic programming tier, and many niche market providers would have to bump up marketing efforts in order to attract viewers. And, while these same special interest networks would thus be incurring (presumably) greater promotion costs, they would also likely be taking a corresponding hit in their advertising revenue. The loss of ad revenue, combined with increased marketing and operational costs, could drive many niche market networks out of business. This would reduce the options available to viewers. Some observers say that this is what has happened in Canada, which has an à la carte pricing model.

The bureau's negative assessment of à la carte pricing extended to both a mandatory approach and a partial, voluntary one. The same cost increases would apply whether the model were mandated or introduced as an option alongside tiered programming. Either way, these cost increases would be passed on to subscribers.

Rather than focus on à la carte as the solution to high prices, the bureau recommended that Congress provide incentives for increased market competition. The bureau noted the emergence of USDTV as an alternative to cable and satellite and the entry of phone companies into the video marketplace (e.g., SBC/Microsoft) as positive developments in this direction. With regard to viewer control over channel and content selection, it suggested that VOD technology and digital video recorders (e.g., TiVo), as well as the V-chip, ultimately offer better means to improving viewer control.

The bureau also addressed the practice of tying the acquisition of rights to a popular program network to the purchase and carriage of less popular program networks, say, for example, in the context of retransmission consent negotiations. Interestingly, it concluded that tying arrangements may well be counter to the public interest because they can lead to less-than-optimal use of channel capacity. However, the bureau ultimately punted, recognizing that Congress established the retransmission consent process, and that it might be imprudent for the bureau to conclude that the process is not working as intended.

With these considerations obviously in mind, the bureau also suggested that if there is a problem, it ought to be addressed in the context of anti-trust laws.

**BE**

*Harry C. Martin is president of the Federal Communications Bar Association and a member of Fletcher, Heald & Hildreth PLC, Arlington, VA.*



Send questions and comments to:  
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## Dateline

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## Gamma correction

BY MICHAEL ROBIN



The cathode ray tube (CRT), the display device used in most computer displays, video monitors, television receivers and oscilloscopes, was invented by German scientist Karl Ferdinand Braun in 1897. It features a phosphor-coated screen that emits a visible light when struck by a beam of electrons emitted by a heated cathode. The electrons are concentrated into a beam, and this beam is deflected by a magnetic field to scan the viewing end (anode), which is lined with phosphorescent material. When the electrons hit this material, light is emitted.

In a television CRT, the entire area of the tube is scanned in a fixed pattern called a raster. A picture is created by the video signal modulating the intensity of the electron beam. In modern television sets, the beam is scanned with a magnetic field applied to the neck of the tube by a magnetic

yoke, a set of coils driven by electronic circuits. Color CRTs use three different materials that specifically emit green, blue and red light closely packed together in strips (in aperture grille designs) or clusters (in shadow mask CRTs). There are three electron guns, one for each color, and each gun can reach the dots of only one color.

### The transfer characteristic

In the early days of television, it was discovered that CRTs do not produce a light intensity that is proportional to the input voltage. The relationship between the video signal and the CRT-generated light (the transfer function) is nonlinear and is usually described as a power law:

$$\text{Light intensity} = \text{Volts}^\gamma$$

Gamma ( $\gamma$ ) has a value of 2.8 (PAL and SECAM) or 2.2 (NTSC). The transfer function is commonly referred to as gamma curve. It is caused by elec-

trostatic effects inside the electron gun.

Because most sensors used in television cameras produce output voltages proportional to the scene light intensity, a correction for CRT gamma must be applied somewhere in the system. Figure 1 on page 26 shows how a nonlinear CRT display is compensated by a pre-correction of the original signal. In this drawing, the input and the output are both scaled to the range of 0 to 1, with 0 representing black and 1 representing maximum white (or red, etc.).

Historically, the gamma correction is effected in the camera. This has a positive effect on visibility of the transmission-generated noise in the reproduced picture. This is due to the fact that the human eye is more sensitive to noise in the dark areas, where the gamma behavior of the CRT reduces its visibility. Essentially, the gamma pre-correction acts as a "pre-emphasis" compensating the "de-emphasis" effect of the CRT. In a color television camera, the green, blue and red signals are pre-distorted to match the reference characteristic of the CRT as follows:

$$G_{\text{transmit}} = G_{\text{pickup}}^{1/\gamma} = E'_G$$

$$B_{\text{transmit}} = B_{\text{pickup}}^{1/\gamma} = E'_B$$

$$R_{\text{transmit}} = R_{\text{pickup}}^{1/\gamma} = E'_R$$

$E'$  is the conventional symbol of a gamma-corrected video signal.

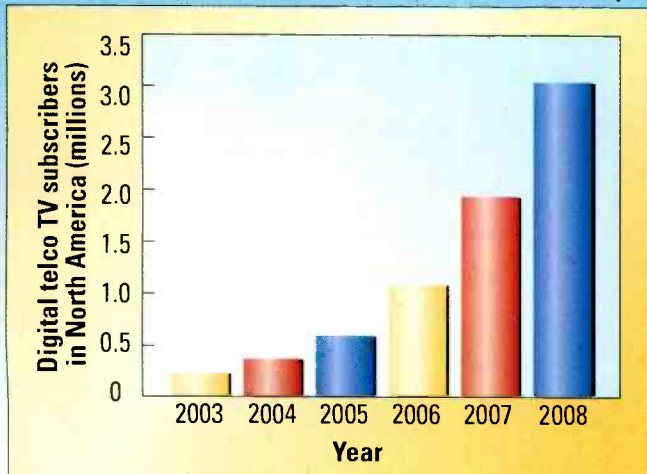
Early cameras using tubes were notoriously unstable. In a multicamera studio, each camera had to be optimized using a gray-scale backlit test-picture source. After each camera was optimized, the cameras had to be matched to produce identical signals.

## FRAME GRAB

A look at tomorrow's technology

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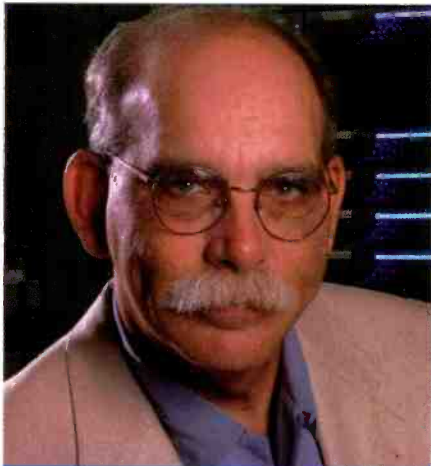
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These camera adjustments used to take a long time, and it was usual to let them heat up and achieve constant temperature. It was not unusual for the cameras to be switched on in the morning and adjusted at 12.00 for the evening news show. The gamma compensation was marginal at best, but that's all that the technology had to offer at the time.

### Contemporary methods

The appearance on the market of solid-state cameras resulted in more stable and predictable performance and the possibility of an improved CRT gamma pre-correction. The ANSI/SMPTE 170M-1994 Standard (SDTV) and ITU-R BT.709 Standard (HDTV) reflect this situation by redefining the CRT electro-optical characteristic and the compensating opto-electronic characteristic of the reference camera.

The CRT electro-optical transfer characteristic is divided into two regions identified as follows:

- The region where  $V_r$  varies between 0.0812 and 1. In this region, the CRT transfer characteristic is expressed as:

$$L_T = [(V_r + 0.99/1.099)/1.099]^\gamma$$

- The region where  $V_r$  varies between 0 and 0.0812. In this region, the CRT transfer characteristic is expressed as:

$$L_T = V_r/4.5$$

where:

$V_r$  is the video signal level driving the reference CRT reproducer normalized to the system reference white.

$L_T$  is the light output from the reference reproducer, normalized to the system reference white.

$$\gamma = 2.2$$

The opto-electronic transfer characteristic of the reference camera is similarly divided into two regions identified as follows:

- The region where  $L_c$  varies between 0.018 and 1. In this region, the camera transfer characteristic is expressed as:

$$V_c = 1.099 \times L_c^{(1/\gamma)} - 0.099$$

- The region where  $L_c$  varies between 0 and 0.018. In this region, the camera transfer function is expressed as:

$$V_c = 4.500 \times L_c$$

where:

$V_c$  is the video signal output of the reference camera, normalized to the system reference white.

$L_c$  is the light input to the reference camera, normalized to the system reference white.

$$\gamma = 2.2$$

While superior to earlier standards,

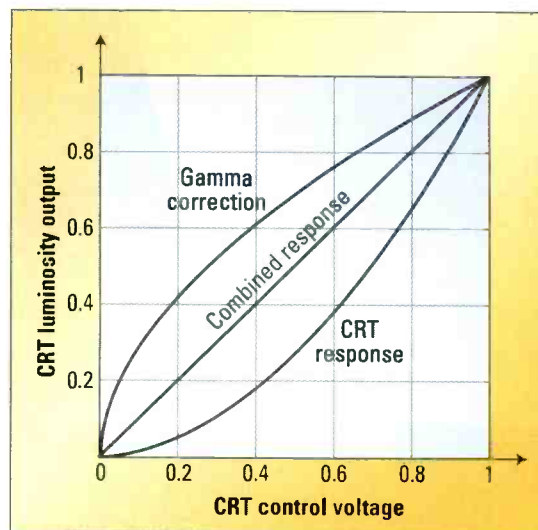


Figure 1. Correction of a CRT nonlinear transfer curve

there still remains a nonlinearity problem in the region of near-black because the CRT curve cannot be perfectly compensated. This has a main effect of the crushing of detail near black (e.g. shadows) and the reduction of saturation of dark colors. These effects are commonly referred-to as "the video look."

Depending on the camera design, the gamma correction may be fixed, variable or missing altogether, e.g. in inexpensive consumer products. Various cameras available on the market offer the operator an additional transfer characteristic control called the "knee." The knee function is used to overcome clipping problems by attenuating or compressing highlights that might otherwise overload the



system. Essentially, the transfer characteristic follows the prescribed curve up to a "knee break-point." Above that level, the gain is considerably reduced.

Depending on the camera design, the knee curve function operates before or after the gamma-correction. Thus, it may be curved or flat. Used by an astute operator, the gamma and the knee controls may be used to create the elusive "film look." Try to standardize this!

### Plasma and LCD displays

Unlike CRT displays, plasma and LCD displays feature a linear transfer characteristic. Early uses of plasma and LCD displays were with laptop computers. With rare exceptions, such as computers used in editing suites, their linear transfer characteristic was ignored.

However, the side-by-side display of the same television picture on a plasma and CRT display revealed that the CRT displayed correct blacks, while plasma displays were unable to display true blacks, turning them into grays. The availability of large plasma displays for home use forced the manufacturers to consider the problem, and they came out with a handy remote-selected black level rendition left to the choice of the user. This function, when selected, forces a nonlinear transfer curve on the plasma display, making its response similar to that of a CRT. Leaving the choice in the hands of the viewer brings back memories of the "hue control," which, when left in the hands of an inexperienced viewer, all but ensured the display of people with green faces.


In a few years, plasma displays will replace aging CRT-display television sets. Given the large quantity of television archives encoded with gamma pre-correction, we are faced with an incompatibility problem that cannot be ignored. Neither the removal of the gamma pre-correction in cameras nor modifying the response of plasma display offers an ideal solution. Suggestions anyone?

BE

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



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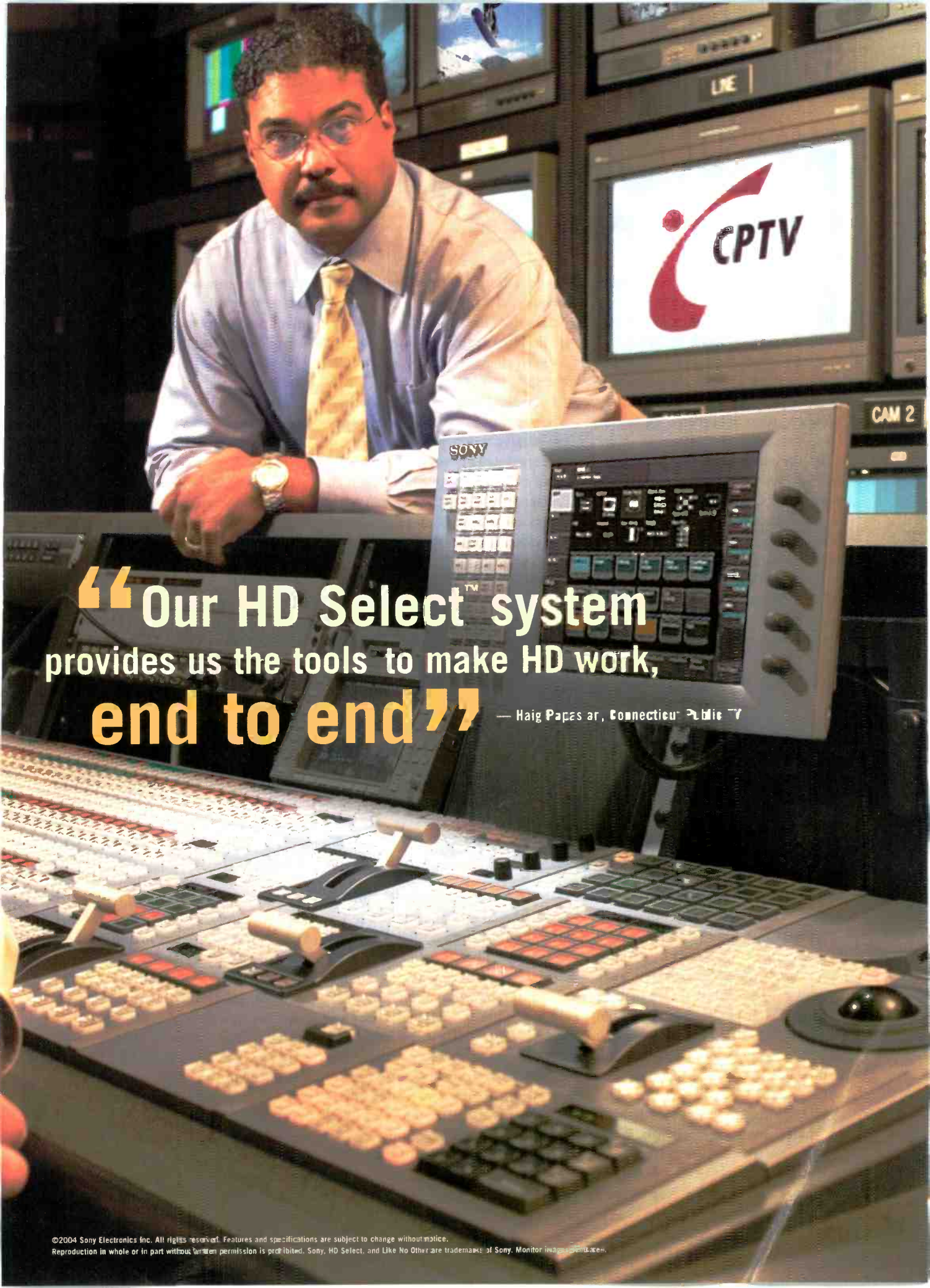
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— Haig Papasian, Connecticut Public TV





# Networking tutorial, part 1

BY BRAD GILMER

**F**requently, all that is required to establish a connection to the Internet is to plug a cable into an available Ethernet jack and turn it on. After a few minutes, the computer is fully configured and ready to go. As with many things, however, there is a lot going on behind the scenes.

For the purpose of this discussion, let's assume you are plugging the computer into a corporate LAN connected to the Internet. Let's further assume that the corporate LAN uses private IP addressing as described in the Internet Engineering Task Force (IETF) Request for Comment (RFC) 1918 (available at [www.rfcs.org](http://www.rfcs.org)). Given this information, you know that the network is likely to be in the range of 10.xxx.xxx.xxx, 172.16.xxx.xxx, or 192.168.xxx.xxx. You could just try

should allow for both fixed IP addresses and dynamically assigned IP addresses. This is exactly what Dynamic Host Configuration Protocol (DHCP) does. (DHCP is more fully described in RFC 2131.)

If you have your network configuration set to obtain an IP address automatically, when your computer is connected to a network it begins a series of exchanges with a DHCP server. The server's task is to assign IP addresses according to a predetermined plan established by the administrator of the network.

I used a packet-sniffing tool (Ethereal) to capture an Ethernet conversation between a computer on the network and a DHCP server. (See Figure 1.) The conversation between the DHCP client (the computer requesting an IP address) and the DHCP

The Offer message contains, among other things, the IP address and the domain name server address the DHCP server is offering. It also contains a lease period. The lease period is an important part of the assignment process.

Imagine that you are a user with a laptop coming to a facility for a meeting. You plug in your computer and obtain an IP address for the local network via DHCP. When the meeting is over, you leave the facility and never return. It would be a big problem if the DHCP server reserved that IP address forever. The solution to the problem is simple — the DHCP server “leases” you an IP address for a specific period of time. Once the lease expires, the IP address becomes available for others to use. If you are a permanent network user, your computer periodically renews its lease.

During the third step in the DHCP negotiation process, the client sends a DHCP Request message back to the DHCP server requesting a specific IP address. The request also includes something called the server

identifier (usually the IP address of the DHCP server) as a check to confirm that the request is being made of the correct DHCP server. (More than one DHCP server can offer an address to the client.)

In the fourth and final step, the DHCP server sends a DHCP ACK message, acknowledging the IP address assignment. Figure 2 illustrates the complete negotiation process.

The DHCP process uses a protocol called BOOTP. This protocol was based upon Reverse Address Resolution Protocol (RARP), which was one of the first attempts to allocate

No.	Time	Source	Destination	Protocol	Info
102	45.765167	0.0.0.0	255.255.255.255	DHCP	DHCP Discover - Transaction ID 0x980a6fa1
103	45.765892	10.0.0.1	255.255.255.255	DHCP	DHCP Offer - Transaction ID 0x980a6fa1
104	45.766180	0.0.0.0	255.255.255.255	DHCP	DHCP Request - Transaction ID 0x980a6fa1
105	45.766859	10.0.0.1	255.255.255.255	DHCP	DHCP ACK - Transaction ID 0x980a6fa1

Figure 1. A screen capture of an exchange between a desktop computer and a DHCP server

some addresses and see if you can establish a connection. There are several problems with this method. First, you might never find the right network address range. Second, if you pick an IP address out of thin air, you could pick an address that has already been allocated to someone else. When this happens, both computers stop talking, with potentially catastrophic results.

What is needed is a system that coordinates the assignment of IP addresses on the network. Ideally, it would allow computers to obtain IP addresses automatically. The system

server (the computer responsible for assigning IP addresses) follows a specific pattern. First, the client sends out a broadcast message asking DHCP servers to reply with an offer of an IP address. This is a DHCP Discover message. The DHCP standard allows multiple servers to reply with an offer. The Discover message can contain suggestions to the servers for an IP address and other IP parameters. Note that this is only a suggestion.

The second step in the process is for DHCP servers to respond to the Discover message with an Offer message.



network addresses dynamically. BOOTP (DHCP) rides upon User Datagram Protocol (UDP). As a result, delivery of DHCP messages is not guaranteed.

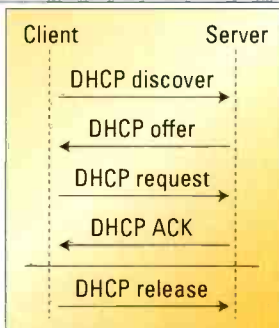
In Figure 1, the source address of the client is 0.0.0.0. This is because

the client does not have an IP address yet. However, it does have a Media Access Control (MAC) address that uniquely identifies the client computer. The source and destination MAC addresses are sent with every DHCP message. This allows computers on the network to determine who sent the message and where it is intended to go. Messages targeted at the DHCP server are sent as broadcast messages with the special address of 255.255.255.255. Any messages with this destination address are intended to be "read" by all network devices. More than one DHCP server could respond to a DHCP Discover message, so these messages should be sent to everyone. Once the DHCP ACK message has been sent, the client may begin using the assigned IP address.

There are two ways that a DHCP address can be put back into the pool. One way is for the lease to expire. The other way is for the client to send a Release message to the DHCP server. The last line of Figure 1 shows that the client is now using the address it was assigned (192.168.1.101). The client sends the Release message to 192.168.1.1, which is the address of the DHCP server. The client saved this address when it received the DHCP ACK message.

Once you have obtained an IP address on an internal network, you may still have problems accessing the Internet. Many corporations have firewall rules that limit the type of traffic permitted to be exchanged between the Internet and computers within their facilities.

There are many other things that can be done with DHCP servers. If you would like to learn more, I encourage you to read the DHCP RFC



(RFC 2131). A search for "DHCP tutorial"

**Figure 2. The DHCP negotiation process involves four steps — Discover, Offer, Request and Acknowledge. Release is a command issued later to release the IP address allocation.**

on your favorite Web search engine will yield many resources as well. **BE**

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



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## The DAW market diverges

BY DAN DALEY

At a time when convergence seems to be the operative notion in the digital domain, the digital audio workstation (DAW) market has experienced a significant divergence — split between a hardware- and software-based approach. While last October's AES revealed that the software component has become more pervasive, the show displayed a wealth of both types of systems.

A bit of context is useful. The last two years produced a slew of acquisitions by major brand names of audio software programs:

- Adobe purchased Syntrillium.
- Pinnacle Systems acquired Steinberg Media Technologies.
- Sony Pictures DTV purchased Sonic Foundry.
- Apple acquired Emagic.

With a hardware-based system, mixers only have to do a major systems upgrade about every six years.

The interface is the consistent point of contention in the software versus hardware debate. Hardware-based systems have a familiar, dependable operator interface. If you're doing a relatively limited set of tasks, such as mixing sound for a sitcom, a hardware system works well. It dedicates movements for every task, which makes the process incredibly simple and allows you to focus on the task at hand, not on pull-down menus and mouse moves. Mixers who use hardware-based systems don't need a lot of upgrades.

But software-based systems residing on host computers perform better in another way that is critical for contemporary facility operations. Computers

connect more easily to internal network systems like LANs, making it easier to move work around and through facilities, and to connect to increasingly large SFX and other audio databases. It's also easier to burn nonlinear media such as CDs and DVDs, which act as backup media for software-based systems.

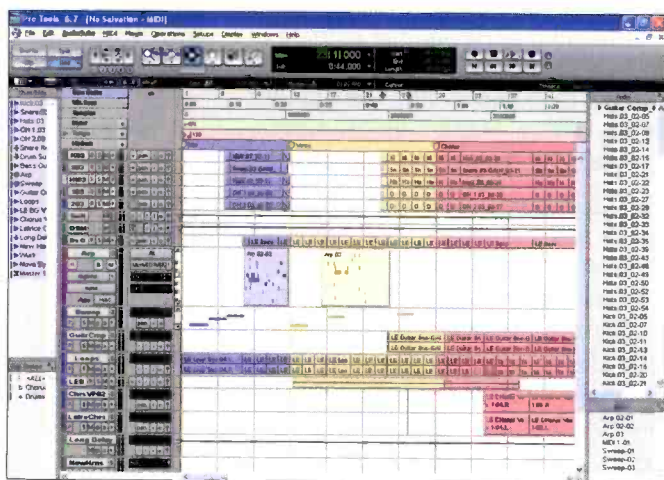
anything to do with digital, it's a double-edged sword. Roy Latham, a mixer who has done much work on long-form animated projects, says he transitioned to Pro Tools primarily for the wide variety of plug-ins, many of which mimic the operation of vintage (and expensive) hardware-based processors. But he acknowledges that managing the myriad bundles of plug-ins can become a career in and of itself.

But third-party development is extending well beyond DSP plug-ins. The more complex operational aspects of Pro Tools can be integrated with QuickKeys software and a Kensington four-button TurboMouse.

The case can be made strongly for hardware- or software-based DAWs. The more specific the task and the more it keeps its operations within certain parameters like mixing, the better the hardware-based approach might be. When post projects require a lot of flexibility, or there is a constant need for multiple signal processors, the software approach seems to come out ahead.

Surprisingly, it might be a perceptual criterion that ultimately makes the decision for some users. Mixers say that clients have come to expect the use of Pro Tools.

Latham says that it is a standard of sorts, and that expectation has tended to push the entire software-based array of systems. He adds that software systems do crash, which is something that his Fairlight rarely did. But you build that into your work-flow. He said that when he gets a crash, he just goes to lunch while it reboots. **BE**



Software-based interfaces are becoming an industry standard for audio production, making upgrades easier. Pro Tools photo courtesy of Digidesign.

Hardware systems have responded by getting smaller, faster, cheaper and better. It also has lubricated its upgrade paths — perhaps the biggest drawback to dedicated hardware systems in the past.

difference between the two domains. The software-based DAW is increasingly diffused with what has become a universe of third-party plug-in processors in which hardware-based systems simply can't participate. Like

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



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# LPTV and translator worries

BY DON MARKLEY

Since DTV's infancy, many operators of translator systems or LPTV stations have worried about their ability to continue operating. Western state operators who routinely depend on large networks of translators to serve small valley markets are particularly worried.

New ATV operation requirements have exacerbated translator operators' problems. David Hershberger of Axcera, LLC has discussed these new problems at length in technical papers presented at NAB conferences and other meetings. Visit [www.axcera.com](http://www.axcera.com) or contact Mr. Hershberger directly at [dhershberger@axcera.com](mailto:dhershberger@axcera.com). The company has done a significant amount of work in this area and offers numerous solutions.

## Timing is everything

The problem with single- or multiple-frequency translator networks lies with the timing signals. ATV modulators require the synchronization information that is included in

the trellis code. But facility transmitters remove the trellis-code data before transmitting the signal, depriving translators of the timing data. The



WPSX-DT's 1kW booster in Altoona, PA, is part of the world's first Distributed Transmission (DTx) network.

solution is to modify the SMPTE310 data stream. The translators are designed to cadence sync using information contained in the distributed transmission packets to synchronize their symbols, timing and pilot frequencies. GPS receivers at each translator location obtain the timing reference. Basically, for two-channel systems, the main transmitter sends out both the main signal and the SMPTE310M signal to the translators. The translators then operate sharing the same channel. The ability of standard consumer receivers to handle multipath makes the whole thing work. When a receiver obtains more than one signal, it simply treats them as multipath. Fifth-generation decoders announced last spring can handle multipath signals equal in strength to the primary signal.

The FCC finally came out with a Report and Order establishing the new rules for translators and LPTV stations. The entire document is available on the commission's Web site. Search for MB Docket No. 03-185, and you'll get all 120+ pages.

## In plain English

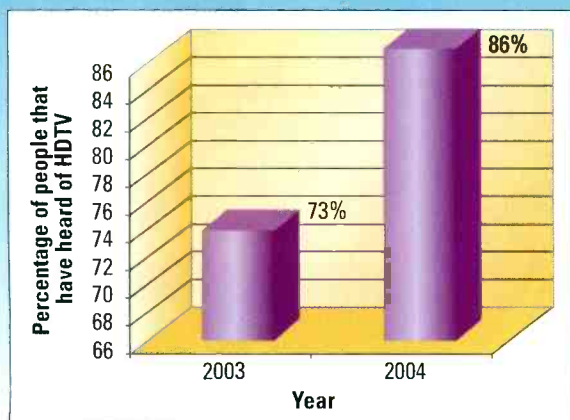
For a great overview of many of the main issues covered by this FCC document, the law firm Fletcher, Heald and Hildreth, P.L.C. publishes a Memorandum to Clients. You can obtain that document by visiting the firm's Web site at [www.fhhlaw.com](http://www.fhhlaw.com). The document is unusually clear and easy to understand. Even engineers can understand it. What's more, the authors have sneaked some humor into it — most un-lawyer-like. The October issue (No 04-10) is quite helpful for deciphering some of the LPTV issues. Most importantly, it reveals that existing analog translators



## FRAME GRAB A look at the consumer side of DTV

Awareness of HDTV has grown

86 percent of people have heard of HDTV



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can rebroadcast converted DTV signals in an analog format. Conversely, digital translators can receive analog signals and transmit them in a digital format. It seems that the commission feels that this policy will get the most signals to the greatest number of people.

The new rules also contain all the normal stuff like power levels, interference prediction and masks. Here, Fletcher, Heald and Hildreth accept the fact that they, as lawyers, don't understand this technical stuff — a rare and gracious admission.

### Coping with changing rules

Because many translators operate outside of the core channels, many operators have expressed concern about their ability to continue operating. But the new FCC rules make it quite clear that they can continue, at least for the time being. The commission's main requirement is

that translators must not interfere with primary facilities. Many of those channels have already been sold, and the commission expects all LPTV stations now on channels 60 through 69 to move to other channels by the time full DTV conversion takes place. That conversion is scheduled to occur between 2006 and 2009.

The commission has stated that a digital transmitter can retransmit over the same channel on which it receives. This brings up the distributed-network problems discussed earlier. Without discussing the legal problems involved in authorizations, the on-channel DTV operation does seem to be the same as an on-channel booster. But, as before, the timing signals rear their ugly heads. The question here is whether the primary station will agree to transmit the 310M signal to give everyone the necessary timing signals. The commission hasn't completed the

full rules for DTS operation, but it's working on them. I've been told that this isn't a real problem and can be resolved in a reasonable fashion.

To allay the fears of the Class A crowd, the commission will allow existing Class A LPTV stations to "flash cut" to DTV without losing their protected status. An interesting term, "flash cut." It gives you the impression that a giant arc of electricity will appear, a deep voice will shout "Shazam!" and your station will be operating in DTV. The giant arc does sometimes occur, but it's usually just a transmission-line center conductor vaporizing.

We'll talk a bit more about the actual technical rules in a future issue. **BE**

*Don Markley is president of D.L. Markley and Associates, Peoria, IL.*



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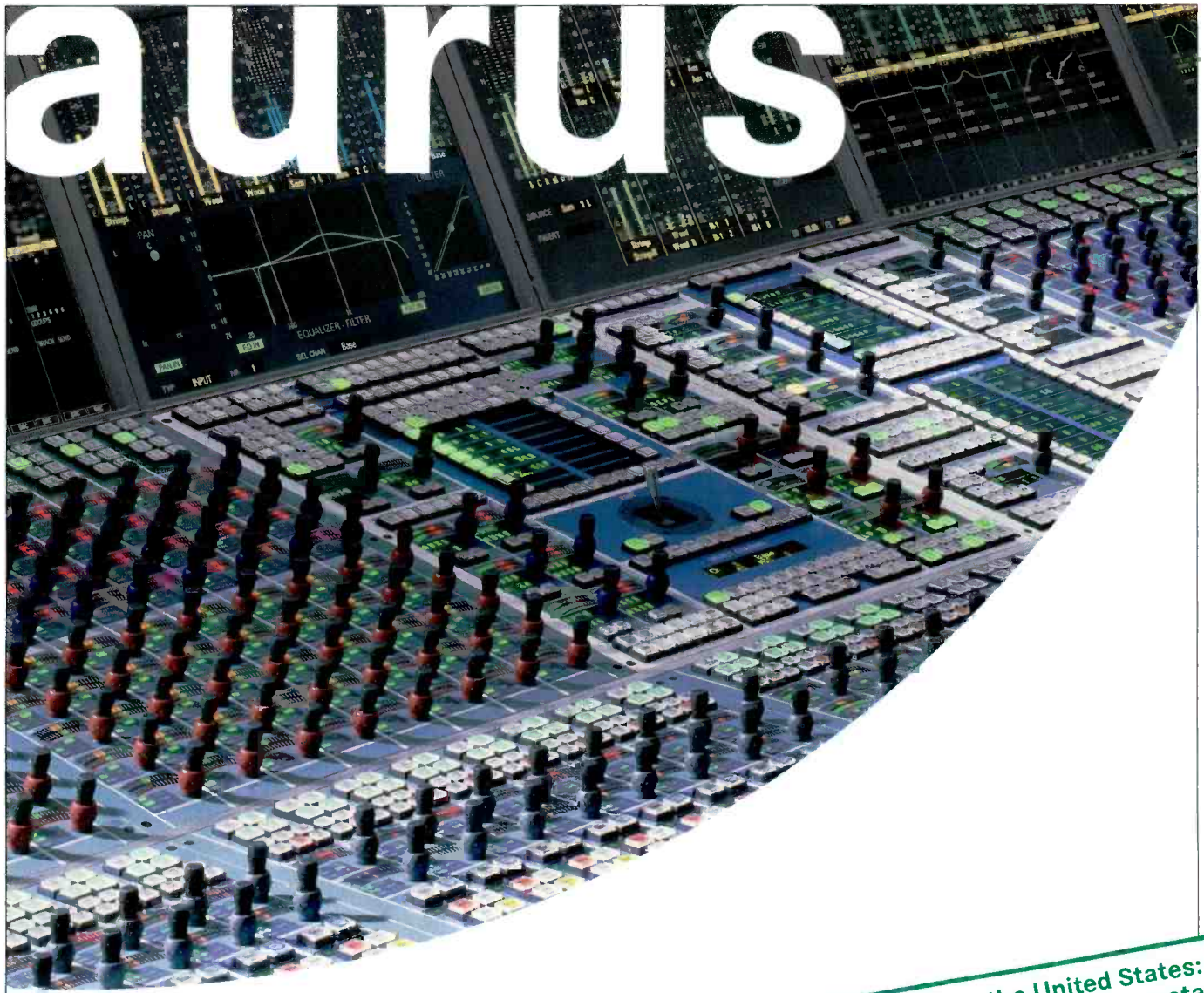
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SYSTEMS  
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# HBO

## serves up secure, tapeless playout

BY MICHAEL GROTTICELLI

**S**ince the HBO Communications Center was built in 1983 as a distribution center working out of a futuristic, custom-designed site, the Home Box Office (HBO) network has always forged new technological ground. That's because its business model demanded it: Over the years, the company has experienced incredible growth, expanding from four channels to a bi-coastal network of 28 standard-definition and four high-definition channels and on-demand distribution.

With such a large responsibility,

the facility has to remain operational 24 hours a day, while providing responsiveness to industry change. In this case, 99.99 percent reliability is not good enough: HBO strives for 99.999 percent, which equates to no more than five minutes of downtime, per channel, per year.

When the network chose the technology that serves as the heart of the network's playout systems, it selected established players in both the broadcast and computer industries. This combination provides a high degree

of system reliability and technology innovation.

The network considered moving to a server-based model back in the mid-1990s, as its tape-based systems began to reach their seventh year of online usage, but the cost of storage was prohibitive.

When the time came to move from tape formats in SD and HD to a tapeless distribution system, HBO chose Grass Valley Profile XP Media Platform servers, Grass Valley Storage



An operator monitors HBO's 32 internal channels on Barco VGA monitors, Panasonic plasma displays and Vivaldi monitor display hardware in the master control suite of the HBO Communications Center.



Area Network (SAN) systems and Venus routers from Thomson, combined with Sun Microsystems 6800 mid-level series servers and Hitachi 9980 storage systems.

#### **Systems must be online 24 hours a day**

The HBO Communications Center is a study in the tight integration of traditional broadcast and forward-looking,

computer industry systems now available to support network operations.

The facility is protected by redundant power distribution that can keep it up and running for 18 days without outside fuel refills. During the massive East Coast blackout in 2003, for example, the facility continued to operate uninterrupted.

Beginning in 2002, HBO has so far

transitioned eight of its channels to the new Sun-Thomson solution. The plan is to have the remaining channels playing from this architecture next year. When complete, HBO will move the same amount of content from the Sun architecture to six Grass Valley PVS 1100 Profile XP Media Platform servers as approximately 75



Digital Betacam VTRs.

HBO online storage starts with redundant Sun 6800 mid-level servers, on two separate floors, holding 50TB of storage each. The storage, provided by Hitachi, equals about 5000 hours, or one year's worth of content. Files are moved between storage arrays at 350MB/s.

These systems are linked to two Grass Valley Open SAN systems, consisting of two Profile servers each that serve the on-air channels directly. Each feature file is encoded as an MPEG-2 file and stored on hot-swappable Ciprico 146GB drive arrays.

Each SAN system is dedicated to four HBO channels, holding about four days' worth of content. Ensuring reliability, one SAN system serves as a backup to the other. Content is moved from the Sun server to the Grass Valley Profile servers via FTP file transfer at about 30Mb/s, with burst rates slightly higher. As a particular feature is readied for air, two copies are stored on the Profile servers about one day before the feature is to air. This process ensures that the content will air at the pre-determined time because the servers work in tandem. There is no human intervention as the FTP process moves about 1TB of data per server per day.

HBO wrote custom Java-based applications that enable the Profile servers to automatically duplicate a file and maintain replication after quality control. Written to be compatible with Thomson's Grass Valley ContentShare software inside the Profile servers, the programs were recognized by the Java community with a special Enterprise Design award. The award was presented by Sun CEO Scott McNeely personally to HBO last year. As a final

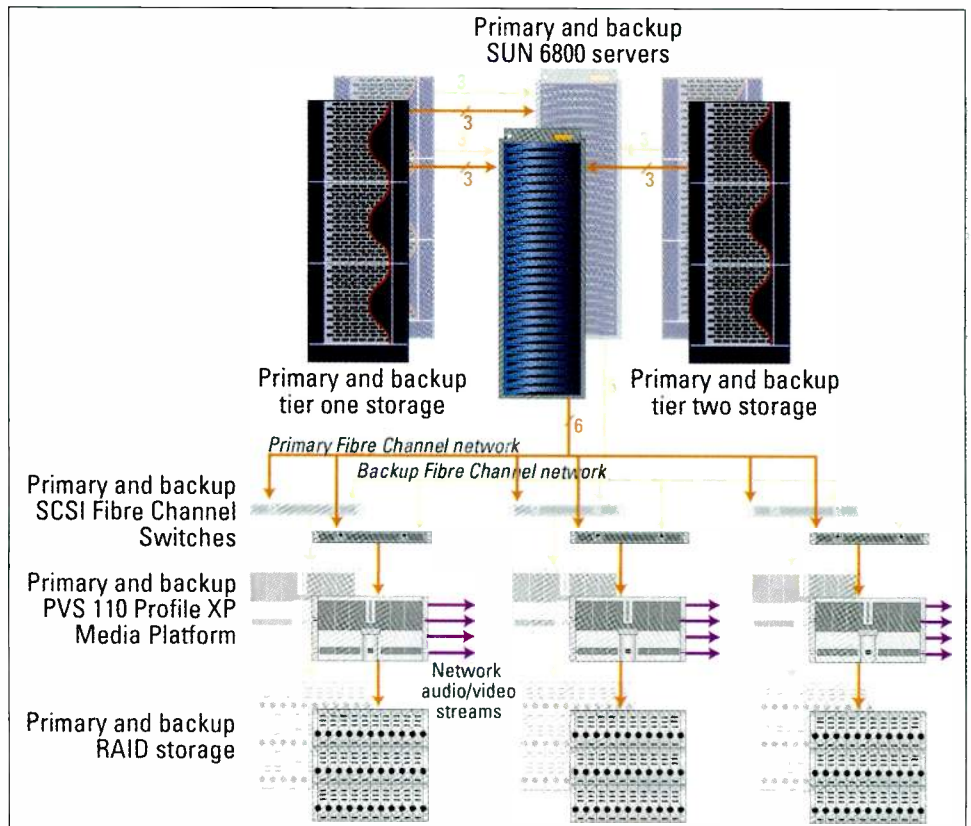


**Multiple Grass Valley Open SAN systems from Thomson, consisting of two Profile servers each, hold about four days' worth of content each for four HBO on-air channels. Each movie file is encoded as an MPEG-2 file and stored on hot-swappable Ciprico 146GB drive arrays.**

disaster-recovery option, HBO intends to create a third copy of a file and send it to the network's production facility in New York City, 50 miles away.

In addition to an advanced server

infrastructure, the HBO facility includes a main master control (MC) suite and three control rooms. The MC suite monitors a total of 32 channels internally and is equipped with a full wall of Barco VGA monitors,



**Figure 1. Storage at HBO includes Sun 6800 servers for offline content (top) and Grass Valley Profile XP Media Platform servers (using RAID arrays) for programs airing that day.**

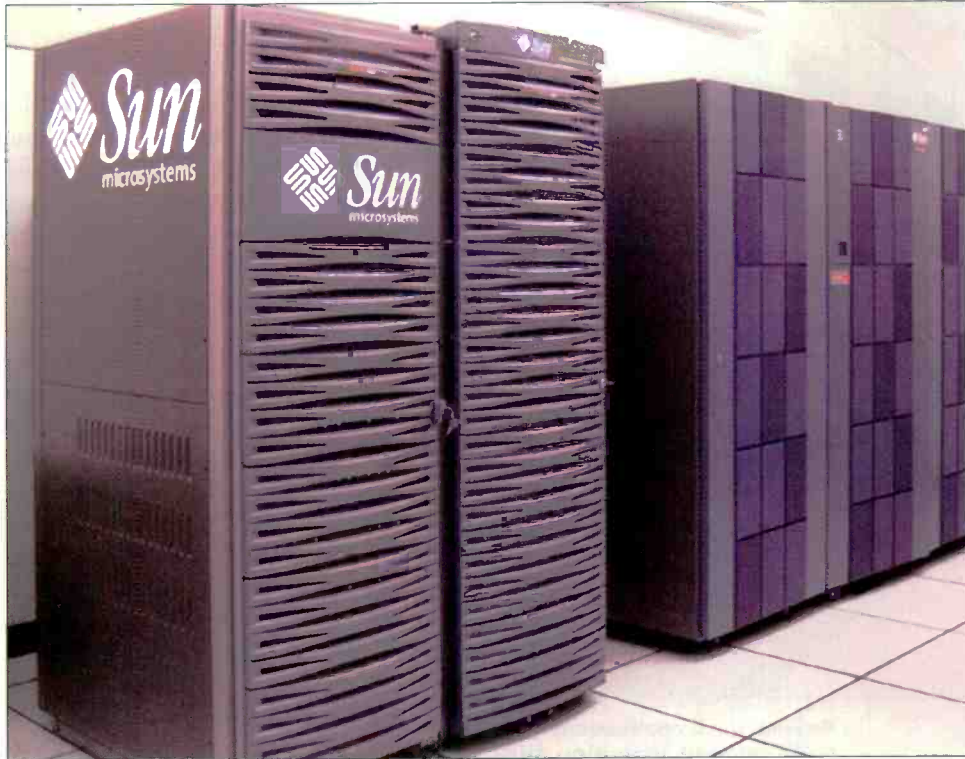


four Panasonic plasma displays, a New Point Technology alarming system and Barco Vivaldi monitor display hardware.

There is one dedicated control room for HBO's 16 East and West Coast feeds, which incorporates both its SD and HD channels, a second control room for CineMax and its 12 East and West feeds, and a third "breakaway" room that handles all live events. During a live telecast, the West Coast feed is "broken away" from the delay (Profile) systems three to four hours prior to the event under automation.

### Tiered storage

HBO is developing a multi-tiered storage infrastructure using Java-based software that directs the content into two tiers. Tier 1 serves as online storage — content that's to be used immediately — while Tier 2 storage is used basically as an archive.



Two Sun Microsystems 6800 series mid-level servers, located on separate floors for redundancy, provide offline storage for approximately one year's worth of content. Content moves between storage arrays at 350MB/s.

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VP, broadcast eng.

Kenneth Chin, TD, broadcast eng.

Most features now come into the facility on a Digital Betacam cassette, but the network is quickly moving toward a true file-to-file conversion approach that, in the future, will eliminate the use of videotape completely. As files are ingested into the system, approximately 15 Java applications help handle the material and reduce human error. Incoming files are automatically encoded and distributed to the proper channel with-in minutes. Interestingly, once a feature has reached its end-of-play cycle, it is not archived at all. When the feature's licensing agreement window has expired, a new file is overwritten on the drive to replace it.

### On-demand distribution

All distribution of on-demand content comes from the HBO Communications Center in Hauppauge, NY, from which HBO distributes approximately 150 to 200 hours of content to cable systems across the United States. HBO has been working with encoding manufacturers and automation providers — as well as developing its own applications — to employ electronic workflow processes that will better support the growth expected in HBO's on-demand service.

The best part about HBO's digital facility and its systems is that moving to the highly automated Sun/Hitachi and Profile servers and Open SAN systems has resulted in the development of electronic workflow architectures that increase efficiencies and allow HBO to put additional safeguards in place to continue its mission-critical distribution. **BE**

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

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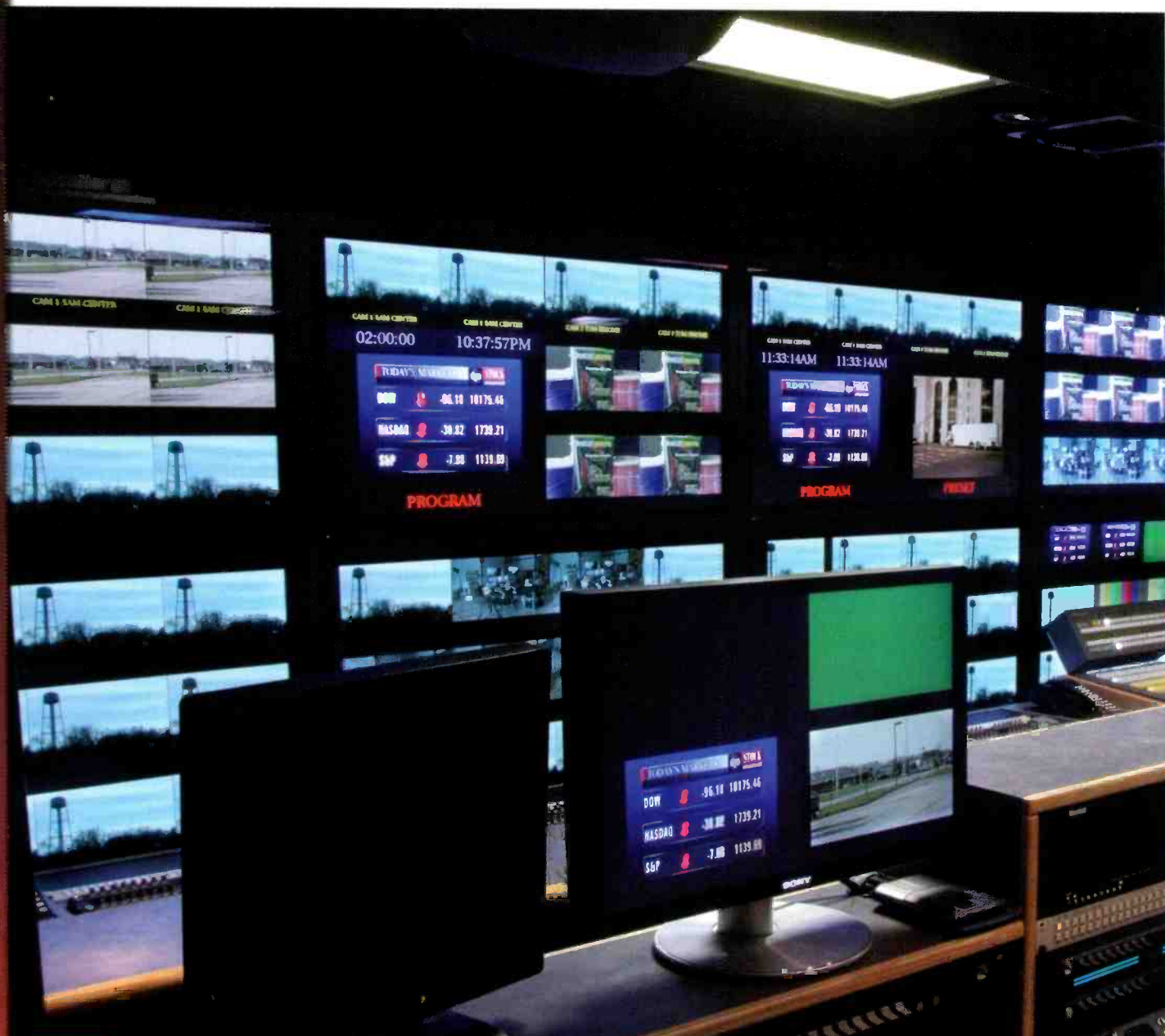
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digital emotion



By Barry Bennett

# Trends in trucks

**F**or mobile system integrators, 2004 was an exciting year. Vendors carefully tested out HD for several months. Today, many have fully embraced it. Sure, HD is still more expensive than other formats, but are there any other options in this digital age? The TV production industry's continuing migration to all digital, specifically HD, has not been lost on the remote truck

business. Some would say that the industry is, in fact, being driven by this business. It's more than a trend; it's a landslide. In large-scale sports and entertainment production, HD has clearly emerged as the format of choice and a competitive necessity. If you don't have an HD unit (or several) in your fleet soon, you're going to be left behind.





This virtual monitor wall, which was recently completed for Lyon Video in a large truck, saved 30in of floor space and about 1000lb.

## Formats

The primary video flow in trucks is now purely digital. And, within the digital domain, many of today's trucks use HD as the primary signal path. They use SDI-601 mostly as a monitoring layer or, in trucks with multiple routers, to route it to the onboard SDI legacy gear.

NTSC usage in new production vehicles is dwindling

rather quickly. But remote truck designers must still incorporate some NTSC into the vehicle design. For the most part, NTSC has assumed a monitoring function in today's large-scale remote vehicles. One practical application of NTSC monitoring is long-haul feeds where the cable distance within an arena may exceed the distance limitations of digital video over coax (although fiber-optic cable is also always an option). New trucks may also need NTSC video or SDI-601 digital video to provide feeds to the outside world, such as the local arena where the remote truck is parked. These signals may also serve as feeds to and from older trucks, which may need to share cameras on a multi-truck remote. This situation will probably continue for several years until all venues have upgraded to digital.

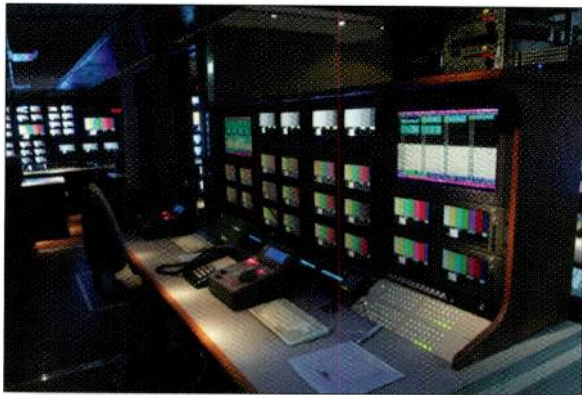
A truck operator might argue that the arenas and other trucks should have the appropriate conversion gear to use his or her pristine HD signals. But, practically speaking, the operator must provide all signals in all formats. Today, virtually all A- and B-grade production vehicles use SDI or HD signals. Like dinosaurs, analog trucks will become extinct, probably fairly soon. But, even when this occurs, NTSC in an HD truck will still find some limited utility, such as in local-area feeds as mentioned above, possibly satellite transmission, and perhaps the inevitable VHS copies of the show. The truck operator may still be called upon to provide all formats for some years to come.

Most, if not all, professional production equipment can now produce video in the majority of the various HD flavors. A discussion of these various formats is beyond the scope of this article. It's sufficient to say that it didn't take long for manufacturers to build obsolescence protection into their equipment. And, to me, it seems fairly obvious that this has been one of the driving factors in the current migration to HD production vehicles.

It would be difficult to justify a multimillion-dollar expense for a specific HD format truck if, even as it were being built, clients were demanding a different HD format for their production needs. This single difficulty was likely the reason that the last couple of years were rather sparse in large-scale remote vehicle construction. Manufacturers have responded well with multistandard equipment, enabling truck operators to put together a truck with a lifespan measured in years instead of months.

## Intelligent terminal equipment

It takes little more than the flip of a switch (or the click of a mouse) to convert cameras, switchers, etc., from 1080i to 720p or to any other HD format. Manufacturers offer intelligent terminal equipment that can switch just as easily; some are even auto-sensing. Need cropped downconverted outputs? No problem. Just click the mouse. How about letterbox? Same answer. If you are an information junkie, your DA can now tell you every parameter of every input and output on the card. Wow! Talk about information overload.



**This customized tape production bench has a monitor wall that includes flat-screen and tube monitors but is still only 11in deep.**

Technologies like smart DAs, IP-enabled monitoring devices and networked card cages are now fully implemented in remote trucks. Couple this with the almost complete implementation of programmable production equipment, and your truck has now taken on the role of being little more than a rolling computer with chairs and the occasional human-interface device. It is technically feasible for an engineer in San Francisco to set up a truck on-site anywhere in the country — perhaps even from a laptop computer in an airport or hotel room. What is perhaps even more useful to the mobile production industry is that an engineering specialist located at a desk somewhere can dial into any part of a truck and perform advanced troubleshooting or reconfiguration in near real time.

Of course, an even more obvious benefit of this IP and computer power is the ability to virtually set up a truck simply by loading a file or a set of files from the truck's server. Now you can set up an entire show from a computer keyboard, or restore a previous show from disk, and do it in minutes instead of hours.

These features are powerful. But along with such power comes some risk. Make sure that your IP-enabled truck is secure from the sinister forces that seem to lurk around every corner in the Internet universe. It is entirely possible for the casual tourist to hack into your truck and, for example, start switching cameras for his or her own amusement, right in the middle of a show. The system operator would be well-advised to keep all critical IP communications that exist within the truck inside the truck. Even so, don't overlook the various

sources of possible trouble presumed to be on the safe side of your firewall. Theoretically, someone could insert an infected switcher, DVE or Chyron disk and either unknowingly or maliciously unleash any sort of horror that can plague any computer system. Careful network security design is crucial in today's facilities. Make sure to restrict the outside world's access to the truck's critical network paths.

### Monitoring

Trucks are enjoying (perhaps, more accurately, have enjoyed) a migration from tube monitors to various forms of flat-panel monitors. The two flat-panel types most commonly used in trucks today are LCD and plasma panels. Recent design advances in flat-panel technology have all but eliminated the need for tube monitors (with the possible exception of the video operator position and, in some cases, the EIC).

Future generations of flat-panel displays will doubtless improve enough to eliminate these last few holdouts. Several recent truck designs employ LCD monitors for video shading, with good results. Flat panels still can't quite match a tube monitor's colorimetry accuracy, so a truck may need at least one tube monitor. But, as the flat panels improve further, the QC station tube monitor will likely fade into history. And, before too long, home viewers will all be watching shows on the same flat panels that now serve in trucks.

### Production monitoring

The maturity of multi-screen display engines, combined with advances in large flat-panel display technology, has enabled completely virtual monitor walls in today's remote units. A monitor wall consisting of multiple 50in plasma or LCD panels and a screen-splitting system is an impressive sight. It also saves approximately 1000lb and up to 4ft of floor space compared to the same size wall built with discrete tube monitors. One recently completed large truck project took full advantage

of this space savings. The designers incorporated an entire second production room into the truck with no apparent loss of floor space. This raises many interesting possibilities for the future of truck design.

The virtual wall introduces a further benefit: All tally and operator information can be on-screen. Want UMD displays? No problem. It's all virtual; just type and click it into existence. Resize your monitors at will, with or without tally and UMD for each virtual screen. Mix 16:9 with 4:3 images. Dedicate one entire 50in monitor to program video. As the saying goes, "Have it your way."

You can also display clocks, count-down and even audio levels in one or multiple locations on your virtual monitor wall. And you can save your show setup on disk for the next time. Have a few default-monitor setups ready for your most anticipated monitor layouts, and you'll have the truck up and running at a remote location in no time. Setting up the production room becomes as easy as a couple of computer clicks.

### Scopes versus rasterizers

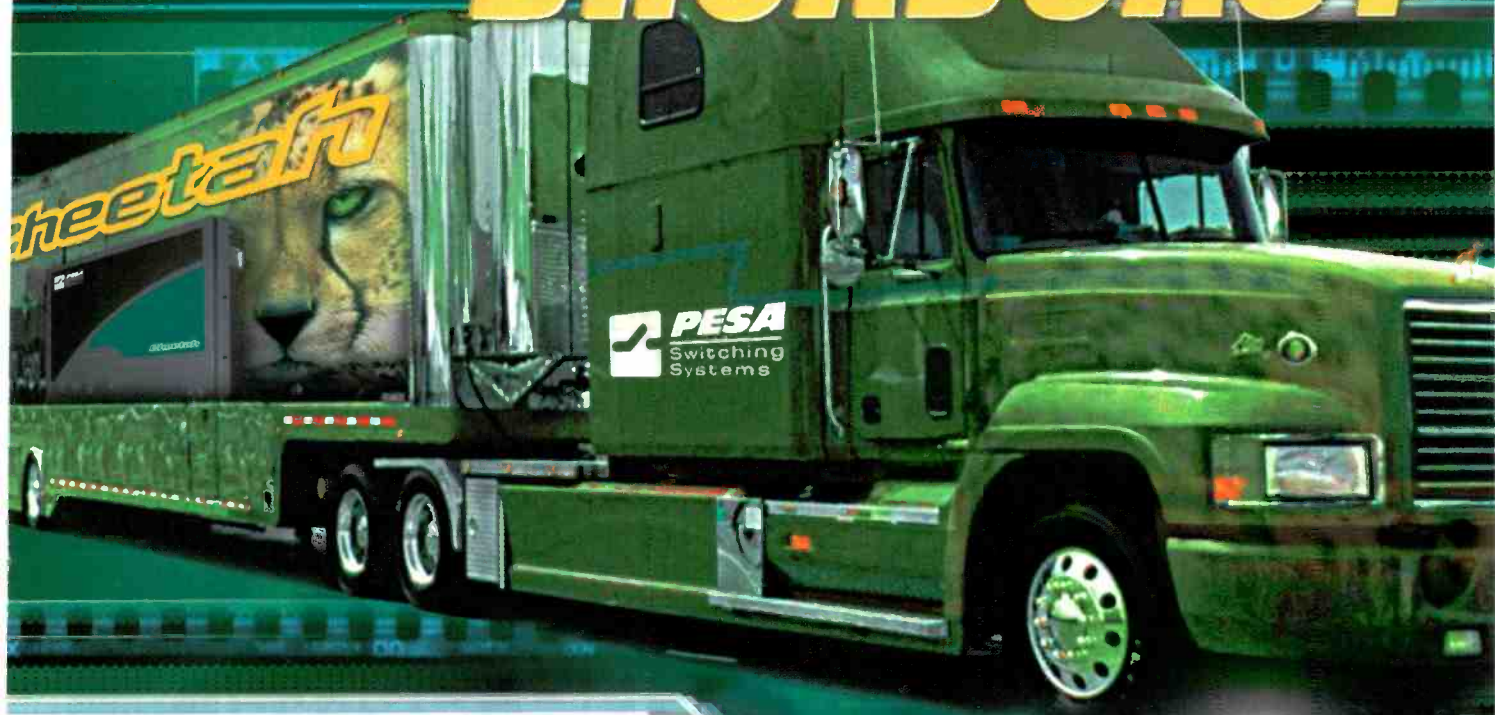
Traditional tube-type monitoring for waveform and vector display is also giving way to flat-panel technology. The new display device may take the form of a traditional instrument that looks like a waveform monitor but replaces the tube with a built-in flat-panel display. Or it may take the form of a



**Flat-screen implementation allowed this entire second production room to fit within the standard large-truck footprint of Mira Mobile's recently completed unit.**



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rack-mount box of electronics coupled with a display device, generally an LCD monitor. Packaging this instrument to fit in a traditional waveform slot allows a more traditional approach to waveform monitoring while taking full advantage of the benefits of flat-panel displays.

As flat panels become the accepted standard for QC stations such as video and transmission, the standalone rasterizer coupled to a 15in, 17in or larger LCD or plasma display will become a powerful tool. The video monitor may also be the waveform monitor, and the display could be placed anywhere in the monitor screen. Where space is a critical concern, you can locate the rasterizer's electronics off-axis from your viewing area (or anywhere in the truck, depending on the operator's need for access to the display controls). Actually, because the rasterizer is an IP-enabled device, it of-

fers numerous remote-control options.

The operational requirements will dictate how designers engineer these devices into a particular truck. Having worked as a video engineer, I like the concept of the waveform monitor integrated directly into the shading monitor. With this configuration, the operator need not take his eyes off the show to see the waveform displays. This same technology can apply to the audio system for monitoring purposes. The main program video monitor in the audio room can be a flat-panel LCD with a rasterizer display of truly bewildering capability.

### An interesting future

The remote broadcast industry finally is seeing the benefits of recent technical advances. Technical solutions that have been in the works for several months have produced many exciting implementations this year.



**This video shading area uses a multi-display rasterizer for video QC monitoring.**

The promises of yesterday are rapidly becoming the realities of today.

It's safe to say that the new generation of large-scale remote trucks will continue to evolve as the technology improves. But, eventually, someone must pay for all these new toys. Fortunately, the price of this equipment is dropping. We seem to have reached a point at which the truck operator can justify the additional expense of the new technology. The future will be interesting, indeed.

**BE**

*Barry Bennett is a truck system integrator at Bennett Systems in Sunbury, OH.*

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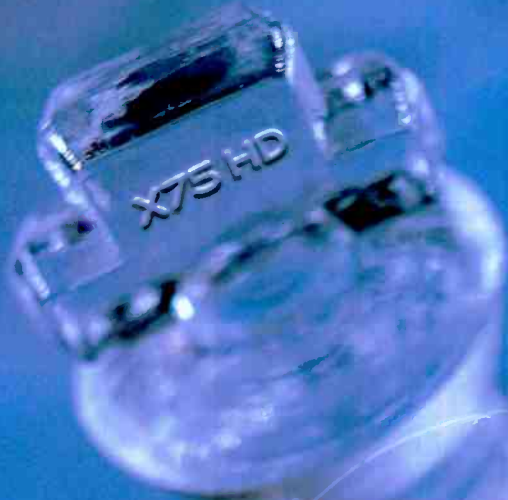
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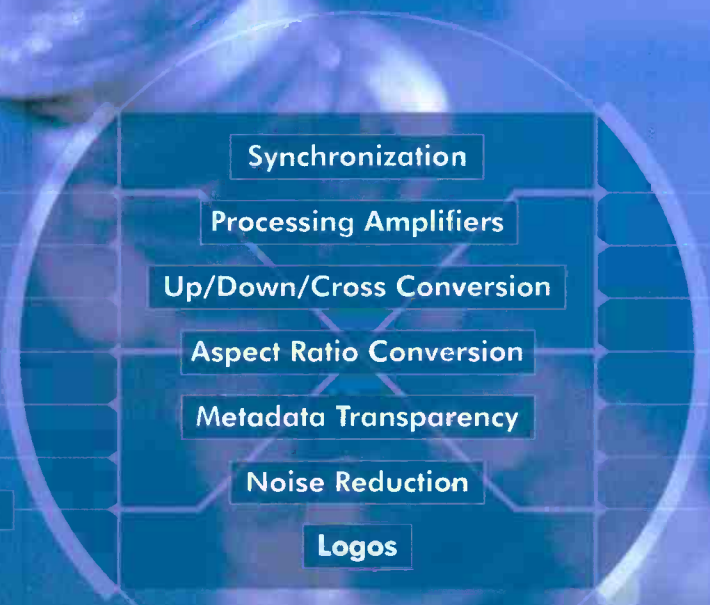


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With capabilities that far exceed a high-definition processing synchronizer, the X75HD allows broadcasters to do more with less equipment. Video processing features include level/color control; 3D adaptive color decoding; noise reduction; frame synchronization and time base correction for non-synchronous signals; and up, cross, and down-conversion with aspect ratio conversion for hybrid standard and high-definition facilities.

The X75HD's 16 channels of internal audio processing include level control, analog-to-digital and digital-to-analog conversion, and embedding and de-embedding for both SDI and HD-SDI serial digital signals for interfacing any audio signal in a professional environment. Integrated Dolby® decompression and voice-over brings even more functionality.

### Infinitely Flexible I/O

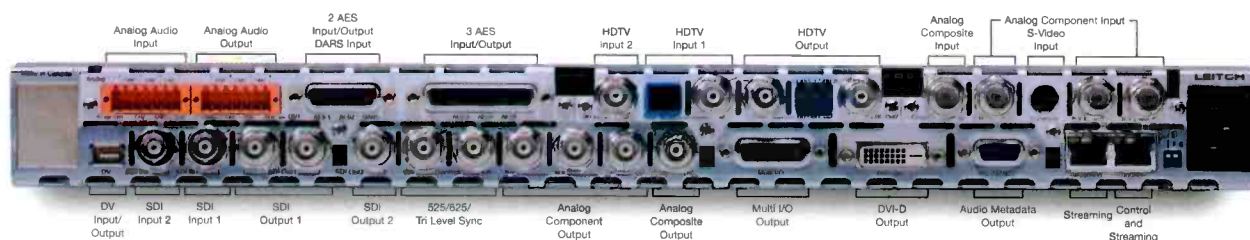
The exceptionally flexible X75HD is able to up, down and cross-convert from up to seven input video formats — more than any similar product currently on the market — to almost any output video format. In addition, the X75HD features auto-detected inputs with auto-changeover and user-selectable alarms for reduced downtime.

Providing separate connections for all video input and output formats, the X75HD allows for convenient front panel selection between multiple input devices — all of which may be connected simultaneously. Video input formats include HDTV optical fiber, HD-SDI, SDI, DV, composite video, component analog video (Betacam®) and Y/C (S-VHS/Hi-8). Ten outputs of the same signals are provided, as well as streaming video and audio over Ethernet, RGB, DVI-D, and PAL-B/PAL-M/SECAM/NTSC composite video output.

### Exceptional Signal Quality

Full 10-bit processing for digital video is used for up, down and cross-conversions using a motion-adaptive de-interlacing technology. Included composite analog video outputs for PAL-B and NTSC are 12-bit wideband digital over-sampled for ultra-flat frequency response and exceptional signal-to-noise performance. The optional analog composite input offers 12-bit processing with the highest performance 3D adaptive comb filtering available in the market.

With the optional Digital Noise Reduction feature, convenient front panel controls permit adjustments for both spatial and temporal noise reduction. In addition, the Digital Bandwidth Filtering feature offers 2D filtering with separate horizontal and vertical bandwidth adjustments, providing entropy reduction prior to encoding or MPEG pre-processing applications.





## Effortless Control

Control and monitoring of signals passing through the X75HD is enabled using IP over Ethernet, and instant operator control from the local or remote control panels allows for easy manipulation of video and audio signals. Using two Ethernet ports per unit (one for control, monitoring and video thumbnails, and one for video and audio streaming) makes PC control and monitoring over large networks entirely manageable.

A built-in Web Server and optional SNMP (Simple Network Management Protocol) are industry standard means of controlling and monitoring the X75HD over Ethernet. Leitch's CCS Command and Control System Pilot and Navigator software further enhance the remote control aspects of the X75HD for any application.

## Limitless Applications

Expanding video processing to include "anything in" to "everything out" and simultaneous up and down-conversions, Leitch's new X75HD is equally suited for use in analog, digital, or high-definition hybrid facilities.

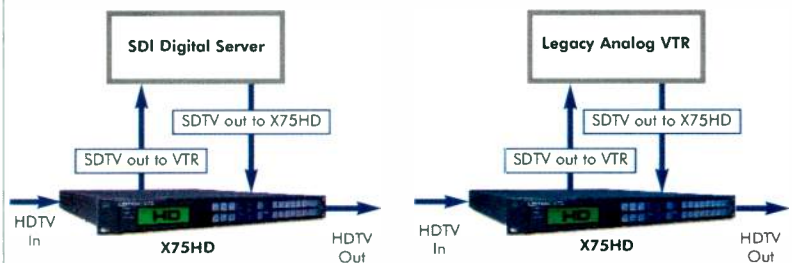
The X75HD provides a simple solution for even the most complex applications. For production and editing, the X75HD provides conversion to and from any signal type for HDTV productions. In news environments, it can time base correct any tape format — analog, digital or HDTV. For broadcast, the X75HD can perform up-conversion for HD output, down-conversion for monitoring/logging, and cross-conversion for programs that are recorded in other than the native format for the station. As a switcher, the X75HD can switch between SD and HD inputs with clean and quiet outputs with voiceover. In mobile environments, the X75HD's fast operator controls provide automatic input select to the proper HD output format, making the X75HD an easy choice for live events.

## M-PATH™ Multiple Path Processing Supports Bi-Directional Processing

Leitch's exclusive M-PATH™ feature provides multiple directional connectivity between analog, digital and high-definition tape transports or routing systems. Enabling simultaneous converter and frame synchronizer operation, M-PATH mode routes HTDV optical fiber or HD-SDI and converts and synchronizes directly to the SDTV analog and SDI video outputs, which feed the inputs of analog composite and component and digital tape machines and routing systems. The analog or

digital outputs of tape machines or routing systems can be simultaneously connected to one of the synchronizer's SDTV analog or digital inputs where it can be processed and output via the HDTV optical fiber and HD-SDI port. Audio signals are handled in a similar fashion, with eight channels of processing in each direction. Analog (two stereo pairs), AES/EBU (five inputs and five outputs) and embedded HD-SDI and SDI audio are also supported.

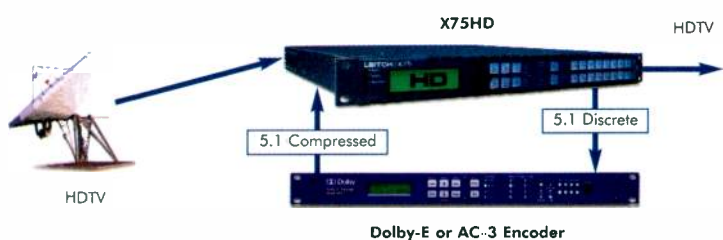
### M-PATH — Simultaneous UP and DOWN Conversion Example



### Simulcast — Switching Between SD/HD with SD and HD Output



### Compressed/Embedded Audio — Audio Processing for Discrete Embedded and Compressed Audio



# [X75 HD]

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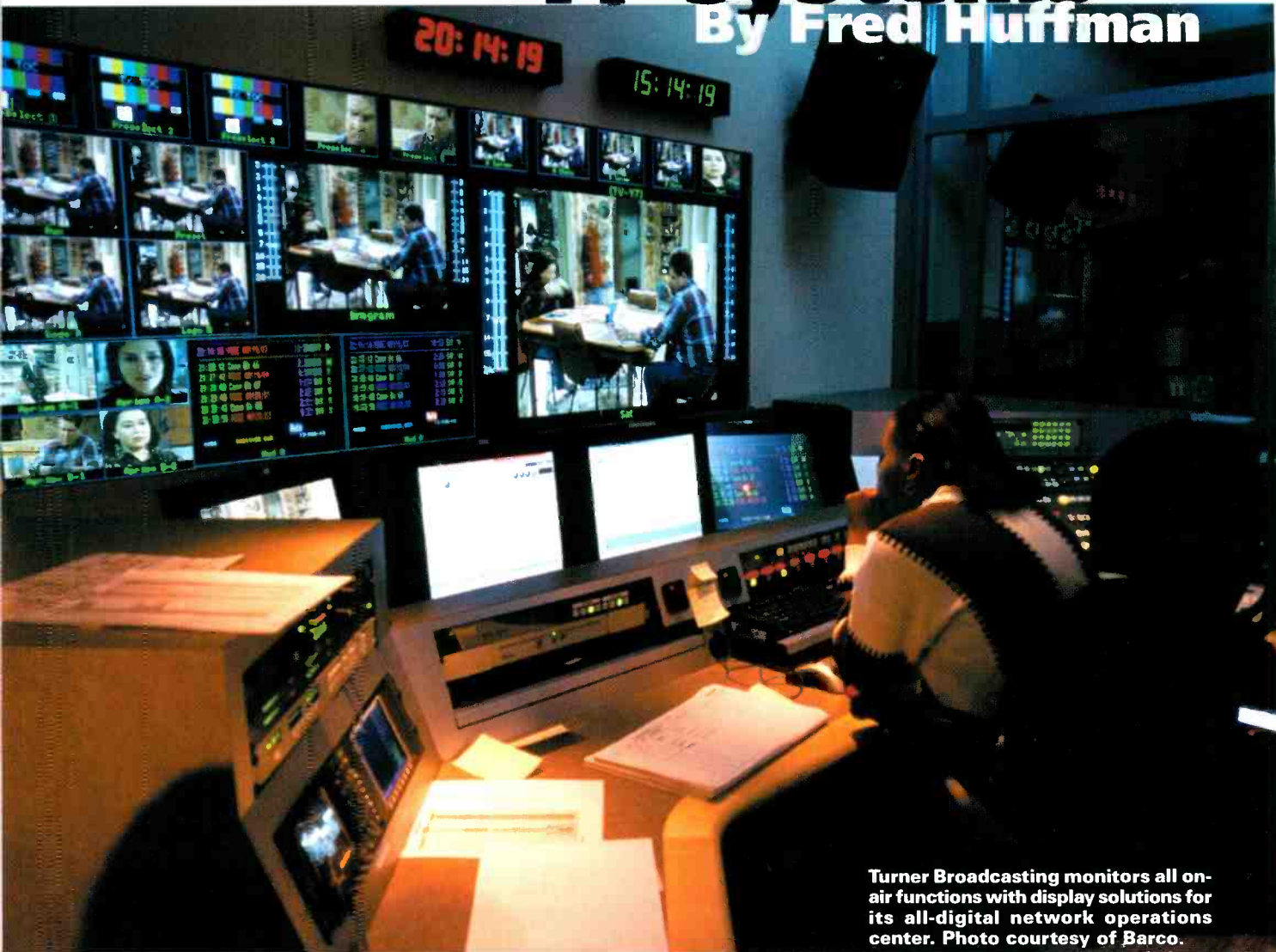
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# Building IT systems

By Fred Huffman



Turner Broadcasting monitors all on-air functions with display solutions for its all-digital network operations center. Photo courtesy of Barco.

**W**ithin the past few years, information technology (IT) equipment and software have become critical components in broadcast systems. Like information systems (IS), IT has its roots in management information systems (MIS). This technology, which was once just a computer in accounting, has become pervasive in content creation, distribution and delivery.

Products in today's broadcast systems are almost 100 percent digital. There is great commonality between

the products in computer and communications systems and the products in modern broadcast systems. It doesn't take rocket science to build one; you can do it with the same basic knowledge, practices and skills that engineers use to build traditional broadcast systems.

This article is the first of six articles on using IT in broadcast and production environments. The objective of the series is to acquaint engineers and technical managers with IT and show them how they can use it in broadcast engi-

neering and technical operations. The series will cover local network equipment, storage, cabling, inter-facility networks and testing of systems used to create, distribute and deliver content.

## Building a system

Digital technology allows broadcasters to create virtual channels and to compress content to fit within a transmission channel's capacity. These two characteristics impact picture quality and sound fidelity. Knowing what is required at the reception point, the





## System Configuration Made Easy



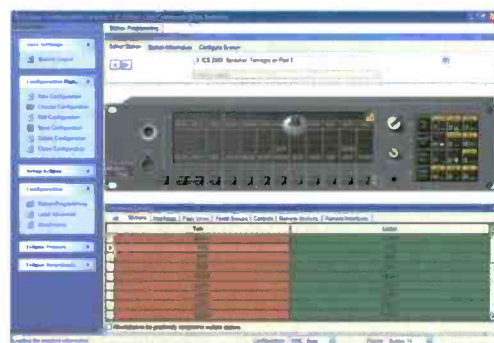
The Eclipse digital matrix intercom gives you amazing flexibility and responsiveness by combining a powerful communications platform with a highly intuitive interface and configuration program.

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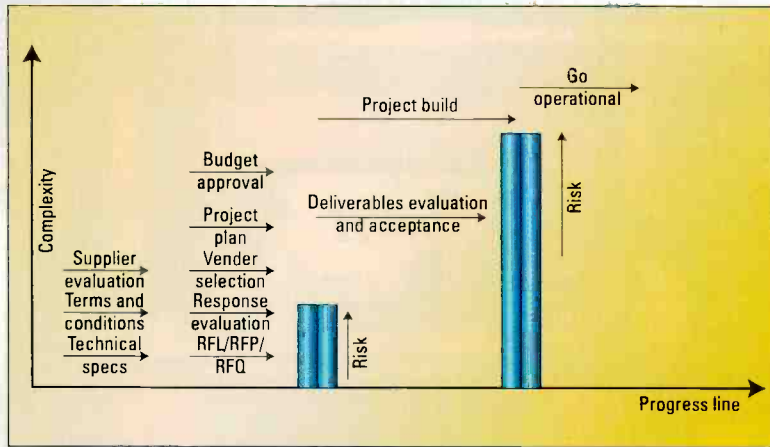


*Drag-and-drop system configuration changes are fast and easy with Eclipse's intuitive software.*



task becomes defining the parameters for an entire system.

On a conceptual level, building an IT system is no different than building a broadcast system. The differences are in the functions, capabilities and limitations of hardware, software and applications hosted on the system. If you are a successful broadcast-system builder, you can handle IT systems. Where appropriate, you can

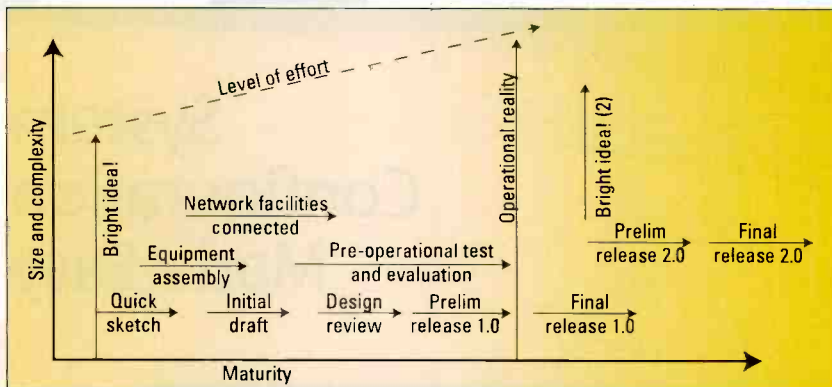


**Figure 1. Building an IT system from start to finish involves different levels of risk along the way.**

or news to create a plan, often called a capital appropriation, capital-spending

approval process that supports a capital-spending request. Typically, this process runs under a one- or two-page accounting department form. The form is likely to be supplemented by additional pages containing technical and financial details sufficient to convince management to approve the project.

The level and content of detail required varies. Expensive projects require a lot of detail and evidence convincing of its value. This phase is considered complete when management signs off on the proposal. This means that the finance and accounting departments recognize the commitment and direction of management and operate accordingly. It also means that the engineering, purchasing and other departments can take the required action to complete the proposed project.



**Figure 2. The effort needed to document a project from concept to completion varies with the project's size and complexity and changes as the project progresses.**

integrate it with network services to reduce operating cost while creating new revenue.

Keep in mind three rules of thumb. First, the sole reason someone builds an IT system is because he believes it will make money. Second, great ideas turn into money only after someone builds something. Third, the most important aspect of successfully building a system is risk management. Figure 1 shows the process of building an IT system from start to finish, and the level of risk the builder encounters during the process.

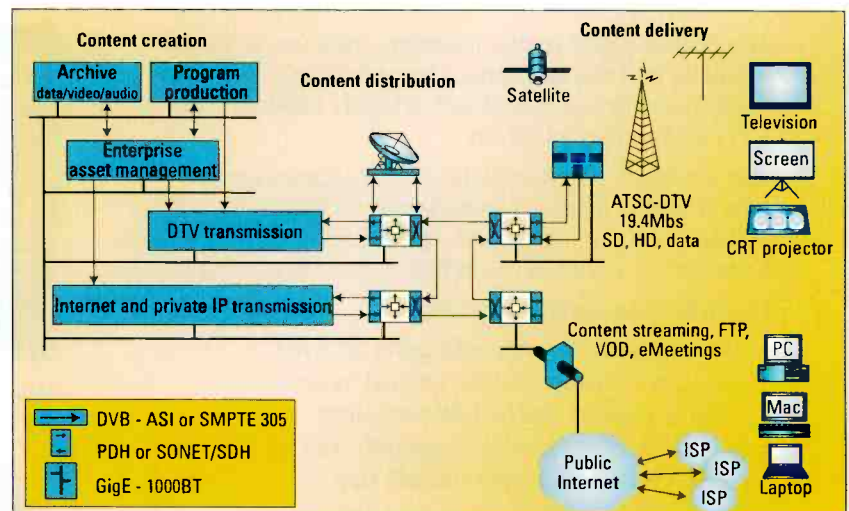
Building a system from start to finish is carried out in two phases: planning and design, followed by construction or implementation. The typical approach to new projects involves working with finance and program planning

request or something similar.

Most organizations have a project-

## Designing the system

The most effective and efficient design starts when someone proposes the project. Even if your organization currently operates similar systems, a certain amount of design must be



**Figure 3. This high-level block diagram shows the architecture of a DTV system and where the proposed project fits within that architecture.**



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# Building IT systems

undertaken before costs can be estimated and a budget prepared. Properly documented, this work can dovetail with construction, test and operational plans.

## Documenting the system

How many times have you been asked to fix a problem, only to find out that the documentation for the system or component is insufficient, incorrect, out of date or nonexistent? Someone once said that the difference between craftsmanship and engineering is documentation. Moving from a bright idea to operational reality requires a certain level of documentation. At least, there should be a block diagram, a

Someone once said that the difference between craftsmanship and engineering is documentation.

list of system components or a parts list, cable and wiring lists, and a layout of the rack(s) and floor. Some cases may require a technical operations manual that you can use to describe system software, utilities and application software. Supplementing this, of course, are user manuals provided by equipment and software suppliers. Documentation is absolutely necessary to support a capital appropriation request and to front-end design documents.

Figure 2 on page 60 lists the documentation process and requirements for a successful project. It highlights all the activities and work required to document a system build from concept to operational reality. Most importantly, it shows how documentation matures as a project reaches completion. The project's zenith — its most desirable state — is when it is complete and operational. At that point, the documentation turns into a final release that matches the final configuration and normal operational status of the system. Lastly, notice that the documentation effort level varies directly according to the size and complexity of a project. It also increases as the project matures. Ideally, project documentation is most valuable when it is carried out in a seamless fashion from the initial idea through operational reality almost without regard to the state of maturity. Conducted properly, the documentation will support the next great idea when it becomes necessary to upgrade, change or replace the system.

## Defining the system

It's important to know where the proposed project fits in the overall architecture of the business. Is the project a part of a national, regional or state-wide network? Perhaps it is a growth facility such as an editing suite or studio production system. High-level block diagrams can offer perspective and clarify where the proposed project fits in the overall architecture. As an example, Figure 3 on page 60 is a high-level block diagram showing the architecture of a DTV





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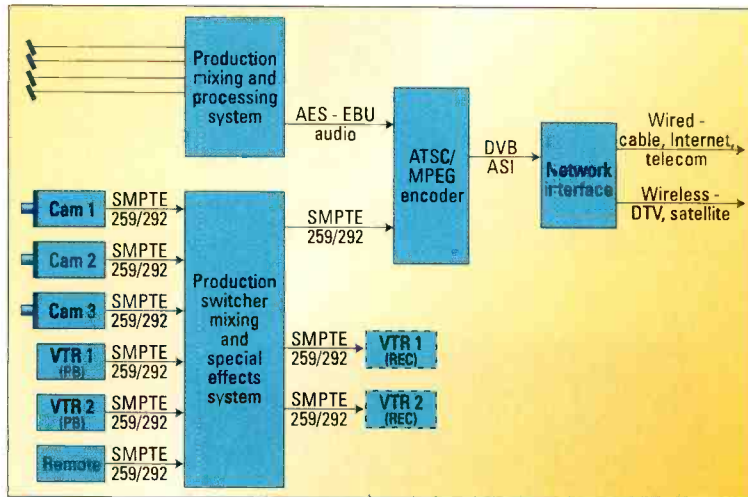
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system. It illustrates key components and operational signal flow for all three stages in the signal chain: creation, distribution and delivery. The drawing also illustrates both intra- and inter-facility networks. If the proposed project is a content-creation system, for example, the high-level diagram can highlight that aspect of the architecture.



**Figure 4.** This functional block diagram of a content-creation system shows the level of detail necessary to support a capital-appropriation request and to front-end design documents.

Figure 4 shows a simple block diagram of a proposed content-creation system. In this particular project, the system uses uncompressed SD and HD video and digital audio, offers digital recording and playback and can compress content for live transmission or feeds across a digital network where the cost of bandwidth is a constraining factor. This is the level of

detail typically required to support a capital-appropriation request and to front-end design documents.

If the proposed system or project has not been defined previously, that's task number one. It's imperative to write out a description of the system, accompanied by block dia-

grams, an equipment list, and rack and floor layouts. Organizing a spreadsheet or database to house wiring lists and circuit IDs round out a documentation package that you can store electronically, print when necessary and easily maintain when changes occur. Documenting exactly what the system will do and the key things it will not do is critical to gaining acceptance

by those using it to perform the intended functions.

## IT considerations

When proposing to integrate IT into a broadcast or production facility, it's important to consider how the facility will transport the content. This includes

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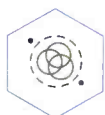
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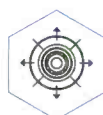
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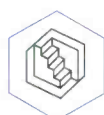
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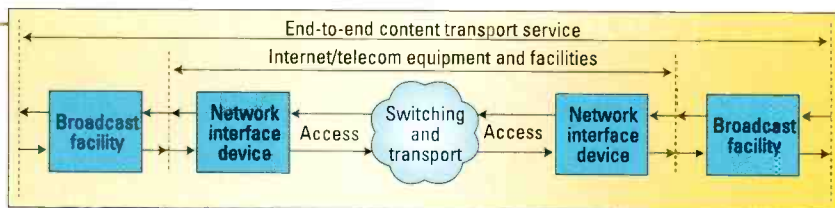
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A key to effectively using IT technology in any broadcast or production environment is to understand where IT can and cannot be used effectively. Some of these aspects will be covered in the next article in March's issue. **BE**



**Figure 5.** Inter-facility content-transport links are usually provided by telcos, cable networks or other outside service providers.

investigating topics such as transport modes and media, service providers, traffic levels and bandwidth requirements, and interfaces and standards.

Type of material	Content creation (Before compression)	Content distribution (After compression)	Content deliver (Before decompression)
HDTV	1.2 - 1.5Gb/s	20 - 150Mb/s	12 - 20Mb/s
SDTV	270Mb/s	8 - 30Mb/s	4 - 10Mb/s
Streaming video	270Mb/s or analog		300 Kb/s - 6Mb/s

**Table 1.** Displayed is the range of payload bit rates across the program content food chain.

Fred Huffman is a systems engineer for the Torino Olympic Broadcast Organization. He is author of "Practical IP and Telecom for Broadcast Engineering and Operations," published by Focal Press.

## Transporting content

Moving content around during the creation process and through distribution and delivery requires some type of vehicle. There are two ways to move content: physically on tapes, disk packs or on other portable media, or virtually through network connections. Content can move within the same facility (intra-facility) or between two or more facilities (inter-facility).

Intra-facility links are typically baseband wire, coax or fiber. Inter-facility links are usually provided by outside vendors, typically telcos, cable or other networking providers. An example of an inter-facility link is the typical STL. (See Figure 5.)

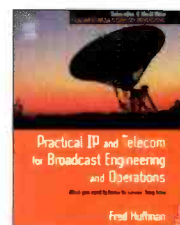
## Traffic levels and bandwidth requirements

Content coming from the production process is typically digitized. Real-time transmission requires a minimum bitrate of 270Mb/s and can be as high as 1.485Gb/s. Carrying these kinds of signals between two points involves coax, twisted pair, fiber and combinations of various kinds of networks. Distributing and delivering it brings compression into the picture. Table 1 shows the range of bitrates required to carry content payloads in real time. Assuming a network capable of carrying these bitrates, the same transmission channel can be used to transfer files, or move content in non-real time.

## Interfaces and standards

Interfaces between system elements are typically standardized. The most com-

mon interfaces are covered in SMPTE or AES/EBU standards. Compression is typically MPEG-1, MPEG-2 or MPEG-4. In the United States, ATSC and FCC standards also are applicable. Table 2 shows the characteristics, interfaces and payload bit rates found in DTV systems.



Fred Huffman's book may be ordered directly from the publisher's Web site at [www.focalpress.com](http://www.focalpress.com).

Application	Analog B/W	Sample rate	Bits/sample	Coding scheme	Channels	Interface	Payload bitrate
<b>Audio</b>							
Studio mastering	20-20,000Hz	48KHz	16-20	AES 10-1991	56	BNC	125 Mb/s
Digital VTR	20-20,000Hz	48KHz	16-20	AES 2/3-1985	2/4	BNC	384-768Kb/s
Live broadcast	20-20,000Hz	48KHz	16-20	AES 2/3-1985	2/4	BNC	192-768Kb/s
	20-20,000Hz	48KHz	16-20	MPEG-2	2/4	BNC	192-768Kb/s
<b>Video</b>							
Digitized NTSC	~6MHz	13.5MHz	8-10	4:2:2 YUV	29.94	SMPTE 259	143Mb/s
Digitized PAL	~8MHz	13.5MHz	8-10	4:2:2 YUV	25	SMPTE 259	177Mb/s
SD720x480/576	~15MHz	27MHz	8-10	4:2:2 YUV	29.94	SMPTE 259	270Mb/s
HD1920x1080	~30MHz	74.25MHz	8-10	4:2:2 YCbCr	29.94	SMPTE 292	1485Mb/s
<b>Application</b>							
<b>Audio</b>							
Digital VTR	20-20,000Hz	43KHz	16-20	AES 2/3-1985	2/4	BNC	384-768Kb/s
Live broadcast	20-20,000Hz	43KHz	16-20	AES 2/3-1985	2/4	BNC	192-384Kb/s
	20-20,000Hz	43KHz	16-20	MPEG-2	2/4	BNC	192-384Kb/s
<b>Video</b>							
Digitized NTSC	~6MHz	13.5MHz	8-10	MPEG-2 MP@ML	29.94	SMPTE 259	10-12Mb/s
Digitized PAL	~8MHz	13.5MHz	8-10	MPEG-2 MP@ML	25	SMPTE 259	10-12Mb/s
SD720x480/576	~15MHz	27MHz	8-10	MPEG-2 MP@ML	29.94	SMPTE 259	10-50Mb/s
HD1920x1080	~30MHz	74.25MHz	8-10	ATSC	29.94	SMPTE 292	30-60Mb/s
<b>Application</b>							
<b>Audio and speech</b>							
CD	44.1KHz		16			RCA	176Kb/s
Digital audio player	44.1KHz		16	RDAT		RCA	176Kb/s
Dolby surround					6	RCA	448Kb/s
Dolby stereo					2	RCA	192Kb/s
PC music (stereo)		22.1KHz	16	WAV	2	RCA	88.4Kb/s
PC music (mono)		10.5KHz	16-20	AES 2/3-1985	1	RCA	10Kb/s
Telephone speech		8KHz	16-20	ITU G.703	1	RJ11	64Kb/s
Internet speech		2KHz		ITU G.723	1	RJ45	16Kb/s
Audio conference							
<b>Video</b>							
Digital STL				MPEG-2MP@ML	29.94	BNC	10-34Mb/s
DVD				MPEG-1 and -2	29.94	RCA	4-6Mb/s
PC based training				MPEG-1	15-30		1-2Mb/s
Video conferencing				ITU H.263	15-20	RJ45	384-768Kb/s

**Table 2.** Listed above are the characteristics, interfaces and payload bit rates found in DTV systems.





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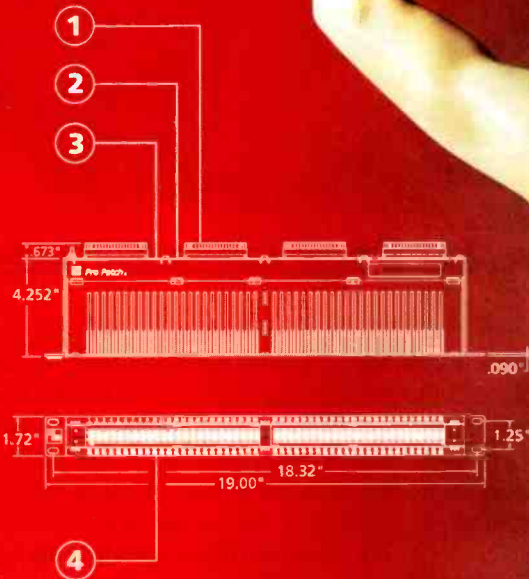
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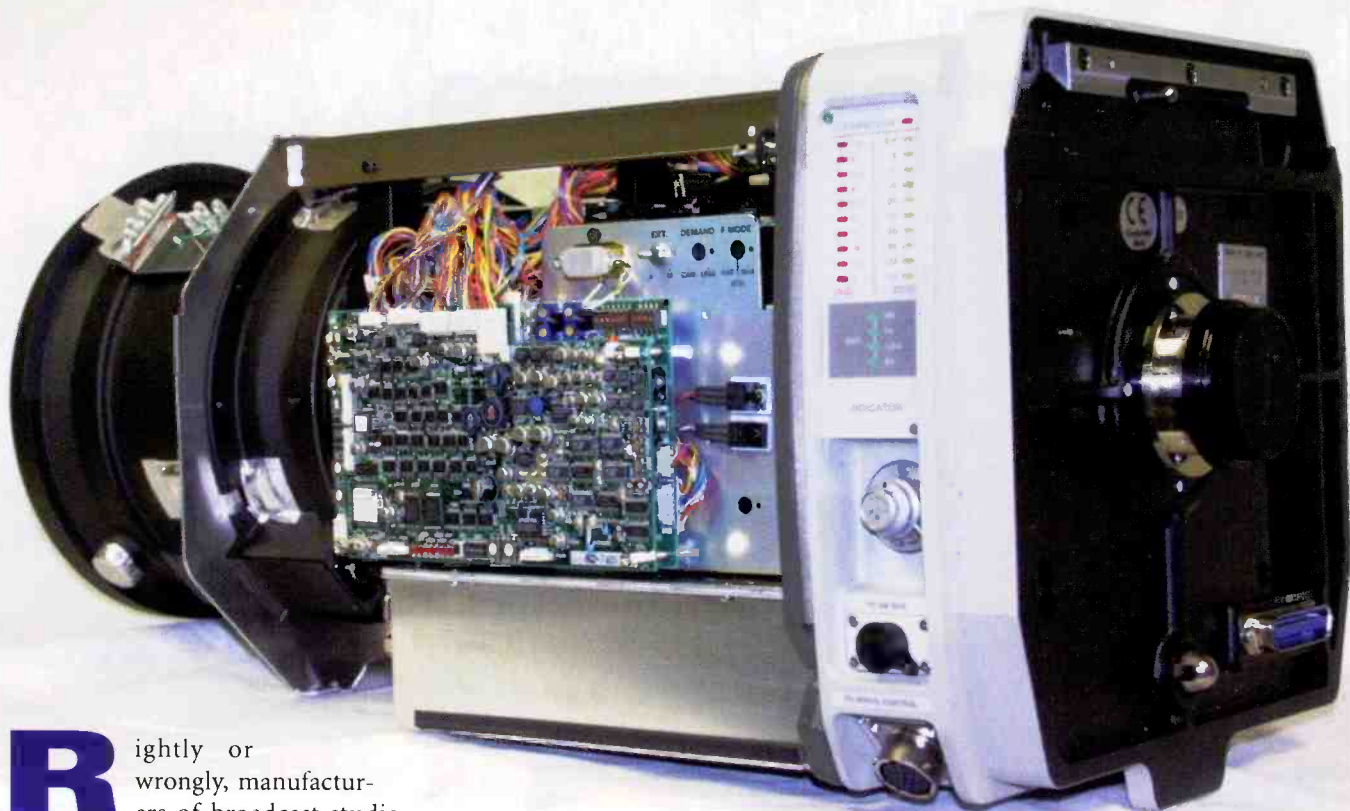


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# HDTV lenses, MTF and picture sharpness



**R**ightly or wrongly, manufacturers of broadcast studio cameras and lenses decided long ago to radically simplify published specifications. This has probably saved the sanity of many a chief engineer perusing competitive specification sheets. But it has also obscured intractable realities that lens and camera designers must still confront.

Manufacturers of modern television cameras traditionally offer a horizontal-resolution specification and, sometimes, a separate specification for vertical resolution (with little correlation between the two) to describe the lens' contribution to picture sharpness. This is a legacy of the "specmanship" long practiced by camera manufacturers. For example, HD camera manufacturers typically specify a depth of modulation at a reference spatial frequency of 800 TV lines per picture height (TVL/ph) or 27.5MHz (for the 1080-line system). Some manufacturers

separately quote a horizontal limiting resolution — the highest horizontal spatial frequency at which the depth of modulation is at least 5 percent.

These published specification numbers are important in establishing a simple way to determine whether a given HD camera meets its resolution performance specification. But the numbers tell little about a camera's picture-sharpness performance. Long ago, engineers established that visual picture sharpness must be correlated with what is called the modulation transfer function of the lens-camera system.

## **Modulation transfer function**

A typical multiburst resolution chart contains groups of vertical black-to-white "picket fence" bars and lines that

**By Larry Thorpe and Gordon Tubbs**

challenge the spatial frequency response of lens-camera systems. Thick, widely-spaced bars represent low spatial frequencies, while thin, closely spaced lines represent high spatial frequencies. When aimed at such a resolution chart, a modern lens-camera system can easily reproduce the full contrast of the bars that represent low spatial frequencies of about 50TVL/ph. The resulting full-amplitude video signal level acts as the reference contrast level.

For the higher-frequency lines on the chart, the system reproduces lower contrast levels. When aimed at a multiburst chart that contains frequencies ranging from the 50TVL/ph reference all the way up to, say, 1000TVL/ph, the lens-camera system





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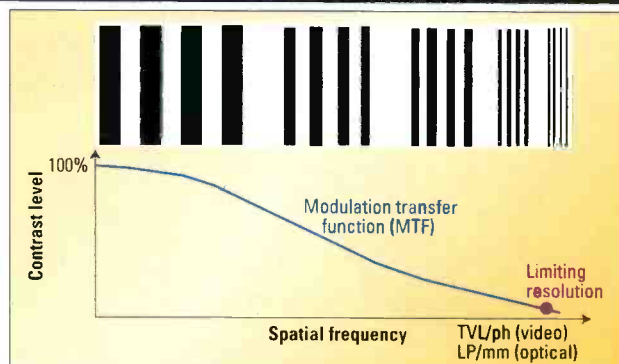


produces a corresponding video envelope on a waveform monitor. It is as if the lens-camera system is modulating the contrast level over this frequency range. A graph can represent this change in reproduced contrast vs. frequency with spatial frequency on the horizontal axis and contrast on the vertical axis. (When expressing spatial frequency, video engineers prefer TVL/ph; optical engineers prefer line-pairs per millimeter.) Such a graph represents a form of transfer function for the contrast modulation, and is, therefore, called the modulation transfer function (MTF) of the lens-camera system. (See Figure 1.)

## Lens-camera MTF and picture sharpness

The MTF concept is one of the seminal works in the science of imaging. The most important result of that work was the revelation that visual picture sharpness for any system involving distant viewing (such as television or cinema) is proportional to the square of the area under the MTF curve. The implication is that the shape of the MTF curve over the useful passband of the camera is of vital importance to perceived picture sharpness. Indeed, it is much more important than the limiting-resolution specification.

Because the lens-camera system comprises two distinct components, the picture sharpness of any HD lens-cam-



**Figure 1. MTF represents the change in the contrast level produced by an imaging system in response to a range of spatial frequencies as they pass through the system.**

era system is ultimately determined by the shape of the lens' MTF curve multiplied by the shape of the camera's MTF curve. The shape of that composite MTF curve below 800TVL/ph — in the all-important range of 200TVL/ph to 600TVL/ph — is, in fact, the best objective way to determine the visual picture sharpness of a lens-camera system. Studio-lens designers must always consider this and include optical innovations that enhance the lens'



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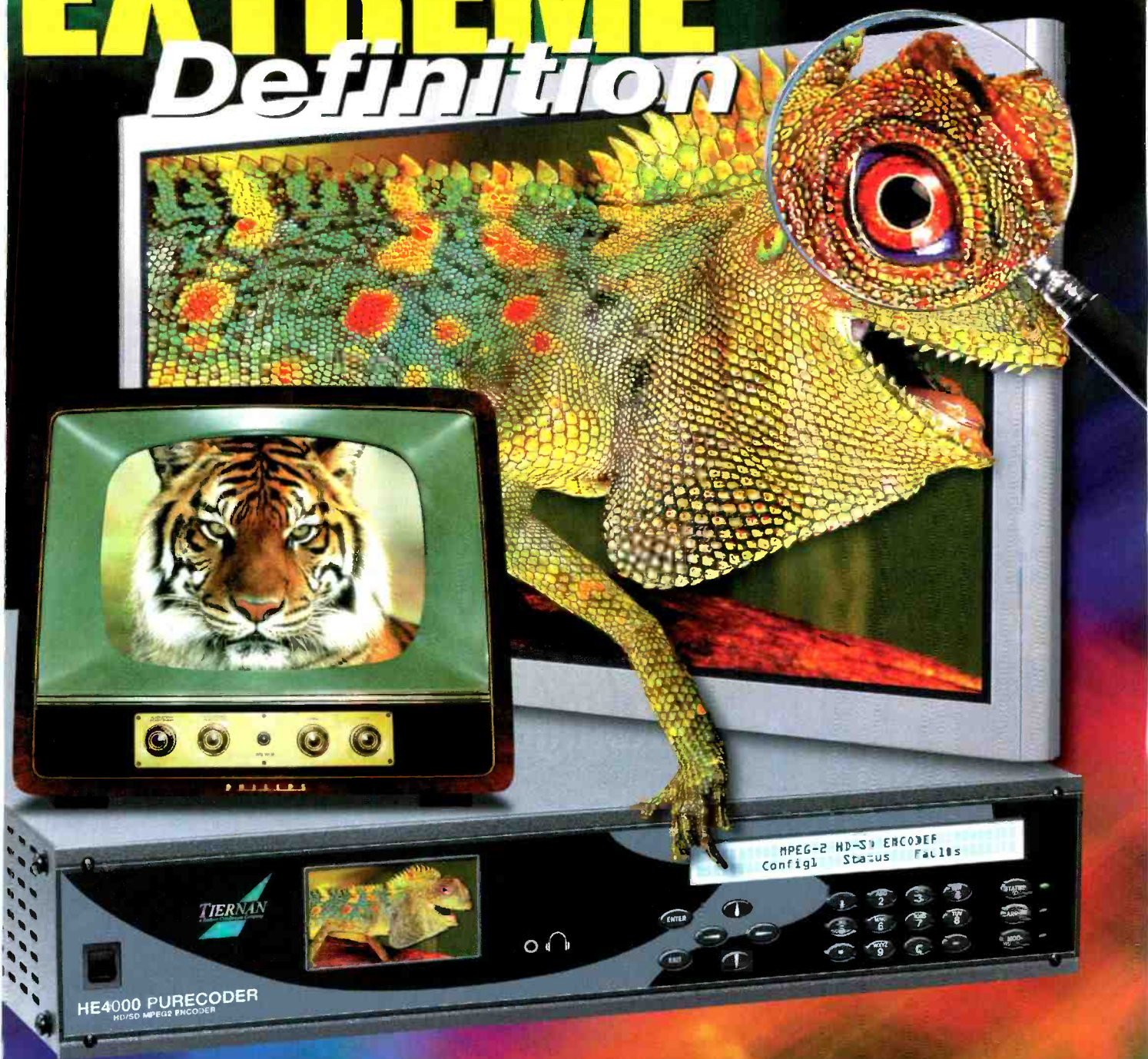


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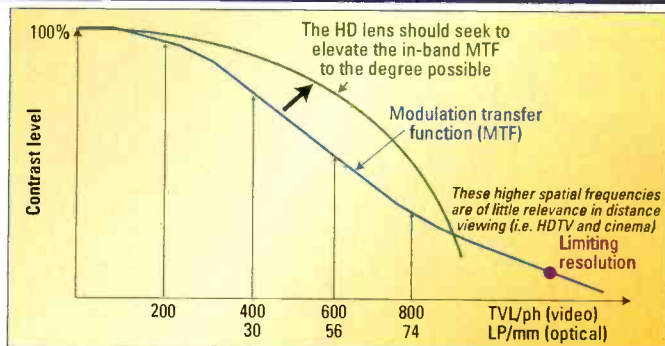
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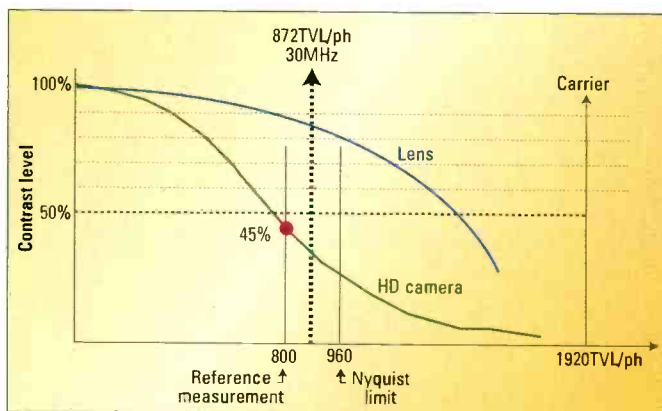


**Figure 2.** This MTF curve for a generic 1080-line HDTV lens-camera system emphasizes the importance of an HD lens design that optimizes the MTF over the critical 200- to 600TVL/ph range.

ability to reproduce contrast over this spatial frequency range. (See Figure 2.) Because MTF is all about spatial-frequency contrast levels, it is important to note that the lens' inherent optical contrast performance (the degree to which the lens can distinguish between different brightness levels and its ability to reproduce a true black with no light contamination) is inextricably bound up in the lens-camera system's overall picture-sharpness performance.

## 1080- and 720-line HDTV cameras

HD lenses do not distinguish among different HDTV production standards. They are all high-definition lenses, so similar optical MTF criteria apply to all of them. Figure 3 shows the MTF curve of a typical 1920x1080 HDTV studio camera operating with a typical high-performance HD studio lens. Contemporary 1080-line HD



**Figure 3.** Here, the MTF characteristic of a typical 1080-line HD camera combined with a typical HD lens is measured at picture center. Generally, manufacturers only publish this specification at the reference 800TVL/ph spatial frequency.

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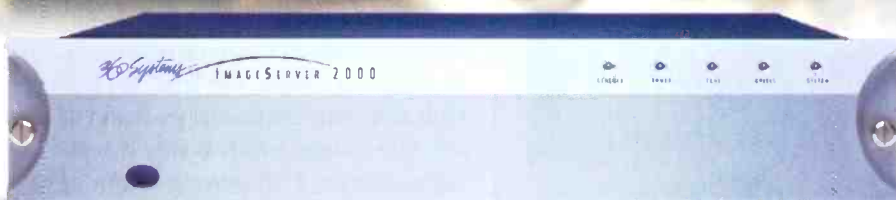
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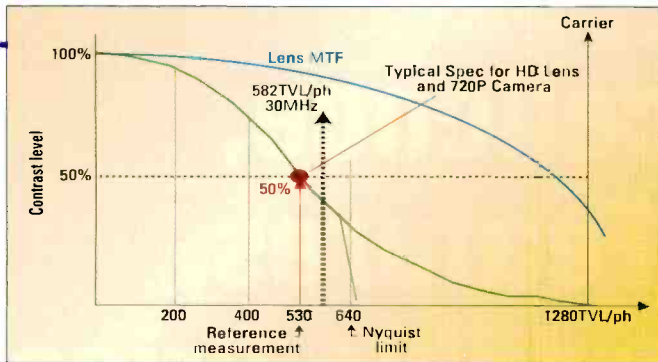
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## HDTV lenses, MTF and picture sharpness



cameras generally claim to reproduce a depth of modulation in the 40 percent to 45 percent range at the accepted reference spatial frequency of 800TVL/ph when used with a “typical” HDTV lens.

**Figure 4. This graph shows the MTF characteristic of a 720/60p HD camera in combination with a typical HD lens measured at picture center. Generally, manufacturers only publish this specification at the reference 530TVL/ph spatial frequency.**

But these camera specifications make no reference whatever to the all-important depth of modulation

at spatial frequencies of 200TVL/ph, 400TVL/ph or 600TVL/ph.

The attenuation in a 720/60p system is less severe than in 1080i systems because of the tradeoff of spatial resolution for enhanced temporal resolution. As Figure 4 shows, the lens’ MTF is high across the horizontal passband of this HD system, which is why it typically achieves a 50 percent depth of modulation at the reference spatial frequency of 530TVL/ph (or 27.5MHz in the video domain). This is one reason why 720-line 60p systems exhibit good subjective picture sharpness.

### Lens realities in the MTF domain

You can’t accurately establish the actual picture performance of an HD camera without including its associated HD lens. And, here, the technical plot thickens considerably. An HD camera’s resolution performance remains essentially constant all over the picture raster. It is irrevocably determined by the spatial sampling of the imager, the optical low-pass filter and the electronic filtering employed prior to the camera’s A/D converter. But the very nature of optical physics within the modern zoom-lens system dictates that its resolution performance is dynamic in three respects:

1. Optical design constraints, manufacturing tolerances and the complexities associated with the concatenation of multiple optical elements within the studio lens system produce an MTF behavior that cannot be constant over the picture raster. There is an inevitable falloff in MTF from the center of the frame out to the four corners of the frame.

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## HDTV lenses, MTF and picture sharpness



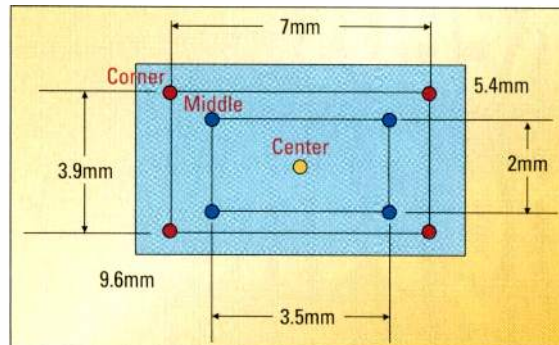
2. Operating the lens' iris to control its aperture for different scene lighting conditions produces a variation in MTF. This is the result of fundamental optical physics associated with diffraction.

3. Most importantly, the alteration of the lens's focal length during zoom operation further alters its MTF.

can be staggeringly large. Thus, only an optimum overall compromise is possible. It is testament to the sophistication of powerful modern computer-aided design techniques that some lenses achieve excellent spatial MTF (with special attention to the 200TVL/ph to 600TVL/ph region).

This dynamic nature of MTF is an

inescapable technical reality for all lenses, regardless of manufacturer. Numerous constraints imposed by optical physics are in play here, and different lens manufacturers make their own proprietary design optimizations. Accordingly, there certainly are systemic differences in the necessary compromises made by each lens designer.



**Figure 5. To manage the optical variables that occur during zoom-lens operation, lens designers consider multiple points on the image plane in their optimization calculations.**

To manage these variables, lens designers must consider more than just the performance at the center of the lens. One approach is to consider several points on the image plane, including some on the periphery. For example, Figure 5 shows nine separate spatial reference points used by Canon's lens designers within a 16:9 image plane. These points include the "picture center," the "middle" (four points) and the "corner" (four points).

These points are used in conjunction with computer optimization programs to achieve the highest total MTF possible at all nine points for the lens' numerous optical elements. But this task is complicated by the fact that the optimization must also seek the highest MTF when the lens iris is being operationally exercised to alter the lens system's optical aperture. The task is further complicated if optimization also takes place when many of the optical elements are physically moved relative to each other while altering the lens focal length during a zoom operation. The sheer number of variables involved in such design optimization

These differences are what broadcasters need to explore in any HDTV lens testing before making a purchase decision.

### Putting it in perspective

Picture sharpness looms large in any assessment of HDTV performance, and the lens plays a major role in sharpness reproduction. It also predetermines the lens-camera contrast performance and plays a significant role in the system's color reproduction. Designing an HD studio lens involves an extensive number of variables. But manufacturers have been successful in overcoming this and other formidable challenges to produce remarkably high-performance lenses.

**BE**

Larry Thorpe is national marketing executive and Gordon Tubbs is assistant director of the Canon Broadcast & Communications Division.

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# Pro-Bel's Morpheus Velocity at Turner

BY JOHN MORGAN

Last year, Turner Entertainment Networks went live with technology that has significantly upgraded its ability to alter and manipulate the length and structure of commercial breaks during live sports events. In these events, exact timing is needed, and the duration of breaks is often not known until they are right upon the broadcaster.

The network's live events group chose Pro-Bel's Morpheus Velocity to meet the technical challenges presented by live events. The system has been used since last year on Turner Network Television (TNT), in connection with its NBA basketball and NHL hockey coverage.

Two years ago, Network Operations moved into a new, state-of-the-art facility. As part of that process, all of the operation's on-air video servers were connected to a central archive called Broadcast Inventory Manager



Turner Entertainment Networks uses Pro-Bel's Morpheus Velocity automation system for easy manipulation of commercial breaks in live events.

(BIM), powered by Pro-Bel's MAPP asset management system. BIM consists of 22TB of fully redundant EMC CLARiiON arrays, two ASACA DVD libraries (for commercial and promotional backups) and two new

StorageTek PowderHorn libraries. All commercials are centrally ingested and moved into BIM. Then, as on-air demands dictate, material is distributed from BIM.

In the deployment, Velocity is in essence the "thin client" application that sits on top of the Morpheus backbone. On the day of a live event, operators load a schedule into the software,

commission the hardware and PC. In early December 2003, the network began playing out material off-air to identify any remaining issues.

This technology not only allows for manipulation of the commercial/promotional material at production's request (for the enhancement of the broadcast), but it also serves as a backup to the master control in the

**Considering that Morpheus Velocity is a new hardware and software system, the installation went extremely well.**

which then queries the Morpheus database to see if any material required for air is missing. If any material is missing, requests are generated and issued to BIM, and the material is restored to the video servers from the CLARiiON arrays.

The system uses the same on-air schedule as the network's other, more traditional playout applications. Live event operators simply trim the schedule to include only the time period for the event before it is loaded into the Velocity.

The application itself runs on a Windows 2000 platform and communicates with Pro-Bel ICON hardware using IP. The ICON hardware controls the server(s) using RS-422 VDCP. The actual PC running the application is controlled remotely.

Considering that Morpheus Velocity is a new hardware and software system, the installation went extremely well. Installation of all hardware, including signal connectivity to Turner Studios (where the production room is) was completed by the end of September 2003. An installation engineer was on-site in September to

event of any problems.

The system allows operators to manipulate events within a commercial break seconds before it airs. Material can be moved using drag-and-drop functionality. Commercial breaks can be combined with a single keystroke or quickly split. Because changes within a live event happen unexpectedly and quickly, it is important to have an application that requires as few mouse clicks as possible. To this end, the new system provides many shortcuts to access commonly used functions.

This solution allows operators to plug into the network's video servers and eliminates the need to manually ingest the commercial promotional material into separate sport servers. This ensures more efficiency and accuracy of inventory for the live broadcast because the material can be ingested once and air multiple times. In addition, equipment can be modernized from a JPEG to an MPEG format and a second channel is available as a backup.

**BE**

*John Morgan is a project manager at Turner Entertainment Networks.*



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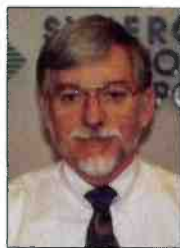
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## Playout automation

BY JOHN LUFF



In an age where computers are embedded in everything from cell phones to PDAs, to the dashboard of your car, the concept of computer control over the playout of TV or radio programming seems entirely logical. To an entire generation, it must be hard to imagine a time when computers did not have such ubiquitous control over disparate aspects of our lives. Though I was not born in that generation, I guess I had something to do with their genesis, as my youngest daughter has followed my path into broadcasting. Still, I can see how the concepts of workflow automation in broadcasting may appear a bit obtuse, even to the latest generation in our industry.

The concept of workflow is the key to understanding how automation can and often does affect playout of programming. In the simplest terms, automation systems replicate the actions humans would do without their assistance. They collate the information needed to assemble a daily log, review its contents to be sure everything is present, go looking for missing tapes or programs, flag numbers that don't look right, make dub lists, and organize the purging of old content that is no longer needed. Automation rolls VTRs and servers, takes crosspoints on switchers, watches the clock and puts in the ID on the hour, keeps meticulous notes about what has happened, and puts the log in the out basket at the end of the shift. It does not figure out where bathroom breaks are but, short of that, an automation system is the computerized workflow equivalent of a human's actions.

It is entirely logical that it should be this way. There are many possible reasons for automation. It can be used to reduce errors or to allow more com-

plex facilities to be controlled by fewer people (although not by zero people — yet). Or broadcasters might implement automation to assure the closed loop of communications between traffic, air operations and back to traffic, as well as deal with a host of housekeeping details. A good automation system provides such thorough workflow automation that a human can intuitively understand the process the automation

ing, and reporting. It must also create a user interface that allows an operator to see and intuitively understand what is happening on perhaps a dozen channels at once. That is the first nontrivial exercise the code writer must face after he is taught what master control is all about. Think of the myriad of details an operator must be trained to take care of, and extrapolate that to the task of programmers of a modern system.

**What is different about automation today is that the amount of information that must be presented to an operator is nothing less than staggering.**

system is using to find, cue, roll and log segments and interstitials. It doesn't exactly take a genius to recognize the obvious. Any good software that replaces repetitive tasks by human workers must in fact replicate at least the effect of the workflow that humans use naturally in the workplace. The first steps might be to define the task and gather the information needed to accomplish the task. Then the system might organize the work logically, perform the task by acting on outside devices and report the results for accounting and billing. I think a college professor might have told me something like that if I had really been listening in my Fortran class.

So, broadcast automation at the core is a pretty understandable process of duplication of human action. What is different about automation today is that the amount of information that must be presented to an operator is nothing less than staggering. As a result, the software now must do more than just the simple tasks of importing a traffic log, finding the media, keeping track of the media, cueing and play-

They must know the workflow in a broadcast station and what can go wrong and how to get out of a jam. In short, they need to know the workflow of a software development company and the workflow of their clients.

Today, playout automation increasingly interacts with other computers as sources of content, including scheduling, PSIP generators, DTV muxes and control systems, as well as switchers and other devices with rich control sets. Take, for instance, the automation of a "branding engine," a new term often mistaken for new-era master control switchers. Branding engines have crosspoints that require take commands, but they also contain rich display sets for background graphics, overlay pages, and audio and video clip files for logos and other content. Automation must gather the data from traffic, parse it correctly to figure out what commands are necessary to load and run the right elements, and then parse it again into the language of the interface to the branding engine. As these elements get more complex, the lingua franca is not static but,



instead, becomes a family of languages needed to talk to similar devices from disparate manufacturers.

Out of this arises a need to have a rich language that can be used to define an API that all character generators, for instance, would understand from the outside. Indeed, a language is needed that all automation systems might use as the basis of simplifying

the job of the many code writers from many companies involved. A consortium of manufacturers, including Pinnacle and others, is exploring MOS as the structure for standardizing the API. MOS is XML-based and well-defined. As such, the code can be human-readable, at least on one side of the interface, though the driver inside the controlled device is still a bit of a mystery. At least they theoretically need to write only one MOS driver to talk to a large number of automation systems.

As systems continue to grow more complex, it seems inevitable that items like archive, media asset management and WAN architectures will become a standard part of broadcast systems. The development of standard interfaces between automation and other devices will make it much easier to interface software modules for these systems into one holistic facility automation system. This holds the promise of reducing the complexity of large implementations and facilitating much more complex small installations in the future. Today, the cost of many software packages integrated together explodes when you take integration management and labor into account.

It is worth noting that we may be seeing movement away from RS-422

as the *de facto* interface between automation and controlled devices. IP communication has become so simple and cheap that it is practical to implement as a standard control on many devices. Certainly, it is simpler for a computer to spit out all the commands on one port via Ethernet. The ability to extend IP communications over WAN circuits is appealing for distributed environments like centralized broadcast operations. Servers, branding, character generators, clip players and, indeed, nearly all devices have embedded processors that facilitate communication via TCP/IP.

Finally, the ability to write complex graphical user interfaces using standardized tools is a tremendous boon to automation companies. For instance, it can allow users to customize the display for individual tastes, or spread the interface across two monitors, using tools that come with graphics cards and software embedded in operating systems. Viva simplicity! It gives us all more time to concentrate on the core issue of workflow. **BE**

*John Luff is senior vice president of business development at AZCAR.*



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**HBO uses Harris ADC-100 automation across its operations. Photo courtesy of Nils Walter Studio.**

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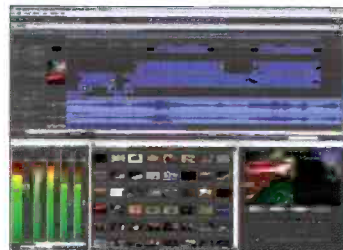
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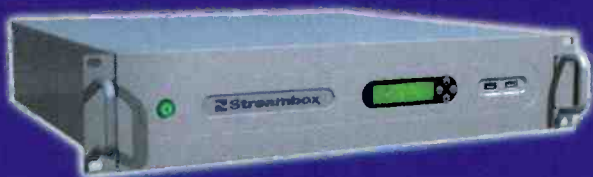
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# Not all of us are adult enough

BY PAUL MCGOLDRICK

**R**eality TV is about something other than just reality. Once you've made people eat squirming bugs or jump between airplanes, and stripped them of all human decency and degraded them before a national audience, what else can you do to shock viewers?

Obviously, the FCC has made it clear that it will impose record fines to make sure the airwaves remain squeaky clean. So anything truly outrageous will have to appear on cable. What do you think it will be? With Howard Stern off to satellite radio, anything visual on the cable system

far-we-can-take-it attitude, and it has fired the first shots in a downhill slope toward voyeurism, with a little "shock and awe" thrown in for ratings.

The program that really got viewers to the phones was when Channel 4 broadcast an autopsy — live. It was the first time since 1832 that the British had seen a public autopsy. Conducted by German professor Dr. Gunther von Hagens, it was a well-shot, well-lit show, with taste certainly in the eye of the individual viewer.

Death was also the subject of a documentary, "Beyond Love," in

point. The University of Tennessee runs a facility that examines the deterioration of corpses under various circumstances. Directed by a forensic anthropologist, Dr. William Bass, and known locally as the "body farm," it serves to find the solution of many otherwise inexplicable deaths.

But this is a little different from Channel 4's proposal to make the natural process public. Is this any worse than when Channel 4 showed a man eating a dead baby's flesh?

These are just some of the wonderful pieces of programming that are coming your way. Just as derivatives have sprung up around "reveal" programs like "Changing Rooms" (with the U.S. version known as "Trading Spaces"), there are certain to be even stranger versions of these questionable Channel 4 productions. These types of programs seem to be good for both viewer numbers and attracting advertisers.

I've never quite gotten into the habit of using adult language or shopping at adult stores, so I guess I have a bit of growing up to do. And, beyond all the strange output from the UK, I have even bigger problems with Comedy Central's first animated reality show, "Drawn Together," which I find even more real than reality itself — if that's possible.

BE

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

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**It seems to have a let's-see-how-far-we-can-take-it attitude . . . with a little "shock and awe" thrown in for ratings.**

is going to be *really* bad. (And why isn't the content from a satellite system subject to FCC perusal? Do they use a different kind of RF that we don't know about?)

The end of Puritanism (which the rest of the world thinks is the motto of the United States) perhaps came with the airing of shows like "The Graham Norton Show," "Coupling" and "British Men Behaving Badly" on BBC America. These shows are direct and in your face about sex, but somehow they come across differently than the lewd programming of a character like Benny Hill. And nudity is hardly something new on European TV. In the 1970s, Italian video pirates started a national addiction to the female anatomy.

The network that broadcast many shows of recent ilk, like "The Graham Norton Show," is Britain's Channel 4. It seems to have a let's-see-how-

which the heroine had a fetish for corpses.

The documentary "Animal Passions" was about a man who made love to his pony; the act wasn't depicted, but it was described in its minutiae.

Things got a little sicker (from my point of view, at least) when Channel 4 broadcast a show called "Sex Inspectors." On the show, couples making love (live) were observed by sex experts who gave advice and recommended different sex toys to help improve the couples' orgasms.

Recently, the channel has created a bit of a stir by advertising on its Web site for a terminally ill volunteer who will subject his or her body to a two-month experiment. The show will exploit the manner in which the human body deteriorates — all in front of the camera, of course.

This macabre proposal, just for reality TV, does have a real counter-





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