

# BroadcastEngineering®

MAY 2008

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## NEWSEUM

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##### LOCATING SPEAKERS FOR BEST SOUND

Properly create the audio image

##### IT NETWORK TROUBLESHOOTING

Keys to fixing problems - fast!

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Tips for meeting the requirements

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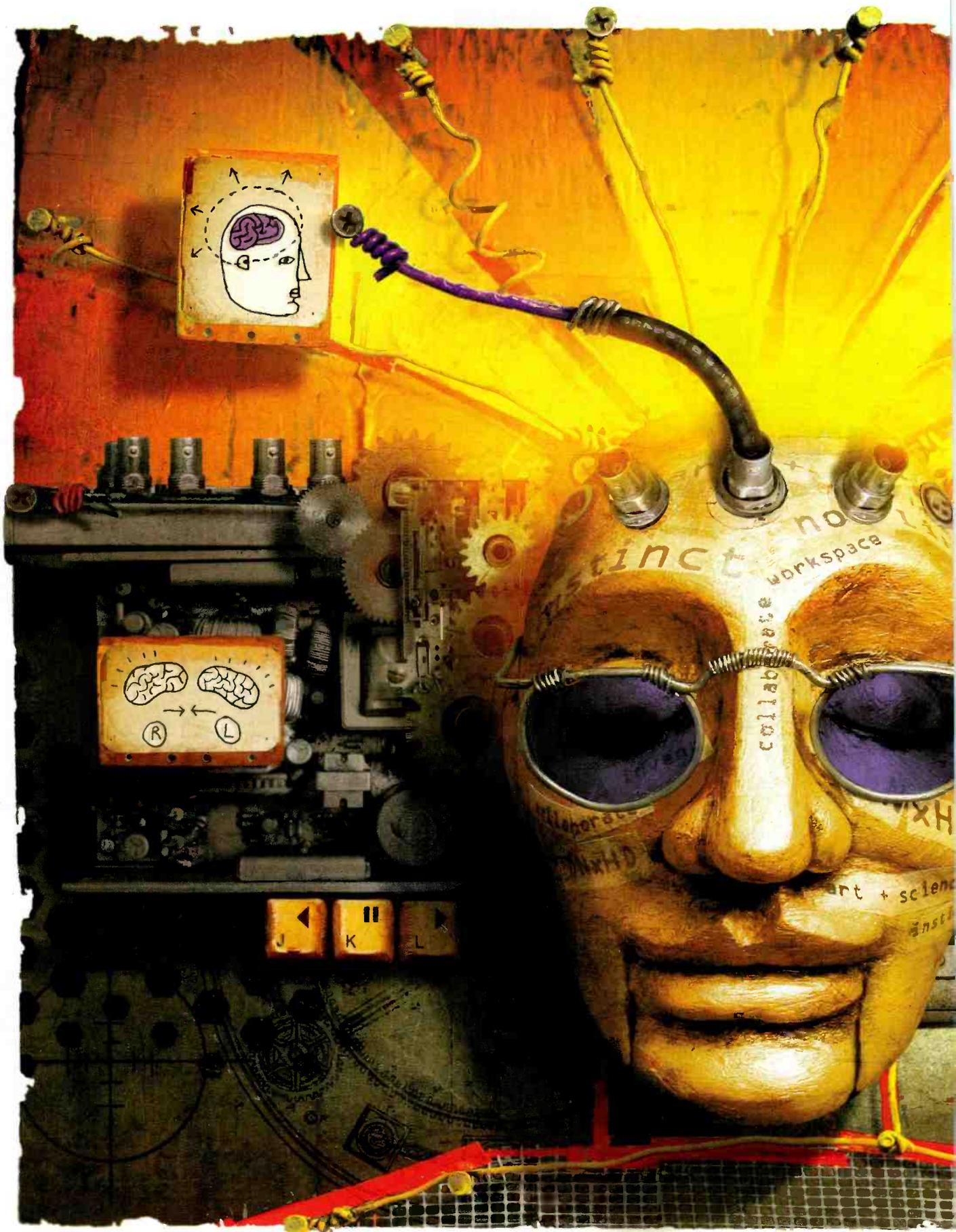
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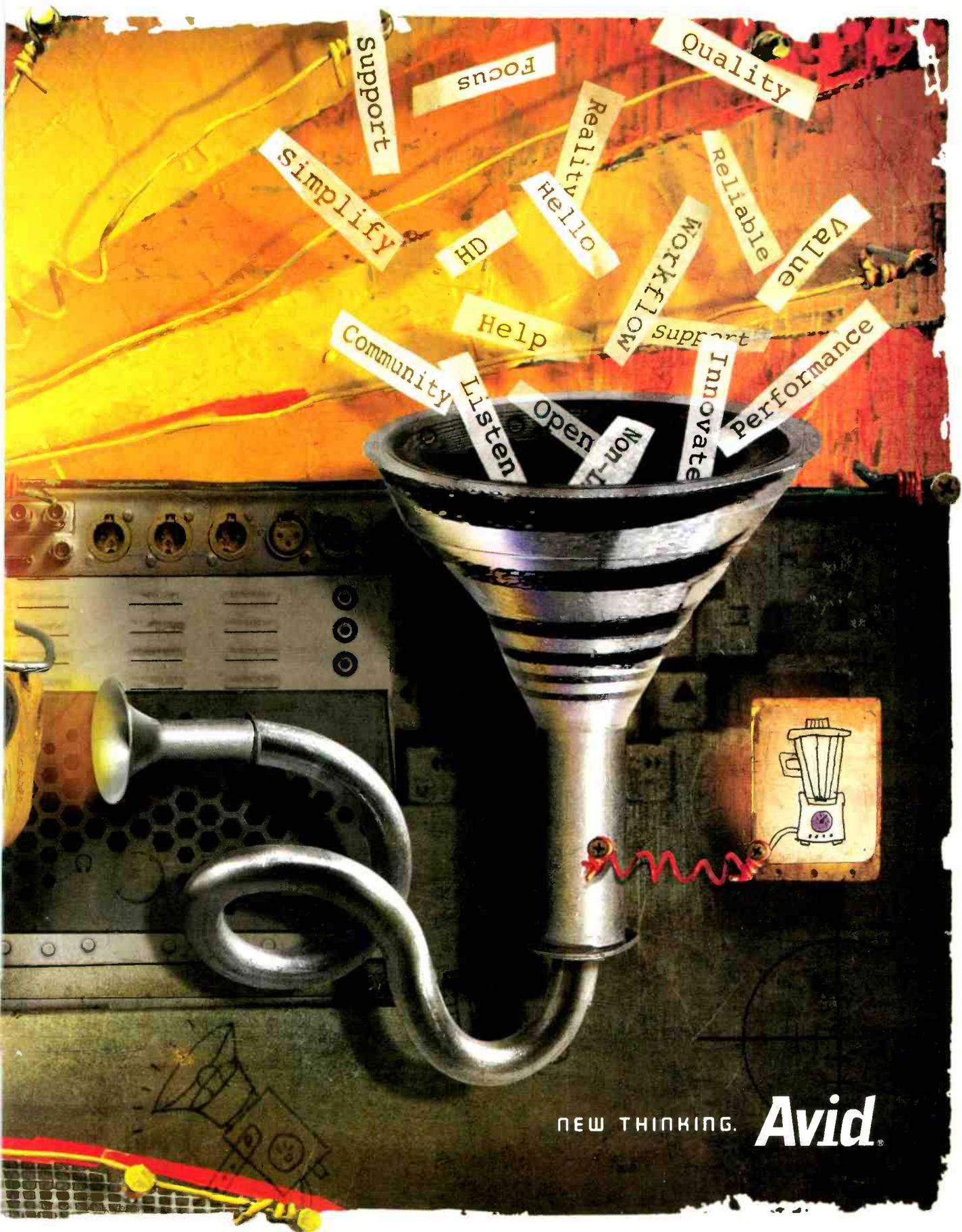
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## MAY FREEZEFRAME QUESTION

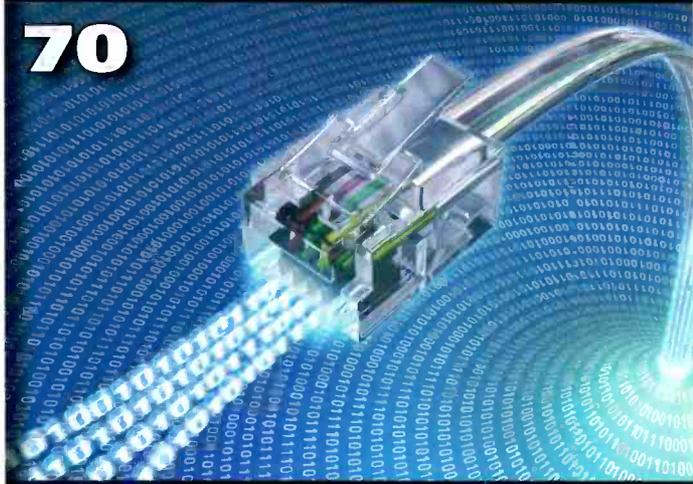
When used in storage systems, what does the acronym RAID stand for?

*The answer is on page 8.*

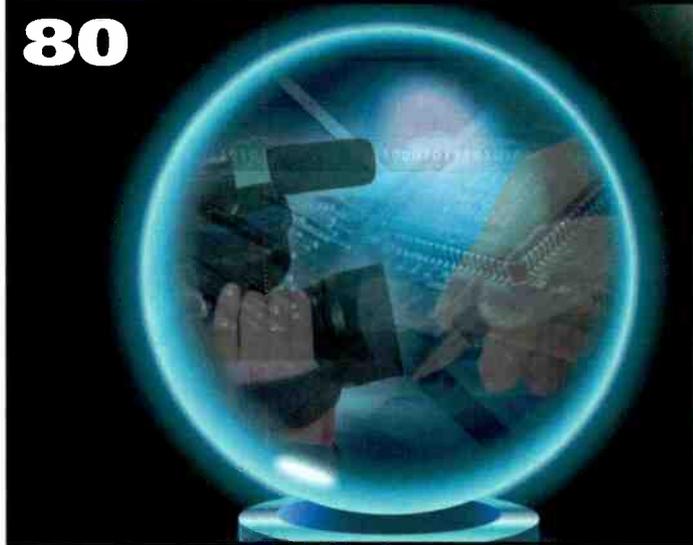
64



70



80



90



# details where you want them



With extraordinary sharp and clean native 1080i image quality and the widest range of precision image control of any camera in its class, the new Panasonic AK-HC3500 HD studio camera system makes everything look good – including you. Incorporating three select 2/3-inch, 2.2 megapixel CCDs, the HC3500 captures an industry-benchmark horizontal resolution of 1,100 lines at a signal-to-noise ratio of 60 dB. Panasonic's exclusive picture-enhancing features like Cine Gamma Curve,<sup>™</sup> Dynamic Range

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Visitors can watch master control operators through a glass wall.

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## MAY FREEZEFRAME ANSWER

Redundant array of inexpensive disks.



# 38

### ON THE COVER:

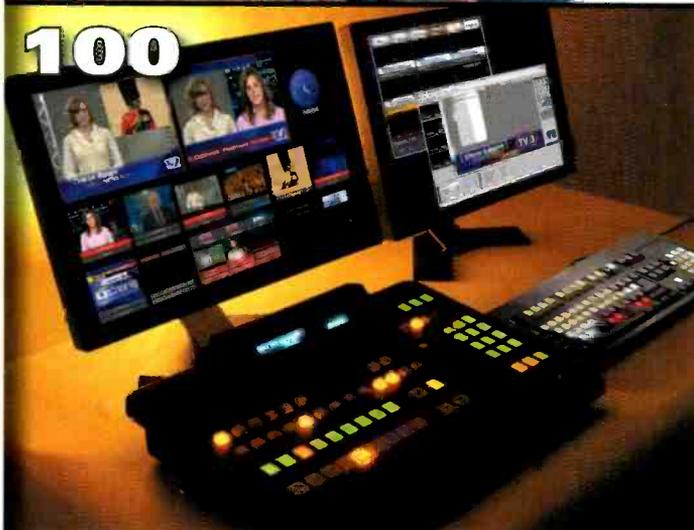
The Newseum's master control room features a glass wall that allows visitors to watch the operators in action. Visitors can also watch the news being made from large LED screens located in the atrium of this innovative facility.



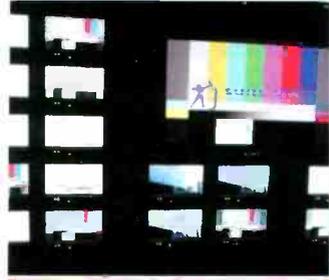
# 98



# 100



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## a sure thing.

When it came to choosing a digital console for their newest truck – Natalie Michele, Sure Shot Transmissions, Inc. based out of New Middletown, Ohio went with their best bet. Installed in a countless number of broadcast mobile trucks, Yamaha's PM5D has developed a reputation for strength, reliability and stellar performance. A crystal clear decision with features such as auto-mix minus, flexible routing and surround sound capability, the PM5D continues to remain a cut above the rest.



When you need help, time zones shouldn't matter. Yamaha provides coast to coast 24/7 technical support. With dedicated staff and regional service centers, assistance is around the corner. If we can't fix it over the phone, we'll put a part or a person on the next plane out. It's that simple.

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commercial audio

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# Crashing into mobile video

**D**id you know watching mobile video on you cell phone or PDA can be harmful to your health? Yep, reports are now surfacing that people are bumping into lampposts while staring at their cell phone screens.

As broadcasters contemplate entering into the exciting world of mobile video, do we as an industry do so without regard to our viewers' health? Should we pause, or stop mobile video's adoption, to protect our fellow human? Do we have a duty to protect humanity from its own stupidity?



I pondered these lofty issues while reading a recent study conducted by the UK directory service 118 118. The service discovered that mobile text users were often crashing into lampposts, sometimes injuring themselves while text messaging.

The company received permission to install padded wraps on lampposts in key sections of London. In trade, it gets to place advertising for its directory service. I suppose if you bump into the post, you'd pretty much have to see the ad.

Thinking about the similarities of texting and watching mobile video, I wondered if a similar problem could occur here with regard to mobile TV? Would unsuspecting viewers bump into lampposts while enjoying their favorite YouTube or FOX News videos? Would they wander into

signs or perhaps miss crosswalk lights, only to be struck by cars?

Imagine the potential for chaos in downtown Manhattan as millions of people rush to and from home, shops and their offices, noses pointed at mobile phones and players — no one watching where they were going. And with earphones, they wouldn't hear the screams of "Watch out!" Oh, the humanity of it!

Now, picture thousands of your station's viewers walking, or driving, heads down, noses perched just inches from those tiny cell phone and mobile video player screens. Your viewers could be heedless to the dangers that lie just ahead.

Can you hear the traffic reports? "There's a mash up on the corner of 12<sup>th</sup> and Johnson, where 22 people crashed together as a hotdog vendor moved his cart into the crosswalk. Pedestrians and drivers are encouraged to avoid this intersection."

This scenario may sound ridiculous, but how many times have you already done something similar? Have you ever text messaged someone or manually dialed your mobile phone while driving? Cops call that distracted driving and give tickets for it.

At my gym, perhaps 75 percent of the members have iPods strapped to their arms and earphones stuck in their ears. Even though there are 10 televisions in front of the cardio machines, most members want to make their own entertainment choices. Mobile TV will be used likewise.

Despite the potential drawbacks, I hope broadcasters make a business of delivering video to mobile receivers. And, when they do, I'll become a mobile video customer. I just hope those padded lampposts are around so when I bump into one, it's only my pride that gets hurt. **BE**

*Broad Dish*

EDITORIAL DIRECTOR

Send comments to: [editor@broadcastengineering.com](mailto:editor@broadcastengineering.com)

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# Rethink multi-image quality

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Rethink what's possible

[www.miranda.com/kaleido](http://www.miranda.com/kaleido)

### Smart antennas

*Dear Aldo Cugnini:*

I just read your "Smart antennas" article in the March issue. Any idea how much these antennas cost? Because of the three-pronged locations of broadcast transmitters in this area, we are frequently hearing about problems with the traditional directional antennas. This could be an important solution for our area.



Sandra Session-Robertson  
President and CEO  
KSMQ Public Television  
Austin, MN

*Aldo Cugnini responds:*

To my knowledge, there are three vendors of antennas, none of which are currently available. Funai/DX, RCA/Audiovox and GE/Jasco each has a smart antenna, but they have not announced availability. The price will probably be around \$40 to \$50. As I mentioned in the article, retailers are not too enthusiastic, as antennas are slow movers. That means it's hard to get the price down to the \$10 to \$20 that would really make them sell.

### STBs for resale

*Dear Aldo Cugnini:*

Great article on off-air digital STBs. (See "Smart antennas" in the March issue.) Our company just made the deadline today and will be accepting coupons for the cutover.

We are mainly a satellite, satellite master antenna TV (SMATV) and RF signal distribution design company located in New Jersey. We hope to see a good amount of commercial establishments that need to be converted — hospitals, nursing homes, car dealerships, etc.

Can you provide me with any information on where I can get STBs for resale?

Greg Frasca  
President  
SkyWeb  
Tinton Falls, NJ

*Aldo Cugnini responds:*

You can go to the NTIA Web site at [www.ntia.doc.gov](http://www.ntia.doc.gov) to get a full list of certified converter boxes. While the coupons are intended for consumers, the same boxes can be sold to anyone, such as your commercial customers. I will also forward your e-mail to a client of mine that makes the boxes.

### Can't hear the dialogue

*Dear editor:*

We've recently upgraded our DIRECTV to HD. Since then, we've noticed that background sounds — music, traffic noise, previously indistinct conversations, etc. — are so loud that they make the dialogue faint. As a result, we have to use closed captioning.

This highly irritating situation is most obvious on two shows, "CSI: NY" and "Cold Case." When we watch or record WINK-TV (the CBS-affiliated television station for southwest Florida) on our non-HD DIRECTV box, there is no problem at all with the audio on these two programs.

The DIRECTV technical staff attributes this problem, which has been frequently reported from this area (Port Charlotte), as a "broadcast problem of which the station should be well aware." I gave WINK a call, hoping to identify the problem's source. After all, it could be that all DIRECTV viewers going to the WINK signal have the same problem.

I was able to talk with an engineer at WINK on my first try. Wow! He was most helpful and told us to turn off any surround-sound features in our TV. Our old DIRECTV box didn't handle 5.1, and the new HD box does, and therein was the clue to the problem. Apparently our three-year-old TV is not compatible with 5.1 sound. Hopefully, the problem will go away now.

Edward and Margaret Barry

### Standards conversion

*Dear editor:*

In a worldwide company, standards conversion becomes a major issue. What are automation providers doing to minimize concatenation problems?

*Sid Guel responds:*

On the world stage, standards such as PAL, NTSC and one-offs are still an issue. As for DTV and HDTV, the trend is automation systems with built-in transcoders. This lessens the need for external third-party transcoders. Research shows that built-in transcoders are more popular with combo and hybrid systems.

### Test Your Knowledge!

See the Freezeframe question of the month on page 6.

# GF

## Tapeless HD in a Flash

### Ikegami and Toshiba Team Up For One Incredible Tapeless HD ENG Package.

Ikegami, the inventor of tapeless ENG, and Toshiba, a world leader in Flash memory, have combined their expertise to deliver unprecedented levels of



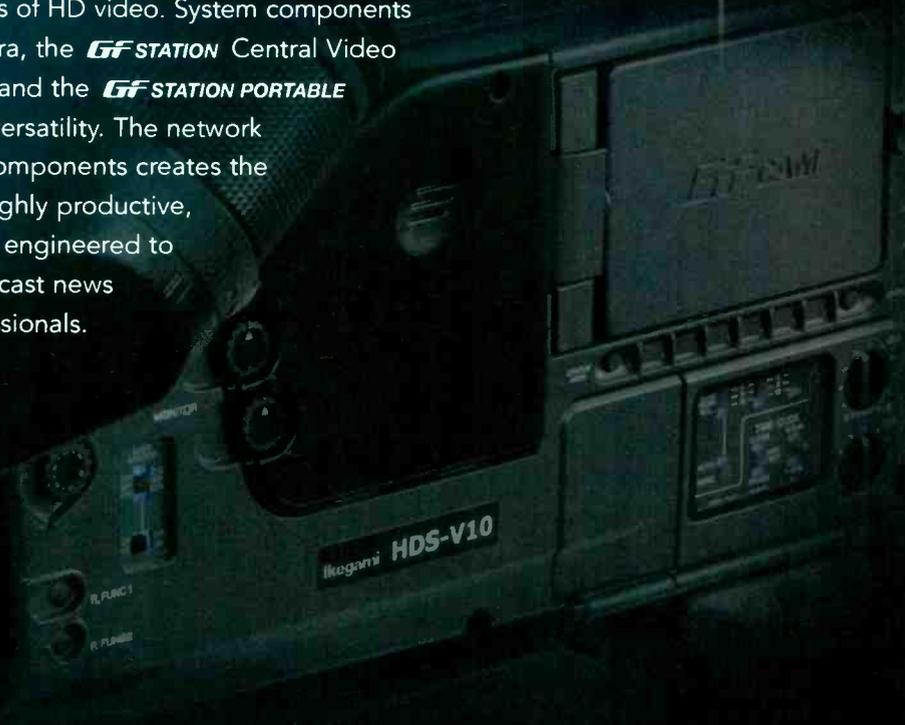
**GF STATION**



**GF PAK**

workflow innovation in the new **GF CAM** tapeless HD ENG system. From digital capture to fast, efficient non-linear editing, to instant IT networking, this revolutionary system features an open-codec HD/SD architecture, proxy video and metadata convenience, and high-capacity **GF PAK** Flash

media to record more than two hours of HD video. System components include the **GF CAM** Tapeless Camera, the **GF STATION** Central Video Management/Playback studio deck and the **GF STATION PORTABLE** field version for added production versatility. The network connectivity of all **GF CAM** system components creates the industry's newest, highly efficient, highly productive, advanced tapeless HD environment engineered to meet the demands of today's broadcast news and digital media production professionals.



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# Convergence

This time it's real.

BY CRAIG BIRKMAIER

Experts and analysts across a broad spectrum of industries have been exploring the convergence of television, computing and telecommunications for several decades. One could even say that this author has built something of a career around the subject, helping to facilitate the transition in the late '80s and '90s to computer-based tools for audio and video production.

Back in 1992, I helped the SMPTE put together a preconference session for the 26<sup>th</sup> Annual SMPTE Advanced Television and Electronic Imaging Conference in San Francisco. The conference theme was "Collision or Convergence – Digital Video/Audio, Computers and Telecommunications." The preconference session involved presentations and panel sessions from television and computer industry executives who, as expected, locked horns in territorial turf wars. A left brain/right brain audience looked on and interacted with the experts who were trying to lead and/or impede the transition to

a new infrastructure for digital media creation and distribution.

On one side of the center aisle were seasoned video industry veterans who believed that no one outside their industry understood the complex issues involved with video content creation. While computers were taking over prepress and graphics production, and beginning to affect audio production, video was simply too demanding for computers. In their minds,

different world. For them, video and audio were just big data files to be manipulated with software, shared across local and wide area networks and distributed in new ways — and this was before the then embryonic Internet gave birth to the World Wide Web!

## Collision

Did I mention that the seasoned video types also proclaimed that no one would want to watch TV on a

**The industry experts were wrong. So are those who claim today that the Internet will collapse under the strain of downloading video content by a new generation of consumers who want their media anywhere, anytime, on any screen.**

real-time dedicated video production gear would never be replaced by software applications running on general purpose computer platforms.

On the other side of the aisle, a new generation of Silicon Valley whiz kids and would-be content creators saw a

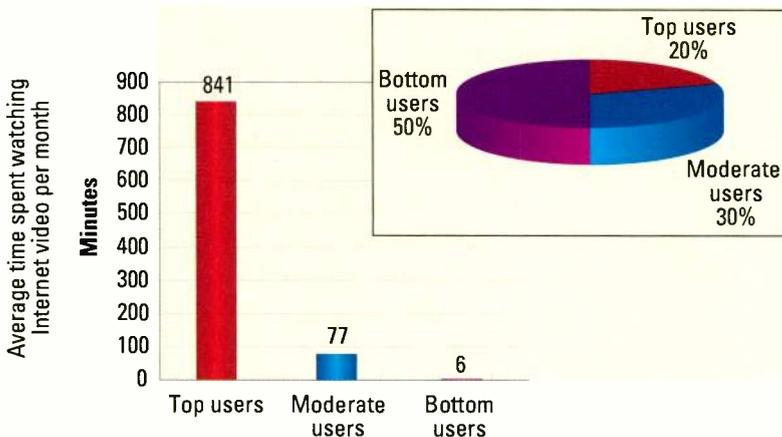
computer? Needless to say, the collision that took place at the 1992 SMPTE conference was predictable. Video industry leaders had no desire to become the next meal for the rapidly growing computer industry. PCs belonged at the office, or perhaps the den, but the family room was sacred turf.

PCs were lean-forward, interactive devices. TVs were lean-back, passive entertainment devices. Consumers would never settle for the postage-stamp-sized videos the PC kids were playing with. Even more important, the video industry was embarking on a digital transition of its own. It wanted to bring the wonders of high-definition television to the family room.

Three years later, I returned to another SMPTE conference in San Francisco and demonstrated a Media 100 nonlinear editing system, playing back online-quality SD video. This was from the same computer I was using for my PowerPoint presentation. The video industry experts were wrong. So are those who claim today that the Internet will

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

**Top 20 percent of online video users see 841 minutes/month**  
The bottom 50 percent only watch six minutes of video per month.



Sources: comScore/Media Contacts

www.comscore/www.mediacontacts.com



## At Last!

### Automatic Loudness Correction for File-Based Programming

For broadcasters and programmers, the delivery of consistent, high-quality content is of primary importance in satisfying viewers. If that content is file based, the **Dolby® DP600 Program Optimizer** automatically analyzes and normalizes loudness levels in a standardized, repeatable way—and in faster than real time. The DP600 ensures your programming, archived or newly ingested, plays out at a consistent loudness level. Whether it's from program to program, between programs and commercials, and even between channels within your service, the DP600 is the ultimate solution for correcting loudness levels. End your viewers' loudness complaints—with the new Dolby DP600.

The Dolby DP600 Program Optimizer is the recipient of two *Broadcast Engineering* Pick Hit Awards, a *TV Technology* STAR Award, and an IABM Award for Excellence 2007. For more information, visit [www.dolby.com](http://www.dolby.com) and click on the DP600 spotlight.

### Loudness applications for the Dolby DP600 Program Optimizer:

#### For terrestrial broadcast

- Automated broadcast media file QC and loudness correction

#### For cable and IPTV

- Broadcast media file QC and loudness correction
- Automated VOD file analysis and loudness correction
- Automated digital program insertion (DPI) file analysis and loudness correction

#### For satellite

- Automated broadcast media file QC and loudness correction
- Pay-per-view (PPV) file analysis and loudness correction

collapse under the strain of downloading video content by a new generation of consumers who want their media, anywhere, anytime, on any screen.

The movers and shakers in the professional video production equipment industry were not alone in their concern about the gathering momentum of the PC industry and the parallel development of the Internet. The consumer electronics industry and the television broadcasters who supplied the content for the TV in the family room had even more to be concerned about. They were trying to develop a new standard to deliver HDTV to the masses when the computer industry stuck its nose under the tent. The computer people suggested that digital television should be designed to promote convergence with the personal computer and technologies being developed for sharing digital media files via high-speed networks.

MIT and Apple lobbied the FCC to consider the potential for convergence of PCs and TVs. FCC chairman Al Sikes instructed the Advisory Committee on Advanced Television Service (ACATS) to evaluate all of the proposed (H)DTV systems on their ability to interoperate with personal computers. ACATS was also asked to evaluate the proposals as to their scalability and extensibility for future applications that would span devices from the big screen in the family room to the PC in the den to what has become the media-enabled smartphone.

As a participant in the ACATS process, I can now look back and say with a fair degree of accuracy that the computer industry overtures were viewed as a major threat by broadcasters and the CE industry. The video industry used the knowledge imparted by the computer industry to create barriers to competition — many of which still make convergence of TV, computing and telecommunications (the Web and wireless) a goal rather than a reality.

### Embracing convergence?

Several recent Download columns



Newer TVs, such as this Sony Bravia, offer Internet connection modules.

have focused on issues related to the convergence of television with the big screen in the family room and the Web as an important source of content in the family room. In March, the Frame Grab chart that accompanies this column illustrated the rapid growth of downloading video from the Internet. In 2007, 45 percent of U.S. homes reported downloading video from the Internet at least once each week. For 2008, that number will grow to 61 percent, with 86 percent downloading video at least once each month.

In my March column, “Decoupling,” I examined the growth in popularity of 1080p display technology and the roles that Blu-ray DVD and Internet downloads may have in the future. (See “Web links” on page 18.) Hollywood and the consumer electronics industry are looking to Blu-ray to deliver HD movies to those 1080p displays and to connect to the Internet to extend the experience around the content on the disc. They are also looking at a complex digital rights management (DRM) regime to keep HD versions of movies from flowing freely on the Internet.

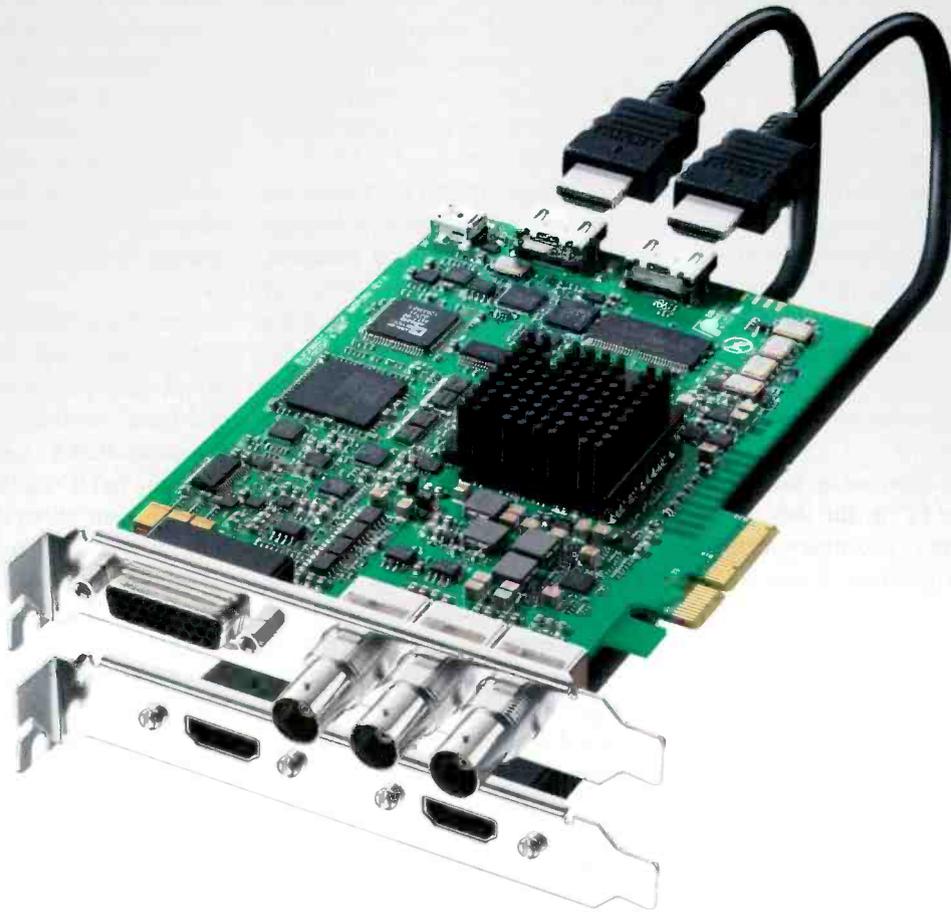
The most important takeaway from that column, in my humble opinion, is that 1080p displays fully enable the convergence of TV and the Web. These high-resolution displays are equally adept at displaying high-quality HDTV content for entertainment, and for Web-based applications aimed at the family room, such as Apple’s new movie rental service for Apple

TV, using the iTunes portal for buying music, TV shows and movies, as well as renting movies. Apple TV does not have any outputs for an analog TV. It requires a progressive display with analog component or HDMI inputs.

Big screen displays are also in demand for the latest generation of game consoles like Sony’s PlayStation 3, which can play Blu-ray movies, and Microsoft’s Xbox 360, which can download movies from the Web. And Sony is now selling an Internet connection module for its Bravia TVs.

In my January column, “Change is imminent,” I examined the challenges that the TV industry is facing as traditional TV audiences fragment in 100 directions. (See “Web links.”) Consumers now have many options for information and entertainment, and many technologies to assist in the selection of content and the venue in which it is consumed. TV viewers are no longer tied to the old appointment TV model where the family sat down for an evening of TV viewing. DVRs make it possible to watch a TV program on your schedule. And missed episodes of favorite shows can now be downloaded and viewed on a PC, a TV or a portable media player.

The TV networks are moving considerable resources to the creation of a Web-based distribution system



## The new DeckLink HD Extreme has SDI, HDMI and analog connections for editing in SD, HD and 2K!



The new DeckLink HD Extreme is the world's most advanced capture card! With a huge range of video and audio connections, built in 3D LUTs and the new 3 Gb/s SDI. Advanced editing systems for Microsoft Windows™ and Apple Mac OS X™ are now even more affordable!

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DeckLink HD Extreme is the only capture card that features SDI, HDMI, component analog, NTSC, PAL and S-Video for capture and playback in SD, HD or 2K. Also included is 2 channels of XLR AES/EBU audio and 2 channels of balanced XLR analog audio. Connect to HDCAM, Digital Betacam, Betacam SP, HDV cameras, big-screen TVs and more.



### Advanced 3 Gb/s SDI Technology

With exciting new 3 Gb/s SDI connections, DeckLink HD Extreme allows twice the SDI data rate of normal HD-SDI, while also connecting to all your HD-SDI and SD-SDI equipment. Use 3 Gb/s SDI for 2K and edit your latest feature film using real time 2048 x 1556 2K resolution capture and playback!

### Advanced Performance

Unlike FireWire, DeckLink HD Extreme has a 10 Gb/s PCI Express connection for powerful HD real time effects in compressed or uncompressed video file formats. This 10 Gb/s connection gives you more HD real time effects and you can take advantage of the 3 Gb/s SDI and built in 3D LUTs to edit your feature films!

### Microsoft Windows or Apple Mac OS X

DeckLink HD Extreme is fully compatible with Apple Final Cut Pro™, Adobe Premiere Pro™, Adobe After Effects™, Adobe Photoshop™, Fusion™ and any DirectShow™ or QuickTime™ based software. DeckLink HD Extreme instantly switches between feature film resolution 2K, 1080HD, 720HD, NTSC and PAL for worldwide compatibility.



Decklink HD Extreme

**\$995**

Learn more today at [www.blackmagic-design.com](http://www.blackmagic-design.com)

with a variety of business models:

- sales of TV shows for download without commercials;
- free downloads with commercials that cannot be skipped; and
- the linking of Web search capabilities with vast libraries of content that have been produced in recent decades.

At the same time, broadcasters are increasingly aware that the ability to deliver bits to things that move may be as important as serving fixed TVs in the family room, especially in a world where more than 85 percent of U.S. homes subscribe to a multichannel TV service.

Surfing the Internet is no longer limited to the PC in the den. Notebook PCs are the 21<sup>st</sup> century portable information appliances. Users expect

them to hookup to wireless networks, play DVD movies and downloaded TV content, and perhaps soon, to pull in TV programming from the telcos or TV broadcasters who dedicate part of their spectrum to serving mobile and handheld devices.

Now some industry experts are saying that smartphones may become the next major computing platform. These devices can surf the Web, play music and videos, and talk to other devices. One can easily imagine a device like Apple's iPhone becoming a game player in its own right, a game controller for multiplayer games on the big screen TV, and a Web surfing remote for the big screen TV.

While Apple continues to help transform the PC industry with new and innovative devices, the company's ability to create an entire ecosystem around these devices is the real story. A song, TV show or movie purchased or rented from the iTunes store can now be enjoyed on the big screen TV in the family room via Apple TV, on the PC in the den, on a notebook computer and on an iPod.

wireless telephones, and the packaged media we buy can easily approach several hundred dollars each month. While industry experts have been arguing about who's going to do what to whom, consumers have been growing accustomed to paying for their media fixes. What the iTunes store has proven is that consumers will pay for content if it is fairly priced and easy to access.

It took less than a decade for computer-based tools to replace traditional video production gear for non-real-time content creation. These computer-based tools have scaled from SD to HD and now support the development of versions of TV content for multiple platforms.

Hoping that the Internet will be crushed under the weight of video downloading is not a good bet. The IT industry looks at challenges like this as new business opportunities, not barriers to competition.

The convergence pie is huge. The question to be answered is how it will be divided, and by whom? **BE**

*Craig Birkmaier is a technology consultant at Pcube Labs.*

## Web links

- *Broadcast Engineering*, March 2008, "Decoupling"  
[http://broadcastengineering.com/hdtv/decoupling\\_dvdlist\\_hdtv](http://broadcastengineering.com/hdtv/decoupling_dvdlist_hdtv)
- *Broadcast Engineering*, January 2008, "Change is imminent"  
[http://broadcastengineering.com/iptv/change\\_imminent\\_television\\_801](http://broadcastengineering.com/iptv/change_imminent_television_801)

## The bottom line

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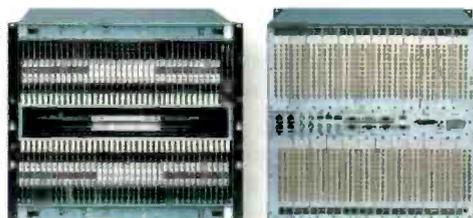
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# DTV education

## A new initiative outlines broadcaster requirements.

BY HARRY C. MARTIN

In March, the commission announced its DTV Consumer Education Initiative, which requires broadcasters to educate the public regarding the DTV transition.

Under this initiative, full-power TV stations will have to select one of three options calling for a combination of PSAs, video crawls, DTV countdown “bugs” and long-form infomercials covering the DTV transition. In addition to satisfying these requirements, stations will also have to file quarterly reports on a new Form 388 to let the commission know which option the station selected and to certify that the station did in fact comply with the relevant requirements during the preceding quarter. The following is a summary of the three options.

### PSAs and video crawls

The first option is a combination of PSAs and video crawls. PSAs must be

## Dateline

- June 2 is the deadline for TV stations in Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming to file their biennial ownership reports.
- In the following jurisdictions, June 2 also is the deadline for TV, Class A and LPTV stations that originate programming to place their annual EEO reports in their public files and place them on their Web sites: Arizona, Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia, Washington, D.C., West Virginia and Wyoming.
- On June 2, TV stations with more than 10 full-time employees in Maryland, Virginia, Washington, D.C., and West Virginia must electronically file their broadcast EEO midterm reports (Form 397) with the FCC.

at least 15 seconds long, and the video crawls must be at least 60 seconds. Such PSAs and video crawls need to inform the public that:

- full-power analog broadcasting will cease on Feb. 17, 2009;
- analog-only televisions may not be operational after that date unless the viewer takes action;

**Full-power TV stations will have to select one of three options.**

- viewers can get more information online or by telephone (Web site and/or phone number must be included); and
- viewers should take certain steps to continue being able to watch the station, depending on whether they receive the station over-the-air or via cable or satellite.

One PSA and one video crawl must be broadcast every six hours initially (with at least one in prime time), with the frequency increasing to three PSAs and three crawls every six hours during the period of Oct. 1, 2008, to March 31, 2009.

### Fewer PSAs and crawls but more outreach

Under the second option, a TV station will have to air an average of 16 PSAs per week. While each PSA must be at least 15 seconds in length, it will take two 15-second PSAs to equal one PSA for purposes of compliance with the commission’s rules. The station must also air an average of 16 crawls (each at least 60 seconds long) per week.

Under this option, the commission will require at least one 30-minute

infomercial each day regarding the DTV transition, and all of the following outreach initiatives once a day: a super-imposed graphic display, an animated graphic display, and an audio message reminding viewers that there are “x” number of days before the end of the transition. These messages must also provide a toll-free number or Web site for more details.

### For noncommercial stations

Under the third option, eligible licensees must air a certain number of “transition-related educational PSAs” per day as well as the same 30-minute infomercial as required in the second option.

### All options

All of the information required by the Education Initiative will have to be closed captioned, in the same language as a majority of the programming aired on the station, and placed on the station’s analog and primary digital stream.

### Cable and satellite companies

Cable and satellite companies must place in their monthly bills notices that the DTV transition will end on Feb. 17, 2009, and that a converter box may be needed to continue reception of over-the-air broadcasts. The statements must also refer the reader either to [www.dtv.gov](http://www.dtv.gov) or to the service provider at a toll-free number to receive information regarding the transition and the subsidized coupons for the \$40 converter boxes. **BE**

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

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# Adapters and tuners

Increasingly, they are being used for DTV viewing.  
Can they be trusted?

BY ALDO CUGNINI

**W**hile many broadcasters have considered the TV to be the sole delivery medium for their service, there is a growing number of cards and adapters designed for PC delivery of over-the-air and cable TV service. How well do they work? Are conventional TVs in jeopardy? To find out, I analyzed the characteristics of various PC DTV adapters currently on the market. To avoid any debate on products and subjectivity, I won't identify them or compare them directly, but this article will look at the grouped characteristics of the devices.

## Performance and ease-of-use varies considerably

PC adapters come in two varieties: a PCI bus card that resides inside the PC and an external pod or dongle that is attached by means of a USB interface. The latter devices add video reception capability to laptop PCs.

All PC adapters use software to decode the ATSC (MPEG-2) video, so the performance of the host PC is a major factor. The adapters can house a VSB and QAM tuner, and some of them additionally provide analog NTSC tuners. The digital tuners transfer the MPEG-2 transport stream over a USB 2.0 or PCI interface to the PC, where it is demultiplexed, decoded and delivered to the display. (See Figure 1 on page 24.) Note that the older USB 1.0 interface on some PCs is not fast enough to carry the transport stream and will cause problems with attempted normal use.

When NTSC capability is supported, the device incorporates an internal analog-to-digital converter to deliver the video to the PC. This often adds an external video capture function by providing either composite or S-video inputs so that a user can acquire video from other devices. Some of the USB units are extremely small, about the



The small size of USB DTV converters enables them to be extremely portable.

size of a USB thumb drive. This portability can make the device a simple laptop accessory. At the same time, although USB hardware installation is very simple and straightforward, the smallest units can get extremely hot in operation due to the heat dissipation of the required chips.

## About silicon tuners

Advances in the silicon fabrication process have now made it possible to put all of the functions of a tuner into an integrated circuit or chip. These silicon tuners can actually replace many of the large tuning components conventionally used in a receiver, such as coils, mechanical tuning capacitors and shielding cans. The motivation for using these parts is lowered parts costs and a smaller size. Manufacturing costs are lower, too, as there is no need for manual adjustments on the assembly line.

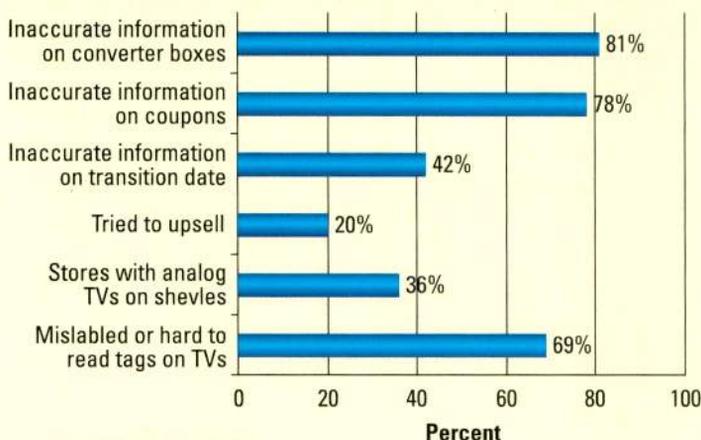
The downside, however, is that some silicon tuners have reduced sensitivity and selectivity compared with the larger mechanical alternative. Some manufacturers have even proposed a zero-IF design, where the RF carrier frequency is directly down-converted to baseband without any intermediate stage. With the reality of strong adjacent-channel interference

## FRAME GRAB

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in the DTV service, such a design would be of very poor performance, as adequate channel isolation can only be accomplished with an IF filter.

### While features are varied, performance can be, too

Many units provide some kind of EPG, and some provide an interface to a Web-supported application for re-

trieving program information. However, because patents protect certain key EPG functions, the utility of this feature will depend on the manufacturer's licensing arrangements. This may be one reason why a combined interface for analog and DTV channels has yet to be seen on any unit. EPGs will show DTV stations or analog stations (when supported) but not both

simultaneously. Also, a surf function can be blind, with no indication of the stored channels or with an on-screen listing of available channels.

With PCs having ever-expanding amounts of disk memory, a DVR function is almost a no-brainer with PC DTV adapters. Many of the units allow the user to pause and record live analog TV, DTV and HDTV, as well as burn HDTV to DVDs and CDs. Recording can be programmed from the EPG or by using a separate scheduling applet. One unit even has a journaling function that generates HTML pages from video captures and closed captions.

Video scaling functions can be varied, as well — but not always with good results. Some units improperly resize the video, such as when 4:3 video is displayed in full-screen mode. When supplied, the NTSC tuners sometimes use a separate antenna input, making it a nuisance to watch both analog and digital programs. Accessories vary as well. Certain units include a remote control, requiring a built-in IR receiver in the device. For ease of setup, some units are bundled with a small flat antenna — certainly of marginal use with weak signals. One even comes with a popular indoor UHF log-periodic dipole

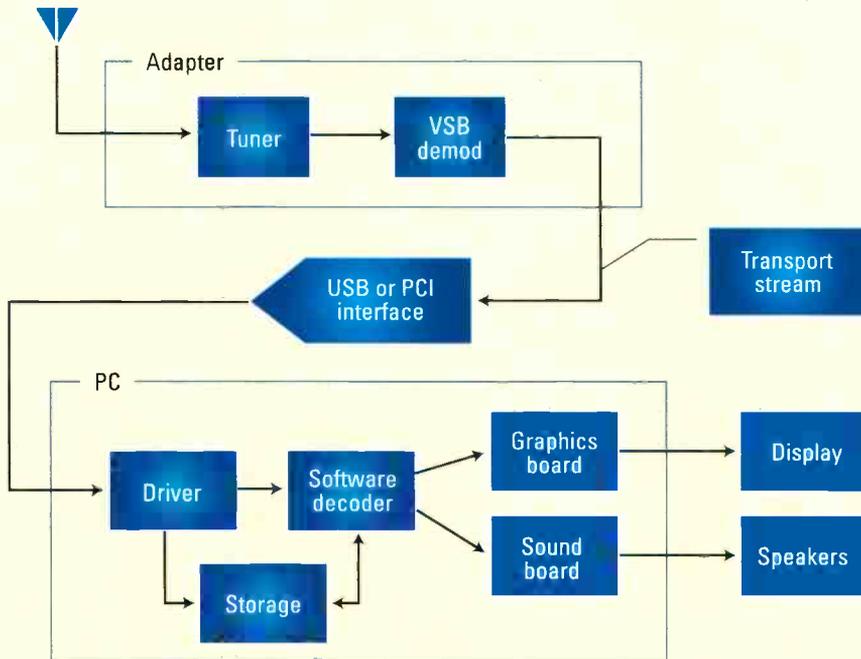


Figure 1. PC DTV adapters rely on the PC for many functions.

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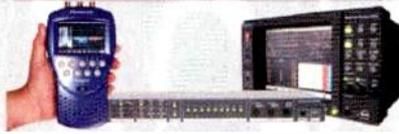
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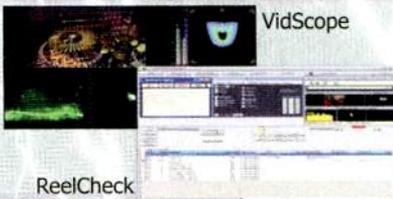
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## TRANSITION TO DIGITAL

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antenna. Most units also include a signal strength indicator, either on the channel information display or by means of a separate applet.

One interesting feature offered on some units is a simultaneous main- and subchannel display. Because decoding the full 19.4Mb/s bit rate must be supported for HD service, decoding several smaller SD services simultaneously

**Because the MPEG decoding is done in software, performance can vary widely as a function of the speed of the PC's CPU.**

results in roughly the same CPU workload as decoding one HD service. This makes possible a multiview video display that shows multiple subchannels at once or as picture-in-picture (PIP).

### Beware of the infamous blue screen

All of these units require some type of software installation on the PC, from a few simple drivers to a full-blown graphics application. Installation varies widely. Certain units can be setup in a few minutes, while others can be problematic, especially when there are conflicts with other devices. Once installed, some units can provide a trouble-free television viewing experience — but don't expect to get television-receiver-like stability on every unit.

Because the MPEG decoding is done in software, performance can fluctuate widely as a function of the speed of the PC's CPU. This is particularly critical when decoding and displaying HD video, as the processor must take care of the labor-intensive decompression as well as generating (rendering) and transferring the video to the graphics card. This can lead to choppy decoding with dropped frames, especially when the PC is car-

rying out other tasks. This is not inconsequential, as there are often many processes running in the background, of which the user is unaware.

With features driven by the PC's operating system, certain situations can cause the PC to become unstable or even crash (i.e. the blue screen of death). This is especially true for the USB devices, where the interaction between hardware and software is particularly complex. Unplugging the USB device while in use will often generate a fault. Lip sync can be lost when switching video display modes. Stopping the software application will sometimes disable the device, requiring it to be removed and re-plugged in. Also, starting the application after PC hibernation while the unit is still connected can cause problems.

### Some general conclusions

The various units represent different efforts by each of the companies to capture the PC DTV market. While some units worked well, others had major glitches, preventing their practical use as day-to-day TV viewers. Some units have the advantage of being pocket-sized and inexpensive (\$50, with rebate) and are extremely easy to use. These units could potentially see application with laptops on the road.

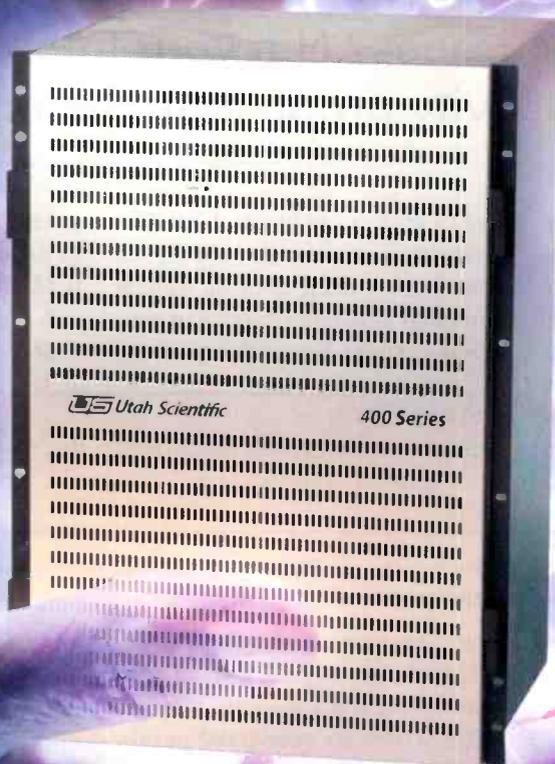
And while certain units rely on a third-party EPG, many of these could have integrated the functions in a better way. Others, however, lack a useful program guide and have poor front-end performance, limiting their application as a full-time television source. So it's still a mixed bag, perhaps an indication of the novelty of the application.

As with most software and hardware, expect multiple generations to improve performance — and don't forget that mobile DTV businesses are now under development, and that could change the landscape as well. **BE**

*Aldo Cuginini is a consultant in the digital television industry.*



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# Network connections

## Having issues? Nip your Internet connectivity problem in the bud.

BY BRAD GILMER

Nothing is more frustrating than trying to get a balky network connection up and running. Everything looks fine, you see a link light, and the computer acts as if it is connected to the network. However, you are unable to access servers on the network or connect to the Internet. In some cases, you can see local servers, but you cannot access the Web. If using a wireless connection, you may be unable to access the Internet, even though things worked just a few minutes ago. What's going on? Why is Internet connectivity so hard sometimes?

Ethernet technology is pretty straightforward. By now, most people know how to get a connection to work. But sometimes establishing a connection can be devilishly tricky, and there are several things that have to work correctly to establish connectivity to the Internet. This month's article will help you troubleshoot some of the most common connectivity problems.

### Basic issues

Your first step is to see whether there is a link light illuminated next to the Ethernet connector. If there is a light, it means that the base physical and electrical connections are completed between your computer and the switch it is connected to. You can verify that a connection exists using either the `ipconfig` command on Windows machines, or `ifconfig` on Mac and UNIX systems. As Figure 1 shows, my computer is not physically connected to a network, as signified by the words "Media disconnected."

As soon as a connection is made, assuming your computer does not have a permanently assigned IP address, it requests an IP address from a Dynamic

Host Configuration Protocol (DHCP) server. In most networks, the DHCP server is part of the network routing technology (probably residing in your network switch). If everything is func-

point: The number of IP addresses in the DHCP pool is limited. If all of the DHCP addresses have been leased out, when your computer contacts the DHCP server, it will not be able to get

```
C:\>ipconfig
Ethernet adapter Wireless Network Connection:
    Media State..... : Media disconnected
C:\>
```

**Figure 1.** `ipconfig` shows that this computer is not physically connected to any computer network.

tioning normally, within a few seconds, the computer will receive an IP address lease from the DHCP server. DHCP servers are configured to provide IP addresses from a predefined address pool. The server leases IP ad-

resses to clients on the network for a period of time. As Figure 2 shows, you can see the lease statistics by entering `ipconfig/all`.

```
C:\>ipconfig/all
-----SNIP-----
    Lease Obtained..... : Tuesday, March 08,
2008 11:19:32 AM
    Lease Expires..... : Wednesday, March
09, 2008 1:19:32 AM
-----SNIP-----
C:\>
```

**Figure 2.** The `ipconfig/all` command displays network connection information, including information about your DHCP IP address lease.

addresses to clients on the network for a period of time. As Figure 2 shows, you can see the lease statistics by entering `ipconfig/all`.

Before the lease expires, the client automatically renews the lease to keep the IP address. Remember this key

If all DHCP IP addresses are leased out, you will never receive an IP address.

If all goes well, after a few seconds, the computer will receive an IP address from the DHCP server. At this point, an `ipconfig` command will

```
C:\>ipconfig
...
    IP Address..... : 0.0.0.0
    Subnet Mask..... : 0.0.0.0
    Default Gateway..... :
C:\>
```

**Figure 3.** `ipconfig` shows that media has been connected, but the computer has not been assigned an IP address by the DHCP server.

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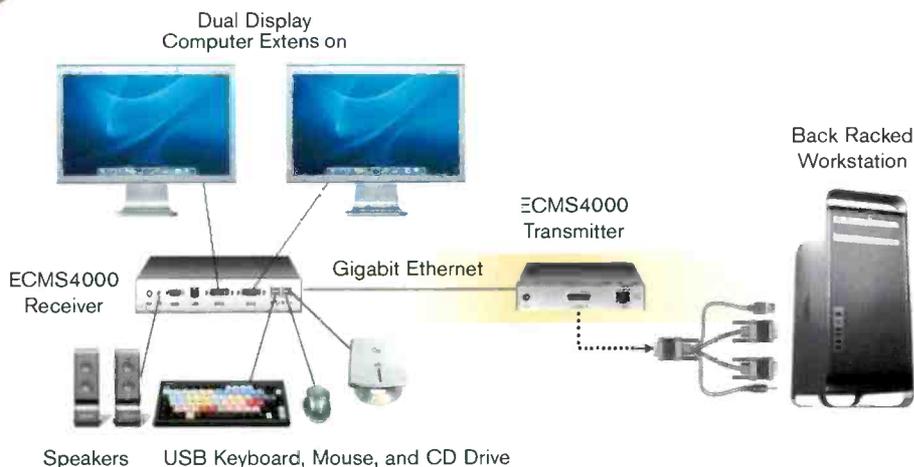
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show the IP address assigned to your machine along with the default gateway. (See Figure 4.) The default gateway is the path from your computer to the Internet and to other networks.

### Default gateways

Your computer has an IP address, and it knows how to get from the local network to the Internet via the de-

set equipment up so that it does not reply to ping commands. If both ping and tracert are unable to communicate with the default gateway, you may be able to communicate with computers on the local network, but you will not be able to access anything beyond this. At this point, it is probably time to ask the network system administrator for help. If you are

called "AsustekC" was sending out broadcast packets every 250ms to all the computers on the network. (The destination is listed as Broadcast, causing every computer on the network to try to read the packets.) This constant dribble of traffic interfered with normal communications on the network. When traffic became too heavy, computers couldn't communicate with DHCP servers and the gateway, making it appear that the network was unavailable. In the end, the culprit was a bad network interface card in a music library computer.

```
C:\>ipconfig
...
IP Address..... : 192.168.0.4
Subnet Mask..... : 255.255.255.0
Default Gateway..... : 192.168.0.1
C:\>
```

**Figure 4.** The computer has now been assigned an IP address (192.168.0.4) from the DHCP pool. It has also learned from the DHCP server that the default gateway address is 192.168.0.1.

fault gateway. But let's say you fire up a Web browser and still can't connect to the Internet. What's the next step?

Check to see if you can get to the default gateway. To do this, you can use either the ping or tracert command (tracert on Mac and UNIX systems). If all is working

the system administrator, break out a packet sniffer. Packet sniffers capture traffic on the network and help users identify problems.

Recently, I had a situation similar to this. Most of the time clients were working normally. But not infrequently, sometimes, computers were

### DNS check

Assuming that you are able to ping the default gateway, but still unable to see a Web site on the Internet, the next step is to check whether Domain Name System (DNS) is available. DNS translates the domain name you type in to the actual IP address of the system you are trying to reach. Let us assume that you are trying to reach *www.cisco.com*. You open a Web browser and type in *www.cisco.com*. The first thing the computer does is ask a DNS server on the network to give you an IP address for *www.cisco.com*. This is the IP address your computer will use to reach the Cisco Web site. However, if the DNS server on your network is down, the computer will not be able to resolve the Cisco URL, and you won't be able to connect to the Web site.

You can see DNS at work by using the nslookup command. Enter nslookup *www.cisco.com*. On my computer, *www.cisco.com* resolves to 198.133.219.25. Because your Web

```
C:\>ping 192.168.0.1
Pinging 192.168.0.1 with 32 bytes of data:
Reply from 192.168.0.1: bytes=32 time=8ms TTL=64
-----SNIP-----
C:\>
```

**Figure 5.** The ping command shows that we can successfully reach the default gateway.

normally, a ping command should yield the output shown in Figure 5.

If you are unable to ping the default gateway, try the tracert command. Some system administrators

unable to get a DHCP IP address, or if they were, they were then unable to access the Internet. Figure 6 shows a partial capture from Ethereal, a free packet sniffing program. Something

No.	Time	Source	Destination	Protocol	Info
1	0.000000	AsustekC_0e:dd:f1	Broadcast	0x88ad	Ethernet II
2	0.420294	AsustekC_0e:dd:f1	Broadcast	0x88ad	Ethernet II
3	0.528029	XimetaTe_03:29:2e	Broadcast	0x88ad	Ethernet II

**Figure 6.** The output of an Ethereal capture shows a broadcast storm created by a bad network interface card in a music library computer.

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browser finds Web sites by using IP addresses, this domain name resolution is performed automatically every time you enter a domain name in the Web browser.

Once you have the IP address of the site you are trying to access, enter this IP address directly in the Web browser. If you can see the Cisco home page, your Internet connection is working perfectly. The problem is not the Internet connection; it is the DNS. (Of course, if DNS is the problem, nslookup will not work.) Because DNS is such a critical function, many people operate multiple servers. Unfortunately, DNS servers go down more often than you might think. In many cases, DNS is provided by the Internet service provider (ISP). If the ISP's DNS servers go down, then it will look as if you are unable to connect to the Internet, even though everything except DNS is working fine. If you operate a personal

DNS, be sure to provide a backup DNS server because without it, your clients will not work correctly.

### Wireless connectivity

If you are having problems with wireless connectivity, be aware that access points, the pieces of equipment that are sources of wireless connectivity, can become overloaded with association requests. This problem is created when many people try to connect to an access point simultaneously. (Think about conventions or hotel lobbies, where many people try to connect at the same time.) Unfortunately, there is no quick fix to this problem. If this happens frequently and you own the access point, you can install multiple access points to improve the situation.

### Closing thought

As Internet security has become more of an issue, many network ad-

ministrators are restricting access to their networks. If you cannot obtain a network connection, it may be that a network administrator has restricted connectivity on the network. If you are trying to connect to a foreign network, check with someone who is familiar with the facility to be sure that connections to visiting equipment are permitted. **BE**

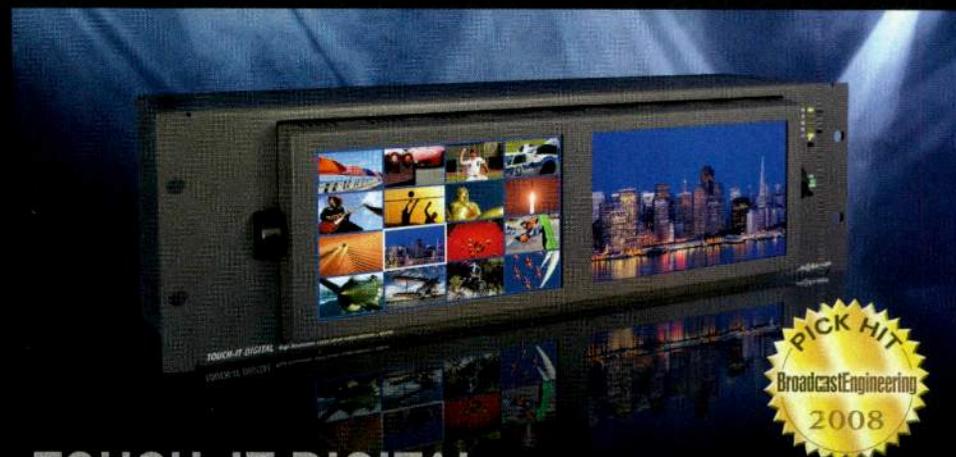
*Brad Gilmer is president of Gilmer & Associates, executive director of the Video Services Forum and executive director of the Advanced Media Workflow Association.*

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VIDEO SYSTEMS

# Speakers and audio monitors

Proper placement and adjustment are the key to accurate sound reproduction.

BY CHRISTOPHE ANET

A monitoring system should reproduce sound without adding or taking anything away from the original input signal. The human hearing features a phenomenon called auditory masking, and modern recording systems have a flat electronic frequency response. To accurately monitor what is recorded, mixed-down or broadcasted, the monitoring system must also have a flat response at the listening position.

However, monitors are built in anechoic conditions, and their response changes when placed into a listening room because of room boundary loading, reflections, reverberation time characteristics, etc. Precise adjustment of the monitor's response is needed for optimal loudspeaker-room interaction and flat frequency response at the listening position.

## Common mistakes

Most audible problems occur because of the effects of the room acoustics. Many control rooms use a combination of loudspeakers, subwoofer and bass management to reproduce six or more discrete channels. Because all loudspeakers and subwoofers are omnidirectional at low frequencies (below 200Hz), cancellation effects, room standing waves and the proximity of boundaries will affect the loudspeakers/subwoofer performance.

When a loudspeaker with flat anechoic ( $4\pi$ ) response is placed against one solid boundary (large compared with the wavelength), the radiation space becomes  $2\pi$ , and the theoretical amplitude gain is 6dB for frequencies below a few hundred hertz. This ap-

plies to flush-mounted loudspeakers or loudspeakers placed with their back against a solid, hard wall. In all cases, this amplitude change has to be compensated to retrieve a flat and neutral frequency balance. (See Figure 1.)

woofer to radiate energy away from pressure minima and maxima.

The wall behind the loudspeaker cancellation is another interference generated by the single reflection from a hard wall behind the loudspeaker.

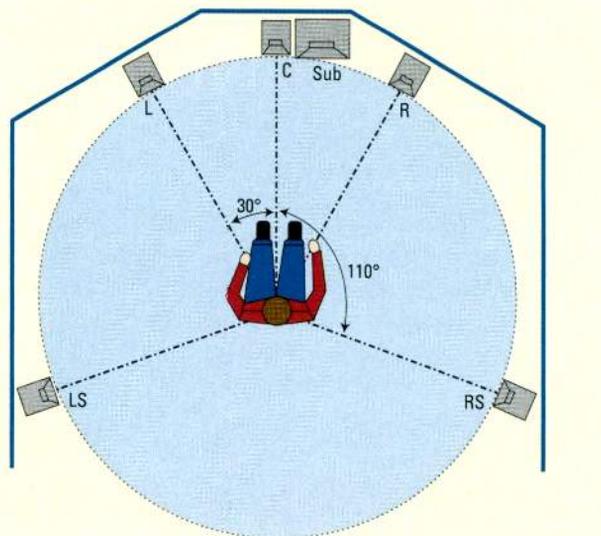


Figure 1. ITU-R BS.775-1 speaker placement with each main speaker placed against a wall (hemispherical loading)

Typical subwoofer location is on the floor and against a wall. These two large boundaries (radiation space  $\pi$ ) cause a +12dB amplitude gain compared with free field. This gain is beneficial, as it provides additional headroom and less distortion. If a subwoofer is placed in a room corner, the radiation space is further halved, and the amplitude gain becomes +18dB. Adjustments of such a system can become difficult due to strong modes excitation from the room corners. Placing the subwoofer slightly offset from the central axis of the room is often beneficial as it allows the sub-

When two identical signals are in anti-phase, they cancel each other. If the loudspeaker is a quarter wavelength away from a reflective wall, the reflected wave comes back to the loudspeaker with half a cycle phase difference and thus cancels the original signal at that frequency. The importance of the cancellation depends on the distance and the reflection coefficient of the wall, but it is usually well audible.

## Proper placement

When cancellation occurs in a monitoring system using an 85Hz crossover between loudspeakers and subwoofer,

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there is a set of practical placement solutions. (See Figure 2 on page 36.) First, the distance between the radiating subwoofer driver and the wall providing part of the low frequency loading must not exceed a conservative 60cm. If the subwoofer (driver) is placed further, cancellation and comb filtering will start to occur below 85Hz, degrading the subwoofer response. Satellite loudspeakers high-

enough so the rear radiation cannot cause a severe cancellation.)

- Move the loudspeaker away from the wall up to 1.1m, causing the cancellation frequency to go below the 85Hz cutoff of each satellite loudspeaker. From 1.1m to 2m, loudspeakers may be placed without serious cancellation compromises. Distances to other room boundaries become smaller, and reflections from

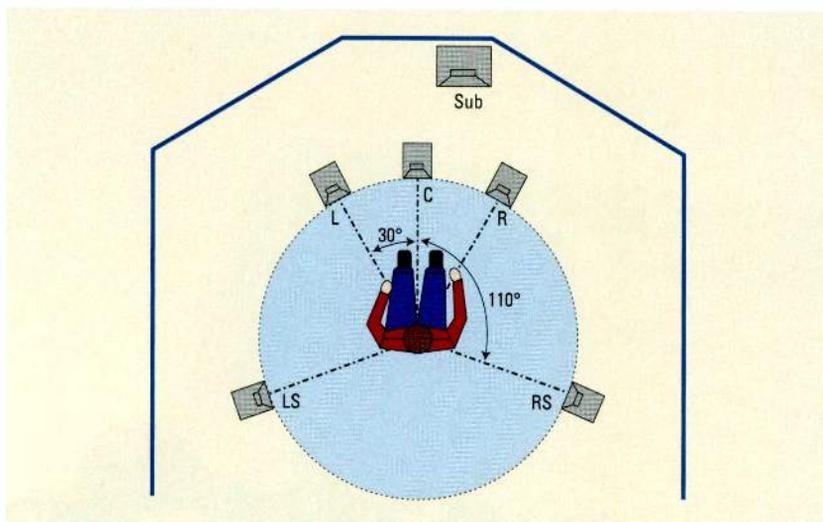
interfering reflections. Interference of first (or higher) order reflections affects a loudspeaker's response at the listening position. For the human ear, imaging is lost as soon as the delayed signal arrives in a suitable time window and from an acceptable direction in relation to the direct sound (Haas and precedence effects).

High amplitude, early reflections can smear the coherence of the spatial information and compromise sound source localization. To avoid this, all reflecting surfaces (racks, computer tables, etc.) placed between the loudspeakers and the listening position should be removed, or at least minimized. All tables and outboard racks placed close to the listening area should be lower than the typical mixing console height. With DAWs, the insertion of large screens into the work surface will significantly reduce first order reflections from the center loudspeaker. Perforated tabletops can also further reduce such reflections. However small the remaining surfaces may be, reflections in the time domain should be identical from both the left and right half of the room. Furniture could be designed so that there are no additional surfaces beyond the job needs.

For the placement of the listening position in the room, research indicates that the reference point be located in the front half of the room so that the engineer benefits from the best direct-to-reverberant sound ratio. In the presence of rear loudspeakers, the acoustic design of the front half of the room becomes more complicated. If the room has hard and reflective front wall surfaces, direct sound from the rear left loudspeaker will bounce on the front right loudspeaker and nearby boundaries. This situation should be avoided, as these strong first reflections will alter the front loudspeaker's direct sound. This calls for some planning in room geometry and adequate location of absorptive surfaces in the mid- and high-frequency band.

**BE**

*Christophe Anet is a technical editor for Genelec.*



**Figure 2. ITU-R BS.775-1 speaker placement with each main speaker placed at least 1.1m from the wall behind**

passed at 85Hz do not have to reproduce very low frequencies, so they may be placed at a distance where low frequency notches do not occur in their passband. Here are three practical placement alternatives:

- Loudspeakers can be flush mounted in a hard wall (or infinite baffle), eliminating rear wall reflection. With two-way loudspeakers, this option is rarely implemented but is almost inevitable with large fullband monitors.

- Place the loudspeaker very close to the wall, increasing the cancellation frequency. (With very small loudspeakers, which are inherently less directional in mid frequencies, the dip just moves to the low midband and might cause even worse coloration.)

In most cases, distances between 0cm and 20cm between the front radiating driver and the wall behind can be considered as safe. (The directivity of the loudspeaker should be high

these other surfaces might start to dominate the response. Despite accurate subwoofer phase control adjustments, avoid placing satellite loudspeakers further than 2m away from the subwoofer. The tonal balance between the loudspeakers and the subwoofer may differ considerably due to excitation of different room modes by the sources.

The acoustical adjustment of the interaction between loudspeakers and room is important before doing any kind of level calibration. The frequency response of the complete monitoring system should be consistent across the entire spectrum without cancellation dips.

### Room acoustics

Ideally the control room environment should be symmetrical, and the listening path should be clear of any equipment that might cause in-

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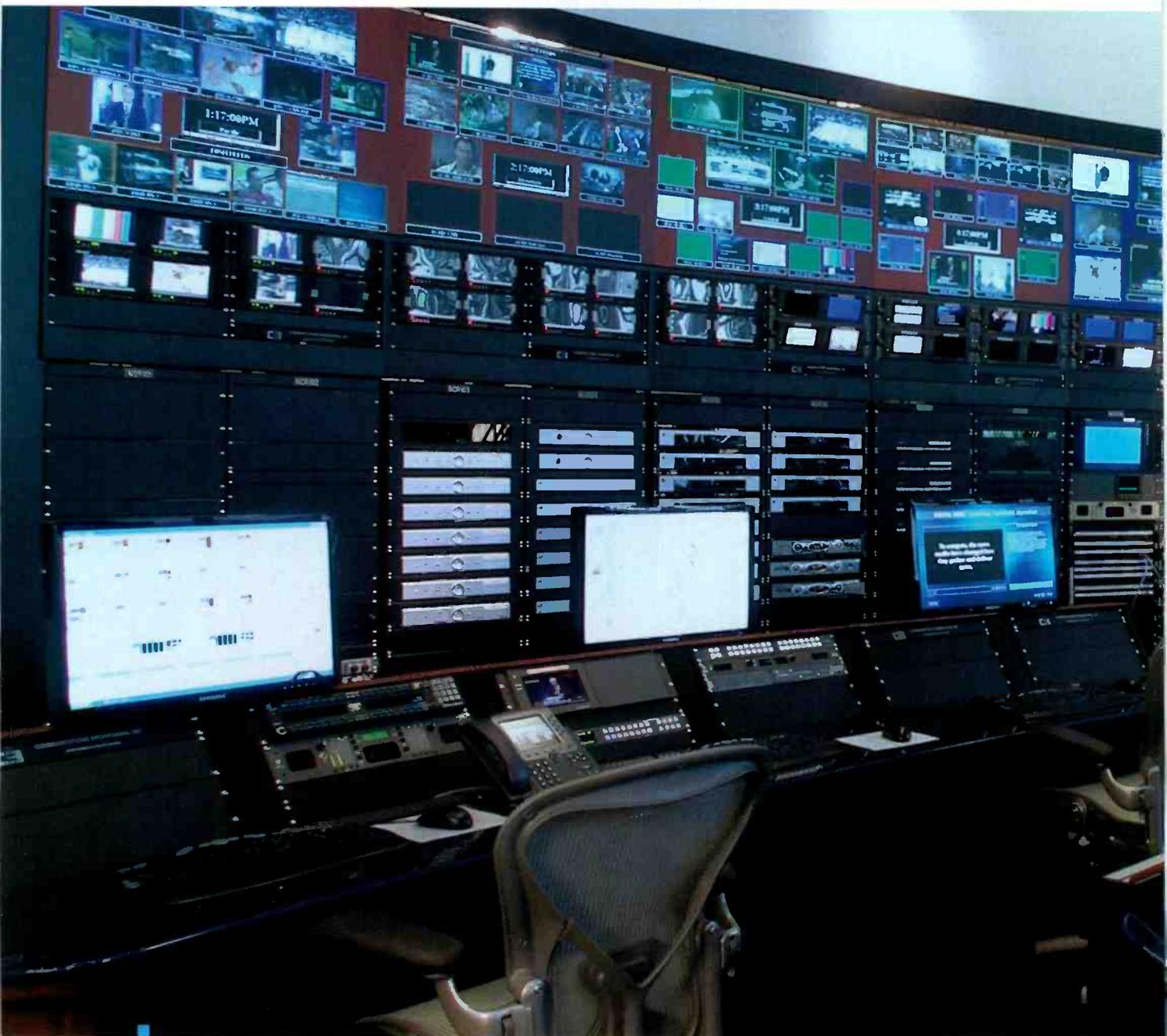


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# NEWSSEUM



## shows news as

**W**hat better way to spotlight the history of the news business and demonstrate how content is developed than by employing the very tools and systems used by

stations around the world today? This is precisely what Newseum is — a multimillion-dollar facility that offers visitors a unique multimedia experience. The building spotlights five centuries of news history, while employing the

latest news production technology. A major bonus is that the new building occupies the last prime real estate left on historic Pennsylvania Avenue (between the White House and U.S. Capitol building), in Washington, D.C.

# FACILITY

SYSTEM DESIGN  
SHOWCASE



The Newseum's master control room features a glass wall that allows visitors to watch the operators in action. Visitors can also watch the news being made from large LED screens located in the atrium of this innovative facility.

## it happens

BY MICHAEL GROTTICELLI

When designing and building the facility, the Freedom Forum's challenge was developing the museum's new home with innovative technology that combines a file-based HD production environment with inter-

active kiosks, multiple galleries and digital theaters.

The Newseum opened on April 11, with numerous interactive exhibits, live news feeds coming in daily from around the world, and a com-

plete multiformat HD production, archiving and asset management infrastructure. More than three years in the making, the new Newseum is much larger than it was in its previous location, which was situated

outside of the city in Arlington, VA. It's estimated that millions of people will visit the museum each year. The ground floor of the building includes well-known restaurants and retail shopping, which should help attract crowds.

This is no mere museum with traditional A/V display systems. The building also functions as two fully

create a seamless image. The projection equipment is controlled by a Medialon show control system.

Inside the new building are the latest HD production facilities, including two control rooms, five edit suites and a multiformat HD news production infrastructure. The backbone of the infrastructure includes an SD/HD Thomson Grass Valley K2 media serv-

er-based storage area network (SAN), with 14 HD inputs, 20 HD outputs, nine SD inputs and 14 SD outputs. The system also include a Trinix HD video router (256 x 256) and two Apex digital audio routers (256 x 256 each). Encore control software keeps everything in check.

Special software was designed to control the networked K2 servers for



The Big Screen Theater features a 10ft x 90ft screen displaying images from five blended Christie DW3K 720p HD projectors.

working HD production studios, including serving as the new home of ABC's "This Week with George Stephanopoulos." It will also house other TV programs and various nationally syndicated radio shows.

### **HD news production and historical exhibits**

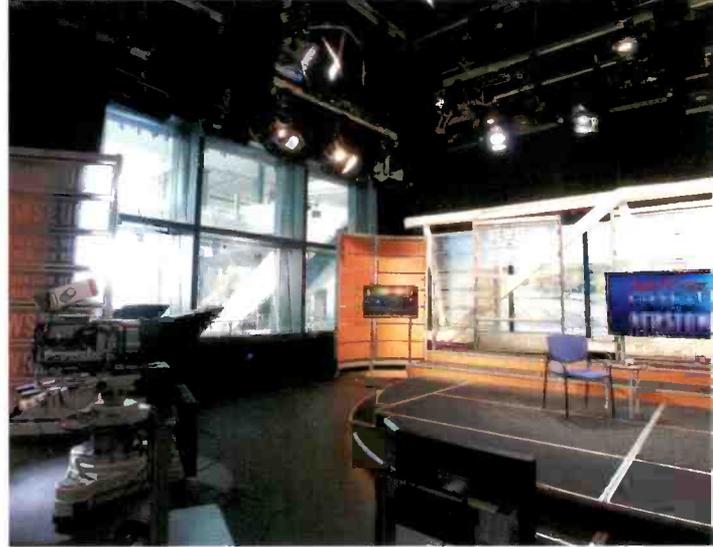
There are seven floors that house HD production areas, museum galleries and 15 theaters. One of the theaters, called the Big Screen Theater, features a 90ft-wide screen with images projected by five Christie Digital DW3K 720p HD projectors. A Vista Systems Spyder video processing engine is used to blend the edges and



The Newseum atrium includes a 22ft x 40ft Barco high-resolution modular LED display. It can be raised and lowered 30ft to accommodate various events.



The Newseum has two identical HD control rooms with three large consoles for managing productions in the facility's two studios.



The large studio features Thomson Grass Valley LDK 6000 HD cameras, audience seating and a glass wall that allows visitors to watch productions from the adjacent walkway.

content playout in the building's many presentation theaters.

### "This Week's" new home

The two identical control rooms include a Thomson Grass Valley Kalypso HD 4 M/E production switcher and an Evertz MVP multi-image display processor. Completely redundant, the rooms can be digitally linked together for larger HD productions, but will usually operate independently. The large K2 SAN supports not only the broadcast control rooms but also

other museum galleries and exhibits throughout the building. There are two audio control rooms with Euphonix digital audio consoles, in addition to five Avid HD edit rooms (with Adrenaline and DS Nitris systems). The fifth suite doubles as an audio sweetening room with a Digidesign Pro Tools digital audio workstation.

For producing television shows, the Newseum's two studios — one of which will host the program "This Week" — feature at least four Thomson Grass Valley LDK 6000 mk II HD

cameras each. "This Week" will be produced in the 720p HD format for ABC. The same equipment can also produce shows for other clients in the 1080i HD format.

The master control room includes a glass wall where museum visitors can watch as a show is in progress. They can also watch the program on a large 22ft x 40ft Barco LED screen located in an atrium at the entrance of the building. When not producing a live show, one of the Kalypso switchers will run a preprogrammed looped segment to simulate its operation.



The audio control rooms feature Euphonix Max Air digital audio consoles. Each console has a compact control surface with four knobs per channel and a central touch-screen interface.

### A long road

In 2006, systems integrator Communications Engineering, Inc. (CEI) was called in to design and implement the IT- and video-centric network (with GigE and baseband HD-SDI) and equipment for the new production and museum space. Raef Alkhayat, director of engineering at CEI and project supervisor, said the extensive build project was divided into two basic systems: broadcast and traditional A/V. Both had specific requirements, with its own message and purpose. CEI worked closely with the Freedom Forum on the design, and then set out to locate and install the most flexible equipment available. It

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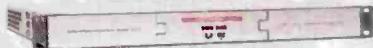
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## Design team

### The Freedom Forum/Newseum

James Updike, vice president of technology  
George O'Connor, director of engineering  
Michael Saunders, project manager  
Frank Ginsburg, broadcast engineer

### Communications Engineering, Inc.

Raef Alkhatay, director of engineering  
Don Brassell, senior manager of systems support engineering  
Ruber Huertas, senior systems engineer

### Electrosonic

Dan Laspa, project manager

## Technology at work

Artesia DAM

Avid HD Adrenaline and DS Nitris editors

Barco

OverView displays

22ft x 40ft LED screen

Canon HJ17EX7.7B HD lenses

Christie Digital DW3K 720p HD projectors

Chyron HyperX HD CG

Cisco Ethernet switches

Digidesign Pro Tools audio workstation

Doremi Nugget Pro MPEG-2 video players

Euphonix Max Air audio consoles

Evertz MVP display processors

Forecast Consoles

Front Porch Digital DIVArchive content storage management

Ikegami HDL-40 HD cameras

Medialon SCM II

Samsung 940T and 244T LCD monitors with ELO Touch

Snell & Wilcox Ukon standards converter

Sony

CRT and LCD monitors

Digital Betacam VTRs

HDCAM VTRs

StorageTek SL500 system

Tektronix WFM audio monitors

Telemetrics robotic system

Telestream FlipFactory transcoder

Thomson Grass Valley

Apex digital audio routers

Encore control software

Kalypso HD switchers

K2 media servers

LDK 6000 mk II HD cameras

Trinix HD video router

Turbo disk recorders

Vista Systems Spyder video processing system

Wohler

AMP2-S8DA and AMP1-S8DA audio monitors

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all had to be HD-capable in order to accommodate the widest variety of paying clients. CEI also worked with various equipment manufacturers to design — and in some cases invent — suitable solutions.

A significant amount of routing was necessary because the new facility, in addition to the broadcast cameras and various CG and still stores, distributes multiple inbound and outbound signals through Verizon. There are numerous Ikegami HDL-40 box-style cameras located on the building, as well as on the roof and across the street. These are controlled by a Telemetrics robotic system. The Trinix router not only feeds the broadcast control rooms but also the various monitors, galleries and theaters throughout the building. Doremi servers are also used to play back video for the various exhibits throughout the Newseum.

### Networked signal distribution

The file-based environment serves two purposes. First, it allows students and journalists to research hundreds of hours of low-resolution video and audio elements, as well as thousands of still images, of historical significance. And the archive continues to grow every day. The idea is to handle and save all material as a digital file for long-term storage.

Second, the architecture allows the museum's video editors, who work on Adrenaline and DS Nitris systems, to cut in-house projects for the museum and to share files via Thomson Grass Valley Turbo disk recorders directly connected to their workstations. Completed files and other content is then sent to the K2 central storage system or to the StorageTek archive system that's managed with a Front Porch DIVArchive system, all tied to an Artesia asset management system. Telestream FlipFactory is used for transcoding files, attached to a Sun Microsystems robotic library, where all long-term storage is kept.

### Conclusion

In the end, the Newseum has become

a showplace for what the news business is all about. Frank Ginsburg, broadcast engineer at the facility, calls it "one of the most technologically advanced museums ever built."

From CEI's point of view, it's a highly advanced broadcast facility project, on top of a compelling museum. Basically, there's something for everyone.

The Newseum uses high-tech equipment to convey a unique message. The design is friendly and easy to use for the average museum visitor, which is good news for everyone involved. **BE**

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

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# Flash RAM storage

The technology is poised to eliminate tape.

BY TORE B. NORDAHL

Flash RAM storage is invading HDTV broadcasting. Sony is challenging Panasonic's P2 with its SxS. And tapeless camcorder pioneer Ikegami reinvented its decade-old nonlinear workflow model with the new GFPACK, while Thomson Grass Valley is finally shipping its CompactFlash-based Infinity camcorder. SeaChange has introduced the first major flash RAM video server. As a result, flash RAM looks like a winning format for the future.

## Acquisition format wars

Format choices in TV broadcast field acquisition have traditionally been between Panasonic and Sony. Historically, when discussing professional and broadcast field acquisition formats, the focus was generally much more about video compression formats than about the recording media, because both companies were recording to tape cas-

ettes, although not compatible ones.

Sony had early successes with Betacam and Digital Betacam, while Panasonic came on strong in the late 1990s with DVCPRO and DVCPRO-50,



Sony's new SxS flash RAM cards are available in 8GB and 16GB, with 32GB to become available later in 2008. In its XDCAM EX HD camcorder application, the 16GB offers a capacity of 50 minutes of high-quality HD.

and then DVCPRO-HD in 2001. Sony successfully introduced DVCAM, SX and IMX in the mid- to late-1990s, but those formats didn't threaten to surpass Panasonic for TV station applications. As recent as 2003, the industry was still using videotape cassettes for field acquisition storage.

At the 2004 NAB show, Sony delivered XDCAM SD camcorders recording to a new technology: removable

optical disc cartridge. There wasn't a tape cassette in sight. Sony was clearly betting on its emerging optical disc technology and proprietary Professional Disc (PD) for future camcorder field acquisition storage. We learned later that this was part of the company's Blu-ray disc development.

In 2004, Panasonic showed its flash RAM card technology named P2, based on the CardBus interface standard developed primarily for laptop computers. The company's implementation also used proprietary hardware and software to support its needed functionality, but with one



Panasonic's P2 flash RAM card is now available in 32GB. It holds roughly 32 minutes of DVCPRO-HD or AVC-I-100Mb/s. In TV ENG applications using an AVC-I 50Mb/s-capable HD camcorder, the capacity is about 60 minutes.

nonproprietary feature — it relied on a standard PC interface port as the physical connection.

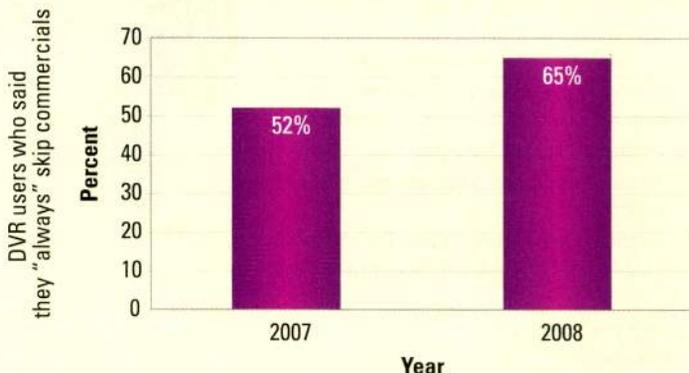
The posturing of the two giants had started. Which technology would replace the tape cassette in camcorder field acquisition in the longer term: optical disc or flash RAM storage? After all, for many years, all professional camcorder manufacturers used videotape cassettes as a common storage media. It is reasonable to project that our industry will soon adopt one common storage media as the dominant tape cassette replacement, not two.

## FRAME GRAB

*A look at the consumer side of DTV*

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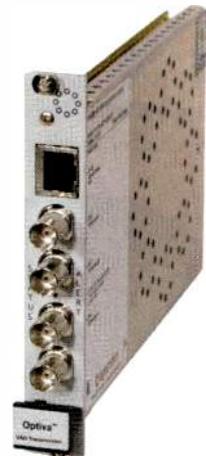
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In 2005, Sony introduced its first professional HD camcorder recording to the PD (XDCAM HD models). At the same time, Panasonic unveiled its first professional HD camcorder recording to P2 (HVX200). Also in 2005, Thomson Grass Valley announced the Infinity camcorder using the cost-effective consumer



**Sony's Professional Disc (PD) is a Blu-ray type optical disc in a cartridge, which first appeared in Sony's XDCAM camcorders in 2003. The single-layer version offers 23GB capacity, while the recent double-layer version holds 50GB. Although well-suited for remove-and-replace HD camcorder acquisition storage, the PD, with its proprietary mechanical drive requirements and comparatively slow write/read bit rates, is receiving increased competition from flash RAM-fitted camcorders.**

market CompactFlash memory card. For nonstorage reasons, the Infinity cameras didn't begin shipping until late 2007.

Let's not forget that in 1995, Ikegami was the first major camcorder manufacturer to introduce a nonlinear acquisition-to-edit workflow (EditCam), working with Avid, and



**Thomson Grass Valley announced its Infinity HD camcorder in 2005, with flash RAM card technology based on the widely available and cost-effective CompactFlash standard. The Infinity started shipping in late 2007.**

using a removable hard disk module attached to its field cameras. Ikegami has recently teamed up with Toshiba to reinvent the EditCam nonlinear workflow using removable flash RAM modules called GFPAC (GigaFlash).

The battle for market share wasn't just about compression formats, but more about acquisition-to-edit portable storage formats. While many agreed that the era of videotape cassettes was quickly diminishing, few could decide if the optical disc would beat the flash RAM card as the ultimate acquisition-to-edit remove-and-replace storage technology. This resulted in two camps of users by 2006 — one for the Sony PD optical disc and the other for Panasonic's flash RAM card technology supported by Thomson Grass Valley and Ikegami.

### Behind the PD optical

Since the dawn of camcorders, Panasonic and Sony have battled for the lead in the professional video market largely based on proprietary formats and technologies. The most basic reason for manufacturers developing proprietary solutions is that once the user installs a proprietary compression and/or storage format, the user is generally locked in to that decision for several years because of the high-cost threshold of format change and re-entry.

Several years ago, if you considered flash RAM for camcorder remove-and-replace storage, you may have experienced a possible long-term weakening in your proprietary hold. But no one can second guess Sony's business considerations for its original decision to incorporate the PD optical disc cartridge as the removable media in professional camcorders.

With the recent availability of XDCAM EX with SxS (solid-state storage), is Sony sending a message to TV broadcasters that it is altering course? Although well-suited for remove-and-replace HD camcorder acquisition storage, Sony's PD optical disc cartridge, with its proprietary mechanical drive requirements and

relatively limited write/read bit rates as compared with flash RAM cards, is now better used as longer term on-the-shelf nonlinear storage. Its random access performance beats the linear tape cassette.

### New HD camcorders

Immediately after the 2007 NAB, Sony announced its cooperation with flash RAM market leader SanDisk to bring the SxS flash RAM cards to market specifically for professional video camcorder acquisition applications. This was obviously in direct competition with Panasonic's established P2 flash memory card technology.

Then, at the September 2007 IBC convention, Sony unveiled its new XDCAM EX HD camcorder line using the new SxS flash RAM cards. Simultaneously, SanDisk announced the availability of SxS cards. The XDCAM EX has been shipping for several months, with SxS cards available in 8GB and 16GB sizes.

Another interesting point: Looking at Sony's suggested XDCAM EX workflow, the company is (not surprisingly) recommending using the PD optical disc media for long-term and archival storage. Prolonging the lifespan of the PD product line makes sense for existing Sony PD customers, as they have already invested in PD recorder/players and other related PD-friendly subsystems.

### CardBus PC Card or ExpressCard?

Panasonic's P2 is based on an older technology CardBus PC Card, while Sony's SxS uses the newer ExpressCard technology. Both standards were originated and promoted by the Personal Computers Memory Card International Association (PCMCIA). The CardBus plug-in slot standard was originally introduced by the PCMCIA in 1990. Numerous updates and improvements were made through 2001, when further standard developments stopped. The final CardBus technology allows PC Cards and hosts to use 32-bit bus



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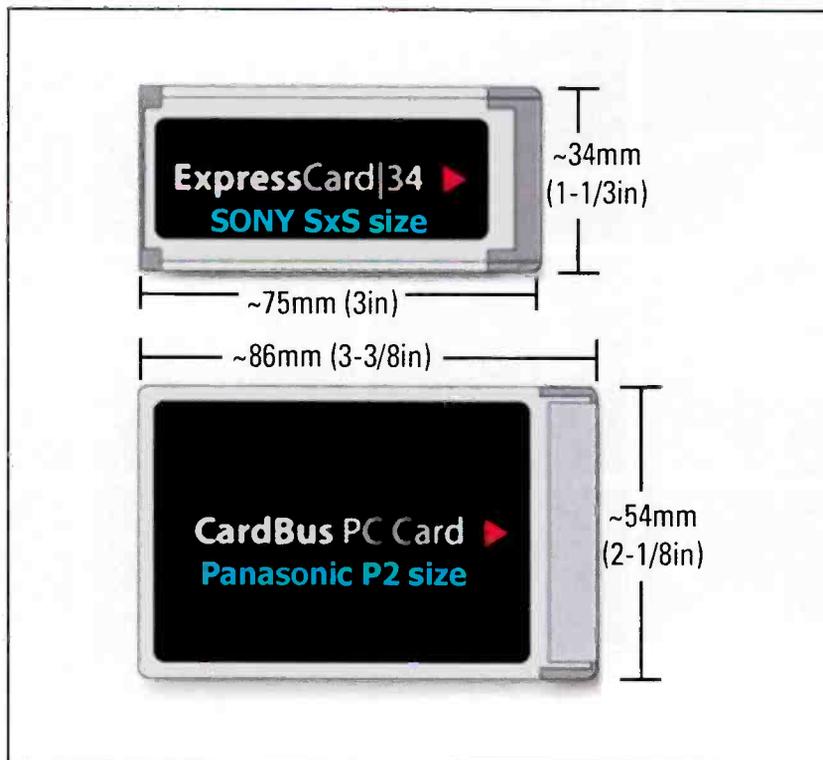


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# TRANSMISSION & DISTRIBUTION

SYSTEMS INTEGRATION



Does size matter? The ExpressCard (top) is about half the area size of the CardBus PC Card (bottom). However, it is fair to say that this reduction in physical size is not material to broadcasters.

mastering and operate at clock speeds up to 33MHz. The connectivity relies on a computer's PCI bus, but not on the new and faster PCI Express.

PCMCIA developed the ExpressCard standard to carry forward the benefits of plug-in I/O cards to the next generation of personal computing devices. The potential benefit of ExpressCard technology over the older CardBus PC Card is a dramatic increase in bandwidth. This is because the ExpressCard uses a direct connection to the system bus over a PCI Express lane and USB 2.0, while the CardBus uses an interface controller that only interfaces with the previous generation PCI bus. The ExpressCard has a maximum throughput of 2.5Gb/s through the PCI Express lane and 480Mb/s through USB 2.0 versus the CardBus' shared 1.04Gb/s bandwidth.

ExpressCard promoters also claim other advantages, including lower cost, better scalability, lower power consumption and better integration

Flash RAM card comparison	Ikegami	Panasonic	Sony	Thomson Grass Valley
Flash RAM product name	GFPK	P2	SxS	CompactFlash
Capacity in GB	16/32/64	8/16/32/64	8/16/32	16/32/48
Street price (as of March 2008)	\$900 (32GB)	\$900 (16GB)	\$875 (16GB)	\$180 (32GB)
Price per GB	\$28	\$56	\$55	\$6
HD capacities in minutes	60 (32GB)	16 (16GB)	50 (16GB)	32 (32GB)
Price per minute for HD	\$15 (32GB)	\$56 (16GB)	\$17 (16GB)	\$6 (32GB)
High-quality compressed HD gross bit rate (video only)	50Mb/s	100Mb/s	35Mb/s	100Mb/s
HD compression format for highest quality mode	MPEG-2 long GOP	DVCPRO-HD AVC-Intra-100 both intraframe	EX HQ MPEG-2 long GOP	JPEG2000 intraframe
Maximum estimated transfer speed faster than real time (file transfer)	More than 5X	More than 3X	More than 10X	More than 2.5X
Estimated maximum actual transfer bit rate (best case read in actual workflow)	260Mb/s USB	400Mb/s	500Mb/s	300Mb/s
Bus technology	SATA (internal) USB (external)	CardBus	ExpressCard	CompactFlash

Table 1. This table compares four HD camcorder manufacturers that have introduced flash RAM card technology for field acquisition storage in the broadcast environments.

with current and future motherboard chipset technology. Unfortunately, the ExpressCard interface is not back-

through a plug-in slot) seems to be 800Mb/s with the SxS platform and 640Mb/s with the P2 platform. On the

**The real operational differences become more apparent when comparing Panasonic and Sony's HD camcorder compression formats and the resulting bit rates.**

wards plug-compatible with CardBus devices. Thus new PCs may need an ExpressCard/CardBus adapter in order to accept P2 cards. One certainty is that future PC workstations, whether desktops or laptops, will generally not incorporate CardBus slots, but will likely favor ExpressCard slots.

The bottom line on theoretical maximum media transfer speed (from RAM card to workstation or server

surface, it appears this is not a great difference in transfer rates. However, the actual maximum transfer speed depends on the specific implementations by Panasonic and Sony.

**Real differences: compression formats**

The real operational differences become more apparent when comparing Panasonic and Sony's HD

camcorder compression formats and the resulting bit rates. Transfer times for a given file are usually specified as X times faster than real time. The real-time transfer time of one minute of video is, of course, one minute whether the program is compressed to 35Mb/s or 100Mb/s. But, through a given broadband pipe, there is the potential to transfer a compressed lower bit rate video file faster than a compressed higher bit rate video file of the same real-time duration.

In its high-quality mode, Sony's XDCAM EX camcorder compresses HD video to 35Mb/s VBR in an MPEG-2 long GOP format. Let's say this produces a gross average rate of 40Mb/s, including overhead and audio. Presuming that the SxS sustained system transfer bandwidth is 500Mb/s at best, Sony can transfer material at more than 10X real-time speed,

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meaning a 10-minute program can be transferred in less than one minute.

Panasonic's direct price range competition to Sony's EX are the HVX-200 (less expensive) and the HPX-500 (more expensive). Both Panasonic models offer DVCPRO-HD compressed to a gross rate of about 120Mb/s.

Presuming the P2 sustained system transfer bandwidth is 400Mb/s at best, Panasonic can therefore transfer material at 3.3X real-time speed. This means that a 10-minute program can be transferred in about three minutes, which is about three times slower than that of Sony's XD-CAM EX platform using SxS memory. This is primarily

**The bottom line is that we may finally be able to forget about tape cassettes all together, because they will be replaced by flash RAM cards.**

due to Sony's much lower bit rate for its MPEG-2 long GOP compressed format, which is only about one-third of Panasonic's intraframe DVCPRO-HD compressed bit rate. Panasonic's new AVC-Intra-50Mb/s format, available in more expensive camcorders, improves the transfer time to about 6X real-time speed, but is still slower than Sony's SxS. Actual trials may produce different results.

But wait; that's not the total picture. We also need to look at storage capacity and media price. Table 1 on page 48 illustrates several key parameters for the four manufacturers currently offering HD camcorders with flash RAM removable storage.

Considering real-time storage capacity and fast workflow potential, Sony's SxS appears fastest. However, this is because of the company's long GOP codec format, while Panasonic and Thomson Grass Valley only offer intraframe formats. Ikegami offers selectable long GOP and intra MPEG-2. The SxS technology, with its extremely wide write/read bandwidth, now enables Sony to introduce a range of professional HD camcorders based on new competitive intraframe HD codec technology, if Sony chooses to do so.

I believe that flash RAM storage for professional video use will eventually settle on common formats of media and connectivity, as is currently championed by Thomson Grass Valley in its use of the widely available and highly competitive CompactFlash memory cards. The bottom line is that we may finally be able to forget about tape cassettes all together, because they will be replaced by flash RAM cards. **BE**

*Tore B. Nordahl is principal of nordahl.tv, a Los Angeles-based consulting firm delivering HDTV technology reporting, product strategy and market research services.*

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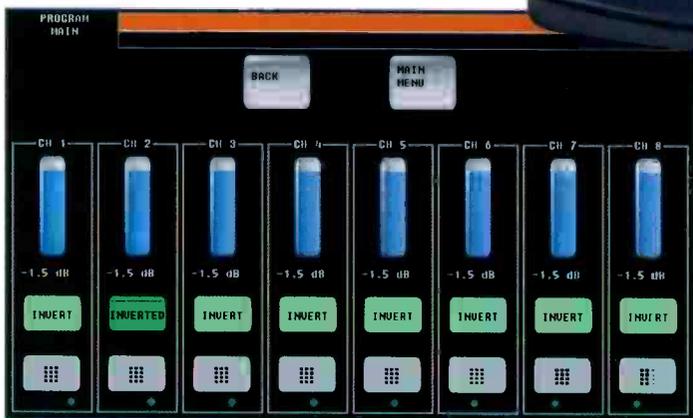
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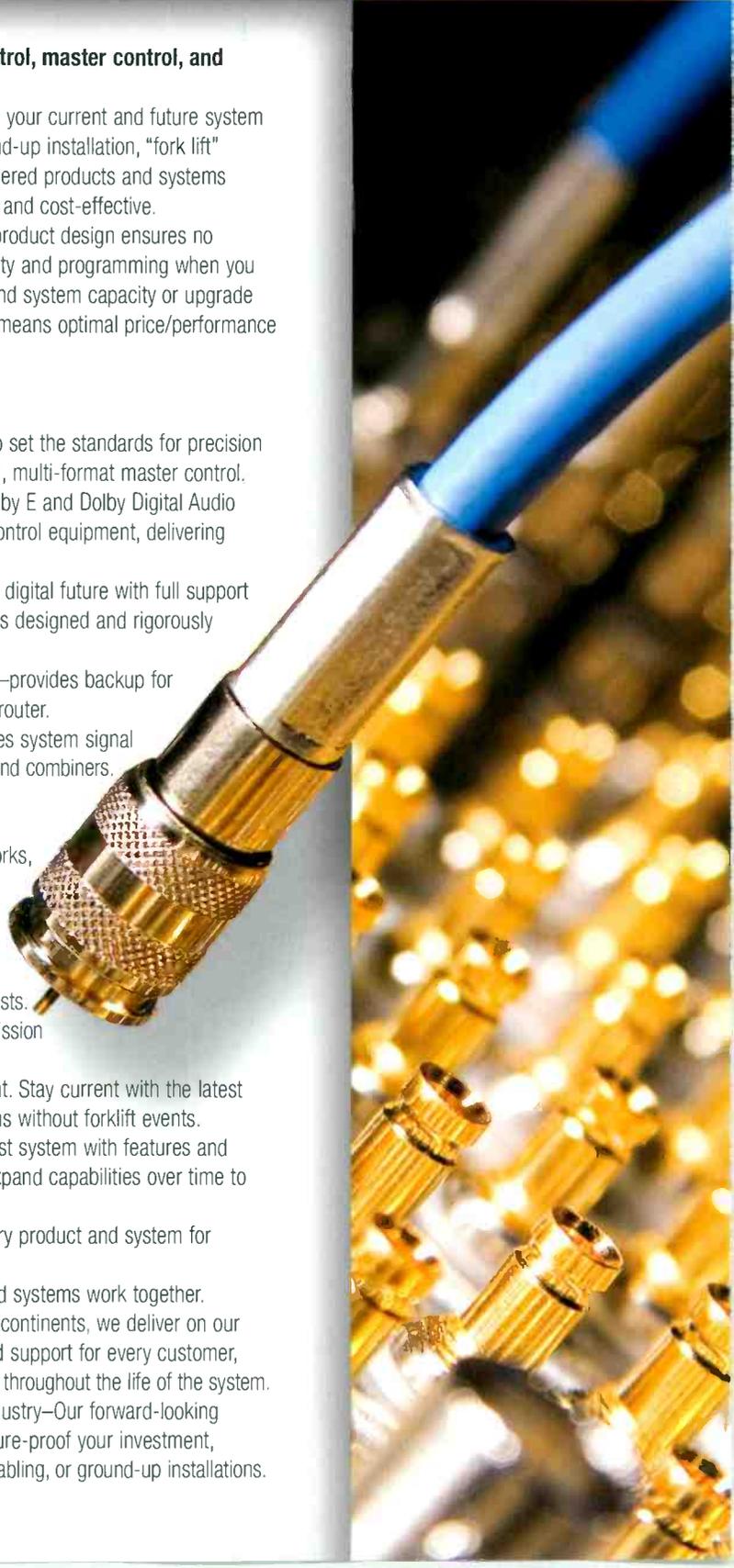
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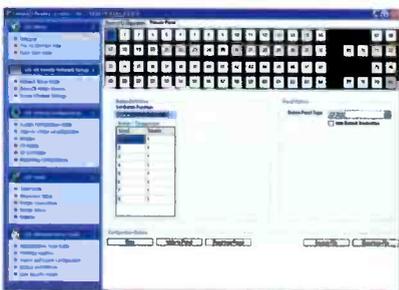


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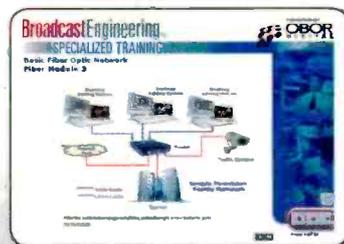
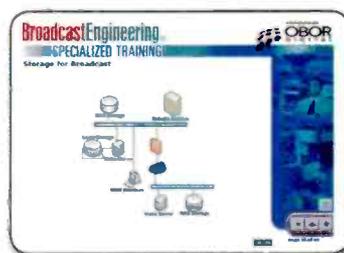
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# Playback automation

A successful implementation requires a lot of planning.

BY LEO DEMERS

Choosing the right playback automation system for your application can be a scary job, knowing that you and your entire operation will have to live with the decisions you make for a long, long time. It's a sobering experience.

Today, the on-air playback automation system forms the nucleus of every television station. In addition to direct on-air playback, it interfaces with many supporting departments, such as traffic automation, newsroom automation, weather computers and graphics. As with any large-scale project, the key to successful implementation is to divide this large project into smaller, bite-sized projects.

Essential components of any broadcast automation playback system include the server(s), the automation software, prep station(s) or ingest technology, and device control. The digital transition approaches the final phase in February 2009; however, many stations still rely on master control digital islands to route network HD to their transmitter, while bypassing an otherwise all-analog plant.

Broadcasters with these digital islands can pay substantially more to implement an automation system than an all-digital facility might. The required A/D signal conversion equipment, device controllers, monitors, machine controls for tape decks, satellite dish, pan-and-tilt controls and tallies for analog control rooms add significantly to the total project cost.

Let's work through a process to build an automation system for your station. We'll start by asking some basic questions. First, what do you expect this system to accomplish for your station operation? The answers to this question are not technical; rather, they are operational.

Is the goal to reduce headcount? Is it

to decrease the number of playout errors? Do you want to handle more channels with current staff? The answers will influence the system's features.

## Space and bit rate

Server selection and sizing is based on at least two key aspects. How much content do you need to store, and what bit rate will be used? Both of these issues apply to SD and HD material. Obviously, HD material

form the total memory and function as one large disk should be configured two-thirds active one-third parody. In a RAID 6 configuration, four RAID drives would be active, and two would be parody drives. Memory may be increased later, usually in 400- or 500-hour increments.

DTV standards do not specify the scanning format to be used by broadcasters; it is as much a business decision as it is a technical one. In effect,



KGO-TV in San Francisco employs an Ignite integrated production system from Thomson Grass Valley to handle its newscasts.

requires both a higher bit rate and therefore more server space.

Begin by calculating how much content you will need to store on the server at any given time. Determine the number of hours needed per week and then for a month. This represents the nearline storage required to house all active program content that may be needed for online playout. Don't forget to allow for seasonal changes. You'll need more space in December than you will in May.

Then add a fudge factor to that total, usually 1.5 times the calculated amount. The fudge factor will absorb unforeseen program changes, additional program streams and seasonal commercial volume variations.

The RAID drives that combine to

any scanning format may be used (720p, 1080i, 1080p), provided the total transmitted digital bit rate — a multiplex of video, audio and ancillary data — is equal to 19.38Mb/s. Standard-definition commercial content is usually processed at 10Mb/s. This bit rate will accommodate most content ranging from SD programs and commercials to news clips.

Select an appropriate bit rate and format to be ingested to the servers. This will determine how much memory or storage real estate will be required per minute of SD video. Do the math, and size the main server memory capacity accordingly. The average mid-sized television market may order 10TB (134 hours of SD), or about five days of program content.

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High definition has a completely different pedigree. While the minimum HD bit rate is 20Mb/s, some facilities, such as PBS, use 45Mb/s for post production, even though the final program video stream is only 19.38Mb/s. Some networks rely on a variable bit rate, but that is a subject for another time.

### Storage

Engineers often overbuy storage. Recently, IBM issued a white paper that addressed the toxic terabyte, which is the inclination to create a vast wasteland of excess server memory or data dumps. Users sometimes find it easier to just keep dumping content into a server than to properly manage the amount of nearline and online storage.

If 10TB were needed today, wouldn't 20TB be twice as good? Maybe not, and here's why: Storage costs continue to drop. Buying 20TB of storage now may cost more than buying 10TB now and another 10TB in 12 or 18 months. Over that time, improvements will be made in the storage platform, and drive costs could drop.

Also, and often not considered, the station will be paying for additional power consumption and cooling re-

quirements for that extra 10TB of storage that's not being used. The one caveat might be if the vendor might go away, or stop supporting a particular type of storage module. If you think that's a possibility, then perhaps you need to reconsider the vendor.

Servers can ingest or output both SD and HD, separately or simultaneously. With HD at 20Mb/s and SD at 10Mb/s, the server capacity requirements are highly dependent on the amount of HD content used. However, the real cost of the HD/SD mix on any program stream actually lies in the external equipment — the conversion, encoding, switching and routing process necessary to achieve a smooth transition between formats.

### Required number of ports

The number of input and output channels required is unique to each station, but this is no place to skimp. When choosing the number of I/O ports, be sure to allow for expansion. Include additional ports for services you may not currently be providing. This might include channels for HD direct feeds to cable system head-ends, ingest sources for news clips, satellite program feeds and commercials. Then, after you've totaled all the needed channels, add two

more. Trust me, you'll need them.

What about audio? Unless your requirements are unique, six channels for 5.1 surround audio should suffice. However, keep in mind that some audiophiles are pushing for 7.1, so it may be wise to allow for growth.

### Choosing software

A critical consideration is ensuring that all of the station equipment under automation control can talk to each other through the automation system. Each device must operate and understand the automation system control commands. Also, proper interfacing with the traffic department software is essential.

Be absolutely certain that the traffic software and the automation software are sufficiently compatible to support the transfer of daily playlists. It's also wise to be sure that your traffic playlists are backed up in master control via a USB thumb drive or other mobile media.

In addition to just routing the program content to air, an automation system must also control bug and graphic insertions for branding and special effects such as breaking news and weather. Simultaneously, the system will control the offline

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router switching and machine control to perform scheduled recordings. This means proper interfaces will be needed for your satellite dishes, tape machines and ingest server.

Automation systems typically support live playlist insertion as part of their standard offering. Scheduled live local weather updates or news-

a master control operator to be able to calculate program and commercial lengths and then manually adjust timings to get back on schedule for the next network join.

An important feature of any playback automation is the ability to provide an accurate as-run log. This log tracks exactly what transpires

tem. This budget-busting, mirrored operation may reduce sleepless nights for engineering management, but it's really unnecessary. However, there are some things you should consider when planning for emergencies.

Be sure your system has provisions for running the playlist from a second control point. This could be a media prep or ingest workstation, but at least one non-MCR location. Also, the automation software should reside in more than one location within the system. Access should be protected by appropriate conditional-access passwords to prevent unauthorized changes or activation.

With careful planning, it's simply not necessary to build two complete systems. Such a solution is expensive, requires constant maintenance and checking and is as likely to fail as the primary system. Today's automation systems are highly reliable. A properly configured transition to manual operation capability is a cost-effective option.

### **Be sure your automation system can provide easy, clean manual break-ins and even more important, smooth rejoins.**

casts are simply part of the daily playlist from the traffic department. This means the live sources must finish on time because, ready or not, the automation system is going to switch.

This is seldom a good solution. Therefore, your selected automation system should permit manual override, ripple any of the time effects down the playlist and then adjust the following events.

Live events such as breaking news or storm/weather updates must be accommodated. Be sure your automation system can provide easy, clean manual break-ins and even more important, smooth rejoins. Don't expect

throughout the day. When problems develop, it can also produce a discrepancy report.

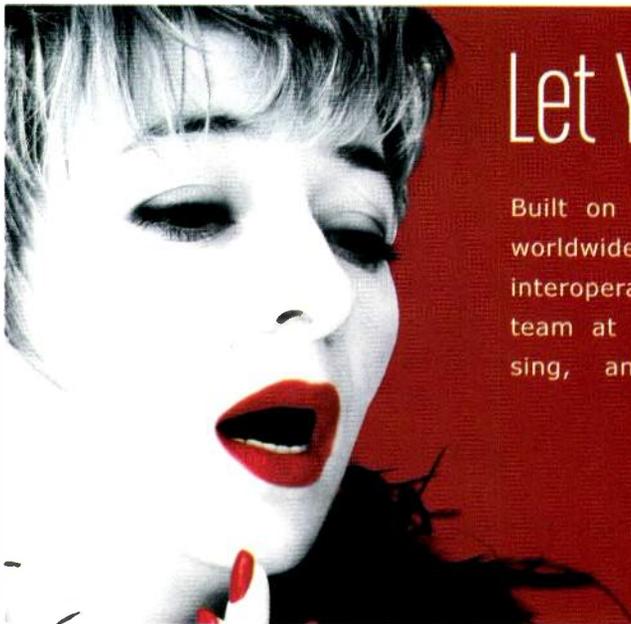
The report will reveal every action taken by both the automation system and an operator. Such information becomes a useful tool when troubleshooting exactly what went wrong. In addition, the report is an impartial and automatic record, eliminating operator claims and counter claims of what happened.

#### **Backup**

Some networks and large operations insist on backing up their operation with a second automation sys-

#### **Archiving tasks**

Some stations decide to install a smaller air playout server and a larger second archival server, where the system will operate in a data push-pull



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manner from nearline (archive) to online. The archive server could be 8TB or 16TB, depending on your needs and budget. The 8TB system will cost about \$35,000, and one twice that size may cost about \$50,000.

Before you reject building an archive system, ask your news director if he or she is willing to just throw away all those old tapes in the library. Probably not. Then consider that archiving anything on videotape is risky. Plus, maybe the only person who knows what's in that library retired two years ago.

A long-term archive must be on an offline medium that is reliable, searchable and stores content on a stable medium, perhaps on DVD, optical or holographic disks or data tape. Anything being stored on videotape should be moved to an acceptable archive format while there's still time — and the technology to playback the content.

### A unique solution

There is no cookie-cutter template for the ideal automation system. Vendors should walk you through how their products will handle each of your desired tasks. Are their solutions inclusive? Do they occur automatically? Do they fit within your workflow?

Here are some key points to remember:

- Do not overbuy storage. Storage costs continue to decline, so wait to expand.
- Buy enough size so you can expand.
- Be certain the operating system is compatible with your operation. Can you tie a Mac OS to a Windows OS to a Linux OS? Yes, but why risk it?
- The system should be controllable from more than one location.
- Stay with reputable manufacturers; you get what you pay for.
- Ask the vendors for a list of current customers, and then call them. Compare how those stations operate to your workflow. Compare apples to apples. You won't be able to get a good comparison to your needs if you're a commercial station and the

vendor suggests you call a noncommercial station.

• Ask about support after the sale. Does the vendor provide 24/7 phone support? Ask how software upgrades are handled. Think about your experience at installing service packs on your own PC. Now, imagine doing something similar on your station's

automation system. Need help?

Purchasing a station playback automation system isn't for the faint of heart. However, break down the desired tasks into a list. Compare your needs with several vendors' products. And ask lots of questions. **BE**

*Leo Demers is a broadcast consultant.*

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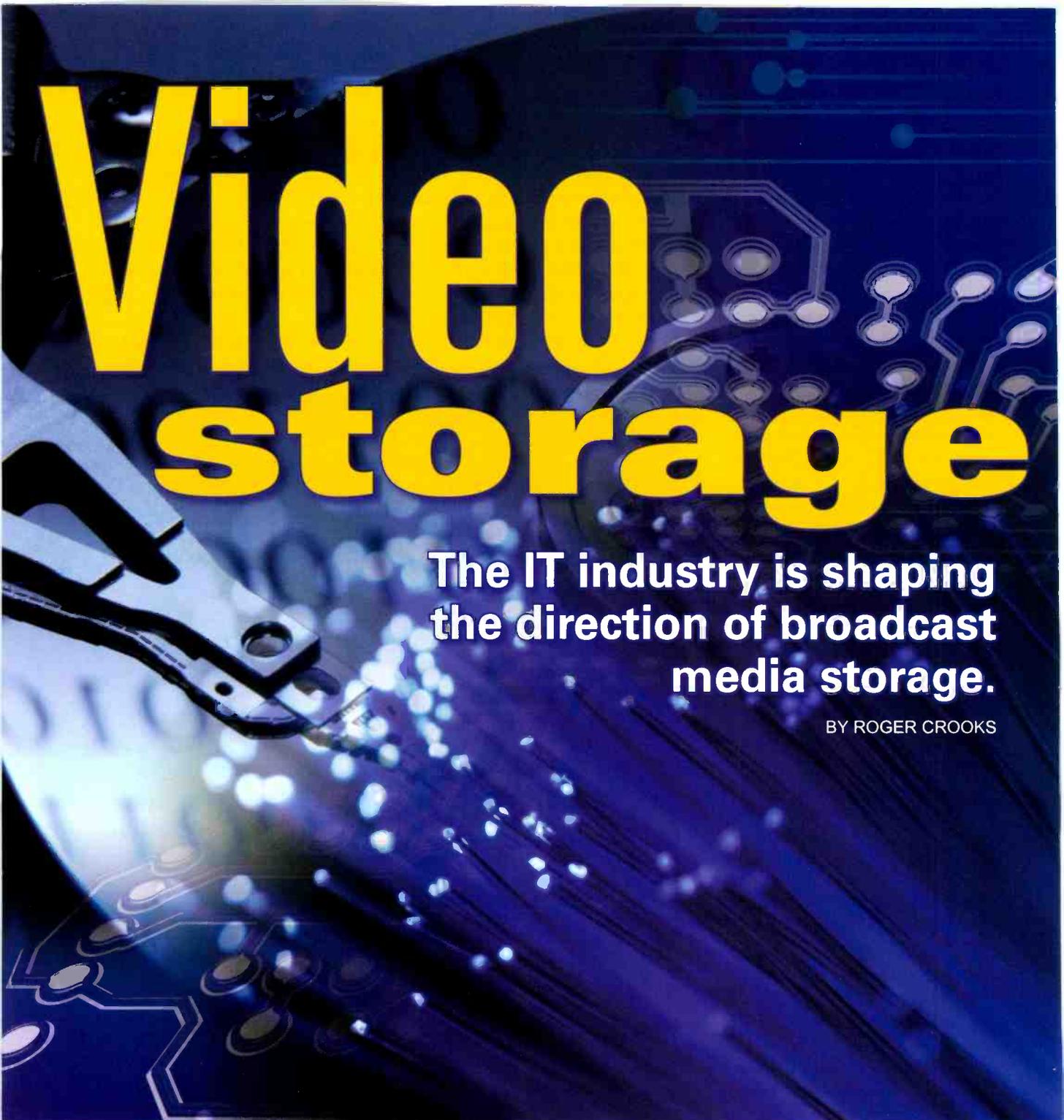
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# Video storage

The IT industry is shaping  
the direction of broadcast  
media storage.

BY ROGER CROOKS

**T**he future of storage and how it's used is being determined today by the IT industry, where most of the components used in professional production and distribution systems and networks originate.

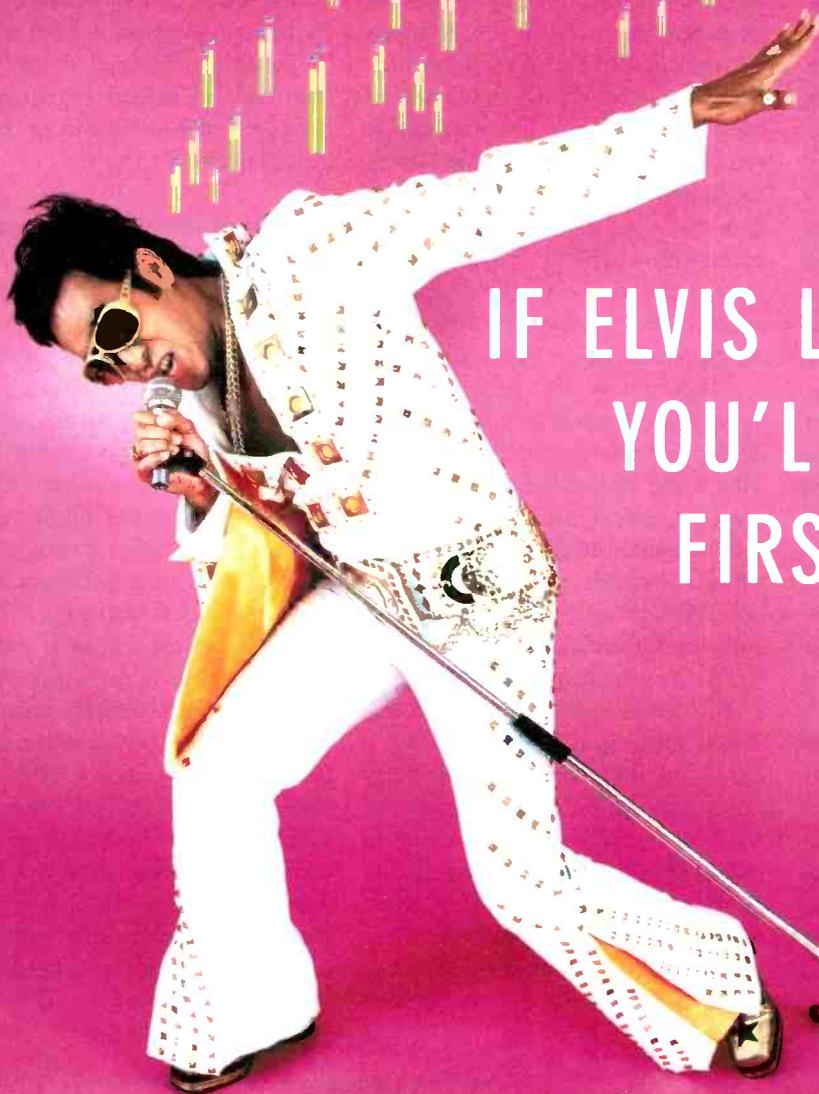
As the broadcast industry moves to file-based systems, storage is a key component in how facilities implement video servers into their workflow. Manufacturers have two op-

tions: use off-the-shelf IT solutions and tailor them for broadcast or design custom storage systems into their products.

In the past, the highly specialized nature of broadcast had precluded the use of off-the-shelf technology — mainly due to performance reasons. However, with the advances today in the IT industry, some manufacturers have qualified specific high-performance computer stor-

age systems for use in broadcast. The advantage is quicker time-to-market with new technology, generally lower costs and more flexible solutions.

When looking at the storage landscape, it's important to focus on two major elements: the physical storage media (e.g. internal data processing technology and form factor) and the workflow that it will ultimately be deployed in.



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### The shape of space

The IT industry designs storage for several markets, with two major customers driving most of the revenue — the PC market and the enterprise market for mission critical applications. In many cases, the design guidelines for these two markets are quite different.

The PC market is primarily focused on price, while the enterprise market demands high performance and reliability. However, new technology advancements have helped to create a new category between these two, called the business critical market.

Within the enterprise drive market, several major trends are driving the use of certain types of physical storage. (See Figure 1.) The enterprise market is currently moving from Fibre Channel (FC) drives to serial attached SCSI (SAS) drives just as the PC market recently moved from parallel connections to serial SATA drives. Driving this migration was the obvious cabling advantages of a serial attachment. Serial clock speeds can be higher than parallel connections. And, SAS provides a direct point-to-point bus connection versus a shared bus connection used with FC SCSI. This means stored material can be accessed much faster. For editors and content producers, this means higher productivity.

The performance of a drive is determined by its clock speed and its rotational speed. Today, many SAS drives often operate at 15,000rpm. A drive's rotational speed helps determine how fast data can be written and then read back from the drive. In a video environment, the faster the storage system the better, but, more importantly, the data rate must be deterministic and consistent. In the IT industry, a few millisecond pause in data transfers seldom matters. However, with video, such a pause can mean black frames.

Video servers are designed with appropriate buffering to avoid these delays, but only up to a certain point. This is why a broadcast storage system must be deterministic. One area that can cause these delays is disk failures in a RAID protected system. Both FC and SAS drives provide good performance and deterministic behavior whereas SATA drives are less predictable.

The latest SATA drives — SATA 3Gb/s, running at 7500rpm — are a significant improvement over first-generation SATA 1.5Gb/s drives. In addition to clock speeds doubling to 3Gb/s, which doubled the transfer rate to 300MB/s, newer SATA drives have other video-friendly features. They include hot-swap capability, improved mean time between failure (MTBF)

and Native Command Queuing. This feature enables the drives to internally optimize how commands are executed for better performance. Even so, while SATA drives continue to get better, they still lag behind enterprise SAS drives for high-performance, mission critical markets.

### The business critical market

These advancements have created a new class of SATA drives, which can cost half the price of SAS drives. This becomes an important consideration for use in lower performance video applications. Seagate, which supplies a large number of drives to the broadcast and video production industry, calls these new devices business critical drives. This indicates a class of drives between enterprise SAS drives and the low-cost, lower performance PC drives.

The broadcast market is a mission critical market. While a disk problem will not result in a fatality, it can result in lost revenue. Broadcasters demand that video servers be as reliable as possible, which has resulted in the almost exclusive use of enterprise drives for professional video servers. However, new advances in these drives make them an ideal choice for other types of video production and less demanding playout applications. These SATA

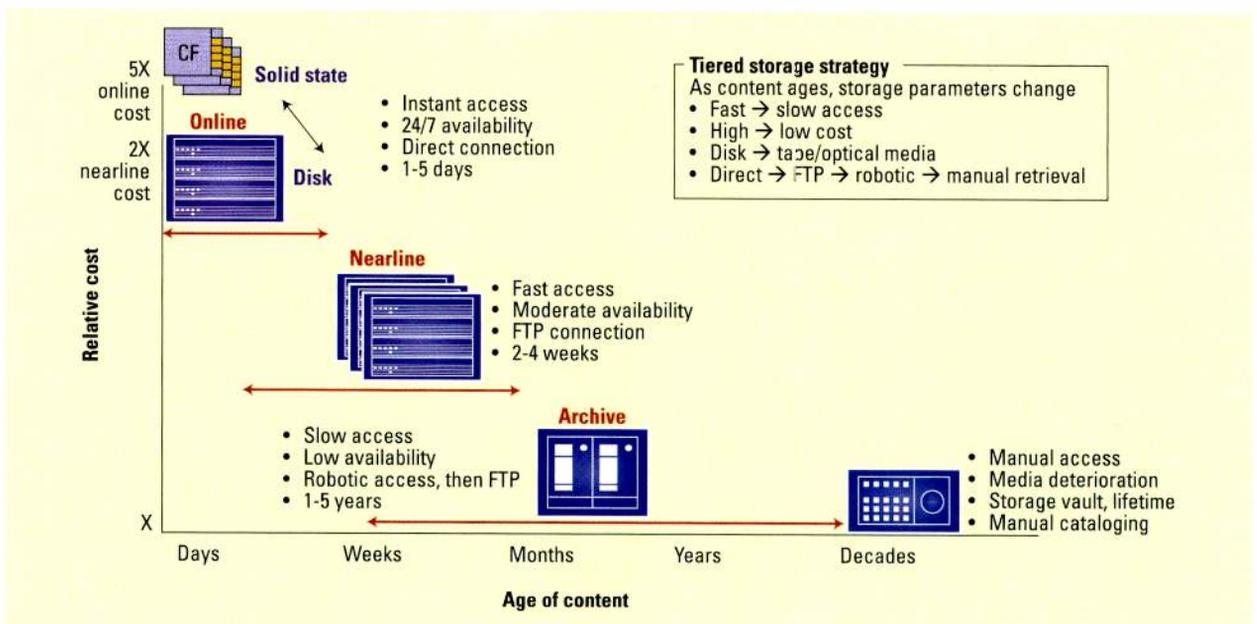


Figure 1. Tiered storage strategy

drives will also be available with a SAS interface. This allows engineers to pick a storage system and then populate it with either drive, based on application and budget. These new drives should begin appearing later this year.

The move from 3.5in drives to 2.5in enterprise drives will result in more compact storage systems without compromising storage capacity. This means physically smaller libraries and servers can hold more material than ever before. Broadcasters and OBs with limited space will appreciate these new 2.5in drives as they start to appear later this year.

The capacity of storage drives continues to increase at an almost unbelievable rate. Today in the PC market, there are low-performance 1TB drives, with 1.5TB drives just around the corner. The high-performance enterprise market currently uses 300GB drives, with 450GB coming later this

year and 600GB drives following in the next 12-18 months. Perpendicular recording technology is allowing the disk industry to pack more bits per square inch, resulting in the need for fewer physical platters while still enjoying higher performance.

A small but growing segment of the storage industry is moving away from spinning discs to solid-state compact flash memory. The price per gigabyte is still prohibitive for most video applications, but future economies of scale will make solid-state storage an option for some video applications. Production trucks or harsh environments that value extreme robustness over massive storage will embrace this solution because solid state is not impacted by the mechanical vibrations trucks encounter.

Solid-state drives are now appearing in consumer PCs like the new Apple Air, and that trend will continue. The attraction of no moving parts,

instant access and fast read time (up to 10 times faster than disks) is just too compelling to ignore.

Solid state's benefits don't come without a downside. The technology is optimal for reading, but it has limited write capability. Memory cells can only accept a limited number of writes. To counter this phenomena, solid-state disks are designed with sophisticated technology that avoids writing data to the same cells and includes additional memory that can be used as storage areas approach their limits. Spinning disks will always offer an advantage in terms of price per gigabyte, but solid state will continue to gain market share over the next few years.

It's become clear that an application will gravitate to the drive technology that best suits its needs, based mainly on performance and then price. SAS drives will certainly be considered for online editing and fast access

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applications. However, the less costly business critical drives are sure to make significant inroads within the production community. Their performance is certainly good enough for many applications where video I/O speed is more important than overall reliability.

### Workflow efficiency

The addition of servers has helped move facilities from a baseband video infrastructure to a file-based infrastructure, bringing with it a long list of benefits that this type of IT-centric architecture affords. Broadcasters and production studios are seeing more cost savings and workflow efficiencies by migrating this way.

The whole idea of a tapeless facility goes back to implementing a workflow that gets away from real-time 270Mb/s (or 1.5Gb for HD) video and into a data file that can be as low as 8Mb/s for transfers many times faster (15Mb/s to 25Mb/s is typical for SD and 50Mb/s for HD). The most benefit is realized when the conversion (encoding) takes place as early in the production process as possible, preferably at ingest.

In addition, file-based workflow operators have the option of working with a low-resolution, browse-level version of the file (1Mb/s or less) for production, including editing, quick

review or archiving. This allows engineers to cost-effectively develop internal networks where hundreds of journalists and producers can access the same file at the same time, while keeping bandwidth requirements low.

### Tiered storage strategy

Another option for tapeless workflows is to implement a tiered storage strategy, with three types of storage: online, nearline and offline.

- **Online:** enterprise drives, highest performance, reliability and highest cost. Usually configured in a SAN system.
- **Nearline:** SATA drives, moderate performance, good reliability and lower cost. Usually configured in a NAS system.
- **Offline:** tape archive; lowest performance and lowest cost. Storage robotic systems can be as small as a desktop or as large as a bedroom.

While online and offline storage is common, the addition of nearline storage offers significant cost savings and performance improvements. For example, in a news production environment, the news director might store footage online for one week, move it to nearline for 30 days and then to offline. This reduces the amount of online storage without the large performance penalty of tape.

### Infrastructure trends

The storage infrastructure is what ties everything together. Enterprise applications often rely on FC and GigE connections. FC has always been the performance leader but costs more to implement.

Gigabit technology has been predominant in the IT industry. Its performance has advanced to where it is considered a good alternative to FC in speed, yet available at a lower cost (with cheaper switches and cabling). Today, FC can support 4Gb/s applications. Ethernet is predominately a 1Gb/s platform. However, cost-effective 10Gb/s switches (actually a few 10Gb ports on a 1Gb switch) are being implemented. New technologies such as iSCSI (SCSI commands over Ethernet) and TOE cards (TCP/IP engines required for off-loading the system CPU) make GigE a good option for high-performance, deterministic video systems.

For the most common server implementations, 1Gb/s performance is certainly good enough, but when engineers need to move massive amounts of data in and out of a server, the more bandwidth the better. This is where 10Gb/s Ethernet becomes ideal. Often a high-performance FTP network will be mostly 1Gb/s with a 10Gb/s backbone — whereby most devices talk to

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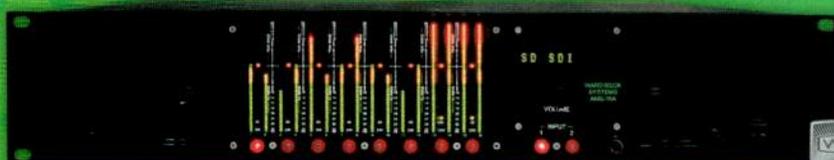
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## FEATURE

### VIDEO STORAGE

the network via 1Gb/s but some devices have the option for 10Gb. For example, if it's necessary to move data to a very fast archive system with multiple tape drives in the 120MB/s range, it's easy to max out a 1Gb/s connection.

#### Embracing file wrappers

Another important aspect of achieving workflow improvements is the constant advancement of file wrappers and how video data is stored within such protocols as the Media eXchange Format (MXF), General Exchange Format (GXF) and QuickTime. The attempt to achieve a common file format that is interoperable across disparate manufacturers' platforms is gaining success. But currently there are still some ambiguities in how the standards are being implemented by each vendor. File structure, with regard to metadata, can be implemented differently.

The industry is aggressively resolving these issues, and many believe that MXF may be the best option for a truly open interoperability standard. The situation will only get better with time, because manufacturers are committed to achieving this goal.

#### Compression still matters

Although the price of storage continues to decline, it doesn't mean that the industry will soon be working uncompressed. In fact, the trend is just the opposite. Practical workflows will continue to rely on the use of compression in order to move files around a facility quickly and unfettered by network bandwidth. Newly emerging compression codecs like H.264 and AVC HD are improving and providing higher quality while using lower bit rates.

For example, in the 1990s, 50Mb/s MJPEG was the standard for SD broadcasts. Today 50Mb/s MPEG-2 long GOP is the standard for HD, with six times the amount of data. Technologies such as H.262 and AVC HD can cut this by 50 percent or more.

This has resulted in infrastructures that require less to deploy, while enabling users to move these smaller files around faster. This will also allow producers to distribute content outside the facility using less bandwidth.

#### Tomorrow

As storage demands increase — which is a certainty given the need to support multiple channels of HD content sent to a variety of distribution platforms — IT-centric technologies will continue to provide the solutions broadcasters require. Applications are still being developed, so no one's sure exactly what technology solution will be adopted.

It is clear that many vendors serving the broadcast industry have recognized the efficiencies of using off-the-shelf IT solutions in their products. Everyone benefits when open approaches are applied across an entire industry. **BE**

*Roger Crooks is product marketing manager for servers and digital news production products at Thomson.*

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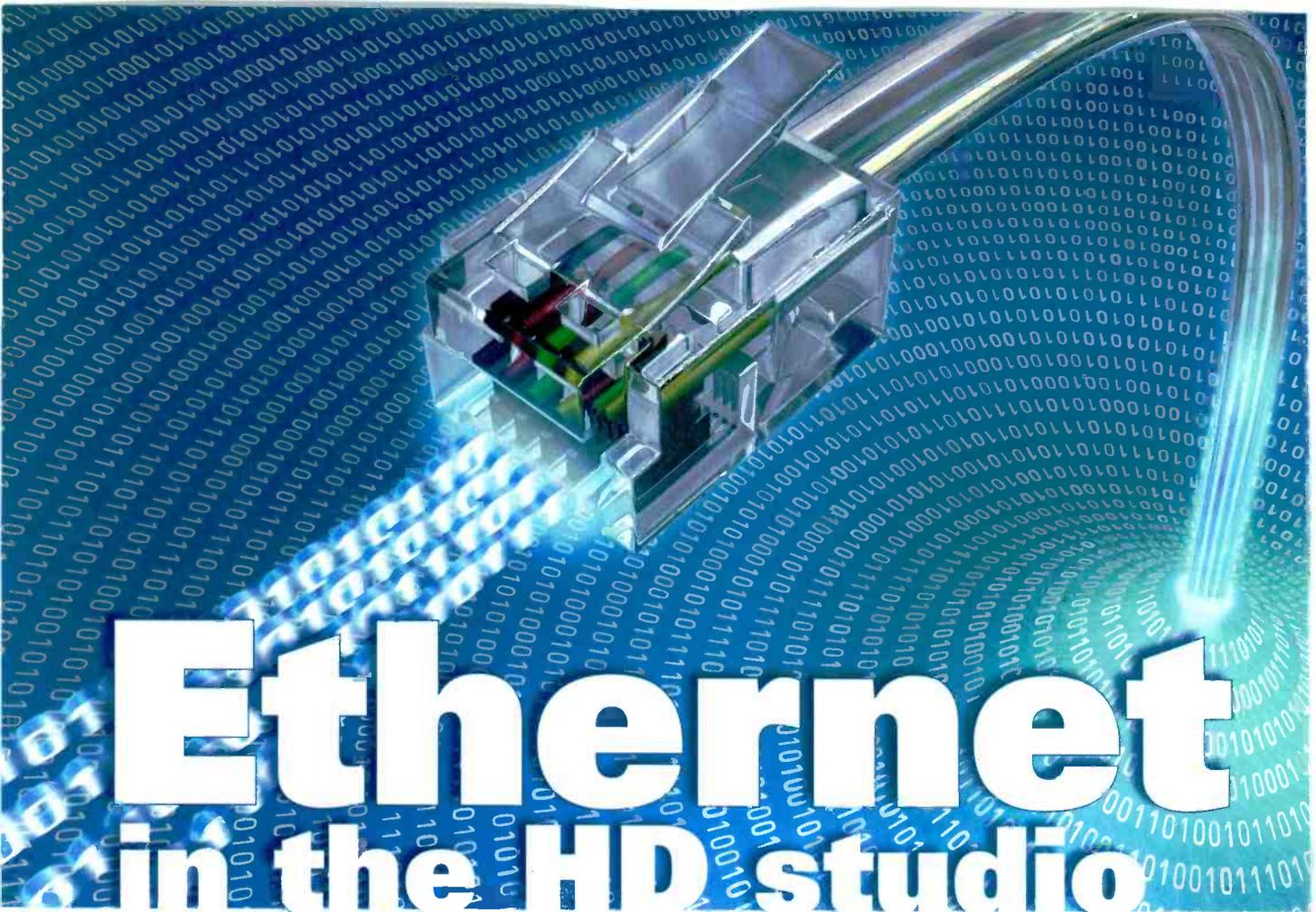


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# Ethernet in the HD studio

Part 1 of this two-part series defines the IEEE standards.

BY MICHAEL JOHAS TEENER AND GAËL MACÉ

The IEEE 802 working groups are in the process of completing significant work that will allow vendors to build a standards-based network with the appropriate quality of service (QoS) for HD production. This new set of standards, developed by the organization's Audio Video Bridging Task Group, provides three major enhancements for Ethernet-based video networks:

- precise timing to support low-jitter media clocks and accurate synchronization of multiple streams;
- a simple reservation protocol that allows an endpoint device to notify the various network elements in a path to reserve the resources necessary to support a particular stream; and
- queuing and forwarding rules that ensure that such a stream will pass through the network within the delay specified by the reservation.

These enhancements don't require changes to the Ethernet lower layers and are compatible with all the other

functions of a standard Ethernet switch (i.e. a device that follows the IEEE 802.1Q bridge specification). As a result, the rest of the Ethernet ecosystem is available to developers. In particular, the various high-speed physical layers (up to 10Gb/s in current standards, with even higher speeds in development), security features (encryption and authorization), and advanced management (remote testing and configuration) features can be used.

This tutorial will be provided in two parts. The first part will outline the advantages of moving to a common network infrastructure based on new-generation Ethernet protocols and provide an introduction to those new protocols and capabilities. The second part, which will appear in the June issue, will describe how such a network can be used in a next-generation HD studio.

## A historical perspective

Those who have experienced television's digital revolution recognize how

much the format of the content structures the production environment. Adding a new format usually requires a new production infrastructure and the inherent investment in a new generation of equipment.

On the other hand, with IT and consumer electronics, there is a convergence of technologies where many sources of content and different formats coexist. In these spaces, the cost of connectivity is decreasing dramatically. Content producers should be able to take advantage of this convergence and avoid having to replace equipment each time a new standard is adopted. This is especially true when the replacement standard represents not just one new solution, but rather an entire flexible family of standards.

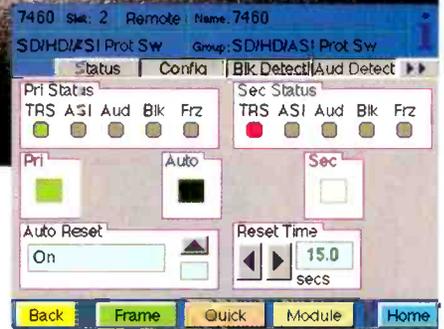
Unfortunately, broadcast production is one of the last industries to migrate to computer-based digital solutions. The reason is, until recently, off-the-shelf network and computing systems were not powerful or fast

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enough to handle the demands of broadcast production. The result has been a plethora of proprietary solutions and format-centric point-to-point connections, switching systems and processors. This includes cameras, servers, microphones, video routers, video switchers and audio mixers as shown in Figure 1.

Let's look more closely at studio architecture. Today's audio and video sources are usually processed separately. The video signals are distributed using SD- or HD-SDI interfaces and coaxial cables. The signals pass through a video router, which brings some flexibility in terms of routing, and are finally dispatched to the video switcher, where the technical director can select and switch between the different sources.

The audio signals follow their own interconnects (e.g. AES interfaces and coaxial cables) to reach the audio mix-

er. The audio is mixed with multiple sources and then combined with the video. It's only at this final stage, after resynchronization operations, that audio and video signals are recombined.

Media production requires additional signals. These include equipment control lines and communication links, such as intercom and camera tally. In addition, audio and video signals need to be monitored throughout the production chain for QoS and content reasons.

### A vision: full Ethernet/IP production studio

Suppose, on the other hand, live TV production moved toward a flexible and future-proof communication infrastructure based on Ethernet and the IP stack. The studio could move from a heterogeneous format-centric approach to a homogeneous network/software architecture where

virtual routing would make every signal available anywhere in or out of the studio. Such a solution would unify the interconnects for multiple audio and video signals, control and program associated data, VoIP and general computer data.

This vision of a full Ethernet/IP studio requires a major rethinking of the current infrastructure and investigation of the technological consequences. It also places some new requirements on the physical network. For some, these may seem like foreign concepts for a video network. A new topology network will require:

- universal connectivity because signals of different QoS must coexist with different QoS requirements on the same wire;
- a virtual switch matrix so routing can be managed with the aid of the network;
- frame synchronization that imposes

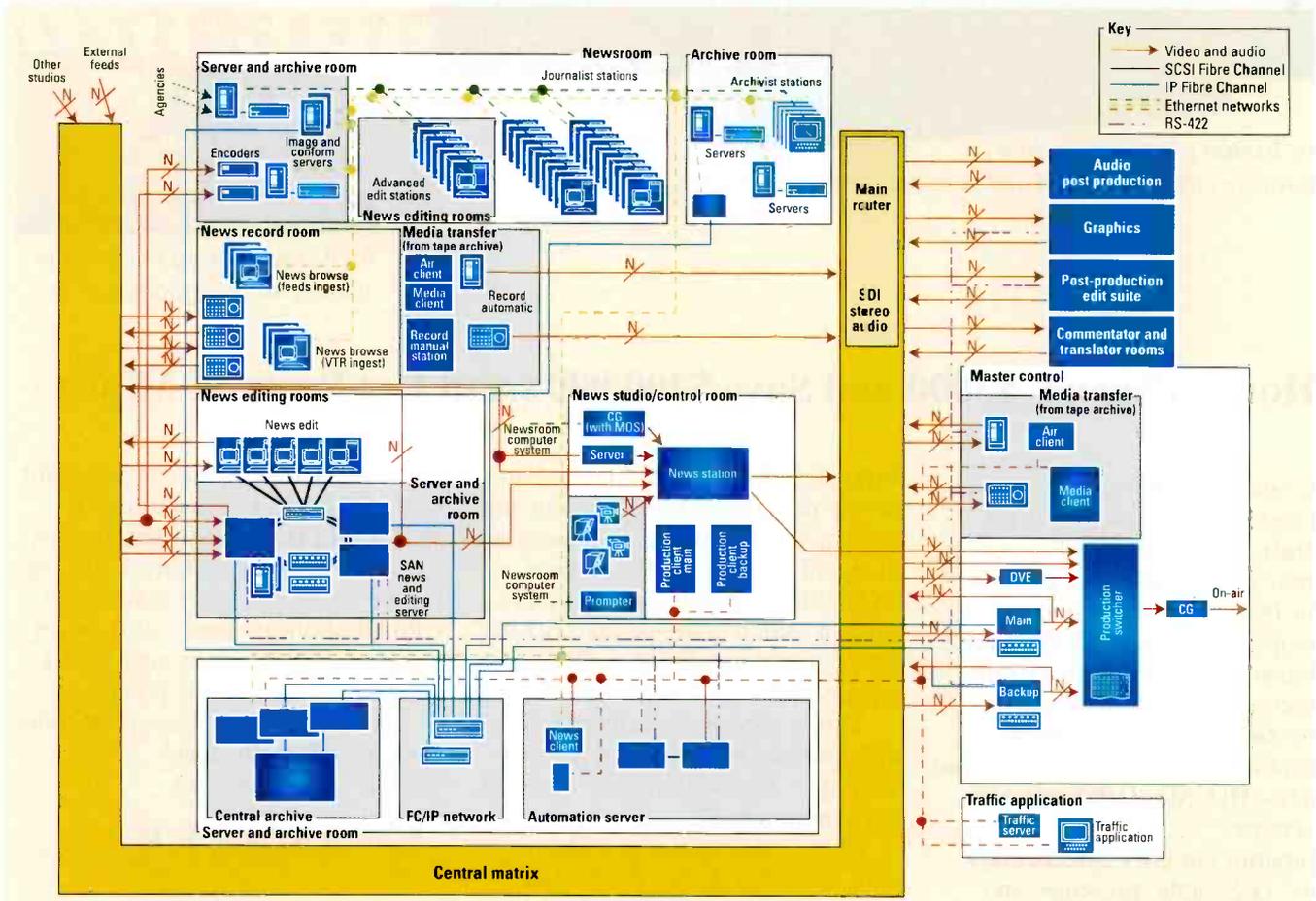


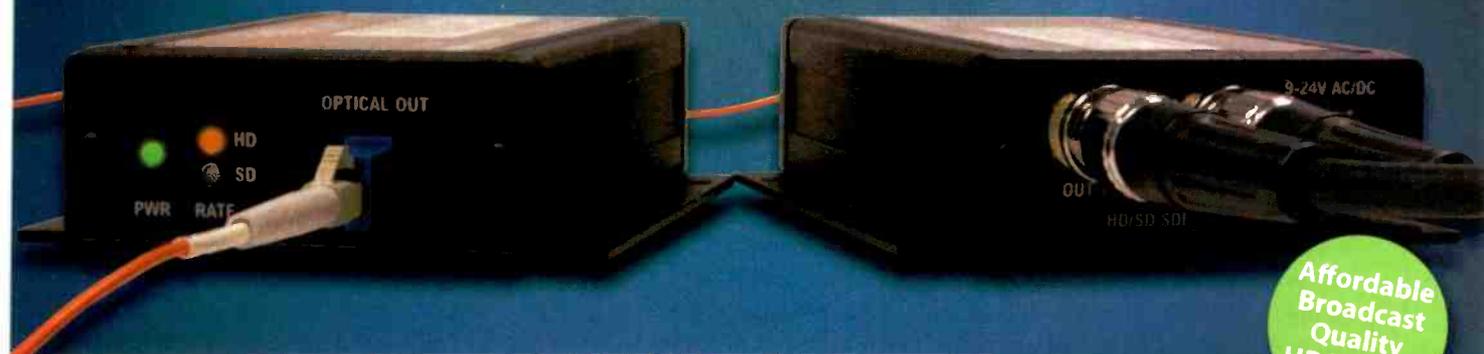
Figure 1. An example of today's studio architecture

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timing requirements not commonly placed on data networks; and

- that latency and jitter introduced by the network be compatible with the requirements of high-quality A/V signals.

An example of such an Ethernet/IP studio is shown in Figure 2. An Ethernet/IP production studio will normally be constrained to a limited location. In the case where the video studio is composed of several buildings or in a stadium, distances are in the order of several hundred meters. Fortunately, this means the Ethernet/IP studio infrastructure can be considered as a single bridged local area network (LAN). This means that there are none of the complications imposed by operating on the WAN.

The studio system will impose severe real-time latency, jitter and management requirements that will exclude certain types of network equip-

ment. In particular, routers and hubs are disallowed.

Routers have unacceptable time characteristics, particularly with respect to latency and jitter, compared with the production constraints. The new system will also exclude solutions exclusively handled by routers using Multi-Protocol Label Switching (MPLS). Hubs and unmanaged bridges cannot be used because they do not allow bandwidth to be managed or latency and jitter to be controlled.

Current digital studios transmit streaming video at 270Mb/s for SD and from 1.5Gb/s up to 3Gb/s for HD. This requires an Ethernet/IP network supporting either GigE or 10GigE links. Today's 10/100Mb/s links could be used for the exchange of IT and control data, but they cannot be used for professional video.

A typical studio may use up to 30 video cameras simultaneously. Such

required bandwidth cannot easily be handled by a low-cost 1Gb/s network. However, a network consisting of the newest 10Gb/s or faster links (the IEEE 802.3 working group is developing both 40Gb/s and 100Gb/s updates) will be able to carry all the video. Furthermore, existing high-performance Ethernet bridges can aggregate several links to create virtual interconnects at multiples of the individual link rates.

### The technical challenges

Manipulating broadcast-quality signals over Ethernet/IP in real time poses many technological challenges. These include the need to:

- define and characterize a suitable Ethernet/IP-based infrastructure for real-time video production;
- define an efficient synchronization system to replace the conventional genlock signal (frequency and phase

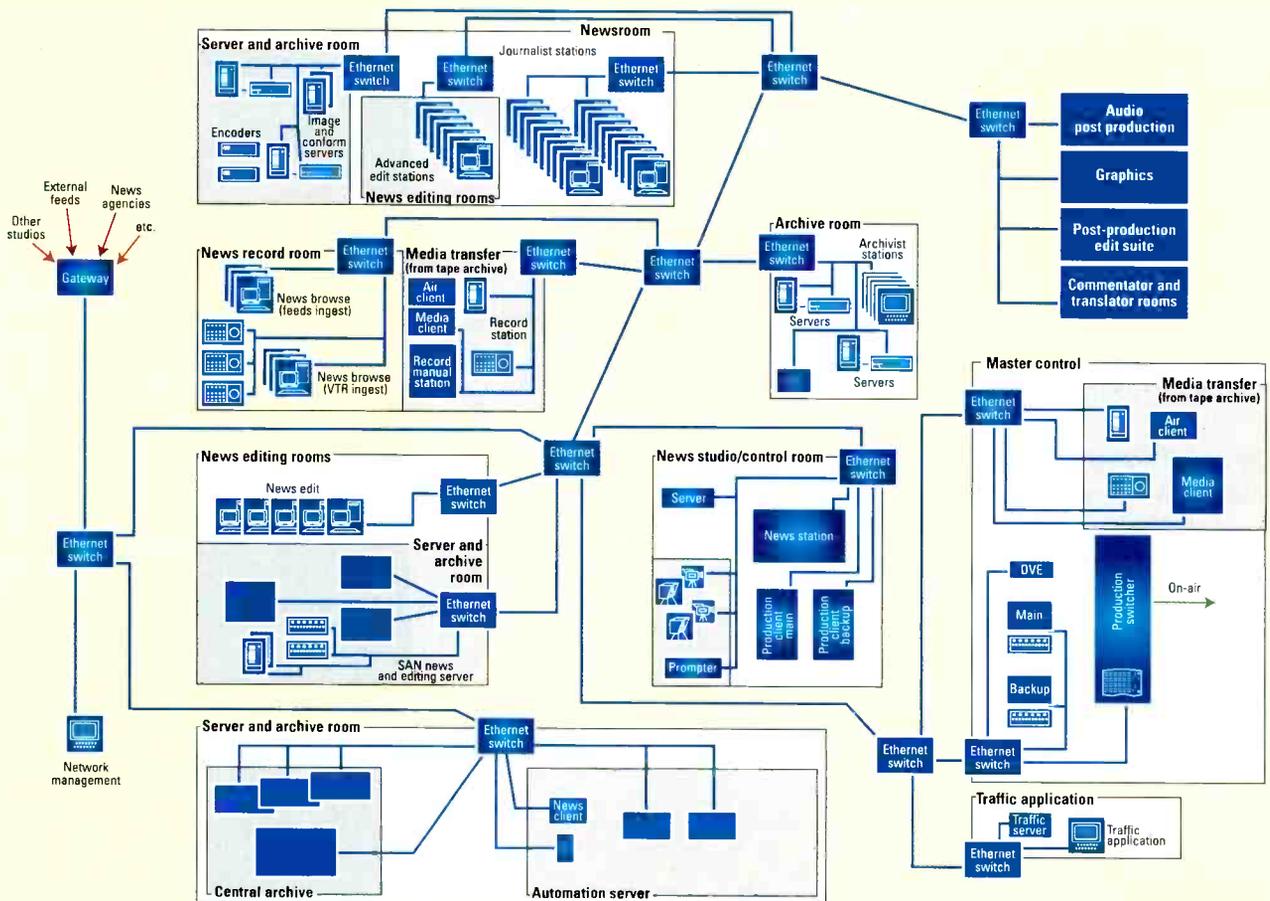


Figure 2. An example of an Ethernet/IP studio

synchronization) and introduce a solution to maintain time relationships between the video, audio and data streams;

- define a studio software management tool to ensure the necessary QoS (e.g. bandwidth, latency, jitter) over the Ethernet/IP network via traffic admission control and traffic prioritization;
- define a security scheme suitable for the valuable and sensitive sources manipulated in the studio; and
- define a studio configuration tool to support integration and administration of the facilities video services.

### Examine some solutions

Now that we've defined some of the technical issues, let's look at several of the proposed solutions. An audio/video bridging (AVB) network is one that implements a specific subset of existing layer 2 standards (such as IEEE 802.3 Ethernet or IEEE 802.11 Wi-Fi)

and IEEE 802.1 (bridging/management/security/interworking). In addition, the solution will need to incorporate other protocols being developed by the IEEE 802.1 AVB group.

It is important to remember that an Ethernet bridge in IEEE 802 terms is frequently called a switch. Unfortu-

aged environments.

There are four primary differences between the proposed AVB architecture and existing 802 architectures. They include the areas of:

- precise synchronization;
- traffic shaping for media streams;
- admission controls; and

**Most switches are little more than store-and-forward hubs without management capability. These have no place in a studio or other place where QoS is important.**

nately, most switches are little more than store-and-forward hubs without management capability. These have no place in a studio or any other place where QoS is important. A bridge is a specific device that has some basic intelligence, allowing it to be used in both plug-and-play and fully man-

- identifying participating devices.

Some of these issues represent significant changes. Even so, they can all be implemented using relatively small extensions to the standard Ethernet Media Access Control (MAC) (defined in IEEE 802.3), Wi-Fi MAC (defined in IEEE 802.11) and bridges (defined

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If you think the ParaBeam looks good on paper, wait 'til you see how it looks on video.

**ParaBeam**



in IEEE 802.1Q). There is also new work taking place in IEEE 1588 for network timing specifications. Using a minimal change philosophy will allow non-AVB and AVB devices to seamlessly communicate using standard

the destination device with the same relative timing.

The protocol used for maintaining timing synchronization is specified in IEEE 802.1AS and is based largely on IEEE 1588, which is currently used

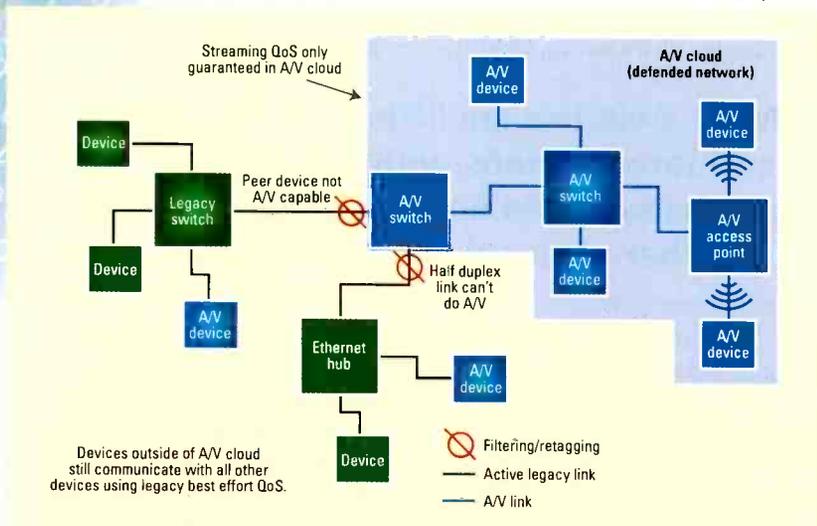
timing hierarchy needs to be specified for other reasons.

AVB devices begin by exchanging capability information during link establishment. If both devices are capable of network synchronization, they will start to exchange clock synchronization and configuration information. Ethernet bridges will act as a simple form of 1588 transparent clock. This means they provide timing correction information on synchronization packets they pass from the grand master clock to the other devices in the AVB cloud. In the AVB form of transparent clock, each port has a slave/master attribute where the slave port is the one pointed toward the grand master, and the master ports point away from the grand master. (See Figure 4.)

There are some additional complications of IEEE 802.1AS that only apply for wireless or other shared-media links. These will not be discussed here because the packet loss statistics and additional latency imposed by these links make them inappropriate for audio or video studios.

### Traffic shaping for AV/ streams

A key part of the proposed AVB architecture is the requirement for minimal lost packets. For Ethernet, this implies full duplex connections. This has been an option for Ethernet connections since the mid-1990s and is already a requirement for gigabit links. This means that there are no



**Figure 3. Only AVB devices will be able to send/receive/relay the new timing-based frames or services.**

802 frames. Only AVB devices, however, will be able to send/receive/relay the new timing-based frames or services. (See Figure 3.)

A note on interactivity: The AVB system will support two classes of media streams based on the latency requirements of two primary classes of applications:

- 2ms for low-latency applications (live musical performances and gaming); and
- tens of milliseconds for less critical applications where interactivity is limited to the kind of responsiveness needed by a typical consumer-electronic remote control.

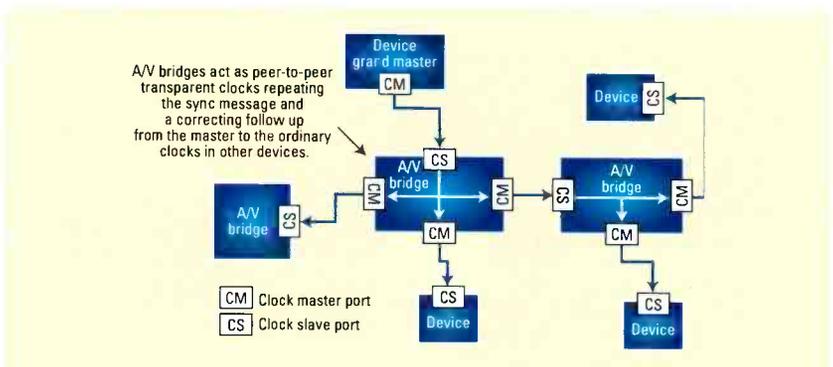
### Precise synchronization

AVB devices must periodically exchange timing information that will allow both ends of the link to synchronize precisely their time-of-day clock. This precise synchronization has two purposes:

- to allow synchronization of multiple streams; and
- to provide a common time base for sampling data streams at a source device and then present those streams at

for industrial control, test and measurement applications.

Within this architecture, there is a single device within the AVB cloud that provides a master timing signal called the grand master clock. All other devices synchronize their clocks with this master. Selection of the grand master is frequently arbitrary because all AVB source devices are master-capable. However, this grand master clock can be overridden if the network is used in a professional environment that requires a house clock (audio) or genlock (video), or if the



**Figure 4. In the AVB form of transparent clock, each port has a slave/master attribute where the slave port is the one pointed toward the grand master, and the master ports point away from the grand master.**

Priority tag	Traffic type (from IEEE 802.1Q-2005)	AVB definition
1	Background	
0	Best effort	
2	Excellent effort	
3	Critical applications	
4	Video < 100ms latency and jitter	AVB Class B: moderate latency stream (tens of milliseconds latency)
5	Voice < 10ms latency and jitter	AVB Class A: low latency stream (< 2ms latency)
6	Internetworking control	
7	Networking control	

**Table 1. AVB redefines the 802.1Q default assignments to more specific traffic classes. AVB technologies identify only two classes of applications mapped on two distinct IEEE802.1Q priorities and leave the other unchanged. The empty cells in the AVB definition column are identical to the IEEE 802.1Q traffic type definition, which is why the cells are empty.**

frame collisions, and all multipoint devices function as bridges.

The Ethernet bridge specification already defines how to forward frames directly to their destination without

flooding the network and how multiple priorities can be handled. The AVB architecture uses these routing and priority mechanisms in a specific way to provide A/V services.

### A/V frames

A/V frames are standard 802 frames with 802.1Q priority tagging and normal restrictions on format and length. The unique elements include the particular mapping of priority tags to a well-defined frame-forwarding behavior within bridges, and traffic shaping at endpoints and within bridges. In particular, AVB redefines the 802.1Q default assignments to more specific traffic classes. (See Table 1.)

### Traffic shaping at the stream source

Endpoint devices must transmit frames for a particular stream evenly, based on the traffic class (AVB Class A or AVB Class B) and the specific QoS parameters that were used when the stream was approved by the network. (See the section on admission controls below.) The specific rules for

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traffic shaping are described in the IEEE P802.1Qav specifications.

### Bridge operation

The basic mechanism used for single-link interactive media transport is carried over to bridges. Interactive media frames will be forwarded in the same manner as best-effort traffic is in existing 802.1Q bridges. In addition, they will be subjected to traffic-shaping rules based on traffic class and the allocation of bandwidth for the traffic class on a particular egress port. This will have the effect of smoothing the delivery of interactive media frames through an AVB network.

The traffic-shaping rules for bridges also require that frames be distributed evenly in time, but only on a class basis. This means that all the traffic being transmitted out of a particular port for either AVB Class A or Class B is distributed evenly in time and measured using the QoS parameters of that class.

This represents the accumulated value of all the reservations for a particular class, for the particular port, made by the admission control process described below. The effect is that delivery jitter accumulates slowly and less than linearly with hop count. It also reduces the size of the output queues needed at all network output ports, even if the network has many hops.

Non-AVB traffic, because it is not subject to the admission control process, does not have reserved QoS and is subject to frame drops if resources are constrained.

Bridges are also required to do a basic filtering function at ports that are not connected to AVB devices. They must remap the priority field of any received tagged frames so that they do not collide with the priority values used for AVB Class A or AVB Class B.

### Admission controls

Even though the preceding mechanism can reliably deliver data with a deterministic low latency and low jitter, it will only do so if the network resources are sufficient. This means

that port bandwidth and bridge buffer space must be available along the entire path from the talker to listener. In this architecture, it is both the talker's and the listener's responsibility to guarantee the path is available and to reserve the resources. The process to do this is specified by the P802.1Qat Stream Reservation Protocol (which is further based on the P802.1ak Multiple Registration Protocol). The process registers a stream and reserves the resources required through the entire path taken by the stream.

Here is how it works: The listener sends a register frame to the network with the stream address (frequently a group address). The intermediate

**Once the talker receives a ready frame, it can start transmitting the stream.**

bridges create a forwarding database entry for the stream back toward the listener and transmit the registration to the other ports. If the bridge is already routing the stream, it can respond on its own, acting as a proxy for the talker.

When the registration request reaches the talker, it returns a reserve frame toward the listener, which includes resources available (or not), worst case delay, QoS requirements (e.g. traffic class, bandwidth in bytes/class interval and the maximum number of packets to be sent in a class interval), address information and stream identification information.

An intermediate bridge receiving a "reserve, resources available" frame attempts to allocate bandwidth on the output port back toward the listener. If the resource allocation succeeds, the bridge sends a "reserve, resources available" frame back toward the listener. (The bridge already has the correct entries in the forwarding database because it has already participated in the upwards registration request.) If the resource allocation fails,

the bridge sends a "reserve, resources not available" frame.

An intermediate bridge receiving a "reserve, resources not available" frame will just pass the frame out to its other ports. When the listener receives a reserve control frame, it will know whether the resources are available, and if so, that the resources have been reserved and the delay for the path. It can then respond with a ready frame that is forwarded back toward the talker.

Intermediate bridges use the ready frame to lock down the resources needed by the stream and to make the appropriate entries in their forwarding database. They allow the stream to be sent on the port that received the ready frame.

Once the talker receives a ready frame, it can start transmitting the stream. Obviously, various time-outs and disconnects affect the process, but the basic ideas have already been worked out. Additional listeners also send registration requests to the talker, but this time an intermediate bridge can respond if it is already forwarding the stream. The talker can take down a stream by sending an unreserve message, and a listener can disconnect by sending a not ready message.

Other methods can be used to take down a connection and release the allocated resources. For example, the listener must periodically resend registrations and ready messages, and talkers must periodically resend reserve messages. That way, any receiving device (including intermediate bridges) could automatically release assigned resources and notify higher layers if the appropriate registrations and reservations were not received.

### Identifying participating devices

Because the entire AVB QoS scheme depends on the participation of all devices between the talker and listener, any network element that does not (including so-called unmanaged bridges) must be identified and flagged so that network edge fil-

tering and management schemes can be applied. The identification method used is a combination of 802.3 link capabilities, plus a small enhancement to the 802.1AB Logical Link Discovery Protocol and link delay measurements performed by IEEE 802.1AS.

Therefore, an Ethernet link peer is considered an AVB device if:

- the link is capable of full duplex 100Mb/s or greater;
- the 802.1AB link layer discovery protocol packets are received on the link with exactly one MAC source address;
- the Link Layer Discovery Protocol IEEE 802.1AB (LLDP) packets include the 802.1AS-capable and 802.1Qav-capable attributes; and
- the round-trip delay is no more than a worst-case wire delay. This will be computed from the IEEE 1588 PDelay exchange and should be no more than approximately 2 $\mu$ s.

### Higher layer interfaces

The mechanisms described represent a network layer 2 toolkit to support a streaming QoS. A useful system requires the addition of several higher layer services.

This would include stream transport protocols for the data. We'll assume that most of the traffic will be IP-based, in particular RTP traffic. Even so, there are other transport protocols in development, including IEEE P1722 Audio/Video Bridging Transport Protocol, which is a simple port of the IEC 61883 formats used by IEEE 1394 FireWire.

Our network would also require a mechanism for discovering the devices in the network and their streaming capabilities. The system also needs to provide mappings between the layer 2 mechanisms and existing higher layer QoS services. For example, RSVP for standard

RTF streams or the universal plug-and-play QoS mechanisms used by the Digital Living Network Alliance (DLNA), a consortium of CE, computing and mobile device vendors aiming to specify a wired and wireless interoperable network for such devices in the home.

### What's next?

With this information as a foundation, we're ready to examine how Ethernet can be used to support the needs of an HD studio. In a June *Broadcast Engineering* magazine article, we will examine how the IEEE 802 working groups are creating specifications that vendors can use to build a standards-based, high QoS HD production network. **BE**

*Michael Jahas Teener is a plumbing architect for Broadcom Corporation, and Gaël Macé is a member of Thomson's Corporate Research.*

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# Broadcast camera developments

## What does the future hold?

BY BERRY EBBEN

**Y**ou might get the impression that there is a revolution going on in the world of cameras. However, SD is still with us, HD is in its growing phase, and the Internet is not ready for broadcast. In 2007, around half of the cameras sold worldwide were still SD.

Institutes like parliaments, high-end security and other audiovisual services are buying broadcast cameras as well, which is keeping the market for SD alive.

The majority of broadcast cameras now are 1920 x 1080/50i/60i, have a 16:9 aspect ratio with HD-SDI and HD analog outputs, and can be

switched between popular formats and ratios. As a kind of insurance, SDI and analog composite video outputs are also provided. That means users can swap their SD cameras with an HD one without replacing their complete broadcast chain. This allows broadcasters to gradually upgrade their studios to HD operation.

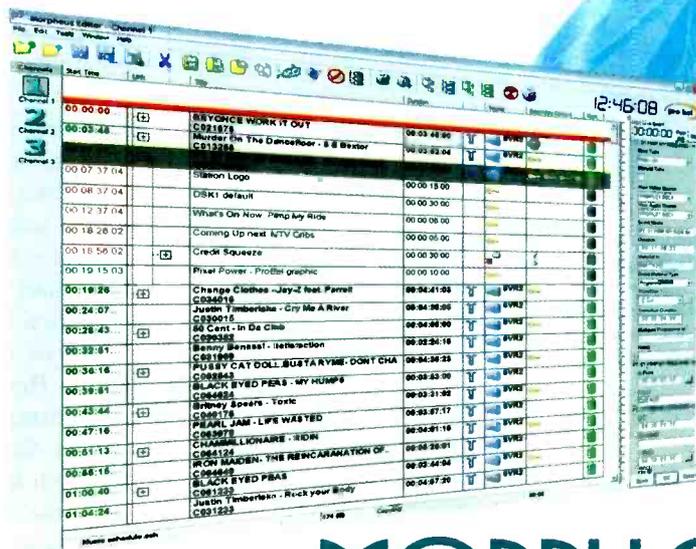
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Engineering The Broadcast Future

### Where are we going?

We are moving from SD 720 x 576 to HD 1920 x 1080 resolution, and in a few years, the industry could move beyond HDTV. Japanese broadcaster NHK offers Ultra High Definition Television (UHDTV) with 7680 x 4320 resolution. In sports, there is a strong demand for high-speed, slow motion in HD, and this will be ex-

pected from UHDTV.

Another issue is 2-D or 3-D. At IBC2007, 3-D displays were demonstrated, but for professional use only. There is the potential for growth here.

The film industry is exploring digital acquisition. Digital cinematography cameras are used more as replacements for 16mm and 35mm film cameras. The latest HDTV cam-

eras are not only producing 1080i but also progressive scan pictures.

Computers offer processing speed combined with high-capacity memories, which make them ideal to use in post production. The idea that future cameras will consist of a computer with a lens and a memory stick is not valid. The reliability of operating software seems to be acceptable for computing, but it is far away from what is acceptable in a live broadcast camera.

The developments of UHDTV and 3-D indicate that camera growth looks to higher pixel counts, more frames per second and higher bit rates. The existing architecture with CCD was introduced in the late 1980s and served broadcast's needs well. Over the years, problems such as lag, smear, fixed pattern noise and leaking pixels have been solved.

CCD technology is mature now, and it will be around for another few years. However, it is clear that another architecture should be in place in that same time frame. The time to market for a new type of sensor technology is around five to eight years.

### Camera applications

Whatever the application for a camera, is there revolution in the offing in camera technology? The best way to find out is to check the unit's components. Start with the lens. Then check the optical input, and end with base station or recorder as an electronic output. Here's a closer look at each component:

- *Lenses.* Since the turret of fixed focal length lenses was replaced by the zoom, the evolution has been longer zoom ranges, digital interfacing and focus assist. The revolution will start when more camera electronics are integrated in the lens. This has already happened with black-and-white security and traffic control cameras. Cameras for these specific applications are really lenses with a video output, much like a webcam.

- *Camera housing.* Cameras have evolved from a large body to a portable (with hip-pack and portable processing



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# FEATURE

## BROADCAST CAMERA DEVELOPMENTS

unit) to the shoulder-mounted camera we know today. The weight has reduced from 25kg to less than 7kg. However, cameras are still front-heavy and roll off your shoulder. There are two possible solutions. One is a well-fitting and adjustable shoulder pad with balancing weights in the back of the camera. A second option is to create a small hand-

held camera. In the prosumer market, the HD handheld weighs around 6.5lb. In the consumer market, HD palmtops weigh about 1lb.

• **Filters.** In the past, a camera carried neutral density filters plus a cap. Today, it is common to include four-, five- and six-point stars in addition to mist filters. Apart from the matte-box

in front of the lens, cameras generally carry two filter wheels between the lens and prism. Some cameras have memories on the video processing board where you can store electronic effect filter parameters. A revolution could be to move all effect filtering in the camera on the RGB level, including the effect filters which are normally carried out in the production switcher. There are no contours on that level, so it will benefit the quality. A remote input controlled by the vision mixer is needed.

• **Beam-splitter.** Since the mirror cross was replaced by a three-way RGB prism block, only minor changes have been made to the beam-splitter design, mainly driven by quality issues. There is a move to use a single sensor with a Bayer filter. The disadvantage is the loss in sensitivity of two stops, which is not acceptable for many applications.

• **Imagers.** Tubes have been replaced by CCDs, which in turn will be replaced by CMOS with system on chip (SoC). Camera video processing is integrated. Light is captured, and bits are coming out. The CMOS sensor chip with SoC can be seen as a digital device. The way to a single integrated circuit (IC) broadcast camera is open.

• **Video processing.** Nuvistors and tubes were replaced by discrete transistors, and then by ICs, including ASICs, EPLDs and FPLAs. Processing has changed from dedicated analog to digital with embedded software. Integration with the sensor is on its way. The future could see the introduction of wide gamut color space like the new xvYCC color standard.

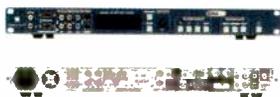
• **Power.** Power consumption on the CCD camera side grows to the extent that batteries need to increase in size or live shorter. The maximum cable length in an OB operation is decreasing. Digital processing consumes more power, and the higher the clock rates, the more the current. The more power, the more heat, the more fans and the more noise. Adding fill-in light, displays, tallies and floor monitoring does not help either. CMOS consumes far less compared with a



Courtesy France 3 UF Paris

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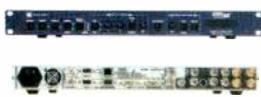
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# FEATURE

## BROADCAST CAMERA DEVELOPMENTS

CCD, and by integrating more video processing, the power consumption should decrease further.

- **Audio.** Audio quality for camera audio channels has improved with the move to digital. The improvement is such that it can be used for more than just ambient. The problem is the synchronization between video and audio. Digital video processing adds delay.

- **Intercom and tally.** The digital intercom benefits from improved quality with digital processing, which is much better than the old analog systems. As an example, a message box for the camera person can be added. The tally is triggered by the video mixer preset or program bus, but digital circuits can cause noticeable delay.

- **Viewfinder.** What was once a mono-

chrome CRT has evolved to a full-color LCD. This revolution, however, is not for the best. Focussing an HD picture is already a problem with a black and white CRT; with an LCD, it is even worse. This area is ripe for development.

- **Camera output.** The camera output has evolved from multicore copper cable to triax with hybrid fiber that provides the bandwidth for HD sig-

Factors	CCD frame transfer	CCD frame interline transfer	CMOS SoC
Architecture	Read-out field store	Read-out field store	Line scanning
Output	Analog	Analog	Digital, 2 x 12 bit fixed
16:9 2.37:1 switching	Native	In FPGA	In FPGA
Power consumption	High	High	Low
Temperature range	Standard	Standard	Standard
Dynamic range	600 percent	600 percent	400 percent
Highlight handling	Adjustable in preamp	Adjustable in preamp	Fixed on the chip
Dark areas	Good	Good	Noisy*
Fixed-pattern noise	Not visible	Not visible	To be solved*
Noise	Well below operational needs	Well below operational needs	Could be better*
High-speed possibilities	2X	3X	3X and higher
Aliasing performance	Very good	Good	Good
Resolution	Good	Good	Good
Sensitivity	Standard	Standard	Standard
Smear	No	Negligible	No

Table 1. Comparison of CCD and CMOS system on chip (SoC) for broadcast. \*CMOS SoC has the possibility to host electronic circuitry, so a choice regarding what to do in the camera chain can be made so that the end result equals or outperforms the CCD.



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nals plus a power supply to the head. Developments in this area must deliver a long cable length with wide bandwidth, but cost, reliability and field repair are major issues.

• *CCU/base station.* The CCU/base station has shrunk from a full-height rack to 2RU for the latest cameras. The ability to fit more cameras in a given space has created a revolution in the OB world, enabling soccer coverage, for example, to expand from five cameras to the 24 cameras now expected for premier matches.

• *Outputs formats.* Apart from the

standards used within the broadcast industry like SDI, smaller camcorders can include FireWire and HDMI, with Ethernet starting to become a feature.

**The coming camera revolution**

The leading edge is the architecture of the imager. Almost all broadcast cameras use CCDs, but a few are already starting to use CMOS sensors. (See Table 1 on page 86 and Table 2 below.) Three CMOS sensors mounted on or glued to an optical beam splitter divide the incoming

light into RGB video information. The standard lens mount is B4, and the imagers are 2/3in.

The quality of the camera can never be better than its imager. Parameters like noise, sensitivity, resolution, dynamic range and aliasing mainly depend on imager specifications.

**A closer look at noise and sensitivity**

These are some signal-to-noise ratio (SNR) numbers, with camera sensitivity 2000lux at f8:

• SD camera specifications are

Factors	With CCD frame transfer	With CCD frame interline transfer	With CMOS SoC
Power consumption	High	High	Low
Size	Too big	Too big	Decreases
Weight	Acceptable	Acceptable	Decreases
Ergonomics	Front-heavy	Front-heavy	Front-heavy
Price	High	High/medium	Low

Table 2. Camera-related factors

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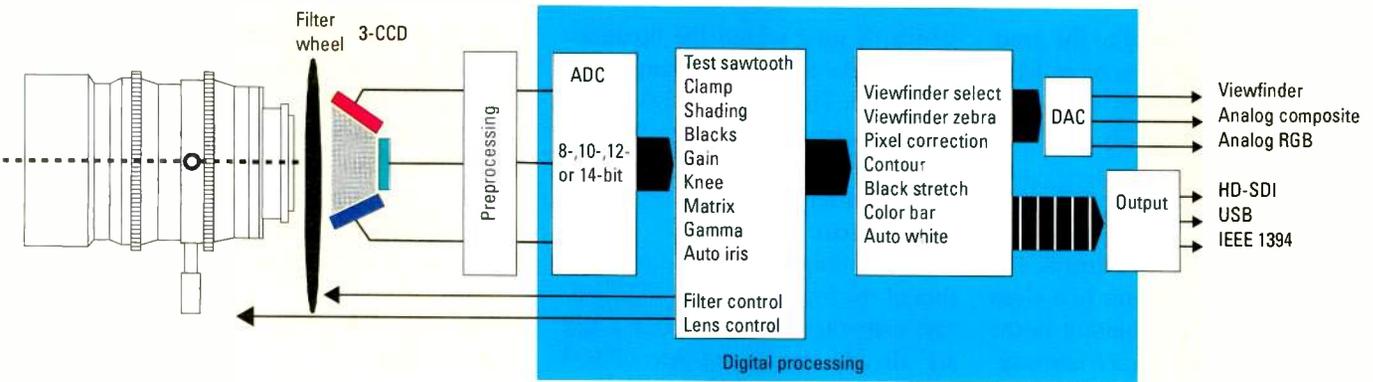


Figure 1. 3-CCD camera with separate video processing

62dB, with a 720 x 525 imager.

- HD camera specifications are 54dB, with a 1920 x 1080 imager.
- UHD camera specifications are expected to be <45dB, with a 7680 x 4320 imager.

The numbers mentioned above are specification numbers and are useful as a comparison between cameras. Depending on gain, gamma and contour settings, the numbers will be lower.

An average 12-bit SD camera under normal operational conditions will be 52dB to 56dB, and a 14-bit HD camera will be 50dB to 52dB. The SNR in a UHD camera will be around 45dB; noise created by the video processing will be far below the sensor noise floor.

Sensitivity is a trade-off between SNR and gain. The standard setting for a three-chip, 2/3in broadcast camera is f8/2000lux/3200K. The SNR for a camera is 54dB in Y.

At HD (54dB) and UHD (45dB),

the SNRs are relatively low. To lose another 12dB for Bayer filtering is not realistic. One stop less sensitivity and a bigger sensor is an option, but then what would you do with the installed 2/3in B4 lenses?

### Beam splitting

A smaller-sized camera with less weight and lower power consumption requires another concept in beam splitting. The f1.4 prism, as widely used in our industry, consumes too much space in the camera. On the other hand, a single chip with a Bayer filter will cost sensitivity.

An example of a new beam splitting assembly is the organic optical layered imager (OOLI). The visible light spans wavelengths from 400nm to 700nm, with blue at 470nm, green at 535nm and red at 610nm. The blue, green or red layer should be sensitive for its spectral band and pass the rest. Such a design cannot light sensitive metal, but probably will need to be an organ-

ic material. The Foveon chip indicates the direction of such concepts.

### Checklist

Look for the trends in CCD, CMOS imagers, developments in HD and ultra HD, plus the specialist high-speed and slow-motion cameras. Make yourself a checklist:

- Check the noise and contours in the darks.
- Test the colorless whites.
- Move the camera and look at the dynamic behavior.
- Assess the ease of operation.
- Feel the body at the end of the day.
- Listen to the noise at the end of the day.
- Ask for specs, prices, delivery time and where the service is located.
- Make a comparison.
- If you want an undisturbed close look, go to the stand of a lens manufacturer.
- If you are really interested, ask for a demo.

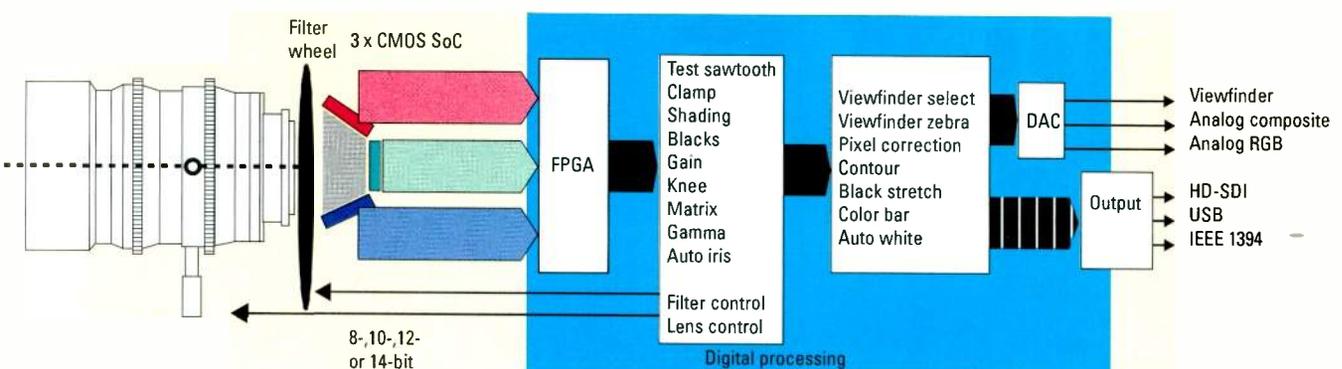


Figure 2. 3-CMOS camera with partly integrated video processing

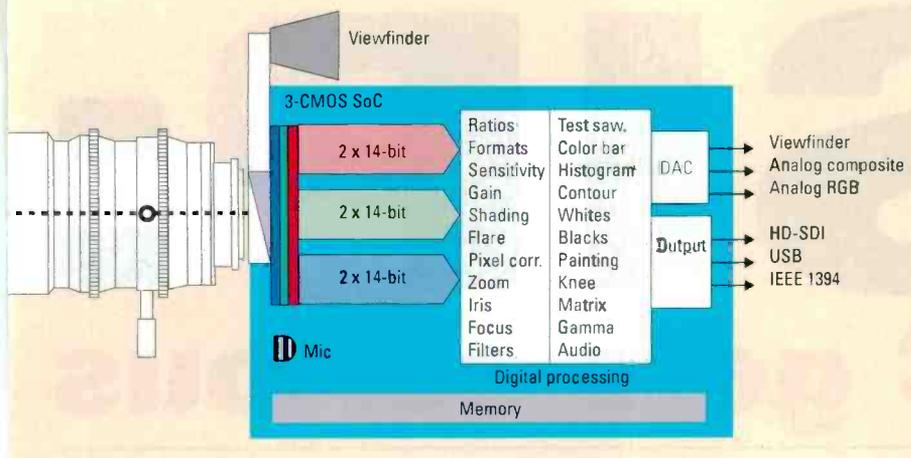


Figure 3. 1 OOLI camera with fully integrated video processing

**Outlook for the future**

CCD will be around for the coming years. (See Figure 1.) CMOS probably needs the same process steps as CCD. It could mean that the price in the end will be the same as CCD, but by that time, it should outperform it.

The three-chip CMOS SoC camera has a promising architecture. (See Figure 2.) However, the imager needs some modifications. The integration of camera electronics into the optical chip would lower power consump-

tion. High bit and frame rates are possible so it is suited to SD, HD, UHD and high-speed cameras.

The single imager with a SoC camera using a Bayer filter has a problem with sensitivity or noise, but nevertheless a CMOS SoC could be a step in between. The camera can be compact and suited to SD, HD, UHD and digital cinematography.

The camera of the future will be a lens with a small adapter. The adapter will host a new sensor with fully inte-

grated camera electronics. (See Figure 3.) A viewfinder will be either a part of the lens or a screen with optical ultra HDMI or wireless interface. The lens and its adapter will be powered locally by battery, so the connection with the OB truck could be a single-mode, dual-window fiber carrying the full video bit rates, controls, returns, audio and intercom.

Because no remote power is needed, the CCU or base station will be just an interface between the fiber and the connectivity of the system. There's no need for a hybrid fiber, and there are no cable length limitations other than the optical loss budget. Such a camera would be suitable for ENG, EFP, drama, sports and digital cinema. **BE**

*Berry Ebben worked for Philips on the LDK 3 camera, was a member of the Viper design team and senior product manager for Thomson Grass Valley cameras, and now works as a consultant on broadcast, digital cinematography and conference systems.*

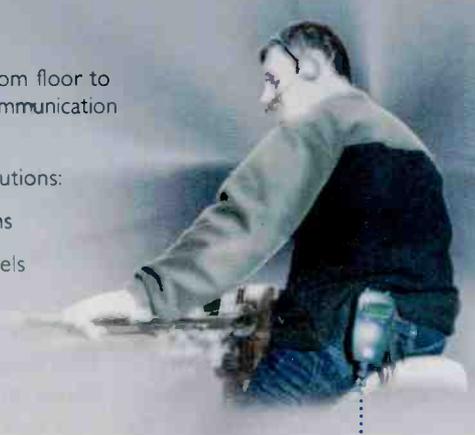
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# PSIP:

## The FCC gets serious

Previous requests to update PSIP didn't incite broadcasters to act. The FCC now demands it.

BY CHRIS LENNON



**P**rogram and System Information Protocol (PSIP) is nothing new. It includes information critical for viewers to know what's on TV and to tune to digital OTA programming in ATSC countries. PSIP information is contained in many systems, and Programming Metadata Communications Protocol (PMCP) was created to enable this data to be easily extracted from these systems and provided to PSIP generators.

It is not news that PSIP is required by the FCC. However, in its Report and Order of Dec. 31, 2007, the FCC seems to have put some teeth into its regulations concerning PSIP.

Beginning May 29, 2008, terrestrial broadcast signals in the United States must include PSIP information that accurately reflects the content being aired. This means either someone must manually update your PSIP generator's event information table (EIT) data — basically the contents of the program grid that appears on viewers' EPGs — or you must implement a system that will do this automatically.

### **A little history**

Back on Sept. 7, 2004, the FCC issued its first rule concerning accuracy of PSIP data. It went into effect

in early 2005, but many broadcasters didn't follow the guideline. The wording of the 2004 PSIP rule was wishy-washy and didn't come right out and say, "Send accurate PSIP or else!" It included weak wording, such as "... correct program titles that can inform consumers about which programs are planned to be broadcast" and "These EITs should be populated with the correct information, so that the user knows what programs are on ..."

It was like the FCC was saying, "Hey guys, we all know what you should be doing, so why don't you just do it, and get your PSIP in line with what



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# FEATURE

## PSIP: THE FCC GETS SERIOUS

you're broadcasting?" However, in the absence of any "shall" or "must" provisions, or the threat of any consequences, the most common reaction was no reaction at all.

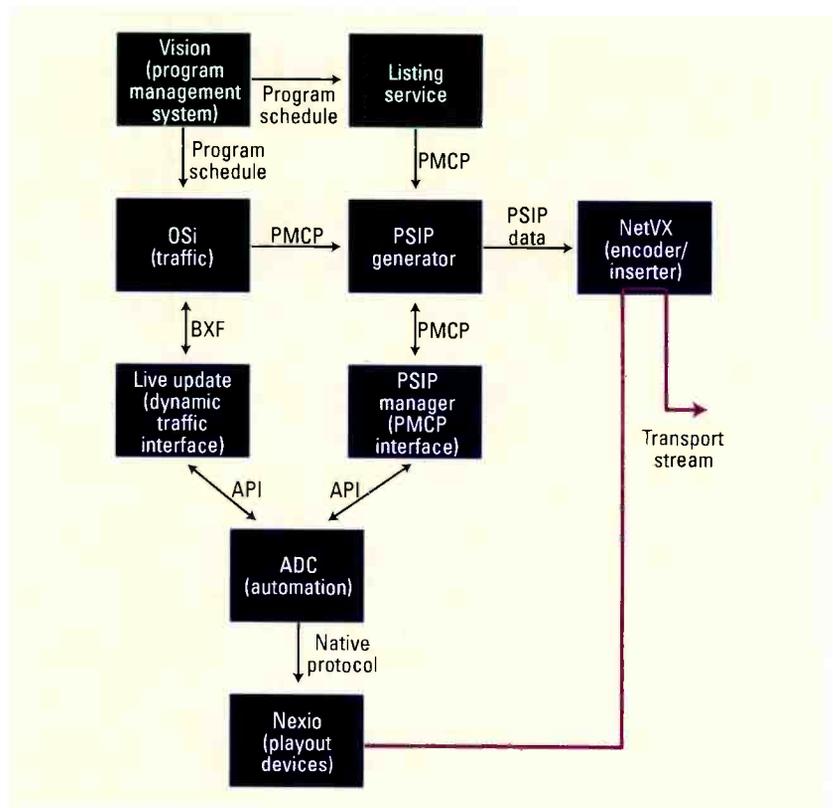
So, the FCC played nice for a while on PSIP. It assigned some fines for blatant violations (such as for those sending out no PSIP at all), but by and large, the commission sat back and hoped the industry would sort out the PSIP issue by itself.

It's rare today to find PSIP data that accurately reflects what a broadcaster is transmitting all the time. This is largely because most broadcasters simply import program listing information days prior to air and never update it.

### The new rule

The FCC's December 2007 Report and Order, as part of the third periodic review of the DTV transition, contained some interesting references to PSIP. Some of the key passages are cited below.

- "This latest revision requires broadcasters to populate the EITs with accurate information about each event and to update the EIT if more accurate information becomes available."
- "Also, broadcasters must accurately fill the contents of the fields and the



**Figure 1. Shown here is Harris' ONE approach to interoperability of PSIP-related systems. The use of industry standards such as BXF and PMCP means any systems compliant with these protocols fit into this workflow.**

descriptors of each event descriptor loop with the known information about each event at the time the event is created and shall update each field if more accurate information becomes available. The Commission will continue to monitor these issues and act accordingly."

- "Finally, a couple of comments noted, in response to our inquiry

in the *Third DTV Periodic Review NPRM*, that PSIP information may not be passed through to cable and satellite subscribers. We will address such program-related PSIP issues in our *DTV Must Carry* proceeding."

It's interesting to contrast this with FCC statements three years ago, as the new rule uses stronger language, such as "requires" and "shall," and promises



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that the FCC will “act accordingly” if broadcasters don’t comply. (The full R&O can be found at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-07-228A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-07-228A1.pdf).)

### Consequences

The new rule implies that the FCC will not hesitate to fine broadcasters who continue to send out PSIP that doesn’t accurately reflect what’s on-air. The commission also plans to actively monitor PSIP information. If past history is a good indicator, fines could be in the neighborhood of \$3000 per violation. That is what the FCC charged a couple of years ago when a group of stations were found to not be transmitting any PSIP.

### What about must-carry?

One thing that has perhaps held many broadcasters back from investing in truly dynamic, accurate PSIP is the fact that most viewers receive their signal via cable or satellite. With PSIP being an over-the-air standard, many thought that there were so few viewers looking at it that it wasn’t of critical importance.

The FCC will address this in the upcoming DTV must-carry proceeding. This seems to imply that we can expect the FCC to include PSIP in must-carry, requiring cable and satellite providers to pass PSIP along to viewers. Suddenly, getting it right becomes far more important for broadcasters, as the number of viewers exposed to inaccurate PSIP will grow significantly if it’s included in must-carry over cable and satellite.

### How to comply?

So, if you only have until the end of May to get your PSIP accurate and keep it so, what do you do? There are two clear options for broadcasters.

First, PSIP generators that are in use at stations today all have some degree of capability for an operator to manually edit the PSIP data being sent out. The master control operator could edit the upcoming PSIP events when the next day’s playlist is loaded

into the automation system, ensuring that everything is in sync at that point. Then, when things don’t quite go according to plan and programs are added, skipped, changed or joined in progress, the operator can make those corresponding edits on the PSIP generator’s GUI.

The second option is to automate the updating of PSIP events. When the automation system loads a new list of events, it can compare those with the list of upcoming PSIP events known to the PSIP generator and signal any differences using the ATSC’s A/76B Program Metadata Communications Protocol (PMCP) to the PSIP generator. The automation system can then continually monitor future events for any changes that will require an adjustment to PSIP, and if any such changes are detected, again, message those to the PSIP generator using PMCP.

Taking the second, more automated approach ensures that your PSIP will be accurate, while keeping your operator’s attention on what’s important — making sure that your programming and commercials are going to air as intended.

Your automation system vendor can recommend how to best provide accurate PSIP for your workflow.

### Timelines

The NAB and MSTV have filed a request for an extension of one year until this new rule is enforced, allowing broadcasters the time they need to deploy automated PSIP solutions. Harris filed supporting comments, expressing support for the new PSIP rules, while at the same time, reinforcing the NAB/MSTV view that more time is needed. Expecting all 1600-plus U.S. stations will have such solutions in place by the end of May of this year seems optimistic at best. How the FCC will react to this and other comments remains to be seen. For the latest updates, visit [www.broadcastengineering.com](http://www.broadcastengineering.com). **BE**

*Chris Lennon is director of integration and standards at Harris.*

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# Harris' CENTRIO

The multiviewer can streamline operational costs and complexity.

BY MIKE GARRIDO

In today's multichannel universe, it's not uncommon for satellite and cable networks to monitor dozens or even more than 100 channels. Many television stations are merging the master station control facilities of two or more affiliates — each of which can broadcast several video, audio and Web-based services — in the hopes of streamlining costs.

The total cost of dedicating a high-grade monitor to each of dozens of signals extends beyond the price tag for the equipment. The more complex the installation, the greater the costs related to systems integration, cabling, maintenance and electricity for power and cooling.

In recent years, manufacturers have introduced multiviewers that enable multiple signals to be displayed on a single monitor. The next challenge: multichannel monitoring at large-scale broadcast facilities.

## Monitoring and control

The Harris CENTRIO multiviewer unifies signal processing, signal management, integrated monitoring tools, sophisticated alarm measures and just-in-time technical assistance. It helps on-duty operators keep every channel on track, within a single solution and user interface.

Because the multiviewer is designed as a module that resides within the output section of any new or existing Harris Platinum router frame, it can use all the audio and video I/Os, format converters, distribution amplifiers, power supplies and redundancy already built into the router. This integrated architecture promotes a simplified operation that can reduce complexity in test and measurement gear, distribution amplifiers, cabling, and rack space.



The Harris CENTRIO multiviewer combines high-quality graphical elements with monitor and alarming capabilities, enabling quicker response times, preprogrammed reactions, and faster access to video and audio references.

## Graphical display

The multiviewer's built-in graphics engine enables users to configure multiple displays onto a single large-screen monitor, across multiple monitors or onto video walls — using plasma, LCD, CRT, HDTV, DLP projection systems, or virtually any

Screen layouts can be changed on the fly, and hundreds of configuration setups can be stored, allowing access to all the layouts without the need for an external computer. Users can decide to make the display of certain channels prominent on the screen, such as a premium pay channel or

**The multiviewer's built-in graphics engine enables users to configure multiple displays onto a single large-screen monitor, across multiple monitors or onto video walls.**

type of display device. Screens can be oriented horizontally or vertically, with a mix of 16:9 HD and 4:3 SD aspect ratios, and the multiviewer can auto detect the aspect ratios to ensure information isn't lost if the ratios change.

high-profile sporting event, while others can be kept smaller or scrolled across the screen to view all sources.

## Systems management

Leveraging the Platinum signal routing capabilities, CENTRIO can

access all of the audio or video inputs in the router frame. The 5RU 72 x 64 router supports up to two multiviewer boards. The 9RU 128 x 128 router supports up to four multiviewers. The 15RU 256 x 256 router supports up to eight multiviewers. And the 28RU 512 x 512 router supports up to 16 multiviewers.

With 16 multiviewer modules installed, the 512-input system can drive up to 32 independent DVI outputs or 64 independent HD-SDI outputs from one chassis. Because CENTRIO feeds the displays directly from the frame, there is no need for stand-alone distribution amplifiers to feed multiple image processors that would supply the monitors. As a result, installation, maintenance and cabling are all greatly simplified.

### Minimizing downtime

When a technical issue arises, the

multiviewer alerts the operator in several ways, including sounding an alarm, giving the problematic picture a flashing red border, making it front and center on the display, sending an e-mail, or any number of responses as defined by the user in the multiviewer's Rules Designer.

The Rules Designer, with alarms customization and technical wizards, prevents lost advertising and subscription revenues from undetected failures. The user can define the conditions under which the operator should be alerted. One alarm condition can also be used to trigger several actions, thereby simplifying the communications process and providing greater flexibility to the system.

### Quality control

Because the router has the ability to take in embedded audio, as well as

discrete audio (not tied to video), the multiviewer can display this stereo or surround-sound audio like any other router input, along with a digital audio meter display, for quality control monitoring.

The multiviewer's built-in test and measurement tools don't require dedicated quality control monitors, and the results of signal analysis can be displayed right on the screen.

While the primary target market for CENTRIO is the multichannel broadcast facility, other applications can also benefit, including HD production trucks and digital signage. The technology can be employed at any venue that uses multichannel, multimedia displays for more efficient communications and greater visual impact.

**BE**

*Mike Garrido is multiviewer product manager for Harris Broadcast Communications.*

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# Live Earth and EVS

Creating efficiencies saves time, money and the planet.

BY KATHERINE COX

Live Earth was the brainchild of Kevin Wall, an executive producer of the Live 8 concert series in 2005, and former U.S. Vice President Al Gore. Their idea was to bring together big name musical acts, actors, artists and other celebrities who care about global climate change and broadcast their message to the world, raising awareness and inspiring change on a global level.

## The goal

To ensure worldwide access to all of the footage, online streaming of Live Earth was available at [www.liveearth.msn.com](http://www.liveearth.msn.com) the day of the event, and VOD footage was posted on the MSN Web site afterward. The challenge of the Live Earth event was obvious: capturing, tracking, editing and formatting 24 hours of live footage from 10 locations around the world quickly and efficiently, while simultaneously providing streaming video of all of the events and preproduced material.

A separate tab on the Web site was dedicated to each of the 10 concert locations. Streaming public service announcements and other information about climate change played before each concert began.

The resulting workflow needed to be able to manage a full online broadcast service, including concert feed ingest; manage delay feeds for different time zones; support preproduced footage for playback online; allow for fast and easy post production, including easy creation of clips for VOD purposes; and convert file formats of all material for seamless movement from source to Web server.

## The workflow

To meet the needs of the workflow,

six EVS six-channel SD XT[2] servers controlled by seven IPDirectors, along with three XFiles with MediaXchange, were used to ingest the two feeds from each location, as well as a world feed. Throughout the event, the system was used to record on average 24 feeds with 12 playback channels.

Before each concert, preproduced material was broadcast from the servers through Incited Media's live encoders and to the Web sites for each of the locations online at [www.liveearth.msn.com](http://www.liveearth.msn.com) so that no city's specific tab at the site was ever playing black. This



For the Live Earth Concert, seven IPDirectors were used to streamline the clip-making process.

preproduced material included special content for each city, with Live Earth short films, information about global warming and tips on how to affect change locally.

All preproduced content was delivered to the site as DV QuickTime files. Using XFile and MediaXchange, the content was flipped from DV to IMX and loaded to the servers for creating the custom preshow loops running for each city.

After completion of each concert at a given location, the digital video server was used to play a loop of that concert on the location's Web site until the rights expired, at which point viewers could view specific songs, artists, backstage footage and celebrity interviews on-demand.

To create this on-demand footage, logging stations were used during the show to create clips of each song or

speech, from Blue King Brown's first song to Gore's closing-night speech. Loggers also grabbed a frame from each clip to use as an icon for the clip's placement on the Web.

The servers recorded material using the IMX codec. Files that didn't need to be converted were sent directly to the Rhozet encoding farm prior to delivery to MSN's Web server.

## Efficiency created

Going tapeless shortened the list of required machines for this kind of project, making the workflow more manageable than in previous years. Fewer machines meant less required energy, from an electrical standpoint as well as a human standpoint, freeing up time and energy for the involved staff to use on other aspects of the show. Taking tapes out of the workflow and requiring less electricity reduced the amount

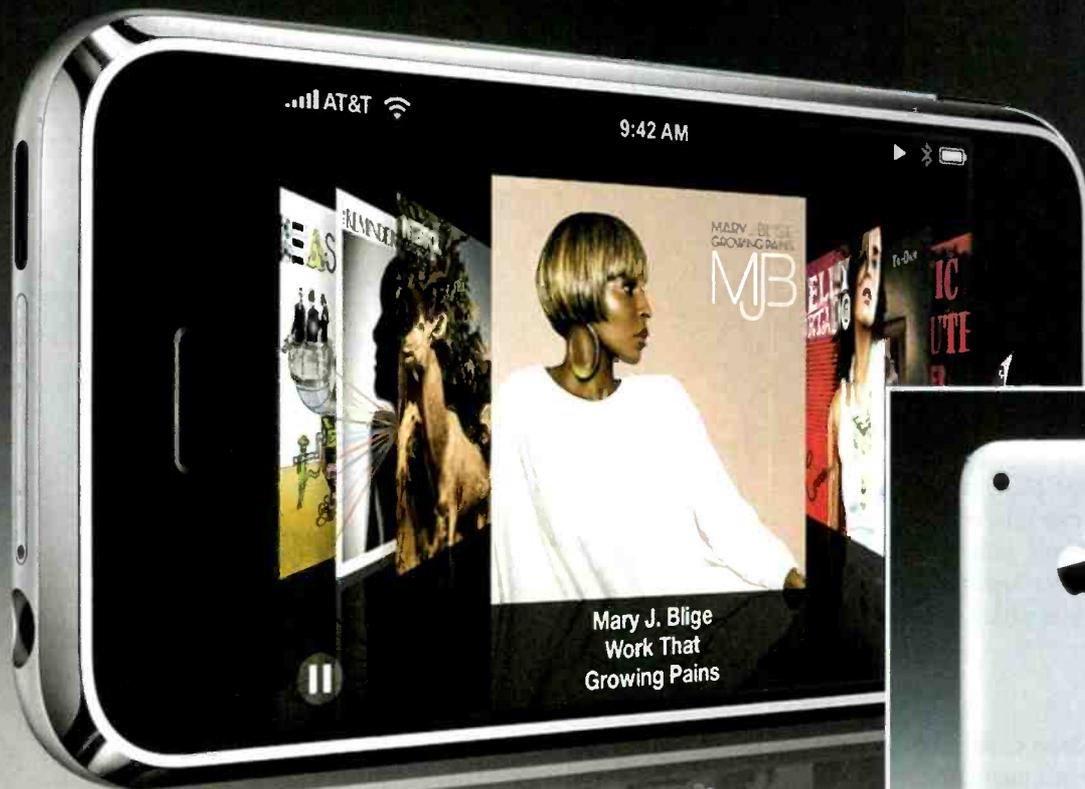
of waste that the project produced, which helped the engineers stay true to the ideals of the Live Earth broadcast.

The XT[2] server provided reliable and instantaneous ingest of each feed so that no footage was lost. Delay feeds were easy to manage from time zone to time zone. The IPDirector streamlined the clip-making process and allowed loggers to snag a frame from each clip without any problems. XFile and MediaXchange allowed producers to convert files between formats easily and effortlessly.

Online hits topped 30 million streams the day of the event. At least 8 million people tuned into the Live Earth Web site to watch the live shows on the day of the event, and millions of others are expected to view the on-demand footage now that the concert is over. **BE**

Katherine Cox is sales and marketing assistant for EVS Broadcast Equipment.

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# FlipFactory and Launch

The Telestream products allow Azteca America to automate news workflow and streamline delivery.

BY MARCO A. RIVERA

**A**zteca America is the fastest growing Hispanic network in the United States, providing programming to 60 affiliates in major Hispanic markets across the country. Last year, we were asked to produce local news for some of the affiliates in Texas and Nevada. We already had the production facilities at our NOC in California. However, we needed a solution to quickly and efficiently move content between locations for newsgathering as well as news delivery back to the local stations.

## The solution

Important selection criteria included the ability to automatically integrate with our news systems, provide important VC-1 and MPEG-2 format support, and meet our tight delivery deadlines. After looking at expensive satellite and fiber solutions, we turned to Telestream and local reseller Key Code Media, who tailored an Internet delivery solution to meet our exact needs at a fraction of the cost. We purchased and deployed Telestream's FlipFactory server-based workflow automation application and multiple Launch personal IP media delivery software licenses to provide the workflow solution we needed.

Local reporters now capture and edit news stories on laptops outfitted with a wireless card, Avid editing software and Telestream media delivery software. The laptop setup provides ultimate flexibility in terms of being able to send a reporter anywhere there is breaking news. Launch software allows us to submit all types of news pieces, including B-rolls, sound bites and full tracks. Material can be submitted from any location that has an Internet connection, and transmis-



Cameraman/editor Jose Salvador Rico edits a local news story.

sion costs run about \$50 per month.

The editor simply exports a QuickTime reference file to the media delivery folder. Launch automatically

transcodes news content to SMPTE VC-1 at 2Mb/s and transmits media via the Internet directly to a FlipFactory server at our NOC.



Avid technician Aldo Necco monitors incoming news feeds on the FlipFactory server at the Azteca America NOC.

We use VC-1 encoding at 2Mb/s because we've found that this combination is the sweet point in terms of quality and the amount of time it takes to send a news story. VC-1 is important because it provides full-resolution interlaced video, which looks very good on television. Below 2Mb/s, the video breaks up. At 2Mb/s, a full two-minute news story takes about 10 to 12 minutes to send to our broadcast server ready for air, making it the perfect bit rate for news.

FlipFactory provides the glue between the outside world and the inside world at our NOC. Everything that is delivered to the station via the Internet automatically goes through the workflow automation server. Telestream's enterprise-class system is completely wide open and cross-platform, supporting automatic transcoding and file transfer between virtually any format and device. FlipFactory is a

workhorse; we've never had to power it down.

We use the same workflow automation system to deliver material out from our NOC. Once local news stories are produced and ready to air, they are sent to FlipFactory for encoding to MPEG-2 at 5Mb/s. Files are automatically delivered to the affiliates' FTP servers for direct insertion into the playout server, ready to air. Higher-speed Internet lines are used for delivery back to the affiliates to avoid bottlenecks. A 22-minute program is delivered in just 16 minutes.

**File-based delivery works**

We're doing things today that a few years ago would only have been done by the very large networks. Next-tier networks like Azteca America are now taking advantage of the same technologies and workflows. We prefer file-based delivery over satellite or video

feeds because files carry metadata, making them ready for direct delivery to our server system. Plus, files enable the process to be completely automated. Low-cost media delivery applications enable independent videographers and reporters to inexpensively submit stories to the networks — the majority of which already own FlipFactory for automated ingest.

Turnaround of news programs has been quick and cost-effective. For the affiliates, it saves money because the technology is here to centrally produce the news stories. We provide all of the same advantages as centralcasting. Why build multiple newsrooms today when you only need one? Add Internet delivery, and you have a news workflow solution that is fast, reliable and inexpensive.

**BE**

*Marco A. Pivera is the chief technology officer at Azteca America.*

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# Production switchers

Today's systems process lots of bits, real fast.

BY JOHN LUFF

It is interesting to note that video switchers are not sold as digital switchers anymore. Today, it's assumed that all switchers are digital, but of course there are several factors driving that change in production technology.

## The difference is the software

Years ago, when Abekas was still selling innovative digital production switchers, I commented on how building complex digital system products must be expensive. An Abekas executive admitted that, in reality, it was easier to build a digital switcher than an analog one. He said that the final test of a digital switcher was a matter of burn-in to get rid of infant mortality and then a verification that the hardware worked. The result was a significant reduction in labor cost, though perhaps an increase in R&D cost. Only a cursory system test was needed after each board was checked in a test jig, which exercised all of the software.

Analog switchers required complex and detailed manual setup of a myriad of adjustments, but digital switchers either worked flawlessly or they didn't. Or perhaps more accurately, the software worked repeatedly, or it didn't.

My point is that digital switchers are just as complex as analog switchers, but the adjustments to the operation of the switcher are made at the time the software is written and tested. There is no shortness of flaws, or bugs, in any software system. When parts of the system are written in DSP code, as is the case in most modern switchers, the manufacturer must test extensively for the quality and technical accuracy of the computations done on a large amount of data, every second.



**Broadcast Pix's Slate HD switcher includes all the functions of a control room, including monitoring, CG and clip store. Its file-based architecture streamlines workflow.**

Think about the amount of data that must be processed. Let's say a switcher has four sources on-screen simultaneously, and let's assume that only 40 percent of each picture contains active pixels on the composited screen at any one time (taking into account keys and picture manipulations). The output picture would

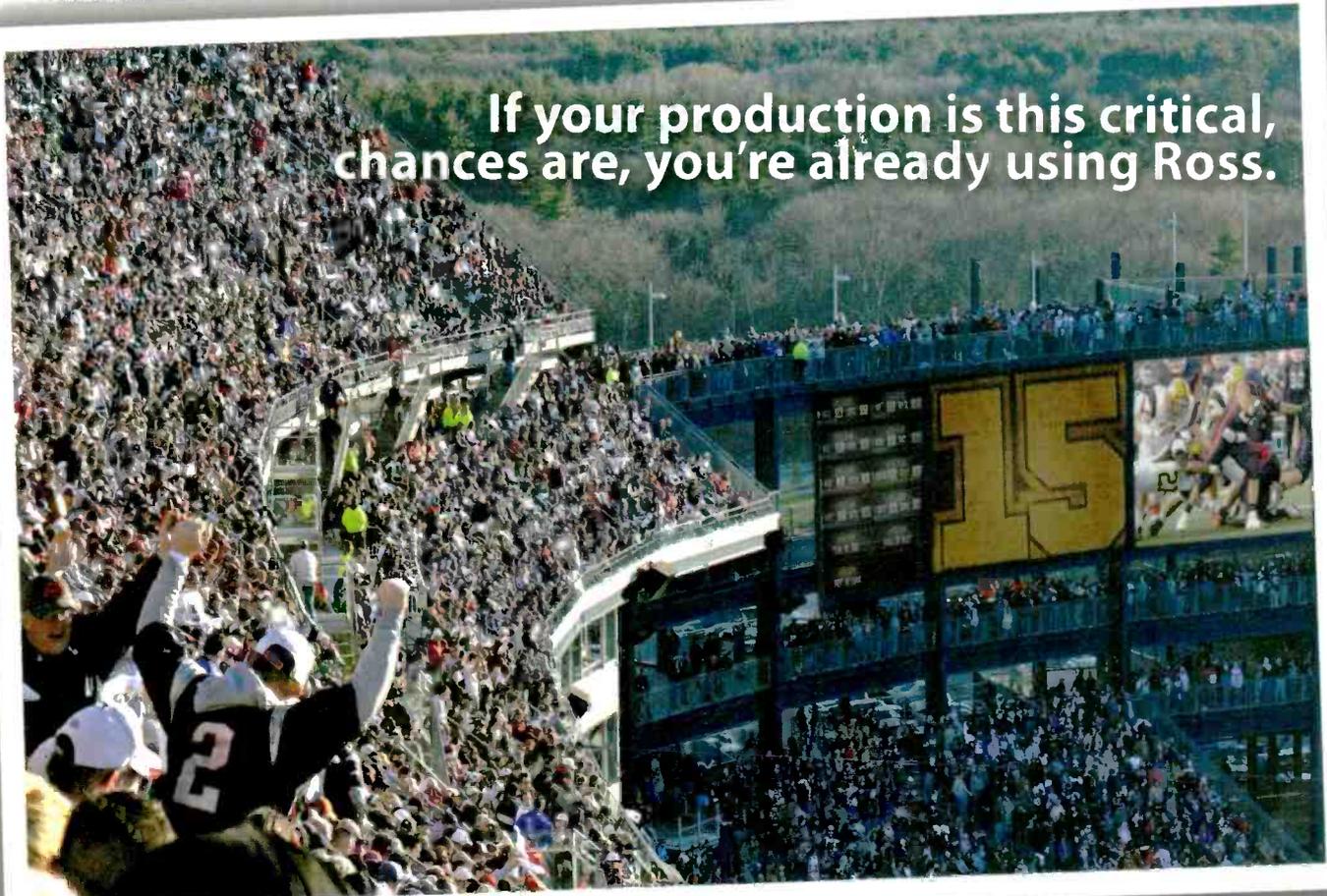
contain less than 2Gb/s of content and be made from input streams totaling less than 5Gb/s. If each output pixel requires five calculations total, which is easily the case with layered effects, the total calculation capability of the system must be in the neighborhood of 6 billion operations per second. In reality, the number of individual operations done is far greater, with deserializing inputs, processing data in parallel and formatting of the output stream each requiring many operations.

Of course, with the capabilities of modern processors, this should be a piece of cake. Put enough processing

**Today, it's assumed that all switchers are digital, but of course there are several factors driving that change in production technology.**

power in the loop, and you can jam almost any number of inputs into a production switcher and perform an arbitrarily large number of calculations needed to manipulate each source in the output stream of bits.

However, there is a fact that must be taken into account. Production



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Ross Video designs, markets, manufactures, and supports a wide range of innovative products for use in broadcast, distribution, live event and production applications. Ross products are found in over 100 countries and are used 24 hours a day, 365 days a year to produce and distribute video and audio signals. [www.rossvideo.com](http://www.rossvideo.com)

  
Live Production Technology™

switchers are isochronous devices (i.e. real time), and the latency of the system must be constrained to low values to make practical use of live sources in a production. Most modern switchers process the full signal path in one video frame, about 33ms. One input or 10 on the screen cannot change this latency, or the system will not work in a real-world implementation.

In practical terms, this would not be possible without specialized hardware processors. Each input is serialized in real time with low latency, and each process must equally be done in a short time period. Manipulations that change the picture size or geometry, often out-board processes called digital video effects, are now inboard processes done sometimes on boards with that function alone.

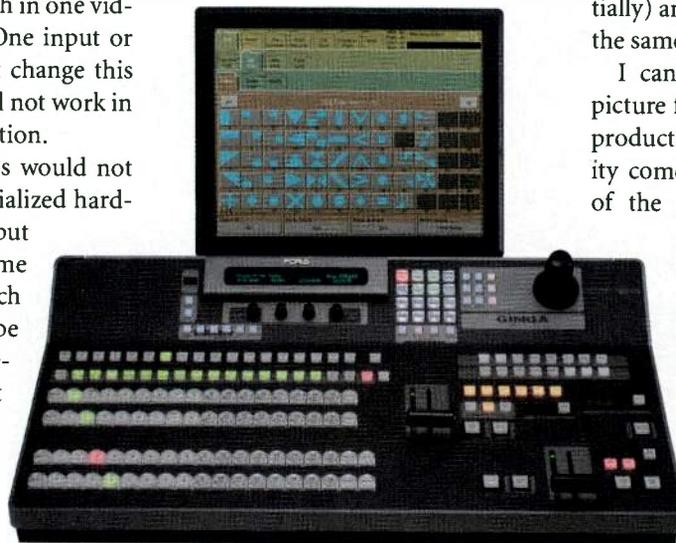
Keys and other pixel-level manipulations are done in DSP, operating at truly astounding speed. Even more amazing to me is that many processes must happen in a series, stacking up calculations and shortening the available time period to produce the final output pixels.

### Supporting software

Behind all of this must be two other supporting software systems. One real-time system moves the data from processing element to processing element, and must do so with tight tolerances, considering that each pixel is less than 1ns long. To provide a reference, light moves about 8in per nanosecond.

The other software system can virtually loaf in comparison, for it controls the operator interface and coordinates communication between the control panel and the processing engine(s). That system is fast enough if it can reliably move commands from the real-time control panel to the processor fast enough to make a cut happen on the next frame after

the button is pushed. The shortest time period for this synchronization of operator interface and processing power is between 1ms and 16ms, dur-



**FOR-A's VPS-715 GINGA 1.5M/E video production switcher enables multilayer, multi-DVE production. All inputs include a frame synchronizer that enables asynchronous input.**

ing which time perhaps a million pixels or more could be processed to the output of the switcher.

### Today's capabilities

The best news is that this technology has been available for a generation and has gotten steadily better.

small measure because digital interfaces for HD signals weren't available. Current products offer HD or SD capabilities, and more than one manufacturer offers processing of (essentially) any input format, SD or HD, in the same output stream.

I can clearly see a trend toward picture format agnostic processing in production switchers. This capability comes quite naturally as a result of the special purpose scaling engines that are available in so many products today, from HD/SD format converters to aspect ratio converters and up/downconverters. Scaling engines are modest cost options in cameras, VTRs, frame synchronizers and other devices. Modular products occupying one or two slots in a card frame can now perform scaling and format conversion that once took many boards in expensive special purpose hardware.

### The Holy Grail

The logical conclusion is that product differentiation will lead to increasingly flexible capacities in switchers and long-term reductions in cost. At some point in the future,

**At some point in the future, the Holy Grail of a blade server, which performs the functions of a production switcher, will be achieved, but for now, it seems out of reach.**

One of the first all-digital production switchers, the Thomson Grass Valley Kadenza, was introduced 20 years ago. It required parallel digital connections (SMPTE 125M) but offered some innovative approaches, such as either a layer approach or a more conventional mix/effects orientation. Over the past 20 years, the cost has come down, and the capability has gone up. The Kadenza was 525/625 only, in no

the Holy Grail of a blade server, which performs the functions of a production switcher, will be achieved, but for now, it seems out of reach for practical and affordable baseband real-time production switchers. **BE**

*John Luff is a broadcast technology consultant.*

**?** Send questions and comments to: [john.luff@penton.com](mailto:john.luff@penton.com)

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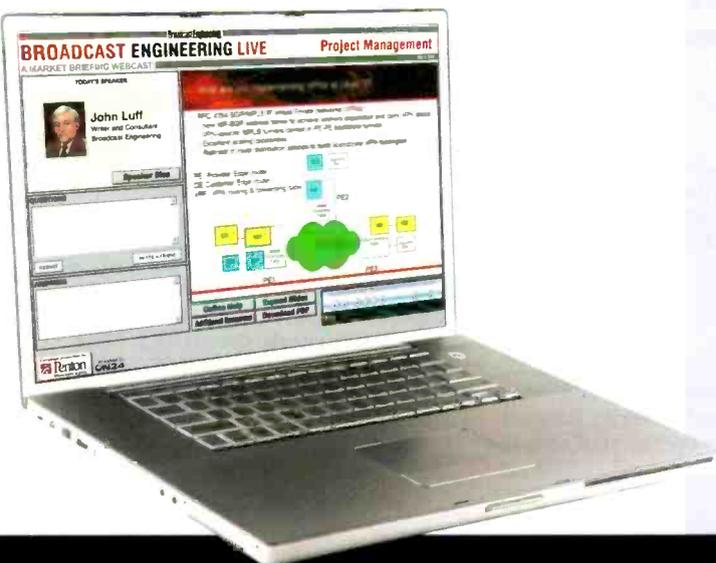
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Archive system provides double fault-tolerant RAID 6 protection of stored program material; features more than 700 hours of program storage at 12Mb/s; has two input channels with frame sync (bidirectional) and four outputs: two dedicated and two bidirectional; provides SDI and composite video on inputs and outputs; offers redundant power and cooling; includes DV, TARGA graphics, file trimming, advanced playlisting and as-run logs.

**818-735-8221; [www.360systems.com](http://www.360systems.com)**

### Express

### Abaltat

Soundtrack composer provides video editors with the tools to compose and arrange a soundtrack; leverages the interface, workflow and composition engine of the Muse software; enables user to drop a QuickTime file into the software, set the parameters for composition and quickly generate a soundtrack, which can be refined through adjustments of keyframes on the timeline; exports projects as .AIFF, .WAV or MIDI files.

**+353 91 504 688; [www.abaltat.com](http://www.abaltat.com)**

### MAGIC TH2 POTS

### AVT



Intercom system provides basic and advanced functions for digital telephone hybrids; incorporates two POTS line interfaces; features analog and digital AES3 audio interfaces with separate sample rate converters, front keypad, graphical display and configurable GPIO contacts; analyzes and displays calling numbers via implemented clip functionality.

**+49 911 527 10; [www.avt-nbg.de](http://www.avt-nbg.de)**

### VADIS Remote Source Assignment

### Klotz Digital

Workflow module allows the studio console selection of remote router sources in the same manner as local sources; provides the communication between a mixing console and central router; router sources are assigned to the console on a need-to-use basis.

**678-966-9900; [www.klotzdigital.com](http://www.klotzdigital.com)**

### QMaster

### QTV

IP-based prompter is part of the QNxt product suite; uses IP architecture and comprises a software application on the control PC, which communicates over an Ethernet link with a highly compact QBox unit to scroll the script; enables operation of remote prompters from a central location.

**212-929-7755; [www.qtv.com](http://www.qtv.com)**

### HDLink

### Blackmagic Design



A full HDTV resolution monitoring converter for DVI and HDMI monitors; includes the quality of 4:4:4 SDI video, lookup tables via USB and analog audio outputs; connects SDI video directly to any supported DVI-D based LCD computer monitor for HDTV resolution video monitoring; the new HDLink Pro model introduces 3Gb/s SDI for high-resolution 2K film monitoring when connected to a large 30in DVI display.

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**[www.blackmagic-design.com](http://www.blackmagic-design.com)**

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### 8VSB Cricket

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Video-quality and service assurance troubleshooting tool detects and decodes 8VSB signals, providing remote verification of the RF and MPEG transport stream layer, as well as the quality verification and troubleshooting of the video and audio payload; tunes to any UHF/VHF channel; supports SD/HD over SPTS and MPTS.

**866-464-4636; [www.ineoquest.com](http://www.ineoquest.com)**

### Pixel Promo DJ

### Pixel Power

Multichannel branding graphics generator automatically imports data from the station's traffic system and uses the graphics system to build promotional page sequences based on predefined templates; manages an entire network of Clarity graphics devices to create an automated, multichannel branding solution; creates appropriate graphics sequences from program junctions and adjusts on the fly for time requirements.

**818-333-5055; [www.pixelpower.com](http://www.pixelpower.com)**

### SeriesONE

### Brightline

The family of energy-efficient lighting provides high-quality performance and reliability in a format designed specifically to work with a wide range of digital cameras, including the latest HD models; available with one, two or four lamps; feature compact, 55W, advanced-phosphor lamp formulations and a variety of dimming-control options, including phase, DMX and DALI, with linear dimming to 3 percent; fixtures come with horizontal or vertical yokes and diverse racking options, allowing for varying profiles and beam patterns.

**412-206-0106; [www.brightlines.com](http://www.brightlines.com)**

### cineweb

### cinegy



A 2.0-enabled Web client that allows users to remotely access their cinegy media archive database securely from anywhere at anytime, using a standard PC or laptop, via a regular Internet connection; enables users to search, browse, select and rough edit their content in Windows Media format.

**202-742-2736; [www.cinegy.com](http://www.cinegy.com)**

### 7460

### Ensemble Designs

Fail-safe protection switch for critical digital paths for broadcast or satellite applications; supports SD-SDI, HD-SDI and DVB-ASI signals; detects TRS, black, silence and freeze for HD and SD signals; detects signal presence, program packets, PMT, PAT and PIDs for ASI signals; detection specifics are user-programmable.

**530-478-1830**

**[www.ensembledesigns.com](http://www.ensembledesigns.com)**

### CCU-PRO26 Clark Wire & Cable



Multicore camera cable connects a video camera to its remote CCU through 26-pin connectors; features less attenuation on the coaxial cables; offers 24AWG conductors on the audio pairs to ensure maximum signal transfer.

847-949-9944; [www.clarkwire.com](http://www.clarkwire.com)

### 2K/HD/SD PCI Express BlueFish444

Uncompressed SD/HD video cards for the Windows XP, Mac OS X and Linux operating systems; used in broadcast and feature film solutions for editing, animation, compositing and digital intermediate applications.

866-314-7785; [www.bluefish444.com](http://www.bluefish444.com)

### Playback Crystal Vision



Replay device plays back 25 seconds of HD or 150 seconds of SD video at a lower price than hard drive alternatives; used with a video switcher, constantly records until operator intervenes, making the last 25 seconds of recorded HD video immediately available for replay; features industry-standard software products on the board to work the video switcher, with the switcher working as the control panel.

978-262-0063; [www.crystalvision.tv](http://www.crystalvision.tv)

### 700MHZ DR Filter

### Dielectric Communications

Stringent mask band pass filter provides a cost-effective solution for broadcasting in the mobile media market; exhibits less than 0.6dB of integrated insertion loss over the band; provides up to an 800W power capacity in a rack-mountable, compact design.

800-341-9678; [www.dielectric.com](http://www.dielectric.com)

### Color Resolution Chart

### DSC Laboratories

Camera color resolution chart consists of a series of zone plates in different color combinations and resolution gradations; the unique pattern is designed to challenge the capabilities of the latest HD and digital cinema cameras and lenses.

905-673-3211; [www.dsclabs.com](http://www.dsclabs.com)

### V-Series Desktop Clear-Com



Desktop unit for the Eclipse Digital Matrix provides advanced digital signal processing for increased control over audio routing and mixing; the compact and contemporary design features gooseneck or headset microphone and a large but low-profile loudspeaker and quick fingertip control with 12 lever keys, eight shift pages, up/down level control, and a keypad for telephone dialing and quick menu access.

510-337-6600; [www.clearcom.com](http://www.clearcom.com)

### MediaVault Digital Broadcast

Archive system features blue laser technology that provides up to 50TB of media storage and a high-speed searchable index based on file metadata; allows archived material to be played at any access-granted desktop computer.

352-377-8344; [www.digitalbroadcast.com](http://www.digitalbroadcast.com)

### Optilinx OLX-3000 Opticomm

Optical switching platform switches digital signals up to 4.25Gb/s with any of its 144 ports, all housed in a compact 4RU chassis; also available in a 288-port version in an 8RU chassis; provides high-speed switching between ports with minimal effect on overall network latency.

800-867-8426; [www.opticomm.com](http://www.opticomm.com)

### BT-LH1760 Panasonic

LCD production monitor uses a new In-Plane Switching panel with 1280 x 768-pixel native resolution; features a 120Hz refresh rate, enabling the monitor to handle fast-motion content and minimizing image blur; equipped with a built-in waveform monitor and vectorscope that display all picture lines for signal level monitoring; features an array of input/outputs to support virtually any production task, such as DVI-D input and two auto-switching HD-SDI/SDI inputs.

201-392-4127

[www.panasonic.com/broadcast](http://www.panasonic.com/broadcast)

### CarbonHD 1.2 Digital Rapids



New version of HD/SD DDR offers integrated HD/SD format conversion; supports both uncompressed video and hardware-based JPEG2000 compression in both lossless and lossy modes; integrated software features a new streamlined user interface for managing capture, clip trimming, playlisting and playout.

905-946-9666

[www.digital-rapids.com](http://www.digital-rapids.com)

### MegaKeyMD Echolab

Clip player/mixer/keyer can serve as a networked storage device for animated graphics and video clips; accepts both HD and SD inputs; features a two-channel internal mixer and internal linear keyer to support playout of dynamic video clips; fully integrated with the company's Overture switcher series to support complex animated transitions through the switchers' Stinger feature.

978-715-1020; [www.echolab.com](http://www.echolab.com)

### VN-V686U JVC Professional

IP network camera features 36X optical zoom lens, silent direct drive for faster and more accurate PTZ functionality, full-frame, dual-stream JPEG/MPEG-4 at 30fps, auto-tracking function that detects and tracks a moving object, image stabilization, IR cut filter that provides higher sensitivity and AC 24V power.

800-525-5308; [www.jvc.com/pro](http://www.jvc.com/pro)

# NEW PRODUCTS

## NEW PRODUCTS & REVIEWS

### HD-SDI to HDMI Scaler **Gefen**

Scaler enables a direct connection between SD and HD-SDI sources with embedded audio to an HDMI display; supports both single- and dual-link modes; outputs HD resolutions to 1080p along with multichannel digital audio in the HDMI format; features an intuitive on-screen menu for an easy selection and retrieval of preferences, also available through the RS-232 connection.

800-545-6900; [www.gefen.com](http://www.gefen.com)

### iCap **EEG**



Real-time IP caption link uses IP connections to improve audio quality, establish a more secure caption environment, provide extensive monitoring services and create a framework for smooth caption operations; completely compatible with pre-existing captioning software packages; the system's flexibility allows it to be run on the same computer as those packages, or on a separate computer connected through a serial port.

516-293-7472; [www.eegent.com](http://www.eegent.com)

### E-frame **Elma Electronic**

Open access test chassis can support up to 21 slots at 0.8in or 17 slots at 1in pitch; features front-accessible test points and monitoring LEDs for all VME, VPX, VXS and cPCI voltages, including +3.3V, +/-5V, +/-12V, +/-24V and +/-48VDC; includes three 150CFM fans under the card cage, a rear A/C power entry module with fuses and GND stud.

510-656-3400; [www.elma.com](http://www.elma.com)

### MetaMAX LA-5180 **Linear Acoustic**

Metadata frame sync generator accepts external metadata via industry-standard RS-485 input or from the VANC space of an applied HD-SDI signal; analyzes and regenerates this metadata to keep it consistent and error-free.

717-735-3611  
[www.linearacoustic.com](http://www.linearacoustic.com)

### Omega HD **Fast Forward Video**

DVR records either SD or HD video with high-quality JPEG2000 compression up to 100Mb/s; the recorder allows users to simultaneously record, play and store multiple SD and HD video files and create video clips, loops and playlists using the simple-touch front-panel controls; ideal for many applications including graphics and key fill, station automation, spot insertion and sports/instant replay; uses standard removable SATA drives; offers accurate frame control via RS-422 or Ethernet using standard control protocols.

800-755-8463; [www.ffv.com](http://www.ffv.com)

### AS-2MD **Eyeheight**

Multidefinition audio shuffler simplifies the task of reassigning embedded audio channels within an HD-SDI or SD-SDI feed; a second input allows embedded audio to be extracted from one feed and added to alternative video from another; enables audio breakaway of any source if installed on an HD-SDI router; a preview output allows users to set up the system with live feeds before taking the configuration to air.

866-469-2729  
[www.eyeheight.com](http://www.eyeheight.com)

### R-44 **Edirol**

A compact, four-channel, solid-state field recorder; uses SD or large capacity SDHC cards as the storage media, enabling quiet and reliable recording; weighs less than 3lb, including batteries; users can get up to four hours of recording time using four NiMH or alkaline AA batteries; captures up to four channels of uncompressed audio with selectable bit depths of 16-bit or 24-bit and sampling frequencies of 44.1kHz/48kHz/88.2kHz/96kHz/192kHz (192kHz stereo mode only).

800-380-2580  
[www.rolandsystemsgroup.com](http://www.rolandsystemsgroup.com)

### PowerCon **Neutrik USA**

Locking three-conductor AC connector system features contacts for line, neutral and pre-mating ground; is designed for high-power distribution systems and supplies for professional audio and lighting broadcast equipment; consists of two connectors — a chassis receptacle and an inline cable connector with locking mechanism.

732-901-9488; [www.neutrik.com](http://www.neutrik.com)

### EOX **Evertz**



Router accepts digital signals from 19.4 (SMPTE 310M) through SDI, ASI, HD-SDI and up to 3Gb/s; sports a fully modular, hot-swappable, redundant design, independent monitoring bus, SNMP interfacing, advanced system control and source-by-source intelligent autoconfiguration; scalable to 576 x 576 in a single 26RU frame; enables input and output expansion in steps of 18.

905-335-3573; [www.evertz.com](http://www.evertz.com)

### DIVArchive 6.1 **Front Porch Digital**



New enhancements to content storage management system include multiple parallel transcode support, rebuild damaged data tape functionality, DIVArchive components running as services, Storage Plan Manager enhancements, LTO-4 tape drive support, IBM TS3550 library support, and partial restore of Harris Leitch AVI DV-25 and Matrox IMX50.

303-440-7930; [www.fpdigital.com](http://www.fpdigital.com)

### CTT6800+ **Harris**

Compressed transport transceiver uses mezzanine-level JPEG2000 compression to transport baseband media signals over an ASI link carrying an MPEG-2 transport stream; allows users to efficiently use available bandwidth for transmitting broadcast-quality video, audio and data while maintaining post-production quality levels; when coupled with the IPA6800+ module, the CTT6800+ allows efficient transport of HD signals over IP networks.

513-459-3400  
[www.broadcast.harris.com](http://www.broadcast.harris.com)

### CapTC-50

Horita



Multi-frame-rate time code reader allows SMPTE time code to be captured and ingested along with camera or other video in Apple-, Avid- and Adobe-based video editing systems incorporating an RS-422 machine control I/O port; responds such that the editing system thinks it is controlling and reading time code from a VCR deck; the time code values from the CapTC-50 are then recorded along with the video signal input into the editing system, adding a SMPTE time code time stamp to the recording.

949-489-0240; [www.horita.com](http://www.horita.com)

### SILVER

Hybrid MC



Robotic camera head supports cameras up to 12kg for multiple applications; can be used with tripods, cranes or wall mounts; eliminates video and audio delay; available in a range of configurations suitable for simple robotic camera applications to high-end virtual set broadcasting.

+33 1 46 73 00 66  
[www.hybrid-mc.com](http://www.hybrid-mc.com)

### MassStore

Masstech

Asset management suite gives broadcasters the ability to centralize storage, move data, distribute people and processes, and search for content across multiple broadcast facilities; allows asymmetrical propagation of assets between multiple MassStore systems; enables decentralization or centralization of storage shared dynamically among all facilities; offers simplified asset searching of all locations, including tape libraries, nearline cache or video servers from a Web browser.

905-886-1833; [www.masstech.com](http://www.masstech.com)

### 4212

Image Video

Ethernet-enabled GPI I/O interface is designed for TSI-1000; provides a higher density with 48 I/O in 1RU and 80 I/O in 2RU; features momentary output control for pulsed applications.

416-750-8872; [www.imagevideo.com](http://www.imagevideo.com)

### UHF RWED-516-U

Jampro



Four-port directional filter/combining unit can be used either as a mask filter or as a constant impedance-combining module for high-power UHF broadcasting; features the high isolation of traditional constant impedance technology but achieves elliptical response without external coupling mechanisms; filters are temperature compensated for close-space combining applications.

916-383-1177; [www.jampro.com](http://www.jampro.com)

### Sonarae

The ISIS Group

Audio monitor allows the operator to listen to the audio, without distortion and without changing it in the process; offers an input mode selector for up to eight AES/EBU data streams or 16 individual audio channels, which allows the user to switch from the main AES/EBU inputs to STEM recorder preview inputs or to an external tone generator; features a set-up, learn and clear function, along with 5.1, 6.1 and 7.1 surround sound stereo mix down selectors; allows the operator to store custom stereo mix-down formats that are available for recall at any time.

888-622-4747; [www.isis-group.com](http://www.isis-group.com)

### Final Effects Complete 5.0 for After Effects

Boris FX

Effects package update adds support for Adobe Creative Suite 3.0 After Effects running on Apple's OS X Leopard and Windows Vista; offers a modernized workspace for optimal effects creation; features contextual tools and onscreen widgets that streamline the effects workflow and multiprocessor acceleration that increases FEC performance by 30 percent; includes more than 800 preset effects.

703-462-1640; [www.borissfx.com](http://www.borissfx.com)

### RFX-PMR-II

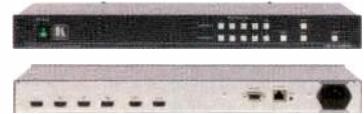
RF Central

Portable digital receiver is available in both SD and full HD configuration; designed for easy and quick setup for ENG and field applications; weather-resistant for broadcasts during adverse climate conditions; accommodates FCC channel plans in conjunction with the BAS Relocation Project; offers manual or preset channels with tuning in 0.25MHz steps; capable of receiving frequencies between 1.990GHz and 2.500GHz; when configured for HD, supports 1080i and 720p formats in addition to SD modes.

717-249-4900; [www.rfcentral.com](http://www.rfcentral.com)

### VS-42HDMI

Kramer Electronics



Matrix switcher offers signal optimization and EDID data capabilities; compatible with all HDTV signal types; can route any or all inputs to any or all outputs simultaneously; supports HDCP; allows the output device to describe its capabilities to the HDMI source, providing the VS-42HDMI with key information about the monitors connected to the outputs; captures the output device's EDID information and stores it in nonvolatile memory.

888-275-6311; [www.kramerus.com](http://www.kramerus.com)

### ATE-1000

KTech Telecom

Signal automated test equipment generates necessary signals to test burst noise, signal combiner, field ensemble data, 8-VSB with phase noise, single static echo, D/U cochannel interference, D/U adjacent-channel interference, 1aboo channel rejection, power measurement using spectrum analyzer and 8-VSB RF dynamic range.

818-773-0333  
[www.ktechelecom.com](http://www.ktechelecom.com)

### Ultimate 2575C

OConnor

Fluid head is designed for cameras up to 90lb; features OConnor's stepless, smooth pan-and-tilt fluid drag specifically designed for film-style shooting, as well as its sinusoidal counterbalance system for accurate balance at any point in the tilt range; a collapsible counterbalance crank handle and numerical readout are designed to make repeatable counterbalance easy.

818-847-8666; [www.ocon.com](http://www.ocon.com)

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**NEW PRODUCTS**

NEW PRODUCTS & REVIEWS

**Avalon Graphite Traveler K-Tek**



Boom pole is constructed with lightweight, high-density carbon fiber; extends 22in to 7ft 8in; features captive collet locking system within collar; available unwired or factory wired with a high-quality internal coiled cord and male XLR receptacle mounted in the base.

760-727-0593; www.mklemme.com

**PS-RM-48V Telemetrics**

Camera robotics power supply delivers 250W/500W of power to operate multiple 48V camera robotics devices, which can effectively reduce the number of power supplies required for complex camera robotics configurations; is a rack-mount power supply; delivers more power over considerably long distances; using the PS-PA-48V power adapter, up to three pan/tilt heads (and attached peripheral devices) can be powered from a single power supply.

800-424-9626  
www.telemetricsinc.com

**iTX Edit OmniBus Systems**

Editing system is tailored to the demands of news and sports applications, with an emphasis on speed and ease of use; eliminates the need render the finished edit before it can be taken to air, as the playback engine can render the EDL in real time, with vision and audio effects, stills, and captions.

303-237-4868; www.omnibus.tv

**Maestro Orad Hi-Tec Systems**

HD/SD 3-D character generator provides dynamic scene blending that allows the triggering of multiple graphic scenes at the same time; can take completely different scenes that are independent from one another and assemble them on the fly using a single payout channel; incorporates real-time 2-D/3-D graphics and animations along with multiple streams of full-res video insertions and multiple video clip playbacks; supports commonly used formats, such as AVI, QuickTime, DV, DV25 and MPEG.

201-332-3900; www.orad.tv

**TeleSight MiraVid**

Multi-image processor allows quality assurance testing of up to 24 channels simultaneously; displays all mission-critical information, including multiple audio channels, closed captioning, VChip ratings and Copy Guard data; customizable to check for audio silence/clipping, video freezes/blacks and loss of signal; supports HD/SD, NTSC/PAL, H.264, MPEG-4 Part 2, MPEG-2 and MPEG-1.

905-927-7724; www.miravid.com

**TP-RGB-1000 MultiDyne**

UTP Cat 5 link transports RGB/UXGA and stereo audio over more than 1000ft of UTP Cat 5, 5e and 6 cables; supports UXGA resolutions of up to 1600 x 1200; includes automatic equalization and anti-skew technology; the anti-skew feature permits video transmission over inexpensive data grade twisted pair cable; expensive non-skew cable is not required; the receiver unit has a daisy-chain or repeater option; one RGB/UXGA source can be daisy-chained to multiple monitors.

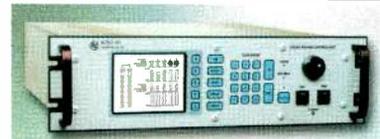
800-488-8378; www.multidyne.com

**Warehouse Web Version 2.0 NETIA**

Broadcast and display platform is designed for Manreo users; allows users to centralize, share and view audio, image, and video archives, and then broadcast them across multiple distribution channels (Web portals, mobile devices, ADSL, etc.); uses the Representational State Transfer (REST) architecture; includes XML Web services; offers up to four easy-to use interfaces.

888-207-2480; www.netia.com

**UCP-L MITEQ**



Uplink power control unit offers the Earth station operator/designer control of the full L-band bandwidth of 950MHz - 2150MHz; the RF signal path uses internal bias tees and diplexers on the center conductor to provide both DC and 10MHz through path in the attenuator, allowing the user to pass the 10MHz reference signal and DC bias from a modem through the UCP-L out to a block upconverter.

631-436-7400; www.miteq.com



**magnum**  
TSG

**HD Test Signal Generator**

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<p><b>Engineer Version</b></p> <ul style="list-style-type: none"> <li>● 20 SD and HD Standards</li> <li>● 40 Test Signals including Moving Zone Plate*</li> <li>● Lip Sync Test</li> <li>● Keyboard Entered Idents</li> <li>● VITC Generator*</li> <li>● Tri Level Sync Outputs</li> <li>● Audio Tones</li> </ul> <p><small>*Specific to Engineer Version</small></p>	<p><b>Facilities Version</b></p> <ul style="list-style-type: none"> <li>● 20 SD and HD Standards</li> <li>● 8 Simultaneous Signals*</li> <li>● Lip Sync Test</li> <li>● Keyboard Entered Idents</li> <li>● 4 Simultaneous Standards*</li> <li>● Tri Level Sync Outputs</li> <li>● Audio Tones</li> </ul> <p><small>*Specific to Facilities Version</small></p>
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**Help Wanted**



NEP Broadcasting, the largest remote television engineering and facilities provider

in the world, is seeking Mobile Unit Engineers of all experience levels to manage and monitor mobile unit broadcast operations at remote sites, perform preventative maintenance, trouble-shoot, execute changes and engineering updates on the mobile unit. Degree, training, 3+ years experience in broadcast technology, equipment, facilities, and production or any combination considered. Maintenance engineering background a plus. Please send resume and salary history to NEP Broadcasting LLC, [hr@nepinc.com](mailto:hr@nepinc.com). An Equal Opportunity Employer. [www.nepinc.com](http://www.nepinc.com).

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- Output: DVB-ASI and/or IP (UDP/RTP)
- 1080i, 1080p, and 720p

858-613-1818  
[www.dveo.com](http://www.dveo.com)

Systems PCI Cards Software

**Chief Engineer**

Position requires extensive experience in maintaining & troubleshooting a wide variety of broadcast equipment. Thales Digital and Analog transmitters, remote translators, microwave and studio equipment, Wolfcoach satellite truck, video servers and IT infrastructure, 40 ft. video production truck. Must exhibit an advanced knowledge of electronics, digital technology, networking, computer and network security, station automation, RF systems as well as studio and remote production. This position is part of the senior management team. The individual must be, diligent, dedicated and driven. Must have at least 10 years experience in the maintenance and operation of broadcast RF equipment. Trade school, military training or college degree preferred. Driver's license required, SBE certification or equivalent credentials desired. Send resume to [info@ksbitv.com](mailto:info@ksbitv.com) or fax: 405 631-7367

**Help Wanted**



**TURNER STUDIOS**

Turner Studios, the state of the art HD television complex serving the production needs of the Turner Entertainment Networks in Atlanta, Georgia, is seeking highly motivated, client service oriented Engineers to support our growing facility.

**STUDIO ENGINEERS:**

Provide control room and studio technical support for live and taped network television productions in a fast-paced environment. This position requires troubleshooting of complex television systems, repair and maintenance. Ability to make sound decisions in rapidly changing situations and solve technical problems prior to and during 'air'. Experience in supporting network level live sports productions desired.

**EDITORIAL ENGINEERS:**

Responsible for technical support of Final Cut & Avid Non-Linear Edit Systems, Production Control Rooms, Tape Rooms and Studio equipment as needed, including installation, upgrades, repair and maintenance. Provide hands-on support during live broadcast, studio event, post-production and advanced computer graphics activities.

**EFFECTS ENGINEERS:**

Supporting high-end CGI, Design, Composite and on-air Graphics systems. Multi-OS, IT and related application experience highly desired.

**Qualifications:**

Successful candidates will be motivated self-starters, detail and deadline-oriented team players, with strong interpersonal, communication and customer-service skills. Minimum 3-years industry experience with strong background in television production and / or post-production engineering. Additional high-level experience, particularly in a large television or related organization is preferred. Advanced proficiency with computer systems, television engineering, and key responsibility in previous large scale and/or critical project or role is desired. Flexible work shifts are required.

Please send resumes to [brad.ramer@turner.com](mailto:brad.ramer@turner.com).

For more information, please visit: <http://www.turnerstudios.com>

*Turner Broadcasting is an Equal Opportunity Employer*

**Help Wanted**

TROY UNIVERSITY is a comprehensive public institution serving more than 28,000 students worldwide with its main campus in Troy, AL; three other Alabama campuses in Dothan, Montgomery, and Phenix City; and its University College division with locations in 16 U.S. states, 12 foreign countries and one U.S. territory. Readers are invited to consider Troy for their career move. The following new vacancies are now available:

**TROY: Broadcast Engineer**

For all vacancy announcements and application requirements, visit our web site at: [www.troy.edu/humanresources](http://www.troy.edu/humanresources) Troy University is an AA/EEO employer and encourages applications from individuals with disabilities, females, African Americans and other minorities.

**Director of Engineering & Technology**

Position for small, energetic Public Television station. Coordinate technological support to ensure smooth function of broadcast operations, production support, and computer-based systems; lead our digital transition and the convergence of television and the web. Create and manage budgets, supervise engineering personnel, write equipment grants, serve as part of senior leadership team.

Qualifications: Several years' successful experience in broadcast engineering at a licensed commercial or public television broadcast facility. Accredited training in electrical engineering; SBE certification at the level of Senior Broadcast Engineer; or equivalent combination of education and experience. Direct experience with RF and microwave systems, studio and master control systems, automation systems, non-linear edit systems, cameras and video tape recorders. Excellent communications, teamworking, self-management, and people skills. Highly desirable: BS degree; experience with LAN and WAN architecture; successful supervisory experience; strong writing skills.

Competitive salary and benefits package, excellent quality of life in a small college town.

Send resume with cover letter to [Schapman@BroadReachStrategies.com](mailto:Schapman@BroadReachStrategies.com).

**Broadcast Engineers**

**Innovative Technologies**, based in Chantilly, VA, is seeking TV Broadcast Engineers with Autocad and VidCAD experience designing television and broadcast facilities. We are also seeking an Integration/Project Manager to manage the schedule of various broadcast design and integration projects.

Please see our website ([www.iti-corp.com](http://www.iti-corp.com)) for more information or call Jennifer at 703.322.9400, ext. 127 and send your resume to [jlighburn@iti-corp.com](mailto:jlighburn@iti-corp.com).

**Help Wanted**

**Television Network Engineer**

Ion Media Networks is seeking an experienced broadcast engineer in the network operations center in Clearwater, FL. Duties include the maintenance and troubleshooting of broadcasting systems which include Harris Automation, Omneon servers, and Avid Dekocast and video editing systems. A qualified applicant will also be able to assist in the design and construction of new systems as directed by NOC Engineering. Strong organizational skills are a must to handle system integration with minimal supervision. Certification through the FCC or SBE and 3+ years experience are preferred.

Send resume to:

ION MEDIA NETWORKS, Inc.

Ref: Position

601 Clearwater Park Rd  
West Palm Beach, FL 33401

Fax: (561) 655-7343

Email: [employment@ionmedia.tv](mailto:employment@ionmedia.tv)

**Vice-President, Delivery Systems**

Location: Tokyo, Japan  
Start Date: Immediate (New Position)  
Pay: Market Salary, Stock Options

Description: Partnered with News Corporation, GEO, Celestial Pictures, Star TV, the Government of France, and other leading global media providers, The New Media Group (TNMG) is an IPTV and VOD content delivery company that owns, licenses, and distributes video and music content via a rapidly growing and proprietary IPTV network. TNMG will be the first company in the world to launch a combined IPTV and Community Management Tool product. Its an exciting VC-backed company that services many different customer communities and has been called "Japan's most innovative new media platform" by the Nikkei Sangyo Shimbun.

Responsibilities: Based in Japan, the Vice-President of Delivery Systems will have responsibilities developing managing the company's IP networking, content capture and delivery infrastructure.

Candidate Profile: Ideal candidates will have 8+ years of professional experience in networks and systems engineering, deep knowledge of servers and server architecture, IP and networking is required, and experience with IPTV and streaming technologies, Set-top boxes, and other related technology is highly desired. In short, this is a position for the dedicated networking and IP technology engineering professional.

Visit [www.TheNewMediaGroup.net](http://www.TheNewMediaGroup.net) for details.

Resumes and cover letters to [jrmcgraw@thenewmediagroup.net](mailto:jrmcgraw@thenewmediagroup.net)

**Transmission and Encoding Maintenance Engineer located in Englewood, CO**

This position will support the transmission of STE program services on satellite and terrestrial methods. Will provide daily hands-on troubleshooting, monitoring, project planning and upgrade installations. Associate degree or equivalent from a 2 year college or technical school. Fax resumes to 720.852.5891 or apply on-line [www.starz.com/careers](http://www.starz.com/careers).

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# DTV transition

## In terms of educating consumers, how are we doing?

BY ANTHONY R. GARGANO

**R**egarding next February's deadline, it has frequently been written that consumer confusion abounds and that how it may or may not affect the typical TV household is a continuing enigma. For the average consumer, the alphabet/numerical soup of DTV, HDTV, 720p, 1080i and 1080p does not aid in helping consumers comprehend what is happening.

DTV education is critical in preventing our own industry's version of the Y2K scare. Well, the education has begun. We are now seeing frequent PSAs about DTV, and some stations are discussing the DTV transition as a part of their news magazines or daily shows. Other stations are manning phone banks to answer consumers' DTV questions. Broadcasters, who have the most to lose, seem to be doing an excellent job of educating consumers.

### Coupons

Broadcasters are just one element of the DTV transition patchwork quilt. In January, I decided to walk down the consumer path, apply for my DTV government subsidy coupons and see how I would fair. The initial course was not a rapid one, as it took almost three months for my coupons to arrive in the mail. But perhaps that is because in the first five weeks of the program, there were a surprising 4.3 million requests for coupons. That would seem to make a very positive statement regarding the level of awareness on the part of the viewing public.

One benefit of the delay in mailing was that early on in the program there were not many converter boxes in inventory, and several of the major retail suppliers had not yet filled their store distribution channels. Because all coupons expire 90 days from date

of issue, this delay in mailing was actually helpful.

Now, back to my coupons. My letter contained two credit card-type coupons, an explanatory letter with a brief FAQ and a list containing the names of 34 coupon-eligible

**DTV education is critical in preventing our own industry's version of the Y2K scare.**

converter boxes. Also, conveniently included was a list of eight nearby retailers. IBM, the subcontractor that won the DTV coupon administration contract, has done an excellent job with this part of the program.

### Next, the retail experience

In the letter, my local recommended suppliers included Best Buy, Circuit City, RadioShack and Wal-Mart. I was pleasantly surprised — no, make that downright shocked — at how knowledgeable and helpful each of the clerks were at all four of these retailers I visited.

Acting as unknowledgeable as I could, I peppered each of the clerks I encountered with basic questions. Truthfully, I must admit to a preconceived bias toward expecting mostly inane responses to my questions. But these folks were just great. Their responses were both accurate and helpful. One of them explained the government subsidy coupon program to me and even offered to help me with the application process. Another explained that if I was only planning to use my old analog set connected to cable or satellite and not connected to an antenna, I could save myself the cost of purchasing a converter

box. Wow! A retailer forgoing a sale? I was impressed!

The most common product offering was a Zenith model that retails for \$59.99. Lacking a sale or promotional price, with a \$40 DTV coupon in hand, that's only \$20 out of pocket. From the perspective of a consumer who doesn't want to or perhaps cannot afford to spend the money for a new DTV receiver, this transition is still quite affordable.

The real story here is that these retail stores are where the rubber meets the road. It's only at retail stores that consumers actually get to speak face to face with someone regarding the DTV transition. That person-to-person contact makes retailers the most influential element in this entire process.

### Other resources

The 888-DTV-2009 hotline is helpful if you don't mind the typical game of telephone menu bingo. There may be a path to talk to a real person, but if it is there, it's not readily apparent. The NAB's [www.dtvanswers.com](http://www.dtvanswers.com) and the NTIA's [www.dtv2009.gov](http://www.dtv2009.gov) are both informative, but again there's a lack of interpersonal touch.

### So, how are we doing?

Let's go back to my original question: How are we doing? I think we're doing pretty good. We're going to wake up the day after the DTV switch, and the lights will still be on — on those television screens. Broadcasters are responding. Federal agencies and our industry associations are responding, but most of all, retailers are responding. We owe you one. **BE**

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

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