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JULY 2006

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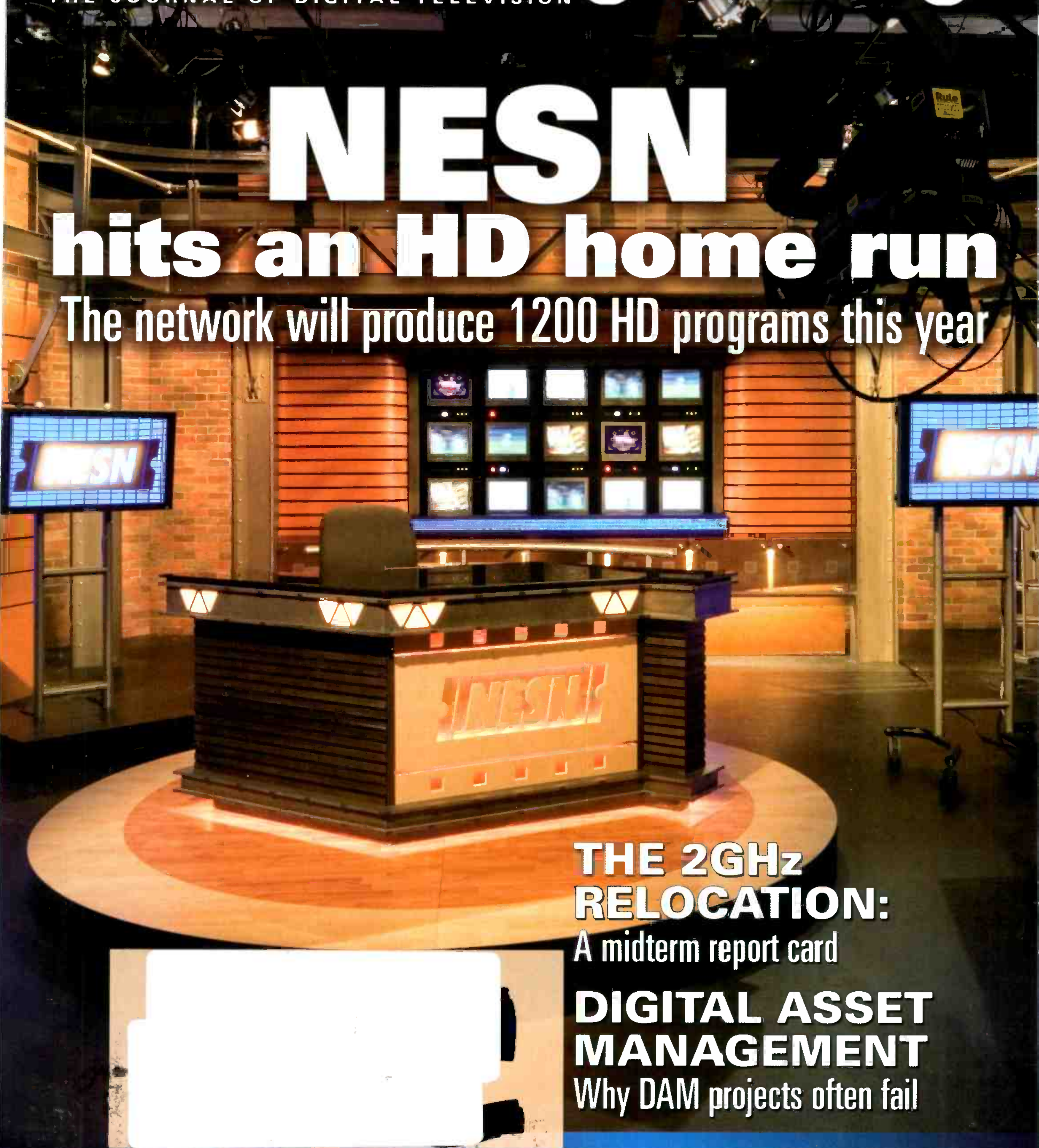
THE JOURNAL OF DIGITAL TELEVISION



NESN hits an HD home run

The network will produce 1200 HD programs this year

THE 2GHz RELOCATION:

A midterm report card

DIGITAL ASSET MANAGEMENT

Why DAM projects often fail

A Prism Business Media Publication

D-12: Compact Enough for OB
Powerful Enough for Breaking News

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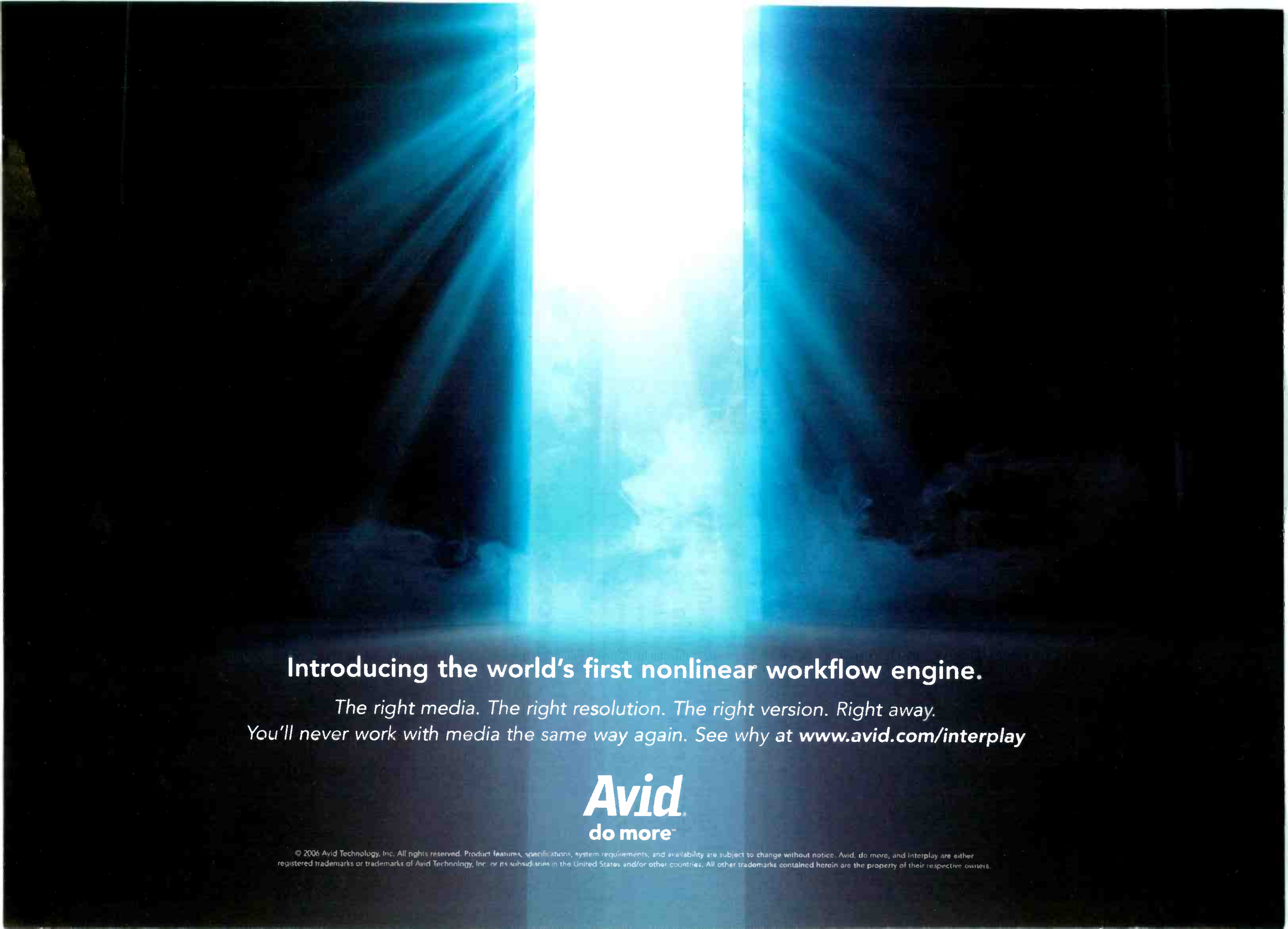
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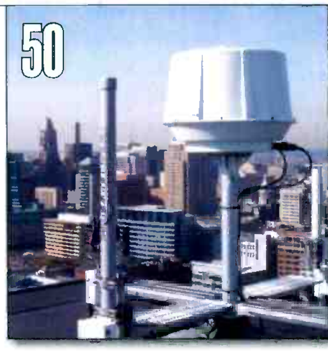

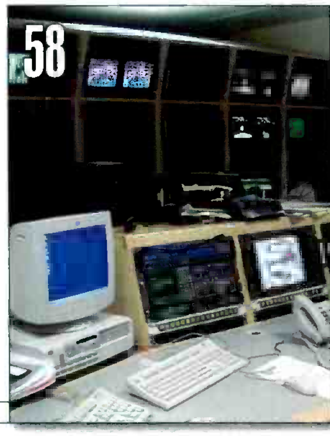

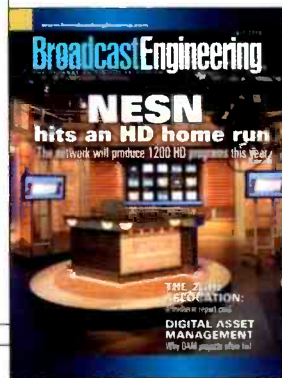

BEYOND THE HEADLINES

DIGITAL HANDBOOK

ON THE COVER:

The New England Sports Network (NESN), home to the Boston Red Sox and Boston Bruins, recently completed a new state-of-the-art facility that will allow it to produce all in-house programming in HD. Photo by Dave King.

(continued on page 8)

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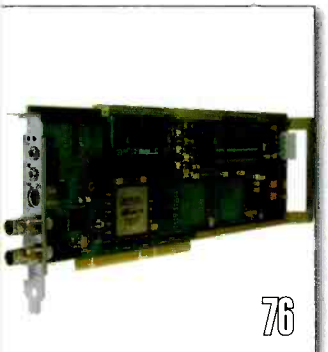
Systems Design & Integration



New Products & Reviews

Departments

Freezeframe

Name the seven layers of the OSI protocol.

This question is answered in chapter six of Al Kovalick's new book, *Video systems in an IT environment.*

Readers submitting winning entries will be entered into a drawing for *Broadcast Engineering* T-shirts. Enter by e-mail. Title your entry "Freezeframe-July" in the subject field and send it to: editor@prismb2b.com. Correct answers received by Sept. 1, 2006, are eligible to win.

March Freezeframe

Q. What is another common name for a bidirectionally predictive-coded picture?

A. B-picture

Winners:

Tim Costley, David Driessen, John Harris, Art Noto, Roger Wilcox, Robert Yent

Let me service pack you

Have you ever installed an upgrade service pack on your computer? How'd it go? Perhaps like me, less than perfect. After installing Microsoft's SP2 on my Media Edition computer, the printers stopped working properly. Even with new drivers, every print job waited 45 seconds before it would start.

Never cured the problem. Shortly after the printers died, so did the hard drive. Even a $400 clean-room inspection couldn't recover any of my data. Was the service pack the culprit?

Sony recently had to upgrade the software in a series of new televisions. Consumers discovered that after the TVs had run 1200 hours, they couldn't be turned off. The company had to send Flash memory sticks to 18,000 customers to fix the problem. Expensive.

Thankfully, there's now another way to upgrade the software in your TV set remotely. A company called Update Logic has proposed what it believes is a better way to upgrade software in televisions. Hidden on each local PBS station's VBI will be data that the set maker can use to change your TV's software. The idea is that Update Logic can deliver and install software updates to millions of DTV sets at a fraction of the cost and time to send out Flash cards. The company claims it will reduce manufacturers' costs and "increase the reliability of digital televisions."

What I'm missing is how updating the software in my TV set makes it more reliable. Sounds to me like the set makers aren't too sure about how this whole analog switch off is going to go come Feb. 17, 2009. We know the analog sets will go dark. But, what if the digital ones quit too?

Maybe the set makers are afraid that all hell will break loose if over-the-air ATSC doesn't work for millions of viewers. At least this way (maybe) they've got a back door way to jimmy the TV sets, hoping to make them work — at least a little bit.

But, what if this whole upgrade thing is much more ominous? What if the set makers have a larger agenda? Sony could use the software download to insert subliminal messages on its sets that say, "You need to buy a new Sony TV. Spend lots of money."

What if RCA wanted to make your set obsolete? Your HDTV may only be two years old, but now it's 2007 and the company wants you to buy a new one. Instead of using a subliminal message, maybe RCA just gradually reduces the display resolution from 1080 lines to 480 lines or adds some jitter to the picture.

A set maker could secretly reprogram all sets more than two years old to suddenly begin having reception or display problems. With a software tweak, the TV set could begin randomly changing channels or the volume becomes erratic, going up and down.

What if someone hacked the system software and was able to turn all TV sets to a specific channel — or to turn them all off? Suddenly, without warning ... America's television sets go dark. No audio. No video. No "24" or "CSI" or "American Idol."

No TV! Hmm, on second thought that might be an upgrade I could go for. BE

Brad Dick

editorial director

Send comments to: • editor@prismb2b.com • www.broadcastengineering.com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T CHANCE OF RAIN, POSSIBLE THUNDERS
VERTIGO XSTATION
XSTATION
PLAYLIST CONTROL

Behind the VEIL

Editor:

I enjoyed your April 2006 editorial "Behind the VEIL."

I'm sick of the hysteria of Hollywood and the music industry. Recently, some music I had legally downloaded and paid for was destroyed when my computer crashed.

Unfortunately, I didn't have the music backed up, and the transferred files would not play without the "licenses," which I never was able to figure how to move to my new machine.

What did I lose? Some 1940s big band music. I can't even remember the artists' names, but the owners weren't cheated of their 2-or 3-cent cut, no sir!

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The missing link

Editor:

Most of your articles relating to manufacturers' products contain a Web site link. However, these links are generally to the home page of the manufacturer's site, not the specific product, causing me to spend an untold amount of time searching the site for the product.

Many times — no, most times — the product cannot be found at all, leaving me frustrated and vowing to never visit the site again.

If the current methods are dictated by advertisers' demands, it may behoove you to point out to them that today's busy professionals are seeking targeted information and are not, in fact, engaged in an impulse shopping spree through Wal-Mart.

In my estimation, it would be a great benefit to your readers if the link would actually bring up the product page of the item in the story or ad, instead of squandering my time.

TOM INGLEDEW
LONG RUN PRODUCTIONS
MINNEAPOLIS

Editorial Director Brad Dick responds:

I understand your position. However, sometimes we get the information to you before vendors even update their own Web sites. In other cases, the link you see is the one the manufacturer requests we use. I agree that a general www.xyzcompany.com link can leave you scratching your head as to where the desired information may be hiding on a vendor's site.

Too many clicks

Editor:

Why do your Web developers force us to click on every single article to read your e-newsletters? I liked the old layout, where I could select the first article and have all of the articles available below it. It was an easy way to print and distribute industry news to master control operators who might not otherwise read this material.

At least give me the option to print all the articles at once if I want to; otherwise, my guys are going to waste a lot of time going back and forth looking for articles.

Not everything is better in an all-online environment.

JERRY PAONESSA
ENGINEERING SUPERVISOR
KENS-TV/DT

Editorial Director Brad Dick responds:

Unfortunately, print editors don't have much control over the mechanics of the Web site. However, rest assured, we'll always do our best to enhance the reader's Web experiences.

Unsubstantiated promises

Editor:

In the April 6, 2006, "RF Update" e-newsletter article "Unlicensed devices pose interference threat to DTV, says Hubbard," Robert Hubbard says, "MSTV respectfully submits that the public's spectrum resource should be managed based on facts and engineering science, not on unsubstantiated promises."

Since when have broadcasters cared about their OTA spectrum? Where was Hubbard and MSTV when 8VSB was being picked as the U.S. modulation? Talk about "unsubstantiated promises."

I suggest that broadcasters lost all credibility as to their concern over their OTA spectrum when they let special interest steamroll the choice of 8VSB in Congress and at the FCC.

Let other people use this spectrum as much as possible. The little interference that it causes is nothing compared to the reception problems of 8VSB.

When broadcasters advocate for a change in modulation and codec so that they can have the best tools to use with their OTA spectrum, I will take their whining seriously.

BOB MILLER

Test Your Knowledge!

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

Send answers to editor@prismb2b.com


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FUJINON

BEYOND THE HEADLINES

Mobile madness

BY CRAIG BIRKMAIER

What is all the fuss about mobile TV? At NAB2006, the topic of mobile video broadcasting created quite a buzz. The NAB Multimedia World Conference included a full day track, the Mobile Video & TV Forum. As this column related last month, the TV industry is finally realizing that mobile TV is a unique market, with unique programming requirements. It's as if the entire concept of broadcasting to small mobile receivers is a 21st century breakthrough. Haven't these people heard of the Sony Watchman?

Portable TVs have been around since the earliest days of NTSC broadcasts. In 1982, Sony introduced the Watchman fd210, with its tiny 2in B&W CRT display. For the past two decades, pocket TVs cost less than $200, often less than $100. Yet these tiny TVs have been an equally tiny niche of the global market for broadcast TV receivers. Apparently, the ability to pull TV pictures out of the air for free has not been all that compelling.

Then again, with multichannel TV services now in more than 80 percent of U.S. homes, one could argue that pulling free TV from the air is not a high priority for consumers, who now spend hundreds, even thousands, of dollars each year for TV entertainment content viewed in homes, cars, and more recently PCs and cell phones.

Mobile TV isn't new. In 1982, the Sony Watchman allowed consumers to watch NTSC broadcasts virtually anywhere.

Considering the low cost and complexity of an analog pocket TV, it seems relevant to ask if there is really a market for mobile TVs. You'll see them occasionally at sporting events, but it is rare to see them dangling from peoples' necks such as the portable music players that have multiplied like rabbits in recent years. Yet the notion of delivering video content to cell phones, PDAs and notebook computers has gained tremendous currency.

To be fair, NTSC never worked well in mobile environments, despite all of the gull wing TV antennas seen on limos. And critics are quick to point out that watching TV while driving, or even walking down the street, can be dangerous, even illegal.

What we're really talking about when we explore mobile broadcasting's potential is supporting true portability for passengers in cars, trains, boats and so on. The obvious appeal is to reach these viewers while they are commuting, traveling and shopping. It is also important to note that these mobile broadcasts may include a variety of services, such as audio and video entertainment, news and information services, and data services that can be pushed to mobile Web browsers.

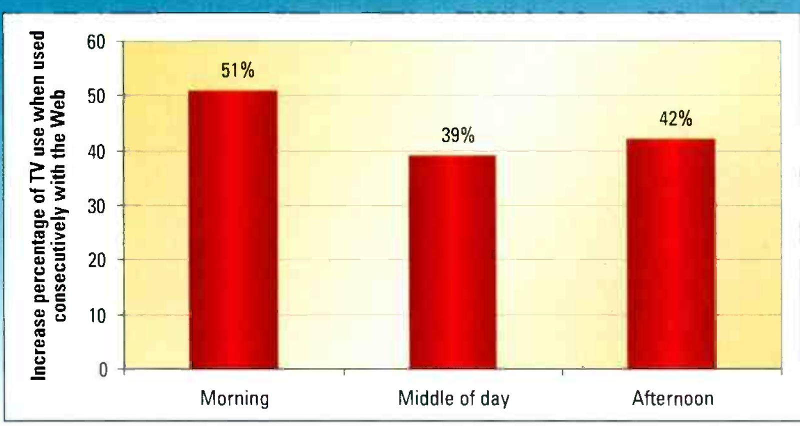
Monetizing the spectrum

Currency may well be the operative word here. Terrestrial U.S. broadcasters hadn't paid much attention to the mobile market. They focused on the fixed receiver market, where Nielsen measures ratings. Only in recent years has Nielsen begun tracking TV

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

Consumers use Web consecutively with TV

Web use increases the reach of TV by 51 percent in the morning



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Nokia has been at the forefront of mobile TV broadcasting in Europe, offering handsets for the DVB-H standard that will be used by Modeo (formerly Crown Castle) and Aloha Partners in the U.S.

viewing away from home in commercial establishments, such as restaurants and sports bars. And U.S. broadcasters have paid little for the use of a valuable public resource. They've enjoyed the use of a broad swath of beachfront spectrum resources without paying hefty fees for its use.

When broadcasters in the United States developed the ATSC digital television standards, the focus was entirely on HDTV and fixed reception. The standard testing configuration was an outside antenna on a 30ft mast. HDTV was to be a service for fixed receivers (for big-screen TVs). SDTV formats were added to the ATSC standard in 1995, just before Congress authorized the service.

But reception and formats are decoupled in digital television. A digital broadcast can carry anything that can be represented with bits — data, audio, video, still images, Web pages, etc. The ability to receive these bits is entirely dependent on the modulation technology and the transmission infrastructure.

While other areas of the world were developing terrestrial digital broadcast standards with the ability to support mobile reception, U.S. broadcasters optimized the ATSC standard for fixed receivers to carry the maximum bit payload for HDTV. Unless things change, terrestrial broadcasters in the United States will be watching from the sidelines as new competitors use the reclaimed spectrum to develop services targeted at the wireless market, such as cellular telephony, wireless data, audio and video.

But this recovered spectrum doesn't come cheap. The demand for spectrum in the UHF bands is intense, due in large part to the improved propagation characteristics of this band relative to the higher frequencies that have been opened up for mobile telephony. Spectrum auctions in the 700MHz band have produced billions in revenue for politicians, who are constantly looking for new sources of revenue. These billions — and the accrued interest on the spectrum investment — must be recovered by the successful bidders, along with the cost of the transmission infrastructures they build, operating costs and profits.

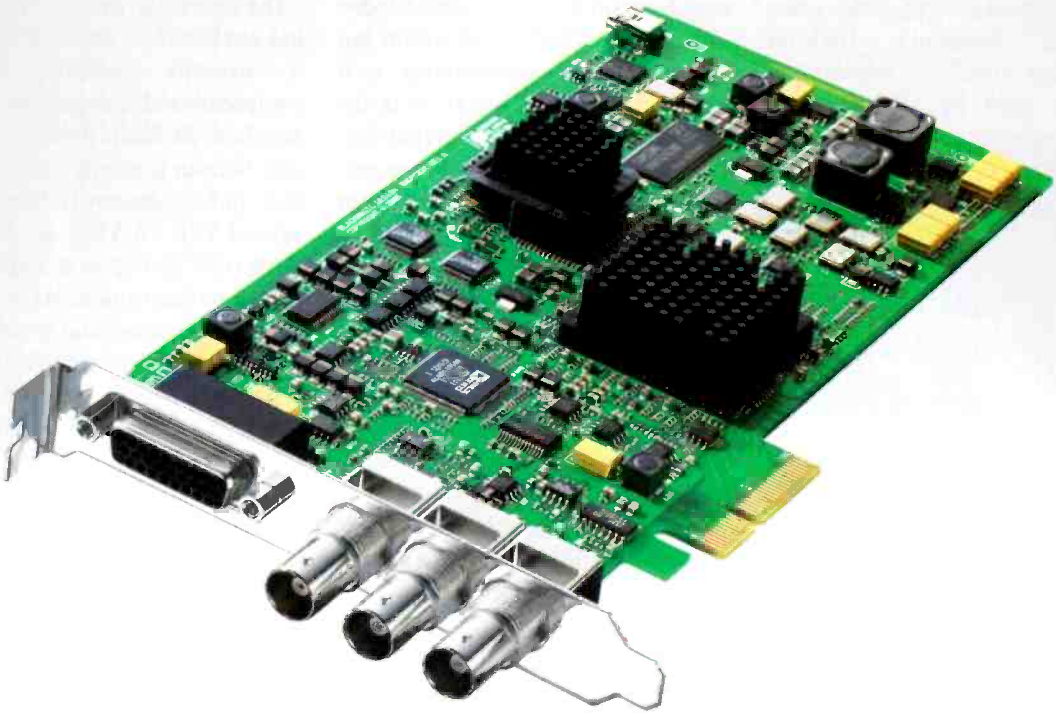
One of the most significant operating costs for a mobile broadcast system is for the delivered content. The ability to collect fees from consumers (monthly subscriptions or per use charges) is one of the primary reasons that the content conglomerates have little interest in enabling existing terrestrial broadcasters to serve the mobile market with "free" advertiser-supported mobile broadcasts. Broadcasters currently lack the transaction networks and customer support infrastructure needed to offer subscription- and fee-based services.

As things stand today, there are three companies vying to serve the mobile broadcast market, two of which have spent billions for small slices of spectrum in the 700MHz band. As the rest of this band is recovered from terrestrial broadcasters, we may see additional entrants. However, much of this spectrum is likely to be acquired by existing cellular operators to expand the currently overtaxed capacity of their networks.

QUALCOMM is building a national network using 6MHz of spectrum currently occupied by UHF channel 55 in many markets. Its MediaFLO subsidiary will operate the network, partnering with cellular operators across the nation to deliver approximately 20 video channels and 10 audio channels to mobile receivers. The system will typically use a single frequency network with two or three medium-powered (50kW) transmitters per market; gap fillers are planned as the system matures. QUALCOMM

Unless things change, terrestrial broadcasters in the United States will be watching from the sidelines.

Blackmagicdesign



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demonstrated the MediaFLO technology during NAB2006.

The MediaFLO technology is proprietary; however, it uses the same Orthogonal Frequency Division Multiplexing (OFDM) modulation techniques used by Digital Video Broadcast-Handheld (DVB-H) and Integrated Services Digital Broadcasting-Terrestrial (ISDB-T). DVB-H was developed in Europe, where it is being deployed in several countries. ISDB-T was developed in Japan and was recently selected by the Brazilian government, though it's not final. South Korea is now delivering mobile broadcasts from satellite using the ODFM-based Digital Multimedia Broadcasting (DMB) standard.

In 1999, this Nokia Mediascreen prototype offered demonstrations of portable and mobile reception of DVB-T at NAB.

In January, Crown Castle Mobile announced a name change to Modeo and plans to build out a national network for mobile broadcasting. Modeo will also use OFDM modulation but will operate at a disadvantage as it owns only 5MHz of spectrum in the 1.67MGHz to 1.675GHz weather-balloon band. The system will use networks of 2kW transmitters to deliver 10 to 12 video channels and 24 audio channels per market.

In June, Aloha Partners announced the formation its HiWire subsidiary, which will use the DVB-H standard for mobile broadcasting. Aloha plans to use 12MHz of spectrum originally purchased for wireless broadband services. As the largest owner of 700MHz spectrum, with 166 licenses in markets with more than 120 million people, including all of California, Nevada and Hawaii and most of Arizona, Arkansas, Ohio, Oklahoma and Tennessee, Aloha may have a competitive advantage in terms of system capacity.

Technology hurdles

Mobile broadcasting faces a number of technical hurdles, primarily related to the receivers that will be used with these services. Current cell phone handsets will need additional demodulators to work with OFDM and larger screens for viewing TV content. Most mobile broadcasts will use QVGA resolution (320 x 240) at 20fps to 30fps.

But the largest hurdle is the increased power requirements for the receiver and display. An additional one to two hours of video viewing during commute time would compete with the battery requirements for cellular telephony and data services. To help minimize power requirements, DVB-H, ISDB-T and MediaFLO technology all use variants of time slicing, so that the tuner is only powered for the portion of time during which the bits of interest are being transmitted.

The interest in mobile broadcasting has not been lost on the ATSC, which is currently evaluating backward compatible technologies for the ATSC standard. At NAB, Rohde & Schwarz and Samsung jointly conducted the first public demonstrations of Advanced-VSB (A-VSB) at the ATSC/NAB DTV Hot Spot. A-VSB was submitted by the proponents to the ATSC in 2005, approved and is currently in standardization process for consideration as an amendment to A/53.

A-VSB is focused at bringing extensibility tools to the 8-VSB physical layer to allow broadcasters new and more reliable terrestrial DTV services in the future, including Supplemental Reference Sequences (SRS) to address the problem of reliable ATSC dynamic reception. A new harmonized method to enable ATSC Single Frequency Networks was also demonstrated based on a new FEC technique (Turbo Stream), which uses Turbo Coding to enable a lower SNR and time diversity to bring new levels of performance in dynamic channels. SRS and SFN Turbo Stream can be used alone or synergistically together. Work is also underway to add time slicing capabilities to enable low-power mobile reception.

It is still too early to determine if A-VSB will allow ATSC broadcasters to get into the mobile broadcast game.

Further development and testing are anticipated over the next year, but it is still too early to determine if A-VSB will allow ATSC broadcasters to get into the mobile broadcast game. The "Web links" for this article include an extensive list of articles and white papers with additional information related to mobile broadcasting. **BE**

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

Web links

Digital Video Broadcast-Handheld
www.dvb-h.org
Integrated Services Mobile Broadcasting–Terrestrial
www.nhk.or.jp/strl/open99/de-2/index.html
Texas Instruments white paper on mobile DTV
http://focus.ti.com/pdfs/wtbu/ti_digitaltvforhandsets.pdf
Nokia Mobile TV Forum
www.mobiletv.nokia.com
QUALCOMM MediaFLO
www.qualcomm.com/mediaflo
MediaFLO technology overview
www.qualcomm.com/mediaflo/news/pdf/flo_whitepaper.pdf
Modeo
www.modeo.com/what.asp

BEYOND THE HEADLINES

FCC cleans up MDS and ITFS service rules

BY HARRY C. MARTIN

In a much-anticipated order, the FCC corrected, clarified and revised most of the miscues that had marred its 2004 decision revamping the MDS/ITFS band. The revisions make the band more commercially viable for the distribution of broadband video and Internet services. The 2500MHz to 2690MHz band had been mired for decades in a mix of channels interleaved for educational service (EBS) and commercial multipoint distribution service (BRS). At the same time, legacy rules and procedures prevented operators from assembling viable bandwidth.

The new specifications

Under the new band plan, the channels assigned to licensees would be shuffled around to create a small core of high-power 6MHz midband channels useable for wide-area video transmissions and two bands of low-power 5.5MHz channels suitable for cellular-type operations. Replacement spectrum for old MDS Channels 1 and 2 and largely unused MDS return channels would create a large swath of prime spectrum in the 2496MHz to 2690MHz band ideally suited for fixed and portable 3G applications.

The problem with the 2004 rules was the FCC ordained that the transition from the old band plan to the new one would be initiated and orchestrated in each market by individual licensees or spectrum lessees. The markets were defined as major economic areas, and they were so vast in size that no one was willing to undertake the financial burden of transitioning a market. Not one market has transitioned in the 19 months since the restructuring was adopted.

The latest order adopts the industry's near unanimous recommendation that transitions occur on a basic trading area (BTA)-by-BTA basis, which will be much more manageable. In addition, the order clarified the following key points:

- Parties have 30 months from the effective date of the new rules to initiate a transition, and the transition must then be completed within 18 months.
- A transition "proponent" may demand reimbursement from the other commercial licensees, commercial lessees of both EBS and BRS spectrum in the market, and from non-commercial EBS licensees who use their spectrum for commercial services.
- Reimbursement of the proponent is due as soon as the transition is complete. However, the FCC established no mechanism for enforcing the payment obligation.
- EBS spectrum leases from educators can last a maximum of 30 years, subject to license renewals during the lease term and subject also to the educator being able to reevaluate its educational needs for the service every five years after the 15th year.
- Build-out requirements were clarified to provide "safe harbors" of service provision levels, which will assure renewal if attained.
- Any decisions about auctioning vacant spectrum have been tabled until the transition process is closer to completion.
- Regulatory fees will be assessed on the basis of market size (in three graduated tiers), and the amount of spectrum will be assigned rather than on a call-sign-by-call-sign basis. BE

The revisions make the band more commercially viable for the distribution of broadband video and Internet services.

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

Send questions and comments to: harry_martin@prismb2b.com

Dateline

October 2 is the filing deadline for renewal applications and EEO program reports for TV stations in Alaska, Hawaii, Oregon, the Pacific Islands and Washington. This deadline also applies to TV translators, LPTV and Class A stations in those states, although translators and LPTV stations that do not originate programming do not have to file EEO reports.

October 2 is the deadline for TV stations in the following states and territories to file their biennial ownership reports: Alaska, Florida, Hawaii, Oregon, the Pacific Islands, Puerto Rico, the Virgin Islands and Washington.

October 2 is the deadline for TV and Class A stations in the following states and territories to place their 2006 EEO public file reports in their public files and post them on their Web sites: Alaska, Florida, Hawaii, Iowa, Missouri, Oregon, the Pacific Islands, Puerto Rico, the Virgin Islands and Washington. LPTV stations originating programming in these locations, which are not required to have public files, must post these reports on their Web sites and keep them in their station records.


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HDTV data multiplexing

BY PETER H. PUTMAN

As we move further into the world of digital television, the spinmeisters are hard at work playing up HDTV as a major drawing card for terrestrial broadcasters, cable system operators and direct broadcast satellite services. "Everyone wants HDTV, and we've got [fill in the blank] channels of it! Compelling movies! Exciting sports action! Special programming! Sign up now!"

It goes on and on. It's certainly true that there is more and more HD content available with each passing month. Of the major networks, ABC, CBS, FOX, NBC, PBS and the soon-to-be-joined WB and UPN all offer film-style and live programs in the 1080i and 720p formats. On the cable and DBS side, you can choose from Discovery HD, ESPN HD, NBA TV, HBO, HDNet, Showtime, Starz, TNT and many other services.

All this is well and good, except there's a small matter of the digital pipeline from the source of the programming (network) and the viewer. That pipe has a fixed, measurable capacity that can't be exceeded. Thanks to MPEG-2 digital compression technology, it's possible to send HD programming down the pipe with excellent picture quality.

But the glass is half full here. One could also say that — thanks to MPEG-2 digital compression technology — it's possible to send HD programming down the pipe with mediocre image quality.

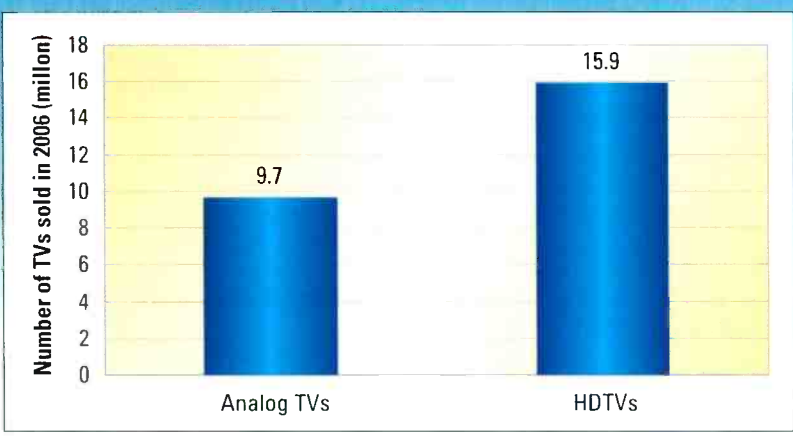
I've watched a lot of HDTV programming since 1999 on a variety of TVs and monitors. Some of that programming has been outstanding, such as CBS' 1080i telecast of the 2003 Grammys, NBC's 2006 Winter Olympics footage, and ABC and ESPN's coverage of the 2006 World Cup.

Unfortunately, some of it has also left much to be desired, such as ABC's early attempts to simulcast Monday Night Football in 720p and 480i. If you are engaged in the production of HD program content, or will be, then you ought to pay close attention to just how many ways your artistic vision can and will be compromised along the way.

FRAME GRAB A look at tomorrow's technology

HDTV will outsell analog TV in 2006

A projected 15.9 million HDTV sets will sell this year



Source: Consumer Electronics Association *www.ce.org*

The digital shoebox

I have taught a course on digital television at every InfoComm show since 1998, and I try to cover a gamut of issues in the two-hour time slot. The topic that always grabs everyone's attention is the concept of signal compression and multicasting — sending multiple program streams in one "channel."

The size of the channel varies from one content provider to another, as well as the signal modulation method. Terrestrial broadcasters transmit DTV programs in a 6MHz channel using 8VSB, while cable companies employ two flavors of quadrature amplitude modulation (QAM) in that same space.

DIRECTV and DISH Network use much larger channels (24MHz and 36MHz) in combination with yet another modulation system, quadrature phase-shift keying (QPSK). A comparison of each modulation system is beyond the scope of this article. But a comparison of the bit rates each can carry is worth a look.

In the terrestrial broadcast system, the maximum data rate is 19.39Mb/s, though in the real world, the ceiling is closer to 18Mb/s. At this data rate, a 1920 x 1080 HD program encoded in a 4:2:0 color space has been packed down by a factor of 55:1, while a 1280 x 720 HD show is delivered with 49:1 compression. These are certainly practical compression factors with good-quality MPEG-2 coding.

But what happens if the broadcaster decides not to fill the channel (or, digital shoebox, as I like to call it)

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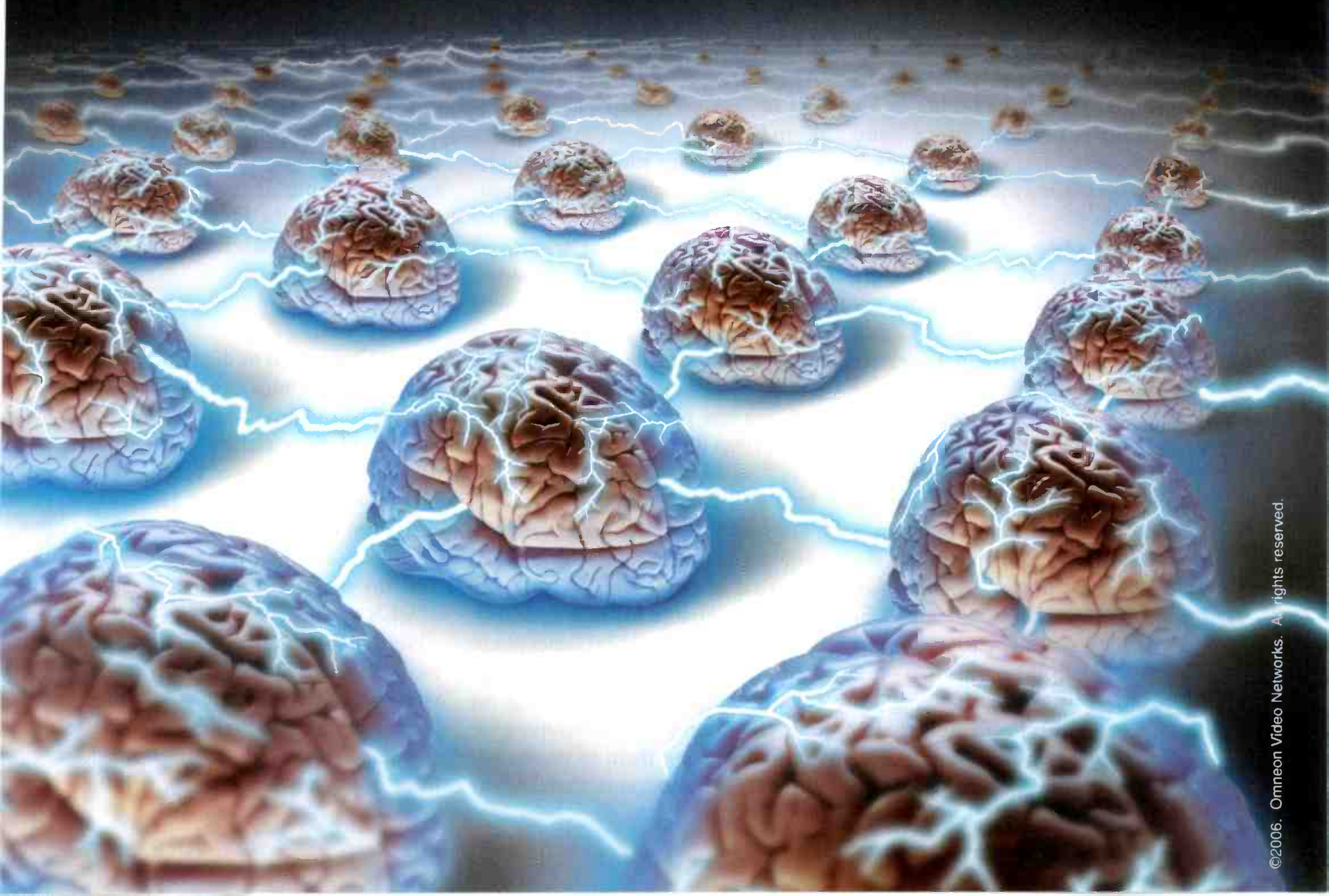


with a single HD program? What if instead the decision is made to send out two or more programs in a multicast, as many TV stations do around the country?

Here's a real-world example. WPVI-DT in my market (Philadelphia) is a local ABC O&O TV station. The WPVI bit stream consists of three programs:

- 6-1 is the HD program stream;
- 6-2 is standard-definition version "talking heads" programming; and
- 6-3 carries a 24/7 weather service.

To jam all of this into the 18MHz terrestrial shoebox means something's gotta give. That something is the bit rate for the HD programs. Typically, that means that 6-1 may now be dropped to 14Mb/s, while 6-2 chugs along at about 2.8Mb/s, and whatever table scraps are left over go to the 6-3 weather channel (around 1.3Mb/s).

How is picture quality affected? For starters, any 720p HD programming on 6-1 has now been packed down by 68:1. The programs on 6-2 shouldn't suffer as much as 3Mb/s is probably the lower limit of what an SD program can withstand (close to the average bit rate of a DVD). As for the weather channel, it's mostly static graphics with a quarter-resolution (360 x 240) video window.

Pack and ship

The cable and DBS worlds aren't immune to this issue, either. By using 64-QAM and 256-QAM digital modulation, cable system operators can choose from maximum data rates of 27.7Mb/s or 38.8Mb/s, respectively. With some judicious bit-rate compression, it is possible to put 10 standard-definition HD programs, each with 2.7Mb/s data rates, in a single 64-QAM channel. Pull out the ol' calculator, and you'll see that two off-air HD broadcasts and a pair of SDTV programs can be packed into a 38.8Mb/s 256-QAM payload.

Satellite services have a bigger problem in that their transponders are expensive to lease or own. So, they also have an incentive to cut the bit rate and keep costs down by offering more program streams in their 27Mb/s channels. For instance, HBO transmits its 1080i HD movies and live programs at 15Mb/s — a 27 percent reduction from the optimum terrestrial bit rate of 18Mb/s — making it easier for satellite and cable systems to add other channels. And there is evidence that data rate may dip as low as 12Mb/s by the time it gets to your living room. 1080i HD is compressed 83:1 at 12Mb/s, while 720p is packed down by 74:1.

High-quality images are a key selling point for HDTV in the United States. Will viewers settle for lower-quality pictures just to get more channels? This remains to be seen.

So, what makes more sense: filling channels with high bit-rate HD programming or adding more channels to the mix and keeping advertisers and subscribers happy? Put yourself in the position of a cable company executive looking at potential revenue streams or a satellite operator facing a stack of bills for transponder space, and you can probably guess the answer to that one.

It's a balancing act

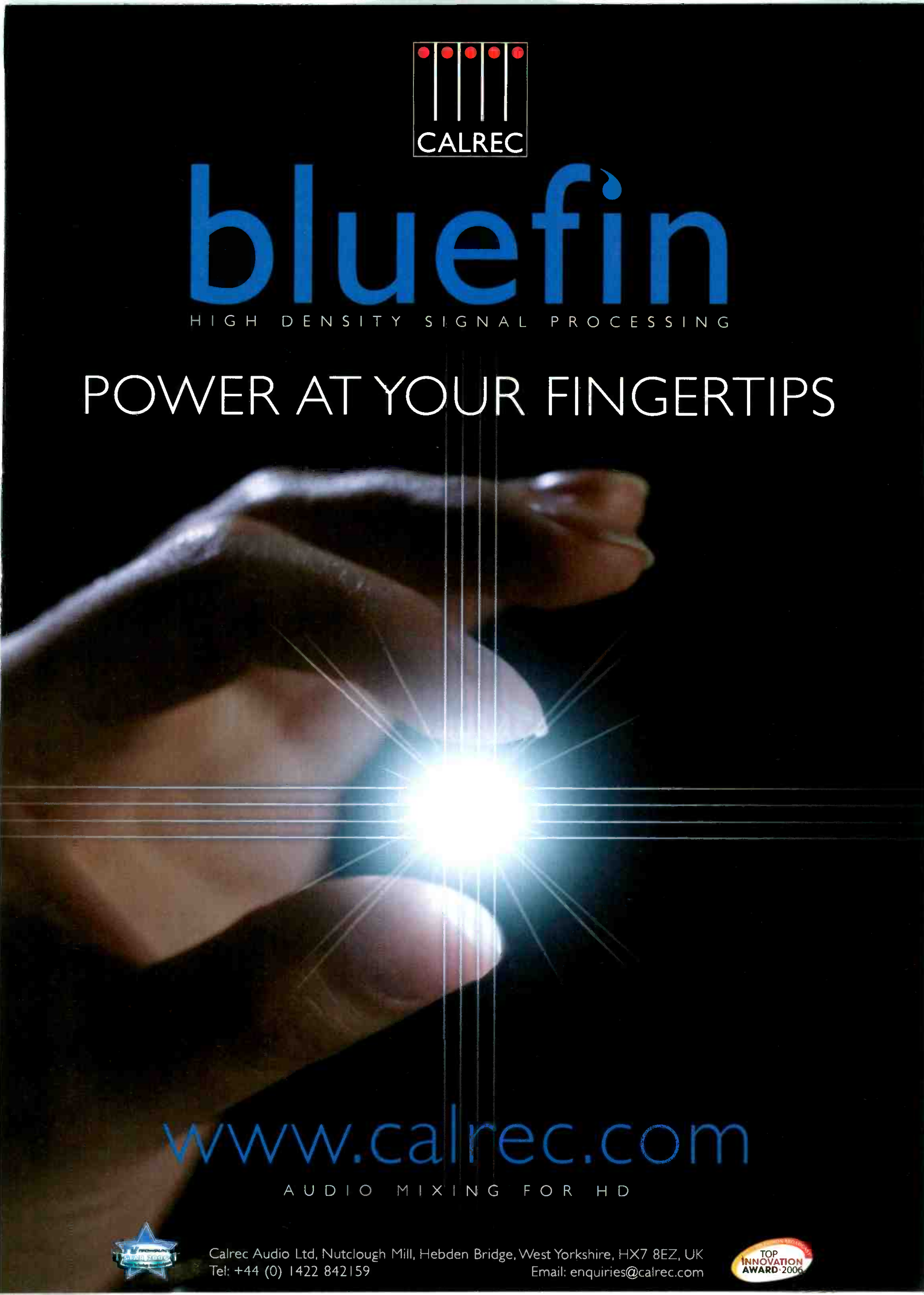
One possible way to get around the problem is to use a technique called statistical multiplexing. That's a $10 word for variable bit-rate encoding. And it requires the MPEG encoder to constantly look at all of its program streams, begging and borrowing (or outright stealing) bits from one program and giving them to another as needed. The programs that, at any given instant, don't have much motion in them lose their bits to the programs that do.

In the WPVI example, the weather service on 6-3 will probably get whacked the most, though with a base data rate less than 2Mb/s, it doesn't have much to spare. So the tug-of-war takes place between the HD and SD programs. Statistical multiplexing is not an easy trick to pull off. An HD program, with spinning graphics, camera zooms and pans, plenty of motion, and fast picture refresh rates (such as Monday Night Football), needs lots of bits. If another program is simulcasting the same action and camera moves, who wins — and who loses?

A way out?

As the transition to digital TV continues, cable companies and satellite operators can and will groom the bit rate of their signals to conserve bandwidth. While two 18Mb/s HD programs can fit into one 256-QAM carrier, so can three HD programs at 12.5Mb/s. Two such programs could also dovetail nicely into a satellite 27Mb/s transponder.

Would the resulting HD images look as good? Nope. Would many viewers notice? Probably not, if they are watching on a smaller HDTV set (screen sizes under 34in). Instead, most of the howls would come from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viewers who have invested in large flat-panel and rear-projection TVs, all of which have a higher native resolution than picture tubes.

One possible solution to the issue is to use a more advanced compression system, such as MPEG-4. This format allows for much lower bit rates, but it has longer groups of pictures (GOPs) and is not part of the terrestrial digital TV broadcast standard.

Another way to solve the problem is to preserve bandwidth for the HD programs and not multicast during certain times of the day. None of CBS' O&O stations are multicasting, and its 1080i HD shows go out nominally at 18Mb/s. Some FOX O&O stations carry one 720p program with bit rates from 12Mb/s to 14Mb/s.

Even PBS stations are experimenting with minimum practical bit rates. Philadelphia PBS affiliate WHYY-TV currently transmits one digital minor channel with 1080i content at 14Mb/s, allocating 4Mb/s to a second SD channel. Earlier experiments with lower bit rates showed diminished image quality with some programming.

As a means of comparison, you can see just how good 1080i HD really looks if you have access to Toshiba's new HD-A1 HD DVD player and a demo disc. The live HD content, shot in the HDCAM format, is encoded at a constant bit rate of 36Mb/s — twice that of terrestrial HDTV, and you can see an improvement in picture quality.

Joe Kane Production's "Digital Video Essentials" also has some amazingly detailed 720p and 1080i sequences mastered from both HD tape and 35mm film formats. All of it was edited and encoded at the D-Theater data rate, and the tapes are a good way to work out your HD-ready monitor or integrated HDTV.

More than meets the eye

The quality of MPEG encoding and the chosen bit rate make the difference between "That's quite a bit better than SDTV" and "Holy Cow!" Both the new HD-DVD and Blu-ray formats will face the exact same problems of balancing bit rate, bandwidth (disc capacity) and cost.

The increasing popularity of large-screen TVs using flat-panel and microdisplay technology will only magnify any encoding flaws. Once viewers see for themselves just how good HDTV can look, they won't settle for less. Will program providers and content distributors rise to the challenge of quality or choose the expedient route of cost cutting in an attempt to add more channels and sell more advertising? Only time will tell. BE

Peter Putman is president of ROAM Consulting.

Network security

BY BRAD GILMER

Network security is an important topic for many broadcasters these days and for obvious reasons. The impact of a breach on our business is potentially disastrous. For this reason, *Broadcast Engineering* recently produced a webinar series in conjunction with Avid Technology and Cisco Systems. One of the webinars in the series focused on network security, a topic I'll discuss further this month.

Overall facility security

It is important to recognize that network security exists in the context of your overall facility security. (See Figure 1.) A security strategy should include four types of security: perimeter, network, server and client.

The strategy should be driven by overall security policies that inform decisions in all of these areas. Developing a security policy can help you create a more cohesive and logical security strategy.

As shown in Figure 1, perimeter security might consist of a firewall between the Internet and the corporate backbone. Network security can employ intrusion protection systems and access control lists (ACLs). Server security might use application access control, user authentication, antivirus scanning, and OS and application patches. Client security may include user authentication, antivirus scanning, and OS and application patches.

Physical security is an important element of your security strategy. Today, access to the core technical areas of most broadcast facilities is limited. It may be useful to determine who has access to these critical areas.

To see how an overall security strategy can be deployed in a typical broadcast facility, refer to Figure 2 on page 30. Most broadcasters use a tiered network approach. The production or on-air core is Ring 1, the enterprise network is Ring 2, and the Internet or the rest of world is Ring 3.

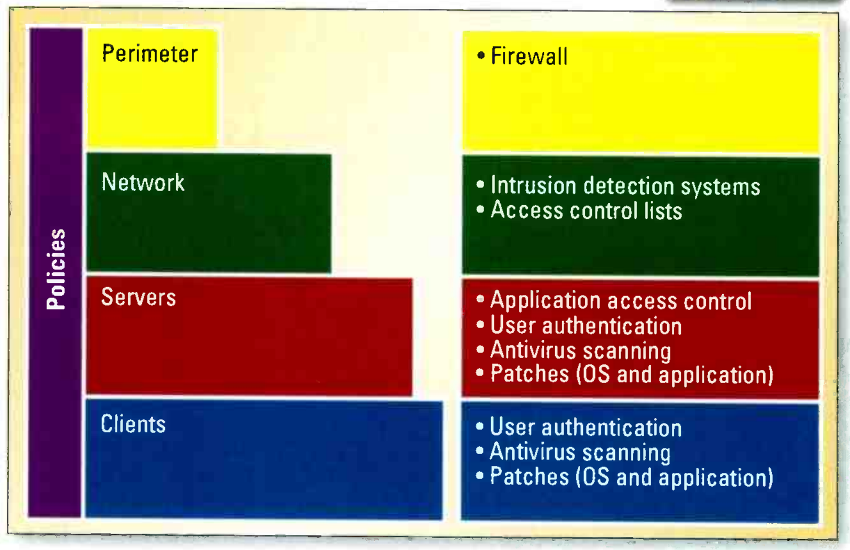

Figure 1. Network security can be divided into areas such as perimeter, network, server and client, all informed by a common policy. (Figures 1 and 3 courtesy Avid Technology and Cisco Systems.)

Firewalls allow permitted communications while denying the bad guys on the Internet access to your internal network.

At the interface points between the rings, security devices are typically employed. For example, at the interface between the Internet and the enterprise network, most organizations use a firewall. The firewall permits or denies traffic based upon previously defined rules and the characteristics of the network communications.

The features and complexity of firewalls can vary considerably, but their purpose is the same — to allow permitted communications while denying the bad guys on the Internet access to your internal network. Similarly, at the interface between the enterprise network and the production and on-air core, a switch/router with ACLs may be employed.

This tiered network approach allows you to deploy different levels of security in different rings. Usually, the highest level of security is required in your production and on-air core.

Intrusion detection and prevention

An intrusion protection system (IPS) can be installed on your network to monitor network traffic and identify suspicious behavior. One of the activities hackers typically engage in before

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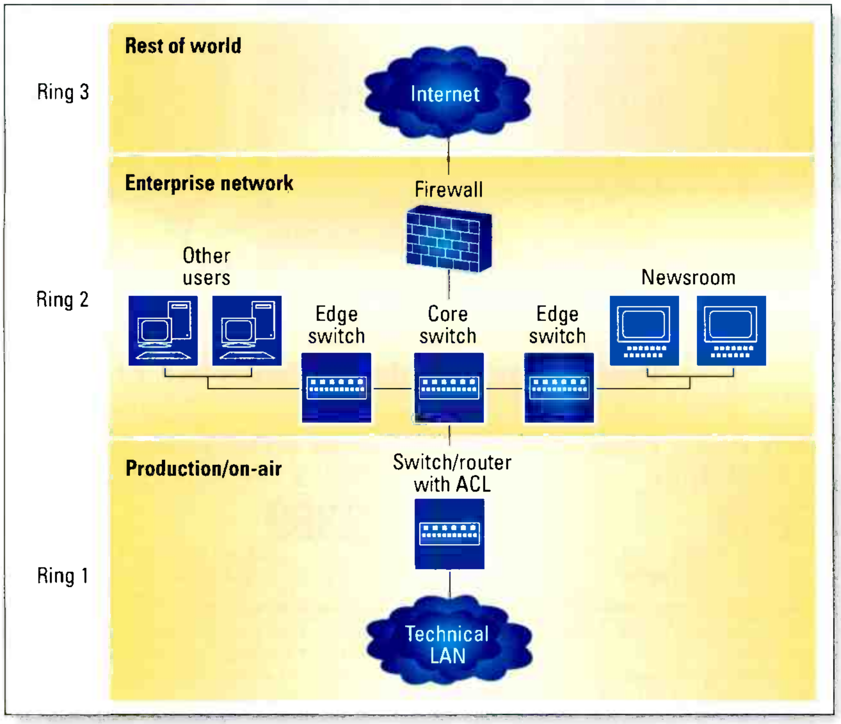


Figure 2. A tiered network approach allows the use of different levels of security within and between tiers.

they actually break into a system is to conduct surveillance of the network, just as a robber might case a home looking for the best way to break in.

Most hackers use a network-scanning tool to conduct this surveillance. The scanning program steps through a range of network addresses, attempting to communicate with different ports and services on each IP address and logging all open ports and active services found. Scanning programs are quite sophisticated and are capable of determining what sort of servers are available, which operating systems they are running and which version of the operating system is loaded. Furthermore, they can determine which ports are available on the server and whether they are open or closed. Each network service requires one or more TCP or UDP ports. For example, a Web server typically uses TCP port 80.

Armed with this information, the hacker can consult a cookbook, which tells him, given the particular OS, version and available ports, which vulnerabilities exist on that server. An educated hacker is then prepared to run a specific exploit on the server, which he knows will allow him to gain access.

An IPS continually monitors network traffic looking for suspicious client behavior. When it sees something suspicious, such as a network scan, the IPS may be configured to deny the client's IP address, thereby blocking any further communication from this client. However, more typically, the IPS will notify an administrator via e-mail, cell phone, SNMP trap or some other means. The IPS may be configured to look for many other suspicious behaviors, including things like brute-force password attacks, in which a client attempts hundreds or even thousands of log-in attempts to a server, each time using a different user name or password.

One of the activities hackers typically engage in before they actually break into your system is to conduct surveillance of the network.

One advantage of an IPS is that it can provide protection against an unknown attack — one that has never been documented before. These "day zero" attacks can be difficult to counter because most detection systems look for certain "signatures" associated with known attacks.

Because day zero attacks are by definition new, detection systems do not know what they look like. But if the hacker runs a scan first to identify a target system, the IPS may allow the opportunity to shut down the hacker before the day zero attack is launched.

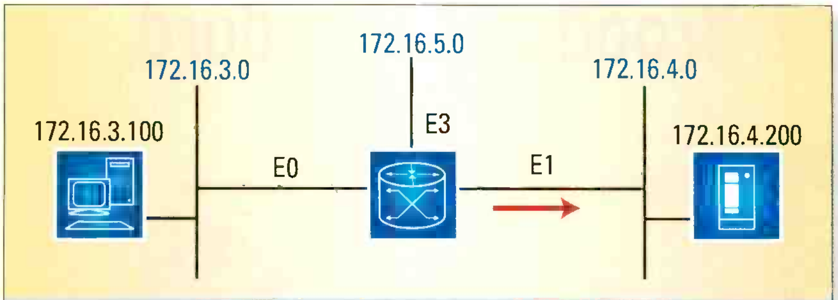
Intrusion protection systems sound great, but it is important to know that these systems come with a cost. It takes time and knowledge to set up one of these systems, and they can produce false alarms.

A large part of IPS management is grooming the system to the traffic on your network so that false alarms are reduced as much as possible, while still keeping the system sensitive enough to detect a real break-in attempt. The systems must also be updated on a regular basis so that they are aware of the latest scanner and hacker behaviors. These are not systems you install and forget. So you might not want to install an IPS unless you are committed to managing, monitoring and maintaining it properly.

Restricting network access

Within your production and on-air core, you may want to implement strict limits on networking. Examples include prohibiting someone from bringing a laptop into the area or preventing someone from communicating from a given workstation to an on-air server in the core technical area.

These policies can be implemented using ACLs. ACLs are stored in routers. When packets arrive at one of the routers interface, the router checks the ACL to see if the originator is authorized and if the traffic is permitted to travel from the originator to the destination given on the packet.




```
Access-list 1 permit 172.16.3.100  0.0.0.0
  (Implicit deny all - not visible in the list)
  (Access-list 1 deny 0.0.0.0  255.255.255.255)

Interface Ethernet 1
  IP access-group 1 out
```

Figure 3. This illustrates an access control list entry permitting a workstation at 172.16.3.100 to communicate with a server at 172.16.4.200, while denying access to all other devices on the network.

Figure 3 shows an example of an ACL. In this figure, a workstation with an IP address of 172.16.3.100 is granted permission to communicate with servers that reside on a network specified as 172.16.4.0. The router, shown in the middle of the drawing, has three Ethernet interfaces: E0, E1 and E3. It is important to realize that if an ACL is applied to an interface, by default, all communication out of that specific interface is denyed. Communications between devices are selectively permitted through statements in the ACL.

To enable the workstation to communicate with the server, the network engineer makes the following entries in the ACL (this example is specific to Cisco's IOS, and other routers implementing ACLs may function differently):

```
Access-list 1 permit
172.16.3.100 0.0.0.0
Interface Ethernet 1
 IP access-group 1 out
```

The first entry defines access list 1, consisting of the single IP address 172.16.3.100. The second and third entries show the application of the ACL E1 interface in the outbound direction. Thus, the only computer allowed to send traffic from one network to another is the one at 172.16.3.100.

This might also be a useful entry in a router located between Ring 1 and Ring 2 in Figure 2. This would allow a single computer, for example a newsroom workstation, to communicate with the on-air systems, while denying all other devices on the network access to Ring 1.

Any device, be it a switch, router, firewall or IPS, may cause latency or delay in the network. Consideration needs to be given to the possible impact on bandwidth and latency to time-sensitive IP traffic as security components are introduced into the network. Each "bump in the wire" induces some delay. **BE**

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

Thanks to Pete Balkus of Avid Technology and Neville Wheeler and Robert Welch of Cisco Systems for permission to use their material for this article. The webinar can be viewed online at www.broadcastengineering.com/webcast/networking_and_security.

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Audio console trends

BY JACK KONTNEY

If you buy the wrong headset, you simply replace it. But if you buy the wrong audio console, you affect operations for years to come. As production needs change, so too does the landscape of product offerings in mixing consoles.

But it's tricky for these high-tech manufacturers. While incremental improvements to existing platforms can be made with relative ease, fundamental changes in technology and architecture (such as analog to digital) can take years to properly develop for practical applications.

Flying in the face of this fast and furious rate of tech change is the need for a new console investment to last awhile. Whether for studio, remote capture or post, today's consoles are expected to earn their keep. A purchasing misstep could cost tens, even hundred of thousands of dollars, both in cash outlay and operational productivity. So, it makes sense to look into the future before making a console purchase today.

The future is digital

The first, and most obvious, trend is the move to all-digital consoles. Digital audio has been a viable alternative for more than a decade now. The technology provides nonlinear production workflow, non-destructive electronic editing, ease of transport and efficient storage. While there will always be demand for the warmth of analog inputs, the future of the broadcast signal path is inevitably digital.

One of the chief advantages of digital desks is channel efficiency. Rather than being locked into a channel count dictated by the number of input jacks, digital designs can have an unlimited number of inputs, routed as needed to the physical channel strips.

This efficiency grows in importance as the penetration of HD video is reflected in the need for surround-sound production, from programming to commercials. Broadcasters will need to manage multiple 5.1 streams while still providing viable stereo and mono feeds.

While there are rumblings that Dolby may upgrade its channel count, the problem for broadcasters remains the same — channel density of the audio feed. Using virtual tracks, digital matrix switching and multipurpose control surfaces, a digital approach allows many more input channels and submixes to coexist within a fairly modest footprint.

Powerful processing and cheap memory has enabled vastly improved audio resolution. Sample rates are moving from 44kHz to 96kHz, with 192kHz on the horizon. Software has become similarly more sophisticated, with plug-ins available for virtually every conceivable need.

Hardware meets software

There is another trend in console design — modularity and scalability. Rather than simply buying all the channels that fit into the available space, it will become increasingly common for users to specify the precise, desired layout of their new console. This will allow users to move outboard gear into their "mainframe" audio consoles, as well as pay for what they need today while retaining the option of upgrading in the future.

This leads us to the next trend — open architecture. In a software-driven environment, the need to communicate with outboard production tools, digital archives and other control rooms will require great flexibility. Much like Apple's long-awaited embrace of the PC, digital consoles will be increasingly sophisticated in their ability to interact in a plug-and-play fashion with all the manner of computers, control devices and hardware.

Another implication of the steady growth of surround sound is the increasing need to capture live content in surround. While this capability is already evident in today's large production trucks covering live sports and music in HD, look for ENG crews to add surround sound to their local coverage. This, in turn, means that station production rooms will need consoles that incorporate 5.1 surround and automated downmixes with the same ease of use that today's stereo desks provide.

While there will always be demand for the warmth of analog inputs, the future of the broadcast signal path is inevitably digital.

Topography and work surfaces

One reason console makers are investing so heavily in interface design: Operators need to use multiple new functions quickly, without having to spend weeks learning a new system. This is a major challenge.

Console surfaces that mirror traditional mixers are faster to learn, but comprehensive onboard DSP and total flexibility in mixdown hierarchy requires either too much real estate

ICONIX
HD-RH1 3CCD

or less efficient, multistep access. The latter may be fine in large-format production mixers, but not in small, fast-paced control rooms.

> **Everyone knows there's nothing like the feel of a high-quality 100mm fader, and these will always be available.**

Increasingly, a single console will be expected to interact effectively with the entire broadcast facility, including control rooms, studios and maybe even the office e-mail system. For console designers, the key will lie in knowing their customers' workflow and production processes and then creating modular, software-driven work surfaces that are easily configured to those immediate needs and yet still maintain a familiar look and feel.

Eventually, console design may evolve into the form factor of a massive touch screen, with photorealistic icons that react with the same sensitivity and functionality as the hardware we work with today. But fear not! Everyone knows there's nothing like the feel of a high-quality 100mm fader, and these will always be available.

Console design is all about meeting user needs, both at the time of purchase and down the road. So look for control surfaces to be on-demand environments that can change with your needs — but with the physical format and familiar tactile feel mixers prefer.

Finally, as audio increasingly takes the form of data streams, a major driving force in future studio environments will be the security of that data. In fact, the consoles of the future may not even pass audio directly.

As the speed and power of networks increase, mixing desks may evolve into pure control centers, communicating with a master media "engine" that drives the entire production environment from input to output — marrying audio, video, Web streams and metadata and then sending them to the appropriate delivery system on demand.

Your future console will be smaller, smarter, faster, more flexible and more reliable. It will adapt to your changing needs. It will, in short, be exactly what you need. **BE**

Jack Kontney is founder and president of Kontney Communications.

Euphonix - Audio Mixing for Broadcast

OB Sports

Client: **Mobile Television Group**
Console: **System 5-BP**
Notes: One of six System 5 consoles in Mobile Television Group's new HDX Trucks. Euphonix StudioHub Router integrates with the truck's Jupiter and Pesa audio/video router systems.

On-Air News

Client: **KVUE Local News**
Console: **Max Air**
Notes: 96 channels of high quality audio controlled from a compact and easy-to-use surface. Max Air is packed with features to make the job of mixing news less stressful and much simpler resulting in a better show.

Production

Client: **KLRU 'Austin City Limits'**
Console: **System 5-BP**
Notes: Their System 5 has 132 channels, 48 mix busses, 12 aux busses, and 41 physical faders. Although the show is currently broadcast in stereo it is mixed in 5.1 surround for archiving.

Whatever the application Euphonix has the experience to meet your needs including fully integrating the console's audio router with most router control systems that utilize the ES-Switch protocol.

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digital emotion

Transmitters:
The new ones are bigger

BY DON MARKLEY

When you wandered through the halls of NAB2006, the transmitter offerings seemed to be the same old things. There were small solid-state ones, ones with a big tube-type device, ones with several big tube-type devices and so on. However, when you investigated more thoroughly, it became apparent that there were some significant changes at the show.

Power levels

The big news, at least to me, was the power levels available in solid-state systems. Until recently, it seemed that solid-state systems were available up to 10kW or so, which was nice for the DTV systems with ERP values of 50kW to 200kW. If a station was going to go the whole way to an ERP of 1MW, it really had no option but to pick out the klystron type it wanted.

While the tube transmitters may still be the system of choice, based on economic factors such as utility bills and replacement costs, solid-state systems are now available for high-power levels.

In addition to the high-power level stuff, several manufacturers showed new models of low- to medium-power solid-state systems that offered improved features for applications ranging from translators to scattered site systems and the majority of DTV stations.

One of those systems was Harris' new Atlas transmitter. It provides up to 13.5kW average power when using multiple cabinets or up to 4.5kW from a single cabinet. The series uses liquid-cooled amplifiers and power supplies. The exciter — the APEX ATSC system, which includes Harris' real-time adaptive correction — has been around long enough to get the bugs out. Add a color touch screen for troubleshooting, and it's a very usable box.

The Atlas is also available for analog systems for stations whose old transmitter won't make it another couple of years. In analog configuration, the maximum available power is 30kW. Of course, the analog version can be converted over to digital by changing the exciter, filters, etc.

For 8VSB operation, the Axcera Innovator HX uses the company's ATSC Axciter exciter.

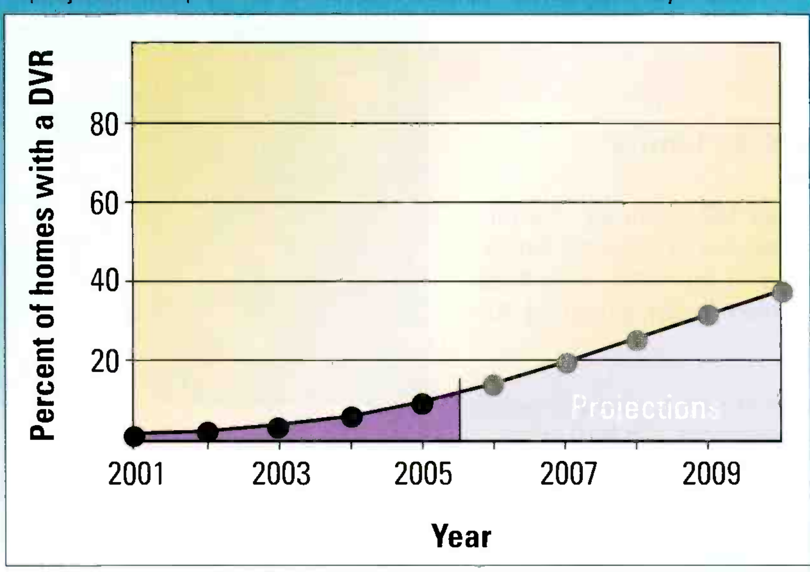
Axcera showed two levels of digital transmitters — that's power, not quality levels. The Innovator LX is a small unit designed to operate as a translator, booster, driver or stand-alone transmitter. The available power levels range from 5W to 3kW for digital systems or from 10W to 6kW for analog. The transmitter's function can be changed by inserting different slide-in modules or rack-mounted components. For example, the available components would include various digital modulators, an analog modulator or a receiver for translator use. The equipment is air-cooled and frequency agile.

The higher-powered box from Axcera is the Innovator HX. The available power ranges from 2kW to 60kW digital and from 5kW to 120kW for analog service. Again, the equipment is air-cooled. With available dual exciters and automatic switchover on

FRAME GRAB A look at tomorrow's technology

U.S. households with DVRs

A projected 20 percent of households will have a DVR by 2007



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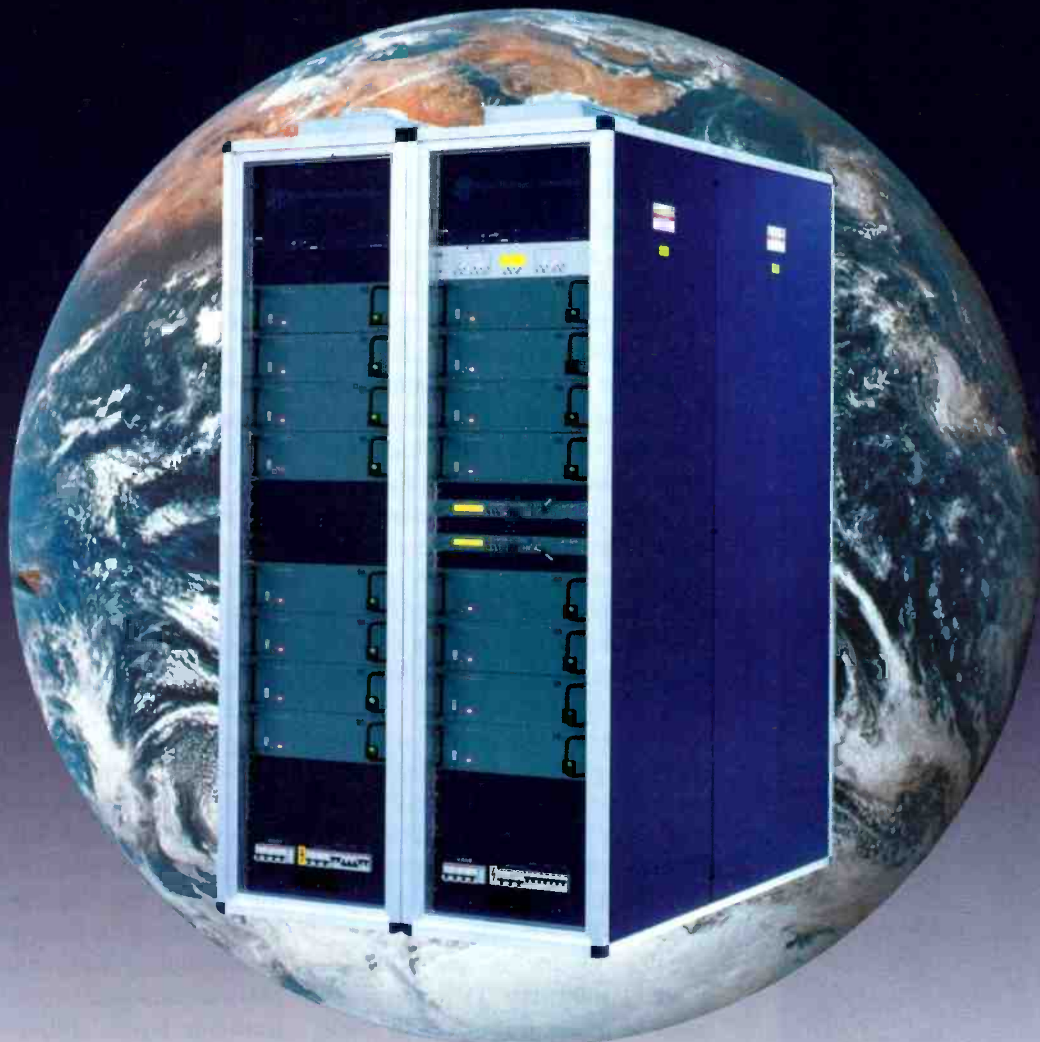

failure, it is designed for long-term unattended operation. The exciter system contains all the necessary correction circuits to maintain the proper digital output signal.

To look at the power level more carefully, let's assume that a station has an authorization for 1MW. For this example, the antenna has a medium gain of 25 and a 1000ft run of 6 1/8in 75Ω line on channel 25. The result would be a transmitter power output of 52.2kW. That means that the system would be doable with the Axcera box. We won't discuss cost and power use. It is important to recognize simply that a box out there is capable of working with big DTV stations. This is a big step up from solid-state transmitters five years ago, and it shows the continuing design of more powerful transmitters.

Another company showing high-powered transmitters at the show was Acrodyne (Ai). Ai's Depressed Collector Quantum transmitters feature power levels up to 120kW average ATSC 8VSB and DVB-T COFDM. The transmitters use the e2v ESCIOT and operate efficiently in either digital or analog service.

DMT's transmitters and repeaters include digital and digital-ready analog models in VHF and UHF bands, with air or liquid cooling. They offer 0.1W to 40kW output power and are compatible with all types of digital terrestrial TV networks.

Thales' Optimum and Ultimate range of solid-state TV transmitters range in power from 2kW to 60kW for analog and 800Wrms to 22kWrms for digital.

LARCAN has a new solid-state series known as the Eclipse. This system uses air-cooling with hot-pluggable modules for power amplifiers and power supplies. For DTV service, it ranges from 5kW to 40kW, with higher power available if needed. The unit is compact. A 20kW system can fit into less than 25sq ft. The system includes extensive monitoring and diagnostics to aid the station technicians. It is worth remembering that modern systems are sophisticated to repair. Therefore, any help that the manufacturer can build in is a huge bonus to the operator.

Air vs. liquid cooling

Going back to the liquid side, Rohde & Schwarz has NV 7000 digital transmitters available with power levels to more than 5kW. The modules are hot-pluggable without the loss of coolant. Each amplifier module has its own power supply cooled by the same liquid. The transmitters are available with dual exciters with automatic changeover. Both exciters fit in a standard 19in rack in only seven units of vertical space. That particular statistic should cause the old-timers reading this article to shake their heads. I remember when an old RCA sync generator, two units with power supply, would fill an entire rack. Adding color took another half rack. Of course, the signal generator has shrunk to a chip, including color, and has a stability never dreamed of in the old days.

The NV 7000 can be operated by a PC with Windows or by the built-in display. The entire construction of the units is high quality.

The one remaining discussion point is whether air or liquid cooling is more desirable. The liquid cooling is cool (pun intended), with little tubes running all over the place. It also is good for keeping the transmitter clean as the amount of air involved is limited. Liquid cooling does require an external heat exchanger to remove the heat from the liquid. Rohde & Schwarz uses a coolant called AntifrogenN.

Air cooling, on the other hand, is simpler. It is only necessary to keep a large amount of filtered air directed at the necessary heat producers. More maintenance is required to change filters regularly and to clean the equipment more often. No great determination is offered here — just a couple of things to ponder when shopping for one of those new and significantly improved digital systems. **BE**

Don Markley is president of D.L. Markley and Associates.


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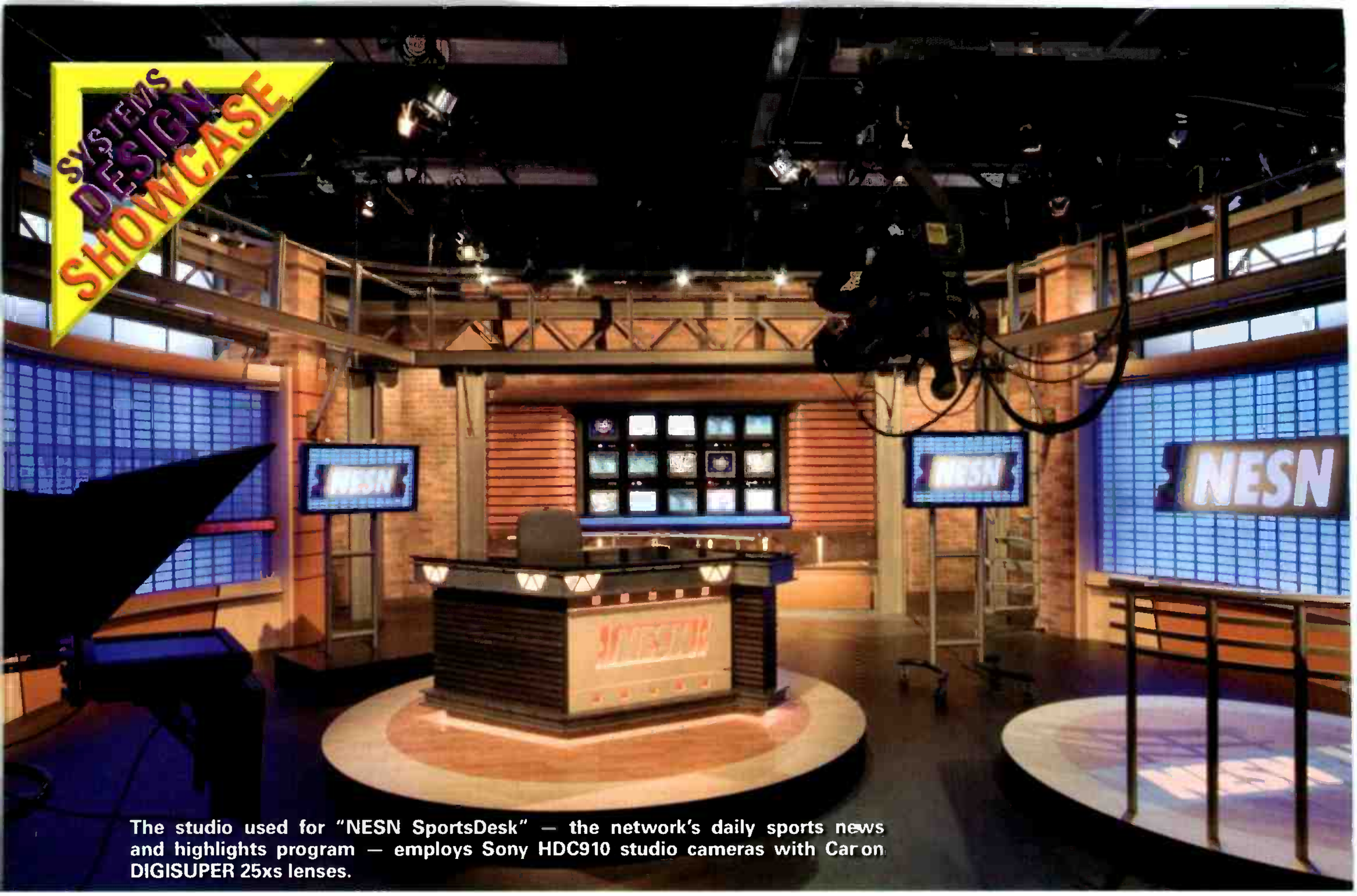
NESN's two 32-fader C100 digital broadcast consoles from Solid State Logic are at the core of a digital infrastructure that will allow multichannel audio broadcast in the future. Shown here is chief audio mixer Mike Testa at the console in Audio Control Room 1. Photos by Dave King.

NESN hits a home run with its new HD facility

BY SUSAN ANDERSON

When Boston Red Sox fans want to watch their team play, the New England Sports Network (NESN) provides just the ticket. Seen in more than 4 million homes throughout the six New England states, the network broadcasts about 150 Red Sox games each season, as well as in-depth pre- and post-game shows.

In addition to baseball, the network covers more than 70 Boston Bruins games each season; regional college sports; sports talk shows featuring columnists from *The Boston Globe*; outdoor programming; and "NESN SportsDesk," the network's sports and highlights program.



The studio used for "NESN SportsDesk" — the network's daily sports news and highlights program — employs Sony HDC910 studio cameras with Canon DIGISUPER 25xs lenses.

A new playing field

In September 2003, the network began broadcasting Red Sox games in HD. However, NESN's goal was to originate *all* in-house programming in HD. Plus, it was outgrowing its small space in Fenway Park, which had just one studio and one control room. It was time for a new facility.

The network had three technical goals for its new space:

- Replace the infrastructure with a wideband digital core that's HD-capable.
- Update the facility to allow HD transmissions and studio productions in HD.
- Update the infrastructure to allow for future technology enhancements.

To turn this game plan into a reality, the network recruited two systems integrators, The Systems Group (TSG) and the Venue Services Group (VSG). While the TSG was in charge of main engineering and master control room facilities, the VSG handled production control rooms and editing suites.

After a year and a half of searching for the right space and after a year of construction, the project was complete. In February, the network moved into its new state-of-the-art facility in Watertown, MA. It more than triples the network's existing spaces within Fenway Park from 12,500sq ft to 40,139sq ft. The facility includes two control rooms, a master control room, seven edit rooms, a voiceover booth, engineering areas and two studios — one that's 40ft x 50 ft and one that's 50ft x 50ft.

All-star line-up

For the control rooms, the network selected equipment from Sony. At the core of production control is a Sony MVS-8000 switcher. The network had a Sony switcher in its previous building, so NESN knew it was reliable. And by selecting the same equipment, the transition was smoother operationally. Plus, the switcher allows the network to have two control panels tied to one mainframe, which was a significant cost savings.

Flanking each production control room is a multiviewing processor wall made up of large LCD screens that can be divided into four screens.

For master control, the network selected an NVISION router and NV5128-MC multichannel master

NESN's goal was to originate *all* in-house programming in HD.

Design team

The Systems Group (TSG)
- Joe Difrisco, project manager
- John Zulick, design engineer

Venue Services Group (VSG)
- Josh Einstein, project manager
- Mike Young, design engineer

NESN
- Dave Desrochers, chief engineer
- Les Correia, asst chief engineer

At the core of production control is a Sony MVS-8000 switcher.

Technology at work

Canon DIGISUPER 25xs HD studio lenses
Chyron Duet HyperX HD/SD switchable CG
Evertz MVP multi-image display and monitoring systems
EVS HDXT[2] disk recorder
Leitch
- Nexio NX4200HD server
- Nexio NX4000TXS shared storage server

Middle Atlantic racks
NVISION
- NV5128-MC multichannel master control switcher
- Multiformat router

RTS Adam intercom system
Solid State Logic C100 digital broadcast consoles
Sony
- HDC910 HD studio cameras
- MVS-8000 production switcher
- Video monitors

Wohler audio monitors

control switcher. The switcher's software GUI interface enables flexibility in the design of master control. It's easy to program in order to make changes, which is important because the network pumps out four channels — three SD and one HD.

NESN's line-up also includes Sony HDC910 studio cameras with Canon DIGISUPER 25xs lenses. The network had been using these already since it began broadcasting Red Sox games in HD three years ago, so it purchased additional units for its HD studios.

Anchoring the studios are two Solid State Logic C100 digital broadcast consoles. The network chose the consoles because they're modular and fully programmable. Plus, the units will support the network's plan to go to 5.1-channel audio in the future.

The seven edit suits aren't all filled. The network brought over its existing editing systems and plans to replace them with a tapeless system this year.

Play ball

To support its goal of all-HD programming, the network employs gear from Telecast Fiber Systems. Viper I, Viper II and Adder modular fiber-optic systems use 14mi of leased dark fiber lines from cable television and Internet service provider RCN to send all communications between its headquarters, sports venues and uplink facility. The systems also perform monitoring, as well as move audio and video signals from Red Sox and Bruins games to the new Watertown facility.

This allows the network to put three uncompressed HD feeds and a combination of analog and Ethernet feeds, in addition to L-Band satellite return monitoring feeds, on redundant RCN fibers. With this four-channel and eight-channel optical multiplexing capacity, the network is able to use fewer cross-town fibers for its transmissions. It also allows room for additional channels or signals in the future.

The new facility controls postgame shows and other programming from the linked venues, with sources coming directly into the network's new control room. The HD signal is compressed only at the satellite uplink; it remains uncompressed

from capture through production. As a result, images remain clean.

Also on NESN's roster is a Viper I Mussel Shell, a portable, modular enclosure that's HD-capable. The network uses the unit for coverage of home Red Sox games, during which its camera crew conducts pre-game interviews. These signals connect through the private fiber network all the way back to the new control room for remote production. In the past, the network managed this from its smaller control room at Fenway Park.

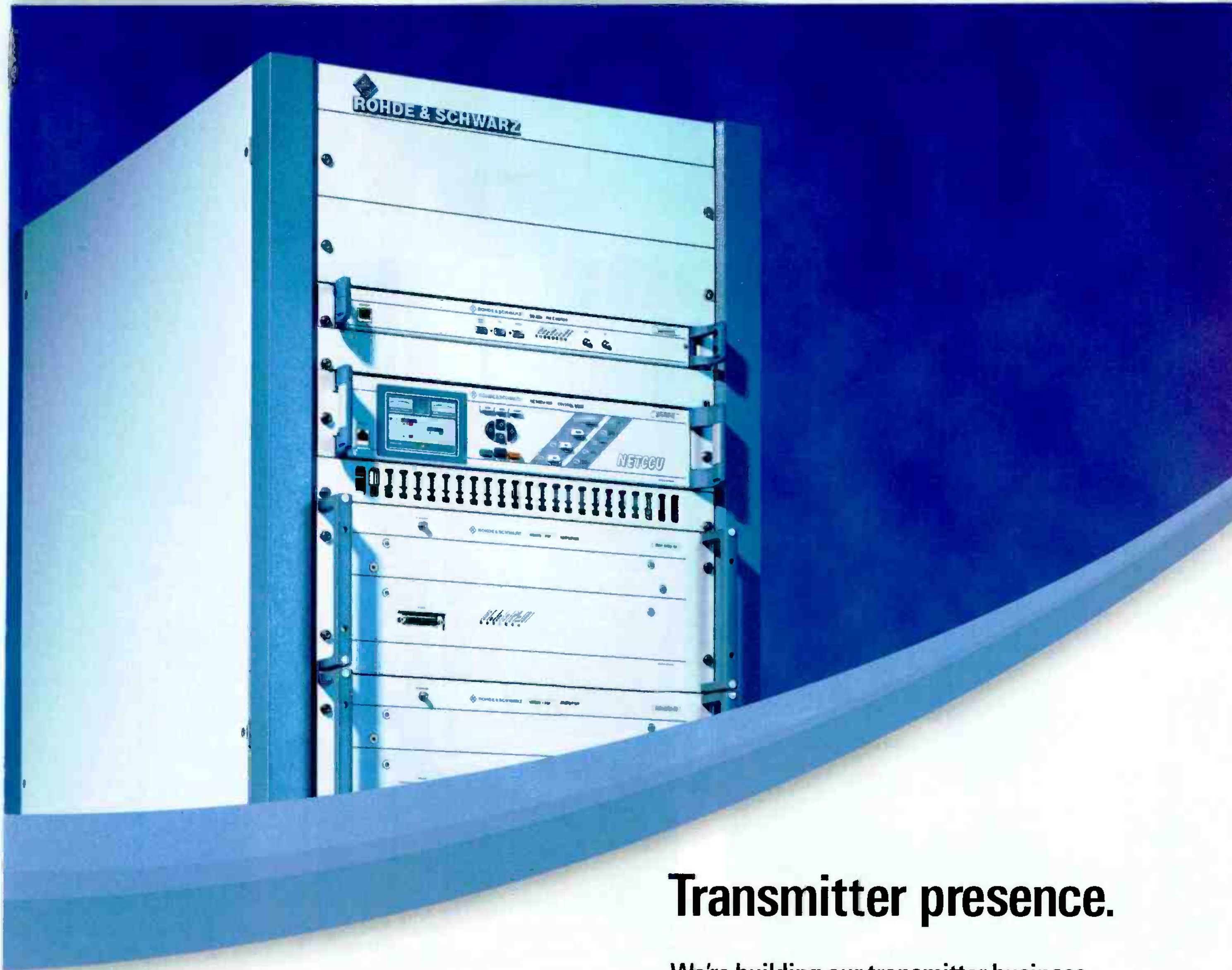
Shown here is NESN's videotape room with EVS operator Jim White (left) and producer Todd Kerrissey.

Box score

The new production center has proven to be a big win for NESN. Its operators now have plenty of room to move around. They're also thrilled to be able to produce two programs simultaneously and produce shows in HD right from the studio — something they couldn't do before.

In fact, this year NESN became the first network to broadcast all its team's games in HD. Last year, it produced 176 HD programs, or 493 hours of HD programming. This year, the network plans to produce more than 1,200 HD programs, or more than 3,330 hours of HD programming. With the new facility, NESN and its staff are at the top of their game. BE

Susan Anderson is managing editor of Broadcast Engineering *and* Broadcast Engineering World *magazines.*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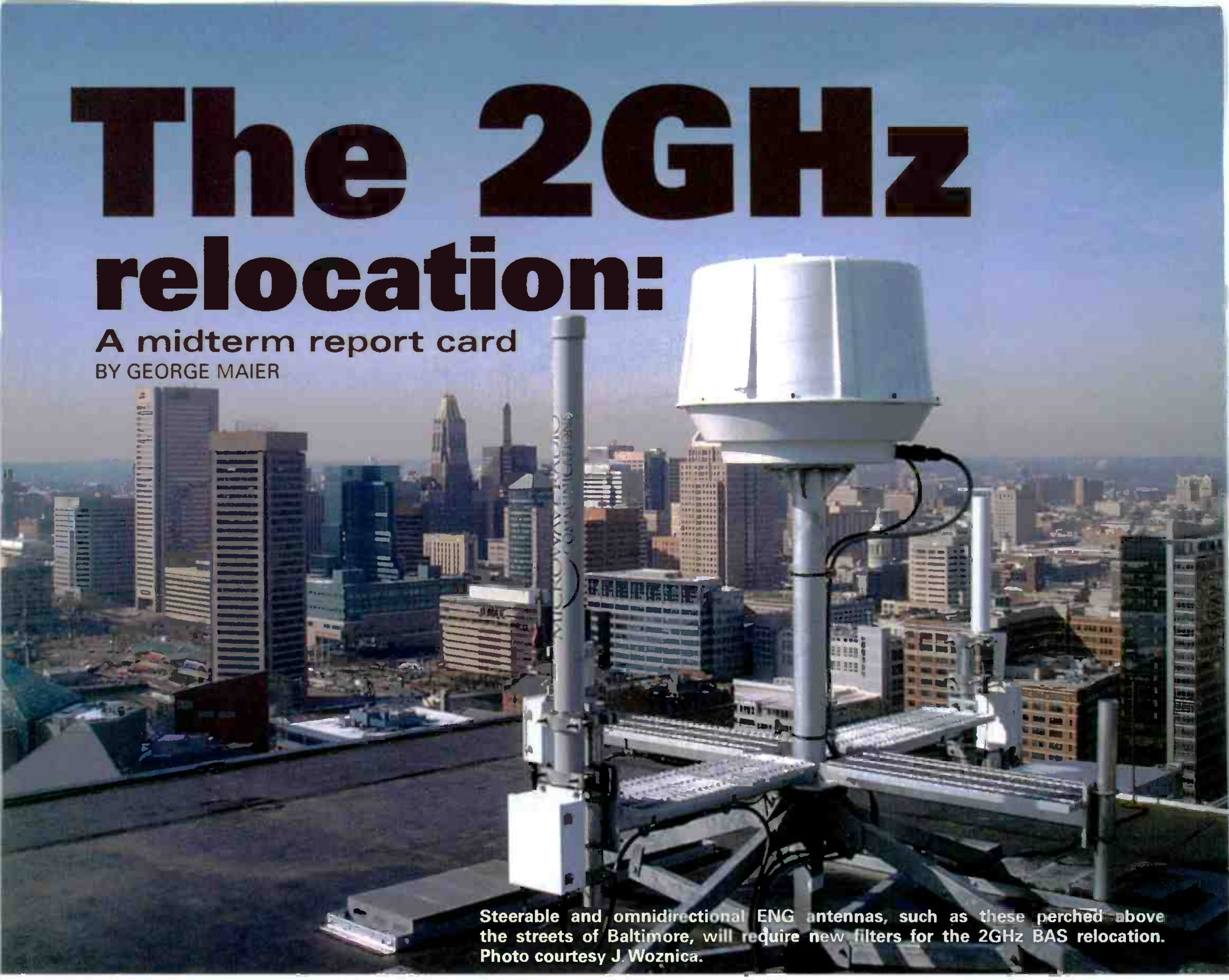
The 2GHz relocation:

A midterm report card

BY GEORGE MAIER



Steerable and omnidirectional ENG antennas, such as these perched above the streets of Baltimore, will require new filters for the 2GHz BAS relocation. Photo courtesy J. Woznica.

As of this month, the clock for the 2GHz relocation project taken on by Nextel (which recently merged with Sprint) has been ticking for approximately 15 months, or about half of the time the FCC allotted for completion of the broadcast auxiliary services (BAS) transition process.

The questions on many minds:

- How well has Sprint Nextel performed up to now?
- Will the company complete the task on time?

To be fair, nothing like this has ever been attempted. The schedule was tight to begin with, and there were no handbooks with an easy-to-follow game plan.

To understand where the process stands, one must be familiar with, or at least review, the original FCC timeline requirement. FCC document 04-168 was released on Aug. 8, 2004, and published in the Federal Register on Nov. 22, 2004, which is the official start date.

The document is officially titled "Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order." The confusing title is because the rulemaking encompassed by 04-168 covers nearly 10 years of ground, as well as FCC decisions, including:

- WT Docket 02-55;
- ET Docket No. 00-258;
- RM-9498;
- RM-10024; and
- ET Docket No. 95-18.

Reduced to its most basic meaning, Sprint Nextel has been granted the right to operate on frequencies at the

DATE	EVENT	COMMENT
Aug. 6, 2004	FCC releases rulemaking	WT Docket 02-55, ET 00-258
Nov. 22, 2004	Rules published in Federal Register	Project clock starts
Feb. 7, 2005	Nextel accepts FCC R&O	Delayed from original date
April 2005	First kickoff meetings commence	
April 2006	12-month progress report to the FCC	
Sept. 7, 2007	Project due to be completed	

Table 1. Important relocation dates

The 2GHz relocation:
A midterm report card

Shown here are rows of MRC DAR-2 2GHz hot-standby STL terminals, flanked by boxes of CodeRunner 2 transmitters and CodeRunner 4 receivers stored in a Sprint Nextel warehouse. Photo courtesy MRC.

low end of the 2GHz BAS band. As a part of this authorization, the company is obliged to relocate all existing broadcast licensees to new frequencies within 30 months of its acceptance of the FCC rulemaking. Even under absolutely ideal circumstances, this is a tall order. (See Table 1 on page 50.)

Prior to the project's start, Nextel had identified 210 DMAs, which the company said would have to be relocated at a rate of two to three per week. This meant it could take anywhere from five to 15 months to complete each DMA.

The fundamental steps each BAS licensee is obliged to follow in the relocation process, including time estimates are shown in Table 2. The first round of kickoff meetings began in April 2005. And the first four steps went rather well. Unfortunately, step five — the placement of equipment orders — proved troublesome.

It is interesting that NAB2006 served as the backdrop to remind everyone that one full year had elapsed since the project started. Relocation talk dominated NAB2005, and here we were at another NAB discussing it again, but not necessarily the same issues. Over the course of the year, sticking points emerged between Nextel and the broadcasters.

The first point of resistance were Nextel nondisclosure agreements that all stations are obliged to sign prior to starting the process. The reasons for the objections were simple. While the management in any given television station may be in fierce competition with others in the same market, the engineering crews are generally on good terms. As a matter of necessity and survival, engineers must cooperate or chaos would result.

The worry was that it would be nearly impossible to keep all terms of an agreement quiet. Also, there were questions about the need for secrecy when everyone is theoretically offered the same deal. While Nextel was able to put initial fears aside quickly, unanticipated problems soon developed.

The Sprint factor

On Aug. 12, 2005, Sprint announced the completion of its merger with Nextel, a process that had started with the initial announcement on Dec. 12, 2004. Certainly everyone involved in the 2GHz relocation was well aware of the impending merger, but the finality of the agreement caused some worries among broadcasters and manufacturers. Would Sprint maintain the same commitment to the project?

In a small industry like broadcast, rumors travel at the speed of light — regardless of their accuracy. The Sprint Nextel merger created rumors that still circulate, with the most prevalent being that the combined company will not continue to support the relocation. Fortunately, the facts do not support this rumor.

According to the terms of the merger agreement, the new company must honor the obligations, rights and responsibilities Nextel originally agreed to, including clearing (the BAS licensees from) 1.9GHz in accordance with the FCC's rules.

MILESTONE	APPROXIMATE TIME REQUIREMENT
Kickoff meetings (public and private)	2 weeks
Completion of equipment inventory	5 weeks
Inventory verification	4 weeks
Frequency Relocation Agreement	6 weeks
Placement of equipment orders	2 weeks
Equipment manufacturing and delivery	8 weeks
Installation	8 weeks
Cutover to new plan	2 weeks
Final cleanup of outstanding issues	8 weeks

Table 2. Relocation milestones and timetable

Inventory, quote, quote, quote, verification and scrub!

Sprint Nextel's computerized inventory process does an adequate job, but firsthand experience with entering the data and reviewing the reports proved that it can take time to understand the system and get it right. In most cases, it is an iterative process. Once the final Enter button is pushed, the Sprint Nextel verification crew compares

the submitted inventory with the actual physical inventory and makes any needed adjustments, and then a "scrubbed list" is generated.

Although the verification process has been fairly painless, the company initially encouraged BAS licensees to start the quote process prior to completing an inventory. And the manufacturers were anxious to respond, until they became bogged down with quote requests and revisions.

The key problem is: Any change in the final inventory and resultant scrubbed list requires a new quote, as Sprint Nextel can only accept a quote that is in total agreement with the final scrubbed list. Once the initial bottleneck was recognized, Sprint Nextel and the equipment vendors finally decided that quotes should be solicited only when the final scrubbed list is complete and accepted.

The FRA roadblock

One of the biggest issues has been the final contract, known as the Frequency Relocation Agreement (FRA) between Sprint Nextel and the BAS licensee. The Nextel legal team prepared the original agreements and viewed things a bit differently than the broadcast legal teams. Not surprisingly, the whole conversion process soon ground to a halt.

In addition to contract language disputes, the issue of tax payments was raised. Effectively, Sprint Nextel is giving new equipment to the broadcasters, which must be treated as a "gift" according to the tax laws. Broadcasters wanted the free equipment, but didn't want to pay the taxes on it.

The resulting slowdown started effecting the vendors. The equipment vendors had built up large inventories and even hired additional help in anticipation of new orders. However, the predicted orders were not materializing. Many wondered if the whole relocation project was in trouble.

A bird's eye view of MRC's Sprint Nextel warehouse area. Photo courtesy of MRC.

One year later

By December 2005, 500 stations had completed their equipment inventories. Even so, only a handful of equipment orders were shipped. With the project running slower than planned, an FCC progress report due soon and NAB2006 in view, Sprint Nextel made a series of procedural changes to speed up the process. (See Table 3.)

MILESTONE EVENT	COMPLETED	REMAINING
Market kickoffs	140	65
Complete inventories	663	392
Verified inventories	414	641
Quote packages in review	45	?
FRAs signed	21	>1000
DMAs converted	1	204

Table 3. Project statistics reported at NAB2006

With the help of MSTV, the company released a revised FRA on April 4, 2006. The changes included clarifying terminology and an improved change order process that provides a mechanism for approval of unanticipated costs after the relocation is underway.

A new, five-person team was formed within Sprint Nextel to focus on the preparation of the FRA and to speed up the equipment cost estimates and implementation schedules. Also, as part of the closing process, the company now provides a summary of all payments made to the broadcaster and reconciles them against final receipts and invoices.

Other procedural changes included:

- the addition of spectrum monitoring equipment as eligible for "comparable" facilities;
- replacement of milestone payments with a monthly reimbursement plan;
- improvements in soft cost spreadsheet models; and
- clarification of the timing of quotes.

Sprint Nextel was highly visible at this year's NAB show. It provided a series of public and invitation-only presentations for BAS licensees and

The 2GHz relocation:
A midterm report card

One Boston Place, the most popular ENG site in downtown Boston, is scheduled for some major work during the 2GHz relocation. Photo courtesy of WCVB.

manufacturers. The company also circulated personnel throughout the convention halls, including at the booths of major equipment vendors. Staff was also stationed at the Sprint Pavilion in the LVCC monorail station. Presentations covered progress made, information on the training sessions, digital equipment operation, the quote process and relocation weekends.

Perhaps the most interesting aspects of the report card addressed what has actually happened to date vs. the original plan and the current plan for completion. As noted earlier, the original estimate for completing the 210 DMAs was based on two or three DMAs per week. The FCC mandate requires completion in 30 months (or 130 weeks), which is September 2007. Some DMAs were combined, but looking at the math completion, projections were:

- 105 weeks with two DMAs converted per week;
- 70 weeks with three DMAs converted per week; and
- 84 weeks with 2.5 DMAs converted per week.

That gave Nextel a built-in margin of 25 to 46 weeks in its original estimates to get the program under way. The process should have been in full swing by the beginning of January 2006 to meet the deadline. According to its original schedule, Sprint Nextel should have relocated 58 markets by NAB2006, but it had not completed any as of May 25. Between that date and Sept. 7, 2007, there are approximately 46 available relocation weekends, which means that an average of 4.5 DMAs must be converted per week in order to make the deadline.

Sprint Nextel still maintains that meeting the deadline is possible and is pushing hard to make it happen. However, the largest concentration of relocation activity appears to be scheduled from December 2006 through March 2007, which is in the dead of winter in many areas of the country.

Relocation weekend

Although many of the major roadblocks appear to have been eliminated, there is still a good deal of apprehension relative to the actual relocation procedure. Because no DMAs have been relocated, there is no way to gauge how the procedure will work in practice.

The basic working assumptions are:

- All equipment in a given DMA has been installed and tested.
- New frequencies have been locally coordinated and agreed to.
- Each radio will require approximately 30 to 90 minutes to retune and test.
- Everyone must agree to the change two weeks in advance and reverify readiness three days in advance.
- Tower crews may be needed to change filters, etc.
- A sanity check/progress assessment will be made at the midpoint of the change process, i.e. Saturday.

The weekend scenario may seem like a good idea, but not everyone agrees. A fair proportion of major news events occur over the weekend, and TV stations are generally at a skeleton staff level during these times. Weather-related issues could be a major factor, particularly in view of the fact that much of the activity is planned in winter. Without a doubt, a lot will be learned in the first few cutovers.

But wait, there's more

As if the whole relocation is not enough to deal with, there are two interrelated issues brewing that threaten to have an effect on the conversion process. One is FCC RM-11308, and the other is Department of Defense uplinks being allowed in the 2GHz BAS band.

Rulemaking RM-11308 is the result of an SBE Petition for Rulemaking proposing to modify the FCC's Universal Licensing System and FCC Form 601 to allow TV pick-up licensees the option of entering the coordinates and antenna height of ENG central receive sites. This would allow any potential AWS licensee to quickly and anonymously do a point-radius search and thereby avoid selecting a new site that may cause harmful interference to an existing ENG central receiver.

The petition was well received by the broadcast community, by virtue of the supporting comments filed by NAB, CBS, Cox, Disney ABC and Tribune Broadcasting. Incredibly, Sprint Nextel filed comments against the petition and maintains that it imposes additional frequency coordination requirements. The petition includes no such language, and Sprint Nextel has not provided any further clarification of its position.

Although not specifically a part of the Sprint Nextel relocation, the FCC has created a situation that may cause an additional threat to 2GHz BAS licensees that Sprint can help to mitigate. In accordance with WT Docket 02-55, U.S. Department of Defense (DoD) tracking, telemetry and commanding (TT&C) satellite uplinks will be moved from the 1761MHz to

Web links

Sprint Nextel broadcast relocation: *www.2ghzrelocation.com*
The SBE: *www.sbe.org*
The FCC: *www.fcc.gov*

1842MHz federal government Space Ground Link System band to the new 2025MHz to 2110MHz TV BAS band. This move was triggered by the reallocation of the 1710MHz to 1755MHz federal government band to the commercial sector to support even more Advanced Wireless Services spectrum.

The DoD uplink transmitters have power outputs up to +70dBm (10kW) operating into 30m uplink antennas with a gain of around 45dBi. This results in an equivalent EIRP of around 115dBm. The side lobe suppression of these uplink antennas is roughly 60dB. The result will be horizontal RF radiation and potentially toward an ENG site on the order of +55dBm. A typical ENG truck might operate with an EIRP around +65dBm, meaning the DoD uplinks could be operated co-channel. If so, then these interfering signals will be seen at the broadcaster's central receiver just 10dB below the desired remote broadcast truck's signal. Even if the DoD agrees to make every effort to avoid interference, without RM-11308, it will face the difficult task of contacting every TV station that may be affected by its transmissions to identify the locations and technical data of each ENG receive site.

Another recent development: In a total reversal of their original position, and perhaps as a sign of the pressure for timely completion, Sprint Nextel released a memo to BAS licensees on June 15. It's intent was to convey that Sprint Nextel would no longer pay to upgrade Microwave Radio Communications (MRC) CodeRunner radios, but would pay for new CodeRunners.

Although the basic message was there, the wording led many to believe that it was MRC's idea, and that MRC was unwilling upgrade its radios. This process will offer Sprint Nextel substantial cost savings, and the company originally applauded the MRC upgrade plan. On June 20, Sprint Nextel circulated a second memo clarifying that it was its decision, not MRC's, and that it had no concern about MRC's equipment or performance. The second memo also admitted that time was the main issue.

Stay tuned

As noted in the beginning of this article, nothing like this has ever been attempted. As relocation continues, additional issues will surface. Sprint Nextel, BAS licensees, the FCC and microwave manufacturers must work closely together if this conversion is to succeed. BE

George Maier is the founder of Orion Broadcast Solutions, a broadcast consulting firm.

Thanks to the SBE for providing advance information about its white papers on RM-11308 and WT Docket 20-55.

Planning for effective digital asset management

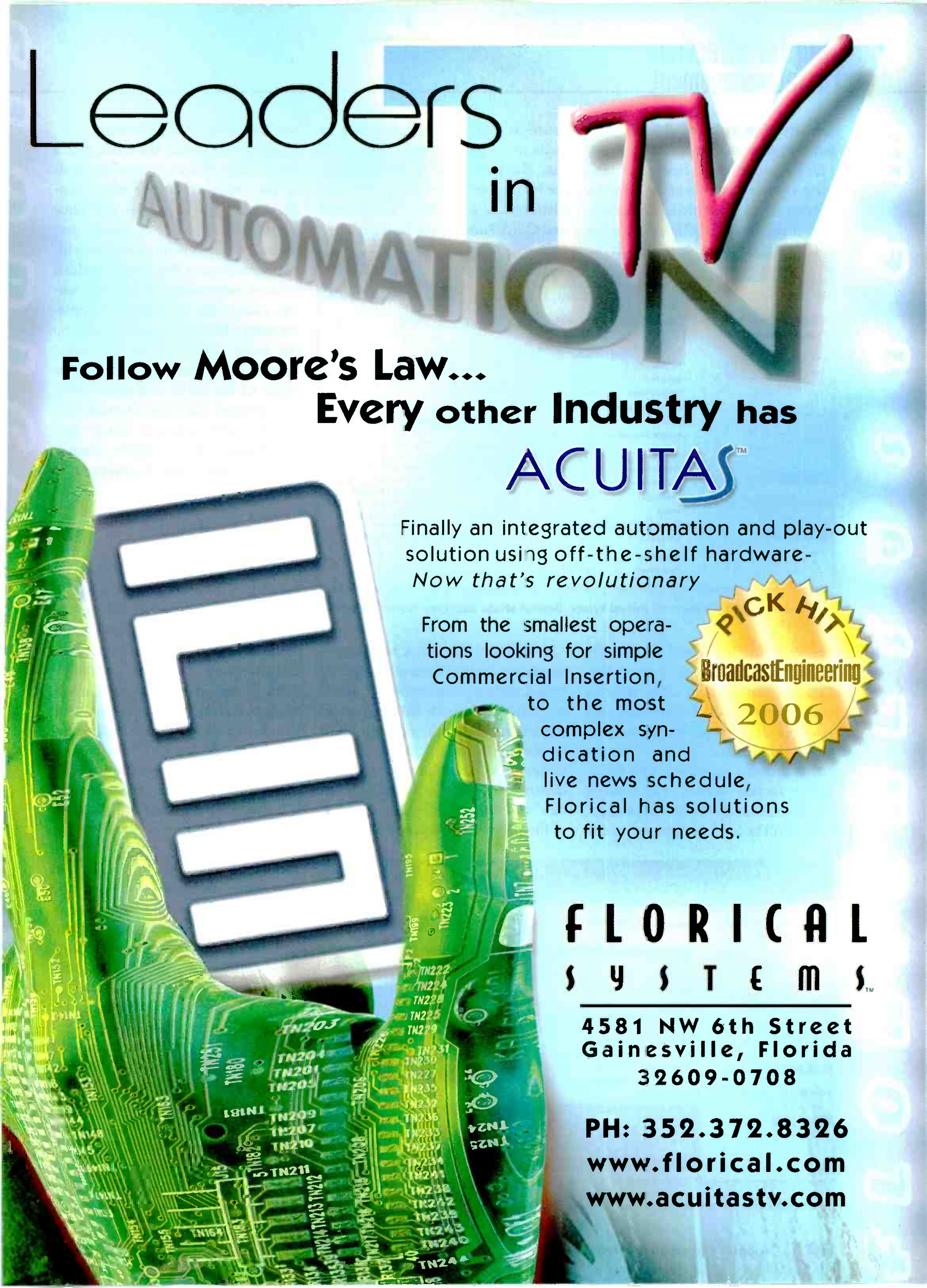
BY ALAN SAWYER

The road to digital asset management (DAM) is paved with good intentions. However, most DAM projects never realize their full potential. The reasons for this are varied. This article presents some of the common reasons DAM projects underachieve or fail altogether and includes suggestions to help you plan for the introduction of effective DAM within your organization.

When implementing a DAM system, you are not just purchasing a product; you are fundamentally changing the way you will work with content, and this may extend throughout your organization. Without careful planning, you will not meet your objectives.

DAM is effective when the content is catalogued in a meaningful way, available in a timely fashion, and accessible in a useful manner and in a usable format. Keep this in mind at all times as you plan your project. As the industry moves toward greater repurposing of content for new delivery platforms such as the Internet and wireless devices, the need for effective DAM in broadcasting has never been greater. These new distribution models make DAM a mission-critical part of your environment, so it is critical to examine your needs thoroughly and plan carefully — not just for today, but also for the future.

Photo: Taj Television in Dubai Media City employs the Harris Broadcast Master system, which manages planning, content and material acquisition, presentation, scheduling, and library management.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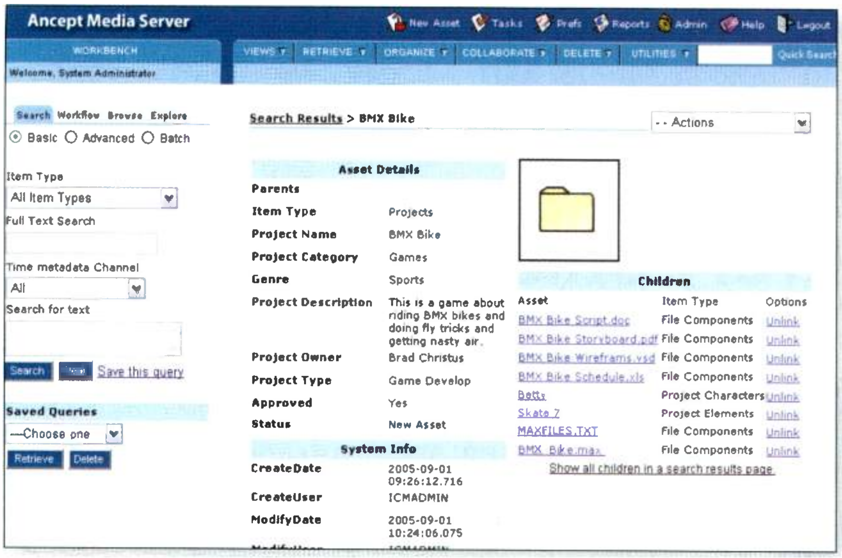
Define the role of DAM within the enterprise

Organizations often have an incomplete vision of the role of DAM in the enterprise. In the evolving broadcasting world, the role of DAM goes far beyond being just a replacement for existing content storage approaches. Content management must now be able to serve multiple purposes and multiple delivery platforms, such as video on demand (VOD), Internet download and streaming, and delivery to mobile devices. The content needs to be available at the production-element level as opposed to the broadcast-segment level in order to facilitate re-packaging of content. It may also need to be stored in multiple bit rates and formats for different platforms (e.g. MPEG-2 for playout and QuickTime for the Internet).



Inter-related digital assets of mixed types. Screen shots courtesy North American Systems.

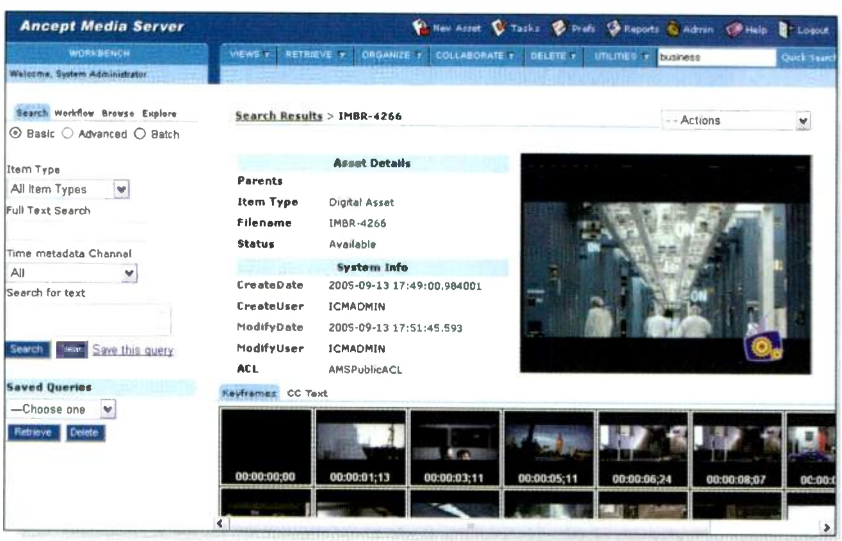
In addition, there is a need to incorporate content from other departments, such as programming, marketing and legal, into the DAM system in order to maximize the value provided by the DAM system. Implementing different DAM solutions for different departments leads to "islands of content" and makes it difficult to bring all of the relevant information users may need together at the same time.

Broadcasters must, therefore, take a holistic view of the information needs of the entire enterprise when considering DAM. To achieve full value from DAM, the scope of your project should extend beyond merely providing management for your broadcast content. Addressing the broader content issues *after* selecting and implementing a DAM system is usually too late in the game. Review your DAM strategy in the broader context of the needs of the entire enterprise *before* you proceed with the selection of a specific DAM solution. Ensure that the chosen solution aligns strategically with your overall content management vision.

Understand that metadata is critical

Metadata literally means "data about data." In the broadcasting context, it really means descriptive information about the video content. This can include basic technical data, such as the encoding format and audio/video bit rates, as well as non-technical information, such as the episode name, the director's name and the original airdate. Metadata also can include much more extensive information at the segment, scene or even frame level.

Taxonomies are standardized ways of cataloging information. Metadata taxonomies define what metadata should be included and the format the information should follow. The metadata used for content storage in your DAM system is important, and you should look to industry-standard taxonomies. The MPEG-7 Multimedia Content Description Interface ISO/IEC standard, for example, was developed by the Motion Picture Experts Group as an industry-standard metadata taxonomy for describing video content to facilitate content searching. The metadata can include SMPTE timecode references, so you can locate and go directly to specific scenes within a program. Other standards exist for video content as well. Choosing the standards you will use



The breakdown of an asset into keyframes

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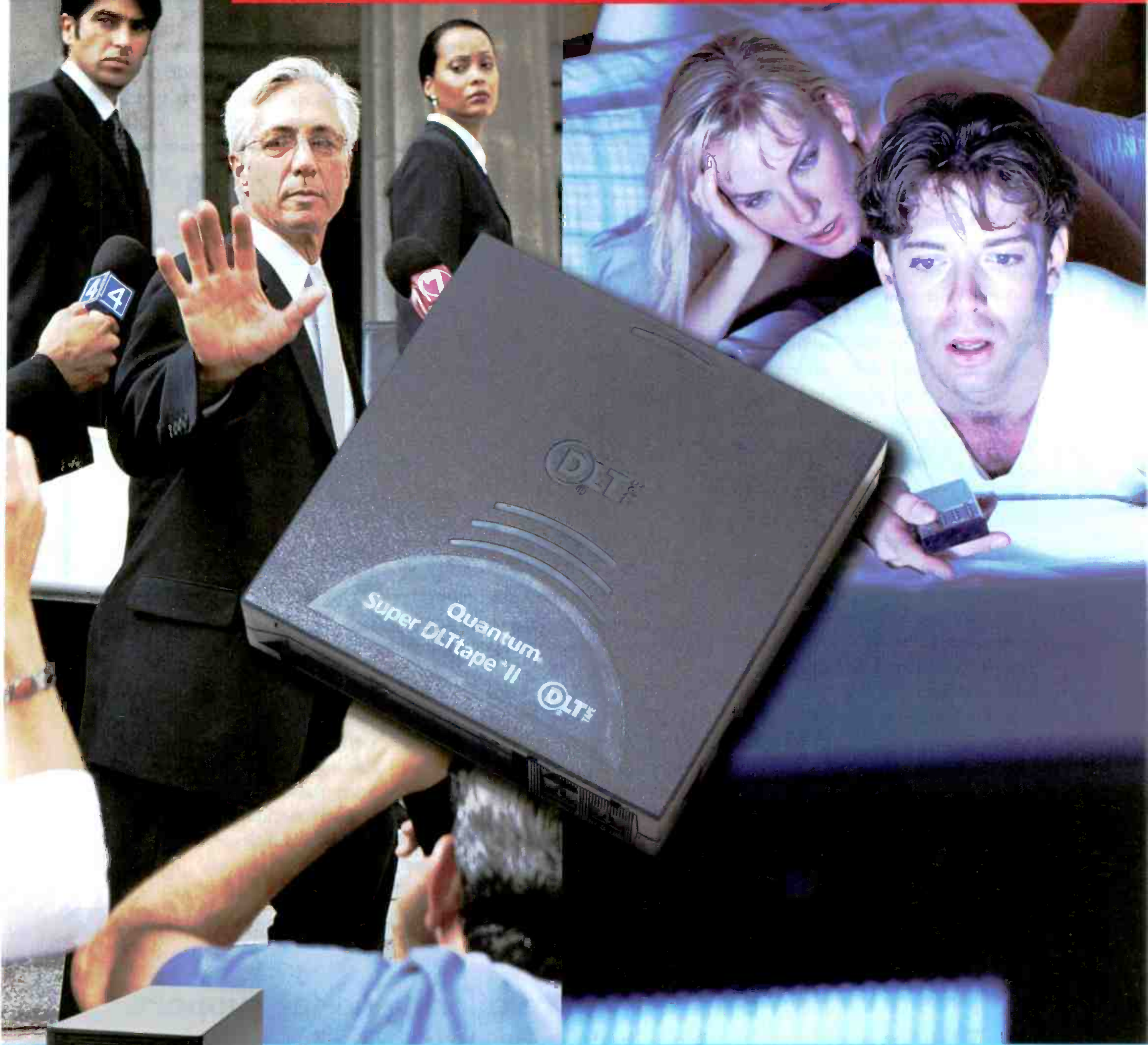

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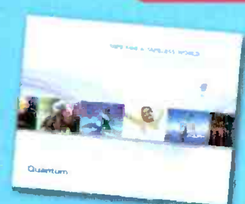

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has significant long-term implications and must be carefully considered.

Manage requirements properly

The failure of most technology projects of any kind can usually be traced to inadequate requirements definition or poor management of the requirements that are identified. Ensure that everyone who has an interest in content management (the stakeholders) has been identified and that their requirements are fully understood. Throughout the planning process, and the subsequent vendor evaluation, ensure that every requirement is addressed.

Understand, too, that requirements change over time and may even change before you have completed your selection process. Stay close to your users in order to understand what they are really looking for. A common reaction to a system that is implemented based on poorly-managed requirements is: "It's exactly what we asked for but not what we need." Understanding the complete requirements — and what is really intended — is critical.

Ensure that all of the requirements you identify are properly recorded in a suitable requirements management software program. This will permit you to understand the implications of future requirements changes and to recognize the side effects and impact of subsequent changes that may be

Avid Interplay Access lets team members navigate project files such as clips and scripts from a standard desktop computer.

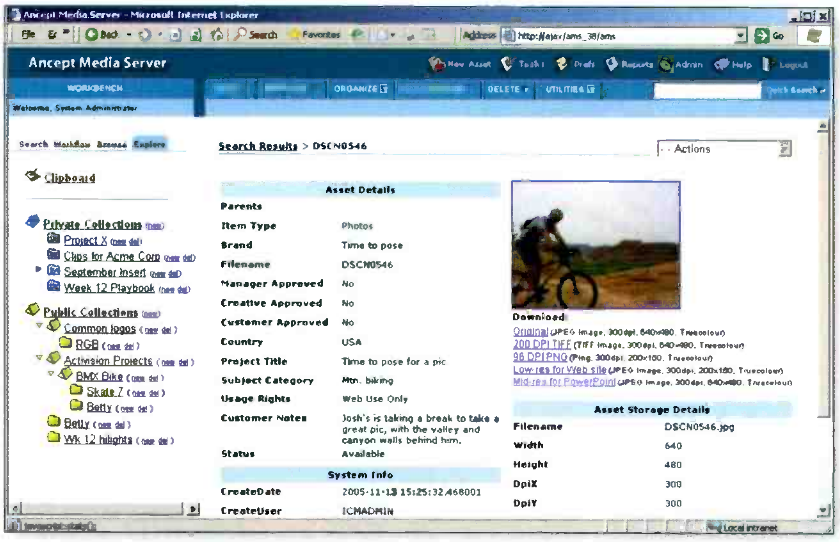
made to the DAM system down the road.

Often the biggest problems with any technology project lies not in the decisions that are made but, rather, in those that are not. Review your solution design carefully. Make conscious decisions to include or exclude functionality and capabilities.

By choosing to include or exclude, you are less likely to preclude. Preclusion occurs when something cannot be done because of limitations of the solution that were not considered at design time. It is okay (and usually necessary) to design a solution that has limitations; just be sure to know what those limitations are by consciously deciding to include or exclude capabilities.

Consider process impact and

organizational change too. Broadcasters sometimes select a product based on specific technical or other merits and then, at implementation time, try to determine how the system will be used in their environment. Before a decision is made on DAM, it is imperative to understand both current processes and, even more critically, desired future processes. If the desired processes aren't defined in advance, the inevitable result is an attempt to define processes that will work within the capabilities (and limitations) of already-acquired solution components. Failure to plan for and manage the organizational impact of changed business processes can lead to resistance to follow the new processes, compromising the quality, integrity or usability of the content in a DAM system.



An example of metadata

Model your current ("as is") processes using a computer program designed specifically for process modelling. Use these models as your baseline for experimentation with your expected "to be" processes. Evaluate the ability of potential solution components to work within these processes. Do "what if" modelling to see how you would approach doing business in ways that aren't part of your current business plans but could become significant due to external forces. Evaluate how your candidate solution components will be able to adapt to these models. Consider how adaptable the products are to allow you to deal with process change and the unexpected.

Perform a detailed gap analysis

There will almost always be gaps between the functional, technical and process capabilities desired by an organization and the ability of any specific product to meet these. The gap analysis process is performed to identify where the gaps lie between your requirements and the capabilities of a product.

To avoid this problem, perform a complete gap analysis on your shortlisted vendor products. Identify the gaps, assess the impact, and determine how you will address the gaps. Be prepared to reject the product if critical gaps can't be resolved either by the vendor or by changing your requirements in a way that is acceptable to you. Failure to perform detailed gap analysis to identify and address

these gaps before selecting a product can lead to disaster.

Examine integration capabilities carefully

Many vendor products are based on closed architectures that make integration difficult. Claims of open integration capabilities aren't always worth the paper they are printed on, either. Nor are all integration capabilities created equally. Ensure that you understand your current integration requirements, and ensure that the chosen product can meet those needs.

Consider the need for integration with your automation, traffic, sales, billing and rights management systems. It is critical to examine how that integration will be done from a technical point of view. Will that integration break the next time a new software version is implemented? Will a minor vendor change to a database design cause the integration to fail?

Involve your IT department to look beyond the functional aspects of integration; pull back the covers and see how stable (or fragile) the underlying integration mechanics really are. Look for a service-oriented architecture (SOA) integration approach or, at the very least, ensure that the products you choose have the potential to be SOA-enabled. The subject of SOA is too complex to discuss in the scope of this article, so turn to your IT department or an outside specialist for assistance in understanding this important consideration.

Define ownership and governance strategies

In a broadcast environment today, and even more so in the future, many stakeholders will have an interest in the content. The various types of content within a DAM system will have different owners with different needs. Clearly, the conventional broadcast content destined for playout belongs to the broadcasting division, but new media content produced for the Internet or wireless devices may have a different owner.

Likewise, contracts and legal documents have different owners, too. Some content may serve two masters (for example, broadcast and the Internet), and it is important that the management of such content be well coordinated so that the needs of both groups are served equally well.

Another important question to determine is who is responsible for the overall management of the digital asset management system. While broadcasting may be the driving force behind the introduction of digital asset management, all modern DAM systems are built on IT technologies. So, the IT department is often best equipped to deal with backups, storage upgrades, the installation of new software versions and so on.

Governance policies deal with such issues as what content will (or won't) be stored on the system, how long differing types of content should be retained, and what metadata must be entered for various content types. If governance policies aren't defined early, or fall by the wayside once the system is implemented, chaos can ensue. As a result, the content becomes unmanageable or does not deliver on its full potential. Content management can be a shared responsibility. Sometimes, however, it is better to adjust your organizational structure to create a new role with overall content management responsibility that includes:

- coordinating the definition of governance policies;
- ensuring that governance policies are followed on an ongoing basis; and
- performing quality assurance and system integrity checks to ensure the health of your system and the content in contains.

Consider the long-term financial requirements

The upfront cost of a DAM system is usually obvious, and most companies budget adequately for that. However, ongoing costs are often overlooked. Budget for software and hardware maintenance, vendor support, and incremental storage costs as you grow your content repository.

In addition, any DAM system needs care and feeding, so budget for training of in-house technical resources and consider the inclusion on staff of an information architect who understands your information classification needs and usage patterns.

Manage the project with the care it deserves

DAM implementations are complex and tend to touch many parts of an organization. Decisions need to be made throughout the selection and implementation process that may affect various stakeholders within the organization. Failure to effectively manage the DAM project at a broad level leads to failed expectations and a solution that does not meet all of the needs of all of the interested parties. Failure to effectively plan and manage communications leads to misunderstanding of what is being done, and can even cause fear and apprehension.

Identify the stakeholders and create a steering committee (a group that represents the various stakeholders, provides project guidance and makes the tough decisions when conflict arises). Put a senior project manager in place who will track issues, risks, and the progress of the project and who will report these to the steering committee in a timely manner. Risks must be well understood. How likely is the perceived risk to come to pass? How severe is the potential impact? For every risk, there must be a risk mitigation strategy in place. Develop a communications plan and execute it so that everyone in the organization who will be affected understands what is happening and how the project is progressing.

Summary

The scope of a DAM project should include, or at least consider, the needs of the entire organization. The decisions you make now will have a long-term impact on your operations, so invest the time today to ensure that you have considered the many facets of DAM and the common pitfalls this article identifies.

And finally, there's no substitute for knowledge and experience. If you don't have the skills in-house to follow these recommendations, go outside of your organization and invest in skilled consulting services to help ensure your success in your DAM initiative. It will be money well spent. BE

Alan Sawyer was a business and technology strategy consultant with IBM Global Business Services, specializing in the media and entertainment industry, at the time this article was written.

Choosing a lens for the new HD studio

BY LARRY THORPE AND GORDON TUBBS

As broadcasters across the country turn their attention to incorporating HD news programming as part of their overall DTV services, questions invariably surface with respect to the related cameras, camcorders and associated lenses. Within the studio, capital budget imperatives will entail close examination of those core HD products and associated accessory systems, such as robotics, pedestals and teleprompters.

Deploying portable HD production cameras is increasingly popular because they produce equal picture quality to their larger hard studio camera counterparts at a lower cost. Having committed to such an HD portable camera, many broadcasters naturally ask if an HD portable EFP/ENG lens will suffice. Given the non-trivial cost differential between all HD studio lenses and portable HD lenses, this is a quite understandable question.

The primary difference

Studio lens design criteria are different from those for portable EFP/ENG lenses. The latter has a central imperative of producing a lens that is lightweight and mobile (less than 5lbs being an industry expectation) when coupled with a camcorder or other portable camera. Significantly lowering the size and weight of a lens imposes restrictions on optical optimization (optics is very physical).

The studio lens, on the other hand, typically puts aside issues of size and weight and instead assigns its first priority to achieving the highest overall optical performance. Larger glass elements and more glass elements are central to attaining this higher level of image performance. As a consequence, a typical studio lens will weigh more than 40lbs.

Expectations of overall lens performance

There are many dimensions to HD lens performance, including optical sensitivity, sharpness, contrast ratio and color reproduction. The lens design also seeks to minimize the multiple distortions and aberrations inherent to all optical elements. Formally specifying such imaging parameters involves a great deal of data, and accordingly, all lens manufacturers have shunned publication of this data in product literature. Regrettably, this

Photo: Suppose, for cost reasons, you buy HD portable cameras for your new studios. What are the trade-offs if you use portable HD lenses on them? There are significant quality issues to consider before making this choice.

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Picture performance attribute	HD studio lens	HD EFP/ENG lens
Sensitivity	Very high	High
Relative light distribution (Evenness of brightness across image plane)	Very good	Good
Black reproduction	Excellent	Very good
Contrast ratio	Very high	High
Chromatic aberration	Tight control	Controlled
Image sharpness (at picture center)	Very high	High
Image sharpness (at picture corners)	High	Reasonably high
Focus breathing (Change in angle of view as focus is adjusted)	Almost zero	High (with ENG lens) Moderate (with EFP lens)

Table 1. The attributes that produce final image quality in the studio HD lens and the EFP/ENG portable lens

obfuscates the essential performance differences between the HD studio lens and the portable EFP/ENG lens.

Overall lens performance can be distinguished by two primary attributes:

- *Image clarity* — an interrelationship between optical black reproduction, color reproduction, brightness, relative light distribution and contrast ratio.
- *Image sharpness* — an interrelationship between contrast, resolution, defocusing aberrations and chromatic aberrations that are the essence of the high-definition viewing experience.

HD portable EFP/ENG lens design has advanced in recent years, and the performance of these lenses is remarkable, given the severe physical constraints imposed upon them. It is, however, physically impossible for these smaller HD lenses to achieve the same overall image performance as the larger studio HD lenses.

Table 1 offers a comparative summary of those attributes that produce final image quality in the studio HD lens and the EFP/ENG portable lens. No one attribute in isolation constitutes a radical difference between the two lens types. Collectively, however, they amount to a significant overall performance difference. This difference has important aesthetic consequence for the look of a news studio and the portrayal of anchors and other talent. That look becomes the HDTV signature of the television station in its market.

Optical sensitivity

The large studio lens employs wide diameter glass, which inherently captures more light. A high-end studio camera can have a maximum relative aperture of *f*1.5 in contrast to the more typical *f*1.9 of the portable EFP lens. But, there is an additional and important aspect to lens sensitivity, known as relative light distribution.

Relative light distribution

This refers to a fundamental optical phenomenon whereby the transmitted light through each lens element is at maximum at the center and falls off toward the extremities of the image plane. Thus, effective lens sensitivity varies across the image plane, dropping from the center to the extremities. This effect is typically greatest at the lowest aperture number (when the iris has its greatest opening) and at the telephoto end of the focal range. It reduces as the lens is stopped down. (See Figure 1.)

Various optical compensating techniques can reduce this effect at the more open iris settings, but only to a limited degree. These techniques are, however, more readily implemented

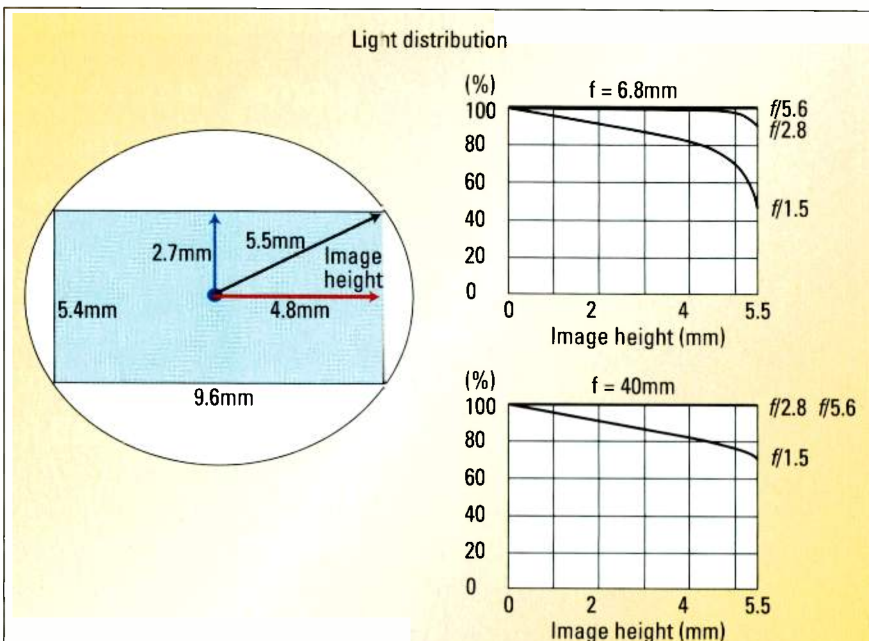

Figure 1. A typical relative light distribution characteristic for an HD studio lens. At a wide angle focal length setting, the light falloff is well controlled when the lens is stopped down to f2.8 or greater. It is even better at longer focal lengths.

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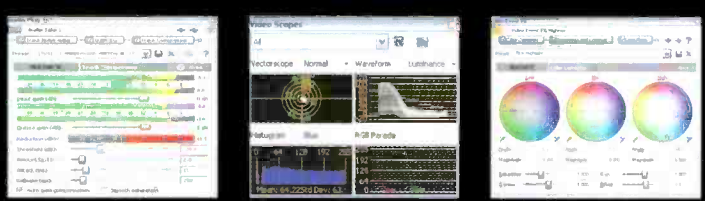

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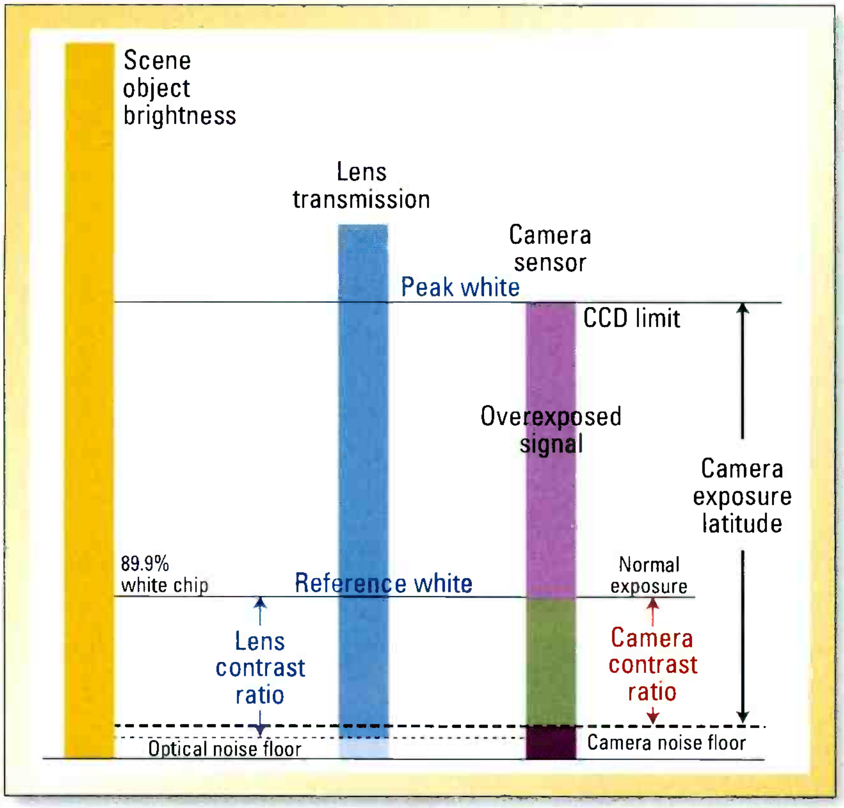


Figure 2. An illustration of an HD studio lens with a contrast ratio greater than that of the HD camera to maximize the overall system contrast ratio

with the larger (and additional number of) glass elements of the studio lens. The typical large HD studio lens will be 30 percent to 40 percent better than an HD portable EFP/ENG lens over the *f*2.8 to *f*5.6 aperture range. This has consequences for the evenness of the lens' contrast ratio across the image plane.

Contrast ratio

This is a measure of the contrast range of the lens from reference white level (the 89.9 percent white chip on the gray scale chart) to a super black in the scene. (See Figure 2.) This range is heavily dependent upon achieving excellent black reproduction, which, in turn, is a measure of how effectively flare, veiling glare and reflections (the combination of which define an effective optical noise floor for a given lens) are reduced.

It is important that this optical noise floor be lower than the electronic noise floor of the associated HD camera. It is equally important that the brightness of the reference white level be as even as possible over the entire 16:9 image, hence the importance of a well-controlled relative light distribution characteristic.

All lenses must deal with reflections at every glass-to-air surface within the multi-element lens. Each untreated glass element can exhibit 8 percent to 9 percent reflectance. In a multi-element lens, this accumulates to considerably contaminate black reproduction through the lens. HD studio lenses incorporate highly specialized multi-layer coatings on each lens element to lower these reflections.

Controlling the thickness and density of the various materials can significantly decrease reflectivity and elevate transmitivity. Managing the reflections of all light wavelengths of interest (approximately 400nm to 700nm) requires many layers. Depending on the material used, they can be deposited on the lens element using vacuum deposition or plasma sputtering techniques.

A contemporary HD studio lens will achieve contrast ratios well in excess of 1000:1 using these techniques. These add significantly to the cost of the lens. To control costs, the typical HD portable EFP/ENG lens will not resort to the same degree of sophistication in such coatings.

Lens image sharpness

Two fundamental optical phenomena impose limits to the resolution of all lenses: defocusing aberrations and

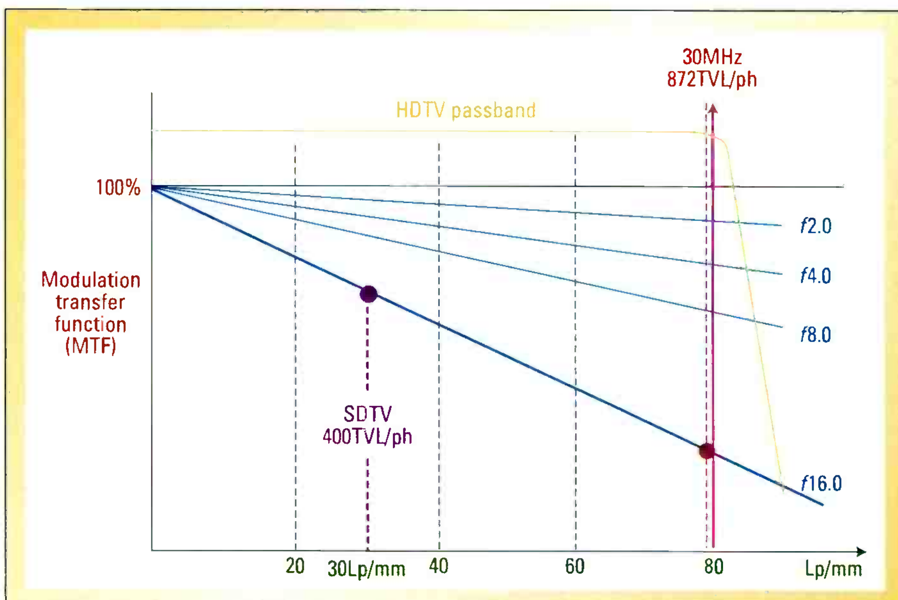


Figure 3. The effects of lens diffraction on a 2/3in hypothetical HDTV lens that is "perfect" in having zero defocusing aberrations

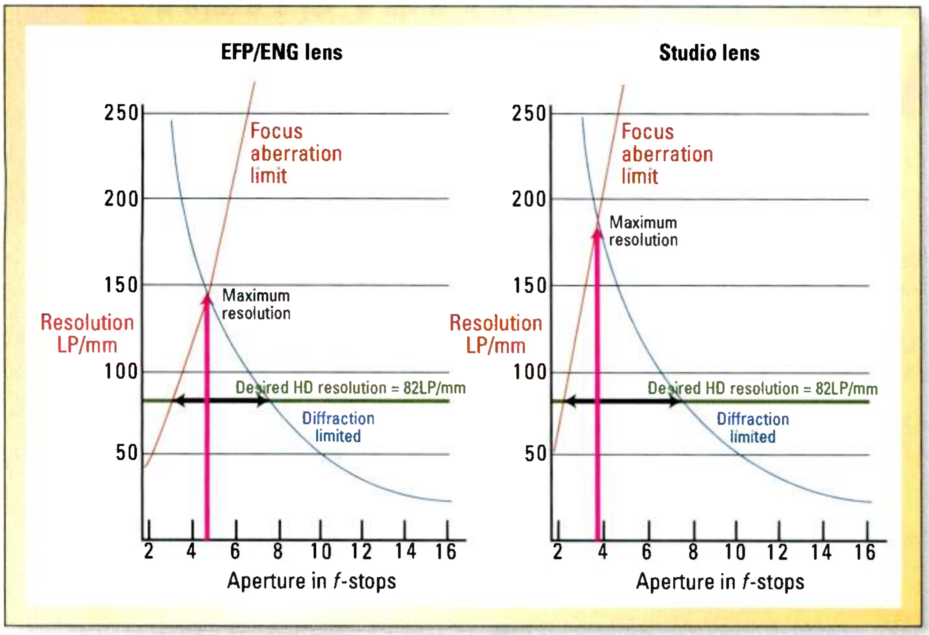


Figure 4. Illustrates the two constraints that dictate the MTF behavior of a lens: the intractable physical limitation of diffraction that worsens as the lens is stopped down and the limitation imposed by the inherent defocusing aberrations (becoming more significant at wide aperture settings). This concept of portrayal is courtesy of Edmund Optics [1].

defraction. They affect the ultimate resolving power of the lens and its MTF characteristic.

Defocusing aberrations are the collective of the four classic monochromatic aberrations common to all lens elements. These errors are at a maximum at low-aperture settings (lens iris near maximum opening), and they generally decrease as the lens is stopped down.

There are many optical design strategies to combat the effects of these aberrations, involving combinations of specially designed elements to implement compensating strategies. The more lens elements that can be mobilized, the more effective the control over these defocusing impairments. Studio lens design involves many more elements than the more compact EFP/ENG lens and consequently has far greater degrees of freedom to counter these aberrations.

Diffraction is an optical behavior related to the wave properties of light. It imposes a limit on how small an optical image spot size can be. This imposes an ultimate limit to the ability of all lenses to transfer contrast at high spatial frequencies. Diffraction effects increase as the lens is stopped down. For the same image size, the resolution of studio and EFP/ENG lenses are both rigidly limited to the same degree by diffraction.

If a hypothetical "perfect" lens could be made — that is, one having zero defocusing aberrations — then diffraction would be the ultimate dictator in defining the resolution limits of a lens. Figure 3 shows that such a perfect lens exhibits a linear MTF roll-off across the optical passband for a given iris setting. As the aperture is decreased (the lens is stopped down), the effects of diffraction become increasingly aggressive. While diffraction certainly has a non-trivial effect on an SDTV lens, it becomes a much more serious issue in HDTV.

If a hypothetical "perfect" lens could be made, then diffraction would be the ultimate dictator in defining the resolution limits of the lens.

The resolution boundary for the 1920 (H) x 1080 (V) HDTV standard is 875TVL/ph, which equates to 82 Line pairs per millimeter (LP/mm) in the optical domain. Clearly, diffraction is becoming a serious limitation after *f*8.0.

All real lenses, however, must contend with the implacable realities of the defocusing aberrations and diffraction conspiring to define a final limiting resolving power and an attenuation of contrast reproduction (lowering MTF) across the optical passband. The separate dynamics of the two is graphically outlined in Figure 4, which portrays the combined effects of aberrations and diffraction on the resolving power of a 2/3in EFP/ENG and a 2/3in studio lens over the full range of aperture settings. (These are generic curves for illustration purposes and do not refer to any specific lens.) The diffraction limit is shown by the blue curves (same for both lenses) and the defocusing aberrations by the red curves (smaller for the studio lens).

The desired HDTV boundary resolution of 82LP/mm is shown as the green line in Figure 4. For most lenses, resolution improves when it is closed down from wide-open aperture (a consequence of the lessening effects of the defocusing aberrations). Then there is the "sweet range" over which the lens delivers resolution higher than the needed 82LP/mm, followed by the onset of diffraction at the higher aperture settings that progressively lowers the resolution. As indicated, the lower defocusing aberrations of the HD studio lens elevate the maximum or limiting resolution of the lens and broaden the sweet range of aperture settings.

In addition to these fundamental physical limitations, the other resolution-related dynamics within all HD lenses include:

- maximum MTF at image center;
- falloff in MTF at image extremities; and
- significant variations in MTF as the operational controls of zoom, iris and focus are exercised.

The studio lens design specifically seeks to control these overall sharpness gyrations to the highest degree possible. This entails larger glass elements, more elements, special materials and multi-element groupings. As a consequence, size, weight and costs are higher than those of the portable HD lens. The portable lenses are severely constrained in size and weight and accordingly cannot achieve the same degree of compensation of these distortions as is possible in the studio lens. Accordingly, the corner MTF roll-off is consequently greater in the EFP/ENG lens. Over the critical range of *f*2.8 to *f*5.6, this shortfall can be 20 percent to 30 percent greater than for the studio lens.

Chromatic aberration

These aberrations are a consequence of another fundamental of optics, the fact that every transparent element produces a different focus and magnification for each color wavelength. The end result is color blurring and a misregistration in the matrixed luminance video in the HD camera, which further reduces MTF. And again, this can only be dealt with by sophisticated optical design entailing compensating element designs and different element materials within lens element groupings. These aberrations are more tightly controlled in the studio lens than in the portable lens.

Putting it all together

The HD studio lens design pays close attention to overall image optimization across the entire image plane. Larger optical elements contribute to this optimization. Additional elements offer extensive flexibilities in managing all of these parameters and in implementing optical compensating strategies that lower optical distortions and aberrations.

Consequently, lens size, weight and costs are higher than the portable lens. The best HD studio picture performance is achieved with the large studio box HD lenses. The EFP/ENG HD lens is not a good choice for the HD studio camera. **BE**

Larry Thorpe is the national marketing executive and Gordon Tubbs is the assistant director of the Canon Broadcast & Communications Division.

[1] Electronic Imaging Resource Guide, *Section 2: "Image Quality," Edmund Optics.*

IPTV's key building blocks

BY TAM DO

Telcos are competing with the cable companies to deliver video content to consumers. However, most telco infrastructures do not have the required bandwidth for high-quality video distribution like the cable companies. So, instead of using the digital modulation technique, such as QAM and MPEG-2 video encoding, to distribute content, telcos are employing IP networks and using new encoding schemes such as MPEG-4 Part 10 (also called H.264-AVC).

This creates a huge opportunity for equipment manufacturers to supply telcos with this new type of encoder and decoder. This article investigates the technology that is fueling this new IPTV environment. The first portion will look at the video encoding method, and the second portion will focus on the video-over-IP (VoIP) network design that is being used for IPTV.

IPTV

Telcos are on the offensive to gain a big piece of the video market share from cable TV providers. Cable multiple service operators (MSOs) have made huge progress in delivering a triple play of voice, video and data services to consumers for quite a few years. Now telcos are responding in a big way to provide the same triple play by offering not only voice and data, but also high-quality digital TV video via IPTV. IPTV is an emerging technology that allows consumers to watch high-quality digital TV over the Internet via an IPTV set-top box or a PC. Traditional cable companies use an RF signal to carry the digital video by means of QAM.

Telcos are employing IP networks and using new encoding schemes such as MPEG-4 Part 10 to deliver video content to consumers.

Technology advancements have made it possible for telcos to bring the same quality of video via the Internet. The key building blocks on the transmission side are advanced video encoding and VoIP. Advanced video encoding is the most critical building block. The availability of HD content along with SD has created a challenge for telcos, because telcos still rely on the bandwidth-limited twisted copper pair of wires and usually do not have the luxury of cable's broadband capability.

A typical HD channel requires 20Mb/s, and an SD channel requires 4Mb/s. Therefore, a bandwidth-efficient video transport mechanism is needed. The H.264 format of MPEG4 Part 10 and Microsoft's VC-1 encoder can offer a 2.5X to 3X more bandwidth-efficient improvement over MPEG-2 encoding. Most broadcasters are adopting the H.264 standard rather than the VC-1 standard. The other building block of IPTV transmission is VoIP, which maps or bridges the encoded video data onto the Internal network for delivery.

H.264 encoder

H.264 is also known as MPEG-4 ISO/IEC14496-10 or MPEG-4/AVC. This standard was co-developed by a JVT group composed by MPEG-ISO/IEC members and VCEG-ITU-T members. Three profiles (main, baseline and high) have been defined, each with several levels. The main profile is required for broadcast video quality,

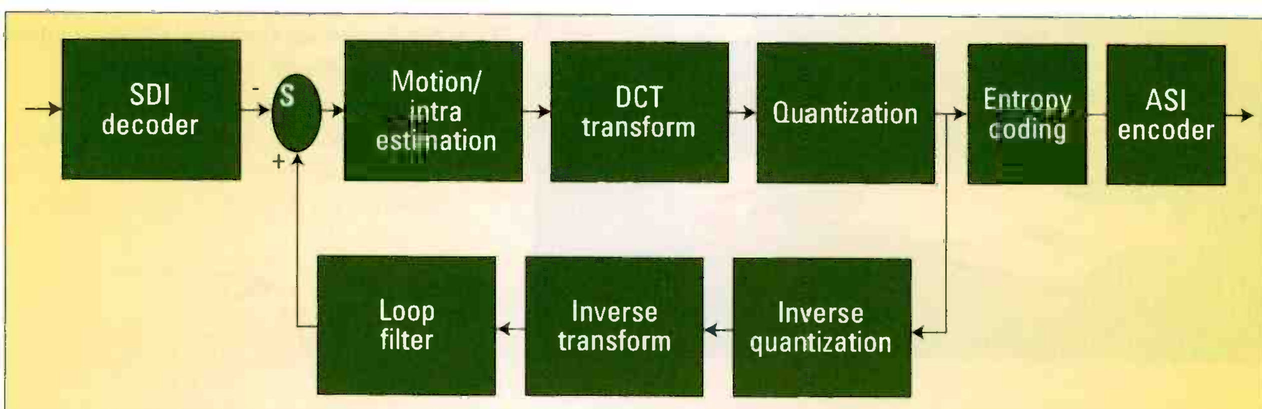


Figure 1. A block diagram of an H.264 encoder

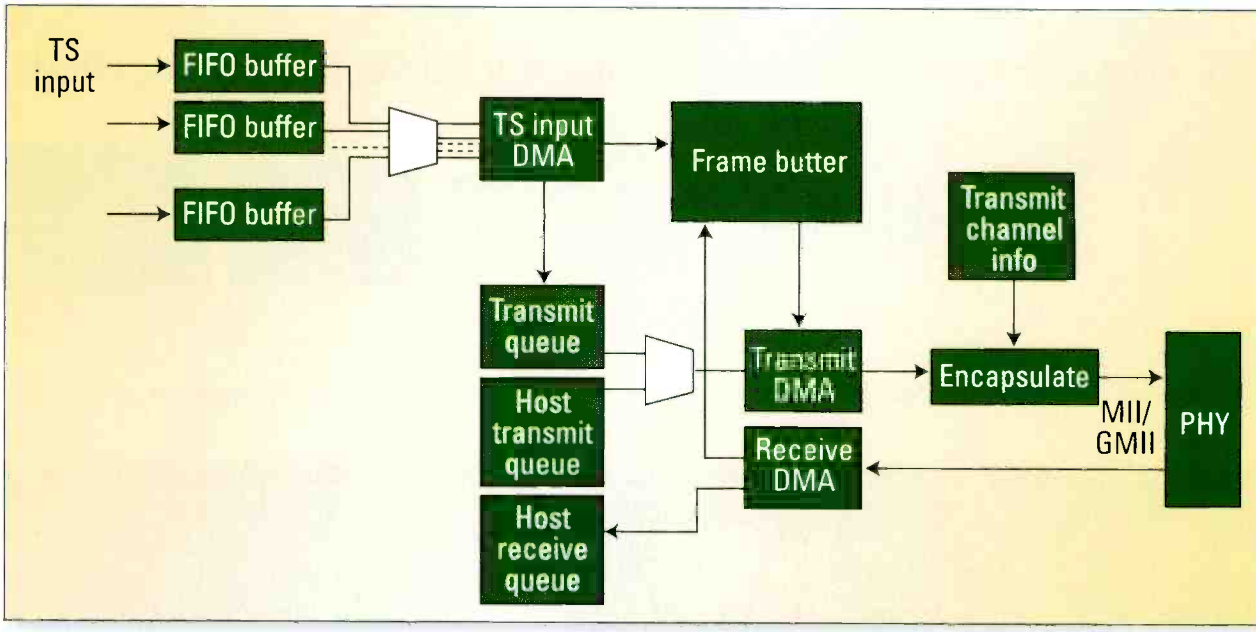


Figure 2. VoIP reference design block diagram

while the simple profile is typically used for mobile and video conferencing applications. The H.264 encoder system block diagram includes two dataflow paths, a forward path, and a reconstruction or feedback path. (See Figure 1 on page 76.)

H.264 encoding is much more complex than MPEG-2 encoding. For the motion estimation/compensation section, H.264 employs blocks of different sizes and shapes, multiple reference frame selection, and multiple bi-directional mode selection.

For the transform section, H.264 uses an integer-based transform that roughly approximates the discrete cosine transform (DCT) used in previous MPEG standards, but does not have the mismatch problem in the inverse transform. Entropy coding can be performed using either a combination of a single universal variable-length codes (UVLC) table with context adaptive variable-length codes (CAVLC) for the transform coefficients *or* using context-based adaptive binary arithmetic coding (CABAC).

The H.264 design is complex, computing-hungry and requires parallel processing.

The H.264 design is complex, computing-hungry and requires parallel processing. If a general-purpose processor is used, it will be limited by its internal architecture. (If it has eight internal multipliers, it can perform eight multiplications per cycle.) A programmable logic device (PLD) is flexible and highly scalable: If an algorithm needs 100 multiplications per cycle, then the PLD can be programmed to perform the required task.

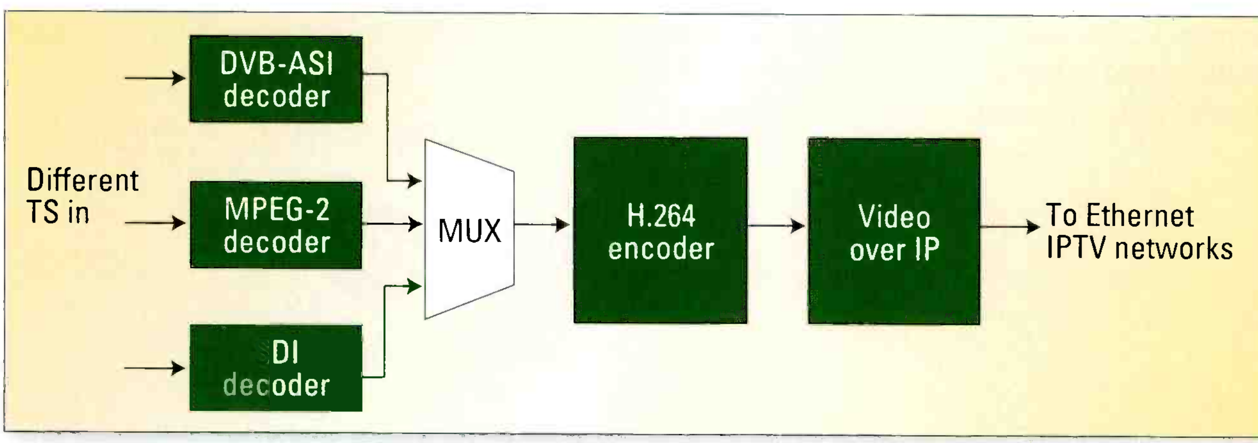
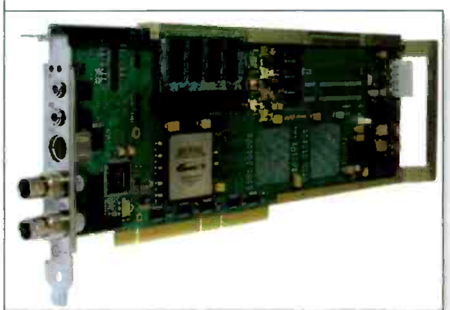


Figure 3. IPTV core block diagram

VoIP

VoIP is the transmission of encoded video transport stream (TS) data over IP-based networks. It bridges between one or more encoded video streams and IP packets carried over 100Mb/s or 1Gb/s Ethernet. The VoIP accepts TS data and encapsulates it for transmission over Ethernet. Various standards define VoIP: real-time transport protocol (RTP), RTP payload format for MPEG video, UDP/IP, Pro-MPEG code of Practice #3 and DVB-IPI.

The TS input to the VoIP is either a DVB-ASI or uncompressed SDI video data that will be mapped onto the Ethernet protocol layer. Figure 2 shows a VoIP reference design block diagram that receives a DVB-ASI TS



Shown here is a single-chip main profile H.264 encoder PLD implementation using an Altera Stratix II device.

and then converting the TS to IP. The design includes the following main blocks: TS input logic, frame buffer, queue system, Ethernet-receive DMA, encapsulator, transmit channel information, receive channel information, timestamp, media access control (MAC) interface and host processor interface.

IPTV system summary

In summary, in order to provide quality VoIP, the latest H.264 video encoding technology is used to conserve bandwidth for delivery. Figure 3 shows the overall IPTV transmission system block diagram. The video content can be either SD or HD, uncompressed video, or previous MPEG-2 TS.

All these formats will be converted to H.264 video format before transmitting. All the key pieces can be implemented efficiently using PLDs for system upgradeability and flexibility.

Further information

Specification details of QAM can be obtained from the International Telecommunication Union (ITU) J.83 Recommendation: *www.itu.int/rec/recommendation.asp?type=items&lang=E&parent=T-REC-J.83-199704-I.* BE

Tam Do is the senior technical marketing manager at Altera Broadcast and Consumer BU.

Video routing

BY JOHN LUFF

Routing switchers are basically an evolutionary line of products that can be traced back at least as far as patch panels. For about two decades, little changed other than rack density, signal quality specifications and warranty offerings. However, in the last 10 years, much has changed in keeping with the function that routing performs in the modern facility and the evolution of signal types.

The birth of digital routing

When digital routing was first introduced, it was parallel digital. If you never saw it, you might think I am out of my mind, but it consisted of 25-pin connectors with tightly controlled twisted pairs, all accurately matched in length. The distance the cables could run was limited. The Holy Grail was, of course, to simplify the cabling and deliver higher bandwidth and longer cable runs.

One engineer at a large European organization once told me that component serial digital routing was impractical, and the limits of physics would keep it from happening. That same year, a European manufacturer began delivering 270Mb/s serial routing that was pricey, but quite feasible for those with deep pockets, alongside its parallel digital products for 143Mb/s and 177Mb/s composite digital video. There were even production switchers with parallel digital inputs, which presented a real cabling challenge.

Video routing today

Today, we find a similar dynamic going on in the marketplace. High definition is barely out of its infancy as a consumer distribution medium. However, display manufacturers and professional equipment suppliers have cooked up 1080p60 hardware, despite the fact that for years, many experts have said that 1080p would never see a market in consumer space.

Well, those who said such (I could be rightfully accused) may find themselves quite wrong. Just as the 270Mb/s router was once considered barely an oddity, now we hear routing manufacturers touting the fact that they can handle bandwidths adequate to carry 1080p60 of 3Gb/s. 1080i60 requires the full capacity of SMPTE 292M (1.485Gb/s for 10 bits). Progressive scanning will require twice the pixels, or approximately 3Gb/s.

SMPTE has been working on standardizing a scaled-up version of SMPTE 292M specifically to accommodate 1080p60 and other future high-bandwidth connections. Twice the bandwidth on the same medium means that the distance will be more limited.

Some in the electronic cinema community feel that even this is not sufficient to handle more bit accuracy and 4:4:4 sampling, which they feel is a necessity in theatrical production and release. In rough calculation, if 1080p24 were sampled as 4:4:4 and 14 bits of depth, it would require 3.3Gb/s.

For electronic projection, the push is for 2k x 4k, which is four times as many pixels per second as 1920 x 1080. Thus, it is entirely possible the routing bandwidth envelope will be pushed a lot further in the future as applications demand infrastructure services that routing can deliver at even higher bandwidths.

> **The Holy Grail was, of course, to simplify the cabling and deliver higher bandwidth and longer cable runs.**

The growth of bandwidth

The bandwidth is but one of several dimensions of the geometric space that routing occupies. As applications and facility sizes have evolved, routing has gotten even larger.

Network Electronics' SD VikinX VD128128M serial digital router at Televisa's production of "Big Brother 3."

Last year, a single-level, embedded audio routing system was installed in an IPTV distribution facility, which was 2048 x 2048, resulting in approximately 4.2 million crosspoints in one level. Such massive needs are quite unusual, but routing systems of 512 x 512 and larger are commonplace today. With monitor walls having as many as 256 inputs, some facilities have moved monitoring paths to a separate level to control the creep of crosspoint and I/O count. The reason is quite simple: Doubling the I/O of a system moves the crosspoint count by a factor of four and the price by approximately a factor of three.

A second technique to control this growth is to use a distributed island of

Distributed Thinking, One Solution

The Cheetah DRS, PESA's newest multi-format audio router, uses patent pending distribution technology to route audio over Gigabit Ethernet with either a single CAT-5 or Fiber cable for multi-frame connectivity. This creates a Distributed Routing System (DRS) scalable from 64X64 (occupying 1RU frame in one location) up to 2048X2048 (in 36RU of space in one or many locations).

Cheetah DRS allows broadcasters to place input frames in equipment racks near satellite ingest from receivers, VTRs, or servers, while placing output frames closer to studio gear for distribution into audio consoles, or master control. This keeps cable runs extremely short, preserves signal quality and reduces cable costs, time of installation and maintenance. Additional inputs or outputs can be added by changing cards or increasing frames in any location. Format flexibility in the Cheetah DRS allows a mix of AES and Analog, Synchronous and Asynchronous audio, with support for Dolby-E.

Simple, Fast, Reliable

Cheetah DRS frames supports redundant power, redundant control, and quick access front-loadable, hot-swappable matrix cards.

Versatile Connectivity

Frames are available with a wide variety of interconnect options. Choose from BNCs for 75 ohm AES, as well as ELCO or DB-50 connectors for analog audio or timecode. RJ-45 connectors are used for optional RS-422 machine control. A 6-pin terminal strip version is also available.

The Clear Path for Clean Audio Distribution: www.pesa.com/drs

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routing and pathfinding to allow signals to flow across a larger fabric. Just as a telecommunications facility is designed to deliver a practical pattern of use without allowing every crosspoint to be in use, a video facility assumes that statistically such a case is highly improbable and not supported.

By carefully analyzing the possibilities and organizing logical connections in smaller blocks, one can significantly reduce the size of a router without diminishing the usefulness of the system. For instance, ASI and SMPTE 259M both can pass through a monolithic router. Let's say you need 64 x 64 of each. You could put both in one monolithic 128 x 128 router or keep them separate because the signal types are incompatible anyway. A connection between an ASI input and an SMPTE 259M output is both illogical and improbable, and it is technically unlikely to be useful unless the receiving device automatically senses a choice of baseband and compressed video.

MTBF's effect on system reliability

There are other reasons to carefully consider how to implement large systems. One critical issue is MTBF and its effect on system reliability. Some manufacturers provide redundant crosspoints as a method of reducing the system MTBF. Others have provided methods of sensing the failure of an input signal and automatically replacing any instance of the failed source with a second copy on another, presumably operational, input. This can be attractive, but redundant crosspoints in a large router can be quite expensive. It is possible that a well-crafted distributed routing installation would be more reliable than a larger monolithic router with redundant crosspoints.

The future of video routing

Although this article deals with video routing, it is important that the idea of distributed routing has reached a logical extension in a product that was introduced and well-received at NAB2006. The product coupled TDM routing systems of modest size (128 I/Os) into a fabric router, which can be physically disbursed to different parts of a facility, putting the connections near the connected devices.

This could be powerful in a large facility, where long cable runs to a central plant router are often difficult. The product was intended for analog and digital audio, RS-422 and time code — not video — but if this concept extended into the video domain, it would have a wide market impact. BE

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

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Vice President of Production: Lisa Parks, lparks@prismb2b.com
Production Manager: Kathy Daniels, kadaniels@prismb2b.com
Classified Ad Coord.: Sarah Goulding, sgoulding@prismb2b.com
Dir., Audience Marketing: Barbara Kummer, bkummer@prismb2b.com
Group Show Director/LDI: Sharon Morabito, smorabito@prismb2b.com

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President/CEO: John French, jfrench@prismb2b.com
COO/CFO: Andrea Persily, apersily@prismb2b.com

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Help Wanted

Soundcraft

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As part of Harman International Industries, Harman Pro North America is the US distributor for the Soundcraft and Studer brands of audio mixing consoles. We are currently seeking a 'Digital Technical Services Manager' to oversee all aspects of service and training related issues for our growing range of digital audio consoles.

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Harman International Industries, Inc. is an equal opportunities employer

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Sales Offices

US/CANADA

WEST
George Watts III
(360) 546-0379; Fax: (360) 546-0388
georgeww3@aol.com

EAST
Josh Gordon
(718) 802-0488; Fax: (718) 522-4751
jgordon5@bellatlantic.net

MIDWEST
Emily Kalmus
(312) 840-8492; Fax: (913) 514-6301
ekalmus@prismb2b.com

INTERNATIONAL

EUROPE
Richard Woolley
+44-1295-278-407
Fax: +44-1295-278-408
richardwoolley@btclick.com

Israel
Asa Talbar
Talbar Media
+972-3-5629565; Fax: +972-3-5629567
talbar@inter.net.il

JAPAN
Mashy Yoshikawa
Orient Echo, Inc.
+81-3-3235-5961; Fax: +81-3-3235-5852
mashy@fa2.so-net.ne.jp

CLASSIFIED ADVERTISING
Susan Schaefer
(484) 478-0154
Fax: (484) 478-0179
sschaefer@prismb2b.com

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LIST RENTAL SERVICES
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Defrag efficiency

BY PAUL MCGOLDRICK

I visited a semiconductor manufacturer a short while ago — one of many visits I make every year when the manufacturers brief me on what they are up to and where they are headed.

During my visit, a lead designer, totally out of the blue, told me, "We're very big on defrag here." For me, it was an elephant-in-the-room moment. For him it was a philosophical statement, a corporate message.

Perhaps I should have looked for it in the company mission statement posted in the lobby, but it made me think that many of us should consider the possibility of a personal defrag. I've been around the broadcasting industry now for more than 40 years, and my brain holds absolutely too much information that is irrelevant to the 21st-century industry.

Think about it: How relevant is it that I could explain the theoretical operation of a beam tetrode? Or that I could still draw the circuit of a Class AB audio amplifier using 6V6s? Heck, I can't even agree with present-day designations of the differences between clamping a video signal and DC-restoring it.

In the test and measurement industry some years ago, we tried to encourage the use of GBR instead of RGB because the G socket on any piece of equipment would also be the socket used for Y in a color-difference signal — so YPbPr would line up with GBR. Makers of real broadcast equipment went with the program, but today the thousands of self-taught video people — most coming from the digital side of things — will look at you strangely if you use GBR.

The slang name for a BNC socket used to be puka (named after the Hawaiian puka shell). But I'm quite sure that if I said to someone today, "Make sure you put that in the right puka," I would get at least a quizzical look, if not a slap in the face.

I'm quite sure that if I said to someone today, "Make sure you put that in the right puka," I would get at least a quizzical look, if not a slap in the face.

Green is all good these days, and I don't have a problem with that. But when someone starts spouting, for example, how important power factor correction is, they really don't like to hear that we thought it important enough to use it on our VHF TV transmitters a long, long time ago.

I still look at a clock or watch when something happens near me. I would be an excellent time witness in a car wreck, for example. This habit derives from knowing that when something failed or there were picture and audio defects, we were expected to immediately log them. And if something lasted for more than a minute (dead air, for example), we sent a service message right back down the distribution chain.

But that was not as farcical as Class I transmissions. When either the monarch or the prime minister was on-air, we had to stand in front of our transmitters in the absurd notion that we could immediately attend to a problem.

I also don't miss the era when I possessed multiple passports (quite legally with a very understanding British government) so that countries I visited would not fuss, or refuse entry, after seeing a visa stamp from a country that they had a hissy fit argument with. Those countries included Cuba, Libya, Israel, Saudi Arabia, the Soviet Union, Taiwan and Turkey. Possessing multiple passports was also convenient insurance against those few countries who took your passport away from you in exchange for a work permit, effectively keeping you a prisoner at their whim.

Nor do I miss having a novel confiscated from me because it was on someone's arbitrary list or was considered politically incorrect by a country's government. Or having to bribe your way into a country, just because that's how it worked.

And the days when I was able to climb a 500ft mast or tower like a little monkey are long gone. I have enough trouble with the Christmas lights.

But who would ever be interested in the fact that I used to be able to jump on RF-live, medium-wave sticks in order to replace a lamp or an isocoupler? Fortunately, I don't have photos to bore you with.

So, I quite like the idea of a human defrag. It would make us all more equal — and wouldn't that be just dandy in the climate of fear that we are compelled to live in today? It would also prevent the publication of some really bad autobiographies … mine especially. **BE**

Paul McGoldrick is an industry consultant on the West Coast.

SEND Send questions and comments to: paul_mcgoldrick@prismb2b.com