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MAY 2004

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THE JOURNAL OF DIGITAL TELEVISION

Video servers

Selecting a solution

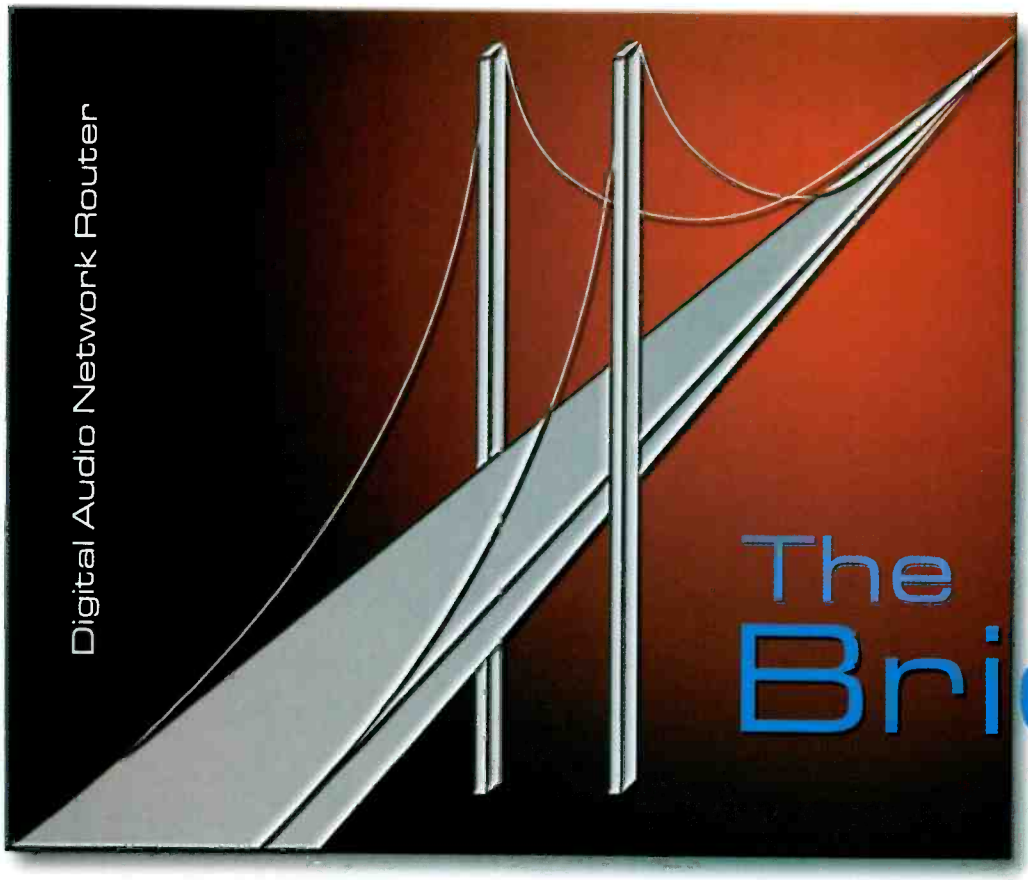
KLCS-TV

Multichannel and datacasting

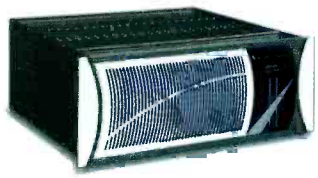
MXF

What's behind this revolution?

A PRIMEDIA PUBLICATION



The Bridge Router can hold all the electronics you'll need for a small console: I/O cards, mix engines, and DSP processors. Naturally it can also have automatic fail-over DSP and CPU cards to keep you on-air. You can expand the system with a simple cage-to-cage interconnect.



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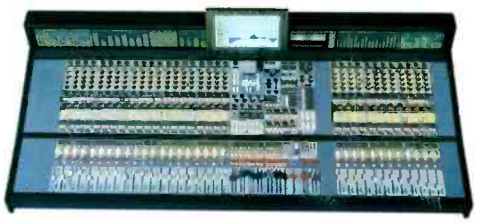

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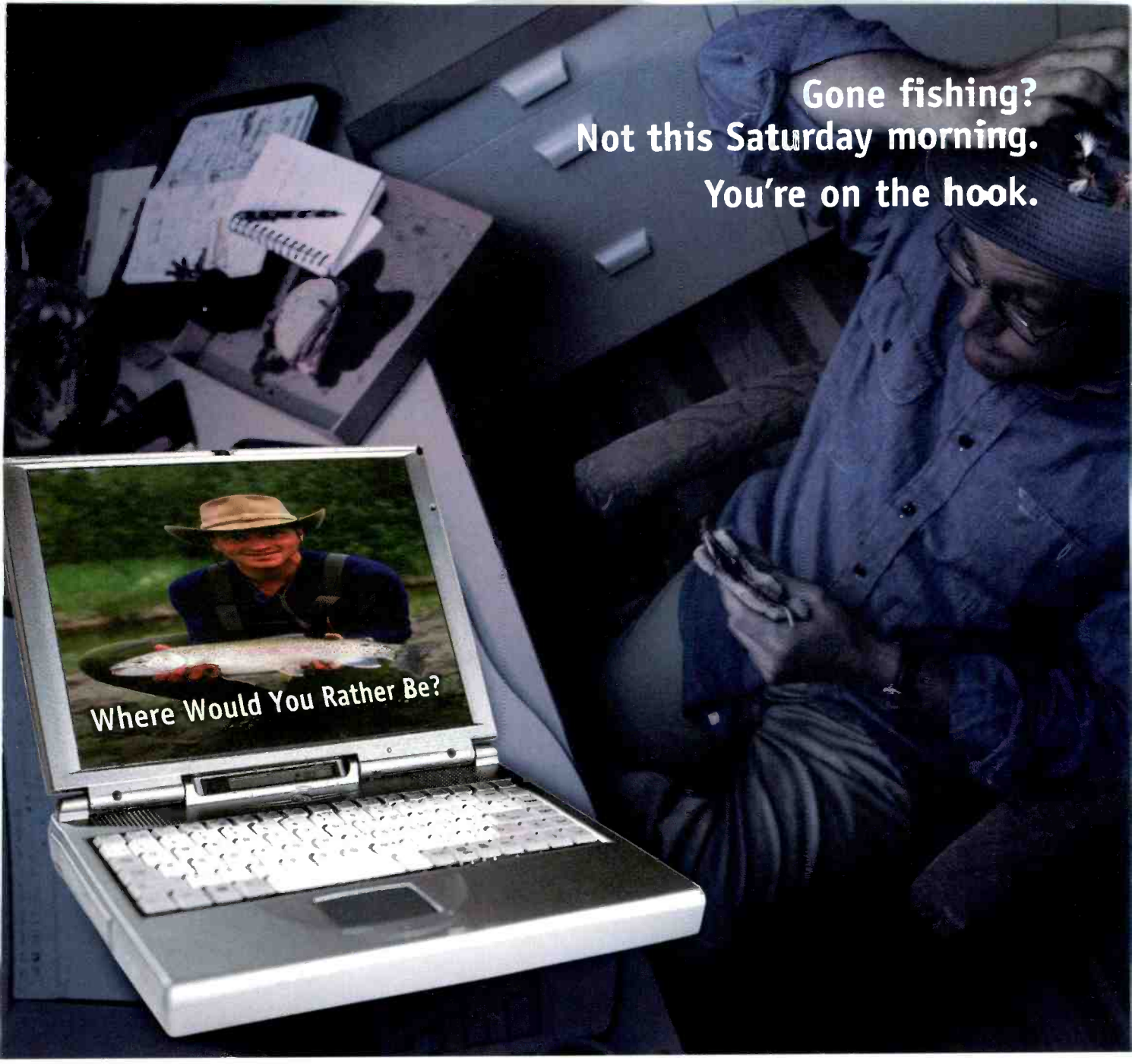

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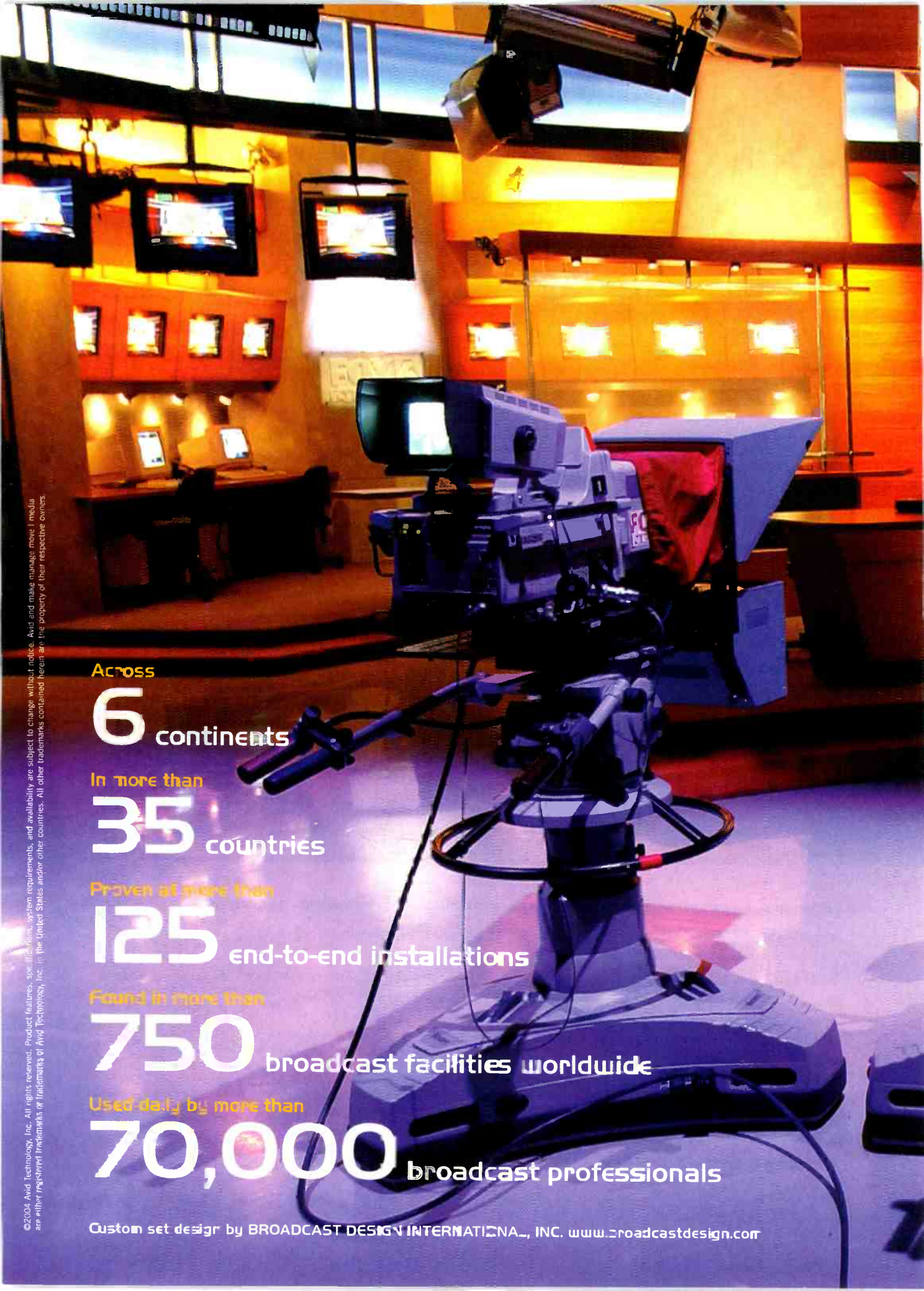

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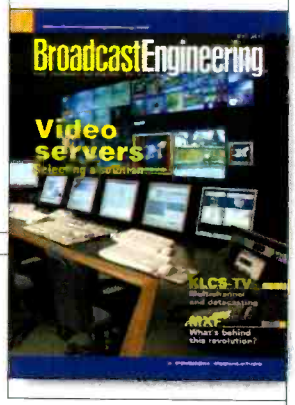
FEATURES



ON THE COVER: Los Angeles PBS station KLCS deployed an Omneon SPECTRUM system in a major facility upgrade and conversion to digital television. Photo courtesy Omneon Video Systems.

BEYOND THE HEADLINES

DIGITAL HANDBOOK

(continued on page 8)

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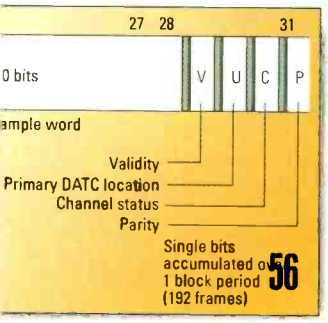
SYSTEMS DESIGN & INTEGRATION



NEW PRODUCTS & REVIEWS

DEPARTMENTS

Freezeframe

What product, first introduced in this magazine, called itself the first "digital storage system" providing what we now know as video serverlike functions? Some have called it the first video server. What company made it, and what year was it introduced? Correct entries will be eligible for a drawing of T-shirts from *Broadcast Engineering*. Enter by e-mail. Title your entry "Freezeframe-May" in the subject field and send it to: editor@primediabusiness.com. Correct answers received by July 1, 2004, are eligible to win.

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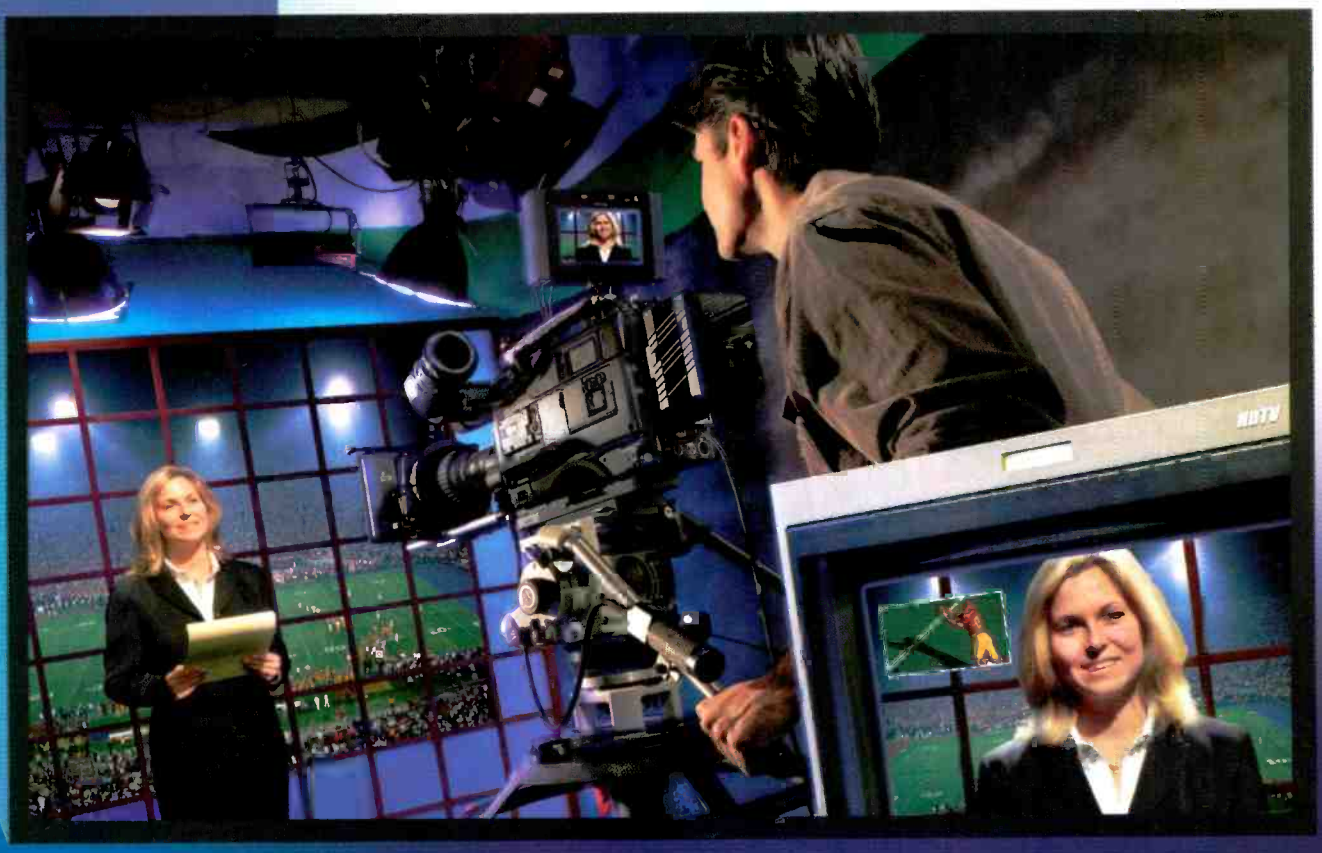

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The value of a good engineer

With all of the talk about how IT (which, by the way, means It's Temperamental) is overtaking video in broadcast facilities, one would think that we video engineers are about as useful as an old vacuum tube.

Now, before you buy into that malarkey, maybe we should consider just how expensive IT technology might really be.

At a recent industry conference, the breakfast discussion focused on system reliability. "My facility is running at four-nines reliability," said one broadcast engineer. Another said that his station was about the same. "Me too," a third engineer said. "I'd get fired if we lost so much as a minute of air a month."

Curiously quiet was one fellow at the table who happened to be new to the industry but in charge of his network's IT broadcast chain. What about your facility? I asked him. "We find that IT-based equipment is highly reliable, typically 99.99 percent uptime," he responded. The table sat in stunned silence.

Let's run the numbers. Four-nines reliability works out to a downtime of about 32 seconds per year. That's what broadcasters expect from their systems. The IT guy said his broadcast facility had about two-nines reliability, which amounts to being off the air a whopping 52 minutes and 33 seconds per year!

That echoed my experience with IT mentality. The *Broadcast Engineering* Web site failed yesterday at 3 p.m. Between the time IS was notified and the time it was fixed was four and a half hours. When the site finally did come back up, the search engine didn't work. In broadcast vernacular, that's like getting the transmitter back on the air (after four and a half hours) but not noticing that the microwave is down. Duh!

Let's consider how a typical IT-trained engineer might deal with broadcast-system failures.

The transmitter goes off the air.

The IT guy tells MC to put up a graphic that says, "We're off the air." He then pages the outsourced engineering company.

Lost air time=30 minutes

Cost to the station=$20,000

During prime time, the network satellite feed goes down in a thunderstorm. The IT-educated MCR operator runs PSAs while he looks for a backup tape.

Cost to the station=$12,000

One of the cameras loses the color green during the 10 p.m. newscast. With the show's director screaming to get it fixed, the IT engineer tells him, "Use what you've got; I'll log the problem." (A video engineer would slap the side of the camera, clearing the intermittent and everything would return to normal.)

Cost of replacing the hair the director pulled out in frustration=$10,000

So, what's the value of a good video engineer? Priceless.

Brad Dick

editorial director

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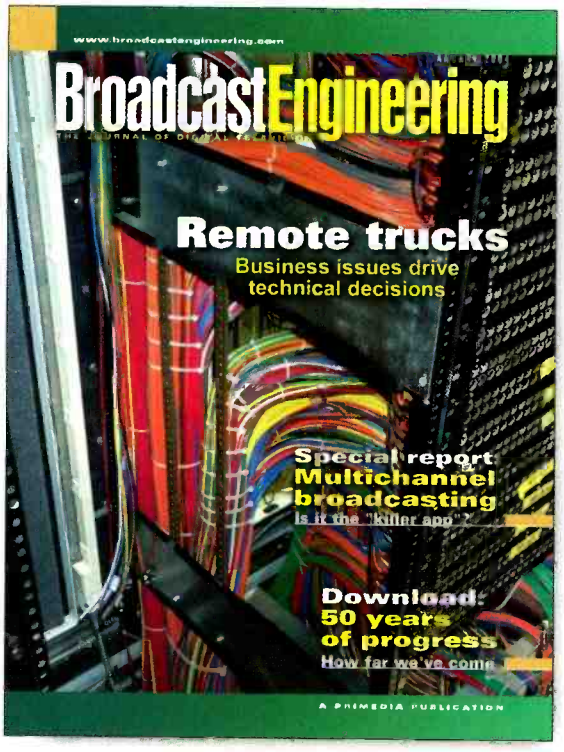
HD service

Brad,

I enjoyed your January editorial and agree completely. Broadcasters need to promote the fact that we're offering digital and HD, and more importantly, that it's free! I'm proud to say that my station is an exception to the rule that you've observed. We're a CBS affiliate, and we've been promoting our HD broadcasts since we launched them in early January. We were the first station in the market to carry the Super Bowl in HD, and we made a point of letting our viewers know, even highlighting the



fact in our newscasts. And even when we're not broadcasting HD, our digital picture is so superior that our GM watches that at home instead.

I've read lots of complaints about the transition. How the deadline is unrealistic, nobody will buy it, etc. The cable guys have shown us that people want it and they're willing to pay for it. While the transition has not been easy or cheap, our feeling is that if we don't offer our viewers the best in picture and sound quality, the cable and satellite guys will. Like it or not, the HDTV train is coming. And I'm sure you know the old cliché: Get on board the train or get run over by it.

MIKE SNYDER

Tables have turned

Brad,

Your comments in your February editorial are spot on — however, you did not go nearly far enough. The tables will, in fact, "over-turn" and the entire room will be re-done. And this is not a transition of several years — but of only a few. Radical? Look at Kodak and Polaroid having to reinvent themselves. Broadcast manufacturers are now at a precipice.

Consumer devices, software and media will rapidly overrun the existing broadcast standards. When consumers replace their computers this year or next, they will have at their disposal a platform capable of decoding and displaying HD video and HD audio. The gaming industry — always the vanguard — will push for resolutions and frame rates beyond HD. Microsoft's next OS in 2006 expects us to run desktops at 3K x 2K resolution. Intel talks about LCOS projection chips beyond HD. The visual revolution is upon us.

HDV is an interim solution that finally brings HD acquisition to a more affordable level — but it is still a "pro" product and priced too high for consumers. But HD, when available in a compact pocket digital camera for $500, will really change the face of things. My contacts tell me this is "within the year" and being pushed hard by everyone that matters: vendors of cameras, displays, solid-state storage, CPUs and graphics chips. Hmmm. Notice the lack of traditional NAB strongholds.

This is when the industry will really get interesting. Can't wait.

DAN

Pulldown

Michael,

Thank you for your excellent series of articles in *Broadcast Engineering*. I have a question about 2:3 pulldown. I understand additional frames of TV must be "created" from the frames of film at a ratio of 5 to 4, due to the respective frame rates of 30fps and 24fps. But why is it done in the manner you described, which makes 2/3 pull-down "conversion" necessary to reconstruct the best picture? Why can't they just scan every fourth frame of film twice in a row, instead of the method they do use?

THANKS AGAIN,
BOB

Michael Robin responds:
Dear Bob:
Old habits are hard to quit. BE

January Freezeframe:

Q. What was unique about the NEC SR-10 recorder?
A. The recorder was completely solid state and recorded 34 seconds of video on 1000 chips.

Winners:

Joseph J. Schwarz
Patrick O'Brien

Test your knowledge!

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

Send answers to *bdick@primediabusiness.com*

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What ever happened to free TV?

BY CRAIG BIRKMAIER

There have been a series of promotional announcements on the radio lately — they sound more like ads to me — talking about the advantages of free radio. The anti-satellite-radio ads, and many other spots that promote broadcast radio, pound home the notion that radio is free. They note that most of us now pay for the privilege of watching free TV. Only 15 percent of U.S. homes do not subscribe to a multichannel television service.

On the surface, it appears that the multichannel TV services are locked into an ongoing battle with TV broadcasters — especially when negotiations about must-carry, retransmission consent or local-into-local regulations become confrontational. At least, that is what consumers have been conditioned to believe.

Maybe the reason that radio broadcasters are so concerned about satellite radio is that they have seen what happened to free TV after people got used to paying for it.

The last impediment to the DTV transition?

With broadcast competitors all going digital, one might ask why broadcasters are dragging their feet on the DTV transition? The answer can be found in a 1997 Supreme Court ruling in the case of Turner Broadcasting System vs. the FCC. Turner brought this case in an attempt to overturn the must-carry rule and its expensive alternative, retransmission consent. Turner lost in a narrow decision. The court decided that the need to make certain that every home has access to all local broadcasts should take precedence over the First Amendment rights of cable systems, which argued that the must-carry rule is tantamount to theft of their private property.

The consensus coming out of that 5-4 decision, and a flurry of U.S. Court of Appeals decisions overturning FCC regulations, was and still is, that the must-carry rule will not hold up to another court challenge. In other words, analog broadcasts retain their must-carry and retransmission-consent privileges, while a similar mandate on digital broadcasts would not stand up to a court challenge.

With this in mind, the FCC delivered a watered-down order regarding cable carriage of DTV signals in January of 2001, leaving the door open to a further rulemaking. Citing the legal obstacles to such a decision, the FCC gave broadcasters the option — during the transition — of carriage of their analog signal or the primary video service contained in their digital channel. A station could also ask for carriage of its primary digital program as an analog signal on the analog tier of a cable system during the transition. The FCC left open a decision about mandatory carriage of DTV signals after the end of the transition. It was expected that this second ruling would take place early this year, but the FCC is unable to reach a consensus on an appropriate policy (i.e., one that will stand up to an anticipated court challenge).

A rock and a hard place

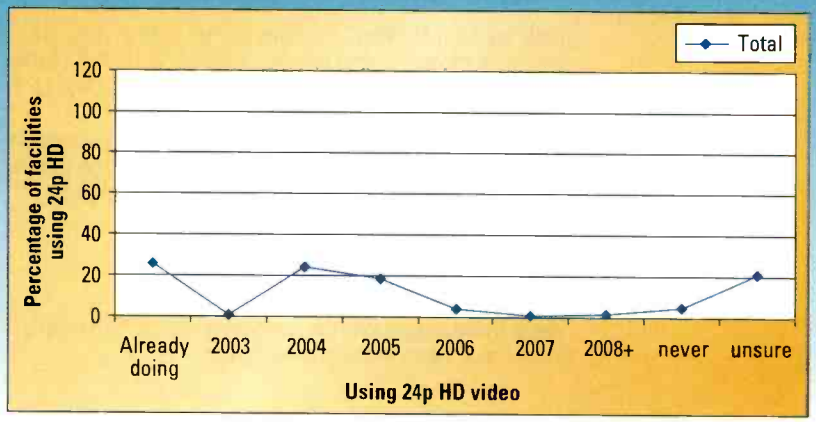
Appearances can be deceiving. On the surface, it appears that confrontation is driving the agendas of each of the participants in the DTV transition. One must remember, however, that these folks are in the business of creating and delivering stories. This would not be the first time that special interests have used techno-political leverage to limit competition, blaming the other guy for endless rate increases.

Local broadcasters are caught between a rock and a hard place. The rules created to protect them have been used by the big media conglomerates to build a new empire. They have been used to generate a second revenue stream from advertiser-supported TV — revenues that rarely

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

24p HD production on the rise

More broadcast and pro video facilities are dealing with 24p HD



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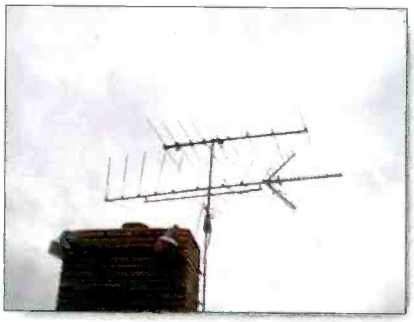
trickle down to the local stations.

What is a local broadcaster to do? The answer is simple: Compete. In recent months, this column has covered the efforts of USDTV to develop a multichannel service using the DTV spectrum. For $19.95/mo., subscribers would get all local DTV broadcasts and a dozen of the most popular cable channels. At the recent NAB conference in Las Vegas, Emmis Communications, with support from 11 additional station-group owners, launched an initiative to get broadcasters to pool their spectrum to compete with cable. They propose offering a package of local broadcast with about 30 cable channels for $25/mo. And they plan to pay retransmission-consent fees to all local broadcasters, hoping to set a precedent that their multichannel competitors must follow.

The good news is that broadcasters are waking up to the realities of the digital transition. The bad news is that they are ill-equipped to compete by offering a small monthly savings for a subset of what their competitors offer. These companies have deep pockets and the ability to respond to such a threat.



Only 15 percent of U.S. homes still receive their TV signals exclusively over the air.

If broadcasters want to get into the multichannel game, they need to renew the contract they agreed to in return for use of the public spectrum: The ads pay for free TV.

There are ample opportunities for broadcasters to generate additional revenues from premium services delivered through the DTV spectrum. The way to compete with cable and DBS is to make advertiser-supported TV free again. BE

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

Web links

To view Entercom radio announcements about satellite radio, visit *www.radiotown.net/audio/*
To view the Supreme Court decision in Turner Broadcasting vs. the FCC, visit *caselaw.lp.findlaw.com/cgi-bin/getcase.pl?court=US&vol=000&invol=U10372*

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BEYOND THE HEADLINES

SHVIA
amendments may erode station viewership

BY HARRY C. MARTIN

According to NAB a recent satellite conference in Washington, D.C, a new digital white-area provision proposed to be added to the reauthorization of the Satellite Home Viewer Improvement Act (SHVIA) could cost broadcasters 35 percent of their viewers.

The new provision, first proposed by EchoStar, would allow DBS operators to provide digital signals in local markets where OTA digital signals are unavailable. One of the main problems for broadcasters is that, currently, 35 percent of OTA viewers are served by translators that repeat a primary station's signal across that station's DMA. As of now, the FCC has not authorized any digital operations for translators or put in place rules for translator conversion to digital operation. Because of this issue, NAB wants a straight reauthorization of SHVIA rather than a rewritten act, which could open the door for unfavorable changes.

From the DBS side, the Satellite Broadcasting & Communications Association (SBCA) says that there are a number of issues related to local programming that put DBS at a disadvantage relative to cable. For example, while cable is allowed to bring in distant network signals when no network is available in a market, a DBS operator would not necessarily be able to do so because local viewers might get a Grade B signal even outside the DMA. SBCA says DBS operators are simply looking for a level playing field, along with the authority to provide superstations such as WGN-TV to their viewers.

At the conference, the FCC representative pointed out that cable also cannot simply carry superstations in the same manner as it does local stations. Saying that she was speaking for herself only, she noted that cable pays more to carry the superstations, and it is subject to the network nonduplication and syndicated exclusivity rules that allow broadcasters to require that repetitious programming be blacked out in certain situations. There appears to be a consensus that the provision of local-into-local service is a benefit for both DBS operators and broadcasters. NAB and SBCA say they view the SHVIA reauthorization process as an opportunity to strengthen the partnership between the DBS and broadcast industries. It remains to be seen, however, whether these cooperative attitudes will continue once Congress begins consideration of the reauthorization legislation in earnest.

Be sure to update ASR data

One item that is sometimes overlooked by new television station owners is the updating of the station's Antenna Structure Registration (ASR) to reflect the new owner's name, address and emergency contact information. Such updating is required to assure compliance with the commission's rules. Perhaps surprisingly, the ASR information is not automatically updated when you (or your attorney) notify the FCC of the purchase. Of course, not every tower must be registered with the FCC. Generally, only towers located near airports or over 200 feet in height must be registered. A tower owner must post the tower's ASR registration number at the tower's base so that anyone can quickly identify and contact the owner if there is a problem with the tower (such as malfunctioning lights, etc.). Owners of registered towers are required to keep the contact information in the FCC's database current. This can be done quickly and easily, and for free, through the FCC's Web site. Current ownership information on file is searchable by registration number on the FCC's Web site (*www.fcc.gov*). Just click "e-filing" at the top of the home page, then "Antenna Structure Registration" and "Search for Registrations," and enter the registration number.

Failure to maintain accurate ownership information in the ASR database is frequently discovered and cited as an additional violation when FCC field inspectors discover physical violations at tower sites such as fencing, lighting, signage and painting problems. If you have recently acquired one or more stations, you may wish to double-check the status of your ASRs. BE

Harry C. Martin is an attorney with Fletcher, Heald & Hildreth PLC, Arlington, VA.

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

Dateline

Renewal applications, EEO program reports and ownership reports for TV stations in D.C., Maryland, Virginia and West Virginia must be filed on or before June 1. The deadline is Aug. 1 for stations in North Carolina and South Carolina, and stations in those states must begin their pre-filing renewal announcements on June 1.

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Digital video basics

BY MICHAEL ROBIN

There are several advantages in using digital video equipment, including:

• A digitized video signal is immune to analog signal impairments such as linear distortions, non-linear distortions and noise beyond the inherent distortions generated by the analog-to-digital and digital-to-analog conversion process. This can be fully realized by processing and distributing the signal in digitized form.

• Digital video equipment can perform efficiently and economically tasks that are difficult or impossible to perform using analog video technology.

• Digitized video signals are amenable to the application of techniques for retention of essential information such as compression.

Early digital technology was restricted to so-called digital black boxes. A digital black box is a device that has analog input and output ports and performs an essential signal processing task by using digital technology. Among the early digital black boxes were time base correctors, frame synchronizers and standards converters.

The 1980s witnessed the emergence of digital videotape recorders based on CCIR recommendations. A variety of digital black boxes, such as digital video effects (DVEs), graphic systems and still stores, operating in a variety of non-correlated and incompatible standards also became available. Digital interconnections between various digital black boxes were thus difficult or impossible. The majority of these black boxes were interconnected with the rest of the analog or digital equipment using analog input/output ports. Compatible digital video equipment was assembled into a digital island, such as an editing suite, using a bit-parallel digital video interconnection.

Figure 1. Block diagram of a typical black box digital device. It can represent any digital device in use in a teleproduction facility.

The 1990s were characterized by intense standardization activity led by SMPTE. A large variety of video production, distribution and recording equipment with standardized bit-serial input/output ports has become available, allowing the assembly of all-digital teleproduction facilities using bit-serial signal distribution and interconnection.

Typical black box device

Figure 1 shows a simplified block diagram of a typical black box digital device. It can represent any digital device in use in a teleproduction facility. The input is a conventional analog video signal. This signal is band-limited by a low-pass (anti-aliasing) filter and fed to an analog-to-digital (A/D) converter to be converted into digital form. This block is usually called a coder. The A/D conversion involves three steps: sampling of the analog signal at a constant rate, quantizing the sampled values and coding the signal.

The digitized signal is fed to a digital processor, which may be anything the designer wishes. In a time base corrector, the processor performs a time base correction in the digital domain. In a video recorder, the processor records and plays back the video signal in digital format. The processed digital signal is applied to a digital-to-analog (D/A) converter. The output of the D/A converter is fed to a low-pass (reconstruction) filter, which removes high-frequency

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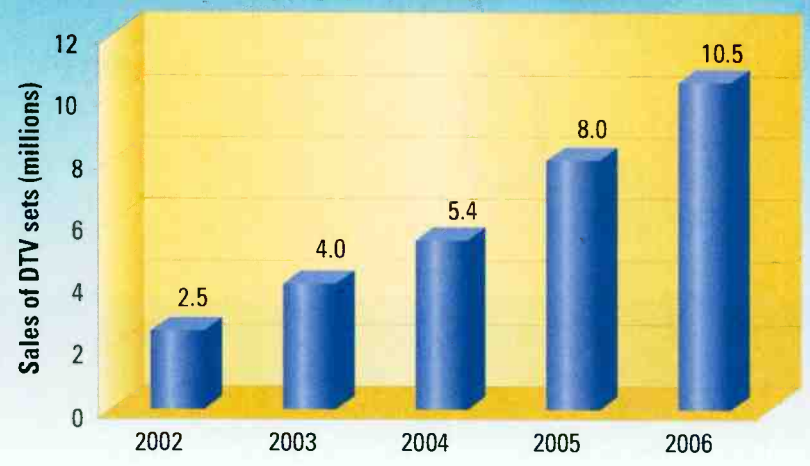
A look at tomorrow's technology

10.5 million projected sales of DTV sets by 2006

Actual and projected sales of DTV sets



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spectral components and allows only the analog video signal to pass. This block is commonly called a decoder and changes the output of the device back into a conventional analog format. The digital black box can be inserted into a conventional television operation, and the operator need not know that the signal is being processed internally in a digital manner.

The sampling of the signal

The sampling rate of video signals has evolved through the years. Analog composite video signals are sampled at a multiple of the subcarrier frequency. Early equipment used a sampling frequency of $3f_{SC}$ resulting in, nom-inally,10.7MHz for NTSC and 13.3MHz for PAL. The SMPTE standardized sampling rates are $4f_{SC}$ resulting in, nominally, 14.3MHz for NTSC and 17.7MHz for PAL. These higher sampling frequencies ease the requirements for the anti-aliasing and reconstruction filters and provide a better frequency response. Analog component video signals are sampled at a multiple of the horizontal scanning frequency f_H.

Quantizing sampled values

There is an infinite number of shades of gray, ranging from black (the lowest video signal amplitude) to white (the highest video signal amplitude) that the analog video signal can represent. When the analog data is converted into digital data, some problems arise. This is due to the fact that the instantaneous sampling pulse amplitudes can be represented in the digital domain by only a limited number of binary values (steps). This process, called quantization, results in a limited number of shades of gray that the system can resolve, depending on the number of bits used. The possible number of shades of gray is equal to 2^n, where n is the number of bits per sample.

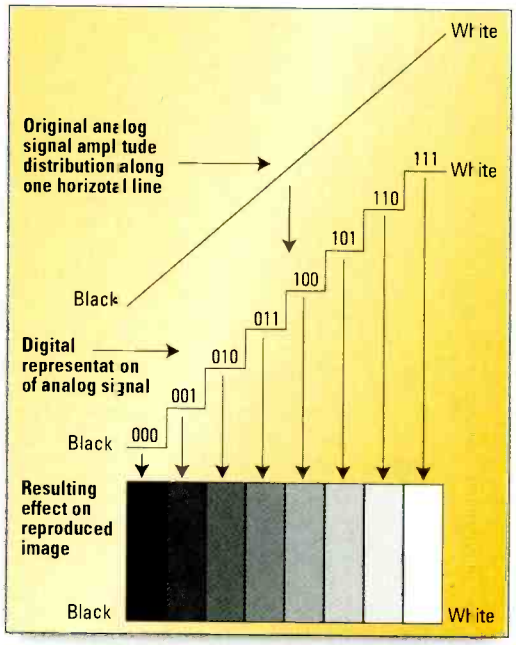

Figure 2. Graphic illustration of quantizing effects with three bits per sample

Figure 2 shows what would happen to an analog video signal known as "horizontal ramp" when an insufficient number of bits per sample is used. Normally, the ramp signal is displayed on a CRT screen as a smooth transition from black, at the extreme left of the screen, to white, at the extreme right of the screen. When sampled and quantized, in this example with a precision of three bits per sample, the ramp can only assume eight "quantizing levels" (2^3=8).

The displayed picture features eight brightness levels ranging from black (digital signal value 000) to white (digital signal value 111). The reproduced image is clearly a distorted representation of the original because the quantizing process introduces "quantizing errors" (Q_e), which are inevitable.

An acceptable digital representation of a video signal requires more than three bits per sample. Experiments have shown that using less than eight bits per sample results in a distortion known as "contouring."

Figure 3 shows the effects of contouring on a CRT displayed picture. In this example, the brightness of the original picture varies smoothly from left to right and from top to bottom with a reduced brightness at the center of the picture. In this example, the system can only recognize five brightness levels, resulting in patches of uniform brightness (contours) separated by sharp transitions. The eye is more sensitive to contouring effects at low picture brightness levels. With eight bits per sample, or more, the quantizing errors appear as random noise in the picture. The number of quantizing steps, and consequently the magnitude of the quantizing error, depends on the number of bits per sample.

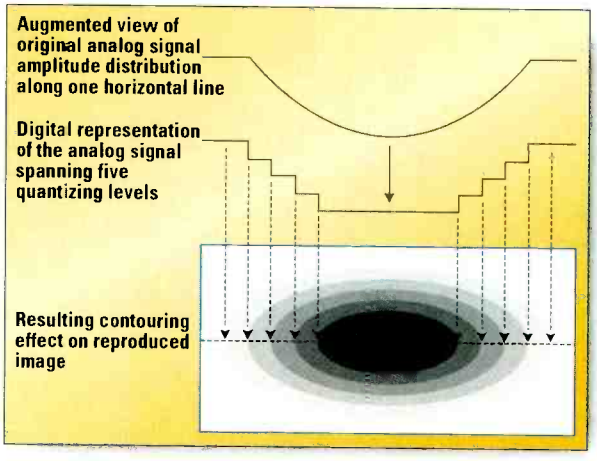

Figure 3. Graphic illustration of contouring effect resulting from quantizing errors

Early technology used seven or eight bits per sample, depending on the class of equipment, resulting in, respectively, 128 or 256 quantizing steps. With few exceptions, contemporary studio-type equipment uses 10 bits per sample, resulting in 1024 quantizing steps and excellent picture quality. BE

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

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Data-backup technology and techniques

BY BRAD GILMER

When considering options for backing up your facility's data, it is important to look at high-capacity, low-cost technologies. Disks with more than 100GB of storage capacity are now in the $200 range. Intel systems with 2GHz processors, which can be used as inexpensive, dedicated backup platforms, are available for less than $1000. High-speed network bandwidth is also available at low prices. Commodity-based networking hardware allows users to aggregate bandwidth across multiple links and construct high-bandwidth connections between a server and a backup device. Also available is sophisticated backup software that allows for continuous system backup. This sort of software used to be available only for expensive enterprise systems. Now, it is available for desktop computers (examples include Norton Ghost and PowerQuest's Data Keeper). Finally, USB storage capacities have evolved to the point that USB drives can serve as a backup devices.

Not too long ago, the most economical way to back up data was with tape devices.

These advances have changed the backup options available to video professionals. Not too long ago, the most economical way to back up data was with tape devices. But tape has really taken a back seat these days. Now, it is possible to back up your critical data using disk systems. (But, for backing up large archives of video data, tape is still the most viable option.)

Mirroring and RAID

Traditional backup solutions include mirroring and RAID, as shown in Figure 1. Mirroring the drives in a server involves installing two disk drives and two drive controllers in the server. When the server writes data to one drive, it automatically writes that data to the other drive. Such a mirroring system is not very expensive, it provides nearly instantaneous, synchronized copies on both drives, and it does not require any special restore process should one drive fail. The other backup solution to consider is RAID, an acronym for redundant array of independent disks. To simplify a rather complicated topic, a RAID system stripes data across a number of drives. If one drive fails, the storage system can recreate data from the missing drive using parity bits. There are a number of different RAID configurations, typically described as levels. These levels specify different configurations of disks and parity. In some RAID systems, it is possible to hot-swap the failed drive in a RAID system for a new one. The RAID system then rebuilds the data onto the new drive in the background. RAID systems can be more expensive than mirroring but, generally speaking, they are also more reliable.

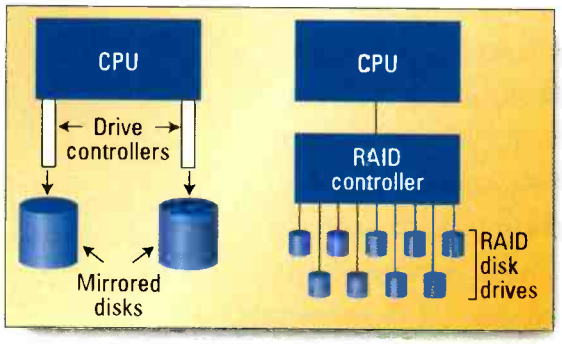

Figure 1. Mirroring duplicates data onto two drives through two separate controllers. RAID stripes data across multiple disks.

Scheduled periodic backup

Another traditional backup solution is to run a backup program as part of normal system-administration tasks. Using a scheduler, a system administrator schedules the backup to occur when the system is not heavily loaded. The backup program is configured so that it performs a complete backup periodically, say, once a week. It is also configured to perform an incremental backup on a more frequent basis, say, every night. Because the incremental backup only backs up those things that have changed since the last complete backup was performed, it takes much less time. The complete backup and the set of incremental backups that follow comprise a backup set. Most administrators keep a complete backup set for a longer period of time, for example, one month. In the past, backups were stored on tape drives. But, as drive sizes increased, this became more difficult because a single backup required multiple tape changes. Now, many administrators use a separate backup server with a lot of storage.

Remote backup

Faster networking speeds, both locally and on wide-area networks (WANs), have made remote backup a reality. Virtual private networks (VPNs) provide a way to link remote sites securely. While remote backup may not be practical for large amounts of data, it makes sense for professional video facilities running critical applications. Remote backups are an important part of a disaster-recovery plan. Having data backed up in a remote location can help your facility recover

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Keeping the OS separate

Here's a critical recommendation regarding professional video applications. When you initially configure the system, be sure to store system data on a partition separate from applications and the operating system (OS), as shown in Figure 2. For example, if you use an automation system, make sure that all the data associated with the automation system application (playlists, logs, etc.) are stored on a drive or partition separate from the OS. System administrators have learned the hard way that some operating systems need to be reinstalled periodically. In some cases, the only thing that will return the system to its normal operating configuration is a complete reformat of the partition on which the OS is located. If your data is stored on a separate partition, you can reformat and reinstall the OS without having to reload your data. Once the automation application is reloaded, you can relink to the automation data and get back on the air.

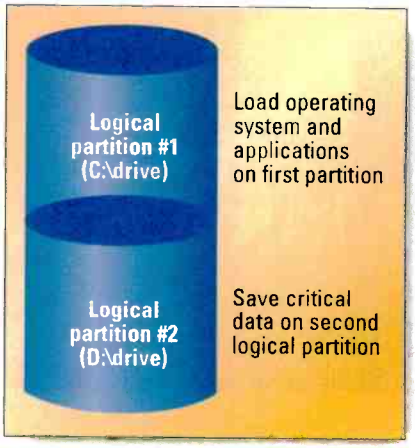

Figure 2. If at all possible, load the operating system and applications on a partition (or, better yet, a disk) separate from where you store critical data.

For applications involving large databases, you might consider running the databases on separate hardware. These servers can be hardened against failure with RAID storage, and backed up across a WAN to a remote location to ensure recovery of critical data. BE

Brad Gilmer is the executive director of the AAF Association, the Video Services Forum, president of Gilmer & Associates, and editor of the book File Interchange Handbook.

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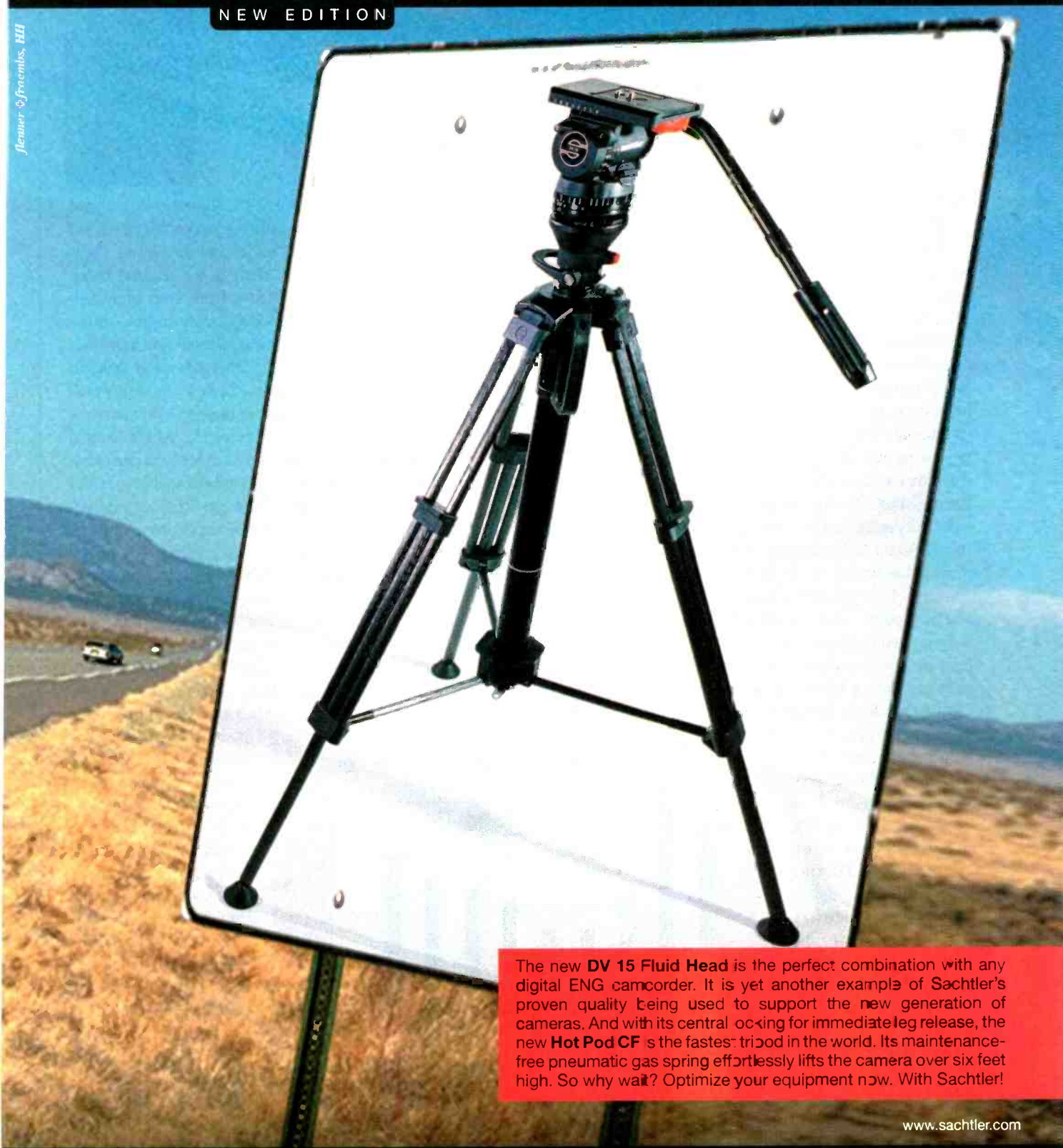

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set your ideas in motion!

Audio compression in 2004

BY NOEL MCKENNA

There is a divergence in the use of digital audio data compression and bit-rate reduction technologies. On the one hand, there are the proponents of higher compression ratios using psychoacoustic techniques to squeeze stereo audio over cellular and POTS lines using compression ratios approaching 20:1. On the other hand, there are the proponents of traditional PCM replacement technology using modest compression rate Adaptive Differential Pulse Code Modulation (ADPCM) technologies.

But why settle for 16-bit PCM quality when the recording/professional market has moved on to 24-bit technology? If recorded audio is the starting point, and if so much care is being taken at source to ensure the best possible quality, then why accept any audio process that lessens the creative results of artists? So what can bit-compression do to help the process?

Let's do the math: Assume we have a Pro Tools file of a 20-minute stereo spot sampled at 48kHz and employing 24-bit PCM. This means it will take at least 180 minutes to transmit the file over a 256Kb/s link. If we instead use advanced compression technologies with 24-bit word resolution to deliver the same file, time can be saved. Typically, these advanced compression solutions are almost lossless in terms of audio quality and can deliver the same 20-minute spot in 45 minutes (same assumptions apply) with all the original content and quality.

If we have access to a 512Kb/s ADSL link, delivery time is further reduced to almost real time of 23 minutes. In high-end applications, bits are not a consideration when compared to attributes such as quality, end-to-end delay and delivery times. Compression technology is changing. Studio and broadcast professionals are no longer limited to links using high compression ratios, but rather can choose from a selection of different technologies that better match the desired function.

If recording engineers, as an example, need to get approval for their creative work from a remote site, sacrificing the creativity of their work on a poor quality audio link isn't a good choice. Broadcasters, on the other hand, are focused more on limiting listener fatigue and retaining listenership.

The best way to avoid the dreaded tune out factor is to make sure the listening experience is enjoyable. This doesn't just mean compiling a great play list or employing famous talent. It also means paying careful attention to the audio transmission chain, both inside and outside the studio.

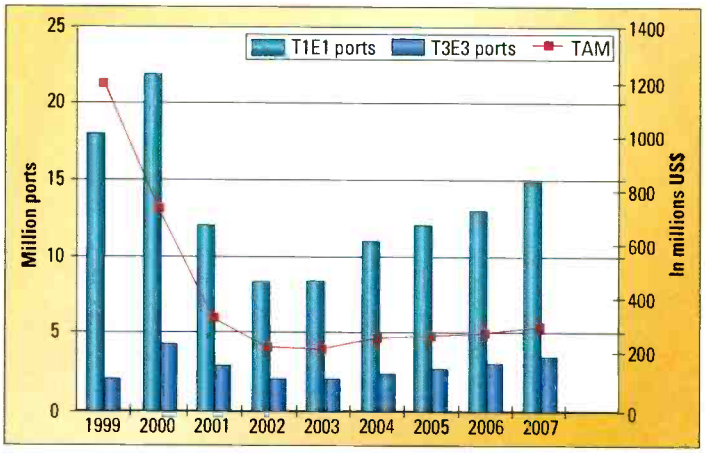
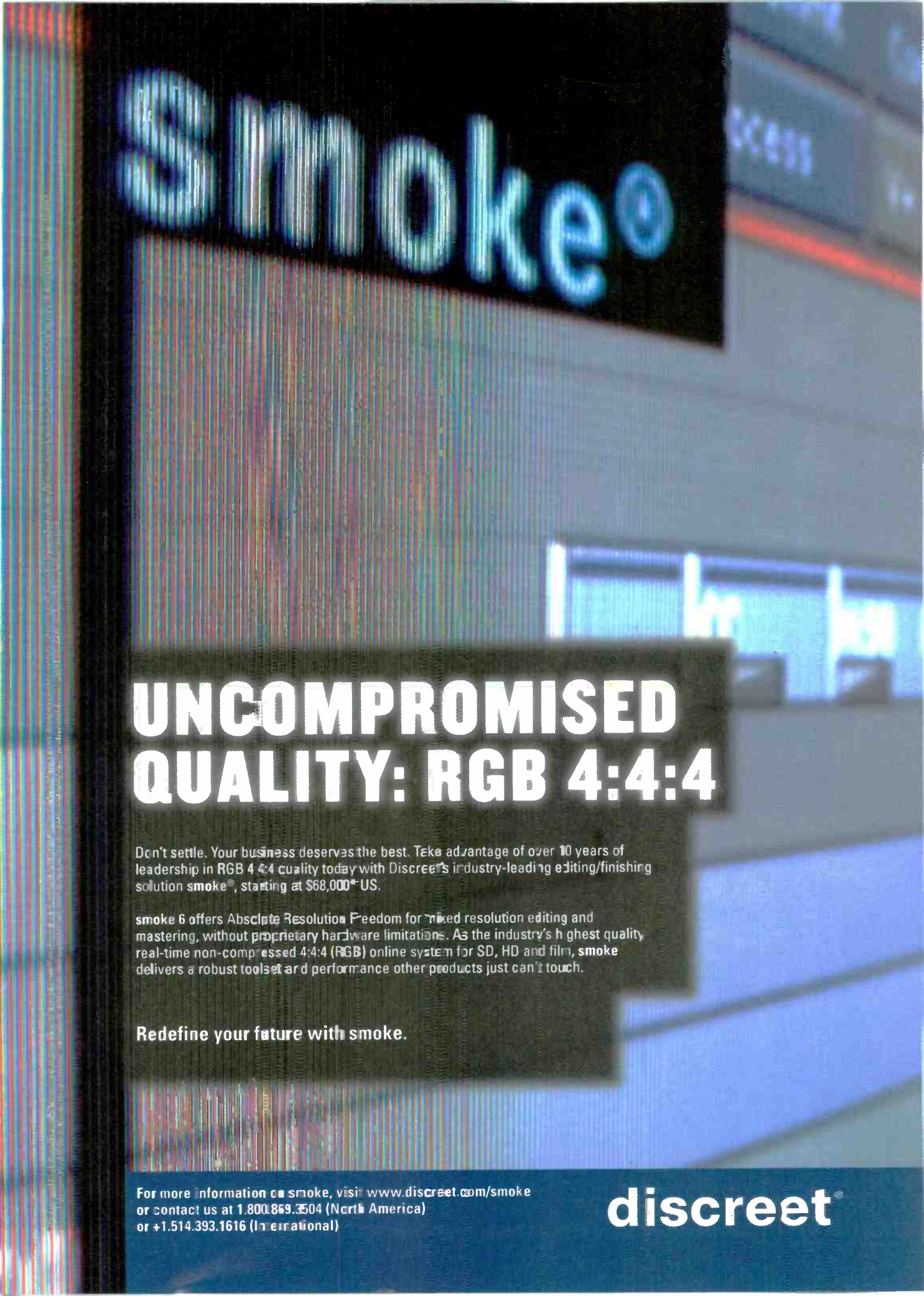


Figure 1. The projected continual rise in broadband E1/T1 chips sales and links in coming years. Courtesy of InfineonTechnologies.

Compression algorithms are not about boastful compression ratios but are intended for the delivery of high-quality content in its original form. Figure 1 below, from chip manufacturer Infineon Technologies, shows the projected continual rise in broadband E1/T1 chips sales and links in coming years. This presumably will lead to cheaper high bit-rate synchronous and IP networks, which in turn may lessen the need for high compression ratios. The result will be a wider selection of delivery link options, often through less expensive channels. So what are some of today's goals? First, 24-bit PCM sampling at 48kHz with low delay is key. This requires moving from 14-bit commanding-based technologies.

Second, ISDN costs, which used to be a determining factor in compression ratio selection, can still result in poor quality audio because of the use of highly compressed MP3 signals. However, as link costs are reduced, broadcasters no longer have to make such negative compromises. IP connectivity can provide a low-cost communications infrastructure, but still has the problem of delay. This is particularly relevant with live broadcasts, where delays cannot exceed 20ms. Therefore, it makes sense to combine higher quality 24-bit audio with low delay (sub 10ms) with the low-cost IP + E1/T1 infrastructure. BE

Noel McKenna is the managing director for APT.



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The production control room at the new KLCS facility in Los Angeles is used for both live and recorded programs. In addition to now broadcasting DTV channels, KLCS delivers a broad variety of educational content directly to the desktops of nearly one million students and teachers. Photos by Paul Turang, courtesy of Omneon Video Networks.

KLCS shifts to DTV

BY ALAN POPKIN

When KLCS-TV, a noncommercial educational television station licensed to the Los Angeles Unified School District (LAUSD), made the shift to DTV in April 2003, the station achieved a great deal more than meeting an FCC mandate. With the support of the Board of Education, the Superintendent of Schools and the station general manager, KLCS took the first step in realizing its goal of providing a broad variety of educational content directly to the desktops of nearly one million students and teachers in the LAUSD.

The digital infrastructure offered more than just the opportunity to go tapeless; it gave the station a chance to leverage some of the inherent advantages of digital transmission for innovative applications — especially in the classroom.

The start of simultaneous broadcasts of a digital signal on channel 41 DT and analog on channel 58 provided a foundation for new services including NVOD, multichannel broadcasts, HD and datacasting.

The first step was to subdivide the digital bandwidth into concurrent subchannels. This multicasting plan allowed the station to deliver content to classrooms by broadcasting video and data over 10 streaming channels.

This strategy for changing the way digital content can be used within the classroom is called daypart bandwidth management. The station broadcasts the main OTA DTV channel from 8 a.m. until 4 p.m. while simultaneously delivering four to 10 high-resolution (WM9 @ 1Mb/s) streaming specialty channels directly to students' and teachers' desktops.

At the close of the school day, the DTV channel shifts from streaming channels to four traditional broadcast channels delivered OTA and through cable systems. At 8 p.m., the station broadcasts a traditional SD channel plus an HD channel. Then, from 11 p.m. to 8 a.m., it broadcasts an SD channel with a heavy data push for delivery of NVOD to the LAUSD campuses.

To handle these complex tasks, the station chose the 28-channel Omneon SPECTRUM media server system, along with Sundance Digital's Titan automation software. Datacasting is accomplished with the Triveni Digital Skyscraper system, coupled with Sundance's Seeker asset-management system, which provides the VOD interface and ordering system.

> Teachers can now browse the digital repository of the KLCS and LAUSD media libraries.

Teachers can now browse the digital repository of the KLCS and LAUSD media libraries. These include not only video and audio, but also PowerPoint presentations, lesson plans and other resources. Low-res thumbnails of available content are available for preview over the internal network or a dial-up modem. Once a teacher selects and requests digital content, the high-resolution version is datacast to the school's edge server for future playout.

The Omneon server enables the implementation of a unique file and codec structure that allows all content

The master control room manages automation and command and control system monitoring for four DTV channels, four streaming channels and eight channels of satellite ingest.

to be treated as data within a fully digital environment. What makes the system unusual is the way it allows engineers to separate studio and edit content, play-to-air material, streaming channels and other assets into different volumes on the same server. The server acts as a hub for I/O devices, with different codecs pointed directly at specific folders. The facility's automation system only sees the material relevant to it.

Media assets are recorded directly to the server and, depending on where the content needs to go, the codec is pointed at the appropriate folder. For editing, the codec points to a specific folder that is automatically swept into the edit SAN. If it is a live-to-server show, the codec is pointed to a folder that is swept into the ingest server for play to air. Multiple encoding formats (MPEG, DV, etc.) are supported by matching the most efficient encoding scheme to the content. For the reverse path, files are loaded directly from the edit bays to a play-to-studio folder for integration into a show. A DNF controller operates the server as if it were a tape deck.

The station's choice of editing systems, Pinnacle's Liquid Edition and Liquid blue NLEs, was influenced by several factors. First, due to the nature of the facility and its mission, the NLEs had to be able to mix different compression formats on a single timeline. Second, they had to be compatible with the firewire drives deployed in the field cameras. Last of all, the station wanted easy-to-use solutions with enough horsepower to accomplish higher-end effects in real time. The editing systems met those goals.

One of four Pinnacle Liquid Edition edit bays used for in-house productions as well as the creation of media-based training materials for Los Angeles Unified School District.

Equipment list

- Omneon SPECTRUM media server
- Sundance Digital
  - Titan automation
  - Seeker asset management
- Intelli-Sat recording manager
- Triveni Digital Skyscraper
- Avalon archive manager
- Grande Vitesse Systems GVS 9000 near-line archive
- Leitch
  - NEO SuiteView
  - Integrator GOLD SDI
  - Opus master control switcher
  - DPS-575AV synchronizer
  - 6800+ video/audio conversion
  - 880 series stereo audio DAs
  - NEO modular infrastructure
  - CCS Pilot software
  - CCS Navigator software
- Pinnacle Liquid Edition and Liquid blue NLEs
- Dielectric 888 antenna
- Axcera solid-state transmitter
- TANDBERG 5710 encoders
- MRC DAR Plus microwave
- For-A Hanabi switcher
- Evertz 9625 LGA

The automation system that controls content flow, Sundance Digital's Titan, features an automation architecture that enables GUI-based, dynamic reassignment of playlist control. It performs station asset management and also serves as the teachers' interface for ordering NVOD assets. The

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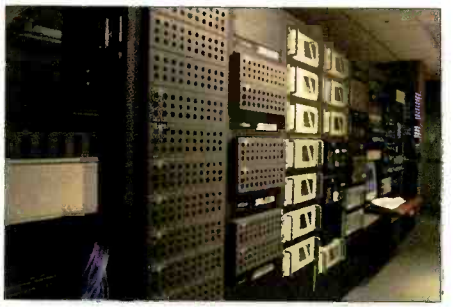
automation oversees near-line archiving for play-to-air material with an Avalon archive, and an Intelli-Sat recording manager handles the recording of incoming satellite feeds.

The Avalon archive folder system features direct API control by the automation and a data-management hierarchy using XDSM folders. Assets from the edit bays, studio and VOD system are auto-archived with this.

The near-line archive supplied by Grande Vitesse Systems (GVS) consists of 22TB of Nomadic storage and is expandable to more than 100TB without downtime. An LTO2 tape system is available for long-term archiving. The system provides a maximum level of fault tolerance and redundancy without sacrificing a lot of storage. Running on the GVS (multi-CPU routing), the system can dynamically reallocate volumes without interruption. The storage system has the bandwidth to handle SD and data, plus HD material.

Master control is primarily a Leitch facility. The equipment includes a Leitch NEO SuiteView multi-source display processor, an Integrator GOLD SDI router, an Opus master-control switcher, a DPS-575AV digital processing synchronizer, a 6800+ video and audio conversion system, 880 series stereo audio DAs, and digital clocks. A NEO modular infrastructure platform routes, controls and monitors the entire infrastructure. Leitch's CCS Pilot and CCS Navigator allow engineering to troubleshoot problems, remotely if necessary, and quickly bypass the problem until repairs can be made.

The DTV transmission system uses a Dielectric 888 antenna for both NTSC and ATSC channels, an Axcera solid-state transmitter, TANDBERG encoding, MRC digital microwave and the Triveni datacast system. The Axcera transmitter provides signal stability as well as good SNR to the station's coverage area. The Dielectric dual antenna eliminated the need for a separate tower for the DTV system.



Sundance Digital's Titan automation system coordinates workflow among an Intelli-Sat recording manager, an Omneon SPECTRUM media server, a Grande Vitesse Systems SAN, and an Avalon archive to efficiently manage both media storage and automation for KLCS.

The TANDBERG encoder is designed as a VBR system with N+1 automatic failover. It is used to encode the DTV stream and to transport the

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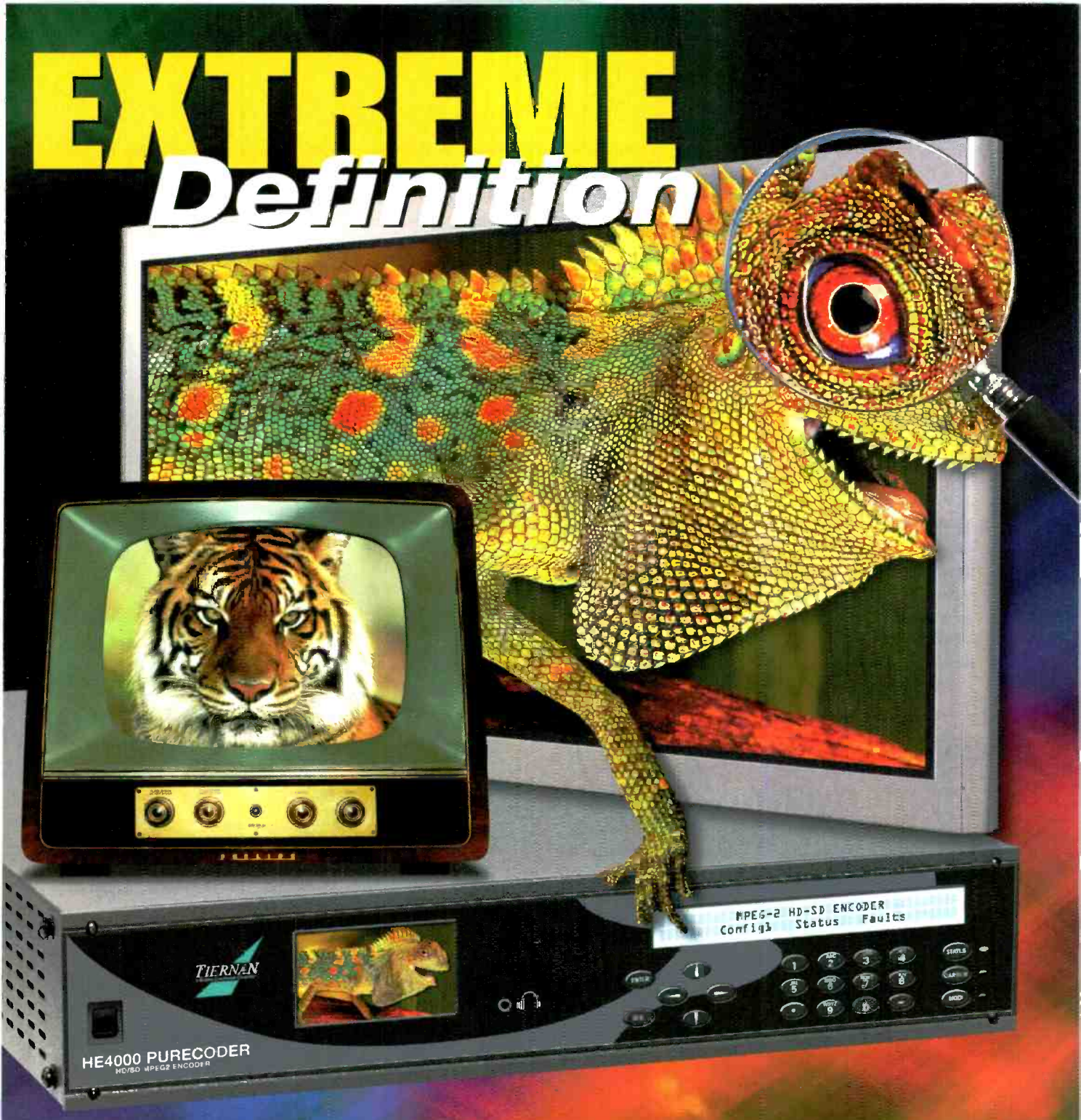

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analog signal as STL. (Even the analog signal is digital until just before it is injected into the analog transmitter.) The station can employ a redundant MRC DAR Plus radio for STL and TSL applications. Using TANDBERG's 6120 and 1260 systems, the stream at Mt. Wilson is ready for distribution to the transmitters. The microwave's T1 circuit for the CCS system integrates the transmitter site into the communication system.

Since KLCS launched the new services in January, the facility has demonstrated that dynamic bandwidth allocation in a broadcast environment is a real-world solution. It also shows that integrating off-the-shelf solutions from a variety of sources and vendors can be successful and relatively easily.

A comparable fiber-based system would have cost $300 million to $400 million and taken years to complete. This entire project cost less than $6 million and took less than two years. As computer vendors begin delivering DTV data cards with computers, this type of solution could provide an opportunity for broadcasters to be more than just TV stations. It could allow them to become digital content-distribution centers. BE

Alan Popkin is KLCS' director of technical operations and TV engineering.

Design team

TV Magic
- Gus Allmann, Kathy Ogburn, designers
- Dean Humphus, project manager

DST
- Janet Crumb, installation supervisor

Gonzales|Goodale Architects
- Gary Popenoe, project architect

Grande Vitesse Systems
- Jano Avanessian, project manager of data infrastructure

KLCS
- Alan Popkin, director of technical operations and TV engineering
- James Mason, chief engineer
- Martin Miller, senior engineer
- Vernardo Watts, maintenance engineer
- Khanh Pham, network engineer

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Television measurements

BY DON MARKLEY

The onset of digital television has raised some new problems for TV stations. The sophistication of new measurement equipment for digital transmission makes the old analog equipment seem simple. The new equipment presents many challenges, even for measurements as simple as power output.

DTV measurements are just more complex than the old analog waveform monitor/vectorscope can handle. So a station transitioning to DTV must buy new measurement equipment, and its staff must learn new measurement procedures. Start with the learning. Make a quick visit to *www.tek.com/measurements* and get a copy of "A Guide to Digital Television Systems and Measurements." Another good reference is a textbook written by Walter Fischer called "Digital Television." These two documents can help keep that new DTV system humming.

A hands-off posture

The FCC rules for measuring analog TV signals are extremely detailed. But, for digital television, things aren't so clear. You can find all of the applicable criteria at *www.atsc.org/standards.html*. The FCC simply requires DTV systems to comply with ATSC A/52. The commission maintains a hands-off posture on DTV and leaves it to the individual stations to determine what they need to do to operate in compliance with the ATSC standard. That doesn't mean that the station isn't held to a high standard of performance; it just means that the way in which stations meet that standard is their choice.

This arms-length regulation of DTV is a reasonable extension of the commission's move over the years toward deregulation and away from dictating exact terms. Some may argue that the commission has given too much slack in some areas, but the overall result has been to give stations the freedom to determine what they need to do to operate properly. Years ago, for example, the rules not only specified the frequency tolerance for radio stations, they required a specific type of frequency monitor. Even more specific rules governed the exact temperature variation allowed in the oven that housed the crystal in the frequency monitor. Now, however, the rules simply specify the frequency tolerance. If you want to measure operating frequency by how the tower feels when you put your arms around it, so be it. Stations can measure the frequency any way they want. But — and it's a huge but — the frequency had better be within the required tolerance when the commission checks it. The FCC doesn't hesitate to hand out fines if it finds that a station isn't operating in accordance with the commission's requirements.

If you want to measure operating frequency by how the tower feels when you put your arms around it, so be it.

After reviewing the two reference documents mentioned earlier, you might need some help to understand them. Test-equipment manufacturers offer an enormous amount of useful information. Again, *www.tek.com/measurements* has numerous application notes and technical papers that can help you understand the measurements, how to perform them and what equipment may be necessary. Other good sources are *www.agilent.com* and *www.sencore.com*. Each company has several pieces of test equipment in its product line designed specifically for the DTV industry. They aren't cheap. But then, the DTV signal is complex;

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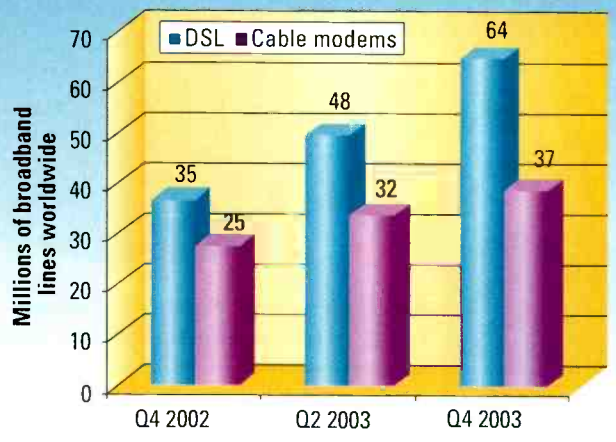

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breaking it down for analysis requires sophisticated equipment.

The right tool

Measuring DTV power is a particular concern for broadcasters. The old wattmeters and couplers designed for analog television or radio simply don't work for DTV. If you attempt to use them on the complex waveform of the 8-VSB DTV signal, they will produce large errors. To understand the problems involved in this area, check out the excellent paper at *www.bird-electronic.com/products/pdfs/broadcast_rf_pwr_mes_techpaper.pdf*. It describes the problems involved in measuring DTV signals and compares various measurement schemes.

Snake oil

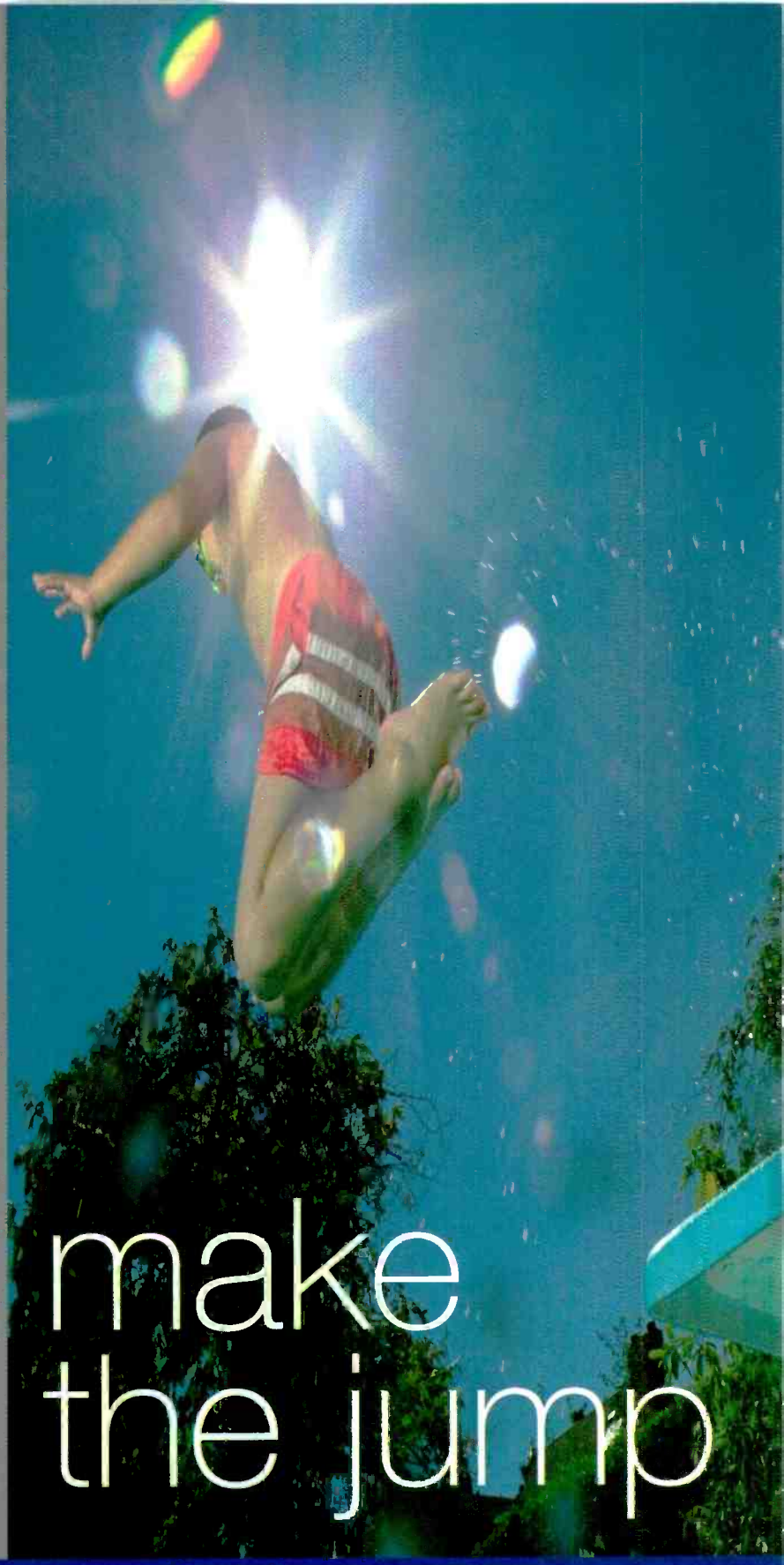
The best way for a station's staff to handle monitoring is to work with the transmitter supplier. All transmitter manufacturers know what measurement equipment is suitable to use with their equipment. In fact, you can often buy a complete monitoring package with the transmitter at a considerable savings. But be careful. Whenever anything new comes along, you can always find a snake-oil salesman who wants to sell you a bottle of his magic elixir. And, like the tonics foisted on unsuspecting customers by those traveling peddlers, it is usually worthless. DTV has opened that bag of worms, and some people are making claims that are just plain wrong.

Sophisticated test equipment such as this Sencore monitoring system is necessary to measure, test and troubleshoot complex DTV signals.

For example, some claim that you must measure signal strength to demonstrate that the digital signal coverage replicates the analog coverage. The truth is that one goal of the initial channel-allocation scheme was to duplicate the analog service. Once a station completed its allocation scheme, it could change its channel, antenna, height, power, etc., by showing the FCC that it would not create a new interference or increase interference by more than a *de minimus* amount. (*De minimus* is Latin for "It don't mean squat.") **BE**

Don Markley is president of D.L. Markley and Associates, Peoria, IL.

Send questions and comments to: don_markley@primediabusiness.com



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Selecting a workflow-oriented server

BY TODD S. ROTH

Selecting a video server requires careful planning and research. A server is a critical infrastructure product, and a station's choice of servers must make both short-term and long-term sense.

Step one in any server-purchase decision is to define the specific application. What does the server need to do? For example, an on-air playback server is quite different from a clip playback server for a production application, both in terms of capability/performance and cost.

Step two is to understand who the key players are in terms of providing solutions. Armed with both need (what the server must do) and solution (vendors), the technical manager or engineer is equipped to begin the decision-making process. It's not an easy task; the industry is constantly in transition.

The application-specific server, designed to support a single function such as transmission or commercial insertion, is a common element in almost every facility. Over the last few years, the progression from cart machines to single-function servers has been logical and necessary. But, because of continuing pressure to accomplish more with less, broadcasters are now moving away from that model toward server platforms that can support multiple applications.

For optimum efficiency, server design must address an entire workflow, not just a single function or even a set of unassociated applications. At most facilities, there are multiple workflows in play, each with a set of associated functions. Thus, the formula for selecting a workflow-oriented server is not simple. But there are ways to improve the decision-making process.

Compelling reasons

With today's strict budgets, stations have to make the most of diminishing resources, be they hardware, human or financial. Thus, the

A well-conceived server design must address an entire workflow, not just a single function, to maximize return on investment. Photo courtesy Leitch Technology.

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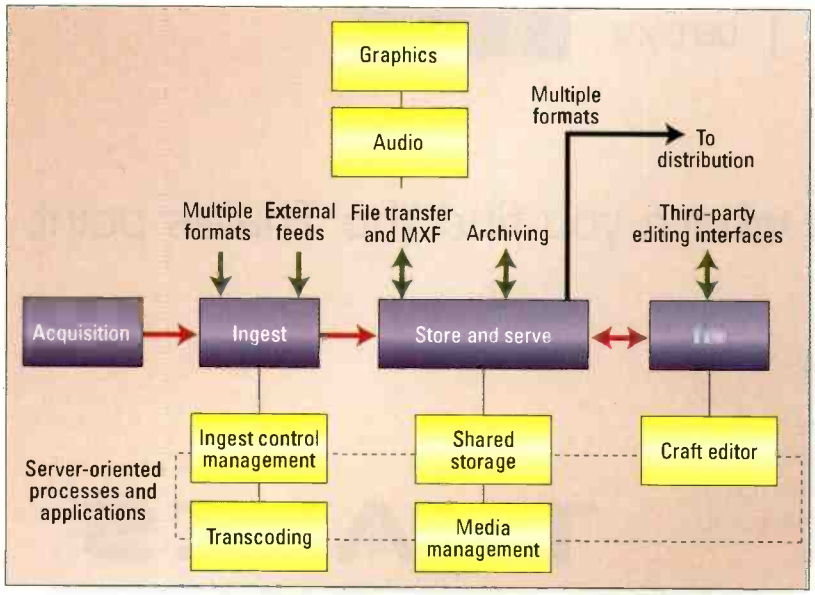

Figure 1. In this production workflow, multiple formats can be ingested, stored and shared among the various server-oriented applications.

reasons to consider a workflow-oriented server rather than an application-specific one are compelling. Broadcasters can improve productivity, reduce costs and maximize resources by analyzing a workflow, breaking it down into the various applications involved and then identifying a server that can support (and enhance) that workflow.

With a news or distribution workflow, for example, a station must identify the primary and secondary applications required, and the I/O and the points of interchange. These criteria must then be incorporated into whichever server architecture provides the best fit for current and future operations. If the station performs this research correctly, it can create an infrastructure that solves a comprehensive set of workflow requirements while addressing issues such as legacy equipment and the company's target path of migration.

By their very nature, shared-storage servers have already simplified station routing by delivering content to specified destinations within a storage-area network (SAN). A server-centric architecture enables specific applications to access a common set of media. The associated metadata can reflect the state of the media within the application chain for increased operational efficiency. The advantages are clear, in terms of workflow, content availability and the ease with which tasks can be accomplished (with fewer resources).

Workflow analysis

The first step in simplifying workflow and reducing cost is a detailed workflow analysis. Many stations have accomplished this already, but not necessarily with servers in mind. It is a good idea to seek assistance from a contractor or workflow consultant, but it is important to also seek the guidance of someone in house.

The chief engineer, news director, program director or a team of in-house experts should map out each phase of every workflow under consideration. Start with large functional blocks and progress to whatever level of detail is necessary, identifying each I/O, required format and point of interface. Look for areas that will benefit from the streamlining and simplification offered by common storage-oriented software applications. Look for paths where file-based media interchange offers advantages over traditional interconnection. Be receptive to changing the staff's skill sets to be in sync with new methods of working. Clarify the areas that will need customization. And, yes, identify each point of complexity or potential trouble.

Those intimately involved in a facility's day-to-day operations must guide the analysis. They know how current operations are performed, why the system was built the way it was and where the trapdoors are hidden.

Research the manufacturers

Once the team has a clear idea of the workflows to address and the components and applications within each workflow, the next step is research. Establish what each vendor has to offer. Research their server hardware and their software thoroughly, realizing that there will be caveats. Products are in flux, solutions are in flux, and that truth is not going to change any time soon.

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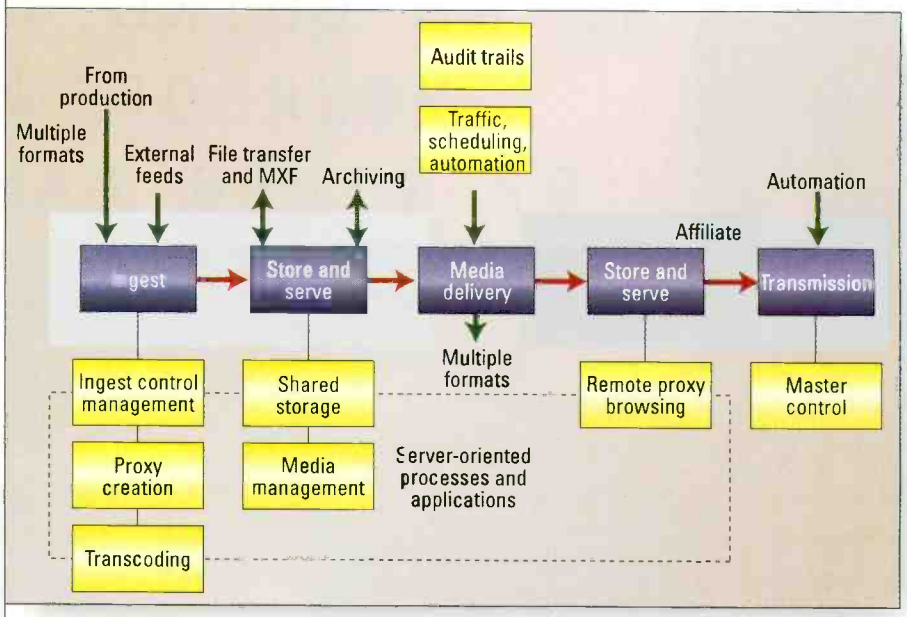

Figure 2. In addition to multiformat ingest and playout, this distribution workflow highlights the affiliate's ability to browse and pull content remotely.

Knowing that the solutions will change, particularly applications and interfaces, plan in advance what is realistic and what isn't in today's environment. Research a manufacturer's available documentation and APIs, as well as how it interacts with other (potentially competing) manufacturers. Your station will be better off working with one that provides a well-documented architecture with defined, sensible APIs and standard protocols.

Vendor presentation and analysis

At this point, armed with in-depth research, invite workflow-specific presentations by key manufacturers and system integrators. Present them with current workflows and requirements for streamlined server-based workflows. Providing these specifics will enable each vendor to hone a solution.

Keep an open mind during these presentations — vendors may present alternate methodologies that you hadn't considered before. Compare different vendors' solutions, and determine how they would impact the facility's requirements. Realize that no quantity of a single manufacturer's off-the-shelf equipment will exactly solve all workflow problems. Finding the right server-oriented workflow will inevitably require some degree of intervendor compatibility and customization.

The ideal manufacturer will provide a well-documented architecture that lends itself to third-party applications as well as to customization by the client or the system integrator. Considerations may include legacy interfaces or the proper API hooks to customize the master control UI. In any case, for greater success, consult with an engineer or programmer who understands the workflow and the interfaces and is handy with an API or protocol.

Perhaps most important, beware vendors who gloss over a point or say "That's easy," or "Don't worry, it will."

Production-workflow server

Figure 1 on page 44 shows a typical production workflow. The first consideration when choosing a server for a production workflow is its ability to handle multiple formats. Production houses are beginning to use multiple formats. Broadcasters need to be more open as time goes on, particularly when new multiformat cameras (producing SD, HD, compressed video and proxy video) become more widely used.

Manufacturers designing new acquisition and production devices are including workflow tools from inception, so it stands to reason that a broadcaster's choice of servers should mirror that principle. This, in turn, requires multiformat flexibility on the server's ingest side and a targeted set of formats

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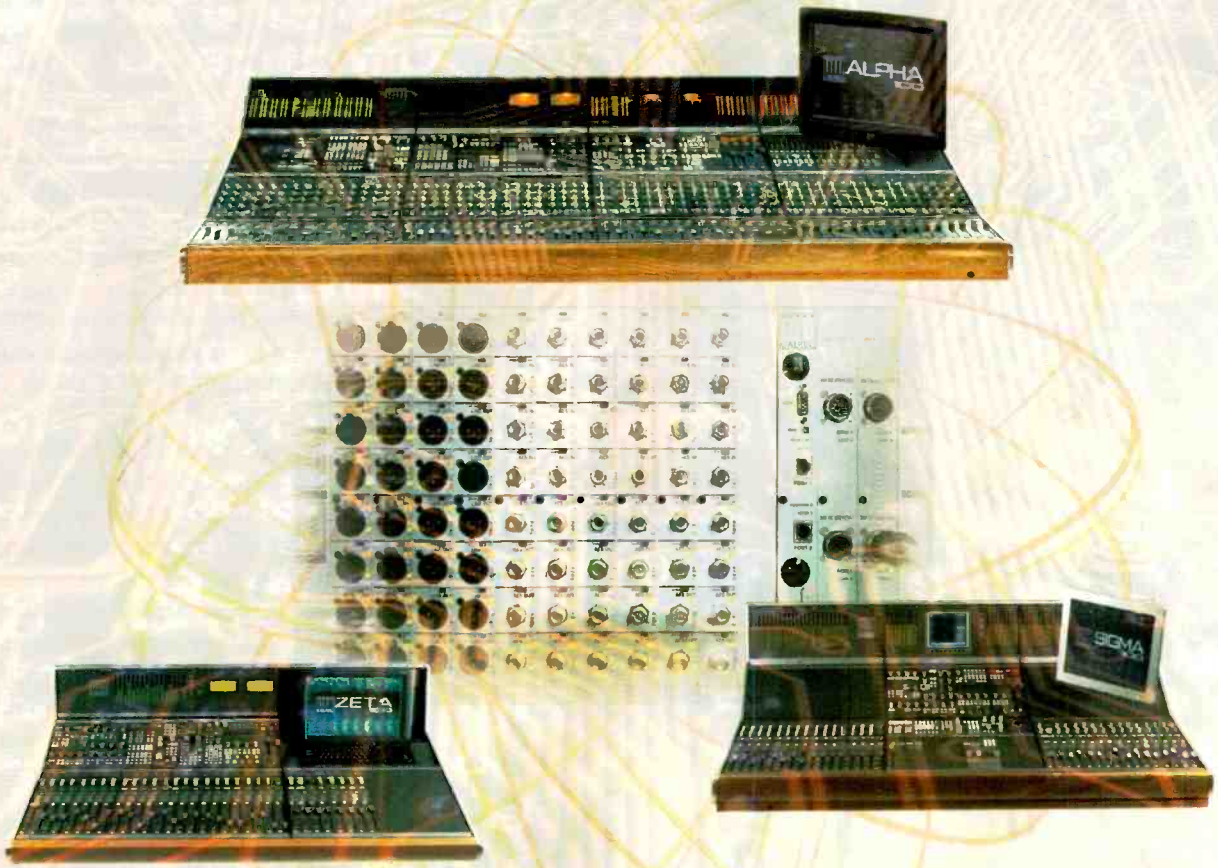

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on the output side. Hand-in-hand with format flexibility, consider the ease (and the cost) of adding a new format or transcoding process to the server. Migration capacity must be built in.

Additional production-workflow considerations include the server's a bility to interface to editing applications, graphics and audio applications, and the ability to process Material eXchange Format (MXF), Advanced Authoring Format (AAF) and metadata. These emerging interchange technologies will make it easier for a facility to transport media between various vendors' systems. They will also increase interoperability in servers for multiple workflows (such as production and news).

The importance of metadata cannot be overlooked when considering a production-oriented server. Beyond the basic advantages of query and search capability, the production server should have built-in capacity to store, parse and manipulate metadata. A server that intelligently incorporates metadata not only has knowledge of all stored media, but also the ability to track the state of the media within a given workflow and communicate this information to other processes.

Distribution-workflow server

Figure 2 on page 46 shows a typical distribution workflow. In this process, a facility ingests and stores master programming and subsequently feeds it to affiliates, cable headends and to air. Ideally, the distribution-oriented server should have flexible format capability on both ingest and playout sides, with the ability to handle long-GOP MPEG through ASI and file-interchange mechanisms such as MXF.

Connectivity is of prime importance with this workflow model. The server not only needs to deliver content in real time (baseband or ASI), it must also be able to stream files without the need for external gateways (which add cost and complexity). At the minimum, Gigabit Ethernet connectivity and FTP support must be built in. Metadata

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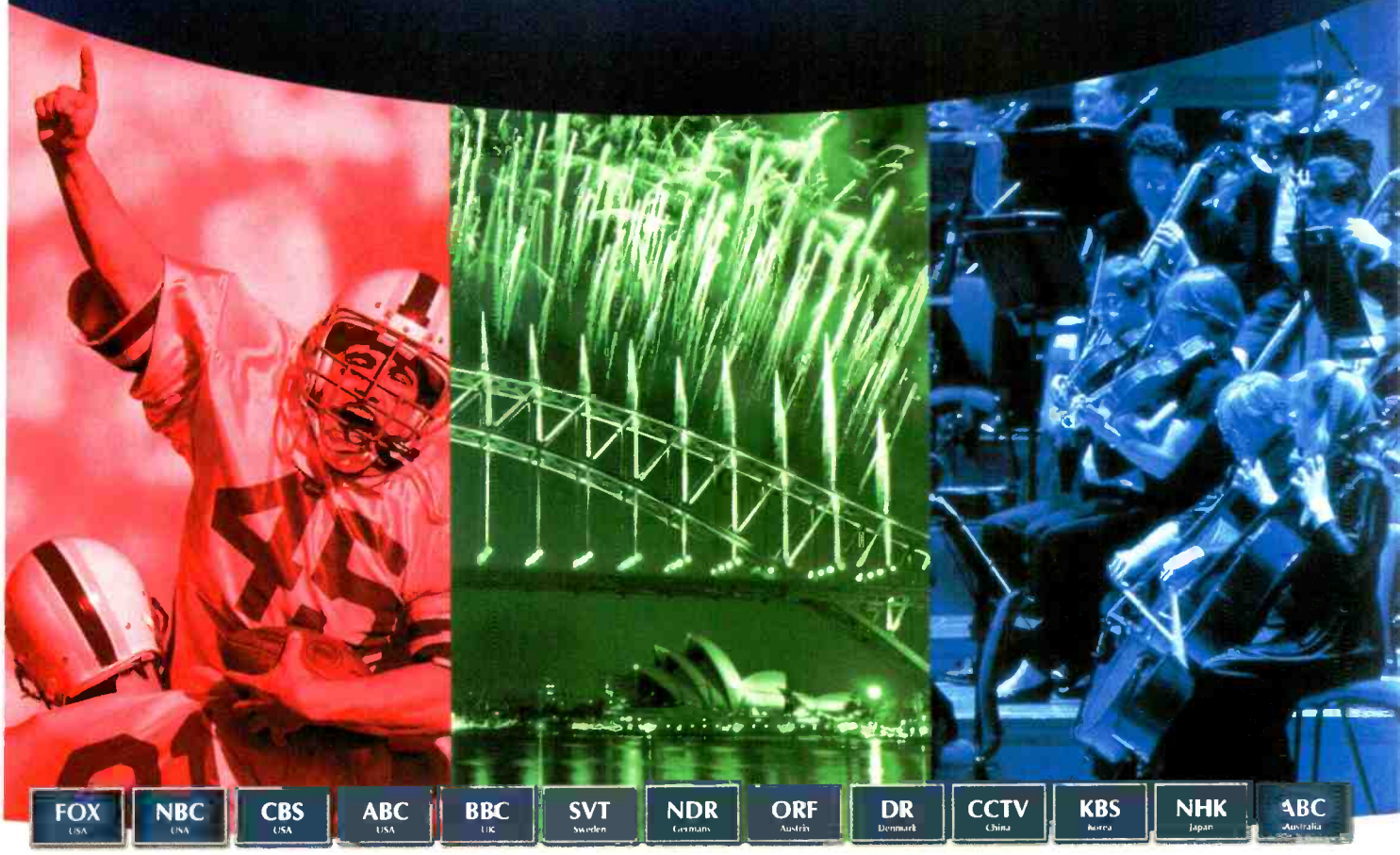

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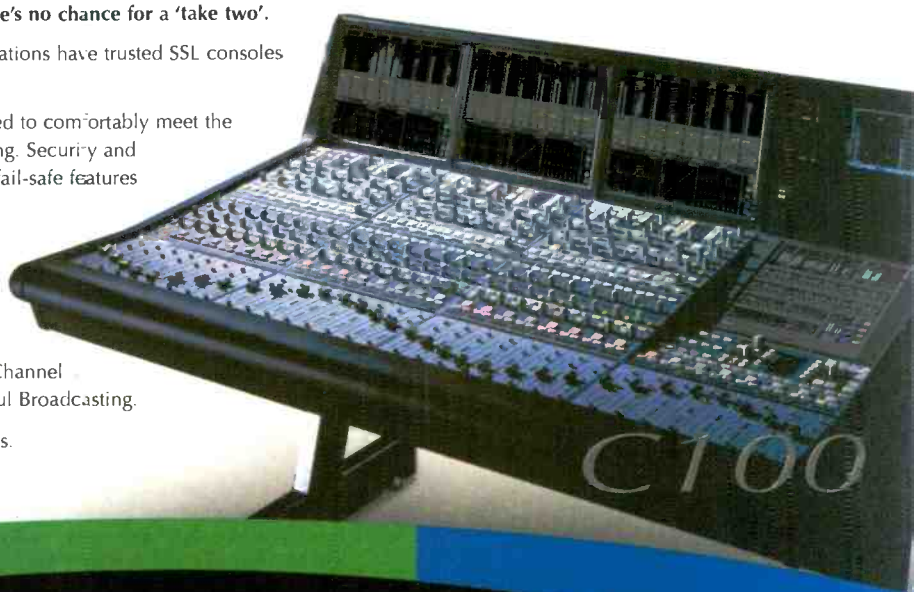

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functionality and a tightly integrated proxy application are equally important, not just for in-house browse and push capability, but also to allow remote users to access the server's content. The server's architecture must support both models and, preferably, should have an integrated browse application.

The server's intelligent metadata processing also facilitates any required interfaces to archive and media-asset-management (MAM) systems, and allows the station to track precisely where and when content was delivered (audit trails). Metadata can also be used to track origination and ownership and to ease digital-rights management.

News-workflow server

Figure 3 shows a typical news workflow. Of the three sample workflows discussed here, news is the most application-intensive and, by necessity, requires key components in its workflow-oriented server. Above all, it requires a shared-storage environment that enhances collaboration and integration. Because speed is essential, it's important not to have to transfer anything. Once material has been ingested, it should be instantly available to all users for browsing, editing and, ultimately, for playout in a rundown.

Format is of lesser importance, primarily because news organizations

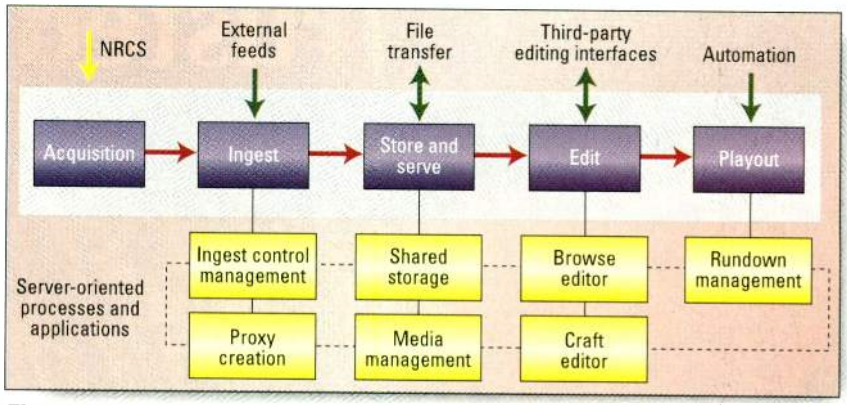

Figure 3. Shared storage is the key to this news workflow. It gives all server-oriented applications instant and secure access to content.

are standardizing field formats and studio formats such as DV. Important factors are high-speed SAN (i.e., Fibre Channel) connectivity and integration of news applications within the server, such as ingest management, browsing, low-resolution proxy editing and high-resolution craft editing. (The fact that many server platforms are PCs solves the integration problem at the outset.) For long-form editing requirements, consider how well the server interfaces with third-party editing systems and the ease with which that material can be brought into shared storage.

Lastly, of all the protocols required, the server's ability to support Media Object Server (MOS) protocol is most beneficial for streamlining communications between the newsroom computer system (NRCS) and the server.

Path of wisdom

Selecting a workflow-oriented server is a path with inherent wisdom, but one that involves detailed analysis of workflow needs and manufacturers' offerings. The investment in a server is simply too critical to lock in a solution that is not scalable and flexible.

For the station that wants to create an infrastructure supporting legacy equipment, current requirements and a migration path, a workflow-oriented server makes good sense and provides a way to build in capacity for new formats and improved applications. The result will be a marked improvement in the efficiency of the facility. BE

Todd S. Roth is vice president of technology for the video server division at Leitch Technology.

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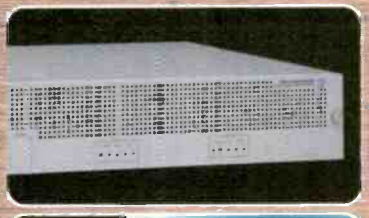

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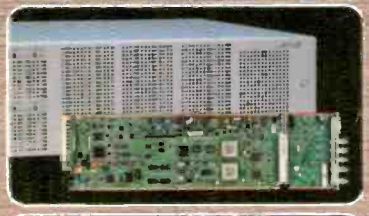

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SPECIAL REPORT:
The MXF advantage

By Bruce Devlin

Acronyms are something most industries readily generate, and broadcasting is no exception. The latest addition is one you heard a lot about at this year's NAB: MXF.

The Material eXchange Format, as it's officially known, represents a next-generation standard for transporting video as files through an IT broadcast infrastructure.

For example, MXF allows a video server from one manufacturer to communicate with another's so that broadcasters can transfer digital files back and forth across a common network without having to transcode them. Transcoding can degrade video images and should be avoided when possible.

The MXF format is built upon the Advanced Authoring Format (AAF). MXF uses the same underlying object model that AAF uses to represent time, structural metadata, time code and any other program-descriptor data, as shown in Figure 1. AAF is optimized for the post-production industry, where complex projects are interchanged among editing, coloring and CGI stations. MXF is a flattened version of AAF, designed to move content between different servers for ingest, playout, nonlinear editing and graphics production. This simplified version of AAF was created to ease implementation of features such as streaming (e.g., for VTRs) and partial-restore functions.

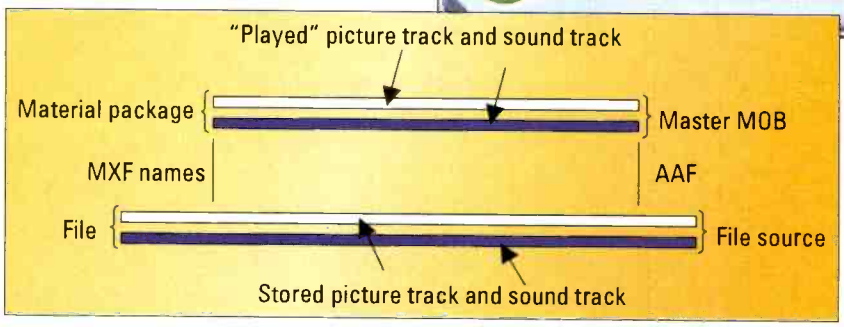


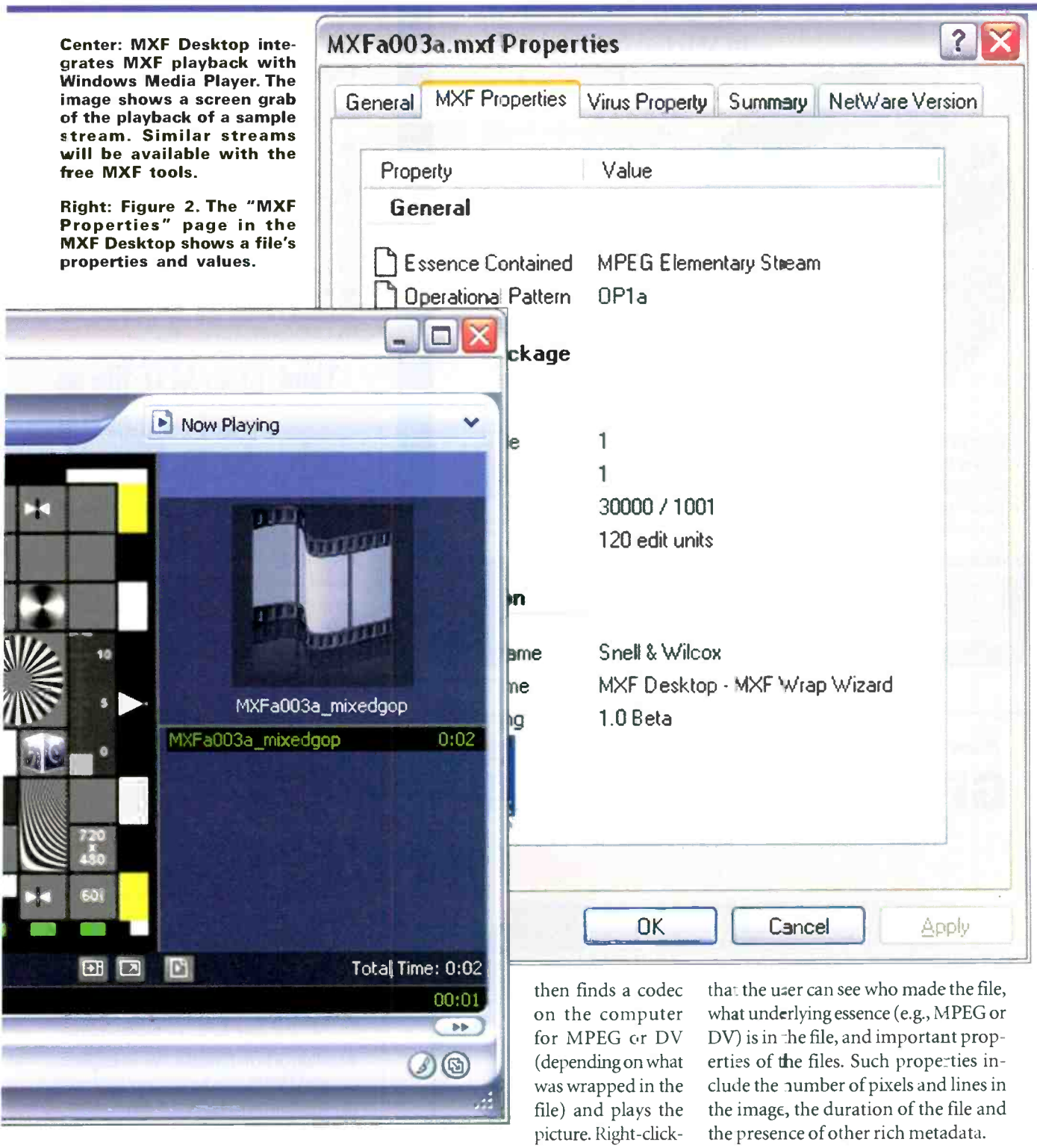
Figure 1. The "played" output and the stored content are related by the edit-decision list (EDL) stored within the file.

Help for MXF vendors and users

The Snell & Wilcox Software Development Kit (SDK) can help vendors

Center: MXF Desktop integrates MXF playback with Windows Media Player. The image shows a screen grab of the playback of a sample stream. Similar streams will be available with the free MXF tools.

Right: Figure 2. The "MXF Properties" page in the MXF Desktop shows a file's properties and values.



(and users) better understand and implement MXF code. MXF Desktop is an application program that installs and integrates itself with Microsoft Windows Explorer. Double-clicking on an MXF file launches Windows Explorer and plays the file. MXF Desktop provides all the needed MXF support, including parsing the header metadata and retrieving the underlying essence. It then finds a codec on the computer for MPEG or DV (depending on what was wrapped in the file) and plays the picture. Right-clicking on an MXF file displays the file's MXF properties, as shown in Figure 2. The software reads the MXF header metadata, parses it and then presents it in a simple "Tabbed Properties" box so that the user can see who made the file, what underlying essence (e.g., MPEG or DV) is in the file, and important properties of the files. Such properties include the number of pixels and lines in the image, the duration of the file and the presence of other rich metadata.

Programmers and equipment vendors will likely want to write their own software to give MXF awareness to their specific products and applications. MXF Express will be available as C++

The MXF format is built upon the Advanced Authoring Format (AAF).

libraries and also as Microsoft Directshow filters to help them do this. The interfaces to the libraries are straightforward and can be as simple as "Write this essence stream to disk wrapped in MXF" or "Read this MXF file and get the essence stream." You can create more complex software by diving into the API calls to read and write your own metadata so that the MXF file-creation information has the correct company name and product version.

Think of an MXF file as a BNC connector for the IT world.

Operational Pattern (OP) support in the SDK reflects the current practice in MXF implementations. OP1a and OP-Atom are the two most popular constraints on the MXF specification. Essentially, they allow creation of a tape-replacement version of MXF and a mono-essence tape-replacement version of MXF. Such features greatly simplify MXF file creation for environments such as videotape where strict limits on essence alignment and partition sizes exist.

Workflow efficiencies

The free SDK will help determine how broadcasters can use metadata in daily production processes and provide some visibility of that metadata. But there are still open questions about the complete interoperability of metadata within the industry. The SDK provides easy visibility into that metadata and a better understanding of how it works. For example, a simple MXF file can have many kilobytes of metadata included in it. With the SDK, the engineer can automatically access that metadata and convert it for other uses.

Common standards benefit everyone. Consider the BNC connector. It's in no one's interest to have an incompatible BNC connector. Users just need to get signals into and out of equipment as quickly and easily as possible. Think of an MXF file as a BNC connector for the IT world — everyone needs to use the same flavor of it.

The goal is to jumpstart the industry's acceptance of MXF and all that it can offer. To that end, Snell & Wilcox hopes that the release of the free MXF Express SDK and MXF Desktop will foster adoption of a single, common MXF specification, and help all stations make a smooth transition to digital. The MXF ExpressDesktop software is available at www.snellwilcox.com. BE

Bruce Devlin is the principal research and innovations engineer at Snell & Wilcox.

MXF Software Development Kit

In an effort to help MXF quickly become a standardized protocol throughout the industry, Snell & Wilcox has decided to make its MXF Express Software Development Kit (SDK) and MXF Desktop player, inspector and wrapper — used for creating and storing files wrapped in an MXF bucket — available at no cost to the broadcast and manufacturing communities. This has caused concern among some of the companies involved in helping to develop the format, but Snell & Wilcox's intent is altruistic. The company is not looking to gain from the SDK, although it would be possible for them to charge for it. The idea is to ensure that MXF is universally supported across the full range of broadcast equipment as soon as possible.

When MPEG-2 was first announced, everyone saw its potential and quickly announced their support. Unfortunately, several different implementations of MPEG-2 emerged, and it caused many interoperability problems. An MPEG-2 file created with one manufacturer's device sometimes could not be recognized by another manufacturer's equipment. This incompatibility set the industry back about 18 months. The compression format only became universal after SMPTE, ISOG, ATSC, DVB and other groups got involved to help implement a single version.

There is a danger that the industry could experience the same thing with MXF, and this is the reason the company is releasing the SDK libraries and tools (but not the source code) for free. The sooner everyone begins using a reference implementation of the original spec — as it's been proposed and standardized by SMPTE — the sooner MXF will be adopted and appear in readily available products. Only then will broadcasters achieve true interoperability between two different servers or edit systems, for example. Frustrated with the problems that different file formats cause, many broadcasters have told the company that, as of this NAB, they will not buy equipment that does not support MXF.

MXF Express will also help vendors, especially small ones, get into MXF without having to put hundreds of man-hours of time into understanding the specification (MXF is over 480 pages long). Snell & Wilcox has done that hard research, and it doesn't want others to have to endure the same thing. BE

Maintaining lip sync

BY NIGEL SPRATLING

As our industry embraces a variety of compression, storage and delivery schemes, maintaining audio/video timing becomes more difficult. Inserting timing indicators into the signals for later comparison is the obvious solution, but so far a simple method has been elusive. Several complex mathematical models have been proffered, and some out-of-service or path-setup techniques have been developed.

Our industry has always been completely videocentric. All existing systems and proposed solutions have been carefully designed to accommodate video timings based on frame rate, which isn't simple — particularly at the 1/1.001 rates (59.94, 29.97 etc) where there are no useful mathematical relationships between video frames and 48kHz audio.

To determine the temporal relationship of several signals with different timing rates, we need a common denominator. There is only one standard that is common to all of the defined world digital television standards — 48kHz audio.

Could digital audio be a timing reference? Absolutely! In the AES audio signal architecture, the largest unit is a data "block." A block consists of 192 AES frames (384 subframes), which, at 48kHz, results in a rate of exactly 250 blocks per second. This block rate can be used as a timing reference because it has a minimum resolution that ranges from more than four times, to 10 times, that of video frame rates.

Digital audio time code

We will never break video's hold as the master of all timing systems. So we must use it to generate a timing slave. Generating digital-audio time code (DATC) is straightforward because the SMPTE time code of the associated video signal is delivered to a clock-locked AES reference generator. First, we discard the frame (:FF) information of the incoming time code and convert it into seconds (86,400 seconds for 24 hours). We then monitor the seconds for change. When change occurs, we reset the AES block counter to zero. Then, in each subsequent block, we insert SECONDS.BLOCKS into the AES reference output. The generated DATC data is accurate to +1/-0 blocks (0.4 percent at 48k) in relation to the original time-code seconds.

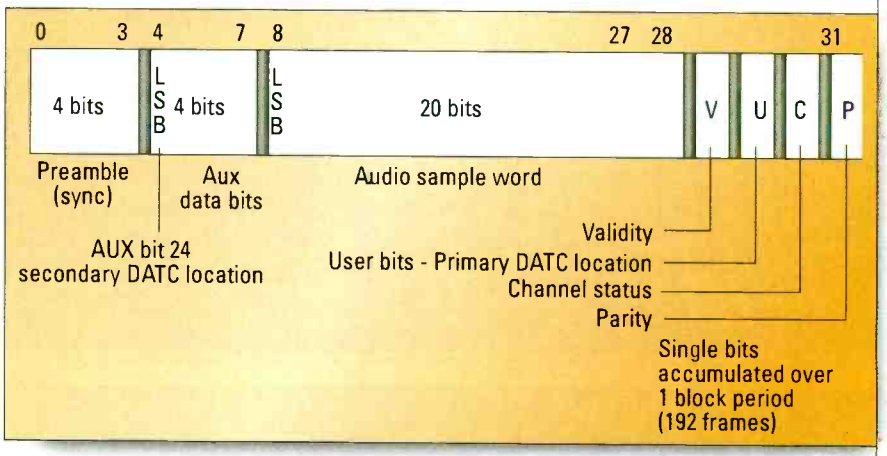


Figure 1. By knowing one DATC value, it is possible to predict all future DATC values in an ideal system. Newly generated DATC data can be added to the video's associated audio signals by inserting it into AES user bits, aux bits or the LSB of the actual audio data.

Like SMPTE 12M, DATC words contain 24 hours of time data. This data is formatted as SECONDS.BLOCKS, and the data word is defined as four bytes: 17 bits for seconds 0 through 86399, 10 bits for blocks 0 through 999, and five bits for data integrity. The 10-bit block number has been chosen to allow DATC to accommodate AES sample rates up to 192kHz.

The DATC numbering system is chosen to provide predictability. This method produces a well-ordered ring of integers, which are modulo the maximum number of AES blocks per day. Therefore, by knowing one DATC value, we can predict all future DATC values in an ideal system. See Figure 1.

Now, we can easily add the newly generated DATC data to the video's associated audio signals by inserting it into AES user bits, aux bits or even the LSB of the actual audio data. Optionally, we can insert the AES data now containing DATC into video ANC data space.

To measure and/or correct path-latency disparity, we must recover DATC from video ANC data or locally regenerate DATC from time code recovered from the video. Then we compare this value with the DATC of the received audio. The measured offset can then be used to steer a delay-compensation device.

If several video signals have been created from an original source and all signals contain SMPTE time code or DATC, we can use DATC as a common reference to reposition the video signals to have the same temporal relationship. This might be useful in automation systems where one "take" is

desired across two or more channels. DATC could be used to reposition signals with disparate frame rates, allowing switching to occur at the next frame boundary of each signal — regardless of the alignment of the frame boundaries.

Because this timing system is based on seconds, continuous DATC reception is not needed. If the DATC data bytes are received periodically, a comparator can regenerate block counts for the input signals to allow an accurate comparison. Consistency of DATC presence only affects the comparison accuracy if the received AES data is no longer at its original sample rate (e.g., if it's been compressed and regenerated from an asynchronous clock). But, if the clock difference is less than +/-20 percent of the original, the system will maintain the comparison accuracy because the block count is always reset by "second" boundaries. Naturally, a good DATC word needs to be received whenever the signal path varies to ensure latency correction.

For baseband AES signals, DATC would be present consistently. But it is only necessary to receive a DATC word once for each new signal acquisition.

DATC and compression

It is unnecessary for DATC to be received continuously because it can be regenerated with a high degree of accuracy. Therefore, a 32-bit DATC word can be inserted periodically into both audio and video datastreams. The insertion period is variable. As a minimum, DATC needs to be inserted once per content item (although a more frequent rate would eliminate possible error).

A single DATC word received can be used to recreate continuous DATC and SMPTE 12M video time code for audio and video signals. The audio DATC will be regenerated as described previously.

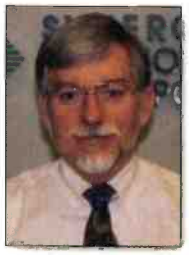
SMPTE 12M is regenerated by converting SECONDS to HH:MM:SS from DATC. At the second change, video V sync is used to increment a new :FF count that is reset each second, which results in the recreation of frame-accurate 12M, provided that the original DATC word was inserted frame accurately. The interchannel accuracy of this regenerated signal will be <-0/+4ms.

Initially, this may seem complex, but it isn't. Many of you may be skeptical about how audio could ever provide a suitable video reference. But available products now prove that DATC can be a reliable clock for television. BE

Nigel Spratling is president/CEO of Sigma Electronics. He is author of "The Book" and "The Book II," published by NVISION.

Centralcasting solutions

BY JOHN LUFF



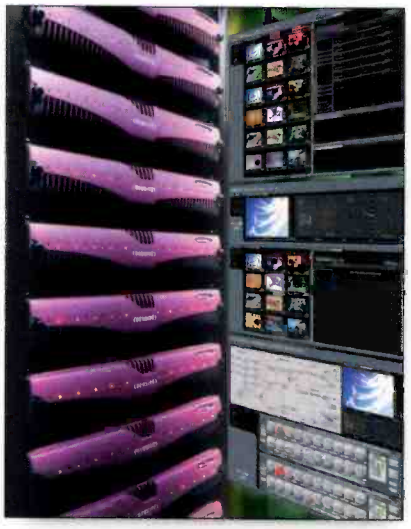
The constant struggle in broadcasting these days seems to be reducing costs. Centralized operations — centralcasting — has been touted for several years as the way broadcasters might reverse the downward spiral of their cash flow. Centralized operations come with benefits, risks and costs. The balance for the technical side of our business is to find ways to tie business needs up with a bow of the right size, without breaking the bank.

The problem arises from the seemingly inexorable decline in broadcast sales revenue and the desire to have increased income. More goes out and less comes in, a recipe for a dying business. The thought of reducing costs by increasing the efficiency of the delivery plant is attractive. The devil is in the details, though, because, in many smaller markets, replacing the average salary by increasing efficiency in the master control room will not move the equation the right direction. The idea is that you move master control to a central site, reduce head count and rely on automation to run the air operations without human fingers on buttons. In an average station, that might save five to seven salaries, but in smaller markets the trade-off might be several thousand dollars to more than $10,000 a month for an interconnection line to feed the station from a distant location. Clearly, the details have to be worked out in individual cases.

Variations on the theme certainly exist. In one approach, the station is simply run remotely from low-speed data lines carrying automation screens and low-bit-rate streaming-media confidence feeds. In this case, the interconnection cost can be low, in the range of less than $1000 per month for a guaranteed bandwidth circuit. Clearly, this looks attractive, but it comes with risk. If the system fails on the remote end, no data circuit will allow you to repair the air chain. Extending the control to include routing, proc amps and audio levels offers a bit more comfort. But, when a patch needs to be thrown, you have to hope the maintenance staff has not gone home. Several group broadcasters have implemented this model with success, so it is not one to ignore. The capital cost for start-up is quite low, especially if the stations involved already have automation.

The thought of reducing cost in areas that increase the efficiency of the delivery plant is attractive.

Another model that has been used in real-world implementations is the exact opposite of the first model. In this case, a remote site runs the entire operation. Think of it as simply a remote transmitter. If local news is involved, it is returned to the central hub site, usually over the duplex return portion of a DS3 line connecting the two sites together. The greatest advantages in this model are obtained when several stations can be combined in one location and the total number of staff can be minimized using highly automated facilities, with one person supervising more than one channel. DBS and cable operations routinely have 10 or more streams monitored by a single operator. With modern monitor matrices such as those available from Barco, Evertz, Miranda and others, it is practical to have flexible monitoring with customized screen views. For instance, a standard view might show many small monitors with streaming media displays of return-confidence monitors. When a problem occurs, you can switch the monitor "wall" to give preference to the site with the issues while maintaining smaller monitors for the remaining sites with a single button push. Some manufacturers have customized the display and control circuitry to allow for intelligent interdependence between the displays and SMTP monitoring of the remote end. This offers flexibility and shows the operator the most relevant information, including the controls needed to fix the problem remotely.



Miranda's Densite series interfacing and distribution range features iControl software that lets desktop users see and hear the signals being processed. The range has 23 new interface modules with advanced control and monitoring-over-IP capabilities.

This model has the highest interconnection cost, because when the lines go down, no signal makes it to the remote site at all. It also has the highest possible labor savings, but with higher capital cost compared to using existing facilities as is. If the current station or

A PRIMEDIA Publication
Broadcast Engineering
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BROADCAST ENGINEERING, ISSN 0007-1994, is published monthly (except semi-monthly in June and December) by PRIMEDIA Business Magazines & Media Inc., 9800 Metcalf Ave., Overland Park, KS 66212 (primediabusiness.com). Current and back issues and additional resources, including subscription request forms and an editorial calendar, are available on the World Wide Web at broadcastengineering.com.

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stations have to be rebuilt anyway, the capital in this case may be lower. As with all equations, however, you can't solve it without knowing the variables and the data involved. If a news operation exists at the station, the latency of the circuits must be considered. Returning the news to the hub for turnaround to the station means that it will likely traverse two codecs, along with networking hardware, frame syncs, etc. The cumulative delay will make mix-minus audio for journalists in the field a challenge. With DTV transmission as the ultimate goal, the latency issue becomes even more problematic. The possible economic return is good, the annual operations cost for interconnection is high, and the return on investment can vary widely.

The final model is one of distributed media and control, with both the local station and the hub having significant portions of the operational facility. I like to call this distributed broadcasting. Modern servers push or pull content to a server at the station under automation control. Content that can be effectively centralized and shared across many stations can be pushed simultaneously to many locations. If the content is live, it need not traverse long lines with serious consequences in the event of failure. PBS is beginning to roll out a system based on this model, which it calls ACE. The goal is to allow stations in public broadcasting to avoid the cost of building multiple stream control facilities that air largely the same programming in many markets. While some stations have embraced this model, others are not yet convinced. Watch the trade publications, including these pages, for results as ACE rolls out later this year. **BE**

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

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

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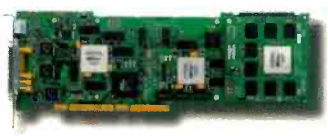

NLE

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Digital Television/ Information Technology Engineer

NYN NEW YORK NETWORK SUNY

The New York Network (NYN), State University of New York System Administration, provides digital television production and transmission services for SUNY, the agencies of State government and the media at large. Located in the South Concourse of the Empire State Plaza in Albany, NYN also operates SUNYSAT, a 9 channel digital television satellite network. NYN seeks nominations and applications for a Digital Television/Information Technology Engineer.

The successful candidate will be responsible for supporting and maintaining the NYN's digital TV broadcast facility which is heavily computer and TCP IP network-based. Must have significant experience in broadcast engineering. The ability to troubleshoot technical problems is required. Organizational skills, leadership, interpersonal skills, and the ability to train and supervise staff are highly desired. NYN is a digital video / audio and fully automated network operating center. Experience in Harris automation utilizing Pinnacle servers is highly desired. The NYN plant uses Miranda/Oxtel MC switchers, Novell GroupWise, Nortel PBX, Ipitek fiber optic equipment, Clearcom intercom. Sony professional equipment and Windows 2000/XP within a one year old, three studio facility. Familiarity with Avid, Mac, Pinnacle CG, Cisco switches, fiber optics, Mpeg encoders, conditional access systems, AutoCAD and broadcasting equipment in general is desirable. Must be flexible for assignments as required by the on-call broadcasting environment. Candidates should possess a certificate of professional training in Computer Science, Electrical Engineering or a related field. A Bachelor degree is preferred. Commensurate professional experience may be considered.

Anticipated Salary Range: $60's. Excellent benefits and working conditions.

Send resume and cover letter stating specific position of interest to:
Roy T. Saplin, Jr.
Search Chair
New York Network
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The State University of New York is an EEO/AA employer. Women, minority persons, disabled workers and/or Vietnam Era Veterans or other protected veterans are encouraged to apply.

Help Wanted

ABC owned station is in search for an Assistant Chief Engineer in Toledo, OH. Pay commensurate with experience. Excellent benefits and corporate opportunities. Candidate should have full knowledge of transmitter operations and computer based equipment. Resumes only to: Lesa James, WTVG 13ABC, 4247 Dorr Street, Toledo, OH 43607 or WTVG.HR@ABC.COM EOE

FOX SPORTS NET currently has the following opportunities available at our Houston, TX location. 1) **MAINTENANCE ENGINEER** This independent worker will perform analog & digital trouble shooting and preventative maintenance of all video and audio equipment. Knowledge of Betacam SP, Routers, various Chyron systems. Tek, GVG, Louth automation required. 2) **TRANSMISSION ENGINEER:** Will possess the technical requirements as follows: Knowledge of transmission systems (satellite, fiber, and microwave); working knowledge of video and audio signal parameters; operate/read all transmission equipment including waveform monitors, vector monitors and audio distortion analyzers; tune and operate satellite reception equipment (receivers, dish control systems, decryption equipment). (For both jobs) Prefer AA Degree in electronics or minimum 2-3 years experience maintaining TV equipment. Excellent communications, organizational and time management skills necessary. Shift work, including overnights and holidays required. Qualified candidates, please respond by applying online to: www.foxcareers.com. No phone calls please EOE M/F/D/V

WBTV, the CBS affiliate in Charlotte, NC has an immediate opening for FT Broadcast Engineering Technician to work Mon-Fri, 3 pm - 11:30 pm. Candidate should have at least 3 years experience in broadcast engineering, possession of strong IT experience in Windows 2000 operating systems, working knowledge of all studio related equipment including switchers, tape machines, cameras, etc. Please send resume to Sharon Griffin, WBTV, One Julian Price Place, Charlotte, NC 28208 or to hired@wbtv.com. No phone calls please. EOE.

MAINTENANCE ENGINEER - WNYC Radio seeks a Maintenance Engineer to provide technical support in the broadcast and production of audio. Responsible for maintenance and repair of WNYC broadcast audio equipment; documenting solutions to technical problems; maintaining inventory needed for repairs; reporting on necessary equipment for department use; responding to service requests for technical assistance and/or repair of equipment. Requires three years experience in analog and digital audio equipment maintenance including component-level trouble shooting and repair; recording studio required. Circuit design skills desirable. EE and Audio Engineering degree preferred. Excellent communication skills a must. If interested send cover letter with salary requirements and resume to employment@wnyc.org or Traci Jackson, HR Associate, WNYC Radio, One Centre Street, 24th Floor, New York, NY 10007. Only candidates selected for interview will be contacted.

BROADCAST VIDEO SALES ENGINEER - Content media distribution company is looking for a director of sales engineer who can thrive in a high energy, fast paced, 24/7 environment. Individual must be self-motivated and work well with others. Digital video server and computer-based systems are at the core of our operations. Installation of server based video & data equipment, satellite and broadband. 7+ years broadcast TV experience (at least 3 years in a project management role) are necessary with strong technical & operational knowledge of analog & digital audio technology, data networks, broadband, broadcast facility operations & industry regulations/standards. An in-depth knowledge of Windows 98/NT/2000/XP (UNIX a plus), as well as strong organizational, planning, excellent communications & interpersonal skills & ability to work on multiple projects simultaneously are required. Some weekends & evenings will be necessary. Domestic travel is involved. Please forward resumes to: J. Ward, DG Systems, Inc., 750 W. John Carpenter Freeway, Suite 700, Irving, TX 75039; Fax: (972) 581-2100, or email jward@dgsystems.com. No calls please.

ASSISTANT CHIEF ENGINEER – A member of the NYT Broadcast Group is looking for a sharp Assistant Chief Engineer. Responsibilities include supervision of our engineering maintenance staff and maintenance of electronic broadcast equipment. Requires a minimum of four years experience in the television broadcast field managing a professional staff. Must be knowledgeable in video, audio, computers and servers. Oversee and maintain both Analog and Digital RF transmitter systems. SBC Cert. A plus. Send resumes to: Human Resources, WTKR-TV, 720 Boush Street, Norfolk, Virginia 23510 or email: HR@wtkr.com EOE

FOX NETWORK ENGINEERING AND OPERATIONS is recruiting a Lab Engineer for Fox's Digital Television Lab located in Century City, California. The Lab Engineer will be responsible for testing and deploying the Fox splicer. Requirements: Two to five years of hands on experience with testing and debug of MPEG encoding, digital video, compression, MPEG transport stream. -Some broadcast television experience is a plus. -Computer skills: Lynx/Unix, Windows XP, 2000, NT

THE GOLF CHANNEL located in Orlando, Florida is currently seeking an experienced Maintenance Engineer to perform maintenance on television broadcast equipment. The Golf Channel is a serial digital cable television broadcast facility with the latest in state-of-the-art digital equipment. This position requires 5+ years of experience, with an emphasis on Avid media composer, NewsCutter, Unity, P.C. and Networking. Strong troubleshooting skills are needed. EOE, M/F/D/V. Send resume with salary history to: HR Manager, The Golf Channel, 7580 Commerce Center Drive, Orlando, Fl. 32819, or fax 407-363-7976.

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BROADCAST ENGINEERING May 2004, Vol. 46, No. 5 (ISSN 0007-1994) is published monthly and mailed free to qualified persons by Primedia Business, 9800 Metcalf Ave., Overland Park, KS 66212-2216. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canadian Post Publications Mail Agreement No. 40597023. Canada return address: DP Global Mail, 4960-2 Walker Road, Windsor, ON N9A 6J3. POSTMASTER: Send address changes to *Broadcast Engineering*, P.O. Box 2100, Skokie, IL 60076-7800 USA. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2216 Phone: 913-341-1300; Edit. fax: 913-967-1905. Advert. fax: 913-967-1904.

Playing chicken with your viewers

BY PAUL MCGOLDRICK

It was tempting to title this column "I want my MTV" or some variant thereof. But the truth is, I don't want any MTV or MTV2 or even MTV Espanol. I do, however, want to watch what I want, when I want. And, when I don't get those two things, I get mad.

The long-term dispute between Viacom and DISH Network came to a crisis at the beginning of March. Both sides claimed that the other was dealing too hard for what it needed. It seemed that Viacom was pressing to do better financially by re-broadcasting 16 local-market CBS affiliates, and that it wanted to push some rather drab Viacom channels into the limelight.

DISH Network, on the other hand, increasingly has less channel space to offer. And the quality of some of its DTV output is questionable. DISH Network also has an overriding need to be able to pitch itself against DirecTV as the most affordable satellite network.

So, in the first week of March, the worst happened: Viewers were held hostage by both sides in the clash. Viacom channels started scrolling messages across the screen urging DISH viewers to encourage DISH to negotiate. After a while, DISH started to blank out the scrolling as quickly as it could. At the stroke of midnight PST, Monday March 8, the battle became a war. DISH Network pulled the plug on Viacom's Comedy Central, the three brands of MTV, Nickelodeon, Noggin, GAS, VH1, VH1 Classic, BET, CBS HD, and Viacom's 16 local CBS feeds.

The next morning, the vitriol was strong. Charlie Ergen accused Viacom of "holding the public airways hostage." MTV's president voiced that DISH Network's attempts to "paint itself as the victim" were laughable. I agree. The viewers were the victms. What was DISH Network thinking?

Then Viacom rammed the point home in a public statement, saying Dish "refused to entertain a reasonable proposal or to negotiate in earnest." The company added the ultimate in insults with, "Fortunately consumers have a choice ... [they] can easily switch to one of these reputable operators. We urge them to do so." The statement is ugly, implying that Viacom did not recognize DISH as reputable. But it also showed that it understood that the important thing was content. Ever heard that here before?

At the stroke of midnight PST, Monday March 8, the battle [between Viacom and DISH] became a war.

DISH Network was clearly on the weaker side of this argument because it was denying content to its customers — customers to whom it had agreed to deliver that content. On that March 9 morning, DISH's phone lines were totally overwhelmed. I don't know how many other DISH customers considered a switch, but I certainly did. I looked again at the more expensive DirecTV, which still emphasizes sports too much for my family's tastes, and I took a really close look at VOOM. VOOM offers over 30 channels, with HDTV content and a bunch of cable channels. But it's not cheap to get in. There are no special deals on equipment, and the monthly cost isn't cheap either. But there are epiphanic moments in life when you say to yourself, "Now is the time ..."

So I almost signed up for VOOM and almost bought an expensive HD-ready monitor. But one small matter stood in my way: VOOM does not carry BBCAmerica. That is a total dealbreaker for my family.

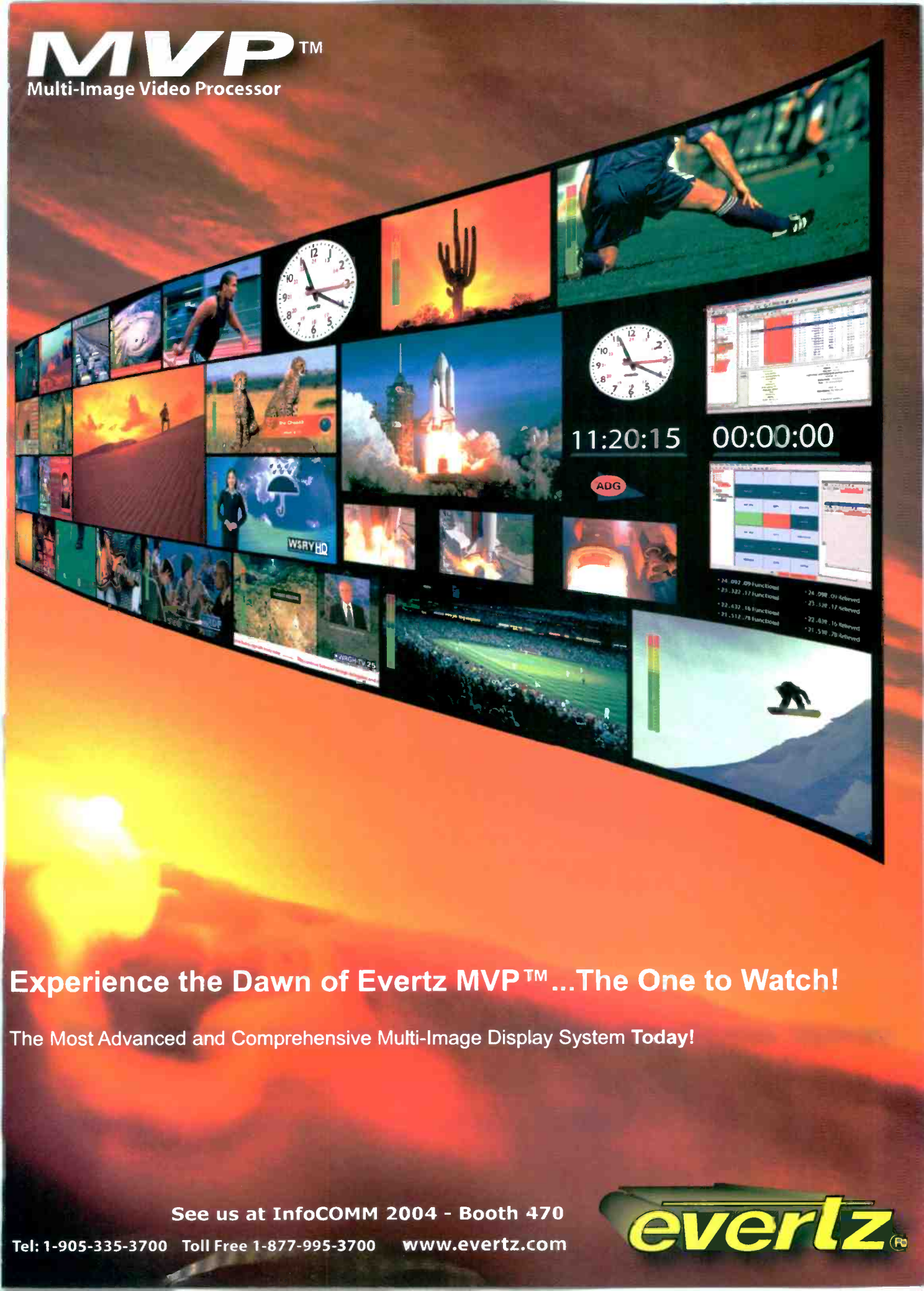
Luckily, the war ended on the morning of March 11. When they struck the deal, both sides were the epitome of sweetness with one another, with DISH saying, "We understand this has been a difficult few days for our customers, and we thank them all for the encouragement they have given us throughout." I don't know where they imagine that encouragement came from but, hey, I guess they had to say it. Viacom's president and CCO Mel Karmazin came over all nice about DISH after apologizing for the disruption.

The effect of the multi-year agreement is that DISH restored the cut channels, added three more Viacom channels (SpikeTV, CMT and TV Land) and will add a fourth one, Nicktoons, when it is finally invented. No one talked about how much this cost DISH Network.

Lessons? Don't hang out your dirty laundry. And don't play with consumers' content; they will revolt. My days as a subscriber with DISH Network are numbered. When VOOM adds BBCAmerica, I'm off. BE

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

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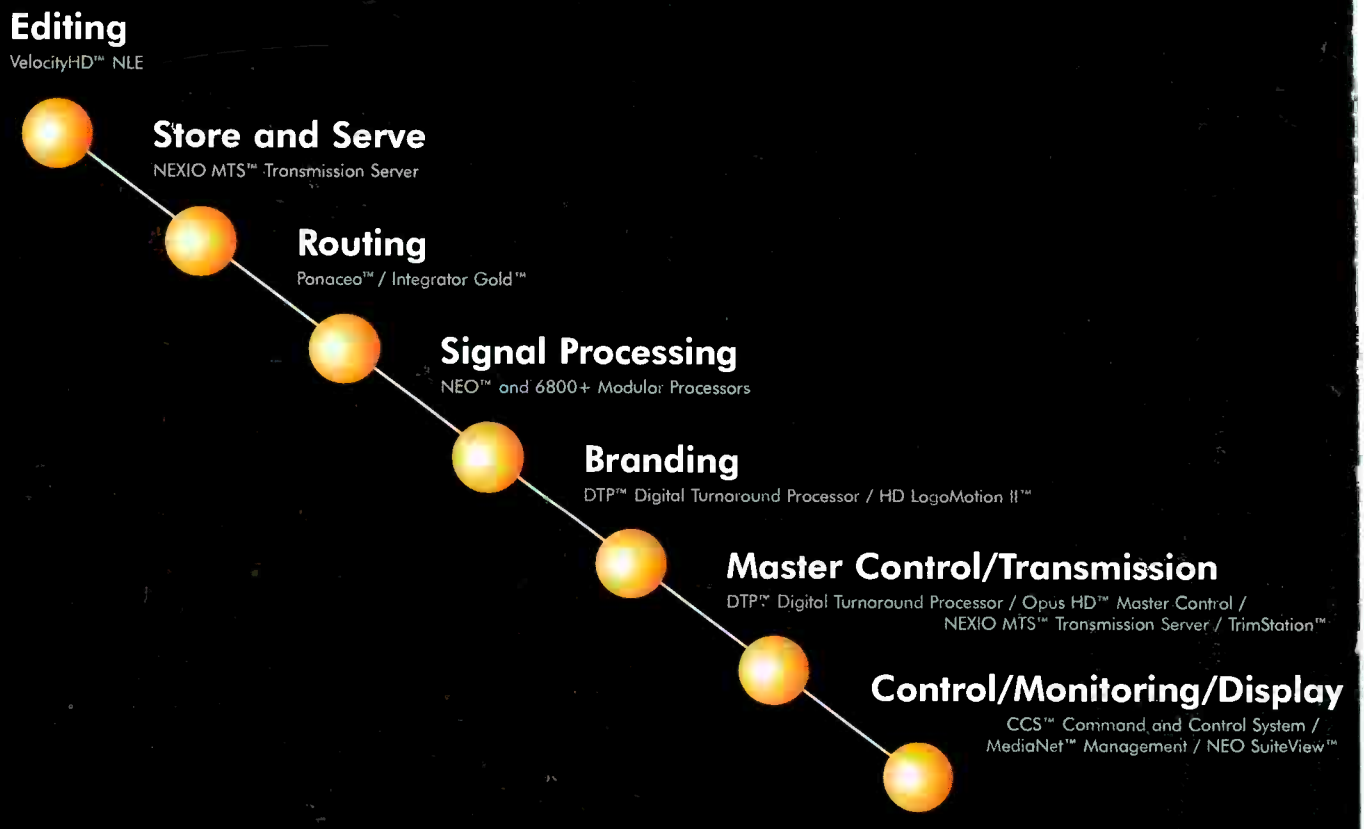

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