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NOVEMBER 2003

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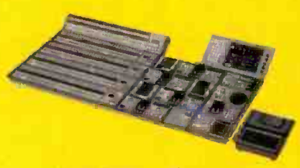

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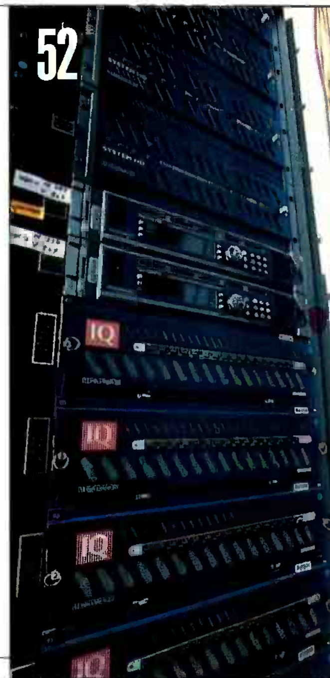
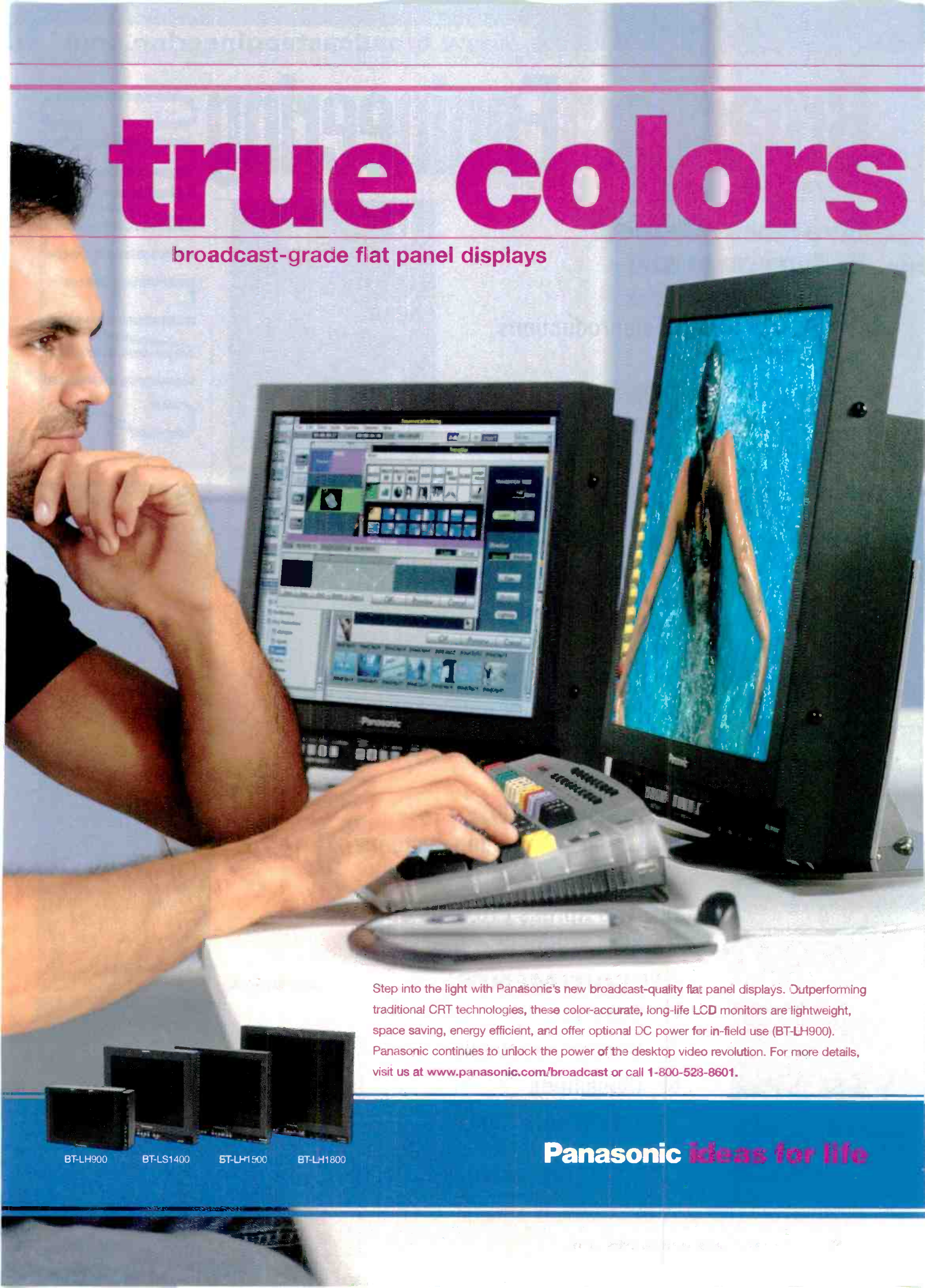


ON THE COVER: The master control center for Studio 6A at NBC Studios' headquarters in New York City. Studio 6A is home of the comedy show "Late Night with Conan O'Brien". Photo courtesy of Snell & Wilcox.

BEYOND THE HEADLINES

DIGITAL HANDBOOK

(continued on page 8)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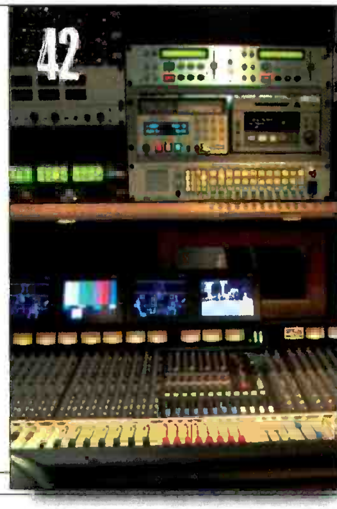
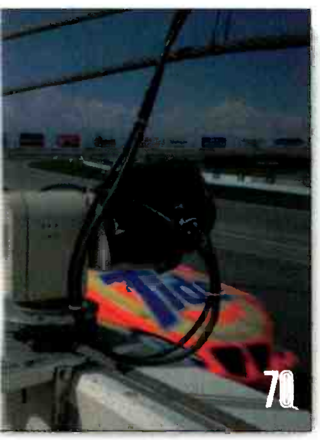
Systems Design & Integration

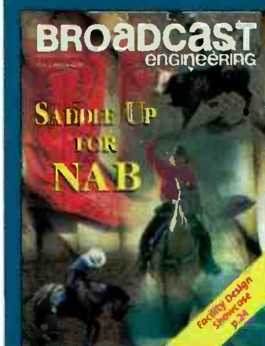


New Products & Reviews



Departments

The birth of DVD



What were the names of the two incompatible digital video disc formats that were later standardized into what is now officially called the digital versatile disc (DVD), and when was the format officially launched? Correct entries will be eligible for a drawing of Broadcast Engineering T-shirts. Enter by e-mail. Title your entry "Freezeframe-November" in the subject field and send it to: bdick@primediabusiness.com. Correct answers received by Jan. 17, 2004 are eligible to win.

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Outsourcing

The headline read, "When specialists do it better and for less." The article focused on the issue of using outside vendors to perform tasks that formerly were handled by a company's own staff. It's called outsourcing. The result is often lower expenses, and the ability for employees to better focus on those tasks that are unique to the business. After reading the article, I began to wonder if this applied to broadcasting.

Outsourcing is simply contracting out for non-strategic services, those tasks that aren't part of a company's core business (or expertise). For instance, most stations hire a janitorial service for cleaning duties. Certainly cleaning the restrooms and emptying the trash are important, but they have little to do with getting the news on air.

Another example might be IT systems and phone maintenance. While your best engineers may be able to repair an extremely complex camera or production switcher, can you afford to have them decipher and fix the phone system when it fails? Payroll is typically one of the first tasks to be outsourced. Why? Because it requires special skills that have nothing to do with broadcasting, and there is no room for error. Today, outsourcing for such duties is typical and considered standard practice.

As managers look for even more cost savings, could other non-strategic duties be outsourced? Consider this. Does a station really need a transmitter engineer? Today's transmitters are highly reliable, which is great. Unfortunately, the downside to this advantage is that when they do fail, the engineer may have little experience in fixing it. There are advertisers in this magazine that can provide round-the-clock monitoring and maintenance of a TV transmitter. Their engineers probably know the transmitter better than a staff employee could. They have direct access to parts and were most certainly trained by the factory. While it's traditional to own and maintain a station's transmitter, where's the advantage in ownership of this particular task?

Could other traditional tasks be outsourced? One duty that is increasingly being looked at for outsourcing is network on-air playout. While this model may not work for local stations, consider a large network or satellite-delivered service. Think about the capital costs required to not only build one on-air playout center, but also construct a full emergency backup facility to keep the network on the air. How much less expensive might it be to contract with a vendor that's equipped to handle network distribution and can amortize their capital costs across several clients? This model is already working well in Europe.

How about your cable system's local weather channel? Local weather channels aren't "local" anymore. They're originated by a couple of vendors who distribute via satellite, and viewers never know the difference. Again, calculate the cost of providing a 24-hour local weather channel, complete with meteorologist? Few cable systems could provide the service — let alone make money on the investment.

As new IT and network technology allows many tasks to be handled hundreds if not thousands of miles away, new solutions for old ways will be developed. Station staff might not easily accept some of these ideas. However, business issues ultimately will drive the decisions made.

Today, the broadcaster's tradition of self-sufficiency may simply be too expensive an option. BE

Brad Dick
editorial director

Send comments to: • editor@primediabusiness.com • www.broadcastengineering.com

Customer no-service

Your hypothetical attempt at contacting a human regarding your cable problems in your August world edition editorial rang so true. Unfortunately I don't have two potential cable suppliers — Comcast has a monopoly.

I don't subscribe to cable television. I use cable merely for Internet access. Shortly after Comcast took over (bought out) AT&T's cable assets, my cable Internet access bill went from \$45/month to \$65/month. In addition, the quality of the service went down the drain for nearly two months. Any attempt to find out if the problem was mine or theirs was totally inhibited by an inability to make contact with anyone at Comcast, or even to locate a Web page that would tell me if they were experiencing service problems in my area. I finally resorted to looking up the name and address of the president/CEO and sending my nasty complaint directly to the top. It got a reaction, but I'm uncertain that the problems have been cured.

Michael Ernstoff

Defining vertical resolution

Mr. Robin,

I noticed that you consistently use a completely different definition of "vertical resolution" than just about any other resource. Virtually every textbook, glossary or technical dictionary I've seen states that the vertical resolution of NTSC video is 525 lines. However, you repeatedly adjust this number using the Kell factor, etc and call the adjusted number the vertical resolution. Is there no firm definition of this term within the broadcasting industry? And aren't we usually refering to the maximum resolution when we discuss resolution? Would it be more accurate to describe the adjusted number as the "effective vertical resolution"? Just curious.

Jack G.

Michael Robin responds:

Here are a few comments on television vertical resolution:

Fiction: All 525 NTSC scanning lines are visible.

Fact: The NTSC raster is made up of a total number of 525 scanning lines. Between 40 and 45 lines are blanked out, leaving between 480 or 485 active (visible) lines.

Fiction: The NTSC vertical resolution is 525 lines.

Fact: The vertical resolution is neither equal to the total number of scanning lines (525) nor to the active number of lines (let's say 485). This is due to the fact that the scanning lines cannot be assumed to occupy a fixed position with respect to the real-life picture vertical details at all times. So the "statistical" vertical resolution is equal to about 70 percent of the number of active lines or about 339 lines per picture height (LPH).

All television systems have been developed based on these facts. The confusion arises from the fact that computer's vertical resolution is equal to the number of active lines. Computers, unlike television, can assign individual, unambiguous brightness values to each active line. So, unaware of television world realities, people who are migrating from the computer world to television apply computer concepts. I would therefore suggest that the resources you are referring to use a completely different definition of "vertical resolution" than that used by the television world.

The use of computers in the television world can create situations when computer-generated (synthetic) images are mixed and/or alternated with images originated by video cameras. In such cases, the computer-generated images would indeed have a higher vertical resolution than the camera-originated images. This situation would however emphasize an unpleasant television-related artifact called "interlace flicker," which occurs when the camera-captured vertical detail exceeds 70 percent of the active lines. BE

June Freezeframe:

Q. One of the 2003 Pick Hit recipients was a second-time winner. The company received its first award in 1990 for its innovation in audio storage. Its 2003 Pick Hit was for a video storage product. Name the company and the technology used as the storage medium in that 1990 Pick Hit award winner.

A. 360 Systems' 1990 Pick Hit winner, the DigiCart, used "Bernoulli" disk technology to record audio.

Winners:

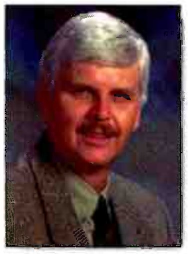
Garen Braun
Brad Meyer, Ozarks Public Television
Alex Joyce, ESPNews
Ken Spickler, Technicolor Creative Services DVD
Steve Alhart, NEP
Bill Gellhaus, WMRG Studios

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*

Off the unbeaten path



BY CRAIG BIRKMAIER

On October 16 the FCC issued a press release claiming that the DTV transition for broadcasters continues to move forward, noting that 1060 TV stations, representing 81 percent of all commercial stations, are currently on the air with a DTV signal. But the real purpose behind the press release — and the FCC actions it reported — was to keep pressure on the laggards; hundreds of TV broadcasters who have yet to construct their DTV transmission facilities.

The press release stated that the FCC took action regarding 141 stations filing requests for a third extension. Out of these requests, the FCC granted 104 stations an additional six months to begin broadcasting a digital signal. Seven stations were denied extensions and given letters of admonishment.

It's no secret that many broadcasters are doing everything in their power to minimize their level of commitment to, and investment in, DTV. Many have chosen the path of minimal resistance — putting a low-power DTV signal out over their city of license. There are a handful of stations in this latest group of extensions with legitimate reasons for delay; those dealing with community resistance to the proposed site of new towers and the inevitable delays brought about by the destruction of the World Trade Center in New York. In addition, some small-market stations have been granted multiple extensions based on financial hardship.

News anchors Morris Jones and Jennifer Gladstone and sports anchor Jonas Schwartz on the set of the Sinclair Broadcast Group's News Central. News Central allows small-market stations to deliver a higher-quality news product while concentrating their resources on local stories.

Most of the rest are traveling the path of maximum resistance. Do nothing and hope that the problem goes away.

To date, none of the 71 stations that were admonished during the second round of extensions have reached the stage of getting fined. If and when the FCC should decide to take action against the most stubborn of the laggards, they may be able to tie things up in court for several more years before being forced to put their DTV channel on the air. Some may simply give up that DTV channel, if they can keep broadcasting on their analog channel.

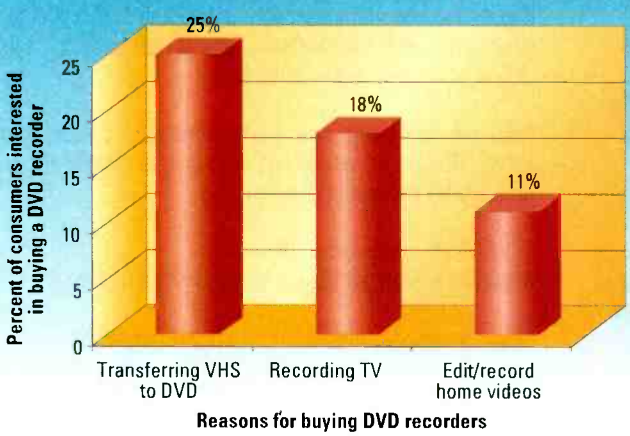
One can hardly blame these stations, especially those in smaller markets, who face the prospect of investing as much, or more, in a DTV facility than the current valuation of their station. To be fair, DTV — at least the U.S. broadcast version — appears to be traveling an *unbeaten* path. About 40 percent of U.S. homes now subscribe to a digital TV service, either DBS or cable, and the number of new subscribers continues to grow. The number of homes capable of receiving terrestrial DTV broadcasts continues to stagnate below 1 percent, and most of these ATSC receivers are integrated with an HD DBS receiver package.

Meanwhile, HDTV is becoming a viable niche market for both cable and DBS, with a growing choice of content that is not available via terrestrial DTV. On Oct. 15, Cablevision dropped a mini bombshell. The company, which recently launched a satellite for a new DBS service, announced the Rainbow

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

The next stage of DVD

Recorders allow consumers to record TV, save legacy material



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

DBS service, which will be marketed under the VOOM brand name. The service focuses on the growing HDTV market, with 21 channels of commercial-free HDTV programming.

More than four million homes now have an HD-capable display. A recent survey by the Consumer Electronics Association found that nine million households are likely to purchase high-definition television products over the next 18 months and another 30 million consumers consider themselves likely purchasers within the next three years.

On October 28, the United States Court of Appeals for the District of Columbia upheld FCC regulations requiring television set manufacturers to install ATSC tuners in some new sets starting next summer. The court rejected arguments made by the Consumer Electronics Association (CEA), that the FCC lacked the authority to impose such a requirement and that the order would harm consumers. It is not known if the CEA will appeal the ruling, and how consumer electronics manufacturers (CE) will deal with the mandates.

A recent FCC action, embracing the agreement between the CE and cable industries for one-way digital tuners, paves the way for the CE industry to develop integrated "digital cable-ready" receivers and to enter the cable set-top box market. The agreement specifies digital I/O ports for IEEE-1394 (with 5C content protection) and DVI (a secure digital link between the receiver and display). These open up the possibility that the CE industry will focus their efforts on monitors rather than integrated receivers.

The FCC also is preparing to adopt rules for the "Broadcast Flag." The flag will signal that the broadcast content must be protected; the onus of protection will fall upon manufacturers of receivers and virtually all

Web links

DTV Transition Moving Forward: FCC Says More Than 80% of Commercial DTV Stations Are On the Air.
hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-240048A1.pdf

Cablevision's Rainbow DBS introduces "VOOM"
www.voom.com/util/press/press_101503.jsp

CEA Survey Reveals 9 Million Plan to Purchase HDTV Over Next 18 Months
www.ce.org/press_room/press_release_detail.asp?id=10330

Nexstar Broadcasting Group
nexstar.tv/default_v1024.asp

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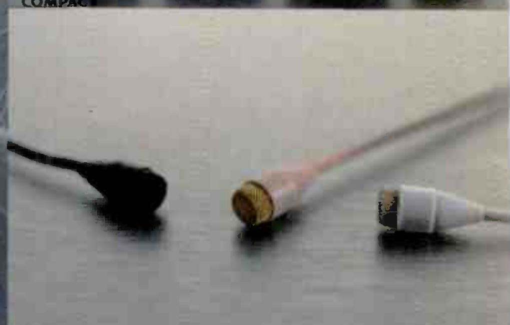

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JUST ADD TALENT

downstream devices that might have access to the DTV bit streams, including PCs. Forcing consumers to buy receivers they do not plan to use, and limiting the fair use rights of consumers could backfire.

The sad reality is that consumers are not traveling the path offered by broadcasters ... the unbeaten path.

Opportunity knocking?

Given current realities, the notion that small-market broadcasters might view the DTV transition as an *opportunity* may seem about as likely as the prospect that the analog channels will be returned in January of 2007.

For example, the Sinclair Broadcast Group, which owns or manages one of the largest groups of stations in the United States, has taken the concept of centralcasting a step further with News Central. Local newscasts are a hybrid mix of stories that originate locally and regional/national stories provided by the News Central staff in Maryland; localized weather segments also are produced at the News Central facility. This allows small-market stations to deliver a higher-quality news product while concentrating their resources locally.

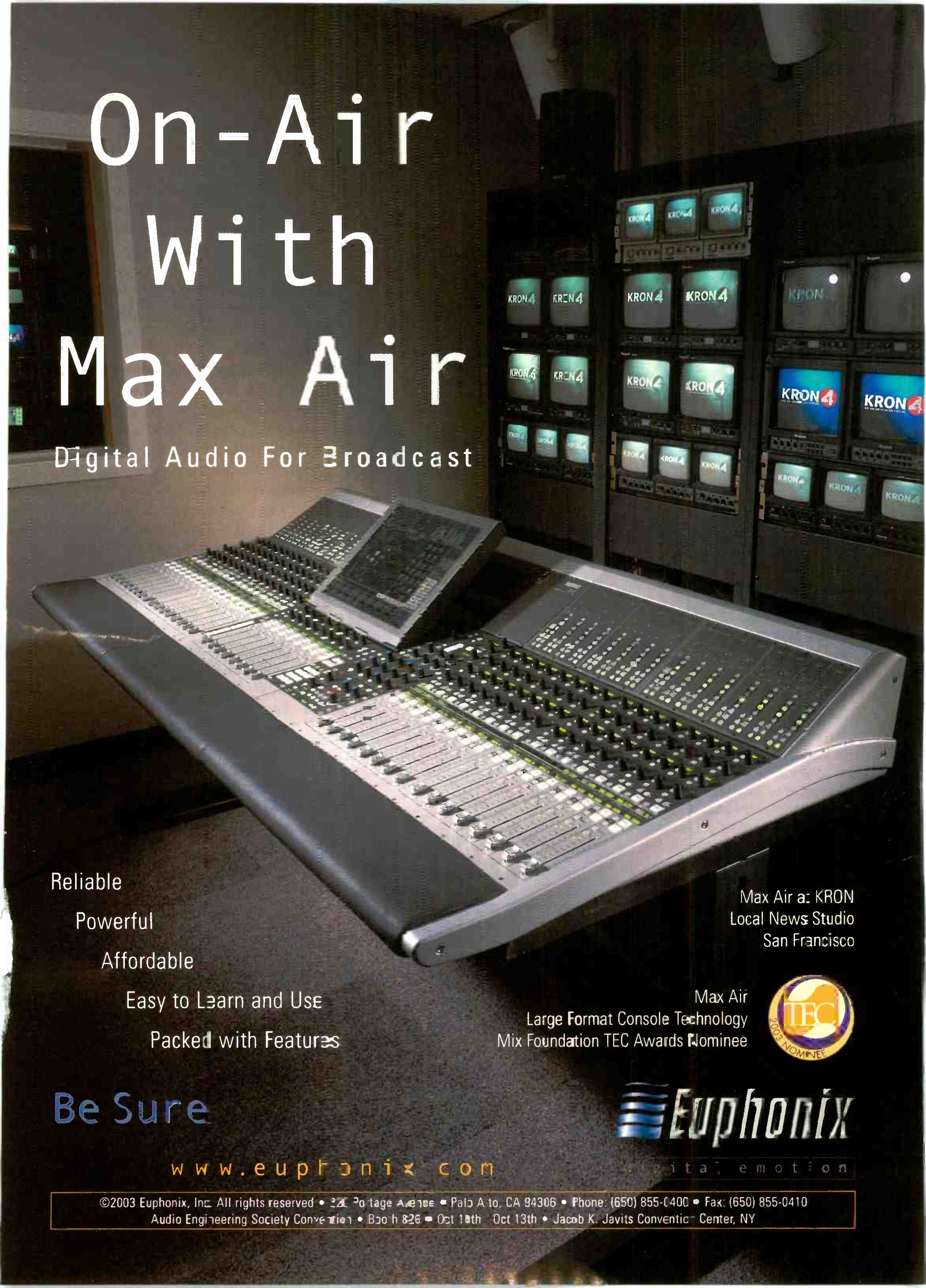
Consider the strategy of another rapidly growing station group, Nexstar Broadcasting Group, headquartered in Irving, TX. Nexstar is a television broadcasting company focused exclusively on the acquisition, development and operation of television stations in medium-sized markets in the United States, primarily markets that rank from 50 to 150, as reported by A.C. Nielsen Company. The Nexstar Web site explains that they are able to acquire stations on more favorable terms than those in larger markets, that they achieve lower programming costs because "the supply of quality programming exceeds demand" in markets with only a few stations, and they employ management techniques typically found only in larger markets.

How does this translate into a DTV opportunity? This is about serving the millions of conventional TV screens found in medium and small markets. It is about creating economies of scale so that the station group can compete effectively for sources of content for a standard-definition DTV multiplex.

The big media conglomerates may use their control over distribution and their political clout to capture more of the revenues from local broadcast operations, but they are not the wellspring of TV industry innovation.

When we get off the unbeaten path of the current broadcast DTV transition, we find smaller media companies also trying to grow. Many times, these companies are limited by competition from conglomerates,with respect to their ability to gain favorable carriage on cable and DBS systems.

Medium and small-market



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broadcasters need to leave the unbeaten path to find this land of opportunity. Despite its obvious limitations, DTV broadcasting can provide the vehicle to transport broadcasters into a future where they have more leverage over content suppliers, not less. Where they can compete based on their knowledge of the market and the community, rather than the ratings of the network that controls them today.

What's more, broadcasters may kick up a few stones and discover that there's more to serving a market than keeping people entertained. DTV broadcasting has the potential to allow broadcasters to enter into new businesses including electronic newspapers and directory services. The opportunity — and the need — to innovate are larger in smaller markets.

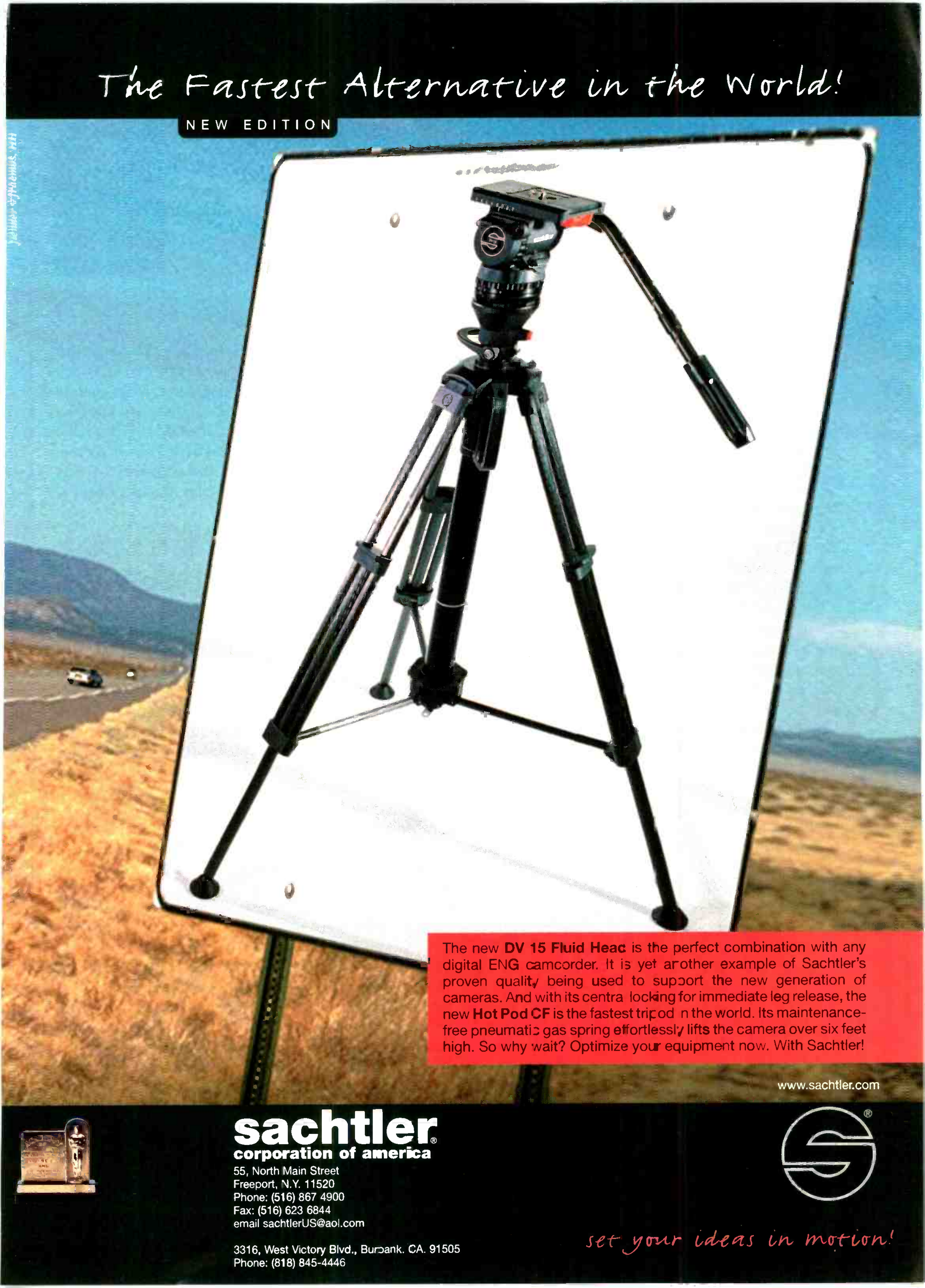
All of this depends on the deployment of DTV-capable receivers. If enough broadcasters talk with one another, they might figure out that it is not difficult to create a platform for competition with cable and DBS, which have placed digital set-top boxes into more than 40 percent of U.S. homes.

The time has come for small-market broadcasters to tell the conglomerates to enjoy their journey down the unbeaten path. There is opportunity out in the digital wilderness; however, those who choose to sit on their analog assets cannot exploit it.

But there is opportunity for small and medium market stations via consolidation. Some station groups are building networks of stations in smaller markets to gain leverage in two ways. First, by using the station group's strength to negotiate better deals for syndicated programming and, second, by using technology to reduce costs, often improving the delivered product's quality. **BE**

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

Send questions and comments to: cbirkmaier@primediabusiness.com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BEYOND THE HEADLINES

FCC approves plug-and-play

BY HARRY C. MARTIN

The FCC has approved equipment standards that will allow digital television sets to connect directly to digital cable service wall outlets without the need for a set-top box ("plug-and-play" TV). The standards are based on an agreement reached by cable companies and equipment manufacturers. Consumers still will need to obtain a security card ("POD" or "cable card") from their local cable operator to insert into the plug-and-play TV sets.

The sets will eliminate the need for consumers to obtain a set-top box or use a separate remote control to receive digital cable service. They also will be able to take their plug-and-play sets to other parts of the country and have them work with different cable systems. In addition, they will be able to fully utilize functions of their television sets that are often disabled when sets are connected to set-top boxes. Plug-and-play digital sets should be in stores in the second half of 2004.

The FCC also adopted requirements to ensure that all sets labeled "Digital Cable Ready" meet plug-and-play standards. It required set manufacturers to provide owner's guides explaining the functions of the sets and POD security cards, and released a further notice of proposed rulemaking to determine whether to require a pre-sale explanation of plug-and-play features.

Plug-and-play digital sets should be in stores in the second half of 2004.

The downside is that first-generation plug-and-play sets will be able to receive only "one-way" programming. If consumers want to subscribe to advanced digital "two-way" services such as pay-per-view, video-on-demand, interactive services or cable operator-enhanced program guides, they still will need a set-top box for the time being. Cable and equipment manufacturers are continuing to negotiate standards that will allow plug-and-play sets to provide "two-way" services.

The FCC's action is intended to speed the transition to high-definition television. As a result of the new standards, HDTV sets (more advanced than standard digital sets) that connect to cable without set-top boxes also are expected to be in retail stores by the end of next year. In addition, the new standards are expected to increase consumer demand for HD sets and encourage program producers to provide more programming in HDTV.

To further speed the transition, starting April 1, 2004, the FCC is requiring cable operators to supply HDTV set-top boxes with HDTV connectors when requested. By July 1, 2005, all HDTV set-top boxes must contain digital or HDTV interfaces, and television sets labeled "Digital Cable Ready" must include tuners for reception of over-the-air digital TV. The FCC will prohibit downresolution of HDTV programming to standard-definition by cable and other multichannel programming systems. It released a further notice of proposed rulemaking regarding downresolution of non-broadcast programming.

The FCC adopted encoding rules that permit cable and other multichannel programming systems (except Internet, cable modem or DSL services) to prohibit consumers from copying digital pay-per-view and video-on-demand programming. The cable and other systems also may limit copying of digital cable channels to one copy. No restrictions are permitted on the copying of broadcast television.

The FCC additionally adopted an interim policy and released a further notice of proposed rulemaking regarding scrambling technologies. The FCC stated that it will address digital broadcast copy protection (the "broadcast flag") in another order in the near future. 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

Dec. 1, 2003, is the deadline for filing biennial ownership reports for TV stations in Alabama, Colorado, Connecticut, Georgia, Maine, Massachusetts, Minnesota, Montana, New Hampshire, North Dakota, Rhode Island, South Dakota and Vermont.

Dec. 1 also is the deadline for stations in those states to place their annual EEO reports in their public files and post them on their Web sites.

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Streamlining

shared content

BY CLYDE SMITH

One of the major goals of Turner Broadcasting System's new all-digital network operations center (NOC) was to manage shared content more efficiently. The company's 19 separate broadcast networks have their own unique identity and programming, but they share up to 40 percent of their promotional spots and commercials. Previously, each network had a separate broadcast operations center (BOC) that ingested and stored this content. That arrangement meant that the system was storing many "masters," and systems for each network were going through the same process more than once for the same files.

To maximize the use of its servers, disk space and people, Turner created a shared-storage architecture in its new NOC using a new SAN management tool, the StorNext SAN file system (StorNext FS) from ADIC. The new system creates a centralized storage system and media-operations group to serve all of the broadcast networks, and has enough capacity to provide shared access to a common set of more than 30,000 commercials and promos. The NOC ingests material for the entire center and manages it in a high-bandwidth, multi-tiered, shared-storage environment. Instead of a separate BOC, each network now has a "pod" that stages content based on its individual playout schedule and creates local copies of shared master files.

Instead of a separate BOC, each network now has a "pod" that stages content based on its individual playout schedule.

When the company first planned the new center, it looked at network-attached-storage (NAS) filers, but they couldn't handle the center's voluminous data. Instead, the company installed a large SAN with 22TB of centralized disk capacity, along with 11 UNIX servers to stream data out to the pods. The key to making this architecture work is the right SAN file system, and the company evaluated all the options before choosing StorNext FS.

The SAN management tool is a distributed file system that manages high-performance shared access to files stored on disk resources over a switched fabric. For its central-storage pool, Turner needed a combination of transparent data access, high performance and high availability. The management system lets each of the servers access all the data in the centralized disk arrays directly and at wire speeds. It offers flexible, high-performance streaming, even with file sizes ranging from 250MB to several gigabytes.

ADIC's StorNext FS manages Turner's broadcast inventory management, the central cache that stores and delivers air material to a network playout server.

Turner often has to create many local copies from the central master, so being able to manage time and bandwidth efficiently is critical. The SAN management system supports multiple network destinations efficiently. For time-critical tasks, it also can give bandwidth priority to specific jobs.

High availability is critical when storage resources are centralized. Because the new storage architecture makes the same content available transparently to multiple hosts, it provides an important built-in protection against the failure of any one host. The system is fully journaled, allowing rapid rebuilds in case of a system fault; it provides fast, automated failover between primary and standby control servers; and it allows for the addition of new hosts without interrupting operations.

StorNext FS provides file sharing equally well for multiple operating systems in heterogeneous SANs. Today, Turner's file streaming hosts are Solaris machines, but the file system allows the company to use a lower-cost Wintel cluster for the metadata servers. It offers the option of adding other platforms as technologies evolve. **BE**

Clyde Smith is senior vice president of broadcast entertainment technology for Turner Entertainment Networks.

Digital video basics

BY MICHAEL ROBIN

Natural phenomena that we perceive as images are analog in nature. The camera's analog transducers transform the original analog information into an analog electrical signal, e.g. voltage. Analog composite signals, such as NTSC, PAL and SECAM, are subjected to various types of cumulative distortions and noise, which affect the quality of the reproduced picture. Separate distortions of the luminance and chrominance components as well as intermodulation between them are likely to occur. Such distortions can be reduced, but not completely eliminated, by performing all or at least a major part of production and post-production operations using component video signals.

The cumulative composite or component analog video signal impairments, and their effect on the reproduced picture, can be considerably reduced by using a digital representation of the video signal and effecting the distribution, processing and recording in the digital domain. The analog-to-digital (A/D) and digital-to-analog (D/A) conversions introduce some impairments. By a proper selection of two parameters, namely the sampling frequency and the quantizing accuracy, these impairments can be reduced to very low values. As long as the digitized signals are distributed, processed and recorded in the digital domain, these impairments are limited to those introduced by a single-pass A/D and D/A processing.

Analog composite signals are subjected to various types of cumulative distortions and noise.

The coded signals

North American and European digital standardization efforts resulted in the ITU-R BT.601 recommendation, which established an agreement on a digital component video format that is compatible with both the 525/50 and 625/50 scanning formats and is at the root of all subsequent component digital developments.

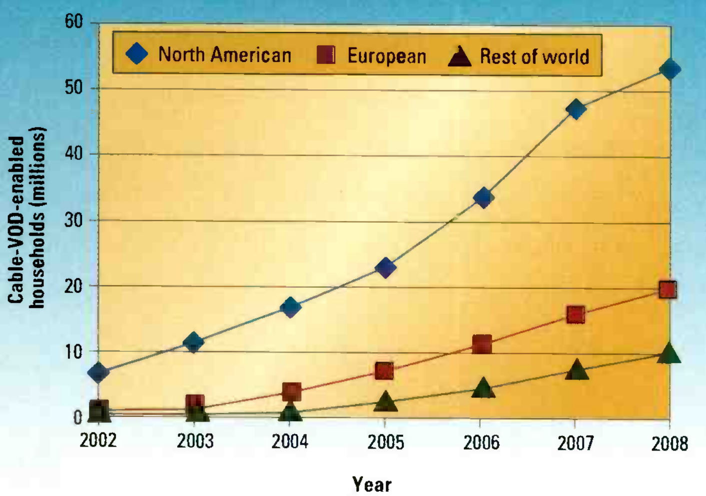
Video signals are usually generated by an analog camera. The camera generates three gamma-corrected wideband primary signals: E'_G (Green), E'_B (Blue) and E'_R (Red). By convention, the symbol "E" represents a voltage, and the prime sign indicates that the respective signal is gamma-corrected. We will discuss two predominant component digital formats:

- *The ITU-R BT.601 component digital standard:* This SDTV standard with a 4:3 aspect ratio covers a family of component digital formats, the well-known 4:4:4, 4:2:2 and 4:1:1. The pervasive 4:2:2 format uses a wideband (limited to F_b=5.75MHz) luminance signal (E'_Y) and two narrowband (limited to F_b=2.75MHz) amplitude-scaled blue color-difference (E'_{CB}) and red color-difference (E'_{CR}) signals.
- *The ITU-R BT.709 standard:* The HDTV formats with a 16:9 aspect ratio specified by SMPTE 274M (1920x1080 interlaced scanning) and SMPTE 296M (1280x720 progressive scanning) are rooted in this standard. These formats are an extension of the 4:2:2 SDTV format and use a wideband (limited to F_b=30MHz) luminance signal (E'_Y) and two narrow-band (limited to F_b=15MHz) amplitude-scaled blue color-difference (E'_{CB}) and red

FRAME GRAB A look at tomorrow's technology

VOD Worldwide

Rollout should be more extensive in North America



SOURCE: Allied Business Intelligence www.abiresearch.com

Standard	Coded signals	F_s (MHz)	F_b (MHz)
ITU-R BT.601	$E'_Y = 0.587E'_G + 0.114E'_B + 0.299E'_R$ $E'_{CB} = 0.564(E'_B - E'_Y)$ $E'_{CR} = 0.713(E'_R - E'_Y)$	13.5 6.75 6.75	5.75 2.75 2.75
ITU-R BT.709	$E'_Y = 0.7152E'_G + 0.0722E'_B + 0.2126E'_R$ $E'_{CB} = 0.5389(E'_B - E'_Y)$ $E'_{CR} = 0.635(E'_R - E'_Y)$	74.25 37.125 37.125	30.0 15.0 15.0

Table 1. Component digital signal characteristics of the ITU-R BT.601 and ITU-R BT.709 standards

color-difference (E'_{CR}) signals.

The mathematical expressions defining these signals are given in Table 1. In both standards, the color-difference scaling factors were chosen to ensure that the signal amplitudes for a 100/0/100/0 color bars signal equal 0.7 V p-p.

The sampling process

The sampling of the video signal is essentially a pulse amplitude modulation process. It consists in checking the signal amplitude at periodic intervals. The sampling frequency (F_s) is a multiple of the horizontal scanning frequency and higher than twice the maximum baseband frequency of the analog signal (F_b) to avoid aliasing. Aliasing is visible as spurious picture elements associated with fine details in the picture. The only way to avoid aliasing is to use an anti-aliasing filter ahead of the A/D converter. The task of this filter is to reduce the bandwidth of the sampled baseband to less than $F_s/2$. Rec. 601 specifies the sampling frequencies of the three SDTV component analog signals as well as the characteristics of the associated anti-aliasing filters. The chosen sampling frequencies for the 4:2:2 format are 13.5MHz for E'_Y and 6.75MHz for E'_{CB}/E'_{CR}. This sampling strategy results in 720 Y samples per active line and 360 each C_B/C_R samples per active line.

The SMPTE 274M and 296M standards specify the sampling frequencies of the three HDTV component analog signals as well as the characteristics of the associated anti-aliasing filters. The chosen sampling frequencies, shared by the two formats, are 74.25MHz for E'_Y and 37.125MHz for E'_{CB}/E'_{CR}. The 274M has 1920 Y samples and 960 each C_B/C_R samples per active line. The 296M has 1280 Y samples and 640 each C_B/C_R samples per active line. Figure 1 details the 4:2:2 sampling structure. Note that the C_B and C_R samples are cosited with odd Y samples. The sampling strategy is called orthogonal sampling.

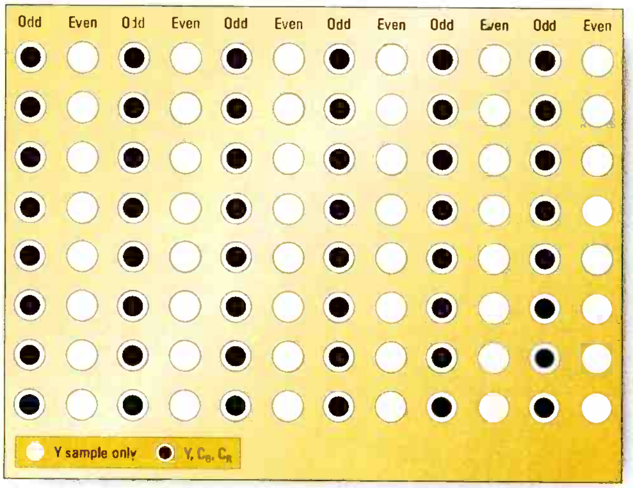
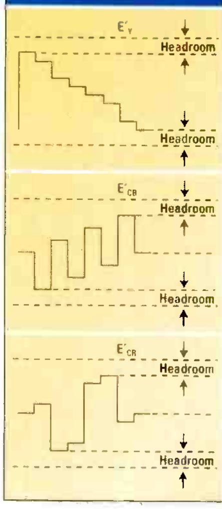


Figure 1. The 4:2:2 sampling structure. Note that the CB and CR samples are cosited with odd Y samples.

The quantizing process

The pulse amplitude modulation results in a sequence of pulses, spaced at $T=1/F_s$, whose amplitude is proportional to the amplitude of the sampled analog signal at the sampling instant. There is an infinite number of shades of grey, ranging from black (lowest video signal amplitude) to white (highest video signal amplitude), that the analog video signal can represent. The instantaneous sampling pulse amplitudes can be represented in the digital domain by only a limited number of binary values resulting in quantizing errors. The possible number of shades of grey is equal to 2^n, where n is the number of bits per sample.

Experiments have shown that using less than eight bits per sample, the quantizing errors appear as "contouring." With eight bits per sample or more, the quantizing errors appear, in general, as random noise (quantizing noise) in the picture. In practical applications, in order to avoid clipping, the signal occupies less than 2^n steps, resulting in a specified "quantizing range." Figure 2



Signal	Analog levels (mV)	10-bit decimal levels	10-bit hexadecimal levels	8-bit decimal levels	8-bit hexadecimal levels	
E'Y		1020 to 10 3	3FC to 3FF	255	FF	Protected levels
	763.13	1019	3FB	254	FE	Highest quantized level
	700	940	3AC	235	EB	Peak level
	0	64	040	16	10	Blanking level
	-47.9	4	004	1	01	Lowest quantized level
		0,1,2,3	000,001,002,003	0	00	Protected levels
E'CB		1020 to 102[illegible]	3FC to 3FF	255	FF	Protected levels
	+396.1	1019	3FB	254	FE	Highest quantized level
	+350	960	3C0	240	F0	Upper peak level
	0	512	200	128	80	Blanking level
	-350	64	040	16	10	Lower peak level
	-396.9	4	004	1	01	Lowest quantized level
		0,1,2,3	000,001,002,003	0	00	Protected levels
E'CR		1020 to 102[illegible]	3FC to 3FF	255	FF	Protected levels
	+396.1	1019	3FB	254	FE	Highest quantized level
	+350	960	3C0	240	F0	Upper peak level
	0	512	200	128	80	Blanking level
	-350	64	040	16	10	Lower peak level
	-396.9	4	004	1	01	Lowest quantized level
		0,1,2,3	000,001,002,003	0	00	Protected levels

Figure 2. The relationship between the E'Y, E'CB and E'CR analog component signal levels corresponding to a 100/0/100/0 color bars signal and the 10-bit and 8-bit Y, CB and CR digital sample values, as specified in ITU-R BT.601, SMPTE 274M and SMPTE 296M


Jack Schmidt
ENGINEER OF THE MONTH
U.S. PATENT AWARD
Awarded to
JACK
SCHMIDT

shows the relationship between the E'_Y, E'_{CB} and E'_{CR} analog component signal levels corresponding to a 100/0/100/0 color bars signal and the 10-bit and 8-bit Y, C_B and C_R digital sample values, as specified in ITU-R BT.601, SMPTE 274M and SMPTE 296M.

In a 10-bit system, there are 1024 digital levels (2^{10}) ranging from 0 to 1023 (000 to 3FF hex). Levels 000, 001, 002, 003 and 3FC, 3FD, 3FE, 3FF are reserved to indicate timing references. Note that the sync is not sampled. This leaves a "maximum quantizing range" of 1016 digital levels, ranging from 4 to 1019 to represent the signal levels. The normalized (700mV p-p) Y signal levels are assigned a range extending from 64 to 940, a total of 877 quantizing levels. This leaves a small upper headroom (940 to 1019) and lower headroom (4 to 64). The normalized (700mV p-p) C_B and C_R signal levels are assigned a range extending from 64 to 960, a total of 897 quantizing levels. This leaves a small upper headroom (960 to 1019) and lower headroom (4 to 64). An 8-bit system would have 220 quantizing levels for the Y component and 225 quantizing levels for the C_B and C_R components.

The overall performance

The picture quality is related to the signal-to-RMS-quantizing-noise-ratio (SNR). The expression of signal-to-RMS-quantizing-noise-ratio yields a complicated formula that takes into consideration the quantizing range and the ratio $F_s/2F_b$. Taking into account the standards detailed above, the formula can be simplified to:

$$S/Q_{RMS}(dB) = 6n + 6$$

where:

S: Quantizing range occupied by the full p-p video signal amplitude

Q_{RMS}: RMS quantizing noise

n: Number of bits per sample

A 10-bit system would thus have an SNR of 66dB, and an 8-bit system would have an SNR of 54dB. 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 recently translated into Chinese and Japanese.*

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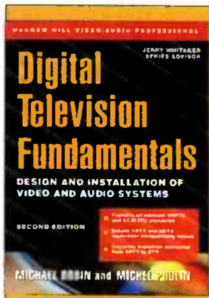

The Second Edition of Michael Robin's book may be ordered directly from the publisher by calling 800-262-4729. The book is available from several booksellers.

Building disaster-resistant computer networks

BY BRAD GILMER

For many years, the most important technology layer in a broadcast plant was video and audio routing: Lose your router and you were off the air. Over the years, computer networks have become just as critical. At first, networks were critical because they carried information (automation, traffic, etc.) about programs being broadcast. With the advent of AAF and MXF, networks are poised to become a major part of the content transfer infrastructure within a facility. The fact is, in many facilities today, if you lose your network, you will be off the air. This means it is important to focus on how to keep your network up and running in the event of a disaster.

Crucial issues to consider in designing networks are fault tolerance and high availability. Because you are using the same network to service a number of clients, a failure in the network can impact the entire operation. For years, I thought the only answer to the possibility of system failure was to design systems to be *fault tolerant*. Fault-tolerant systems are designed to be resistant to faults. Typically, a single fault will not cause a total system failure. Fault-tolerant designs usually include dual power supplies, redundant disks and automatic changeover software. Systems of this type are designed as a single unit or set of interconnected units; they are sold as a system; and they may be quite expensive. Many are designed so that the only way you know there has been a failure is by checking status monitoring and alarms. For example, if you lose a disk in a RAID array, you may not know there has been a failure.

Another approach, which can be much more economical but may or may not provide the same protection from failure, is *high availability*. With high availability, the point is not to prevent failures. Instead, a designer uses off-the-shelf components to design a system such that a single failure has little impact or causes a minimal outage. For example, a high availability design might incorporate two completely separate Ethernet systems. The servers and clients might have two Ethernet cards in them instead of one. High availability typically takes advantage of the low price of consumer computer hardware. It might seem cumbersome to put together two completely separate Ethernet networks, but Ethernet is practically free these days unless you are talking about high-speed technology.

Crucial issues to consider in designing networks are fault tolerance and high availability.

High-availability systems may have a higher fault rate than fault-tolerant systems, although this depends entirely on decisions made by the system designers. The bottom line? Fault-tolerant systems may indeed be more "fault tolerant" than high-availability systems, but there is a cost associated. It is up to the user to decide if fault tolerance is worth the expense.

Keep a backup

The first thing you may want to do is invest in backup hardware that can be put into operation in the event of a major failure. It is important to note that this technology moves fast. It is best to buy the minimum number of extra switches that will do, since next year there will always be a newer, faster technology available. In a typical facility, you'll need the switch you put on the shelf before the year is out anyway. The point is to have a spare available — just as you would have a spare klystron or VTR head wheel. Next, you should consider having a spare server available to be pressed into service on a moment's notice. In one facility where I worked, we planned that if the server went down, we would use a desktop unit as backup. We had the software loaded on a spare hard disk ready to go. One day the server crashed. We pulled the workstation out of an office in the engineering shop, installed the hard disk, and had the new "server" up and running in about five minutes.

You also should consider physically separating critical equipment, if possible. For example, if you have multiple T1 or DSL lines coming into your facility, make sure that at least one of those lines comes onto your property from a different direction. Backhoe fades are more common than you would expect. If you have multiple servers on your network, try to locate the servers in different spots in your building. Keep your tape or CD-ROM backup unit in a different part of the building from the devices it is backing up.

Some of you may need to recover from network outages more quickly than you can install a spare switch — say on the order of one to six seconds.

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In this case, you will need to look for active solutions. Both open and proprietary solutions are available that will provide failover in case of a network media (wire or fiber), switch or network interface card (NIC) failure.

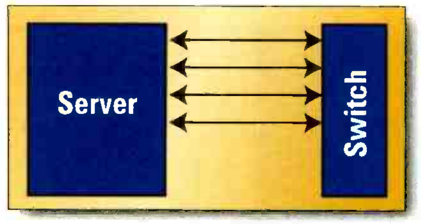

Figure 1. Multiple connections between a server and a switch not only provide backup in case of NIC failure, but also allow users to build "fat pipes" to heavily accessed network equipment.

Hardware-based solutions typically involve NICs and switches. In some cases, the manufacturer allows a server to be connected to a hub through multiple NICs using multiple ports on the switch. In case of NIC failure, the other cards automatically take up the load. Not only does this solution provide protection from failure, it also allows users to aggregate bandwidth across multiple connections, providing a "fat pipe" on to the network for heavily used servers (see Figure 1). Note that this solution does not help if the switch fails.

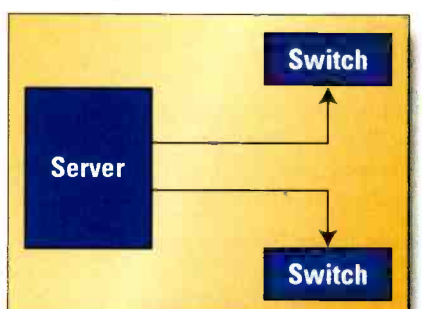

Figure 2. Connecting NIC cards to two different switches protects against a switch failure.

Another solution is to connect the server to two different Ethernet switches. In this configuration, the goal is to protect the system from a switch failure. Both switches are connected to the same network. In case of a switch failure, traffic automatically is routed to the remaining switch. (See Figure 2.)

In some cases, networks — especially networks built to handle broadcast content — must handle heavy traffic. Some manufacturers enable users to build "fat pipes" between switches using multiple connections. This not only provides the user with redundancy, but also allows them to increase the speed of their networks. If a cable between the two switches fails, the switches will automatically reroute traffic to the remaining ports.

Some manufacturers carry this arrangement to its logical next step. They provide switches with multiple redundant physical connections to each port. Should a port fail, the switch changes to a backup port and media (see Figure 3).

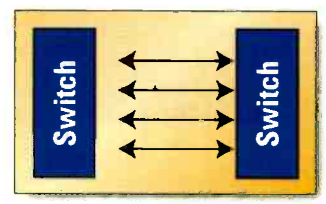

Figure 3. Having multiple connections between switches provides redundancy in the case of the failure of a connector, wire or fiber optic cable.

Redundant routing

It is relatively easy to keep a spare Ethernet switch on the shelf. It takes more work to keep a backup server at the ready, but there are numerous options available — from ghosting server drives to clusters. But there is another area in large networks that requires some creative thinking. If your network is sufficiently large, you already may have deployed a router. I am not talking about the small DSL or T1 routers frequently deployed as edge devices to connect to the Internet. I am talking about more full-featured routers that are typically used in Intranets to segment traffic in different departments, provide network address translation and port address translation, execute complex firewall rules, and allow tight control of access to critical on-air operations. In many cases, these routers are actually active computer devices rather than dedicated single-board computers. The routers can have complex configuration files and they build sophisticated tables as they learn about your network. When one of these systems fails, it is not as simple as grabbing a spare box off the shelf. Routers are dynamic boxes with configurations and tables that change in real time. This makes recovery from a failure challenging to say the least. Router manufacturers understand that in some cases, failure is not an option. So they have developed a number of proprietary technologies that offer hot standby and load-balanced configurations.

In a hot standby configuration, the main and backup routers are in constant communication. The backup router is being kept up-to-date in near real time. If the main router fails, the backup automatically and almost instantaneously switches online. In load-balancing configurations, there is more than one router in the system. The load is distributed among multiple routers according to user-configured parameters. The system is designed so that there is enough spare capacity that, should a router fail, the others immediately and almost instantaneously take over the load. These solutions are not cheap, and installation and configuration is non-trivial. However, if your network needs to remain up no matter what, it might be worth the investment. BE

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

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DIGITAL HANDBOOK

Dolby Pro Logic II vs. SRS Circle Surround

BY KAICHOW LAU, NERMIN OSMANOVIC AND KEN POHLMANN

In the same way that digital technology has replaced analog, surround sound is replacing stereo. Phenomenal sales of DVD-video players and home theater systems confirm that consumers enjoy sound from all around. Savvy broadcasters understand that they must somehow squeeze 5.1 channels through their 2-channel audio signal paths.

While matrix surround systems such as Dolby Pro Logic II (DPLII) and SRS Circle Surround (CS) cannot perform as well as discrete digital systems, they are effective solutions for many broadcasters. To learn more about the operation of each system, and in particular to test the sonic performance of them, we assembled a Dolby DP563 encoder and DP564 decoder, and SRS CSE-07 encoder and CSD-07 decoder, and put them through their paces.

The well-known Dolby Pro Logic (DPLI) technology was first introduced in 1987, allowing broadcasters, via 2-channel audio delivery, to deliver surround sound audio to home users. Subsequently, Dolby introduced its improved matrix surround technology, Dolby Pro Logic II. DPLII allows the encoding and decoding of stereo surround channels with full bandwidth, with improved channel separation and more intelligent logic steering mechanism. It also permits flexible mixing of the LFE channel so that broadcasters can tailor the signal to the end users' needs. As in DPLI, home audiences can switch between stereo and surround sound playback of matrix-encoded content, depending on their preference and playback systems.

SRS burst onto the scene in the late 1990s with its CS technology, a conceptually similar matrix encoding/decoding system. The company has expanded its market share by securing deals with several major broadcasting networks. CS claims to offer a more versatile system that delivers multichannel audio from any stereo, matrix-encoded (including DPLI/II) or CS-encoded content. It provides full bandwidth in all channels; the capability to encode an L, R, C, Ls, Rs, Cs or LFE signal as the dominant channel; dual-band steering logic for good channel separation and smooth steering between Ls and Rs; and front and surround channels. Moreover, its decoder is bundled with other proprietary SRS technologies such as Dialog Clarity and TruBass for center channel and bass enhancement.

Both the Dolby and SRS systems are fully backward-compatible with mono, stereo and surround. (CS is also compatible with DPLI/II). This compatibility makes this matrix surround technology a powerful and flexible way to deliver realistic surround sound for broadcasting, film, music and game applications, as well as Internet streaming. In other words, both are very viable products.

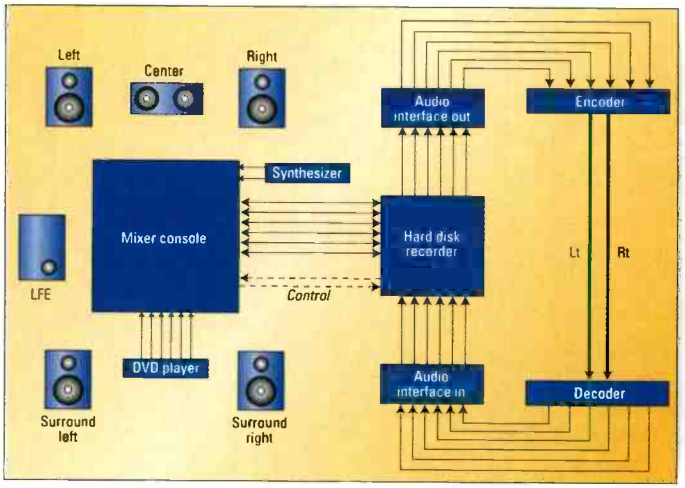


Figure 1. The listening test comparison of the Dolby Pro Logic II and SRS Circle Surround matrix audio systems was conducted in an audio/video post-production studio.

But because DPLI/II-equipped A/V receivers can be found in millions of household home theaters, can CS, the new kid on the block, compete with the more established technology? One key to potential success is sound quality. To find out if either has a sonic edge, we set up both systems, ran identical source material through both encoder/decoder pairs and listened to the results.

The hardware setup

The systems were set up in a post-production studio equipped with two Yamaha 02R consoles, ProTools, audio interface in/out and other typical gear, as shown in Figure 1.

Next, the SRS encoder was connected to a hard drive recorder audio interface output; six analog channels were directed to the encoder via balanced inputs. The encoder's outputs, (total left channel and total right channel) were directly connected to the decoder's inputs with two analog cables. Six distinct outputs from the decoder were then directed back to the hard disk recorder so the encode/decode signal could be stored for playback.

Setting up the SRS system was a simple task, which is a significant advantage. The signal path was tested with the encoder's internal test signal. The system was calibrated by adjusting the output levels of each channel using gain trim controls on the front panel of the decoder. (There are no level adjustments on the encoder.) The system is designed to drop into an analog signal path; the encoder has analog inputs (its own A/D), and the decoder has analog outputs (its own D/A).

The Dolby system was connected in a similar manner. However, because the DP563 encoder has only digital BNC inputs and outputs, an additional A/D converter was needed to convert the six analog channels from the audio interface into three digital channels for input into the encoder. (We used a Dolby model 587 multichannel audio converter, but any 8-channel converter can be used.) Controls on the encoder's front panel provided access to setup parameters such as monitor status and speaker configuration for system testing. Also, the decoder can be remotely controlled. Altogether, it is more sophisticated and flexible in operation and configuration than the SRS system. However, extra features and flexibility also increase complexity and require more setup time.

The listening test

To conduct an impartial A/B listening test comparing the Dolby and SRS matrix surround systems, we used our own source materials: two original surround recordings and several commercially available DVD movies. We also created special files for our very own matrix surround "torture" test.

We began by listening to a passage from a live recording of Mahler's *Symphony No. 5*. Both systems performed equally well in terms of overall pleasantness. However, there are some fairly audible differences between the two. The CS-decoded version accurately reproduced the original with a more diffused and spatially wider soundfield across the front speakers compared to that of the DPLII version. Different sections of the orchestra and choral could be easily localized, yet the sense of envelopment was preserved.

The DPLII version outperformed CS with a more accurate reproduction of the original spectrum; the balance of the high-frequency range to the low- and mid-range was well-maintained. A bass boost was observed in the CS version, which imparted a fuller sound but also at times "muddied up" the mix.

However, the most significant difference between the two systems occurred at the end of the recording. The audience applause, which was mixed

drake

predominately to the rear surround channels in the original recording, was distributed over the front channels in the DPLII version, while the CS version preserved the front-rear channel balance more accurately compared to the original with just slight leakage to the front speakers.

Turning to rock 'n' roll, we chose an original surround recording that had very little center channel content, as is the case in some surround recordings. We immediately identified the bass boost in the CS-decoded version. Because rock music typically has greater bass content compared to classical music, the boost was clearly noticeable and sometimes overpowering.

Both systems handled the "phantom center" quite well; no significant spatial artifacts were observed. The CS version had more separation across the front speakers with good clarity that was similar to the classical example, while the DPLII version had more emphasis in the middle, which provided a better sense of definition and presence.

We next auditioned several soundtracks (from DVD) filled with explosive sound effects. The DPLII version excelled with accurate reproduction of the originals in terms of transparency and dynamics spectrally, and surround envelopment and localization spatially. It had a tight and punchy bass that was more than sufficient for rumbling explosive sound, while the high end was crispy and sharp. Spatially, it provided excellent separation between all speakers with excellent localization of panned sound sources in all directions.

The CS version, on the other hand, had a ground-shaking low end for the explosions but a slightly darker high end compared to that of the DPLII version. It had a much diffused soundfield and smoother panning, which worked quite well for ambient sound. However, it suffered from poor localization due to interchannel crosstalk. For example, circling helicopters sounded like they were coming from all directions.

Finally, our torture test. To stress the steering logic of the two systems, we sequenced and recorded a series of kick drum hits bouncing between the front channels (L-C-R), the rear channels (Ls-Rs), front and rear, and between the LFE and the five main channels. The DPLII-encoded version excelled in this category. Interchannel crosstalk was minimal with few spatial artifacts, especially between the five main channels and the LFE channel. With only a slight clipping in the center channel and double flaming of the drum hits (due to a default 15-ms rear surround delay), the DPLII system passed our test easily.

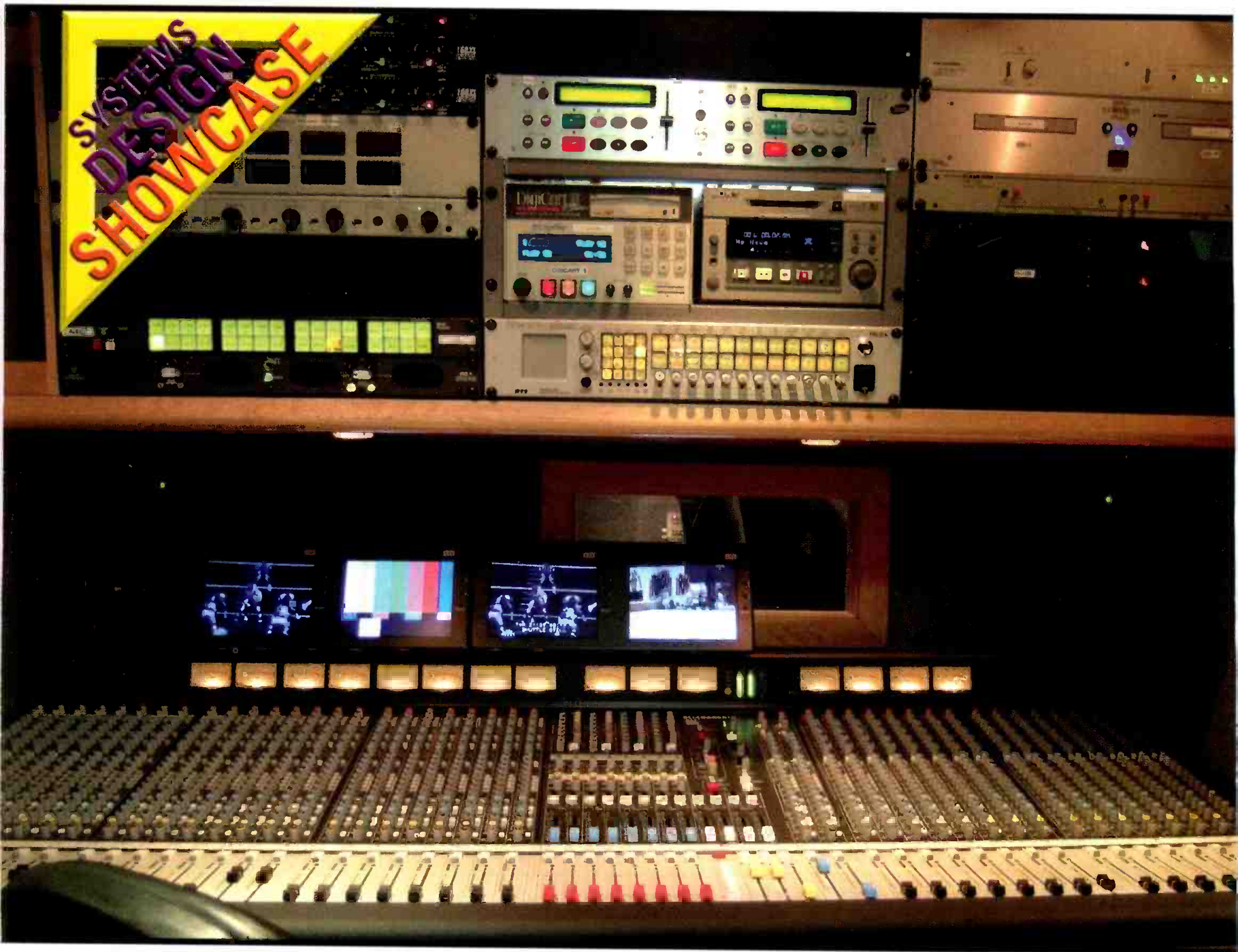
The CS steering logic, however, seemed to be confused by the test. With an apparently slower reaction time, the CS-coded version exhibited severe crosstalk between all speakers and abruptly switched content from the LFE to the main channels. In this torture test, we particularly preferred DPLII.

Summary

DPLII and CS are competing products, but each offers advantages and disadvantages to a potential buyer. Because of the built-in A/D converters in the SRS CSE-07 encoder, it and the CSD-07 decoder are easy to drop into an analog signal path. Moreover, it is fast to set up and simple to operate.

Because of its digital-only input, the Dolby DP563 encoder is more suited to a digital signal path. It and the DP564 decoder, at the expense of complexity, offer greater operational sophistication. Finally, at least in our listening tests, although neither system is as transparent as discrete digital coding, we generally preferred DPLII over CS. Both systems provide surround sound over any 2-channel service and accomplish a significant upgrade from stereo to multichannel sound. **BE**

KaiChow Lau and Nermin Osmanovic are graduate students in the Music Engineering program at the University of Miami. Ken Pohlmann is the program's director.



Satellite Digital Teleproductions' ExpandoLink

BY JENNIFER SOULE

The evolving landscape of network television is being driven by harsh economic realities. The erosion of advertising revenue, as well as increased competition, have brought about radical changes in our business. Having the ability to do more with less is now the dominant paradigm. Mobile providers have responded by developing hybrid facilities, which combine satellite transmission capability with production facilities to provide increased cost efficiency. The norm has been to house these functions in separate mobile units. Satellite Digital Teleproductions (SDTV) worked with Corplex to design a new hybrid truck, ExpandoLink, to meet broadcasters' needs.

Space efficiency

During truck design and equipment implementation, an important issue was to keep the satellite uplink and production package in an efficient configuration for ease of transport. The primary obstacle was how to incorporate the production value of a tractor-trailer into a footprint of 40 feet. The integration team had experience with building mobile expando facilities, and was in a good position to handle the challenges involved in fitting the greatest amount of equipment into the least amount of space

Above: The separate audio room in SDTV's ExpandoLink hybrid mobile unit includes an audio patchbay with 816 patch points, a 40-channel Allen & Heath Model ML4000, and an RTS SAP panel (conveniently located above the audio console). The viewing window to the production room keeps the audio on cue with video. Photos by Chip Moore, Sardis Media.

The production room's expansive video wall is all patchable with a full 3.5M/E Sony 7350 switcher and two-channel Sony DME 3000 DVE.

possible. A main space-saving feature in the mobile unit is the floor-to-ceiling video/audio patch panel. The stand-alone patchbay is housed in a triangular cubicle that borders the audio room and video engineering, and provides easy access to both jack fields by the truck EIC. The original design submitted had fewer than 260 video patch points; the patch panel now in the truck has more than 806 patch points, making it more capable and flexible than the patchbays in most 53-foot trailers.

The truck uses eight Sony BVP-570 triax cameras and a full-scale Sony 7350 36-input, 3.5M/E, component digital switcher, with a DMK 7000 downstream keyer and a two-channel DME 3000 for effects. Router control is by a Sony laptop computer on a pullout drawer. By using all Sony equipment, we gained complete compatibility from camera to router through the switcher onto tape machines. No special translation boxes are needed to convert Sony protocol for use with other systems.

Router control in the production room is handled from a Sony laptop computer on a pullout drawer. The truck's complement is all Sony equipment, eliminating the need for special translation boxes to convert Sony protocol for use with other systems.

SDTV's ExpandoLink was designed to provide production and transmission capabilities — including eight cameras, 40 channels of audio, and analog and digital satellite uplink — in a 40-foot layout.

A sideways video production monitor wall, usually only found in 48- to 53-foot production trailers, gives the engineers the feeling of being in a larger truck. The wall utilizes 42 LCD monitors and 40 black-and-white monitors. Preview is handled on 19-inch high-resolution Sony BVM series monitors, which offer excellent off-access viewing and use tallies from Carter Electronics.

A stand-alone Chyron iNFiNit! graphics workstation offers a simple interface for integrating computer graphics. It has Transform II, three extended frame buffers, version 12 software, 060 processor, TV store, 230 Bernoulli disk drive and 2Gb Jazz 250Mb Zip drives.

An Allen & Heath ML4000 console was selected for audio because it includes all the necessary features for live television without the complexity involved with a digital audio board. The mobile unit features a separate audio suite — typically unheard of on a satellite truck — complete with a cart machine, CD player, compressors, intercom source assign panel and telephone line patchbay.

The truck provides multiple analog and digital uplink paths. MITEQ upconverters, Scientific-Atlanta modulators, MCL HPAs and Tiernan digital encoders are used for transmission. All units are fully redundant and dual-feed operation is available.

Lightening the load

Honeycomb composite flooring and fiberglass composite wall structures were used to save weight, rather than eliminating metal framing (steel or aluminum). The use of Belden 1855A 3GHz miniature precision video cable and the incorporation of LCD monitors also reduced the truck's weight. The team's choice of materials saved weight, heat and power in the vehicle. The finished truck with its complete equipment complement weighs in at just under 54,000 pounds.

With this new product, extensive services are provided within an efficient package that covers any market at a

SYSTEMS DESIGN SHOWCASE

Technology at work

Sony
- 7350 production switcher
- DVS 64x64 serial component digital video router
- Digital BVW D75 VTRs
- DVW-500 Digital Betacam VTR
- DNW A45 Beta SX studio editing deck
- BVP-570 triax cameras
- Betacam SP ENG camera package
- ECM-77 lavalier mics
- MDS-B5 Mini Disc
- DMK 7000 and two-channel DME 3000

Accom Abekas still store system
Pixel Instruments VS5200 frame syncs
Leitch DPS-575 frame sync conversion
PESA Cougar 32x32 stereo analog audio router
ESE master clock/time code generator
Wohler audio monitors
Tektronix 1710B and 1750 waveform/vectorscope
Canon 18x1 lens with internal focus
Cartoni Delta two-stage tripods
Chyron iNFiNiT! CG/Transform II

fraction of the cost. The vehicle can be used in its non-expanded mode for "breaking news" projects, or expanded on site to provide an additional 45 square feet for added comfort during production. Extra-rigid material was used for the slide-out, to enable it to open even when the truck is parked on uneven ground.

By using the ExpandoLink over a similar two-truck package, a conservative daily savings estimate can be between 15 percent and 20 percent. This can add up quickly to a budget value of a $1000 per day. BE

Jennifer Soule is director of sales and marketing at SDTV.

Allen & Heath ML4000 40-input audio console
Stanton S-500 professional dual CD player
DK Audio stereo phase scope and analyzer
Genelec nearfield powered bi-amp'd speakers
Sennheiser
- shotgun mics
- E 845 stick mics

RTS intercom and IFB system

Another visit to antenna measurements

BY DON MARKLEY

Last month, we discussed the vector network analyzer's functions and its on-site calibration. We covered the need for calibrated adapters and gave a brief explanation of how to use gating techniques. Now we can discuss measurements.

The analyzer supplies the incident (reference) signal to the device under test, which transmits part of the incident signal and returns the rest. The analyzer's receiver compares the transmitted signal and the returned signal to the reference signal (see Figure 1).

Preliminary precautions

Make sure that the voltages present on the transmission line are not too high before taking measurements. The analyzer puts out 20dBm when turned up all the way, and can cope with levels somewhat higher than that before the front end of its receiver burns out. The analyzer will indicate the presence of high signal levels on the transmission line by displaying error messages, usually indicating that the analyzer is losing its lock on the reference signal. The next indication of excessive signal levels will be the failure of the analyzer's front end. To prevent this, devices are available that limit the signal power to the analyzer. If you have any doubt about the levels on the line, you should use such a device.

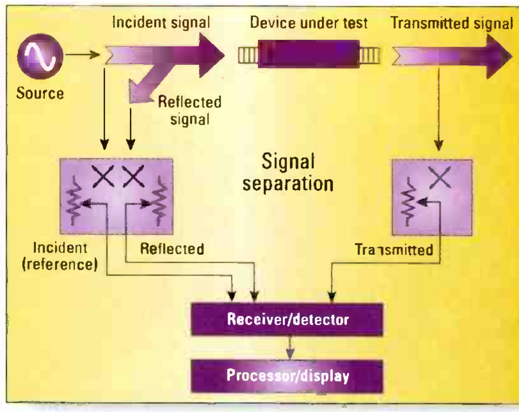


Figure 1. A network analyzer uses an incident signal, along with the reflected and transmitted portions of that signal to measure various characteristics of RF transmission lines, antennas and other components.

VSWR

The first measurement you want is a frequency-domain presentation of VSWR. Some engineers prefer to use return loss, but both measurements are based on the same data.

A display with a bandwidth of 12MHz shows not only the channel of concern; it also offers a better picture of the system's bandwidth. In the time domain, that bandwidth can give you a good idea of the match between the transmission line and the antenna. A narrower bandwidth will make it more difficult to determine the location of a mismatch near the antenna. A wider bandwidth will cause a reflection that masks the actual match to the antenna. As a rule of thumb, the time-domain VSWR at the antenna should be 1.04 or less.

For analog systems, the VSWR should be near or below 1.1:1. This measurement is significant at the three carriers: visual, aural and color. It is most significant at the visual carrier because that is where the greatest power density occurs. Even if you can't bring the system below 1.1 at the aural carrier, it is still acceptable for normal use. The same applies to a peak or two that exceed 1.1 at frequencies other than the visual carrier. In complex systems with many elbows, it may not be possible to get everything down around a 1.05.

Return loss

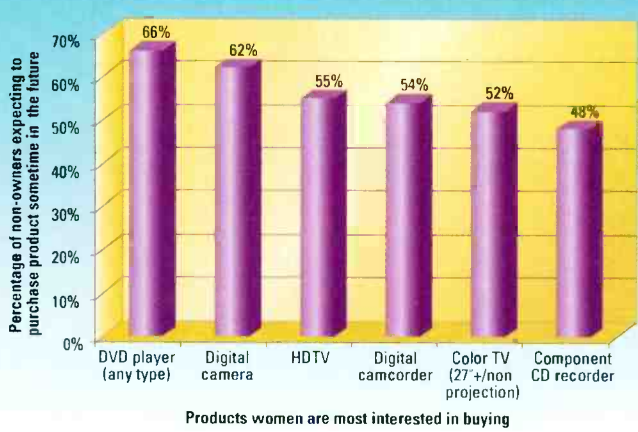
For DTV, a good target for tuning is a return loss of 30dB. This is often not possible, especially at the higher UHF channels. Some say it is more

FRAME GRAB

A look at the consumer side of DTV

In the market for consumer technology

DVD players top many women's wish lists



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


BROADCAST VIDEO NETWORKING
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important to look at the average return loss or VSWR over the channel than any single part of the channel, but it's too soon to know the impact of antenna VSWR on the digital signal.

Finding the mismatch

When determining if there is a mismatch in the antenna or if the problem is in the elbow complex right at the antenna, you must measure the system's response at the end of the transmission line right at the antenna. Some network analyzers allow you to gate the transmission-line response out of the system and all can calibrate the system at the antenna. The resulting measurements are the response of the antenna only. The hardest problems to pin down are those that occur at the base of the antenna because of so much hardware at that location.

When tuning matching sections, remember that the analyzer is not a swept device giving an instantaneous response. You must wait until the equipment completes a set of measurements and updates the display.

Coax and waveguide measurements

For waveguide measurements, the band of frequencies cannot exceed the cable's cutoff frequency. Don't try to look at a waveguide from 50- to 200MHz. Use reasonable bandwidth, such as 50- to 75MHz, where discontinuities will show up in the time domain. A narrower bandwidth, such as 12MHz, is better for tuning matching sections.

Wideband measurements

A final set of measurements with a bandwidth of 350MHz will show even the smallest of discontinuities. Be careful not to exceed the cutoff frequency of the cable. With such a large bandwidth, the display will show down to the individual insulators on the center conductor of the line. You can spot as small a problem as a single bent-over insulator. Obviously, such a problem might not cause difficulties over the years, but, you won't know if it's a bent pin or a dead mouse until you open the line up and pull it apart. Be sure to save your test results as electronic files, so you can make reference copies whenever needed. BE

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

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

IN ADDITION

For additional information or an expanded version of this article visit our website at www.broadcastengineering.com

DTV format converters

BY STEVE DABNER

Which one is right for you?

Format converters have been with us since the 1950s, when the NTSC, PAL and SECAM video formats emerged and pervaded the industrialized world. With the recent advent of DTV, the number of video formats has increased greatly, and so has the need for format converters. These devices perform many functions: upconversion (from SD to HD), downconversion (from HD to SD) or crossconversion (SD to SD or HD to HD). There are several processes common to all format conversions: de-interlacing (for interlaced inputs), rate conversion, image re-scaling, color-space conversion and metadata handling. But different conversions emphasize different processes. Let's look at the different types of program material that a converter might see.

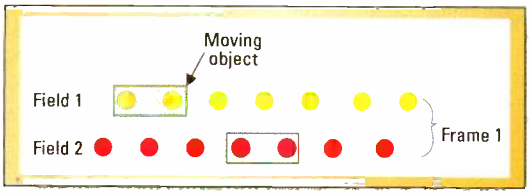


Figure 1. In this representation of the interlace raster, an object comprising two adjacent lines in a field moves vertically from a position in Field #1 (shown in yellow) to a different position in Field #2 (shown in red).

Scan modes

Program material can be categorized according to the scan mode it employs. There are three main types of scan modes: interlaced, segmented frame and progressive.

Two things identify interlaced (I) material. First, the raster has an interlaced structure. Second, objects can move at the field rate. Figure 1 is a representation of the interlaced raster showing an object moving at the field rate.

Segmented frame (sF) material also has an interlaced raster, but objects can only move at frame rate. sF also is known as progressive segmented frame (pSF) and 2:2 film material in 50Hz areas. The film industry has used the sF concept for many years — where the film is played at 25fps, but is interlace scanned at 50 fields per second by a telecine device. Figure 2 is a representation of the segmented-frame raster showing an object moving at the frame rate.

Progressive (P) material is contained in a true progressive raster. Examples include 720p/59.94 and 1080p/24. Figure 3 on page 53 is a representation of the progressive raster showing an object moving at the frame rate.

Another common format is 2:3 motion profile, but it is considered to be a derivative of the sF format because it is frame-based material with bonus repeat fields thrown in.

A keen sense of algorithm

To convert incoming video signals properly, the converter must apply the optimum conversion algorithms. Therefore, it must properly identify the incoming material. Format converters usually make strenuous efforts to properly pair up sF or 2:3 input fields into frames before applying the format-conversion filters. There are several reasons for this. First, customers normally want to maintain the integrity of the input frame rate as close as possible to their original. Second, treating the input as a progressive image allows the converter to use different types of vertical filters. These filters help maintain resolution while reducing judder and aliasing at the output. Finally, since progressive images don't have moving objects between frames, they don't have motion artifacts.

To properly identify the incoming signals, the converter must analyze the motion profile of objects within the program. For example, a 1080i signal at 59.94Hz might be 1080/59.94 interlaced, 1080/29.97 sF or 1080/23.98 with a 2:3 motion profile. Typically, the converter analyzes the signal

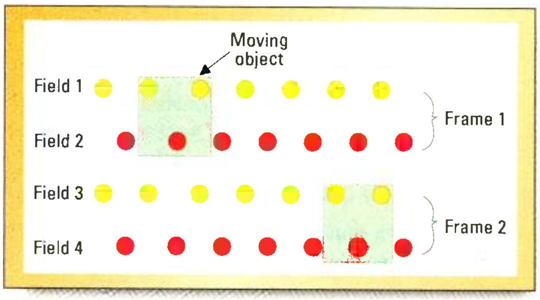
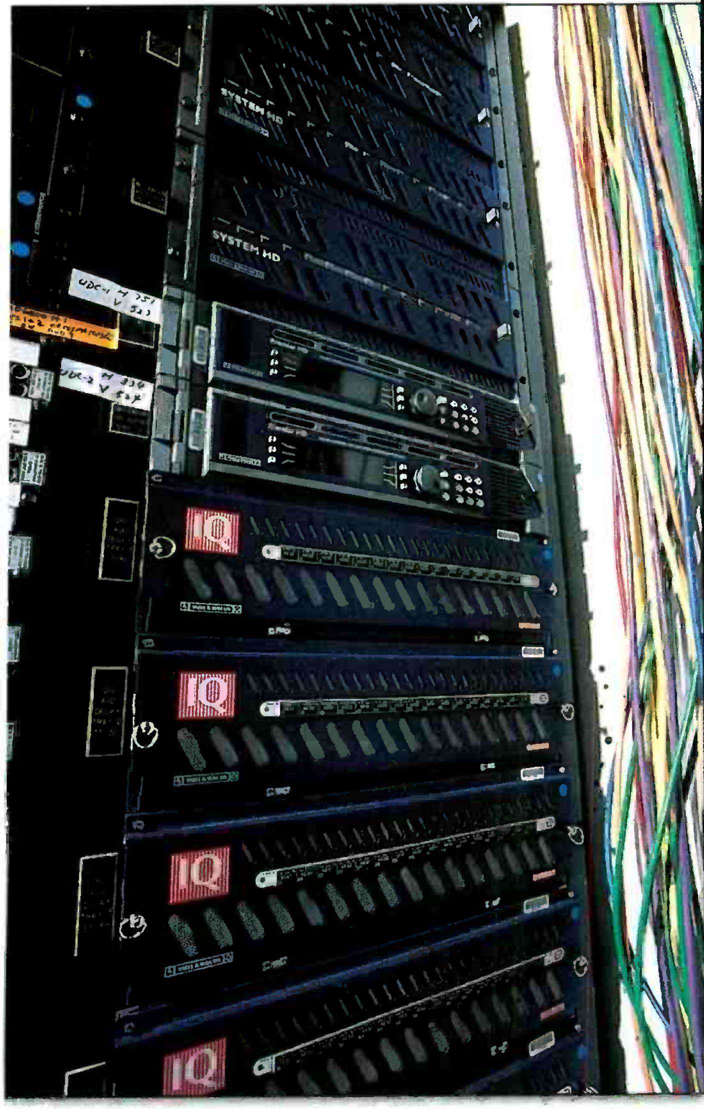


Figure 2. This diagram represents the rasters of two consecutive segmented frames. The moving object comprises three lines within a frame — two from one field and one from the next field in the frame. The object moves vertically from a position in Frame 1 to a different position in Frame 2.



Several Snell & Wilcox Ukon universal conversion platforms and numerous IQ modular systems are used in the equipment room Studio 6A at NBC Studios in New York (left). The Ukons downconvert up to 45 incoming video signals, while the IQ enclosures contain digital audio delay modules for audio/video synchronization. Ukon universal conversion platforms (right) are also used in NBC Studios' network transmission area for upconverting the network feed to prepare HD signals for transmission to affiliates.

by looking at differences between incoming fields and frames, and trying to identify movement. The converter can use any available motion vectors in this process.

Once the converter has analyzed the incoming signal and identified its motion profile, it selects the required conversion algorithm. This selection also depends on the desired output format. For example, if the user calls for an sF format output, the converter must strictly ensure that all paired fields for its output constitute a single frame and no objects move within the frame.

Coping with motion

If the input signal is interlaced, you must use a converter with special deinterlacing filters, regardless of the desired output format. For the conversion process itself, you can choose a linear, motion-adaptive or motion-compensated converter, depending on your requirements and your budget. Linear converters are the least sophisticated and the least expensive. Motion-adaptive converters are more sophisticated and more expensive. Motion-compensation converters are the most sophisticated and the most expensive. If the conversion requires little temporal interpolation, linear conversion can provide acceptable results. Conversions involving a significant amount of temporal conversion (for example, 50- to 60Hz) are best performed with a fully motion-compensated converter. Note that the design of the converter's vertical temporal filter can be complex, and it is critical to picture quality. Many converters have a single field filter especially for downconversion. For manufacturers, this is relatively simple to implement. The downside is that, to avoid aliasing, it limits the available vertical resolution. A small modification to the temporal processing allows the converter to perform video-to-sF conversion without difficulty.

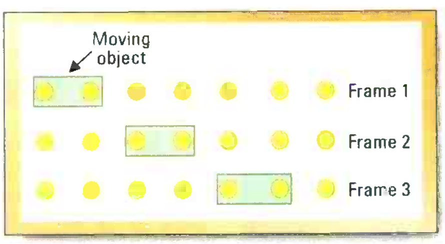


Figure 3. This diagram represents the rasters of three consecutive progressive frames overlaid on top of one another. The moving object (comprising two adjacent lines) moves vertically from one frame to the next.

As mentioned above, a single frame

filter is sufficient for sF material if the converter can correctly identify the incoming motion profile. These converters are simpler to design than interlace filters, yet they give better results on frame-based material. But there are two main sources of difficulty for these converters. First, identifying the motion profile can be tricky if, for example, there is little motion in the scene or there is noise or a compression signature that masks the underlying motion. Incorrectly paired frames will produce outputs with conversion artifacts. Typically these take the form of a vertical high-frequency banding sometimes known as "Venetian blinds." (See Figure 4.) Second, some conversions are inherently difficult. For example, converting between 24sF and 25sF (in either direction) can give unsatisfactory results. If the material is treated as sF, then it's necessary to do a frame repeat once per second, which is disturbing for the viewer.

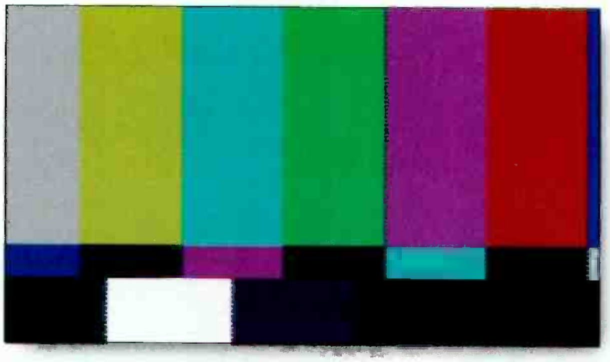
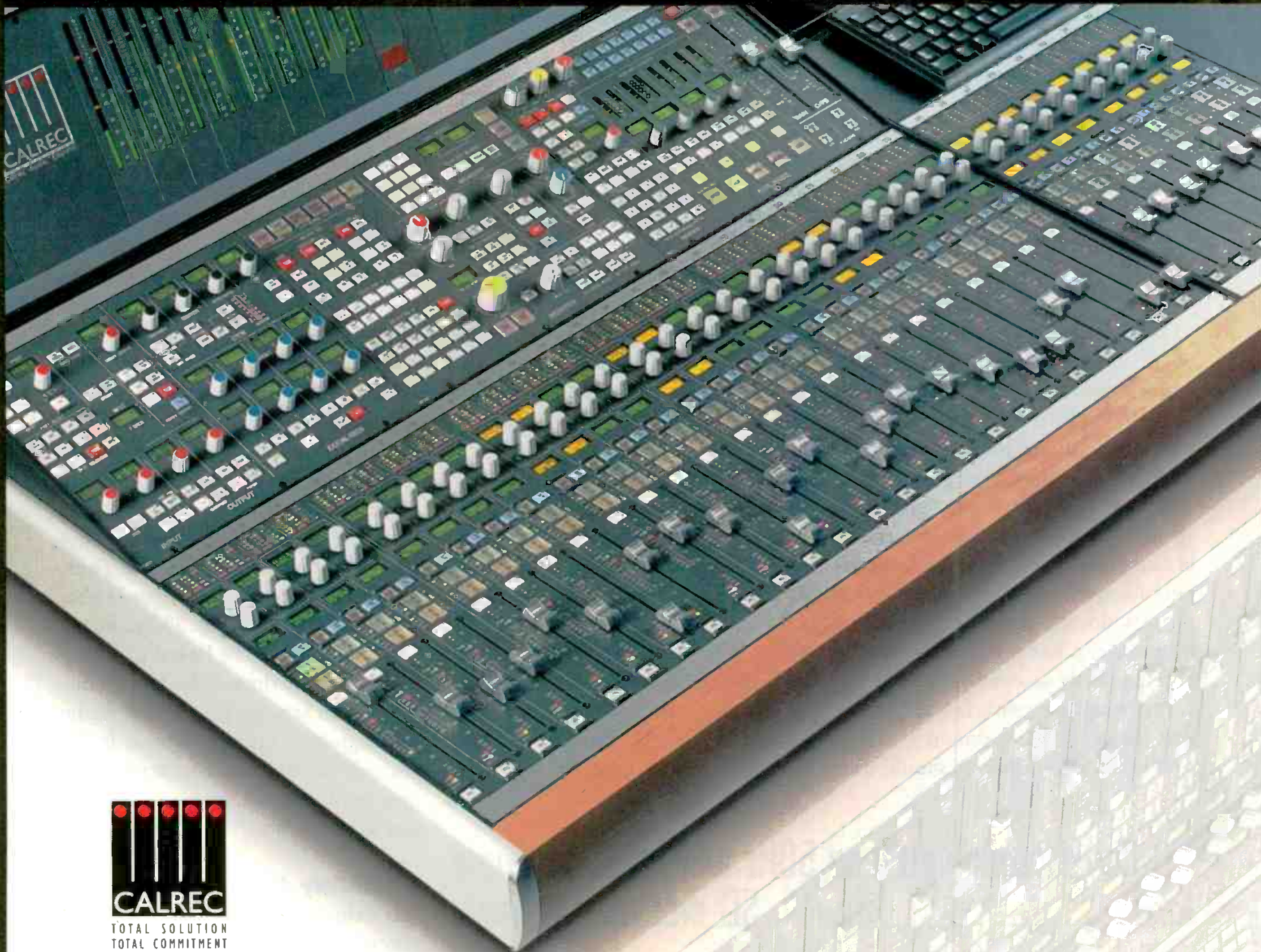


Figure 4. A converter with a single frame filter can have difficulty pairing frames, resulting in conversion artifacts that typically take the form of a high-vertical frequency banding sometimes known as "Venetian blinds." This effect can be seen here on horizontally scrolling SMPTE bars.

The alternative is to treat the material as interlace and temporally interpolate it. The low-beat frequency between the input and output makes linear conversion difficult. A better solution in terms of video quality is to play the source material back at 25Hz and live with the program-duration change. However, the audio may require pitch shifting for off-speed playback.

The format converter also will need to handle 2:3 motion and either be able to remove the repeat fields (for 60Hz-to-24Hz conversions) or to insert repeats (for 24- to 60Hz). Sophisticated converters also can repair material with broken 2:3 sequence. This can be important if the program is to be compressed downstream because the encoder can exploit the redundancy. This



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The Sigma 100 medium format digital production console

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does require the motion-profile analyzer to be able to react instantaneously to sequence changes because any internal sequence flywheel will cause fields to be incorrectly paired until it is reset.

Up, down and sideways

Conversions between 50Hz and 60Hz dominate SD crossconversions. These conversions require a great deal of temporal interpolation, and a fully motion-compensated format converter produces the best results. Some engineers argue that aspect-ratio conversion is actually a format conversion because it involves changing the number of active lines or pixels. Since this process doesn't require a change of frame rate, a linear converter usually gives perfectly acceptable results.

During upconversion, it is important that the converter maintain as much resolution as possible. It should also provide the user with controls to enhance the picture to make the signals appear subjectively as sharp as possible. The user should also be able to reduce any defects in the incoming signal (such as noise) because upconversion tends to make noise more visible.

During downconversion, it is important that the converter reduce the resolution to prevent aliasing, but do so in a way that minimizes the artifacts caused by filtering. Filtering in the downconverter can be more closely controlled than filtering in an SD-originating chain (the camera lens, CCD processing, etc). This means that it is possible to produce sharper images by using downconversion than by using SD-originated material while suppressing alias signals. So, to blend SD-originated and downconverted material seamlessly, the converter should offer enhancement controls to soften the downconverted image.

Since there are many HD standards, HD-to-HD crossconversion can take many different forms. For example, converting 1080i at 59.94Hz to 720p at 59.94Hz does not require any temporal interpolation, whereas converting 1080i at 59.94Hz to 1080i at 50Hz requires substantial temporal interpolation. Thus, the most appropriate conversion method will vary with the conversion and, as described above, with the type of video being processed.

Conversions between 50Hz and 60Hz dominate SD crossconversions.

Audio and metadata

Of course, video is only one element of a complete program. There also is associated audio and metadata, such as time code and closed captioning. Considering audio first, the DTV converter must be able to extract embedded audio from an incoming signal, or to accept a separate audio feed (e.g., AES/EBU digital audio) and synchronize it to the video output. The audio usually will be automatically delayed to match the processing delay of the format converter and then re-embedded in the output video signal and sent to separate audio outputs. It is convenient if the converter has audio delay controls to allow the user to compensate for any other disparities in the audio/video paths. Usually, the synchronization requires audio-rate conversion, but if the incoming audio is compressed (e.g., Dolby E), then it cannot be rate-converted because this will corrupt the compressed data. Therefore, the converter must allow the user to turn off the audio rate conversion. If the input and output audio clocks are locked together, the user still can pass the audio through the format converter. This is easily arranged, if you lock the audio source and the format converter to a common reference.

Time code is metadata that must pass through the format converter. The way the converter handles time code varies with the type of format conversion. If the input and output frame rates are the same, then the converter can delay the incoming time code to match its delay and re-insert it at the output. But, if the input and output frame rates differ, the converter must employ more complex methods involving internal time-code generation and synchronization.

Some converters link the video and time-code processing to provide a powerful tool. For example, if a format conversion involves outputting a continuous 2:3 sequence, the converter can lock the 2:3 sequence at the output to the input time code. Thus, any input frame can be assigned to be, say, the A-frame output. The same input time code can be linked to a reset of the output time code. Some converters can arrange for the first frame of program to emerge as an A-frame with on-the-hour time code preceded by a minute of continuous time code and 2:3 sequence.

Flexibility for the future

At a time when digital and HD television are growing in popularity and DVD is leaving VHS in the dust, the importance of the DTV format converter is more evident than ever. Also, broadcasters and production houses are finding that converters that perform only one type of upconversion, downconversion or crossconversion are not necessarily the answer anymore. Manufacturers are addressing this by introducing a more flexible format converter to perform a combination of conversions. For many users, the ideal format converter is a universal unit that can convert SD or HD, in any combination. Universal converters with further capabilities for aspect-ratio conversion, comprehensive audio processing and time-code conversion are finding their way into the market. Armed with such devices, the broadcast industry is well equipped to face the challenges of digital television headed in its direction. **BE**

Steve Dabner is a design engineer at Snell & Wilcox.

As broadcast facilities grow in size from an individual building to geographically separate locations, broadcasters must be able to monitor the whole system from a central location. An easy-to-use facility monitoring system can help broadcasters understand and operate increasingly complex infrastructures.

Equipment using Simple Network Management Protocol (SNMP) can enable broadcasters to monitor a large, decentralized broadcast infrastructure through an easy-to-use, integrated central system. Many equipment manufacturers are incorporating SNMP capabilities into their products, and offer data sheets and manuals describing these capabilities. Many also offer facility-monitoring control applications that run on a variety of computer platforms and operating systems.

What is SNMP?

Simple Network Management Protocol consists of a set of agents, a management-information base (MIB) and a network-management station. An agent is a program that resides in a device and monitors its operation. An MIB stores this information in its data record. A central network-management station monitors and displays the status of the network devices. A command, control and monitoring (CCM) network facilitates communication among these three components. The SNMP monitoring application, using the CCM network, periodically polls devices for their status condition. If a device develops an error, the resident agent sends an alarm message to the monitoring application. (For more information regarding SNMP, refer to IETF RFC 1155, RFC 1157 and RFC 1213.)

SNMP was born in the IT world. But equipment-monitoring and topology-mapping techniques designed for telco and computer network environments do not easily fit the broadcast infrastructure. Currently, there is no system available that offers a complete network-monitoring solution for broadcasters. Therefore, it is up to broadcasters to manage the design and implementation of such a system.

Currently, there is no system available that offers a complete network-monitoring solution for broadcasters.

Design and implementation

An SNMP monitoring system comprises four main functional areas: facility modeling, dynamic signal-path monitoring, fault detection and corrective action. To develop a plan for monitoring the entire facility through SNMP from a central location, begin by investigating requirements in these areas.

Facility modeling. Understanding the complexities of a broadcast infrastructure can be difficult. The monitoring system can use physical and logical drawings to create a conceptual model. The resulting model can help you document and manage elements such as signal flow through equipment, wire-run lists, database models and many others.

The monitoring system can generate on-screen facility-infrastructure diagrams by importing CAD drawings, media-network topology maps and architectural drawings. It should document equipment locations in the facility, generate essence flow-tracing diagrams and identify control-room sources and destinations. Figure 1 on page 60 shows a simplified block diagram of how a graphics workstation can interconnect with the facility's devices and resources to serve facility modeling. Remember that each manufacturer has developed an implementation particularly for its own equipment. To make all the features of each vendor-specific application available in a single monitoring system, you have to develop a single, user-friendly, infrastructure- and device-specific GUI.

Dynamic signal-path monitoring. The system must dynamically monitor the sources and destinations of all broadcast equipment so it can trace the signal path through any resource in the entire broadcast infrastructure. Essence is often converted from its native format into a file, so the monitoring system must trace the essence in various formats through both the traditional broadcast infrastructure and the media network. Also, it must update the media-network topology as routing tables change. The system can perform these tasks through MIB updates and subsequent SNMP agent reports. The monitoring application must then incorporate this information into its database. By generating a block diagram of facility resources, the system can facilitate autotracing of the flow of a signal to a trouble spot. Figure 2 shows an example of signal tracing in the monitoring system.

Fault detection. Many manufacturers are replacing RS-422 ports with RJ-45 connectors in their products. Through a LAN network, RJ-45 connectors allow software applications to monitor and control the equipment, and allow SNMP agents to monitor devices. If an error condition occurs, an agent can inform the network-management station and, if necessary, trigger one or more alarms.

If the monitoring system can access "rundown" information, it will be able to check for all necessary program elements (video, audio, CC, data, etc.) as they exit a program control room. Similarly, access to the automation "playlist" will allow the monitoring system at the master control room to verify compliance with traffic commitments, regulatory requirements and technical specifications. It can ensure that what gets to transmission is what you intend to air.

Of course, to get programs to air, you must ensure that routers, servers, automation and other equipment remain operational. You can do this by designing the system to periodically monitor applications to see if they are up and running and communicating properly with the equipment. Such applications must verify transfers of program files to the primary and backup playout servers and report the status of the transfers to the central monitoring station. This will confirm that the system redundantly stores program material. The system must also monitor individual computer configurations for compliance so that no one can install software on a machine

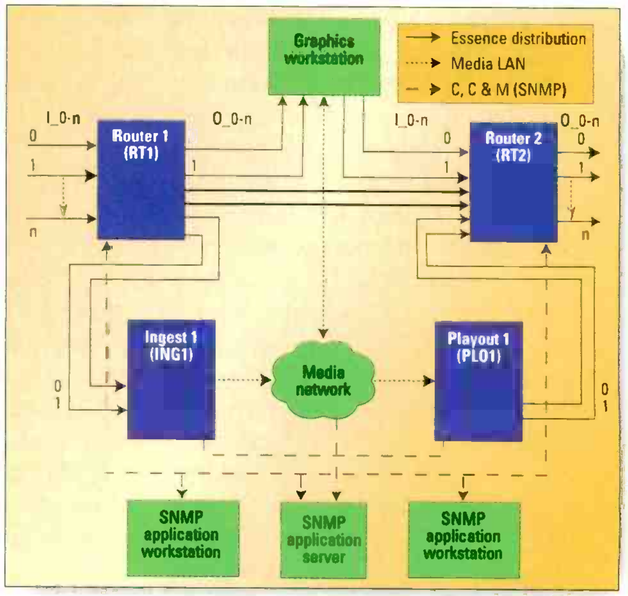

Figure 1. In an SNMP-based monitoring system, a graphics workstation can interconnect with a facility's devices and resources to serve facility modeling.

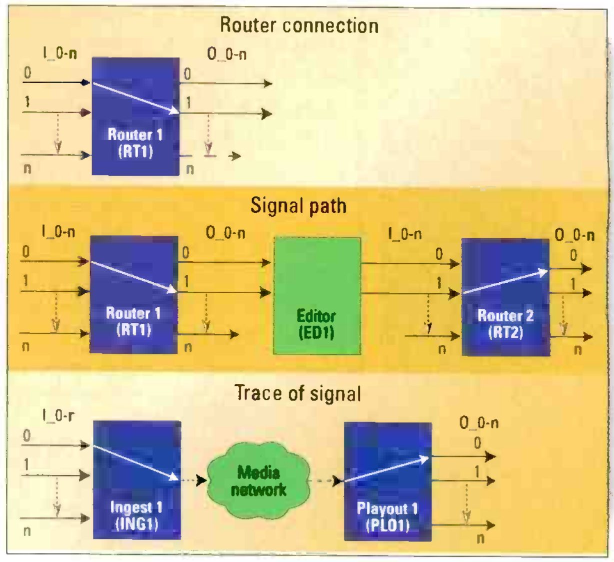

Figure 2. In this example of signal tracing, the router connection can be described as S1 = RT1(I_0, O_1) and the signal path as S1 = RT1(I_0, O_1) -> ED1(I_1, O_1) -> RT2(I_1, O_0). The trace of this signal is S1 = ING1(I_0) -> media network -> PLO1(O_0). The route of the file through the MN by IP addresses is S1 = ING1(I_0) -> 10.0.0.12 -> 10.123.0.1 -> 192.0.12.1 -> 168.23.0.1 -> PLO(O_0).

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The Cheetah provides the ultimate solution to today's multi-format digital switching requirements. Router frame sizes start at 64x64 and expand up to 512x512. Cheetah offers the most flexible routing switcher family on the market and with the new Flexi-Frame, rectangular sizes from 256x448 up to 1024x256 are possible.

PESA's Cheetah router frames are quite simply hard to beat. They provide fiber and/or copper I/O in virtually any combination, small cross-point granularity, and wide data bandwidth ranging from 3Mb/s to 1.5Gb/s. Cheetah routers provide single or dual outputs per bus, with combination copper and fiber, or even internal D to A cards for analog outputs!

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without authorization. SNMP can facilitate these monitoring requirements.

Corrective action. In broadcasting, on-air support responsibilities are distributed across a number of departments and numerous staff members. Broadcasters must manage the level of privileges that each staff member has to monitor, and control each resource according to the staff member's job function and department responsibilities. Broadcasters must be able to do whatever is necessary to keep the facility on air in an emergency — without the interference of login-restricted access.

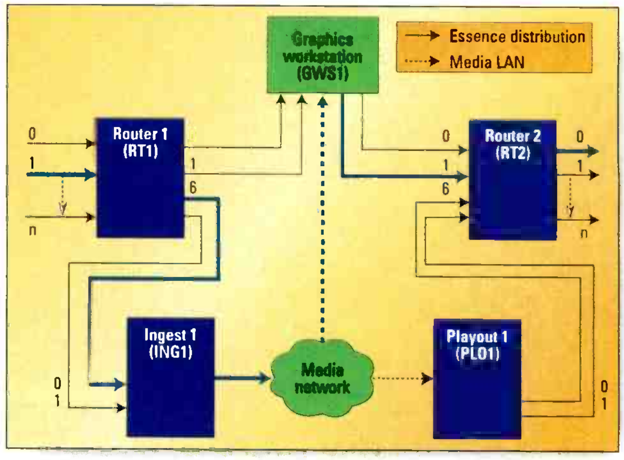


Figure 3a. In this graphical representation of signal flow, the heavy blue line illustrates the route the SDI essence has taken through the infrastructure. Note that the arrow now points <u>out</u> of the MN cloud to the GWS, representing a file transfer to the GWS. The trace of an SDI essence is described here as it is ingested through Router 1, transferred as a file over the media network to the graphics workstation, and transferred as SDI essence to Router 2 as S1 = RT1(I_1,O_6) -> ING1(I_0) -> 10.0.0.23 -> GWS1(O_1) -> RT2(I_1, I_0).

Intelligent signal-path tracing allows the monitoring application to prioritize alarms. This prevents operators from being overwhelmed by cascaded phantom alarms and allows them to find the origin of a problem condition. Pop-up dialog boxes can advise operators of the proper procedure to resolve a problem, warn them about the consequences of various actions, and let them know whom they should notify. Intelligent signal-path tracing also supports automated activation of e-mails, beepers and trouble-ticket initiation. Knowledge-based diagnostic capabilities can facilitate an "auto failover" selection of an alternate guard-signal route and keep the station on the air. Intelligent learning capabilities that develop a knowledge base of past problems and solutions can allow a monitoring system to suggest corrective actions based on previously successful actions.

The SNMP-driven monitoring application can "virtually" guide on-duty personnel to the point of failure on the display at the central monitoring station. The operator can then select the indicated device and quickly determine its status, reroute the signal, switch to backup equipment or make adjustments. If necessary, the application can direct the operator to the appropriate physical location to correct the problem through a visual map derived from the facility model showing the shortest route.

An engineer also can diagnose and isolate a problem by querying for signal traces of essence transfers or by probing system equipment and verifying its operating condition. Figure 3a is an example of a query by signal. Figure 3b on page 64 shows the resultant trace of multiple essences to a single "program" (i.e., a query by program).

Challenges

The infrastructure for each facility will vary greatly. A small operation with one or two racks in a single room may only need a block diagram showing device interconnection and signal flow. A simple audio buzzer or indicator-lamp alert system with minimal GUI-accessible features would suffice. By contrast, a large facility with numerous racks and equipment rooms, program-control rooms, master-control rooms, and studios needs to have a central monitoring station and instant fault

analysis, notification, isolation, location and resolution. Otherwise, ascertaining the status of any resource and maintaining the infrastructure would be difficult. This could jeopardize the facility's ability to get its programs to air.

Managing change. Facilities are often upgraded, so there should be a relatively painless way to update the monitoring system's database without bringing the system down. There are no built-in maintenance windows in a 24-hour operation. MIB updating and SNMP reporting to the central management station can help automate this task.

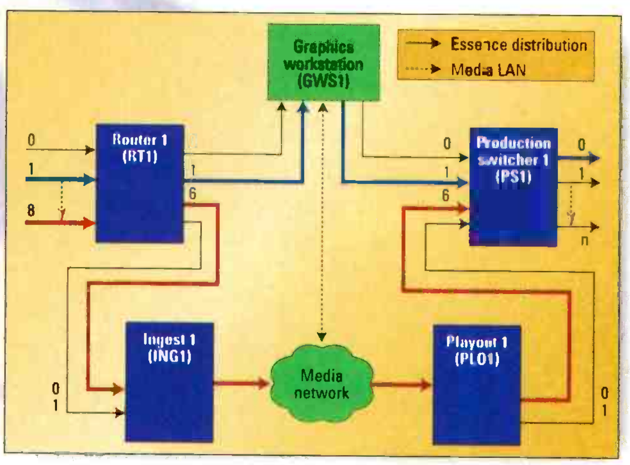


Figure 3b. In this query by program, the trace of the two SDI essence signals are described through the infrastructure, mixed to a single SDI signal for air in production switcher 1 as Air Signal = S1 + S2, S1 = RT1(I_1,O_1) -> GWS1(I_1, O_1) -> PS1(I_1, I_0), and S2 = RT1(I_8,O_6) -> ING1(I_0) -> 10.0.0.23 -> PLO1(O_0) -> PS1(I_6, I_0).

Managing the project. The amount of information communicated by each device is relatively small, but the total amount of SNMP traffic on a LAN can affect overall media-network performance. Make sure space is made for SNMP- dedicated network switches in equipment racks and for additional CCM LAN cabling in cable trays.

Failsafe backup. It is important to design LAN equipment-control capabilities in such a way that, if LAN connectivity is lost, programs will still get to air. Operators must be able to access equipment front panels to manually select routing functions and adjust signal levels; they can't be locked out by an SNMP network failure. Also, it is important to provide backup routing of all necessary essence (program elements) to circumvent the media network and stay on the air in case the media network experiences a catastrophic failure. BE

Philip J. Cianci is a broadcast media technology engineer at ESPN.

Exavio's
ExaVault and ExaMax

BY JI ZHANG, PHD

The ability to stream broadcast-quality audio/video files within a collaborative LAN or WAN setting while guaranteeing QoS is in its infancy. Tens of gigabits per second must be available through the network for multiple users to share uncompressed digital content over the network in real time.

The strategy chosen to seamlessly integrate storage with the production environment largely determines the total cost of ownership. It is important to look at the problem not just from the viewpoint of hardware system complexity, but also based on how the system improves workflow efficiency.

On-demand streaming

A major goal of a multi-seat HD production environment is that all users would have real-time access to the content. Storage capacity and processing power have increased by 100s or even 1000s of times, but disk drive performance has only increased a modest fourfold, due to mechanical limitations that hamperseek, read and write times. This can be a serious problem when multiple copies of an asset are requested — reducing I/O throughput by as much as 90 percent.

Attacking the problem

The most straightforward approach to this problem is to de-couple the I/O performance of the server from the performance of the disk drives. Utilizing existing solid-state memory, processing and software technologies, streaming servers can be developed that no longer depend on attached online disk storage. Whereas today's streaming servers struggle to provide a few hundred megabits per second of streaming performance, a solid-state system at roughly the same, or even less, cost could stream tens of gigabits per second. Expensive SCSI and Fibre Channel disks and SANs can be eliminated, and streaming content can be sourced directly from lower-cost ATA/IDE disk-based archive systems over LAN or WAN connections.

Exavio's solution allows operators to scale the storage capacity independently of the throughput. The solution consists of two separate subcomponents. The high-density and low-cost media storage system, ExaVault, provides access to digital content through file- or block-level access via Ethernet or Fibre Channel interfaces. Using current drive capacities, one of these subsystems can scale from 3TB up to 120TB. The second piece, the ExaMax media switch, is a media pumping engine with solid-state memory and powerful media processing capability that incorporates intelligent caching, guaranteed broadcast-QoS delivery, and support for scalable and variable bit rate streaming without the need for provisioning. The switch, which can aggregate storage capacity and bandwidth in combination with the storage subsystem, will seamlessly interconnect enterprise and broadband service provider networks over an IP-based infrastructure.

The media switch directly interfaces with multiple end-user workstations to provide file- or block-level access to the media content providing high-quality and reliable transfers of data to the end user from local or remote storage systems. This lets the user reduce the requirement on the underlying data transport network, along with the data loss, data jitter and out-of-order packets that plague today's low-cost networks (see Figure 1).

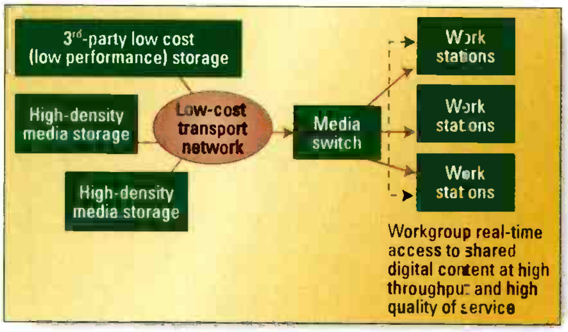


Figure 1. Exavio's ExaVault works with the ExaMax media switch to aggregate storage capacity and bandwidth while guaranteeing QoS in a multi-seat production enviroment.

Combining this technology with Gigabit Ethernet and Fibre Channel-based storage solutions, makes it possible to provide high-throughput connections between multiple networked workstations and shared storage over today's LAN or WAN, without the need for dedicated SAN infrastructures. Operators would be able to retrieve multiple uncompressed HD files over the network, while performing special effects and nonlinear editing, all in real time. Processed content could then be transferred back to shared storage for other members of the team. Eliminating time-consuming data transfers between digital tapes and storage, as well as enabling operators to work in real-time, will greatly improve efficiency and lower production costs. It's conceivable that such technologies will assist in lowering the cost of deployment for broadcast servers. BE

Ji Zhang, PhD, is president and CEO of Exavio.

Harris' NetVX helps WSU go digital

BY TOM HANDY

The public television stations for Washington State University (WSU), KWSU-TV and KTNW-TV, reach far beyond the campus' walls. The stations can be seen in eastern Washington and northern Idaho.

Searching for a solution

WSU was looking for a solution that could support its existing DS-3 microwave transport. It needed a product that could transport an NTSC and two ATSC program streams to its transmitter sites at Kamiak Butte and Jump Off Joe Butte, while providing IP connectivity for monitoring and control of the transmitters. The Harris NetVX one-box transport solution was chosen because it was the only product WSU could find that had a central-management tool and could do what they needed it to do. A single NetVX system can provide a link to any type of packet-based network — ATM, IP or microwave.

NetVX supports WSU's existing DS-3 microwave transport and helps carry one NTSC and two ATSC program streams to each of the university's transmitter sites.

The installation of this system was the first step toward digital broadcasting for KWSU and KTNW. The university decided to go digital at the same time it moved master control for both stations to a joint facility in Spokane, WA.

Options and flexibility

Using the system as a part of the digital transition provides the university with several unique options for digital broadcasting, including the option of creating a network with other stations. For example, the university is investigating the option to link its NetVX with KCTS-TV and its sister station KYVE-TV, another Washington Public Television station group, to create a statewide link.

The unit's modular architecture offers the university flexibility for its future needs. The device can transport analog or digital video, audio and/or data over any combination of unidirectional satellite, COFDM, bi-directional ATM, IP, DS-3, E-3 or T1 networks simultaneously. A 5RU chassis can hold up to 17 separate software modules, eliminating up to 14 hardwired components.

A quality signal

The university believes its viewers will appreciate the significant improvement in signal quality achieved with the product. The signal is solid from the studio to the transmitter to the home, and picture quality is greatly improved. Sending the program stream over a digital microwave system will not only allow the university to feed the digital transmitters; it also will provide a digital-quality signal to the university's analog transmitters. The device allows the university to use its digital microwave for both, and gives it the flexibility to make changes in services in the future.

With the help of the Harris team, the installation went well. The team was responsible for initial installation and configuration, and was in close contact with the university's engineering team throughout the entire process.

Implementing NetVX into the broadcast chain turned out to be one of the simpler parts of the project.

Sophisticated, yet simple

The university's transition to digital has been a relatively large undertaking, because it also involves moving the operations to a city 75 miles away. Such a project has a multitude of details. Implementing NetVX into the broadcast chain turned out to be one of the simpler parts of the project — disproving the notion that new technology has to be complicated to work. **BE**

Tom Handy is engineering project manager at Washington State University's KWSU-TV.

Read more technology reports in the Special Technology Focus section of our Web site, www.broadcastengineering.com.

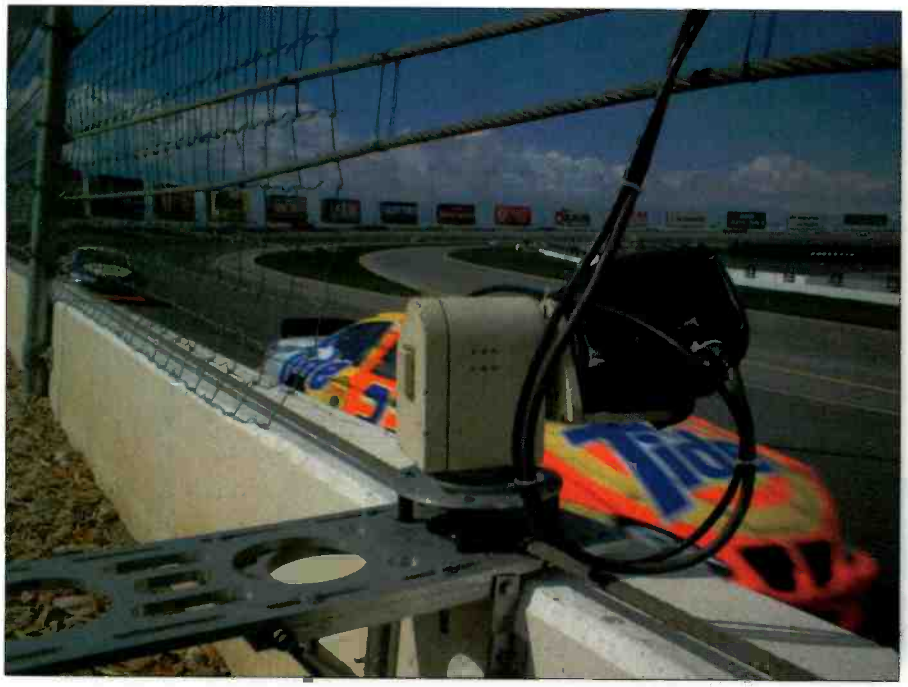
Robovision

captures the action with Vinten

BY JIM WARDEN

Ten years ago, only big sporting events had the budget for robotics. Today, it's common to have two or three systems on an event. Robotic camera systems are allowing networks to bring their audience a view of the action from places manned cameras can't go. Robovision has been providing these specialized robotic services to NBC, FOX, CBS, ABC and ESPN for the past 12 years. The company was one of the first to install a robotic camera system in a sports venue — building one into the legendary turn 4 at the Daytona Speedway in 1991. The implementation was so successful that the following year, it integrated eight systems into ABC Sport's coverage of the Indianapolis 500.

Our inventory is built around the Vinten AutoCam system, which enables us to control multiple cameras with only one operator. This saves both man-hours and production expenses, two important factors for the networks. The workhorse of our complement is the AutoCam HS-105P pan-and-tilt head. The heads provide reliable service, despite abuse in the field. Several of these systems were designed for us, specifically for use with larger ENG cameras and lens combinations. We also make use of substantial inventory of HS-102 lightweight servo pan-and-tilt heads for a variety of applications. The heads work well, as they are small and unobtrusive. Add to this 18 Sony BVP-950s and 550s with splitblock configuration, an in-house metal shop where all custom mounts are fabricated, and a selection of Fujinon and Canon lenses for close-up sports coverage.



Robovision uses a complement of Vinten Autocam systems to give viewers a taste of the speed involved in NASCAR racing.

Capturing the action

This year, we will televise more than 190 network sporting events, with as many as 10 robotic systems. This includes providing trackside robotics for

Robotics systems give viewers a whole new perspective on sporting action.

Winston Cup, Championship Auto Racing Teams, Indy Racing League, NASCAR Trucks, NASCAR Busch and a variety of smaller race series. We also provide trackside coverage for the popular "Crank it up" segment of Fox Sports' coverage of the Winston Cup. The NBC portion of the season usesfive special robotics systems we developed for panning cars traveling almost 200 mph. It is our objective to take the home viewer trackside so they can appreciate the speed of the event. Television can be deceiving — in most cases, the sense of speed is lost in television coverage.

Robovision specializes in auto racing, but we also have worked with NFL and college football for years, providing the networks with goalpost cameras and robotics in positions where a manned camera is not possible. BE

Jim Warden is president of Robovision.

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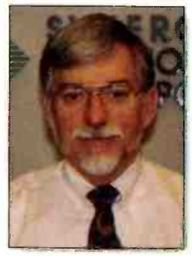


On-air automation systems

BY JOHN LUFF

I suspect that many in the broadcast business have had the same reaction to the term "automation" that I do. I first think of labor "saving" and cost cutting, but careful reflection shows that automation is much more than that today.

The complexity of modern broadcast operations exceeds what a person could be reasonably expected to accomplish by manual action alone. Indeed, the automation pond has been entered on tiptoes in many operations in the last three decades, as spot playback moved from film and discrete videotape playbacks to robotic playback systems, such as initially the RCA TCR-100 and Ampex ACR-25. These systems, while primitive by today's standards, allowed 2-inch quad videotape spots to be sequenced into entire breaks without intervention. The labor freed from manually loading videotapes and hand switching between multiple sources was seldom turned to the street, but rather turned to other tasks to permit stations to expand their range of services without adding overhead. As labor costs increased over the years, the net savings to owners allowed margins to remain acceptable. The era of 2-inch robots gave way to a new generation of machines that were essentially the same (Sony Betacart/LMS, Odetics TCS series, Panasonic Mark), and performed the same functions, with some seeing use in news operations as well. However, seldom did stations in all but the largest markets opt for full station automation systems, in part due to the complexity, and cost. It is hard to justify the cost of an automation system (upwards of $250,000 in some cases) on the back of labor savings when the labor released was paid $10-$20 per hour. The math is simple: at $20/hour the hours saved would have to exceed six years of full-time labor.

Today the situation is radically different. The cost of an entry-level automation system is less than $20,000, and its capability is likely to be superior to that of a few years ago, when the cost was much higher. This couples with a radically changed set of requirements in station master control. Breaks are more complex, with effects, voice-over items, graphics, squeezeback, and shorter interstitial lengths feeding a structure that is hard for humans to accurately switch. The "coup de grace" that often forces stations' hand is the increasing number of channels being switched. LMAs, duopoly, centralized broadcast operations and local cable feeds often tax the conventional MCR system and staff beyond what can be reasonably and reliably handled. Quite simply, machines do not tire or make mistakes as often. With modern technology the failures are most often created by the human inputting the data on which the system runs. When traffic leaves errors that the machine intelligence in automation cannot analyze and repair, a human must step back in to figure out just what has gone wrong and how to fix the problem, hopefully before it gets to air.

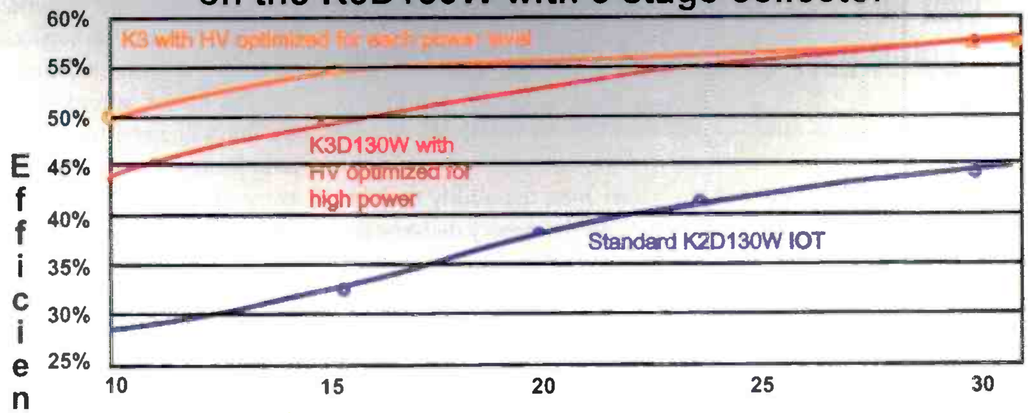
The architecture of modern systems varies only in increments when viewed from 25,000 feet. Traffic outputs a log, automation ingests the data, parses it into commands for hardware playback devices, and then runs the resultant list on a strict time- line synchronized to a reliable clock. However at the 10-foot level the view can be quite different. Automation systems vary in scale to change operations in the markets for which they're best

Court TV recently went live from its new digital master control facility in Manhattan, NY, with a fully redundant two-channel Sundance Digital FastBreak automation solution. The system drives three Profile XP video servers: two PVS 1026s for play to air, and one PVS 1044 for ingesting the content. Photo courtesy Court TV. Photo by Andy Washnik.

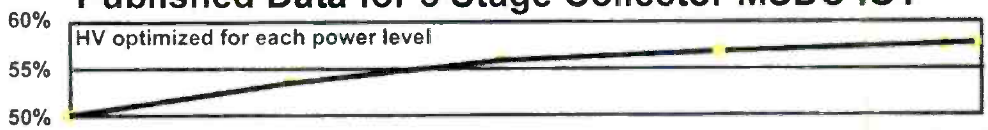
Elegant Efficiency

The Real Facts about EIMAC's K3 MSDC IOT

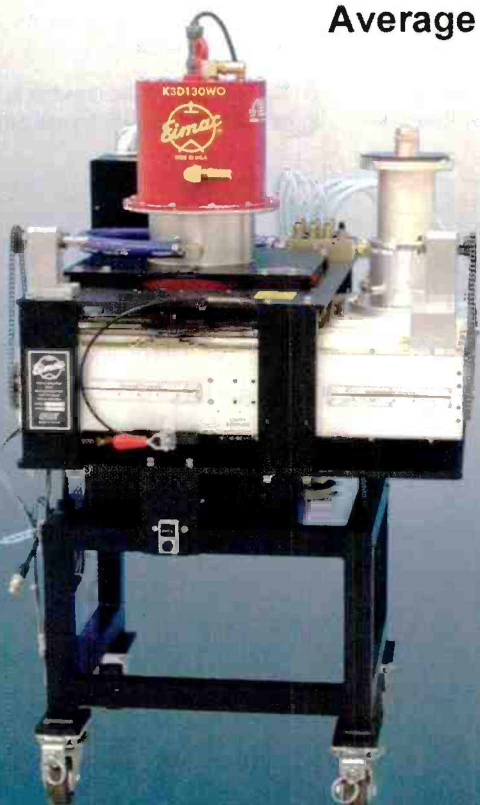
ACTUAL EFFICIENCY MEASUREMENTS on the K3D130W with 3 stage collector *



Published Data for 5 Stage Collector MSDC IOT



Average power 8VSB (kW)



* Test results with uncorrected standard 8VSB input.
High voltages between 30 kV and 34 kV.

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suited. It might serve well to review the areas where systems vary in order to put structure to the discussion.

Most automation systems offer satellite control and program record. These are the basis of much of the program schedule for many stations and, as such, can separate vendors quite rapidly. Important points to consider include the process of record schedule generation, resolution of conflicts for available hardware (VTRs or server ports, crosspoints, antennas and antenna controllers, and receivers), status monitoring and reporting. A good system will be able to handle multiple record devices and schedule the use of a considerable amount of time in advance if the data is available.

Spot ingest is becoming a moving target. Though for more than a decade now many stations have played spots to air from a server after ingest from a VTR, spot delivery to stations is now increasingly from a service that "drops" the content on a small-scale server along with metadata describing the content (advertiser, agency, air dates, spot ID number, etc) instead of a physical videotape shipped in from an agency. Fully featured ingest must in the future have the ability to query a directory on the agency delivery system and pull content into the system, notifying all concerned of the arrival, or perhaps notifying the appropriate parties of the *non*-arrival in time to find a solution. Ingest also will need to deal with both file delivery and ingest of HD and SD content.

In the future, automation, as well as traffic, will need to be able to issue commands to cover new classes of events that arise from the needs of DTV.

The architecture of the underlying real-time engine and machine control is often quite different. Many systems, especially long-established ones, operate over RS-422 control for playback devices and switchers. Increasingly the devices are network controllable, and many modern automation systems use TCP/IP control over Ethernet to greatly simplify system architecture. This lends itself well to wide-area connections, which can be quite useful in centralized broadcast operations. At least two vendors have developed local control engines that hold in local memory machine control commands issued by the central system. This can even include time synchronization via NTP over the same Ethernet connection, with time offset capabilities to account for system latencies.

In the future, automation, as well as traffic, will need to be able to issue commands to cover new classes of events that arise from the needs of DTV. The accuracy of events will be pushed to no worse than frame accuracy, which includes the generation of frame-accurate traffic logs. Without such capability the programming of encoders, multiplexers, and data synchronization for interactive services may well require a degree of accuracy not routinely achieved by currently available systems. **BE**

John Luff is senior vice president of business development for AZCAR. To reach him, visit www.azcar.com.

SEND Send questions and comments to:
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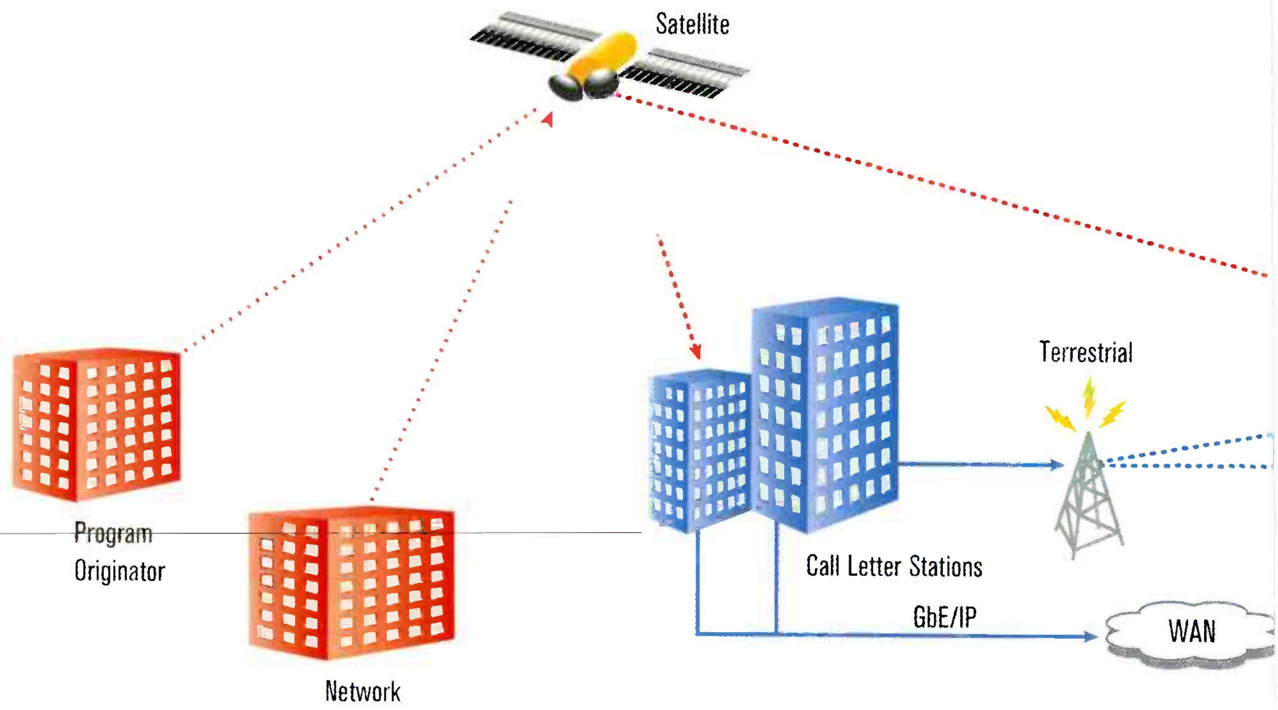

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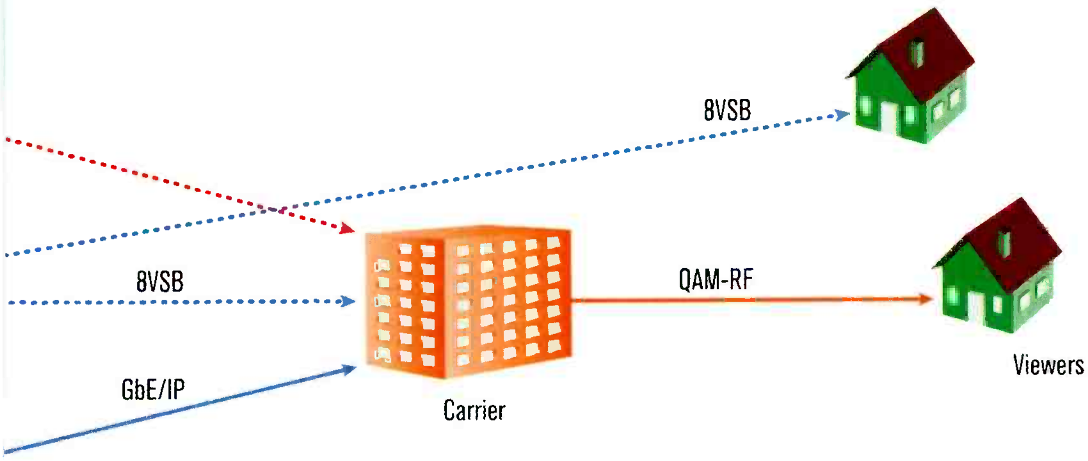

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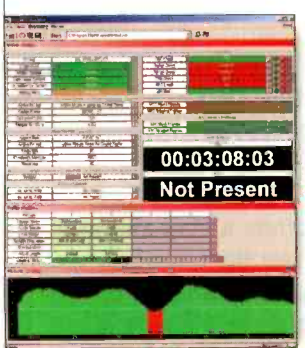
978-640-6789; *www.avid.com*

MEDIA CONVERTER

Stratos Lightwave VMC-R-X-2: Has typical link distance up to 20 km at 1.485 Gbps and up to 35 km at 270 Mbps; features a Digital Diagnostic Monitoring interface; includes 75Ω BNC simplex electrical interface, error-free pathological pattern operation and an LED indicator; has a rugged die cast/over molded construction.

800-323-6858; *www.stratoslightwave.com*



QUALITY MANAGEMENT TOOL

Omnitek and Pixelmetrix Quality Auditor: Monitors digital video, embedded audio and metadata, and logs analyzed data against timecode; includes an integrated Pixelmetrix QMM picture quality analysis software with Omnitek's PC-based solution; selected errors and warnings are logged to an XML format data file; checks for gross video signal errors, features 16-channel audio peak overload and silence detection; has adjustable warning and alarm threshold timeouts.

+44 1256 881 110; *www.omnitek.tv*;
866-749-3587; *www.pixelmetrix.com*

SLOW-MOTION CONTROLLER

DNF Controls ST300-DSR1K: Developed to provide control over the Sony DSR-DR1000 DVCAM stream-based hard-disk recorder; provides instant access and simultaneous record and playback functionality; offers users a T-Bar for fast, simple and smooth slow motion instant replay; features single-keystroke cue marking for access of up to 100 cue points per DSR-DR1000.

818-898-3380; *www.dnfcontrols.com*

ING TAPELESS PRODUCTS

Panasonic DVCPRO-based P2 series: P2 card: Stores 18 minutes of DVCPRO at 25Mb/s and nine minutes at DVCPRO50; P2 cam: includes five P2 card slots, has a total record capacity of 90 minutes with 4 GB P2 cards at DVCPRO; P2 editor: laptop editing system based on Panasonic's Toughbook notebook PC; equipped with a PCMCIA card slot for P2 cards and an NLE software editing system; P2 deck: links the ING system into the standard broadcast infrastructure; on-air transmission is possible from an OB truck using a P2 deck capable of handling five P2 cards and with interfaces and operation similar to a VTR; P2 drive: A five P2 card reader/writer equipped with a USB 2.0 interface that links the cards into a PC; provides one of the routes linking ING to newsroom networks.

800-528-8601; *www.panasonic.com/broadcast*

DIGITAL ROUTING SWITCHERS

PESA Cheetah: Handles SD, HD, analog, and AES audio signals all within the new 448 Flexi-Frame; offers DAC (10-bit SDI to analog conversion), HD to SD downconversion capability via optional output cards, and/or dual outputs for HD, SD, or analog video; provides copper and fiber input and output modules; standard frame sizes are offered to accommodate a wide range of requirements.

256-726-9200 x460; *www.pesa.com*

VIDEO SERVERS

Leitch NEXIO: Provides a foundation for any Integrated Content Environment; designed for both transmission and news environments; has fault-tolerance and interoperability; features new, high-performance single or dual Intel Xeon processors; runs the RAIDSoft system, which allows all channels and network ports simultaneous access to content for maximum operational efficiency; users can build systems up to 12 terabytes in a single domain.
800-231-9673; 888-843-7004; *www.leitch.com*

NLE VIDEO EDITING APPLICATION

Pinnacle Liquid Edition: Has real-time compositing, effects and DVD authoring, all within the same intuitive interface; uses both the CPU and GPU to provide more than 1000 real-time 2D and 3D effects; features Pinnacle's CX primary and secondary color corrector, and Dynamic slow-motion controls; offers background rendering; provides DVD authoring; XSend capability allows for rapid sharing of clips and projects with Pinnacle Commotion Pro, Adobe After Effects and Macromedia Flash MX.
650-526-1600; *www.pinnaclesys.com*

MULTI-LAYER VIDEO MIXER

Chyron C-Mix: Is 1RU; designed for use with Chyron's Duet character generators; can mix and layer up to four video and key input pairs, plus program video in any order within the mixer; has a bypass relay so program video is not lost in case of hardware failure; commands can be animated on the timeline and stored in a Lyric message for playback.
631-845-3862; *www.chyron.com*

NETWORKING PLATFORM

Harris NetVX: Can support any contribution and/or distribution application; offers a plug-and-play upgrade path for the future; a single 5RU chassis can hold up to 17 software modules; analog or digital video, audio, and/or data can be transported over any combination of networks simultaneously; is available with MPEG-2 encoding and decoding and transport stream demultiplexing and remultiplexing modules.
800-442-7747; *www.harrisbroadcast.com*

MODULAR ROUTER SYSTEM

Network Electronics VikinX: Ranges from 32x32 to 128x128; is available in SDI or HD-SDI; supports data rates from 19.4 Mb/s to 540 Mb/s in the SDI version and 19.4 Mb/s to 1485 Mb/s in the HD-SDI version; SD and HD can be mixed in the same frame; provides a fully hot-swappable architecture independent of signal formats.

818-701-6201; *www.network-electronics.com*

SOFTWARE UPGRADE

Studer V3.3: Applicable to Studer consoles using the D950 processing core – the D950 M2, Vista 7 and Vista 6; has improved snapshop facilities in static mode; includes an undo function for snapshot recall; can snapshot crossfades over any interval up to 100 seconds; protects against accidentally changing patched connections; other features vary depending on the console type and its existing feature set.

+41 1 870 75 11; *www.studer.ch*

United States Postal Service

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PS Form 3526 (Facsimile), October 1999

MASTER CONTROL SWITCHER

Quartz QMC-HD: Can be used as a stand-alone system or as part of a mixed SD/HD system; offers multiple key layers, built-in Logo Store, two voiceovers, and signal protection features; audio capabilities are enhanced to handle the needs of 5.1 surround; video standards include 1080i and 720p; includes cut, mix and fade transitions, and up to two additional internal linear keyers fed from external sources of key and fill per channel; is supplied with built-in signal protection as standard, including emergency input and optional redundant power supply.

888-638-8745; *www.quartzus.com*

GROUNDING SYSTEM

Electrorack Enclosure Products Automatic Grounding System: Eliminates the need for users to drill through the surface to the ground; features a specially designed grounding clip and standard butt splice; the clip system eliminates having to drill and install braided cable; complies with UL standards for equipment grounding conductors.

800-433-6745; *www.electrorack.com*

New Products

DIGITAL ROUTING SWITCHER

Sierra Video Systems Shasta 1602HD-LS: Resolves on-air switching of embedded audio for live broadcast facilities; switches HD video without the pops or clicks associated with embedded audio; includes route locking, manual chop, tally and adjustable blade; built with an auto-timer feature that automatically time-aligns inputs within a 2H window.

530-478-1000; *www.sierravideo.com*

DESKTOP ENCODER

Popwire Technology Compression Master 2.1: Mac OSX-based encoder supports ISMA and 3GPP specifications; features Pre-view, support for 2-pass encoding, MPEG-4 Advanced profile, improved filters, optimized performance and improved GUI; has an extended format support and extended filter features.

+46 8 506 667 00; *www.popwire.com*

NOW SHIPPING

EDITOR

Incite Editor 3.1: Features new commands and tools for rendering and batch render management; includes background-rendered, keyframeable transitions; has greater interactivity between Incite Project Configuration and Incite Media Manager M2; supports for VLAN and Tape-to-Tape editing; features definable mixer configuration templates, new tools for timeline codec selection and real-time sub-pixel rolls and crawls.

949-509-6558; *www.inciteonline.com*

MULTI-DEFINITION DIGITAL DISK RECORDER

Accom WSD/HDe: captures both SD and HD uncompressed video content; provides real-time playback for rendered material; offers plug-and-play operation; has 2.5 hours of built-in recording capacity at 24p format; includes RAID-3 parity protection for video with redundant mirrored disks for audio.

650-328-3818; *www.accom.com*

VISUAL WORKSTATION

SGI Tezro: Supports a full suite of SGI DMedia Pro options; includes up to four processors for CPU-intensive applications; has high-bandwidth architecture; features VPro graphics; supports two streams of HD 10-bit 4:4:4:4 RGBA video; can also display large data sets at high resolution and can support four simultaneous, synchronized displays for help in data analysis and problem solving; has two form factors designed for serviceability and deployability.

659-960-1980; *www.sgi.com*

TRAFFIC AND BILLING APPLICATION

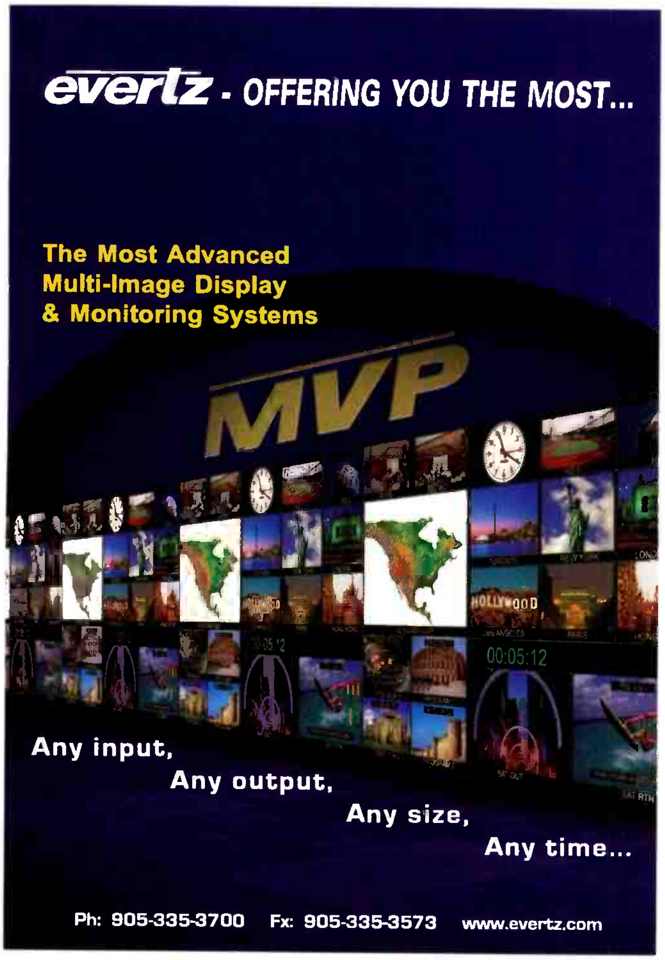
Cam Systems Eclipse 3.2: Includes integrated inventory control, reporting and sales and traffic management; features an advanced make good functionality, enhanced programming, network format capabilities, and simplified order entry; has fully customized invoicing and financial control/reporting features.

408-446-7000; *www.camsystems.com*

HD LCD MONITOR

ERG Ventures HDM-EV30D HD monitor: Offers enhanced color and gamma adjustment functions, framing markers and a memory preset function; has a rugged, compact design and low-power consumption; features a wide and stable site angle, panel brightness and a color adjustment function that allows for near-exact color reproduction.

949-509-6558; *www.erg-ventures.co.jp/e*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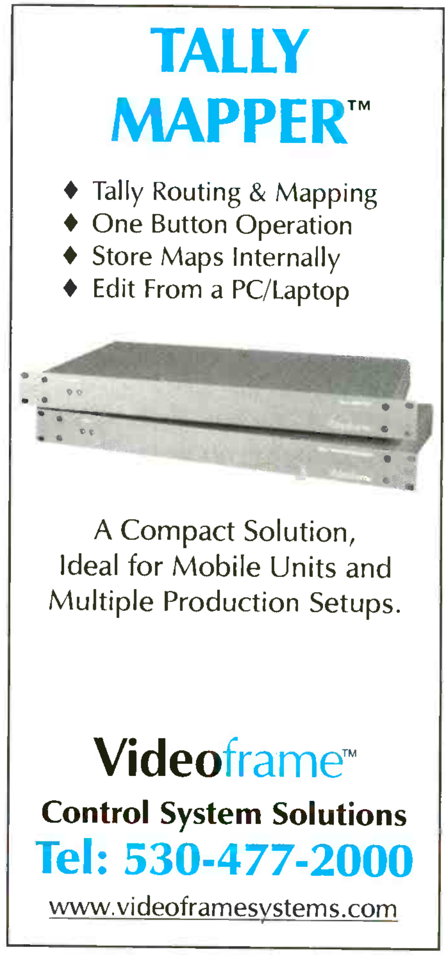
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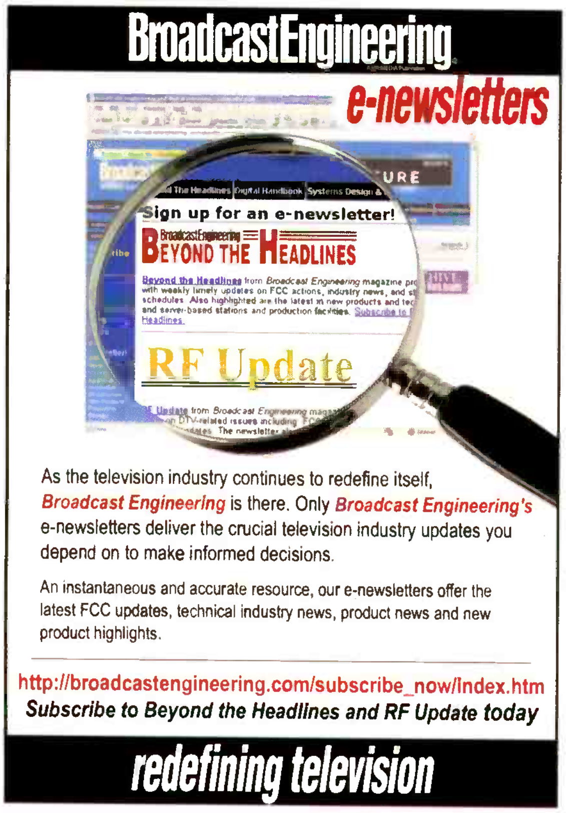
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ITV Engineer

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Selected professional will have 5+ years experience as a Broadcast or Cable engineer with additional experience in interactive/digital media. Must have a background in IT, including, TCP/IP, UNIX and enterprise web applications. 4-year degree preferred, Tech schooling or vendor training a plus.

Successful applicant will have strong technical proficiency with all types of STUDIO, ENG, SNG, MCR and routing equipment. Flexibility and familiarity with technical trends is a must.

For consideration, send resume which must include **REF#1117BE8116JPP** in subject line, to: **Jpiombin@cablevision.com**

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LAS VEGAS, TV AND RADIO STATION is receiving applications for the position of Assistant Chief Engineer Candidate must have minimum 5 years experience, or equivalent Associate's Degree in electronics/electrical engineering. SBE certification preferred. A valid driver's license is required Position consist in assist Chief Engineer in UHF TV and radio high power transmitters, LP translators, STL's, digital and analog studio equipment, LANs, WANs, and computer networking among other duties. This is a hands-on position as part of a 3 person team responsible for multiple transmitter sites within a 3 state area. Must be a team player with a positive attitude and ability to work in a news environment. Please mail resumes at KINC TV, 500 Pilot Road Suite D Las Vegas NV 89119 Attn: Human Resources EOE

NORTHSTAR STUDIOS, a large television production complex in Nashville, Tennessee is seeking an Engineer In Charge (EIC). The successful candidate will possess a Class "B" Commercial Driver's License; an Associates Degree in Electronics, Computer Science, Telecommunications or Broadcast Engineering; 3-5 years of Broadcast Engineering; and RF Transmission experience. SNG (Satellite News Gathering), studio production experience and SBE certification are a plus. For an application visit our website at www.northstarstudios.tv, or call (615) 650-6040. Resumes may be faxed to (615) 650-6275.

BROADCAST OPERATIONS- BROADCAST ENGINEER Bloomberg TV has a challenging opportunity within the Broadcast Engineering Group. Will be responsible for coordinating and performing maintenance of equipment as needed to support live broadcast operations. We will look for this engineer to be proactive and troubleshoot production and on-air issues. Will also be responsible for updating transmitter/shift logs, conducting tests, diagnostics evaluations and executing checklists to discover equipment and/or system anomalies. The engineer will also have the opportunity to coordinate and install new components and systems, as well as create and update engineering documents and diagrams. Requirements: Qualified candidates will have strong knowledge of technical TV and radio broadcasting equipment (including cameras, robotics, VTRs, routing equipment and production switchers). Knowledge of broadcast automation systems and thorough understanding of PC hardware and software operations. Ideal candidate should posses strong troubleshooting skills and have the ability to work independently and quickly in high-pressure situations. Please apply online at http://careers.bloomberg.com

SENIOR STUDIO TECHNICIAN WJHL-TV/ MEDIA GENERAL WJHL-TV, Newschannel 11 is seeking a Studio Maintenance Technician. Desired applicant will perform repair, replacement, modification, installation, removal, adjustment and integration of all technical equipment related to the operation of WJHL Newschannel 11. Formal education should include a college degree in electronics or military training/trade school certification. Good communications, writing and computer skills are required. Must be a team player and be available to work NIGHTS and WEEKENDS. Excellent benefits package. Please email resume to HR@WJHL.com or mail to WJHL-TV, Attn: Human Resources, PO Box 1130, Johnson City, TN 37605-1130. EEO M/F Pre-employment drug screen required.

TV BROADCAST TRANSMITTER ENGINEER WSVN Television in Miami, Florida is seeking a TV Broadcast Transmitter Engineer. Candidates must have a minimum 5 years experience with VHF Transmitters and good people skills. Experience in troubleshooting and installation of RF equipment a must. Applicants should send resumes to: WSVN-TV, Human Resources, 1401-79th Street Causeway, North Bay Village, Florida 33141, Or Call (305) 795-2677 EOE

BENCH/FIELD ENGINEER Audio Video Resources has unique opportunity for the right individual with the right attitude in the Phoenix, AZ area. The responsibilities for this position include professional and broadcast diagnostics and repair experience for vtr's cameras, monitors, switchers, video conferencing products, video walls and all types of professional projectors. Manufacturers training and certification for Sony, Panasonic, JVC, Polycom and Clarity is a plus. In addition field responsibilities include all aspects of installation, maintenance and repair of commercial audio video systems. The successful candidate should possess good customer service skills, an attention to detail and the ability to multi task. In addition, this individual must be able to take on tasks with little supervision, exercise good judgement in performing these tasks and complete them in a quick and efficient manner. Excellent verbal and written communications skills are a must. 5-10 years experience encompassing these responsibilities is preferred.Also experience with standard electronic test equipment is a must. Salary DOE. Drug test required Email only to service@avrinc.com. No phone calls please.

BROADCAST OPERATIONS- RADIO ENGINEER Bloomberg has an exciting opportunity for a motivated radio broadcast engineer. You will be directly responsible for the hands-on support and implementation of broadcast equipment and systems for WBBR 1130AM and its global radio networks. You will also design, install and troubleshoot audio components, wiring and applications for our reporter workstations, studios and transmitter site; perform preventive maintenance and diagnostics of hardware and software systems; create diagrams and document procedures, oversee FCC compliance of Public files, EAS, Annual/ Quarterly ownership programming documentation and update transmitter site logs and EEOC reports. Requirements: The ideal candidate should possess strong problem solving skills and have a hands-on working knowledge of radio broadcast FCC regulations, procedures, components, applications and operating systems. Candidate must also be capable of performing physical labor, multi-tasking and be available to work a flexible schedule...Please apply online at http://careers.bloomberg.com

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Inaccurate marketing descriptors

BY PAUL MCGOLDRICK

If you ever want to witness a fun, truly free sports game, then travel to Naples, Italy, and get a good seat on the bay of Via Marittima, south of the Capri ferry terminals. Nearly every evening a line of small boats fills the horizon at sunset. Then on some cue invisible to the watching public, the boats will start to race at full pelt toward the shore; on board are cigarettes and tobacco that will be smuggled, if and when the boats reach land. To the right of the bay, on the same cue, one or two customs boats will race out toward the smugglers.

Like gazelle being chased by cheetahs there will be only one victim for each attacking animal. In Naples, virtually every boat gets ashore and gets its cargo unloaded before the shore authorities can catch up to them. Some of the boats allow themselves to be caught, and are found with no contraband. It's a numbers game.

It's not surprising that the same technique was used in Italy to create pirate TV. When a different person occupied every channel in Rome and Milan, it was impossible for the Italian PTT to catch them all. And if they did catch one and put the station off the air, another entrepreneur quickly snapped up that empty channel. For this reason, the pirates had to stay on the air around the clock, or else their purloined channel would be "rescued" by another pirate. Even the current Prime Minister of Italy was involved; he had one of the first channels out there, and his enterprise survived and grew after the government caved in to the pressure against the so-called boring and unwatched output of the national broadcaster, RAI.

I visited a lot of these pirate stations and found a common belief that they were transmitting "broadcast quality" video. Most were using U-Matics with consumer modulators driving a PA into the antenna. A few later went on to use time-base correctors and, of course, some of the equipment became sophisticated enough to spawn a complete transmitter business.

It's our fault in the broadcast industry for not defining "broadcast quality" in performance terms. There is equipment available that can be used to create cheaply produced home video shows from the most questionable signals. But every time I see "broadcast quality" used as a marketing attribute it makes me groan internally.

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The entertainment industry also avoided defining the performance standards of a CD, so we entered a long phase where everything was produced in "CD quality" — from satellite radio to MP3 players to "HD" Radio. In the case of one of the satellite radio providers, the allusion that its output was something you could hear from a decent CD player shows a deranged mind at work.

Does it stop there? No. It grows with technology, and the latest bandwagon to get on is describing products as offering "DVD quality." The products I have seen using this descriptor include MP4 players, the output from computer processors and camcorders, and mobile networks offering "DVD-quality" video. There is one startup from the Northeast that delivers video "in background" — in other words, not streaming live — that the company says "mimics what consumers expect." What are "mimics" and "DVD-quality" doing in the same sentence?

I've seen claims of DVD-quality from products that "compress 20 times" that of MPEG-2. Ouch! And, of course, some of these products use display screens as large as 3.5 inches. The viewing experience obviously is going to be very compelling to broadcast-quality engineers.

There also are major issues associated with the expected use of products. Take some expensive portable CD players and then use an external audio chain to listen to the output. You may be surprised at how nasty the signals are. The manufacturer relies on you to use the sub-standard headphones supplied with the equipment to get rid of the higher-frequency hash. I'm going to try and do that with one of the relatively expensive portable DVD players to see what the video quality is really like. Just because it plays DVDs doesn't make it "DVD-quality" in my book.

Some of the airlines now are giving their first-class passengers laptop DVD players to while away flights of four hours or more. The quality of the players may be questionable, but I have seen the battery peg out before the end of the movie. Ensuring they have enough fuel is obviously something the smugglers in Naples take much more seriously. **BE**

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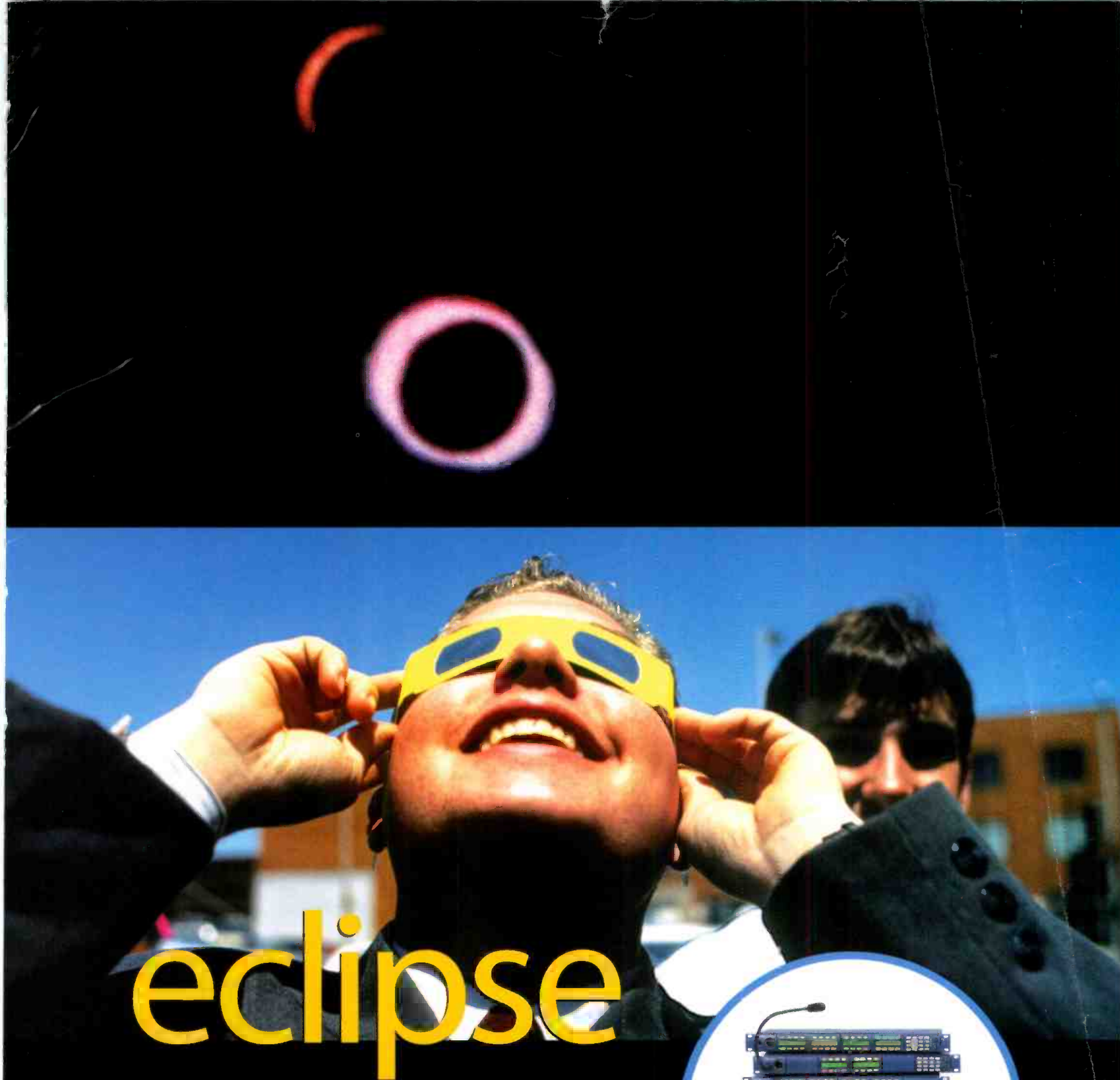
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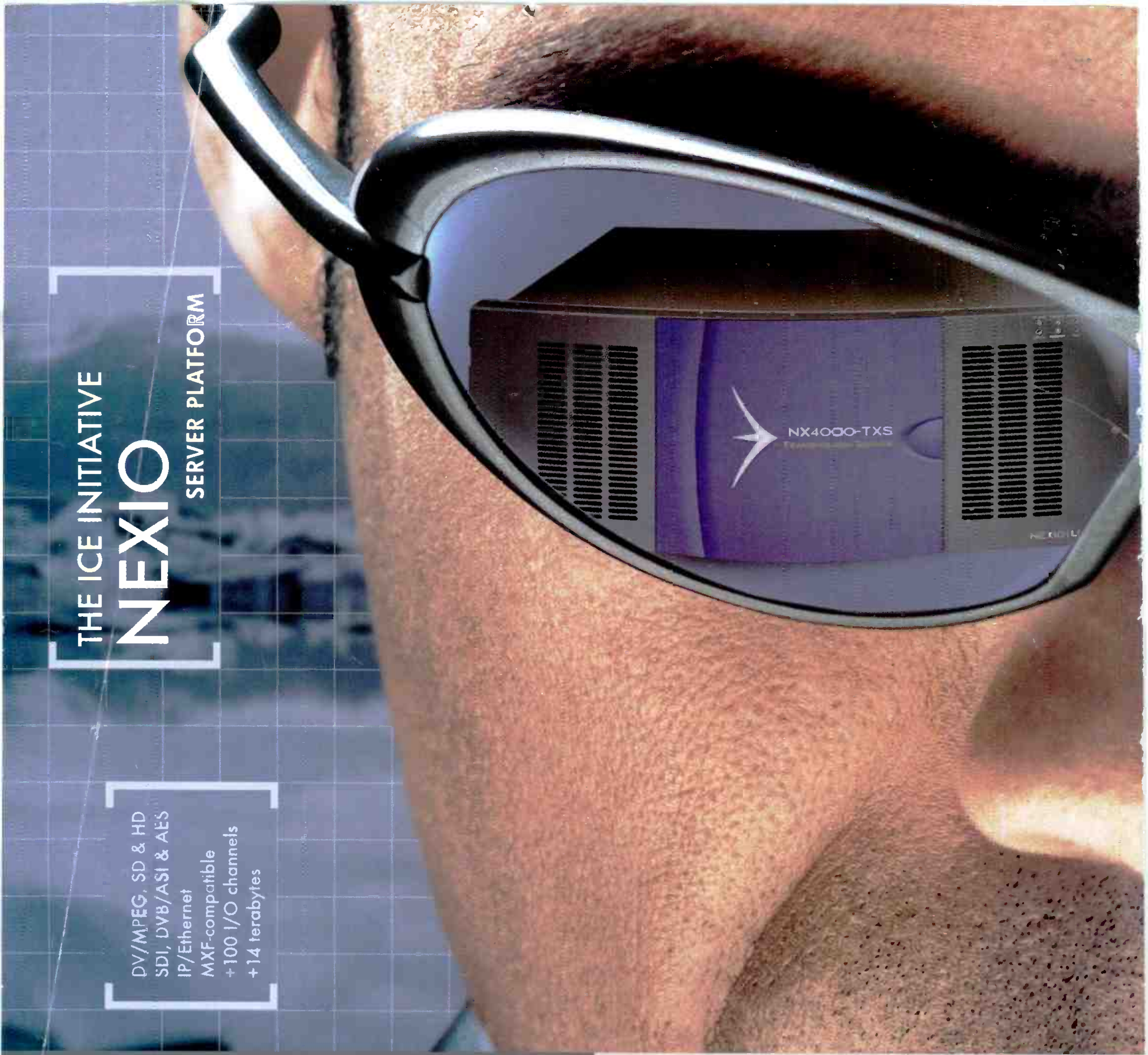
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