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JANUARY 2002

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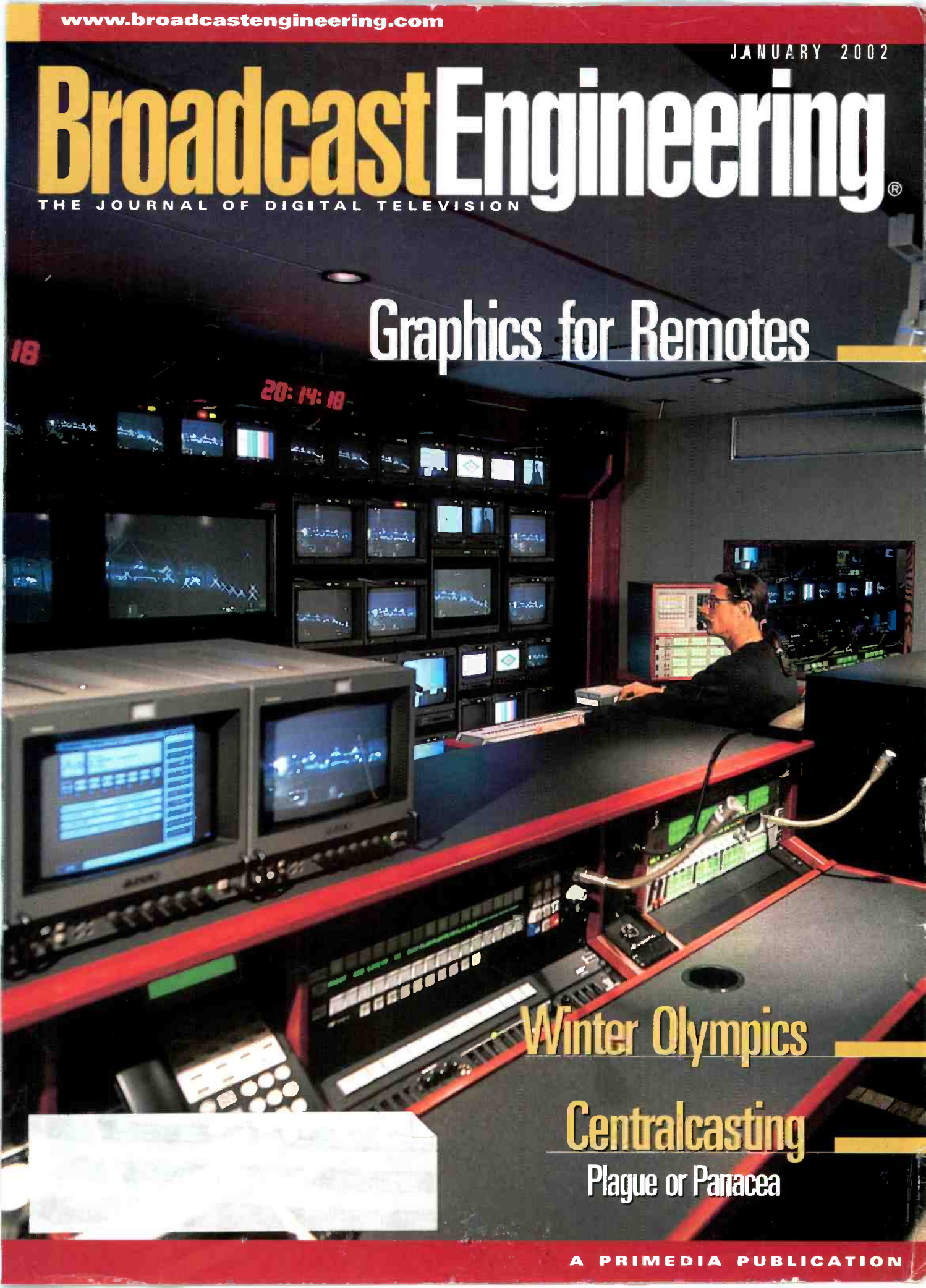
THE JOURNAL OF DIGITAL TELEVISION



Graphics for Remotes

Winter Olympics

Centralcasting

Plague or Panacea

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A pioneer in HDTV broadcast technology, WRAL-TV was the first USA station to broadcast an HDTV signal in 1996 and is the country's first news operation to present HD local news on a continuous basis. The station is committed to delivering the *highest* quality signal to its viewer audience. Their audio board? A WHEATSTONE TV-80 SERIES LIVE TELEVISION CONSOLE.

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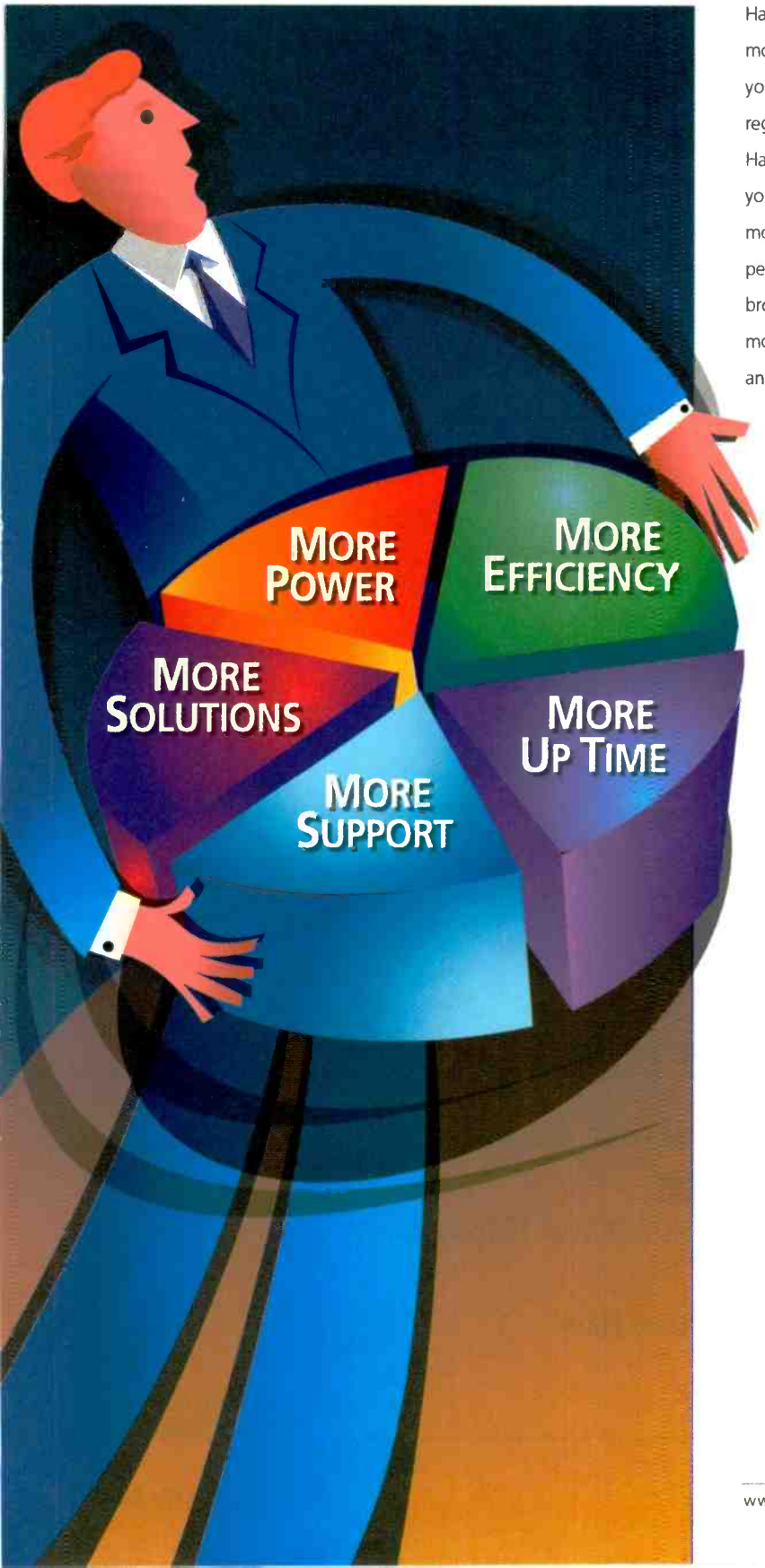

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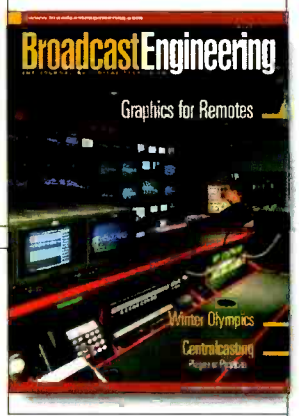
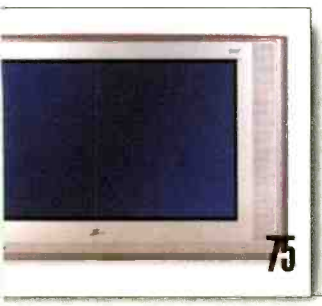


ON THE COVER: The NMT HD-2 mobile production truck broadcasting a professional football game from the Oakland Coliseum. The HD truck was designed and integrated by Sony Systems Integration Center, San Jose, CA. Photo courtesy of Sony SIC. Concept: John Benson and Deborah Rice

BEYOND THE HEADLINES

DIGITAL HANDBOOK



(continued on page 6)

The right partner makes all the difference.

Panasonic: The Olympic Games' Broadcast Technology Partner.

Gold medal-winning performances require the right partner. As the supplier of leading-edge digital video equipment to host broadcasters for the past four Olympic Games, Panasonic has proven itself a reliable and trusted technology partner. From the skin-drenching humidity of Atlanta to the bone-chilling cold of Nagano, Panasonic DVCPRO systems have flawlessly captured the spellbinding imagery of Olympic sport and pageantry.

At the heart of the Salt Lake Games is Panasonic's 50Mbps DVCPRO50 format, the official recording format. With its full bandwidth, 4:2:2 sampled, studio-quality video and multi-channel, uncompressed audio facilities, DVCPRO50 will preserve the breath-taking performances of this year's Games for future generations to enjoy.

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To acquire your piece of Olympic Winter Games history–the actual equipment used in the production of these Games–visit us at **www.panasonic.com/olympicseries**. And to learn more about the DVCPRO family's superb technical and operational benefits, **visit www.panasonic.com/broadcast**.

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Name this VTR

Name and date this VTR. Called a "Videocorder" it claimed "electronic editing" complete with the ability to "tape your material from other tapes, or off the air, or live camera and insert them into your pre-corded tapes with perfect synchronization." Correct entries will be eligible for a drawing of the new *Broadcast Engineering* t-shirts. Enter by e-mail. Title your entry "Freezeframe-January" in the subject field and send it to: bdick@primediabusiness.com. Correct answers received by Feb. 17, 2002, are eligible to win.

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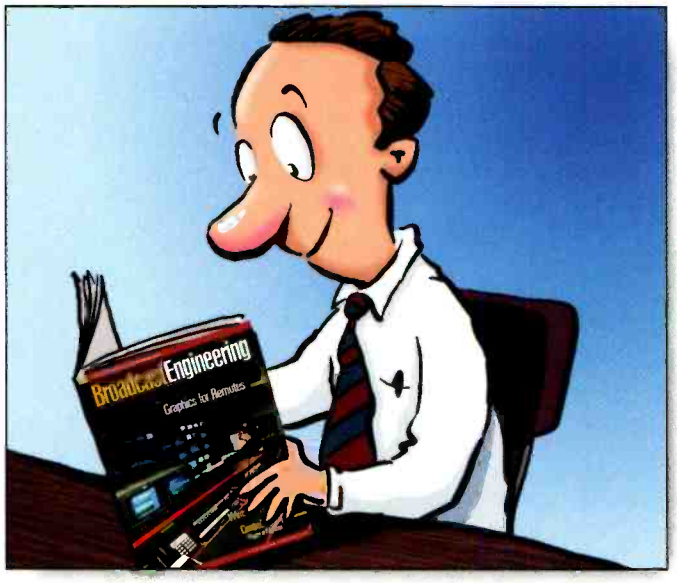
The New Broadcast Engineering

Notice anything different about *Broadcast Engineering*? We've changed.

It's with a lot of pride and enthusiasm that we present the newly designed *Broadcast Engineering* magazine. The staff has spent the last six months working with leading magazine design firm Alpanian Design Group to develop the best looking and most readable magazine possible. We reviewed the latest research in reader needs and preferences for



magazine look and feel. Then, led by Alan Alpanian and his staff, we set about developing a completely new look and feel that we believe is both unique and easier to read. The new format is more open, more colorful and easier on the eye.

Our goal was to improve the presentation, while keeping the award-winning contents that keep readers coming back. We've kept the knowledgeable authors that have made *Broadcast Engineering* the *Journal of Digital Television*. Inside, you'll still find the work of Brad Gilmer, Michael Robin, Don Markley, John Luff, Paul McGoldrick and Harry Martin. Plus, we've added a new technical writer, well-known and respected industry guru, Craig Birkmaier. Craig will be focusing his research and writing on several new topics designed to help you better understand the application of technology to business.

We've also developed a new column, *Download*, to look at a different technology each month. You'll learn how the technology applies to your business and what it takes to implement it. This will be a "heads-up" look at developing applications that broadcasters and content developers are just now beginning to implement. You'll learn what you can to do to bring their success to your facility.

We've also made corresponding changes to our Web site. Perhaps most beneficial to readers is the online classified ad section. Need a job, or want to post a job? See our Web site, **www.broadcastengineering.com**, for help.

Over the last year, most of you have asked, "Will the industry survive; will business get better?" You bet it will! As evidence, a recent report commissioned by the NAB and MSTV estimates that DTV set penetration could reach 75.5 percent by 2006 if all new sets sold after Jan. 1, 2004, had DTV tuners. And HDTV is increasingly popular. Just visit your local electronics store and watch people plunk down their credit cards for large-screen, HD-capable sets. Indeed, this editor has committed to HDTV with the purchase of his own set. And as soon as my local stations begin HD transmissions, I'll be there with a tuner.

HD Olympic coverage will be provided on NBC and on HDNet on a delayed basis. Millions will now have an opportunity to view the Olympics in HD. When viewers see HD in their friends' homes and at the local electronics stores — they'll want it! And we want you to share in the building excitement.

Over the next year, *Broadcast Engineering* will be bringing you many exciting articles — all designed to help you and your facility be more successful. From implementing HD to datacasting to interactive TV, the answers lie in the upcoming pages of *Broadcast Engineering*.

Brad Dick

editorial director

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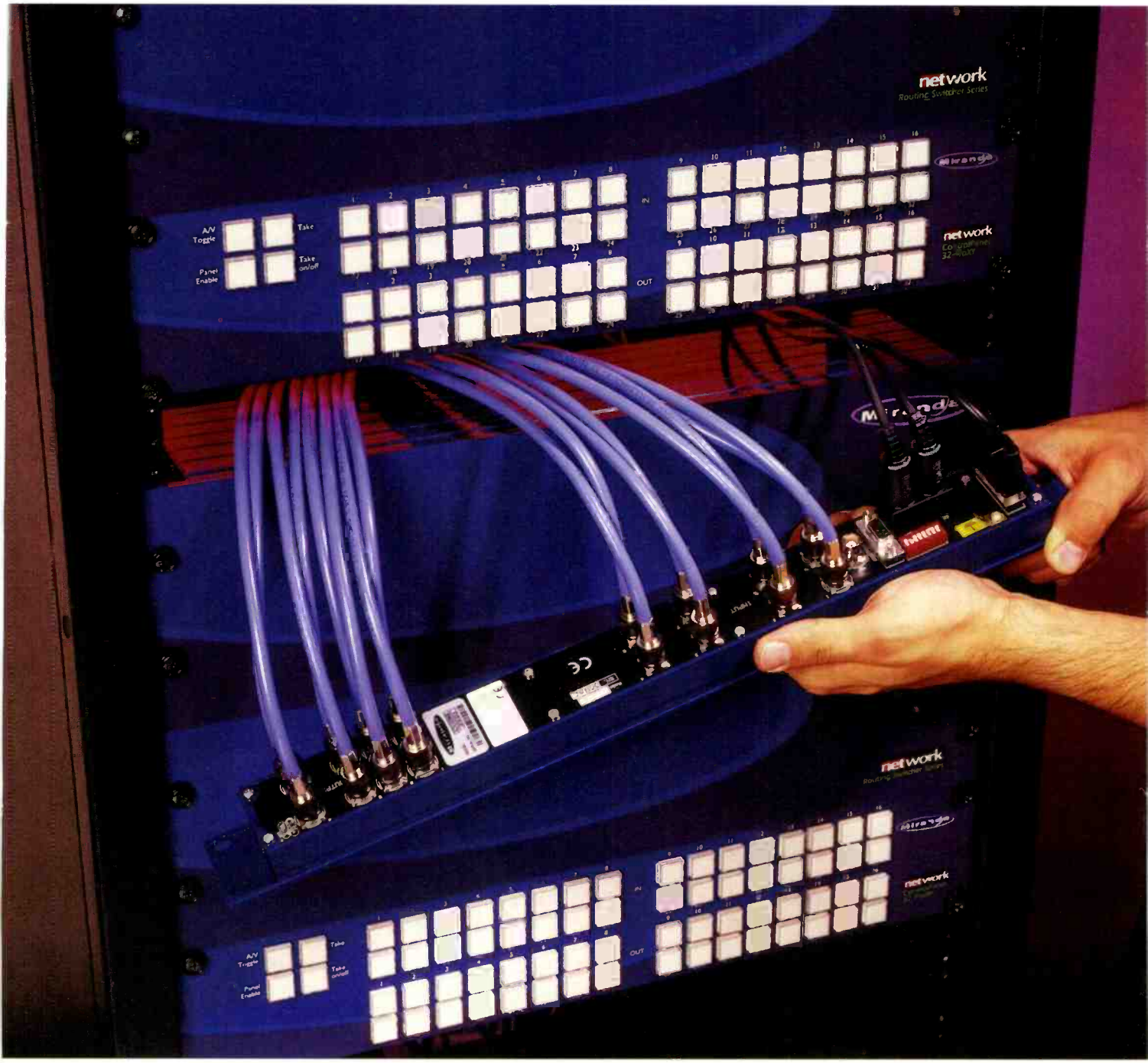

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SGI in Centralcasting

Newsflash! SGI led the centralcasting revolution—even before the term "centralcasting" was coined. It's a well-known fact that SGI® graphics workstations are a respected staple in broadcast weather graphics, virtual sets and content creation. It's a less well-known fact that SGI Media Server™ systems are powering centralcasting operations in broadcast, and cable networks. Add the huge number of SGI® Origin® family servers used to cache and store media on the Internet or stream media in video-on-demand deployments and a different picture of SGI® solutions begins to unfold.

Open Standards and Interoperability

The revolutionary SGI Distribute Data, View Video approach to video serving, adopted by European centralized broadcasters, is a key enabler to implementing the centralcasting models currently being proposed throughout North America. The flexible and scalable SGI approach applies open-system design to a variety of centralcasting models. SGI Media Server for broadcast interfaces with popular automation, news automation, and news services applications. A host of powerful SGI partner products can also be integrated for browsing, editing, transcoding, caching, streaming, digital asset management, and archiving.

The SGI Media Server for broadcast is at the center of some highly efficient centralcasting infrastructures already implemented in Europe. These customers see great performance advantages in the combination of video serving and TP (total performance) storage technology from SGI.

SGI Media Server for Broadcast

Proprietary systems are very good at doing what they are supposed to do. That's the problem. The rules and your needs change and closed systems can't keep up. Unlike other media servers on the market, the SGI system is based on Origin family servers and the industry's most robust UNIX® operating system, IRIX®. And its operation is based on open standards for video, data networking, file transfer, and storage. Format agility is key to SGI Media Server for broadcast which supports the most popular broadcast digital formats—MPEG-2 (GXF and MXFfile formats), DVCPRO, and uncompressed. For moving video within or between facilities, the SGI Media Server for broadcast manages video as data and distributes files at faster than real-time rates over data networks. It is a powerful and versatile solution for mission-critical applications including acquisition, play to air, commercial insertion, serving digital news editing systems, and distribution between and within facilities.

Digital Asset Management and Centralcasting

A centralcasting model generates a need for asset management. The layer of the centralcasting architecture above media servers is the asset management software that controls the transfer and archive of video files. SGI® StudioCentral™ Library is a digital asset management infrastructure that is globally scalable and built on open standards.

The SGI approach is that asset management and broadcast serving must work hand–in–hand: This is why SGI StudioCentral Library 3.0 integrates with Media Server for broadcast and tape robotics for backup and archives. StudioCentral is engineered to seamlessly scale to global, usage and harness the content-sharing power of fast wide area networks. Media Server for broadcast, StudioCentral, and SGI® Total Performance storage products provide the structural framework for other third-party applications.

Scalable Serving and File Sharing

Regardless of the distance, moving video over data networks with highly scalable Origin family servers preserves the quality of the content. Data is identical from where it left to where it arrives. But, even more important, the speed of the transfer is a business decision that can be controlled by you instead of the server manufacturer because SGI has the largest variety of network interfaces available. The Origin series provides unparalleled sustained throughput for high-speed support of the latest networking protocols. With their superior scalable processors, storage, I/O network connectivity, high-bandwidth, and efficient resource distribution, Origin family servers are performance leaders—the most modular in the industry.

Total Performance Storage

SGI® Total Performance 9400 (TP9400) storage arrays enable customers to solve large, complex content management challenges with standard or customized solutions designed for reliability and throughput. The 2Gb SGI TP9400 storage system with the SGI® CXFS™ clustered file system serves as a broadcast SAN uniquely enabling heterogeneous, simultaneous and faster-than-real-time shared file access between multiple hosts for applications such as direct server editing while simultaneously protecting bandwidth for critical broadcast applications. CXFS software with an SGI TP9400 SAN provides faster time to content creation and distribution by enabling users to share the same video over fast data connections, avoiding the need to move or copy data during each step of the workflow process.

SGI Worldwide, Corporate Headquarters, 1600 Amphitheatre Pkwy., Mountain View, CA 94043, USA

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SVERIGES TELEVISION (SVT) of Sweden transitioned to all-digital production with 34 SGI Media Servers for Broadcast and an SGI Origin 3400 system, moving all of its news, sports, and current events programming units into a new, all-digital facility in Stockholm supported by the SGI infrastructure.

"Sveriges Television is very pleased to have launched a new digital production system based on Internet technology. The new system was put to a test during the extreme news situation the first week of operation in early September, and came through without failures," said Niklas Krantz, project manager for SVT. "The networked system, where playout is done from seven SGI Origin 200 Media Servers, ingest from three 4-channel SGI Media Servers and file transfers directed through an SGI Origin 3400, covers the whole of Sweden: 10 news rooms in Stockholm and 10 regional news rooms around Sweden, connected on a network for faster than real-time transfers of video files. We have been able to do more than we ever thought possible with SGI Media Server."

THE WEATHER CHANNEL relies on two SGI Origin 2000 servers, and more than 50 Silicon Graphics O2 high-performance graphics visualization systems to deliver weather information to cable head-ends throughout the U.S. Over 2,000 SGI media servers receive the centralcast localized weather information and play to air under central control. SGI systems also enable the Weather Channel to broadcast local weather forecasts to over 10,000 different locations.

"The Weather Channel uses SGI visual workstations to process, store and distribute weather imagery to cable systems throughout the United States," said Raymond Ban, executive vice president for meteorological affairs and operations, The Weather Channel. "Thanks to SGI technology, The Weather Channel is able to bring viewers the newest graphics and most accurate, up-to-the-minute forecasts."

FRANCE TÉLÉVISION PUBLICITÉ, the advertising production subsidiary of national broadcaster France Télévision, converted last year to all-digital ad insertion using SGI Origin servers for their public service networks (France 2, France 3 and La Cinquième) and six cable TV stations.
"La Cinquième broadcasts clips in MPEG-2 formats, which are transferred from a central production to the remote transmission facilty then served directly from the SGI Media Server for Broadcast," says Christophe Scherer, France Télévision Publicité's IT director. "It not only saves considerable editing time, but also enables us to react rapidly to any last-minute changes before on-air broadcast."

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ATSC Table 3

Michael Robin:

I enjoy reading your articles. In your column *Getting from 4:3 to 16:9* on the *Broadcast Engineering* Web site, you did make one (to some people) faux pas. There is no 720 horizontal format in Table 3 in the ATSC standard.

JOHN GOLITSIS
MISSISSAUGA, ONTARIO, CANADA

Michael Robin responds:

I have several comments as follows:

1) Format conversions from 4:3 SDTV to 16:9 HDTV use signal sources as specified by the ITU-R BT.601 Recommendation with a 4:2:2 sampling strategy. Table 1 of the ATSC A53 lists this standard as well as two HDTV standards and refers to them as "Standardized Video Input Formats."
2) The "601" signals using the 4:2:2 sampling strategy have an active luminance sampling grid of 720 pixels by 483 lines. While the 720 sample structure is slightly adhered to, some signals may change the active number of lines to slightly different values. In my example, I used the 720x480 source format.
3) The change from 720 horizontal pixels to 704 occurs in the ATSC compressor. Table 3 of the ATSC A53 lists the allowed compression formats. The ATSC document does not explain why 720 is changed to 704 in the compressor. Interestingly, the ATSC A63 version intended for countries using the 625/50 scanning format specifies 720 pixels instead of 704. So, this is another ATSC item needing revision.

In response to the *Could Dead Birds Delay DTV?* editorial, *Broadcast Engineering* writer and consultant Don Markley reports:

A few years ago, I had the occasion to testify at a zoning hearing for a new 2000-foot tower north of Des Moines, IA, the third in an existing antenna farm.

Some of the protestors to the new tower presented a paper that had been prepared by either Iowa State or the University of Iowa showing the results of a two-year study of the dead birds around the tower. The protesters used the research to argue that any new structure would simply kill more birds and should not be allowed.

Upon studying the report, we found that none of the dead birds discovered around the towers were on the endangered species list or even presented a concern about their populations. In fact, many of the birds the protesters were concerned about were on the U.S. Department of Agriculture's listing of birds that are considered to be common pests and disease carriers.

We argued that the tower, therefore, provided a valuable public service in reducing the population of those undesirable pests without killing any endangered or concerned species.

While the zoning commission didn't buy our argument as to the public service provided by the tower, they also didn't consider the bird kill to be objectionable and approved the tower.

Is cable preventing HDTV?

Since August of this year, I have been on a list of people waiting for HD boxes from Time Warner cable (located in a large mid-United States city). As of two weeks ago, I was number 492 on a list of 700 or so local people who are also waiting on HD set-top boxes from the cable company. The customer service rep I talked to had no idea how much longer I might have to wait.

This is an improvement over when I first put my name on that list. Then, the customer service rep at the Time Warner office couldn't (or wouldn't) even tell me how long it might take or how many people were ahead of me. In fact, she seemed to want me to stop asking questions and leave as soon as possible.

This time when I called, they had a partial answer for the delay, "They're made by hand."

Aside from the question of hand construction, this seems like a strange way to do business, especially with this kind of demand. If there are 700 people on the list for an HD STB that will cost them an extra $10 per month into eternity, that amounts to a minimum of $84,000 per year for the cable company. All that money is sitting on the table right now! And, that doesn't take into account the many potential subscribers who may have gotten discouraged and went to DirecTV.

The slow penetration of HDTV is often rightfully blamed on the broadcasters' lack of HD content. But, with major cable companies like Time Warner as the gateway to these programs, it seems hypocritical for the cable industry to claim that it can't (won't) make HD STBs available to the customers who've been waiting months to get them.

SBE CERTIFIED BROADCAST TELEVISION ENGINEER
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Casting for DTV
Business Models

BY CRAIG BIRKMAIER

Is data the big fish that got away?

Two years ago data broadcasting was catching the enthusiastic interest of broadcasters looking for additional revenue streams from their investments in the DTV transition. Everyone was casting their bait into the DTV stream.

Today, a business plan that will turn data broadcasting into a viable business remains elusive.

Questions about modulation and reception have cast doubt on the viability of DTV broadcasting to push IP data and digital media content to the masses.

Questions about the use of the DTV channel to compete with other broadband services have been raised by Congress. This despite the fact that ancillary services were authorized by the 1996 Telecommunications Act.

Questions about the allocation of bits for these new services have been raised by the broadcast networks, apparently concerned about the impact on the delivered quality of HDTV programming and/or the ability to entice affiliates to carry network data services.

And the question of how to deploy a sufficient quantity of data-broadcast-capable receivers to enable a viable business remains unanswered.

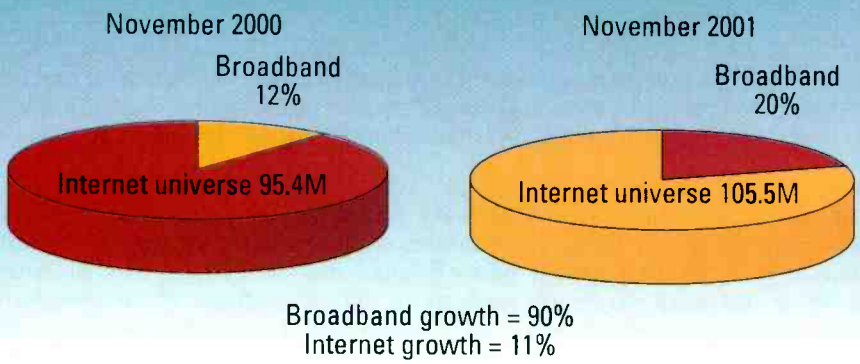
Today, the only platform that exists for data broadcasting is a PC, to which one must add a DTV receiver board that costs between $300 and $500. External receivers that interface with a PC

Action on the Internet has shifted to business-to-business applications.

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

Broadband adoption rate continues to soar

One fifth of surfers now use broadband



SOURCE: Nielsen/NetRatings

www.nielsen.com

Where's the competition?

Congressional subcommittees of the Justice and Commerce committees held hearings about the proposed merger of DirecTV and Dish Networks on Dec. 4, 2001. As if to demonstrate just how confusing these issues are, at these hearings, most Congressmen took positions for or against the proposed DBS merger, but they did not divide down party lines, or along rural/urban lines.

The fundamental question is who's competing with whom?

If the merger is viewed from the narrow perspective that DirecTV competes only with DISH Networks, it seems clear that the merger would be denied. But DISH and DirecTV argued that the real competitor is cable, and that they need economies of scale to compete more effectively.

A key factor in the debate is carriage of local broadcast signals via the DBS services. Since DirecTV and DISH are competing for the largest markets, where they can reach more potential subscribers, they duplicate the local signals they carry. New spot beam satellites are on the way that will make it possible to carry more local broadcast channels, but there would be better synergy if the competing DBS services did not need to duplicate both local channels and the 100 to 200 national channels they deliver today. At the hearings they promised to deliver all local signals to 100 markets, including at least one TV market in every state. BE

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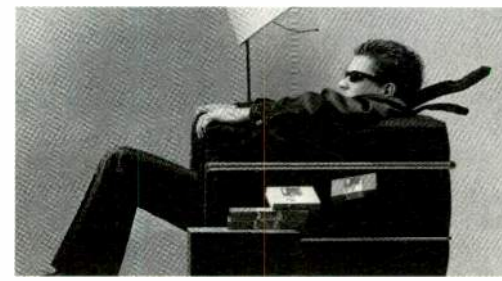

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via USB or Firewire have not been developed for ATSC.

The collapse of the dotcoms, not to mention the downturn in television ad revenues, didn't help. Geocast was unable to line up additional funding and pulled the plug March 1, 2001. iBlast managed to secure additional funding, and is now testing the first of more than a dozen proposed services in Los Angeles. DTVPlus, a joint venture with WRAL-DT, recently launched TotalCast, the first regularly scheduled data broadcast service, in Raleigh/Durham, NC. Dotcast is working with Disney to develop a system that will use both analog and digital broadcasts to deliver movies to local cache storage for consumption on demand. Meanwhile, SpectraRep has focused on business-to-business

DTVPlus and WRAL-DT recently launched a datacasting service to transmit broadband content such as the game shown above directly to personal computers.

applications using encrypted DTV broadcasts.

The PC remains at the center of the datacasting pond, largely because of the rapid proliferation of new forms of digital media based upon the Internet's TCP/IP packet data standards. The programmable nature of the PC enables entrepreneurs and early adopters to test the waters of this new medium in hopes of landing the killer app that will drive DTV into millions of homes.

To address this opportunity, a wide range of companies, with technologies relevant to the development of the markets for datacasting, have formed the PC DTV Promoters Group. Member companies offer technology or services that enable PC users to receive digitally broadcast signals from terrestrial stations, cable services or satellite providers. Products include DTV receiver cards, HDTV software decoders and data broadcasting services.

Business models for datacasting

Despite the lack of success with datacasting to date, there are those who are still optimistic.

Pete Lude', vice president of broad-cast engineering for iBlast, is one. Lude' believes that the current DTV transmission standard is solid enough to build a viable datacasting service upon. "High-speed cable and DSL data services can't reach everyone today. We can reach more potential customers than cable or DSL in most markets." iBlast counts among its affiliates 255 TV stations in

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BEYOND THE HEADLINES

156 markets.

Still, Lude' concedes that the real question is "What is the business model?" Hoping to answer that question, iBlast is testing a PC-centric new service called Powercast to deliver news, entertainment, movie trailers and program reviews, with content being provided by iBlast investors.

In Raleigh/Durham, WRAL-DT recently began deployment of the TotalCast service in collaboration with DTVPlus and AccessDTV. The service broadcasts broadband content including video on demand and local programming directly to personal computers using the digital television signal.

Products that integrate analog television/cable tuners and personal video recording capabilities for PCs have been selling briskly. But the total number of consumers using DTV datacasting services may still number in the hundreds.

Today the real action on the Internet is in business-to-business applications. Most businesses have broadband capabilities, a critical enabling technology for applications enhanced with digital media. One business focused on this opportunity is SpectraRep.

SpectraRep bridges the gap between the content provider and local content distributors by bringing them together by delivering content via satellite to a local broadcast station that then becomes the hub of a local wireless streaming media network. The DTV broadcast infrastructure is used much like an STL. Each reception site benefits from a fixed professional antenna installation and any equipment required for bridging into the facility's analog TV or data networks. For example, SpectraRep is working with its affiliate KLAS-DT in Las Vegas to create distribution networks focused on the trade show business in Las Vegas. The Las Vegas and Sands Convention Centers and a number of area hotels are equipped to receive and distribute the data broadcast.

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Cooperation

According to John Able, a former head of the NAB, broadcasters need to work together to develop a competitive business model. He believes they first need to develop a receiving device that supports existing TV sets. BE

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

IN ADDITION

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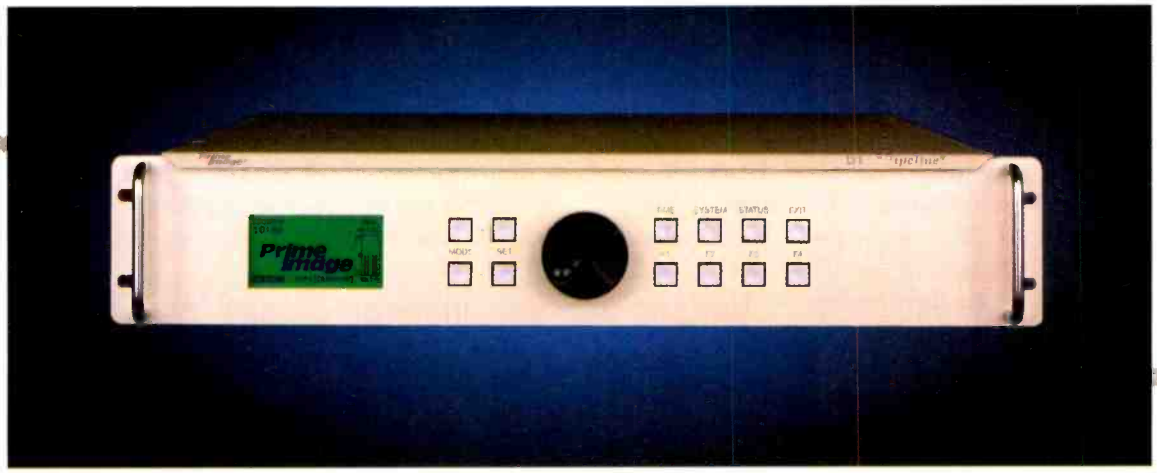

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BEYOND THE HEADLINES

Use of Digital Frequencies for Analog Operations

BY HARRY C. MARTIN

In September, the FCC issued an order regarding its ongoing 700 mHz "band-clearing" proceedings in which it said television stations now operating on Channels 59-69 can move to their digital channels and operate in the analog mode until the latter of December 31, 2005, or the date in which there is 70 percent penetration of DTV receivers in their markets.

Previously, the Commission had encouraged band clearing by Channel 59-69 licensees, but said that any station moving its DTV channel as part of a band-clearing plan would have to convert to DTV and abandon analog operations altogether by the May 1, 2002, DTV operations deadline.

Various wireless industry groups have been pushing the FCC to adopt procedures to encourage clearing the 700 mHz band so it will be available for public safety and advanced wireless services. The FCC wants to clear the band so it can proceed with a planned June 19th auction of 700 mHz spectrum, which the government hopes will bring in billions of dollars. But with broadcasters occupying the band for the indefinite future, the FCC may be selling "green bananas" and will not likely receive the huge sums it expects.

The National Association of Broadcasters and the Association of Maximum Service Telecasters have been participating in these proceedings in order to ensure that existing TV stations do not find their service areas compromised by the new short-spaced analog facilities. The FCC allows a DTV station to cause interference (calculated according to the Longley-Rice method) to up to two percent (2%) of the Grade B service area of an incumbent analog station. However, the analog-to-analog interference rules are based on the minimum mileage spacings contained in Section 73.610 of the FCC's rules. An industry study shows that of the 82 stations in the Channel 59-69 band which have DTV channels in the core (channels 2-51), only two could meet the FCC's analog spacing standards using their DTV channels. This is not surprising. If DTV-allotted channels were fully spaced under the analog rules they would have been added to the Table of Allotments as analog stations years ago.

This means the FCC's September initiative to further encourage Channel 59-69 band clearing may be a complete flop. Such a failure, as noted, would have disastrous consequences for the FCC's efforts to get top dollar at its upcoming 700 mHz auction. Potential bidders for the frequencies will have no idea when they will be vacant and available for wireless use. Unless the FCC agrees in the context of individual waiver requests or through further action in its band-clearing rulemaking proceeding to relax its analog-to-analog interference standards, there will be very little band clearing until the nation has converted to DTV. With most DTV receivers still on the shelves at Circuit City and Best Buy, such a conversion is years away.

Individual applications now are pending that propose the use of DTV channels in the analog mode. The short-spacing waiver requests in some of these applications show that less interference would be caused than the FCC has already permitted the station to cause if it operated on the same channel in the DTV mode (e.g., 1.9 percent interference to the co-channel station's Grade B when the new facility is operating in the analog mode vs. 2.0 percent if the facility were operating, as already authorized by the FCC, in the DTV mode). Ultimately, the FCC may need to take the rulemaking route to determine how much protection should be given to the incumbents from the temporary analog operations. BE

Various wireless industry groups have been pushing the FCC to adopt procedures to encourage clearing the 700 mHz band.

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

Dateline

The deadline for commencement of DTV operations by all commercial stations is May 1, 2002. For noncommercial educational stations, the deadline is May 1, 2003.

IN ADDITION

For a look at how NCE-TVs may profit from DTV, visit our Web site at www.broadcastengineering.com and click on FCC Update.

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

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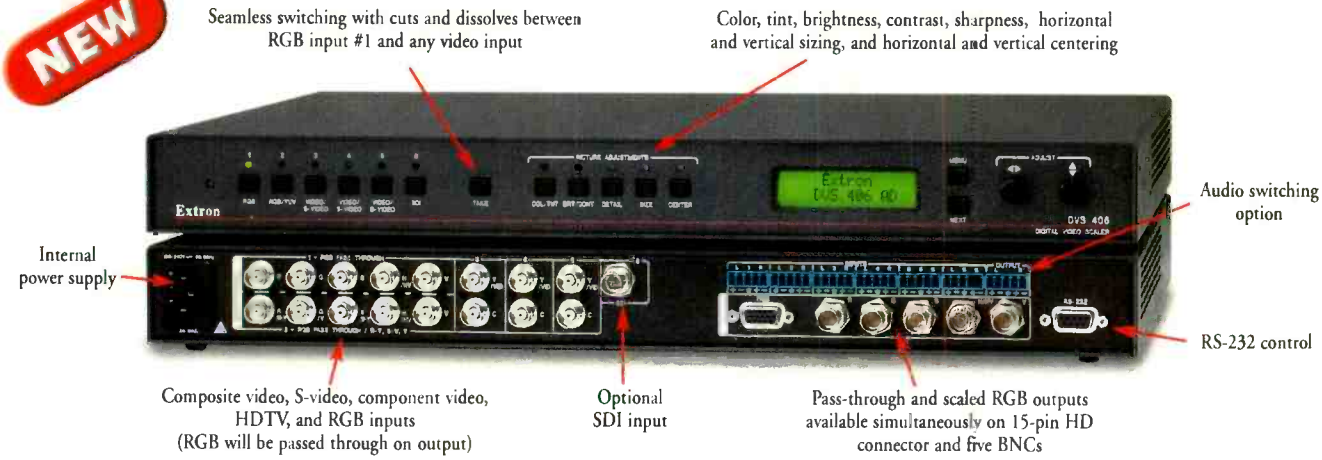

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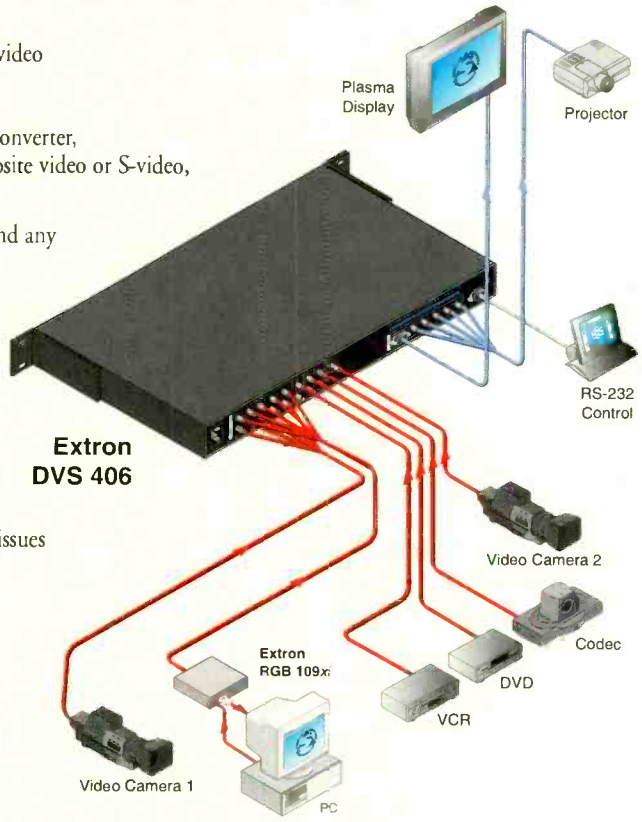

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BEYOND THE HEADLINES

PPV/VOD

BY LARRY BLOOMFIELD

Video on demand (VOD) and interactive television (iTV) currently seem to be popular topics with broadcasters.

When it comes to multicasting, the FCC says a television station is only required to transmit its main channel in the clear. Depending on the quality of service needed and the type of multiplexing used, a station can transmit more than a dozen channels to serve almost any need, purpose or audience. Cable and multipoint distribution systems have been generating revenue by subscription and pay per view (PPV) for decades.

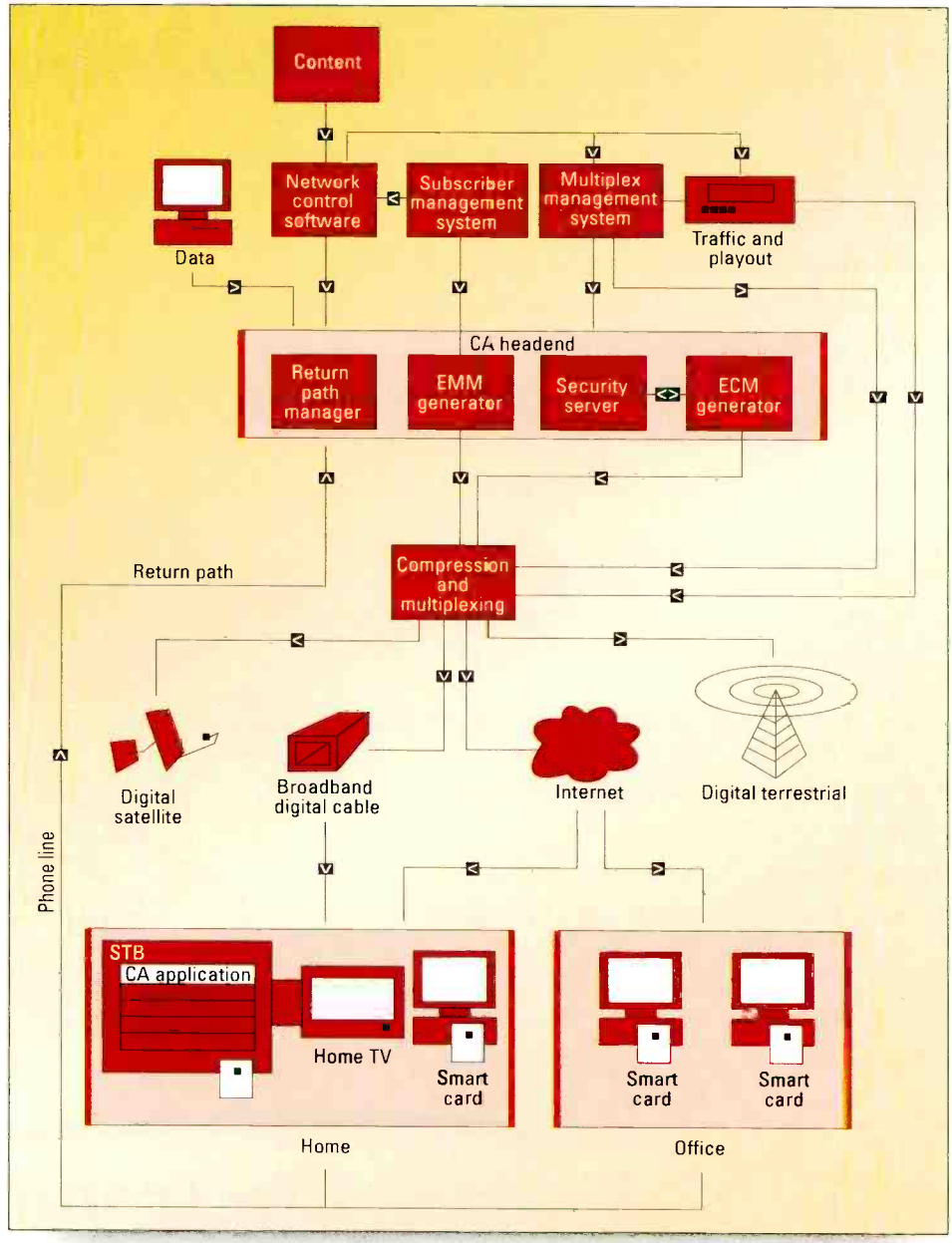
Other potential revenue generators include near video on demand (NVOD) and subscription video on demand (SVOD). But marketable content is critical to making any of these services successful.

The term "pay per view" usually conjures visions of movies, concerts, sports and other special events, but why not add to that educational opportunities or other non-entertainment applications?

In addition to the DTV approach of over the air (OTA) multicast, there is also the option of offering VOD/PPV and iTV material using the Internet. If real-time delivery is not necessary, VOD can offer QoS that could exceed that of HDTV, provided end users have storage and playback facilities in place to accommodate it. As the quality of IP delivery improves this could become an important alternative delivery approach.

iTV is slowly coming into its own also. There's little question that iTV will make use of both PSIP and IP to afford full two-way digital communication.

The University of California at



An integral part of utilizing PPV/VOD for revenue generation is having mechanisms such as the system shown above in place to control access to material and handle billing. Image courtesy NDS.

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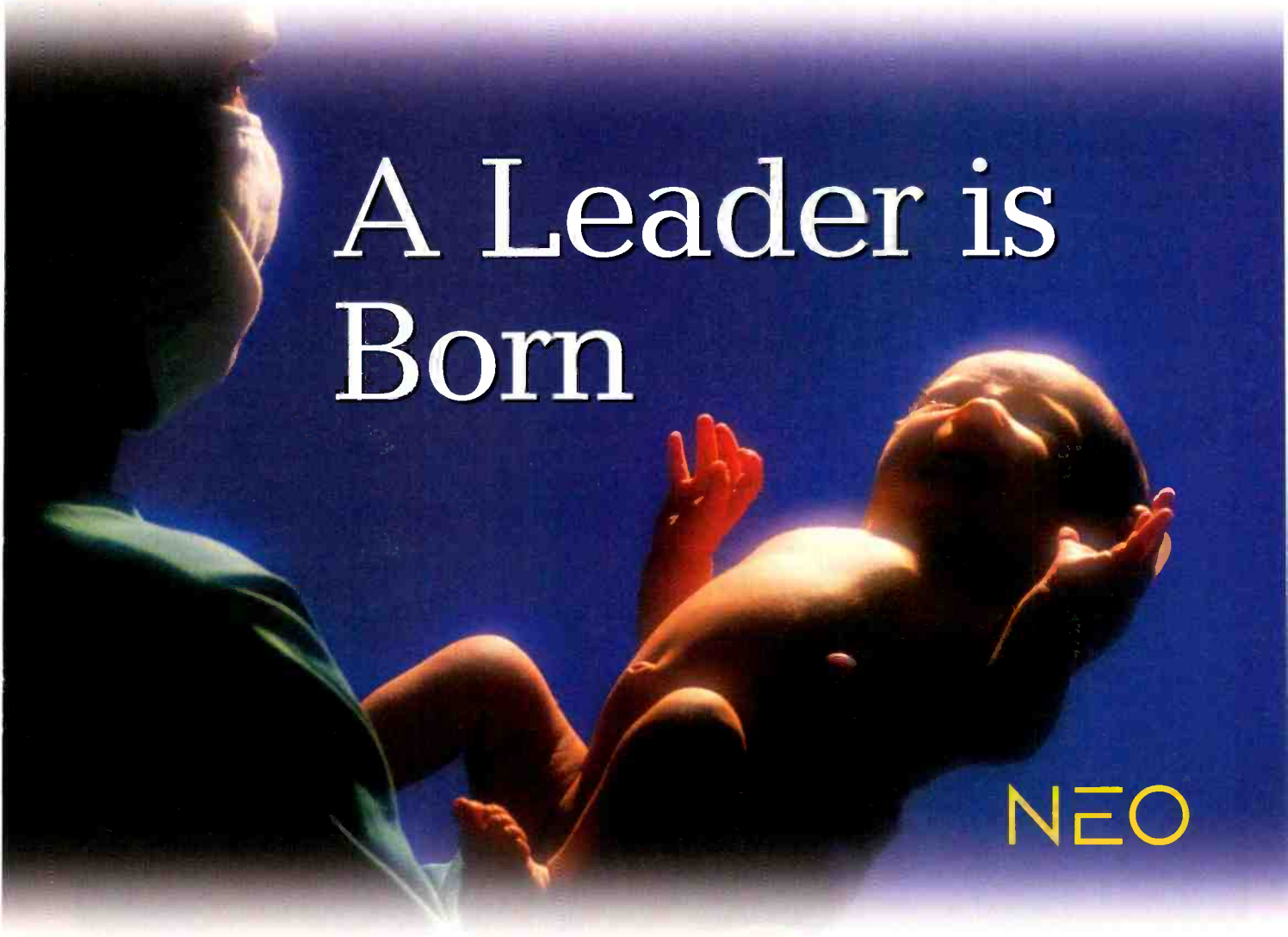

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Berkeley, for example, has a VOD system that is designed to provide access to a large amount of video information over computer networks. Clients can submit requests over the Internet to the VOD system to view audio, video and graphical streams. Data is then streamed from a media file server through the network to the client's computer.

CNN has a rather impressive VOD service available on the Internet, as well as by subscription to other delivery technologies. This technology could be scaled down to fit the needs of a local or regional operation.

If broadcasters wish to get paid for their on-demand services, they need to maintain control of the content. Figure 1 (on page 22) shows a typical demand video system for hire. Whether the delivery method is terrestrial, broadband, hardwire or satellite, conditional access is important to the delivery of content.

A subscription management system (SMS) can be used to grant access to the method of distribution. Once there is a subscriber base, the next level of control grants conditional access to specific material and provides a level of protection to the producer of the content. This is key in light of concerns about copyright protection and intellectual property rights.

Conditional access systems determine the time, delivery method and length of subscriber access to the selected material, ensures they get billed for that access, and protects content from unauthorized viewing.

There are a number of ways of letting subscribers know what is available for purchase, including a menu or GUI where selections can be made. Some systems rely on a set-top box with a smart card that the end user addresses. Other approaches require the subscriber to call in to select what they want to see. Both record the choices for billing purposes.

Broadcasters wishing to implement on-demand video services must have access to the material they wish to distribute, either in-plant or from one of several "networks" offering these services.

Video servers are becoming a mainstay in most television facilities and can be used to provide local access to material for on-demand services. The capacity and the number of output ports are the only limiting factors in granting access to a video server's contents.

Purchasers of an automation system would be well advised to find out if their intended system will accommodate SMS, CA and other such add-ons; some of the better known names in this field will not at this time.

Cable and DTH operators have found PPV and NVOD lucrative and many are introducing iTV. Broadcasters might do well to give some consideration to this method of generating revenue. BE

Larry Bloomfield is a consultant in the broadcast industry.

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Understanding
Composite Analog Video

BY MICHAEL ROBIN

All color television systems use the principle of additive colors, with green, blue and red as primary colors. The precise colorimetry coordinates are set in relevant standards. Monochrome compatibility requires the generation and transmission of a full-bandwidth signal representing the brightness component of the televised scene. This component is called the "luminance." The mathematical expression for the luminance signal is:

$E'_Y = 0.587\ E'_G + 0.114\ E'_B + 0.299\ E'_R$, where

E'_Y = The gamma-corrected voltage corresponding to the luminance information

E'_G = The gamma-corrected voltage corresponding to the green information

E'_B = The gamma-corrected voltage corresponding to the blue information

E'_R = The gamma-corrected voltage corresponding to the red information

In a studio environment, the bandwidth of the luminance signal is restricted only by the state of the art of the equipment used. Normally, the bandwidth of the luminance signal generated by the camera is at least 8 MHz, or a horizontal resolution in excess of 600 LPH.

In a studio environment, the bandwidth of the luminance signal is restricted only by the state of the art of the equipment used.

The chrominance information is conveyed by two of the three primary signals minus the brightness component. These signals are known as the blue and the red color-difference signals. They are:

$E'_B - E'_Y = -0.587\ E'_G + 0.889\ E'_B - 0.299\ E'_R$

$E'_R - E'_Y = -0.587\ E'_G - 0.114\ E'_B + 0.701\ E'_R$

The $E'_G - E'_Y$ signal can be recreated in the receiver by a suitable combination of the blue and red color-difference signals.

The color-difference signals are scaled in amplitude by suitable multiplication factors to avoid transmitter overloading. The NTSC scaled color-difference signals are:

$E'_{B-Y} = 0.493\ (E'_B - E'_Y)$ and

$E'_{R-Y} = 0.877\ (E'_R - E'_Y)$

Component analog and digital standards use different scaling factors.

The NTSC system

The NTSC color-television system is a single-channel television concept. Luminance, chrominance and synchronization information are combined to be transmitted in a 6 MHz RF channel originally specified for monochrome transmissions. The transmission of color takes advantage of the characteristics of monochrome video's spectrum. Essentially, the chrominance information is transmitted in the spectrum "holes" of the monochrome information. As described in the SMPTE 170M standard, the concept uses a wideband (4.2 MHz) luminance signal and two narrowband chrominance color-difference signals of equal bandwidth. The color-difference signals may be B-Y and R-Y or I and Q, as in the original 1953 specifications of the NTSC system. The bandwidth of each of the color-difference signals may be 600 kHz or 1.3 MHz, depending on where they are used. The wider bandwidth is used within studio environments where there is no significant bandwidth limitation. But transmission

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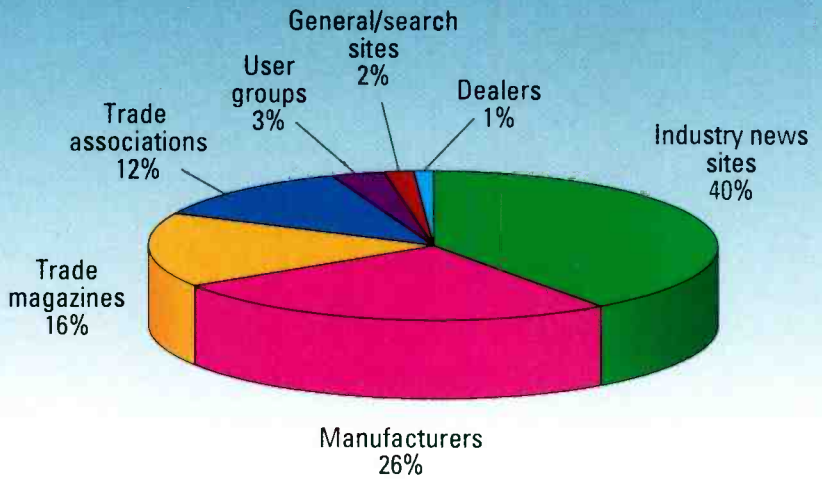

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and reception constrains the chrominance bandwidth to 600 kHz, and the remaining chrominance bandwidth is wasted.

Each of the scaled color-difference signals modulates a subcarrier. The two subcarriers are identical in frequency but differ in phase. The phase difference between the two subcarriers is 90°, so the original signals modulating the two carriers can be recovered without crosstalk. The two subcarriers are obtained from a common crystal oscillator. The type of modulation is suppressed-carrier amplitude modulation. It is consequently referred to as suppressed-carrier quadrature amplitude modulation. Since the subcarrier is suppressed, only the sidebands are obtained at the output of the modulators. This results in the complete cancellation of the chrominance signal when no colors are present.

The frequency of the chrominance subcarrier is an odd multiple of the half horizontal scanning frequency. This results in the interleaving of the luminance and chrominance spectra. The type of spectrum interleaving used in NTSC is called half-line offset. The frequency of the subcarrier is equal to

$$f_{SC} = 455f_H/2 = 3{,}579{,}545 \pm 10 \text{ Hz}$$

This leads to a slightly modified horizontal (15,734.25 Hz instead of the original 15,750 Hz) and vertical (59.94 Hz instead of the original 60 Hz) scanning frequencies. The chosen subcarrier frequency results in a reduced visibility, on a monochrome receiver, of the subcarrier sidebands and a potential 920 kHz beat between the color subcarrier and the audio carrier.

Figure 1 shows details of the NTSC frequency-division multiplexing of the luminance and chrominance spectra around the chrominance subcarrier.

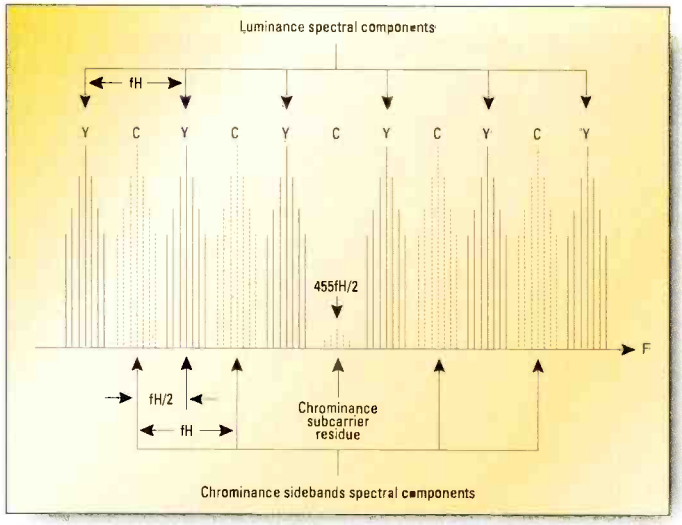


Figure 1. Details of NTSC FDM spectrum around the chrominance subcarrier

Figure 2 shows a simplified block diagram of an NTSC encoder using B-Y and R-Y color difference signals. Green, blue and red signals are fed to a resistive matrix that algebraically combines percentages of these primary color signals to form the luminance (E'_Y) signal and the two color-difference signals. Each of the color-difference signals is band-limited before being fed to the respective balanced modulators. A 3.58 MHz subcarrier feeds the B-Y modulator and, through a 90° phase-shift network, the R-Y modulator. The E'_Y signal is delayed to compensate for the chrominance delay introduced by the color-difference low-pass filters. The adder combines the luminance, chrominance sidebands, composite (horizontal and vertical) sync and a 180° phase-shifted gated subcarrier burst into a composite color signal.

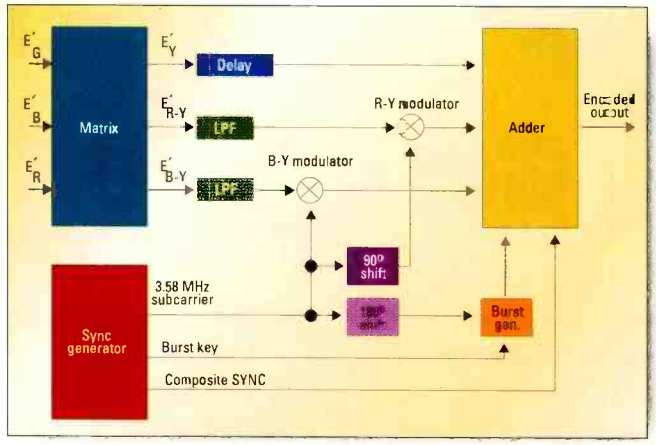


Figure 2. Simplified block diagram of NTSC B-Y/R-Y encoder

Figure 3 shows a phase-domain representation of the B-Y subcarrier (0°) and the R-Y subcarrier (+90°). A third subcarrier identifies the synchronizing burst (+180°).

Figure 4 shows a vector representation of the chrominance subcarrier-modulation process. A given color, described by a given set of E'_{B-Y} and E'_{R-Y} signal values, is represented by two amplitude-modulated subcarriers in phase quadrature. The instantaneous values of the two modulated subcarriers result in a vector described by its amplitude and phase angle with respect to the B-Y phase (0°). The vector amplitude represents the color saturation and its phase angle represents the hue.

Figure 5 shows a 100/7.5/100/7.5 (100 percent) color-bar signal waveform resulting from the addition of

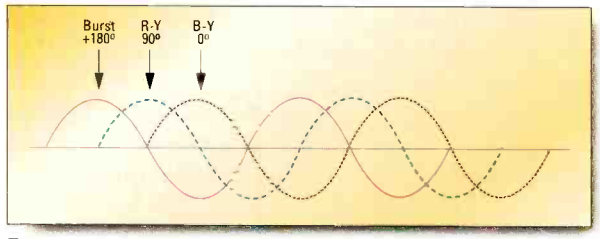
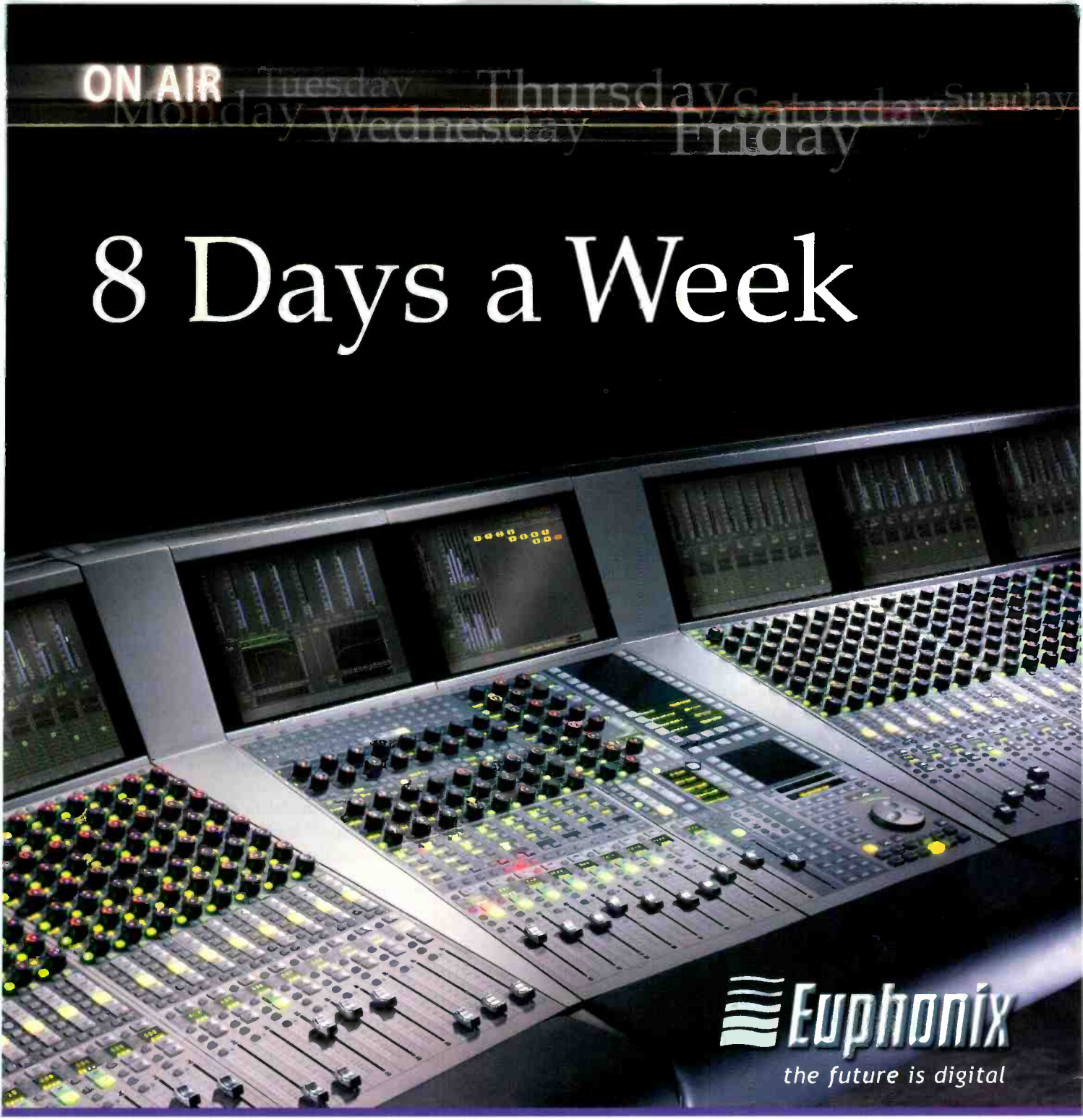


Figure 3. Phase domain representation of the two significant equal frequency subcarriers. The third subcarrier represents the synchronizing burst.



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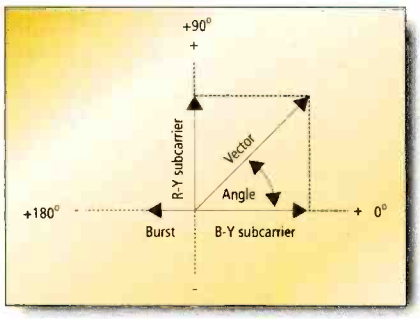

Figure 4. The instantaneous amplitudes of the subcarrier result in a vector whose amplitude represents saturation and phase represents hue.

luminance and chrominance components. A burst of nine cycles of frequency and phase reference subcarrier is transmitted during the back porch of the horizontal blanking interval. This reference signal is used to assist in the regeneration of the suppressed carrier required for the recovery of the B-Y and R-Y signals. Note that the peak positive signal excursion, for yellow and cyan colors, is 130.8 IRE, which is beyond the overload level of a television transmitter. Figure 6 shows the relationship between video signal level and percentage of video-carrier modulation. Television transmitter tests are carried out with a reduced amplitude color bar signal known as 75/7.5/75/7.5 (75 percent) whose maximum signal amplitudes don't exceed 100 IRE. It is important to stress the fact that peak-amplitude green, blue and red primary signals will generate composite color signals equivalent to the 100 percent color bar signal. Since there are no highly saturated yellow and cyan colors in nature, the probability of transmitter overload under normal operating conditions is very low. Problems occur, however, with synthetic signal sources, such as character generators and graphic systems, which can create primary signals resulting in excessive-amplitude composite-color signals and lead to transmitter overload. Video transmitter overload problems will affect not only the transmitted picture quality but also the accompanying sound. The sound is recovered in the television receiver by using the intercarrier beat approach. This approach creates a signal that is frequency-modulated by the audio signal and amplitude-modulated by the video signal, resulting in a modulated beat frequency of 4.5 MHz to recover the audio signal. The 4.5 MHz signal is filtered by a bandpass filter to remove the video-signal component and is treated as a frequency-modulated carrier. It is amplitude-limited to remove video interference, and FM-detected to recover the original audio information.

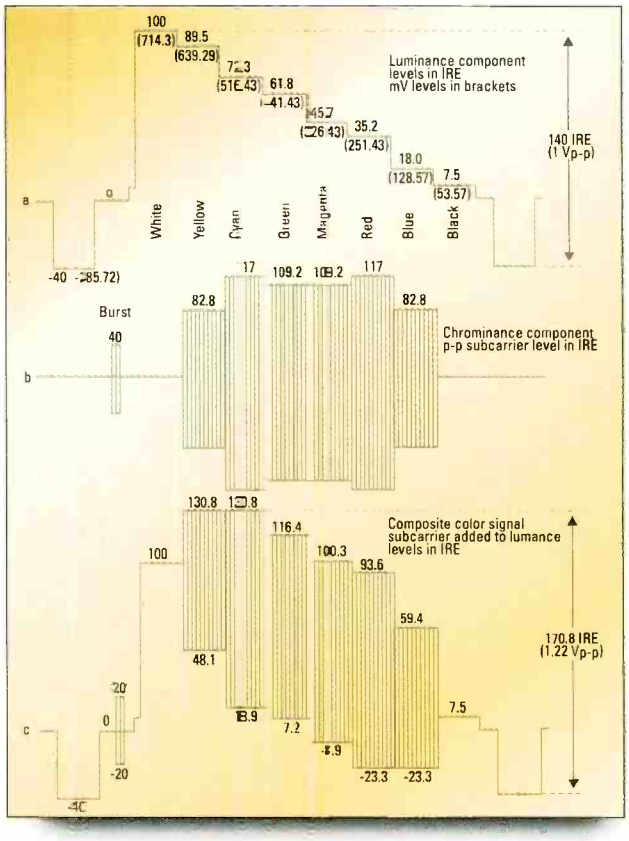

Figure 5. NTSC 100/7.5/100/7.5 color bars signal waveform

Overmodulation of the video transmitter will result in cancellation of the video carrier. Under extreme circumstances, the derived 4.5 MHz audio carrier is periodically cancelled at the video horizontal and vertical scanning rates. This results in the so-called intercarrier buzz effect. This can be avoided by carefully monitoring and controlling video-signal levels to avoid transmitter overmodulation. BE

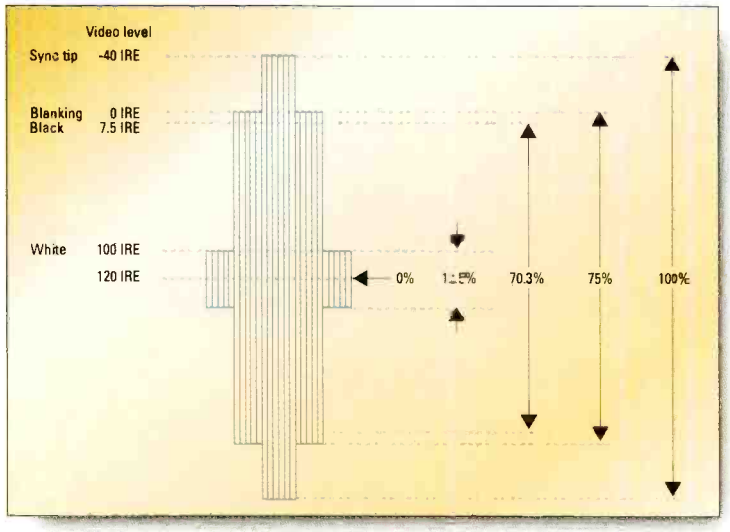

Figure 6. Significant video signal levels shown as a percentage of carrier amplitude in negative amplitude modulated systems

Michael Robin, 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.*

Send questions and comments to:
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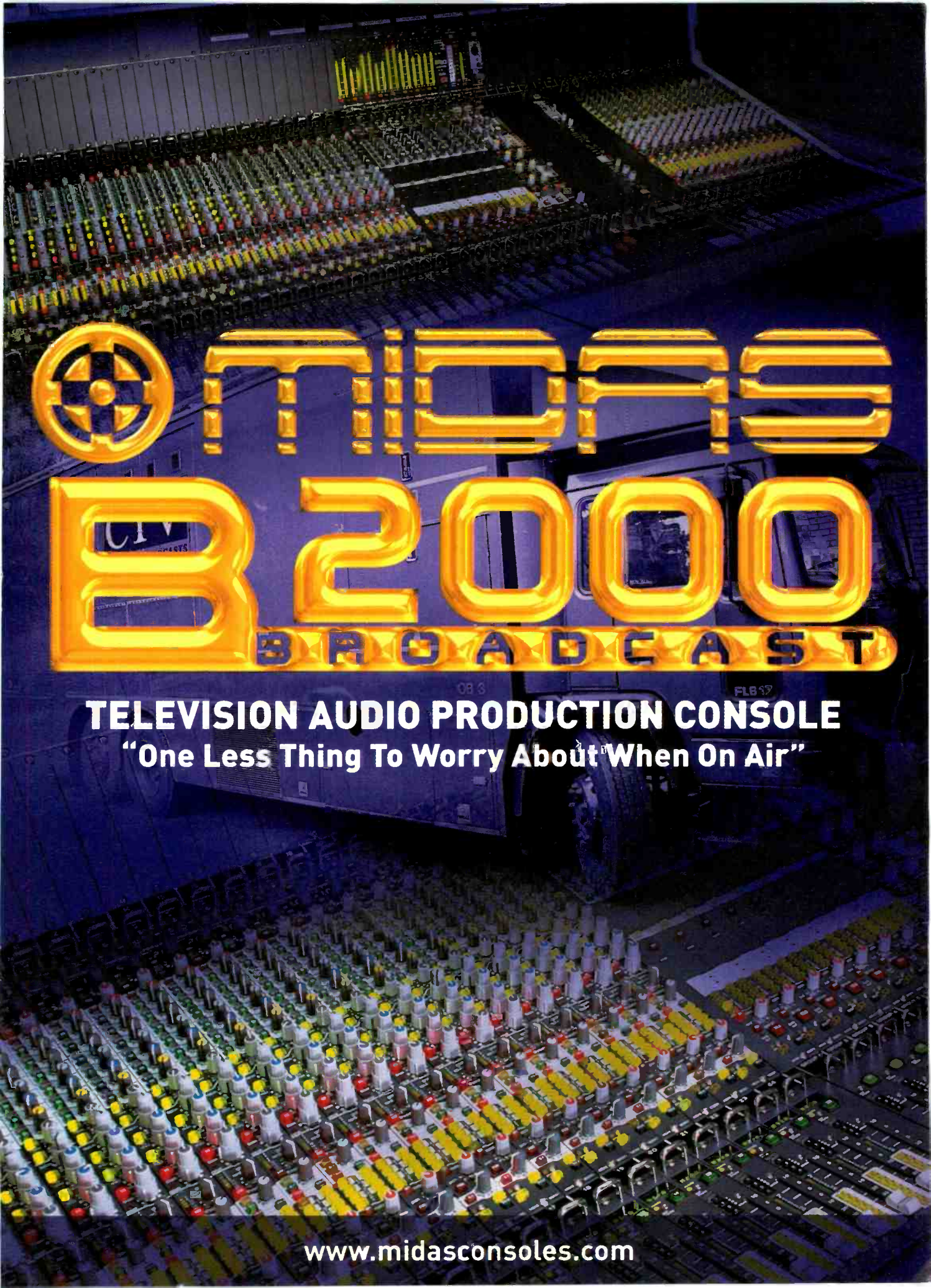
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Compression, Computers and Networks

BY BRAD GILMER

Compression is one of the enabling technologies that allow computers to process video.

It is vital because it conserves precious storage space. Uncompressed video files are big. How big? Well, 100 hours of uncompressed video (the average size of an active commercial library in a local television affiliate) requires about 8.5 terabytes. That's a lot of storage.

But storage is only one dimension of the problem. Moving uncompressed files over conventional 10BaseT or even 100BaseT networks can take hours. Also, video can crash other applications trying to coexist on a network. Applications may crash due to timeout errors as they wait for an application at the other end to respond. As more video users are added to the network (instead of using simple point-to-point connections), conventional "dumb" hubs must give way to switching technology to increase available bandwidth to each user. Gig-E or 1000BaseT makes things more tolerable, but large transfers can still bring traffic on these networks to a crawl.

When computer scientists and video engineers first tackled the problem, they applied compression/decompression schemes, also called codecs, that had been used in the traditional IT sector. These early codecs allowed for bit-rate reductions on the order of 50 percent, or 2:1. These schemes reduced the number of bits transmitted by looking for repetition of bit sequences. For example, a scene of a person sitting in front of a white background contains a lot of repetitive information. These codecs look for repetition of strings of bits and compress the data by saying, in effect, "repeat this pattern of bits *N* times." Such codecs are lossless.

As the name implies, lossless codecs compress a file and then uncompress it so that the final result is an exact, bit-by-bit copy of the original. If you have an exact copy of the original, then by definition there are no compression artifacts. Unfortunately, the compression ratio of lossless codecs seems to be limited to somewhere between 2:1 and 3:1. Past this point, codecs must achieve some of the bit-rate reduction by "throwing out" bits that are deemed unnecessary. And as soon as you start throwing out bits, you no longer have a perfect, lossless copy.

As soon as you start throwing out bits, you no longer have a perfect, lossless copy.

Most users are willing to sacrifice the perfect copy at the receiving end in exchange for an additional 30 percent to 40 percent bit-rate reduction. However, as soon as you employ these schemes, you introduce artifacts. Lots of effort goes into trying to hide the artifacts from the end viewer. Engineers have engaged in a very interesting interplay between physics and biology to achieve this. Without straying too far from the subject, it is important to realize that the human being at the end of the chain is a vital part of the whole system. The eye and brain have certain characteristics that make them less sensitive to missing bits in some areas than others. Engineers developed compression techniques to take advantage of the specific characteristics of the human visual system.

With the advent of more complex compression algorithms, bit-rate reductions up to 100:1 and beyond are now possible, but users have to make tradeoffs between bit-rate reduction and artifacts, editibility and delay. A decision about compression quickly becomes a balancing act. One combination of compression choices might be acceptable for transmission from a station to its viewers, but might be unacceptable for a transmission of a sporting event from the field to the station. To further complicate the discussion, there is the issue of time delay through the compression chain. As a general rule, the more aggressive the compression, the more delay involved. A large amount of delay may be acceptable for one-way transmission, but may make a circuit unusable for a two-way live interview. For example, in a live-interview situation, the average

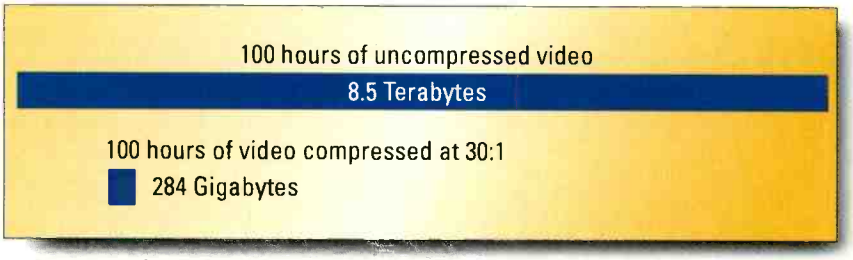

Figure 1. A visual representation of 30:1 compression. One hundred hours of uncompressed video would occupy about 8.5 terabytes of storage. At 30:1 compression, the same 100 hours would occupy about 284 gigabytes.

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untrained person is able to communicate over a circuit with a delay up to about 850 ms. Delays larger than that result in the person repeating a question or reply before the person at the other end has a chance to respond. When delays become larger than this, trained on-camera talent is required.

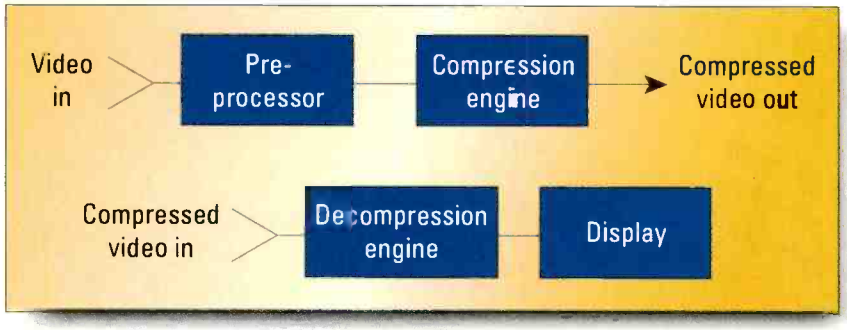

Figure 2. Decisions made about pre-filtering can be as important as decisions made about compression.

So how much compression can you use and still have "acceptable" artifacts and delay? The answer, of course, depends on a number of questions. Are you designing a one-way circuit? Are you planning to edit the video at the receiving end? Are you planning to recompress the video for onward transmission? What is the end-viewer environment? To give you some frame of reference, bit-rate reductions of about 30:1 result in what may be described as an acceptable combination of level of artifacts and delay for some applications. Going back to our original figure of about 8.5 terabytes for 100 hours of uncompressed video, if a 30:1 compression ratio is acceptable, total storage can be reduced to about 284 gigabytes. (See Figure 1.) For many applications, it may be much easier to justify the cost of the smaller system.

Decisions made about the video being fed into the compression system can be as important as decisions about the compression system itself. Compression schemes reduce repetition in the data. If a scene is highly repetitive (a plain background behind a stationary speaker) the scene can be highly compressed without generating observable artifacts. If a scene has very little repetition (sports sequences with lots of action) it will be more difficult to compress. Noisy video images are some of the most difficult to compress because of the random pattern of the noise. For this reason, many compression systems use pre-filtering to increase performance. These pre-filters can be quite complex in their own right, using the

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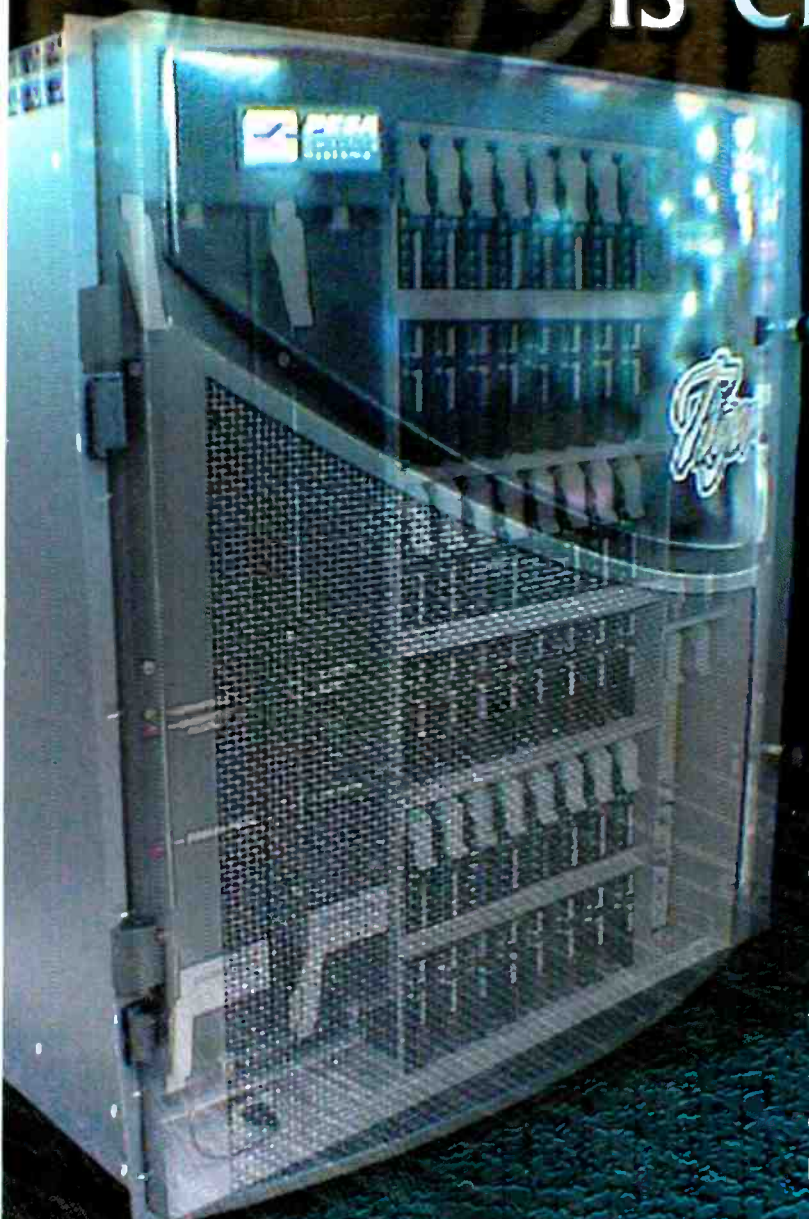

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characteristics of the human visual system to hide the information they are filtering. In addition to filtering noise, prefilters may also reduce the bandwidth of the video signal fed to the compression engine so that the compressor has less information to compress. There is a direct interaction between choices made in pre-filtering and choices made in the compression engine itself. It can take quite a bit of work to achieve the right combination of pre-filtering and compression. Fortunately, most manufacturers have done a lot of research in this area. Researchers have learned that simple bandstop filters or other non-intelligent pre-filtering algorithms produce poor results. After several years of development, engineers have come up with a number of more complex filtering techniques that are almost imperceptible to the average viewer.

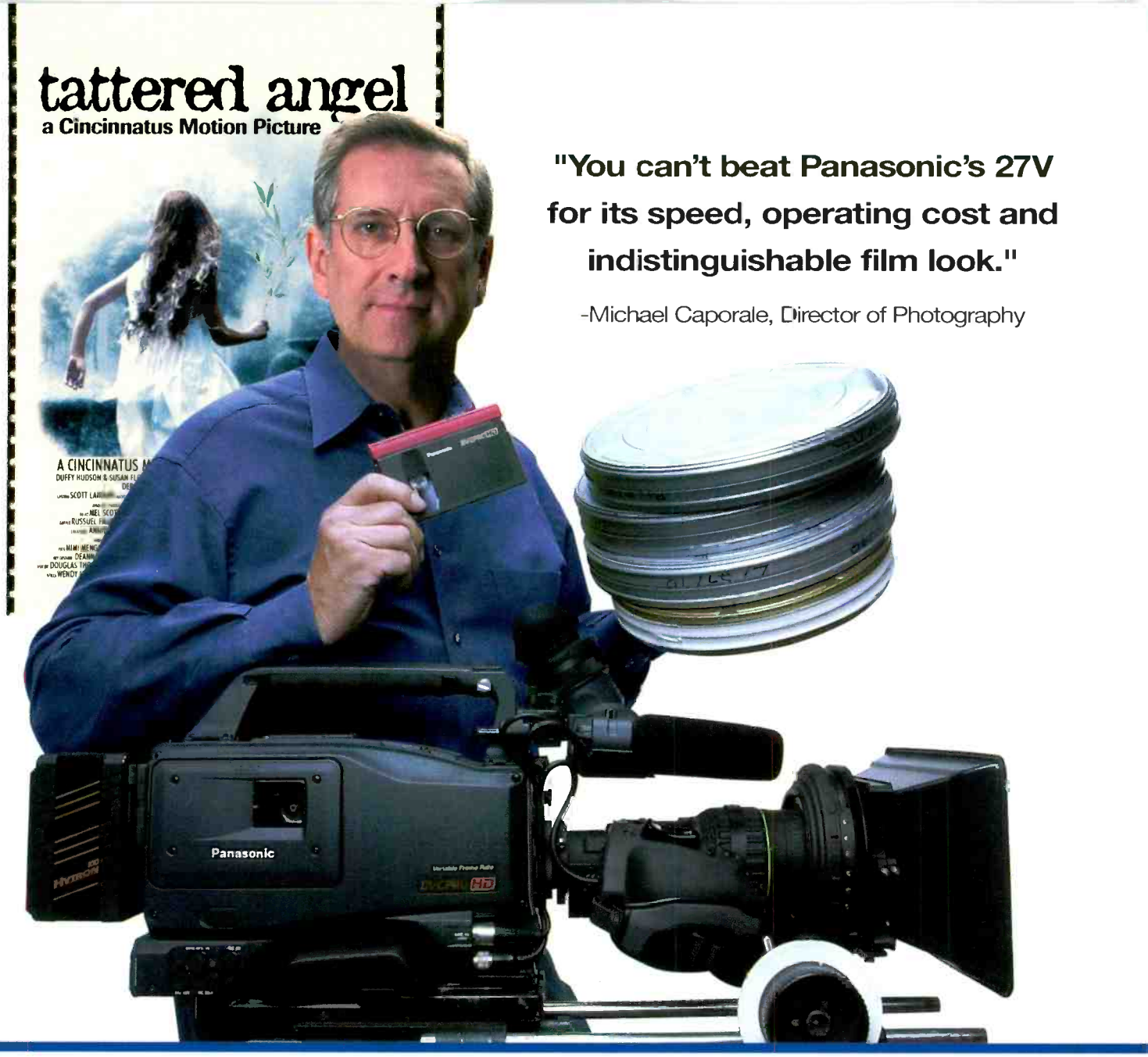
There are many excellent articles and texts on compression. Dave Fibush, Chairman of the SMPTE Technology Committee on Compression, has written an excellent overview of video compression, which is available at www.tektronix.com/Measurement/App_Notes/backgrounders/vidcomp.html. A much more technical paper on desktop compression systems is available at crl.research.compaq.com/who/people/ulichney/papers/swcodecs96.pdf.

What about more conventional computer compression methods? Here the list seems endless. There are the Windows Media Format, TIF, GIF, MP3, ZIP, and on and on. The best thing to say is that there are many codecs, new codecs come out every day, and the situation is likely to stay this way. The good news is that vendors have developed plug-ins that allow them to support a wide variety of codecs.

But, despite the fact that compression has been one of the key enabling technologies, its importance may be waning. Imagine a time of infinite bandwidth and free disk drives. In such a world, compression becomes unimportant. You may think that this view is crazy, but a number of top CTOs believe that, while disk and bandwidth will not be free, eventually their cost will become so low that other factors will become much more important. As one CTO explained recently, "If you can build a multiple Gig-E network for several thousand dollars, and if you can get disk storage for $50 per gigabyte, why worry about compression? Just build a faster network with bigger servers." We will see what the future holds. For now, it's hard to imagine a world where costs are so low that compression becomes unimportant. BE

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

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



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Audio for Post: Frame Rate

BY PAUL D. LEHRMAN

Drop or non-drop? Pull-up or pull-down? 30 or 29? And what is 23.976? All questions that strike terror into the hearts of post-production audio engineers, sound designers and even composers, all over the country.

Anyone who works with sound has his or her own nightmare stories about dealing with this issue. One of my favorites, from the days when analog multitrack ruled the post-production world, involved a studio who striped 29.97 SMPTE on one track and 60 Hz Nagra resolve tone on another and then tried to get their synchronizer to lock to both. The hapless two-inch machine bucked until the tape snapped.

Even now, in the age of digital, we still can't escape problems with sync. I just went through this, working on a score for a 15-minute film on Beta SP video that was being posted by an expensive transfer house in New York. They asked me to provide the music in ordinary DAT format and to tell them at what frame of the film to start the audio.

When I got the videotape back, the audio started right on the money, but it ended about 40 frames after the picture did. For the next three days, the transfer house and I argued about mismatched frame rates and how to make the audio and the video come together. They tried different DAT machines, different video machines and different operators. They tried transferring it from DAT to another videotape, and pulled it up and down, and probably in and out as well. Ultimately, I determined that the DAT machine wasn't locked to house sync. All of the fretting about frame rates was unnecessary. As long as everything in the house was running from the same master clock, there was no problem.

For many of us, sync issues are routinely solved by having our computers do the required complex math on the fly. But the equipment only works correctly if it is set up and operated correctly. At some point in the process of scoring this particular film, my synchronizer changed its default clock value to 30 fps instead of 29.97 non-drop, and suddenly all my hits were in the wrong place and the MIDI tracks weren't agreeing with the audio.

Sync issues are routinely solved by having our computers do the required complex math on the fly.

AMS Neve Logic 2 digital mixing console and AudioFile hard disk editor in Chicago Recording Company's new Studio 55A.

In Europe, their video frame rates are nice, whole numbers. They don't understand why we would make our video run 0.1 percent off, or why we spend so much time and energy trying to deal with it. The version that most people know is this: In the early days of television, when everything was shades of gray, the standard frame rate in the United States (and Canada) was 30 frames per second. Since each television frame consists of two "fields" of alternating lines, the field rate was 60 Hz. When the color standard was adopted in 1953 by the NTSC, it was discovered that the new color signals were susceptible to interference from 60 Hz AC fields, and if there was any difference between the line frequency and the scan rate of the received signal, it would show up as a visual "beating." But if you altered the field rate enough, the beating would speed up to the point that it was no longer visible.

Unfortunately, this version is simply not true. Line-frequency beating never was a problem. And if it were, the cure is worse than the illness. At a field rate of 59.94 Hz, if there really were beating caused by AC-line leakage, you'd see a bar roll across the screen about every 17 seconds. Not pretty.

The real reason for the difference in frame rates is this: The lower frame/field rate is designed to prevent potential visual beating between the chrominance subcarrier in the broadcast signal and the audio subcarrier. For various reasons, the color subcarrier frequency in the television signal needs to be modulated onto the picture carrier at 455/2 times the horizontal line frequency. At 30 frames per second, and

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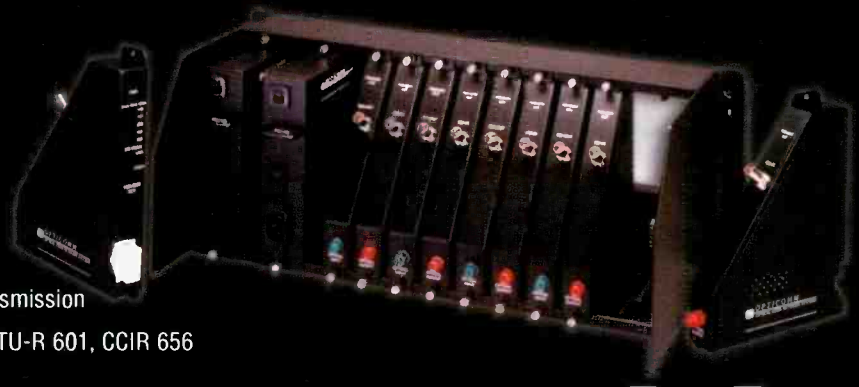

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with 525 horizontal scan lines per frame, this frequency is 15.750 kHz, which means the color subcarrier would have to be at 3.583125 MHz. The sound subcarrier (as established on the first monochrome TV systems) is at 4.5 MHz. If the two subcarriers were to interfere and beat against each other, the 916.875 kHz difference might be visible — and in fact, according to one report presented to the NTSC, it was visible in some monochrome sets at the time, under some conditions. Since backwards compatibility was a major consideration for the NTSC, this was a problem.

This report went on to say that if the difference signal happened to be an odd multiple of one-half the scan rate, this beating would be reduced. If the frame rate were dropped 0.10001 percent, the scanning frequency would be 15.734264 kHz, the chrominance subcarrier would be 3.579545 MHz, and the beat product (if there was one) would be 920.455 kHz, which is very close to the 117th multiple of half the scan rate.

But a close look at the technical documents and the committee proceedings around this point seems to show that the problem never really existed.

An engineer who was there at the beginning, Rollie Zavada of Eastman Kodak, diplomatically calls the decision to change the frame rate "debatable." Other sources say that the first generation of color sets, and the black-and-white sets that were made by the time the color standard was adopted, had good enough filters on the audio section that leakage between the subcarriers was simply not an issue. The decision meant expensive alterations to transmission equipment, as the AC line could no longer be used as a frequency reference for sync, according to video engineer Tim Stoffel.

We had the chance to change the frame rate with the advent of digital television and HDTV but didn't. The original HDTV standards all specified a frame rate of 30 fps. Progressive, interleaved, 1080, 720, whatever variation you looked at, there was no mention of 29.97 anywhere in the proposals. But the HDTV programs now in production and going out over the air are running at — you guessed it — 29.97 frames. The FCC mandate for HDTV is incredibly vague, and has over the years been increasingly dictated by the broadcasters themselves, which means networks and stations have been free to do just about anything they want with it. And dropping the frame rate is something that came easily. BE

Paul D. Lehrman is Insider Audio *columnist for* Mix *magazine, and Web editor for* Mix *and related sites.*

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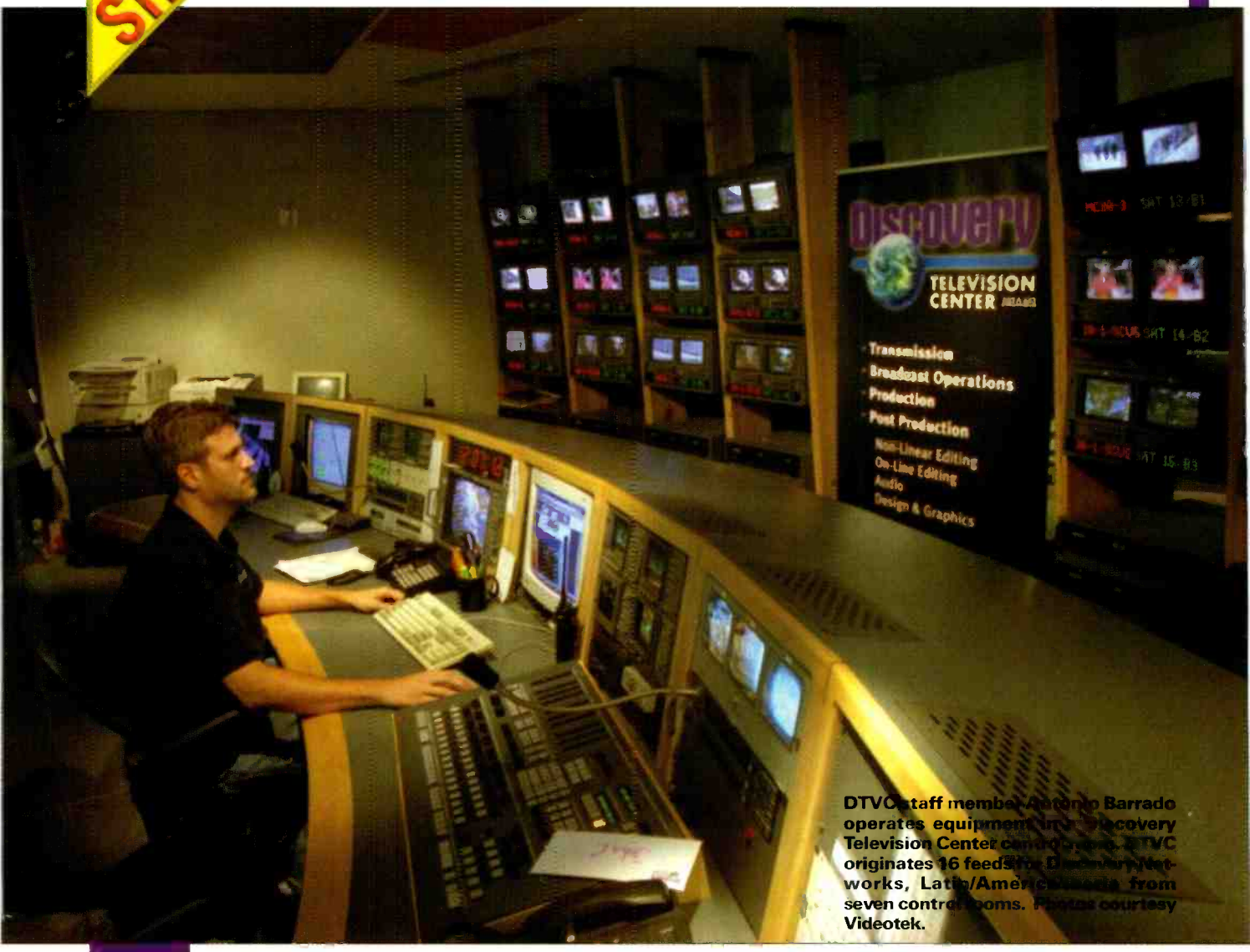
SYSTEMS DESIGN SHOWCASE

The Discovery Television Center

BY LISA HYAMS AND PEDRO VILLABONA



DTVC staff member Antonio Barrado operates equipment in the Discovery Television Center control room. DTVC originates 16 feeds for Discovery Networks, Latin/America[illegible] from seven control rooms. Photos courtesy Videotek.

The Discovery Television Center (DTVC), a subsidiary of the Discovery Communications Latin America/Iberia, recently completed construction on new quality control, editing and post-production suites to support increased services for their Spain, Portugal and Latin American markets. DTVC had to ensure that the facility could meet the challenge of an aggressive network channel rollout and maintain high production quality.

Miami-based Discovery Television Center is owned by Discovery Communications, a privately held, diversified media company headquartered in Bethesda, MD. The fully digital 50,000-square-foot facility is capable of servicing multichannel uplink, and currently services 16 feeds for Discovery Networks, Latin America/Iberia. It has multilingual capability for language customization in Spanish, English and Portuguese that includes Castilian and Latin American Spanish.

Services

In addition to its network-related services, the Discovery Television Center offers access to producers, writers and graphic designers to take projects from concept to final product on film, video or special effects. For post-production, they are equipped with several Avid Media Composers, a nonlinear DS suite, five digital online edit suites and two nonlinear audio rooms that can incorporate digital audio components such as voiceovers and music composition.

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For network origination and quality control, DTVC has seven master control rooms, each with the capacity to control up to three simultaneous feeds. Presently, DTVC originates 16 feeds from RAID-protected, redundant video servers, with the capacity to originate up to 19 feeds. They also provide complete duplication and recording services from simple offline editing to expert mix-to-layback services for tape formats including Beta SP, digital Beta, PAL and NTSC.

DTVC also offers uplink video and multi-language tracks for its satellite services, as well as 24-hour transmissions monitoring and after-hours support for affiliate sales-conditional access.

Design criteria

The facility was originally constructed in 1997 with the intent of handling six feeds for the existing networks servicing Latin America and the Iberian region: Discovery Channel, Discovery Kids, Animal Planet and People + Arts. When Discovery designed the facility, they wanted the quality and capabilities of a fully digital operation, and they became one of the first to broadcast with an all-digital output/signal in the Latin American market. Because Discovery planned for future expansion, their intent with going digital was to get a better quality signal to the market through compression.

Discovery's intent was to get a better quality signal to the market through digital compression.

Discovery chose to use glass walls as part of the interior structure to allow for further expansion. Instead of knocking down walls, the glass panels can easily be removed to allow movement.

There were similar considerations when designing the technical space with a heightened attention to QC. From the scopes and monitoring equipment by Videotek to the ergonomic keyboards and Pro Tools workstations, the area required a more multipurpose feel. Rather than having a dubbing station just to dub, Discovery wanted to have the ability to have edit controllers in case a need arose for quick offline edits or machine-to-machine edits. In addition, more tie lines were added to the router and a couple of Envision machines were incorporated to make it easier to manipulate and reconfigure audio.

DTVC's new QC workstations are multipurpose and are used for machine-to-machine editing, screening and dubbing, as well as real-time quality control with Videotek's VTM-300, to meet increased production demands.

Operational goals

A top priority for the operations was to increase throughput. Taking into account the peaks and valleys in workflow (especially in the domestic market's busy fourth quarter season), the challenge was to meet the needs of an international operation's more aggressive deadlines. For every dub made, the material needed translation and, in the case of the Discovery network in Latin America, not just to one language but to multiple regional languages of Portuguese and Spanish. To address this concern, the design team closely monitored the workflow to come up with the most efficient way of handling it without going overboard on capital expenses.

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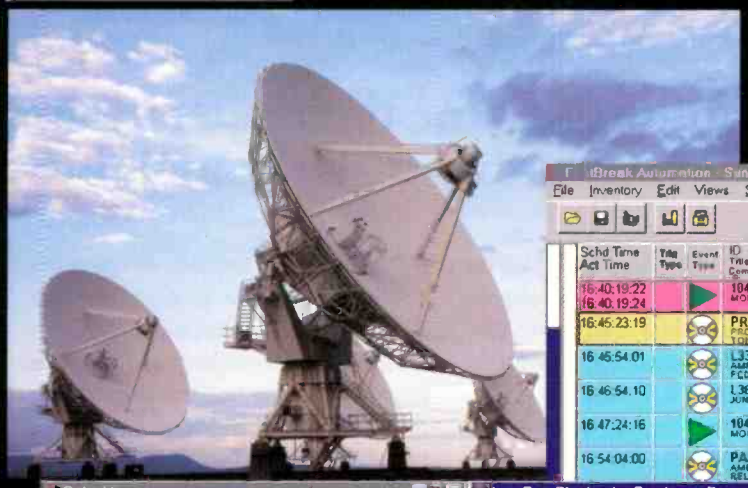

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Each room in the core areas, including post-production, audio suites and edit suites, was acoustically designed with a treatment of approximately 200 small wooden boxes, each one with separate dips, for optimum audio reflection. Discovery Television Center wanted nothing to affect the audio, so operators would be able to hear the audio that will air. A primary acoustical concern was the proximity to Miami International Airport and the effects of air traffic on the core areas. The building's physical structure and subsequent glass treatment played a large part in combating this.

Equipment and issues

Discovery Television Center works closely with the home office in Bethesda and typically upgrades as the demands of the network change. An Operations and Technology group meets on a regular basis to discuss everything from the latest server designs, asset management, technology and upgrades, to efficiencies and how to operate better and more cost effectively.

From that operational initiative, the Discovery Television Center has started creating technology that other branches are now using, including the development of audio file delivery via the Internet for their translation process. The old methodology required the center to receive a Spanish or Portuguese translation on DAT tape via courier (which would often get hung up or lost in customs). Now vendors utilize a customized protocol and transfer the MP3 files using the technology available via the Internet. Because Discovery is mono-mixed it is compatible with the translation files.

Approximately 300 companies create the programs for Discovery coming from Latin America and Europe, which results in varying tape quality. Discovery Television Center staff sets up programs for quality control 11 weeks in advance of the air date. They use Videotek's VTM-300 for automated quality control to ensure that DTVC's signals pass 75 points of test in video and audio before air. The VTM-300 is used to check the tape before dubs are made and sent to the translation houses to create the different language tracks. Before installing the VTM-300, DTVC used to run quality control on three separate units, which caused integration concerns. With all three in one unit, DTVC has been able to streamline their operation and cut costs.

The DTVC added five edit suites to the three existing suites, including two online suites and a DS suite. The new suites allow DTVC to accommodate the increased need for its on-air promotion group and its international programming group's services. For offline editing they have six Avid suites, upgraded with Meridian to be able to handle true digital I/O.

For the edit suites, DTVC selected a combination of Sony equipment – a switcher, audio mixer and DME, as well as an Accom editor and DDR. DTVC required the flexibility to handle everything from complex video compositing to simple conform projects in both NTSC and PAL formats. Keeping everything in 601 was another consideration for quality. Finally, DTVC required the ability to keep up with peak workflow demands – therefore device sharing and routing were key factors in the design scheme.

A top priority for their operations was to increase throughput.

On the audio production side, DTVC clients required a flexible format interchange allowing them to handle a variety of creative projects from M&E recreation to multiple language track recording. The combination of a Pro Tools digital audio workstation and the Solid State Logic Scenaria gave the facility operators this flexibility. The design team, responsible for creating both print and broadcast, uses a combination of Discreet Logic Flint and Macintosh bundled with Photoshop, Quark and Maya 3D.

For broadcast operations, the short-term goal was to move into server technology (again keeping everything in 601) with the longer-term goal of sharing similar content as technology becomes available and asset management becomes more sophisticated. DTVC accomplished the first phase of this plan using Harris/Louth Automation and HP MediaStream servers. One of the challenges they anticipate in the near future is dealing with multiple language tracks in an efficient manner, so eventually DTVC envisions a server that houses the audio files for playout. BE

Lisa Hyams is director of operations and Pedro Villabona is a technical support manager for Discovery Television Center. (Additional reporting by JB Duke.)

Design team

Architecture: Studio Architecture, Phil Olson
Acoustic Design: Russ Berger
Design Group: Russ Berger, Richard Schrag
System Integration: Harris Corp.
System Design: Discovery Communications Inc. and Harris Corp.

Equipment list

Sony DVS 7200 switcher
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What's Happening Up There?

BY DON MARKLEY

Traditionally, we monitor the television signal at every stage of the process from the initial generation point in the cameras until it leaves the transmitter itself. We then trust in the antenna to do its thing, hoping that all will be well and that the RF energy will leave the system somehow, please.

In older systems, the forward and reverse power was sampled, usually with probes in the transmission line in the combiner area. Those samples were detected and applied to meter relays. These were electromechanical devices that could be adjusted to a desired level. If the meter exceeded that level it would cause a contact closure that could be used to shut down the system. This was normally done to protect the transmitter in the case of a VSWR trip or in the event of the VSWR increasing gradually until it reached an unacceptable level, such as would occur if the antenna acquired a significant coat of ice. (As is known by most of the old-timers, some of the old antennas could accumulate enough ice around the feed points to cause the VSWR to increase to an unacceptable level.) Those devices did act to save the system but had no ability to sense minor gradual change or to predict future system faults.

Transmitters came to be equipped with positive automatic power controls aided by microprocessors in the transmitter control systems.

The next level was the era of in-line monitoring equipment such as the Bird Watcher and similar items from other vendors. These systems worked very well within their design limitations. They were truly on/off type devices in that they could be set for a maximum forward power and a maximum reverse power. If either of those were exceeded, a relay closed, giving you either a contact opening or closing that could be used to shut down the transmitter. They functioned a lot like the old meter relays, but they added the service of measuring power continuously. They also added the capability to systems that didn't have the old relay capability, such as the old FM transmitters.

The next level occurred when the transmitter manufacturers started actually including more protection in their equipment. This included VSWR trip circuits and VSWR foldback circuits. The foldback circuits acted to reduce the transmitter power so that the reverse power did not exceed a preset level. Therefore, when the antenna iced up, the transmitter would simply keep backing off on output power to a point that no damage was going to occur to the system. In addition, transmitters came to be equipped with positive automatic power controls aided by microprocessors being utilized in the transmitter control systems.

On to the next level... There is a new Bird power meter, and similar systems are being prepared by other manufacturers. The new Bird system accurately measures average power and provides a digital data stream containing both forward and reverse power levels. This

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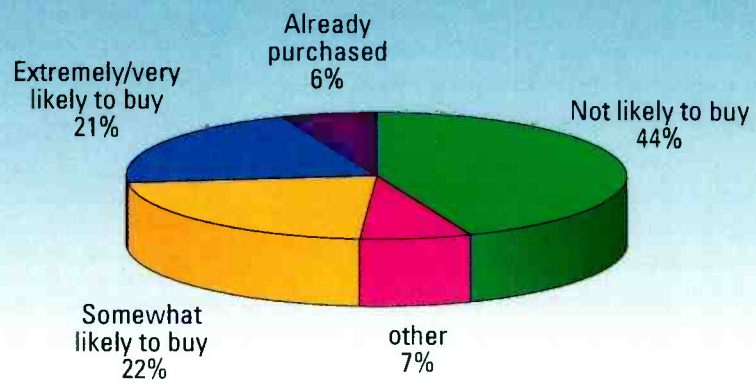

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provides the basis for more complicated systems to be used, not only for remote control, but also for trend spotting. Furthermore, these systems provide accurate power measurement without field calibration or the need for a calorimeter other than the rather archaic provisions of the FCC rules. Hopefully, those rules will change someday and allow the industry to take full advantage of the accurate power metering capabilities that are currently available.

The next level leads to devices such as VSWR Vision from Dielectric. Obviously, if the device achieves the level of acceptance that is anticipated, there will be similar systems following from other vendors. This system is online full-time determining the VSWR and recording the VSWR values. Those values can then be downloaded to a central point where trend-spotting programs can be used to identify problems that are starting to occur in the transmission line. This system monitors VSWR incidents and records the time when they occur. The system will then also call designated parties as part of an alarm function to notify them of a VSWR event. With computer analysis of this data, it is possible to determine where the problem occurred and to have repairs effected before the line is totally burned up.

At the top level are complete integrated systems that are being built utilizing a multitude of devices such as the Bird power meter and/or the VSWR Vision. These large systems monitor forward and reverse power on multiple transmission line/multiple antenna/multiple user systems such as are being installed at major antenna sites. In addition to simply monitoring the RF levels on the transmission lines, these systems calculate non-ionizing RF levels in the vicinity of the antennas on the roof of a building or along the length of a tall tower.

The days of a simple prayer that the RF will go away from the antenna are over. We now have more than adequate systems that allow us to monitor the existing conditions, sense unacceptable conditions and provide good prediction capabilities to avoid failures and future downtime. It is much better to schedule the replacement of a failing component than it is to have it occur during a high-income event. No, it never happens when those commercials are scheduled. Downtime will always occur when revenue is at its highest and all the station brass are touring the transmitter plant. That is, if anybody in the station brass actually knows where the transmitter is located. BE

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

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Graphics Technology for Remote Broadcasting

BY JIM BOSTON AND GEORGE HOOVER

Ten years ago, a remote-production truck would have included a character generator (CG), usually with a dedicated operator, and maybe a still store, usually operated by the technical director (TD). In 1994, that started to change radically when Fox wrestled NFL away from CBS. In a few years, the graphics effort grew to include impressive graphic displays and animated moves – with sound effects. Ten years ago, most of us would have never guessed that many CGs today would have audio channels. In that time, the graphics component of a remote production for at least two of the networks has expanded to require its own 53-foot trailer. At the start of each sports season, the mobile-unit vendors review their contracts and re-configure their production and support trucks for the upcoming season. Network and freelance crews, plus talent, often use the same set of trailers each week. The mobile-unit vendor will configure those units based on the unit's job (A-game unit, B-game unit, etc.). Often, a stand-alone production truck will be re-configured to become the graphics trailer in a particular unit (typically, three trailers comprise a unit).

In the case of ESPN's Sunday Night Football, the truck vendor, prior to the start of the season, gathers the staff assigned to the graphics-support units at the field shop, along with personnel from the network. Gear supplied by the truck vendor and rental houses are unpacked and installed. Monitors, router heads and communication gear are placed and wired in. This can be one or two items, or, in the case of ESPN, over 100 cases of equipment. Once the gear is wired and in place, the two trucks are interconnected, all the connections,

A production compartment in a remote truck. Many broadcasters use more than one trailer to cover remote events – one housing production and another with graphics equipment. Photo credit Gerling & Associates.

timing and other signal-integration concerns are verified.

ESPN requires a three-trailer unit. The A trailer has production, VTRs and camera controls, along with routing, distribution, and communications infrastructure. The ESPN B trailer carries audio effects (a Calrec C2 console), graphics (two Chyron Duets and an Aprisa), four super-slow-motion systems (two LDK/EVS and two Sony BVP9500/MAV). Other equipment in this unit include robo-cam operating positions and a Grass Valley Profile, which is used to edit feature pieces. The B trailer is a 53-foot expando. The ESPN C trailer carries the Sportvision first-and-ten yellow-line system, the tech manager's office, and the two Chapman sideline camera cranes, along with all the extra equipment, such as lighting gear.

The Fox A game has A and B units only. The B unit has an iNFiNiT! and an SGI O2, the first-and-ten line equipment, and carryall space for the sideline vehicles. Super slo mos and Profiles are operated from the main truck. The CBS A game is similar to Fox's.

Now let's look at the systems required for many network graphics packages.

Graphics systems

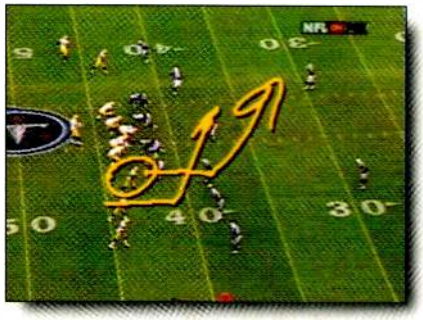
The current workhorse CG for remotes is Chyron's iNFiNiT!, which was first shipped in 1989. Just about every remote unit on the road has one. Common configurations would find a 68060 processor with Transform II board and a three-channel mix buffer, a 230 MB Zip, and/or 1 GB Jazz drive. It is used for most sports productions. The notable exceptions are ESPN's Sunday Night Football and ABC's Monday Night Football, which use Chyron's newest CG and still store, the Duet and Aprisa. The iNFiNiT! is used to produce most of the lower-third graphics. It uses proprietary hardware, operating system and application software. Although not used in truck environments, Chyron did begin offering a Windows client (WiNFiNiT!) in 1997 that runs on a separate PC and controls the iNFiNiT! via Ethernet.

Most of the network productions call for an SGI Onyx2, or SGI's scaled-down O2 visual workstation running VizRT (formally Peak Everest and RT-SET) Discreet, or Sportvision software. These are real-time animation applications that run on IRIX, which is SGI's implementation of Unix. SGI developed and helped standardize a common set of application-programming interfaces (APIs) known as Open Graphics Library (OpenGL). These APIs are, in essence, applications that sit between the real-time applications that are OpenGL aware and the OS. Calls to an OpenGL API result in calls to an IRIX API. This allows for a common way of creating and manipulating graphics independent of the underlying OS and hardware. The applications OS and hardware just described are used to produce the "Fox Box," which is the little upper-corner score, down and yards graphic. No matter which network uses this type of graphic, its nickname has become the "Fox Box." Fox has actually reformatted the box to look like a ribbon across the top of the screen. The Onyx2/O2 is used for all those snappy little real-time animations where flags, time outs and first downs fly in and out. It also is used for scoreboards that fly together and then apart. It takes a lot of processing horsepower to perform these complex graphics in real time. The SGI hardware is based on 64-bit MIPS RISC processors. In the graphics display part of the O2 system, an integrated 32-bit, double-buffered (one buffer to air while the other buffer is filling with the next frame of video), OpenGL graphics engine renders very high-quality images for display at up to 1280x1024 pixels at 75 Hz.

The Onyx graphics engine consists of three sub-components. The first is a Geometry Engine, which has a model of the graphic in 2D or 3D. An object modeled in 3D can be made to spin, tumble or appear to be stationary as the viewpoint moves. Objects, which can be text, pictures or banners, are stored and manipulated separately. They are brought together, or composited, only when needed for output. This allows graphics to be constructed only as templates. The template is a framework to hold pointers. These pointers point to one or more Oracle-type databases that contain the actual objects. Thus the player line-up graphic, whose format doesn't change game to game as the players do, stays essentially the same. The template for that graphic might hold only pointers such as quarterback and halfback, which point to a database record that contains additional pointers to such fields as QB_picture, QB_name, QB-stats, etc. This second set of pointers would be the variables that change every week, or even at the last minute. The operator would sit at a PC or a laptop, running a thin client that would be used to input changes such as distance or down, and then send the command via LAN to the SGI system. The system would then perform the transitions from old info to new.

In addition, data streams such as game clock, which are often wrapped in TCP/IP, can also arrive into the same box. Thus the graphics box would have sockets open to the operator's PC and the device providing the clock data via a couple of sockets.

Sockets are a method for communication between a client program (such as the operator's control application) and a server program (the graphics applications running on the graphics box) in a network. A socket is defined as "the endpoint in a connection." Most OSs today have API calls that support sockets. Calls to these APIs prompt the OS to open threads (separate processes that wrap outgoing data or unwrap incoming data in the necessary protocol to send the data to the appropriate recipient). Often, the wrapping is a few layers thick. The most common way to initially wrap the data is Transport Control Protocol (TCP), which is a service that lets the receiver put the data back in order (because some packets might take longer paths than others from point A to B), and makes the recipient return a receipt verifying that the data arrived intact. The next layer would be Internet Protocol (IP). It provides the addressing that allows routers on the network to push the data towards the receiver (small networks would not need routers). The third wrap or layer would be the information necessary to traverse the local Ethernet, either to a router for travel onto another LAN or out to the Internet, or, if the receiving device is on the same LAN, straight to the device.



Color announcer draws on stylus touch pad overlaid on a monitor. This used to be performed with a light pen. The key is generally performed with a Chyron Codi.

The second SGI graphics component is the Raster Manager, which takes the calculations from the 3D geometry engine and creates a 2D raster. This block does all the pixel operations, color and transparency blending, texture mapping and multi-sample anti-aliasing. It must perform these operations at real-time rates.

The Raster Manager hands its output to the third graphics component, the Display Generator, which converts the digital data into the desired analog or digital format. The internal bandwidth of the Onyx2/02 is greater than 6 GBytes/s, so the box can handle SD or HD video.

The blur between graphics and storage continues to grow. Pinnacle Systems is the main graphics package being used by NBC at the Olympics, by CBS in the U.S. Open Tennis and their NFL A game, and by TNT at the Goodwill games. Pinnacle products use Microsoft NT as their OS. Pinnacle has a family of products that treats graphics as a collection of objects. A composite graphic is made up of objects. These objects are stored separately but related to other objects that come together to form a composite or complete video signal only when desired. An object, which could be a block of text, a picture (animated or still), or a background, can be modified individually. Templates are created that bring the required objects together to create a composite output. What is interesting about this approach is that the objects, such as the network's "bug," a banner, or an animated background, can be created on one graphics machine and be made available to other machines. These objects are shared and transferred between machines via an Ethernet LAN. Two machines simply open a socket connection between each other.

CGs are not the only devices that deal in objects. Pinnacle's DVEs, still stores and even their servers deal in these objects. This means that stills or video clips can be modified remotely by changing a centrally controlled object. In this way, the whole still or clip doesn't need to be replaced, just the changed object. This concept allows objects to be created and edited on laptops, perhaps by a graphics person sitting at the airport waiting for a flight. But, more likely, the changes will be made on desktops back at the network and downloaded over the Internet by the truck crew once on site.

Chyron, which introduced the broadcast character generator, is still a major player in Graphics. ESPN and ABC use the Chyron Duet – the replacement for the iNFiNiT! – for NFL games. The Duet (and its family of surrounding products like the Aprisa) also treats composite graphics as an associated group of objects. The Chyron application running on the Duet is Lyric. Lyric is a text, animation and graphics authoring software and contains features such as the animation tool and clip playback device used for creating Monday Night Football's promos, lineups and animated 3D bar charts. The Duet can even have a digital disk recorder installed in it. This allows for a single-channel clip player in the CG with its storage via a SCSI drive. While the user-interface application on a Duet rides on top of NT, the Chyron's graphic engine uses VXWorks, which is a real-time operating system. NT passes the OpenGL-requested tasks off to VXWorks. OpenGL is a part of Lyric.

In a few years, the graphics effort grew to include impressive graphic displays and animated moves – with sound effects.

ESPN and ABC also use Chyron Aprisa for the NFL. The Duet controls the Aprisa 300 systems, which provide Sunday/Monday Night Football directors the flexibility to include animated clips for the Aprisa. During the game, the stand-alone Aprisa 300 systems are used to play back network-promotion material as well as full-screen, rendered

graphic elements. The Aprisa can also run a scaled-back version of Lyric, which allows editing of objects residing on it. The Aprisa comes in a number of variations. The 100 is like the still stores we have known. The difference is an integrated content- and asset-management

Fox box in upper left corner provided by SGI O2, lower banner provided by Chyron Infinit!, and Sportvision's first-and-ten line provided by SGI equipment. The score in the upper right is a linear key, usually provided by a Digital PC Codi.

database that can manage content across the other Chyron still stores, CGs and servers. The 200 adds a DDR to the 100's capabilities. The 250 is a 200 that has two channels, which can be any combination of clip player, still store or one of each. The 300 adds internal transition effects.

Another item in the graphics racks is the Chyron Codi Telestrator, with a 15" flat-panel touch screen located up in the announce booth that lets the color announcers (John Madden being the most well known) doodle on the screen. Companies such as Sportvision and PVI are now offering systems that use chroma inclusion/exclusion techniques developed for their first-down line to key the drawing in such a way that it appears to be under the players and officials.

Some B games and local college games use a Chyron Maxine, which produces a basic Fox Box without animations.

The four common still stores found on trucks:

Accom (formally Abekas) A-42 still store, the senior member of this family, has been around for nearly 18 years.

Pixel Power Collage still store/CG

Leitch Stillfile

Leitch DSF 3121 four-channel Stillfile

In games where the game clock must still be shot with a camera, older Abekas A-53s are still occasionally used for clock positioning. Many trucks also have a Leitch Logo Compose for bug insertion.

Grass Valley Profiles are used for game bumpers and transitions into and out of replays. Two channels are required for video – one provides a key signal and the other the video fill. Two channel of audio are also used for the audio that now accompanies these transitions. The graphics are usually built back at the network by their graphics departments.

Whereas game statistics used to be collected, compiled and interpreted manually, today a lot of the stats you see on screen and stated by the announcers are created automatically. One company that does this is SportsMEDIA Technology Corp. They perform data integration and distribution services and provide a central place to keep stats. What this means is that raw data generated during a game, such as scores as determined by the official scorer and official time-clock information, are fed into a proprietary database. However, the score is often entered manually to allow for timely updating of the score because most automatic systems won't display a score until it is official. Other game activity is also entered manually into that database. But SportsMEDIA's database can be used to automatically fill template pages created on a character generator. The CG is set to automatically request data updates as records in the database change. In this way, the CG will automatically update its display as the official score, time and other information changes.

One of the most interesting graphics overlays today is the first-and-ten line. Two companies provide these systems, and they are indeed systems. CBS uses systems from PVI, while Fox and ESPN use systems from Sportvision. The Sportvision system comprises four SGI O2s. The system gathers very accurate camera pan/tilt-head and zoom-lens telemetry, which is generated by a Sportvision modified Vinten head. The collected data is sent via a microphone channel down the camera triax. From the camera's CCU, it is sent to a Sportvision computer called the gather PC. The gather PC sends the compiled pan/tilt-head data to a computer called the FIO. This is one busy processor. It contains a virtual map of the playing field, and makes the geometry calculations to determine where the first-down line is in 3D space. This computer also accepts data from another PC called the matte PC. The matte PC operator decides what colors in the video are to be keyed over, and what colors can't be keyed over. The operator will have to make subtle changes as field, sun and uniform conditions change. In the case of an indoor game, this position is often a set-once-and-forget proposition. The FIO computer must do one other computational operation: It must recognize which camera is on-air. It does this by comparing video fed into the system vs. the video from cameras equipped with the modified heads (usually the three-up cameras at both 20-yard lines and the

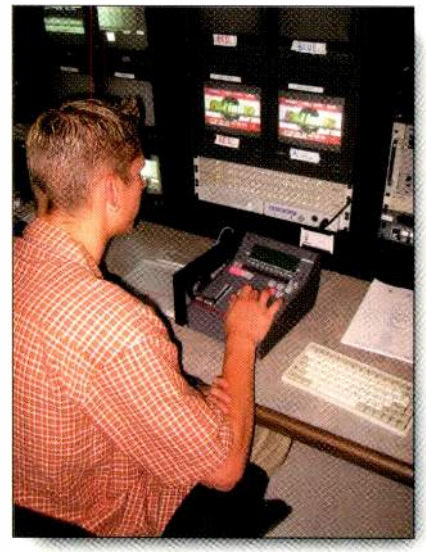
The tape compartment in the Supershooter 18 - the Fox A unit. Photos by NicholasTraub Photography, Pittsburgh, copyright 2002.

50-yard line) to determine which camera's telemetry to use. This approach was taken instead of using tallies because the Sportvision equipment is installed downstream from the switcher, and, because of convoluted video paths from sources to switcher, it was felt that cameras couldn't always be guaranteed a tally signal.

The output of the FIO computer is data, which indicate which pixels to write to depict the first-down line. The render PC processes this data, and its output is the key and fill signals for the line. These signals go to a keyer. This process takes 22 frames in NTSC (or SMPTE 259) time. To compensate for this, the dirty video out of the switcher is delayed via a Sierra Video Digilinx and then fed as the background signal to the first-down-line keyer. There is a second operator, the lead operator for the system, who turns the key on and off based on director input. A third operator is upstairs in the booth. He communicates to the lead operator where the first-down marker should be placed.

In the case of PVI's system, the line is added upstream from the switcher. PVI's system also collects pan/tilt-head telemetry and sends it to a box they call the Elvis. This is a proprietary box based on VME-bus technology. The PVI approach is heavily hardware based. This results in only seven frames of processing delay. A second PC running a user-interface application controls the Elvis. PVI's system requires three people to operate also.

When it comes to sheer size of a remote production, nothing compares to the Olympics. The Winter Olympics is no exception. In some ways, the Olympics is like an NFL Sunday, but continues every day for nearly two weeks. Just like NFL games, all the various venues need to be transported back to a broadcast operation center (BOC), processe and sent on to the required destinations. The host broadcaster must make every event available to various broadcasters around the globe. In addition, many broadcasters add their own capability to the mix. NBC, the U.S. broadcaster, adds a significant amount of infrastructure, much of it for their graphics packages. This system is centered around a central server that is a repository of stills and clips created by Quantel Henrys, HALs and Editboxes, plus Apple G4 Macs running Adobe After Effects. The Apple G4 Macs are used to create special effects and elements that are composited in a Henry. NBC Olympics and Proximity Corp. developed this central-server concept. Thus, the initial creation of graphics occurs in Quantel and Apple equipment. The newly developed central server makes the various graphics content available to CGs and still stores at the various venues. NBC is using Pinnacle Fx Deko IIs with ClipDeko internal clip players and Pinnacle Thunder XL four-channel clip/still stores.



An EVS slow-motion control in a production truck. Photo courtesy EVS.

The IDS Corp. will provide scoring and event timing data for automatic display. Chyron Codis will input and display event timing data, while results data will be fed into each Fx Deko II at the venues covered. As with football, graphics templates or beds were built by the network – in this case, NBC – in New York.

The two new major items at this year's Olympics are Proximity's "Xenoclip" clip translator and the "2 ME Box." The Xenoclip system allows NBC to translate clips produced on Quantel gear and put them in a data format that is immediately accessible to all character-generator and still/clip-store gear – not just stills anymore, but the ability to unify all clips into one format accessible to all. The "2 ME Box," produced in collaboration with Pinnacle Systems, allows NBC to have a centralized storage area that contains all the clips translated by Xenoclip. They configure all the Fx Dekos and Thunder XL units to have the "2-ME" setup as a locally attached drive. This provides the ability to drag and drop clips from this server to a local drive (giving it instant access to playback). All venues are connected to the graphics section of the IBC using either ISDN or T1 lines. This provides the venues this drag and drop ability as well. After Xenoclip translates the clips, they are sent to the "2-ME," where anyone, whether local in the IBC or distant at a venue, can acquire either still or moving images for playback.

A significant portion of many remote-production efforts today is graphics. One major network worried as long ago as the mid 70s that graphics would distract the viewer. Today the viewer often gleans as much from visual information presented with the action as the dialog presented by the announcers. The graphics area will continue to expand as many players in the graphics realm are leading the foray into interactive television (ITV). The information gathered and displayed as television signals can now also be "re-purposed" for shipment to "Web servers." As ITV-aware set-top boxes become available to DTV viewers, the ever-growing graphics "engine" deployed in these boxes will generate the data that provide the viewer's interactive experience.

Jim Boston and George Hoover are in the process of writing a book about the remote-truck industry. They have established a Web site to promote this project. If you have anecdotes or other information that you think should be in the book, please visit www.remotetruckbook.com. BE

George Hoover is senior vice president and general manager of NEP, and Jim Boston is a West Coast consultant.

Olympic Players

BY LARRY BLOOMFIELD

Listed below are some of the companies providing equipment and expertise for the 2002 Winter Olympics. While space here does not permit a complete listing, you can view the entire report on the *Broadcast Engineering* Web site, www.broadcastengineering.com.

Accom will provide two turnkey equipment packages incorporating the Abekas 8150 Digital Vision mixer with Dveous digital video effects. The equipment will be used by the Finnish broadcaster YLE and the Norwegian broadcaster NRK.

A complement of HyTRON 100 batteries and InterActive 2000 PowerChargers from Anton/Bauer will be used in portable cameras and Ultralights for remote events.

Canon will be the exclusive lens supplier for NBC's coverage of all Olympics through the year 2008.

The Clear-Com Q700 programmable, frequency-agile UHF wireless intercom will supplement communications systems for the Opening and Closing ceremonies.

DNF will provide their DMAT and ST300 slow-motion controllers.

Dolby Digital 5.1 sound tasks will be provided through the DP562 digital decoder. Dolby Surround will be handled by the DP563 encoder.

Editware's DPE-551 hybrid editor will be used in some edit suites in the Salt Palace Convention Center. The controller incorporates Graham-Patten's D/ESAM IV protocol.

Evertz Microsystems will be supplying several key products including the 8010-SIE vertical interval SID encoders and Evertz's HD test generators, downconverters and distribution amps.

Fujinon lenses are used on several of the mobile trucks including National Mobile Television, Southwest Television and Corplex Television. Corplex will also use Fujinon's OS-TECH image stabilization adapter at some locations.

At least 16 Graham-Patten D/ESAM 8000s are located in various edit rooms.

HDNet will provide the 1080i HD feed, which will be delayed 24 hours. The network is using Ampex and Sony servers, and a Snell & Wilcox switcher fed by Sony cameras. The new Sencore TS3030 HD server will handle the delayed playback. Packaging the digital program material will be Divicom and Tiernan encoders.

Microwave Radio Communications and Northwest Communications Systems are supplying some affiliates with CodeRunner equipment for live coverage of the Olympic torch relay.

At the heart of Olympic coverage will be more than 250 DVCPRO50 recorders, 50 digital cameras and more than 900 monitors from Panasonic.

A competitor skates at the World Single Distance Speed Skating Championships in the Utah Olympic Oval. ©2001 SLOC photo by Laura Schaffer. Photo courtesy Panasonic.

Key Panasonic equipment includes: AJ-D910WA 2/3" DVCPRO camcorders; AJ-D960 DVCPRO50 studio editing, slow-motion VTRs; AJ-D950 DVCPRO50 studio editing VTRs; AJ-LT95 DVCPRO50 laptop editing systems; AJ-D940 DVCPRO50 studio players; AJ-D95DC DVCPRO50 portable AC/DC VTRs; AJ-HD3700 multiformat D-5 HD VTRs, AJ-D610WA 16:9/4:3 camcorders, a total of 35 Ramsa sound systems at 14 different locations and 16 Astrovision giant displays.

Pinnacle Systems has supplied the Thunder and FX Deko II systems.

Several flight packs will feature Ross Synergy digital production switchers and RossGear terminal equipment.

Snell & Wilcox will provide much of the standards conversion equipment necessary to feed broadcasters outside North America. Seven Network Australia will employ a Snell & Wilcox Alchemist Ph.C TX standards converter. A Snell & Wilcox Mach 1 will feed C7, Australia's cable sports network.

The 2002 Winter Olympics will rely heavily on Sony's new MVS 8000 production switcher. Three 8000s will be used, two for live feeds from the International Sports Broadcasting complex and one for post work.

Telecast Fiber Systems will supply the Viper II modular communications platform and Adder multiplexers. They will be used to provide coverage of the Opening and Closing, as well as the alpine skiing, snowboarding and freestyle aerial events at the Park City Mountain Resort, Snowbasin Ski Area and Deer Valley Resort.

Telex is providing a 464-port RTS ADAM intercom system, complete with their custom "Override IFB" feature.

Thomson Multimedia will supply 10 LDK 23HS MKII high-speed super slow-motion cameras. They are also providing their "Service Pit Stop."

Vela is providing their IDS line of integrated, inter-networked distribution products. Included in the package are Vela analog and digital video DAs, monitoring equipment and software.

For more information on the equipment in use at the Olympics, go to www.broadcastengineering.com. BE

Larry Bloomfield is a consultant in the broadcast industry.

CENTRALCASTING: No Benefit Without Risk

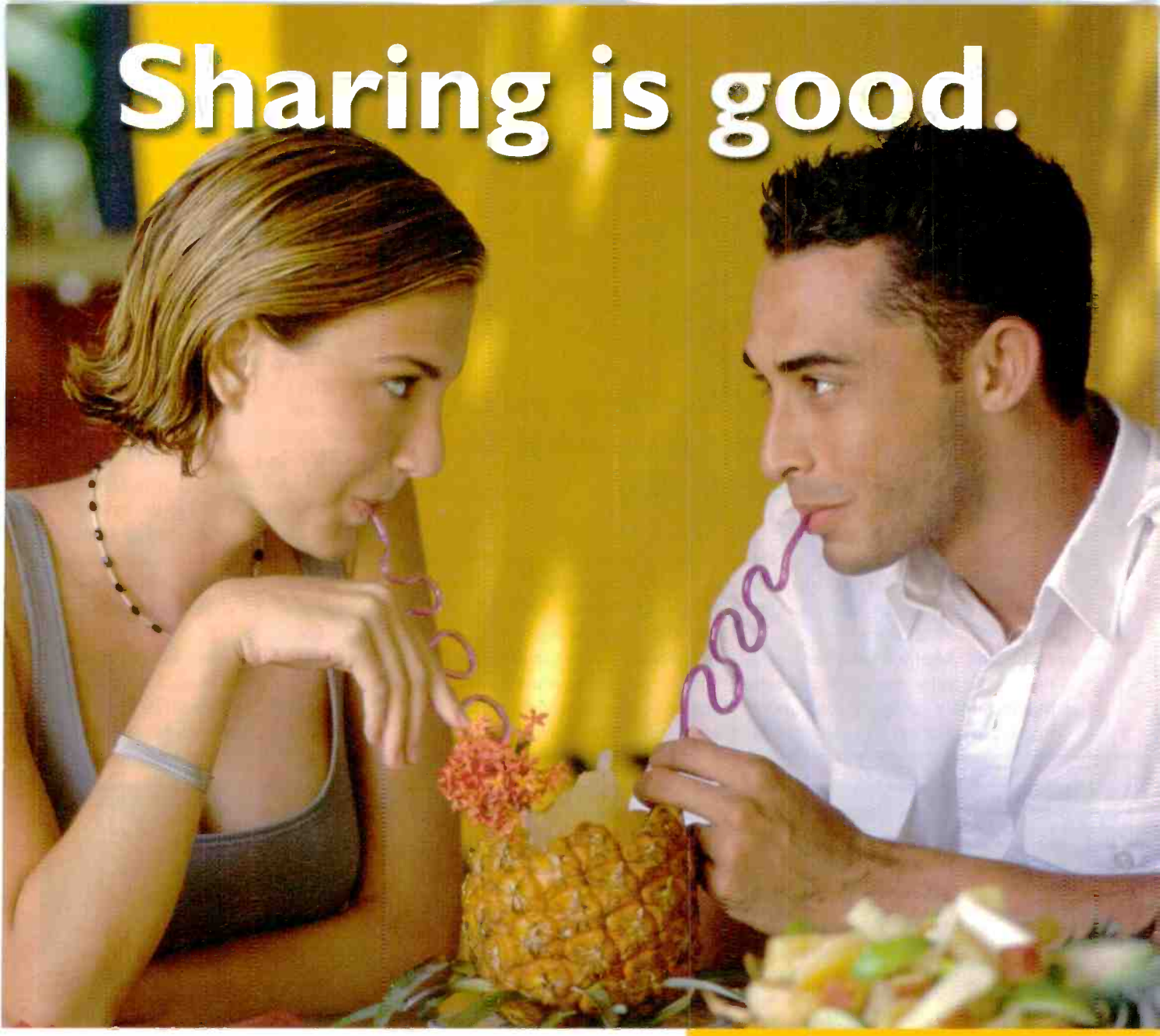
BY JOHN LUFF

As stations seek cost effective ways to interconnnect facilities for content sharing and centralcasting, IP and Ethernet technology are increasingly being tried. Last summer, KCTS-TV, Seattle successfully transmitted a real-time, multiple-program digital stream from Spokane to Seattle via an Ethernet connection. Shown here is the KCTS-TV control room. Photo courtesy Harris.

Broadcast stations used to be largely autonomous. Some still are. Managers of local stations can easily make local decisions on programming, advertising, personnel and all other questions that must be reviewed daily to keep a transmitter on the air. But the economics of broadcasting have dramatically and irreversibly changed. The combined effects of falling revenue and rising costs have tipped the scale permanently towards less autonomy for all stations, whether they are part of a group or not. Ad revenues have fallen steadily for an uncomfortably long time. Networks are considering reverse compensation to stem their own altered economics. Unfortunately, all this has happened in an era when the FCC has granted the broadcasters' wish to have an extra channel on which to broadcast HDTV (or other services as finally authorized).

Every month, boardroom conversations consider ways to improve economics for broadcasters. Some broadcasters postulate that centralization, commonly termed centralcasting, may be the only way to save local broadcasting from imploding in the jaws of the economic vise it is caught in today.

Centralcasting, or more generically, centralized operations, can increase cash flow and help balance the balance sheet. But it involves making careful, sometimes difficult, choices. Experts



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CENTRALCASTING: No Benefit Without Risk

who have studied centralized operations liken these choices to picking fruit from a tree. The low-hanging fruit represents the easiest changes to implement, the higher fruit more difficult – and some fruit may be out of reach. When broadcasters think of centralcasting, their concept is often limited to creating a common master-control operation for stations with common parents. But there is other, lower fruit to consider first.

Centralcasting may be the only way to save local broadcasting from imploding in the jaws of the economic vise it is caught in today.

One candidate for centralized operations is the traffic department. Before today's highly computerized operations, a station's traffic department worked hard to output a log from paper records. Now, the staff is decidedly smaller and the work highly automated. By centralizing traffic, a group owner can marginally reduce the number of people required to keep multiple stations operating, and the relatively low bandwidth required to connect a local sales operation to central traffic makes it quite economical.

Only slightly higher up on the fruit tree is the promotions department. Often, the promotions department bargains hard to get the personnel and capital resources needed to do a good job of promoting the station. Computer nonlinear editing and production systems have made sophisticated spot creation less expensive, but the creative individual is no easier to find or cheaper now than in the past. Centralizing promotions also comes with a little penalty in distribution cost. If the central promotions department is created as part of a broader interconnection, the distribution may come nearly for free.

Above the low-hanging fruit lies the potential for large savings over the long haul. The true redundancy among broadcast stations varies with factors that are principally tied to the overlap of the individual programming grids. If all of the stations to be centralized have the same network affiliation, it seems logical that redundant processes can be centralized.

One of the approaches first used was based simply on remotely controlling the station from a central site, but not moving any of the video hardware or

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CENTRALCASTING: No Benefit Without Risk

content to a central repository. Using software like PCAnywhere, or a remote-desktop control built into Microsoft's free NetMeeting conferencing package, it is easy to see how you could simply remote the display from the automation system to a central site and eliminate the local person watching the screen for errors. When coupled with a return path for low-bandwidth video and control/status on the transmitter, this approach seems to be the least capital-intensive topology possible.

Of course, with low cost comes tradeoffs some stations will find unacceptable. If the connection to the remote PC is lost due to a power failure, the process of restoring control, perhaps even programming, might not be quick. With few, if any, eyeballs watching the store at the local station, minor problems that might be solved in a couple of minutes by a skilled operator become much more complicated.

At the other end of the spectrum lies a fully centralized facility in which a local station without news programming might consist of nothing more than a

Master control operations at KGET-TV, the Ackerley Group's NBC affiliate in Bakersfield, CA. The station provides centralcasting for itself and three other stations. Photo courtesy KGET.

connection to the transmitter and the return status that is required in all interconnection topologies. This allows the local station to avoid any renovation as equipment wears out. And, if the interconnection bandwidth is high enough, the full ATSC DTV signal can be sent from the centralcasting site. If the DTV stream contains a copy of the NTSC programming, it is possible to decode that stream from the multiplex and convert it to NTSC at the transmitter site, reducing the bandwidth to no more than 19.3 Mbits downstream, and perhaps 1.5 Mbits upstream. The central site can provide a level of N+1 redundancy that the local station might not be able to afford, since spares are spread across a larger capital base.

Full centralcasting works best when the stations all are of one network affiliation, since one program stream could be concatenated and only interstitials would vary. But that's a pretty idealized case, to which any owner of multiple stations will attest. Thus, the probability is that a unique program stream is assembled for every station and some of the redundancy the

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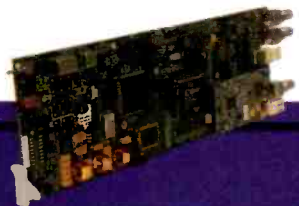

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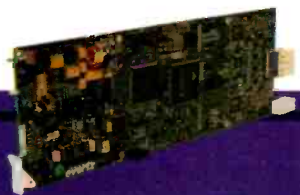

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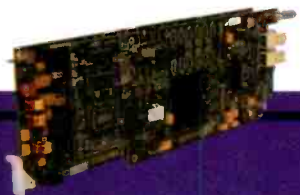

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Centralcasting comes in many flavors and should not be thought as just another way to get rid of people. In fact, centralcasting technology may be the only way some communities can be served by small staffs. Photo courtesy Harris.

centralcasting site could enjoy is lost, requiring more hardware.

Centralcasting has its own Achilles' heel. The cost of interconnection is the combination of local access cost to a high-bandwidth network (local loop), and the long-haul interconnection circuit (often inter-LADA). WAN circuits with the appropriate quality-of-service guarantees and sufficiently robust disaster-recovery provisions can be expensive. High-quality video can be transmitted in as little as 6 Mbits/s, but full-time 6 Mbit circuits are hard to book unless one uses DS3 service (nominally 45 Mbits/s). The excess bits cost the same as the fully occupied ones, wasting money.

Packetized transport, like ATM, offers potentially flexible WAN bandwidth. Some argue that ATM is inappropriate for dedicated video service. While it might suffice to note that FOX Sports and others use ATM on a permanent and full-time basis, the engineering arguments should not be ignored. Confusion about the suitability of ATM begins with its ability to deliver isochronous video, i.e., with deterministic delivery. However, ATM adds other features that are potentially useful in centralized operations, including multicasting the same packets to multiple locations, a wide variety of standard computer-industry interfaces, and interfaces designed specifically for converting video data types to ATM.

Another variation on the centralized operations theme stands with one foot in both camps. Distributed broadcasting, a technique that requires careful evaluation by competent personnel, holds the promise of reducing labor to the same extent as centralcasting, but does not necessarily play all programming from the central site. The probability is high that the station has equipment in place to receive and air network programming without receiving it from the hub site. Taking advantage of that existing hardware may reduce the bandwidth requirements in the WAN. Such an approach requires that

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some of the programming plays from the distributed broadcasting site and some plays from the station. While complex, this approach allows distributed servers to move media efficiently between sites in the background using FTP or other techniques under automation and asset-management control.

If all television was recorded and played under automation control, all of these strategies would work well. But what seems simple becomes potentially difficult when considering live events. In the centralcasting-hub case, it may be necessary to have multiple operators on duty during peak sports times. Networks have a habit of regionalizing networks, and football teams don't coordinate their plays to fit into a standardized model for inserting commercials. A hub that sends out signals to FOX, NBC, ABC and CBS stations might find a situation quite impossible for one operator to handle, though one operator could arguably control most normal programming on over 10 stations.

As the number of combined stations rises, the potential total capital-cost reduction rises, but not exactly at the same rate. As the number of streams at risk rises, the level of redundancy needs to rise to avoid the catastrophic case of many stations going off the air due to a single failure. It seems unlikely that many broadcasters would have the capital to take such an approach; at least until operations have proven successful for a while and net savings have accumulated. But the savings in capital cost have to be looked at over years. With depreciation on an aggressive five-year basis, a 20 percent savings nets only 4 percent of that amount to the bottom line per year. While the total is important, the boardroom will not see that 4 percent as worth much risk. The real savings are in human resources, traded against the cost of interconnection. This is where the rubber truly meets the road in centralized operations. If the approach you take can save sufficient personnel to overcome the cost of interconnection by a wide enough margin, you will have a persuasive case.

It is worthwhile to note that centralized operations is a fundamental shift in the business operations of the company as well. Broadcasting essentially has been a local business since radio began over 70 years ago. In the last few years, radio has moved aggressively to centralized operations, and the once-marginal local-radio business has returned to profitability. A change at the root of television broadcasting may well achieve the same result. But it will take years to fully explore the quirks in the factory operations required by centralized operations, years to minimize risks and years to see the full benefit of centralized operations come to fruition. BE

John Luff is vice president of business development at AZCAR.

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Consumers' new high-definition TV sets are dependent upon PSIP tables to find broadcasters' digital signals. Photo courtesy Zenith.

A Broadcasters' Guide to PSIP

BY JERRY C. WHITAKER

Although proper implementation of the DTV Program and System Information Protocol (better known as PSIP) at the television-station level is not particularly complex, neither is it straightforward. Broadcasters have voiced their need for simplified information regarding the implementation of PSIP Standard A/65A. To this end, the ATSC is developing a draft Recommended Practice to explain the operator-oriented elements of PSIP and to provide practical examples of typical station operation. The draft document will also provide guidelines that should allow designers of PSIP-related hardware and software to prepare clear operating instructions for the users of such equipment.

PSIP is the glue that holds the digital television signal together.

Inside PSIP

PSIP is the glue that holds the digital television signal together. Although PSIP is a voluntary standard of the ATSC, and the FCC only requires parts of the standard, it is, in fact, a requirement in terms of actual real-world operation. In most locations, multiple DTV stations can be received — in some cases, from multiple markets. The PSIP protocol was developed with these real-world situations in mind.

PSIP is a small collection of tables designed to operate within every transport stream (TS) for terrestrial broadcast of digital television. Its purpose is to describe the information at the system and event levels for all virtual channels carried in a particular TS. Additionally, it may incorporate information for analog channels as well as digital channels from other transport streams.

There are two main categories of information in the ATSC PSIP Standard: system information and program data. System information allows navigation and access of the channels within the DTV transport stream, and program data provide the information necessary for efficient browsing and event selection. Some tables announce future events and some locate the digital streams that make up an event. The PSIP data are carried via a collection of hierarchically arranged tables. Figure 1 shows the primary components and the notation used to describe them. The base tables are:

- System Time Table (STT)
- Rating Region Table (RRT)
- Master Guide Table (MGT)
- Virtual Channel Table (VCT)

The Event Information Tables (EITs) are a second set of tables whose packet identifiers are defined in the MGT. The Extended Text Tables (ETTs) are a third set of tables and, similarly, their PIDs are defined in the MGT.

The System Time Table is a small data structure that fits in one transport stream packet and serves as a reference for time-of-day functions. Receivers can use this table to manage various operations and scheduled events, as well as to display the time of day.

The Rating Region Table transmits the rating system in use for each country using the ratings. Provisions have been made for multi-country systems.

The Master Guide Table provides indexing information for the other tables that comprise the PSIP Standard. It also defines table sizes necessary for memory allocation during decoding, defines version numbers to identify those tables that need to be updated and generates the packet identifiers that label the tables.

The Virtual Channel Table, also referred to as the Terrestrial VCT (TVCT), contains a list of all the channels that are or will be online, along with their attributes. Among the attributes are the

channel name and number. This table is critically important as it contains the set of data that enables a receiver to tune and locate the service being broadcast. The VCT is essentially a list containing information about each service that a broadcaster creates (or has announced that it will create) within the DTV major channel assignment, as well as information about the broadcaster's associated analog channel.

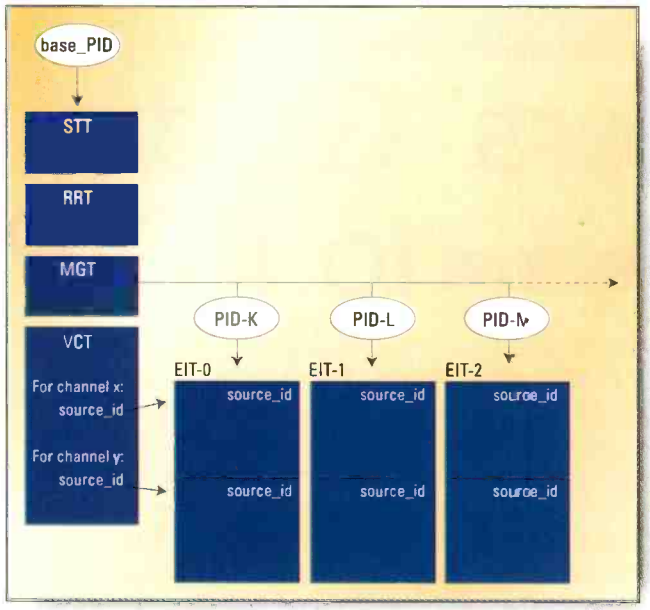


Figure 1. Overall structure of the PSIP tables

There are several Event Information Tables, each of which describes the events or television programs associated with the virtual channels listed in the VCT. Each EIT is valid for a time interval of three hours. Because the maximum number of EITs is 128, up to 16 days of programming may be advertised in advance. At minimum, the first four EITs must always be present in every transport stream, and 24 are recommended.

Basic PSIP requirements

The three main tables (VCT, EIT, STT) contain information that makes it easy for suitably equipped receivers to find the components required to present a program (event). Although receivers are expected to use stored information to speed channel acquisition, sometimes parameters must change. The VCT is the table that must be accurate each instant because it provides the actual connection path. If nothing has changed since an EIT was sent for an event, the anticipatory use of the data is expected to proceed. When there is a change, the new parts would be used. These relationships — and the tables that carry them — are designed to be kept with the DTV signal when it is carried by a cable system.

There are certain "must have" items and "must do" rules of operation. If the PSIP elements are missing or wrong, there may be severe consequences, depending on the type of receiver. The following are key elements that must be set and/or checked by each station:

Transport Stream Identification (TSID). The station must set the TSID correctly in all three locations (PAT, VCT common information, and virtual-channel-specific information).

System Time Table (SST). The station should check the STT time daily and lock it to house time.

Short Channel Name. This is a seven-character name that the station can set to any desired virtual-channel name. For example, WNABSD1, KNABSD2, WNAB-HD, KIDS, etc.

Major Channel. In most cases, the previously assigned, paired NTSC channel is the major channel number.

Service Type. The service type selects DTV, NTSC, audio only, data, etc., and must be set as operating modes require.

Modulation Mode. This parameter must be set appropriately.

Source ID. The Source ID is a number that associates virtual channels to events on those channels. Typically, it is automatically updated by PSIP equipment or updated from an outside vendor.

Service Location Descriptor (SLD). The PIDs identified here and in the PMT must be the same for the elements of an event/program. Some deployed systems require separate manual setup, but PIDs assigned to a VC should not change (unless there is a good reason).

continued on p. 85

Snell & Wilcox's System HD

BY RICHARD SCHILLER AND SPENCER BARR

As more TV stations begin to broadcast in high definition, an area that must be given careful consideration is interconnection. For the most part, TV stations use coaxial cable for SD transmission, driving signals more than 300 meters at the SD data rate of 270 Mbits/s. Once the shift is made to HD, however, the data rate is raised to 1.5 Gbit/s. At this rate, the maximum transmission distance over coaxial cable drops dramatically to a range of 100 to 150 meters, and then only if high-quality coax is used along with a suitable cable equalizer at the receiving end.

The restrictive transmission characteristics of coax at HD data rates make the use of optical fiber transmission very attractive. Two types of optical fiber exist: single-mode and multi-mode. Single-mode fiber has a very small (nine micron diameter) center core, which is used to carry the optical signals.

The worldwide adoption of a single-mode fiber-based solution by the telecom industry has seen many barriers of adopting high-speed optical networks considerably reduced. Widespread component availability at affordable prices is now a reality.

Snell & Wilcox manufactures a range of modular distribution products especially for the demanding world of high definition known as "System HD." These are far from typical as they can drive up to 150m of good coax cable.

Most high-definition products are limited to approximately 100m. Even this capability will not get you very far in a stadium, TV station or even in a large studio. For longer distances, fiber makes sense and often is the only practical alternative. Other considerations include fiber's immunity to electromagnetic radiation as well as its small size and light weight, both of which make it a fantastic signal transport medium.

The single-mode fiber transmitters in the Snell & Wilcox System HD modular enclosure can be supplied with one, two or four optical outputs like traditional coax distribution amplifiers. These multi-output variants are highly cost-effective for one-to-many connections. If the same signal is to be fed to two or more destinations, this is the way to go.

Up to 12 modules can fit into the Snell & Wilcox System HD, including transmitter, receiver and transceiver cards.

Widespread component availability at affordable prices is now a reality.

When designing the fiber system, you'll want to decide whether two signals should share the same fiber. Fibers are small, light and very easy to lay, so you'll want to install enough to cover any requirements. In fact, many people install extra unused "dark" fibers just in case. However, there are times when it is just easier for two signals to share a fiber. This is where Wave Division Multiplexing comes in. By ordering transmitters with different wavelengths (colors) of laser light, a combining rear connector panel can join two signals onto one fiber.

Though optical transmission networks provide superior signal handling characteristics to coax networks for long-distance/high data rate applications, they cannot work miracles. A poor quality electrical input signal to an optical transmission system will result only in a poor quality optical signal being transmitted. To simplify the design and installation, System HD's optical modules equalize and re-clock any HD electrical input signals before optical transmission and then re-clock the recovered electrical signals before distribution.

System HD provides comprehensive monitoring of many factors affecting the continuing operation of the system. These can be read locally or remotely using the Snell & Wilcox RollCall equipment monitoring and control system. On an optical transmitter module, for example, monitoring includes board temperature, input signal quality, the presence of CRC (cyclic redundancy check) errors in the video, the line standard and frame rate being transmitted as well as the laser device health status. It also can estimate the length of coax feeding its HDSDI input. BE

Richard Schiller is senior product manager, modular products, and Spencer Barr is senior design engineer for Snell & Wilcox.

IN ADDITION

Visit our Web site, www.broadcastengineering.com, for more discussion on the Snell & Wilcox System HD.

Miranda:
Networking the Network

BY LARRY BLOOMFIELD

In the early days of broadcasting, "the patch panel" was the only way to get sources and destinations changed that were otherwise hardwired to each other. It is difficult to credit the person who first came up with the passive mechanical patch panel, but they soon gave way to active devices that would permit one source to be delivered to multiple outputs. Thus, the routing switcher was born.

In the early days of broadcast routing, switchers just switched audio and video. More complex systems that would switch video, multiple channels of audio, time code and even machine control were soon developed. As digital became a part of the broadcast industry, and since all the bits representing each of these functions could be multiplexed together and sent down the same path, wiring became much simpler and easier.

One company capable of addressing all these configurations is Miranda Technologies, with their Network series of routers which offer a complete range of analog and digital, video, audio, high-definition and telecom routers in compact packages.

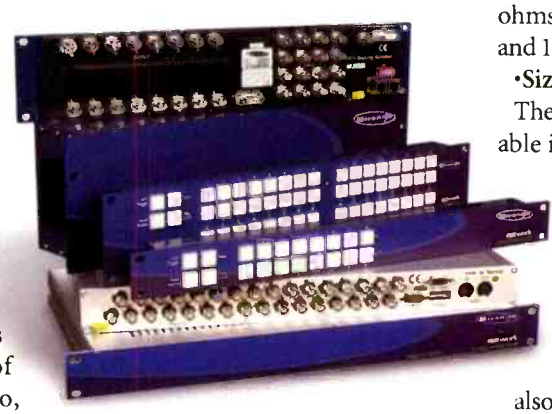
The goal in designing this equipment is to create a maintenance-free environment. Each router and control panel is equipped with its own local controller, thus ensuring overall system integrity and decentralizing the control of the system.

The routing switchers are compact so they can be easily mounted in the rear of a rack to maximize rack space. The routers can be configured for standard definition or high definition to meet each facility's digital configuration.

The routers offer eight levels of independent control. All models in the series can be combined with each other to form larger multi-level audio and video systems.

They feature a PC multi-user access control system, and single bus and X-Y control panels are also an option. The monitoring and control of the system is done by using iControl Web-based management software. Additionally, the routing switchers will interface with nearly any of the automation systems currently available in the broadcast marketplace.

Typical applications for today's modern routers go beyond the single station application.



The Miranda Network 8x8 serial digital router is capable of up to 360 Mbit/s with equalization out to 300m.

Making sure that nearly 200 stations get what they are supposed to, when they are supposed to, is no easy task. An elaborate router system, driven by a specialized automation system, has to be in place to accomplish this. After significant evaluation, NBC selected the Miranda Network 8x8 serial digital router as the backbone for switching their new digital Skypath system and the associated integrated receiver decoders (IRD) at their affiliates to the appropriate outputs.

The model router NBC purchased is capable of up to 360 Mbit/s with equalization out to 300m.

The Miranda Network series routers feature the following options:

•Formats

The Network series routers are available in wideband analog video (up to 250 MHz), analog audio, digital video (143 to 540 Mbit/s), DVB/ASI, HD from 143 Mbit/s to 1.5 Gbit/s, digital audio (balanced 110 ohms or unbalanced 75 ohms), telecom formats 34/45 Mbit/s and 140/155 Mbit/s, and in RS-422 data.

•Sizes

The Network series routers are available in sizes of 16x2 up to 128x2, 8x8, 16x16, 32x32 and 64x64.

•Control Panels

A variety of push button control panels are available in sizes of 8x1, 8x8, 16x1, 16x2, 16x16, 32x1, 32x32, 64x1 and universal alphanumeric X-Y. Panels are also available with an optional GPI/Joystick/Tally interface.

•Multi-Level Systems

All models in the Network series can be combined with each other to form larger multi-level audio and video systems.

For more information on routing switchers go to www.miranda.com. BE

Larry Bloomfield is a consultant in the broadcast industry.

VCI's STAR II+
Traffic System for Centralcasting

BY W. LOWELL PUTNAM

The centralcasting discussion most often revolves around master control operations and technology. This is mostly because consolidation of engineering operations offers opportunities for achieving immediate economies of scale. Of equal importance, however, is the consolidation of core business functions, including sales, traffic and accounting.

Broadcasters moving towards centralized operations should begin by evaluating the capabilities of their current traffic system.

Traffic system requirements

As the broadcast business continues to evolve, so must its supporting systems. Broadcasters moving towards centralized business operations should begin by evaluating the capabilities of their current traffic system.

Speed is one important element in a traffic system for use in a centralcasting environment because of the volume of data being managed and the number of users being supported.

VCI's traffic system is an option for broadcasters trying to meet the increased data management requirements of a centralcasting environment.

In addition, it should not be necessary to bring down the entire system for backups or spot placement. The system should be able to complete invoicing during normal operational hours without slowing down the entire system. Finally, the systems should allow for expansion of PCs, users and printers without performance degradation.

Reliability is also an important criterion. To increase reliability, the system should take advantage of standard and readily available hardware components, including redundant power supplies, disks and fans. There should be a reasonable balance between the level of redundancy desired and the expense of implementing it.

Another requirement is for the traffic system to provide a sophisticated automation interface. In the centralized operation, where master control is simultaneously supporting several individual stations, a highly automated environment is desirable to cut down on manual manipulation of logs. This improves productivity and reduces costly errors.

Integrated sales force automation is also key. Multiple remote sales teams need to be able to interact easily with the centralized operation. They should be able to manage their accounts electronically and have instant, real-time access to accurate inventory data. The traffic system should also accommodate different sales philosophies.

A traffic system should allow for as many data types as needed to support both clusterwide and individual station requirements.

It should also offer flexible reporting to meet unforeseen requirements. With centralcasting still in its infancy, it is difficult to predict the ultimate reporting requirements of any individual group, cluster or station. A modern traffic system should offer flexibility for both consolidated and individual station reporting.

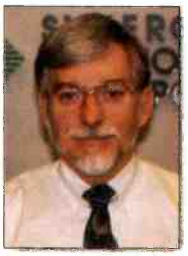
In addition, the traffic system should eliminate redundant data entry to the greatest extent possible and should support large volumes of data.

While an ultimate goal of centralcasting is to achieve economies of scale by consolidating common functions, broadcasters must be careful not to force a cookie-cutter approach on individual stations within a cluster. The system should offer complete flexibility to support unique program formats and sales practices. BE

W. Lowell Putnam is president and CEO of VCI.

News Editing:
Cut . . . and Paste?

BY JOHN LUFF

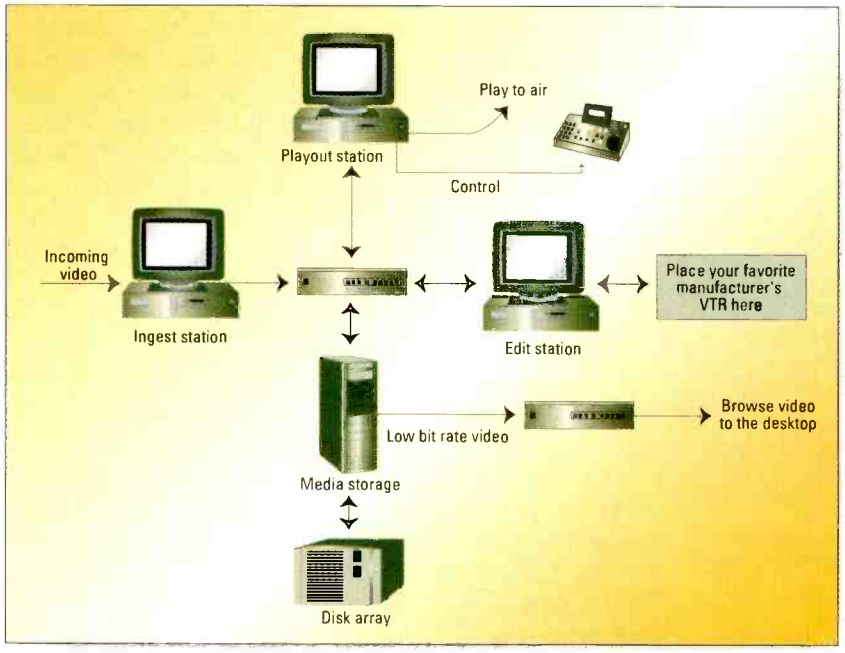


I have often wondered what percentage of all editing done for television, broadcast and non-broadcast is done for news purposes. Many of our broadcast clients report putting 75 to 100 cut stories on the shelf on any given day. Multiply by the number of stations in North America that produce news (my guess is over 85 percent of all TV commercial stations) and you get well over 100,000 news stories a week. Add to that the prodigious output of the 24-hour news channels and the thousands of broadcasters overseas and you arrive at some pretty staggering numbers – well into the millions per year. A typical story might have a dozen edits. If the worldwide output is what I think, something like a half a billion edits are done per year. That's enough to perk up the interest of anyone who sells equipment to that market.

Even more staggering, if you could make that output just 10 percent more time efficient think of the labor saved or, in economic times like this, put out of work. There are huge issues at stake for users and manufacturers. It ends up all being about workflow. How can you get pictures from a camera and sound from location and voiceover cut together coherently and prepped for air with both appropriate technical quality and an editorial approach that makes the media more compelling? At one time, broadcasters looked at news as part of what the Communications Act of 1933 required: use of the public airwaves "in the public interest, convenience and necessity." Today, the high motives have been joined by big money, and with big savings come profits that can be compelling. Margins are squeezed every day, so savings generated by workflow are highly valuable.

The bulk of edits in news stories are cuts, and few graphics are added to many stories. When breaking news is considered, it is almost always cuts only. When electronic editing was invented and news film was replaced by Umatic tape, broadcasters and networks found huge savings in both the cost of shooting crews and the cost of operation for news. Coupled with the immediacy of being able to air a story minutes after it is recorded to tape, the revolution that electronic editing created is quite incredible.

Margins are squeezed every day, so savings generated by workflow are highly valuable.



New editing systems offer broadcasters features not available in VTR-only systems, including a desktop browse system, so editors can view material as it is ingested.

Now we are on the verge of a second revolution. Computers are ideally suited for cut and paste editing of any kind of media object. We all discovered drag and drop editing for word processing years ago. Now, inexpensive hardware and fast processors are making the same simple process out of editing video. My home computer came with editing software and an IEEE 1394 interface for DV files and cost $900. In a stand-alone configuration it could easily replace one of two VTRs in a news editing suite and do so with nearly the workflow speed of the ubiquitous Betacam or DVCPRO editing suite that populates broadcast news by the thousands.

So why hasn't it taken hold? Two reasons: complexity and speed. Only recently have nonlinear editing systems for news become networked. True, there have been some attempts in the past to create systems, but they used expensive computers, high-cost high-bandwidth network hardware, and

closed proprietary interfaces. They also used an operator interface that was optimized for making editing decisions that you might want to change your mind about. They were not optimized for rapid news editing. Just the ingest process (capturing the content to the hard disk) was a drag on efficiency.

Now many systems can edit directly to the timeline. The VTR is controlled just like it would be in a VTR-to-VTR editing environment. At least one manufacturer permits the stand-alone VTR to control the computer! A "guest" editor who might be competent, indeed very fast, can sit down at such a system and use the "user interface" on the front of a VTR to edit with video stored on the hard disk of the edit system. While not the most efficient way to work, it allows for a more orderly transition for operators.

Some VTRs support high-speed transfer of media for these applications. Doing so can cut the time to load material into the editing environment by a factor of four. In the future we may see the VTR acting as an FTP device to the editing system.

Recently, the availability of low-cost networks to operate at sufficient bandwidth for such dense media as video have transformed the economics of networked news environments completely. The only items of video hardware that impinge on the process are the inputs and outputs of the system, including the optional VTR. The playout goes straight to the production switcher just like the output from a playout VTR would, and remote control panels that would be applicable to a VTR work just fine.

Among the savings is the maintenance of VTRs for ingest and edit. This can be a large cost to a station and one that requires everyone today to have excess machines, or be willing to shut down an editing booth when a VTR dies. The computer certainly can fail, but as the MTBF of the computer hardware is likely much higher and the maintenance cost much lower, the net operating cost can be a substantial savings.

One thing a network can provide that is not available to closets with VTRs is a desktop browse system. This allows producers, assignment editors, copywriters, reporters and others involved in the workflow to view material as it is ingested to plan the final story before they begin the editorial process. This is the same revolution that newsroom automation software has done for the copy side of news, and these systems will be considered in a future article in this column.

But beyond the simple review of low bit rate copies of the media, some of these systems allow editorial decisions to be made on the "skinny media," and automatically conformed on the "fat media." Imagine the change in workflow this can provide! When the producer moves to the edit suite he has already rough cut the material he wants in the story, allowing the editor to do the polishing he is best at, including mixing audio and packaging the final story for playout. By spreading the production process across more individuals, the workflow can be significantly improved.

It is possible with some systems to complete final versions ready for air without ever resorting to editing on special-purpose systems. For simple stories the crew might be only the reporter. One 24-hour news network has equipped its reporters with laptops that have editing software and hardware. By the time they return from the field the story may well be ready for air. Of course, the danger is that production values will decline without the skills of the professional editor. But these advancements allow the field kit to be a camcorder, fishpole and mic, and laptop. One could even see the transfer of cut stories via FTP directly to the media library, complete with metadata containing the script, graphics requirements, length and other pertinent information, over modest bandwidths when time is not critical. (Cell phone transfers? Maybe so!) BE

John Luff is vice president of business development for AZCAR.

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It is recommended that broadcasters set up a minimal set of three days of tables. The recommended table cycle times result in a minimal demand on overall system bandwidth.

Most common mistakes

Experience has shown that certain errors are common in many PSIP implementations. Typically, these problems include the following:

- Missing tables, specifically the STT and EIT.
- Major channel number set to the DTV RF channel number, rather than the associated (legacy) NTSC channel number.
- TSID set to 0 or 1, the NTSC TSID, or to another station's TSID; or it is not the same in the three required places.
- System time missing or set to 00:00:00 on 1/6/1980

Some receivers react to these errors by not tuning to that station.

About the VCT

Broadcaster must input essential station-specific VCT information to allow viewers to tune programs properly.

Because the VCT also allows each minor channel to be assigned a permanent short name and channel name, and since each minor channel will keep the same TSID, carrier frequency (zero or not), and modulation mode over time, the PSIP encoder-system software should allow the user to create a local look-up table that associates each minor-channel number with these fixed values. This allows the user to create new VCTs simply by entering the number of the minor channel he or she wants to include in the new VCT. The PIDs for each minor channel should not be changed unless the nature of the virtual channel changes, because it will likely increase the time it takes for the receiver to tune to the station.

Even though the station can permanently assign the TSID and other parameters for each virtual channel, the minor channels that the station is using may change over time. When a program on a new virtual channel is announced in the EIT, the PSIP standard requires that the VCT contain EIT VCT information, and vice versa. Because of this, it is recommended that broadcasters update the VCT first to reflect a change in the channel lineup and then use the appropriate source_id to construct the EITs.

A broadcaster can transmit a new VCT containing updated information at any time by increasing the version_number by one. However, since a VCT normally describes the channels in the same transport stream, if virtual channels are added to the VCT at arbitrary times they will not be detected by the receiver until it is tuned to that particular transport stream. For this reason, it is highly recommended that broadcasters add channels in advance (with the program_number set to 0) to give receivers the opportunity to scan the frequencies and detect the channel presence. This is one reason for programming three days of EITs for transmission. The system design assumes the receivers scan all RF channels at least once just after being turned off. For sets that are never turned off or that experience extended power outages, filling three days worth of EITs once a day should reduce the risk of not having information at the time of tuning.

Moving forward

To underscore the PSIP implementation challenge facing broadcasters, WHD-TV — the model station project sponsored jointly by CEA, NAB and MSTV — has released a report on current PSIP implementation issues. The report, dated Nov. 14, 2001, can be obtained from the MSTV Web site at www.mstv.org. BE

Jerry Whitaker is technical director of the Advanced Television Systems Committee, Washington, DC. The author wishes to acknowledge the work of the ATSC Specialist Group on Data Multiplex/Transport, which developed the draft Recommended Practice upon which this article is based.

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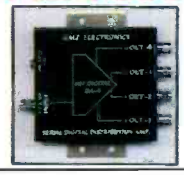

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The Value that is Left Behind

BY PAUL MCGOLDRICK

The importance of employee stock option programs in the world of electronics has never been questioned by those companies that want to attract and retain the best talent available in the field. The fact that such options have become almost ubiquitous for starting enterprises is a measure of both the success of such programs and their effectiveness as a control on the initial costs of getting a new business on its feet. Options are still not as widely adopted, or as generous, on the eastern seaboard of the United States, and I have been continually surprised by the near-naivete of many supposed leaders from that coast.

Not, of course, that options are always a real benefit. For example, we all probably know some people who exercised options in the year 2000 (when, if you remember, the markets were soaring), only to end up paying taxes on money they no longer had at the year's end: Tax traps abound in this area. And many people can look at the options they are holding today and see that the values are totally "upside down," making them similar to the position you will find yourself in if you try to get out of a 36-month car lease after only six months. Some companies have been recognizing that situation and, even with recruiting becoming a good deal easier, they have been re-evaluating their option programs for both new and existing staff to retain the best in their industries. They have also been revising stock purchase plans to take into account the long-term values that might have to be exhibited in today's economy.

Given the whole purpose of stock options (the chance for key, or sometimes all, employees to share in the wealth that they are helping to develop), it would seem to be rather pointless to deliberately shaft those employees at a later stage. But that seems to be happening more and more frequently as companies get close to the endgame strategy that has been devised, leaving the reputation of some of the executives involved in the garbage can while they recycle themselves into their next "opportunities."

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A lot of this employee shafting happens using corporate restructuring, changing the type of company in a legal sense, and like methods. Often it happens with many employees being totally unaware that anything at all has taken place. The victims — and that is the only possible descriptor — are often unaware until after the company goes to IPO or the whole enterprise is sold or merged, and then there is no check in the mail.

In one classic case, an operation in the East Bay of San Francisco was restructured before its sale in a way that denied the engineers a penny of its success. The principal stockholder was already extremely wealthy so the few extra millions he gained hardly made a difference to his fortune; but it made one heck of a difference to his reputation. In California, at least, some restructuring has to be approved by a state commissioner, but his power is miniscule when it comes to the protection of employees. Even when hearings prove that the executives involved are totally illogical, the commissioner has the power to embarrass, but not much more.

We can look too at a company such as Enron, which got itself into the delivery of broadband data instead of sticking to its core energy business, to see corporate decisions — and delusions — that left its many employees out of work. The decisions tore apart their lives by reducing their 401(k) plans to junk status and made their company-assisted stock purchases give them returns that you wouldn't even tolerate from a casino slot machine. Never mind the fact that those who masterminded the demise of such a giant of a company walked away with fortunes in their pockets.

Yes, 2001 sure showed a lot of employees that loyalty is expected by the employer, but that the employee should not expect much return for that loyalty, certainly not when it comes to the remuneration that the senior executives or corporate investors want to walk away with.

When you are looking for your next opportunity, make it a point to check out the management's history in these areas. Were any of them at startups that moved forward in another guise? Were there any at operations that did more than one round of mergers? I personally could have one wall in my house papered with options that are as worthless as many of the stock certificates that have been issued over the years for fictitious gold mines, which I guess is exactly the same thing. **BE**

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

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