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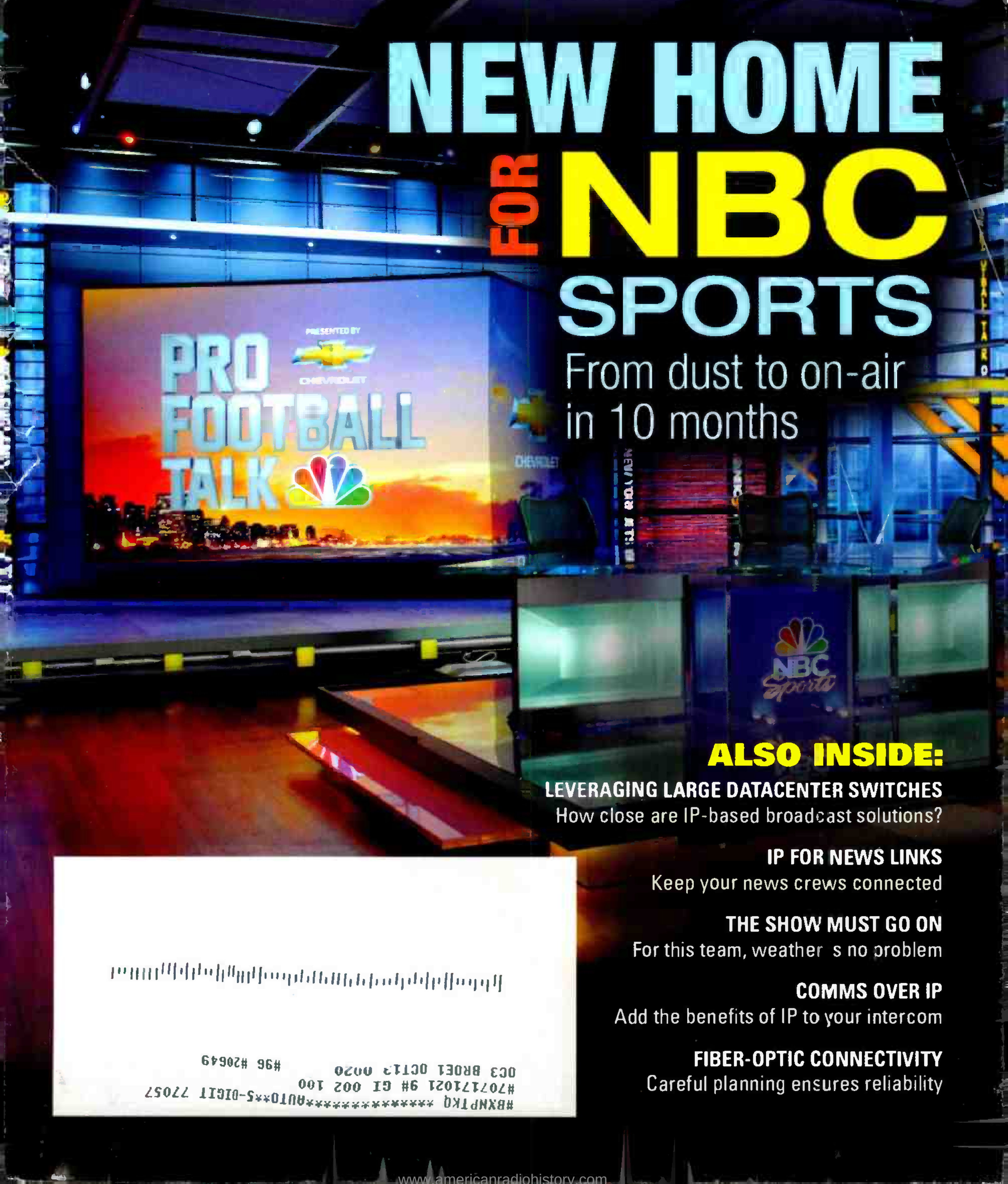

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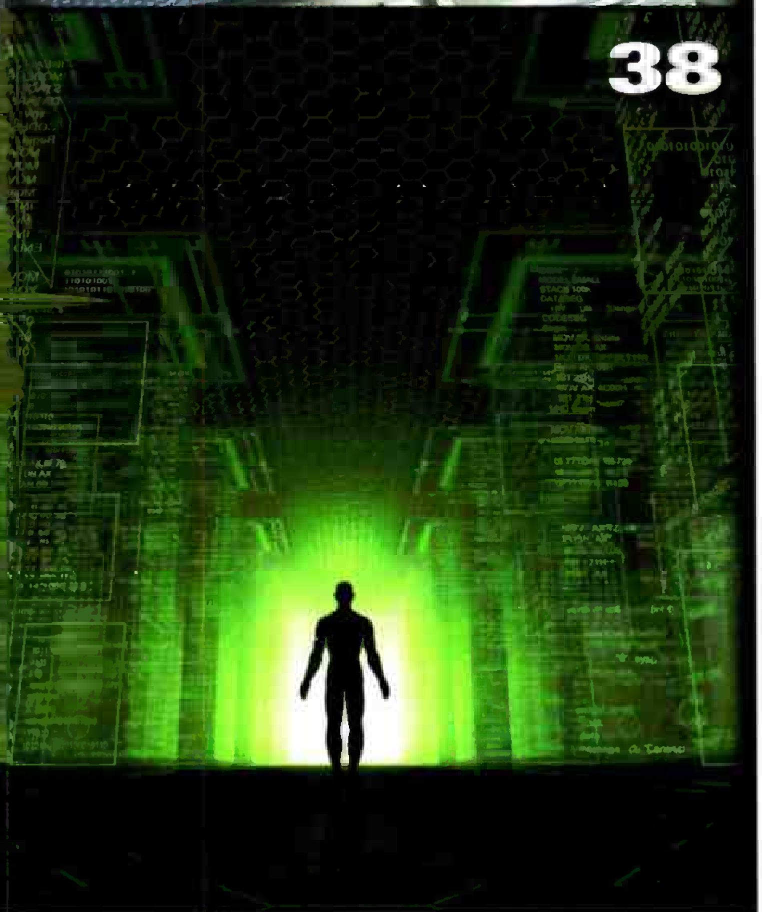

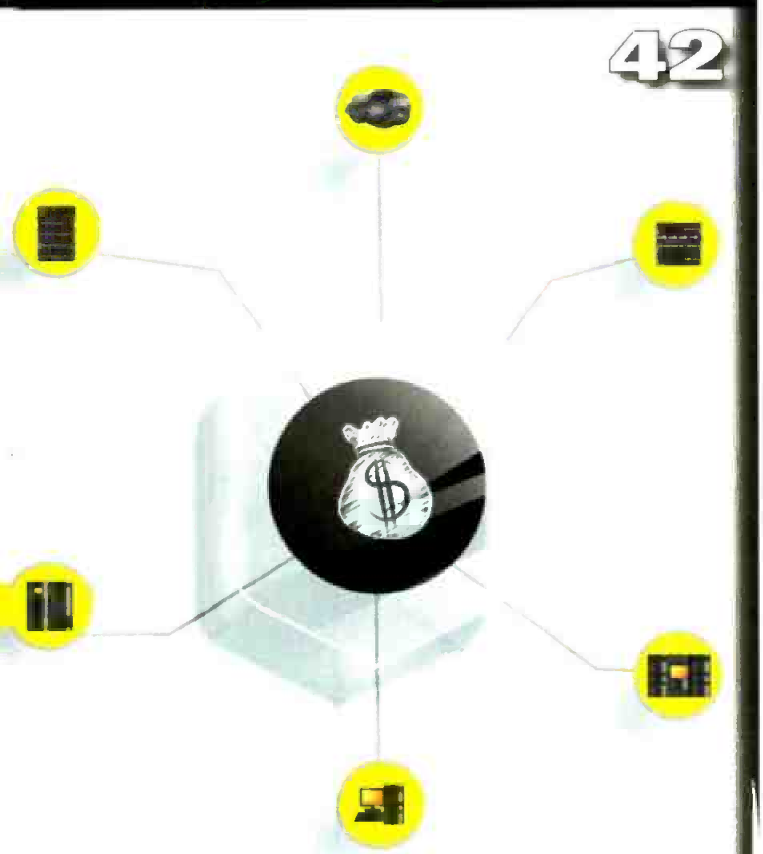

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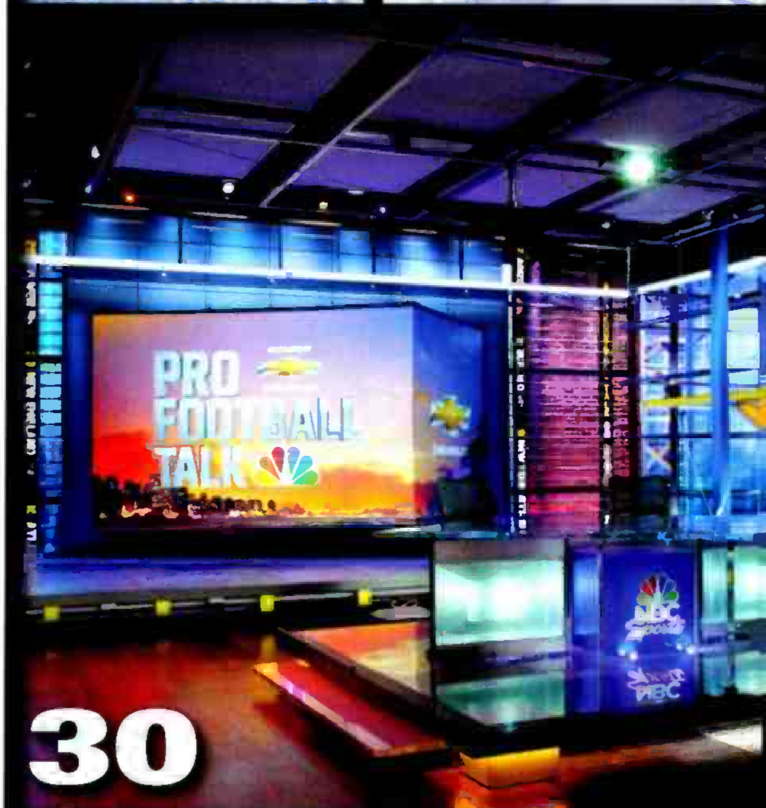

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Twitter: riches or ruin for broadcasters

Having just returned from IBC2013, I can tell you that at least the exhibitors were fully engaged with products that support dual-screen audiences and all the social media that entails. What I couldn't see was the level of interest from broadcasters in all things Twitter and social media. While researching for this article, I saw one writer question broadcasters' love affair with social media as simply a quest for additional income. Maybe, but so what?

Said Paul Donato, Chief Research Officer, Nielsen, "... we saw a statistically significant causal influence indicating that a spike in TV ratings can increase the volume of Tweets, and, conversely, a spike in Tweets can increase tune-in."

In plain English, that means there is a connection between increased Twitter activity and increased ratings, but even the experts can't tell which is cause and which is effect.

Several new TV programs have embraced the use of Twitter and social media: "Game of Thrones," "Emmy Awards" and "Fox News" via Bing polls. While the implementations are different, the goal is the same: increase participation and viewership of the content.

The changes are hardly one-sided, with broadcasters hawking Twitter. The 140-character message company has itself launched several projects to gain additional advertising and broadcaster participation. Twitter recently purchased the companies Bluefin, a data-analytics company that tracks the real-time sentiment about video, and the digital and social media business intelligence platform, Trendrr.

One Twitter product that has captured broadcaster attention is Amplify, which allows the insertion of video clips with ads into the Twitter stream. CBS recently signed up for the service. Other Amplify partners include BBC America, Fox and The Weather Channel. The CBS partnership involves 20 of the company's brands and 42 of its shows. One of the concepts being discussed is a clip service that will summarize "60 Minutes." It's called "60 Minutes In 60 Seconds."

The Amplify program will feed users video clips from Twitter's partners, accompanied by short advertisements. Those tweeted videos will connect with TV programs from Amplify partners, like CBS, as well as commercials. The Amplify partners will target their videos at users with promoted tweets.

I admit to being a skeptic, but there are some big-time players and a ton of money being shoved at these partnerships. Whether viewers may get tired of seeing similar an ads on both TV and Twitter remains an unanswered question. In addition, will those who Tweet during a program push back when targeted with show-related advertising?

The company is estimated to generate more than $1 billion in advertising revenue next year, which is anything but small change. Of course, a lot of this recent activity may be directed at Twitter's predicted year's end IPO.

We should have more answers about how Twitter users engage with broadcast content by next IBC. Meanwhile, to give readers some advance guidance, Broadcast Engineering conducted last month an Avid-sponsored web seminar on the use of social media. The seminar lays an excellent groundwork for understanding many of these issues. In addition, it offers suggestions on how to place your bets now on a winning strategy. That free web seminar is available here. **BE**

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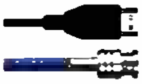

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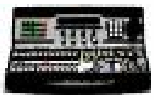

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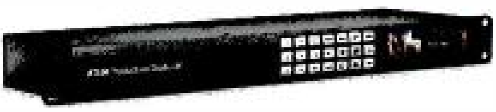

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News loners

Just because you're alone in the field reporting doesn't mean you're not connected.

BY PHIL KURZ

With the help of small, lightweight, high-performance HD cameras, solid-state recording media, laptop computers, multimedia tablets, and an amalgamation of contribution technology — including Wi-Fi, WiMAX, bonded cellular circuits, IP satellite and traditional COFDM microwave transmission — it's never been easier for a sole reporter to "do it all."

While this approach to newsgathering is far from new, relatively recent developments in the industry and the availability of IP-centric solutions are taking the concept of what can be done by one person reporting in the field to a higher level. For years, many journalism grads landing jobs at smaller market stations have grabbed their camera and their kit, slung their tripod over their shoulders, and headed out of the newsroom for a story. Today, however, that kit is far smaller and lighter, and it certainly includes a laptop or tablet computer with Internet connectivity so that the newsroom's resources are just a few clicks away.

Today, rather simply being a newsgathering approach relegated to entry-level television reporters, one-person news "crews" are valuable field resources complementing more traditional ENG and SNG setups at local stations of all sizes, network news operations and news bureaus in places as diverse as state capitals and the streets of Egypt.

The latest Hofstra University/RTDNA survey of newsroom staffing sheds light on where multimedia journalists stand in the minds of newsroom managers as they make decisions about who to hire. The results, released in July, show multimedia journalists ranked fifth among top replacement hires and tied for fourth among new hires with photographer and Web producer at local U.S. television stations.

WJHG-TV, the Gray Television NBC affiliate serving Panama City, FL, is leveraging IP transport via satellite to expand its newsgathering reach.

While certainly not at the top of the newsroom managers' hiring priorities, multimedia journalists were far from last. In fact, they essentially were in the middle of the pack, which included titles as diverse as anchors and Web producers.

Ups and downs

Multimedia journalism may offer news operations a variety of advantages, but for Jim Ocon, Gray Television VP of Technology, it all comes down to speed.

"This approach to newsgathering provides a quicker path to air," he says.

With IP-based news contribution, Gray reporters can grab a backpack and have one-button, bonded cellular circuit access to IP transport back to the station.

Another advantage is reach, Ocon says. Recently, the station group has embarked on a program of equipping its TVU Pack-equipped multimedia journalists with small, light Ku-band satellite setups from On Call Communications. Designed for IP satellite connectivity, the new technology removes one of the last hurdles for IP-based news contribution: lack of connectivity in remote areas.

"This gives our reporters in the field one-button access back to the station, from wherever they are," he says. "It also provides them with Internet access and telephone access in the field regardless of their location."

He adds, "The power of this approach is it lets us go places we couldn't traditionally get into with our SNG or ENG trucks."

At Capitol Broadcasting, owner of WRAL-TV serving the Raleigh-Durham-Fayetteville, NC, market, multimedia journalists complement the newsgathering activities of traditional reporter-photographer teams, says Pete Sockett, director of Engineering and Operations.

"Journalists in remote bureaus are doing one-man-band newsgathering," Sockett says, "and we regularly deploy one-man band setups for Web-only streaming coverage of court cases."

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Broadcast engineers and IP

The broadcast engineering community takes up the challenge of IP networking and content transport.

It is tempting to say baseband video around the station is in decline, headed towards a distant demise. However, even the biggest proponents of what IP technology can do for contribution, distribution and workflow acknowledge that as long as there is a need to transmit ATSC digital television, baseband video will have a place at the station, even if it is in the form of an IP-to-ASI encoder to feed the transmitter.

Even with its advancement in recent years, some traditionalists in the broadcast engineering community cast a wary eye towards IP. Wayne Pecena, assistant director of educational broadcast services in the Office of Information Technology at Texas A&M University, says such skepticism grows out of a lack of understanding and experience with IP technology.

Pecena, who serves on the board of directors of the Society of Broadcast Engineers and is chairman of the society's education committee, has spent the past three years training broadcast engineers online and in person in IP networking technology. What he has seen over that period has been a slow, steady increase in how much broadcast engineers know about IP technology and an overall desire to learn.

At a recent event in Los Angeles, Pecena asked his 50 students, made up of broadcast engineers from around the area, to describe their IP expertise.

"One person considered himself at the advanced level, 10 said they were at the intermediate level, and the rest said they were at the beginning stage," says Pecena, who has trained hundreds of broadcast engineers in IP networking since embarking on this mission in 2010. "I think that is pretty representative of where the industry is on the whole."

Pecena notes that while using Ethernet for control and monitoring of various pieces of broadcast gear has been done for some time, the idea of relying on IP as a transport technology at the station to improve workflow and share content among various departments — such as news, promotions and creative — is rather new.

"Moving content around by IP would simplify a technical plant," Pecena says. "Clearly, this is where the industry is headed. Eventually, as a few more areas get a little better sorted out, you will truly have interoperability between different manufacturers' products like you do with ASI."

With the efforts of Pecena and other trainers, broadcast engineers are well under way preparing for this eventuality.

Editor's note: SBE offers two IP-related certifications: Certified Broadcast Networking Technologist, an entry level certification, and Certified Broadcast Networking Engineer, a professional level certification.

WRAL has deployed a combination of contribution technology to enable its one-person news contribution. Reporters in the field use LiveU IP-based newsgathering technology. Those in news bureaus simply use a setup based on an Evertz IP encoder to contribute reports.

"We have also begun dropping our own bandwidth into venues and walk in with IP encoders," Sockett says.

Two examples are the Durham County and Raleigh Country courthouses.

"When they built the two new courthouses, they invited us in during the design phase," Sockett explains.

The result was IP connectivity for news contribution paid for by Capitol Broadcasting, not the counties, he adds.

This type of deployment serves as an example of another benefit of the multimedia journalists equipped with IP connectivity — the ability to free up traditional ENG and SNG vehicles for more productive uses. Rather than tying up hundreds of thousands of dollars in mobile newsgathering resources at the curb of a public building, IP connectivity at the two courthouses in North Carolina allows newsgathering trucks to be reassigned to stories breaking elsewhere.

If there is a downside to the one-man-band approach to newsgathering, however, it may be the need to sacrifice greatness for being good enough. The chances that the same individual will consistently be a great reporter, a great shooter, a great sound person and a great editor are less than having specialists in all of these aspects of news production.

Sockett says to those in the television business, there is typically a noticeable difference in the quality of the camera work done by a one-man band vs. a two-person crew. Interestingly, he says, for news photographers taking on the one-man band role, visual storytelling will be powerful, but other aspects may be lacking.

"One of our photographers in particular will actually do some stories on his own that are based on a human

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interest," says Sockett. "They typically rely heavily on the visual. He will shoot the piece and send it in himself, but I don't think he normally voices anything himself."

Great enablers

High-quality, relatively low-priced HD cameras with good low light sensitivity, solid-state recording media, easily transferrable files, powerful yet affordable laptop computers and nonlinear editing programs that likely are the same ones that are being used back at the station have all emerged to enable a single person to report, write, interview, capture and edit stories.

Perhaps the most important enabler to have emerged, however, is IP transport of content. Whether for live or edited stories, IP transport is delivering reliable contribution from the field without the complexities associated with setting up ENG and SNG shots, aspects of traditional field contribution that make them less well suited to the multimedia journalist approach.

"IP connectivity is the backbone of the world of communication outside of broadcasting," says Mark Aitken, VP of Advanced Technology for the Sinclair Broadcast Group. "IP offers standard interfacing and a selection of product from countless vendors."

He adds, "IP transport is universal, and as long as you have an IP connection, you have the ability to fling that content wherever you want it."

IP connectivity also offers two-way communications, which reporters in the field can use for phone and Internet connectivity. The studio can use this same two-way connection for IFB and PL. It also offers a way for the one-man-band journalist to take his or her desktop into the field via a virtual private network.

"The newsroom computer system really needs to be thought of as something that lives both inside the station and on the laptop of a reporter in the field at the same time," Ocon says. "IP connectivity allows us to extend the reach of the newsroom system, which opens up a lot of possibilities."

Not only does extending the NRCS into the field offer reporters access to newswires and rundowns, but in theory it gives them access to all of the resources they would have if seated at their desk back in the newsroom.

In mid-September, a number of station groups — including LIN Media, Sinclair Broadcast Group and Capitol Broadcasting — were invited to Austin, TX, to learn about a new way reporters equipped with IP newsgathering systems may one day be able to use the 2GHz Broadcast Auxiliary Service band. Gray Television demonstrated for the broadcasters GrayMax, a two-way IP communications system that in essence provides Internet hotspots in 2GHz BAS spectrum. Deployed under an FCC experimental license in College Station and Bryan, TX, GrayMax is an intelligent pipeline that allocates bandwidth as needed to support differing contribution requirements.

"Our intention is to make this an open standard along with other stations," explains Ocon, who says he is hopeful the FCC will see GrayMax as an effective way to share spectrum and thus protect broadcasters from possible reallocation of 2GHz spectrum currently assigned to ENG. Sockett, who first learned of GrayMax earlier this year, says the concept makes a lot of sense.

"When Ocon told me about it in the spring, it seemed like a great idea," Sockett says. "If we can start getting out of the mindset that you only have two ENG channels per market for yourself, we'll all be much better off." BE

Phil Kurz is a contributing editor to Broadcast Engineering. *He also writes several e-newsletters for the magazine and is a frequent contributor to broadcastengineering.com.*

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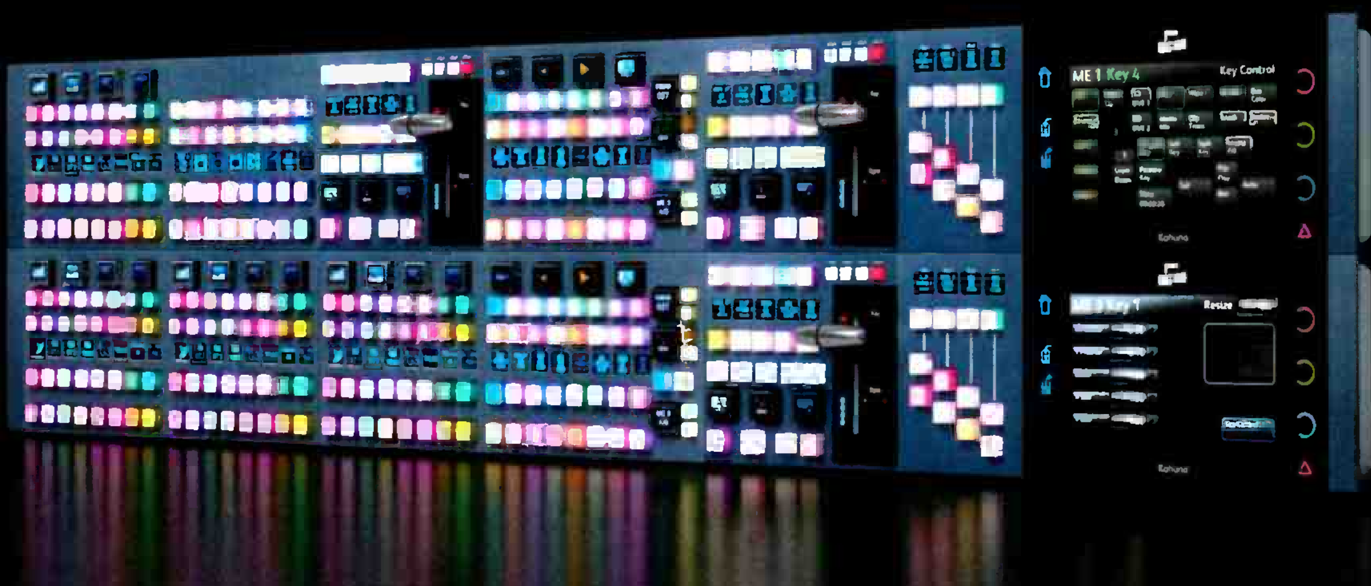

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Video distribution

Broadcasters have many options for the distribution of digital content.

BY ALDO CUGNINI

Video distribution was historically a simple concept involving analog distribution amplifiers to send live video to multiple devices. In the broadest sense, distribution today typically entails the complicated transport of digital content from one place to another. Broadcast technology organizations like DVB and ATSC specifically refer to distribution as one part of the media chain that includes contribution, distribution and transmission. Contribution describes how to aggregate content, distribution describes how to transport it in an extended video infrastructure, and transmission describes how to send it to consumer receivers.

This article will extend the definition of "distribution" to include ways of moving content within destinations like homes, businesses and campuses, because the associated technologies bring value to broadcast operations. (See Figure 1.)

In the plant

Whereas the handling of video had at one time been divided between "live" and "recorded" media, the infrastructure to transport content now includes that of handling file-based content — and that means that the interfaces between sources, storage and destinations are becoming increasingly IT-based.

Twisted-pair wiring is now becoming a viable alternative to the widely-used coaxial cable of the video industry. Baluns (balanced-to-unbalanced transformers) enable operators to distribute HD video over an existing Cat 6/7 twisted-pair infrastructure, in either analog or digital form. Full analog-SD video can be provided at up to 1970ft or (1.24mi) distances, and up to 6562ft with active baluns; power and bidirectional signaling can also be carried over the twisted pair. Digital video can also be carried over twisted-pair cable such as Cat 5e, ordinarily used for Ethernet data networks. Passive baluns can support distances of up to 150ft for 3G-SDI signals.

Twisted-pair cables are classified by the ISO/IEC 11801 standard depending on their electrical performance characteristics, which include various factors that depend on the transmission frequency, such as insertion loss, inter-pair cross talk and return loss. Class D carries up to 100MHz using Cat 5 cable; Class E runs up to 250MHz using Cat 6, and so forth, up to Class-FA, supporting up to 1000MHz over Cat 7A.

Cat 5 uses the EIA-T568 standard for wiring, which specifies up to four pairs per cable. T-568 specifies two different color-coding conventions, for compatibility with different existing and legacy communications equipment. In its most basic form, a Cat 5 interconnect consists of two twisted pairs of 100Ω characteristic impedance, with each pair carrying a unidirectional signal downstream or upstream. When assembling connectors, correct pairing must be observed, or there will be a large cross-talk component induced between the downstream and upstream signals — as can happen with inexperienced cable installers.

One confusion arising with Ethernet data cables has come from the need for "cross-over" connections, providing a connection between "source" (also called Data Communications Equipment or DCE) and "sink" components. As networks have become more complex, however, devices have increasingly adopted automatic cross-over detection (also called automatic MDI/MDI-X configuration), so that the need for cross-over cables has been reduced.

10BASE-T and 100BASE-TX Ethernet (which support data rates of 10Mb/s and 100Mb/s, respectively) each use two pairs of Cat 5/6 cable, which allows carrying two complete circuits in one cable with appropriate adapters. GigE (or 1000BASE-T), which operates at 1Gb/s, and 10GBASE-T (10Gb/s) use all four pairs. The maximum length for an Ethernet cable in a network environment is limited to 328ft.

Locations outside the plant

Microwave and satellite links continue to be the preferred method of distributing mission-critical video in the broadcast industry.

Digital video-over-fiber is typically based on the SMPTE 297 standard, using Wavelength-Division Multiplexing (WDM), which uses different wavelengths (colors) of light to carry multiple signals. SDI per SMPTE 424/292/259, (3G/HD/SD)

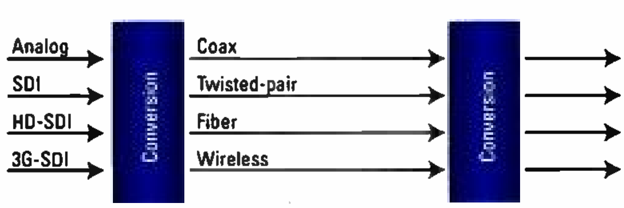

Figure 1. Broadcasters have a range of video distribution technologies at their disposal to suit different requirements.

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with embedded audio and data, as well as DVB-ASI, can be carried over one single-mode fiber. Three or more SDI channels can be transported over a minimum distance of 6.2mi, compared with a maximum distance of about 2045ft with SD-SDI or 570ft with 3G-SDI signals.

Although video streaming over the Internet to viewers is appropriately the subject of a separate discussion, the use of the Internet to distribute file-based video to affiliate stations, as well as storage archives, is becoming practical and merits consideration by planners given the explosive amount of content now being generated. The newly developed MPEG HEVC can form part of such a solution, thanks to a lossless coding mode that provides perfect fidelity with an average bit-rate reduction of more than 13 percent. Significantly outperforming existing lossless compression solutions such as JPEG2000, the artifact-free performance is achieved by bypassing transform, quantization and in-loop filters, while keeping the lossless entropy-coding elements. Combining this with an appropriate encryption wrapper makes Internet video distribution attractive and secure.

Video in the home

Although many video technologies have been developed specifically for consumer use in the home, these same technologies can make production and monitoring facilities more economical to build and maintain. HDBASE-T is a consumer-facing standard that uses Cat 5E/6 cable to transmit 10Mb/s video, plus audio, two-way control signals and 100W of power, at up to 328ft. With a total capacity of 10.2Gb/s, HDBASE-T provides an extension to HDMI, with Ultra HD video at up to 4K resolution, and can also support multiple simultaneous 100BASE-T Ethernet users. A distance of up to 2624ft can be supported with repeaters.

Optical fiber and converter devices are now available to consumers, too, capable of relaying HD video, audio and control signals through one fiber cable at distances up to 1000ft Essentially HDMI extenders, these products use no compression, and support HDCP content protection.

When transporting video to displays, several wireless technologies are now becoming practical, including Wireless USB, Wireless HD (WiHD) and Wireless Home Digital Interface (WHDI). Although some of these are intended to work over a relatively short distance of about 10ft for near-lossless video, others, like WiHD, can support uncompressed digital transmission of HD video and audio and data signals over DisplayPort or HDMI interfaces, with theoretical data rates as high as 25Gb/s at distances up to 30ft.WiHD is reported to support 1080p/60Hz HD with deep-color video content at a distance of 108ft.

Another cross-over application is that for professional A/V and digital signage. Low-cost fiber-optic extenders and matrix switchers are now available that can transport SDI/HDMI/DisplayPort/VGA video, audio, RS-232, IR-remote and USB signals at a distance of more than 6600ft for multi-mode operation, and even up to 18.75mi for single mode.

Web integration

Management, delivery and tracking of digital content now require extensive integration of repurposed content across multiple channels. Digital distribution now extends to the cloud for production, affiliate management and consumption. Broadcasters must continually adapt their infrastructure and workflow to keep pace. **BE**

Aldo Cugnini is a consultant in the digital television industry.

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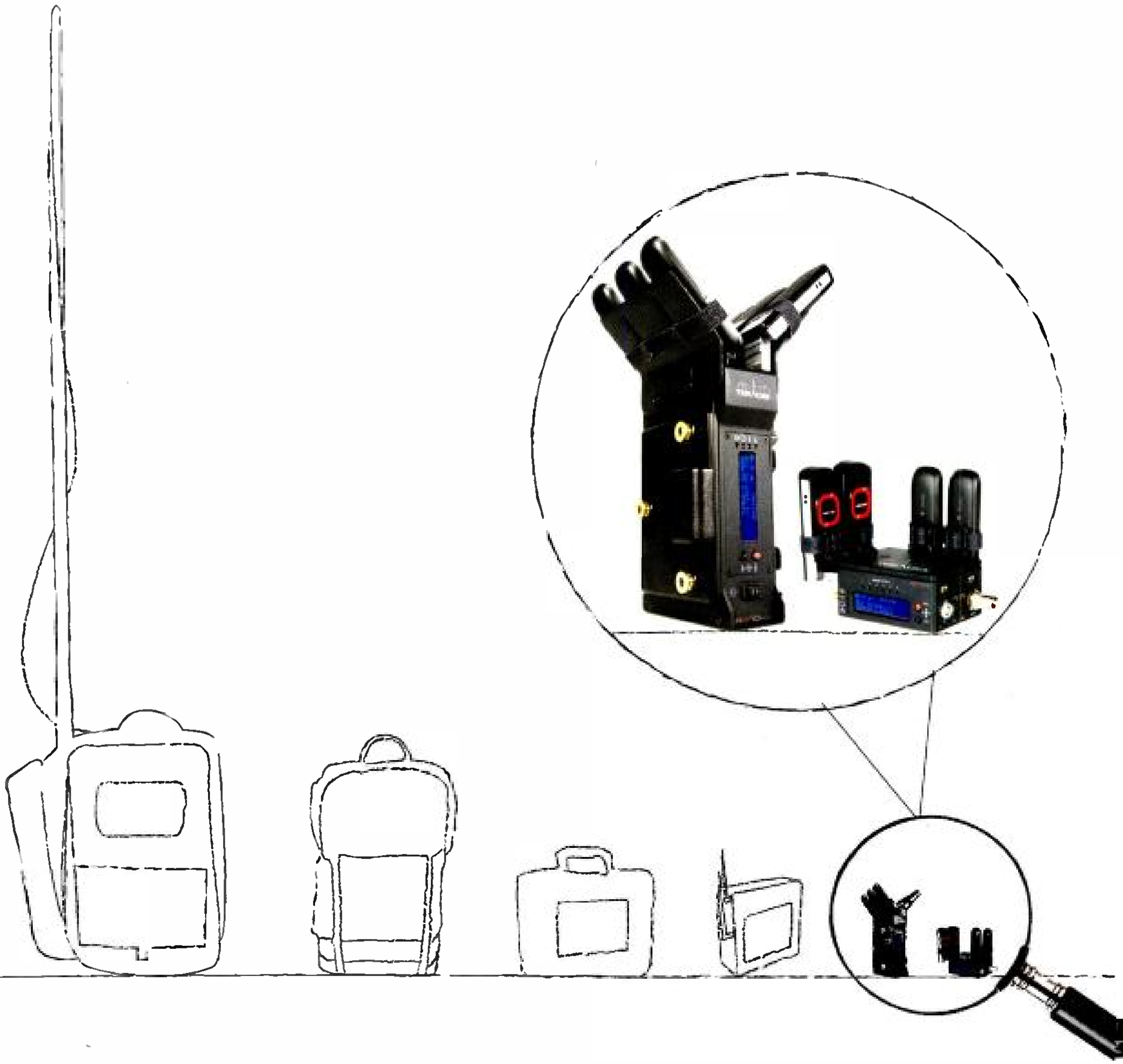

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Joint Task Force on Networked Media

Users and manufacturers plan for a future without SDI.

BY BRAD GILMER

At the outset, let me say that I believe that equipment using the ubiquitous Serial Digital Interface or SDI will be around for a long time, perhaps 10 years or more. However, there is no question that a transition has already begun. That transition is a move away from broadcast infrastructures that are based on specialty broadcast equipment and interfaces such as SDI and AES to IT-based packet networks such as Ethernet and IP.

The transition from SDI to networks

When speaking to audiences, whether in the United States or abroad, over the last several years I have asked how many people are planning to purchase a large SDI router in the next five years. Usually, a hand-full of hands go up. Next, I ask who expects to be purchasing a large SDI router in 10 years. I have *never* had a single hand go up.

It appears that no one plans on buying any core SDI equipment in 10 years.

This poses an obvious follow-on question: If people are not planning on buying SDI routers in 10 years, what are they going to be using for their core infrastructure for professional video? The answer is obvious — some sort of packet-based network technology.

But this just raises more questions. Will people make a dramatic switch from SDI to networks, or is this transition going to take place over several years? (Again, an obvious answer: The transition takes place over several years.) If we are talking about a transition that takes several years, when will we start? Again, there is an obvious answer. I have not been in a single professional media facility in the last 10 years that has not had a professional media network (a network that is used to move professional content from place to place in a facility) in place.

In some cases, these networks are based on carrier-class, high-availability equipment, and they are maintained by highly-trained networking professionals. In other cases, these networks have evolved over time, perhaps starting with installations in audio or graphics, and expanding into other areas over time. But in all cases, these networks have evolved to stand alongside traditional broadcast infrastructures, and in all cases, if you disabled these networks, the professional media organization would suffer significantly.

So, in short, the transition from SDI to networks began years ago. This may come as a surprise to some of you, but think about it: This significant change is already occurring. If you were at IBC this year, you would have seen any number of professional broadcast products taking advantage of packet-based networking technology. The shift to networking seems to be well under way. But there is a big problem.

The problem

SDI and AES interfaces are very well defined, standardized, and there are countless interoperable implementations. The same cannot be said about implementations of professional media networks. In fact, the only standard that has been widely adopted relating to the transmission of professional video over IP networks is SMPTE 2022, and the authors of this suite of documents will tell you that they are intended for transmission *between* facilities, not inside facilities. Nothing else is even on the horizon.

Given that it has taken the industry somewhere between two and three years to come up with a standard as significant as SDI, and given that even after adoption, it is likely to take another five years before such a standard is widely implemented in the industry, we are in a bind. Early proprietary implementations already exist. It appears that no one plans on buying any core SDI equipment in 10 years. If it is going to take us seven to eight years before a standardized replacement is developed and becomes widely implemented, we probably should get started. Now.

The solution

The European Broadcasting Union (EBU), the Society of Motion Picture and Television Engineers (SMPTE) and the Video Services Forum (VSF) agree. They have formed a group called the Joint Task Force on Networked Media, abbreviated JT-NM.

Generally I am not that big a fan of mission and vision statements. But in this case, these statements answer, fairly succinctly, the questions of how this group is going to function and why the group was formed. First, the how. The mission statement of the JT-NM describes how it intends

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to perform its work and what the expected output is:

In an open, participatory environment, help to drive development of a packet-based infrastructure for the professional media industry by bringing together manufacturers, industry associations (standards bodies and trade associations) with the objective to create, store, transfer and stream professional media.

Why do this? The vision statement describes what the task force hopes the future will be like if it is successful:

New business opportunities are enabled through the exchange of professional media, including file-based and live content, across a network taking advantage of the benefits of IT-based technology at an affordable price.

But before we rush off to create a solution, there are a couple of additional significant questions. First, is there any business reason to do this? Most engineers have learned that if we cannot describe what the technology will do for the business, then that technology is going nowhere — especially if it is costly to implement.

The second question is key: Are there things that you can only do with SDI? This turns out to be a controversial question depending on which side of the infrastructure argument you come down on. But if you think about it, as engineers, we should be impartial about the technology and look to employ the best technological solution in any given situation.

It turns out that there are a number of technologies available now, or available in the near future, that could allow networks to carry professional video as reliability and with functionality very similar to SDI. But we should be careful. When the industry went throughout the transition from videotape to files, we first treated files just like tape, missing many of the benefits of this transition.

User stories

It turns out that to this point, no one had asked end users what they wanted in terms of functionality in professional media networks. What are the business drivers? What new things could be enabled from a business perspective if standardized interfaces for media networks were available? The JT-NM started its work by collecting more than 150 business-driven use cases in order to determine the drivers this transition. These use cases have been published and may be viewed at *http://tech.ebu.ch/groups/jt-nm.*

With use cases in hand, the JT-NM set out to condense these stories into 16 "super user stories" that capture the essence of the original contributions. It then authored a Request for Technology (RFT) that asks for

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technological responses that serve to meet one or more of the requirements listed in the user stories. Once responses are received, the JT-NM intends to perform a gap analysis, identifying any areas where there are business use cases, but no technology has been submitted. Once this work is completed, the task force will identify future work.

Several important ideas have come out of the user stories. The first is that many media companies stress that data needs to be treated as a first-class citizen. For years, data has trailed alongside of what was generally agreed to be the most important asset, the content (video and audio).

Now media companies realize that data such as closed captioning, camera position data, rights information and so on is as critical as the pictures and sound themselves. Having infrastructures that treat these items equally *and in the same technical environment* is critically important.

A second point coming out of the user stories is that the era of purpose-built broadcast and professional media infrastructures is largely coming to a close. It is critical to the future of our business that we be able to leverage the billions of dollars spent worldwide on IT infrastructures. The key is in understanding how we can adapt these technologies to meet our business needs.

Finally, there may be another shift on the horizon — the death of files. I know many of us are just getting our minds around the transition from video tape to files, but in the not too distant future, the notion of a movie existing as a single grouping of bits stored on some sort of file system will be passé.

It is much more likely that any end-viewer experience is going to be comprised of any number of "grains" of content and data that are brought together "just in time" in order to create that particular viewing experience. The infrastructures needed to support the creation and exploitation of professional media content are likely to be very different from existing SDI plants. In fact, the transition has already begun. **BE**

Brad Gilmer is a co-chair of the Joint Task Force on Networked Media, executive director of the Video Services Forum, executive director of the Advanced Media Workflow Association and a consultant to the professional media industry.

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Comms over IP

Take advantage of the advanced capabilities offered by IP-based systems.

BY MALCOLM REED

Thirty years ago, the majority of intercom systems in the U.S. were based on the two-wire party line concept, not unlike the hand crank telephone your (great) grandmother had on her wall with "Ernestine the Operator" organizing a "one ringy dingy" style connection, often so she could listen in with everyone else. (Those younger than 45 can start their favorite search engine, now.)

Such systems meant — in the simplest terms — that there were one or two channels of communication that were used by everyone. Stations using such systems survived with headsets to communicate with their control room rather than open microphones and speakers, which doesn't work particularly well on a two-wire system given the number of operators in the same room. All you get is acoustic feedback. A comms system based on a series of headsets plugged into a single twisted pair of wires may sound very simple, and they were. All you needed to connect the headsets was old-fashioned analog microphone cable and an XLR three-pin connector to link various boxes, headset stations and beltpacks.

However, the byproduct of such an approach was that it was not only highly limited, but subtly divisive. You were either a Channel A person (production personnel perhaps) or a Channel B person (the engineers). If you were lucky (or unlucky), you could hear a cacophony of both channels mixed together. It also had the effect of stopping people from constantly talking because they knew what they said could be heard by everyone on their line, which in some cases was not necessarily a bad thing.

It was only at the turn of the 21st century that the concept of IP-based systems started to emerge.

Beyond two-wire systems

Things soon got a lot more complicated, though. Two wires simply weren't enough for more contemporary productions. Expansions to four-channel and eight-channel party lines soon led to spaghetti bowls of cables, devices, interface boxes, splitters, source assignment panels and IFB controllers — all of which had to be assembled, maintained and configured by an experienced audio engineer who knew what he or she was doing. And that is not to mention the confusion over who was, or should be, talking to whom.

However, major U.S. and European networks soon moved to four-wire matrices, where everything was linked to a single central matrix, and all comms functions were performed within that matrix. Legacy party-line beltpacks for the studio floor crew went through two- or four-wire adapters to convert them for use with a four-wire matrix. They would still communicate on one or two channels, but those channels were all connected to a central matrix, and that required a lot of cable.

Digital revolution

It all changed when matrices went digital in the '90s. Comms systems suddenly morphed from requiring hundreds of bits of copper wire to transporting millions of bits of data over Cat 5 cable or a length of coax. Connections between key panel stations via Cat 5 or coax to the central matrix considerably reduced the need for hundreds of bits of wire, and the millions of bits of data meant that the matrix-based systems could become much more sophisticated with digital displays on control panels, PC configurability, and a limited degree of diagnostics and monitoring.

IP

It was only at the turn of the 21st century that the concept of IP-based systems started to emerge, and with all things new, there were naysayers who declared that it couldn't be done. Throughout the 2000s, we encountered a lot of resistance from traditional broadcast engineers who said, "Well, that may be what the IT guys think, but they don't understand broadcast, and we don't understand IT." Communication, they reasoned, was simply too important to trust to perceived IT infrastructure issues of bandwidth and latency limitations. Some still argue the point today, but those voices are fading rapidly, and here's why.

In fairness, there was a lot of new information for both sides to get their heads around. It was difficult. Broadcast engineers weren't familiar with IP gateways, subnet masks and the like. IT folks couldn't get to grips with broadcast workflows. It's taken a while, but video and audio file transfer mechanisms over IT infrastructures are becoming the norm. Slowly but surely, IT and broadcast professionals have coalesced into a far more mature, constructive and mutually beneficial partnership.

If you compare an IP-based comms system with four-wire matrix technology, one major differentiator leaps out: An IP-based intercom doesn't require

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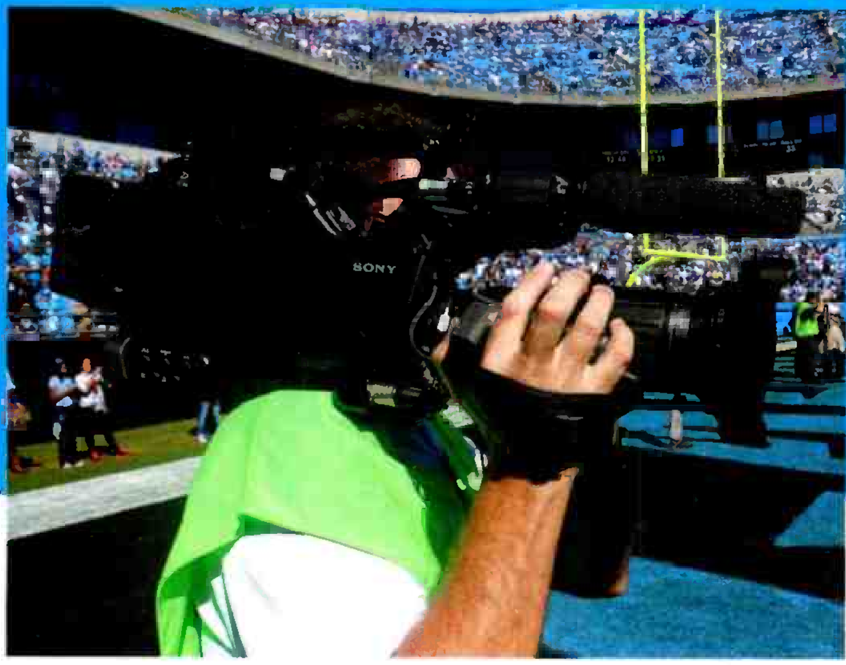

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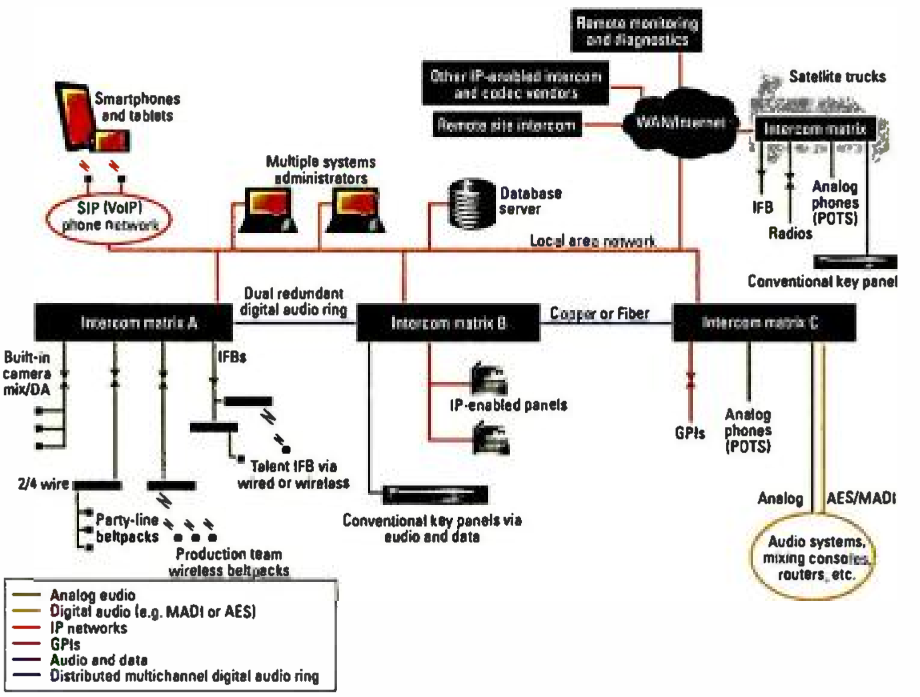

Figure 1. With IP-based systems and SIP-compliant interoperability, it is now possible to establish multisite communication to sat trucks, news bureaus and affiliates over common and multivendor comms systems — all via IP.

bespoke infrastructure. It can use the existing IT infrastructure to establish reliable connectivity and functionality between matrices over a LAN.

As more and more people began to understand and become comfortable with IT and what it could do, the benefits of sending audio over IP — such as connecting intercom panels, matrices and VoIP phone systems — became clear. Suddenly, a satellite truck in Poughkeepsie could be connected via satellite and the local talent receive an IFB feed from the studio back in Des Moines — all over IP rather than old-fashioned phone systems, microwave links, etc. Voice communication at the truck could be easily integrated with the main station's intercom, all over IP, and that's the crux of the benefits of an IP-based system — the ability to seamlessly interconnect multiple, and sometimes disparate, devices. However, it required a whole new world of common understanding and a lot of research and negotiation to get there, some of which is ongoing.

Session initiation protocol

Today, the trend is for VoIP intercom systems to incorporate session initiation protocol (SIP) connectivity for use over redundant fiber networks. Although SIP looks like a protocol, walks like a protocol and talks like a protocol, it is not, in and of itself, a protocol.

SIP is a somewhat confusing acronym because it isn't a protocol in the sense of defining a codec, which of course details the parameters of an IP stream such as bandwidth, audio quality, packet size, latency, etc. What SIP actually represents is a characterization of how two devices should establish communication. Within that characterization are a number of codecs, which can be loosely described as communication protocols.

To use a simple analogy, SIP provides the introductions between multiple devices without knowing initially what language each device speaks. SIP will scan its database of languages (codecs) and negotiate the preferred common language (codec) that will enable the devices to converse with fluidity and complete understanding. SIP is, in effect, the matchmaker that enables interoperability.

Intercom vendors have spent the better part of two years involved in an on-going dialog with an EBU technical team formed to establish a common standard (EBU Tech 3347) for intercom compatibility between manufacturers. At one point, the EBU team organized a "Plug Test" between intercom vendors and manufacturers to establish whether their systems could indeed "talk" to one another. The aim for European broadcasters was to distance themselves from dependence on ISDN lines for interconnection as ISDN was in the process of being phased out for comms and program audio purposes. There are perhaps parallels in the North American market that should be considered. The result of the one-to-one testing was, overall, encouraging, but it was also clear that a great deal of work remains to be done to ensure that audio over IP can be shared between intercom devices, no matter whose name is on the box. That works continues today.

Recent improvements

The development of comms interoperability standards is still in its early stages, but we have already used SIP-compliant technology to establish intelligent communication between systems. In a recent demonstration, an operator of one intercom simply pressed a panel key that was configured to talk to a specific operator using a completely different system at another location. Using SIP, the system called the other and said, in effect, "You have a call from another system," and audio connectivity between the two was established immediately.

This is a completely new and previously unheard of approach in multivendor comms systems. It's never been feasible before, but what's more important from a user's perspective is that it opens up huge possibilities for improvement by removing dependency on a single supplier. Suddenly it becomes possible to choose technology from multiple vendors rather than be tied to a single system that may not be performing to modern standards yet is too expensive to replace in its entirety.

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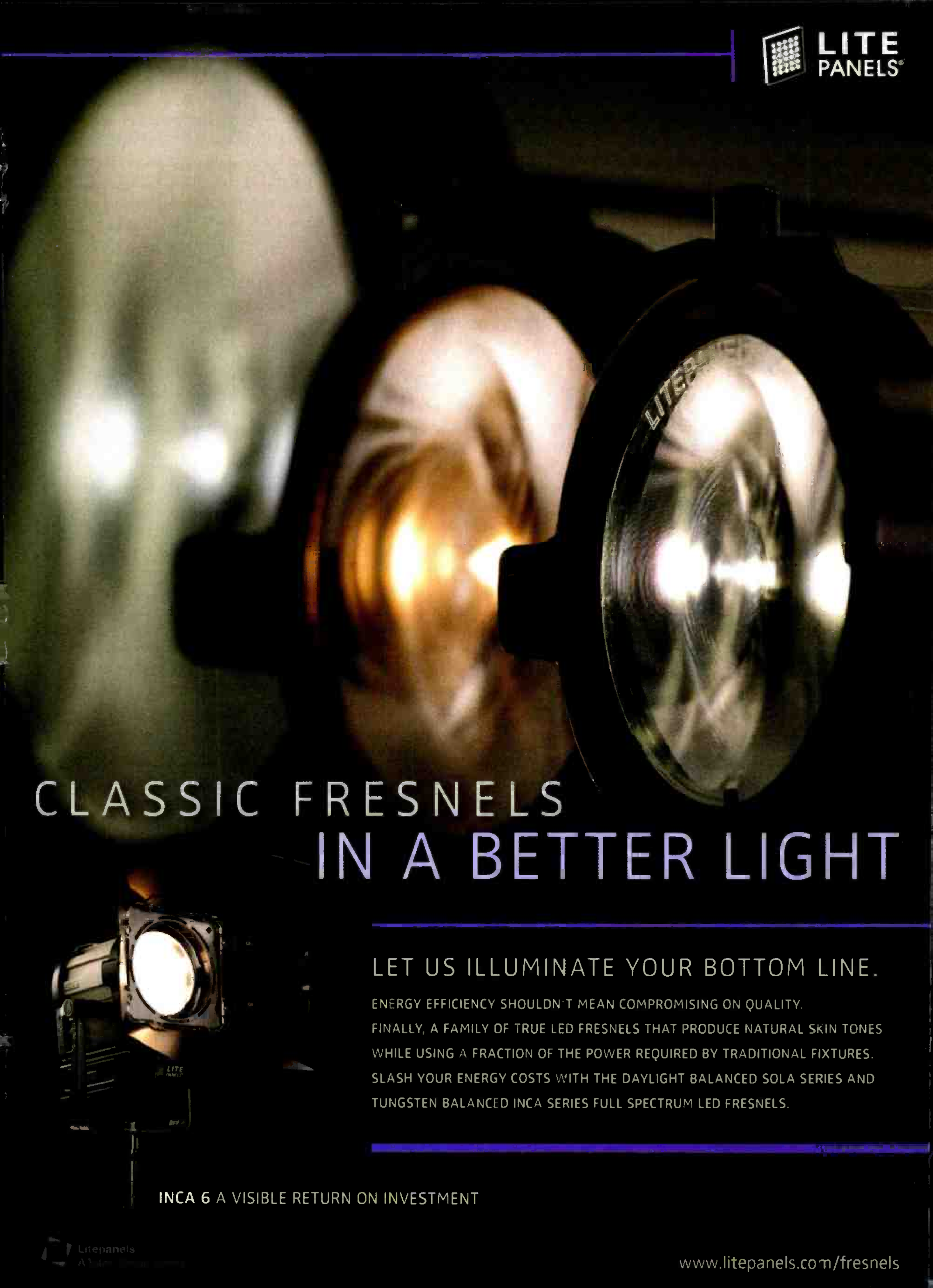

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With IP-based systems and SIP-compliant interoperability, it is now possible to establish multisite communication to sat trucks, news bureaus and affiliates over common and multivendor comms systems — all via IP. (See Figure 1.) It doesn't matter if multisite means the next room or the other side of the world. The design of modern matrix technology includes the whole IT infrastructure it is destined for, plus built-in IP capability and SIP compliance from the start. It's no longer something you have to add boxes or fiddly software to achieve.

Distributed matrix

Let's now examine what's called the *distributed matrix* concept. It's subtly different from a centralized IP-based matrix.

Consider a new intercom system — perhaps your own — to be located in a 10-story building. The facility will include multiple studios, master control, edit suites, playout and lots of other areas, all connected by a conventional four-wire system tied to one large matrix — 64 x 64 , 128 x 128 or 256 x 256 — in a central apparatus room. Such a design requires everything to be cabled back to it.

If the cameras are located in studio A, you have to run cables back to the central apparatus room. The same with interfaces, control panels, everything. Engineers have to find their way through the ducting of the whole building to run cables to a central point somewhere else, perhaps quite some distance away. Such a solution is often disruptive, costly and time consuming.

With a distributed matrix system, you can avoid all of that by physically breaking the big central matrix into three or four smaller matrices, or nodes located throughout the building. The nodes are connected via multichannel digital audio with built-in redundancy on an IP platform. Voilà! You have a modern, IP-based distributed comms matrix architecture. The production team, engineering staff, directors, station managers, finance director and IT guy will immediately appreciate the numerous advantages, one being that they only have to talk to each other if they want to. **BE**

Malcolm Reed is projects manager, Trilogy Communications.

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The show must go on

A veteran sports production company prepares for weather-related contingencies.

BY COLLEEN STANLEY

In a business where most of its work is done outdoors, it's no surprise that weather plays a huge role in how Broadcast Sports Inc. (BSI) prepares for events week to week. The company provides wireless audio, video and communications technology and support for live broadcasts of golf, racing, marathons, parades, sailing, surfing and skiing competitions, and a variety of other sport and entertainment events. Many shows involve setting up equipment in exposed areas, running thousands of feet of fiber-optic cable over varying types of terrain and deploying cameras and microphones to the far reaches of a particular location.

Extreme weather

Certain environments regularly present challenging conditions that BSI has become adept at handling. For many years, the company has provided wireless technology to ESPN for the Winter X Games. As an event that takes place primarily on the side of a mountain, it's one where deploying wireless equipment is extremely beneficial. It's also one where our team of technicians must take special precautions to ensure that the equipment is still fully functional even in below-freezing temperatures. One of the simplest things the team does is to store and prepare all of the camera equipment in temperatures at or near the external temperature. This prevents condensation from building up and freezing on the camera lenses which occurs when constantly moving between warm and cold environments.

Although we monitor and prepare for forecasted weather conditions prior to arriving at a venue, there's always a chance that unexpected weather events may arise. The most notable example recently was the "derecho" that hit last year's AT&T National golf tournament at Congressional Country Club in Bethesda, MD. Although the forecast accurately predicted the approaching storm, the region was completely unprepared for its magnitude. With winds reaching 80mph, heavy rain and intense lightning, the storm left millions in the area without power. Downed trees and debris covered the course and surrounding roads, leaving tournament organizers to delay play and prohibit spectators from entering the course.

To prevent condensation from freezing, BSI teams store their camera gear at or near the external temperature.

Despite the severity of the storm, the field team arrived at the course and, as expected, found all of its equipment in place and fully functioning, ready for the day's broadcast. They credited their careful worst-case scenario preparations and a little bit of good luck for the outcome. When the network broadcasts went live, our technology and RF infrastructure allowed the camera operators to travel freely around the course without being inhibited by the obstacles that resulted from the storm.

"Our teams take great pains to ensure that every show goes smoothly," said Peter Larsson, General Manager, BSI. "We can't control what Mother Nature will send our way, but we have strict quality control standards in place that mitigate the effects of an incident like this. After 30 years in the business, we've seen our share of weather-related issues so we are always prepared for the worst."

Equipment design

When the broadcast environment presents challenges, such as exposure to water or debris, that can't be addressed with simple precautions, the company takes preparation to the next level by designing equipment that can withstand or neutralize these hazards.

When the company was tasked with designing cameras for the sailing events at the 2012 Olympic Games in London, not only did the cameras need to have a wide range of remote functionality, they needed to be completely waterproof as well. The resulting device, known as the PTRZ or Pan-Tilt-Roll-Zoom Camera, is capable of capturing 1080i video and enables complete wireless remote control of the pan, tilt, roll and zoom functionality as well as iris, focus, shutter speed, saturation and a number of other options. It's sealed waterproof housing protects the battery, transmitter and internal moving parts from being damaged by sea spray and potential submersion.

We have also designed onboard cameras for auto racing that mitigate the effect that both weather conditions and general track conditions have on camera operation. Onboard

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cameras mounted on the exterior of a car are subject not only to rain, but also to asphalt, hot rubber tire particles and a variety of engine fluids from other cars. Without the ability to clean the lenses throughout the race, these cameras would become useless as races go on due to lack of visibility and clarity of the images they produce.

We addressed this problem with its tape clear camera system. The tape clear camera system incorporates a scrolling cellophane layer over the camera lens of certain onboard cameras. As the cellophane becomes wet or covered in debris, it can be scrolled to place a new, clear section of the tape over the lens. With a fresh roll of cellophane tape installed before each race, the tape can be cleared numerous times during the broadcast. This feature is controlled remotely from the production trailer as the team monitors the quality of each camera in operation during a race and makes adjustments to ensure impeccable video is produced for the broadcast.

The old standby

Although BSI works hard to prepare for weather conditions and incorporate advanced solutions into its technology, industry veterans know that in some ways, protecting equipment from the elements has not changed that much in the last 30 years. When a storm approaches and rain begins to fall, you'll still see our crew covering thousands of dollars worth of equipment not with specially designed waterproof covers, but with good old-fashioned trash bags.

"In some ways, it's the advancements in trash bag technology that have done the most to improve the protection of equipment in the elements," Larsson jokes. "Despite how fast BSI's technology is changing the way television is produced and viewed, there are times when we just have to follow the K-I-S-S principal and keep things simple. Sometimes a trash bag does the job just as well or better than anything else will." BE

Colleen Stanley is a sales and marketing specialist with Broadcast Sports Inc.

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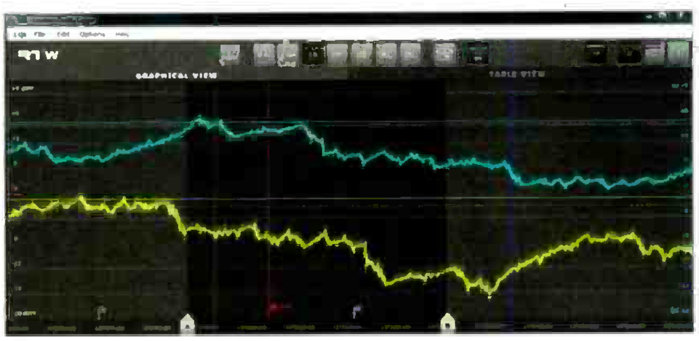
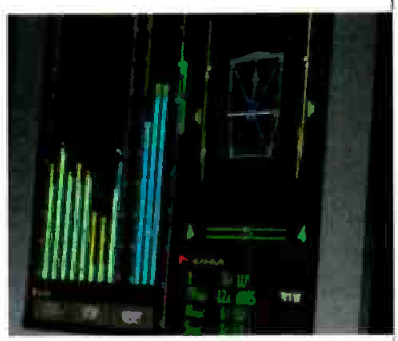

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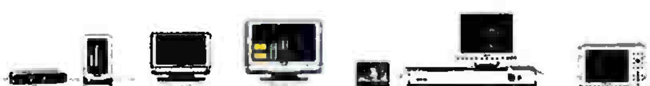

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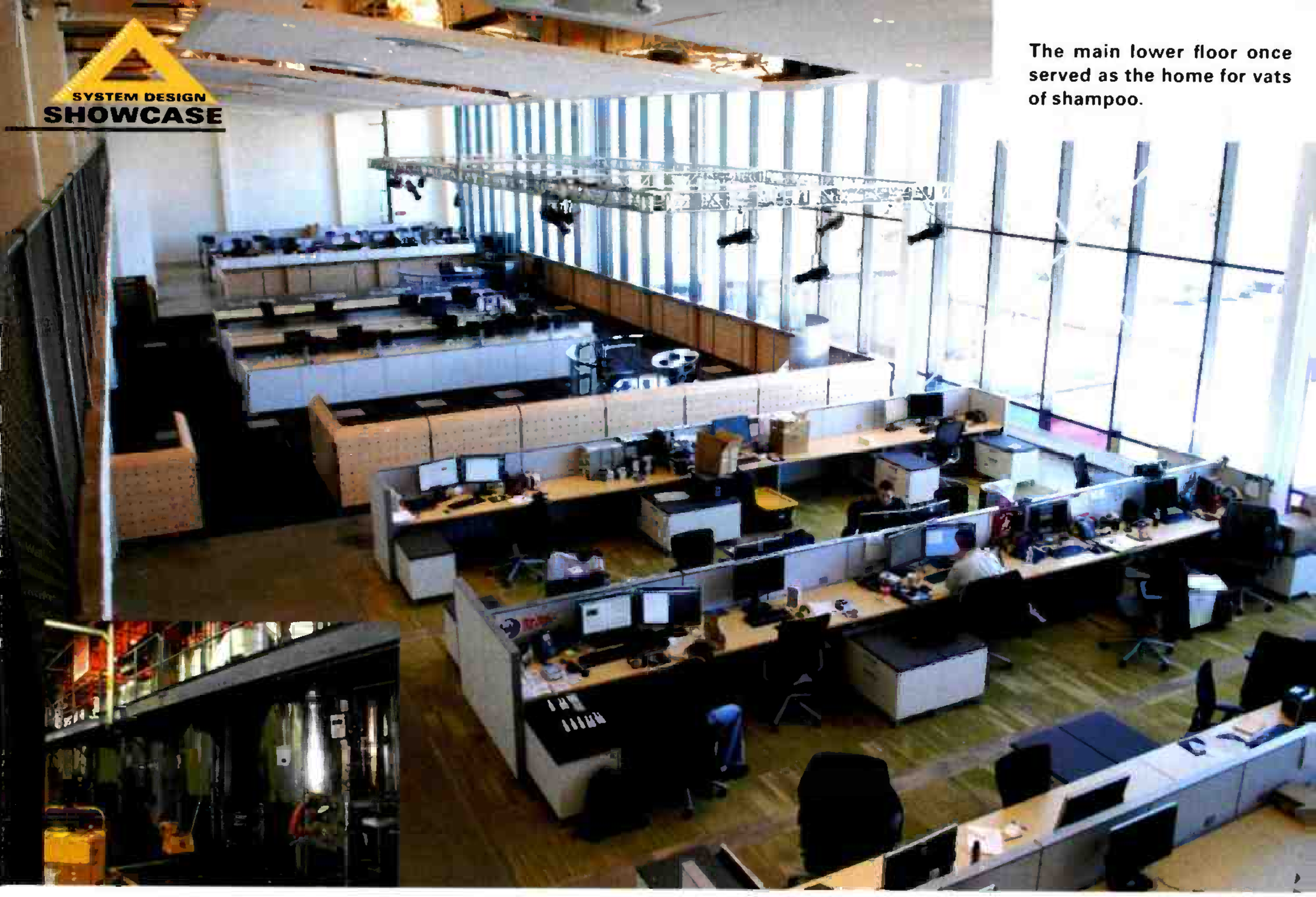

The main lower floor once served as the home for vats of shampoo.

NBC Sports Group builds new home

Comcast consolidates NBC Sports Group's operations in the former Clairol factory.

BY MICHAEL GROTTICELLI

The new International Broadcast Center that NBC Sports Group is now completing in Stamford, CT, to house the division's NBC Sports, NBC Olympics, NBC Sports Digital, NBC Sports Network and the NBC Sports Group Regional Network's management team is a conglomeration of ingenuity, technology resourcefulness and vision.

As part of Governor Dannel P. Malloy's "First Five" economic development program, in 2011 NBC Sports Group signed a lease for production, studio and administrative office space in the former Clairol factory that made Herbal Essences shampoo. But it was in late 2010 when Comcast's VERSUS (now NBC Sports Network) began looking at possible new homes for the growing network. Similarly, NBC Olympics, housed in a different office in Stamford, was also looking for a larger facility. It turned out both of their respective leases were set to expire within six months of each other.

This was during the same time that NBC was planning and gearing up for the 2012 London Olympics. In fact, many of the lessons learned from NBC's experience with past Olympics broadcasts have been brought to bear in the new place. (NBC has held the American broadcasting rights of the Summer Olympics since the 1988 games and the broadcasting rights to the Winter Olympics since the 2002 games. In 2011, Comcast paid $4.38 billion to broadcast the 2014, 2016, 2018 and 2020 Olympics, the most expensive television rights deal in Olympic history). The facility is designed to support all future "at-home" Olympic efforts, which previously had

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Shown here is the master control and transmission room. The transmission area employs a 512 x 512 EQX router to handle 132 incoming feeds, while an internal IP-based network allows signals to be monitored from any desktop in the building.

been housed at NBC's New York hub at 30 Rockefeller Plaza.

"We had a lot of real-world experience to pull from to really make this a showplace for the best content creation workflows," says David Mazza, CTO & SVP, Engineering, NBC Sports & Olympics. "The team understands how a networked system works, and we know the successes and pitfalls of file-based HD production. We also recognize the need to do things as efficiently as possible in order to sustain a successful business model for Comcast and the NBC Sports Group."

Finding a factory

NBC Sports Group looked at more than 20 locations across the region before settling on the former Clairol factory and its two floors of 170,000sq ft each of unencumbered workspace with 24ft high ceilings, wide spacing between the support columns and, on the lower floor, a 10-bay loading dock. It also had its own water supply (a half million gallons replenished almost daily, previously used to make shampoo) and 8MW of diverse power fed directly from a utility substation. The new address is 1 Blachley Road and, as of late April, finishing touches like outside landscaping and other accoutrements were still being installed.

A 100,000sq-ft administration building and commissary was completed by July. The facility supports 500-plus employees regularly, and up to 750, combining four different offices from three different states.

The concept of a large facility that could support all of the various sports properties under one roof immediately appealed to upper management at NBCU/Comcast, and with the support of Governor Malloy and Stamford Mayor Michael Pavia, the decision was made to go ahead and co-locate every sports and digital media division except The Golf Channel (which is based in Orlando, FL) and the 11 locally-based NBC Sports Regional Networks. A new multi-year lease was signed in early November 2011, demolition began that Thanksgiving, and design and construction began in earnest in February 2012.

Through much intense schedule and manpower coordination, systems integration and sweat, NBC Sports Group went live from the facility in December of 2012. Paul Koopmann, VP, Engineering, NBC Sports Group, likes to say that they went from "dust to airwaves in a mere 10 months," including redundant signal paths throughout, finished edit suites, control rooms, audio suites, voice-over rooms and all of the necessary requirements of a file-based video production center that supports both NBC's television and online operations.

Getting the building ready for staffing was a monumental task, made more challenging because in June 2012, nearly half the staff went to London for the Olympics, leaving Koopmann and Project Manager James Lee to manage the project until the start of the NHL Hockey season in September. The subsequent NHL lockout gave the team a bit of breathing room, but not much, according to Larry Thaler, president of Positive Flux (based in New York), whose team helped keep the project on track and coordinate with the engineers in London for all the equipment decisions and ordering.

Thaler says that having many of the key decision makers and producers away at the Olympics didn't make things any easier. Most of the final designs were being completed while the engineering leads were away focused on the Games. Also, many of the major systems were in use in London until the end of August and needed to be quickly delivered to the U.S., installed and tested.

"There were significant logistics and coordination between teams to make this happen," Thaler says. "A large number of talented people worked long hours to make this a success. It's really an amazing feat of engineering."

Al Cohen of Diversified Systems, Inc. (DSI, in Kenilworth, NJ) worked closely with Sony to implement all of the equipment and systems. DSI employees are still on-site and will be for some time. Cohen says it was one of the largest and fastest builds his company has ever completed.

Flexible foundation

After removing all signs of its past — including vats of "green goo" and massive manufacturing equipment — the crew installed a completely new audio and video infrastructure inside the building, complete with new HVAC and power systems, a wireless intercom network and HD-SDI, IP and embedded audio signals running everywhere. This

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Shown here is one of three new production studios constructed within the building. The production studios have been outfitted with LED lighting, saving the company significant sums of money in power bills.

all-3Gb/s 1080i/50/60 HD system design includes more than 1100mi of SMPTE hybrid coax, 600mi of Cat 6 and 500mi of single-mode fiber cables linking $40 million in equipment. (Much of that equipment repurposes from past Olympics projects.)

Comcast now has one of the most advanced television facilities in the country. Indeed, the facility has gone from a previously thriving shampoo factory to a vibrant digital media creation factory and (pardon the pun) has seen silky, smooth results.

The production systems are primarily Sony and Calrec, with playback from EVS, post production from Avid, and archive/MAM from Avid and Harmonic. In addition, most of the infrastructure is made up of signal distribution technology from Evertz Microsystems. There's an Evertz EQX 1152 x 1152 router (with a 10GB backplane) that will "someday soon" be increased to a 2300 x 2300 I/O matrix. They make heavy use of passive optical splitting patch panels that convert the signals as necessary and eliminate the need for hundreds of D/As. This also conserves space in the central machine room, which has been built on a raised floor with extra rack space for future growth.

The transmission area employs a 512 x 512 EQX router to handle 132 incoming feeds, while an internal IP-based network allows signals to be monitored from any desktop in the building. It's a state-of-the-art MPEG-2/H.264 (future) based MATV system supported by technology from Harmonic (for encoding) and Triveni Digital (for PSIP information) in which every feed gets its own dedicated IP channel. These MPEG-2 signals are converted to QAM for display on all of the TV sets throughout the building.

A mezzanine level of offices overlooks a centrally located newsroom and features a full complement of EVS and Avid logging stations, with uploaded assets stored on a central Avid ISIS system. Also feeding into this are 60 Avid Media Composer edit rooms, which are strategically located into separate areas that serve the different

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sports properties now housed inside the new building. Small details, like an elevating workstation desk (made by TBC Consoles) that allows producers and editors to comfortably work side by side and collaborate on projects lend a unique feel to the workplace.

Olympics-tested HD production

All production occurs inside four large studios (with room for two more), complete with Sony HDC-2400 cameras and adjourning HD control rooms. These rooms feature Sony MVS-7000 switchers and a Miranda Kaleido-X multiview monitor wall (with 10 Sony OLED and LCD flat panel monitors). There are also numerous seats of Chyron HyperX graphics workstations (all are instantly available to the production staff) and three large audio mixing rooms, complete with Calrec Artemis consoles. All of this

Design team

NBC engineering and design team: Joe DiFrisco, Chris Jorgensen, Terry Adams, Darryl Jefferson, Jim Miles, Phil Paully, Bob Dixon, Kamal Bhangle, Craig Lau, Chris Lubbers, Matt Maresco, Bob Kiraly, Tom Duff, Jasper Veldhuis, Dominic Torchia, Jon Ort, Stacey Georgiou, Bob Gilmartin, Matt Green, Steve Kaufman, Rob Laug, Chip Adams, John Pastore, Craig Bernstein, Steve Wong, Steve Cuneo, Tom Saylor, Terri Leopold, Paul DeRubeis, Kathy Mosolino, Tom Popple

NBC Sports Group management team: David Mazza, CTO/SVP, Engineering, NBC Sports & Olympics; Paul Koopmann, VP, Engineering, NBC Sports; John Fritsche, SVP, Olympic Operations & Stamford facilities, NBC Sports & Olympics; Mike Meehan, SVP, Operations, Sports & Olympics

NBC sourcing and procurement: Robert Sanders, VP, Sourcing NBC Universal; Randy Raddatz, VP Sourcing & Production Logistics, Sports & Olympics; Mike DiBenedetto, Sourcing Manager, NBCUniversal

Integration team: Al Cohen, Don Niehoff , Sony/Diversified Systems, Inc.; Larry Thaler, Positive Flux

Architectural design, mechanical/electrical and construction management team: Mancini & Duffy: Joe Montalbano and Amanda Colonna; AMA: Arthur Metzler, Anthony Cucuzza and Chris Bodenmiller; Gensler Associates: James Lee, Proj. Mgr.; Pavarini Construction: Brian Boyce, Paul Poellot

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Evertz Microsystems: EQX router, IRM and modular
EVS: XT3 servers
Harmonic: Ingest servers, video servers, MPEG-2/QAM encoders
Image Video: Tally systems
Miranda Technologies: Kaleido multiview processors
RTS: Communications systems
ScheduALL: Scheduling systems
Sony: HDC-2400 HD cameras, MVS-7000 production switcher, LCD and OLED monitors, 4K projector
TBC Consoles: Workstation desk
Spectra Logic: T-Finity tape archive driven by SGL software
Telestream: Transcoding and workflow
Tektronix: Scopes and rasterizers
Wohler: Audio monitoring, AMP1-MADIe panel

equipment was previously used at the 2012 London Olympic Games.

The production studios — and indeed the entire building — have been outfitted with LED lighting, saving the company significant sums of money in power bills. The latest-generation lighting fixtures, although more expensive than traditional incandescent studio lighting, use about 6W of power per square foot, compared to 50W per square foot for a typical studio lighting rig. They're also using DMX controllers to shut off the LED lights completely at the end of the day, saving more power. Due to this efficiency, Koopmann says that NBC received a $500,000 credit on its power bill because it had saved so much on usage. To date, it is one of the largest rebate checks in the state's history.

Next to the studios are two screening rooms where the talent and production teams can watch ongoing sporting events between appearing on-air. These rooms include a Sony 4K projector for pristine viewing of live game feeds.

In addition, NBC's famed "Highlights Factory," responsible for all of the short clips ingested, edited and sent out over the Internet — which had been previously housed at NBC's famed Studio 8H, home of "Saturday Night Live" at the 30 Rock headquarters for the 2008 and 2012 Olympics — is now based inside the new Connecticut building. There's more space and people to get the job done. Leveraging the on-site AVID MAM, the digital media group can access all clips from the archive as well as from incoming feeds. Once finished, online stories are pitched to streaming encoders associated with the various delivery platforms that NBC Sports uses to distribute content to the outside world. In general, all content is accessible to all groups within the building. Another innovation is a new, MADI-based hot-mic system leveraging a new panel design made by Wohler.

Having it all under one roof will bring new efficiencies and get content to air (or in viewers' hands) faster. Mazza says the system will be enhanced in some areas, as it gets ready for next Winter Olympics in Sochi, Russia. The Stamford facility will have full, real-time connectivity to the on-site IBC in Russia. In preparation for the at-home effort for the Olympics, the facility was designed to be switchable between 50Hz and 60Hz.

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On a daily basis, once content for any of its distribution platforms is finished in Stamford, it is sent to NBC's 30 Rock for commercial insertion, and other types of program IDs are added before being distributed to viewers of the TV networks. Content is also distributed via 10GB ASI links to the CNBC building in Englewood Cliffs, NJ, for playout and commercial insertion for Comcast/NBC Universal's Cable Networks. There's also seamless connectivity to Comcast's Digital Media Center in Denver, CO, and Encompass (a teleport in Glenbrook, CT).

The new facility allows Mazza's team to set up entire working systems to test out before being shipped out in the network's field-proven Racks-in-a-Box System (RIBS) containers to the next Olympics site. They've never had that kind of space before.

Heads above the competition

If Koopmann and Mazza tend to use the word "factory" a lot in describing the new facility and how they expect it to operate, that's not an accident. The mentality of a finely tuned operation that efficiently produces content on a massive scale is exactly what they were after in the initial design drawings. The demand from consumers for more and more content dictated the type of workflows and workspace that NBC has now put into place.

"The irony is that if we had started from scratch and taken three years to build a brand new building, it would probably look a lot like this one does today," Mazza says. "But, that took an extraordinary effort by a lot of incredibly talented people who worked countless hours to get this done on time."

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Indeed, the building maintains a factory look and feel, but the overall goal to be open and somewhat informal with recycled elements throughout makes it refreshing in terms of new television production facility design. Basically, it's a place that encourages a happy work environment and unlimited collaboration among the staff. And due to its heritage, maybe — among all of the new HD production gear and signal monitoring and distribution technology — the content will appear more clean and shiny. BE

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

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Leveraging large datacenter switches

IP-based systems will catch up in the next three years.

BY JOHN MAILHOT

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Over the next few years, we will all hear a lot about "packet-based facilities" or the "all-IP plant." It seems like the next big thing, but really this is just the continuation of a long, steady migration that has been going on since the late 1990s.

There is no question that IT technology has slowly taken a strong foothold in broadcast plants over the past decade. Previous to this, it was considered only for financial and administrative tools — certainly not for on-air operations, much less studio and production work. Both NLEs and video servers were radical shifts for broadcasters to not only grasp, but also trust since they use IT technology. (See Figure 1.)

At the same time, the broadcast world was wrestling with consolidating multiple functions into the baseband router that historically were performed by external equipment. Analog-to-digital audio and video conversion equipment was integrated into the core I/O of the broadcast router. Coaxial and fiber interfaces are equally available to provide for any desired connectivity. Mux/demux technology allows the creation of embedded audio infrastructures with the functionality of discrete audio plants. Integration of multiviewers into the core capability of the router functionality produced a radical shift in the design of monitor walls and how they were used.

IP delivery

Video-over-IP first began with compressed video, typically in bit rates suitable for consumer delivery of SD video signals using MPEG-2 (around 3Mb/s). At these rates, consumer television services could be offered over ADSL technology, and telecom operators in many areas began offering consumer services based on SD and MPEG-2. Supercomm in 1999 featured demonstrations of this technology from several vendors. The deployment of HDTV in the U.S. actually slowed down ADSL-based video, as ADSL technology needed to evolve enough bandwidth for HD services to homes; H.264 compression also helped to close that gap through increased coding efficiency.

The rise of digital cable TV deployments in the late 1990s provided a large digital pipe to the home. While not IP-based in the (256QAM) delivery system, the digital cable infrastructure drove a need for switching and routing of compressed video signals into every cable headend and many satellite uplink infrastructures as well. These headends began with vendor-specific bespoke interfaces but rapidly evolved to standards-based TS over IP in order to save cost and provide interoperability among vendors.

Today, most compressed video signals in headends worldwide (IPTV, digital cable, satellite and even digital terrestrial broadcasters) are switched, routed and transported using RFC2250/SMPTE 2022-formatted data over IP on Ethernet. This is now regarded as a mature stable

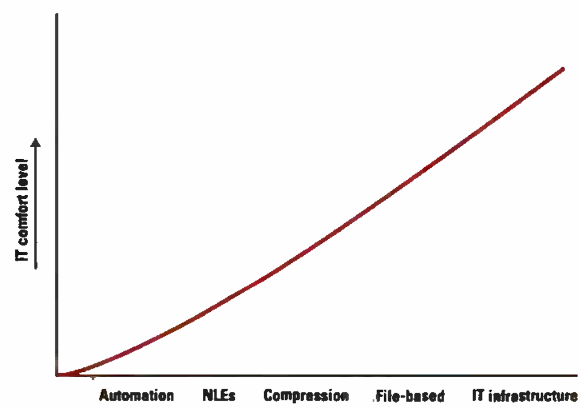

Figure 1. IT technology has slowly worked its way into broadcast plants over the years. As broadcasters became more comfortable with it, they have used it for more and more tasks.

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technology with high reliability and reasonable cost structure, and coaxial DVB-ASI is relegated to special cases and test equipment.

Ethernet

Meanwhile, over the past 10 years, Ethernet interfaces and their related packet switching technologies have undergone extreme capability growth. Twelve years ago, GigE was mostly on fiber, and fairly expensive. Today, 10GigE on Cat 6A copper is widely available, and highly capable Ethernet switches with hundreds of 10GigE ports are available from multiple vendors at reasonable (for what they are) prices. Fiber-based 40Gb/s — and even 100GigE interfaces — are available in these same switches. This capability growth, and the large marketplace of high-capacity switches, is driven by the rise of large-scale datacenters and cloud/virtualization centers, a demand generator that is larger than the broadcast equipment industry and likely to continue for many years.

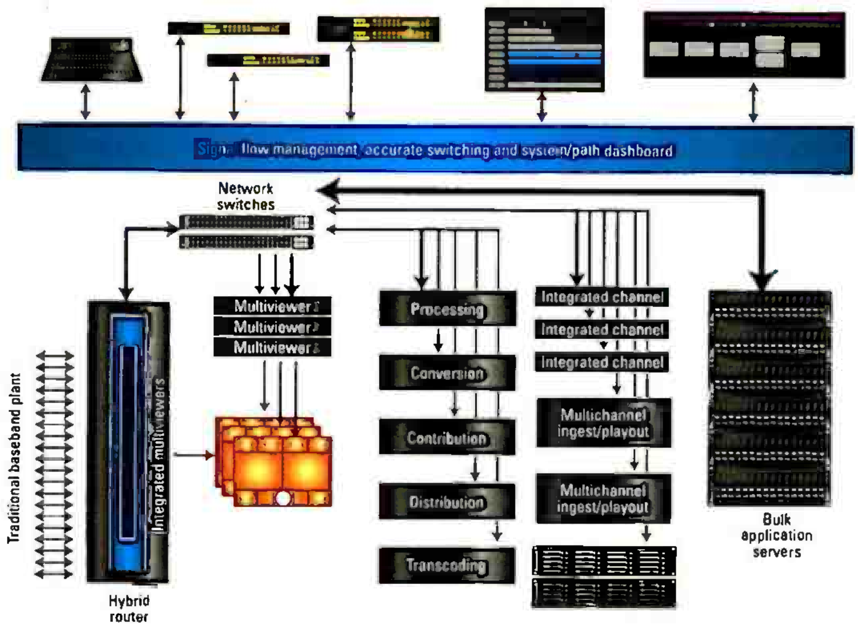

Figure 2. Hybrid plants will exist, with islands of coaxial and islands of IP bridged together. The routing control system will make it act like one plant in the same way it does today with multiple routing matrices.

SDI

Inside the broadcast plant, SDI technology has also evolved, matured and improved over the same time period, with advances in re-clocking and equalization technology enabling 3Gb/s SDI signals over 390ft of coaxial cable, and 3Gb/s capability across SDI routing fabrics up to thousands of ports at ever-declining cost. Fiber interfaces for SDI have also been standardized and packaged using interchangeable SFP optics, further reducing cost and improving interoperability of SDI infrastructure. HD-SDI today is one of the most vendor-interoperable interfaces in the broadcast industry.

Routers

But an SDI router is more than just a switcher of bits; the routing control system (RCS) is the organizing fabric

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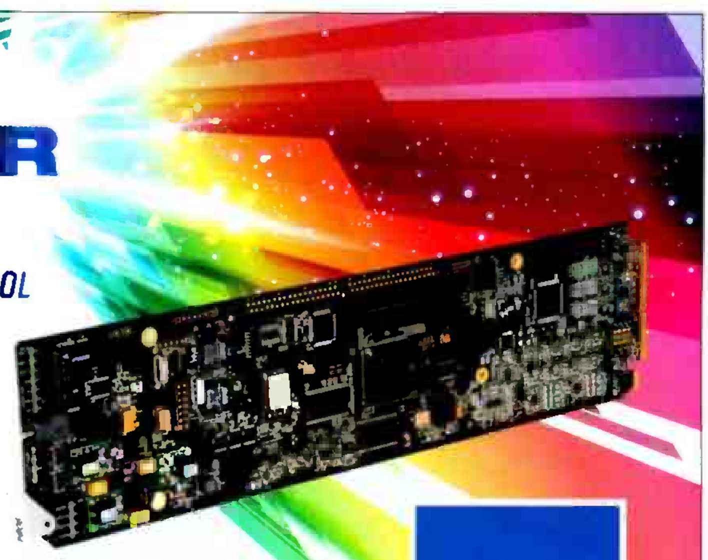

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of the plant. The RCS gives human, operational names to the signals, groups them logically and provides a consistent operational interface to the people and automation systems. An operator needs to select the source and destination regardless of which format or transport structure the signals are currently in. This requires a control structure that takes into account conversion and intelligent tie-line management to perform the grunt work of ensuring a seamless flow of signals throughout the plant.

While the core plant may evolve with video and audio signals transitioning to being carried over IP/Ethernet technology in the future, the unifying control layer provided by the RCS is more important than ever, integrating the various IP-connected endpoints into an operational, controllable system.

IP/Ethernet technology promises to revolutionize the plumbing of the plant. Instead of expensive coaxial cables carrying pixels to a central "house router," equipment can be interconnected with simple 10GigE cables to Ethernet switches, consolidated together with 100GigE fibers. Hybrid plants will surely exist (and may be the norm) with islands of coaxial and islands of IP bridged together. (See Figure 2.) The RCS will make it act like one plant in the same way it does today with multiple routing matrices. The efficiencies come over time through reduction in the number of cables, the types of cables and the installation/maintenance effort. Over time, endpoint equipment will have native IP interfaces for video and audio, enlarging the IP infrastructure, but the RCS will still be the control layer that makes it "act like a router."

The finished look and feel of television programming today depends on frame-accurate control of switching, graphics and playout, with careful time-alignment of signals to switch cleanly. Traditional SDI routers, SDI playout servers, SDI switchers and SDI graphics inserters provide this frame-accurate execution and clean switching today at reasonable cost and great scale. Saving money on improved plumbing will only be welcome if it also produces competent-looking output.

In the future

As an industry, we are working through the standards, practices and methods required to produce excellent television using packet-based technology. Standards for how to do all this on IP are being worked on today. While a few early adopters may deploy limited-functionality IP infrastructure in 2014, we anticipate "functional parity" of IP-based production systems with current top-of-the-line baseband systems sometime in 2016 or early 2017.

So what does this "plant of the future" look like? If the past is any indication, the plant of the future will look, at first, a lot like the plant of today. It will still produce television content by putting together segments of programming and interstitial elements including advertisements. It will still handle live news and live sports, and deliver them through many parallel delivery systems to millions of consumers. The underlying technology may change at some levels, but the core mission of the plant remains the same: to produce and deliver the content people want, at an appropriate quality level, through multiple delivery systems and to multiple devices. BE

John Mailhot, Solutions Architecture, Harris Broadcast.

? Send questions and comments to: editor@broadcastengineering.com

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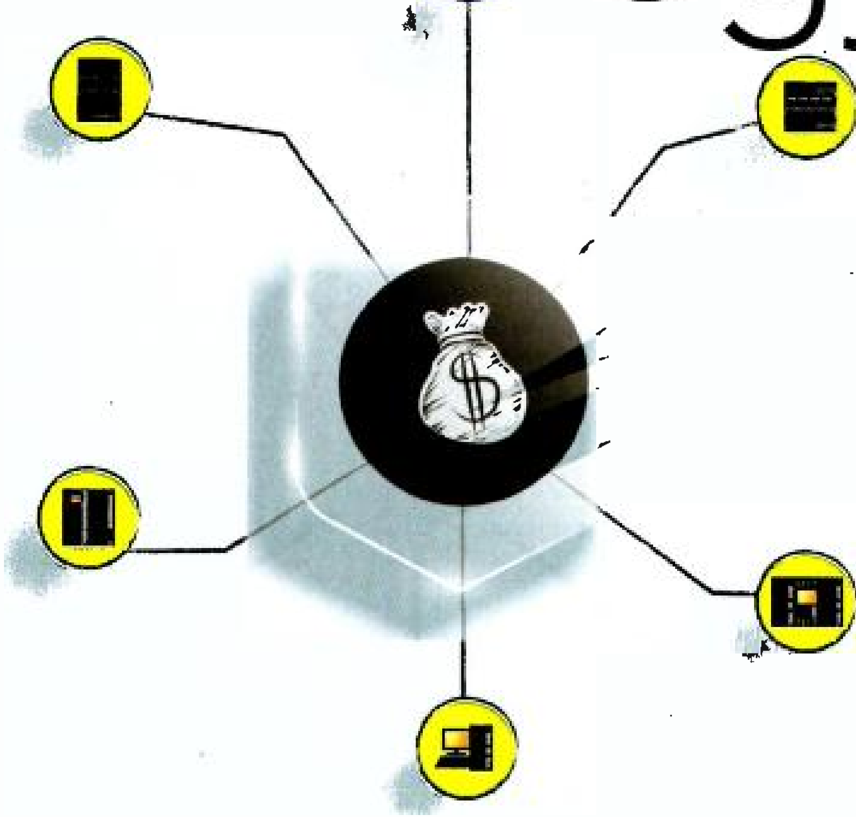
Solution-oriented technology



The broadcast industry is shifting to a business-driven approach.

BY TONY TAYLOR

Much paper has been covered over the last few years with articles about huge paradigm shifts in technology. The debates at IBC and NAB have all focused on these changes, talking about "file-based infrastructures" and "service-oriented architectures" taking us away from the comfort of SDI on BNCs and audio on XLRs.

But there is an even more fundamental shift that, while some are reluctant to make it, is ultimately inevitable. This is the shift from a technology-driven approach to a business-driven approach, in which the hardware — the servers, the transcode farms, the asset management — are all enabling elements.

In this view, the requirements will be defined in terms of outcomes and cost per unit. The systems engineering will have to support those business requirements. That is a big shift from the traditional, engineering-led television station. It is the only way that the challenges we all now face can be addressed.

One major international content producer found that, in the space of a year, its audiences moved from choosing 30,000 hours of online content to 750,000 hours — an increase of 2500 percent. The inescapable fact is that consumers have the ability to watch what they want, when they want, on the device they want, and they like that ability. All content owners need to find a response.

Automation

No one would argue that delivering to multiple platforms can be done without seamless automation. There are simply too many combinations of resolution, codec, wrapper, metadata and streaming for it to be possible to create all the variants by hand.

In turn, that means that metadata has to do much more than simply

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be accumulated. Workflows have to be automated, making intelligent decisions based on the metadata to determine what happens to the material. We now routinely hear of the "workflow engine." The critical point here is that the workflow engine must be capable of rapid configuration by the user to meet developing needs.

In this content factory model, the workflow engine is alerted to the presence of new material by the asset management registry. It then interrogates the rights management database to see what the content is, what can be done with it and when it should be available. That triggers a series of workflows that ensure that the media ends up in the right form at the right place at the right time.

The important point to underline, though, is that once the workflows are established, then content will move from ingest to being delivered on multiple platforms with zero human intervention. The workflow engine alone moves the content, making its

The workflow engine must be capable of rapid configuration by the user to meet developing needs.

decisions based on commercial rules, all the way to the playout suite, the content distribution network or the mobile streaming drivers. That is what I mean by seamless automation.

Each delivery format will require a new packaging process and thus a new workflow. The logical path for such a workflow might include:

- Identify the content and the intellectual property rights attached to it, to determine if it can be offered on this platform;
- Determine the resolution and frame rate of the content, and if necessary modify them to suit the target device;
- Encode it using the appropriate codec and bit rate (or, in the case of mobile devices, bit rates for adaptive delivery);
- Perform quality control checks on the content;
- Select or set the required metadata and reformat for the target delivery platform;
- Perform quality control checks on the metadata;
- Bundle the essence and the metadata in the appropriate wrapper;

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- Deliver the content to the buffer store or to the content delivery network. (See Figure 1.)

Each step requires the content to be routed to a specialist device, which might be a piece of dedicated hardware, or it might be software running on a standard server or processor farm. It might even be a cloud service. So as well as pushing the content down the chain, the workflow engine has to consider priorities in those devices. What happens if there is congestion in any part of the workflow? Again, intelligent decision making will resolve the problem. If congestion is routine, then the system should report the fact, which suggests the need for additional capital investment.

SOA

The obvious technical route to achieve this is the service-oriented architecture (SOA), and I would argue that is the best way to do it. It is important to remember, though, that the SOA is not a technology; as the name suggests, it is an architecture that binds the technology together. Its value is in linking the islands of processing to create a robust and reliable system that will work day in, day out, and if necessary, create its own workarounds should any element fail.

I return to my key point, though, which is that the technology platform is there to support the business requirements. The other benefit of the solution-oriented technology, therefore, is to generate business analytics, information that can be delivered to the enterprise management system and on which commercial decisions can be made.

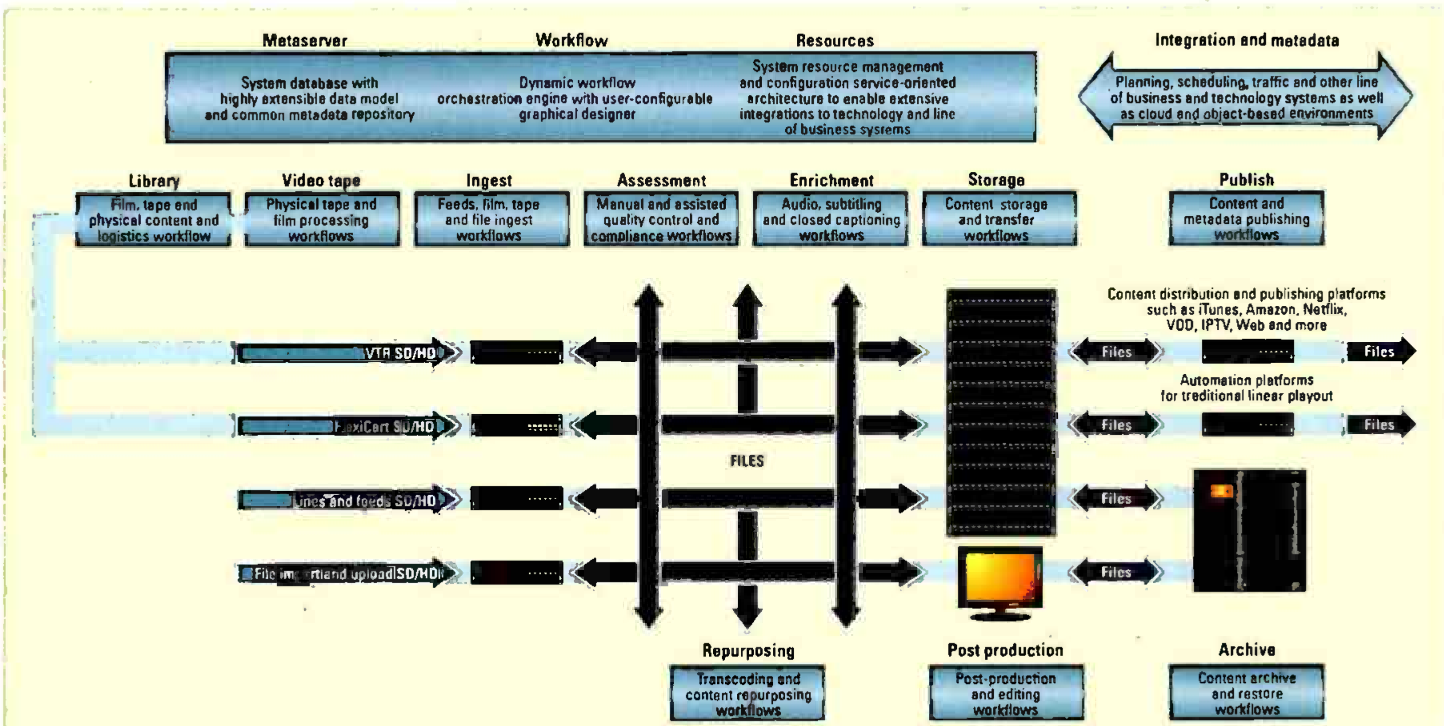

Figure 1. Workflows have to be automated, making intelligent decisions based on the metadata to determine what happens to the material. The workflow engine must be capable of rapid configuration by the user to meet developing needs.

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A few paragraphs back I outlined the workflow that needs to be established every time there is a new delivery platform — a new model of tablet or smartphone, for example. The workflow requires the use of a number of technical resources along the way to package the content correctly.

The other benefit of the solution-oriented technology approach is that it generates business analytics.

How much of these resources is required? Will this new workflow create bottlenecks? Will it put established workflows at risk? Business analytics, as part of the workflow engine, will give you the answer.

Most important, though, it should give you the answer to the most important question of all. How much does it cost to implement this workflow? If we want to serve a new device, what are the financial implications? How will we recover those costs? Will our income from the new service be more than the cost? Is it financially viable to do this?

We are now seeing broadcasters using business analytics to put real numbers into their return on investment calculations. Irish national broadcaster RTÉ has just implemented a comprehensive file-based architecture, on the basis that it can develop its own workflows using the simple tools in its digital and media asset management platform.

The broadcaster is saying publicly that it will save around $600,000 in the first year alone. That is value created across the enterprise, which again is a new way of looking at investment in broadcast engineering that until now has been focused on the cost of implementation. It's another shift in attitude, driven by solution-oriented technology. BE

Tony Taylor is chairman and CEO, TMD.

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ADDITIONAL RESOURCES

The following are available on the *Broadcast Engineering* website:

- An examination into the processes needed to convert video for transport, Part 1.
- An examination into the processes needed to convert video for transport, Part 2.

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Fiber-optic cabling

A well-planned optical infrastructure can provide the framework for reliability and future-proofing.

BY KARI EYTHORSSON

At its core, fiber-optic signal transport, where pulses of light are carried through a strand of transparent material, enables signals to move at a faster rate and further than ever before.

Following its development and adoption by the telecommunications industries in the later part of the 20th century, this technology has become commercially feasible for other industries and a much-needed answer to the broadcast and AV industries' ever-evolving hunger for more bandwidth over long and short distances that were previously unfeasible, whether for technical or economic reasons.

As it is especially well-suited for high-speed transport of a high rate of data (think HD, 3-D and 4K/UHD), a fiber-optic infrastructure has become, and continues to be, a smart cost-conscious alternative to copper, which by its physical features fights every change between 0 and 1, while maintaining total electrical isolation, immunity from crosstalk, grounding problems and external interference in any cable plant.

The immense benefits of optical transport and its ease of use have supported fast-paced development of fiber-optic components, while driving the price of optical connectivity to an all-time low. All of this comes at a time when the price of copper-based connectivity is at an all-time high.

The widespread availability of optical cabling has led to the development of various audio, video and broadcast products that are capable of converging and simplifying cabling infrastructures, as well as enabling reliable transport and routing of an immense number of audio, control and ultra-high definition video signals over long and short distances. For these reasons and more, fiber-optic cabling is a welcome solution for several different applications. However, as with all of the professional broadcast and AV systems we use, optical transport does have a learning curve with regard to specifying, deploying and maintaining such systems. Here, we discuss the various applications where fiber-optic transmission is well-suited.

Broadcast studios

With the immense space-savings that can be realized in conduit and patchbays alone, television studios can greatly benefit from a fiber-optic infrastructure. Distance limitations of high-bandwidth video signals can be easily overcome, allowing more flexibility in determining the locations of equipment rack rooms and control rooms relative to the studio floor.

In addition, multiple audio, control, intercom, RF and video signals can be multiplexed onto a single fiber strand or pair, allowing connection panels that previously needed to be permanently mounted within a studio to now be portable and even shared between multiple facilities with automatic discovery and routing upon connection. This provides a studio with greater operational flexibility while maximizing the ROI of the infrastructure.

OB vans/ENG trucks

When it comes to outside broadcast operations, an efficient deployment of portable equipment is of absolute necessity. For example, during a sporting event at a stadium or an arena, multiple channels of video, camera links, microphone inputs, IFBs and intercoms are required around the field of play, at the commentator position and to tie into the facility's broadcast control center.

Modern facilities — be it a sporting arena, theater or the like — often have an extensive infrastructure of fiber-optic cabling for temporary deployment, allowing convenient connectivity from the truck bay to different connection points around the facility. As the dark (unlit) fiber is adaptable to the signal it carries, any I/O device that the truck carries can be used by the infrastructure.

If further connectivity is required, portable fiber cables are lightweight, robust and deployed quickly, so they can carry multiple signals, with cabling redundancy, as compared to


Here, fiber was run underwater out to man-made islands. The fibers each carried hundreds of channels of redundant audio and control channels for distribution of audio for PA systems, control for lighting fixtures, and video for projection and LED screens during Kuwait's 50th Constitution Day Celebration.

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bulky and heavy copper cable looms that carry a limited number of signals. Audio and video splits from live productions can be achieved easily using fiber without loss of data and external interference.

Long-haul transmission

Fiber-optic cabling was originally developed for military and civilian communications due to its superior long distance and high-bandwidth capabilities for digital signals. Today, telephone and cable television infrastructures consist of extensive networks of fiber-optic cabling between and within metropolitan areas with significant efforts to push fiber connectivity to "the last mile" to commercial facilities and residential homes.

Unlike the previous generation of copper telecom infrastructures, with fiber optics, adding bandwidth by optical wave division multiplexing, or simply by pulling more strands than is needed, is easier and more cost-effective than ever. Renting a dark fiber or an optically multiplexed wavelength within a metropolitan area on a temporary or permanent basis is now possible, making it easier than ever to get reliable, non-compressed, low latency signals between different sites using endpoints managed by the end customer.

Live event production

The production of live events is becoming increasingly more complicated as patrons expect to be dazzled in new ways at every show they attend. Technical producers are expected to cater to the ever-changing requirements, often at the last minute, involving changes that exceed capacity and/or distance limitations, while still having to keep the event costs on budget.

At an outdoor event, for example, multiple locations may require connectivity over thousands of feet, requiring audio, control and monitoring of remotely connected loudspeakers, cameras and video screens, often in harsh environments. Corporate events and tradeshows can span an entire convention center with multiple breakout and overflow rooms requiring intercom, loudspeaker feeds, video and audio feeds, and video monitoring. Simply put, the weight and volume of fiber-optic cabling is a fraction of what traditional portable copper cabling would cost to achieve this, providing the client with extensive savings in terms of transport and labor during set-up and teardown.

Shown here is an example of multiple copper-based signals combined onto a unified fiber-optic routing and transmission platform.

Performance art centers and houses of worship

Today's performance art centers and contemporary worship facilities feature an extensive array of technical systems to support artistic performances and getting the word out. It is not uncommon that these facilities now include recording and broadcast capabilities as well, not to mention sound reinforcement systems that rival those used by the most prominent touring artists.

Traditional audio infrastructure has previously required expensive, multiple strands of copper wiring per audio channel, as well as loss-inducing splitters for different requirements of sound reinforcement, recording and broadcast feeds. Along with this often comes the headache of maintaining hundreds of circuits and connection points, as well as electrical services, grounding and operating multiple circuits to get signals from A to Z.

When using a modern optical infrastructure instead, all audio signals can be combined on a unified infrastructure, providing noiseless cabling that can be portable, if necessary, and redundant. What you get is an infrastructure that allows lossless splits and decentralized routing control that can be set and configured from anywhere as well as acting as a bridge between different audio formats. Additionally, when more channels are required, I/O devices can simply be added to the existing infrastructure.

Conclusion

As you can see, there are several types of applications that can greatly benefit from a fiber-optic transport infrastructure. Of course, before installing one, it is important to specify the correct cabling and connectors, as well as to make sure the infrastructure has been given a thorough commissioning before being put into use. Educating and tooling yourself to be prepared to provide proper care and maintenance to ensure prolonged, optimal performance is equally important. When specified and used correctly, maintained with the right tools and methods, a fiber-optic infrastructure will provide a very reliable service.

Fiber-optic cabling has immense benefits over a traditional copper cable plant due to its low signal attenuation, the ever-expanding bandwidth availability and its immunity to external interference. Paired with the lower prices of transceivers, cabling solutions and the continuous development of easy-to-deploy tools to install and maintain, this make optical fiber infrastructures an essential piece of a modern cabling workflow. Coupled with today's innovative audio, visual and broadcast solutions that use optical transport, fiber-optical cabling infrastructures have the potential to unify, simplify and future-proof any cabling infrastructure. **BE**

Kari Eythorsson is Application Engineer, Optocore and BroaMan.

? Send questions and comments to: editor@broadcastengineering.com

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Digital Nirvana's AnyStream IQ

The cloud-based system records, logs and monitors live and recorded streamed broadcasts.

BY HIREN HINDOCHA

Streaming video on smartphones, tablets and computers is becoming commonplace, to the point where some content producers create programming only for web streaming. If content producers don't have a video streaming strategy in place, most are working on one or planning a move in that direction.

Given the growing importance and prevalence of streaming media, it's important to maintain high picture and sound quality and that the stream runs when scheduled. This means monitoring and logging all the moving parts that go into generating the stream and the stream itself.

Web captioning and proof of compliance

Digital Nirvana's AnyStream IQ records streaming video, including HTTP Live Stream (HLS) and Flash video. It provides alarms when it detects a loss of audio or video or if captions are missing. New FCC web captioning mandates require broadcasters to provide web captioning for hearing-impaired viewers. Broadcasters must provide proof of compliance for these new mandates as well. AnyStream IQ can demonstrate compliance with these regulations.

Within their streamed programming, producers often insert ads that differ from those running on the traditional broadcast. TV stations must create a log of their streaming content to provide a "proof of airing" to their ad clients. Industry experts forecast a triple-digit increase in ad growth for online media through 2017, so the need for online ad monitoring will only expand. AnyStream IQ provides proof to advertisers that their commercials ran when they were scheduled.

Benefits in the cloud

Now that web-based services for storage and online project management — aka "cloud services" — have proven capable and reliable, the power of the web can be used to monitor, log and analyze video streams. This removes the need for expensive equipment to record, log and analyze streaming video. With a cloud-based monitoring system, all that's required is a computer with a browser and an e-mail address that will be sent alerts and alarms.

Today's monitoring and logging systems must also record all of the available metadata — such as closed captions, commercial insertion information and audio level data — embedded in the transport stream. Along with its standard browser interface, our streaming media monitoring system also allows for convenient monitoring using an iPad tablet. A content owner's advertising representative can use an iPad to access programming and advertising information during sales calls with clients.

As a cloud-based service, users specify the URL of the stream, and AnyStream IQ records the stream, extracts the closed captions and provides a browser-based interface to search the

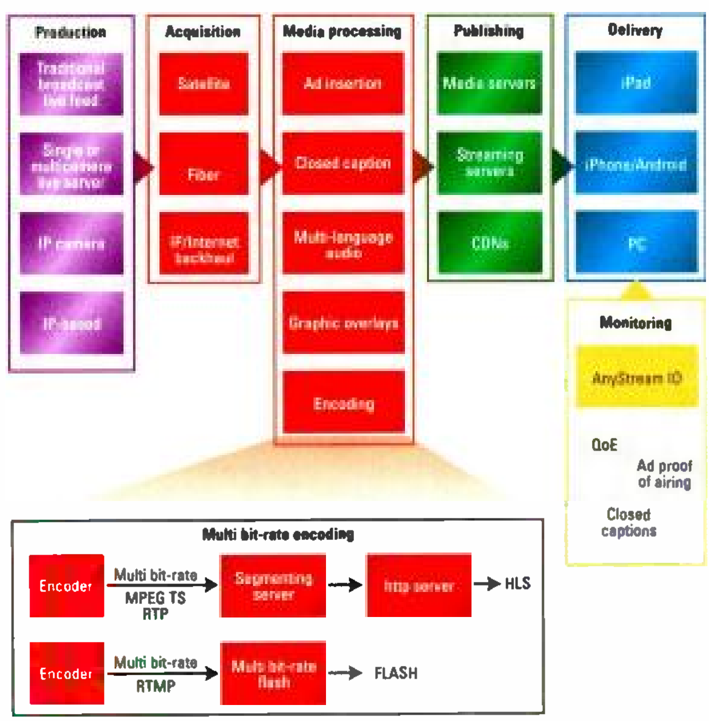

Figure 1. Shown here is the live stream workflow of AnyStream IQ, which provides proof of advertising and web caption compliance.

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recorded stream. With its cut/clip feature, users can make frame-accurate in-and-out points on video and share the clip for either compliance or proof-of-airing purposes. Figure 1 shows the live stream workflow.

Captioned text increases value

Efficient cloud-based processing of captions opens new doors for valuable video content. Content owners can view the FCC's recent requirement for online captioning as a business opportunity. Captions are an ideal way to provide text for video streams that can be found via search engines — increasing the searchability and value of programming.

Web captions that provide searchable information increase the commercial life of content. If there is no text, it's harder for viewers to find and consume content, thereby limiting the program's value. Exploiting caption data is a way to unlock previously difficult to recover value in your content.

Traditional broadcasters are moving rapidly into web streaming. Some content owners use web streaming just for distribution. AnyStream IQ supplies the tools you need to record, log and extract metadata information that makes content infinitely more searchable. It also provides a convenient way to confirm advertising playbacks, which helps maintain client relationships and provides confirmation that FCC caption requirements have been met.

Affordable monitoring

Possibly the best part is that monitoring with this subscription cloud-based service requires only a web browser and an e-mail address; no additional equipment is required. It eliminates upfront installation and server maintenance costs, and turns monitoring into an operating expense as opposed to a capital expense. With subscription-based pricing, the cost of monitoring is spread over the course of an entire year, making it affordable to a range of broadcasters. BE

Along with its standard browser interface, the streaming media monitoring system also allows for monitoring using an iPad tablet.

Hiren Hindocha is CEO of Digital Nirvana.

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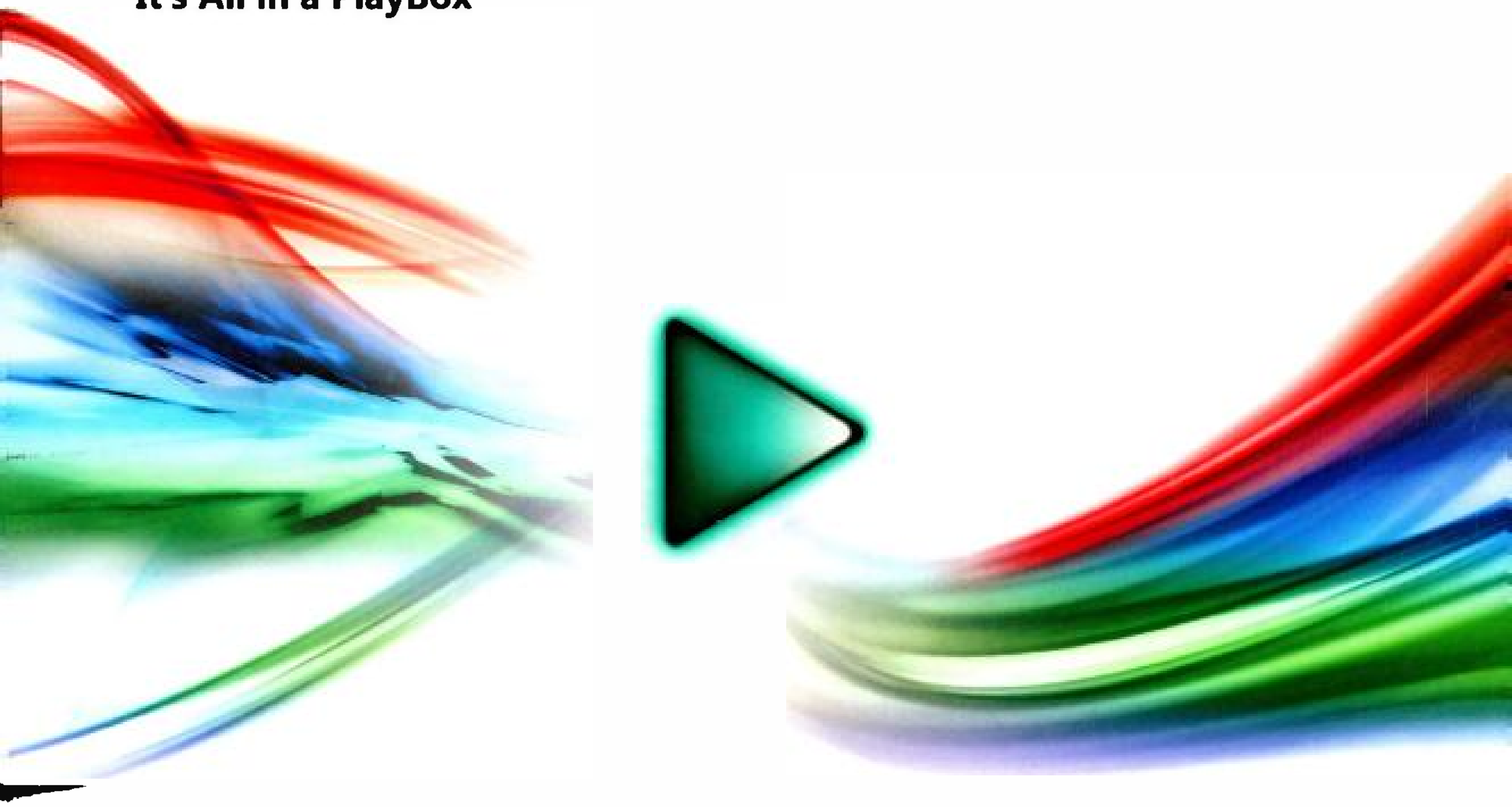

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