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JUNE 2013

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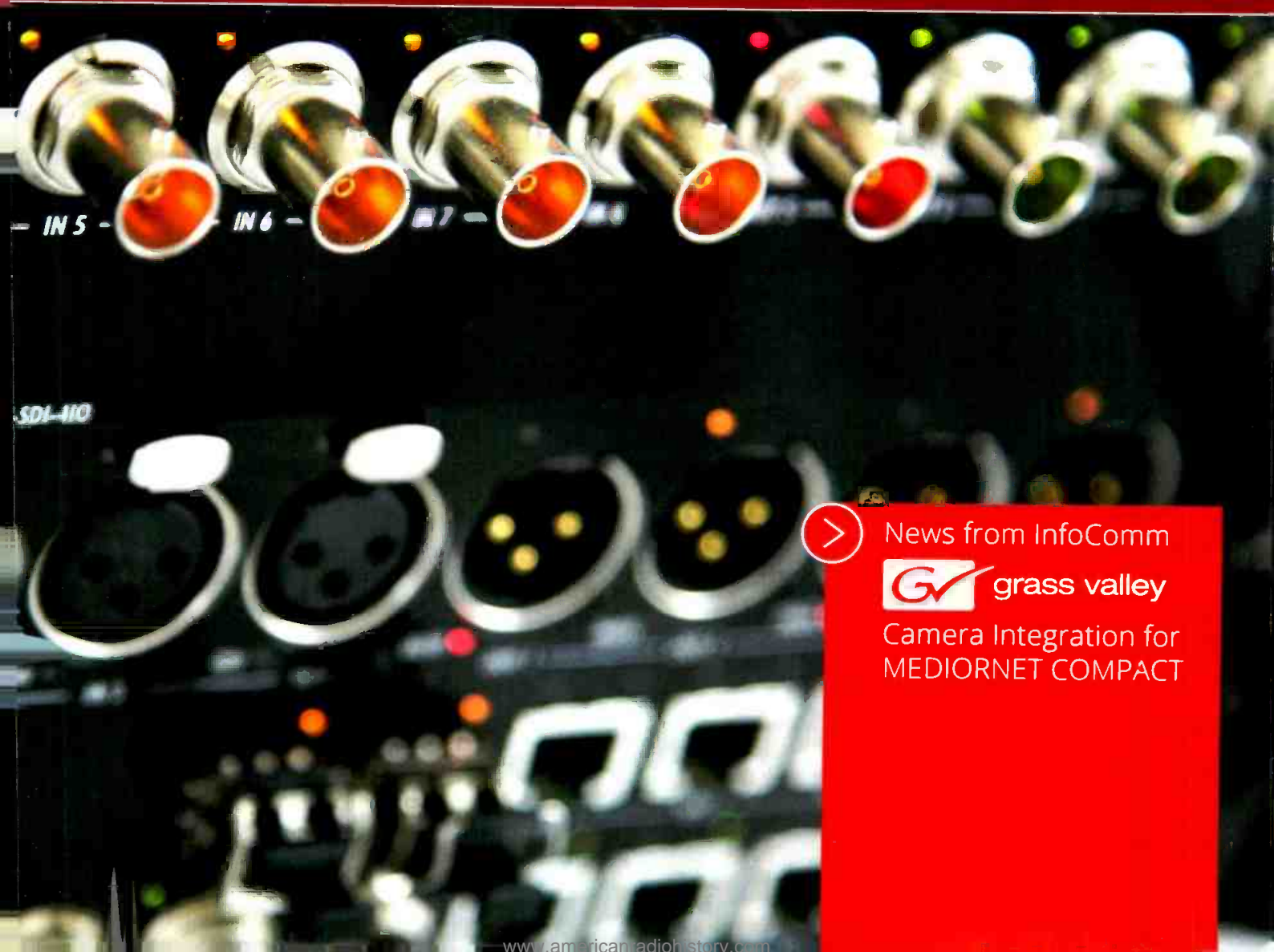
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Camera Integration for
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FEATURES

30 Pick Hits

A panel of independent judges has selected the top products from the 2013 NAB Show.

40 NAB product jackpot

Get one last look at some of the newest and hottest products from this year's NAB.



48 The future of imaging technology

CMOS sensors for broadcast cameras are here to stay.

BEYOND THE HEADLINES

DOWNLOAD

10 Fiber fundamentals

As data rates increase, facilities should cut their coax ties.

DIGITAL HANDBOOK

TRANSITION TO DIGITAL

14 Smart TV

Developers are making progress on online TV.

COMPUTERS & NETWORKS

18 Troubleshooting media networks

Check the power, and then use these other tips.

PRODUCTION ROOM

20 RAIDers of the lost archive

Learn the benefits of each storage strategy.

continued on page 6

LATEST NEWS!



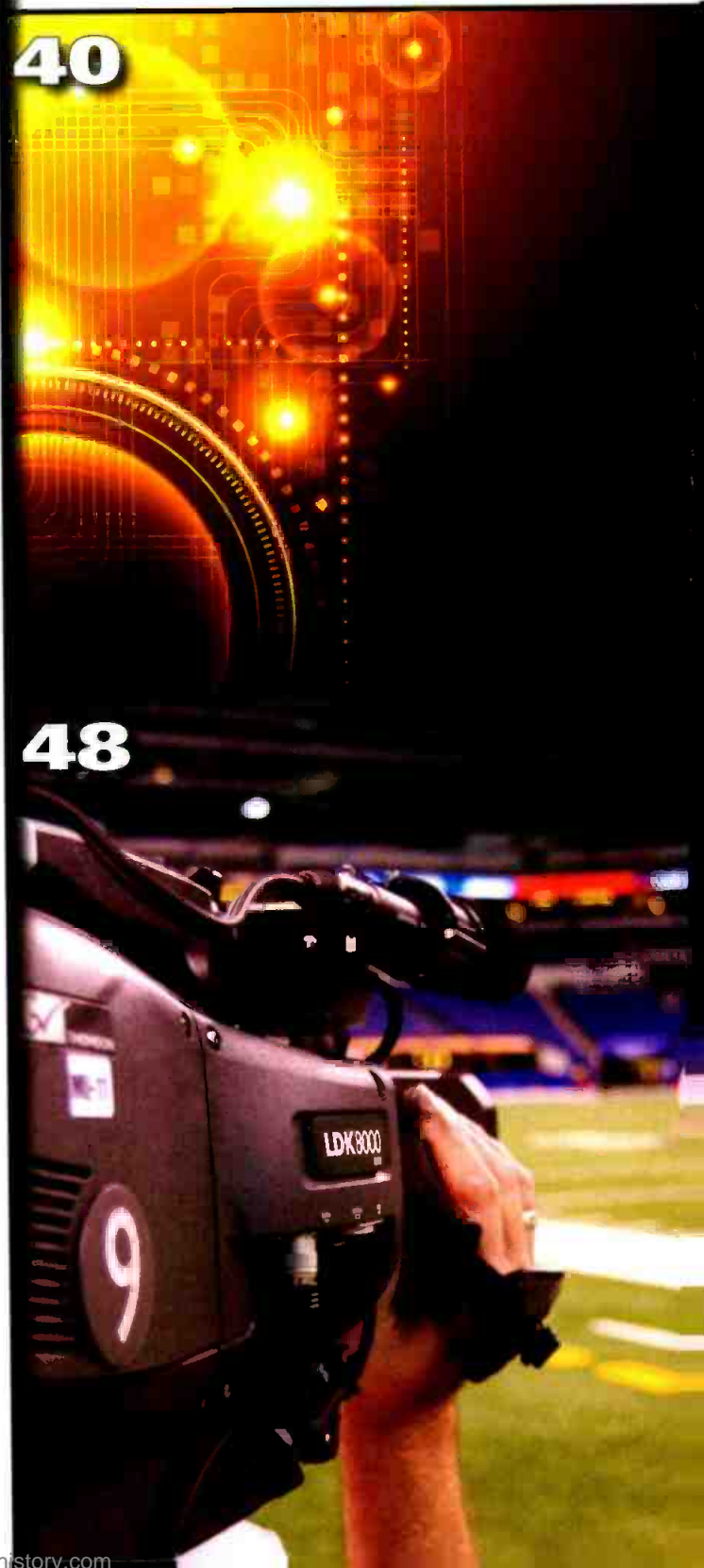
William Lake, head of the FCC Media Bureau, told those attending the ATSC Annual Meeting on May 9 that there's no time to dawdle in developing a new TV standard, but that it's not likely to play a role in the incentive auction and repacking process.

Learn more at www.broadcastengineering.com

30

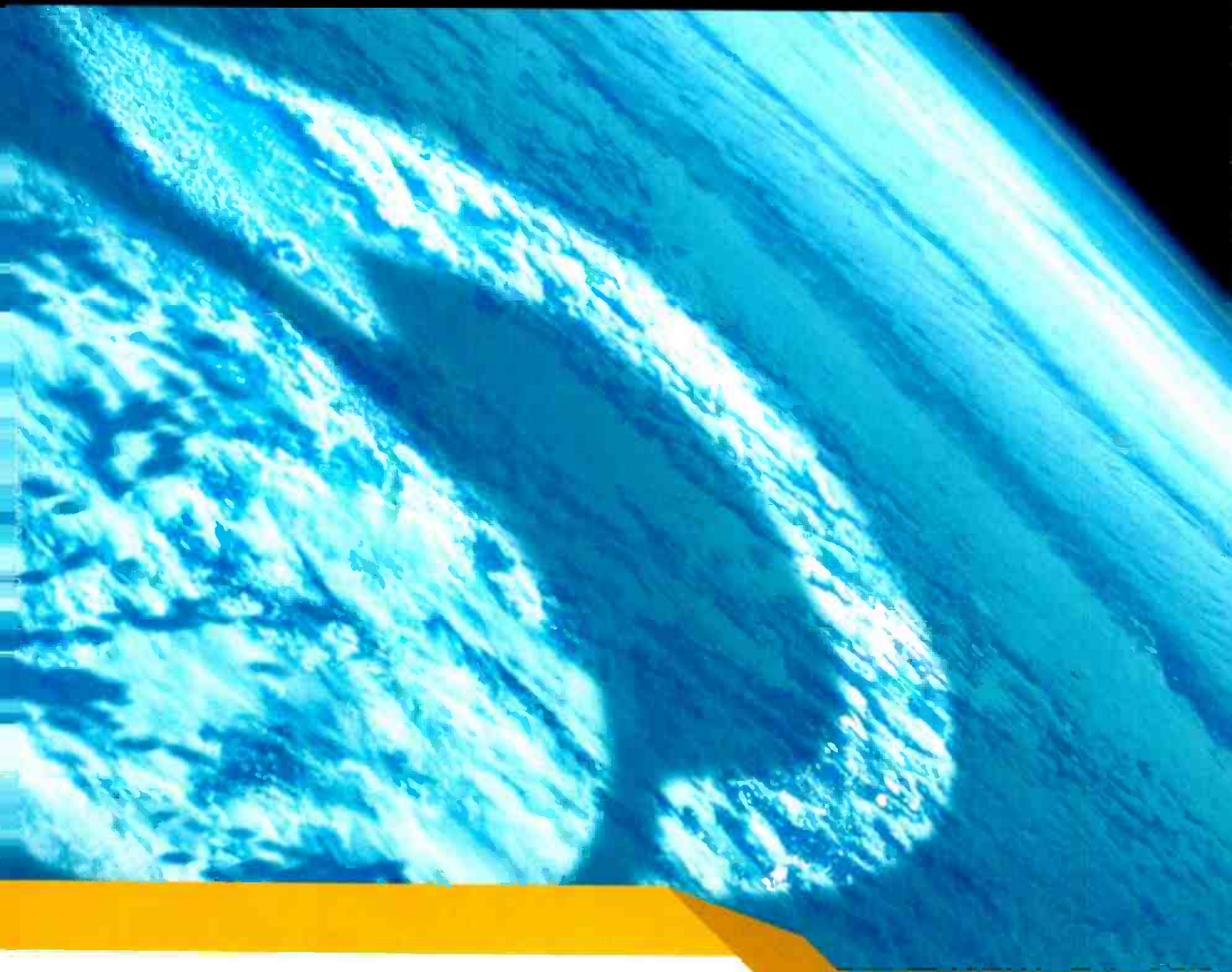


40



48

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SYSTEMS INTEGRATION

NEW MEDIA NETWORKS

24 Wireless audio

System advances have it keeping up with its video counterpart.

SHOWCASE

26 QVC

The retailer expands its multichannel capability.

NEW PRODUCTS & REVIEWS

APPLIED TECHNOLOGIES

52 Camera Corps' Q-Ball

54 Marquis' Project Parking

TECHNOLOGY IN TRANSITION

55 The rise of AVB

Precise timing lets broadcasters use IT networking.

DEPARTMENTS

8 EDITORIAL

57 CLASSIFIEDS

58 ADVERTISERS INDEX



LATEST NEWS!

President Barack Obama nominated Tom Wheeler as chairman of the Federal Communications Commission. Wheeler, 67, has served as president of both the National Cable and Telecommunication Association and CTIA, the Wireless Association.

Learn more at www.broadcastengineering.com



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- Additional resources at the end of articles

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26

ON THE COVER:

Video retailer QVC installed Evertz switchers and routers, Omneon servers, Vizrt graphics engines and Haivision's KulaByte encoder in its new master control room to oversee the production of multichannel content.

52



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FCC future cast

On May 1, 2013, President Obama announced his selection as the next chairman of the FCC, Thomas Wheeler, currently managing director of Core Capital Partners. Let's consider what skills Mr. Obama might have seen in Mr. Wheeler to make him qualified to head the FCC.

Particularly noteworthy might have been Mr. Wheeler's skill as an Obama fundraiser. According to Opensecrets.org, an organization that tracks political donations, Wheeler helped raise \$500,000 for Obama's 2012 presidential campaign, and between \$200,000 and \$500,000 in the 2008 election. Also, he raised money for now Secretary of State

television and the wireless industry hall of fame' and highlighted his private-sector success."

When asked about Wheeler's background, Senate Commerce Committee Chairman Jay Rockefeller said, "A lobbyist is a lobbyist."

Could this make Wheeler's confirmation as FCC chairman an uphill battle?

"All of the senators in the Commerce Committee know Tom as a lobbyist who funnels funds to them, not as a stand-up guy from a regulatory agency who is able to take heat," said one veteran Washington telecommunications insider, who spoke anonymously because of the political sensitivity of the subject.

So much for the fundraising and political connections. What does Mr. Wheeler think about broadcasters?

In his own blog, he writes, "This brings us to the issue that stands between today and the wireless broadband future ... regarding proposals for the FCC to run a voluntary incentive auction that would reallocate broadcast spectrum for broadband wireless purposes. [I said] the future looked bright for entrepreneurial broadcasters, as well as for those who wanted to continue delivering the traditional single-channel linear service — but individual broadcasters have to move beyond 'we've always done it this way' and decide in which vision of the future they want to participate. When broadcasters 'just say no' to any repurposing of the spectrum assigned to them by the government they are exacerbating what could become a national crisis, as well as missing a business opportunity.

"When television signals went digital, however, the ability to do so much more with the broadcast capacity opened up. As we approach the second anniversary of the digital conversion, however, broadcasters have done little to support the proposition that they can use the efficiency of broadcasting to satisfy the demand from consumers for flexible video consumption as opposed to when the broadcaster chooses to deliver the program."

If I may slightly turn a phrase from Bette Davis playing Margo Channing in the 1950 movie, "All About Eve": "Fasten your seatbelts, broadcasters. It's going to be a bumpy ride."

BE

Bruce Dick

EDITORIAL DIRECTOR

Send comments to: editor@broadcastengineering.com

ADDITIONAL RESOURCES

Multiple additional resources are available in the June editorial on the *Broadcast Engineering* website, or in the June digital edition.



John Kerry's 2004 presidential campaign. So, Wheeler passes muster as a longtime Democrat fundraiser.

Wheeler has also served on Obama's Intelligence Advisory Board since 2011 and advised Obama's transition team. Visitor logs show he has made numerous visits to the White House in the past five years, attending one-on-one meetings with staff, as well as several holiday receptions with the Obamas. Such activities might help him be perceived as an Obama team player.

But, perhaps the main skill he brings to the FCC is that he's a serial lobbyist. Wheeler was president and lobbyist for the NCTA from 1979 to 1984, and CEO and lobbyist for the CTIA from 1992 to 2004.

Wrote Obama's hometown newspaper, the *Chicago Tribune*, "Obama, who famously in 2007 pledged never to allow lobbyists to 'run my White House', joked about Wheeler being 'the only member of both the cable



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Fiber fundamentals

As data rates increase, facilities should cut their coax ties.

BY SARA KUDRLE

Why is fiber fundamentally important? Bandwidth. As data rates increase for applications such as HD, 3-D and 4K (or UHDTV, as it is also known), so will the need to transport that data from cameras to trucks and then studios and throughout facilities. Traditional coax has been the primary method of transport, but fiber has properties that are essential as we move to the transportation of higher data rates.

To start, coax cannot go the distance. The maximum distance that a 3Gb/s signal can travel on coax is 100m, whereas the distance 3Gb/s can travel over fiber is more than 35,000m. That's huge.

There is also weight to consider. For example, 100m of TAC2 fiber can support two camera feeds, return, stereo audio, gunlock, Ethernet and more. The fiber needed for this would weigh about 6.2lbs. To get the equivalent support in coax would require three coax and four copper audio wires, which would weigh approximately 124lbs.

Fiber can accommodate high speeds and multiple signals on one cable.

Then, of course, there is speed and bandwidth. Fiber can accommodate high speeds, virtually limitless bandwidth and multiple signals on one cable. Fiber also benefits from immunity to electromagnetic interference. Coax is susceptible to interference, has a maximum speed of 3Gb/s and can only carry one signal per cable.

How fiber works

Fiber-optic cables are essentially a "light pipe" of flexible glass (silica)

or plastic fibers that guide light as it passes through at high speed.

A fiber cable is made of five elements: core, cladding, buffer, strengthening fibers and a jacket. The core is the actual optical fiber and is surrounded by cladding that keeps the light inside. These two elements are encapsulated within a buffer, which

Tactical fiber is amazing and can withstand being driven on by trucks, dollies and cranes. It can also be bent, hung over the edge of a building or crushed. Or, you can slam cable in a door or bend it to a point where light cannot pass. Even then, you only have to release it, and the picture pops right back.

Core: This is the glass or plastic fiber where light pulses travel through.

Cladding: This surrounds the core and keeps light inside the core with its mirror-like reflective.

Buffer: This hard plastic coating protects the core and the cladding.

Strengthening fibers: Kevlar-strength members give the cable pulling strength.

Jacket: The outer protective coating is typically made of PVC.



Figure 1. A fiber cable is made up of five elements beginning with the core, where light passes through, out to a jacket normally made of PVC.

is a hard coating that protects both core and cladding. Covering the buffer are strengthening fibers that give the cable pulling resilience. Finally, the cable is fitted with a PVC jacket as further protection. (See Figure 1.)

Fiber cables can be single cables (one fiber per cable), or they can be bundles of up to 24 strands, which are quite useful for infrastructure applications. For fixed infrastructures, air-blown fiber speeds up installation considerably. What used to take four to six people eight hours to install now only requires two people and about 30 minutes.

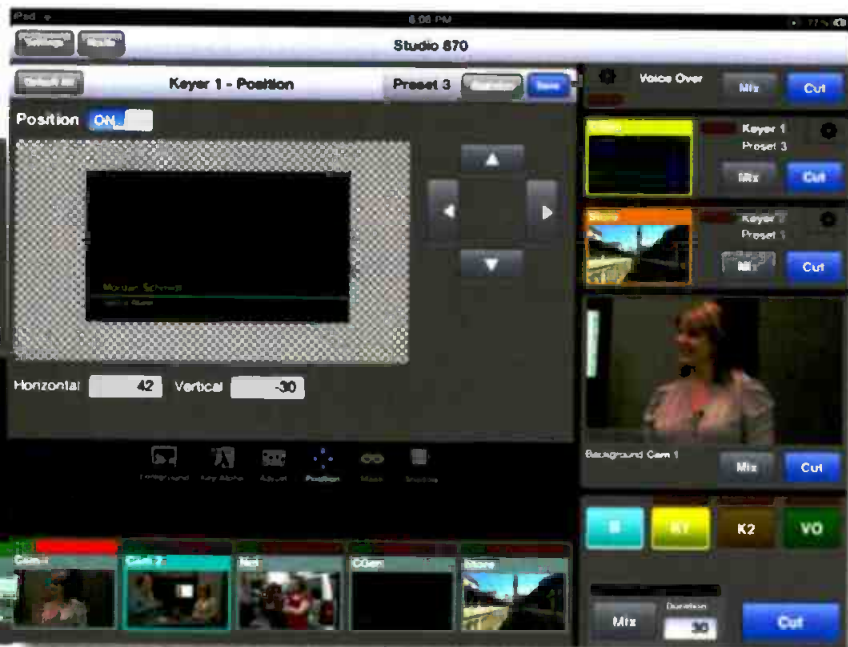
For field productions, hybrid cables, which combine fiber, copper and tactical cables, are important. Hybrid cables combine fiber and wire in one jacket to allow power to accompany the fiber cable for applications that require it, such as cameras. For these applications, SMPTE has defined a standard cable known as SMPTE 311M.

Fiber connections

There are many different connectors for fiber. Small, single-fiber connectors such as FC, ST, SC and LC are the most common and are best for protected infrastructures. In harsher broadcast environments, connectors such as MX or Delphi, which are rated for military conditions, work well. When you are using hybrid fiber, you can use SMPTE 304 (Lemo) or OpticalCON (Neutrik) connectors, which have both copper and fiber contacts. SMPTE 304 can handle the higher voltage of broadcast cameras, but isn't as strong or easy to clean as OpticalCON. Neither hybrid option is as reliable as a fiber-only solution because copper and glass react differently to extreme temperatures, as well as to being bent and stretched.

An MX "expanded beam" connector makes connections easier because precise alignment is not as critical. Plus, the MX is not as susceptible to

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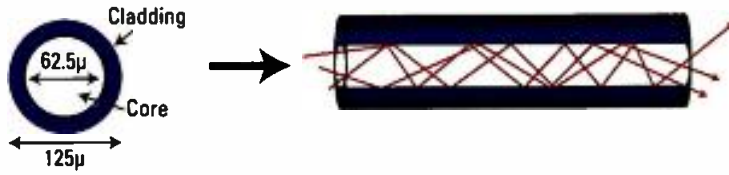


Figure 2. In a multimode setting, light waves travel down the fiber on different paths.

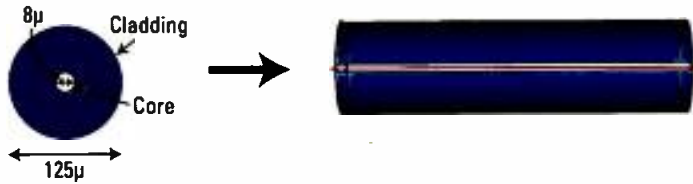


Figure 3. Single-mode fiber was developed after multimode and has a much smaller width. The smaller space enables light to travel a straight path.

dust because lenses inside magnify and refocus the light beam down the connector, which makes it less likely to be obstructed. It's similar to the difference between using your index finger to block light from a laser pointer and doing the same in front of a car headlamp.

Single-mode vs. multimode

Single-mode versus multimode is the most misunderstood concept when talking about fiber. Multimode means light waves, after leaving the laser, bounce down the fiber on different paths. (See Figure 2.) This is due to the 62.5µ diameter of a multimode fiber, which means that photons arrive at varying times (which is not good for HD television).

Single-mode fiber was developed much later than multimode, and it has a much smaller radius of 8µ. (See Figure 3.) This enables light to travel straight down the fiber, thus incurring less loss and allowing increased bandwidth to be carried. At distances greater than 500ft, single-mode fiber is the only option for HD/SDI.

Does fiber have issues?

Issues with fiber are more related to system design than fiber itself. Fundamentally, the presence of dirt and lack of appropriate power are common challenges. Fiber is susceptible to dirt at the points of connection. Particles can scratch connector ends as well as absorb light. That is where expanded beam connectors

mentioned earlier are useful because they are much more forgiving.

Power budget calculations are needed to ensure that links do not exceed a "link budget," which is the output power of a transmitter minus the maximum receiver sensitivity. (See Figure 4.) Splices, patch points, patch cables, dirt, connectors at each end of the fiber and the fiber cable itself need to be factored in when designing the power requirements of a facility.

Applications, appetite for fiber are growing

As data rates increase to support 4K and beyond, so will the appetite for fiber. There are great applications for fiber, including ENG, SNG, live events and sports. An outside broadcast vehicle particularly will enjoy noticeable economies on fuel and setup times, with no compromise on the ability to move high-quality video.

Without fiber, the number of cables required to pass standard signals, including video, audio, data and Ethernet, would be well over 80 cables. However, the exact same signals can be muxed onto a lone three-strand fiber cable.

Fiber can also be used in production studios and intra- or inter-facility transport, which is increasingly important given the interest in 4K. By transitioning to fiber now, a facility will be prepared to support increased bandwidth as video bit rates increase on the path to 4K and beyond. In short, your facility's future is in fiber. **BE**

Sara Kudrle is product marketing manager, Miranda Technologies.

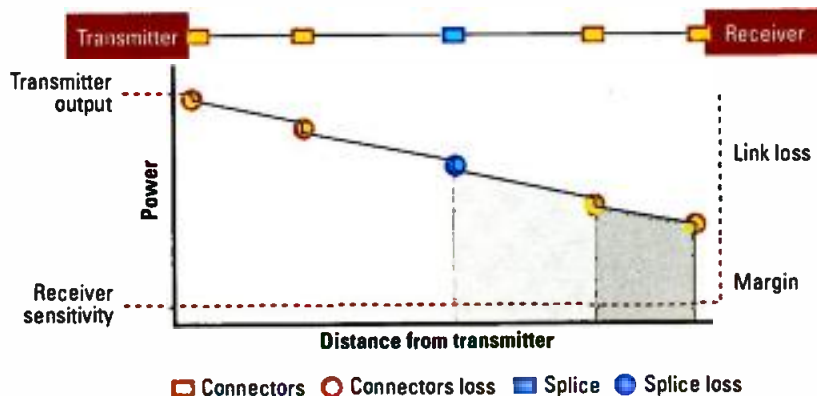


Figure 4. A power budget calculation (output power of a transmitter minus the max receiver sensitivity) helps ensure that links do not exceed a link budget.

Send questions and comments to: editor@broadcastengineering.com

ADDITIONAL RESOURCES

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

- Learning to use fiber optics in the studio
- Fiber Optics, a 3-part series



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Smart TV

Developers are making progress on online TV.

BY ALDO CUGNINI

Although Internet-TV functionality as a Web service has been implemented in various TVs by several manufacturers — often under the moniker of “Smart TV” — there has not been a unified protocol for handling the TV-receiver integration of Internet-provided content and broadcast content, nor has there been a way to provide uniform features across TV manufacturers. But various initiatives are starting to define a common set of protocols that broadcasters and consumer electronics manufacturers can use to provide consistent user experiences across devices, programs and channels. These include IPTV, NRT, DASH, HbbTV and that of the Smart TV Alliance.

Internet TV is a catch-all phrase that typically describes a service that provides content — audio/video, apps, media streaming, Web browsing and games — to PCs and television sets, either by means of built-in functionality, or through a set-top box or game console connected to a TV. Internet TV can take the form of a dedicated service, like Internet Protocol TV (IPTV), which provides constant multichannel video programming distribution to users over a permanent connection, or a shared Web service, such as over an Internet connection provided by an ISP.

IP formats live video into a packetized delivery medium. When streaming video to an Internet terminal (i.e., sending a continuous “live” feed, meant to be presented in real time to a display) IP is used, which provides a method for encapsulating data into packets called datagrams and sending them to a unique terminal over a shared network. Because IP is a connectionless protocol (i.e., the transmitter does not wait for the receiver to be available), some packets

may be lost in the transmission. This requires a mechanism to ensure reliability and circumvent lost or out-of-sequence packets. For this reason, IPTV that provides VOD services uses Real-time Transport Protocol (RTP), which provides jitter compensation and detection of out-of-sequence datagrams, and Real-time Streaming Protocol (RTSP), which uses DVR-like commands (e.g., play, pause, etc.) to control the stream.

Non-real-time content

NRT content is an ATSC component that can, in the near future, integrate live TV with file-based content via broadcast and Internet. The standard provides for triggers that can be used to control the presentation, behavior and synchronization between the live and stored content.

MPEG-DASH (Dynamic Adaptive Streaming over HTTP) uses adaptive-bit-rate (ABR) streaming that can accommodate channels with varying bandwidth and/or reliability. To solve the quality-of-service issue, ABR allows each device to determine the quality of its connection, and use different levels of compression as different “program chunks” that can be selected dynamically during the stream transmission. DASH

as a technology is related to various proprietary schemes used by different software providers. (For more on NRT and MPEG-DASH, see the May 2013 “Transition to Digital.”)

The Hybrid Broadcast Broadband TV specification (HbbTV) provides a way to integrate live and broadband content and apps, as shown in Figure 1. HbbTV provides a framework for the download and execution of applications on an Internet TV. Formally standardized as ETSI TS 102 796, the specification defines a Web-based terminal (Internet-TV receiver) that receives applications in the form of documents (written in HTML, JavaScript, CSS and XML) and multimedia files that together make up a complete interactive service package.

The HbbTV system architecture comprises a browser, application signaling and transport via broadcast and broadband, and synchronization of applications and broadcast services.

The HbbTV specification addresses two types of applications: broadcast-related and broadcast-independent. A broadcast-related application is an app associated with one or more broadcast services (or events therein) that may be launched automatically or explicitly upon user request. This type of application may be downloaded via

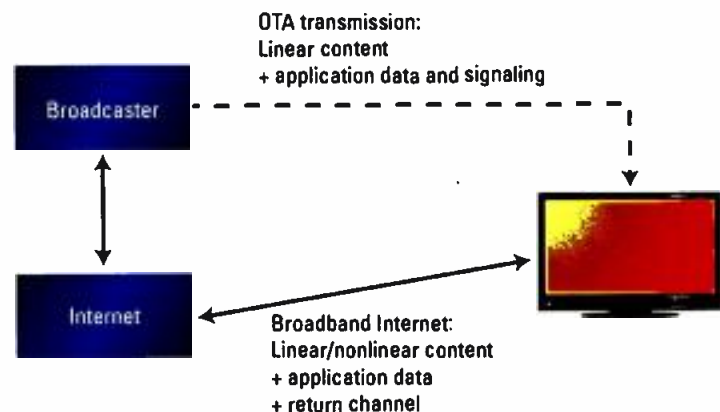
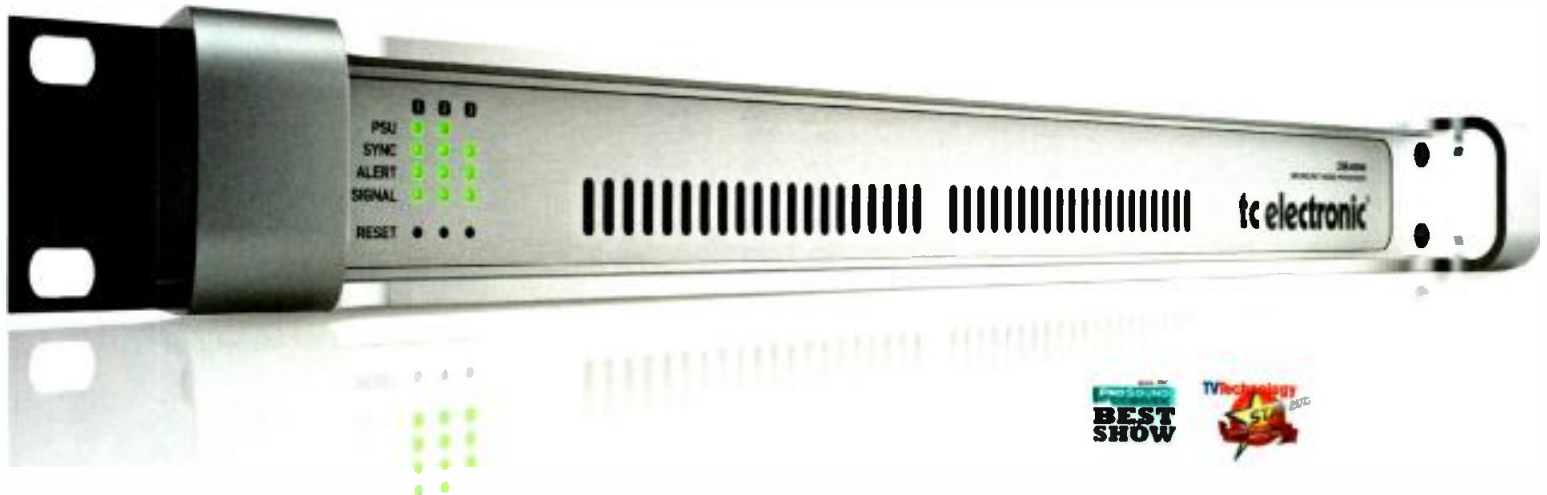


Figure 1. HbbTV architecture provides a link between OTA and Internet content.

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broadband or broadcast and may access its data via either method.

A broadcast-independent application, which is not associated with any broadcast service, is downloaded out-of-band (e.g., via a broadband Internet connection), and accesses all of its associated data via broadband.

The HbbTV platform has a number of characteristics that make it attractive to both broadcasters and CE manufacturers. The specification is open and is not based on a single controlling authority or aggregator, and it makes services and content from many different and independent providers accessible by the same terminal. Applications or services provided by a device manufacturer are not specified by HbbTV, nor are video, audio and system formats for the broadcast channel, and applications can run on different types of terminals such as TVs, set-top boxes and DVRs.

HbbTV also provides a measure of security, so that applications will not have deleterious effects on the TV hardware or software. Although standard functions of the TV are available to all applications, sensitive functions like firmware upgrade or access to user information are available only

to trusted applications. Services and content may be protected, too, providing a path to numerous business models. Although HbbTV was developed in Europe with DVB services in mind, its structure and signaling elements could be applied to other systems, such as ATSC. Such harmonization is currently under discussion for a future standard.

Smart TV Alliance

The Smart TV Alliance is driving common functionality from the CE side. Last year, LG and Philips (now TP Vision) agreed to work together to define common technical requirements for their Smart TVs, based on open standards such as HTML5, CE-HTML and HbbTV. Officially branded as the "Smart TV Alliance," the group's objective is to help define technical specifications that will enable application developers to create their applications once, reducing application development time and costs, and run them on multiple TVs, regardless of the platform. The alliance now includes Toshiba, Panasonic and several other technology companies.

The Smart TV Alliance has made its software development kit (SDK) widely available for developers to download at no cost and use to

develop their applications. The SDK is based on open Web technologies such as HTML5 and allows for Web applications to run on certified Smart TVs from participating members regardless of the underlying platform.

The Alliance built on this first version and announced specifications of SDK 2.0, followed by the actual SDK 2.0 software release.

Typical applications are expected to provide a "lean-back experience," meant to be viewed at a 10ft distance, with low involvement ("passive-entertainment-centric") and operable using common remote-control navigation keys (up/down, etc).

A new SDK supports richer applications, including 3-D video, using upgraded HTML5, CSS3 and JavaScript specifications. MPEG-DASH is supported, providing more reliable audio and video quality with less stuttering and freezing. For more information on the newest SDK, check out the extended Digital Edition of this month's *Broadcast Engineering*. **BE**

Aldo Cugnini is a consultant in the digital television industry.

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Troubleshooting media networks

Check the power, and then use these other tips.

BY BRAD GILMER

As professional media engineers, it is our responsibility to design, implement and maintain our facilities. Increasingly, this means that we are in charge of ensuring that our professional media networks are operating correctly.

Professional media networks differ from other IT networks in the following ways: First, they are used in professional media applications — sharing video and audio that is used on-air, for example. Typically, these networks are carrying high-resolution images and full bit-rate motion video. Second, it is likely that these networks are being managed, meaning that there are some policies in effect that, for example, might prohibit using the network to access the Internet, or that might ensure that e-mail and other office applications run on a separate business network. These networks, along with traditional SDI infrastructure, form the backbone of the media operation.

If you are new to network troubleshooting, you could be forgiven for thinking you need to invest in expensive network analyzers or other test gear in order to identify and repair network issues, and in some cases, this could be true. But, the good news is that, for the majority of cases, you probably already have the tools you need right on your computer.

Is it plugged in?

Let's assume you are called in to look at a system on your professional media network. The operator tells you, "I can't access anything on the network." Where do you start?

We are all familiar with the first questions you are typically asked

when you contact computer technical support: 1) "Is it plugged in?" 2) "Is it turned on?" When you are troubleshooting, this is the first place to start: Does the Network Interface Card (NIC) indicate that you have a good electrical connection? Usually, you can verify this by looking for an LED next to the place where the network connection plugs into the network device. No light, no joy. Period. In almost every case, if you do not have a link light, there is something physically wrong with a cable or

Many network engineers prefer to use a command line interface to troubleshoot network problems.

The commands *ifconfig* or *ipconfig* will show you the status of all of the network interfaces on your device in *NIX and Windows, respectively. Look for the status or media state entries. If you see "media not connected" or "inactive," these indicate that, as far as the OS is concerned, no network exists. (See Figure 2.)

In almost every case, when you see this indication, you also do not have

```
Ethernet adapter Local Area Connection:
Connection-specific DNS suffix ... :
IPv4 Address..... : 192.168.1.34
Subnet Mask..... : 255.255.255.0
Default Gateway ..... : 192.168.1.1
```

Figure 1. This shows a properly configured network adapter.

a connector. In some rare cases, you will not get a link light because something in the networking hardware did not initialize properly during the boot sequence.

If you have a link light, the next step is to see if the device's operating system (OS) recognizes that a network connection is present. (See Figure 1.) The LED is a low-level indication that a link has been established. If network card drivers are damaged or improperly configured, the OS will not be able to access the network even though the link light is lit.

a link light, so the trouble is either physical or in a low-level driver. Plug a laptop into the same cable. Do you get a link light? If yes, then you may have a driver problem on the computer. If you do not get a link light, then you know that either the cable or connector is likely to be bad.

If you have a link light, and the status of the connection is "active," check to see if the computer has an IP address that makes sense. You probably know the IP address range of the network, the gateway and the netmask. If not, you can either find someone who

```
Ethernet adapter Local Area Connection:
Media State..... : Media disconnected
Connection-specific DNS Suffix.... :
```

Figure 2. Though a cable is connected to the system, a network adapter can still show the media in a disconnected state. Here, a connector wire was broken.

can give you this information, or you can go to another computer on the same network, open a command line interface and enter either *ifconfig* or *ipconfig*, depending upon the OS.

Computers get IP addresses in two ways: Either someone manually configures the computer (a likely scenario in a professional media network), or the computer gets its address from a Dynamic Host Control Protocol (DHCP) server. If the computer does not have an IP address, has an IP address that does not match the host network, or does not have gateway and network entries that make sense, then the computer will not be able to access the network, even with an active network connection.

One common problem is not being able to “pull” a network address from a DHCP server. There are many things that could cause this problem, but without the correct IP address, netmask and gateway entries, your computer will not be able to operate correctly.

What if you have a link light, the status of the NIC is “active” and you have valid network parameters assigned to the NIC, but you still cannot access the network? Well, now it is time to get a little more specific about what “access” means. If this is a computer on the Internet, you can


try using the ping command. At a command line interface, if you enter *ping* followed by a name or IP address, your computer will make repeated attempts to contact the remote device. If everything is working normally, the remote device will reply, and you will see the results on your command line.

Ping Google

Google has helpfully configured its servers to respond to pings, so a quick *ping google.com* will tell you if you have connectivity to the Internet. If your computer is not connected to the Internet, note that internal gateways frequently are configured to respond to ping requests. Use *ipconfig* or *ifconfig* to determine the gateway address, and then send the gateway a ping command.

A critical component of any network that uses domain names such as *google.com* rather than IP addresses such as 192.168.0.33 is the Domain Name System (DNS). Put simply, DNS servers answer queries such as *google.com* with an IP address such as 173.194.43.5. If you can ping your gateway, but you cannot ping *google.com*, the Internet may be down, but it could also be the case that your DNS server is unavailable. Entering *ping google.com* generates a

DNS request. The DNS lookup returns the IP address of a Google server, and the ping utility then pings the actual IP address. If your DNS server is down but your Internet connection is up, pinging *google.com* will fail, but pinging 173.194.43.5 will succeed. So, the problem is not with the Internet connection, but with the DNS server. This is just one example where it is important to understand how computer networking functions.

These are some basic network tips, but this is an expansive topic, and there are more resources and tools that may help you track down network problems. You can find those in the extended Digital Edition of this month's *Broadcast Engineering*. 

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

? Send questions and comments to brad.gilmer@penton.com

+ ADDITIONAL RESOURCES +

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- Building IP Video Networks
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RAIDers of the lost archive

Learn the benefits of each storage strategy.

BY DREW ROBB

Hard disk storage has been around since 1956 with the advent of the IBM 350, which used 50 24in platters to store 5 million 6-bit characters (3.75MB of data), providing much faster access to data than was possible from loading punch cards. While we now store 1 million times that much data on a 3.5in drive, the basic issues of data storage are the same as they were 60 years ago: capacity, speed, reliability and recoverability.

One of the common features now found in disk storage is RAID. RAID comes in several flavors — RAID 0, RAID 1, RAID 10, RAID 5, RAID 6 — each of which takes a different approach to the issues of speed and recoverability. This article describes the types of RAID; the newest method, RAID 6; and some hybrids.

What is RAID?

In 1987, with disk prices falling to less than \$20/MB and capacity increasing into the hundreds of MB, David Peterson, Garth Gibson and Randy Katz of UC Berkeley's Computer Science Division published a paper, "A Case for Redundant Arrays of Inexpensive Disks (RAID)" (www.cs.cmu.edu/~garth/RAIDpaper/Patterson88.pdf), which laid out five methods for improving reliability and speed by storing data across multiple disks. Although the word "inexpensive" has since been replaced with "independent," the numbering system for levels of RAID described in the paper remains in use.

As disk capacity rapidly increased, read/write speeds did not keep up, an issue that persists to this day. To improve I/O, RAID stripes the data in a file across multiple disks, allowing

several heads to simultaneously read or write portions of the data. Read and write speeds then become a multiple of the number of disks used, rather than being limited to the speed of a single head.

Striping the data across several disks, however, increases the chances of data loss. When a file is stored on a single disk, the data is lost when that one disk fails. When the data is striped across four disks, the data is lost if any of those four disks fails. RAID addresses this in two ways: by storing multiple copies of a file on multiple disks or by calculating parity data and storing it on a separate disk, which can then be used to reconstruct data lost by a disk failure. RAID is designed for recovery from a disk failure, not to recover individual files and so does not replace backup. However, it does operate in real time, so the data is current as of the point of failure.

Vendors take different approaches to RAID, implementing it in a storage array, in software or in the storage controller. No standards body defines the RAID levels or certifies vendors' implementations.

Types of RAID

In addition to the original five RAID levels described by Peterson, et al, developers have created several others over the years, including some proprietary versions such as RAID-S, which EMC developed for its Symmetrix storage systems.

The RAID levels commonly in use today are:

- **RAID 0.** Designed purely for speed, RAID 0 splits the data evenly across multiple disks without any type of parity information or data redundancy. For applications such as file

serving or video streaming where a backup copy exists elsewhere, RAID 0 provides quicker access and higher data rates than a single disk. Do not use it for storing the only copy of a file. (See Figure 1.)

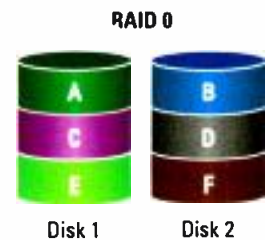


Figure 1. RAID 0 splits data evenly across multiple disks without parity information or redundancy.

- **RAID 1.** RAID 1 takes the opposite approach to RAID 0 — redundancy, not speed. RAID 1 doesn't stripe the data across disks, but creates complete mirrored copies on separate disks. If one disk fails, the other disk takes over. It is useful for applications where redundancy is paramount, and a single disk, perhaps supplemented by a cache, can write fast enough. Read speeds, however, are faster than a single disk since both disks can read simultaneously. (See Figure 2.)

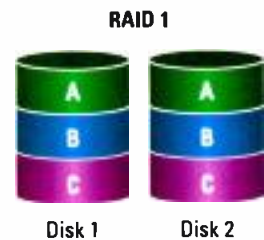


Figure 2. RAID 1 mirrors data across multiple disks, emphasizing redundancy over speed.



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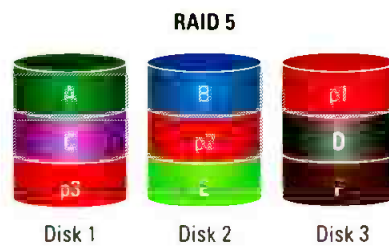
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- **RAID 3.** RAID 3 requires a minimum of three disks. It stripes the data at the byte level across two or more of the disks and uses a separate disk to store the parity information generated by the controller. RAID 3 is seldom used for applications with a lot of small data requests, but it performs well for large sequential data

Figure 3. RAID 5 combines block-level disk striping with parity data and can survive the loss of one disk.



transfers, such as editing uncompressed video files.

- **RAID 5.** The most common RAID type, RAID 5 combines block-level disk striping with parity. Unlike RAID 3, which stores the parity data on a separate disk, RAID 5 stripes the parity information with the actual data. Under normal operations, the array doesn't read the parity data. However, when there is a read failure, the array uses the parity information to reconstruct the missing information. (See Figure 3.)

- **RAID 6.** RAID 6 can withstand a loss of a single disk. RAID 6 uses two parity blocks per stripe instead of just one, allowing it to survive the loss of two disks. Even if a disk goes down during a rebuild, no data is lost. (See Figure 4.)

- **Hybrid RAID.** RAID methods can also be combined or nested. The two most common hybrid RAID levels are RAID 10 (or 1+0) and RAID 01 (or 0+1). RAID 10 requires a minimum of four disks paired in two sets. The controller stripes the data across the disk pairs, but each disk in the pair is a mirror of the other. RAID 01 takes the opposite approach, striping the data across one set of disks which are mirrored to a second set. (See Figure 5.)

RAID 6 for broadcast

Each of the RAID methods has its trade-offs in terms of available vs. total disk space, read/write speeds, reliability and processing overhead for computing parity. Banks and broadcasters don't need the same level of RAID. Even different applications within the broadcast environment can use different RAID levels, such as RAID 0 for video streaming and RAID 3 for editing.

For simplicity, however, particularly when using shared storage, companies prefer to settle on a single technology to support. The standard has been RAID 5, but anyone who



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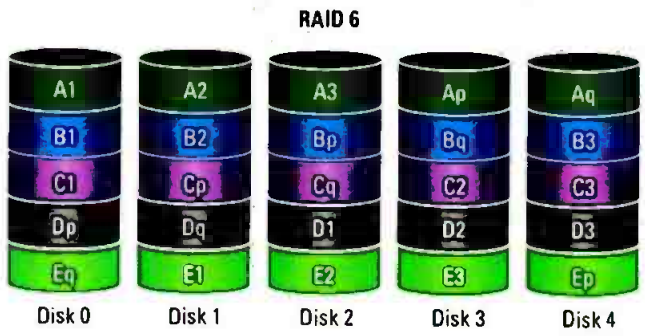


Figure 4. RAID 6 uses two parity blocks per stripe, so it can survive the loss of two disks.

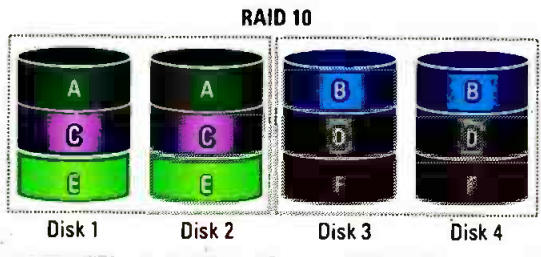


Figure 5. RAID 10 combines RAID 1 and 0 by striping data across two pairs of disks, where each disk in a pair is a mirror of the other.

uses RAID 5 should consider RAID 6 at the next upgrade. The problem with RAID is that disk capacity has far outstripped I/O and

network speeds. In the Peterson paper, the authors are talking about a 100MB personal computer disk and a 7.5GB IBM mainframe disk array that filled

24 cubic feet. When RAID came out, even with the slower disks and networks, disks could still be rebuilt in minutes. With the multiterabyte drives in use today, restoration can take hours.

RAID 6 offers greater protection in the event of a failure, providing full service and allowing a rebuild even if a second disk goes down.

BE

Drew Robb is a freelance writer covering engineering and technology. He is author of the book "Server Management of Windows System" published by CRC Press.

Send questions and comments to: editor@broadcastengineering.com

ADDITIONAL RESOURCES

The following are available on the Broadcast Engineering website

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Wireless audio

System advances have it keeping up with video.

BY GARY PARKS

We're gaining the freedom of motion to capture images and action without a trail of cable following behind. This is true with video as well as audio.

Wireless microphones have been used with cameras for years, as they provide a variety of benefits to the production. A concealed transmitter and mic on the talent grabs his or her words at a distance with usable level and intelligibility, in sync with the video and without the masking of extraneous noise. Sight lines and sets are cleaner. A clear wireless signal can prove more robust than long cable runs with multiple connections that create the possibility of induced hum or other signal degradation.

The latest generation of wireless mics has drawn on advances in computing, networking and digital audio processing to offer an even more reliable signal — one with a resolution that melds with high-definition visuals provided by new cameras. What are these characteristics, how do they help, and in what ways are they adapted to the needs of today's camera operator?

Digital wireless

The key word in all of these advances is digital. Within the past couple years, almost all manufacturers of wireless microphones have introduced one or more systems using digital transmission and processing, along with expanded frequency agility and networking capabilities. The transition from analog to digital provides a myriad of benefits.

Modern cameras convert incoming images to digital information, in which form it can remain through processing, editing and transmission through various methods to the viewer. New wireless mics can do the

same with the audio signal, making the conversion to digital within the transmitter — right after the microphone capsule. Many new receivers will output the signal in the digital domain, and some cameras will accept this signal directly. So, now both video and audio are digital from the source, and can remain that way until reaching the TV set.



Shown here is a BMS HD transmitter hidden inside the pictured Sony camera's right-side cam shell. Photo courtesy BMS.

Wider audio bandwidth

One quite beneficial aspect of this capability is audio bandwidth. The typical 24-bit/44kHz or 48kHz sampling rate can yield a virtually flat frequency response from 20Hz to 20+kHz, with any variation coming from the behavior of the particular mic capsule used with the transmitter. Also, companding circuitry with its potential to color the sound — a necessity with analog wireless — is no longer an issue. With digital wireless, high-definition sound joins HD video.

Digital transmissions require a lower signal-to-noise ratio to provide a useable signal. Several benefits arise from this characteristic. Range is usually greater in a digital wireless system for an equivalent RF signal strength from the transmitter.

A number of manufacturers offer variable-level transmitters, allowing the user to select an output sufficient to cover the distance without overly adding to RF congestion. Even the highest output levels are usually below the 50+mW typically used in analog transmitters — leading to a longer battery life of 10 or more hours.

Since the audio signal has been converted to numerical data before it is transmitted and meets error-correction algorithms within the receiver, it is much less prone to signal degradation that affects analog wireless mics. At the receiver output, audio is either excellent or gone. So, possible buzzes, hums, distortions and compromised audio bandwidth are no longer a factor. Greater interference resistance also leads to enhanced reliability, and signal encryption is widely available.

Finding open frequencies

The flexibility that analog frequency-agile wireless brought has been increased with new digital systems. A system that spanned 20MHz to 25MHz of UHF spectrum was the norm, yet new digital systems will operate over a much wider bandwidth. Some cover "only" 64MHz within a single receiver band, while others go beyond 150MHz. With such wide coverage, finding usable wireless channels, even in a crowded RF environment, is assured — without having to carry different bands of receivers and transmitters.

Frequency-agile systems usually have a scanning function that uses the receiver to run through its entire bandwidth and detect existing RF signals and clear spectrum. When the scan completes, it either offers or automatically sets a clear channel, which will then be synced wirelessly via an IR link or manually with the transmitter.

Typically, one frequency from a pre-coordinated group will be selected. Then, additional wireless mics can be set to the group's other clear channels. In some systems, frequencies can be evenly spaced in open spectrum without interfering with one another.

Monitoring and control

Most professional digital (and analog) wireless receivers have the ability to be networked for monitoring and control. This control can stretch beyond the connected receiver, so frequency and other parameter changes can be made on transmitters without touching them. One new wireless system even has a bi-directional link, with the capability to put a transmitter that is on the talent into sleep mode to conserve battery life.

Some systems are even smart enough to monitor RF environments for problems, select backup frequencies and automatically switch a particular system to a clear channel. Supporting this networking software, both wireless mic manufacturers and third-party vendors provide powerful tools for RF analysis, site surveys and frequency coordination, including: spectrum analysis, visual depiction of your transmitters within the

spectrum and alarms that notify of potential problems.

Camera-specific features

When a wireless system is used with a camera, a more stringent set of requirements arises. The typical 1RU or half-rack receiver format in need of an AC plug is much too bulky and heavy, so many manufacturers offer a compatible ENG receiver.

Many pro cameras provide a slot into which a compatible receiver can be inserted. This allows antennas, controls and display to remain accessible. Wireless mic manufacturers use the dimensions and connection specifications of these slots to design specialized receivers, and some provide several rear-panel kits to correctly interface with particular camera models. When slots are not available, trays and brackets — or even Velcro — allow miniaturized receivers to be attached to the camera.

Because receivers must sometimes endure field conditions, resistance to water, dust, temperature and rough handling must be integrated. In addition, these receivers must be powered during use, either via their own detachable battery packs or through the camera's battery.

Where is it going?

A prominent manufacturer of both wireless microphones and video cameras has interfaced systems so that when the receiver is mounted in the slot, the camera operator can monitor the status of the wireless mic through the viewfinder, and even control the receiver and transmitter through the camcorder's menu. Though this degree of integration takes major commitment, it can be expanded by cooperative agreements, common protocols and sharing of information between engineering departments.

In summary, the latest digital wireless systems are keeping up with advances in video technology, giving viewers breathtaking visuals with the dynamic, full-bandwidth audio to match.

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Gary Parks is a freelance writer, formerly with EV, Vega Wireless, Clear-Com and Meyer Sound.




Send questions and comments to: editor@broadcastengineering.com

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

- Wireless cameras
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Video retailer QVC installed Evertz switchers and routers, Omneon servers, Vizrt graphics engines and the Haivision KulaByte encoder in its new master control room to oversee the production of multichannel content. Photos courtesy Beck Associates.



QVC

The video retailer expands its multichannel capability.

BY PAUL KAST

Since its first U.S. telecast in 1986, e-commerce retailer QVC has added broadcast operations in the United States, Japan, Germany, the United Kingdom and Italy, and entered a joint venture with China. Its U.S. operation deploys three HD control rooms and more than 30 cameras to produce live programming.

The network's production capabilities have always been strong, and the current configuration

allows the signal to be viewed on multiple platforms, such as smartphones and tablets, as part of the QVC-Everywhere initiative. Before the transition, however, the content available on each device type was the same, as there was only one original stream.

The goal of the master control/NOC project was to expand playout capabilities to allow more content choices down the road, provide better monitoring of both outbound

and return signals, and increase fault tolerance.

Joe Micucci, director of broadcast engineering at QVC, was tasked with bringing this to fruition by November of 2012. "We needed to be online and fully functional well before the holiday season," said Micucci. "This meant that all training and issue resolution had to be completed before Nov. 1. Because QVC broadcasts live around the clock, the transition needed to be completely seamless."

Design criteria

The goal was to replace the single, redundant master control system with multiple identical channels, some of which were to be redundant. All channels had to be 3G-capable and able to carry unique, independent content, or be capable of following the main channel.

Channels were divided into two categories: on-air and online. On-air channels would be inherently redundant, while online channels would be single-ended. Both were able to back each other up if needed.

Additional control positions and monitoring were required, allowing for multiple operators, as well as an overall supervisory position and comprehensive hierarchical fault reporting. The master control system needed to operate separately from production, with its own router for source selection.

Equipment decisions

One of the difficulties during the design stage was selecting between baseband and IP-based master control platforms. After deciding that the more traditional master control platform suited it best, the network employed a multi-segment network infrastructure for device control, file transfer and SNMP reporting.

Dalet is used for asset management in its production workflow, and the network decided to continue with Dalet to manage master control as well.

Playout architecture

Nine physical channels comprise seven playout streams. All channels are identical and can be used for any playout purpose. Each channel's equipment complement is physically mounted in its own

rack, to provide channel redundancy, growth space and isolation for troubleshooting purposes.

Primary channels are designed using the "X/Y" concept, whereby both halves operate in parallel from beginning to end, yet share no critical equipment. Each channel has a dedicated graphics engine and server play ports.

The new playout architecture performs the following functions:

- **MC switching.** The Evertz 3025EMC master control switcher is fed by two router outputs in a Background A/B configuration. It includes additional fill/key inputs for external graphics devices. All of the audio is embedded. The switcher also has internal logo and clip playback capability with DVE squeeze and tease. The outputs of the switcher feed an air path chain consisting of a closed-caption encoder and frame sync,

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The network went with a traditional master control platform, with a Vizrt graphics engine and Evertz EQX ports for each channel physically mounted in individual racks to ensure channel redundancy.



In the newly redesigned control room, Evertz monitors route the appropriate multiviewer outputs to one of 13 overhead displays, which are fed by a redundant analog Raritan KVM matrix.

with a built-in loudness monitor and gain control.

- **Bypass selection.** An Evertz EQT-1602 Clean and Quiet is the final output of each channel and feeds the transmission path via a primary and secondary encoder Channel A router output.

Although all sources are synchronous, only a few are actually in time;

the Clean and Quiet option allows hitless source selection regardless of timing. Control of the bypass switchers is completely independent of any other system, and relies only on a coax bus to panels located in the control room.

- **Routing and router control.** An Evertz EQX router is the heart of the master control system. Inputs are

comprised of about 50 percent sources for air, and 50 percent master control monitoring points. The system uses three crosspoint cards: two as main and backup for normal router operations, and a third to feed the 14 VIP-X multiviewers. (Evertz has now combined router and multiviewer controls into one unit, called the MAGNUM.) Redundant MAGNUM servers increase fault tolerance and allow for hardware upgrades.

- **Monitoring.** Monitoring is done via 14 multiviewers, two per channel, which are fed back into the router as HD-SDI. Multiviewer outputs are assigned per channel, and do not change. This offers the advantage that multiviewer outputs don't have to be redrawn, and can be monitored by anyone with a router output. Monitors in the control room simply route the appropriate multiviewer outputs to one of 13 overhead displays or four QC stations.

Selecting a channel on a switcher control panel triggers a macro, which automatically routes the appropriate multiviewers to that position's monitors. All monitors are routable, including computer displays, which are fed by a redundant KVM matrix.

- **KVM switching.** Redundant Raritan analog matrices are used to switch KVM ports of any computer to any of 12 control points. Matrix outputs are distributed equally among

Equipment at work

Beck Associates: Turnkey systems integration

Cisco: Catalyst switches

Dalet: Automation

Evertz: 3025EMC master control switchers, EQT-1602 Clean and Quiet bypass switchers, EQX 3G/HD/SD/ASI routers, VIP-X 32 x 2 multiviewers, MAGNUM router and multiviewer control

Haivision: KulaByte encoders

Image Video: TSI-3000 (tally)

Omneon: Spectrum MediaPort servers

Raritan: Paragon dual 64 x 16 KVM routing

Skyline Communications: DataMiner

Vizrt: Multichannel graphics insertion system

Design team

QVC: Jennifer Bonsall, business architect; Wayne Chmielecki, broadcast proj. mgr.; Greg Gialloredo, dir., proj. eng.; Joe Pendyck, mgr., live graphics; Joe Urzillo, sr. mgr., broadcast sys. eng.; George Dolphin, broadcast eng. architect; James Marquette, sr. broadcast eng. architect; Victor Florio, mgr., master control and network ops.; Patrick Schumaker, proj. eng.; Kenneth Torres-Zickler, broadcast sys. eng.

Beck Associates: Paul Kast, VP of eng., east. reg.; Matt McMurray, sr. proj. mgr.

operator positions. A matrix failure would reduce simultaneous access, but each operator would still have access to every computer on the system. An added benefit of the KVM system is that it allows CPU sharing. Two users can simultaneously monitor any computer, and control it in an arbitrated fashion.

An analog system was chosen over KVM-over-IP, because it allowed isolation from the data network, and was compatible with a similar system in use on the production side of the operation.

- **Graphics.** Each channel has its own dedicated Vizrt graphics engine controlled by Dalet automation. To allow for future possibilities, a Vizrt Multichannel system has also been installed, providing multiformat, template-based, automated graphics insertion across multiple engines.

- **Servers.** Each channel has a dedicated Omneon Spectrum MediaPort. Storage is redundant and shared among MediaPorts. Content is pushed to the servers from the production server system via Dalet's Media Asset Management.

- **Encoding.** The new master control system uses Haivision's KulaByte encoders, with each encoder capable of accepting two HD-SDI inputs. Each MC channel is distributed to at least two encoders.

- **Fault management.** Skyline Communications' DataMiner is used for fault monitoring and control of much of master control. In addition, QVC has moved its production distribution equipment to DataMiner, monitoring existing Miranda and Evertz devices. The system allows operators to receive tailored messages on the severity of any problems, and

helps them to quickly identify the ultimate fault.

- **Networking.** A stack of 10 Cisco Catalyst switches serves as the backbone of the networking infrastructure. Critical network segments are redundant. Using different subnets, they are physically wired to separate switches, but because of the stacking, any port on a switch can be assigned to the V-LANs as needed.

Channel launch

The system launched on schedule, supporting four channels in November of 2012. As of today, it's been expanded to five channels and is performing well. **BE**

Paul Kast is VP of engineering, eastern region, for Beck Associates.

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

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Broadcast Engineering's Pick Hit Awards are the industry's longest-running product technology awards for broadcast and production. With a 29-year history, Pick Hits are the most prestigious technical awards given at NAB. Here are the top products selected from the show by our panel of independent judges.

After Effects with MAXON CINEMA 4D Lite

Adobe

www.adobe.com

Next version of After Effects includes CINEMA 4D Lite, which is designed to give artists access to an exceptional selection of the software's functionality; since CINEMA 4D Lite launches directly from within After Effects, the availability of a full 3D application is expected to have a significant impact for artists interested in or already incorporating 3D into their After Effects workflow; instead of waiting for a 3D render to come out of CINEMA 4D, users can drop that CINEMA 4D file into After Effects and start to composite, color correct and add the extra things they do in After Effects directly on top of their 3D projects; integration speeds up the workflow.



ROI

AJA Video Systems

www.aja.com

Mini-converter allows high-quality conversion and real-time scaling of computer DVI-D and HDMI outputs to baseband video over SDI; seamlessly incorporates computer signals into video production; features Region of Interest scaling control for selective source screen isolation and resolution matching, as well as aspect ratio conversion and frame rate conversion for maximum compatibility; offers audio embedding in SDI output via analog 3.5mm connector input; can connect KONA 3G SDI-based 4K output to 4K HDMI displays; genlock input enables locked SDI output for clean switching and integration.



Pocket Cinema Camera

Blackmagic Design

www.blackmagicdesign.com

Pocket-sized digital cinema camera is less than 1in thick and be held easily in the user's hand; compact design allows it to be used in more situations where a larger camera would not be practical; features an industry standard Super 16 sensor size; super wide dynamic range of 13 stops allows feature-film quality images; includes an easy to use SD card recorder that enables the full sensor dynamic range to be recorded in professional ProRes 422 (HQ) format, as well as 12-bit Log RAW lossless compressed CinemaDNG format; these files can be read by high-end video software as they are all open standard.



SmartScope Duo

Blackmagic Design

www.blackmagicdesign.com



Dual-rack monitor with built-in broadcast-accurate waveform monitoring features two large 8in LCD screens in a compact rack-mount design that's less than 1in thick; includes powerful image processing, allowing each of the two screens to be independently selected between video monitoring and waveform monitoring; handles all SD, HD and 3G-SDI video standards; all screens can be remotely adjusted via the user's Ethernet network; includes full tally features, making it ideal for live broadcasters; tally borders can be independently displayed in red, green or blue.

PlayerTracking System

ChyronHego

www.hegogroup.com



Player tracking graphics system applies graphics onto live video to track sports players in 3D space; takes live 3D player tracking data from the ChyronHego Tracab system and applies a variety of different real-time visualizations, such as name-straps or highlighting tools, to be able to identify players and help provide better insight into sports play; as the graphics are time-coded in synchronization to the video, they can be applied not only live, but also on first replays; this enables sports analysis to be aired almost immediately on a first replay.

DMON-4S

Decimator Design

www.decimator.com



Quad (3G/HD/SD)-SDI to HDMI multiviewer and converter includes four independent mini HDMI outputs that can each output any of the four inputs or a quad-split all of them; inputs two and four can be individually changed to output active loop copies of inputs one and two, respectively; quad-split mode allows selection of audio from any input; portable converter incorporates an easy-to-use LCD and button control system, providing users with easy access to the unit's features without using LED/button control or dip switches or having to carry around a computer to change a simple setting.



Dejero + Nucomm Connect Live

Dejero, IMT

www.dejero.com

www.imt-broadcast.com

Next-generation, camera-mounted bonded cellular and microwave system for ENG; designed to offer mobile news teams a flexible and powerful alternative to traditional satellite and microwave links; transmitter combines IMT's coded orthogonal frequency division multiplexing technology and Dejero's patent-pending Adaptive Bitrate Encoding technologies; using a single camera with this device, a mobile news crew can begin transmitting broadcast-quality live video in less than a minute from locations that are not practical or advisable for satellite or microwave trucks.



DTU-351

DekTec

www.dektec.com

USB-3 unit for getting HD-SDI signals into a tablet, laptop or PC; full frames are transferred so that applications have access to 16 audio channels and all HANC and VANC packets; is bus powered, so no power supply is required; bundled with SdEye, the DTU-351 becomes a waveform analyzer; for application developers, the unit comes with DekTec's standard SDK and the advanced Matrix API; both are supported, for Linux and Windows; all 10-bit samples from the full SDI frame can be read.

Deluxe MediaCloud

Deluxe Entertainment Services Group

www.bydeluxe.com



Cloud-based play-out platform offers benefits such as reduced upfront infrastructure, technology and staff costs; facilitates fast time-to-launch while enabling broadcasters and content owners to fully exploit rights for brands and major events; new play-out model is designed to bring a new way of broadcasting, with the potential to interface to media assets and create a television station anywhere in the world; delivers to any broadcast format, with a high service quality from a highly resilient infrastructure; full disaster recovery is implicit.

BrightEye NXT 430

Ensemble Designs
www.ensembledesigns.com



Compact router has 11 BNC connectors that can be configured as either inputs or outputs; two SFP modules slots (small format pluggables) can be populated for additional inputs or outputs — fiber optical or electrical; Embrionix-powered SFPs — about the size of a stick of gum — let users choose the type of input or output connectors needed, including mini BNC and optical; includes a reference BNC for genlocking the unit to house sync; can be controlled via the dedicated front panel buttons, or from a computer or iPad via the on-board web browser interface; accepts 3G, HD and SD-SDI signals.

FA-1010

FOR-A
www.for-a.com



Signal processor offers multichannel routing between sources, as well as effective video and audio signal processing for line, relay, reporting, production, editing and delivery applications; supports 1080p, 1080i, 720p, NTSC and PAL video formats; 10 3G/HD/SD-SDI inputs and outputs come standard, each synchronized independently for a clean switch; provides extensive audio support, with 16 channels of embedded audio for 3G/HD-SDI synchronous/asynchronous input and 12 channels for each synchronous SD-SDI input.

Dreamcatcher

Evertz
www.evertz.com



Slow-motion replay system is designed to provide enhanced story-telling capabilities by allowing the production team to capture the event from all angles, while never missing a moment of the action; these captured events can instantly be replayed or packaged after to re-tell and relive the moments of the event; features a highly scalable and flexible system architecture; supports 3G, HD and baseband I/O; an 8-channel system packaged in 2RU can provide more than 70 hours of high-performance, fault-resilient HD storage; control interface allows operators to create customized work surfaces for more efficient workflows.

FreeAxez

FreeAxez
www.freeaxe.com



Raised access floor system is designed to offer effortless wire management; moves, adds and changes can easily be performed by in-house personnel, without the need for special tools; eliminates the need to run power, voice and data cables through the ceilings and down power poles; also makes it unnecessary to acquire integrated wire management from the systems furniture manufacturer; intended to be installed under every desk; ideal for the distribution of power, voice and data cables for new construction as well as retrofit; depreciable in seven years; open areas are installed at a rate of 1000sq ft per installer per day; all-steel construction.

LEGAL-6

Eyeheight
www.eyeheight.com



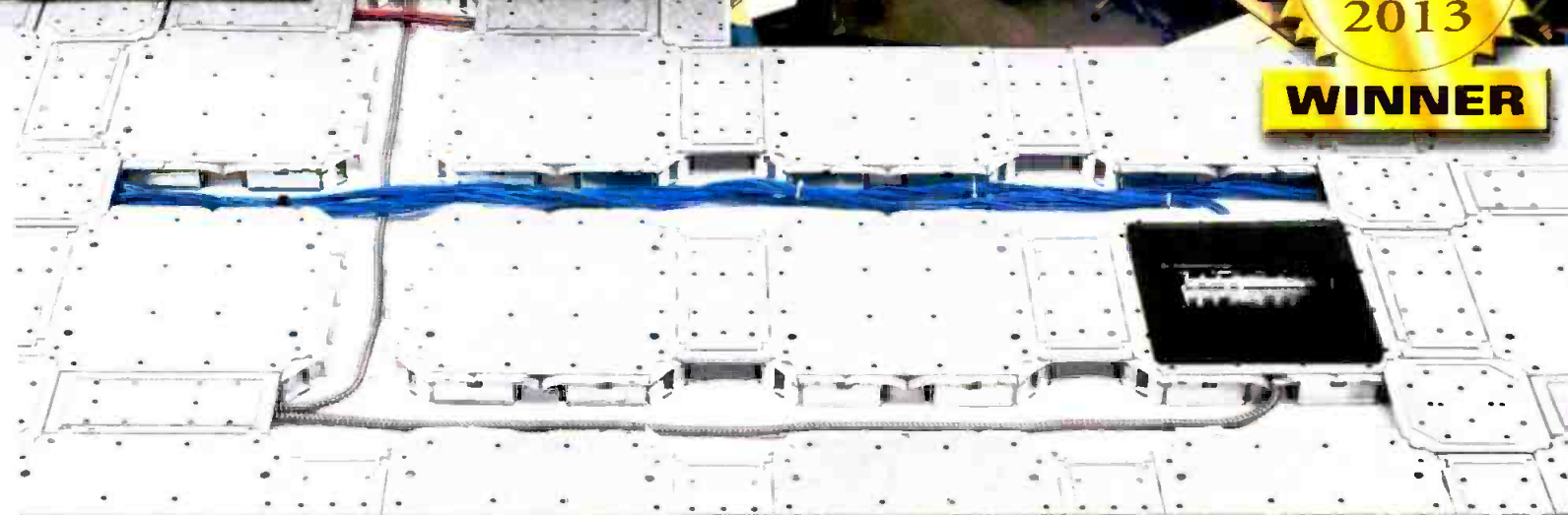
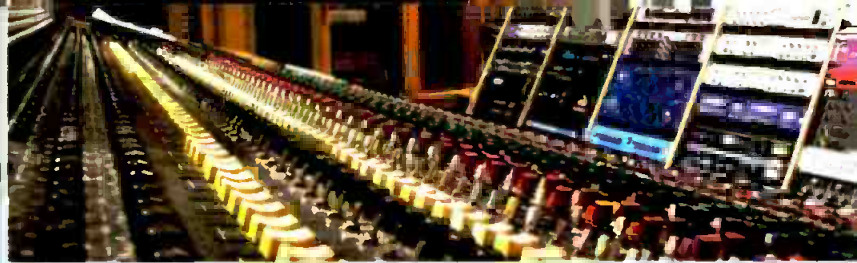
Legalizer incorporates the company's clobberRing automatic luma overshoot and undershoot suppression together with luma and chroma gain, black level adjustment, hue rotation, adjustable clipping levels and soft-clipping-knee levels; an out-of-gamut channel displays overshoot or undershoot severity and highlights the precise position of any signal correction being performed; provides automatic real-time control of perceptual loudness and true peak level; auto-detects the incoming SDI or HD-SDI video signal format and applies the appropriate legalizing format.

GY-HM650 2.0

JVC
<http://pro.jvc.com>



With the company's exclusive dual codec design, as well as built-in FTP and Wi-Fi connectivity, the ProHD mobile news camera allows live transmission or file transfers in the background as shooters continue to record footage in their normal workflow; when equipped with a Verizon 4G LTE modem, which connects directly to the camera via USB, the GY-HM650 can transmit footage to a broadcast facility in real time — no add-on boxes or backpacks required — while simultaneously recording a full HD file to solid-state memory cards; records HD or SD footage in multiple file formats; features a Fujinon wide-angle 23X zoom lens.



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Broadcast and audio engineers, operations managers, architects, IT professionals and facility managers have discovered that FreeAxéz is the best solution for meeting the diverse challenges of 21st century wire management and network infrastructure. In fact, we are so distinct from traditional concrete panel and pedestal raised floors that the CSI (Construction Specifications Institute) has taken the extraordinary step of designating the new MasterFormat # 09 69 33.

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MasterFormat Number
09 69 33



info@freeaxe.com
856.764.0400
www.freeaxe.com



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yellobrik CDH 1813

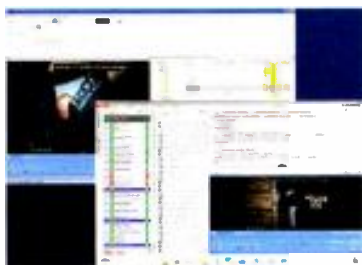
LYNX Technik
www.lynx-technik.com



SDI to HDMI converter features 3D format support, making it an ideal tool for monitoring single-link 3D-SDI streams on a 3D HDMI monitor; this feature supports side-by-side, top and bottom, and frame packing 3D HDMI display modes; offers clean feed of the SDI video signal, burn-in windows for timecode, bit depth, video format, metadata presence indicators, AFD format codes and 16-channel audio level meters on the HDMI video output; includes H/V delay to view the horizontal and vertical blanking interval, as well as programmable safe area markers.

Emerald for News

Masstech Group
www.masstech.com



Media asset management system delivers its core functionality for archive, search and restore by being embedded directly within the desktop interface of Avid iNEWS and Associated Press ENPS newsroom computer systems; enhances the content creation power of a newsroom computer system by giving users rapid, direct, non-disruptive access to shared and archived content stored locally or at any bureau in their group; there are no external application interfaces for news staff to learn; technical processes such as archiving, conform and transcoding are automated and invisible to the user.

Arkki

MediaPower
www.media-power.it



Media asset management system in a box combines efficient MAM technology with a robust storage platform of up to 64TB; offers multi-user features such as user groups and group access control, enabling content to be managed securely; access to the system is via a standard web interface; provides an easy upload and transcoding engine; incorporates a powerful search engine with rough-cut and sub-clip functionality to help users retrieve, select and download the necessary video material; thumbnails and low-quality browsing versions are automatically generated, allowing users to find desired content in seconds.

ProTrack TV

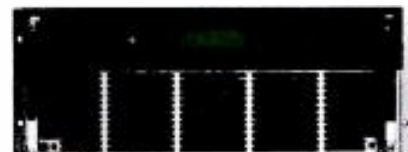
Myers
www.myersinfosys.com



Comprehensive broadcast management system for single, multichannel and multi-station media facilities; provides a high level of structure and flexibility, without sacrificing scalability, for today's rapidly evolving media environments; interconnects Traffic, Scheduling, Sales, Engineering and IT departments; allows for the efficient use and repurposing of content; provides automated scheduling tools that simplify multichannel and multiplatform responsibilities; includes a robust collection of sales management features and reporting tools that provide teams with actionable insight, facilitating revenue-generating opportunities.

NT Series

Nautel
www.nautel.com



Low-power UHF digital TV transmitters support major digital transmission standards, including DVB-T, DVB-T2 and ATSC; sophisticated linear and nonlinear adaptive pre-correction ensures spectral compliance and a high standard of digital transmission performance; simple air-cooling and an efficient 185-264 Vac switching power supply make it suitable for all facilities; uses an advanced software-defined modulator, which provides options to upgrade the exciter to meet changing standards without replacing hardware; includes the NT150 150W UHF digital and NT500 500W UHF digital transmitters.

FOPA-200

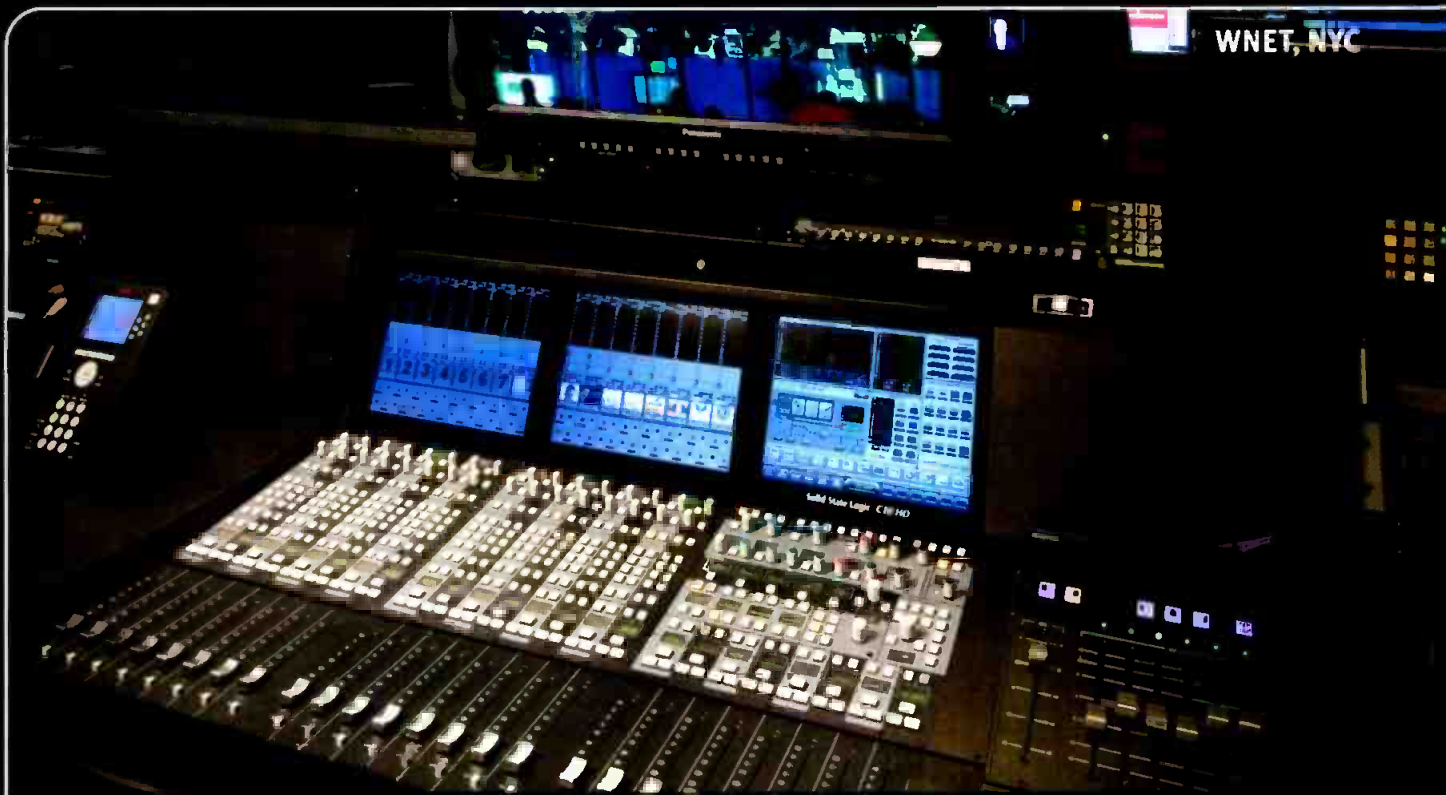
Nemal
www.nemal.com



SMPTE fiber-optic patch panel is a 2RU, six-position, 45-degree enclosed breakout panel; available in several different configurations; each configuration meets specific customer needs for input and output connector types and genders for fiber, as well as electrical components; full enclosed panel is rack-mountable; features a backplane splice panel; available fiber connectors include LEMO male and female SMPTE chassis mount versions (input), and ST, SC, LC and FC discrete fiber (output); available electrical connectors (output) include Molex and CPC.

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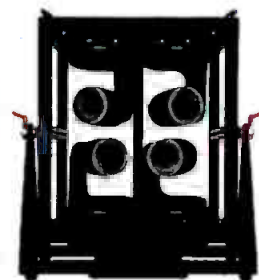
AUTOMATION & PRODUCTION SYSTEMS

2013 Pick Hit Winners

Ultra Wide Angle Camera

Panasonic

www.panasonic.com/broadcast



Stitches the images taken by four HD cameras in real time to produce 4X wide (64:9) panoramic images; ideal for analyzing sports action; the entire field can be seen at once, so the moves and formations of all players are clearly visible; HD 4X resolution is sharp enough to make the numbers of all players easily legible, even when enlarged; installation is designed to be easy, with four AW-HE120WP/WE/KP/KE HD integrated cameras assembled into a single-rig configuration; a pan/tilt/zoom automatic adjustment function eliminates the need to make adjustments among the four cameras; system is ready to use immediately after set-up.

XD1080

Replay XD

www.replayxd.com



Rugged HD video action camera is designed to feature ultra-sharp HD video, high audio quality and limitless mounting options due to its small form factor and all-round shape; features a weather-resistant, hard anodized, rugged aluminum housing for users to record and replay their extreme adventures; simple, ON/OFF and Start/Stop make the camera easy to operate; includes built-in LED and Vibration Feedback; offers One-touch recording; has a custom-designed, 135-degree wide-angle, f3.1 lens with anti-glare coating; streams full 1080 HD through its built-in HDMI out connector.

VENICE

Rohde & Schwarz DVS

www.dvs.de



Future-ready Media Production Hub for highly optimized file-based TV production workflows; manages classic video server tasks such as HD-SDI ingest and studio playout combined with intelligent file-based features such as file ingest, transcoding and media transfer operations; features flexible handles the growing need for multiple video formats and codecs in a broadcast studio environment with its flexible multiformat video and codec pipeline for each channel; features an open platform and file system architecture; available in multiple versions with different chassis heights, channel numbers and storage capacities.



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Carbonite eXtreme

Ross Video

www.rossvideo.com

Is a combination of production switching with signal routing and distribution in the same chassis; the production switcher is at the heart of the routing matrix; up to two Carbonite Production Matrices can be added to the Carbonite eXtreme Chassis, providing two independent production systems in one; can be configured with an I/O of up to 144 x 144 in increments of eight; ideal for mobile production vehicles as it simplifies installation and operation, while also offering flexibility and cost savings; is available with any Carbonite control panel; destination-based signal routing control is managed with the company's NK router panels.



Inception

Ross Video

www.rossvideo.com

Social media management tool allows clients to take control of social media, providing a single tool to create, publish and incorporate content from Twitter, Facebook or the web into productions; V5 rounds out the product with the addition of a one-time search engine and polling support; search engine enables users to quickly identify relevant social content; polling provides graph-based outputs of Twitter polls that can be brought to air using XPression graphics systems.



HXR-NX30U

Sony

www.sony.com/professional

Ultra-compact, palm-sized, professional NXCAM camcorder is compatible with the latest full HD formats, including 1080/60p video; features a 26mm ultra wide-angle lens with 10X optical zoom and a back-illuminated Exmor R CMOS sensor for versatility; features include flexible timecode/user bit settings and XLR audio inputs for high reliability and high sound quality; key feature is the newly developed Balanced Optical SteadyShot image stabilization system, which allows the entire optical black — from the lens to the image sensor — to “float” and absorb movement from the body.

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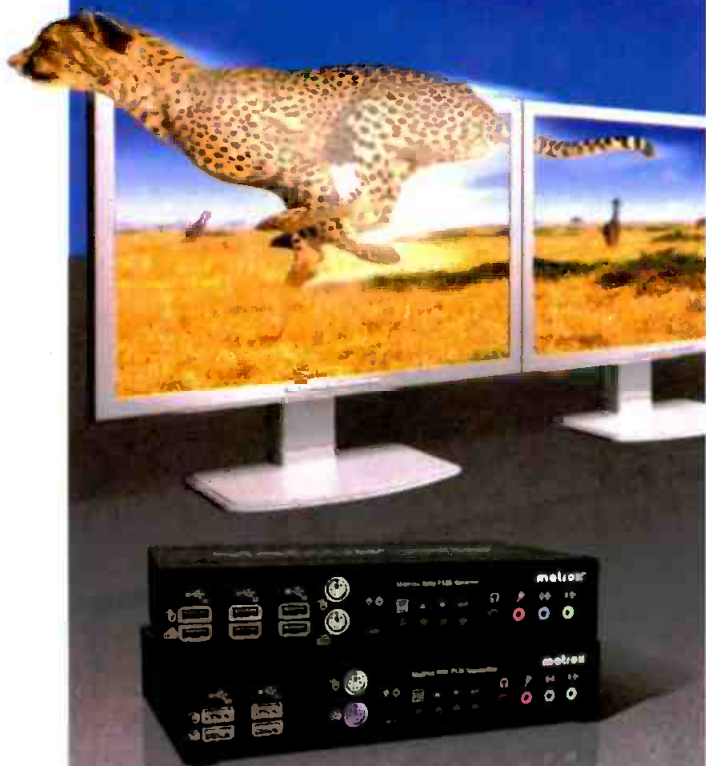
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www.matrox.com/avio/be
1-800-361-1408

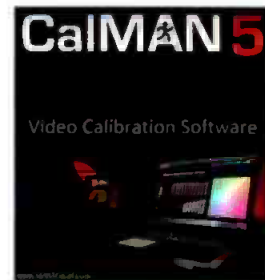
matrox

**2013
Pick Hit Winners**

CalMAN 5 Ultimate

SpectraCal

www.spectracal.com



Display calibration software is designed to precisely calibrate and manage 'n' number of displays in a display wall using the newly redesigned Calibration Record System; ideal whether users need to calibrate one display in a digital cinema or multiple displays tied together in a display wall; supports all of the known standards; is hardware-agnostic, so users can calibrate using the equipment they already own; additional benefits include exclusive pre-designed step-by-step calibration guides for single and multiple displays that require little calibration experience and a reporting system for documenting before and after calibration results.

IEC Lock Cords

Stay Online

www.stayonline.com



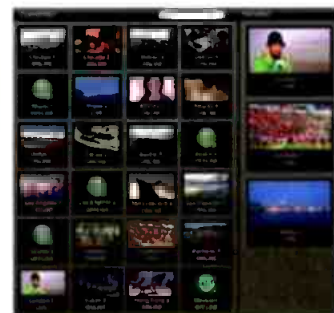
Locking cords are designed to stay connected despite vibration or other accidental disconnection incidents; work with any standard IEC inlet; once locked into position, the chances of an accidental disconnection are greatly diminished; require no tools or hardware; cords are available in black, blue and white, as well as in various cable lengths; female C13 and C19 connectors are suitable for use with any standard IEC inlet; molded male plugs available include Schuko, UK, C14, C20 and 5-15; other male plugs can be customized upon request.

TVU Grid

TVU Networks

www.tvunetworks.com

IP-video distribution and switching system gives stations the ability to ingest live video from the field via TVUPack or from local live studio feeds and simultaneously distribute the feed to other transceivers set up on the grid to receive the feeds; decodes video streams and then encodes the signal for distribution to other TVU transceivers; whether the live video feed originates from an in-house production facility or a TVUPack transmitter unit in the field, TVU Grid distributes the feed to one or multiple transceivers with as little as three seconds of latency; ideal for large broadcast networks and station groups.



Pulsar

Venera Technologies

www.veneratech.com



Content verification software tool for file-based content automates quality check and control at every stage of the content lifecycle; along with Rapid add-on module, Pulsar can be used to perform quick scanning, QC, auto sorting and in-depth verification at any stage of the workflow; processes HD files at 4X real time; users can set up a Pulsar farm for high content volumes; users can perform technically complicated checks such as Digital Hits, Blockiness or Active Aspect Ratio; users can also make sure their media is in compliance with regulations and standards such as the CALM Act or EBU R128; has an intuitive interface.

NewStream

Vislink

www.vislink.com



Multi-purpose van/OB microwave transmission system combines ENG, cellular news gathering and SNG in one compact rack-mounted unit; combines both licensed and unlicensed RF technologies together within a user-friendly platform; provides multiple ways to transmit up to two simultaneous live videos anytime, anywhere; ergonomic programmable multi-function OLED pushbutton switches automatically configure themselves based upon the user's desired mode of operation; use of OLED smart switches reduces front-panel congestion; user-selectable MPEG-2 or H.264 (AVC) encoding available in 4:2:0 and 4:2:2 profiles.

iON

Wohler

www.wohler.com



Monitoring platform meets current and future signal management and confidence monitoring needs from a single platform that can be remotely accessed and controlled from any web-enabled device; provides real-time streaming of content and metadata from locally installed, modular rack-mounted hardware devices that manage all I/O connections at their source; audio, video, captioning/subtitling, loudness, metadata, MADI and MPEG stream monitoring and analysis can be performed from a single user-configurable software interface; future-proof modular design supports multiple I/O cards in a 1RU chassis.

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• COFDM • 4G / LTE • Satellite

Nucomm + Dejero LIVE+

A joint technology partnership



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NUCOMM
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www.imt-broadcast.com

PRODUCT JACKPOT

NAB 2013

The NAB Show is the place to see product launches and demonstrations. If you didn't make it to the show, here is a round-up of some of the products that were on display. And for even more NAB product coverage, be sure to check out our *NAB Special Report*, which is polybagged with this issue.



Turnkey video streaming system

Telestream Wirecast 4.3

New version adds live thumbnail feature for real-time monitoring of all live sources, countdown clock and integration with Teradek; brings high-quality, multicamera live video production and broadcasting capabilities to live event producers.

www.telestream.net

Scan converters

Ensemble Designs BrightEye Mitto

New high-resolution support for line of BrightEye Mitto high-performance scan converters; new software supports 1920 x 1920 pixel images; converters provide ultra high-quality conversion from computer video to SDI video; computer video is converted to serial digital SD, HD and 3Gb/s on BNC electrical or fiber-optic outputs.

www.ensembledesigns.com

Expansion cards

Riedel Communications MN-GV-2, MN-C-OPT-GV-2

Expansion cards for MediorNet Compact and Modular allow users to connect Grass Valley LDK and LDX cameras to MediorNet, as well as base stations; this provides a solution to route bi-directional camera signals, including all embedded audio and telemetry control data, through the MediorNet fiber.

www.riedel.net

Desktop capability

AmberFin iCR

Network License Server (NLS) enables facilities to use the same technology in their single standalone PCs as in a network of 100 workstations; each iCR workstation operates all the software required to implement the four main functions of media ingest, file transcode, playback and quality control.

www.amberfin.com

4K camera

Blackmagic Design Production Camera 4K

High-resolution 4K digital film camera with innovative large Super 35 size sensor and professional global shutter; combined with precision EF mount optics and high-quality Apple ProRes 422 (HQ) file recording; supports the new 6G-SDI video connection for use in live video production.

www.blackmagicdesign.com

Handheld HDTV production camera

Hitachi SK-HD1200



Outstanding images are acquired by three (R,G,B) 2.3 million pixel UAIT 1080-line progressive CCDs; advanced digital processing technology assures low-noise, high dynamic range pictures.

www.hitachikokusai.us

3G conversion gear

Cobalt Obsidian

Three OBSIDIAN3G models: 9501-DCDA-3G provides comprehensive 3G downconversion, the 9501-DCDA-HD for when 3G downconversion isn't presently needed but will be in the future, and the 9502-DCDA-3G for when production is switching to 3G but still needs to interface to legacy HD gear.

www.cobaltdigital.com

IQ video format converter modules

Snell IQ Modular



Designed for local monitoring with LCD displays; provide cost-effective yet high-quality conversion of common SD, HD, and 3Gb/s formats for broadcast systems; based on Snell's next-generation KudosPro motion-adaptive format converter technology.

www.snellgroup.com

Time code display

ESE ES-976

Time code display features 7in bright red LED display housed in aluminum wall mount; accepts ESE time code, SMPTE/EBU time code or RS-232C ASCII time code; Time Zone option enables offset for different time zones.

www.es-web.com

Real-time loudness meter

TC Electronic LM6

Is compliant with EBU R128, ATSC A/85, TR-B32 and ITU-R BS.1770-3; can be switched to the ungated, original BS.1770 measure; displays include both a loudness history radar and true-peak bar graph; supports mono, stereo and 5.1.

www.tcelectronic.com

Wireless camera transmitter system

Vislink INCAM-S

Fully integrated wireless camera 3G-SDI transmitter system is built into the Sony HDC-2400, 2500 and 2550-series HD cameras; provides full HD broadcast-quality encoding at 1080p, 1080i and 720p; includes built-in wireless camera control.

www.vislink.com

4K Mini-Converter

AJA Hi5-4K Mini-Converter



Provides simple 4K monitoring connection using four 3G-SDI outputs to 1.4a HDMI inputs; enables a flexible 3G/HD-SDI to HDMI conversion for HD workflow; audio embedded in the SDI input is passed as embedded audio in the 4K HDMI output.

www.aja.com

Automatic remote playback

PlayBox Technology EdgeBox

Offers fully redundant automatic remote playback anywhere in the world via the Internet; makes a TV station, complete with local branding and content, an economic reality — even for small audiences.

www.playbox.tv

1RU software-based server

Harris NEXIO Volt

Addresses customer needs for higher channel counts in a compact form factor, while increasing options for robust media storage; new server platform doubles the number of available record ports with four bi-directional HD channels (up to eight SD).

www.harris.com

MPEG decoder

IMT Nucomm NCRx4

Rack-mountable compact HD/SD MPEG2/4 decoder features MPEG-4 H.264 SD and HD decoding; enables broadcasters to decode HD content over the same infrastructure they use to transmit SD or MPEG-2 content; ASI, SD-SDI, HD-SDI and composite outputs as well as AES decryption.

www.imt-broadcast.com



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- Multiple wireless connections
- Starts up in seconds
- Fits easily into production workflows

Scan or TVUPack.com



Media encoder and DA

Miranda SME-1901



Provides multiformat video/audio monitoring over IP; combines an H.264 streaming encoder with a 1 x 6 SDI (3Gbps/HD/SD) DA; has high frame rate, low bit-rate encoding and optional fiber connectivity; operates with a wide range of decoders.

www.miranda.com

TDM routing system

Wheatstone BRIDGE TDM



A true router-based studio networking system capable of switching 3072 audio channels to 3072 destinations — all at once, virtually latency-free, with no blocking; uses gigabit Ethernet protocol to link studios over Cat 6 interconnected rack-mounted blades with no central point of failure.

www.wheatstone.com

Instant replay

NewTek 3Play 425

Delivers professional instant replay with network-quality production in native HD; features a six-channel live sports “sweet spot”; seamlessly mixes live video with assets from a media library; compact 2RU design fits perfectly in control rooms and production vehicles; includes control surface with premium T-bar, speed presets and jog wheel.

www.newtek.com

IP streaming monitoring

Digital Nirvana AnyStream IQ

Cloud-based system for streamed media monitoring; designed to provide reliable recording, logging and monitoring of live and recorded streamed broadcasts for Web captioning compliance and proof of advertising.

www.digital-nirvana.com

Video cards

Riedel Communications

MN-HDO-4IO, MN-C-OPT-HDMI

MN-HDO-4IO for MediorNet Modular and MN-C-OPT-HDMI suite for MediorNet Compact Pro; MN-HDO-4IO is a universal input and output card offering four SFP ports that can be individually equipped with specially developed interfacing SFPs for HDMI I/O, DVI or composite PAL/NTSC; MN-C-OPT-HDMI cards offer HDMI connectivity for MediorNet Compact Pro.

www.riedel.net

MPEG-2/MPEG-4 transport stream analysis

Triveni Digital StreamScope MT-40

Provides end-to-end MPEG-2/MPEG-4 transport stream analysis and monitoring for DTV services carried by broadcast, cable, satellite, IPTV or mobile networks; using the MPEG analyzers, users can monitor multiple ATSC M/H transport streams and ensure transport streams meet current industry standards.

www.TriveniDigital.com

Portable camera system

Sony HDC-2570 HD

50p/60p digital triax camera live production system is comprised of four new digital triax transmission products: the HDC-2570 HD portable camera, the HDFX-200 digital triax camera control unit (CCU) adapter, the HDTX-200 digital triax camera adapter and the HKC-TR27 side-panel digital triax adapter.

www.sony.com

MPEG-2 encoder

Linear Industries LEX2000

Uses intelligent scene analysis, adaptive decision logic and nonlinear quantization to achieve high-quality video, even with multiple video programs and challenging bandwidth constraints; offers integrated add-on functions, such as video format conversion, remote monitoring and ASI re-multiplexing.

www.linear-tv.com

Field-production lens

Fujinon PL 14-28mm

Features a focal length of 85-220mm at T2.9 and 300mm at T4.0 with 200-degree focus rotation, to facilitate shooting documentaries, nature and wildlife, and commercials; designed using the latest optical simulation technology.

www.fujinon.com

Cable deployment reel system

Optical Cable MARS

Modular Advanced Reel System is lightweight and designed for harsh environments; reel can be used with axials (“broom sticks”) or with integrated A-Frames; features a flip-out handle, 30ft built-in divider, connector cradle design and stackable features.

www.occfiber.com

Multiformat production switcher

Snell Kahuna 360 4K

Now offers 4K functionality at no additional charge, which enables users to mix and match any combination of SD, HD, 1080p and 4K sources seamlessly in the live production environment; 4K support is transparent, requiring no change to the switcher layout.

www.snellgroup.com

Newsroom computer system

OCTOPUS Newsroom Octopus7

New version enhances workflow efficiency and adds tools for working with social media, Web and mobile devices; new features include Topic Bins for organizing and sharing news information, Assignment Desk for planning and a REST API for interfacing with custom third-party applications.

www.octopus-news.com

Media production

Quantel revolutionQ

Suite of software services delivers efficient media production on generic storage; supports Framework for Interoperable Media Services (FIMS); the software supports FIMS and FIMS Capture, Transform and Transfer services — enabling plug-and-play operation with a FIMS-compliant system.

www.quantel.com

Contribution encoder

Harmonic Ellipse 3000



Employs MPEG-2 and MPEG-4 AVC 4:2:0/4:2:2 8-bit and 10-bit compression technologies to enable transmission of pristine real-time video over satellite and broadband contribution networks; ideal for DSN operations and live sports coverage.

www.harmonicinc.com

Video server

Ross Video BlackStorm



New BVS-104P playout server offers the same compact 1RU form factor as the BVS-102P 2-channel system, but doubles the channel count; available with three different storage options, including a 4TB HDD model, 8TB HDD model, and for the ultra-performance and reliability, a 400GB solid-state drive model.

www.rossvideo.com

Enterprise storage

Spectra Logic T950

Library system offers encryption and key management as seamless, integrated standard features; includes BlueScale GUI software; system can seamlessly add encryption to backup strategy, with no changes to backup policies and no additional hardware or software.

www.spectralogic.com

Field production monitor

TVLogic SRM-074W

High-luminance version of the popular 7in viewfinder/field production monitor weighs only 2.07lbs and has a magnesium housing; features 1024 x 600 LCD display; has two 3G/HD/SD-SDI inputs, HDMI in and out, HDMI to HD-SDI converted out, waveform/vector scope and H/V image flip.

www.tvlogicusa.com

Production system

Broadcast Pix Flint

Production system features end-to-end workflow integration; delivers built-in HD streaming and live video outputs; allows operators to include cloud-based content in addition to cameras and file-based graphics and video; anchored by Broadcast Pix's established toolset.

www.broadcastpix.com

4K monitor

JVC PS-840UD



Features a native screen resolution of 3840 x 2160 and 60p display capability; was developed specifically for rigorous commercial use by broadcast, production and other AV applications; features an In-Plane Switching LCD panel with 120Hz refresh rate and 10-bit color depth.

pro.jvc.com

Fiber-optic connector

Fischer FiberOptic

Specially designed for extreme environments; has high ingress protection of IP68 (2m/24hr) when mated and IP67 in unmated conditions; features optional gas tight panel receptacles and removable mono-block mate.

www.fischer-fiberoptic.com

Graphics system

Pixel Power Pixel Factory

Turnkey, server-based implementation of Pixel Power's core graphics engine; supports file-based operations in broadcast workflows; can produce graphics overlays for QC, web delivery or post production, as well as graphics for program material and overlays for thematic/static channels.

www.pixelpower.com

Console

Solid State Logic C100 HDS



Fully scalable console, processing and I/O system is designed to meet demanding HD production applications; offers comprehensive 5.1 production tools with metering, monitoring, bussing, single-fader stem control, intuitive panning and 5.1 upmix.

www.solidstatelogic.com

Loudness meter

Linear Acoustic LQ-1

Supports ITU-R BS.1770-1/2/3 loudness metering standards; includes selectable Dolby Dialogue Intelligence automatic speech gating to accurately reflect listener perception; signal levels are clearly displayed alongside measured loudness and dialnorm metadata.

www.linearacoustic.com



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Aurora QC, Hydra Player and Eos AutoFix are uniquely designed to work together with your transcoder and workflow tools to make your QC process, review and correction faster, simpler and saner.

We're Digimetrics, and we enable smart decisions with advanced tools for the modern media organization with True Next Generation QC...www.digi-metrics.com

Routing switchers

Utah Scientific
UTAH-100/UDS 4K family



Offer 6Gb/s UHD-SDI signal capabilities to support new 4K signal formats (both single- and multi-link) used in UHD TV production; 4K routers are available in 32 x 32, 64 x 64 and 144 x 144 matrix sizes; complementing the new 4K routers is a 4K signal-processing module that provides multiplexing and demultiplexing of 1.5Gb/s and 3Gb/s streams to and from 6Gb/s format.

www.utahscientific.com

Encoder/decoder

PESA XSTREAM

Multi-input, HD-SDI and IP megapixel encoder/decoder comes with audio synchronization, quadview monitoring USB playout and optional HD-SDI outputs; integrated Web server allows for full remote capability; packaged in a 1RU frame with internal power.

www.pesaxstream.com

Converter

Apantac Pinnacle

Turns a low-cost consumer LCD monitor into a broadcast-quality display; is a standalone 3G/HD/SD-SDI to HDMI converter; features a built-in scaler/de-interlacer, analog audio monitoring output and embedded audio on HDMI output.

www.apantac.com

COFDM RF system

Anton/Bauer Gold Spectrum
Wireless Series

A collaboration between Anton/Bauer and Integrated Microwave Technologies; AB-HDTX sends its signal directly to the AB-HDRX dual-diversity receiver or the AB Direct VU; offers an RF output of 100mW; is capable of accepting a wide range of HD/SD video formats along with embedded audio from the HD-SDI output on the camera.

www.antonbauer.com

3RU matrix intercom

Clear-Com Eclipse HX-Delta



New 3RU matrix intercom offers the connectivity and high capacity of a larger matrix system; compact intercom provides two CPU cards for redundant system control, along with the option of up to four varied I/O frame cards and up to three interface modules.

www.clearcom.com

Loudspeaker

Genelec M series

M series bi-amplified active monitors continue company's sustainability initiative by using new Class D amplifiers developed in-house; new amplifiers are highly efficient and have low distortion; Intelligent Signal Sensing power management powers monitors off and on in response to audio signals.

www.genelec.com

Technical furniture

TBC Consoles SmartTrac

Console provides enhanced ability to gang individual workstation components to form complete Master Control and Production Control consoles; modular rack turrets available in 2RU and 4RU heights; vented and removable with 10-32 tap front rack rail.

www.tbconsoles.com

3G SDI audio metering

RTW TM3-3G TouchMonitor

Compact yet versatile system for metering, de-embedding and monitoring 3G SDI audio; features a 4.3in touchscreen for horizontal as well as vertical orientation, which can display any of the eight audio channels contained in a 3G-SDI stream.

www.rtw.de

Thunderbolt connectivity

Small Tree ThunderNET

Provides post-production pros with a cost-effective solution to integrate Thunderbolt-equipped platforms into high-performance storage and data networks; combines high-performance I/O capabilities of Thunderbolt with the flexibility of PCIe.

www.Small-Tree.com

Audio console

Calrec Artemis Light

Is the newest member of the Artemis family of Bluefin2/Hydra2 audio consoles; new is a compact processing rack dedicated to delivering digital signal processing and routing capabilities in a 4U enclosure; can be fully integrated with any existing Hydra2 network.

www.calrec.com

SGL

SOFTWARE GENERATION LIMITED

www.sglbroadcast.com

LTF5 is the new archive tape technology that is changing the landscape of file-based workflows for the broadcast industry.

SGL provides *native* support for LTF5 drives and libraries, allowing complete content portability between systems and streamlining workflows to increase the revenue that you generate from your content.

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7.J15a.

Audio, loudness meter

DK-Technologies DK5

PC Logging application allows for session-based real-time logging of metering data history on loudness, along with peak channel performance; features an integrated log session database to provide safe data search and storage; exports data in several file formats for additional analysis and visualization.

www.dk-technologies.com

File-based QC

Digimetrics Aurora

File-based verifier for video, audio and metadata allows automated testing of nearly any format in existence; unique tests for artifacts in video and audio streams ensure that false positives are kept to a minimum; ideal for use in high-volume ingest, VOD, tape conversion and archival operations.

www.digi-metrics.com

Effects software

Autodesk Entertainment Creation Suite

New features includes 3D animation, visual effects and creative tools, Autodesk Maya 2014, Autodesk 3ds Max 2014, Autodesk MotionBuilder 2014, Autodesk Mudbox 2014, Autodesk Softimage 2014 and Autodesk Sketchbook Designer 2014.

www.autodesk.com

HDTV tuner

Contemporary Research ATSC+SDI

Features an onboard HD-SDI port; controllable via RS-232, IP and IR commands; onboard Web page enables remote Web control; new menu-driven display simplifies setup, and a front-panel USB port makes firmware updates easy; compact enclosure allows mounting of two tuners in a single rack space.

www.crwww.com

Video distribution over IP

Matrox MaeveX

Video-distribution-over-IP solution consists of MaeveX 5100 series encoder/decoder pair that extends 1080p60 video and audio over a standard IP network; operates on standard 10Mb/100Mb/1000Mb Ethernet networks; features excellent image quality with low network bandwidth consumption.

www.matrox.com

HD production camera

Panasonic VariCam

Third-generation VariCam improves upon the camera's signature features — off-speed shooting and film-like image production — while incorporating the company's new AVC-ULTRA family of video codecs; uses three advanced, full 1920 x 1080p wide dynamic range MOS images for native 1080/60p recording/operation.

www.panasonic.com/broadcast

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Video server

Avid AirSpeed 5000 2.5



Latest version video server features broadcast-quality slow-motion playback on any channel for sports and live event programming under AirSpeed Remote Console or external control; low-latency Play While Record feature allows near-instantaneous ingest to playback turnaround.

www.avid.com

Portable PTZ production system

RUSHWORKS REMO 22



Designed for single-operator, multicamera production using a touchscreen and PTZ cameras, so no camera operators are required; supports four or eight HD/SD-SDI ins; features two clip players, multilayer DSK, full-motion overlays, transitions and effects, PIP, and chroma key.

www.rushworks.tv

Up/down/crossconversion

Evertz MMX series

7814 series builds upon the 7812 series for high-quality and feature-rich 3G/HD/SD up/down/crossconversion; is a dual-conversion path modular product that incorporates advanced motion adaptive spatial temporal (3D) noise reduction; provides new de-interlacing technology for superior resolution and artifact reduction, as well as high-quality scaling using standard or user-defined ARC modes with full AFD (SMPTE-2016) support.

www.evertz.com

Extension card for Cat 5e/6

Opticomm-EMCORE

Optiva OTC-1HDP



Card provides uncompressed transmission of one channel of 3G HD-SDI video with embedded digital audio, up to 100m on a single Cat 5e/6 cable; supports resolutions up to 1920 x 1080/60Hz, as well as analog stereo audio; also features HDBaseT compatible transmission.

www.emcore.com/opticomm

File delivery format validation

Signiant CloudSpeX

Software application validates media file delivery formats prior to transfer; matches file types and metadata against a cloud-based directory of published specifications to ensure that assets comply with customer-defined delivery format requirements.

www.signiant.com

Branded channel playout system

Harmonic Spectrum ChannelPort

Now delivers dual digital video effects capabilities, extended codec support and Pitch Blue compatibility; additional enhancements include independent branding of simulcast channels, support for external key/fill and live feeds, voiceover from live or file-based sources, and on-board closed-caption file insertion.

www.harmonicinc.com

Digital audio coaxial patchbay

Bittree Digital Audio

Coaxial Patchbay

Designed for discreet AES signals and offers significant cost savings over video patchbays otherwise used for this purpose; BNC rear interface is designed for fast and easy installation; developed in response to the rapid growth of digital audio content.

www.bittree.com

Camera-mount condenser microphone

Shure VP83F LensHopper

Camera-mount condenser microphone offers same detailed, high-definition audio with full low-end response as the VP83; captures uncompressed WAV files at 24-bit/48kHz sampling rate; has dedicated headphone audio output for real-time headphone monitoring.

www.shure.com

MXF clip server

FOR-A MBP-120SX

Two models, MBP-120SX and MBP-125SX, support ingest, playback and playout applications; can capture files from an external XDCAM drive or network drive, converts HD/SD-SDI signals to MXF files in real time, and support up to eight channels of embedded audio.

www.for-a.com

Hard disk dock

Blackmagic Design MultiDock



A rack 1RU mount hard disk dock; supports up to four independent disks to be inserted and mounted on the user's computer; option for multiple disks to be striped together to build an inexpensive Thunderbolt-based disk array.

www.blackmagicdesign.com

Multiviewer

Avitech Rainier 3G Plus

Allows users to monitor four SDI (3G/HD/SD)/CVBS (NTSC/PAL) sources in a single card via a full HD 1080p output; up to four cards can be installed in a 1RU chassis; high flexibility is achieved through internal multiple path cascading; incorporates HDMI technology.

www.avitechvideo.com

Acquisition camera

Grass Valley LDX Flex

Cost-effective camera delivers the same high-quality images and performance — and supports the use of the same accessories — as other cameras in the LDX Series for a single production format; can be upgraded through the entire LDX range as required.

www.grassvalley.com

Full duplex wireless system

Eartec Simultalk 24G

Provides hands-free, two-way voice communication with no base station; not voice-activated and no buttons to push; simply turn on and talk; operates at 2.4GHz frequency; battery life is five hours transmit, 10 hours standby; no license needed.

www.eartec.com

LTFS notification service

SGL Notification Service

Enables material to be transferred directly into the archive; using a simple subscription setup, it announces the arrival of new material to the controlling MAM system; pushes relevant data to the MAM, describing material archived based on rules selected by the broadcaster.

www.sglbroadcast.com

Turnkey newsroom system

Dalet News Pack

Fully packaged end-to-end HD newsroom system includes hardware and software for traditional TV broadcasting, as well as Web and mobile distribution; features full NRCS, range of desktop and centralized ingest tools, video production tools and A/B roll layout tools.

www.dalet.com

MADI-over-Cat5 switch

Optocore MADI switch

10 or 18 ports of MADI switches allow distribution over Cat 5 cabling; each port supports a 64-in/64-out point-to-point connection, as well as 100Mb of Ethernet on one single Cat 5 cable; each switch has two redundant high-speed 2GB fiber uplink ports that switch and route 16 MADI streams.

www.optocore.com

Playout software controller

EVS Nano Air

For TV studios and on-stage entertainment; combined with the company's XSnano servers, it integrates smoothly with any file-based workflow; enables simultaneous playback of up to four HD or SD channels from the XSnano server to several destinations.

www.evs.tv

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The latest HD cameras, such as this Grass Valley LDK 8000, offer sensitivity and S/N ratios comparable to the last generation of SD cameras.

The **FUTURE** of imaging technology

CMOS sensors are here to stay.

BY KLAUS WEBER

Since its broadcast camera introduction in 1987, CCD technology has been used in nearly all of the typical broadcast applications. Most of today's camera systems that are used for these applications are still based on three 2/3in CCD imagers. This imager size, in combination with the RGB prism beam-splitter technology, has been the de facto standard for more than 25 years. Even when the SD cameras were replaced by HD cameras, which offer more than four times the pixel count, this standard has not changed.

There are good reasons for this: Some are economical, while others are based on technology and physical factors. For instance, a 1920 x 1080 2/3in HD imager has a pixel size of 5µm x 5µm, which is approximately four times smaller when compared to an SD imager. That is why the first generation of HD cameras were approximately 1 to 1.5 f-stops

less sensitive than the SD cameras, while also providing an approximate 6dB to 9dB lower S/N ratio. This gap has been closed thanks to improvements in imaging technology, combined with the implementation of digital noise reduction systems.

The latest HD cameras now offer sensitivity and S/N ratios that compare closely to the last generation of SD cameras from more than 10 years ago. However, this is only true of the 1080i and 720p formats. Changing to any of the 1080p formats will lower the sensitivity of the CCD camera by 1 f-stop, or 6dB, again. Why is that so? CCD imagers have always had the advantage that the signal charges from two adjacent pixels could be added to each other in the vertical shift register. That means a CCD imager that reads out an interlaced format has an improved sensitivity of 6dB, compared to a full progressive read out.

Today's interlaced formats are now only used for broadcast applications, and they will soon be replaced by progressive formats. The demand for 1080p, 4K and even 8K production is increasing. They are all progressive formats, and the improvements in the interlaced formats of the CCD imagers will no longer work.

CMOS

In CMOS imagers, the signal charges are converted inside the pixel into a signal voltage. Therefore, they must always work in a progressive mode as they cannot add signal charges from two adjacent pixels to one another. If needed, the interlace formats can be generated from inside the camera signal processing using the full progressive signals from the imager. A camera with a CMOS imager

A camera with a CMOS imager will have an identical sensitivity in the interlaced and progressive formats.

will have an identical sensitivity in the interlaced and progressive formats. This is one of the reasons why CMOS technology has fully replaced CCD technology in all applications other than broadcast.

In the past, CMOS imaging technology was not accepted for broadcast applications because of its performance when reacting to fast movements and light flashes — the so-called “rolling shutter” effect. This was caused by each pixel taking a slightly different start and end in terms of exposure time. This problem has been solved in the latest CMOS imagers by adding a storage node inside every pixel. They now react to fast movements and light flashes identically to CCD imagers with their “global shutters.”

Limiting factors

So how will this affect new formats such as 1080p, 4K and 8K? As previously explained, with the 1080p format, CMOS imagers offer a solution that not only provides the same imager size, but also a sensitivity and S/N ratio that is at least identical to what the best CCD cameras can achieve only in the 1080i formats. Therefore, there is no need to change the imager's size or the principle of the RGB prism beam-splitter technology when going from 1080i to 1080p production. One advantage of this is that all the current 2/3in HD lenses, which are available in large numbers and in a wide range of sizes and zoom factors, can be used without any limitations. This is obviously not the case if a format with a higher pixel count (such as 4K) has to be produced.



HD Module

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Hybrid Module

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Quick Disconnect for easy setup

36 Consolidated Connections with 1/2 Turn Engagement



vpc.com/iconhd



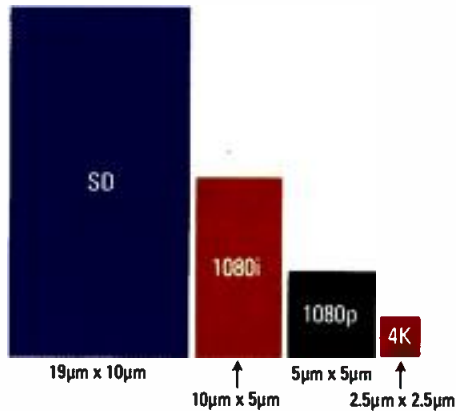


Figure 1. For a 2/3in imager, pixel size decreases as resolution increases, diminishing sensitivity and limiting saturation levels.

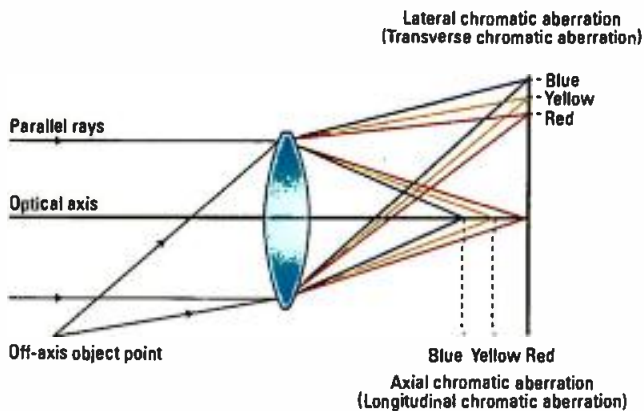


Figure 2. There are two kinds of chromatic lens aberrations: axial (longitudinal) and lateral (transverse). Axial aberration produces different optimum focal points depending on the wavelength of the light. Nothing can be done on the camera side to reduce this effect; the lens must be optimized to reduce it. Lateral aberration manifests in color fringing on the sides of an image. This effect can be corrected if the camera knows the amount of error at the actual lens position.

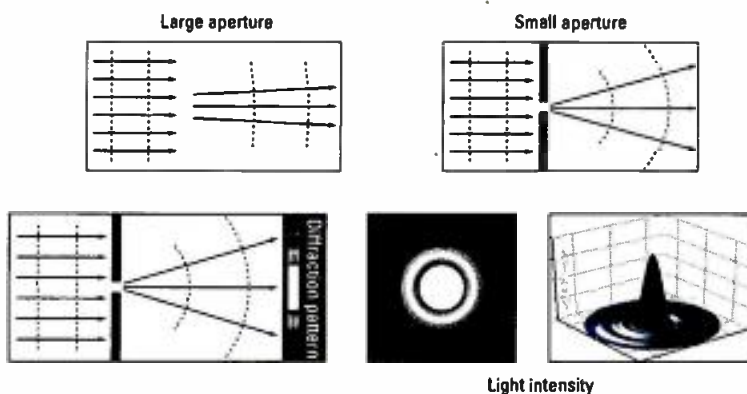


Figure 3. Diffraction effects are seen mainly at greater f-stops. As pixels on an imager become smaller, the resolution demand of the lens becomes greater. Aberration and diffraction effects could limit the useable iris range.

4K requires double the amount of pixels in both a horizontal and vertical direction. If they are put inside a 2/3in imager, the size of each pixel would be reduced from $5\mu\text{m} \times 5\mu\text{m}$ to $2.5\mu\text{m} \times 2.5\mu\text{m}$ (or in other words, the size of the pixel would be four times smaller). (See Figure 1.) Because of the smaller pixel size, the sensitivity would be at least four times lower too, which is not acceptable for most applications. The smaller pixel size would also limit the saturation level, which directly influences the dynamic range of cameras.

The camera manufacturing industry has taken more than a decade to compensate for the comparatively lower sensitivity of the smaller HD pixels and a similar time frame may be required to compensate for the smaller pixel size of a 4K camera. There are other limiting factors relating to the resolution and sharpness of the lens. The first is caused by the different aberration effects, which

are mainly visible at lower f-stops, while the second is caused by the diffraction effects, which are mainly visible at higher f-stops. (See Figures 2 and 3.) As the pixels become smaller, the resolution demand of the lens becomes greater, and the aberration and diffraction effects could limit the usable iris range to an unacceptable level.

So what happens if the pixel size remains (approximately) $5\mu\text{m} \times 5\mu\text{m}$, but the imagers increase in size? Although it would not generate the same limitations in terms of sensitivity, the larger imager size requires the lens to face the same angle to produce a larger focal length, which reduces the depth of field. This is an effect that many broadcasters want to use for cinematography applications, but it is not necessary or even desirable in many instances, especially around live sports and entertainment productions. There are other questions to address in terms of the necessary size, weight and cost of these lenses, and the maximum zoom range that can be achieved. The cost of the three large imagers and the much larger prism beam-splitter could also prove limiting factors in terms of a full 4K RGB camera system.

4K today

The 4K cameras available today for high-end applications have been based on the design of a large (CMOS) single imager, where a color filter in front of the pixels (which in most cases is a Bayer pattern filter) is used. (See Figure 4.) With the Bayer pattern filter, half of the pixels are used for the green part of the light, and a quarter of

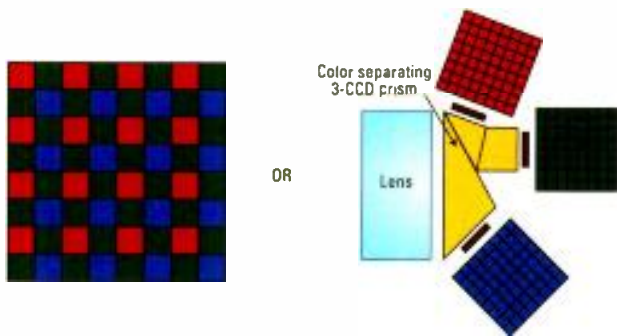


Figure 4. Single CMOS imager cameras use a Bayer pattern filter (left) in most cases as compared to a beam-splitter system as used by 3-CCD or 3-CMOS imager cameras. For the single-imager cameras to obtain a resolution comparable to the 3-CCD or 3-CMOS cameras, it would need more, smaller pixels or a larger imager. Neither option is optimal for broadcast cameras for reasons of noise, sensitivity, diffraction effects and compatibility with the 2/3in lens mount standard.

the pixels are used for each of the red and blue parts of the light.

A full-quality 4K RGB signal cannot be achieved with this type of camera system as it would require a far higher pixel count, and the imager size would need to be even larger. Nevertheless, these camera systems are an acceptable compromise for cinema-style shooting and deliver good performance with the prime lenses and the limited-range zoom lenses, which are available for the larger imagers.

Can the current single imager for 4K cameras adapt for live broadcast applications? Can broadcasters compromise by using a camera with three smaller full 4K RGB imagers? Or will another solution deliver a superior result? The only thing that seems to be certain at this stage is that the future of cameras will be based on CMOS imaging technology. What the best imager size is, and what is the best color separation system for these cameras will be, still needs to be defined. It's an interesting challenge that will need to be addressed by camera manufacturers and users around the world over the coming years. **BE**

Klaus Weber is Director of Product Marketing Imaging, Grass Valley.

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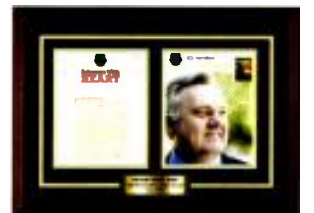


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Camera Corps' Q-Ball

The robotic mini-cam helps produce enhanced content.

BY JIM DANIELS

Producing enhanced content in the age of budget constraints is a daily challenge for broadcasters around the globe. Producers and directors alike must grapple with the increasing demand for more complex and interesting content, while working with a fixed or reduced staff.

So, where can those in the broadcast community turn for ways to deal with this dilemma? What does a production team in a major stadium do to enhance production options without adding dedicated staff? How can an OB truck provide value-added services to live events without adding complexity and, therefore, increased charges, to a setup? Is there a pathway for a central broadcast control room to increase creative opportunities for a live sporting event in another location run by existing production staff? How can one add inconspicuous video capabilities to a green room without an intrusive camera and operator?

These dilemmas have prompted the manufacturing community to devise equipment that not only offers more production options, but also streamlines existing production workflows. One such solution can be found in the robotic cameras and control systems provided by Camera Corps' Q-Ball robotic camera and Vinten Radamec's control systems.

The advantages of a fixed, high-quality camera capable of being operated remotely are many. The Q-Ball, a remote HD mini-camera packaged in an unobtrusive spherical case, offers high-quality video from locations inconvenient or impossible for a standard camera/operator team to access. Although the camera comes equipped with a dedicated control system, its compatibility with Vinten Radamec's control panels

— including the new CP4 — greatly expands the opportunity for its use in remote and studio installations.

Under the hood

The camera is structured around the highly respected Sony chip-electronics-and-lens combination based on a 1/3in, 2MP CMOS camera sensor. It is a compact package with a pan-and-tilt head and comprehensive control protocols for remote access. The camera itself offers HD 720p and 1080i performance at 50/59.94Hz and SD performance covering 625/50Hz and 525/59.94Hz, with aspect ratios of 16:9 and 4:3. This enables coverage of a wide range of production applications employing varying degrees of technical sophistication. Nightwatch infrared and an integrated 10X zoom optical lens allow for enhanced production options.

Further, wide-angle lens adapters are available as performance options. These features are married to smooth accelerating pan/tilt motors housed in a sturdy, fully weatherproof aluminum sphere with a diameter of

just 4.5in. The mini-cam supports four channels of embedded audio to enable stereo or multichannel capture. Master black level and color-saturation control allows for color matching between other HD/SD cameras, an important factor in situations where different camera types are used.

Users can mount the camera upright or in an inverted position from a ceiling, wall, cabinet, floor, backboard or tree — allowing the system to be present but not intrusive. For reality TV or green-room applications, a small camera that blends into the background is ideal for capturing the natural response from the participants. For sports applications, stadiums can install Q-Ball cameras in dugouts, for example, to get intimacy shots of baseball players, or high up on the stadium infrastructure for spectacular overview shots.

Users can specify the camera housing in a variety of colors to better correlate with the production's needs. Although the Q-Ball has its own hardware-based control system that

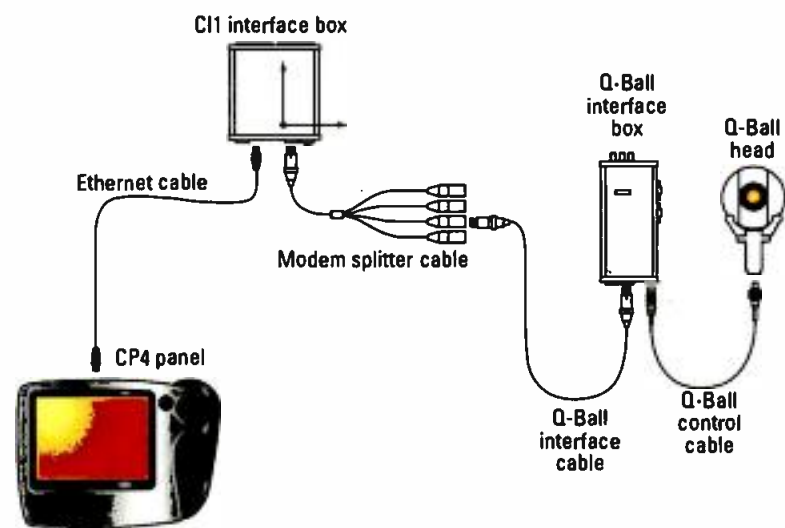


Figure 1. Operators can use the Q-Ball with the Vinten Radamec CP4 controller to connect it to their existing production system using only an Ethernet cable.

can handle up to 96 remote cameras, compatibility with Vinten Radamec's new control system brings it into the production studio.

Taking control

The CP4 design philosophy takes its cue from the iPad and similar tablet devices. It is a virtual, touch-screen-based controller with an integrated three-axis joystick for moving a camera and focus wheel/rocker switch for zoom control built for operators without extensive knowledge of robotic camera systems. Specifically created for use with small robotic heads, the unit uses Ethernet network architecture for straightforward and quick installation.

Operators can configure the Windows-based touch-screen interface to control up to four heads and store up to 40 preset shots out of the box. They can also upgrade the system

to control up to eight heads and 200 preset shots. The unit supports the Intelligent Control Engineering (ICE) protocol, which the company incorporated into its recently released series of next-generation heads.

Using the combined system shown in Figure 1 allows professional facilities to use the remote mini-cam within an existing production system without the cost and difficulties associated with running multiple cables beyond an Ethernet connection. This relationship also allows the smaller facility or remote location to enjoy the production benefits of high-quality components coupled with remote capabilities, without the costs involved in deploying and training personnel on larger systems.

The remote camera is designed to go places where camera operators typically cannot, allowing them to capture B-roll beauty shots for a

given segment with ease. Beyond the standard camera shots, it can provide much needed close-ups for out-of-the-box, unique broadcast shots, making viewers feel like they are a part of the action. As the camera blends into the background, it does not reflect on-camera behavior, giving broadcasters the added ability to capture more realistic interviews/reactions for those that tend to be camera-shy on-air.

The benefit of the combined system is that the controller is easy-to-use and intuitive, offering the ability to control multiple camera heads using one touch-screen interface, without the need for extensive training. **BE**

Jim Daniels is technical director for Camera Corps.

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Marquis' Project Parking

The application helps editors more efficiently archive Avid projects.

BY BEN MILES

One of the original promised benefits of file-based workflows was less footage. Digital cameras could be turned on and off more quickly. Some could record constantly to a loop before you hit record, so the need to "leave the tape running" vanished.

However, in reality, less footage has not happened. It is not uncommon for crews to log 500GB of media after less than a week of shooting, and, these days, you can carry 10 hours of media in your back pocket. So, the challenge has become the issue of an always full edit storage, and many post-production editors wonder what they can do about it.

Marquis Broadcast's Project Parking gives editors the tools to find out what is using up space on their Avid edit storage through a storage and project analysis. Once that is done, users can then delete clutter before archiving storage-intensive projects and all of their media elsewhere.

Projects and media can be analyzed by size, project, location, age, duplicated or orphaned files. Snapshots of versions of projects can also be taken at the touch of a button. The solution then allows projects to be moved between tiers of storage or to different locations and incremental project archive versions to be created, while still maintaining a usable and accessible format for future retrieval and use.

Storage and recall

Edit storage can become full for many reasons: stalled projects, finished projects, left over render files, duplicate files and media files no longer used by any online project. Project Parking helps manage that storage more efficiently.



Figure 1. Project Parking transfers allow users to move Avid projects to new workstations or locations.

The solution works by analyzing all projects and media across all workspaces. It then allows that analysis to be viewed in the UI, and users can rank projects how they see fit. This may be in order of total file size, number of files associated with a project, which workspaces the media is on, or whether media is offline. The location of any duplicate files can also be identified, as can any orphaned media.

Stalled projects can then be taken offline to free up space. It is possible to archive whole projects (all bins, sequences and media files) and update with new versions or archive only important bins. Archived projects can be moved through the cloud and around the world. A project is transferred with its entire media to any storage so that it can be restored to a new facility, workstation or laptop and edited immediately. (See Figure 1.) Also, orphan and duplicate media files can be managed by moving them offline, which frees up the edit storage.

Project Transfer functionality can be used to ensure all media for a project is in a specific media workspace. For example, media often gets placed in the wrong location, which makes it difficult to find or move later on.

The solution allows media residing in several places to be collected and restored to one location, so it can be edited by another workstation in the future. Alternatively, the Transfer functionality allows a project's media to be moved to a laptop's local disk for editing off-site, or to a new removable disk for transportation to a new facility.

Retrieval (bringing a project back from deep storage or just from a weekend's editing at home) is achieved by restoring whole projects or just the required bins of an archived project, for re-editing to any other project by listing all archived Avid projects in each destination. Each archive provides creation date information. It also details the number of versions available along with user comments. Users can choose which version and where to restore the project, selecting how original workspaces map onto currently available ones. Users also can merge a new version of a project with one currently online. **BE**

Ben Miles is business development manager, Marquis Broadcast.

Send questions and comments to: editor@broadcastengineering.com

The rise of AVB

Precise timing lets broadcasters use IT networking.

BY JAN EVELEENS

Chances are you've heard of audio/video bridging (AVB). Chances are even better you don't really know what it is. Read on, because AVB technology offers some real advantages over SDI, the kind of benefits that mesh with the new IT-driven video landscape.

The professional media transport market is still dominated by point-to-point analog wiring systems. (See Figure 1.) But there is an explosion of digital networks steadily replacing analog cabling and point-to-point digital cables for more scalable, flexible and high-performance AV systems. The dominance of digital signal processing, continual improvement in the price and performance of networking technologies, widespread deployment of IT networks and the increasing use of computer equipment for playback, storage, and processing of media signals are all driving digital adoption. Now that AV equipment can be networked without sacrificing performance, the AV and IT industries are converging, enabling new AV applications and collaborative, networked systems.

Yet, for all of its promise, conventional IT networking has lacked the precise timing needed by the professional broadcast environment. AVB's primary drive is to add the timing precision so professionals can rely on traditional performance from inexpensive, off-the-shelf network fabrics. The IT industry has, in a sense, caught up, delivering the speed and reliability demanded by broadcasters and content providers.

Infrastructure

AVB, an open standard established by the IEEE, is a group of network protocols for the distribution of time-synchronized, low-latency audio and video streams over Ethernet. All

audio and video streams, as well as associated control, metadata and synchronization needed for a live production, are on a single cable/layer — one connection that works as both an input and output.

The highly scalable IT-based system enables the use of current as well as new standards, such as 4K, with standard, off-the-shelf switches with software on top, providing broadcasters with predictable, reliable, consistent and uncompressed video delivery. The system is synchronous on top of an asynchronous network. What you put in is what you get out for stable, fast, low-latency transport with an overall network delay of 2ms.

AVB technology lays the foundation for high-quality, low-latency guaranteed media streaming over Ethernet networks. The three core protocols allow for timing and synchronization, bandwidth allocation through the stream reservation protocol (SRP) and traffic shaping to ensure that low-priority Ethernet traffic does

not interfere with critical AVB video traffic. AVB devices also periodically exchange timing information so both ends of the link synchronize their time base reference clocks precisely for synchronization of multiple streams.

Advantages

Today's Ethernet devices predominantly support full-duplex operation at 100Mb/s or greater. Since the total available bandwidth available over such an Ethernet link is both known and constant, an AVB reservation over those Ethernet links combined with the appropriate traffic shaping assures both throughput and delivery latency parameters are met for packets of reserved streams. AVB devices are able to reserve a portion of network resources through the use of admission control and traffic shaping and send and receive the new timing-based frames.

Historically, increases in cost-effective bandwidth have enabled new

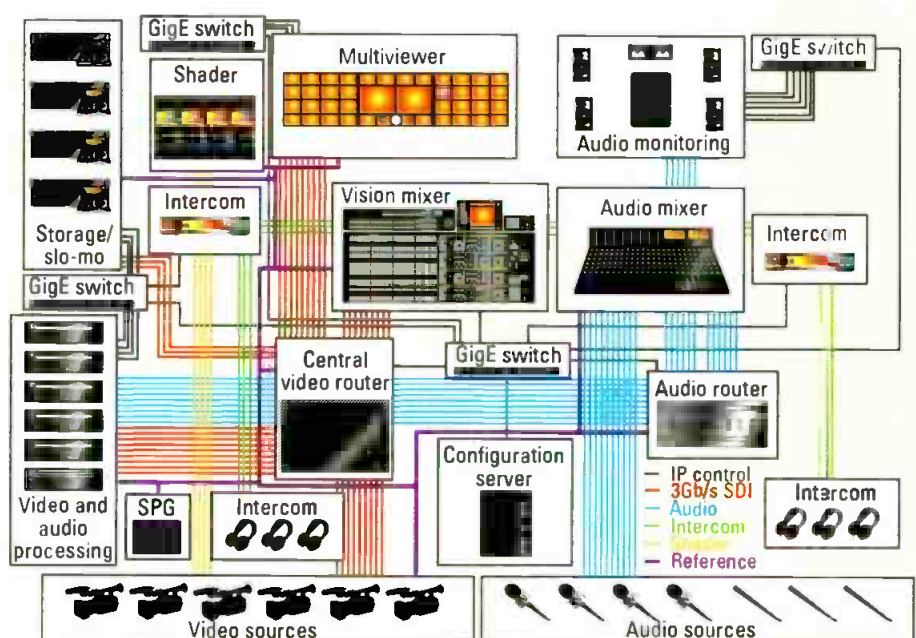


Figure 1. SDI-based facilities often end up with massive star-shaped architectures.

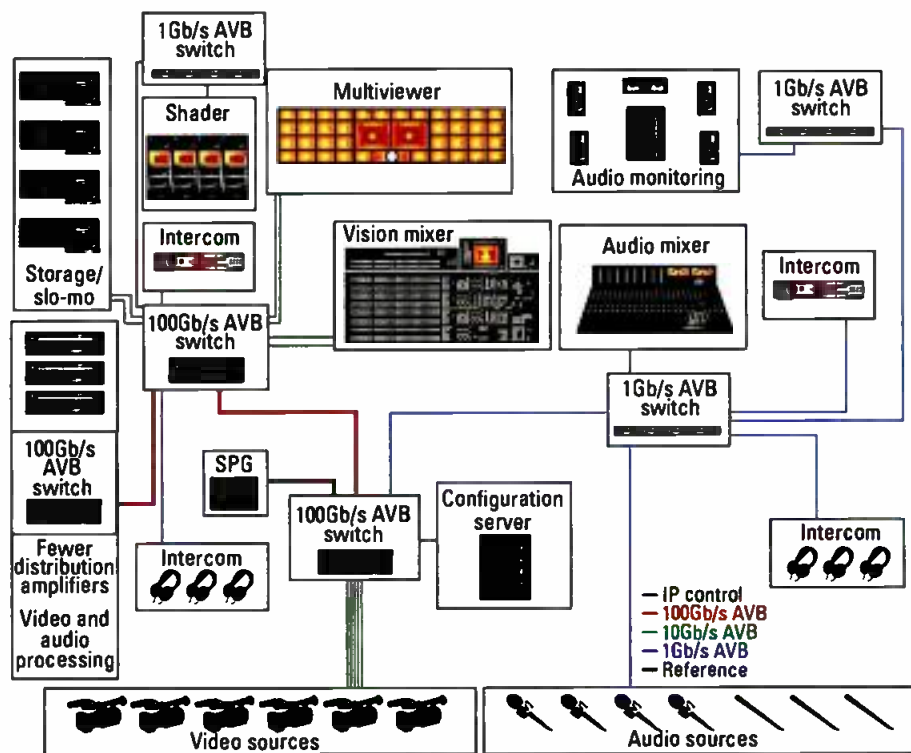


Figure 2. An AVB-based facility is simpler, with far fewer cables.

network services. In the case of AV systems, the shift to gigabit networking creates the necessary bandwidth for truly high-performance AV networking systems. Increased bandwidth improves every aspect of AV networking systems, lowering latency, increasing channel capacity or quality, and improving synchronization.

The key advantages of AVB networking are:

- Simple, single-layer infrastructure;
- Completely synchronous, stable, fast and low-latency transport;
- Co-existence with legacy systems;
- Traffic shaping and prioritization, ensuring no media bursts;
- Bandwidth allocation through the stream reservation protocol (SRP);
- Economies of scale.

In addition to the continuing standardization work of the IEEE, an industry body, the AVnu Alliance, is working to advance AVB and its standardization. Its remit: to create compliance test procedures and processes that ensure the interoperability of networked A/V devices and the highest quality streaming A/V experience, as well as AVB applications

in automotive, professional and consumer electronics markets.

The production facility of the future

Sometime in the not-so-distant future, production studios will likely be constructed with far less wiring and a lot more efficiency. With AVB, the design and build of a broadcast facility suddenly becomes much easier, more flexible and less costly. (See Figure 2.) Removing the inherent bandwidth, speed and set-up problems of single-wire SDI infrastructure, AVB provides agile, easy and instantly connected network access. At a glance, it avoids the old connection model that results in massive star-shaped architectures and muddled masses of cables.

While greenfield deployment of AVB equipment will be straightforward, networks with one or more islands of AVB connectivity might need to be more carefully considered, at least for the short to medium term.

Next-generation media networks

AVB is engineered from the ground up for media streaming

applications, providing an edge over legacy Ethernet technology due to its bandwidth allocation and priority rules based on timing. And like all Ethernet-based technologies, seamless end-to-end management of AVB networks is critical to successful operations. With sophisticated software, providers are able to integrate full monitoring and management functionality while hiding any underlying complexity.

In time, the interoperability of AVB switches and endpoints will be expanded and will drive the penetration of digital AV networked devices. As the professional broadcast community is educated about what AVB can achieve and how, AVB standards will be finalized and compliance certification processes completed. A transition period is sure to follow until AVB switches are prevalent and OEM AV manufacturers develop new products incorporating compliant versions of AVB. It won't be one infrastructure or one networking provider that dominates the market. Many organizations across regions will need to embrace the technology to advance its adoption and speed creation of AVB devices, equipment and applications.

It will undoubtedly take time for the industry to adopt AVB. Professional content providers won't abandon tried-and-true SDI applications overnight, but AVB is here, and it can be deployed alongside existing legacy infrastructures. It's making noise and warrants a close look. **BE**

Jan Eveleens is CEO of Axon.

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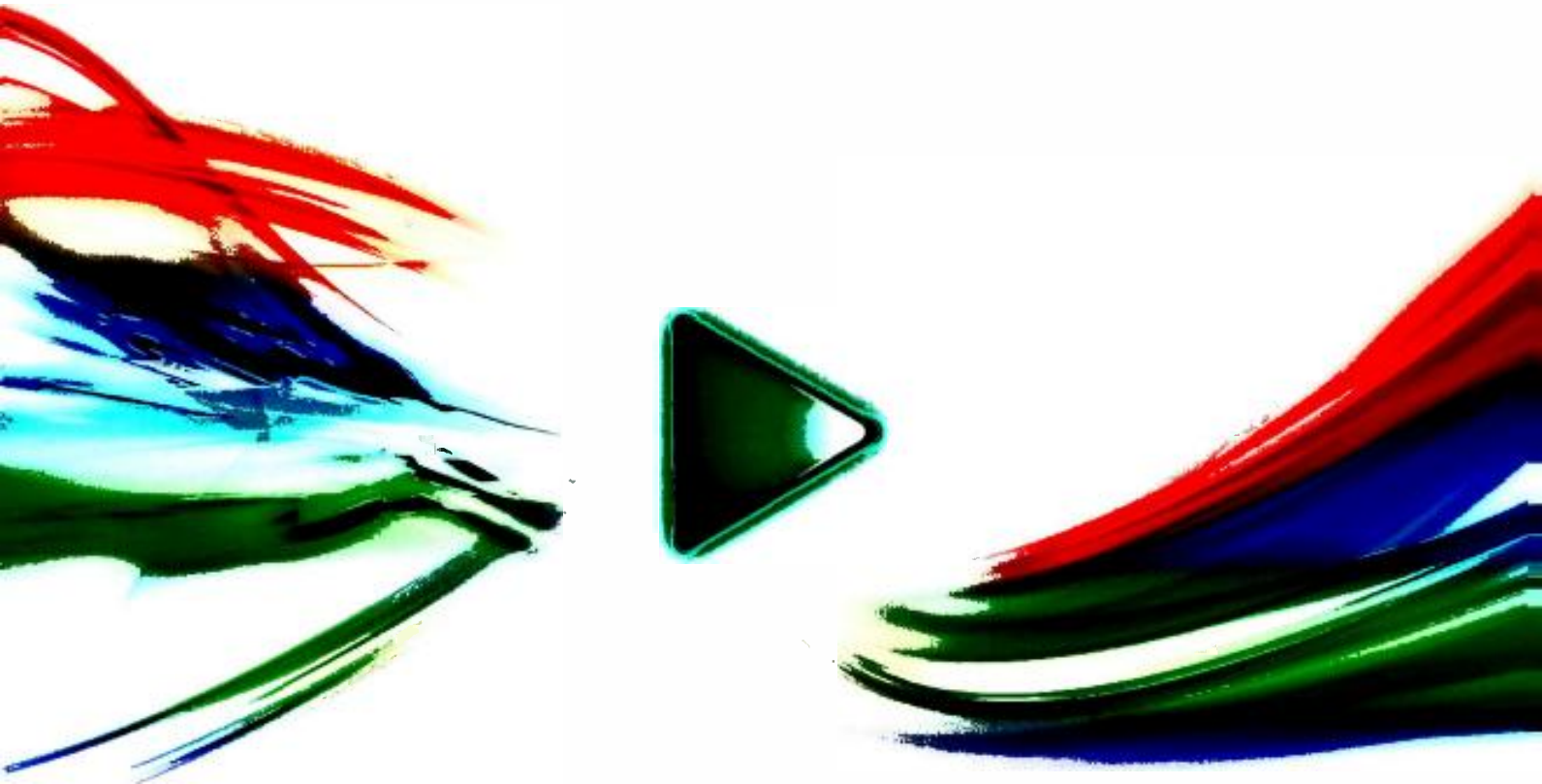


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