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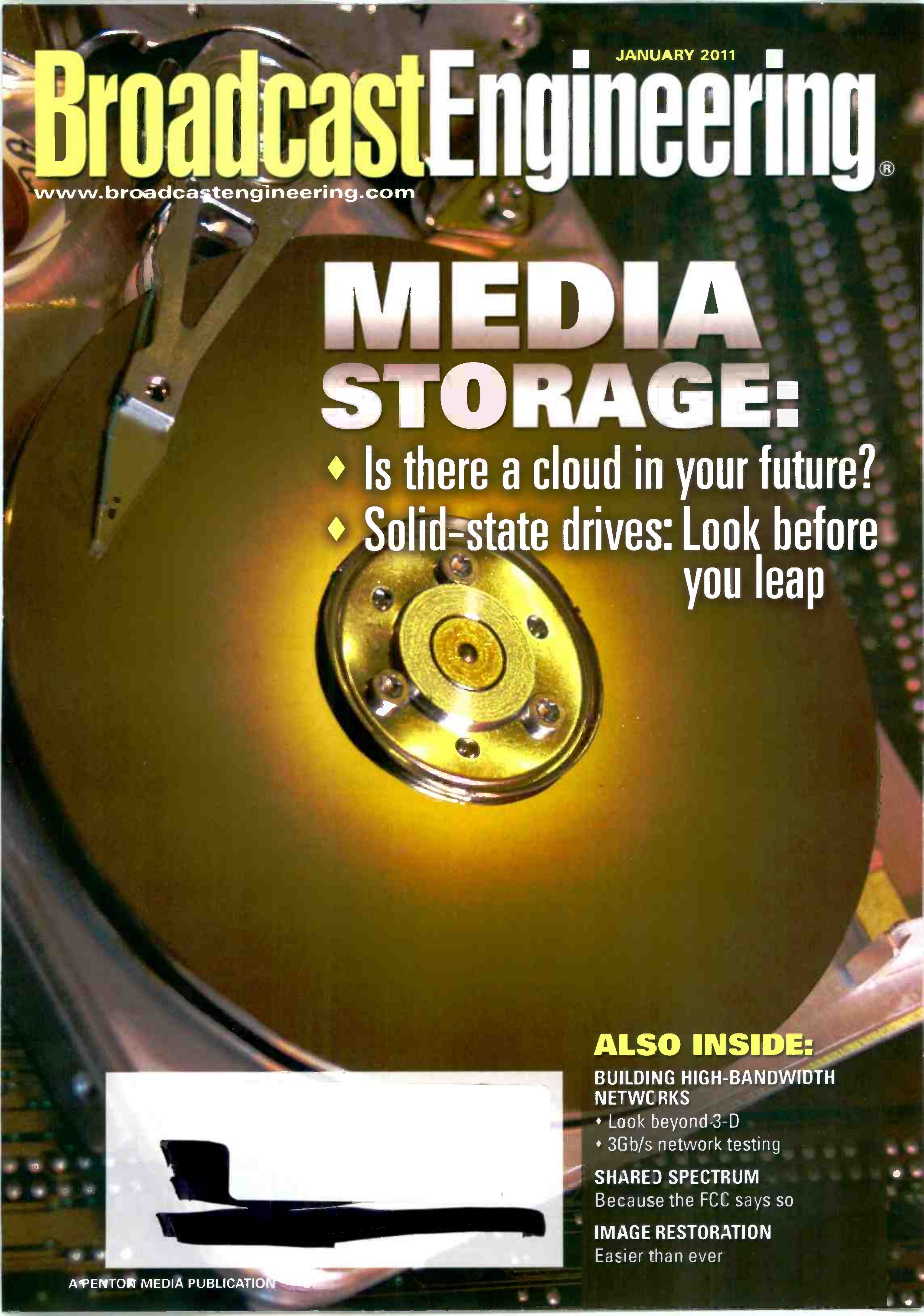

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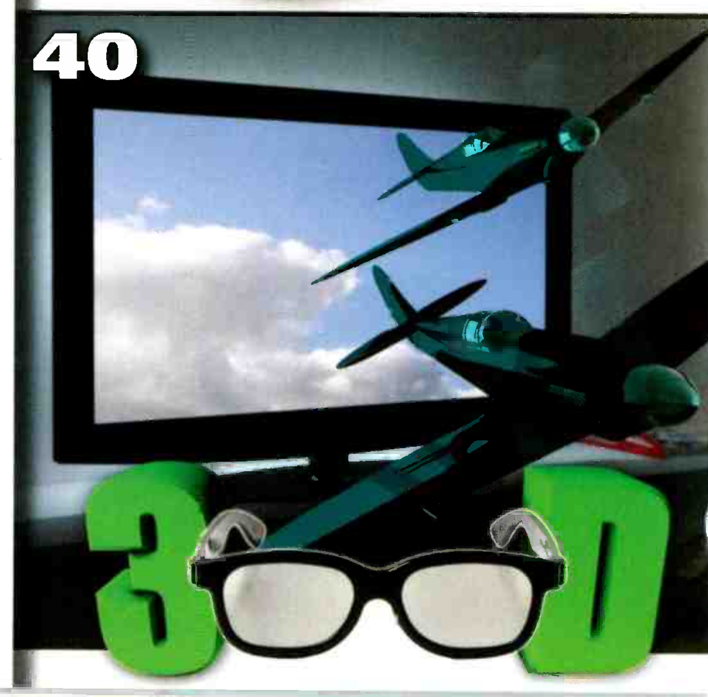

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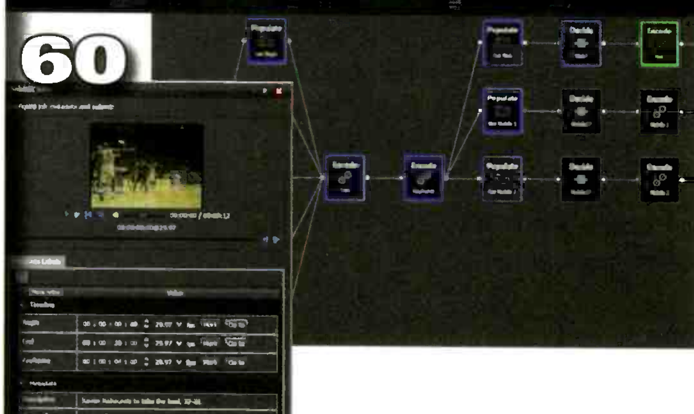

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Kill the 8-VSB Frankenstein, redux

It was August 2000 when I wrote on this page, "8-VSB technology is a Frankenstein, built from the scraps of other failed ideas … 8-VSB has had almost six years to make itself work, and it still doesn't. We should not gamble on promised future fixes that *might* make tomorrow's 8-VSB as good as COFDM is today."

It is not surprising that the editorial drew strong responses on both sides of the issue. The editorial was simply my opinion that many 8-VSB backers were choosing to remain blind to other options, specifically anything like COFDM.

Six years earlier, in 1994, *Broadcast Engineering* magazine suggested implementing a 15-month delay to accommodate a range of (C)OFDM tests. It seemed a small price

to pay for something as important as this nation's DTV platform. Unfortunately, vested interests pushed back with claims that new generations of receivers could solve any reception problems.

A key argument in the original editorial was that 8-VSB was being touted as superior to COFDM under false pretenses. More than a few knowledgeable engineers believed that COFDM would better serve the current (HD) and future (mobile, multichannel) options than would 8-VSB; however, 8-VSB backers claimed those, as of then, nonexistent consumer applications were not sufficiently important to be included in the platform's patchwork solution.

Another straw man argument used by 8-VSB backers was that it would be too expensive to convert the 8-VSB receivers already in the field to COFDM. That couldn't have been true because Sinclair offered to *pay* for those TV set conversions.

The pro-8-VSB argument focused on two basic, but critical, points: HD is what matters, and it's ready to go.

It is now 17 years later, and an FCC commissioner has proposed that the industry consider replacing 8-VSB with (C)OFDM. I hate to say it, but I told you so.

On Nov. 30, the FCC released its NPRM on opening TV spectrum to wireless broadband services. Along with the clawback provisions in the proposal, this industry's possible technological future was hinted at by Commissioner Meredith Attwell Baker. She said, "I accept that this item represents an initial step in updating our TV band rules. Significant and fundamental issues are deferred. In the future, there needs to be a fulsome discussion on additional innovative proposals to address sharing of broadband and broadcast in the TV bands, including the possibility of a broadcast transition from MPEG-2 to MPEG-4, the adoption of a more cellularized broadcast system or *a transition from ATSC to OFDM technologies*" [my emphasis added].

According to an April 2010 Nielsen report, fewer than 10 percent of homes receive their TV signal via OTA reception. That means up to 90 percent of a station's audience never relies on a transmitted RF signal. These viewers don't give a damn about 8-VSB or ABCD; they just want to watch TV.

Would COFDM have been a better solution for the delivery of DTV and today's mobile and multichannel iterations? We'll never know. To paraphrase Donald Rumsfeld, "You go to market with the technology you have, not the technology you might like to have."

We as an industry picked this Frankenstein, for better or worse, and now we have to live with it — that is, until the FCC decides otherwise. BE

Brad Dick
EDITORIAL DIRECTOR
Send comments to: editor@broadcastengineering.com

The three-screen promise

A unified media infrastructure can help you serve new audiences cost-effectively.

BY ALEX DOBRUSHIN

One result of the interplay of evolving technology and evolving consumer behavior is redefinition of the Web. In its early years, consumers thought of the Web in a limited way — Internet accessed via PC. Today, the Web has literally escaped the bounds of the PC screen and has reasserted itself on the screens of mobile phones, mobile tablets, television sets and game consoles, as well as on the speakers of Internet radio.

At the same time, the wide availability of high-bandwidth connectivity has opened the doors for what was once considered an unthinkable volume of content, including high-quality streaming media, to viewers beyond the boundaries of a living room.

Both the common wisdom and the numbers indicate the insatiability of the viewing audience's appetite for media anytime anywhere. According to the Pew Research Center's Internet and American Life Project, this year 85 percent of Americans report owning cell phones, 52 percent own laptop computers, 42 percent own game consoles, and 4 percent own tablet computers.

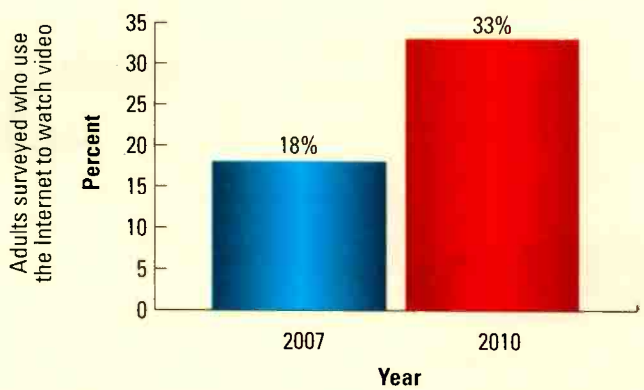
Destination	Media platform	Transport protocol
PC/Mac (desktop/laptop)	Flash	RTMP or HTTP Dynamic Streaming
	Silverlight	HTTP Smooth Streaming
	QuickTime	RTSP/RTP
iPhone, iPad	Apple iOS	HTTP Live Streaming
Android, BlackBerry, other 3GPP mobile devices	3GPP	RTSP/RTP
Windows 7 mobile phones	Silverlight	HTTP Smooth Streaming
IPTV set-top boxes	Conventional	MPEG-TS
	Flash	RTMP or HTTP Dynamic Streaming
	iOS	HTTP Live Streaming

Table 1. The world of popular media platforms and transport protocols is complex.

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

More Americans are using the Internet to view video

Thirty-three percent of adults used the Internet to watch video in 2010.



Source: Forrester *www.forrester.com*

Reaching new audiences

These consumption trends represent tremendous opportunities for broadcasters, content producers and other media enterprises to reach new audiences. However, technical challenges abound.

To understand why, you only have to look at all the variables in play. There are at least five different popular media platforms: Flash, Silverlight, HTML5, Apple iOS and 3GPP, while the number of transport protocols in common use is higher still: RTMP, RTSP/RTP, MPEG-TS and multiple HTTP methods, not to mention various adaptive bit-rate approaches. (See Table 1.)

Add to that the multiplicity of devices, each with its distinctive idiosyncrasies and capabilities — including screen size, resolution, decoding abilities, and encoding format and profile support. Compounding the issue further are the restrictions imposed by individual networks, which may include router and firewall filtering or protocol blocking. Then add bandwidth and other limitations imposed by different delivery methods — DSL, cable modem, WiFi, 3G and 4G.

Success requires strategic approach

Success requires a strategic approach that takes into account the complexities of both the technology and the marketplace. The first and most obvious consideration is where the content is going to be viewed — PC, mobile, game console or OTT. A second consideration is what content will be viewed. Is the programming going to be streamed live — a major sporting event, for example? Or, like a classic movie, will it have the same appeal if it's delivered on-demand?

A third issue is identifying the best infrastructure to support delivery. This is where the choice of technology first comes to bear.

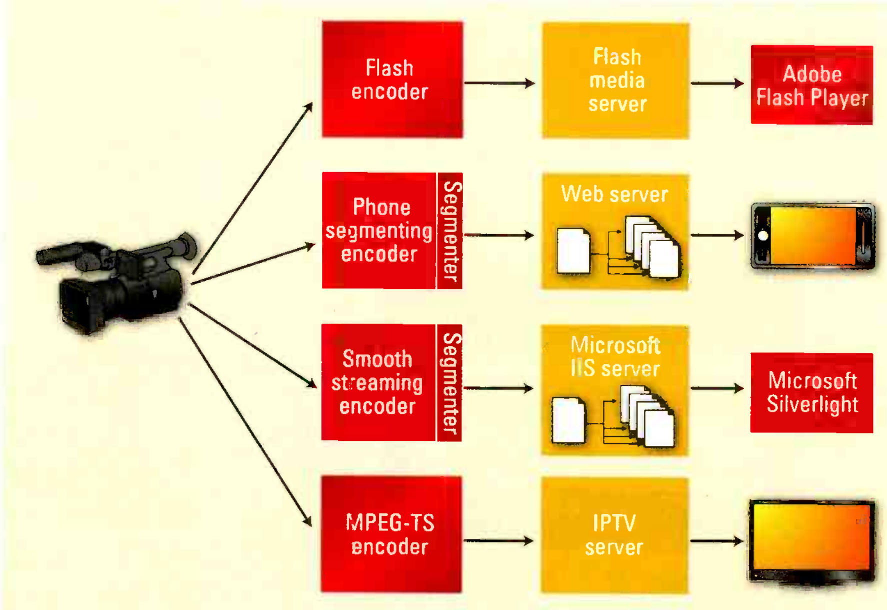


Figure 1. A segregated streaming workflow requires buying, implementing and maintainin multiple separate server types.

Optimizing the revenue model

Among monetizing options available to broadcasters are in-stream or in-player advertising, subscription and pay-per-view. Broadcasters also need to make their brand or website "sticky" to keep viewers coming back. In the mobile domain in particular, broadcasters have an opportunity to enhance revenue streams with apps for the iPhone, iPad, Android, BlackBerry and other devices.

One traditional solution is to implement separate media server infrastructures, each targeted at delivery to specific screens or media platforms. This so-called "segregated workflow streaming" may be many things, but it's not cost-effective. (See Figure 1.) In fact, that approach requires buying, implementing and maintaining multiple separate server types — a Flash media server for Flash, Microsoft IIS for Silverlight, QuickTime streaming server for 3GPP mobile delivery, and so on.

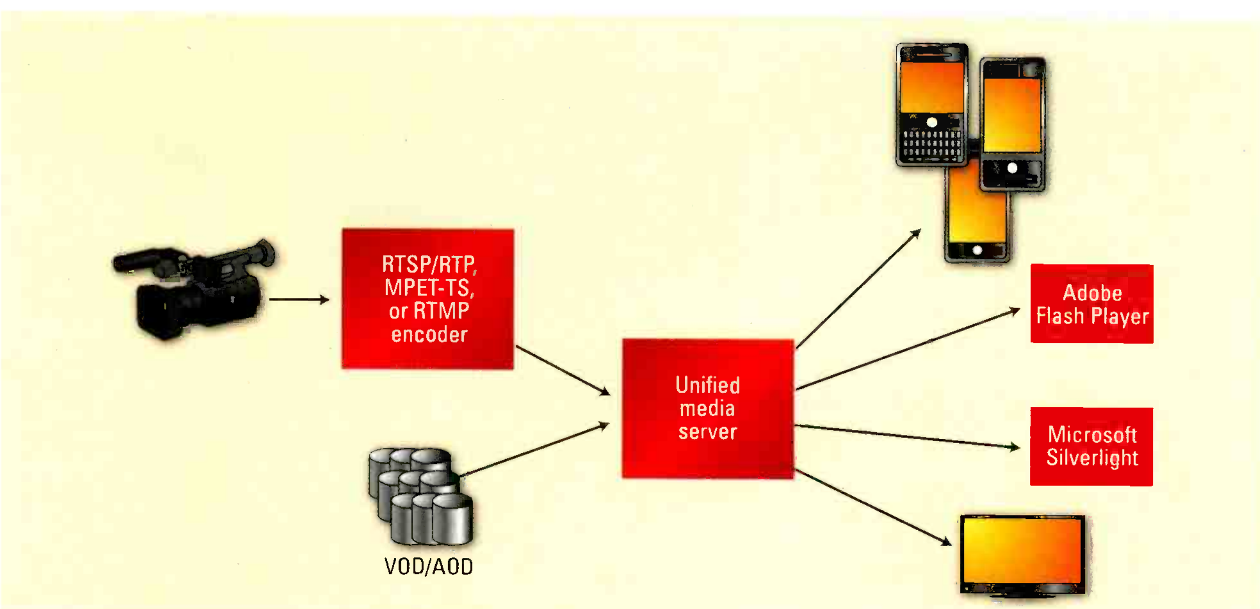
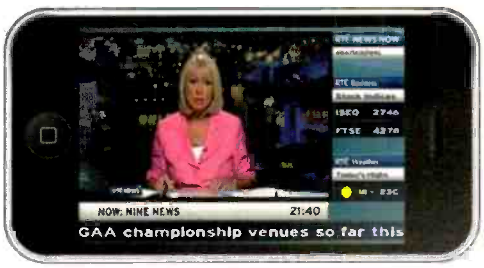


Figure 2. A unified streaming workflow eliminates the need for client-specific encoders.

Besides up-front and operating expense, a further problem is inflexibility, which makes planning for the future a nightmare. Guess wrong now, and you may have to replace everything much sooner than necessary. And even if you guess right, an inflexible system will fail to keep pace with inevitable, incremental improvements in technology.

Unified media infrastructure

A better approach is a unified media infrastructure supporting what is also known as "unified workflow streaming." (See Figure 2.) The model is based on a unified media server, a single server software type that enables streaming from a common set of on-demand or live asset encodes simultaneously to any supported player device over any protocol.



Irish public service broadcaster RTÉ's "NewsNow" program feeds rely on unified media servers to stream news and current events 24 hours a day to any screen anytime, including the iPhone.

A unified media server eliminates the need for client-specific encoders and, because it can be deployed or redeployed on commodity server hardware, it can take quick advantage of evolving performance increases. Unified media server software also makes it possible to achieve in excess of 10Gb/s per-server streaming performance using off-the-shelf hardware.

Providing a real-world example is RTÉ. The Irish public service broadcaster provides free-to-air television, radio and online services. The network's "NewsNow" program feeds rely on unified media servers to stream news and current events 24 hours a day to any screen anytime, supporting Flash, iPhone and Android devices. RTÉ implemented the unified server solution after recognizing that the traditional, segregated model would require twice the number of servers along with the commensurate multiplication of staff and costs.

Good for business, good for consumers

For consumers, the availability of Web-based media on any screen at any time is good. For broadcasters and other content providers, the Web's evolution presents both new opportunities for business expansion and new challenges. When considering a business's move into these new delivery opportunities, it is important to carefully consider both initial and ongoing infrastructure and staff costs. BE

Alex Dobrushin is chief marketing officer at Wowza Media Systems.

Shared spectrum

The FCC is moving toward forced TV spectrum sharing.

BY HARRY C. MARTIN

On Nov. 30, the FCC issued a Notice of Proposed Rulemaking (NPRM) looking toward the eventual accommodation of mobile broadband services in the UHF TV band. The agency sees broadband as a more important and efficient use of this spectrum than over-the-air broadcasting.

The goal of the proposed rules is to coax existing TV licensees off their current channels in order to free up blocks of prime spectrum, which would then be auctioned off for broadband use. While the commission does not yet have the authority to offer broadcasters a portion of the proceeds from such auctions, bills now pending in Congress would provide such authority. The NPRM is intended to put the commission in a position to move as quickly as possible toward the planned spectrum repurposing should Congress give it the power to share auction proceeds with displaced broadcasters.

Dateline

- Noncommercial TV stations in Arkansas, Louisiana, Mississippi, New Jersey and New York must file their biennial ownership reports by Feb. 1, 2011.
- By Feb. 1, TV and Class A TV stations in the following locations must place their EEO public file reports in their files and post them on their websites: Arkansas, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, New York and Oklahoma.
- Feb. 1 is the deadline for TV stations in New Jersey and New York to electronically file their broadcast EEO midterm reports (Form 397) with the FCC.

The NPRM proposes three significant changes to the FCC's rules, detailed below.

Shared use with broadband users

The FCC is proposing to amend its rules to include fixed and mobile wireless services as potential uses in the VHF and UHF spectrum blocks currently reserved primarily for television.

This change by itself would not mean that broadband users would flood the television spectrum. Rather, it would mean that the commission *could* authorize such uses. However, there is little doubt the FCC *will* authorize such uses once other changes, described below, are implemented.

Shared channel use by TV stations

The commission is proposing rule changes to permit two television licensees in the same market to "share" one of their 6MHz channels, thereby freeing the second channel for broadband uses. Under such a sharing arrangement, two stations would share a single transmitting facility, although each station would remain separately licensed. This plan, the FCC says, would free up for broadband use as much as 50 percent of the spectrum currently devoted to television. Licensees that agree to share channels would be able to maintain their must-carry rights on cable, satellite or other MVPD systems.

Maximization of VHF spectrum use

The commission is proposing to move as many incumbent TV stations as possible from UHF onto the VHF band because UHF spectrum is particularly good for broadband operation. To provide incentives for such channel moves, the FCC is proposing VHF power increases and other means to improve the performance of indoor antennas. The goal is to try to offset any disadvantages, perceived or real, in VHF operation. In particular, the commission is seeking comment on the adoption of the baseline standards for indoor antennas using the 2009 ANSI/CEA-2032 standard, which establishes testing and measurement procedures for indoor antennas.

Conclusion

While the NPRM clearly sets the stage for TV repurposing, it's only the first step in what will likely be a complicated and contentious process. At a minimum, the repacking of large numbers of TV operations into a tighter block of the spectrum will present thorny issues, including how to come up with a new DTV Table of Allotments. Additionally, thousands of low-power TV, Class A TV and TV translator stations operating on channels not included on the current DTV table will face displacement. While some of these stations may be able to take advantage of the proposed channel-sharing rules, it is not anticipated that such accommodations will be high on the FCC's priority list. The current FCC sees over-the-air television as inefficient and expendable in the context of the broadband revolution.

Comments on the NPRM will be due in the first quarter of 2011. It is expected the FCC's proposals will draw heavy fire from the TV industry, which is reeling from the DTV transition; from increased competition from cable, satellite and Internet services; and from a loss of ad revenues as a result of the down economy. BE

Harry C. Martin is a member of Fletcher, Heald and Hildreth, PLC.

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Video and audio sampling

How much resolution do we need, anyway?

BY ALDO CUGNINI

One of the fundamental processes involving digital signals is sampling. When sampling video and audio, the question inevitably comes up as to what is optimum sampling. Just how much resolution do we need, anyway? The question is difficult to answer because there are many factors that contribute, including the subjective characteristics of human vision and hearing.

Years ago, there was a research project conducted at RCA Labs called "Light-to-light," which set out to derive an overall transfer function describing a complete camera-encoding-transmission-reception-decoding-display video system. Hardware was built to simulate the effect of changes to parts of the system on the final images. Eventually, real-time digital signal processing and simulation systems like the Princeton Engine overtook the project. But all audio and video distribution systems can be looked at the same way — as a cascade of signal processing elements. First, let's go over the basics of signal sampling.

Sampling is fundamental to digital signals

The Nyquist Theorem states that information signals must be sampled at a rate at least twice as high as the highest frequency component; otherwise, aliasing will result, and no amount of processing will retrieve the complete original signal. In the frequency domain, the sampling process creates repeat spectra; the original signal spectrum will repeat, centered at multiples of the sampling rate. Thus, the input signal must be band-limited so that the repeat spectra do not overlap.

Most color video systems incorporate chrominance subsampling; the RGB pixels are converted into a YUV color space, and then the U and V chrominance components are spatially subsampled to save transmission bandwidth. Whereas U and V were historically used for analog systems, and the designations C_B and C_R (for "component-blue difference" and "component-red difference") grew from the use of digital encoding, the latter two are also often used for analog signals derived from a digital decoder. This color encoding gives rise to the commonly used 4:2:2 and 4:2:0 subsampling grids, where 4:2:2 provides full vertical resolution and one-half horizontal resolution of the color components compared to the luminance signal, and 4:2:0 provides one-half vertical and one-half horizontal resolution of the color difference components. (Full horizontal and vertical color resolution is given by 4:4:4 encoding.)

This *J:a:b* notation stems from the notion of a reference sampling block with four pixels horizontally and two pixels vertically. *J* is the number of luminance samples in the top row, and *a* and *b* are the number of chrominance samples in the top row and bottom row, respectively. Figure 1 on page 18 illustrates this notation.

Because chrominance subsampling can generate aliasing of the chrominance components that is different from that of the luminance component (which is further complicated by interlace), contribution and distribution signals preferentially use 4:2:2 sampling, especially when processing or editing video, whereas

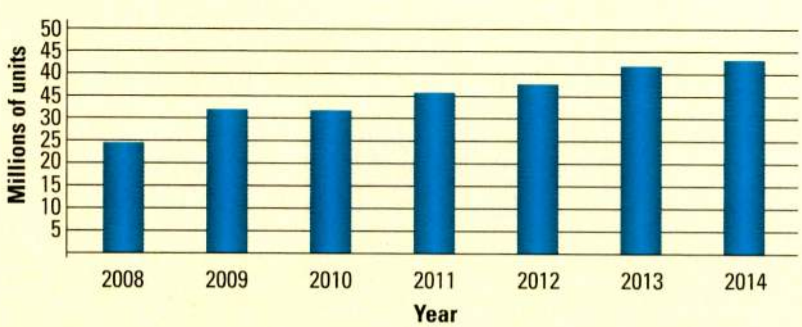
The Nyquist Theorem states that information signals must be sampled at a rate at least twice as high as the highest frequency component.

FRAME GRAB

A look at tomorrow's technology

U.S. LCD TV shipments decline for first time

Shipments will total 31.9 million this year, down 1.2 percent from 32.3 million in 2009.



Source: iSuppli

www.isuppli.com

transmission signals most often use 4:2:0 sampling to save bandwidth.

Audio sampling

We mentioned earlier that sampling must be performed at an appropriate rate, lest aliasing will occur. We can see this graphically in the spectrum plots of the undersampled signal shown in Figure 2, which include the repeat spectra inherently formed by the sampling process. With audio, this will result in an artifact that sounds like intermodulation distortion.

A critically sampled signal, where the sampling rate is exactly twice the highest frequency component, will avoid aliasing, but it will require an extremely steep analog low-pass filter when converting back to analog. For this reason, the signal is often upconverted to a higher sample rate, where a more economic digital filter can remove the repeat spectra, and a simpler analog filter — with a more gentle roll-off — can be used to reconstruct the analog signal.

Of course, the aliased signal in the example above could be post-filtered to remove the artifact, but this would result in a decrease in the high-frequency response of the system — perhaps an acceptable trade-off in certain (e.g., low-cost and low-complexity) situations.

How much is too much?

A key consideration in the design of any video system is the response of the final receptor — the human visual system. When trying to determine the resolution capability of the eye, we can start by measuring visual acuity, i.e., the measure of the spatial resolution performance of the human visual system. The term "20/20 vision" is defined by a Snellen chart as the ability to just distinguish features that subtend one-arc-minute of angle (one-sixtieth of a degree). The standard feature developed by the chart's eponymous inventor is the optotype, such as one of the well-known letters of the chart. Distinguishing optotype features on the 20/20 line — such as the cross-arm of the E — occupy a space of 60 features per degree or 30 cycles per degree.

Simple trigonometry produces the result shown in Figure 3, that the optimum distance from which to observe a 1080-line display is 3.16 times the picture height, where the vertical viewing angle is 18 degrees. Further than that, a person with 20/20 corrected vision can't resolve the smallest displayed details; closer than that, and you'll start to see individual pixels. Stated in screen diagonals, this works out to 1.55 times the diagonal measure of a 1920 x 1080 display.

Thus, if you've got a 1080-line monitor with a 15in diagonal, the optimum viewing distance is just under 2ft; with a 42in display, it works out to about 5.5ft. Because most people view their TV from a larger distance of about 9ft (the so-called Lechner distance, named after TV researcher Bernie Lechner), the required optimum screen size grows proportionally.

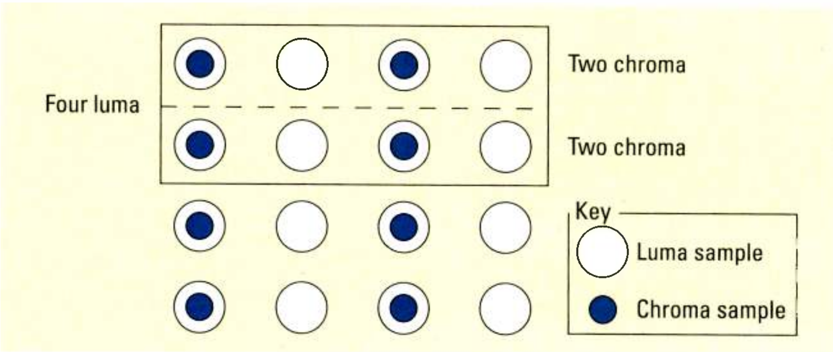


Figure 1. 4:2:2 color encoding results in the sampling grid shown here.

If you've got a 1080-line monitor with a 15in diagonal, the optimum viewing distance is just under 2ft; with a 42in display, it works out to about 5.5ft.

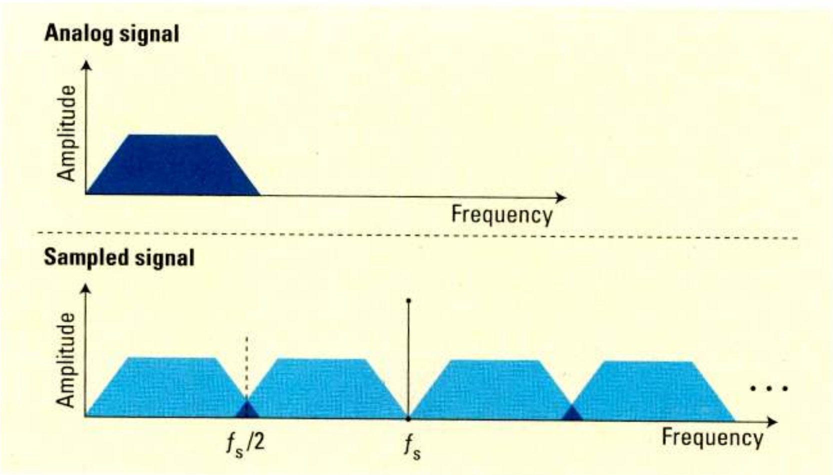


Figure 2. Undersampling creates aliases. Note the overlapping spectra. f_s is the sampling frequency.

These calculations, however, assume that there are no other limiting conditions. In reality, factors based on Kell factor, interlace, the interpixel grid, contrast and the sharp edges of the optotypes must all be taken into account. And making the case for Ultra-HDTV, NHK researchers wrote in a 2008 paper that test subjects could distinguish between images with effective resolutions of 78 and 156 cycles per degree.

This suggests that some people can tell the difference between a 42in display with 1080 lines and one with 2160 lines, when viewed within the practical confines of a living room. Perhaps the era of a complete video wall in the home is not that far off! **BE**

Perhaps the era of a complete video wall in the home is not that far off!

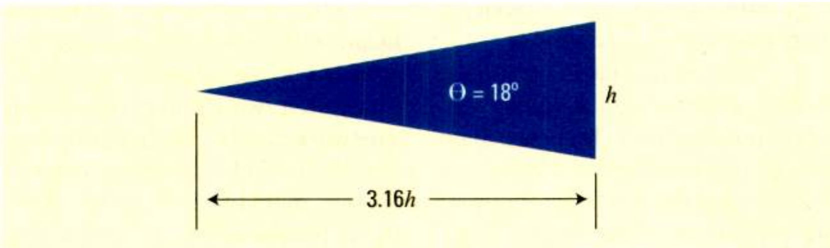


Figure 3. A 1920 x 1080 image is optimally viewed from about three picture-heights distance.

Aldo Cugnini is a consultant in the digital television industry.

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Media network design

Paying attention to network architecture can keep media networks operating efficiently.

BY BRAD GILMER

Professional media has special characteristics that must be considered when transporting this content over computer networks. (See the September article "System administration" online at *http://broadcastengineering.com/storage_networking/system-administration-0810.*) These characteristics can affect everything from router design to disk drive throughput. But nowhere are these characteristics more important than in the layout and configuration of your computer network and in the configuration of key networking components. This month's article will cover networking basics regarding the design and deployment of media networks.

IP over Ethernet is the most ubiquitous networking available by far. Working with professional media, you may encounter other networking technologies such as Fibre Channel, which is used to connect high-performance storage devices, and IP over SONET (Synchronous Optical NETworks), which is used for long-haul video-over-IP applications. However, for this basic article, we'll stick with IP over Ethernet.

I am going to assume that you already have a pretty good knowledge of computer networking basics. If not, there are many excellent basic references available. I happen to like the books published by Cisco.

The focus of this article is to provide practical guidelines for media networks. Here are some points to consider:

- Media networks and business networks should not be mixed.
- Careful attention should be paid to routers to ensure that network traffic goes where it should and does not go where it should not.
- Use the right wire, the right connectors, the right wall plates and the right technique.

Not mixing media networks and business networks

It is important that the traffic on media networks and business networks not be mixed. There are many reasons to keep them separated:

- *It increases security.* Media networks are at the heart of our facility. Keeping office traffic separate from media network traffic increases security and reduces the risk of outages caused by human error.
- *It allows you to deploy high-capacity networks where they are needed.* Media networks move very large files. Keeping the networks separate allows you to deploy high-speed networking where it is needed without having to build out the entire facility using the same transport. You may choose to use 10GigE fiber in the media network but less expensive unshielded twisted pair (UTP) GigE or 100BASE-T to business desktops.
- *It avoids affecting office network performance with large file transfers on the media network.* Even if you deploy high-speed networking technology, the performance of the media network may slow when several clients move large media files at the same time. Some decrease in speed at peak times may be acceptable on the media network, but business office personnel probably will not accept having their systems slow down every afternoon as editors and graphics operators begin preparing for evening newscasts.
- *It keeps a networking component failure in the office network from propagating into critical on-air operations.* I have seen two separate cases where a network card began chattering constantly. In both cases, the network became unusable because of all the traffic generated by the faulty card. Proper network design, including isolating network traffic to business units, will keep a failure in one area from affecting the entire facility.
- *It follows engineering best practices.* There are a number of other reasons it is a good idea to segment networks according to business unit functionality or according to some other method. I do not have enough space to list them all here, but suffice it to say that for many reasons, it is a best practice to segment network traffic by area.

It is important that the traffic on media networks and business networks not be mixed. There are many reasons to keep them separated.

Separate networks isolate traffic

The first step in separating traffic is to create separate networks. You do this both by physically separating the networks (separate cables and hardware, etc.) and by giving them different network addresses. It is possible to run two logically separate networks on the same physical wires, but unless you use a virtual local area network (VLAN), this will have unintended consequences. We will talk more about this below.


LIVE SKY
DOPPLER
RADAR
10
10
Utah Scientific
2020 Series
Master Control

Using the simple example shown in Figure 1, the business network is on one physically separate network, and the broadcast core is on another physically separate network. The Internet connects to the facility through a firewall/router, and the two networks are connected through a firewall/router.

You could give both networks the same addresses, but as soon as you tried to allow any communications between the two networks, problems would result. Entire books have been written on network addressing, but for now, there are two types of IP network addresses — public and private.

In a typical network, something called the subnet mask determines which part of the address refers to the network and which part refers to the host or computer. For example, given the network address 10.0.0.0 and a subnet mask of 255.255.255.0, we can determine that the network address is 10.0.0 and that there are 254 addresses available in the range of 10.0.0.1 through 10.0.0.255. In this case, the address is of the form nnn.nnn.nnn.hhh, where nnn.nnn.nnn indicates a network address and hhh indicates a host address. Thus, we could assign business computers addresses starting at 10.0.0.2. (Convention reserves 10.0.0.1 for the network router.)

On the broadcast core, we can choose another network address, say 10.0.1.0, and then begin assigning addresses from 10.0.1.2 to equipment on this network. We have created two separate physical networks with two separate logical network address spaces. But how do you get traffic from one network to another?

Pay careful attention to routers

If you configured the computers in Figure 1, as described above, and connected them all to the same switch, you would quickly find that the business computers could talk to each other and the broadcast core computers could talk to each other, but that business computers could not talk to broadcast core computers (and vice versa). It may seem that we have achieved our objective, but there is a problem. As soon as a media client begins a large transfer, the business network would be affected by that traffic. This presents a challenge. How do we keep these two networks from affecting each other, but allow selected computers on each network to communicate with each other? One way is to use a VLAN. Another, perhaps better way, is to use routers and firewalls. The main purpose of a router is to route traffic from one network to another. The router/firewall in Figure 1 is carefully programmed to allow only particular types of messages from specific computers to communicate across the network boundary. Traffic on the media network is never seen on the office network switch and vice versa. The goal has been achieved.

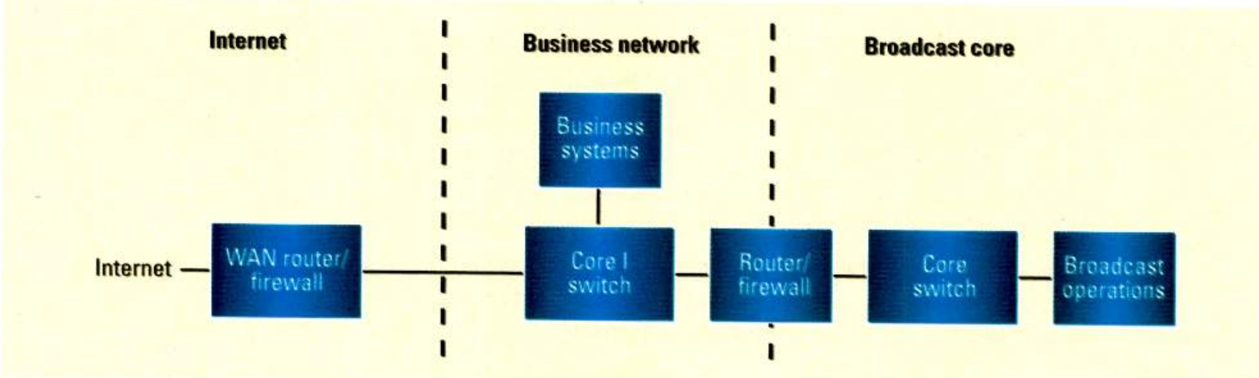

Figure 1. Media network traffic and business network traffic should not be mixed.

Using the right wire, connectors, wall plates and technique

In media networks, it is critical to use the right wire (or fiber), connectors, wall plates and techniques. Anything else will cause network performance to suffer because media networks typically push network performance to its limit. In the limited space available, I cannot go into details, but here are some places where I have seen problems:

> **It is critical to use the right wire, connectors, wall plates and techniques. Anything else will cause network performance to suffer because media networks typically push network performance to its limit.**

- Pay special attention to network speed compared to network cable rating, especially in situations where you are reusing existing cabling. You may be able to get away with using Cat 3 cable for 100BASE-T installations (but Cat

5 is ideal), or you may find that Cat 5 cable works for GigE (you need to be using Cat 5E or Cat 6). Over time, the network may become unstable.

• Watch out for patch panels or patch cords that are not properly rated for the network speed being used. I once spent several days troubleshooting an intermittent problem affecting an on-air automation system only to find that the patch cords being used in one part of the system were flat ribbon cable and were not rated for use in Ethernet networks at all.

• Use the proper cable-laying techniques, especially if fiber is being used. If you exceed the maximum bend radius of a fiber, the light cannot follow the fiber, and errors or link failure will result.

• Watch out for maximum length cable runs and maximum overall network length. These specifications are required due to tightly controlled timing on Ethernet networks. If transit time across the network becomes too long, errors will occur regardless of the quality of the cable.

• Pay attention to instructions and the quality of workmanship if you are terminating cables or fibers yourself. Get a network cable tester, and test every cable. Cables can look fine but may not meet network specifications. BE

> **Pay attention to instructions and the quality of workmanship if you are terminating cables or fibers yourself. Get a network cable tester, and test every cable. Cables can look fine but may not meet network specifications.**

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

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

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Image restoration

Restoration technology has come a long way in just a few short years.

BY PAOLA HOBSON

Restoration is a hot topic for content owners, broadcasters and producers alike these days. Viewers are more discriminating than ever now that HD programming is becoming the norm, and high-quality, large-screen HD displays are showing up in every living room. In addition to live and current programming, demand is high for classic films, features and television series to be remastered for distribution on DVD and Blu-ray, or for transmission on satellite and cable. Much of this material — especially older titles — requires comprehensive restoration in order to meet consumers' high-quality expectations.

But restoration is not just for old reruns of "I Love Lucy." Even with today's sophisticated production equipment, errors such as noise, flicker and unstable sequences can still creep into new content. Often these errors are not noticed until much later, when it is impossible to reshoot the scene. Likewise, state-of-the-art restoration technology is becoming a boon to independent producers who want to incorporate archival footage into documentaries, historical and nature series, travel shows, and biographies. With the right restoration technology, material that might otherwise be unusable can be included without any sudden quality drop-off that could adversely affect the overall impact of the program.

Advanced restoration techniques

High-quality film and video restoration has traditionally been a laborious and time-consuming process requiring frame-by-frame editing, but the technology has come a long way in just a few short years. More powerful processors and improved efficiency algorithms have made available new restoration systems that can restore HD material within just two or three times its running length, delivering a clean product that often surpasses the original version. The state of the art

Figure 1. This original, untouched content shows excessive grain, which is often more noticeable and distracting when content is shot in low lighting conditions.

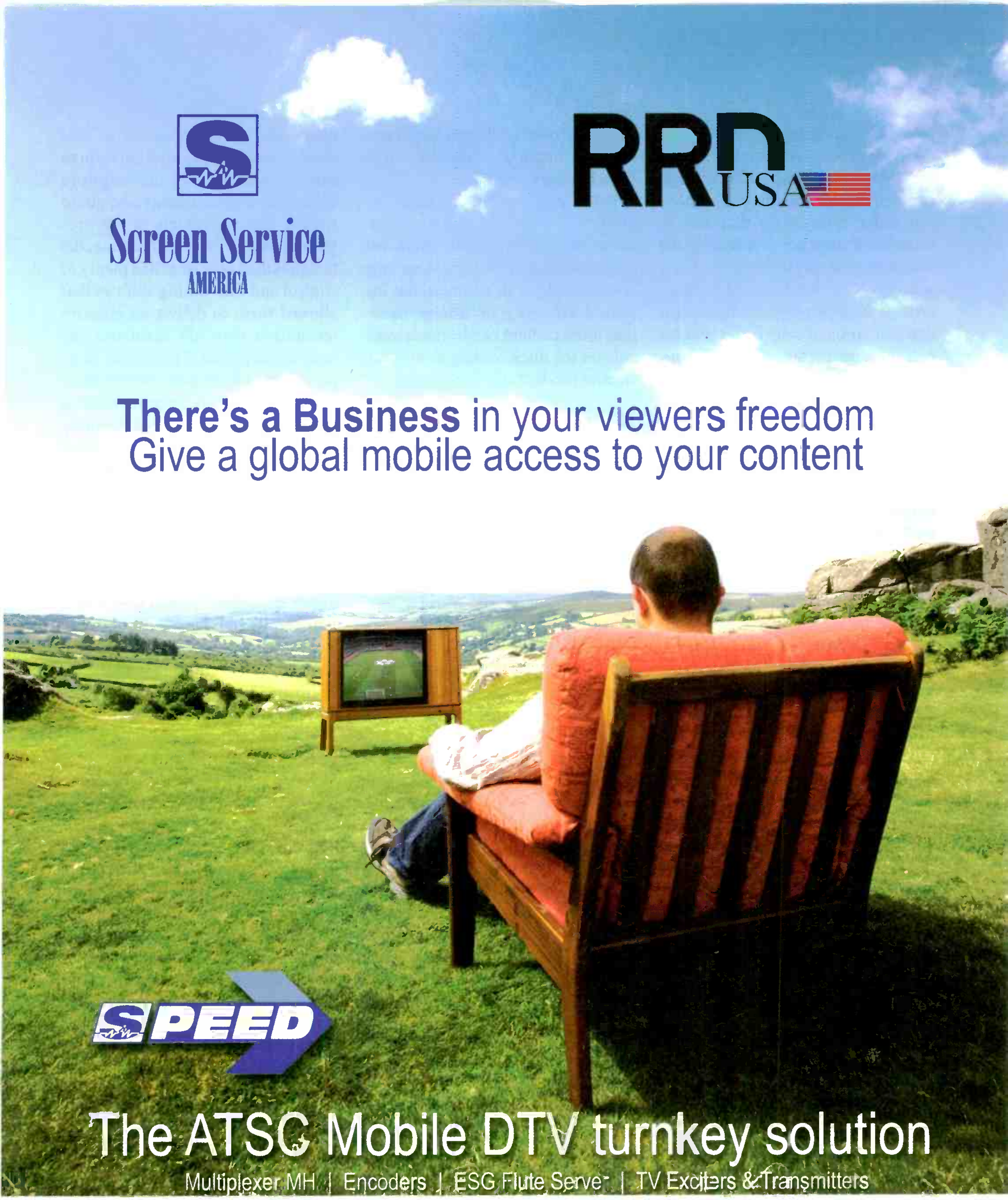
Figure 2. Here, the content has undergone noise and grain reduction.

in restoration systems includes tools for real-time removal of dirt, dust, grain, noise, scratches, instability and flicker with a result that requires less bandwidth for digital transmission. Consider the problem of physical dirt and dust that can mar film even if it has been carefully stored. When the film is transferred to video, dirt and dust show up as white, black or colored speckles, spots, or lines of varying sizes and shapes. Motion-compensated processing is a fast and highly effective method for removing dirt and dust because it can automatically rebuild a frame from the previous and subsequent frames.

Another irritating defect is visible film grain that results from the physical composition of the film itself. With video, the thermal properties of cameras can produce noise that has a similar appearance to film grain. Grain and noise are often more noticeable and distracting when content is shot in low lighting conditions, such as the example in Figure 1. When the content requires downstream compression for transmission or distribution on Blu-ray, high levels of noise and grain severely affect the compression codec because it must waste valuable bandwidth coding these unwanted picture artifacts.

Noise and grain reduction tools can significantly improve content without sacrificing picture quality, as shown in Figure 2. The most powerful technologies will adapt between temporal recursive filters and spatial filters to obtain the best possible results in both moving and stationary areas in real time. In addition, such tools allow operators to adjust the level of noise and grain reduction on the fly so that they can rapidly obtain the most pleasing subjective effect — for example, leaving some visible grain if this is the artistic effect desired by the original director.

Vertical scratches are another common type of picture defect, typically


Screen Service
AMERICA
RRD USA
There's a Business in your viewers freedom
Give a global mobile access to your content
SPEED
The ATSC Mobile DTV turnkey solution
Multiplexer MH | Encoders | ESG Flute Server | TV Exciters & Transmitters

introduced to content during the film scanning process. Although scratches are often associated with archival content, even modern productions can suffer from errors that lead to scratches if there are problems in the scanning process. However, the latest generation of hardware restoration systems include powerful algorithms that can automatically detect and repair unwanted scratches in real-time, and can distinguish the scratches from areas of fine picture detail. The user can choose how sensitive the scratch detection should be and what degree of repair should be applied.

Improved compression efficiency

In addition to a less-than-optimal experience for viewers, noise and grain in video content add an underlying movement that reduces the ability of a compression codec to achieve efficient compression for transmission or Blu-ray/DVD production. If the noise and grain can be removed before compression, the content can be compressed into a lower bandwidth, allowing more channels to be transmitted per transponder and thus lowering the costs of transmission.

The most advanced restoration systems use a sophisticated adaption technique to select between motion-compensated temporal processing and a complex spatial filter. Automatic threshold calculation distinguishes between noise or grain and motion to ensure removal of noise and grain without reducing any of the wanted detail in the image. In experiments with a high-quality, real-time noise reduction process for one product, the noise and grain filter was found to reduce the compressed data rate down to one-fifth of the bandwidth for the same transmission quality.

Thus, broadcasters can either use a lower data rate for the same quality of transmission, or they can achieve a better-quality picture at a fixed data rate. All these benefits lead to more satisfied viewers and lower costs because transmission bandwidth — especially over satellite transponders — is an important cost element in broadcast services.

Better compression efficiency also enables Blu-ray publishers to create higher quality results, which will be guaranteed to look good on large screen displays. In addition, the improved efficiency of storage means that more content can be made available on the discs, leading to more attractive products for consumers.

A case study: "The World at War"

One important role for state-of-the-art restoration is to enable historic footage to be incorporated into new productions without affecting their overall quality. A case in point is a stunning new HD Blu-ray edition of the documentary "The World at War," recently completed by London-based post-production company Dubbs and its restoration and digital media division, Eyeframe. Originally broadcast in 1973 by ITV, the 26-episode "The World at War" series focuses on the events immediately before, during and after World War II, with rare color film footage and interviews with major figures of the Allied and Axis campaigns.

Eyeframe and Dubbs oversaw the complete restoration process for the new version, including telecine, regrading and completing a full set of HD broadcast masters. The project presented numerous challenges — not the least of which was working with 37-year-old material and original source footage that was almost 70 years old. In addition, the Blu-ray edition would include several additional features with never-before-seen footage, which meant working through many hours of very old and fragile film.

The restoration team relied on an automated restoration solution that could maintain the series' original production values while delivering new experiences to viewers. With tools for stabilization, deflicker, dust and dirt removal, and tramline filters, the system operated in real time, allowing the restoration team to continuously monitor the output to ensure the highest quality and guard against adding artifacts to the program material. At the same time, the team's skilled operators had plenty of control and fine-tuning abilities that allowed them to deliver an effective restoration that still maintains the look of the period. The system completed the job in only two to three times the program length, enabling the team to avoid time-consuming frame-by-frame "painting out" work and helping them meet a very tight delivery schedule.

A win-win

Today's state-of-the-art technology has brought the important and highly specialized field of restoration into the digital age, enabling rapid and cost-effective delivery of both old and new content that measures up to the high-quality standards of HDTV and Blu-ray. Everyone in the content delivery chain reaps the benefits. Content owners are able to reuse assets that might not have been considered candidates for HD remastering before because of their questionable quality. Thus, they can monetize and generate new revenues from assets that are currently languishing in costly storage.

At the same time, specialized restoration service providers can rely on real-time hardware-based systems that automate a wide range of repairs, allowing specialist operators to focus on more difficult restoration tasks. In simple terms, this means restoration is more affordable for providers and clients alike.

But perhaps the biggest winners are consumers, who can access their favorite programs in dazzling HD without the distraction of artifacts arising from older production methods, poor storage or poor initial post production. BE

Paola Hobson is product manager for conversion and restoration at Snell.

Building a 3Gb/s infrastructure

Testing during and after installation ensures success.

BY MIKE WAIDSON

By following careful engineering practices during initial planning stages, the transition to a 3Gb/s-SDI infrastructure can be accomplished without too much trouble. It all starts by selecting and carefully installing the correct type of cable designed for high data rates and avoiding incorrect crimping, twists, bends or stress to that cable. During installation, thorough test and measurement procedures are vital to ensure that each link and piece of equipment performs to its specifications. A waveform monitor with eye and jitter measurement capabilities along with appropriate signal generators enables engineers to efficiently detect and investigate physical layer problems with high-speed SDI signals.

Healthy cables, healthy system

Given the importance of the channel as speeds increase, treating cables with respect during installation is critical to a healthy system. HD-SDI or 3Gb/s-SDI signals are less forgiving than an SD-SDI signal, and stress to the cable, which often cannot be physically seen, during installation will reduce margins.

Although it may seem appropriate to bundle up cables nice and tight and to place cable ties or "J" hooks at identical distances apart, these are two common mistakes that lead to problems down the road. The point where the cable hangs from the "J" hook can lead to deformation at a given wavelength that can cause an accumulated reduction in return loss within the system. To prevent this, cable ties should be placed at random distances apart and allow for movement of cables within the bundle.

Using a waveform monitor, you should run a series of measurements including cable loss, cable length and source signal level. These types of measurements can be particularly useful when qualifying a system and verifying its performance. By knowing the performance specification of the cable type used within the installation, you can verify that each link is within expected operational performance for the maximum cable length.

Stress testing

Unlike analog systems that tend to degrade gracefully, digital systems tend to work without fault until they crash. To date, there are no in-service tests that will measure the headroom of the SDI signal; out-of-service stress tests are required to evaluate system operation. Stress testing consists of changing one or more parameters of the digital signal until failure occurs. The amount of change required to produce a failure is a measure of the headroom of the system.

Starting with the specifications in the relevant serial digital video standard (SMPTE 259M, SMPTE 292M or SMPTE 424M), the most intuitive way to stress the system is to add cable until the onset of errors. Although the video is encoded as a digital data stream, the SDI signal itself is still analog in nature and suffers from the same types of analog distortions, such as attenuation and phase shifts.

SDI check field

The SDI check field (also known as a pathological signal) is a full-field test signal and, therefore, must be done out-of-service. The SDI check field is designed to create a worst-case data pattern for low-frequency energy, after scrambling, in two separate parts of the field. Statistically, these intervals will occur about once per frame.

One component of the SDI check field tests equalizer operation by generating a scrambled non-return to zero inverted (NRZI) sequence of 19 zeros followed by a one or 19 ones followed by one zero. This part of the test signal may appear at the top of the picture display as a shade of magenta, with the value of luma set to 198h and both chroma channels set to 300h, as shown in Figure 1.

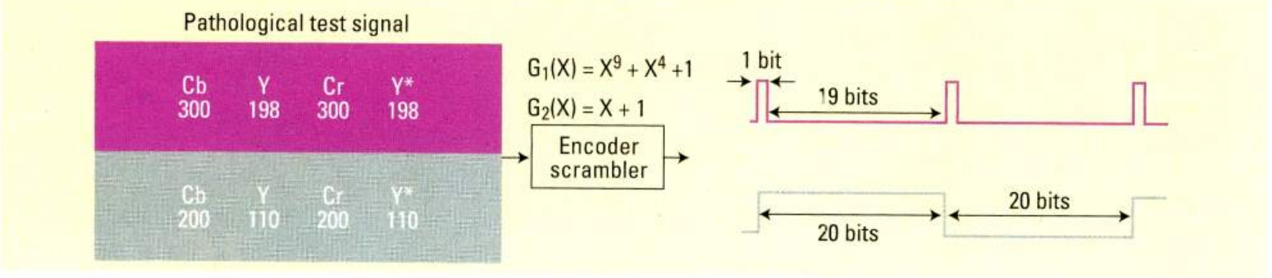


Figure 1. One component of the SDI check field, or pathological test signal, tests equalizer operation (shown above in magenta), and another checks phase-locked loop perfomance (shown on the bottom in grey).

Figure 2. This status display shows the CRC errors of an HD-SDI signal.

The other part of the SDI check field signal is designed to check phase-locked loop performance with an occasional line consisting of a scrambled NRZI sequence of 20 zeros followed by 20 ones. This provides a minimum number of zero crossings for clock extraction. This part of the test signal may appear at the bottom of the picture display as a shade of grey, with luma set to 110h and both chroma channels set to 200h.

CRC error testing

A cyclic redundancy check (CRC) can be used to provide information to the operator if data does not arrive intact. A unique CRC pair is present in each video line with a separate value for chroma and luma components in 3Gb/s and HD-SDI formats. In HD-SDI and 3Gb/s signals, a CRC is caculated for every line, one for chroma and one for luma. At the receiver, the CRC values are compared to newly calculated values to determine if there is an error.

A waveform monitor allows the engineer to keep tabs on the number of CRC errors along a transmission path. Ideally, the instrument will show zero errors, indicating an error-free transmission path. If the errors increase to one every hour or minute, the system is approaching the digital cliff, and it's time to investigate the transmission path to isolate the cause of the error.

Visible errors may be noticed on the picture monitor initially as sparkle effects (black and white pixel dropouts) as the receiver fails to recover the data correctly. If the signal degrades further, there will be complete or partial lines that will begin to drop out from the picture display before the picture will freeze or go to black. This indicates the transmission has crossed the digital cliff. To prevent this situation, the health of the physical layer needs to be continuously monitored. (See Figure 2.)

If the number of CRC errors increases to one every hour or minute, it's time to investigate the transmission path to isolate the cause.

Monitoring eye and jitter

Eye diagrams are invaluable for analyzing serial data signals and diagnosing problems. The basic parameters measured using the eye pattern display are signal amplitude, overshoot, rise time and fall time. Jitter can also be measured with the eye pattern display if the clock recovery bandwidth is specified. As cable length increases, the amplitude of the eye display will decrease and the frequency response will be reduced, causing the rise and fall time of the signal to increase. The eye and jitter display also can be used to analyze the physical layer of the SDI signal, as shown in Figure 3.

One situation in which the eye display is useful is in spotting termination problems. With 3Gb/s signals,

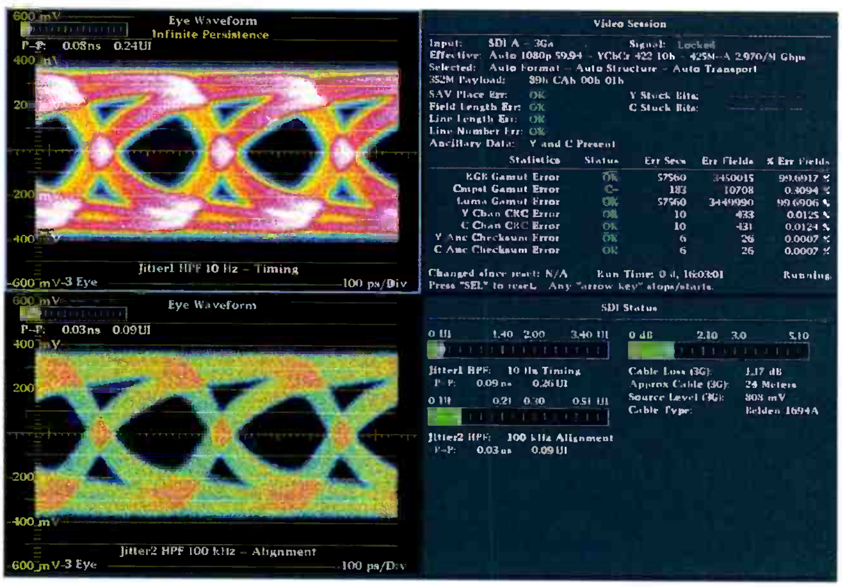


Figure 3. Shown here is a 3G eye display after about 79ft of cable.

a result of improper termination can result in only a portion of the energy being absorbed by the receiving termination or device. This residual energy reflects back along the cable to create a distorted waveform. As shown in Figure 4, these reflections can produce ringing within the signal and show up as overshoot and undershoot on the eye display. In this case, the SDI source device has two weakly isolated outputs. One was left unterminated, creating a reflection onto the other output signal being monitored, even though it is properly terminated.

Commissioning of an SDI facility

To commission an SDI facility, each link should be initially qualified by applying a known test signal source of both color bars and pathological test patterns at one end of the link while monitoring the signal at the other end with a waveform monitor. Once a check of the cable system is complete, video equipment can be brought online. Ideally, this should be done in a gradual and methodical way by testing each piece of the system to ensure it is operating normally and within its specifications.

Many pieces of equipment have their own built-in test generator, which may allow the device's output to be tested and verified rather than the pass-through of the SDI signal through the device. This also allows the isolation of input and output devices and can help in troubleshooting through the signal path of the system. A waveform monitor can be used to view the physical layer characteristics to verify and maintain the quality of the system at key points within the facility.

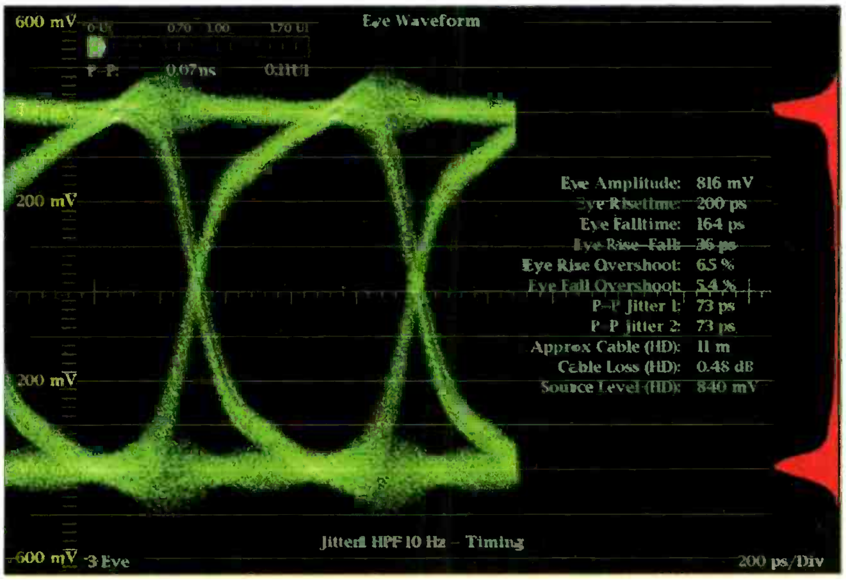
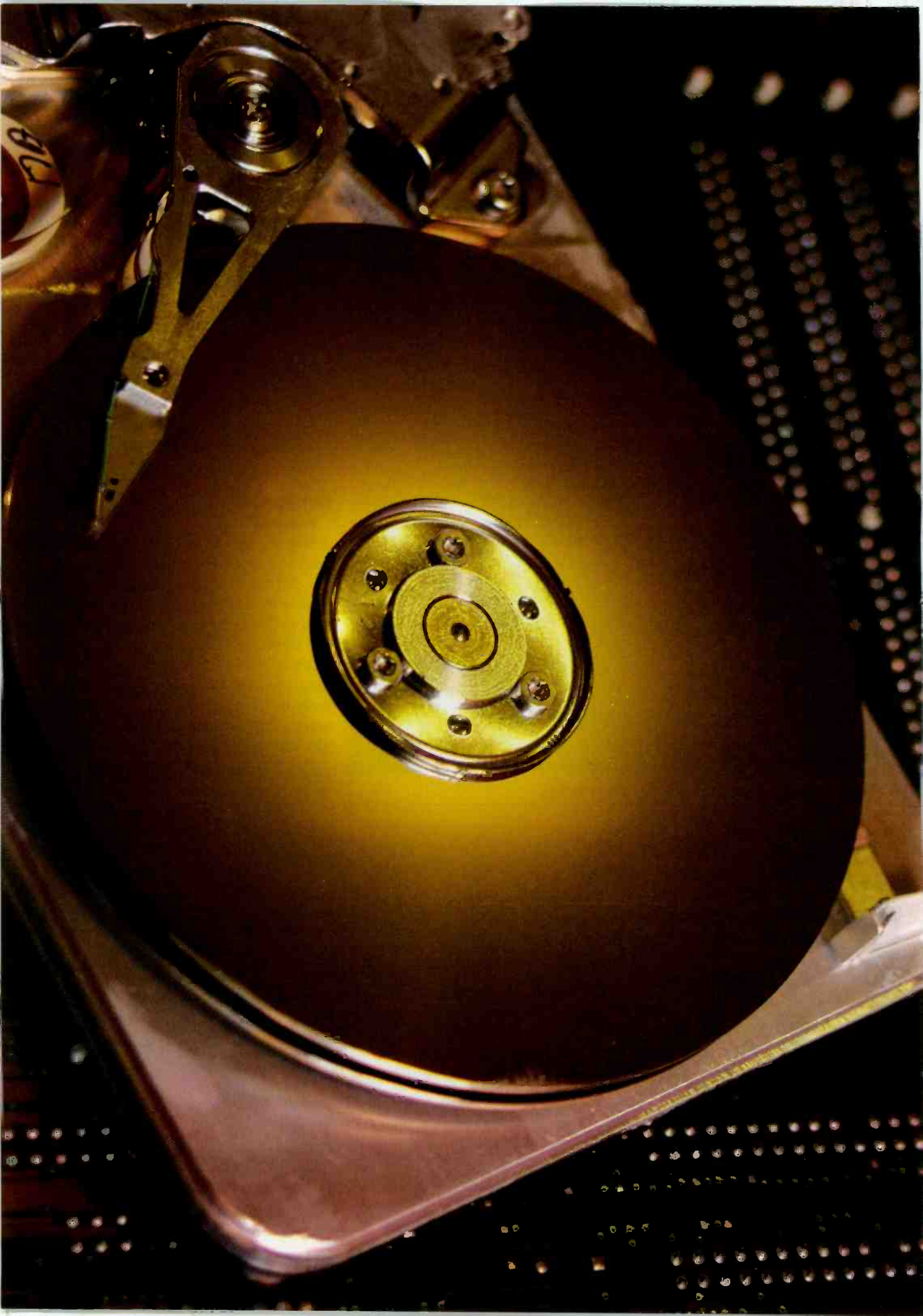


Figure 4. An eye display shows incorrect termination.

Conclusion

Following good engineering practices during installation and using suitable cable for transportation of the 3Gb/s or HD-SDI signal is critical to ensure error-free transportation of the SDI data stream. Test equipment, such as digital test signal generators and waveform monitors with eye and jitter measurement capabilities, enable engineers to verify the performance during installation and enable continual performance monitoring of the facility. BE

Mike Waidson is an applications engineer for the video products line at Tektronix.



Storage primer

BY CIPRIAN POPOVICIU
AND MOHAMED KHALID

The first question that might come to mind seeing the title of this article is: Why would I care to learn about storage? Isn't it a mundane component of the infrastructure that simply stores data? The reality is that of all components of the infrastructure, storage is truly unique. Not only does it store some of the most valuable assets of the organization, business-critical data, but unlike the other resources (network and compute), storage demand grows continuously along with the data accumulated by the organization. If that was not convincing enough, it is worth mentioning that lack of understanding of the storage options can lead to expensive storage hardware that does not optimally match needs. The world of storage is one of the most dynamic and hot technology areas today. This article provides a high-level overview of storage and the trends relevant to content distribution.

Storage types

The key thing to remember is that there are two dominant storage technologies: storage area networks (SAN) and network attached storage (NAS). (See Figure 1.) SAN is a block level storage technology (fixed sized blocks of data or collections of disk sectors are read or written to storage) wherein the storage devices are made accessible to servers in such a way that the devices appear as if locally attached to the operating system. A SAN typically has its own infrastructure connecting storage devices that are generally not accessible through the local area networks by regular devices. By contrast, NAS is file-level data storage technology (entire files are read or written to storage) connected to a local area network providing data access to heterogeneous clients. This ubiquitous connectivity led to NAS gaining popularity, as a convenient method of sharing files between multiple computers. Potential additional benefits of NAS include faster data access, easier administration and simple configuration. In the end, price and performance are the main differentiators between NAS and SAN. The selection of one technology over the other comes down to deciding how much complexity is acceptable, and what is needed to meet the performance needs of the application and the budget.

> **Benefits of NAS include faster data access, easier administration and simple configuration.**

Storage system components

The main components of the storage system are the data containers, which typically are hard-disk drives (HDD) or solid-state drives (SSD). The drives distinguish themselves through capacity and read/write

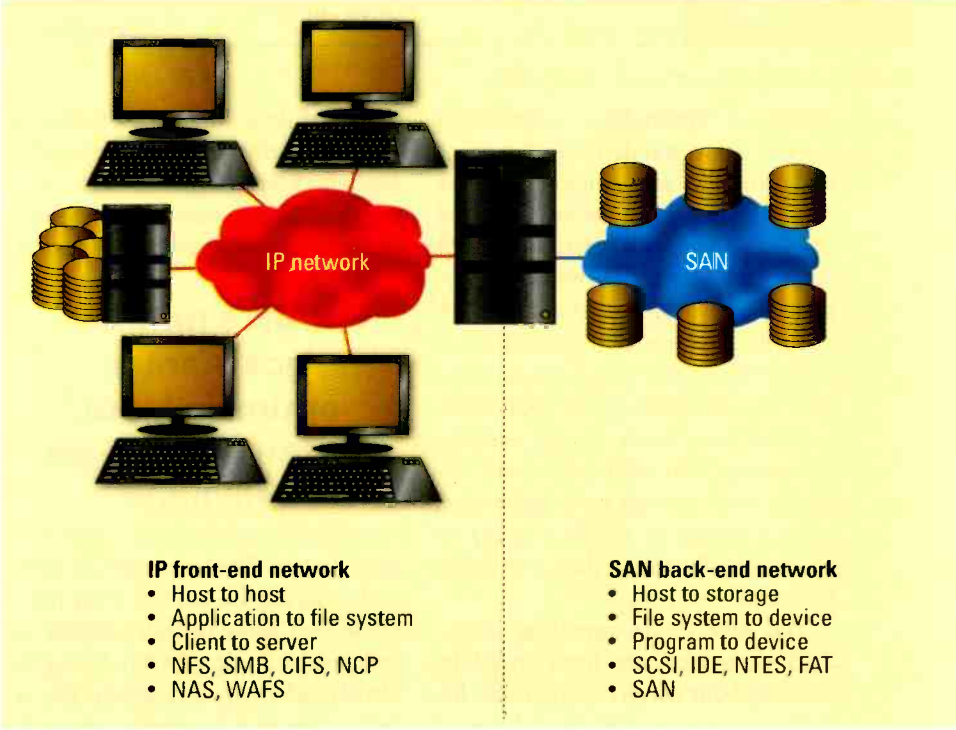


Figure 1. Storage toplogies

speed. Technology enabled disk sizes to grow from megabytes to gigabytes and today to petabytes of data. The access speed is measured in terms of number of I/O operations. The faster the drive spins, the higher the I/O. Solid-state drives provide the highest performance (especially on read but less differentiated in write), and that is naturally reflected in price.

The performance of the overall storage system depends also on the interfaces and protocols used to connect to disks. In fact, most often, disks are named by the name of the connecting interface: FC drives, SATA drives or SAS drives. Fibre Channel (FC) is the cornerstone of SAN. Serial Advanced Technology Attachment (SATA) is a standardized interface replacing ATA and delivering higher speeds than its counterpart Parallel ATA (PATA). Serial Attached SCSI (SAS) is a new serial protocol compatible with SATA; however, it's much faster. From a selection perspective, it is thus important to understand what level of performance your application requires and select a cost-effective technology that supports it. For example, even though more expensive, Fibre Channel at 4Gb/s is going to be marginally faster than a 3.2Gb/s SAS drive.

The disk arrays prevalent in today's enterprises are front ended by purpose-built servers responsible for facilitating and optimizing disk access. These storage appliances distribute data over multiple disks and perform many other operational optimizations and management functions as well.

Storage system operation

When it comes to writing data on the disks, the simple option would be to place the entire data set of files on a single disk (assuming it fits). One challenge is that the I/O is not optimal because the process is serial. The alternative would be to write chunks of the original data set on multiple disks in parallel. The other challenge is that all data would be lost if that particular disk fails; there is no redundancy unless data is duplicated to another disk. Finally, when dealing with such large blocks of data, disk space cannot be used very efficiently. Today, storage appliances are responsible for writing data across multiple disks while embedding various error recovery mechanisms. They are responsible for orchestrating the pool of disks into a redundant array of independent (or inexpensive) disks (RAID). Using this distributed method, cheaper, less reliable disks can be used without the fear of losing data.

RAID's primary goals are to optimize input/output and create reliability.

RAID's primary goals are to optimize input/output and create reliability. Based on the techniques used in the process, they are identified as RAID 0 through 6, where RAID 0 means data is block striped but without any parity or mirroring. At the other extreme is RAID 6, with block-level striping and double distributed parity. (See Figure 2.) It is important to note that there will always be a trade-off between disk space use and the amount of redundancy built by increasing RAID levels. The important takeaway is that good choices of disk types and RAID levels can significantly reduce costs. Back to the earlier example, instead of expensive FC disks at RAID 5, one can use cheaper SATA drives at higher RAID level.

There are several protocols used to access storage disk arrays over an enterprise network, via the storage appliance (or filer in the case of NAS). The main ones are iSCSI, where the SCSI protocol is transported over IP, FCoE discussed below and NFS, a file level protocol that runs on top of UDP or TCP over IP.

Trends in storage

One of the key recent technology innovations in storage consolidates infrastructure and reduces operational costs. It enables the transport of FC frames over Ethernet (FCoE). This is a block level protocol that delivers the same reliability and security as Fibre Channel while using

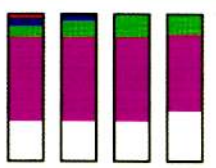
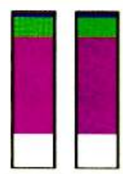
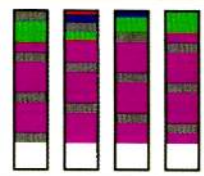
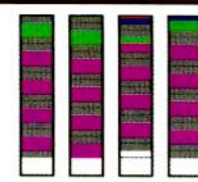
	RAID 0	RAID 1	RAID 5	RAID 6
Diagram				
Description	Striping	Mirroring	Striping with parity	Striping with dual parity
Minimum disks	2	2	3	4
Maximum disks	Controller dependent	2	Controller dependent	Controller dependent
Array capacity	Number of drives x drive capacity	Drive capacity	(Number of drives - 1) x drive capacity	(Number of drives - 2) x drive capacity

Figure 2. Comparison of single RAID levels

underlying 10Gb/s Ethernet infrastructure. FCoE enables both local network traffic and storage traffic traverse over the same wire, which results in I/O consolidation.

An important area of optimization for storage is the elimination of duplicate information. With data continuously growing, the last thing we need is having the same data in multiple locations just under different names. Data deduplication is a specialized data compression technique that eliminates coarse-grained redundant data, typically to improve storage use. In the deduplication process, duplicate data is deleted, leaving only one copy of the data to be stored along with pointers to the unique copy. The size of the savings depends on the workloads of the enterprise and the type of data.

Further optimization of storage can be achieved through proper design. Instead of using a "one size fits all" setup, which has to support the highest performance needs, the design should tier storage to match the right disk and access protocol to the right (usually three) group of applications or services. Recently, dynamic mechanisms and technologies for tiering have emerged. For example, fully automated storage tiering (FAST) moves data from one tier (slow/cheap) to another (fast/expensive) based on how often the data is accessed.

Cloud storage for video content

Nowadays cloud computing and cloud-based services are on the minds of technologists and business people alike. This overview would not be complete if we would not discuss the cloud-related trends in storage. Object storage organizes data in flexible-sized (unlike block storage) containers along with metadata that helps not only locating data but also applying policies to it. Compared with complex, difficult-to-manage, antiquated file systems, object storage systems leverage a single flat address space that enables the automatic routing of data to the right storage systems, specifies the content lifecycle, and keeps both active and archive data in a single tier with the appropriate protection levels. This allows object storage to align the value of data and the cost of storing it without requiring significant management overhead typically created by manually moving data to the proper tier. Object storage is also designed to run at peak efficiency on commodity server hardware. More importantly, object storage provides the scalability necessary to support the on-demand capacity delivered by cloud storage.

> **Object storage will enable true cloud storage, the most efficient and cost-effective option.**

Cloud storage is changing the way companies think about storage in an era of runaway growth of unstructured data (video is a typical example of unstructured data) by enabling capacity on-demand and other benefits. While simple and scalable, object storage makes it easier to search data, and it enables administrators to apply policies that enforce data lifecycle and prioritization. Going forward, object storage will enable true cloud storage, the most efficient and cost-effective option for storing content. While the technology is relatively new, several cloud storage offerings are currently available. The migration, however, should be carefully planned and implemented. BE

Ciprian Popoviciu is the director of the infrastructure/cloud group and Mohamed Khalid is chief architect at Technodyne.

THE FUTURE OF DATA STORAGE

Solid-state drives are beginning to replace hard drives in key applications.

BY ZSOLT KEREKES

Solid-state drives, such as the one shown here from Samsung, excel in performance compared to traditional hard drives.

How broadcasters survive and thrive in future markets will depend not only on their ability to create, aggregate and brand unique digital content, but also on how effective they are in making strategic decisions about where and how their content is stored. In today's connected economy, it will be crucial for broadcasters to be able to quickly repackage and deploy content to new markets.

The required business and creative decisions will need to be managed by an integrated set of ASPs supporting micro-payments, advertising and subscription models. If a content owner can't perform these creative and business functions economically and rapidly, the competition will.

Some history

Many established mainframe computer companies initially ignored new microprocessor technology and assumed it was similar to projects they were already doing internally. The entire PC revolution occurred because thousands of electronics people who were not previously in the computer industry saw it differently and created an entire new range of products. Before the 1990s, arrays of processors were mostly used in scientific computers or DSP systems. The introduction of multiprocessor-based desktop

workstations in 1992 by Sun Microsystems, along with its version of Unix, allowed software developers to use multiprocessing as a mainstream business environment.

It was the commercialization of the Internet in 1995 that set off the real dotcom revolution. Nowadays we take it for granted that every household and every cell phone can have an Internet connection. Serving this worldwide marketplace offers enormous business opportunity.

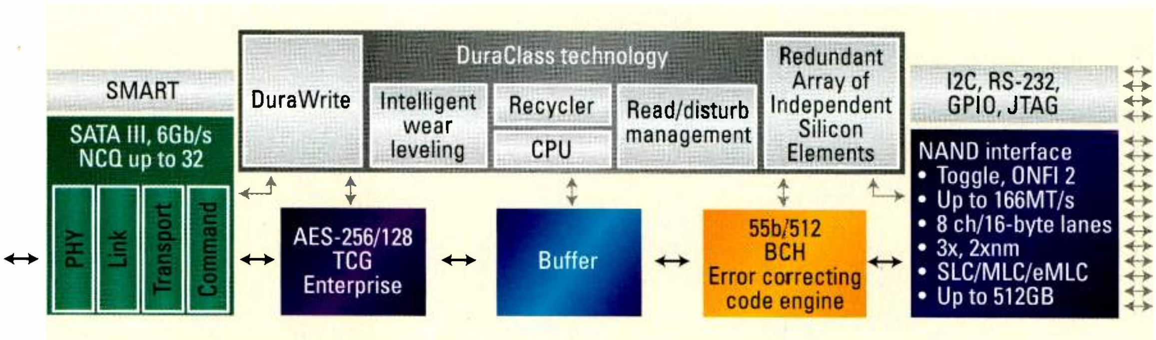
Solid state disks (SSDs) are data storage devices that can currently store data at the same density per module as hard disks. SSDs have been around in one form or another for more than 30 years. Because of their high cost, they were initially used as accelerators in high-end servers. Today, retirement beckons to the hard disk drive. Hard drives have been a cornerstone of the computer market for 54 years. Hard drives represent the safes in which computers store data. Over the decade 2000 to 2010, the maximum capacity of a hard drive grew 17 times (from 180GB to 3TB). In 1999, a 1TB hard disk array cost $79,000. By the end of 2010, a 3TB hard disk cost less than $250. That's a 1000 times cost reduction for the same storage capacity.

But hard disks haven't gotten any faster or more reliable. Random access times are exactly the same, and user replacement cycles are the same as they were a decade ago. This is despite improved MTBFs, which have been cast in doubt by some large-scale user studies. Simply put, the data integrity of hard drives has failed to keep pace with their growing capacity. Large disk populations are vulnerable to random uncorrectable data losses.

The solution is that drive manufacturers simply add wraparound layers to protect users from data loss with the unfortunate side effect of slower data access times. Despite the success of the hard disk and its apparently dominant position in the storage market today, over the next five years, sales of hard disks for enterprise applications will fall by about one half and by 2019 will cease to be used in enterprises altogether. The main market for hard drives will become consumer products, which have lower performance, data integrity and cost-of-ownership requirements.

What's next?

Look first for SSD accelerators initially to be added to larger storage systems. This will allow users to realistically increase application speeds by a factor of three and increase burst Web apps acceleration rates by 40 times.



Internally, SSDs are complex systems with controllers that sculpt the unique personality of the SSD — with respect to performance and reliability — from the raw potential in the flash memory array. Shown here is a block diagram of the SF-2000 family of SSD processors from SandForce.

In the second stage of the storage revolution, SSDs will be added to notebooks, allowing them to run faster and provide longer battery life. Initially, SSD-equipped PCs will cost more and, therefore, appeal to a small subset of the notebook market, but prices will drop.

Consumer SSDs have actually been used in high-end laptops since 2007. Unfortunately, market acceptance has been slow because of poorly designed notebooks. In many cases, mediocre SSDs were simply dropped into motherboards, which had been designed for hard disks. In nearly all commercial notebooks shipped up to the third quarter of 2010, notebook chipsets wasted most of the theoretical speed

Growth of SSD manufacturers

The number of SSD manufacturers has continued to increase over the years and is projected to explode during the next three years. One reason for the rapid growth over the 2010 to 2013 period is that OEMs will be attracted by growth in SSD revenue and a lack of clear monopolistic style leaders. There will be many different market leaders in many different SSD segments.

1998 - 10 companies
2005 - 30 companies
2007 - 63 companies
2008 - 92 companies
2010 - 200 plus companies
2013 - 1000 plus companies (forecast)

advantages of SSDs. It will require several more product generations of notebooks before the real advantages of SSDs will become obvious to users. In the last stage of the SSD revolution (2015 to 2019), we'll see an entirely new class of SSDs. I call this product class bulk storage, and these SSDs will replace hard disks in the data center. They will offer higher storage density than HDs, lower operating costs and faster performance. Internally, these SSDs will have different architectures, which will be optimized for low power consumption, data healing and long operating life rather than just raw speed.

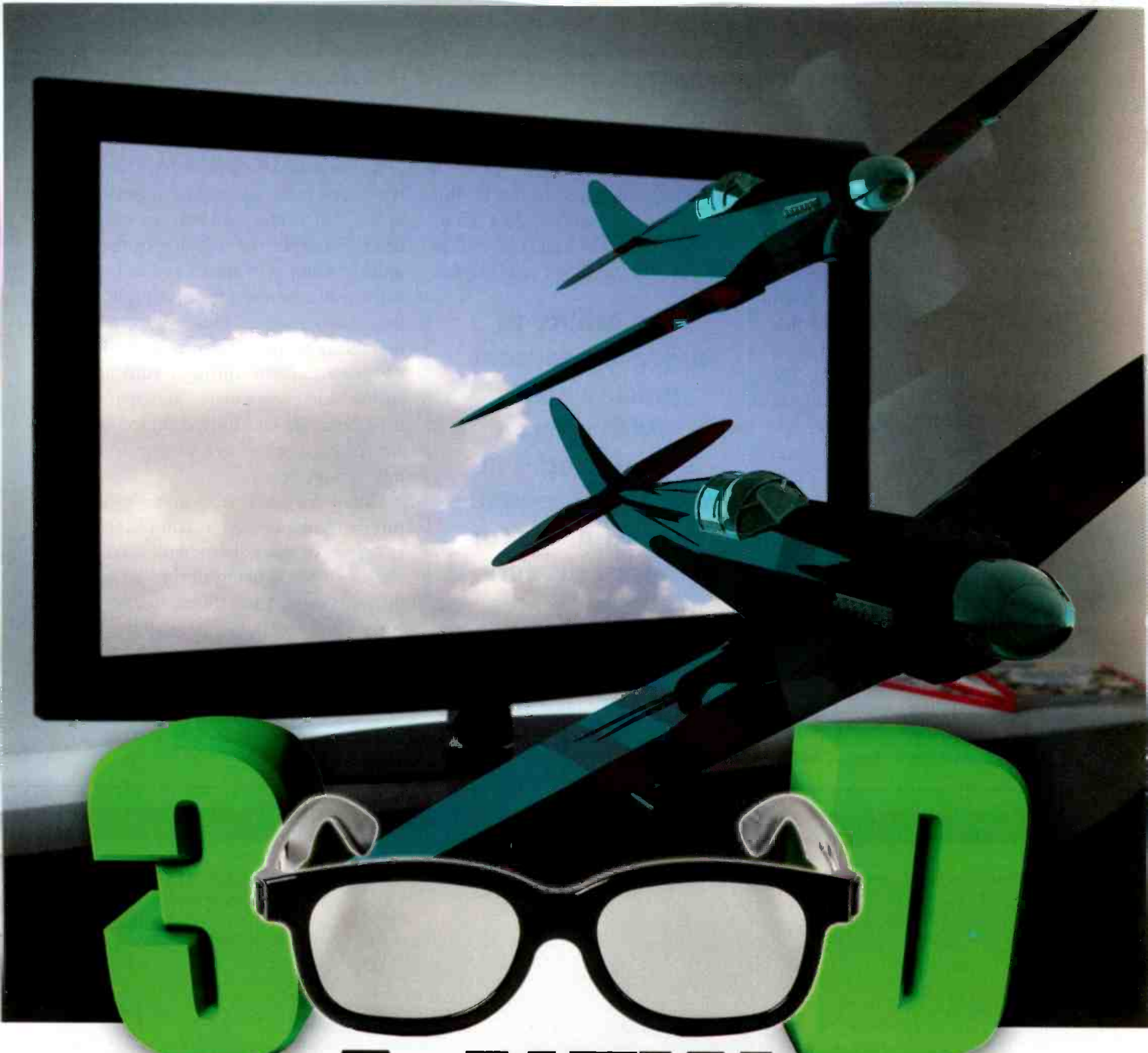
In many ways, the software architecture of tomorrow's bulk storage SSD rack will more resemble that of tape libraries. Instead of a robot mechanism grabbing a tape cartridge, some sections of the SSD will simply be powered down and then powered up only when the information is needed. Another key factor in this scenario — the atomic data interchange between the bulk SSD and its neighbor, the auxiliary acceleration SSD (which sits on the SAN) — will by today's standards be a huge chunk of data. This data will sit two levels away from the main acceleration SSDs and appear as a DAS connection to the applications.

The ability to redeploy content quickly along with micro accounting will create new revenue opportunities for content owners.

In tomorrow's data-driven content factory, storage will be regarded as a profit center and not an overhead. The ability to redeploy content quickly along with micro accounting will create new revenue opportunities for content owners. This will include the ability to manufacture (customize) new content through software agents to prepopulate anticipated user demands and fully embrace the any content, anywhere at any time business model.

Going forward, storage architectures will remain just as complicated as they have always been, with several classes of SSDs being optimized for different roles. A key difference, however, will be that the only spinning devices in the storage cabinets will be the cooling fans. BE

Zsolt Kerekes is editor of StorageSearch.com.



A NEW dimension in broadcast facility planning

BY CHRIS LENNON WITH STAN MOOTE

It's hard to think of an industry development that has generated as much excitement as 3-D television. The rise of 3-D in terms of industry buzz has been quick and all-inclusive, touching every corner of the broadcast world. We have been bombarded by this on a global level: helping broadcasters get on the air, speaking about the topic (individually and on panels) and participating in 3-D standards efforts.

When planning a new channel launch, the wealth of detail can overwhelm even the most knowledgeable engineering staff without even putting 3-D into the equation.

As the ESPNs and Discovery Networks of the world bring their 3-D channel visions to life, engineers across the industry need to start

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planning their own 3-D strategies. The reality is that management could come calling any day with a 3-D agenda and a launch plan.

When learning about 3-D, don't get caught in the loop of how 3-D production and distribution is accomplished today. This will come back and bite you. 3-D is now far different than it's likely to be in the near future. The cool thing is that planning for the near future now will allow for future 3-D developments. The 3-D craze took everyone by surprise, and everyone scrambled to get on-air. Some of the shortcuts taken will definitely hurt later.

The first step is to understand 3-D visually, whether doing a simple pass-through or adding some production. 3-D is an illusion, and it clearly has drawbacks. A logo insertion could look great on one size screen and completely fall apart on a smaller screen. How do you account for this? Keep it simple. Don't try to be fancy, and don't exaggerate the 3-D illusion.

In terms of setting up your facility to handle 3-D, distill the pertinent details from a very deep well. It all starts with one question: How do I get on the air with 3-D? It is entirely possible that there is gear in place, notably in the infrastructure, that can accommodate 3-D signals as-is or with a simple upgrade. In other cases, some existing equipment may require replacement.

The good news is that this can be done without breaking the bank or creating a technology dead end. 3-D-capable gear doubles as HD gear, so the risk factor is generally low if the decision is made to upgrade certain components to handle 3-D. They will serve HD needs well, even if 3-D plans don't develop as expected.

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3-D workflow

As engineers, we want to maintain the highest quality. Certainly this isn't being done now for 3-D, not because we can't, but because of the need to get on-air quickly. Reality often hits hard when dealing with one-off events and

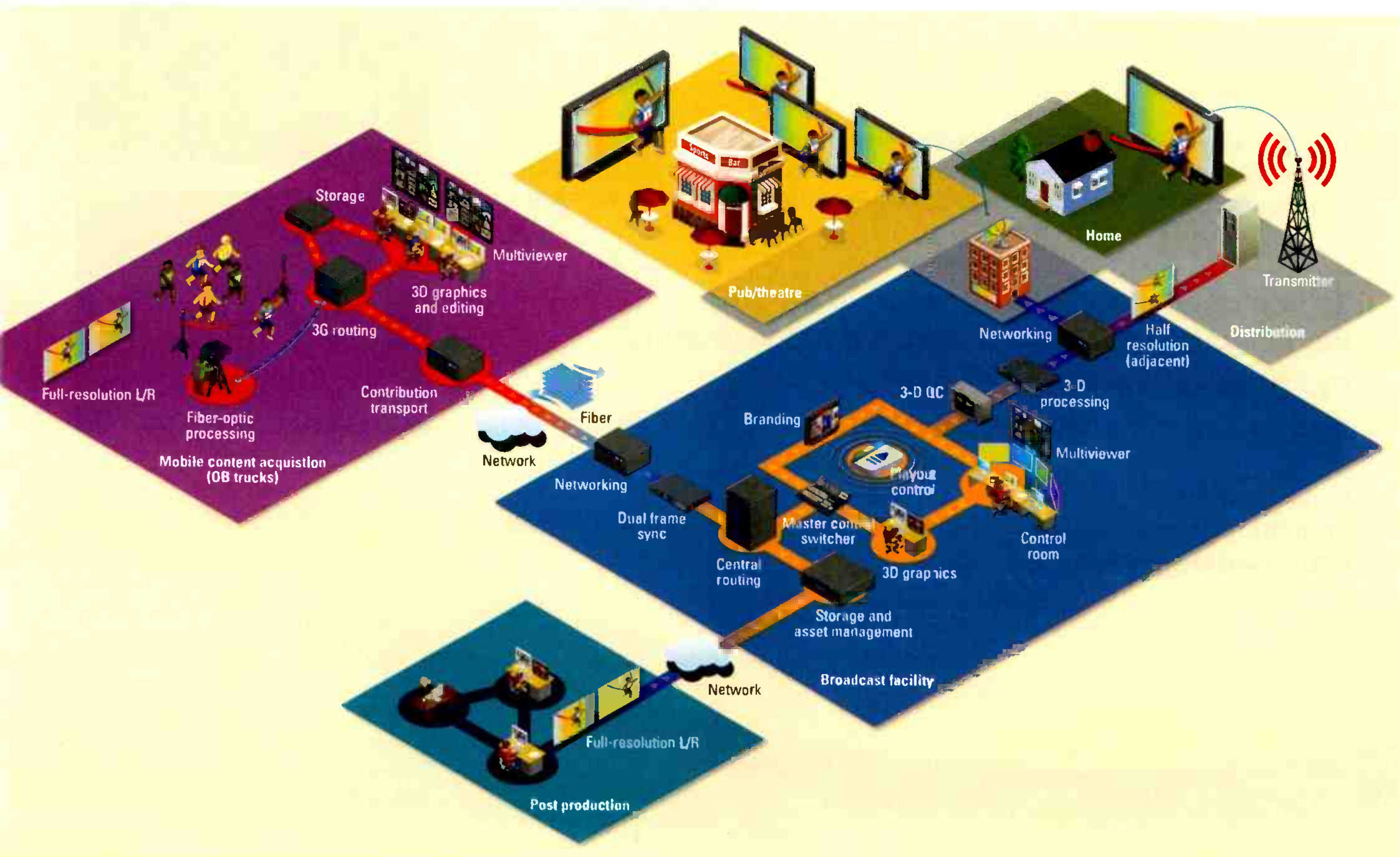


Figure 1. 3-D end-to-end workflow

the need to maintain compatibility with existing infrastructure.

A survey of products and vendors is likely to result in some confusion and intimidation. There will certainly be mixed messages when disparate voices speak to 3-D requirements.

This is not to say that talking to different sources is a bad idea. However, it is a better idea to first understand the 3-D workflow from production through to broadcast. A broad view of the workflow and equipment interoperability will provide a clearer frame of reference moving forward.

The cleanest and highest-quality approach to 3-D television starts with true image preservation. Most broadcasters will opt to maintain full-resolution HD images for each eye through the production and air chain.

A frame-compatible approach will degrade the resolution by half in the case of side-by-side. Storing the images in this format for later conversion to another format, such as over-under, will potentially lower the resolution by half. The result is quarter-resolution images, which are not a pretty sight.

The following overview will consider deployments for full-resolution 3-D broadcasts, focused on content and production, facility infrastructure and workflows, post production, and external networking and distribution. Figure 1 outlines the various stages and specific components in the end-to-end chain.

Production

The large orange box represents the first stage: mobile content acquisition. This is particularly crucial in remote and outside broadcast applications such as sports and live event production.

The camera remains the starting point. There are a number of 3-D camera options from multiple vendors, including side-by-side dual camera rigs, beam-splitter rigs, and single camera units with single or dual lens options. Developments in fiber-optic systems have made this the ideal method to transport left and right images to the router as two distinct, full-resolution pictures.

The router presents the first technical challenge in the chain. In a 1.5Gb/s infrastructure, a full-resolution 3-D environment requires two feeds for every source at the input and output. The router must treat L/R dual-link signals as a 3-D pair and frame-accurately route them to dual-link destinations in single control transactions. (See Figure 2.) A typical HD-capable router may not be large enough to accommodate 3-D production due to this doubling of inputs and outputs.

A 3Gb/s-capable router and infrastructure ensures that full-resolution signals are transported on a single wire. This supports routing two full-resolution 3-D signals to multiple points, including storage platforms, multiviewers, production graphics and networking systems. In this environment, only half the inputs and outputs that would have been required for full-resolution 3-D in a 1.5Gb/s infrastructure are needed.

In the area of production storage platforms, 3-D-capable servers must be able to handle synchronized dual ingest and playout. Editing systems present a larger challenge, as some are not capable of supporting 3-D. A talented editor working on a capable system must be able to edit the two eyes as if working with a single video source.

Graphics adapt far easier in the 3-D television universe. 3-D modeling has long been in the picture for many vendors. Applying currently-available graphics systems to the 3-D environment is less of a challenge based on

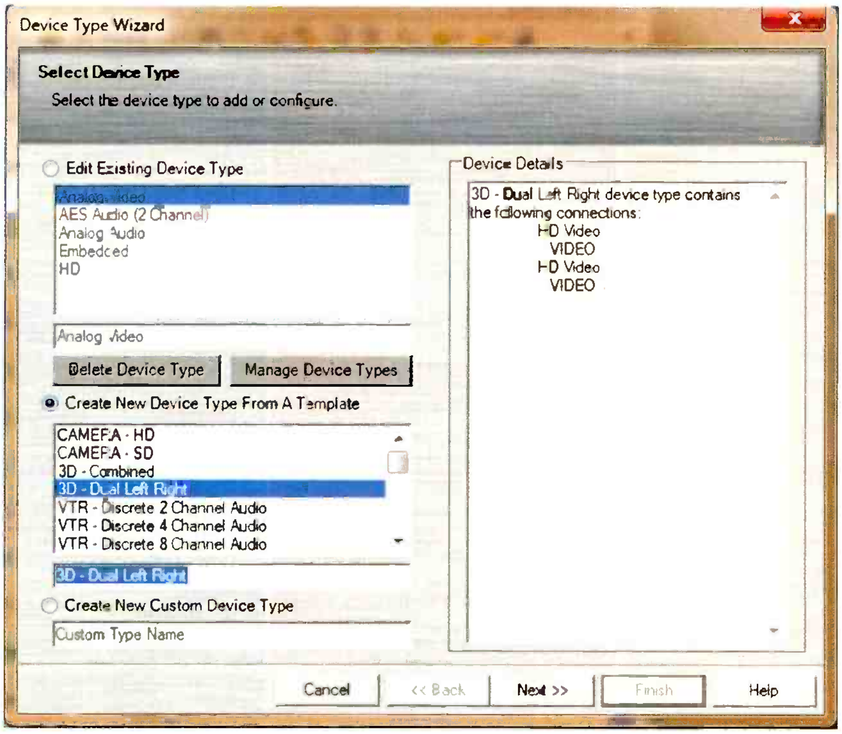


Figure 2. Router control system selecting 3-D modes for simultaneous L/R switching

The cleanest and highest-quality approach to 3-D television starts with true image preservation. Most broadcasters opt to maintain full-resolution HD images for each eye through the production and air chain.

existing capabilities, but it's still an important (and highly visible) portion of the 3-D picture.

The multiviewer, once somewhat overlooked, has become a significant consideration in the digital TV space. Multidisplay systems continue to evolve with richer features and better interoperability with other components in the workflow. Technical operations staff will benefit from a multiviewer that can produce separate left and right feeds, while creative staff will need to see the 3-D image. This means that the ideal multiviewer

	Frame-compatible on single HD-SDI feed	L/R full-res two HD-HDSI feeds	L/R full-res single 3Gb/s feeds
Routing	Same as 2-D	Tie two 2-D feeds together with the router control system. (See Figure 2.)	Same as 2-D 3G
Backhaul	For side-by-side or over-under, same as 2-D. Other compatible systems may require a special compressor.	Dual 2-D backhaul feeds required with frame syncs	Dual 2-D backhaul feeds required with frame syncs
Servers	Same as 2-D	Two 2-D feeds slaved together on ingest and playout	Two 2-D feeds slaved together on ingest and playout on single 3G BNC
Graphics	3-D graphics system with special software for side-by-side or over-under. Not typically possible with other frame-compatible systems	3D graphics system	3D graphics system
Automation	Same as 2-D	Slaves two channels	Same as 2-D
Multiviewers	Typically will only display the frame-compatible picture	2-D units will properly display left and right pictures. 3-D units will display 3-D and left with right channels.	2-D units will properly display left and right pictures. 3-D units will display 3-D and left with right channels.
NLE	2-D NLE works for basic cuts/mixes for side-by-side or over-under. Not possible with other frame-compatible systems	3-D NLE gives full features.	3-D NLE gives full features.
Processing/frame syncs	Standard 2-D system for side-by-side or over-under. Other frame-compatible systems may have horrible results.	Dual proc/frame sync. Some procs have this as standard in 2-D models.	Dual proc/frame sync. Some procs have this as standard in 2-D models.
Switching	2-D switcher works for basic cuts/mixes for side-by-side or over-under. Not possible with other frame-compatible systems	Slave two switchers together or 3-D switcher	3-D switcher
Test and measurement	Frame-compatible 3-D test and measurement product is available now.	Dual-channel 2-D test sets provide limited functions; 3-D sets are available.	Dual-channel 2-D test sets provide limited functions; 3-D sets are available.

Table 1. Infrastructure effects

for this environment will be capable of displaying both HD and 3-D feeds.

Contribution is the final stage of the mobile production environment. Video networking systems exist to manage and transport contributed signals into the broadcast facility. The ideal 3-D-ready system can accommodate standards-compliant audio, video and data into the plant while supporting the left- and right-eye feeds together.

Broadcast facility

3-D contribution feeds come in and are handled in much the same way as they were on the way out of the mobile content acquisition environment. Fiber management and video networking systems handle the two signals together as a related pair.

Frame synchronizers and converters can recover phase errors that can adversely affect the signal while using traditional contribution solutions for separate signals. This is especially true when working with long links. A routing switcher will pick up the signal once synchronization for the two eyes is confirmed.

A storage system within the broadcast facility will surely be one important destination. As in the acquisition and production phase, its ability to handle coordinated ingest and playout of the L/R pair is pertinent. Digital asset management systems tied to storage must be able to distinguish 3-D from HD content and accommodate unique metadata requirements for 3-D content.

The master control switcher should be configured in a L/R slaved configuration to support dual-link, full master control processing in a 3-D environment. This allows the operator to switch both eyes simultaneously with the press of a button. Nonsynchronized switching can ruin the 3-D experience, which would be unfortunate at this stage of the workflow. A reliable multiviewer, similar in capability to the production environment, will provide the appropriate level of master control confidence monitoring.

The master control operation incorporates the channel branding elements. This is an extension of on-air graphics, and should offer 3-D compliance for appropriate placement of logos, bugs and promos. Often viewed as a nuisance in traditional viewing, 3-D channel branding can actually enhance the viewer experience if done properly. Alternatively, it can make for a miserable viewing experience if not applied correctly.

Automation systems can be tricky in the 3-D environment as virtually everything tied to the system is doubled. The deployment grows in complexity as the playout automation operation expands. At its core, the playout element must control two signals simultaneously in a frame-accurate manner. This translates to dual, synchronized playlists. Secondary events related to channel branding elements must also be properly supported across the two playlists.

3-D test and measurement has come a long way in a short period of time. An array of reliable tools and solutions exist to help the 3-D broadcaster identify signal quality issues.

3-D test and measurement has come a long way in a short period of time. An array of reliable tools and solutions exist to help the 3-D broadcaster identify signal quality issues. Scopes with left and right waveform displays, and performance tests for luminance/chrominance and position measurement, will ensure that viewers receive the best possible 3-D picture.

Format considerations represent the final stage in the broadcast facility. Every destination needs to be considered (typically cable and satellite at this point). The system requesting two full HD streams makes life easier for the broadcaster as it is simply a continuation of the process that has worked its way through the broadcast facility.

A more significant challenge is presented when the operator requires an encoded signal in a frame-compatible format, such as side-by-side or over-under. This requires an additional synchronizer and/or converter to perform the task. If required, it makes sense to integrate a unit that can output the 3-D signal over HDMI. This provides a final QC stage, enabling display on 3-D television sets similar to those the end user would be using.

Effects of various approaches to 3-D

The ideal approach is to feed two full-resolution images as far through the chain as possible. Unfortunately, this is not always practical. Since there are three primary approaches to implementing 3-D in the plant (frame-compatible, two full-res feeds over 1.5Gb/s and two full-res feeds over a single 3Gb/s), it's helpful to understand the effects of each.

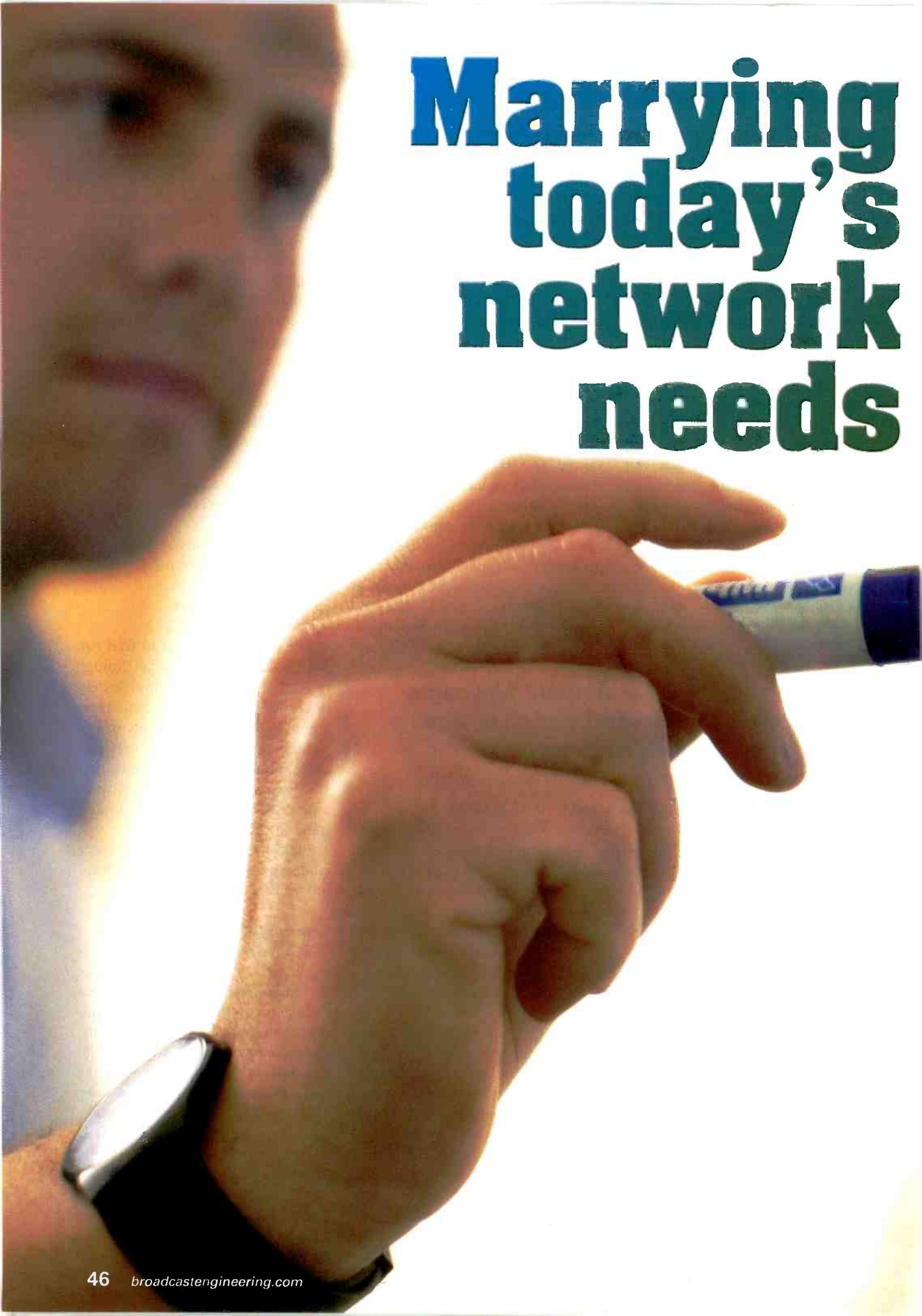
Table 1 serves as a quick reference guide regarding the effects of each approach that can be used.

Conclusion

The 3-D television workflow is essentially an ecosystem — a suite of interoperable components that complete a cycle for advanced broadcasting. It makes sense to look at the complete picture from acquisition to transmission instead of addressing single point products one at a time. This strategy will minimize problems as you move forward with a 3-D channel launch. BE

Chris Lennon, CTO Group, and Stan Moote is vice president of corporate development for Harris Broadcast Communications.

Marrying today's network needs



with those of the future

BY JANNE MORSTØL

When covering special events, broadcasters have to mediate between the myriad requirements of news reports, extended clips and full coverage of the event in SD, HD or even 3-D, not to mention the backhaul of extra footage and live interviews.

Major events are a perfect demonstration of the flexibility that today's broadcasters need. While consumers now accept that the once static appliance of the television set has to be upgraded from time to time to receive new services, broadcasters need systems that are future-proof.

That's just what the earliest pioneers of digital broadcasting thought they had when they adopted MPEG-2 compression and first-generation DVB transmission standards. And who can blame them? Twenty years ago, it was state-of-the-art and indeed still gives sterling service on a global scale.

However, over time, it became clear that the signals from this combination were simply too bulky to support next-generation services such as HDTV and 3-D TV. The genesis of a solution came in 1999 with the first publication of an MPEG-4 specification, but it was only in the last few years that a true alternative emerged with the development of MPEG-4 Part 10 (H.264 Advanced Video Coding) compression. This development made a serious cut in last-mile bandwidth requirements, making HDTV and 3-D TV commercially viable.

Many of those blazing the digital broadcasting trail are now augmenting their legacy MPEG-2 networks with the newer technology to support next-generation services, while digital latecomers have the luxury of adopting leaner systems from the outset.

It's not surprising that the standards employed to deliver television to the home get the lion's share of attention both in the specialist press and to a lesser extent the mass media, as it directly affects a large number of people. But what tends to be overlooked is the impact that the contribution or backhaul links can have on bandwidth and quality of viewing experience.

JPEG 2000 characteristics	JPEG 2000 benefits
Frame-by-frame compression	• All images have same quality • Low latency • No propagation of error
Wavelet transform	• All pixels subject to same processing • High efficiency
Compression range	• Lossy to lossless
Visual impairments	• 10 or 12 bits video range • Blur (no blocking on low rate)
Layered code stream	• Remote edit on low-quality layer
Distortion on multiple generation	• Low

Table 1. The characteristics of JPEG 2000 for broadcasting

JPEG 2000

Selected for distribution of Digital Cinema in 2005, JPEG 2000 is a picture-by-picture compression scheme now being used in the broadcast space. It features 4:2:2 support and 10-bit resolution (expandable to 12 bits), ultra low latency, lossless and low loss compression, and no quality loss in workflows requiring multigeneration compression. Another advantage over MPEG-2 is that JPEG 2000 does not employ macroblocks. This avoids blocking errors and means that downstream MPEG-4 encoders can optimize the macroblock size independently of earlier compression. Due to JPEG 2000's higher-quality 10-bit pictures, the downstream MPEG-4 encoder is not burdened with encoding errors. These factors combine to give greater compression efficiency, which in turn enables operators to launch additional channels or services. (See Table 1.)

Additionally, after carrying out lab tests comparing JPEG 2000 and MPEG for video distribution over IP, video professionals are increasingly finding that advantages in latency, video quality and performance when handling cascading encodes/decodes make JPEG 2000 solutions far superior to MPEG-based solutions at contribution rates over 30Mb/s. (See Figure 1 on page 51.)

Stereoscopic 3-D

For 3-D broadcasting, synchronizing the left and right eye images is crucial. It may sound simple; however, in reality, this continues to be a challenge for many video transport systems. The SMPTE Technical Committee 10E is currently developing a standard to define the mapping of the left and right eye signal into a 3Gb/s HD-SDI signal. JPEG 2000-based solutions are ideal for the contribution of full-resolution stereoscopic 3-D, as the wavelet transformation of JPEG 2000 provides the same processing for all pixels, and the frame-by-frame nature of this compression codec provides consistent quality for all images and ensures that errors are not propagated from frame to frame. In order to deliver an excellent viewer experience, home mastering requires left and right eye images in full resolution. High quality needs to be maintained throughout the contribution chain so that editing and production can be performed at the left eye/right eye signals with the maximum resolution and quality. The advantage of this solution is that it provides high video quality through 10-bit dynamic range, full HD resolution for both left and right eye, and low latency.

Flexible encoding

The beauty of JPEG 2000 is that it is extremely flexible. Take, for example, the transport of a full HD feed, which for noncompressed HD-SDI would require a link running at 1.5Gb/s. Visitors to IBC2010 could see mathematically lossless JPEG 2000 encoding, at a typical bit rate of just 600Mb/s. Mathematically lossless compression uses reversible integer wavelet filtering to ensure that the compressed data has all the information of uncompressed SDI video and therefore provides video transport of equal quality, while delivering a bandwidth saving of at least 60 percent.

The advantages of lossless video compression follow naturally from the wavelet nature of JPEG 2000 and are enabled through the following two alternatives:

• *Mathematically lossless.* This uses reversible integer wavelet filtering to ensure that the compressed data has all the information of uncompressed SDI video and therefore provides video transport of equal quality, but with a typical bandwidth saving of at least 60 percent.

• *Visually lossless.* This method employs floating point filtering and quantization techniques to provide greater compression with no perceived loss of video quality. Typically,

visually lossless JPEG 2000 uses from 120Mb/s-150Mb/s, while the backhaul of uncompressed SDI video needs a 1.5Gb/s pipe.

The arguments in favor of deploying JPEG 2000 lossless video transport as an alternative to uncompressed SDI video in the backhaul chain are now overwhelming. By providing two compression options, visually lossless and mathematically lossless, it is now possible to meet present service and quality requirements for all HD contribution applications. This provides broadcasters and content providers with the opportunity to save bandwidth costs without sacrificing quality.

In the end, success is down to the quality of programming and viewing experience served up by the broadcasters.

Using HD-SDI visually lossless JPEG 2000 encoding — which employs floating point filtering and quantization techniques to provide greater compression with no perceived loss of video quality — typically shrinks the bit rate to just 120Mb/s-150Mb/s.

All in all, JPEG 2000 gives broadcasters a great deal of freedom to allocate different bandwidths to various feeds according to the importance of each.

Quality of service

There's little doubt that the broadcast world is moving to IP because of greater efficiencies and the falling costs of fiber. Recent research indicates that presen eo contribution n are for IP-based sc move toward IP is acc

By taking advantage ent flexibility of IP, broa program producers gain cost-effective and scalable s for professional quality video port. In addition to IP netw being much more cost-effec than legacy distribution, IP also en ables significant setup and running cost savings.

Historically, there have been concerns regarding the inherent quality of service (QoS) of IP networks and the ability to carry time-critical IP packets such as those building up a video stream. These concerns can be addressed by deploying managed networks combined with video gateways supporting forward error correction (FEC), both for the recreation of lost

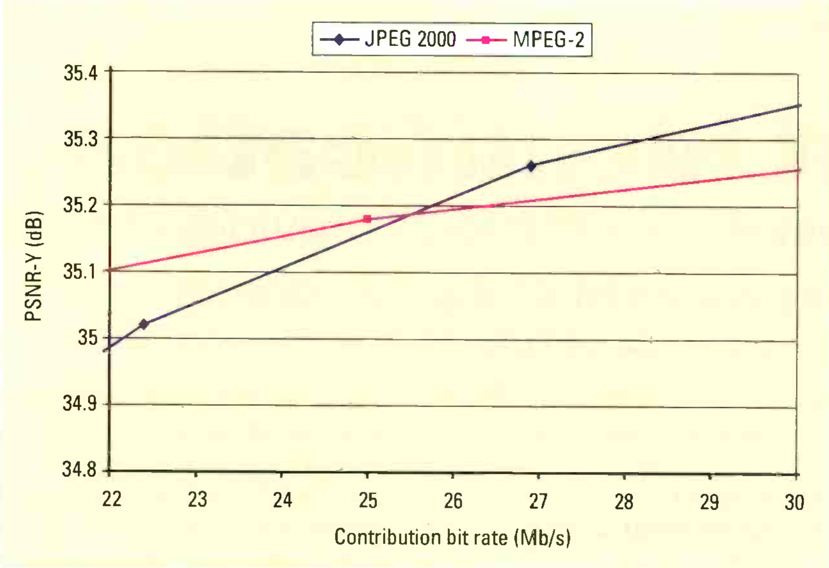


Figure 1.These test results for MPEG-4 with MPEG-2 and JPEG 2000 video backhaul were taken with the PSNR measured at the output of an H.264 coder operating at 3Mb/s. Replacing the MPEG-2 contribution with JPEG 2000 will result in improved performance of downstream MPEG-4 AVC encoding.

packages and removal of network jitter with advanced buffer management.

It's clear that IP is increasingly moving toward a dominant position for the delivery of video content. By choosing IP-based solutions, the expected lifetime of the infrastructure is extended, because it is relatively easy to introduce new functionality.

Basically, the increased availability of good-quality Ethernet links combined with the high quality enabled by a JPEG 2000 video transport means that broadcasters no longer have to choose between high quality and cost-effectiveness, as the best video gateways now provide both.

Equally important is the distribution network linking the headend to the final distribution point, which — given the high cost of building a network — needs to be both resilient and future-proof.

In the end, success is down to the quality of programming and viewing experience served up by the broadcasters. It's the job of solutions providers to ensure that video networks deliver the best in entertainment so that everyone in the video chain can live happily ever after. BE

Janne Morstøl is CEO at T-VIPS.

Content identification

iPharro's Media Seeker Core Platform provides control over growing volumes of digital content.

BY JOSHUA COHEN AND RENÉ CAVET

The move to file-based workflows has given content producers an unprecedented degree of freedom and flexibility while simultaneously offering them the opportunity for improved delivery times and cost savings. However, as is the case with the introduction of any technological change, file-based workflow implementation creates its own series of challenges, which in turn must be remedied by complementary technologies. In particular, challenges such as more digital assets, more distribution points and increased pressure to turn around productions in less time all contribute to the necessity for content producers to maintain a greater level of control over their content at any given time.

Moreover, archives are getting larger and disorganized, more versions of content are created for more distribution platforms, and metadata is becoming less consistent and more complex. In such an environment, manual resources are proving too imprecise and expensive to employ in order to address these issues.

Built on Adaptive Video Fingerprinting technology developed at Germany's Fraunhofer-Gesellschaft, the iPharro MediaSeeker Core Platform offers content producers and owners a noninvasive and highly customizable approach to content identification and, in turn, enables them to identify those assets at any point in the future. Created with a combination of core fingerprinting methods, an extensible use case framework and an easily accessible Web Service interface, the platform also operates on economical industry-standard PC hardware. It provides a foundation for maintaining control over growing volumes of digital content and enables effective monetization of that content.

How video fingerprinting works

A video fingerprint is a data file in which the audiovisual characteristics of a piece of video content are stored. Computer vision techniques are applied to material sampled at a given temporal parameter, with more intensive fingerprinting requiring more frames over a given time period and less intensive fingerprinting requiring fewer. The fingerprinting engine looks for a series of characteristics, such as color, contrast and borders, that are present in the sampled frames and reduces this information to its minimal representative form. This unique numerical representation of the fundamental characteristics of the set of sampled material is its fingerprint.

As fingerprints are created, they are used to populate the iPharro Database Indexing Server (DIS), which in turn serves as the reference for content identification. Queried media content is fingerprinted, and the extracted fingerprint is then compared against those stored on the DIS. Every distinct video has one unique fingerprint, so even slightly altered versions of the same video will be recognizable by their slightly different fingerprints.

Stored fingerprints typically are indexed and mapped into catalogs, much like directories, that help to speed the matching process. Either a piece of media or a fingerprint can be submitted for analysis and matching against video fingerprints within the DIS. The speed at which analysis is performed depends on the processing resources dedicated to the task, but in any workflow, the iPharro system delivers results many times faster than real time.

Benefits

Given the transparency and speed of video fingerprinting and analysis, this approach to content identification can reduce reliance on manual tasks and improve the efficiency of digital workflows. For example, if a content producer wants to know if a piece of footage appears in a content archive or on TV, the producer needn't look for it manually but instead can fingerprint it, store the fingerprint and automatically search for those characteristics in media from either of these sources.

Given the transparency and speed of video fingerprinting and analysis, this approach to content identification can reduce reliance on manual tasks.

As distribution venues for content continue to expand, the broadcast and media industry must create multiple versions of content for language dubbing, subtitling and content ratings. It is precisely in these areas where digital fingerprinting is of great assistance. It is often the case that a single program may have between 15 and 60 versions. By fingerprinting multiple pre-existing versions of various assets of differing quality, identifying their differences, and storing only the high-resolution master file and these "deltas," media companies can reduce storage space and quickly and automatically create high-resolution versions that conform to the requirements of any distribution platform.

Fingerprinting technologies are not created equal. Most video fingerprinting providers offer services focused on downstream content identification designed to prevent content producers from losing control of their valuable assets once those assets have been released into the marketplace. Such technologies are able to identify content from a large content pool or single source with limited precision. What content producers need in order to assure that their content is organized, comparable and ultimately future-proofed is an adaptive fingerprinting method that can incorporate both precise frame-by-frame searches and rapid, large-scale searches. In other words, the fingerprint user should be able to customize the type of fingerprints being used to meet the demands of the particular application.

The platform architecture easily manages different types of fingerprints, and different matching algorithms can be customized to specific requirements or use cases. (See Figure 1.) For instance, advertisement monitoring requires indexing of a relatively small amount of reference material, on average about 20,000 clips of 20 seconds each. The volume of query material, however, typically comprises several channels recorded on a 24/7 basis — a potentially unlimited amount of data. In this use case, the platform can be configured to extract the query fingerprint only on the I-frame sampling level, enabling faster decoding, while the reference fingerprint is created using all frames. When an enormous amount of reference material, such as an archive, is being compared to query material made up of single small video clips, the model can be reversed, with reference fingerprints extracted from the I-frames and the query fingerprints from all frames.

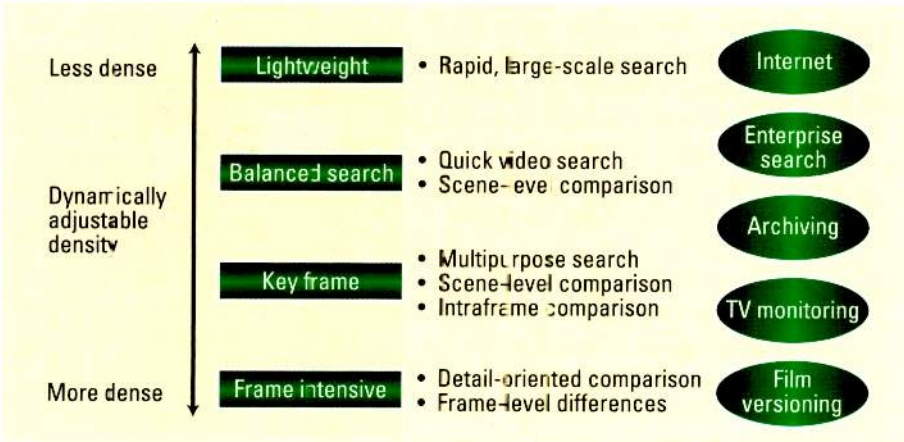


Figure 1. iPharro's Adaptive Video Fingerprinting technology is configurable to address all use cases.

Integrated easily into any pre-existing workflow, thanks to a Web Service API, the iPharro MediaSeeker Core Platform automatically fingerprints in-progress or finished (distribution-ready) content. (See Figure 1.) These fingerprints are stored in a central database/metadata archive, and they remain constant even as the media is sent downstream for transcoding and as metadata is reconformed for the requirements of the specific video sharing or platform provider. Ultimately, the platform could be employed to scan a library of properties, including media archives, Web properties or TV, and determine where a copy of the footage is present, be it the entire copy or merely a short subsequence.

Launching the fingerprinting process early in the life of a media asset is crucial because it precludes the later need for further content identification mechanisms.

Launch the process early

The implementation of file-based workflows and the digitization of tape-based archives offer broadcast news producers and other content producers the perfect opportunity to begin proactively organizing, streamlining and ultimately protecting their content. Launching the fingerprinting process early in the life of a media asset or the archive holding it is crucial because it precludes the later need for further content identification mechanisms. By making video fingerprinting a part of their digital media workflows, media companies not only increase the efficiency of content management, but also protect the continued value and integrity of that content. BE

Joshua Cohen is CEO and René Cavet is head of research and development at iPharro Media.

Sky News' HD tapeless workflow

The new HD channel is supported by EVS technology.

BY SÉBASTIEN VERLAINE

Sky News is a 24-hour domestic and international satellite television news broadcaster. It was launched in 1989 and has established itself as a world-class breaking news service with a spirit for innovation. The broadcaster currently provides news to roughly 145 million people in 36 countries in Europe alone, with distribution across Africa, the Middle East and Asia.

Although owned by British Sky Broadcasting (BSkyB), Sky News is partially-owned by Rupert Murdoch's News Corp., which holds a minority stake in BSkyB. The station's headquarters are in Osterley, West London, employing more than 50 on-screen staff (anchors, correspondents and reporters) and more than 600 behind-the-scenes staff. Sky News has eight bureaus outside the United Kingdom and shares many more with other News Corp. networks.

After the successful HD broadcast on the Sky Satellite platform and HD online streaming of Barack Obama's inauguration in January 2009, as well as an increasing viewer demand for high-quality programming with the intensity and vividness of HD, Sky News decided to launch a permanent HD news channel. At 9 p.m. on Thursday, May 6, in time for the 2010 general election results, Sky News HD was launched. That evening, it became the first UK news channel to broadcast in HD.

The news operations center (NOC) at Sky News allows operators to manage the 40 incoming feeds from field reporters and agencies. EVS IPDirector manages the capture process.

Challenges

To provide HD broadcasts, Sky News needed to introduce new technology at its headquarters in West London and upgrade its Central London studio as well as several bureaus both in the UK and around the world. The project required a setup in which the entire production workflow, from field to playout, is in full HD and based on tapeless technology. (See Figure 1 on page 56.) The selected technology also had to be fast and open to third-party systems for graphics, archiving, asset management and post production.

As a multiplatform news provider, Sky requested technology that would allow it to easily link up people with its news at all times and wherever they may be. This implied the distribution of news not only to Sky News television viewers, but also online via *skynews.com*, on the radio, on mobile phones (including iPhones), on UK train platforms, Virgin Atlantic flights and via a ticker tape in Piccadilly Circus.

Finally, the satellite broadcaster's existing SD infrastructure needed to be replaced with the new HD setup while the channel remained on-air. Introducing HD without compromising the existing SD service was a challenge. The broadcaster didn't want the viewers to notice or the journalists' jobs to be affected.

EVS solution

The new HD channel is supported by a tapeless workflow based on EVS technology, which includes A/V production servers, varying software applications for browsing and editing, online media storage, as well as content management and networking solutions.

Ingest

There are around 40 lines dedicated to the incoming feeds, which are recorded in HD. About 20 recording lines in ingest are set permanently in loop recording mode, so feeds can be protected and named. Ingest is made with EVS XS servers that are controlled by IPDirector software via several workstations. XL[2] proxy servers provide instant access to live

record trains in low-res format without the need for scheduled ingests.

Footage from Sky News ENG crews is shot in 1080i DVCPROHD 100 and maintained as such through the entire production process to avoid time-consuming file conversions.

All feeds are sent to an EVS XStore-SAN, a 200TB-plus nearline storage system offering combined Gigabit Ethernet and Fibre Channel networks. Media content can then be instantly accessed through the entire network for production, editing and playout. Video can also be pushed to a Vizrt Ardome asset management library. Media managers working on the IPDirector workstations control what is held for production and what goes to the library.

Content management and timeline news editing

In addition to ingest control, IPDirector software is used for browsing content and compiling clips. More than 200 IPDirector workstations are available for the bulk of the newsroom, as users browse incoming feeds and prepare rough-cut edits by creating simple playlists. The playlists can be pushed to EVS' Xedio CleanEdit systems or Apple's Final Cut Pro for further editing, or directly to playout if need be.

Xedio CleanEdit is a nonlinear editing tool that offers timeline editing with no rendering required for fast turnaround news production. Journalists at Sky News use the software via a few dozen workstations to improve rough-cut edits by adding text and graphics, prepare news bulletins and reports, as well as voice-over recordings. Finished edits from the system can be pushed to playout or to Final Cut Pro for advanced editing.

The stations were given to the on-air news journalists and to key specialist areas, such as sports and business, to boost their ability to shape content, and to get material to air fast. The stations are also used by online and multiplatform production teams that can carry out the majority of work without FCP.

Post-production integration

Sky News craft editors work with Final Cut Pro suites, which are fully integrated with production servers and online storage solutions. This implies that files can be readily exchanged between the servers and Final Cut Pro via the Ethernet network.

Apple's high-end edit suite also uses a new EVS export plug-in to allow restores direct to a server as soon as Final Cut Pro starts rendering the files, meaning near-instant playout of files as soon as the edit is finished.

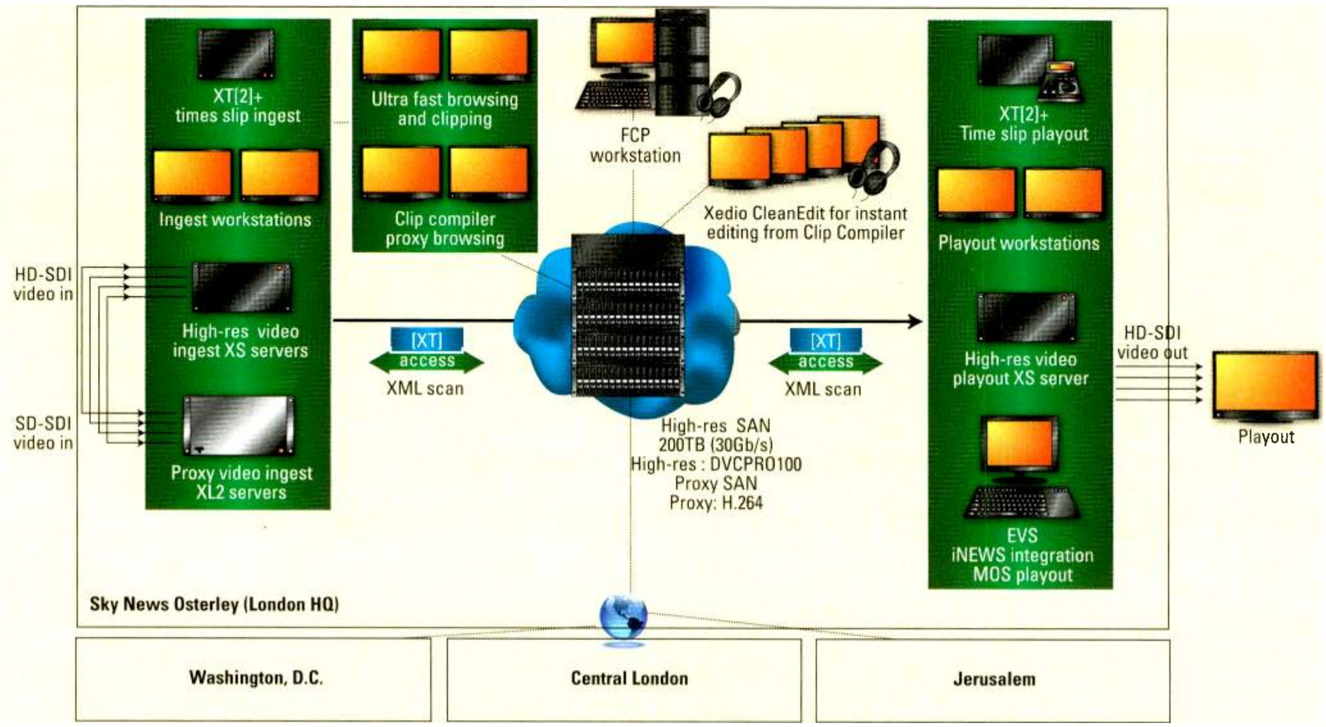


Figure 1. Sky News' new HD tapeless workflow allows the broadcaster to distribute news to TV viewers, as well as to *skynews.com*, the radio, mobile phones, UK train platforms, Virgin Atlantic flights and via ticker tape in Picadilly Circus.

Playout

The 24-hour news broadcaster employs XS servers for playout operations. Playout at Sky News is fully redundant, with four main playout channels and two for backup. Also operating from the system are several of Sky's interactive and online services, bringing the total number of playout channels to around 32.

Sky News also uses the new AB-Roll playlist application, organized by Avid iNEWS NRCS, to play out rundowns.

IPDirector integrates with iNEWS through MOS protocol support and the introduction of EVS' new ActiveX plug-in database browser. NRCS operators can therefore access any clip and associated metadata referenced in the IPDirector database, and add it with a simple drag and drop to the rundown list. In fact, the ActiveX browser allows the user to do a search on any database field. In addition, any running order managed from the iNEWS client interface is kept up to date on the IPDirector control panel, ensuring full control over the rundown of playlists.

A pair of LSM-XT[2]+ systems are used for live slow motion and time-slip operations, offering excellent abilities for fast-turnaround review of events as well as delaying live events so nothing is missed.

After playout, finished edits are pushed to the Ardome library. Full metadata integration is available between EVS and Ardome, so nothing is lost when files are transferred.

Web service integration

EVS also integrates with Sky's Web service, using the Irdeto platform. Again, metadata added in the EVS system is passed through to Irdeto to dictate which platform the file should be delivered to and indicate the type of content in the file.

Conclusion

The key success factors of the project include:

- fast and efficient HD tapeless workflow;
- instant access to live record trains;
- record buffer of 24 hours per input;
- stability and speed of servers;
- ultra-fast browsing and clip-compiling tool;
- easy-to-use timeline editor that gives journalists the ability to shape content;
- integration with third-party NRCS, automation, post-production and archiving systems;
- a global solution from ingest to playout integrating all phases of production; and
- technical training and unyielding support for smooth changeover.

When the new channel finally went on-air, the broadcaster knew immediately that all of the effort would pay off. BE

Sébastien Verlaine is marketing manager, EMEA, for EVS.

PWS wireless systems

Chicago's WMAQ teams with PWS to solve multichannel wireless signal interference.

BY MICHAEL GROTTICELLI

Studio engineers and audio producers working in crowded RF areas understand the importance of avoiding signal interference at all costs. It can be tricky to find an available frequency and keep it for long periods of time.

At NBC WMAQ-TV Chicago (including WSNS-TV and WMAQ Studio Productions), the station multiplies that by a magnitude of five, as it operates four studios and control rooms in its main building, as well as a separate street-level studio located between the Hancock Building on Michigan Avenue and the Willis Tower (formerly Sears Tower), about 1mi away. Each show — including such major syndicated shows as "The Ellen DeGeneres Show" as a remote, "The Jerry Springer Show," "The Steve Wilcos Show," "Judge Mathis Show" and "Judge Jeanine Pirro" — requires a minimum of 48 wireless mics, along with wireless video and other crew communication signals. (In addition to the syndicated shows, the team is responsible for the production and broadcast of news, weather, sports and original programming for NBC affiliate WMAQ and Telemundo station WSNS.)

So, with 48 wireless mics needed for two main studios, 14 channels for the street-level studio and 16 more for two newer news studios, the station manages more than 130 channels of wireless audio signals alone.

BAS relocation and white space spectrum concerns

Signal interference was only one of the issues facing Edward S. Mann, NBC Chicago manager of technical operations, news, and Lane Lucatorto, engineer in charge at WMAQ Studio productions, who manages the audio operations there. They were also faced with having to replace analog equipment with digital and move mics off the 700MHz spectrum and shift from VHF to UHF as part of the government Broadcast Auxiliary Spectrum (BAS) relocation project. This became a real issue (and continues to be) because with the move, the FCC has taken away six previously licensed channels from its street studio.

In addition, a new independent digital television station recently went on-air and — because microphones are now considered "secondary devices" — wiped out an entire band of 16 channels that WMAQ was using. Lucatorto said they would try to use spectrum for their wireless mics from a station in nearby South Bend, IN, without interfering with them. Initial tests have been positive.

The PWS solution for WMAQ includes a customized 24-output configuration of the company's DB-16 filtered receive multicoupler (left) and a number of off-the-shelf helical antennas (right).

(The latest FCC white space ruling allocates only 16 channels for unlicensed devices like wireless microphones in the Chicago market, which Lucatorto calls "absurd" because he figures he'll be left with a single channel to work with.)Add all of this together, and you get an RF frequency allocation nightmare.

A new frequency plan

Working with Orlando, FL-based Professional Wireless Systems (PWS), WMAQ knew it needed a way to expand coverage of its existing microphone transmitters and add new ones to allow the various shows to shoot outside of their respective studios (in the street, down the hallway, etc.) when necessary. The PWS solution incorporates a mix of proprietary technology — including a customized 24-output configuration of the company's DB-16 filtered receive multicoupler, which it calls "an RF decongestant" — and a number of off-the-shelf helical and LPDA batwing antennas.

The combination of antennas has allowed WMAQ to get coverage of nearly a block away, or farther than a video RF signal can travel.

A batwing antenna provides added coverage when a subject is walking down a hallway.

Managing the RF signals of five different studios, with the street-level studio enclosed in glass (which can be problematic for wireless signal propagation) was equally critical. Located 1mi away from the Willis Tower and other broadcast signals, Lucatorto said the station routinely gets "bombarded" with RF.

So the team at WMAQ worked with PWS Project Manager Brooks Schroeder over a period of six months to design a new antenna system scheme and a new frequency usage plan within its relocated RF environment, using the combination of helical and batwing antennas. These antennas are used in tandem with Shure wireless transmitters and receivers and DPA mic elements.

(Schroeder also collaborated with Tom Krajecki of Shure and with John Garrido, RF special projects , for the on-site installation. The PWS team included James Stoffo, company founder; Dave Shoman, director of manufactured products; and Vern Sullivan, who designed a custom VHF antenna and modified other elements of the extensive equipment package.)

The helical antennas work better in the studios (Studio "A" is the largest in Chicago) to cover a large space, while the batwing provides added coverage when a subject is walking down a hallway. The helical antennas are also mounted near windows so that they can secure coverage when someone walks outside on the street.

Covering all bases

The combination of antennas has allowed WMAQ to get coverage of nearly a block away, or farther than a video RF signal can travel. Often, during live band performances outside the street level studio ("Studio 5"), the station will have to zoom in with a camera from a distance while getting a clean signal directly from the mic transmitter.

In the end, PWS designed a few systems from scratch and suggested a few existing technologies to make it all work. A year later the "The Jerry Springer Show" and "The Steve Wilcos Show" have gone away, but WMAQ still produces the "Judge Mathis Show" and "Judge Jeanine Pirro" with the same technology, and the system remains reliable and virtually free of interference.

Since PWS installed the system in 2009, the company has continued to support the system and fix small issues that have come up. Much of the follow-up work has been fine-tuning the install with a few antenna position corrections and microphone adjustments.

All agree that the most valuable addition has been a series of custom antenna combiners designed and installed by PWS. Previously, there was always an issue of how to sustain reliable coverage around the entire building. When a subject would move outside a coverage area, an assistant had to quickly move antennas to keep the signal stable. With the combiners, that is no longer an issue. BE

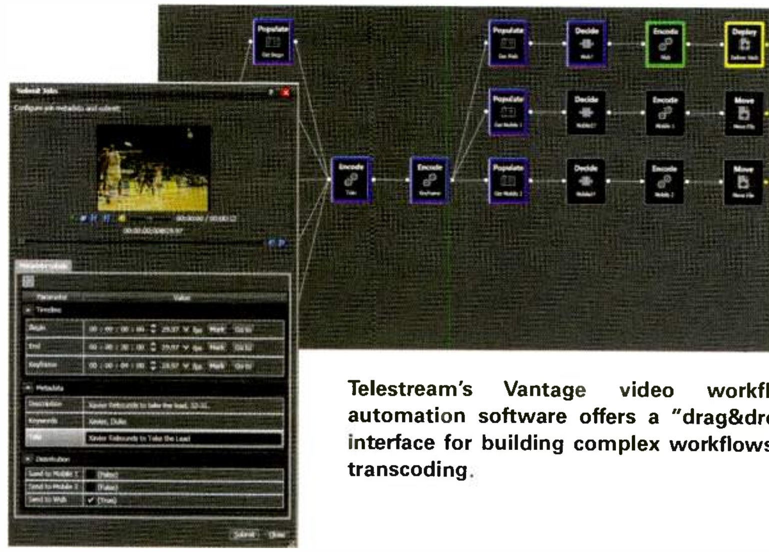
Michael Grotticelli regularly reports on the professional video and broadcast technology industries.

Hybrid broadcast/ IT facilities

IT technology is dominating broadcast.

BY JOHN LUFF

Here we are in the second year of the second decade of the 21st century, and we are still discussing the transition between baseband and IT-based systems. Baseband digital systems are in fact only marginally different from analog video and audio, which have been with us for generations, since long before the turn of the century (20th to 21st that is). Let me explain, because this context is important to understand the magnitude of the change to IT-based systems, or hybrid systems embracing both.



Telestream's Vantage video workflow automation software offers a "drag&drop" interface for building complex workflows in transcoding.

Baseband analog and digital

Baseband analog and digital systems are unidirectional and deterministic in timing. Every 1/30th (or 1/25th) of a second another frame of video traverses every baseband interface. Signals occupy the full circuit between one device and another. Digital is no different in this respect from analog. Similarly, any discontinuity in the signal, be it a broken connection or a defective circuit, means the content is lost, unlike most IT-based systems that will pick up where they left off when the circuit was interrupted. The nature of time is inviolable. In fact, it is precise down to the nanosecond. One or two degrees of subcarrier in error in an analog system would be noticeable to a consumer viewing the affected content. In digital systems, built-in buffers ease the problem, but interruptions still lose content.

Switching between signals requires precision as well, with switches required to be locked to the same clock as the content or discontinuities cannot be avoided. Synchronization of audio and video is done by physical means because the signals generally are not referenced to a common time stamp.

Most importantly, a digital baseband signal is simply a sampled representation of the analog original signal. All of its characteristics as content are faithfully reproduced, though the transmission may be more robust and less prone to degradation in transmission.

We are still discussing the transition between baseband and IT-based systems.

Integrating baseband with IT

Integrating these two well understood signal types with IT-based systems requires good understanding of what IT systems require, which in many ways is not at all like baseband systems. First, and most obvious, IT systems are bidirectional and networked. That is to say that a "circuit" becomes virtual because more than one signal can share the same physical interface. Bits from two video signals, or even a database replication and a slew of audio and video essence, might live on the same "wire" at the same time and might be flowing in both directions. In addition, the network contains its own command and monitoring system in the same packets that carry the content.

Content is also not delivered on a network in an IT system as a precisely timed isochronous set of signals, though recent standards can emulate the effect of isochronicity across a network for media content. Rather it is a best effort approach that statistically delivers 25fps or 30fps. If a system has a sufficient buffer built-in, there's no challenge, but it does lead to a completely different approach to "switching" signals. It is often the case that the receiving application requests that different content be sent across a connection instead of selecting at the receiving end in a device doing processing.

In general, special-purpose devices don't do the processing in an IT network, though there are some exceptions. Most often, general-purpose computing systems are programmed to manipulate video and audio essence and metadata. Some compute-intensive processes — or when speed is critical, like image scaling, compression and decompression — may be done with special hardware but not by converting to baseband. Rather, they may be done by delivering the essence to the processing subsystem from a compute engine, which receives the result back after processing the content to be directed to the next step in the workflow.

Thus, the insides of an IT processing system are inherently different and fundamentally incompatible with the approaches that baseband systems require. This gives rise to some interesting changes in our industry. For instance, SMPTE, which used to referee "discussions" about competing hardware video and audio standards and the electrical interfaces between them, now has many interface standards that are entirely software. The group is now working on standards that define how to carry essence on IT network platforms without blocking or latency that plagues many attempts at sending uncompressed media over IP networks.

So the issue becomes: How do we knit together IT and baseband in this decade of transition? The first step was islands of IT processing in a baseband world. We are rapidly moving to islands of baseband in an IT world. We also have systems that live across the boundary at all times. For instance, a video switcher has many IT interfaces for live feeds, but IT interfaces for delivery of file-based content for still stores and clip players within the switcher. Increasingly, we see devices that do their processing using compute engines, but provide at least some baseband interfaces. An example is a format converter, with entirely compute-intensive electronics inside, including special-purpose GPUs for scaling and other computations. The same processes could be ported to a server without baseband interfaces, perhaps operating only on files or streams of content delivered over IP.

Conclusion

We all have much to learn about this intersection of two disparate technology sectors. A lot of great engineering has been done to bridge the gap and allow hybrid broadcast/IT systems

I can't help but squirm every time someone predicts that the end of broadcast technology is upon us and the era of IT predominance has started. I also can't deny it may be true.

to achieve much of the complicated workflow we expect today. But we continually expect more, and Moore's Law predicts the inexorable decline in the cost of computing and the increase in power to be used. The net result is an expectation that eventually IT will subsume baseband techniques. Perhaps it will, but the processing power in a video switcher has been achieved with an extremely high degree of reliability, and freedom from bugs and reboots (mostly). I can't help but squirm every time someone predicts that the end of broadcast technology is upon us and the era of IT predominance has started. I also can't deny it may be true. **BE**

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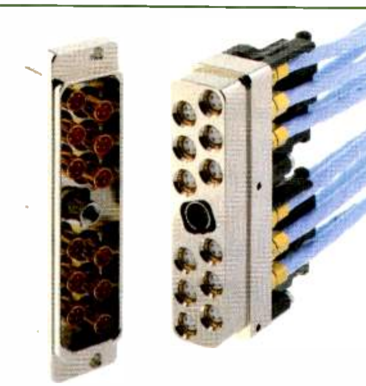
605-978-4600; www.sencore.com

Radiall **HDQX**



Connector for high-speed Ethernet and RF data transmission offers 12 size 8 cavities in a high-density, rectangular shell; accepts ARINC 600 Quadrax and size 8 BMA connectors as well as twinax and triaxial contacts; enables high-speed, high-density applications; can use BMA contacts in RF connections at frequencies up to 18GHz; features a center-locking device for reliable mating and easy connection, lightweight, composite strain relief and contacts that are grounded to the shell for low electrical resistance; environmental sealing is available with an interfacial sealing on the shell as well as sealing boots on the contacts.

480-682-9400; www.radiall.com

Wohler Technologies **AMP1-E8-MDA-3G**

Eight-channel, 1RU audio monitor supports audio monitoring of Dolby E, Dolby Digital (AC-3), Dolby Digital Plus, 3G, HD-SDI, SD-SDI, AES/EBU and analog signal sources; provides embedded Dolby D, E, Digital Plus and AES audio processing with metering and alternate undecoded Dolby, AES and analog inputs as well as complete downmixing capabilities; provides optimally focused sound for operators in an ultra-near-field environment of 1ft to 3ft; design enables a higher SPL for the operator while reducing overall ambient sound and adjacent bay crosstalk.

510-870-0810; www.wohler.com

Anton/Bauer **QR-DSLR**

Power solution for Canon EOS 5D Mark II, EOS 7D and EOS 60D DSLR cameras; uses Logic Series batteries; can mount to most third-party support rigs; offers a counterbalance to the rig; can be configured in a pouch pack worn on a belt when handheld production is necessary.

800-422-3473; www.antonbauer.com

Analog Way — Smart Edge

Edge-blending system offers 10 universal analog inputs including two fitted with DVI and two fitted with HD-SDI; outputs digital and analog signals in SDI, DVI and VGA (RGBHV); enables the creation of wide blended screens horizontally or vertically, and one unit can handle two video projectors; multiscreen edge blending can be achieved by linking up to three units, resulting in a panoramic image with up to six video projectors without any loss or synchronization; offers seamless transitions with cut, fade, wipe and slide; a downstream keying function is available to add title.

212-269-1902; www.analogway.com

Atlona Technologies — AT-LINE-PRO4

Video processor upscales signals from any A/V device to the native resolution of an attached display; any one of the inputs can be scaled to a variety of different resolutions up to 1080p or 1920 x 1200; HDMI output is capable of both digital and analog switching as well as full 3-D support for the HDMI pass-through; features 50Hz/60Hz (PAL/NTSC) conversion, on-screen display and digital coaxial audio output; controllable via front-panel buttons, IR remote or RS-232.

877-536-3976; www.atlona.com

Barix — Exstreamer P5

All-in-one solution for high-fidelity audio-over-IP distribution supports universal IP standards including TCP/IP, RTP, SIP, Multicast and Ethersound; can directly connect 8Ω speakers to an IP or Ethersound network; operates reliably in high-temperature environments; enables zoning applications for multispeaker systems; includes PoE support and Class D audio amplification.

866-815-0866; www.barix.com

Eyeheight — playoutHD

Multidefinition version of company's playout compact SDI presentation switcher; offers an upgrade path from 525/625-line to 1080i operation; structured as a modular A/B switcher with four-group, 16-channel audio facilities; housed in an FB-9E chassis; can be expanded with a wide range of modular options including keyer and bug/crawler inserter; features automation, manual and/or emergency control as well as redundant power supply available as an option; single or multiple expansion chassis can be connected to accommodate additional facilities or channels; includes TCP/IP-based Ethernet and RS-232/422 control interfaces plus 14 GPI/tallies.

623-328-5800; www.eyeheight.com

Roland Systems Group — VR-5

Fully integrated audio mixer and video switcher features a four-channel video switcher, two mono and five stereo mixable audio channels, built-in scan converter for PC input, built-in dual LCD monitors with touch control for easy video source selection, three video layers that include two video sources plus downstream keyer, MPEG-4 player/recorder and USB A/V class device for Web streaming.

**800-380-2580
www.rolandsystemsgroup.com**

Sonnet Technologies — SD-SXS-E34

SDHC adapter for an SxS camera slot enables the use of Class 10 and faster SDHC memory cards in place of SxS memory cards; interchangeable with SxS cards; ensures that the camcorder's memory card slot door closes completely with the adapter inserted; can be inserted directly into a notebook computer's ExpressCard slot to read the SDHC card and can be read in any SDHC card reader.

949-587-3500; www.sonnettech.com

Volicon — Observer RPM v5.5

Upgraded Remote Program Monitor addresses the effective management of large-scale installations with the new element management services module, which enables centralized configuration and alert management of multiple probes in a large operation; includes enhanced interactive services module, which enables users to reliably test complex on-demand or interactive services using pattern-matching, advanced decision-making and improved QoS detectors; includes an interactive services wizard, a desktop application for the development of interactive services scripts, and a module that enables the interactive services module's operation on every encoder.

781-221-7400; www.volicon.com

Telecast Fiber Systems — Mini-Mussel Shell

Unit provides a portable and compact universal enclosure for the company's new line of T-Block Viper function modules; can be mixed and matched to provide highly customized, portable solutions for electronic field production; features integral optical power metering, informative system LED indicators and an assortment of powering options.

508-754-4858; www.telecast-fiber.com

Thomson Broadcast — Elite 1000 GreenPower

High-performance UHF transmitter features 50V LDMOS technology and an output power of up to 9.6kW DVB per unit with an energy consumption savings of up to 15 percent over the previous Elite transmitter series; uses digital adaptive precorrection to provide leading-edge DTV transmission efficiency, optimized output power, exemplary signal quality and high redundancy.

860-763-1100; www.thomson-broadcast.com

ikan — Elements Shoulder Mount Deluxe

Unit latches securely to the user's shoulder using two adjustable clamp pads for locked-in stability while the included foam grips provide control; two durable 15mm rods are the base for a reliable shooting foundation provided by a 15mm rail mount and cheese plate offering 62mm spacing as well as receiver slots for DSLR compatibility; offers a variety of rear-loaded receiver slots for multiple mounting options including 1/4 20, 3/8, 4mm and 100mm VESA.

713-272-8822; www.ikancorp.com

For Sale

Help Wanted

BROADCAST SALES ENGINEER

Seeking a well-rounded Broadcast Engineer to support our manufacturing facility. Strong exp. and market knowledge in the RF Engineering side of UHF and VHF broadcasting required. Must have exp. with filtering, combining and switching with knowledge of standards such as ATSC, ISDBT, DAB, DMB, etc. Be the lead tech. liaison and inter-face with customers to provide both pre and post sales support. Must be able to create quotations and answer RFQs. Some travel is required. Must have EE or ME, 2+ years RF broadcast and telecommunications experience; equipment selection; field exp. with transmitters, towers and antennas – microwave, UHF/VHF. Must have broadcast application and installation experience. Relocation not required. Great benefits including 401(k), Medical, Dental, Vision. Send resumes to: **debra.jimenez@spinner-group.com** or Debra Jimenez, Spinner Atlanta, Inc. 4355 International Boulevard, Suite 200, Norcross, GA 30093 – NO PHONE CALLS.

Help Wanted

CHIEF ENGINEER

WDAM-TV, Raycom Media's NBC affiliate located in Hattiesburg, MS is interested in reviewing resumes for consideration for the position of Chief Engineer. The Chief Engineer is a hands on departmental management position and has the responsibility and authority over all studio operations, technical maintenance, building facilities, and information systems. Your background should include experience with digital transmitters (specifically a Harris Platinum), knowledge in the area of legacy analog equipment, maintenacne engineer expereince, and FCC knowledge. IT expereince a plus.

Send resume and salary requirements to:
jcameron@wdam.com
EOE/MFHV

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File-based workflows

There are cost savings but also challenges.

BY ANTHONY R. GARGANO

Displacing cost is a relentless pursuit in today's business world, and the broadcast industry is no exception. Broadcasters have been at the forefront of exacting maximum efficiencies from the technology available to them, thereby driving down operating and maintenance costs, as well as reducing required head count.

Having squeezed out all the available costs savings at the micro facility level, broadcast executives began examining processes and functionality from a macro view. About 15 years ago, the concept of centralcasting was introduced. It involves operating multiple facilities in a hub-and-spoke configuration with duplicative functions performed at the hub and distributed to the spokes. Originally, centralcasting ran the gamut from centralized master control to running spoke stations in a virtually unmanned lights-out configuration. It not only affects technical staff but on-air talent as well. One major broadcast group I met in the mid-1990s was already looking at centralizing news, weather and sports such that the "local" nightly news segment for each of its stations would emanate from one or two sets of on-air talent broadcasting from a single central studio.

Centralcasting continues to engender support today. The Corporation for Public Broadcasting (CPB), long an advocate of centralizing operations, put teeth into its push earlier this year by adopting a rule to no longer fund master control centers unless they were shared facilities.

File-based challenges

While centralcasting continues to run its course, the latest in technology at the facility level has prompted a renewed focus on examining cost savings at the micro level. Enter file-based workflow. File-based workflow has become an umbrella term applied to any process involving the use of video in the form of a digital file as opposed to video in a real-time or streaming form. In the film industry and in long-form video for television, digital processes have been adopted from capture through editing and effects to final output. The capture of content as files that can be quickly reviewed, ingested and edited has greatly reduced the timeline from shoot to release. The combination of shortening the interval to revenue generation along with the costs saved by eliminating practices dictated by analog processes make file-based workflow increasingly appealing.

Movies and long-form video involve a predictable beginning to end process; broadcast, on the other hand, involves the two quite different areas of transmission and production. And, within transmission and production, there are various activities whose workflows interconnect but can exist independently as islands. Examples are local production, ENG, newsroom, traffic and play-to-air. The sheer variety of applications that exist within a broadcast facility for file-based technology poses interesting challenges with how to best adopt this new technology for maximum benefit. There is a danger in the conceptual nature and imprecise definition of what constitutes a file-based workflow. This lack of clarity can result in the double-edged sword of suppliers who over commit and then fail to live up to customer expectations that have been set unrealistically high. Often the challenges in implementing file-based workflow systems fall back to the customer.

But, the use of video files in broadcast is ever increasing, so these are challenges that must be dealt with. In news, the typical broadcaster's primary revenue generator, image capture, runs the gamut all the way from camera phones to the high-end RED camera. The common denominator: output of video as a file. In local production, file-based capture provides the opportunity for immediate ingest and virtually real-time editing of ingested content. Spots, many of which still come in on tape, can be encoded as files, stored on a server and then compiled with program material for play-to-air serving. Incoming program material, particularly network content, arrives as a file, becomes an asset to be managed and is readied for play to air compiling with spot inserts. The play-to-air server essentially takes on the form of a "comp reel," playing out program material interspersed with the commercials as dictated by the traffic department. This exemplifies file-based workflow throughout a broadcast facility.

From a practical standpoint, file-based processes are introduced incrementally and not as a function of technology refresh. Rather, introductions to these processes are driven by highly convincing cost displacement benefits or equipment amortization schedules and replacement cycles.

But be careful. File-based workflow systems for broadcasters mean infrastructure investment, the creation of new backroom processes and new skill set requirements that entail staff retraining and/or replacement. Adopting file-based workflow processes will lead to efficiencies, but manage your expectations. There are cost savings to be realized but perhaps not quite as much as you anticipate. BE

Anthony R. Gargano is a consultant and former industry executive.

? Send questions and comments to: anthony.gargano@penton.com