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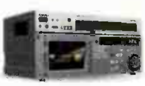

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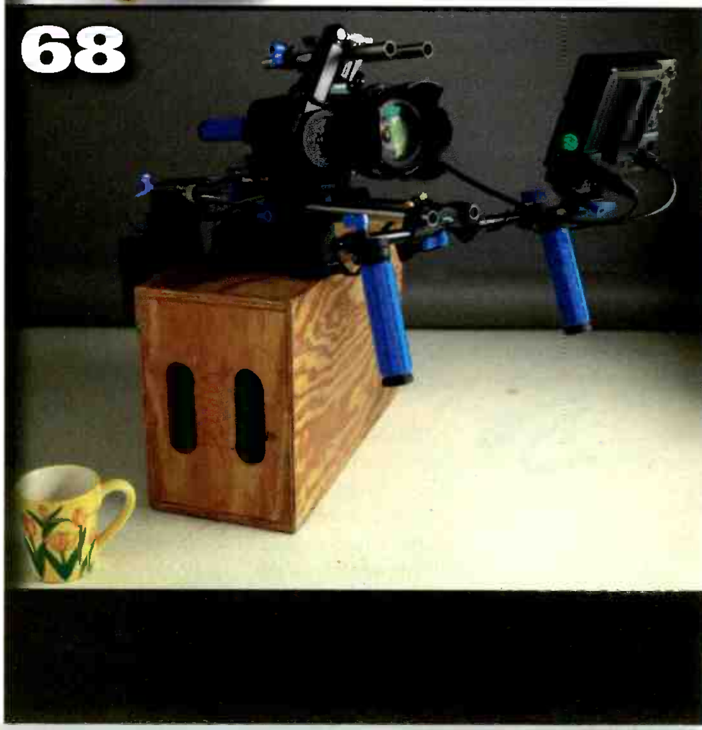

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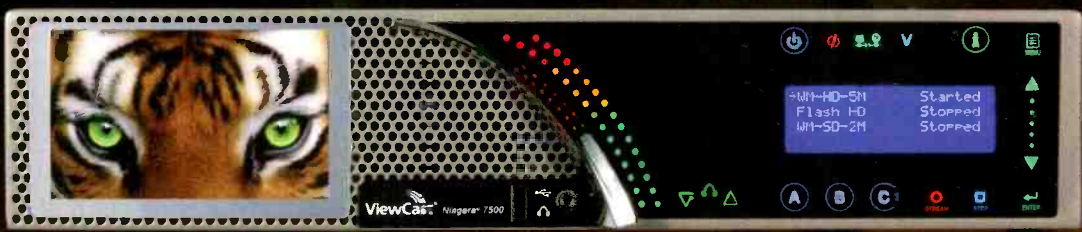

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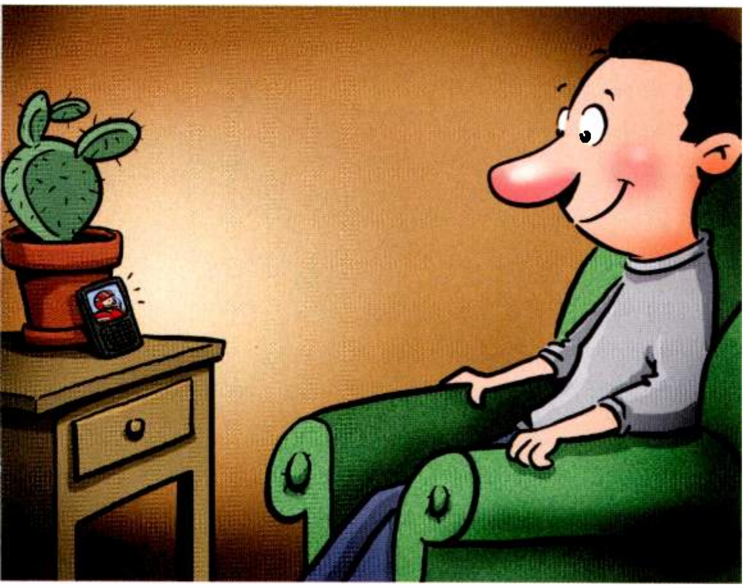
Mobile TV: broadcast's best-kept secret

A recent story on the *Broadcast Engineering* website reviewed Qualcomm's potential decision to sell its video delivery business, FLO TV. Qualcomm's chairman and CEO, Paul Jacobs, said his company is open to "selling its struggling FLO TV mobile broadcast unit."

"It's not likely that FLO TV will stay the way it is today, which is just cable TV content sold primarily through cellular operators," Jacobs said at the summer Uplinq 2010 Conference in San Diego.



FLO TV President Bill Stone told Bloomberg that the service's future hinges on extending its parameters beyond TV content into new solutions such as electronic magazine delivery. "If it's only mobile TV, we're dissatisfied; we're not happy with it," he said.

Broadcasters can take these comments as either good or bad. On the bright side, if FLO TV goes away, it means one less competitor for broadcasters entering the mobile TV delivery business. Through a pessimistic lens, if FLO TV fails, it did so because there is no future in the mobile TV delivery business.

Peeling back some of Qualcomm's statements, one gets a more complete picture of how the company perceives the data delivery business. "Mobile is changing everything," Jacobs said in his keynote address. The growth of data traffic is causing consumers to experience dropped calls and what he called "digital brownouts."

Jacobs highlighted that mobile phone data traffic already exceeds voice traffic. The monthly data traffic in 2009 exceeded the combined data traffic of 2008. Social networking appears to be driving much of this growth: Facebook is growing at a rate of 600 percent, and Twitter signs up 300,000 users a day. FLO TV's Stone said, "One person streaming a video takes up as much bandwidth as 100 cell phone calls." All these factors combine to make it difficult to continue to support any video delivery on today's cellular networks.

FLO TV's solution is to off-load data hogs like streaming video and electronic magazines to a "dedicated broadcast technology." With a broadcast model, it takes the same bandwidth to deliver an electronic version of *Broadcast Engineering* magazine to one or 1 million users. That has always been a key advantage of broadcast.

Even so, Qualcomm's comments indicate that the window of opportunity for mobile TV delivery could be narrowing. If broadcasters plan to broadcast mobile TV, they need to do it now. If they don't, someone else may, permanently, lock them out of a potentially new station revenue stream.

The problem for a company like Qualcomm is that it has control over only one part of the business process: the transmit side. Without the willing participation of handset makers (funded by cell phone companies), the receivers will never reach the market. The result is limited availability, high prices, little promotion and no advertising. The bottom line: Few consumers have even heard of mobile TV, and even fewer have tried it.

For broadcasters to successfully deliver mobile TV, several things need to happen. First, a wide selection of compatible phones, dongles and receivers need to be cheaply and widely available. Second, a large number of broadcasters need to participate by transmitting mobile TV. Lastly, everyone involved in the product chain — receiver manufacturers, broadcasters and industry organizations — needs to promote the service.

Without an across-the-board effort, mobile TV could remain one of the industry's best-kept secrets. **BE**

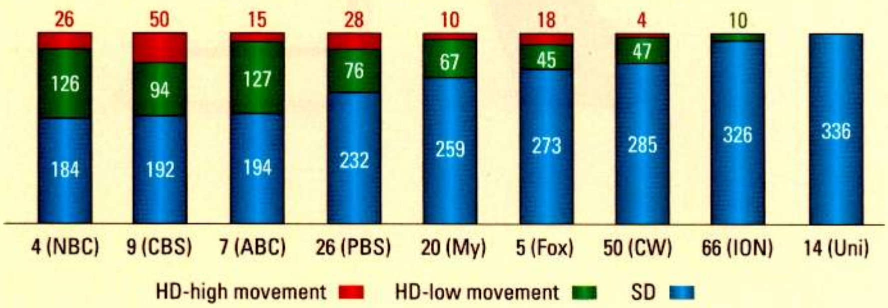
Brad Dick
EDITORIAL DIRECTOR

Send comments to: editor@broadcastengineering.com

HD channel sharing

In a recent article, "Technical paper finds HD channel sharing to be viable in achieving FCC spectrum goals" (available online at *http://ow.ly/2hrPs*), *Broadcast Engineering* contributor Phil Kurz reported on a new FCC report titled "Spectrum analysis: Options for Broadcast Spectrum OBI Technical Paper No. 3." In the report, the FCC suggests that it would be feasible to recoup 120MHz of spectrum if it allowed competing broadcasters to share a single 6MHz channel — even if both channels transmit HDTV signals. Below are two responses we received in response.

Programming breakdown of bit rate intensity of nine stations in the Washington, D.C., market
Number of 30-minute blocks in one week (336 blocks)



Dear editor:

Once again, if it theoretically works on paper within the Beltway, it will automatically and magically work theoretically everywhere else in the world.

What if the two hypothetical stations sharing one channel both ran HD NFL football games at the same time? Worse, what about two HD NHL hockey games at the same time? Don't even mention NASCAR! The stations have no control over game schedules in these examples, but there is little doubt either game is going to look like the wonderful new viewing experience the FCC and other organizations over-promised at the start of the (expensive) conversion to ATSC and abandonment of NTSC, and viewer acceptance of picture degradation will be decidedly unpleasant.

MPEG-4 television sets coming online in some timely manner? Get real. I spent $1500 on an HDTV set one year ago, and the damned thing won't see the dumpster for many years unless it dies a premature and ignominious death. Nope, MPEG-2 will be around for a long, long time.

Maybe some new government-supported MPEG-4/MPEG-2 "converter box" program will cause this magic consumer conversion to evolve more quickly? Don't bet on it.

Internet-delivered real-time delivery pushes MPEG-4 forward? That use of bandwidth is even less efficient than OTA, the place from which 20 more OTA television channels will be stolen and then repurposed to a redundant and far more inefficient function. If the unspoken but long-term goal is to kill OTA once and for all, this will be a big step forward.

Glad I'm retired

Dear editor:

This "technical" paper from the FCC is one of the biggest loads of baloney I have ever read regarding ATSC. To believe two HD channels can co-exist in one existing ATSC MPEG-2 6MHz channel is simply dead wrong. Just the way it's referenced, like this is some brilliant, new technical accomplishment, is more baloney.

From day one of ATSC, broadcasters were able to put as many HD channels up as they wanted; it's completely within ATSC standards and always has been. Fortunately, broadcasters were professional enough to realize there was only so much bandwidth in 6MHz, and two HD channels simply could not exist without one or both being severely compromised for HD image quality.

The proof of this is the massive failure of ABC's attempt to do just that with LiveWell HD. Regardless of ABC's attempt to throttle bandwidth for LiveWell HD, uniform viewer rejection of what ABC HD looked like was the result. The only market where LiveWell HD was accepted well was WTVG in Toledo, OH, where it was downconverted to 480i 16:9.

Further, the only idea with merit mentioned in this "technical" paper is to use MPEG-4, which would require all new digital TV tuners to receive the new MPEG-4 data stream. That's the only way two HD channels can properly be broadcast in the same bandwidth in ATSC. Unfortunately, this paper is not a technical paper. It's bandwidth grab propaganda with the sole purpose of supporting the FCC position of voluntary return of existing ATSC frequencies by local broadcasters, regardless of the real-world consequences.

Ken Holsgrove

Phil Kurz responds:

Thanks for the comments. I encourage you and anyone else in the industry with an interest to express these concerns to the FCC.

As commissioner Robert McDowell told a gathering of the Virginia Association of Broadcasters on June 25: "In addition, the broadband team staffers released a 'technical paper' that puts more flesh on the framework of their proposal. I encourage you to read it and give us your perspectives on the ideas in it."

One of the reasons for doing this article is to give busy broadcasters and others who may not have time or motivation to read and digest the lengthy OBI Technical Paper No. 3 an idea of what it says, perhaps motivate them to read the document and contact the commission with their thoughts.

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The compression question

A move to MPEG-4/AVC/H.264 could cut bit rates.

ARE OLAFSEN

Digital television transmission depends upon highly efficient codecs for its financial viability. Bandwidth is a significant cost, and making the best use of that bandwidth is critical.

For most broadcasters, the foundation is MPEG-2, a compression scheme developed specifically for broadcasting around 15 years ago. The significance of this is that it was designed around the processing power that could economically be put into an encoder in the mid-1990s. If we accept Moore's Law — the density of components on silicon doubles every 18 months — then processors today have 2^{10} more components for the same size. In approximate terms, they are 1000 times more powerful.

The increase in processing power does not mean we can achieve ever lower bit rates for a given compression standard; there is a distinct limit beyond which the codec losses are beyond recoverable quality. We would probably agree that anything much below 2Mb/s for MPEG-2 SD will produce unacceptable artifacts. For MPEG-2 HD, the current recommendation from the European Broadcasting Union is that 10Mb/s is the cutoff point.

The solution was a new codec designed to achieve comparable video and audio quality at half the bit rate of MPEG-2. We now know this as MPEG-4 Part 10 (AVC) or, to telecoms people, the ITU-T standard H.264. While this standard was published in 2003 — still a long time ago in terms of processor development — it was a forward-thinking standard with a number of optional tools that manufacturers could choose to add as the hardware became available.

These additional tools include the ability to use multiple reference pictures, up to 16 frames or 32 fields, and multiple motion vectors to improve the predictive capabilities of long-GOP sequences. There are also major developments in entropy coding, which use (processor-hungry) statistical analysis to predict data and picture detail based on the probability of that data appearing.

All of this, together with high processing power, means that the target of a 50 percent reduction in bit rate can be comfortably achieved by AVC. Does this mean, therefore, that all channels will migrate to MPEG-4?

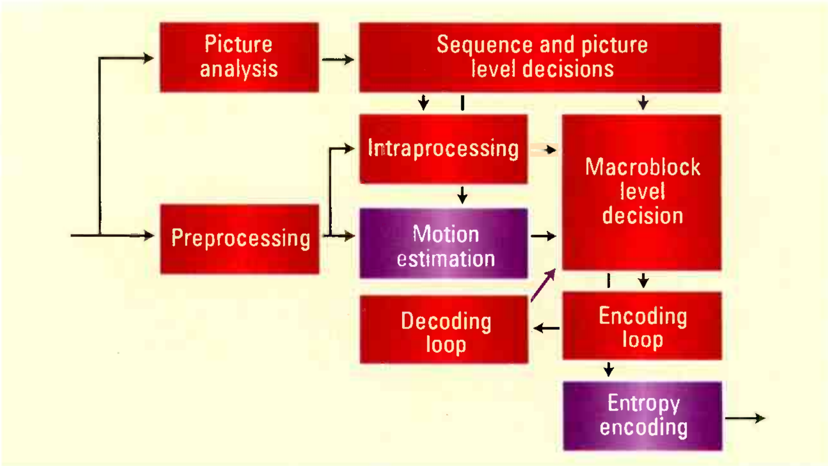
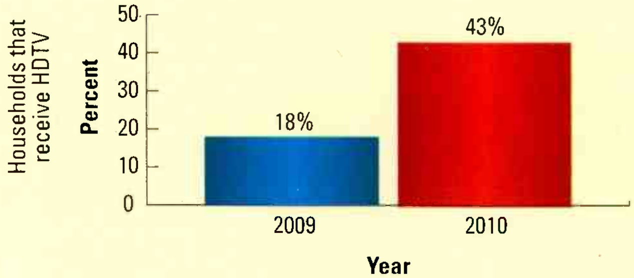


Figure 1. Processing power has increased by about 1000 times since MPEG-4 was developed. This additional power enables new AVC encoders to provide superior imagery while reducing required bandwidth.

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

HDTV households increase significantly

Forty-three percent of households now receive HDTV, compared with 18 percent in 2009.



Source: Nielsen www.nielsen.com

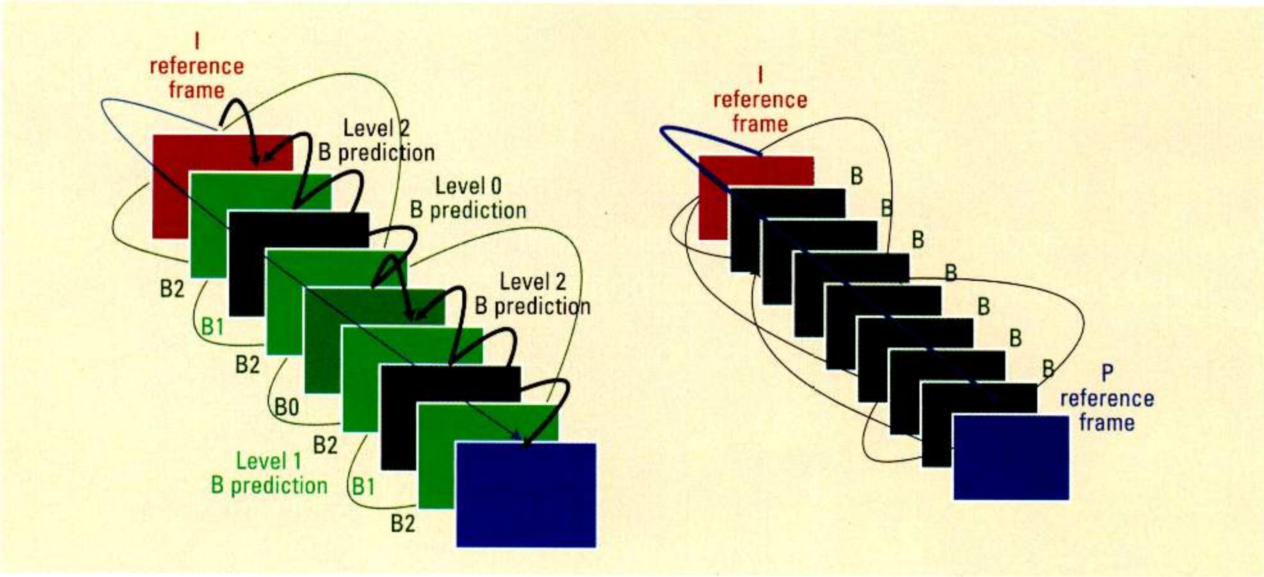


Figure 2. One encoding option for AVC developers is the ability to use multiple references (frames or fields) and multiple vectors to improve predictive capabilities.

Or, by bringing the same processing power to bear and achieving the maximum possible compression efficiency, does MPEG-2 continue to make commercial sense even if it takes twice the bandwidth?

It is certainly true that, given the processing boost, improved motion estimation and picture level decisions have sliced another 15 percent or so off the bit rate requirement for MPEG-2 without prejudicing its compatibility with decoder designs that could be 15 years old. There are about 27,000 channels on-air around the world at present according to research by Merrill Lynch, and of these, about 7 percent are HD. Over the next five years, the number of HD channels will more than double, but that will still leave SD channels — overwhelmingly transmitted using MPEG-2 — outnumbering HD by 15 to 1.

One future plan would be to move all transmissions to MPEG-4, but that can only happen when all the MPEG-2 SD-only set-top boxes in the field are replaced with MPEG-4 compatible devices. DIRECTV in the United States is already seeing two-thirds of its new subscribers select an HD (MPEG-4) STB, and Sky in the UK has gone further by only offering its HD box to new subscribers.

There is a huge leap from migration to a wholesale replacement of millions of STBs at perhaps $100 each. Smaller service providers certainly could use and new operators will certainly want to use MPEG-4. The digital terrestrial service in Norway, for example, only uses MPEG-4, and the country's national broadcaster NRK has just announced that all of its channels will be HD by early 2011.

A more pragmatic decision for most will be to maintain a mix of MPEG-2 and MPEG-4 but invest in the latest technology to ensure the best compression efficiency and use statistical multiplexers, which can mix both codecs in the same transport stream to ensure that capacity is not wasted. As an example, imagine a satellite operator offering 100 channels of MPEG-2 SD and 12 channels of MPEG-4 HD using previous generation encoders and multiplexers. It would require three transponders for HD and 11 for SD.

By replacing the headend with the latest generation, high-processing power technology codecs, the operator could eliminate one transponder for the HD services and (at least) two for the SD services, without reducing the quality of service provided to viewers nor requiring any changes to consumer premises equipment. The return on investment calculation is straightforward: eliminate the cost of three transponders versus the capital cost of new headend hardware. An operator could release those transponders or introduce new channels, or a combination of both.

For the future, with the prospect of mobile television, 1080p, stereoscopic 3-D and maybe even ultra-high definition, the distribution platform will need to be even more flexible. The network abstraction layer in MPEG-4, added in November 2007, introduces scalable video coding. This allows a single high-resolution service to be transmitted with lower resolution versions to be derived from it, again with the aim of increasing the options available to audiences without adding to the bit budget.

With the continuing growth in the number of channels, it seems likely that a shortage of bandwidth will be a limiting factor on all platforms: terrestrial, satellite and online IP connectivity. Making the most of that bandwidth through the use of new codec technology will be central to meeting audience expectations and remaining competitive. BE

Are Olafsen is the director of satellite headend solutions for Thomson Grass Valley.

STELA passed

The Satellite Television Extension and Localism Act will allow more households to receive distant signals.

BY HARRY C. MARTIN

The long-delayed extension of the law covering direct broadcast satellite retransmission of television stations became effective at the end of May. While being negotiated, the Satellite Television Extension and Localism Act of 2010 (STELA) was seen as a possible vehicle for several major changes in the relationships between television stations and satellite carriers and other multichannel video program distributors such as cable and telecom services. But STELA delivers few sweeping changes, although certain television stations may find that the new law works some changes in their particular markets.

Changes for unserved households

STELA's primary purpose was to reauthorize the Satellite Home Viewer Extension and Reauthorization Act of 2004 (SHVERA), which allowed satellite operators to make use of a compulsory copyright license to transmit distant television signals to households that are "unserved," i.e., households that cannot receive a good quality over-the-air signal from the local affiliate of a particular network. SHVERA's authorization technically expired Dec. 31, 2009, although it was extended on a stop-gap basis while STELA was finalized.

STELA extends the compulsory copyright license another five years, to Dec. 31, 2014. In the process, however, it also made changes to the definition of unserved households and otherwise made it easier for the satellite companies to import distant television signals into many markets.

One such change concerns the type of antenna used by the households in question. Under SHVERA, a household was classified as "unserved" only if it could not receive a local network signal through the use of a conventional, stationary, outdoor rooftop receiving antenna. STELA, however, provides that a household may be considered unserved if it cannot receive a signal using *any* antenna. Thus, if a household cannot receive a signal through an indoor antenna, it would not be required to mount a rooftop antenna before being eligible to receive a distant network signal.

STELA also gives households seeking to receive distant signals a choice in the method used to determine the adequacy of a local signal. And it provides that over-the-air service from stations located outside the market will no longer count in considering whether a station is unserved. These changes in the law are likely to increase the number of households able to receive distant signals.

STELA provides that a household may be considered unserved if it cannot receive a signal using *any* antenna.

On the other hand, STELA limits the availability of distant signals in circumstances where the satellite provider offers a "local-into-local" package that includes the affiliate of the network at issue. Unserved households lawfully receiving distant signals prior to STELA's enactment are generally grandfathered.

Digital broadcasting

STELA makes several changes recognizing the switch to digital broadcasting and the increase of "multicast" channels. In addition to technical changes addressing the differences between analog and digital signals, it extends protection from duplicating distant signals to multicast channels affiliated with television networks. Additionally, the new law requires satellite carriers, by 2011, to offer subscribers the HD signals of public broadcasting stations in local markets where the carrier provides other local stations in HD. BE

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

Send questions and comments to: harry.martin@penton.com

Dateline

- Noncommercial TV stations in Alaska, Hawaii, Oregon, the Pacific Islands and Washington must file their biennial ownership reports by Oct. 1.
- By Oct. 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: Alaska, Florida, Hawaii, Iowa, Missouri, Oregon, the Pacific Islands, Puerto Rico, the Virgin Islands and Washington.
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MPEG-4 AVC

MPEG-4 scalability affords a way to provide different picture quality levels to different devices.

BY ALDO CUGNINI

With the growing interest in repurposing video to multiple media and diverse means of display, including mobile TV systems, it is useful to consider how MPEG-4 scalability affords a way to provide different picture quality levels to different devices.

Scalable coding is an efficient way to offer different levels of performance in a compression system — all simultaneously and compatibly. MPEG-4 Part 10 (AVC/H.264) offers various levels of scalability so that simpler receivers only need to decode those elements needed for a particular level of performance. Scalability provides a way to support different native resolutions, different temporal rates or even different encoding parameters. It also provides a method for more efficient bandwidth use when it is desirable to transmit multiple programs of different quality, without having to encode each program separately as a complete bit stream (the simulcast scenario).

A layered approach

With scalability, the program is coded into different layers, and all layers are transmitted in a bit stream. The simplest decoder will only decode one service (the base layer) and form pictures at that associated quality level while ignoring the higher layers. A more sophisticated decoder will decode multiple services (base and enhancement layers) and use the additional information to produce a higher-quality program. Note that different devices have different display resolutions, and the computational horsepower — and associated power consumption — will vary as well. Scalability thus allows broadcasters to support devices that have very low power consumption, when a lower display resolution is used, while enabling higher performance (e.g., with larger displays) on devices that are capable of higher power consumption.In a scalable codec, each layer is coded using the standard MPEG-4 AVC tools, and additional SVC tools can be used to increase the coding efficiency. (See Figure 1.)

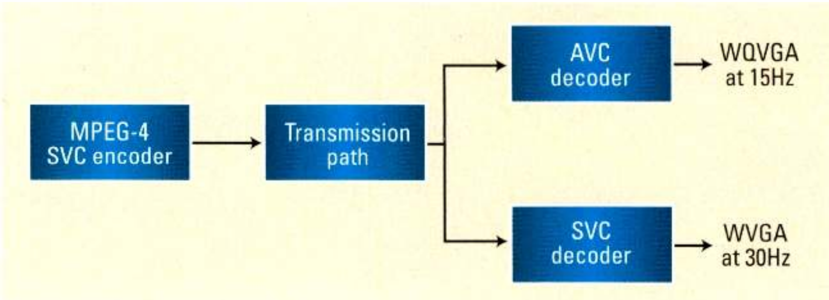


Figure 1. Scalable encoding allows for different levels of performance in a single multiplex.

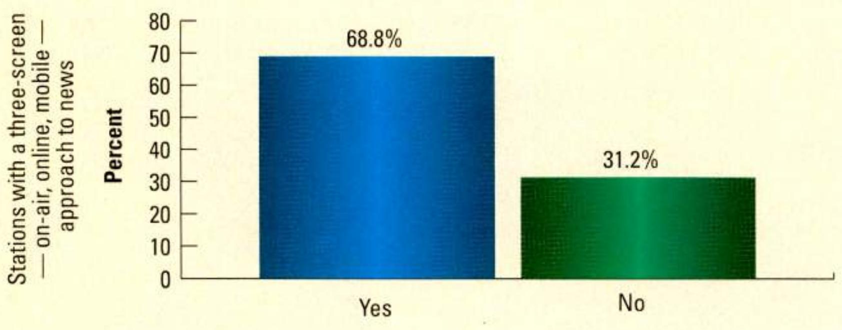
MPEG-4 AVC is used with ATSC Mobile and DVB-H, and both transmission systems support scalable video coding (SVC). AVC and SVC streams can be transcoded into one another, with no loss of coding quality when certain parts of the process follow certain rules. Also, when converting from SVC to AVC, a "rewriting" process can be used that is significantly less complex than a full transcoding of the SVC bit stream. This can be useful, for example, when repurposing content to other broadcast, storage or distribution means.

FRAME GRAB

A look at tomorrow's technology

More stations have a three-screen approach to news

About two-thirds of TV stations provide news on-air, online and on mobile devices.



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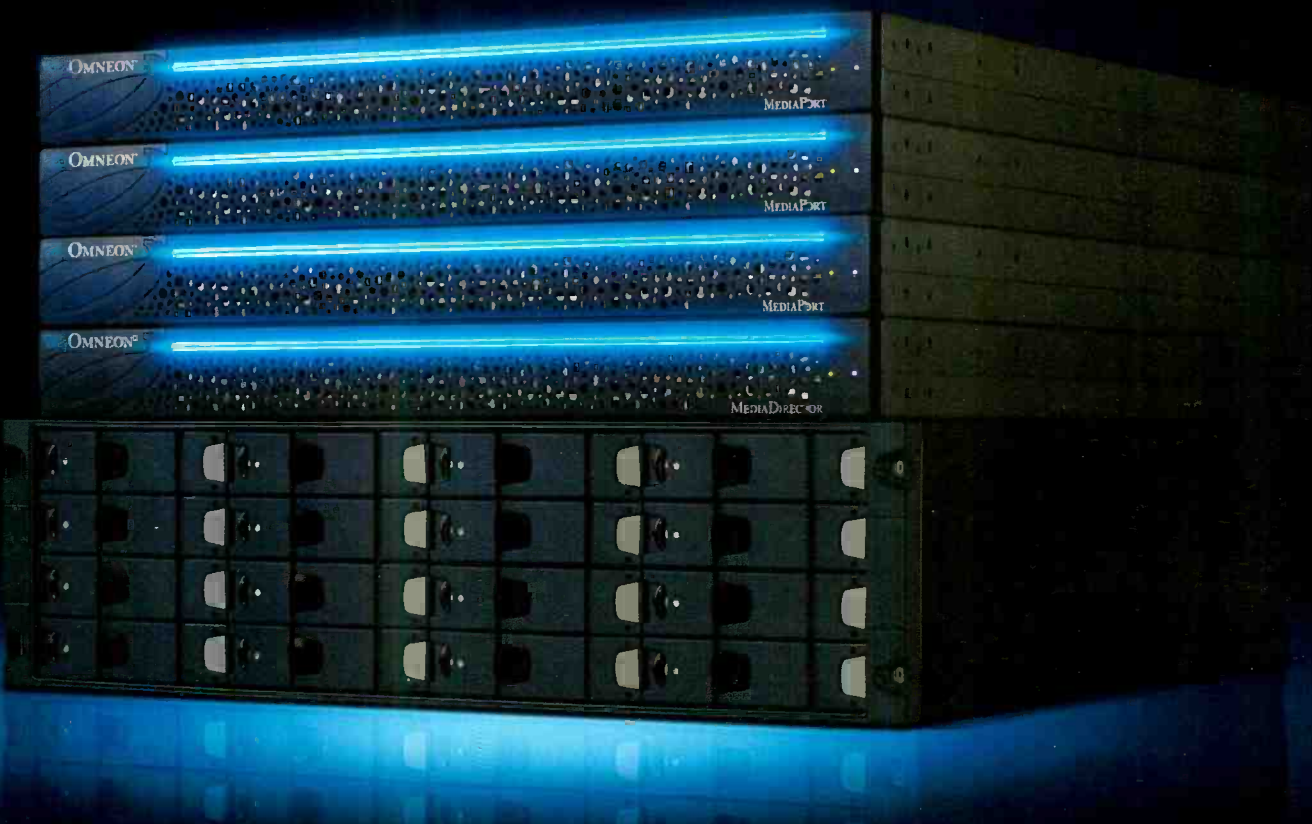

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Scalability can be more efficient than simulcast because the bit rate needed for the scalable signal can be less than a simulcast of both the low- and high-quality signals. The addition of the enhancement service must provide a noticeable improvement, and this means that there must be a significant quality difference between the two services.

Repurposing

A key issue in repurposing and scalability is the conversion of video from one resolution to another. In television production, video source images are generally captured in one of the 1080i, 720p, 576i or 480i formats, i.e., at 1920 x 1080, 1280 x 720, 720 x 576 or 720 x 480. To repurpose this video to different display devices, the resolution must be rescaled; when targeting small displays on mobile or handheld devices, various rescalings are possible. For ATSC M/H, a nominal resolution of 416 x 240 (WQVGA) is specified. For DVB-H, a typical video service of MPEG-4/AVC level 1.2 uses a resolution of 288 x 352 (CIF).

As a working example, let's look at the various resolutions afforded by the ATSC M/H standard. When starting with 1920 x 1080 interlaced video — and the target is an image of 832 x 480 (WVGA), 624 x 360 (3/4 WVGA, sometimes called nHD) or 416 x 240 resolution — the source image must be cropped to 1872 x 1080 (with a horizontal resolution loss of 2.5 percent) and deinterlaced. The three target resolutions mentioned above result in sampling conversions of 9:4, 3:1 and 9:2, respectively. There is no distortion of the image (i.e., the aspect ratio of 15.6:9 is maintained) because square pixels are used in each case. Similarly, a 1280 x 720 progressive image must be cropped to 1248 x 720 (horizontal resolution loss of 2.5 percent), and then downsampled to a target of 832 x 480, 624 x 360 or 416 x 240. These three sampling conversions amount to 3:2, 2:1 and 3:1, respectively, and again, there is no distortion of the image.

At SD resolutions, however, re-scaling is somewhat more complicated. A 704 x 480 image must be deinterlaced (if necessary) and upsampled to 832 x 480, or downsampled to 624 x 360 or 416 x 240. Because the 704 x 480 format can encode either 4:3 or 16:9 video, and the pixels are not square, the horizontal and vertical resamplings are not necessarily the same, thus there can be distortion of the image. The inherent complication is the choice of rendering 4:3 video as 16:9 with dark bars on the sides (pillarboxed) or stretched horizontally, either linearly or nonlinearly. With this source video, the three sampling conversions amount to 1:1, 4:3 and 2:1, respectively, in the vertical dimension. In the horizontal dimension, however, the resampling amounts to 13:11, 39:44 or 22:13, respectively. Because of hardware bandwidth limitations, it's not practical to do these "awkward" resamplings as exact interpolation-decimation operations, which would require upconversion to extremely high pixel rates — even with multiple integer scalings. In practice, the resamplings are done using filter-assisted approximations (splines), which will result in a certain amount of aliasing that is tolerable at the resolutions in use.

MPEG-4 AVC offers many other tools for efficient coding of video. While MPEG-2 has achieved widespread use, the higher efficiency of MPEG-4 AVC is resulting in a growing number of applications, perhaps eventually replacing the earlier standard altogether. The quest for more bits goes on. BE

Aldo Cugnini is a consultant in the digital television industry.

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System administration

If you're a broadcast engineer turned system administrator for media networks, training is key.

BY BRAD GILMER

If you're an accidental system administrator, it's important to receive training on the operating systems your organization supports. Another key area for education is networking fundamentals.

One of the challenges facing system administrators in the post and broadcast space is that they almost always start out doing other things. In my case, I was the engineer who had a knack for computer-related projects; I became a system administrator by accident.

If you are lucky, your organization will realize that it has grown to the point that it needs someone to devote time each day to system administration tasks. Even if you are not given specific time for system administration tasks, it may help to recognize that simple networking projects here and there have grown to the point that you are now a system administrator.

Get on the learning track

You may have gotten some training on equipment when it was delivered, but I would guess that you have not received any education in system administration. Therefore, training is imperative. First, it's important to get training on the operating systems (OS) you support. The training should be specific to system administration if possible. You should also get training on networking fundamentals. Many community colleges offer excellent network training courses. There are also many online courses, and Cisco operates a certification program too.

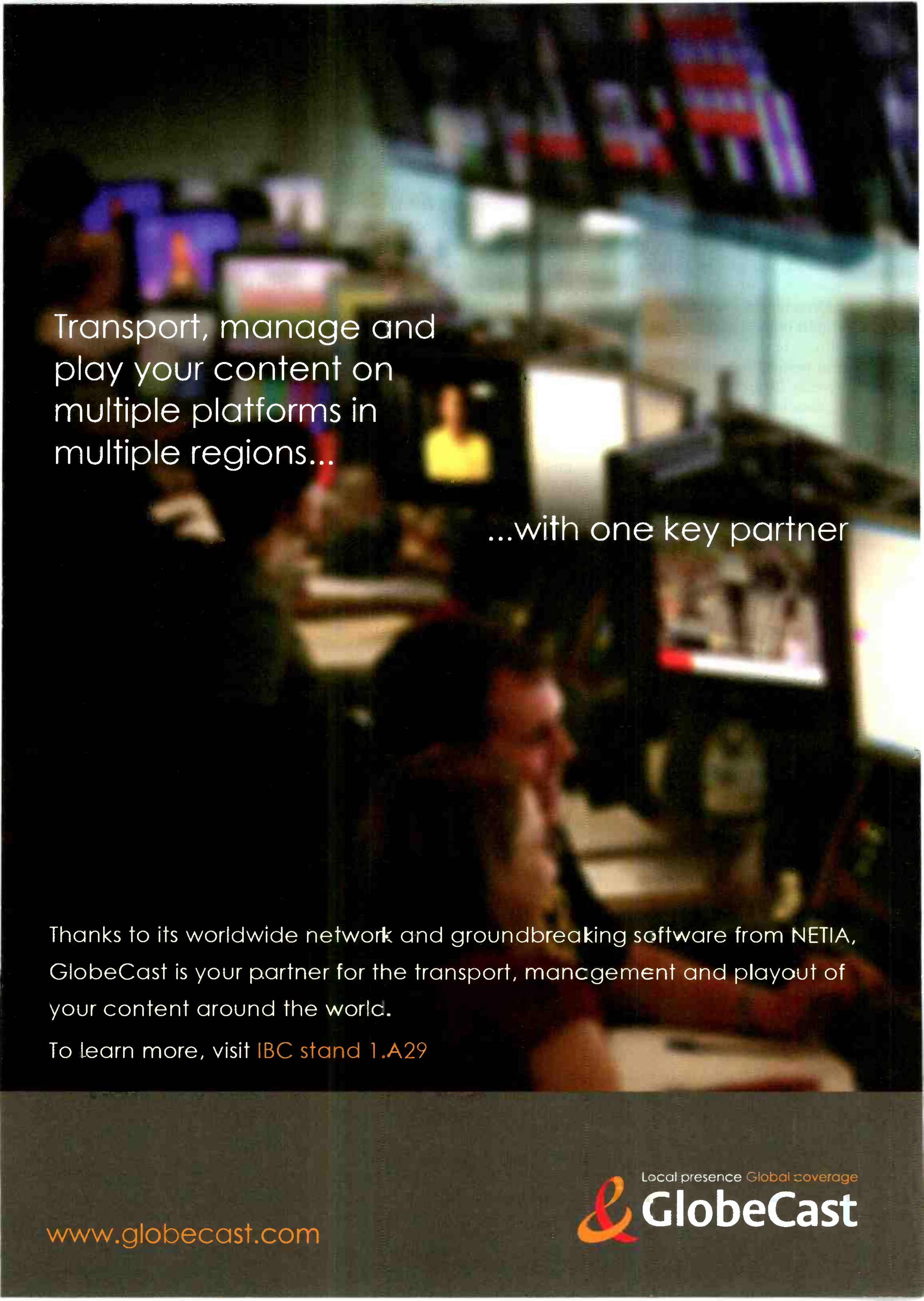
Second, read everything you can get your hands on. There are good books on system administration, usually written with a particular operating system in mind. This is because every operating system has specific administrative commands and maintenance tasks that differ from OS to OS. Because computer books are frequently expensive, I suggest you check Internet auction sites or my favorite bookstore for used technical books — Powell's Books in Portland, OR, (*www.powells.com*).

As you grow into your system administration role, become familiar with some of the characteristics that make media networking so challenging. Here are a few things to note:

- *Large file sizes.* Media files are much larger than typical office application files. I may be stating the obvious, but in a file transfer, the bit rate on the network can be so high for so long that network devices start behaving strangely. Testing was done that showed under some conditions a manufacturer's switch was guaranteed to start dropping packets, even though the network was not fully loaded. Certain common office technologies such as FTP will not handle large media files well, especially over long distances or unreliable networks. This is not because the technologies are broken, but because the designers never assumed that the technology would have to handle such large files.

As a network administrator, it is important to think about how large file sizes will impact typical network topologies and applications. In most cases, people have come up with solutions. For example, there are file transfer acceleration programs available that address the problems associated with moving large files on IP networks.

- *Professional streaming media.* Many office networks now sustain a large amount of streaming video traffic. But in the professional media environment, the stream sizes are significantly larger. A failure to properly account for the bandwidth required to support this functionality may result in a total failure of the network. In professional media facilities, you may have to construct physically separate networks or virtual local area networks (VLANs) to support the streaming transfer of high bit-rate media.
- *Sensitive to bit error.* Typical office applications are unaffected by a single bit error. However, media applications can be sensitive to bit error when transferring large media files. In non-optimized configurations, a two-hour movie transfer might have to be started over if even one bit error occurs on the network. This could be serious if there is not time to restart the transfer.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Additionally, a single bit error occurring on a B-frame of an MPEG-compressed stream may cause a disruption that lasts more than one second. There are ways to avoid these problems, but proper network engineering and the use of appropriate applications are required. You may be called upon in your role as network administrator to address bit error issues. Be aware that regular office applications may be unaffected by the occasional bit error, but that professional applications may be severely disrupted.

- *Sensitive to network outages.* Media companies operate 24/7. Network outages can have serious consequences. Just because a facility has moved to a largely IT-based infrastructure does not mean that the organization is any more accepting of outages. Take this into account as your organization relies more on IT-based infrastructure for its core media functions.
- *Sensitive to security breaches.* Network security is a sensitive topic for media companies. A network administrator working in this environment should be aware that the company and its mission-critical applications may be a target for hackers. Administrators need to pay careful attention to security issues, as a security breach could have grave consequences.
- *Combination of mission-critical and office traffic.* Media facilities always contain a combination of mission-critical traffic and typical office environment traffic. Proper network design ensures that issues on the office network do not affect mission-critical functions. I have seen cases where a single failed network interface card (NIC) took down an entire network segment. If the network had not been segmented, the failure would have brought down the station automation system.

Share what you learn

As you become familiar with administering media networks, share what you learn with others. For some reason, many people in a network administration role are adverse to sharing information. But there are many good reasons to spread the knowledge. When you teach someone else, the knowledge is cemented in your own mind. Also, there may be areas where you need to expand knowledge.

In the process of sharing knowledge, you will educate another person in the organization who can help with administrative tasks. Contrary to what you might think, you will not be working yourself out of a job. In fact, it is likely that your organization will acquire more IT-related media technology as time goes on. By getting someone else up on the learning curve, he will be able to help with the additional work.

Find a mentor

Find a mentor; you will need one. This person does not need to be in the same company. My UNIX mentor lives about 800mi away in another state. I try hard not to bother him with simple questions, but when I really get stuck, I can count on him to roll up his sleeves and help out.

One of the best ways to find a mentor is to regularly read one of the Internet news groups associated with the operating systems you maintain. To search these groups, go to Google, select "groups," and then look under comp.os. You will find groups dedicated to almost every operating system known to man. Make note of someone who regularly contributes to the group and writes in a way that you can understand. The next time you get stuck with a problem, send him a short e-mail asking if he would mind helping out with your problem. In almost every case, these people are extremely eager to share their knowledge and help you out.

Be respectful of end users

They say that absolute power corrupts absolutely. As a system administrator, you may find yourself in a position to hold power over others. Please remember that the creative people in our industry are there for a reason. They are the ones who are making the content that we show on the air. You should use what you know to help them, not stand in their way. Many times these people do not have a technical bent, and they may not understand why doing something is not a good idea, or why it cannot be done immediately. If you must deny someone's request, try to be respectful, and bear in mind that if they were not there, you would not have a job. BE

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

Signs you have become an accidental system administrator

- You have so many username/password combinations on different systems that you cannot remember them all.
- You understand network subnetting, but when you explain it to others, their eyes glaze over.
- You find yourself dreaming about firewall configurations.
- You wish there was someone else who could help with your administration tasks, but you do not have time to train them.
- No one can assign an IP address on the network without consulting you.
- You have more cell phones than can fit on your belt.
- You have had to come into work on two of the last four weekends to deal with a computer problem.
- While the symptoms may seem humorous, they are indicative of a problem. You are in a position of growing responsibility, perhaps without proper planning and support.

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I arrived at the station and found another message from an unhappy viewer. He was complaining about sudden loud audio when we went to commercial and how he had to lunge for his remote. And then again when a new program came on. I'd been getting calls like this daily. Something had to change.

So, I decided to install the demo of the audio level control that Mondae from Ensemble Designs left for me. It was easy, no changing out cards or re-wiring was necessary. I just typed the serial number into my Avenue PC software. I was already using it to control embedders, frame syncs and HD upconverters anyway.

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News storage

The move to HD changes bandwidth and capacity requirements.

BY ANDREW WARMAN

The advent of video servers changed the way we handle spots, news and long-form material. While this might be viewed as a revolutionary step for broadcast, we have since found ourselves in more of an evolutionary process.

The latest stages of this evolution are the growing importance of file-based workflows and the transition from SD to HD, which leads to the need for greater flexibility in media storage. The modern newsroom faces perhaps the most daunting challenges. This includes handling and storing a vast array of media types and their respective compression schemes, data rates and resolutions. This is typified by the ongoing SD-to-HD transition.

The approach taken to storage will not only dictate how much a broadcaster can store in any given storage system and how well it is protected, but also how many devices can be simultaneously serviced. Video newsroom production systems tend to go through pronounced cycles of high and low system use. It's important to design for the high-use times so that users or critical systems are not excluded. The way that storage is implemented as we move from SD to SD/HD workflows can have far-reaching effects.

News departments from local stations to major networks continue to learn about the impact on storage when transitioning to HD and how different storage technologies can be applied to solve their problems. For example, there are a number of scenarios and challenges related to the choice of codec and compression rate and how it affects capacity and bandwidth requirements. This equates to a variety of differences dependent on the broadcaster's technology choices.

The effects of media compression

There is certainly the possibility that storage capacity requirements will jump up dramatically upon transitioning to HD news. However, there are ways around this thanks to incremental video compression improvements that can provide good image quality at similar data rates.

One example is a station that migrates from DVCPRO50 (SD) to AVC-Intra (HD). By choosing AVC-Intra Class 50 (50Mb/s), the data rate for SD equals the data rate for HD. The number of storage hours remains the same, as does the performance of key workflow elements such as file transfer. Meanwhile, users with HD workflows can experience significant gains when switching from DVCPRO HD to AVC-Intra Class 50 — allowing their effective capacity and bandwidth to double.

Consider also the transition from IMX 50 (SD) to XDCAM HD422 (50Mb/s). The data rate is again the same for SD and HD, so the storage capacity and bandwidth are unchanged. Switching from IMX 50 to XDCAM HD (35Mb/s) or XDCAM EX will actually result in an increase in available bandwidth and storage.

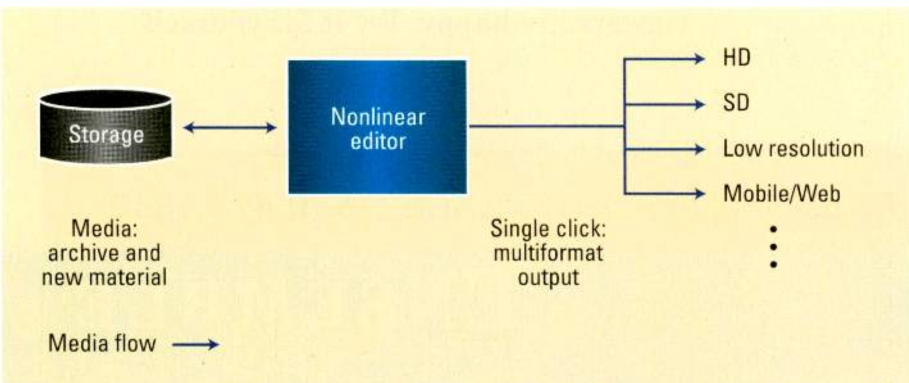

Figure 1. Multiformat output from a single timeline with a single click

Storage bandwidth

The transition to HD can translate to an increase in storage bandwidth requirements. Early adopters who chose DVCPRO HD found that they were significantly affected by the higher demands for bandwidth in HD when compared with SD. Server manufacturers either had to improve bandwidth within the server or introduce a completely different approach to the storage architecture. The latter amounted to the use of additional components and added a layer of complexity to the workflow. Over time, increased processing power within the server and high-capacity storage systems with much improved bandwidth and connectivity helped all but the largest network systems.

Ultimately, the codec and compression scheme selected dictates the bandwidth requirement. As newer compression schemes such as MPEG-4 H.264/AVC take hold, they will use less bandwidth and provide significant storage savings compared with MPEG-2.

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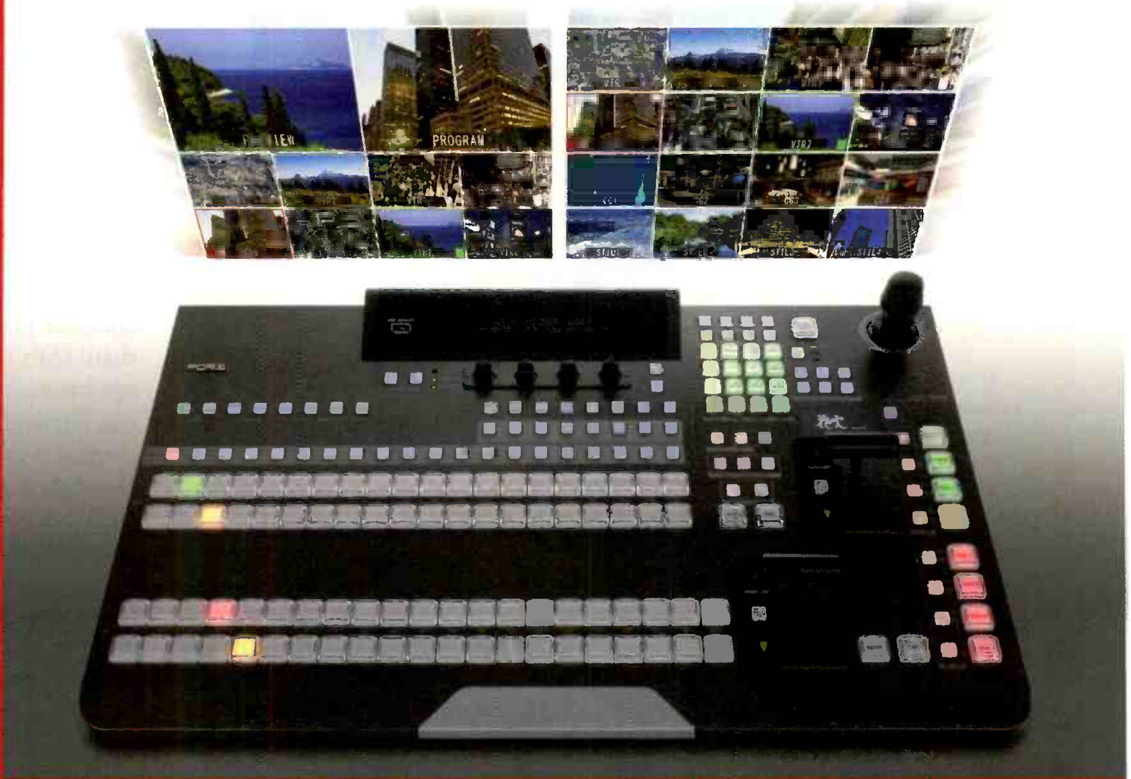

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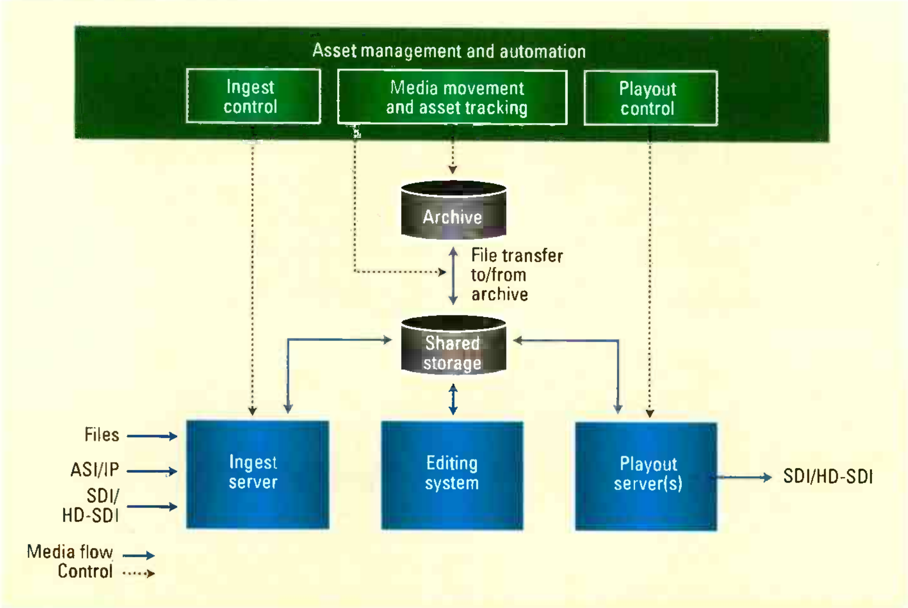


Figure 2. Single high-bandwidth shared storage system for end-to-end news production

Edit-in-place

The edit-in-place process gives editors access to news assets while ingesting. The ability for editors to work with content as it is recording or being transferred in as a file is crucial to quick turnaround and the ability to access news assets. Allowing for alternate sources such as P2, XDCAM or shared folders during this process further enables quick editing progress.

Editors can access the appropriate assets for a story directly from shared or attached storage, cut them into the appropriate sections and turn around the finished product to playout with expediency. It is an ideal example of how co-location of the record, edit and playout elements within a single storage system is pivotal to speedy turnaround.

The rise of citizen journalism has received its share of press, and citizen journalism applications available through devices such as the Apple iPhone successfully employ MPEG-4 compression. Handled correctly, the video assets can be intermingled with other codecs to create finished content for air that aids storytelling.

The many choices for shared or attached media mean that a system can be dealing with a wide range of codecs and associated data rates. A single timeline can be composed of HD content at 100Mb/s or higher and cell phone footage that is less than 1Mb/s. Determining peak usage bandwidth can become challenging, particularly if the high data rate content is used on an occasional basis. (See Figure 1 on page 26.)

Asset management

Newsrooms have an ever-expanding library of video files accessible at a moment's notice to insert into a breaking story. The video library is a strategic asset that must be preserved. The evolution of the library to include high-quality HD formats that can be used for HD or SD broadcast, mobile, webcast or on-demand IPTV is driving many storage upgrades.

News departments are increasingly looking to work with a single defined HD mezzanine format that will serve all their archive needs. (See Figure 2.) While older assets may be legacy SD

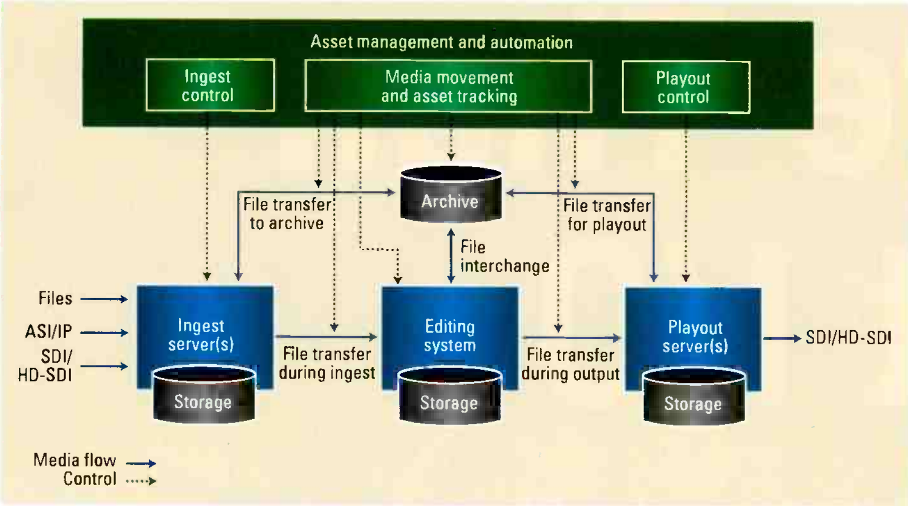


Figure 3. Workflow divided into multiple storage systems under asset management control

or HD formats and wrappers, new material is standardized on high-quality compression and common wrappers such as MXF-OP1a. Overall quality is preserved with the constant need to decode and re-encode for different playout formats (HD to air; downconversion for SD and lower resolutions for mobile).

New architectures allow an editor from one timeline, with a single click, to create a final output and employ the NLE to create HD, SD and low-resolution browser (Web) versions — creating quick turnaround of multiple versions of the same content from the same storage system, all at first-generation quality. This first-generation quality feeds back into the archive as mezzanine quality for finished/aired media.

New pressures and new solutions

There is increased momentum toward file-based transfer of content from the field, even as news editors receive field tapes delivered by hand and take in real-time feeds.

The push to transfer content into the storage system as quickly as possible doesn't differ whether received by tape or within a file. Still, the ability to work with a data stream as opposed to a baseband tape speeds the availability of content. File-based content sources can be imported much faster than real time, and all users have access to the content when the transfer begins.

The ability to move media with greater speed is enabled by prevailing IT technologies, such as 10GigE and PCI-Express. Catch servers and tapeless acquisition formats are able to take advantage of these changes. As a result, system bandwidth needs increase.

The result of these increases in performance is that editing, QC and playback systems can access content much more quickly. To enable systems that support these needs, the single storage system needs to be able to either support an increasing amount of bandwidth, or the components of the system need to be divided, normally by workflow operations, so that each step in the process is sustainable under peak use.

Workflow division across different storage environments that are linked by an overarching media management system not only allows for separation of raw ingest files, work-in-process files ready for final review and transmission-ready content, but also enables bandwidth management. (See Figure 3.) IT-based clustered storage technologies encompass expandable bandwidth architectures and also allow edit-in-place with user rights and associated folder structures. This ensures that certain users and groups can only access specific assets for specific jobs in their areas of responsibility, creating separate, compartmentalized environments for ingest, editing and playout.

This organization benefits the workflow process, and it allows the news organization to scale the system from as low as one-in, one-out plus editing, to hundreds of record and playout ports and editors. Storage capacity and bandwidth for SD and HD news content can strategically be addressed and scaled along the way.

Looking forward

Broadcasters continue to look for lower-cost solutions, and they often turn to IT-based nearline systems. These typically do not tackle all the needs for broadcast servers for shared storage.

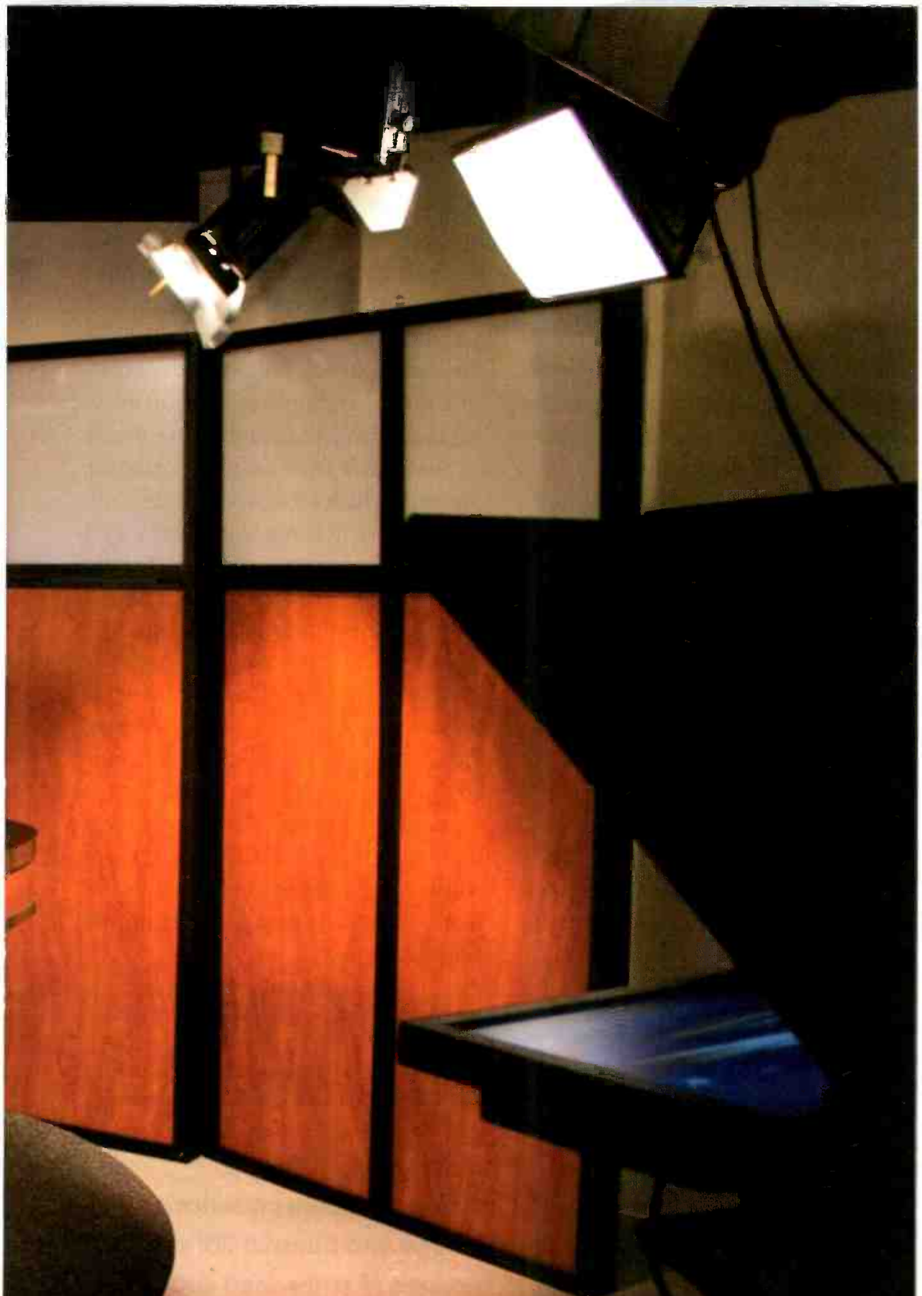
Systems can end up with a less effective nearline store, with ingest and air being cached to smaller dedicated broadcast servers. This can end up being an operational advantage in scenarios such as large network systems, as it naturally segments the workflow and simplifies management of high media volumes.

Modern storage systems are able to accommodate the increasing need for bandwidth and storage capacity, from single, shared-storage systems that deliver on immediate access to all assets to different storage systems that divide the workflow. This gives broadcasters a number of viable options as they continue the move toward full HD systems. **BE**

Andrew Warman is group product marketing manager, servers, at Harris Broadcast Communications.

Newsmax builds next-generation Web TV studio

BY MICHAEL GROTTICELLI



From a new 400sq-ft studio, "Newsmax.TV" presents two 90-second wrap-ups of the daily news that are distributed over the Internet.

Multimedia company Newsmax Media, based in West Palm Beach, FL, started out as a general news website and a monthly newsletter about 11 years ago. Since 2008, the company has been distributing a 100-page magazine (250,000 subscribers), 15 online newsletters and producing a twice-daily Internet newscast called "Newsmax.TV."

Britain's *Financial Times* recently published a business profile of Newsmax Media, stating that the company's website (*www.newsmax.com*) has become "one of the strongest conservative voices online." The article also noted that while U.S. media brands including CNN and *The New York Times* have suffered through a difficult period, Newsmax's business is booming in terms of revenue and traffic.

John Trapp, a veteran video engineer, was originally hired as a graphic designer for the company's main magazine. He later made the transition to running its online video editing and production activities. The company's full-time video staff now consists of Trapp and another editor, Matt Vigil, in addition to two anchors and a producer.

From a new 400sq-ft studio, the small, high-energy video production team produces "Newsmax.TV" and hundreds of hours of Web-based and DVD-distributed programming each year that is seen by close to 1 million viewers per month.

Everything in the department's studio is designed to be as flexible as possible to accommodate a variety of subjects. From here, "Newsmax.TV" presents two 90-second wrap-ups of the daily news that are distributed over the Internet, one in the morning and another in the afternoon. The HD (1080i) shows are produced live to a hard drive or solid-state media card, edited and post produced with graphics added. Segments are then sent on to Brightcove, a content delivery network for outside distribution. Finished files are sent as QuickTime videos. The turnaround happens in a matter of an hour. Often, people are interviewed outside the studio (sometimes in another state), and the footage is sent via FTP to the headquarters for inclusion in the daily newscasts. Newsmax also has relationships with sites such as NewsBusters.com, a comedy site, and *The Washington Times*.

Everything in the department's studio is designed to be as flexible as possible to accommodate a variety of subjects.

The highly versatile main production studio includes three Sony PMW-EX3 solid-state HD camcorders on Manfrotto tripods and dollies with teleprompters. There's a three-sided back wall that includes light panels that can change colors as needed, as well as a curved wall of wood with an LCD screen and a 10ft x 8ft green screen on the opposite

At "Newsmax.TV," all of the switching of cameras is done in post-production using Apple Final Cut Pro HD workstations.

wall. The studio is usually busy, with two to four interviews shot there each day. There's even room for a 12-seat live audience.

At "Newsmax.TV," there is no traditional control room. All of the switching of cameras is done in post production using Apple Final Cut Pro (FCP). Effects are created in Adobe After Effects and Apple Motion. Each camera feed is recorded live to SxS cards, as well as to a hard drive, and then stitched together in FCP. The hard drives are part of a capture station, which feeds camera signals via FireWire connections. This computer station on wheels features a MacBook Pro laptop and a 15in LCD HD monitor to preview camera sources. Two Mac Pro computers are used for editing and redundancy during the recording of a show. Several Blackmagic Design cards enable the company to ingest and stream content live and capture Apple's ProRes 422 Codec, but the cards are not used that often — generally for content destined for DVD.

Storage is a continuing necessity at the studio. Originally, the department started out storing images to a 750GB hard drive connected directly to a single ENG camera. As things progressed — there are now three cameras utilized — the staff has used up about 8TB of storage over the past two years, which is regularly backed up off-site. There's also a 5TB NAS system that stores content for editing and video archiving. Locally, the capture station holds that day's content on the MacBook Pro's 250GB internal hard drive. All content is eventually archived on 400GB data tape cassettes, copies of which are stored off-site.

The two edit stations each have 4TB of RAID-protected storage directly attached, which are used to ingest footage from Blackmagic Design PCI cards. Images for longer programs, such as infomercials, which are shot between newscasts for extra revenue, are captured in Apple ProRes 422 video to maintain image quality.

Audio is captured with Sony lavalier mics in the studio and Sennheiser wireless transmitters and mics in the field and mixed on an Alesis Multimix 8 audio console.

Trapp said the productions his staff creates stand up to anything on traditional TV. In fact, he said some of the "Newsmax.TV" segments are used on commercial television stations in Florida and on national news. **BE**

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

The highly versatile main production studio includes three Sony EX3 solid-state recording HD camcorders on Manfrotto tripods and dollies with teleprompters.

Design team

John Trapp, senior video engineer
Matt Vigil, editor

Technology at work

- Adobe
  - After Effects CS4
  - Creative Suite CS4
- Alesis Multimix 8 audio console
- Ambrosia Software Snapz Pro X
- Apple
  - Final Cut Pro Suite
  - Mac Pro workstations
  - MacBook Pro laptop
  - QuickTime Pro
- Blackmagic Design PCI cards
- Bose Companion 2 series speakers
- FileZilla FTP
- Manfrotto tripods
- NCH Software Switch
- Sennheiser wireless transmitters and mics
- Sony
  - DSR-400 ENG camcorder
  - HVR-A1U camcorder
  - Lavalier microphones
  - PMW-EX3 cameras
- Squared 5 MPEG Streamclip video converter
- Tasty Apps Videobox Flash video download tool
- Telestream Flip4Mac QuickTime plug-in

MPEG monitoring

Implementing tactical and strategic monitoring points can help ensure a problem-free broadcast.

BY RALPH BACHOFEN

What matters most to TV viewers is the ability to watch their choice of shows or movies without a hitch. Monitoring is a critical element of broadcast operations that helps ensure that, apart from the character and quality of programming itself, the viewing experience is a good one.

Most viewers don't care about standards and formats such as MPEG, 8-VSB, IP, RTP and QAM, but these standards are everyday concerns for the broadcaster. The ability to monitor the entire content distribution system is crucial in assuring the integrity and quality of an end-to-end broadcast service. With all the information now incorporated into the DTV stream, monitoring can be a complicated task and one threatened by alarm overload. By establishing tactical and strategic monitoring appropriate to existing service and business models, the broadcaster can maximize uptime and the viewability of their channel lineup, in turn reducing complaints and viewer churn.

Issues that commonly plague DTV services include dropped packets, metadata errors and inconsistencies, PCR jitter, AV buffer under/overflow and underprovisioning, all of which can affect the viewing experience by causing such visible errors as video tiling and lip-sync problems, as well as practical problems, such as the loss of channel-related information or the inability to tune a channel. Because every device across the broadcast chain that touches the MPEG stream has the potential to introduce a problem, isolating and troubleshooting these issues can be very difficult. By implementing proactive monitoring of the MPEG transport layer, the broadcaster can catch issues and reduce or eliminate any negative effect on the viewer experience.

Troubleshooting vs. monitoring

The difference between troubleshooting and monitoring is that the former is a reactive approach, and the latter is a proactive approach. Troubleshooting generally is triggered only after a problem is discovered — often by a subscriber rather than an engineer. After the on-air issue is discovered, the broadcaster performs analysis to uncover and mitigate the root cause. If troubleshooting is the only way in which transport stream errors are addressed, both uptime and the reputation of the broadcaster can suffer.

Proactive monitoring is a preferable approach, and it is essential if the broadcaster is to minimize the time and resources that must be dedicated to resolving transport stream issues. Through 24/7 monitoring of the MPEG transport layer, the broadcaster can continuously test and compare transport streams against preset rules. When a stream violates these rules, the monitoring system can apply a standards-based filter and determine the severity of the problem and its likelihood of affecting the on-screen product. With urgent issues automatically brought to the attention of engineers, the facility is equipped to solve problems before they lead to a visibly compromised signal.

The targeted deployment of monitoring and analysis systems enables engineering staff to narrow the focus of their troubleshooting efforts.

Tactical and strategic monitoring points

Simple cost constraints make it impossible to monitor every point in the broadcast chain, but a combination of strategic and tactical monitoring can help the broadcaster keep an eye on the most critical areas in the most effective manner.

Typical strategic monitoring points include the satellite down/uplink and the transmitter. Monitors fixed at these more remote locations ensure the integrity of incoming and outgoing signals, effectively addressing the two ends of the chain. As a rule, any signal being delivered from an external source should be monitored, and the studio output is also often included among the continuously monitored points. Across the station, tactical monitoring supports a more focused approach to stream monitoring and analysis.

By bringing these two monitoring models together, starting with strategic monitoring and enhancing it with tactical monitoring points, the broadcaster can cost-effectively realize an end-to-end services view as well as get more complete reporting. In addition, the targeted deployment

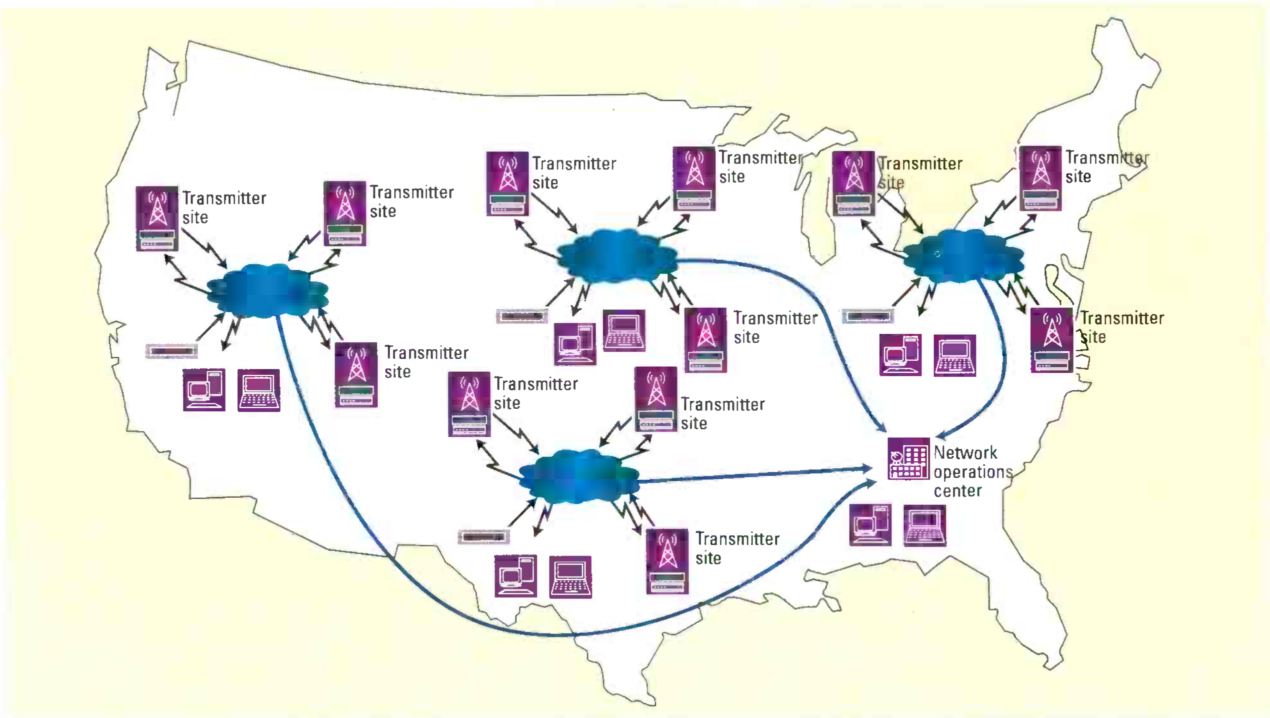


Figure 1. Larger networks and station groups often have centralized architectures with a number of regional hubs for operations, including monitoring.

of monitoring and analysis systems enables engineering staff to narrow the focus of their troubleshooting efforts and use portable systems to test the stream at specific points in the chain. By positioning monitors tactically, broadcasters can isolate actionable impairments quickly and limit subsequent troubleshooting to a reasonable subset of systems.

Monitoring in centralized architectures

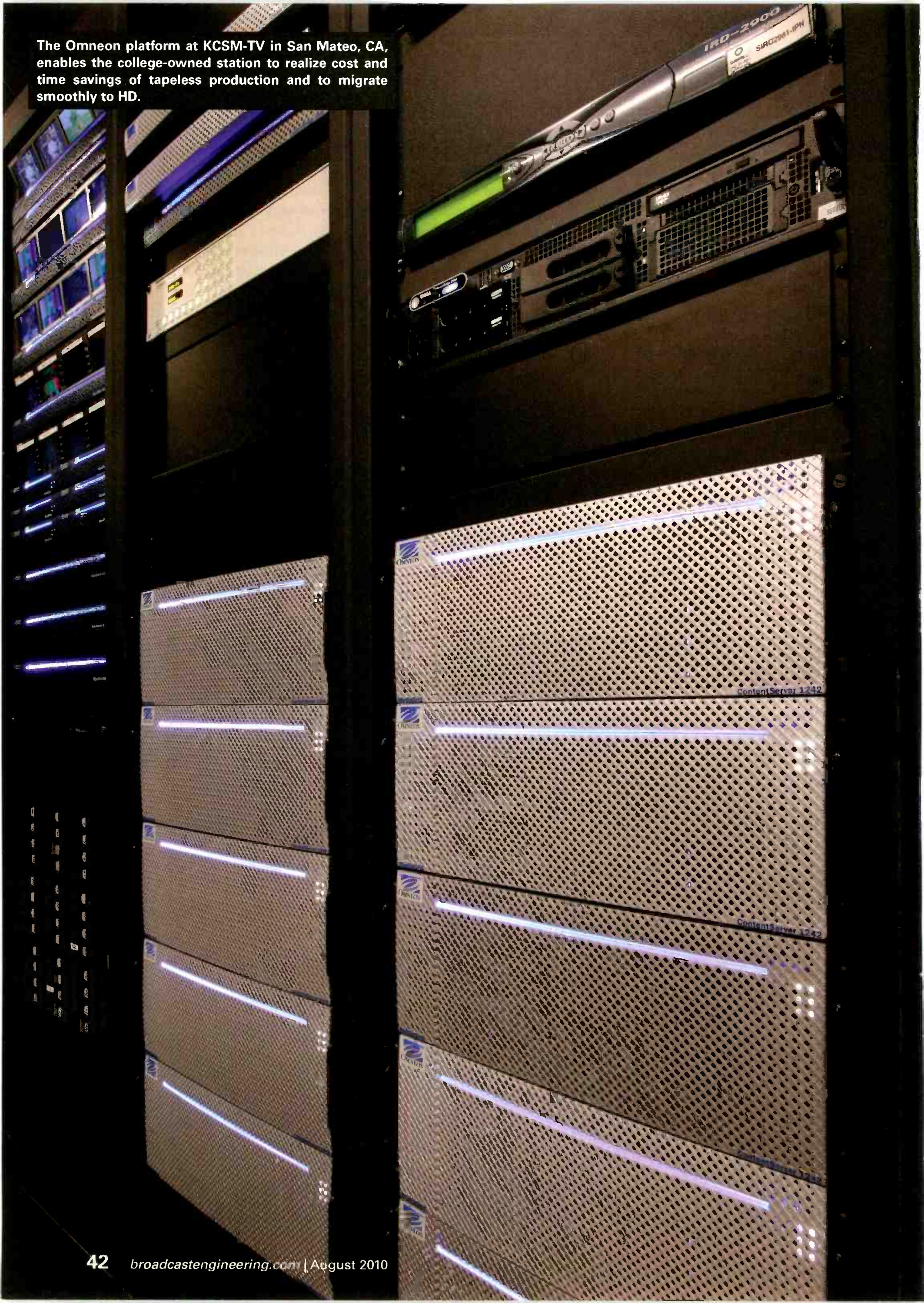
Larger networks and station groups have centralized operations at one or more hubs to reduce their operational and capital expenditures. This model tends to put expertise at the central hub, maintaining fewer resources at the edges. Just as day-to-day broadcast operations benefit from consolidation of resources, so too can the monitoring workflow.

Figure 1 illustrates a monitoring model for large, centralized architectures incorporating a number of regional hubs. Some large groups have centralized all their monitoring, with some transmitter sites being monitored from one office. Others, however, have taken a multistep approach, each with a regional site boasting a resident expert and a connection into the central hub in what's effectively a multihop chain. Depending on how the network has developed, regarding taking on or launching new stations as well as its approach to adopting new technologies, either architecture works equally well.

Real-world monitoring success

The strategic and tactical monitoring model has shown in real-world implementations to provide both broadcasters and cable operators with a valuable tool when resolving stream issues that threaten the quality of the on-air broadcast. In one case, the subscribers of a cable service were seeing glitches in their pictures every seven minutes, whereas those viewers watching the over-the-air broadcast saw nothing irregular. Working together using a combination of strategic and tactical monitoring, the broadcaster and cable operator were able to track down a buffer problem in a conversion device that took seven minutes to overflow, affecting video, audio and, sometimes, nothing at all. These types of issues are commonplace, and with a thoughtful approach to monitoring, their effect on the viewer can be minimized quickly with little waste of time or resources. BE

Ralph Bachofen is vice president of sales and head of marketing at Triveni Digital.



The Omneon platform at KCSM-TV in San Mateo, CA, enables the college-owned station to realize cost and time savings of tapeless production and to migrate smoothly to HD.

Managing storage in file-based workflows

BY PAUL TURNER

A media company's decision to implement a tapeless, file-based workflow marks the start of significant work for the facility's engineering department. A failure to define this undertaking in concrete terms at the outset can make it difficult or impossible for engineering to implement such a system successfully. Any individual workflow incorporates many discrete processes, and the goal of an efficient file-based workflow can only be realized when all these processes have been optimized to the greatest extent possible. To realize a complete file-based workflow, the system designer must include the concepts of centralized storage, clip management and overall process management, considering the impact of each of these on the overall system design and complexity.

Infrastructure considerations

The first step in migrating any facility to a file-based workflow is to replace the physical transport infrastructure, and this can be a relatively straightforward process of replacing the original baseband (and therefore real-time) interconnection of processors with IT-based connectivity schemes. IT-based backbones can offer significantly higher aggregate bandwidth between media processors, and that increase in performance, coupled with transportation of media as compressed data, can lead to an improvement in throughput. But simply replacing an existing video-centric routing scheme with an IT-centric routing scheme in and of itself cannot be classed as creating a file-based workflow.

Problems arise if the individual media processors in the facility (logging systems, NLEs, graphics systems, QC systems, transcoders, audio processors, etc.) still operate as processing "islands," each with its own media storage subsystem that holds the media while the processor acts upon it. Reliance on islands of storage makes it likely that, at any point in time, a broadcast facility is storing a number of copies of any single piece of media — probably in multiple formats. In this case, the broadcaster needs a way to track and manage that material in order to maximize the efficiency of the operation.

A centralized storage system architecture can offer huge benefits to any media enterprise.

A classic example in which islands of storage present a problem might be when a particular processor, such as an NLE, requires 40GB of local storage to hold a piece of media that it needs, but only 30GB are available. Though another NLE in the facility may have spare capacity available, the first system can't use that storage, as it's dedicated to the second NLE, which may or may not be from the same manufacturer. The "island" model would suggest that the broadcaster solve this problem by buying more storage for the first NLE system. A far more cost-effective solution is to share storage across this nonhomogeneous edit environment and allocate it to systems as needed.

To realize a complete file-based workflow, the designer must include the concepts of centralized storage, clip management and overall process management as part of system design. The rest of this article will examine the impact of each of these on the overall system design and complexity.

Centralizing media storage

A centralized storage architecture can offer huge benefits to any media enterprise. As a single entity, a centralized storage system offers significantly reduced management requirements, as storage can be allocated to external devices as needed and modified as the broadcaster's needs change. Such storage systems also can simplify expansion of storage capacity, as any added storage becomes available to any external device rather than being dedicated to a single function. (See Figure 1 on page 44.) When designed with an open file system, the storage system can allow multiple nonhomogeneous systems to access stored material.

For the central storage model to be effective, system design must address a number of additional parameters. First, as a central resource, the storage system cannot simply be taken out of operation for a software update, storage expansion or similar maintenance.

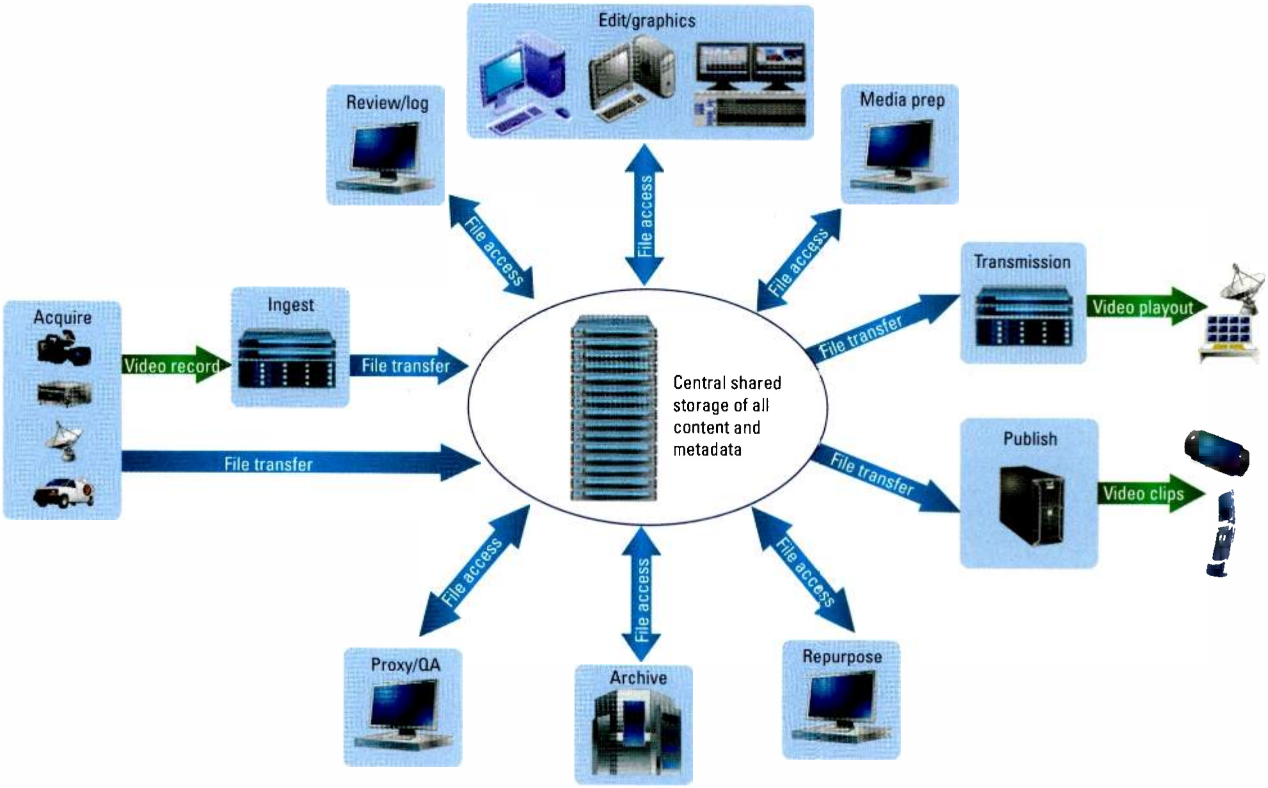


Figure 1. Central shared storage architecture

If this were to happen, the facility would grind to a halt. Storage systems are available that offer "hot" upgrade capabilities, but the system designer should take this real-world issue into consideration and exercise care when choosing a storage product; otherwise, a backup storage infrastructure must be deployed to keep the facility operating while the central storage is offline. This scenario also requires that source material and finished material be migrated to and from the central storage in a managed fashion before and after the downtime occurs.

Another consideration when adopting a centralized storage system is bandwidth scaling capability. As the demand for available storage increases, there is an associated increase in the number of clients who wish to access that storage. In addition, new business requirements often dictate that higher bit rate files be processed by the facility, which means that larger files are being stored on the system itself and that increased bandwidth to the client will be needed to guarantee acceptable operation. Thus, the storage system needs to be able to grow in available bandwidth in a managed manner, or the inevitable result is that the system disintegrates into a number of islands of storage, each providing capacity and bandwidth to a constrained number of clients.

If the storage will be used as a replacement to local storage on NLEs, then experience shows that one of the crucial parameters for the central storage is access latency. Operators are used to a certain level of service in terms of immediacy of content — as provided in the past by their local media storage — and their expectation of a new central storage scheme, regardless of its scale, will be that it consistently provide the same or better performance.

Even in a facility that employs central storage, some islands of storage will likely remain. Ingest and playout servers, for example, may continue to operate on their own storage systems for security purposes. Consequently, the broadcaster still will need a solution for managing and monitoring the multiple copies of content residing on multiple file systems, if only to ensure that a particular clip can be appropriately archived or all copies can be deleted from the system as required.

Managing stored material

A crucial factor in any true file-based workflow is management of the material on the storage systems. There are many levels of content management, and each level offers a balance between ease of implementation (cost) and complexity of solution.

The simplest level of management is file-based, and in this case the user, librarian or administrator simply opens a window into the file system in question and interacts directly with the files. While this is basically a "no cost" option, it has several drawbacks. First, the client can only interact with one file system at a time. Without consolidation for the purposes of management, the broadcaster cannot manage the same files on multiple file systems. Second, users must understand the storage system's folder structure if they want to locate the material in question. Finally, and probably most importantly, users must understand

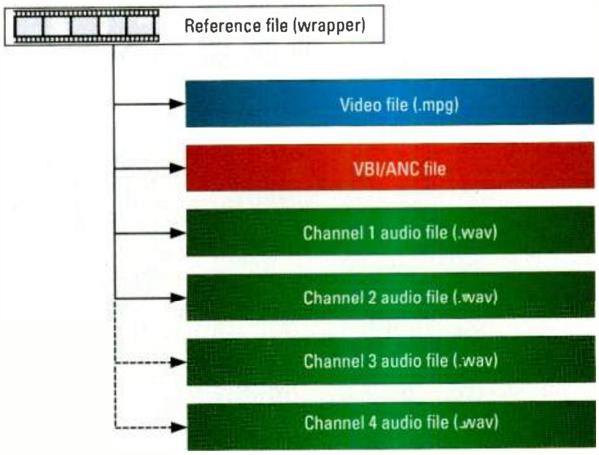


Figure 2. Example of a clip containing multiple essence files

the file structure of a specific media item. Clips are often made up of separate wrapper, video, audio, time code and VBI files. (See Figure 2.) If users don't understand which files belong to particular clips, they run the risk of moving or deleting the wrong files and creating problems that cascade throughout the workflow. A system that relies on user skill is unlikely to bring about significant improvements in workflow efficiency.

A second approach is to manage the storage systems at the clip level. In this case, the management system takes on responsibility for associating all of the files that make up a clip, and the users' interaction occurs at the clip level. Much more intuitive for the user, this model avoids the possibility of human error, such as the wrong essence file being moved or deleted, and allows some process automation to be enacted. Clips can be automatically moved, transcoded, archived or deleted based on a set of business rules. Once certain criteria are achieved (such as approval of an edit by an edit supervisor or completion of a file-based QC stage), an action may be initiated on the clip as a whole, with an associated improvement in overall system throughput.

Finally, the management of stored material may be approached as management of specific "assets." In this context, an asset would be a conglomerate of media, such as all of the copies of a particular clip, regardless of location, format or bit rate. Through this approach, storage management can be extended enterprise-wide. A single search query can turn up all copies of a particular clip, even though those copies may be scattered across multiple file systems in the facility. Implementing this model yields substantive process improvements as the use of a single search operation, rather than individual searches on each file system within the facility, reduces the overhead involved in even the most mundane of management tasks. When coupled with clip-based storage management, the true efficiencies of a file-based workflow can begin to be realized.

Conclusion

A well-thought-out storage infrastructure is fundamental to a successful file-based workflow. Only when all elements are optimized can real workflow benefits be attained by the broadcaster. Solutions exist within the marketplace, and it's up to designers to evaluate each according to key design parameters and determine which storage system is most appropriate for their specific needs. BE

Paul Turner is vice president, broadcast market development, for Omneon.

Virtualized media

BY LUC ANDRIES

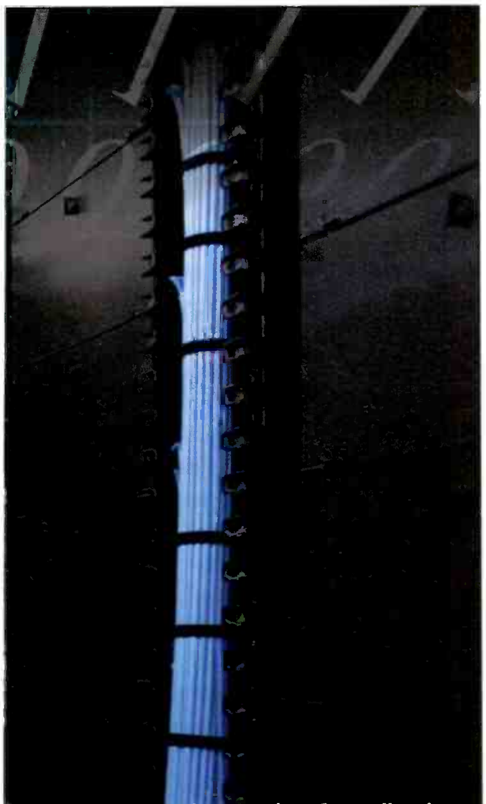
Media companies have embraced IP-based architectures as the standard solution for file-based media production. This evolution enables today's media environments to treat video as ordinary files, independent of the video format. On a broader scale, it has launched a paradigm shift away from closed, proprietary media workflow solutions and toward architectural solutions constructed with generic IT technology.

The innovation of Data Center Bridging (DCB), including the creation of a lossless, high-quality storage networking environment, puts the Ethernet-based network at the center of both storage and client infrastructures. (See the article "Employing Data Center Bridging in media networks" in the January 2010 issue of *Broadcast Engineering*.) However, potential problems remain when porting media applications to a file-based environment.

The high throughput and quality demands of file-based media production require powerful, scalable storage systems with lossless characteristics. At the same time, the peculiar "bursty" characteristics of media file transport to client applications, such as high-resolution post-production editing, pose similar requirements for the IP client network — requirements that only data center networks have historically addressed.

Media production workflows are typically complex and dynamic, integrating many different media services (i.e., ingest, storage, transcoding, etc.). Given the heavy transport demands of media, most media services would benefit from being physically closely coupled with the clustered storage.

data centers



Implementing a virtual media data center shortens transport paths and simplifies data flows compared with other typical file-based media architectures.

Hence, the optimal media workflow architecture should integrate both storage and media services within a storage cluster environment, based on a scalable virtual platform.

Our laboratory tested the viability of a virtualized media data center architecture and found that this approach simplifies data flows, increases workflow efficiency and radically reduces overall workflow execution times.

Media-oriented architecture

The broadcaster back office has evolved to accommodate file-based workflows in a largely unstructured, chaotic way. Often, vendors have created solutions for a particular media service without taking the complete technology picture into account. As a result, most architectures today simply link multiple self-contained media service products — each with its own local storage, servers and network — in a best-effort mode via the central IP network.

This approach creates a great deal of duplication and complexity, to the point that the system is nearly unmanageable. Even more problematic, the architecture becomes heavily dependent upon the central IP network — a network composed of classical IP switches designed for the IT world, which are no match for the bursty nature of media traffic. (See Figure 1.)

Because most media services (and their local storage and servers) reside in the client IP network in a loosely coupled way, the overall infrastructure consists of file-based islands. Most data traffic is launched by the media asset management (MAM) application or the media applications themselves, independent of each other and unaware of the underlying architecture. Effectively, traditional sequential tape-based workflows have been replaced by almost identical sequential file-based workflows. This leads to inefficient data flows, as files are exchanged back and forth between islands in an any-to-any traffic pattern, with many duplicated copies. Because of the bursty nature of the traffic, packet loss results in unpredictable transfer delays or

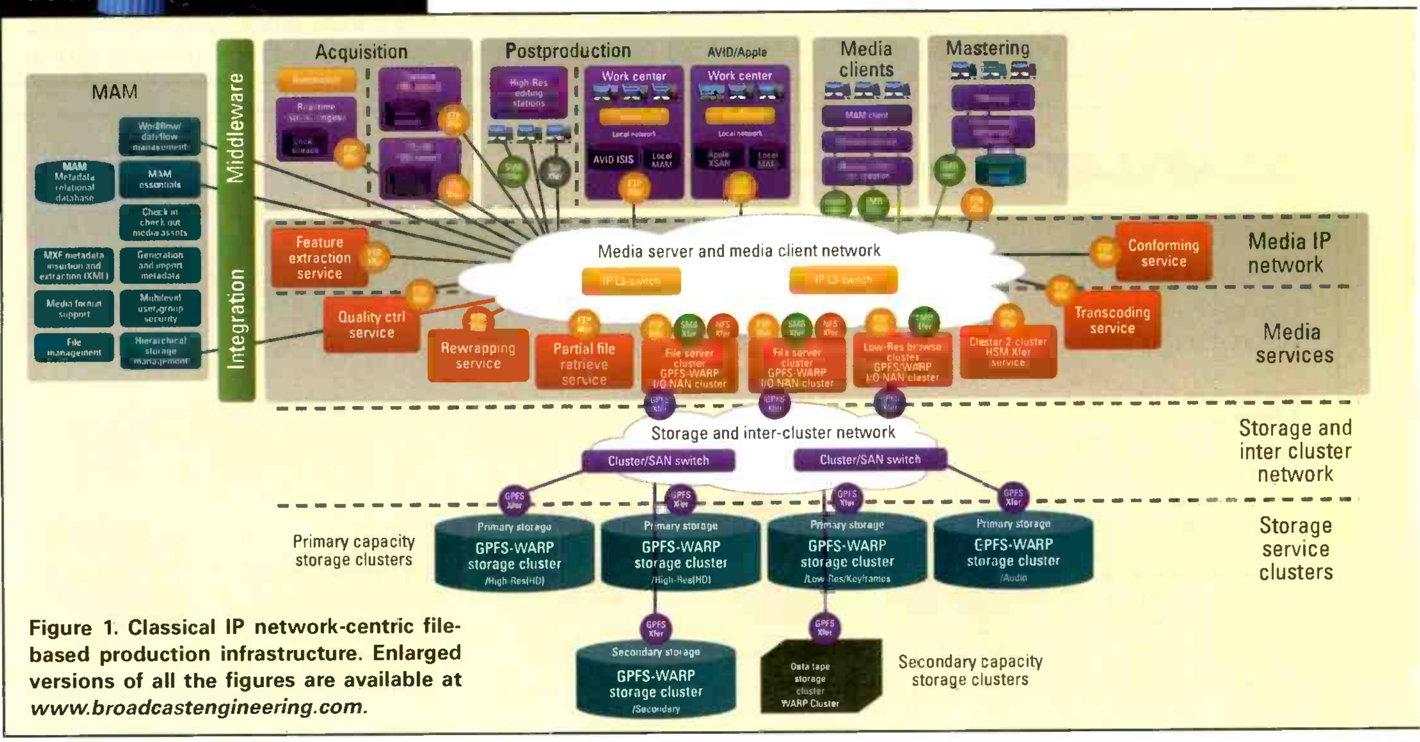


Figure 1. Classical IP network-centric file-based production infrastructure. Enlarged versions of all the figures are available at *www.broadcastengineering.com*.

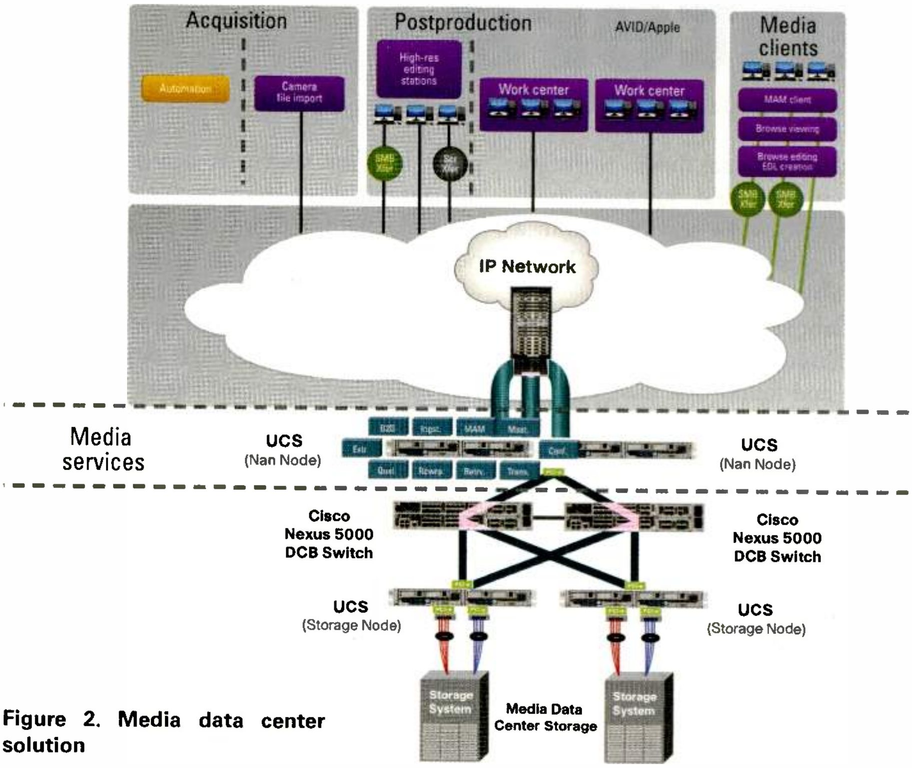


Figure 2. Media data center solution

even transfer loss. Fortunately, we can envision a solution.

The reason many media services use local (and often, proprietary) storage is that they require processing power close to that of a storage service. The straightforward answer then is to unify local server and storage platforms for all services into a centralized platform — a virtualized media data center. Assuming such a platform meets several core requirements (guaranteed throughput, linear scalability, high reliability, support for multiple operating systems, flexibility and efficiency through service virtualization, etc.), it can create a much simpler, more efficient architecture. (See Figure 2.)

In this scenario, almost all media services run on the processing nodes of the virtualized media data center cluster and use the cluster's uniform central storage. This scalable clustered system now replaces the IP network as the basic platform for interconnecting media services.

Virtual media data center

To test the viability of this approach, we created a media data center architecture using a DCB-based Workhorse Application Raw Power (WARP) media storage cluster employing IBM's General Parallel File System (GPFS), the Cisco Nexus 5000 DCB switch and Cisco's Unified Computing System (UCS-C) servers. (See Figure 3.) As demonstrated in our previous tests, a DCB cluster with Priority Flow Control (PFC) implemented can sustain 100-percent efficiency and ideal scalability in file-based media environments. (See the article "Building IP-centric media data centers" in the March 2010 issue of *Broadcast Engineering*.)

The DCB cluster enables the physical machines of the processing network-attached cluster (NAN) nodes to run different operating systems (Windows, Linux, etc.) and run multiple media services using different operating systems within the same cluster. However, we can optimize resource utilization of these processing nodes by defining multiple virtual

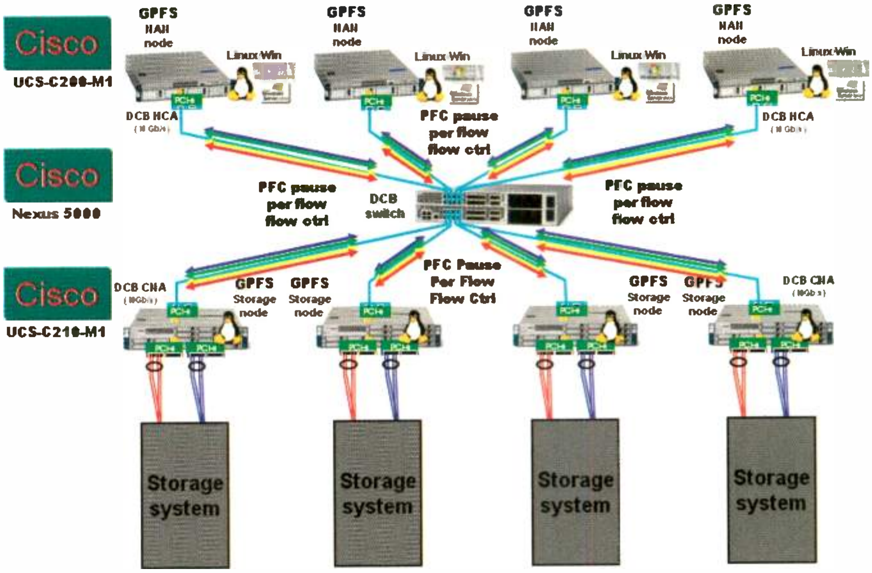


Figure 3. PFC-enabled DCB WARP cluster using Cisco UCS-C servers

machines on the physical NAN nodes. Each virtual machine acts as a GPFS cluster node, meaning that the same physical machine can now run multiple instances of different operating systems, creating a virtualized architecture. (See Figure 4 on page 50.)

Optimizing workflows

Implementing media services on the processing nodes of a virtualized media data center mounted on clustered, lossless central storage can shorten the transport paths and simplify data flows considerably, increasing workflow efficiency and optimizing the client IP network. To demonstrate this, our lab tested a relatively simple workflow example: the ingest of a video clip from a file-based camera into the central storage, and the selection of the material and transport to a high-resolution editing station.

To understand the advantages of the virtualized media data center approach, let's first explore this workflow in a typical file-based production environment. It consists of essentially three steps:

- Material is transferred from the memory card of the camera into central storage.
- A low-resolution proxy is created so that any journalist can view the material and select the relevant clips. The journalist creates an editing decision list (EDL) to mark the selections.
- The system uses the EDL to transport

selected pieces of material to the nonlinear file-based editing suite (in this example, an Avid Media Composer connected to an Avid ISIS platform). There, the journalist works with the editing technician to perform the editing and create the result as a media file or multiple media files.

When we view the data transfers required to execute this workflow in a conventional file-based production architecture, we see that the actual data flow is much more complex than the simple workflow would suggest.

There are several reasons for this. Because the individual work centers in this model operate as islands — and have not been optimized to integrate efficiently into an overall file-based workflow — many extra file transfers are required. (For example, format conversion to proxy video may require fetching the video from the central storage, transporting it over the central IP network to the transcoding work center and transporting the result back again.) Work centers from different vendors may also require multiple copies of the same media with different Material Exchange Format (MXF) file wrappers. Today's file-based production environments also make many duplicate copies of media for redundancy and data protection purposes.

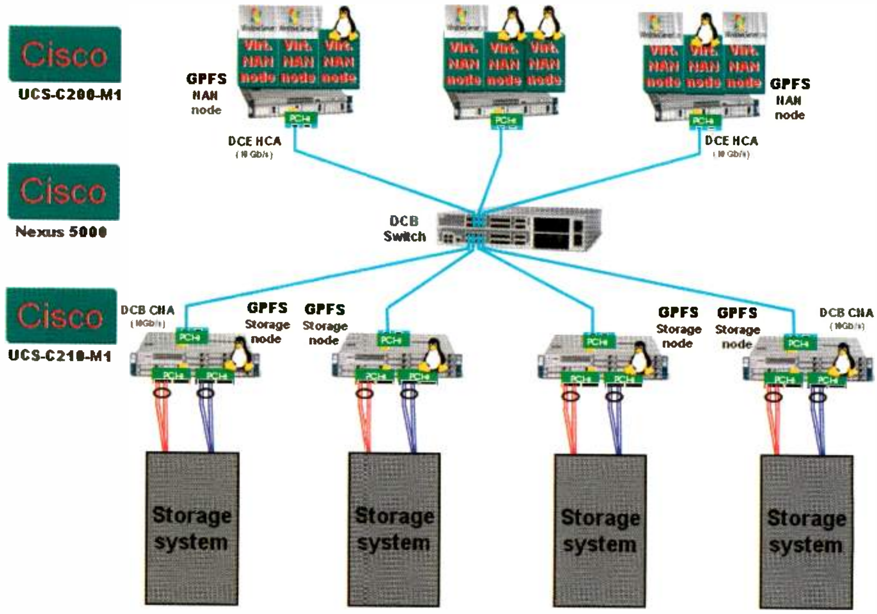


Figure 4. DCB-based WARP cluster with virtual NAN nodes

This seemingly simple workflow results in a data flow that requires 36 file transfers over the storage and IP network. This includes video and audio file transfers between local and central storage for ingest, rewrapping, conforming, transcoding for both high- and low-resolution versions, backup copies of all versions, etc. Even though this network uses 10Gb/s backbone links, packet loss induced by the bursty nature of the media traffic heavily deteriorates the throughput efficiency to as low as 10 percent of the theoretically available link bandwidth. This, together with the large number of consecutive transfers, leads to a long overall execution time.

Now, let's examine this same workflow as implemented on a virtualized media data center platform, using Ardrome MAM system media services.

The setup for this test employed the virtualized media data center described earlier, configured as follows:

- A Windows GPFS NAN node served to ingest video files from the camera.
- The main media services used in this workflow (rewrapping between MXF file formats, transcoding and browse visioning) were implemented on a single physical NAN node configured for up to eight virtual nodes: two Windows virtual machines to perform the rewrapping, five Linux virtual nodes to perform parallel transcoding tasks

and one Linux virtual node to expose the proxy video to the browse viewing client. (The UCS-C server provided more than ample RAM capacity to support all of these virtual nodes.)

- A third NAN node was used to run the respective MXF Linux- and Windows-based server gateways for both Apple Final Cut Pro (FCP) and Avid editing clients accessing the high-resolution media. (Virtual Linux and Windows nodes were implemented side by side on the same physical machine.)

The workflow was implemented as follows, for both Apple FCP and Avid Media Composer material:

- Files were ingested into the clustered central storage. Immediately after arrival, a hard link was created linking the high-resolution media files to the correct directory structure of the respective FCP or Avid project structures. This gave the high-resolution editing clients access to the media without the need to move or copy the files to a different directory.
- The files were read by the rewrapping process running on a virtual Windows node.
- Files were written back to the central cluster directly to the correct final location — the high-resolution directory.
- The files were then read to the transcoding engine on the Linux virtual machine of the same node. (In the future, this could be further optimized by transferring the file directly between the memory of the rewrapping virtual machine and transcoding node, since these virtual nodes reside on the same physical machine). The transcoder generated the low-resolution version and placed it into the low-resolution directory of the central storage. Transcoding ran at 1.2X real time (using DNxHD 120Mb/s HD video).
- The media item was then checked into the MAM system itself.

The virtualized media data center implementation effectively ran the workflow and clearly simplified the resulting data flow.

Ultimately, the test demonstrated the following advantages of this approach:

- Total overall workflow execution time was 80 percent faster than the traditional architecture (with the transcoding speed, not the network, setting the maximum speed).
- Total file transfers were reduced by an order of magnitude.
- The virtualized media data center performed all processing steps, offloading all media traffic from the IP network and making optimal use of available CPU and memory resources.
- No excess, duplicate, or intermediate copies of media files were stored.
- There were no bottlenecks of the 10Gb/s lossless cluster network in any of the workflow steps.
- High-resolution material was made available to editing clients immediately after ingest, with no double wrapping/unwrapping process required.
- No time-consuming transfers of high-resolution material to external storage systems were necessary.

Conclusion

We have demonstrated that implementing media services on a virtualized media data center mounted on clustered central storage shortens transport paths and dramatically simplifies data flows compared with today's common file-based media architectures. This approach can reduce the number of file transfers, reduce IP network traffic by 90 percent or more and improve workflow execution time by 80 percent. For media network architects, the ability to radically reduce dependencies on the client IP network will also make it much easier to design a media-aware client network capable of handling bursty media traffic, and avoid bottlenecks and performance issues. **BE**

Luc Andries is a senior infrastructure architect and storage and network expert with VRT-medialab/IBBT/CandIT-media.

Embrionix's 3Gb/s SDI SFP coaxial modules

The modules enable high-density configurations.

BY RENAUD LAVOIE

Production studios and broadcast infrastructures are in transition to 3Gb/s SDI, creating increasing demand for interfaces that support long cable distance in a wide range of applications. For this reason, SDI fiber-optic interface usage is growing in a variety of implementation. A major trend is to design products around small form-factor pluggable (SFP) modules for easy replacement and modularity, but fiber comes at a higher cost than a coaxial interface.

The EB30CSRT-LN SFP transceiver module is designed to transmit and receive SDI signals up to 2.97Gb/s over 75Ω coaxial cables via DIN 1.0/2.3 connectors.

One of the key challenges that is facing manufacturers, system integrators and users is to choose the right interface for their needs. Manufacturers must first decide: Do I offer fiber or coaxial interfaces? If both are needed, what is the fiber/coax ratio for my product? Which connector will I use to improve the product density? System integrators and users will need to determine: What distance do I need to cover with my SDI signals? Which product provides me a cost-efficient solution for my interface needs? Does the product give me enough flexibility for future needs?

Embrionix provides a solution to answer all of these questions by introducing its 3Gb/s SDI SFP coaxial series. Available with DIN 1.0/2.3 75Ω connectors or with the new HD-BNC, the modules are a direct replacement to existing video optical SFP modules. With their unique connector mechanical configuration, they achieve a matchless density for coaxial interface by supporting ganged and stacked cages.

A new way of thinking about the SDI interface

With the 3Gb/s SDI SFP coaxial, manufacturers and integrators now have the opportunity to design the product interfaces around SFP cages, allowing users to decide what the best configuration is. Don't miss any opportunity because you don't have exactly the right interfaces configuration; just let the user decide if he needs fiber, coaxial SDI interfaces or a mix of both. As a result, equipment will come with a higher scalability and modularity.

The Embrionix SFP modules are compliant with SMPTE return loss requirement, providing a typical margin level of -4dB over the whole bandwidth. This offers manufacturers a way to design cost-effectively by removing SDI interface compliancy issues from their schedules. The SFP innovative construction and parts integration provide immunity from signal interference. Because time-to-market is critical, these new modules help manufacturers reduce their development costs and the risks associated with a new design.

A flexible solution

For system integrators and users, Embrionix's solution gives the flexibility to build an optimized system by mixing electrical and optical video SFP modules. Consequently, with a standard equipment platform, they can design their cabling infrastructure based on the application needs. The SFP modules are also hot-pluggable, so the replacement of the interfaces is possible without affecting the whole system behavior. It also allows hot scalability of the system by providing users the opportunity to customize interfaces and increase the number of signals when they need to.

An intelligent diagnostic feature provides the SFP host a way to monitor the temperature and supply voltage, and take full advantage of the integrated National Semiconductor auto-sleep equalizer for unused inputs. The host can disable an output or detect if an input has lost its signal. The SFP's housing includes a safe latching mechanism to lock it inside the cage.

Embrionix will soon introduce a new green series of SFP coaxial modules with short reach. They will consume less power and will be available at a lower cost than the typical coaxial SDI interface. Many applications require short cable lengths; those new modules will provide a way to fully optimize the whole system architecture. Embrionix SPF modules are fully compatible with existing video optical SFP and are available in different configurations: transceivers, dual receivers and dual transmitters. All SDI formats (SD/HD/3Gb/s) are supported. BE

Renaud Lavoie is president and CEO of Embrionix.

Mosaic DAM

Tata Communications' digital asset management system marries cloud computing with local control.

BY STEVE RUSSELL

We are now several years into the digital revolution in content production. Yet, tape is still a fact of life for many, and for others, the overhead of wrestling with FTP, digital format conversions and file archiving is just as problematic. It is easier to create digital workflow islands, individual departments or companies than to link those islands together. Further, many digital asset management implementations have proved expensive and time-consuming, and some do not deliver at all.

Tata Communications' Mosaic provides a collaborative platform for content production and distribution. (See Figure 1.) It allows users to share content and data securely, delivering workflows that link production sites, improving productivity and reducing the cost of media creation.

The cloud service allows users to deploy asset management services rapidly because much of the difficult integration work has already been done to build the platform. Content companies can pay for what they use, aligning cost with other delivery costs instead of capex, and avoid embarking on the distraction of a challenging IT project.

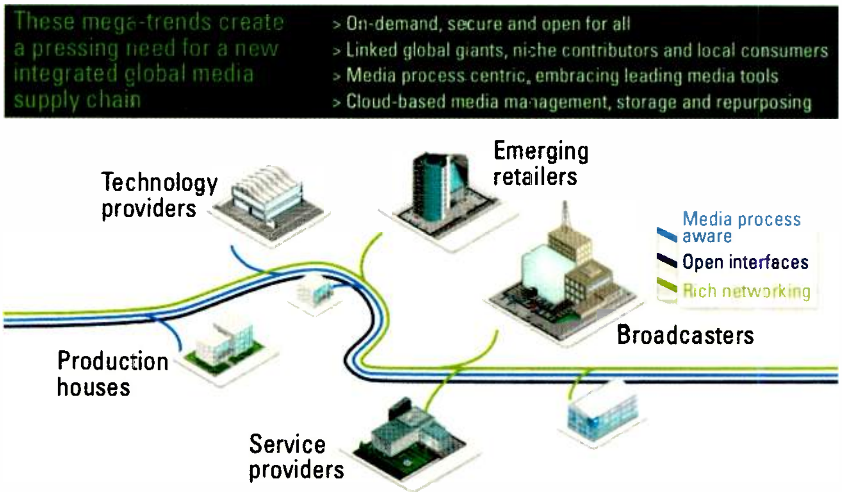


Figure 1. Globalization, device proliferation, digitization and global economics create a need for an integrated global media supply chain.

What powers Mosaic?

The platform is built on a hybrid model that delivers the key benefits of cloud computing — flexible capacity and lower costs due to economies of scale from sharing resources — with control over content. At the system's core is the data — metadata and business process data — that is truly in the cloud. To ensure security and performance, the content itself is held in local data centers that could be on the user's site if desired.

One of the key principles behind the development of Mosaic is open architecture. Media production relies on a plethora of specialist tools and applications. While the platform includes integration with the likes of Avid and Apple Final Cut, there will always be another app on the list. Consequently, it is intended to be straightforward to link new tools.

The platform's foundation is workflow; managing and improving business processes is how the service delivers compelling benefits. However, it is not just a blank canvas. Out-of-the-box, sample workflows, which can be purchased as individual modules, include:

- *Review and Approve* — review work in progress and tag it with time-coded comments.
- *Content Vault* — online media-specialized archiving for primary storage or disaster recovery.
- *Content Monetization* — editing, transcoding and publishing operations.
- *Metadata Enhancement* — creating descriptive metadata to improve searchability. Mosaic facilitates the outsourcing and offshoring of these tasks.
- *Languaging* — subtitling/closed captioning, particularly managing complex processes involving independents and freelancers.

Many companies are already working across multiple sites and countries, and therefore must address security and performance problems. Mosaic allows them to link different departments and technologies used in the media production process and facilitate collaboration through an "outside-in" service design. Both top- and bottom-line metrics are influenced by an organization's ability to manage its partners, suppliers and customers better. With Mosaic, organizations can quickly and securely share, manage and distribute media. BE

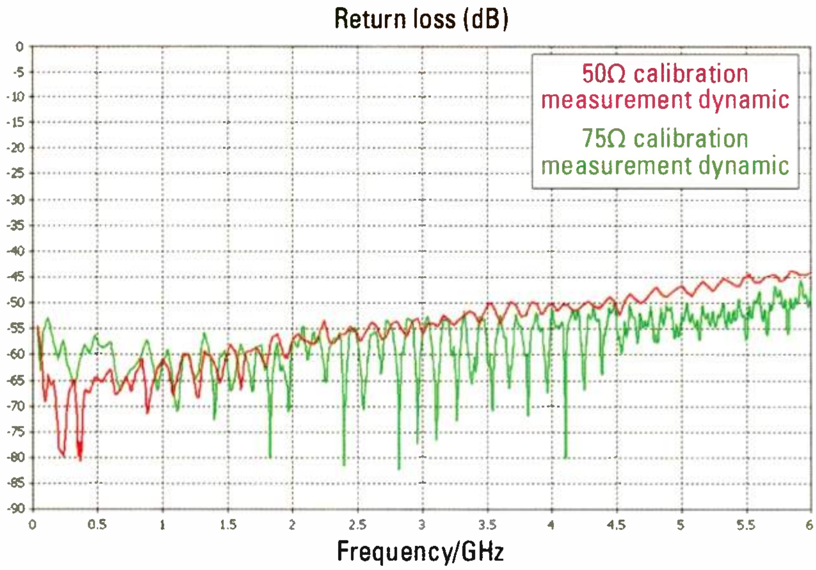
Steve Russell is head of product and commercial for Mosaic at Tata Communications.

Radiall BNC connectors

The company validates a 75Ω calibration test kit up to 6GHz.

BY CHARLES POPULAIRE, MANSOUR MBAYE AND FABIEN BOURGEAS

With the introduction of high-definition video signals operating at data rates up to 1.485Gb/s for 1080i and 2.97Gb/s for 1080p, a new generation of BNC connectors needs to perform at significantly higher frequencies than standard BNCs in broadcast studio and transmission applications. To meet the broadcast industry's stringent HDTV standards such as SMPTE 292M and 424M, Radiall designed a new 75Ω HDTV BNC connector that offers a true 75Ω interface with low VSWR and return loss over a frequency range from 0GHz to 6GHz.



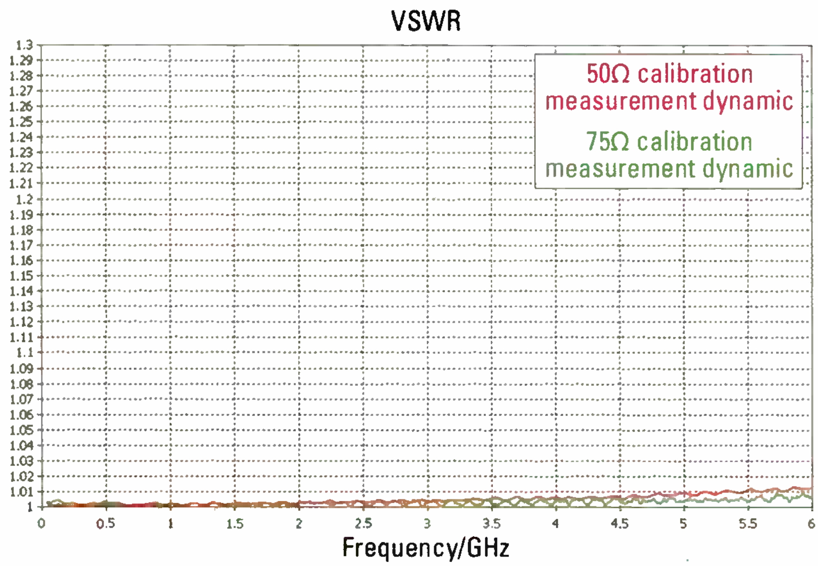


Figure 1. The RF dynamics of the 50Ω and 75Ω kits were quite close.

The new connector design needs to keep a suitably low VSWR to ensure signal integrity. The increased frequency range — from 3GHz to 6GHz — presents concerns over testing the connectors. Commercially available 75Ω calibration kits are specified only to 3GHz. But kits should be usable at higher frequencies once they are validated to such frequencies. This article explains how we validated our existing 75Ω calibration kit for performance to 6GHz. Specifically, we wanted confidence that we could accurately measure VSWR and return loss for the connector.

Calibration kits are essential to adjusting a vector network analyzer (VNA) and other test equipment for accurate measurements. A kit contains precision components of known characteristics to allow the VNA to be accurately calibrated and to remove the effects of adapters and other components from the results. Once calibrated, the VNA reveals valuable information about a component's VSWR, return loss, incident, impedance and other characteristics by evaluating reflected and transmitted energy.

To validate the 75Ω calibration kit at higher frequencies, we compared its performance to that of a 50Ω kit at frequencies up to 6GHz. Since the 50Ω kit is specified up to 18GHz, comparing the VSWR of the two kits allowed us to determine the suitability of using the 75Ω kit to characterize the new connectors at high frequencies.

RF dynamics

We began by evaluating the RF dynamics of the two kits by measuring return loss and VSWR. As shown in

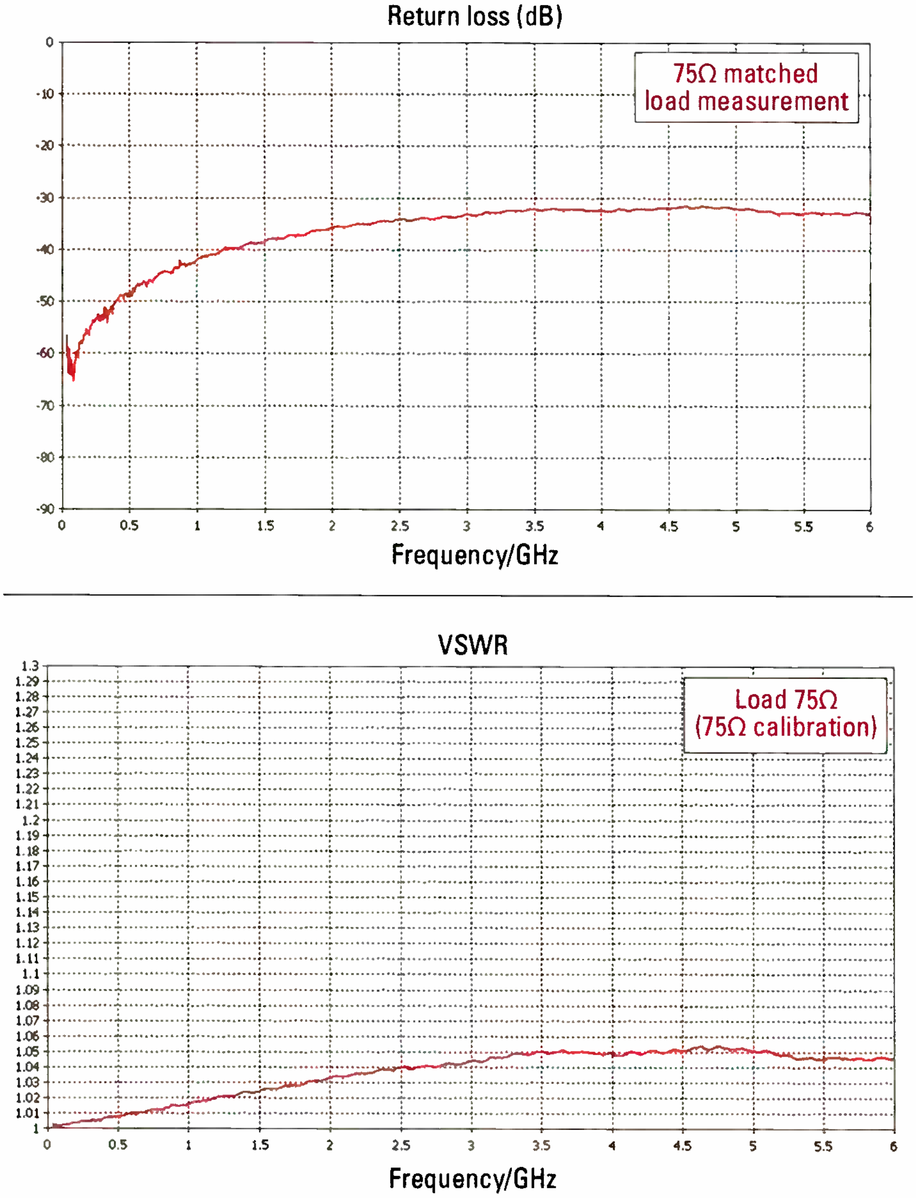


Figure 2. The VSWR measurement of 75Ω matched load with the 75Ω calibration kit is lower than 1.1 in the frequency band of 0GHz to 6GHz.

Figure 1 on page 54, the results were quite close. For our testing needs, a dynamic lower than -50dB between 0GHz to 3GHz and -40dB between 3GHz to 6GHz are acceptable. The dynamic of both the 50Ω and 75Ω calibration are lower than -45dB for return loss and 1.01 for VSWR over the entire 0GHz to 6GHz frequency band. We thus have a high-level correlation in terms of reflection due to the connection component between the VNA port and calibration plane

75Ω matched load

We then used the 75Ω calibration kit to measure a 75Ω matched load. The return loss and VSWR results are shown in Figure 2. The VSWR of the matched load is lower than 1.1 in the frequency band of 0GHz to 6GHz. The results show that the calibration done with 75Ω calibration kit is suitable for measurements up to 6GHz.

50Ω and 75Ω air line

Using the two calibrations, we then measured 50Ω and 75Ω air lines. Since air lines are the "ideal" for measurements by minimizing the effects of a plastic dielectric, we can again correlate the results. Taking into account geometrical dispersion between 50Ω and 75Ω air lines and measurement dispersions, the VSWR of the air lines are lower than 1.1, as shown in Figure 3. We can conclude that the measured VSWRs are comparable. The two lines have a VSWR lower than 1.1 up to 6GHz. Equally important, more than 99.8 percent of the energy passes through the connector with only a low 0.2 percent reflected.

To validate that the 75Ω calibration presents the same reference (calibration) plane as the 50Ω calibration, we measured phase for the two air lines. The maximum phase difference between the two air lines is less than 2 degrees at 6GHz. Both calibration kits measured with the same phase.

As a result of the process described here, we are now able to test and characterize our new BNC connector design through 6GHz. Figure 4 shows that the new design provides considerable headroom in meeting design goals and ensuring the high-performance needed for evolving broadcast applications.

Conclusion

By testing to see the correlation between an 18GHz, 50Ω calibration kit and a 3GHz, 75Ω kit, we were able to validate the performance of the 75Ω kit to 6GHz confidently. The 75Ω kit allows the VNA to be calibrated for testing to 6GHz with accurate results. In fact, the test results will be worst case. Products tested will perform better than the measured values. BE

Charles Populaire is an R&D manager, Mansour Mbaye is an R&D RF technical expert and Fabien Bourgeas is an R&D product designer at Radiall.

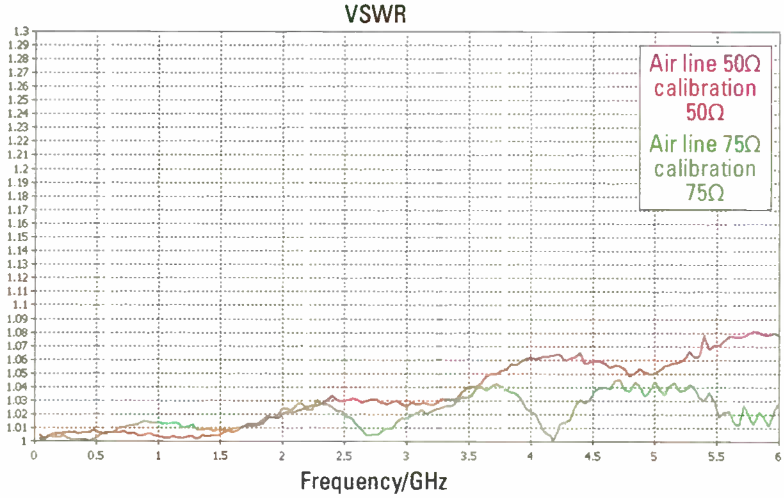


Figure 3. The VSWR of the air lines are lower than 1.1.

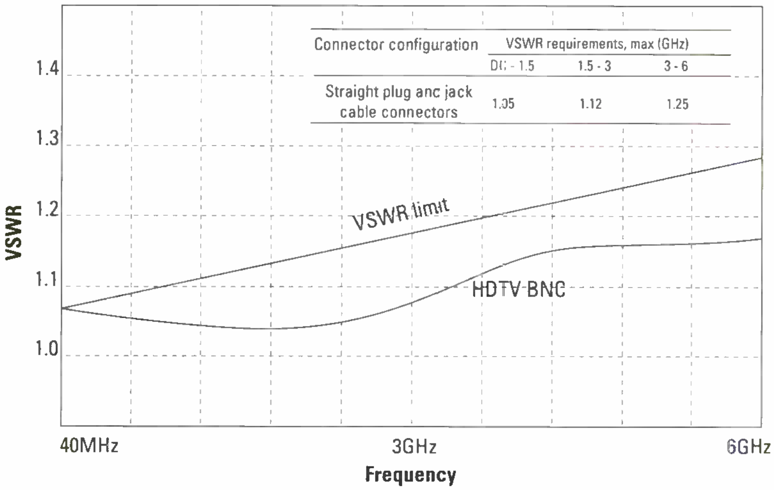


Figure 4. Shown here is the VSWR measurement of the Radiall HDTV BNC connector to 6GHz.

Interra Systems' Baton

Improve workflow efficiency with automated QC throughout the content lifecycle.

BY KRISHNA UPPULURI

The migration of media content from tape-based analog to file-based digital media creates opportunities to improve operational efficiencies across the content lifecycle. Factors contributing to operational efficiencies include human productivity, improvement in content throughput, quality, management and monetization across the content lifecycle. While the efficiency potential of file-based workflows is appealing, there are many hurdles to realize these efficiencies.

Tape-based workflows are driven by a rigid medium. The operational groups transform media content using dedicated devices, physically transfer the content and visually qualify the content hand off. New, emerging file-based workflows are driven by a more flexible medium, and they offer opportunities to speed up the content lifecycle. A file can be modified by software, analyzed by software and transferred via high-speed networks. From creation to playout, file-based content can be transformed and transferred faster. This increased flexibility and speed introduces new challenges to ensure the media content is correct at each phase of the content lifecycle. This need is fulfilled by recent technology advances in automated content verification/QC solutions.

Interra's Baton

Interra Systems' Baton is an automated content verification/QC solution that ensures content readiness of file-based media in terms of standards compliance, AV quality, playout specification compliance and more. As file-based content evolves across various workflows, the content is presented in various formats with its associated metadata, and it requires relevant quality checks at each stage. In each workflow, Baton applies appropriate QC measures to verify the format, quality and playout compliance of the content.

Automated content verification is a common thread across content workflows to verify every transformation and transfer of file-based content. Figure 1 illustrates how this QC solution can affect efficiency across workflows in the content lifecycle. Baton's content verification is objective and independent of any tools that transform the content.

Automated content verification is a common thread across content workflows to verify every transformation and transfer of file-based content.

QC in ingest, post production and playout

The ingest process typically involves getting the content from multiple sources, such as traditional VTRs, tape libraries and live camera feeds, and from different locations. Externally, post-production teams or content providers can upload content to FTP locations; internally, interoffice files are transferred using smart automated

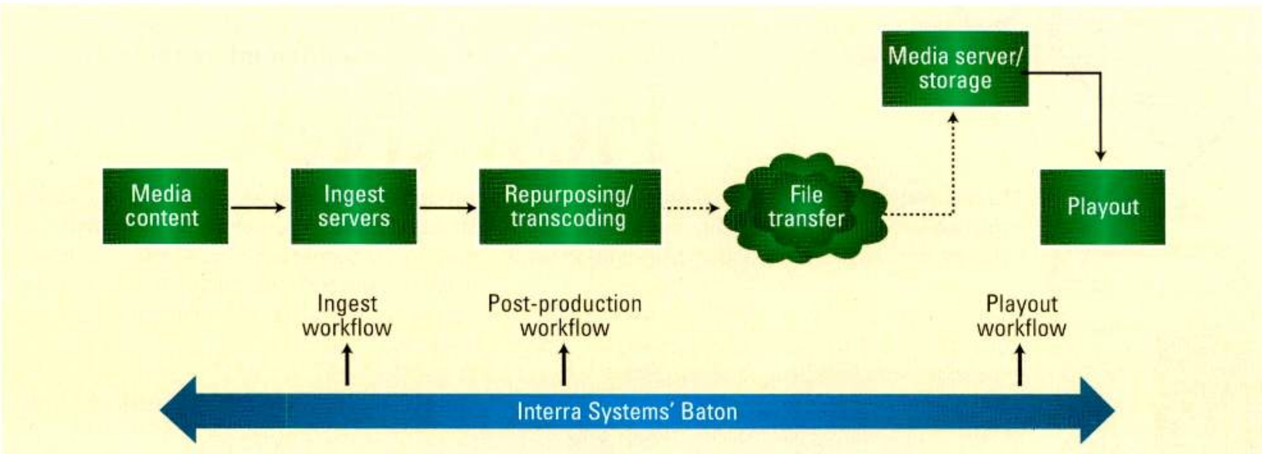


Figure 1. Interra Systems' Baton enables automated content verification/QC in various workflows across all stages of the broadcast production chain.

file transfer utilities. The diversity of content sources, formats and locations make it difficult for content aggregators to ensure quality of the ingested content. A QC solution for this stage in the content lifecycle can speed content acquisition and enhance the supplier throughput to automatically comply with predefined specifications/quality standards. Baton can detect the artifacts at an early stage of the content lifecycle with simultaneous scans of multiple watch folders, FTP locations and shared SAN or NAS storage to optimize the ingest workflow.

The post-production process involves tasks such as content editing using nonlinear editing tools, closed-captioning insertion and stitching the contents into a timeline. The process also involves multiple levels of transcoding, including insertion of multilanguage audio and enforcement of region-specific censorship policies. The post-production process is complex, and it can introduce many compatibility issues, quality issues in video, human errors or even insertion of incorrect audio or video that could remain undetected until playout. The QC solution in this workflow can ensure content quality, thus minimizing long delays and disruption to content monetization. Baton verifies transcoding defects and generates reports with embedded thumbnails, time code and content summary. Reports can be widely used as industry-standard, hand-off protocol between content aggregators and post-production houses. Again, an independent QC is critical to verify that the transcoders have not negatively impacted the content quality.

The playout workflow typically involves compliance with playout specs and integration with automation infrastructure such as video servers and content distribution systems. The QC solution at this stage helps streamline the content workflow to avoid distribution errors. Baton supports various playout specifications and is integrated with video/SAN servers and file-transfer and content distribution systems to ensure content readiness.

Conclusion

File-based workflows can improve operational efficiencies across the content lifecycle. The digitized content in these workflows helps speed the content lifecycle, automate content transformation for enhanced monetization and enable operational cost savings. As content is transformed and transferred faster, automated content verification becomes a critical factor in streamlining and realizing the efficiency potential of file-based workflows. BE

Krishna Uppuluri is VP of marketing for Interra Systems.

File-based workflows

Service-oriented architecture is a game-changing technology.

BY JOHN LUFF

Change is good in life. It is what encourages new thoughts and approaches to many things. The broadcast industry has seen three distinct eras in technology since the advent of broadcast television before the middle of the last century. In the early years, all television was live. The only recordings were kinescopes, which were film recordings shot off special-purpose monitors. However, when it played to air, the film was running in real time. It allowed reruns, but editing was at best cumbersome. Film was used for a lot of origination, which resulted in the importance of film islands for slides, commercials and library content. In the mid-1950s, commercially available electronic recording was first deployed, but it changed little until electronic editing was made practical about a decade later.

Once electronic editing was practical, it became possible to change the dominant workflow that had been developed to support the kinescope/videotape/film content system. Live television was no different, but the ability to process content in a separate electronic workflow was a huge change. It was, however, not simpler. Editing bays had multiple VTRs to allow signals to be mixed freely (audio and video). Interestingly, to cut the cost of post production, an offline technique was developed using proxy copies of the content on lower quality formats, often U-Matic 3/4in. This actually made the workflow even more complex, but akin to film rough-cut approaches.

The most important thing about offline editing was that computer-based approaches quickly were developed. The first editing done with computers was thought of as an offline technique because the computers of the day could not process full-bandwidth content. As a result, multiple compression approaches were used, principally motion JPEG and fractal decomposition. As the capabilities of computers and the quality of compression systems improved, we entered the third era of production — that of fully file-based workflow.

It is critical to recognize that file-based workflow changes everything. How we acquire and process content is now tailored to the workflow in which the finishing of the content is completed. We have largely abandoned the approaches used for 75 years to embrace what I like to think of as virtual content. I say virtual because in a fully file-based workflow, you cannot put your hands on the content the way you could with videotape (digital or analog) or film. Obviously, field acquisition content can be transported on physical media, but we are moving to electronic movement of the files for many workflows. This is not subtle change; it is *revolutionary* and as a result begs that new standards and structures — not built on old technology — need to be deployed.

We stand today with a direction established and technology deployed, which allows adaptation of former workflows that used streams instead of files. In truth, we are still using some crossover techniques that rely on recording bits to physical media, but I am convinced that will disappear in professional applications. We are headed into a much more flexible world where IT technologies replace what I believe is late phase television-specific technology, some of it adapted with hybrid IT interfaces. Consider for a moment the promise of service-oriented architecture (SOA).

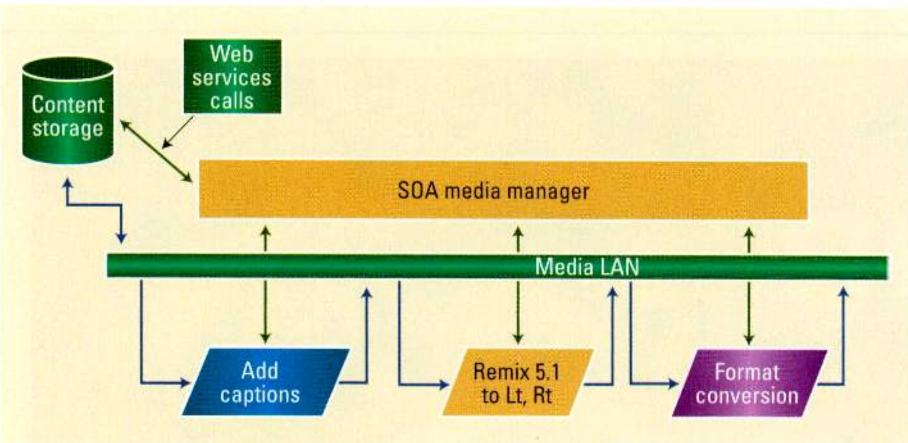


Figure 1. SOA workflow

Service-oriented architecture

SOA employs a middleware layer to build workflow between applications designed to interact with files. (See Figure 1.) Envision a template used to draw lines between processes that might be used in a broadcast plant. For instance, one process might be to add captions, and another might be to remix surround sound to Lt, Rt.

In a stream-based facility, you would move the content between islands in a serial fashion to accomplish both processes. If problems come up, human intervention interrupts the process and looks for a remedy.

In an SOA-based facility, you would build a template that moves the content from one application to the other, with analysis determining when a failure has happened, likely either automatically repairing the content, or notifying a human of the error so a decision can be made. Clearly, this notes that there must be several planes interacting. In the most simplistic case, those are essence, metadata and management. The management plane may be viewed as both monitoring and control, and messaging related to errors and commands.

One might accomplish this processing by linking watch folders in multiple applications without using a middleware application. But if you do so, the design of the workflow must be accomplished by setting up the options manually in each application. You also would likely have to plan monitoring and management plane yourself, programming those to send notifications as appropriate.

But in this era, we have everything needed to design automated workflows with complex analysis and control, with one exception. SOA was not developed for broadcasters, but as an industry, we are exploring how to rebuild a world of wires,

This game-changing technology has had a more disruptive effect than the change to color or the adoption of HD, but it promises tremendous benefits.

patch panels and switchers into one which moves content over networks in a flexible workflow that can be different for every program.

We need a way to send media-specific messaging between applications so that they will be aware of the content, but more importantly that they will act on messages in ways understandable by any media application.

Luckily, the Advanced Media Workflow Association (AMWA) and the EBU have begun a process that hopefully will lead to delivering that "interface." They have jointly established a Task Force on Framework for Interoperable Media Service (FIMS).

In the press release announcing a Request for Technology issued by the FIMS Task Force in April, Brad Gilmer, executive director of AMWA, said, "The professional media industry really needs a standardized, open framework for media services, along with standardized definitions for common processes in the industry. It is our hope that the report and standards created as a result of this process help guide the industry as we work to create more flexible facilities and workflows."

This game-changing technology has had a more disruptive effect than the change to color or the adoption of HD, but it promises tremendous benefits. BE

John Luff is a broadcast technology consultant.

Send questions and comments to: john.luff@penton.com

Evertz — HD2014

High-performance, multipath 1RU video conversion, frame synchronization and decoder platform integrates four independent paths of video processing; all four paths can be fed from four different input signals; each processing path includes full frame sync and up/down/crossconversion capabilities in addition to noise reduction, video proc and video enhancement capabilities; optional MPEG-2 and H.264 flex modules allow the unit to accept ASI input signals and generate decoded baseband video that can then be sent to conversion engines.

877-995-3700; www.evertz.com

Actus Digital — Actus 4

Media management platform provides an agile environment for supporting a wide range of media monitoring, analysis and management capabilities; features multichannel ingest, multiformat conversion engine, analysis automation, media database and broadcast player for content redistribution; available in four distinct packages.

+972 3 769 4737
www.actusdigital.com

Analog Way — Smart MatriX

Scaled matrix offers a 12 x 2 scaled native matrix mode with seamless switching, and the switch between any of the 12 inputs can be in cut or fade and synchronized on the two outputs; can display up to two PIPs on a still background by output, one PIP on a still background with seamless effects or one PIP with title effects on a live background; records eight still logos, including an animated one, and eight full screen frames to nonvolatile memory; integrated audio stereo switcher features 12 inputs (eight analog and four from embedded SDI) and two outputs; video output card provides SD or HD formats in various signals from composite video to HD-SDI.

212-269-1902; www.analogway.com

Band Pro — Ruby 14-24mm T2.8

Zoom lens offers full coverage even for F35 sensor; has a front diameter of 110mm and will accept a 102mm screw-in filter; works on all 35mm PL-mounted cameras; focus direction is reversed to go in the traditional cine direction; features focus travel of 126 degrees.

818-841-9655; www.bandpro.com

Barix — Exstreamer 120

IP audio decoder can serve as the end decode/receive link for high-quality audio streaming and control over point-to-point or multipoint IP networks; acts as a versatile solid-state player for various applications using Barix's Digital Message Repeater application; carries over features from Exstreamer 110 (LCD display, relay closure, channel selection) and adds a MicroSD card slot for extra content protection when playing audio direct from the device.

866-815-0866; www.barix.com

Compix — AutoCast 3.0

Live sports system automates the live CG overlay process and allows real-time data streams from scoreboard controllers to be inserted into predefined templates, enhanced with logos, player preview information and stats pulled from other sources, and be delivered along with video information; system is highly customizable and configurable for various degrees of automation.

949-585-0055; www.compix.tv

Highwinds — Infinite HD

Streaming technology couples Highwinds' global content delivery network with Octoshape Infinite Edge throughput optimization technology; enables HD streams of live and on-demand video, consistent HD quality, global reach and massive scalability regardless of video origin; offers customizable HD viewing experiences and advanced HD features; provides robust, real-time analytics and reporting on all HD streams.

866-872-0357; www.highwinds.com

EditShare — Flow 2.0

Production asset management system offers advanced media management capabilities for post-production and broadcast production workgroups; features edit while capture and bandwidth-controlled, file-based ingest; supports P2, XDCAM, XDCAM HD and AVC-Intra formats for file-based and HD/SD-SDI ingest, multichannel ingest, batch capture and scheduled ingest imports from templates, various scan options, bin and sequence creation, and logger enhancements.

617-782-0479; www.editshare.com

Element Technica — Neutron

Extra-small 3-D rig is designed to mount lightweight 3-D camera packages for stereoscopic video capture from smaller jibs, Steadicams, portable cameras and point-of-view positions; provides 3-D imaging from the smallest form factor with the ability to mount 2/3in or 1/3in imager HD cameras; integrates with standard stereoscopic production controls; changes easily between side-by-side and beam-splitter modes; can be configured into both over/through and under/through beam-splitter modes.

323-641-7327
www.elementtechnica.com

Front Porch Digital — SAMMA v4

Updated suite includes SAMMA Solo, SAMMA Robot, SAMMA Prep and SAMMA Clean; features enhanced versatility, interoperability and functionality for migrating media content from videotape to safe, secure and readily accessible file-based formats; makes is easier to perform high-volume migration of media assets from videotape to digital files and to store, protect, access, retrieve and manipulate them for repurposing later.

303-440-7930; www.fpdigital.com

Harris — CMN-LA

Loudness analyzer incorporates TC Electronic-created radar display, which shows loudness on short-term meters, graphs covering periods from one minute to 24 hours and numeric display of the long-term center of gravity (average loudness) and consistency (loudness range); also available in CMN-41 and CMN-91 models for testing signal integrity across all DTV broadcast signal formats up to 3Gb/s.

800-442-7747
www.broadcast.harris.com

MultiDyne — HD-Multi-Link

New version of the cable solution is designed for the drop-and-repeat, daisy-chain optical distribution of SD-SDI and HD-SDI signals on single-mode fiber; offers full compatibility with SMPTE-compliant HD-SDI products; available in 3GB and 1.5GB versions; features an electro-optical DA that provides a mid-point fiber distribution breakout box for one copper HD-SDI output with a signal quality of up to 3G HD-SDI; provides an HDMI output for local video and audio monitoring; supports audio and data that has been embedded externally and provides for audio de-embedding from the HD-SDI stream for output on HDMI or on separate RCA connectors.

516-671-7278; www.multidyne.com

Technomad — PowerChiton4

Weatherproof amplifier module is IP66-rated and can produce 1600W for 8Ω systems and 1800W for 4Ω systems; available in Ethernet/IP, RF and twisted-pair networking options; includes a broadcast-quality balanced line input for improved sitewide audio, a second input that can be used for local audio or as a secondary audio source, and an internal mixer.

800-464-7757; www.technomad.com

Linear Acoustic — AERO.qc

Audio quality controller allows users to monitor and fix loudness problems automatically in real time; couples ITU-R BS.1770 loudness measurement standard with signal analysis techniques to evaluate content and make adjustments; operator intervention can range from full control of measurement and audio adjustment to highly automated processing that requires little oversight; features full-color, front-panel metering to provide comprehensive real-time loudness indication; options include Dolby E/Digital decoding, AERO-style multiband loudness and dynamic range control, multichannel analog output with speaker EQ, and HD/SD-SDI input and output.

717-735-3611
www.linearacoustic.com

Litepanels — MicroPro Hybrid

Professional LED light combines continuous output and flash feature in a single unit; continuous mode provides luminous, wrap-around, soft output; flash feature produces 400 percent brighter burst; produces 1.5 hours of continuous output from six AA batteries or five to six hours from Li-Ion cells; features integrated dimmer that offers instant 100 percent to zero dimming with minimal color shift; includes filter holder on the face that allows for work with three included color/diffusion gels, and additional filters can be stored on the back of the fixture; designed for mounting on a DV or DSLR camera.

818-752-7009; www.litepanels.com

VMIX — Analytics and Reporting

Comprehensive set of video analytics and reporting tools enables users to track and compare multiple metrics over time in a single graphic or data table view; users can also build highly focused, personalized reports that can be exported and embedded to display dynamic, up-to-the-minute data, and create custom reporting dashboards on company intranets or any website to allow stakeholders and partners to see up-to-date video analytics.

858-792-8649; www.vmix.com

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OConnor — O-Grip

Handgrip features smooth-functioning, single-handle ball joints with a maximum payload capacity of 44lbs; capable of fitting all three standard rod systems (15mm, 19mm studio and 15mm LWS) with single bridge; can be used with all common camera configurations and configured to create double or multijoint handles; each grip is fully adjustable and capable of a half sphere of stepless articulation, or a complete sphere by combining two grips; features a 3/8 stainless steel top screw and 3/8 bottom thread to enable attachment at many points on a camera system.

818-847-8666; www.ocon.com

Petrol Bags — Black Deca

Equipment bag features a plastic exchangeable logo frame and an internal LED lighting system, the lights of which can be replaced and easily installed or removed via an internal zipper; includes shock-resistant, molded AbsorbaPad on the floor of the bag and twin connecting brackets on the bottom of the bag to allow for the quick and easy connection of the Snaplock wheel and trolley system; power is supplied by standard AA batteries.

845-268-0100; www.petrolbags.com

PPC — PPC PRO

Line of connectors and cables is designed to provide flexibility for AV professionals at live events, in the studio and for commercial operations; features compression connectors for XLR, 1/4in mono and 1/4in stereo/balanced connectors and RCA, BNC and F-type connectors for solderless, customized cable lengths; lineup will include new, specially designed cables and installation tools for use with PPC PRO connectors.

315-431-7200; www.ppc-online.com

Boris FX — Boris RED v5

Integrated 3D compositing, titling and effects application upgrade introduces support for 64-bit applications, adds more than 30 filters and provides new user interface and workflow enhancements, including ergonomic panels, a curve editor and a spreadsheet-style key frame editor window; new filters include three-way color grade, noise reduction, pixel fixer, DV fixer, smooth tone, lens blur, LED, prism, scan lines, damaged TV and turbulence.

888-772-6747; www.borisfx.com

Sennheiser — KH4

Self-powered, two-way line array speaker features 12 8in cone drivers for low-mid frequencies and is powered by six power amplifier channels; mid-high frequency section uses five 1.75in voice coil compression drivers that drive 1in by 4in constant directivity wave guides; transducers are driven by an internal DSP module, backed by dedicated remote-control software, which allows control of the speaker from a PC.

860-434-9190; www.sennheiserusa.com

ARG ElectroDesign — Media Combiner software

Software upgrade for Media Combiner range of broadcast network adapters features Zero Jitter technology, which eliminates network jitter and makes it possible to feed DTT SFN transmitter sites and link GSM backhaul circuits over IP networks without external synchronization sources; includes FPGA algorithm that maintains the timing integrity of synchronous and plesio-synchronous signals such as 2Mb/s G.703 and DVB-ASI signals over IP- and packet-based networks, so Media Combiners don't require external reference clocks.

203-376-3372; www.arg.co.uk

Pixled — **F-37L**

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DSLR video production

DSLR technology enhances the storytelling for episodic television.

BY ANTHONY R. GARGANO

In the February 2010 edition of *Broadcast Engineering*, I wrote a column about nontraditional tools for use in broadcast and production applications. One such tool I mentioned was the DSLR with HD video capture capability.

For those program directors and directors of photography who have been experimenting with this form of video capture, the Canon EOS 5D Mark II seems to be the current tool of choice. It offers 1080p video capture and uses a sensor whose size rivals traditional high-resolution

Canon 5D Mark II cameras on RedRock Micro mounts were used to shoot the season finale of "House." Photo courtesy RedRock Micro.

film capture devices. The pixel area for HD video capture of the 5D Mark II's sensor, for example, is equivalent to the formerly used feature film and special effects format VistaVision. As the camera has been seeing wider usage in video production applications, Canon has been quick to respond by expanding its capabilities with additional video features. Most recently, a 25fps mode was added for PAL along with a 24fps (actually 23.976fps) capture mode and the modifying of the 30fps mode to 29.97fps.

At the beginning of this past TV season, a groundbreaking approach was utilized when this camera was used exclusively to shoot the opening sequence for NBC's long-running weekend hit, "Saturday Night Live."

As the TV season progressed, the groundbreaking continued when the Fox network hit show "House" shot its entire season-ending episode exclusively with three 5D Mark II DSLRs. Cinematographer Gale Tattersall, director of photography for "House," described "the incredible look for out-of-focus imagery" that the DSLR can deliver. With oversized sensors and fast, large aperture lenses, DSLRs can deliver extremely shallow depths of field with selective focus. Another unique feature of certain DSLR lenses is the ability to provide pleasing out-of-focus areas. Photographers call this characteristic bokeh. Being visually subjective, good bokeh defies measurement. But like Justice Potter Stewart's famous reference to obscenity, you'll know it when you see it.

The story line for this season's finale of "House" provided the perfect setting to exploit the unique imagery that DSLR video capture can deliver. With the principle dramatic sequences incorporating a woman trapped in a small crevasse under a collapsed building, director Greg Yaitanes and Tattersall delivered compelling footage that immeasurably enhanced the storytelling.

Storytelling is what it is all about as I learned over lunch one day many years ago. In my then role as a Sony senior vice president, after waxing poetically about our latest technology strategy, one of my luncheon partners, then ABC Network executive vice president Alex Wallau, said, "We're not in the business of buying technology; we're really in the business of storytelling. So, tell me how this technology will enhance my ability to tell stories." It's not about the technology; it's about the storytelling — a simple truism I have never forgotten.

But back to "House." For dramatic impact, sometimes the director wanted to sharply isolate the central characters — at times from one another, at times from the background and at times from reality. Through the creative use of sharp focus and extremely narrow depth of field, Tattersall captured some amazingly dramatic sequences. When discussing it with him afterward, he was so inspired he said, "We were able to create images never seen on television before."

Not all was perfect. Tattersall explained that one necessary adjustment was eliminating the initial few frames of a scene due to "Jello" shutter. This is an effect whereby distortion is created initially as the camera settles on the scene. It's the result of the shutter rolling across the image area to expose the scene as opposed to exposing the scene in a single capture.

But there were benefits aplenty. For example, the shooting rig is so compact it afforded the opportunity for a rover or Ninja cameraman who was free to roam and shoot, and in the final edit, almost one-fifth of the footage was from the Ninja camera.

Technology to enhance storytelling — Alex, you must be a happy storyteller. BE

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

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