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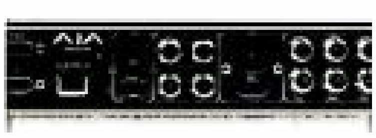

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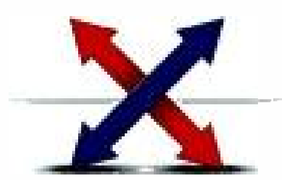

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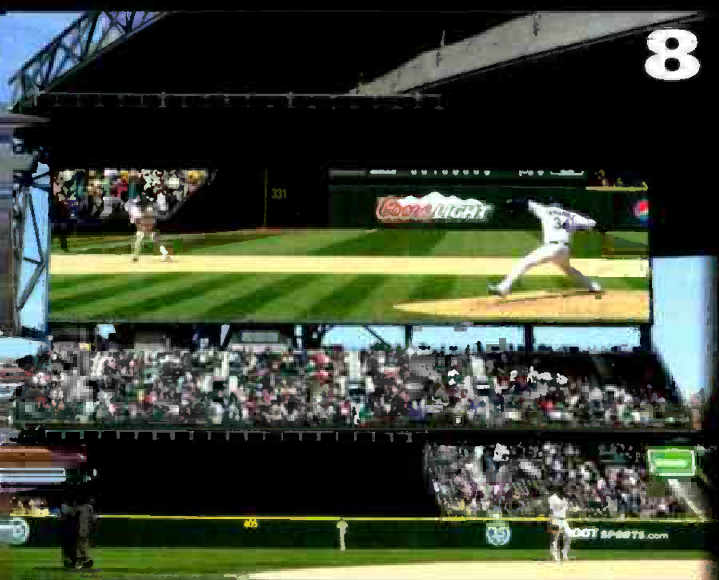
Advances in workflows — greater integration, more speed and new agility — are making newsrooms themselves more scalable, flexible and streamlined, and thereby more cost efficient.



NEWS

LATEST NEWS!

The primary issue facing the FCC as it develops a post-incentive-auction band plan is "the real-world problem" of co- and adjacent-channel interference, the NAB told the agency in comments filed in mid-June. The comments, filed in response to a public notice issued May 17 by the agency's Wireless Telecommunications Bureau, said the commission has "failed altogether to acknowledge" that serious engineering concerns must be addressed before moving forward.

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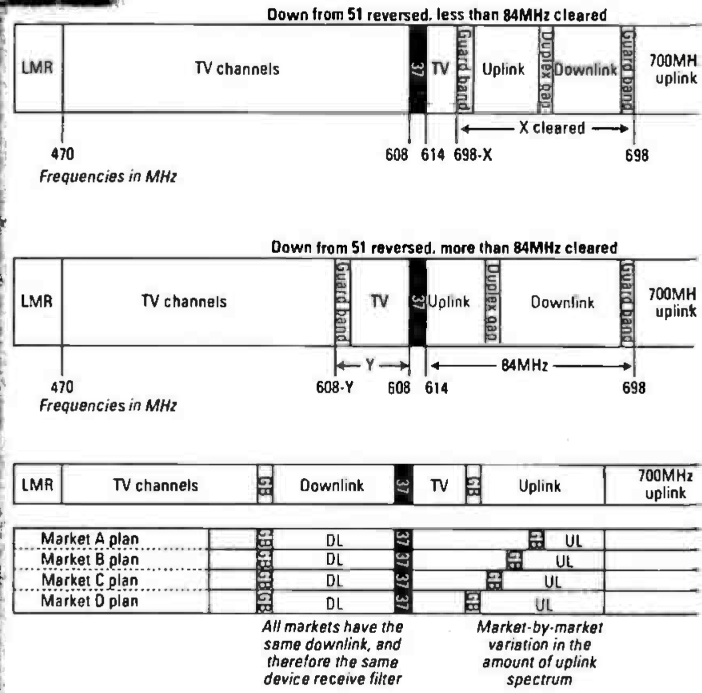

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What's a Zero-TV?

With the advent of new delivery technology, more viewers are discovering, even seeking out, new ways to receive content. The idea that everyone sits around the living room and watches appointment TV died years ago. Today, viewers want to be able to consume entertainment on many platforms, ranging from the 65in HDTV set in the living room to their smartphones.

To more closely examine viewing on these newer platforms, the audience measurement company Nielsen has begun looking more closely at a small portion of American homes now called "Zero-TV" households. These households do not fit Nielsen's traditional definition of a TV household because they consume media in a wider variety of ways.

In 2007, fewer than 5 percent of viewers consumed entertainment on anything other than a television set. Only six years later, 2.5 times more households view programs on non-television devices.

Although the Zero-TV audience is still relatively small, it continues to increase. About 75 percent of these households still have a traditional TV set, but the majority (67 percent) get their content from "other devices." Those devices include computers, Internet TVs, smartphones and tablets. Almost half (48 percent) get their TV content via subscription services. Some of those services include Netflix, Amazon, Hulu, Aereo, Redbox, VUDU, iTunes and Apple TV. What is missing here is cable, satellite and Telco-delivered content.

The Zero-TV household tends to be young; almost half of them are younger than 35. Two other common traits: 85 percent of these viewers are non-Hispanic, and 81 percent have no children.

When the Zero-TV households were asked why they did not have wired cable or satellite service, about one-third of the survey respondents replied that those services were either too costly, or they simply weren't interested. Only 18 percent said they had considered subscribing to traditional TV services.

The Nielsen report does indicate that some things have yet to change. Measured across the last four years, total consumption of entertainment by category has changed very little. In average time spent per person per day, appointment TV has fallen only five minutes, from 4 hours and 44 minutes in 2008 to 4 hours and 39 minutes last year.

Time shifting (DVR usage) has almost doubled, going from 14 minutes in 2008 to 25 minutes per day last year. Another significant trend is the aging of the high-consumption TV viewer. When it comes to watching television, the seniors win, watching an average of 48+ hours per week. The amount of time spent in front of the TV set falls rapidly with decreasing age. The 18- to 24-year-old demographic uses the TV set about half as much — 29 hours.

Why should broadcasters care?

With increased viewing options, consumers expect their content to be available on their schedules, on their devices. No longer can the local TV station rely exclusively on that RF signal to reach audiences. Think multiplatform, multiformat and multi-device.

Fortunately, there are plenty of vendors inside these pages to help you make the required equipment and workflow changes. BE

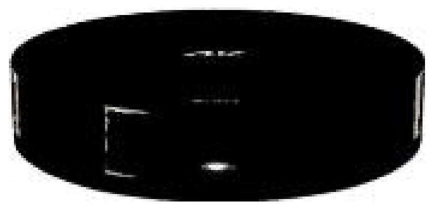
Brad Dick
EDITORIAL DIRECTOR
Send comments to: editor@broadcastengineering.com

1080p and beyond

The benefits of Ultra HD technologies transcend eye candy.

BY NED SOSEMAN

In October 1988, the theme of *Broadcast Engineering's* then sister publication *Video Systems* was "Resolution Revolution." The highlight of the exciting news was, wait for it, Super VHS. The magazine also carried an article about HDTV, but at the time, HD was considered a technical curiosity similar to the soon-to-be-emerging Internet. The only HDTV network at the time was operated by the Mayo Clinic in Minnesota. It allowed doctors to conduct video consultations at 1050-line resolution. Other parties actively interested in HDTV were the New York Port Authority and a Canadian grocery store chain wanting to display closed-circuit in-store HD ads. Broadcaster interest was conspicuously absent.

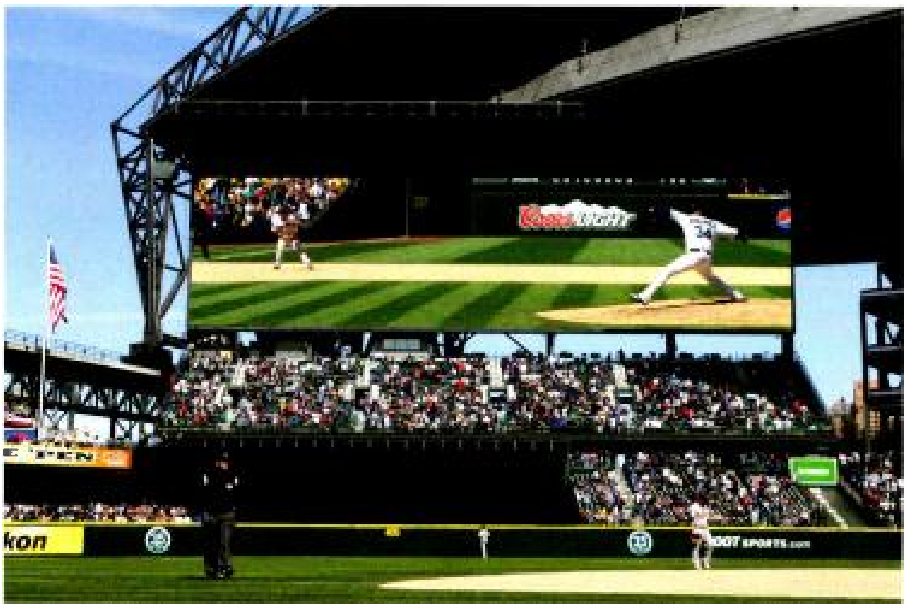


Sony's FMP-X1 Media Player for the consumer market will be preloaded with 10 4K movies and shorts.

In 1972, NHK created "NHK Color," an 1150-line 60Hz system with an aspect ratio of 5:3. According to an Annenberg Washington Program presentation in Chicago, SMPTE first discovered HDTV as it was being used in a Japanese auto parts factory. While some might question the validity of that claim, there is no question that SMPTE recognized the future and established its authority in HDTV testing and studies in the 1970s. The analog NHK Color evolved into Hi-Vision, aka MUSE, and was first broadcast in Japan via satellite in late 1994. In 1996, WRAL-HD in Raleigh, NC, was the first on-air station in the U.S. to broadcast an HDTV signal. Then came DTV, and the rest is history.

Today, HDTV is everywhere. Looking as forward as possible at the time it was implemented, ATSC's Table 3 definitions of HDTV streams go no further than 1080p. Clearly outdated, the group is working on ATSC standard 3.0 to keep up with the now-perpetual resolution revolution. The problem today is that broadcasting and its audience is like an aircraft carrier — huge, powerful and slow to change course. The Internet offers the agility of a modern speed boat and is, therefore, the greatest challenge to broadcasters. Already, YouTube allows a maximum resolution upload of 4096 x 3072, which is a 4:3 aspect ratio 4K format containing 12.6 megapixels. Unfortunately, at this time, most 4K Internet video is so highly compressed, it's difficult for average viewers to clearly observe the advanced 4K quality.

As of now, there are no 4K DVD or 4K Blu-ray specifications. One reason is that even when compressed by HEVC, a feature-length 4K movie would contain twice the data a dual-layer Blu-ray disc can presently hold. When Sony recently announced prices and availability of its new line of 4K TV displays at the 2013 NAB Show, it also announced the FMP-X1 Media Player. Although it looks like a disc player, technical details are being held close to the vest. The player comes preloaded with 10 feature films and shorts, stored non-optically. The company also announced an upcoming video distribution service to bring the 4K entertainment experience to viewers at home, assumedly by download.



The massive 11,425sq-ft Panasonic Lighthouse HD video display recently installed at Seattle's Safeco Field could benefit from higher resolution sources.

At January's Las Vegas CES, the company announced a library of "Mastered in 4K" Blu-ray discs meeting Blu-ray specs, but not actually 4K. Not surprisingly, the company


FILMS

says when the content is "upscaled" by its line of 4K Ultra HD TVs, the "discs serve as an ideal way for consumers to experience near-4K picture quality," somewhat reminiscent of the interim and short-lived 1440 x 1080 HDCAM/HDV format.

The HEVC enabler

Distribution of 4K to the general public is a difficult proposition. On one hand is the Internet, which with leading-edge, high-speed systems like Google Fiber, can easily handle 4K or better bandwidth requirements, although people on the last mile of standard DSL service won't see it. On the other hand is broadcast television, limited to the traditional 6MHz channel. If it weren't for another big step forward in video compression, namely HEVC, aka H.265, discussion of formats for mass distribution beyond 1080p would be somewhat moot. Even at this point in time, although allowable under ATSC standards, there are no U.S. TV stations broadcasting 1080p OTA. One likely reason is a lack of 1080p broadcast content. There are no official specifications for 4K broadcasting, yet. However, HEVC appears to be the magic key that could open that door.

Encoding H.265 requires approximately 10 times the processing power of H.264, and it needs approximately double to four times the processing power of H.264 for decoding. Right now, codec latency has ample room for improvement, primarily because there are no H.265 chipsets available. As discreet H.265 silicone is developed and released, latency and costs will be greatly reduced. However, there is a huge universe of H.264 gear, such as OTT and TV displays, that will have to be replaced. H.265 is not backwards-compatible with H.264.

Will the consumer electronics world will buy into 4K and later 8K video? Will the ATSC adopt 4K in ATSC 3.0? Will dumpsters overflow with "old" MPEG-2 and H.264 displays? These are questions your boss, friends and neighbors might ask you, but they are well beyond the scope of this article. After all, who could have guessed 3-D HD would have hit the market with such a spectacular thud? Instead, let's focus on the use of the newest formats outside of distribution.

4K content creation

4K is essentially a 2 x 2 array of HDTV images. Thus, the base bandwidth of 4K is four times that of HDTV. Similarly, 8K is a 4 x 4 array of HDTV images requiring eight times HDTV bandwidth. Within a production environment, that problem is rather easily addressed, just as some early adaptors addressed 3-D HDTV by creating dual-stream signal paths to carry the bandwidth. The introduction of 3G-SDI eliminated the need for a dual-stream path for 3-D, just as 6G-SDI will, when finalized, eliminate the need for two 3G-SDI streams to support 4K. The prospect of 12G-SDI for 8K seems to be within the foreseeable future.

It is important to note that 4K is not the end-all resolution. At the recent NAB Show, nearly everyone who was talking about and showing 4K products and technologies was also talking about 8K being just around the corner. For example, back in the corner of the North Hall, NHK was showing a prototype Super Hi-Vision camera and theater presentation. The camera had 8K resolution, operated at a frame frequency of 120Hz, with 12-bit A/D conversion and contained three 120Hz, 24.7mm 33-megapixel sensors. The output circuit consisted of 96 parallel channels. NHK said an image sensor with greater sensitivity was under development. The images were spectacular.

Given imaging progress that seems to so accurately follow Moore's Law, at what point will resolution be good enough, if ever? More realistically, is 4K just another rung on the technical progress ladder?

New SFX

There are certain unique special effects that can best be accomplished on a large canvas such as 4K, 8K and beyond. Just as 1920 x 1080 HDTV is generally considered to be 2K, the 4K format is actually a number of formats, all derived from a 4096-pixel-wide native resolution raster. (See Table 1.) One of the original 4K devices, the RED ONE camera, recorded

FORMAT	RESOLUTION	ASPECT RATIO	PIXELS
Academy 4K (storage)	3656 x 2664	1.37:1	9,739,584
UHDTV	3840 x 2160	1.78:1	8,294,400
DCI 4K flat cropped	3996 x 2160	1.85:1	8,631,360
DCI 4K CinemaScope cropped	4096 x 1714	2.39:1	7,020,544
Digital Cinema Initiatives 4K native resolution	4096 x 2160	1.90:1	8,847,360
Full aperature 4K storage format	4096 x 3112	1.32:1	12,746,752

Table 1. The term *4K* refers to a host of unique individual formats.

at 4096 x 2304. The 4K Ultra HD television (UHDTV) format is actually 3840 x 2160.

The most obvious production advantage of 4K ultimately destined for HDTV distribution is the ability to pan and zoom with an HDTV window in a 4K space. One of the easiest concepts to relate to is the ability to properly frame up a poorly framed camera shot at a live sporting event. If the action was captured in the corner of a 4K screen being down-converted for HDTV broadcast, the replay can zoom in and center the action with scalable downconversion that maintains a full HDTV image. Imagine how well that could enhance the effectiveness of instant replays, not only for viewers, but for referees and umpires as well. It's almost a mistake eraser.

Another facet of 4K, 8K and higher resolutions is the benefits they offer the emerging market for huge screens in venues such as sports stadiums and other public places. While the average living room viewer might find it difficult to fully appreciate the difference between 4K and 8K 60in displays, fans in stadiums watching screens such as the recently installed 11,425sq-ft Panasonic Lighthouse HD video display at Safeco Field in Seattle won't be able to miss it. Again, the ability to electronically pan and zoom without resolution compromise at the display will be a huge advantage for those producing closed-circuit sports venue feeds.

Let's not forget the many non-broadcast users hungry and willing to spend money for higher resolutions. Expect the medical industry to continue to be willing to pay for increased resolutions. It would also make sense that the security industry, both private and government, will be eager to take advantage of the benefits of higher resolutions as the technology progresses.

If 4K doesn't sway the consumer TV market, HEVC technology also opens the door to doubling the number of traditional HDTV channels without increasing bandwidth. Either way, everyone benefits. **BE**

Ned Soseman owns LAKETV LLC in Camdenton, MO, and is chief operator at KRBK-DT, Springfield/Osage Beach, MO.

Send questions and comments to: editor@broadcastengineering.com

ADDITIONAL RESOURCES

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

- Headlong into 4K
- Future-proofing plants and trucks
- H.265 and UHDTV Ultra High-definition TV Getting Ready for Primetime

Wireless opportunities

Broadcasters need to reclaim available spectrum.

BY ALDO CUGNINI

The foundation of broadcasting is wireless transmission — a fact often taken for granted. We've covered many aspects of broadcast transmission systems in this column, including characteristics of ATSC, DVB, ISDB and DTMB, all usually employed for high-power, wide-area broadcast. But wireless systems, at lower power and reaching a more local footprint, are starting to encroach on the legacy broadcast trade. This month, we'll look at some technologies that broadcasters should better understand.

White space

Broadcasters can use new wireless technologies today. With the advent of global white spaces initiatives, creative businesses are starting to develop new uses for the spectrum — and that represents an opportunity for broadcasters to expand their capacity, too.

We're already seeing proposals for low-power devices that wirelessly transmit compressed video to receivers, using existing transmission standards like ATSC and DVB, and in a form that takes low-power TV and scales it down in power. One such device is aimed at providing video to digital signage in shopping malls. Although using this form of transmission to blanket wide areas could be problematic from a self-interference and channel availability standpoint, it nonetheless opens up new possibilities for distributing content to a geographically targeted audience.

Wi-Fi

Wi-Fi is being used at a growing number of locations outside the consumer home. As such, it represents a spectrum resource that should be considered for content distribution.

With a large number of users, connection "collisions" cause the throughput per user to decrease exponentially, with diminishing returns. A similar problem occurs when the connection is first established and the initial connection negotiation is set up. A Wi-Fi connection is established by a handshaking process whereby the wireless access points (WAPs) send out a beacon that the client stations pick up; this usually includes a Service Set Identification (SSID) so that the clients can select the right access point. With multiple users simutaneously connecting to a live event at a pool of WAPs, a massively parallel first connection can swamp a system.

Once a connection is established, the access point and the client station continuously send messages back and forth that control the connection; if packets are dropped due to interference, the client stations can ask for a retransmission or else ignore the dropped packets. In the first case, retransmissions will increase latency, and thus result in a lower throughput, which can be offset by using higher compression of the AV content. In the latter case, lost packets will cause video and audio decoder errors that can be concealed or corrected to some extent. Either situation, of course, impacts the quality of the presented content.

One way to circumvent these issues is to use Wi-Fi broadcast, a technique being explored by some companies, where all client stations "listen" to a common broadcast. Here, the handshaking is conducted between a particular access point and the "weakest link," so that all other listening stations get a connection that is always equal to or better than the handshaking connection. Other methods to increase the number of users include load balancing, where the network dynamically adjusts the channel assignment and priority for different WAPs, depending on usage. Because wireless users are expected to be mobile, a sophisticated scheme for handoff of multiple WAPs is required,

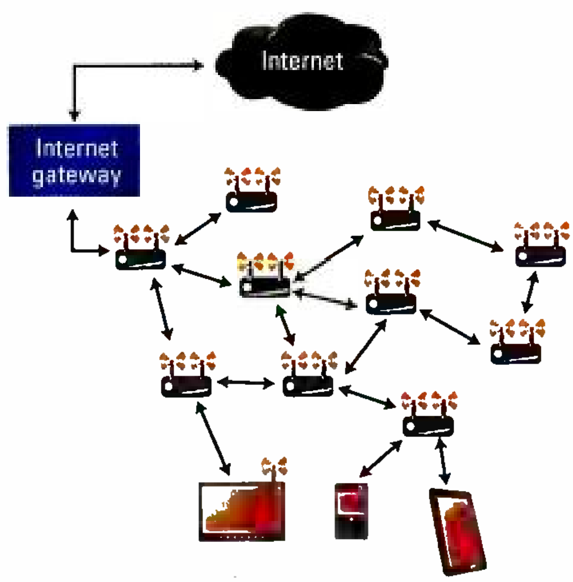


Figure 1. Mesh networks can improve throughput and deliver a higher QoS to users, but with a higher degree of complexity — and cost.

similar to those schemes used for cellular networks.

Wi-Fi networks covering an area larger than that of any one WAP can rely on various network technologies in order to provide an expected level of QoS. Typically, such networks are formed in a rather haphazard way, as a function of the local cabling constraints, and such a network will operate inefficiently.

Check out the July Digital Edition, or the July issue online for more information on using Wi-Fi, including Wi-Fi radio, for broadcast.

Other options

Mesh networks, such as the one shown in Figure 1, can improve this situation. A mesh network is a local or wide area network (M-LAN or M-WAN) where each node (station or other device) is connected directly to several (or all) of the others. Mesh networks have the advantage that they can be self-configuring and self-healing; if a node breaks down or is overloaded, traffic can be re-routed to other nodes. In some applications, the nodes themselves can act as wireless repeaters, essentially an extension of the wireless hotspot functionality. The tradeoff, however, is in higher system complexity — and cost.

3G/4G, and possibly 5G

Cellular providers are now planning to deploy evolved multimedia broadcast multicast service (eMBMS), a multicast technology that mobile carriers believe can efficiently multicast video content by sending it to a large number of subscribers at the same time, essentially broadcasting using the cellular radio spectrum. The challenge to these operators is in upgrading their networks to handle the increased traffic, including the backhaul between cells and central hubs. It's also not clear that all existing receivers can handle the new protocols, meaning consumer device upgrades could be necessary.

Cellular networks have a more fundamental dilemma: Although 4G-LTE offers up to 20 times the bandwidth of 3G networks, some analysts estimate that by 2015, when LTE networks are fully built out, mobile data traffic will have grown by the same factor, rendering them obsolete before fully deployed. This forms one oft-quoted rationale for "freeing up broadcast spectrum," which by many accounts would solve the problem only temporarily.

In the meantime, companies are scrambling to invent new technologies that can increase bandwidth over wireless networks. Multiple-input-multiple-output (MIMO) technology uses multiple transmitting and receiving antennas, and shows promise as a bandwidth-enhancing transmission technology.

There have been announcements of new systems under development, including one with an early label of 5G, which uses an adaptive antenna array that promises to deliver from 1Gb/s to 10Gb/s of bandwidth wirelessly in the millimeter waveband. Developers hope to deploy such technologies by 2020.

But the real problem is that consumer use will always expand to fill capacity, much the same as more highways increase the number of drivers. Broadcasters are now challenged to consider new and innovative ways to reach their audience — like combinations of OTA and one-to-one networks — using all spectrum resources that are now available. BE

Aldo Cugnini is a consultant in the digital television industry, and a partner in a mobile services company.

QoS vs. QoE

While QoS assesses technical performance, QoE assesses how consumers react to the total viewing experience.

BY BRAD GILMER

Since the beginning of television broadcasting, engineers have been obsessed with improving quality. One does not have to look hard to find a long list of technological advancements, all focused on improving the quality of images delivered to the home. Early on, many measurements focused on legal aspects of transmitted signals — maximum white level, sync amplitude and horizontal blanking width. Not only did these measurements ensure that the emitted signal was legal, but also they helped to ensure that viewers received good pictures and sound.

Quality of Service

As broadcasters began to interact with satellite and terrestrial transport vendors, we began to look for tools that would allow us to set measurable criteria for the performance of the video links. Specifically, we were looking to establish criteria that could be tied to a contract for carriage. These criterion were collectively referred to as Quality of Service or QoS.

Over time, QoS has evolved significantly, especially in relation to the carriage of professional video over IP networks. These days, QoS measurements might include things like IP loss ratio and cumulative jitter. (For more information on QoS in media applications, I would recommend a book by Al Kovalick called *Video Systems in an IT Environment*, published by Focal Press.) QoS is a valuable tool to assess whether a system meets pre-established technical criteria. Most transport contracts these days contain QoS provisions.

But there are some problems with QoS. It does not take into account the interaction between the technology and the viewer. This can be a big problem. QoS also does not take into account other factors that might affect the viewing experience, such as the effect of large audio level variations between program audio and commercials. So while QoS is an effective tool for assessing technical performance, broadcasters realized that perhaps another tool was needed to assess how consumers were reacting to the total viewing experience.

Quality of Experience

Not long ago, a group of industry experts focused on the way video and audio content interact with the transport medium, e.g. an IP network.

Perception matters, and that gets to the heart of QoE.

The Video Services Forum created a Quality of Experience Metrics Activity group to identify and describe metrics required to accurately characterize professional video and audio quality for streaming video transport over IP.

Some of the objectives of the group were to encourage development of test devices that could measure the selected metrics, to speed troubleshooting of problems affecting video quality, and to facilitate problem resolution between customers and service providers by defining standard metrics that could be monitored at the demarcation point. The group also tackled the issue of creating standard metrics that work well in correlating network impairments with the visual experience for different codecs — a challenging task.

Importantly, the group did not tackle the issue of unambiguously defining *Quality of Experience* (QoE) or *quality*, but instead focused on identifying a set of metrics that contribute to the quality of professional video transported over IP networks. Also, the work did not identify metrics that would require complete decoding of the video/audio bit streams since the goal was to provide monitoring that could be used as the signals were in flight, meaning quality could be predicted at a number of places along the transmission path.

Specifically, the metrics that were selected were chosen because they provide assistance in monitoring, troubleshooting, verifying delivered service statistics, designing new equipment and ultimately, improving the overall QoE for end users.

QoE metrics

Several different metrics were identified. The first group were metrics that describe the relationship between transport losses and the impact of those losses on video/audio payloads. The second group were metrics that characterized compression used. The third group helped to characterize the content.

It is important to understand why different classes were needed. In the first case, the impact of a bit error on the observed video differs greatly depending upon whether the loss affects an MPEG-compressed intra/inter predicted macroblock versus the loss of a B Frame, which might have a much less observable effect. In the second case, it is important to know

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phone +1 252.638-7000 | wheatstone.com | sales@wheatstone.com the quantization and video bit rate to understand the potential impact of errors on video and audio. In the third case, we know content that is high motion is much more stressful on compression systems. Identifying this content is important when studying the impact of transmission errors on a system that is already stressed to the limit by high motion content.

One thing to remember is that the QoE metrics described in this article were designed to be used for analyzing professional video transported over private IP networks; this is a far different application from transporting consumer video over the generic Internet. The group also focused on the use of private networks to transmit video over cable systems to the home. The group determined that, except in extreme cases such as breaking news, professional video is almost always transmitted over private IP networks, so this restraint seemed reasonable. The group also looked at a particular protocol stack, basically consisting of either MPEG-2 or H.264 compressed video transported over UDP and IP.

Another important consideration that was used in the development of these metrics is that many of these metrics were designed to be measured over time — meaning that the metrics may have benefits when

GROUP	METRIC
Network – compression interaction	Frame loss length
	Frame loss events
	I-slice/frame losses
Compression characterization	Program rate
	Average quantization parameter
	Intra period pattern
Content characterization	Motion activity
	Scene cuts
	Audio dropouts

Table 1. Shown here are representative metrics from the VSF report.

monitored instantaneously, but that they may also convey important trend information when they are sampled repeatedly and results are compared. The point is that trend information may be used to identify problems before they significantly impact video/audio transmission.

A sample of the metrics defined in the VSF report is shown in Table 1. Note that this is not an exhaustive list of metrics contained in the report.

A closer look

There is not enough space to cover all of these metrics in detail, but to take frame loss length as an example, the report defines *loss event* as the maximum number of consecutive slices/frames lost in a single loss event in a measurement interval. The report goes on to state that the measurement is important because IP losses typically happen in bursts. Together with the number of loss events, loss length is a major factor in determining the severity of a bursty loss. The longer the loss, the more it will affect the quality of decoded video.

Motion activity is the average length of motion vectors in a measurement interval. Put another way, the amount of motion in a video determines its encoding complexity to a large degree. Video with a lot of motion is generally more difficult to encode than content with low motion.

Motion activity can help in estimating the base quality of the video stream as long as network losses are not present since, generally speaking, the higher the motion, the more difficult the content is to encode, and the more observable any compression artifacts are. The presence of network losses only makes a bad situation worse, and a high loss rate combined with a high motion activity metric is predictive of a lower QoE.

Perception matters

I should note that much of the material for this article came from the VSF report, and is the work of Pierre Costa, Stephan Winkler and other members of the Activity Group.

QoE is a topic that should be studied by broadcast engineers. While QoS is important, we should remember that perception matters, and that gets to the heart of QoE. These metrics try to quantify the impact of measurable impairments on the perceived quality of video and audio delivered to the end viewer. BE

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

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

Mirror, mirror, in the rack

When selecting a monitor, keep these criteria in mind.

BY PETE PUTMAN

Are you in the market for a new video monitor? Confused by the myriad acronyms, screen sizes and pixel counts, not to mention all of the consumer-centric input and output connections? Is 720p resolution enough, or do you need 2K? What the heck does WUXGA mean? And why would you ever use HDMI connections in a control room?

You're not alone. The world of display technology has been turned upside down over the past 20 years with flat screens, higher pixel counts and a new class of digital signal interfaces replacing the "plain vanilla" CRT monitor equipped with composite video jacks. Instead of the professional display market driving the consumer market, the tables have been turned, and the "tail" now "wags the dog."

The world of display technology has been turned upside down over the past 20 years.

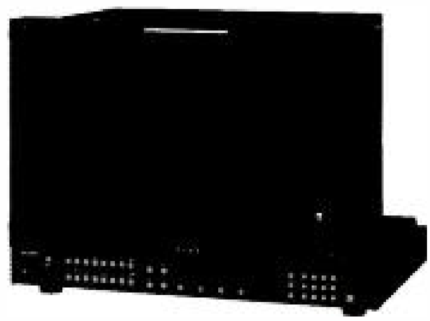
The surge in sales of flat-screen TVs during that same two-decade interval motivated Japanese manufacturers to build larger fabrication lines ("fabs") so they could crank up TV production to the tune of millions of LCD and plasma panels per year. Some of these manufacturers (Sony, JVC, Panasonic, Hitachi) had also previously sold broadcast and professional CRT monitors, but in much smaller quantities.

Seeing opportunities, Korean manufacturers joined the fray, and now Taiwan and China have joined the table. This rapid shift over to LCD and plasma technology killed off CRT displays and also created a large wholesale market for panels. It also resulted in some strange alliances to get product to market, such as Sony's first partnerships with LG Display (Korea) and then Samsung (also Korea) to obtain LCD TV panels that Sony couldn't make on its own.

Samsung showed a prototype of its 85in 4K S9 Series television at the Adorama booth at the 2013 NAB Show. The UHDTV features 3840 x 2160 resolution and is being marketed to prosumer "videophile" enthusiasts.

The worldwide recession that started in late 2007, coupled with excess LCD and plasma fab capacity and cut-throat competition from Korean and Chinese manufacturers, triggered a downward slide in panel prices that has yet to bottom out. As a result, LCD panels are commodities now, particularly in the smaller sizes that are often used in equipment racks and master control consoles. And plasma technology is on the endangered species list, with sales falling through the floor in the past five years.

How do you differentiate one type of monitor from another? How many companies actually make the LCD panels used in their products? (Answer: Only a few.) With so many companies buying panels on the open market, it's not unusual to see one manufacturer's "glass" show up in many NAB booths. Case in point: LG Display's new 84in 4K (3840 x 2160 pixels) LCD panel is available as a TV from LG, and is also being sold by Sony, Toshiba and JVC.



Sony showed its new OLED monitors at NAB. These super-thin emissive displays have wide color gamuts, wide viewing angles, high dynamic ranges and super-low black levels.

Know before you buy

Here's some helpful information you should know before you purchase a new monitor. While almost every commercial video monitor uses LCD technology, you may not know that there are two flavors of LCDs. The first uses a vertical alignment (VA) process, and this refers to how the liquid crystals shift position in operation to block or pass light. Samsung, Sharp and Chi Mei all manufacture VA LCD panels.

The second process is known as in-plane switching (IPS). In an IPS panel, the liquid crystals rotate on their horizontal axis. Panasonic, LG Display and CPT are all examples of IPS panel manufacturers, while Hitachi (which invented IPS) has largely exited the market.

While VA panels are widely used in consumer televisions and tablets, IPS is the preferred technology for professional LCD monitors. One reason is the consistent grayscale images produced by IPS panels when viewed off-axis, as is often the case in an edit suite or control room. All LCD monitors suffer from contrast flattening when viewed off-axis, but a grayscale ramp will reproduce without any color tinting on an IPS LCD monitor.

While VA LCD panels also have excellent dynamic range, they introduce subtle color tinting at different luminance levels when viewed off-axis, a condition that would be unacceptable in a reference or critical monitor. However, VA panels are fine where off-axis viewing isn't an issue, such as air check monitors in racks and confidence monitors in cameras. Individual monitor spec sheets should clearly indicate which alignment type is being used in each panel.

Another question that pops up: How much resolution do I need? Given that 4:3 monitors have all but disappeared from the pro market, your choices will generally be an HD-resolution format (1280 x 720 or 1920 x 1080 pixels) or a widescreen variation of a computer resolution standard. (Wide XGA 1280 x 800, Wide XGA 1366 x 768 and Wide UXGA 1920 x 1200 are all common.)

Which one should you choose? If your primary application is video monitoring, then stick with either 720 or 1080 pixels of resolution. Note that there aren't any interlaced monitors — that scanning technique went away with CRTs — so all flat-screen monitors use progressive scan, and the shorthand notation for these is "720p" or "1080p." You can find 1080p resolution in monitors as small as 15in.

If you need to view computer graphics and video, then you should purchase a workstation monitor. Common resolutions for these products include 1366 x 768, 1440 x 900 (Apple), 1680 x 1050 (Apple again) and 1920 x 1200 pixels (WUXGA). There are even "retina" displays that have resolutions as high as 2550 x 1440 pixels.

While workstation monitors support 720p and 1080p signals, their native aspect ratios are 16:10, not 16:9. That means any video content you view will present with black bars top and bottom when sized correctly. You'll find more connector options on workstation monitors, but they will be more consumer-centric (HDMI, DisplayPort, VGA) and won't support SDI or HD-SDI connections.

Conversely, 720p and 1080p video monitors will offer little support for computer graphics resolutions. In fact, many of them limit their support to the 27-year-old eXtended Graphics Array (XGA) standard. However, these monitors will provide HD-SDI interfaces, along with a handful of analog inputs (composite and component video) and probably an HDMI connection for interfacing camcorders, Blu-ray players, STBs and other prosumer gear.

While VA panels are widely used in consumer televisions and tablets, IPS is the preferred technology for professional LCD monitors.

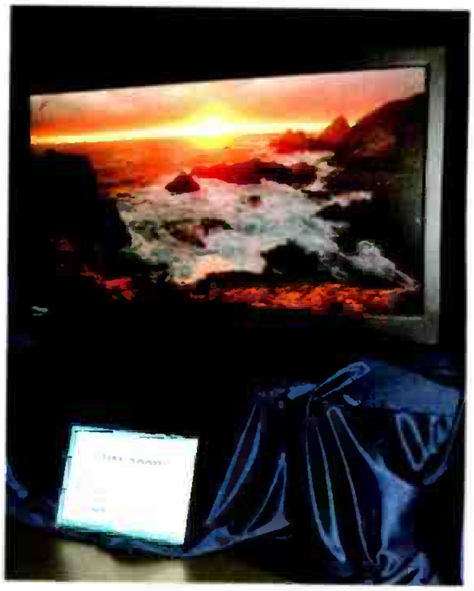
The next wave

You've probably heard about or even seen a new monitor technology called OLED. These super-thin emissive displays have wide color gamuts, wide viewing angles, high dynamic ranges and super-low black levels.

OLED research and development has been going on for several decades, and these displays are only now

JVC demonstrated its new PS-840UD Professional Series ProVérité 4K 84in LCD monitor at the 2013 NAB Show.

Panasonic announced the BT-4LH310, a 31in 4096 x 2160 resolution professional monitor at NAB.



TVLogic showed a prototype of its LUM-300W 30in 4K monitor, which featured 4K DCI resolution.

reliable enough to bring to market. Unfortunately, OLEDs are expensive to make as manufacturing yields are still low. A 25in BVM E-series OLED monitor from Sony has an SRP of $26,000, while the PVM version

At NAB, a new crop of 4K (3840 x 2160 pixels) video monitors took the stage.

(some minor panel defects) still fetches $6400. In contrast, you can buy a 26in WUXGA LCD monitor with all the bells and whistles for about half that amount.

At NAB, a new crop of 4K (3840 x 2160 pixels) video monitors took the stage. Most of them employ LCD technology as well, but they'll set you back a pretty penny. Unless your facility is supporting high-end cinema production or experimental 4K shoots, you should just pass these by, but you won't have to wait long for prices to drop. JVC announced at NAB that its 84in 4K pro monitor would retail for less than $15,000, and it's expected that some of the 32in 4K monitors seen in Las Vegas will be tagged well under $10,000.

The wrap-up

Thanks to the Internet, you can easily window shop monitor specifications and compare one brand to another before you buy. Some LCD monitors serve double duty and can work in the field from battery power; that could be a handy option. Likewise, small LCD and OLED monitors are available that attach to camcorders for studio use or sit on desktops for reviewing footage.

You can also buy large TV-sized monitors for green rooms, lobbies and edit suites at reasonable prices in the $50/in range. These displays come with modular video and audio input slots and also provide picture calibration tools. Some use plasma technology; the rest are LCDs. Individual features (support for AES digital audio, markers, blue screen, real-time video/audio waveform displays) are up to you and your facilities' needs.

Good hunting! BE

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Send questions and comments to: editor@broadcastengineering.com

ADDITIONAL RESOURCES

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

- Video monitors
- What's on your wall?

Spectrum repacking

The industry responds to the FCC's plan.

BY JAY C. ADRICK

In the December 2012 issue of *Broadcast Engineering*, I presented an article focused on the eventual television band repack and how stations should prepare for this event. At the time the article was written, the FCC had just released its Notice of Proposed Rule Making (NPRM) (Docket No. 12-268). My plan is to present periodic updates on the process that will look at the FCC's actions, industry reactions and the thoughts of some industry leaders.

We now have many comments and reply comments that have been filed in response to the FCC's NPRM. The FCC has also released several proposals and actions, such as the revision to OET-69 and comments on possible ways that initial valuations might be made on television spectrum. At least one group has surfaced, announcing it has properties that it plans to put into the reverse auction process.

The NAB and others have reacted to the OET-69 revision. Spectrum issues were a hot topic at the recent NAB convention; the FCC recently conducted a workshop on issues surrounding the proposed 600MHz band plan; and the FCC implemented a freeze on television facility changes. It has been a busy six months.

If this wasn't enough, the FCC also announced that it is beginning proceedings on the T-band segment (TV Channels 14–20), where the television service has shared, in some markets, this spectrum with public safety users.

NPRM responses

Hundreds of companies and organizations filed comments on the TV Spectrum NPRM. Both the broadcast and wireless communities were aligned on one major point: No one liked the FCC's proposal for a split-band plan. (See Figure 1.) Most support the idea that the reclaimed spectrum should come off of the top of the TV band. Another issue that had less cross-industry support, but was unanimous among broadcasters, was that the band plan must be uniform across the nation. The FCC has pushed the idea that the lower limits of the reclaimed spectrum can vary on a market-by-market basis, while broadcasters reminded the commission that co-channel interference will result from such a plan.

- A joint letter submitted to the FCC by NAB, Verizon, AT&T, T-Mobile, Qualcomm and Intel rejected the FCC's proposed split-band plan and advocated for the following principles:
- Adopt a contiguous "down from TV 51" approach with uplink at the top.
- Maximize the amount of paired spectrum above TV 37. (Rely on supplemental downlink configurations where spectrum is cleared but pairing options are not viable.)
- Rely upon 5MHz spectrum blocks as building blocks for the wireless band plan.
- Incorporate a "duplex gap" or spacing between uplink (mobile transmit) and downlink (base transmit) of a minimum of 10MHz, but no larger than technically necessary.
- Avoid broadcast television stations in the duplex gap.
- Preclude any operations in the duplex gap or guard bands that would result in harmful interference to adjacent licensed services.

Many broadcasters supported loosening the proposed reverse auction eligibility requirements to allow

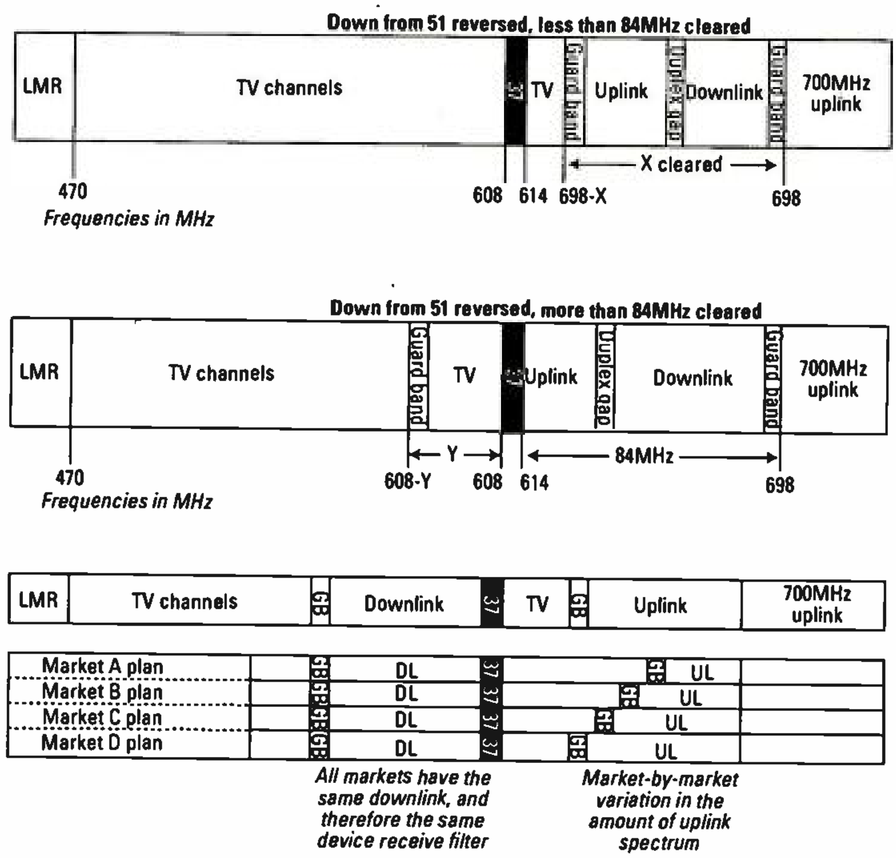

Figure 1. Shown here is the FCC's proposed repack plan of the 600MHz band.

more licensees and permittees to participate. They argued that one or more of the following should be eligible to participate in the auction: full-power or Class A licensees appealing the expired, cancelled or revoked status of their license; permittees of new, unconstructed full-power stations with construction permit applications granted as of Feb. 22, 2012; licensees with applications to convert stations from low power to Class A status pending as of Feb. 22, 2012; low-power stations able to demonstrate compliance with Class A eligibility requirements; and entities faced with "exceptional and unique circumstances" that prevented them from licensing their facilities by Feb. 22, 2012.

Most broadcast commenters supported expanded bid options for licensees, such as moving from a UHF channel to a VHF channel, agreeing to accept additional interference, and agreeing to accept a smaller service area or reduced population coverage.

Many broadcast commenters, including NAB, argued that the Spectrum Act requires international coordination with Canada and Mexico as a prerequisite to conducting the incentive auction. Various state broadcaster associations noted that border coordination affects about one-third of broadcast television stations. Putting off international coordination, therefore, would complicate the repacking process and delay reimbursement beyond statutory time limits. Wireless carriers, including CTIA, also urged prompt attention to international coordination measures, but not at the expense of an auction delay.

An unreasonably short deadline

Many broadcasters criticized the proposed 18-month deadline for construction of new broadcast facilities as unreasonably short. Harris Broadcast argued that the engineering infrastructure could not handle the expedited 18-month timeline and suggested a phased, geographic-based transition that would account for unforeseen circumstances like bad weather and tower damage. Other commenters stated that the DTV transition and BAS relocation demonstrated that three years is the bare minimum needed to complete construction and transition to new channel assignments.

Wireless commenters supported the FCC's position that three years is too long for the transition to repacked facilities. U.S. Cellular supported the 18-month deadline, while Sprint argued that the final 25 percent of a broadcaster's relocation payment should be conditioned upon relocating within six months of a timeline adopted by the Commission.

In the previous article, I reminded readers that a maximum of 434 stations could undergo antenna changes within a three-year period, with the limitation being the number of qualified tower crews.

NAB, supported by other broadcasters, argued that the $1.75 billion allocated by Congress for the relocation fund should be enough to cover the reasonable relocation costs of between 400 to 500 stations. NAB's comments stressed that the FCC should consider $1.75 billion as a cap on its repacking model.

NAB also advocated for broadly defining what would constitute eligible broadcaster costs, while Harris Broadcast stated that the FCC should adopt and release a detailed list of covered expenses prior to the auction. One major broadcast owner also noted that the FCC should anticipate higher costs than during the DTV transition because of the short time frame.

NAB rejected both NPRM proposals for repacking relocation payments and instead proposed a two-stage approach. In Stage 1, eligible entities would file a request for advanced payment based on a schedule of values, and all entities would receive the same percentage of estimated expenses that would be no higher than 80 percent of those estimates.

In Stage 2, 30 months after competition of the forward auction, eligible entities would file documentation of their actual expenses. The FCC would then determine the "true up" amount or be paid back unused funds from the advance payment.

In addition, stations facing delays beyond 30 months would file additional documentation of expenses yet to be incurred. To reduce abuse to the relocation fund process, NAB proposed appointing a third-party administrator to the fund that would conduct spot audits of stations' documentation.

Will broadcasters volunteer?

A frequently asked question is: Will broadcasters actually volunteer to participate in the reverse auction? Recent news articles indicate that more than $345 million has been spent by several speculators to acquire television properties for the purpose of selling them in the reverse auction.

One well-known former broadcaster, Preston Padden, is the Executive Director of Expanding Opportunities for Broadcasters Coalition. This is a group of more than 70 stations interested in participating in the reverse auction process. Padden indicates that of those stations involved, there is about an even split between full-power and Class A station groups.

Proper planning missing

Last December, I stressed that three years was insufficient for repacking implementation, given that we do not know how many stations will be required to move. I also pointed out that no repacking spectrum plan has been presented and reviewed by the engineering experts.

At the 2013 NAB Show, both repacking and the auction process were covered during the Broadcast Engineering and Management Conferences. Bill Meintel, of Meintel, Sgrignoli & Wallace, gave an excellent presentation on some of the issues, such as the changes to OET-69 and the spectrum planning that will have to go into the repack process.

When asked about the planning process, Meintel reminded the audience that each station affected by the spectrum changes would have to be modeled individually. There is no single answer on what channels will work. His estimate was that planning could take up to a year.

Keep in mind that we will not know how many stations will relinquish their licenses and where they are located until after the reverse auction is completed. The spectrum repacking planning can't begin with any credibility until we know the above information. If that takes a year, then we only have two years remaining in the allocated time to actually do the repack. That is certainly insufficient time if there are more than about 288 stations forced to relocate.

Both the Commission and the wireless industry seem to be in a rush to do all of the steps nearly simultaneously without proper time to plan as information become available. At a recent FCC LEARN Workshop on the 600MHz band plan, it became obvious that the 120MHz recovery of TV spectrum was wishful thinking at best. Most talk was around 84MHz, and some comments even indicated that less spectrum might be recovered.

Remember, this whole process is not just about adding spectrum for wireless services; it is also about putting funds into the U.S. Treasury. Original estimates were in the neighborhood of generating up to $28 billion from the spectrum auctions. Congress took a subset of that number and spent the money well before it was ever generated. Remember, too, every station that relinquishes spectrum is going to be compensated in the auction at some price that is at least equal to the value of the business in a sale, and every station that must move to a new channel will be reimbursed from a $1.75 billion fund set up by Congress. It is only after those expenses that the auction returns money to the treasury.

At the recent FCC LEARN Workshop, Harold Feld, Legal Director for Public Knowledge (an FCC watchdog group), reminded the Commission that unless sufficient stations participate and unless wireless entities are willing to pay prices for spectrum that are premium to past auctions, this whole process could end up costing the Treasury rather than adding funds to it. BE

Jay C. Adrick is technology advisor, Harris Broadcast.

The changing demands of news consumers have contributed to the rise of a new breed of digital newsroom outfitted with fast, scalable systems.

TODAY'S digital newsroom

Newsrooms today have to be fast to keep relevant.

BY HENRY ALEXANDER

The advent of the 24-hour news cycle and the tremendous number of broadcast outlets covering local, regional and global news are driving a technology revolution in today's newsrooms. Being relevant and gaining and keeping viewers depends on speed and agility. In the newsroom, time is money.

Quickly and reliably executing the entire production workflow is critical to news organizations. End-to-end live broadcast technology enables stations to gather, prepare and broadcast news as it breaks. Within this workflow, integrated editing, storage, and archiving tools and software are delivering new speed, reliability and capabilities. Nonlinear editing tools provide timeline editing with no rendering required for fast-turnaround news production and to improve rough-cut edits by adding text, graphics and voice-over recordings.

Flexible storage solutions, based on scalable and modular architecture and including metadata, enable operators and journalists to browse and search by keywords, and to edit content. Content can also be instantly accessed throughout the entire network for production, editing or playout. Today's editing, storage and archiving tools are more nimble and robust than ever, bringing new levels of speed, productivity and reliability to newsrooms and to our daily news.

Creating the workflow

Moving the production workflow from tape-based to digital was the first step of innovation, but the innovation hasn't stopped there. Advances across the workflow — greater integration, more speed and new agility — are making newsrooms themselves more scalable, flexible and streamlined, and thereby more cost efficient. Modular and open systems are delivering outstanding returns on investment. Let's take a look inside the digital newsroom and see how it all happens. (See Figure 1 on page 28.)

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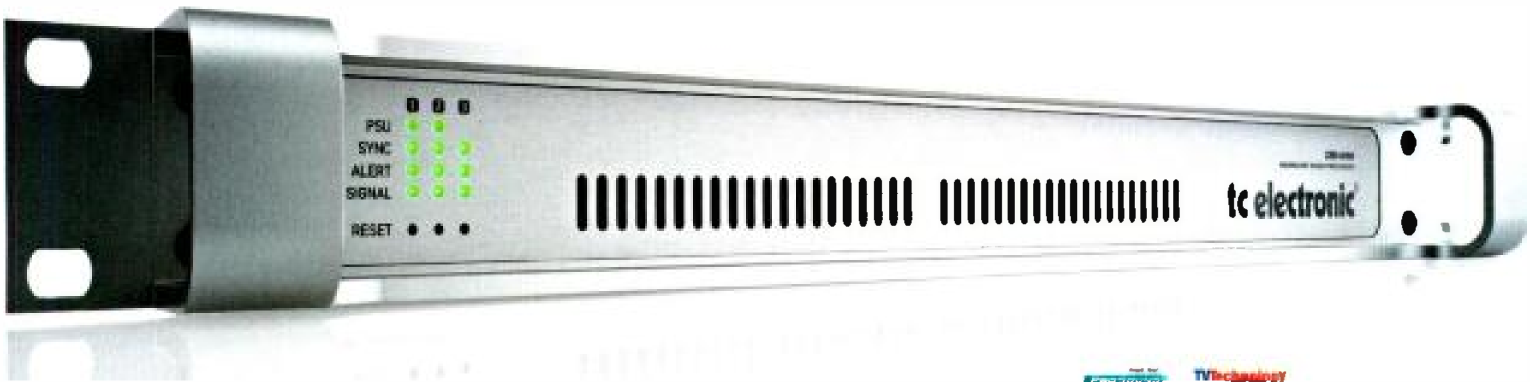

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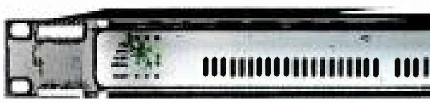
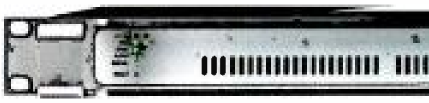


DB6 Single - for the Local Broadcaster and OB Vans



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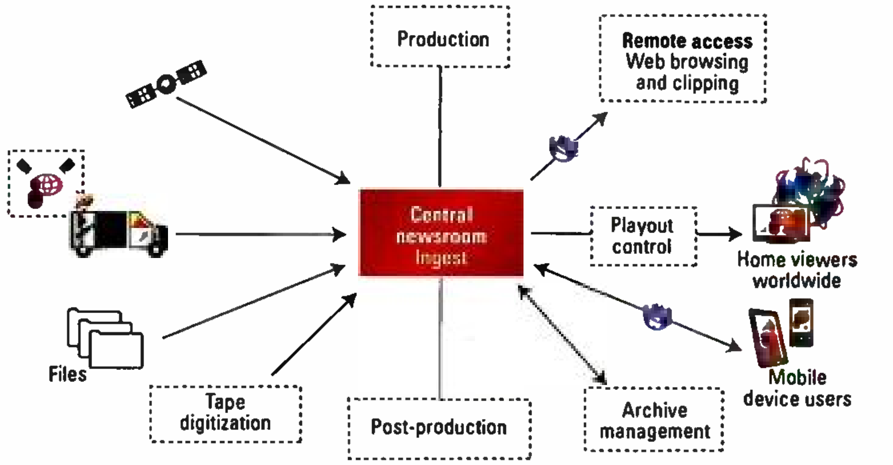


Figure 1. The new digital newsroom is fast, integrated and tapeless — and capable of making news available to consumers on a range of devices.

• *Ingest.* Ingesting live video feeds is where the production process begins. In the most productive newsrooms, any SD or HD feed can be ingested, most often through an encoder platform or server-based technology. Best-of-breed encoders support all codecs and formats, and can be configured either as an encoder or playout channel for maximum infrastructure flexibility.

Intelligent server technology handles all ingest functions, recording multiple video feeds and making this media available throughout the production workflow for simultaneous preview, rough editing, archiving, playback or post-production. A process of loop recording can ensure that no incoming feeds are missed during recording, even when they're not scheduled or managed. The feeds are then available throughout the production network.

Regardless of ingest method, the ingest process must be managed. In today's workflows, this is most often achieved through integrated production management applications that give the user complete control of production workflow, from ingest control and metadata management to on-the-fly editing and playout scheduling, often from a single intuitive interface.

Ease of use is key, with the goal of enabling every member of a production team to use the system without extensive training. Talent should be focused on operating and editing tasks, not on figuring out how to use complex systems. These systems must also integrate with third-party resources. System and components accessibility is critical, as it helps streamline all aspects of the workflow and save resources.

A discussion of media ingest is not complete without addressing storage. The ability to easily access and browse stored media is a critical aspect of the entire workflow and can be a significant stumbling block if not handled correctly. Footage from ENG crews can be imported directly — in the right format and codec — with simple tools that enable editing, browsing, transfer and transcoding of all clips to central storage. Regardless of media origination, these systems offer short- and long-term archiving of clips, AV feeds, and highlights with all associated metadata, where editors can easily browse and search content by keyword or edit media content. Media can also be accessed throughout the entire network for production, editing or playout.

• *Content management and timeline news editing.* Once content is quickly and efficiently ingested and stored, it needs to be ready for immediate editing and preparation for air. Workstations are equipped to allow users to browse incoming feeds and prepare rough-cut edits by creating simple playlists. Playlists can then be pushed to nonlinear editing systems, allowing access to any frame in a clip for additional editing, or directly to playout if required. This greatly improves the speed and quality of the media editing. For instance, timeline editing with no required rendering is used to improve rough-cut edits by adding text and graphics, to prepare news reports, and to enable voice-over recordings. Support for multiple formats and resolutions on the same timeline and robust metadata management features are other examples of tools that can increase editing speed and quality.

• *Post-production integration.* Digital workflows should fully integrate craft editors with ingest and production processes and online storage, facilitating rapid file exchange with external post-production applications. Editing suites often use plug-ins to enable rapid post-production file rendering so playout begins as soon as editing is completed. Production systems should seamlessly integrate with all major editing software from Avid, Apple and Adobe.

• *Playout.* Like other parts of the digital production workflow, there is more than one option for playout. Server technology, encoder/playout systems or even off-the-shelf newsroom control systems (NRCS) such as ENPS can accommodate playout. The key is interoperability. Playout technology — either via a server or encoder — and software-based management technology must interoperate to achieve successful playout operations, ensuring all clips and associated metadata can be accessed, complete playlist functions are facilitated, and news stories are managed across the news workflow. Additional tools and software enable capabilities such as live slow motion and timeslip operations for fast review of events, or delay of events so that nothing is missed.

• *Web service integration.* As media organizations move to push their news over multiple platforms, Web service integration is an increasingly important part of the process. Metadata is added to the workflow system, indicating which platform should receive media files and the type of content contained within the file.

Sky News Arabia uses EVS XS servers, IPDirector video production management suite, Xedio CleanEdit editing applications and XStore SAN storage in its digital newsroom.

One size does not fit all

There are many options, both in terms of system architecture and software and hardware, to achieve highly reliable and digital workflows. There are now turnkey, yet feature-rich, systems designed for small and regional newsrooms. There is no right answer, only the best fit for an individual news organization. How many feeds must be handled? Is the newsroom operating globally, regionally or locally, and is this reality likely to change? Parameters such as budgets, future plans and existing infrastructure can all play a part. Integrated digital systems provide the ability to scale and evolve with a broadcaster's needs. They need to be nimble to accommodate technology advancements, organizational changes or new workflow approaches. Yet building these types of systems requires long-term commitment and trust between broadcaster and technology provider.

New challenges are sure to emerge. Many news providers are now operating as multiplatform providers, making news available online, on radio, and to a range of connected devices — including mobile phones and laptops — so consumers can access news at all times, wherever they are. This capability is critical to leveraging greater revenue and reaching larger audiences in the future. There's a new breed of newsroom: It's tapeless. It's fast. It's scalable. And it's fully interoperable. BE

Henry Alexander is SVP, entertainment and news, at EVS.

HEVC and cameras

Different applications need different codecs, so interoperability will remain an issue.

BY DAVID AUSTERBERRY

The line of compression schemes is stretching out. Soon, we could potentially have MPEG-2 through to HEVC in use in a single program chain. All this complicates workflows and calls for careful planning to avoid unnecessary transcoding.

Do we need all these compression standards? Well, yes. As resolution increases, the demand for more efficient compression will increase in step. MPEG-2 started out for SD but has been stretched for HD.

MPEG-4 was going to be the answer to everything, from small phones up to movie screens. That has only worked by adding a new Part for a new compression scheme. Video started out as Part 2 — Visual Objects. That didn't prove much more efficient than MPEG-2, so AVC was born — MPEG-4 Part 10. However, the demands for mobile video and the advent of 4K have led to the need for an even more efficient codec than AVC, and that has come to fruition as HEVC, or H.265.

Storage

Where does that leave camera makers? One benchmark is record time. In the days of tape, shooters came to expect three or four hours of record time; that's probably one day's work. Wind forward a few years, and writing camera files to memory cards gives a record time somewhere between 30 minutes and two hours; it all depends on how much compression you use. Some cameras have multiple card slots to give longer record times.

Camera vendors will design whatever gets the best pictures to sell their cameras.

That's going to mean a handful of cards to manage and offload to backed-up disk storage each day. I can hear the film guys thinking, "A luxury — we had 10-minute reels. We had to stop, change reels and check the gate before you were off again."

After a period of limited record times, solid-state memory cards, with 128GB and larger capacities, have eased those restrictions.

Codecs

Camera vendors will design whatever gets the best pictures to sell their cameras. But that has led to all manner of coding schemes and compression formats — and there is the matter of containers or wrappers. The rise of the single sensor has added an additional choice: raw or coded.

Camera designers have to adopt a codec format that meets a number of, sometimes conflicting, requirements. First, it must meet the quality expectations for the camera, for its price and format. Second, it must not be power hungry. Third, the data rate must be as low as possible to ease demands on the camera storage cards. And fourth, sometimes a little overlooked, it must be compatible with popular NLEs.

The low data rate demands indicate an efficient codec design, but the more recent the compression format, the more processing power is needed, immediately conflicting with the low power requirement. Hence, the popularity of MPEG-2 long after AVC was released. This is where the big engineering compromise comes in.

If the camera has an adequate internal compression format, then uncompressed or raw data can be made available via SDI or HDMI for users who want more of the sensor information. External recorders have become common, especially with single-large-sensor cameras. Many allow encoding into an edit format such as DNxHD or ProRes, speeding the ingest process in post.

Workflows

For the broadcaster, all this choice gives flexibility at the production stage but does not lead to standardization in the workflow. The edit bay must deal with this plethora of formats, a far step from the days of two primary tape formats, the Betacam family and the DV family. Even a format like AVC I-frame encoding comes in two flavors: Panasonic's AVC-Intra (and Ultra) and Sony's XAVC. The former is high 422 profile, level 4.1, and the latter is level 5.2. So much for interoperability.

The drive to support 4K is one reason Sony has adopted 5.2, as lower levels only support up to 2K resolution, and Panasonic has introduced AVC-Ultra to support higher data rates.

Editing AVC requires a recent NLE workstation, as it needs considerable processing resources. Many editors prefer to work with DNxHD or ProRes, transcoding everything at ingest, and this can ease the demands on the power of the workstation.

For point-of-view shots, many productions are using GoPro Hero cameras, which are not edit-friendly and require a transcode before ingest. For example, the Hero 3 uses AVC level 5.1 long GOP to get small files in the camera. It also uses an MPEG wrapper, so it may require rewrapping to MXF or QuickTime at the transcode stage. It's just another process that forms part of post production.

Will there ever be a single codec for cameras? I think not. The requirements of each programming genre are so different. Compare newsgathering with a high-end VFX shoot. One needs small files for backhaul; the other needs as much of the original sensor information as possible. And what of HEVC? So far it's going to see application as a distribution codec. The processing resources for encoding do not make it practical for current camera electronics, but if we get to 4K 3-D newsgathering, who knows? BE

David Austerberry is the editor of Broadcast Engineering World.

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

+ ADDITIONAL RESOURCES +

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

- HEVC to have a revolutionary impact on OTT video and UHDTV

ONLINE For more information on these products, go to www.broadcastengineering.com.

Contemporary Research
QMOD-SDI 1.5

HD-SDI modulator has evolved by the power of two: optional two-channel operation (with upgrade key), RF and IPTV outputs; features AC-3 and stereo audio, 708/608 and Line 21 captioning, two MTS language tracks, rackmounts two across, and adaptive encoding.

www.contemporaryresearch.com

Digital Rapids **Stream V3.8**

Software for StreamZ, StreamZHD and Flux ingest, encoding and streaming systems; advances in the new version include H.264 encoding support, expanded support for automated multiscreen advertising insertion workflows, and new predefined project files for transforming content for Netflix delivery.

www.digitalrapids.com

Matrox
MuraControl 2.0 for Windows

Video wall management software enables precise remote or local control of Mura MPX-powered video walls; blending videos and images with the desktop, a background image or another video is now possible by setting transparency levels for one or more windows.

www.matrox.com

Blackmagic Design
Desktop Video 9.7.5

Software update adds full support for Adobe Creative Cloud software across the company's desktop video products; allows users to take advantage of the many new features in the Adobe Creative Cloud desktop applications, such as powerful new editing timelines and shortcuts and audio mixing with Adobe Premiere Pro CC and new creative and visual effects tools with Adobe After Effects CC.

www.blackmagicdesign.com

Harmonic **ProStream 9100**

Real-time stream processor has been enhanced with linear ad splicing capabilities; new functionality enables service providers and broadcasters to frame-accurately insert targeted local and regional advertisements into broadcast programming delivered via MPEG-2 and MPEG-4 AVC SD/HD transport streams.

www.harmonicinc.com

FOR-A **MINI M/E**

New functionality of the HVS-390HS video production switcher is an extension of the aux bus system that allows operators to deploy any aux bus transition with cuts, mixes or wipes, and display a keyer complete with DVE functions; brings the power of a virtual 6 M/E switcher in a 2 M/E unit.

www.for-a.com

Sony **PMW-300**

Semi-shoulder mount XDCAM camcorder combines the benefits of ½-type Exmor Full HD 3CMOS sensor technology with 50Mb/s HD recording at MPEG HD422; includes Sony's advanced signal processing technology to suppress noise effectively and create noticeably clearer images.

www.sony.com/professional

TC Electronic **TouchMonitor TM7**

Loudness meter for mobile trucks and small installations where space is an issue; accepts all SD, HD and 3G formats available on the market; features a 3G SDI interface (including SDI loop through).

www.tcelectronic.com

Sound Devices **788T Version 3.0**

Software update offers 788T users a 192kHz sampling rate for up to four tracks (L through B) recording to one drive; provides for scene, take, notes, false takes, circle and track name metadata to be synched between C-Linked 788Ts.

www.sounddevices.com

Triveni Digital
StreamScope Portal

Portable, tablet-based MPEG analysis and monitoring tool; leveraging the unit's ultra-personalized form factor and a variety of dongle-based input options, users can cost-effectively perform real-time, file-based MPEG-2/MPEG-4 analysis and remote monitoring of DTV transport streams on GigE networks and other key interfaces.

www.TriveniDigital.com

TV One **CORIOmaster mini**

Compact all-in-one videowall processor fits up to 12 high-density universal DVI or HDBaseT ports within a 1RU frame; this allows users to design full-scale 3 x 3 video walls while eliminating a rack's worth of discrete video components; designed to save up to 10X the power req.

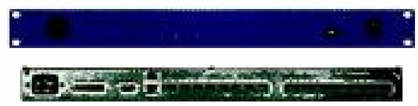
www.tvone.com

Visionary Solutions (VSI) **D1000**

H.264 and MPEG-2 based decoder supports SDI (3G/HD/SD), HDMI and DVI outputs with resolutions from 480i up to 1080p60; designed to bridge the gap between expensive IRDs and consumer STBs.

www.vsicam.com

Audio-Technica **AT-DMM828**



Digital matrix mixer is the next generation of the company's SmartMixer family of automatic mixers; is a microprocessor-controlled, programmable, automatic-switching eight-channel matrix mixer; keeps the number of open microphones to a minimum.

www.audio-technica.com

PlayBox Technology **AirBox 4.1**

New features of the master playout automation system for TV channel playout include support for AVC Intra for MOV and MXF containers, support for MXF with multiplexed DV/DVCPRO HD, and support for playback of files located on network storage.

www.playbox.tv

NewTek **TriCaster 40 V.2**

Complete HD multi-camera video production studio is designed to enable anyone to create professional streaming television on a small budget; version 2 provides unprecedented access to the same production capabilities used by major networks, including customizable animated transitions and effects, network-style titles and graphics, and improved file interoperability.

www.newtek.com

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