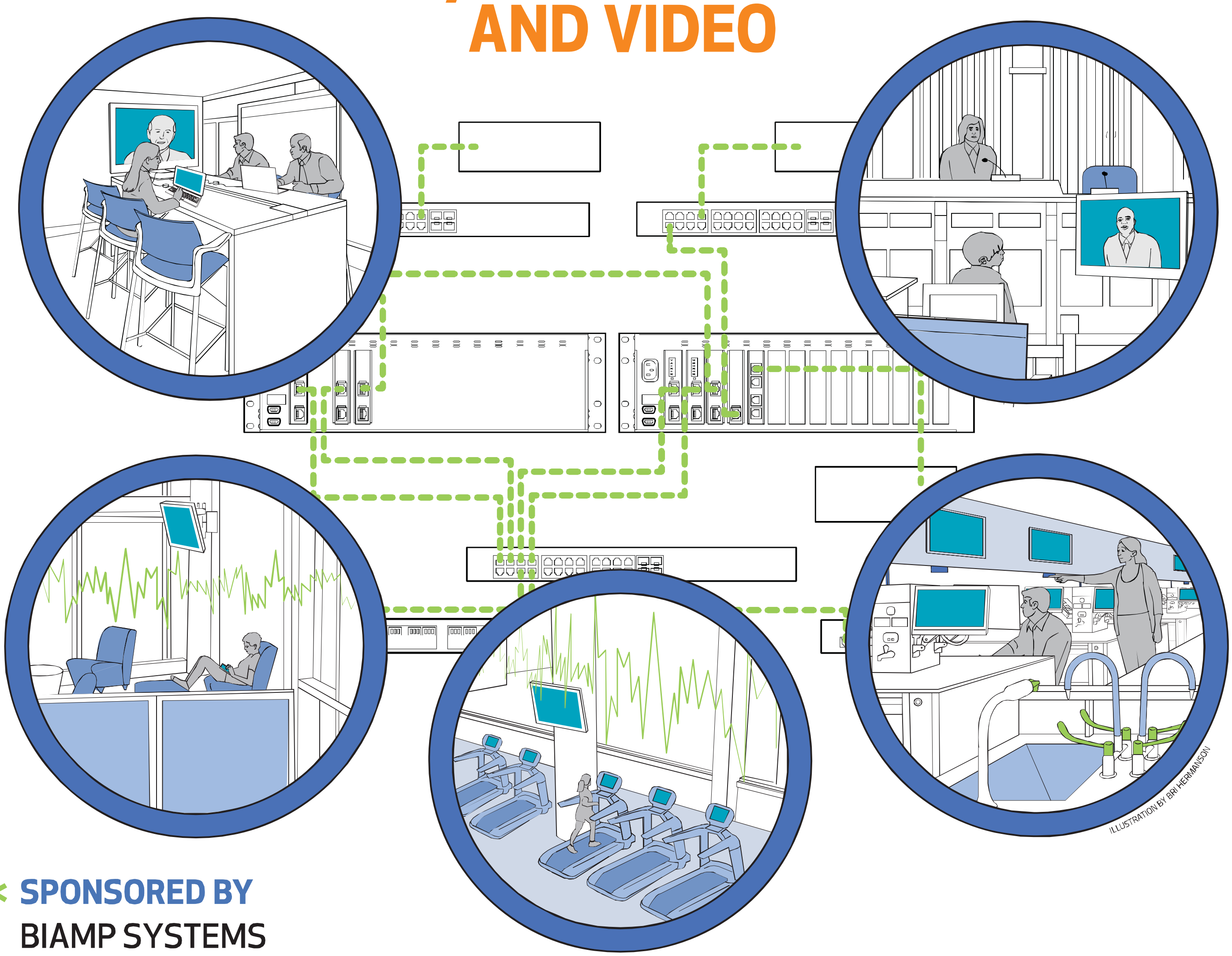
ENTERPRISE MEDIA NETWORKS

AVB/TSN FOR AUDIO AND VIDEO



SPONSORED BY
BIAMP SYSTEMS

A SUPPLEMENT TO SOUND&VIDEO CONTRACTOR

— *the difference between* —

FRUITION & FRUSTRATION

Let's be real: nobody likes hold music or robotic phone tree mazes. That's why we guarantee you'll reach an actual person when you call us. To streamline our support process, we've created a dedicated support phone number. Call us at virtually any time, from anywhere in the world, and connect directly with the Support team member who's best suited to your particular challenge. We'd love to hear from you.

1-877-242-6796 (1-877-BIAMP-XO)

From outside the U.S. and Canada, +1.503.718.9257

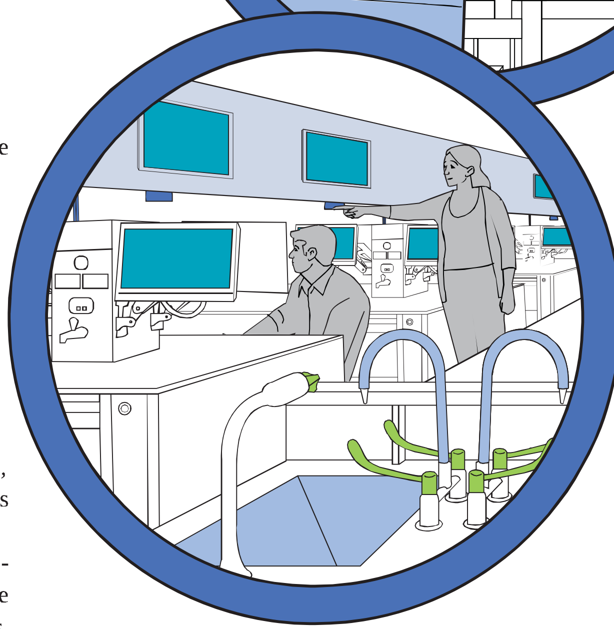
TECH SUPPORT CALL: 5:16AM

THE "V" IN AVB

Time-sensitive networks are now available to audio and video; both can now benefit from deterministic networks and the low latency guarantees of the IEEE AVB/TSN standards. The AVB/TSN standards simplify real-time distribution of audio and video, and guarantee network transit latency at less than 2ms over seven hops. The standard has matured worldwide as the demand for media networks has grown exponentially, along with user expectations for quality and synchronization.

MANY FACTORS ARE SHAPING MODERN MEDIA NETWORKS

- A desire to use standard Ethernet transport and switches, and to escape the limitations of traditional AV matrix switches
- The convergence/co-existence of AV and IT networks
- The convergence of AV and IT stakeholders
- A desire to synchronize high quality audio with visually lossless video
- A need for more control in managing networked media and traffic and the ability to intelligently balance quality, bandwidth and latency
- A need for easier and more affordable expansion
- A better understanding of how variables such as resolution, refresh rates, chroma sub-sampling, bit depth, high dynamic range (HDR); factors such as content type and viewing distance affect the subjective experience of viewing video



Systems designers and installers understand that quality viewing/listening experiences mean different things depending on the application, content type, infrastructure, and budget. Modern media network design must balance many factors to achieve the optimal experience for the people who own, use, and maintain the system. Every choice has a network impact, so those choices should be easy to make and manage.

As the industry moves away from traditional AV matrix switches and further into networked media over standard Ethernet, AV distribution will become increasingly flexible, scalable, and manageable over converged networks. Audio and video will work better together, but new challenges and expectations will surface.

In the following pages we'll look at some of the important considerations and opportunities for simplified enterprise-wide media and real-time audio and video networks.

AVB/TSN SPECIFIES A DETERMINISTIC, TIME-SENSITIVE NETWORK THAT PROVIDES GUARANTEED BOUNDED LATENCY AND PRECISE TIMING/SYNCHRONIZATION FOR REAL-TIME AUDIO AND VIDEO

THE BIG PICTURE

AVB/TSN is relatively new to ProAV, but it has a longer history and wider role in consumer, automotive, and industrial applications. AVnu Alliance members include more than 95% of the Ethernet silicon suppliers in the market, leading players in the networking infrastructure space, and household names from the automotive industry. The AVB/TSN standards are inextricably linked through a range of worldwide companies such as Intel to the Internet of Things (IoT). As technology advances, the ability to have a fixed end-to-end latency and order in which data packets are received is crucial. From Smart TVs to thermostats to Wi-Fi enabled refrigerators and automobiles, more and more devices now live on the network. This trend shows no sign of slowing down, just like the demand for advanced audio and video capabilities continues to grow through a variety of applications.

AV devices are now part of the IT realm, and indeed they have long been a part of IoT—which simply means machines talking to other machines. This results in more devices jockeying for a finite amount of bandwidth, which can place strain on the network and cause frustration if not managed properly. In order to ensure all devices play nicely together, it's important for the Pro AV industry to understand the nuances and advantages of IoT. This cooperative coexistence enables networks to transmit data packets in proper order, delivering them with very low latency, as well as managing the network bandwidth availability.

By adopting the IEEE open standards that are the basis of AVB/TSN, integrators can provide synchronized and deterministic data transmissions for AV systems, allowing content to be streamed at predetermined times, or on the fly, due to the stream and bandwidth reservations specified by the standards. The AVB/TSN standards, and their relationship with IoT, provide a powerful platform to carry the AV industry into the future. These standards are the deterministic protocol of IoT.

A LITTLE HISTORY

- **1980** IEEE starts project 802 to create standards for local area network (LAN) applications
- **1985** 802.3 becomes official standard for Ethernet
- **2003** First 4K digital cinema camera released
- **2005** Audio/Video Bridging Task Group of the IEEE 802.1 standards committee formed
- **2005** Biamp begins to look at AVB for video and audio transport
- **2006** First UHD TV broadcast
- **2007** SMPTE releases standard 2036 for UHD TV
- **2009** AVnu Alliance founded by Broadcom, Cisco, Harman, Intel, and Xilinx
- **2010** IEEE 802.1Q (AVB) ratified and published
- **2011** Sharp and NHK demonstrate first UHD 85" direct view LCD
- **2011** Chuck Van Dusen joins Biamp
- **2012** Audio/Video Bridging Task Group 802.1 renamed as Time-Sensitive Networking Group
- **2013** Chris Fitzsimmons joins Biamp
- **2014** Lee Minich and LabX mindtrust join Biamp
- **2015** Extreme Networks releases 802.1Q switches
- **2016** TesiraLUX launches

DEFINITIONS

AUDIO VIDEO BRIDGING

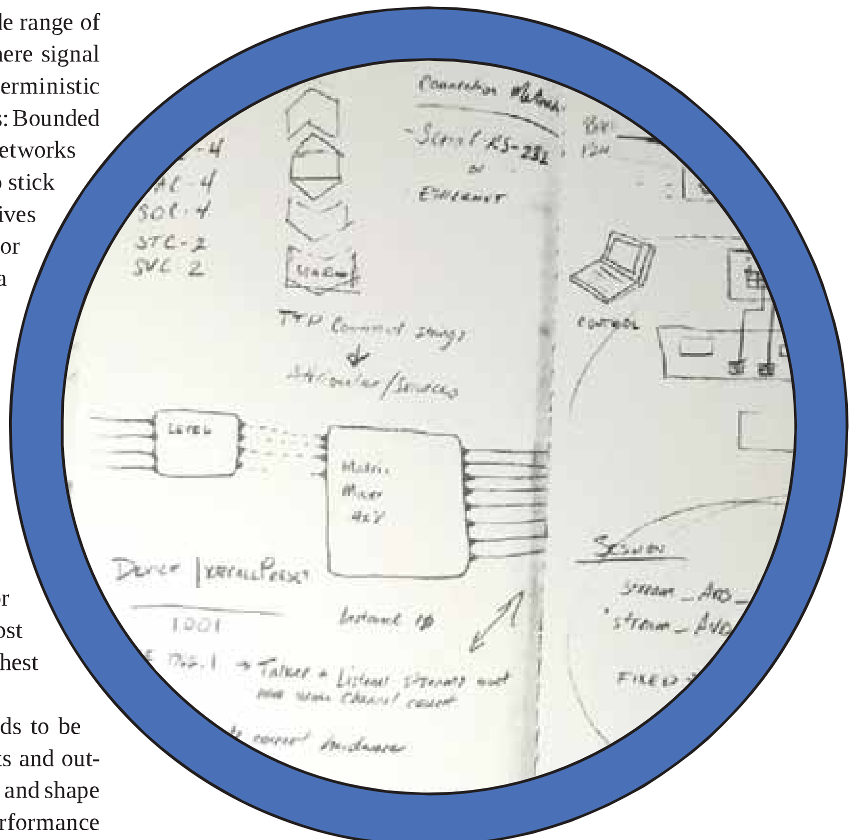
AVB is an evolution of standard Ethernet intended to add support for real-time audio/video and control applications using standard network switches. It is the common name for the set of technical standards developed by the IEEE 802.1 Audio Video Bridging Task Group. AVB standards add capabilities to the Ethernet network and provide for precise timing to support accurate synchronization of multiple streams; a simple reservation protocol in conjunction with queuing and forwarding rules guarantee that a stream will have sufficient bandwidth and will pass through the network within the delay specified (if any).

TIME SENSITIVE NETWORKING

Time Sensitive Networking is the evolution of AVB, and a continued expansion of the range, functionality, and applications of the standard. TSN is the new name for the same IEEE 802.1 Task Group that developed AVB. Some of the new key features in TSN include added fault tolerance and redundancy, and further improvements in time sensitive scheduling and latency control. The AVB/TSN standards are an upgrade to existing networks (wireless and wired)—representing the synchronization and bandwidth layer for time-critical applications.

DETERMINISTIC NETWORKING

Deterministic networking is required in a wide range of current and next-generation applications where signal delivery and predictability is critical. Deterministic networking depends on two vital technologies: Bounded latency and precise timing/synchronization. Media networks that carry real-time audio and video information need to stick to strict timing rules; if an audio or video packet arrives late to its destination, this might mean dropped frames or artifacts. Precise timing is needed to enable audio data to be presented from different speakers with a known phase relationship, and to ensure synchronization between video and related audio streams.



The AVB/TSN standards provide for deterministic networking, and also support automatic device discovery and setup, traffic shaping, and bandwidth management. Through bandwidth reservation and queuing and forwarding rules, the integrity of network streams is guaranteed. This has proven valuable in networked audio and is even more advantageous for video, to ensure that the larger files move in the most optimal way across the network and deliver the highest quality experience to the user.

When designing a modern network, bandwidth needs to be considered a resource, the same way we consider inputs and outputs on a traditional matrix. The ability to easily allocate and shape guaranteed streams helps ensure optimal network performance and the best possible audio and video for the user's application; it also simplifies device discovery, setup, and troubleshooting. These benefits apply whether or not the AV shares the data network or operates independently converged approach.

One of the key features of a deterministic media network is the ability to split audio off for additional processing and then add it back in, even across multiple network hops. This allows designers to increase the size and scope of systems, and to support optimal sound reinforcement synced to the picture. Imagine what that can mean for teleconferencing, auditoriums, distance learning, courtrooms, and the like. This is an enormous step forward from having to break out analog audio, run it through separate DSP, and manually tune and compensate for the delay between two separate systems, and among loudspeakers. It allows us to think of "video reinforcement" the way we think of sound reinforcement.

People are painfully aware of just how much bandwidth video uses and how much care and feeding the network requires. For people who have experienced the benefits of AVB for audio, there is pent up desire to extend that paradigm and benefits to video.

LIP SYNC

An AVB/TSN network guarantees network transit latency of 2ms over seven hops; the network is aware of exactly how long it takes for each signal to pass over the network, allowing it to synchronize audio and video automatically.

Lee Minich was president of LabX Technologies for over 17 years, a leading engineering design firm specializing in connectivity and interoperability. He and his team joined forces with Biamp Systems in 2014, where he is currently the Engineering Program Manager for video products. He served as the Marketing Work Group chair of the AVnu Alliance for four years.

COMPRESSION COMPARISON

JPEG

This is an acronym for Joint Picture Experts Group and became a joint ISC and ITU standard in 1992 when the ITU issued T.81 and in 1994 when the ISO/IEC issued 10918. Widely used for still photography, it can be applied to motion video as an interframe (I-frame-only) compression type. It supports 12 or more bits per component and very large image resolutions. Its extension to video sequences from still images is called Motion JPEG or MJPEG. It is an open standard with no royalties.

JPEG 2000

This is a wavelet-based compression having some use in video production where its low accumulation of multi-generational losses makes it suitable for multiple compression/decompression cycles typical of non-linear editing and video production. The motion version is called MJPEG2000 or MJP2. Royalties are still potentially an unsettled issue, as some underlying patents are not fully licensed, although the 'core coding system' is intended to be free to use.

MPEG 2

This is another ISO & ITU joint standard, and an outgrowth of the earlier and short-lived MPEG 1 used on CDs. This video-specific standard from the Motion Picture Experts Group was used in the initial satellite-to-home services and digital cable systems. Because it was directed to delivering video to the end user, acceptable minor artifacts were tolerated to achieve low bitrates, and component depths of 8 bits were considered acceptable. Resolutions were SD and HD video. MPEG 2 is usually a variable bit rate compression per stream, with the longer latency not being an issue in one-way distribution. This method uses both spatial and temporal compression, using a group of pictures (GOP) to represent an initial self-referenced image—an I-frame—and a subsequent mix of predicted and bi-directionally predicted frames of increasingly more compact coding—the P and B frames. Long GOP processing increases latency. MPEG 2 is officially known as ISO/IEC 13818 and dates from 1995. MPEG LA is a non-affiliated licensing authority that has a patent pool, which makes payment of the large number of royalties on MPEG video a bit simpler, although MPEG audio is licensed separately.

DEFINITIONS

INTRAFRAME COMPRESSION

Compression techniques are performed relative to information contained only within the current frame, and not relative to any other frame in the video sequence. No temporal processing is performed.

INTERFRAME COMPRESSION

Compression is performed in terms of one or more neighboring frames through predicting the difference between a frame and previous or subsequent frames. This kind of prediction tries to take advantage of temporal redundancy between neighboring frames allowing higher compression rates.

WHAT IS "VISUALLY LOSSLESS"?

According to the Federal Agencies Digitization Guidelines Initiative, visually lossless is defined as "a form or manner of lossy compression where the data that is lost after the file is compressed and decompressed is not detectable to the eye; the compressed data appearing identical to the uncompressed data." In more accessible terms, visually lossless means that if you look at original content and processed (compressed) content side-by-side, at normal viewing distances, you can't tell the difference between the two images, and there are no discernable artifacts including blocking, ringing, edge business, and loss of detail.

MPEG 4 PART 10/H.264/AVC

This is an advanced version of MPEG 4 that is used on HD DVD and Blu-ray discs. Like MPEG 2 it uses long GOP processing, but is capable of resolutions of up to UHD. The standard number is ISO/IEC 14996. It has similar royalties and license pools as earlier MPEG variants. It is suitable for relatively high compression ratios, allowing feature length movies on a single DVD if coded as 8-bit 4:2:0 chroma sub-sampling.

HEVC/H.265

This is the most recent compression format that addresses the very high compression ratios needed to allow 4K/UHD content to be sent over lower bandwidth connections (YouTube and the like…). It can support 10-bit color components so is suitable for the HDR and WCG enhancements to 4K content. Licensing is thought to be many times higher than for AVC, and still unsettled. The added compression efficiency of this codec comes with a large increase in its complexity, and while some lower latency implementations exist, its major application focus is on delivering large images such as UHD at lower data rates. It has been standardized in the Ultra-BD documents for UHD on the next generation of Blu-ray discs.

COMPRESSION IN CONTEXT

Much of the development of video compression standards for playback was driven by digital cinema, Blu-ray and VOD—all situations where real-time performance and synchronization were not the imperatives. Many compression standards were revolutionary in their ability to overcome issues of bandwidth and storage, allowing very large files to fit onto available distribution media; today compression is both a mature and continually evolving science.

Significantly, compression must always be evaluated in context. What is the content type and format? What is the network infrastructure and capacity? What are the goals of the user experience? What role does compression play in balancing variables such as quality, cost, heat, traffic, file size, and time/latency? Most importantly, what will deliver the best possible experience to the user in a given application? Obviously the needs of a surgeon performing a remote operation will be different than the needs of a videoconference or distance learning application. And the best recipe for visually lossless motion video content may be different than the recipe for graphics content such as spreadsheets.

For real-time video, calculating the type and extent of compression that will yield a visually lossless result considers chrominance and luminance sampling and component depth, the benefits of spatial vs. temporal compression, and computational intensity. In choosing an algorithm to work from, it's important to consider the QoS requirements of professional AV networks (as opposed to streaming IP video environments). As a practical matter, there are also issues of royalty cost.

BANDWIDTH MANAGEMENT

An important part of network design is the ability to make intelligent decisions about what to send over the network. Further, the designer or integrator needs to ensure that content is handled for maximum network efficiency and visually lossless transmission. Depending on content type and viewing distance, these decisions can ideally be defined—and easily tuned—within a system, including setting maximum resolution, frame rate floor, and/or rate of compression.

High Performance Simulation Demo Space

- 3840x2160p60, 4:2:2, 10-bit YUV
- 2:1 compression
- 4.97 Gbps video payload
- 1.5 Mbps for each audio channel

Typical Conference/Classroom

- 1920x1200p60, 4:2:2, 10-bit YUV
- 5:1 compression
- 553 Mbps video payload
- 1.5 Mbps per audio channel

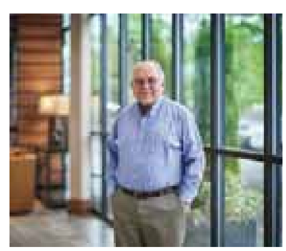
Overflow Space Distribution

- 1920x1080p60, 4:2:2, 10-bit YUV
- 8:1 compression
- 330 Mbps video payload
- 1.5 Mbps per audio channel

WHY MOTION JPEG?

When transporting visually lossless content over networks, requirements are first and foremost low artifact; second is low latency, and fairly low complexity so the stream will fit onto devices that are of appropriate size, cost and power dissipation. JPEG is mature, extensible, and it can be adapted with various rate control techniques to maintain low latency and nearly constant bit rate. Because JPEG is interframe-only, every frame is individually compressed, and any artifacts last no longer than a 50th of a second. I-frame compression is also friendly for synthetic/computer images. It supports 10-bit chroma sub-sampling and HDR luminance, as well as color space conversion. On an AVB network where reservations guarantee bandwidth for the stream, compression can be as light as possible because the budget for constant bit rate is already there and the channel can be filled without the 'caps and gaps' required in variable bit rate. Further, JPEG is an open standard and royalty free which is an important factor in keeping the cost of devices down.

Motion JPEG image processing also responds to scaling and rate control optimization, and supports intuitive bandwidth apportioning. The standard is continuing to be developed and is compatible with both 1GbE and 10GbE and capable of processing images well beyond 4K60 video in 4:4:4 at 16-bit color depth.



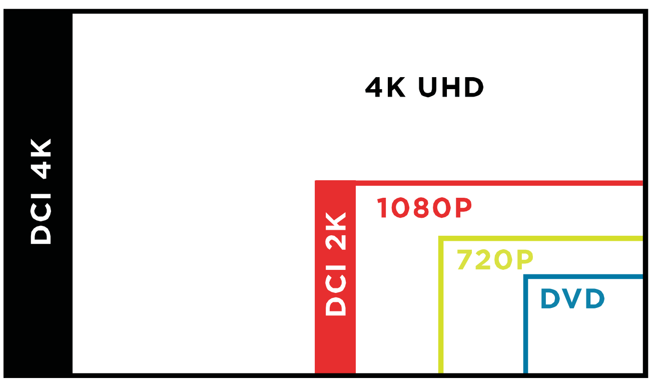
Chuck Van Dusen has decades of experience in video compression for broadcast and telco applications including at Grass Valley Group, Tektronix, and spinoff VideoTele.com. He holds ten US patents, the majority in video compression, and has been active in MPEG standards generation, ITU networked architecture and other interoperability initiatives. He joined Biamp Systems in 2011 and is the company's Video Systems Architect.

VIDEO PERCEPTION

WHAT DOES 4K REALLY MEAN?

Essentially, 4K has become a marketing term (much like "the cloud") intended to make the technology easier for consumers to understand, while simultaneously leveraging the "more is better" approach for consumer sales. Prior to 4K, resolution was typically measured by image height (720p, 1080p). "4K" loosely describes the image width (3840 pixels). If you measure 4K resolution by image height, then it's called 2160p. A UHD image is also twice as wide and twice as tall as a 1080p image—four times the resolution—but that is an area measurement and not a linear dimension.

There are a few technical standards that are typically lumped together under the 4K umbrella. Ultra-High Definition (UHD)



is the 4K standard for television, and has a resolution of 3840 x 2160 (16:9, or approximately a 1.78:1 aspect ratio). For movies, Digital Cinema Initiatives (DCI) is the dominant 4K standard, with a resolution of 4096 x 2160 pixels (approximately a 1.9:1 aspect ratio). In addition to the standards themselves, the conversation is complicated by the question of whether a 4K stream is presented at 30 frames per second (fps), or 60 fps (theatrical movies are usually 24fps). Typically, manufacturers will list their product as "4K60" if it is in fact capable of supporting 60 fps. However, some will say simply 4K if their product supports only the lower 30 fps.

WHY DO VIDEO DISPLAY SYSTEMS STRUGGLE WITH SPREADSHEETS?

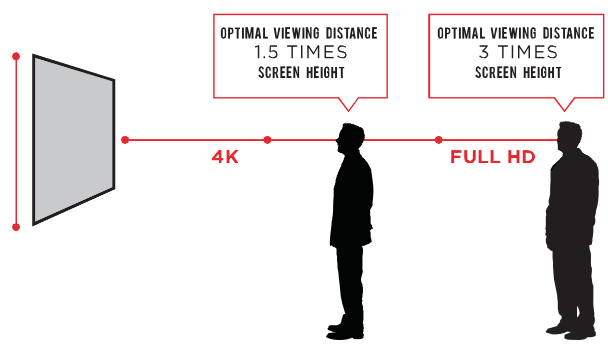
Most video compression algorithms are "tuned" to continuous tone images (the real world as viewed through a lens), whereas synthetic (computer) images have much different spatial frequency distributions. Spatial frequency refers to the level of detail present per degree of visual angle. A scene with small details and sharp edges contains more high spatial frequency information than one composed of large, coarse/uneven features. By optimizing for continuous tone (natural) images, which by their very nature (no pun intended) are typically large and coarse, most compression algorithms don't process synthetic images as well.

Images in motion make observing small spatial compression artifacts nearly impossible. Blink and you'll miss it. That's one of the reasons many video vendors only display rapid motion at trade shows. Ask these vendors to show you a still synthetic image with fine detail/high spatial frequency content (like a spreadsheet) to get a better idea of how visually lossless their system truly is.

RESOLUTION AND VIEWING DISTANCE

Optimal viewing distance is based on visual acuity—the ability to discern letters or numbers at a given distance according to a fixed standard. Optimal viewing distance represents the point beyond which some details in the picture are no longer able to be resolved, so pixels begin to blend together.

When looking at a 4K UHD screen (2160p), if you back up beyond 1.5 times the screen height, the human eye can't benefit fully from the added resolution of a 4K image compared to a 1080p image, and at about 2.5 to 3 screen heights there is no resolution advantage at all. Let's take an example of a 60 inch diagonal



TV. For a 16:9 screen ratio, the screen height will be 29.4 inches. To see all of the image detail on a UHD TV, you would need to view the image from 44 inches away—assuming you have 20/20 vision, that is. For a 1080p image, the optimal viewing distance is 88 inches.

A WORD ABOUT HDCP

First, some little known (or possibly widely ignored) facts about HDCP: It stands for High Bandwidth Digital Content Protection, NOT High Definition Content Protection! DCP LLC's main customer is Hollywood, and it was founded by Intel. It's not something cooked up by the AV industry to ruin lives. Remember that and it makes a little more sense.

HDCP FEATURE COMPARISON

	HDCP 1.x	HDCP 2.2	Draft HDCP 2.2 Pro
Network capable	No	Yes	Yes
Max levels	7	4	Unrestricted
Max devices	128	32	Unrestricted
Leave/join tolerant	No	No	Yes
UHD type 1 support	No	Yes	Yes
White list sites only	No	No	Yes

The legacy version, 1.x, is still in the market and is still present on a huge number of devices. It is mostly interoperable with 2.x devices, which simply convert 1.x to 2.x when they pass content through. However, "type 1 content" may not be delivered to any device that is not fully HDCP 2.2 compliant.

I'd like to draw attention to one significant difference between 1.x and 2.2 – **1.x does not support transmission of protected content over networks**. If a vendor is distributing HDCP media over a network, they must use HDCP 2.2.

Now let's look at another difference; Max Devices. HDCP 1.x supports 128 devices; HDCP 2.2 only supports up to 32. Now this is where it apparently gets complicated for some vendors of allegedly HDCP-compliant network video equipment. Many of them potentially fail the following quiz:

1. If I am sending HDCP protected content over a network I should use which HDCP specification?
   a. Version 2.2
   b. Version 1.x
2. HDCP 2.2 supports a maximum of how many devices?
   a. 32 Devices
   b. 128 devices

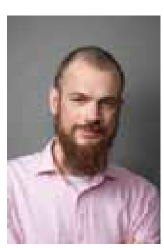
The correct answers are 1a and 2a, which tells us that vendors of network video distribution systems that claim to support more than the 32 allowed devices are either not aware of, or are being misleading about, the capability of their products. They may be breaking the rules unwittingly, or knowingly so and assuming that compliance will not be monitored or enforced in ProAV applications.

There is one company in the market that by default doesn't pass HDCP content. If you wish to do so, you are asked to phone the vendor directly. They will then issue some verbal instructions over the phone, have you interrupt the device boot, create a special text file that needs to be uploaded to the device, check an unmarked checkbox in the product UI, and then ask you as the customer to click an acknowledgement taking responsibility for all the content on their network.

So what about HDCP 2.2 Pro, which we hear tell about? Can't we just use that? Not yet, since it only went into internal final draft in April and was only published to the HDCP internal adopters website in May. No one has yet had a chance to make a product based on it!

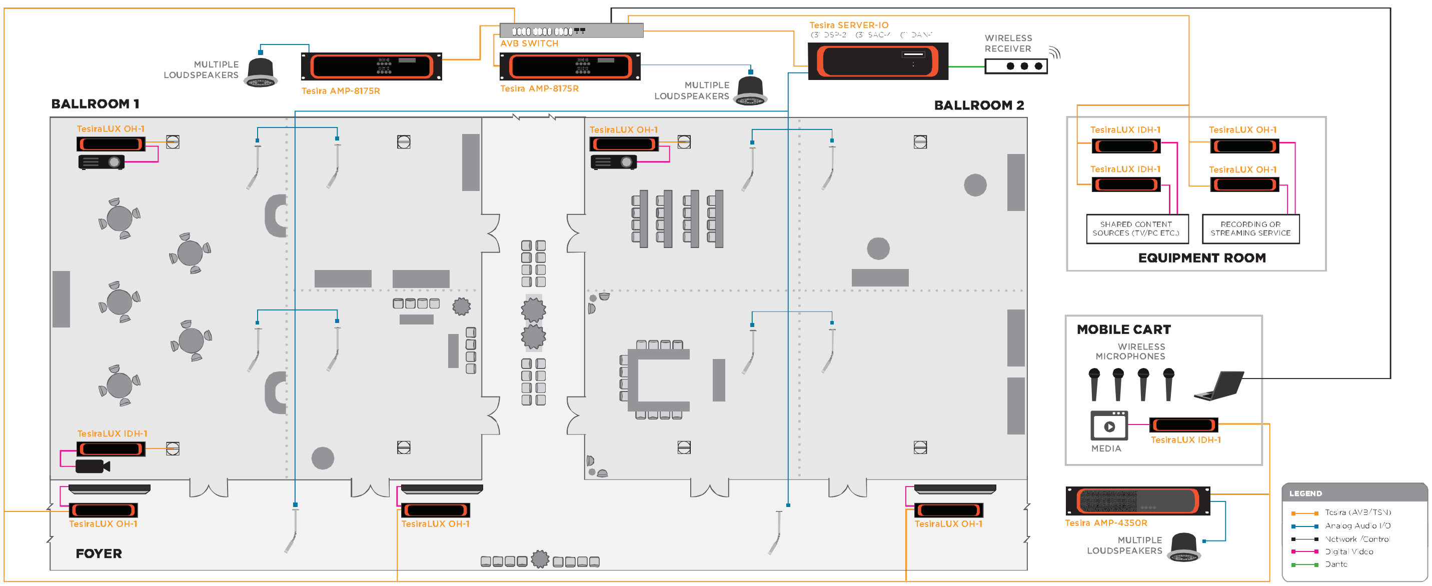
HDCP 2.2 Pro will indeed be a robust way to implement HDCP on commercial AV networks. It has no restrictions on the number of devices. It will support wired and wireless networks and even better it eliminates some of the constraining factors of HDCP. But HDCP Pro does come at a cost. Vendors will need to build separate HDCP Pro repeaters, which are labeled as such. They will only be able to sell them to authorized installers (who will have become so by entering into a legal agreement with DCP), and those installers must only install them in projects that fit the criteria of the HDCP Pro White List.

Until HCDP 2.2 Pro arrives in products, network video vendors are bound by the limitations outlined by HDCP 2.2 – 32 devices only. Doesn't matter which language—thirty-two, zwei und dreissig, or trente deux—it's still only 32 devices. Definitely not 128 or "an unlimited number" or even "yes." Anything greater than 32 is breaking the rules, whether they know it or not. Integrators should know and understand that.

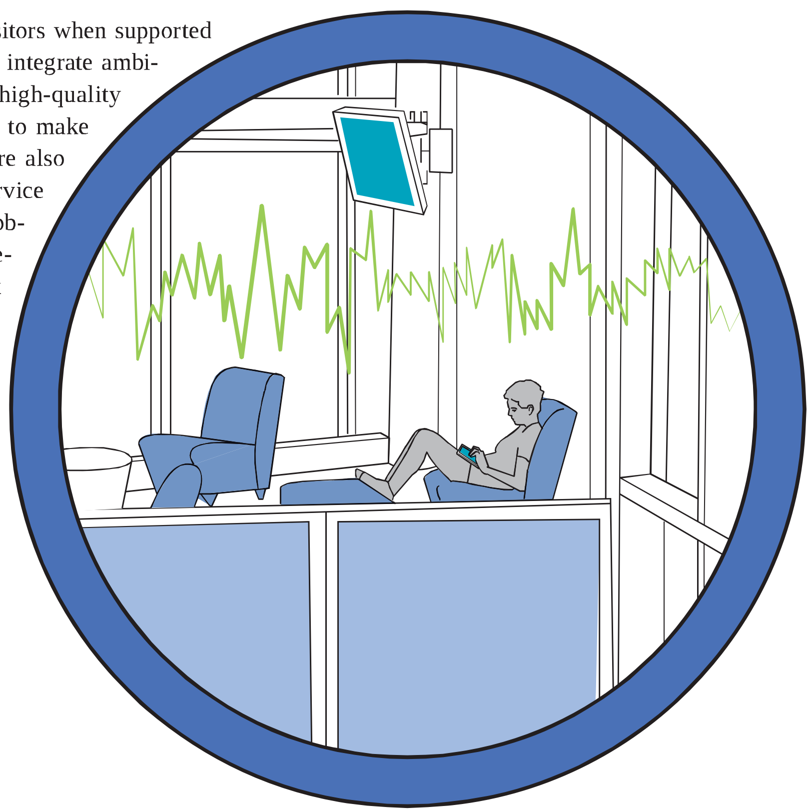


Chris Fitzsimmons is the product manager for Video Products at Biamp Systems.

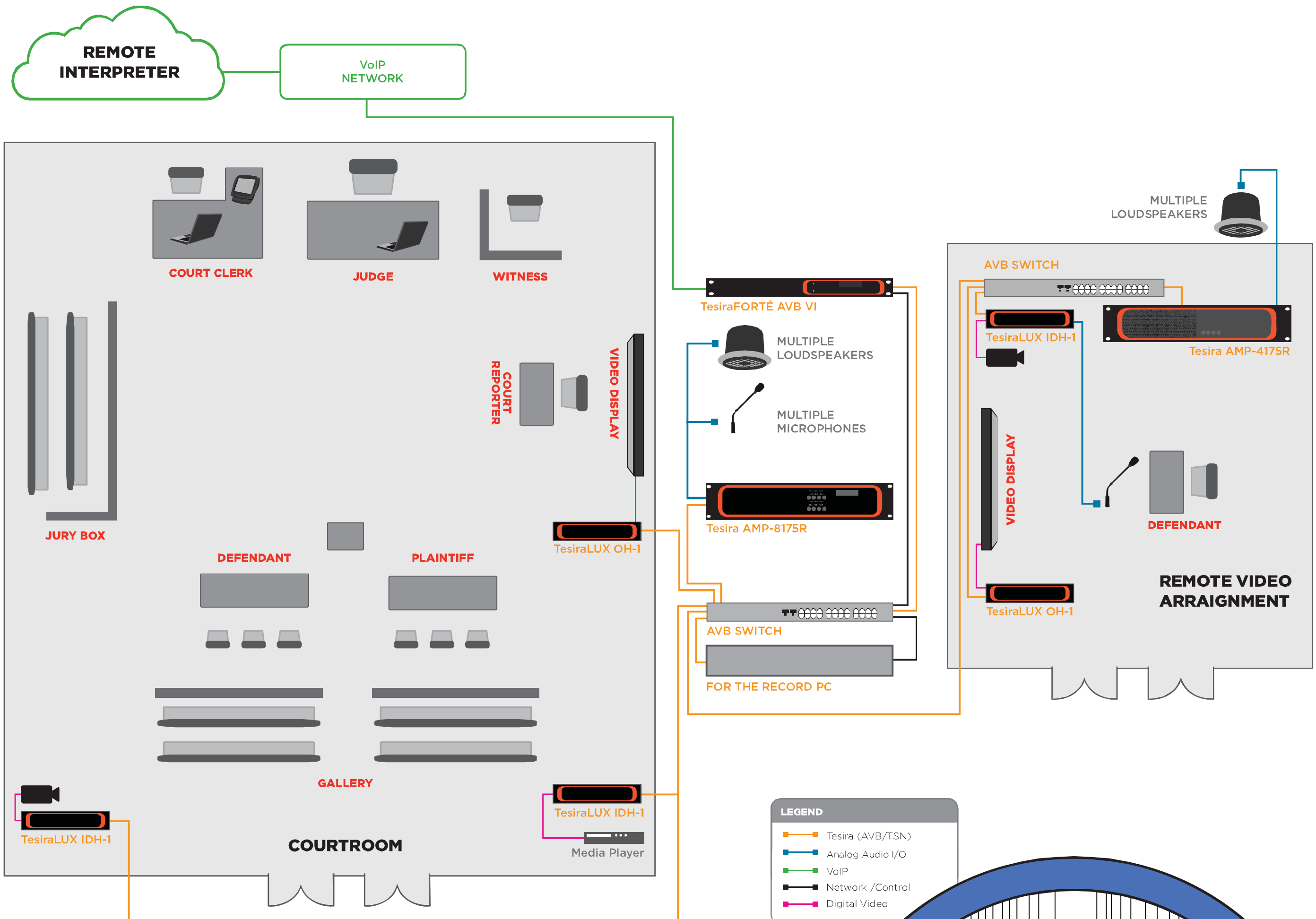
APPLICATION: HOSPITALITY



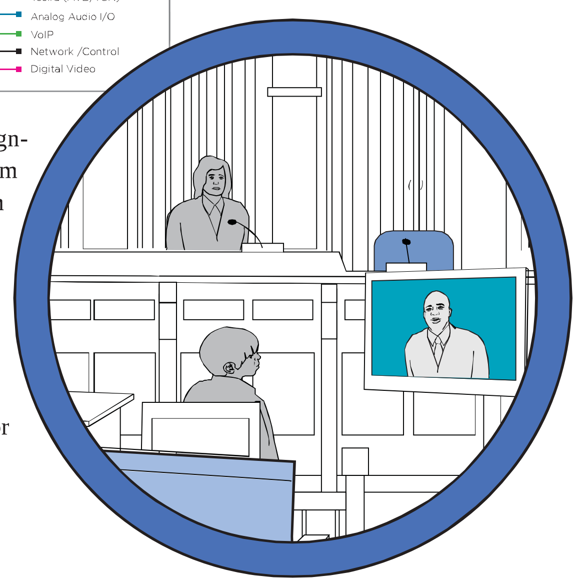
Hotels and convention centers function best for visitors when supported by a robust AV network. Whether it is a system to integrate ambient noise compensation or to control distribution of high-quality ambient audio and/or video, networks can be used to make guests more comfortable and engaged. Networks are also critical to revenue because they support valuable service offerings, managing systems for dining facilities, lobbies, small meeting spaces, and ballrooms—the lifeblood of convention centers. A flexible AV network can accommodate gatherings of different sizes and quickly and easily allow the physical space to be reconfigured accordingly, and audio and video routing to be redistributed without disturbing nearby spaces. When combined with software and adaptive DPS to manage ambient noise and levels, these networks can help hotels and convention centers get the most out of these high-demand spaces.



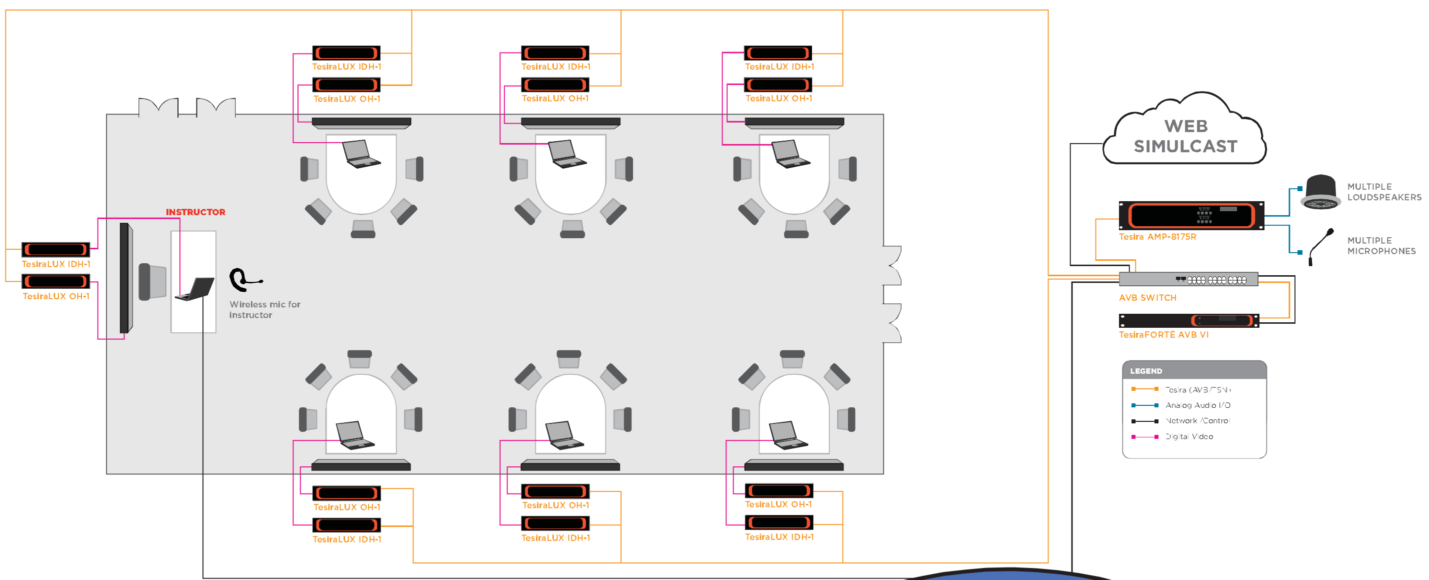
APPLICATION: REMOTE ARRAIGNMENT



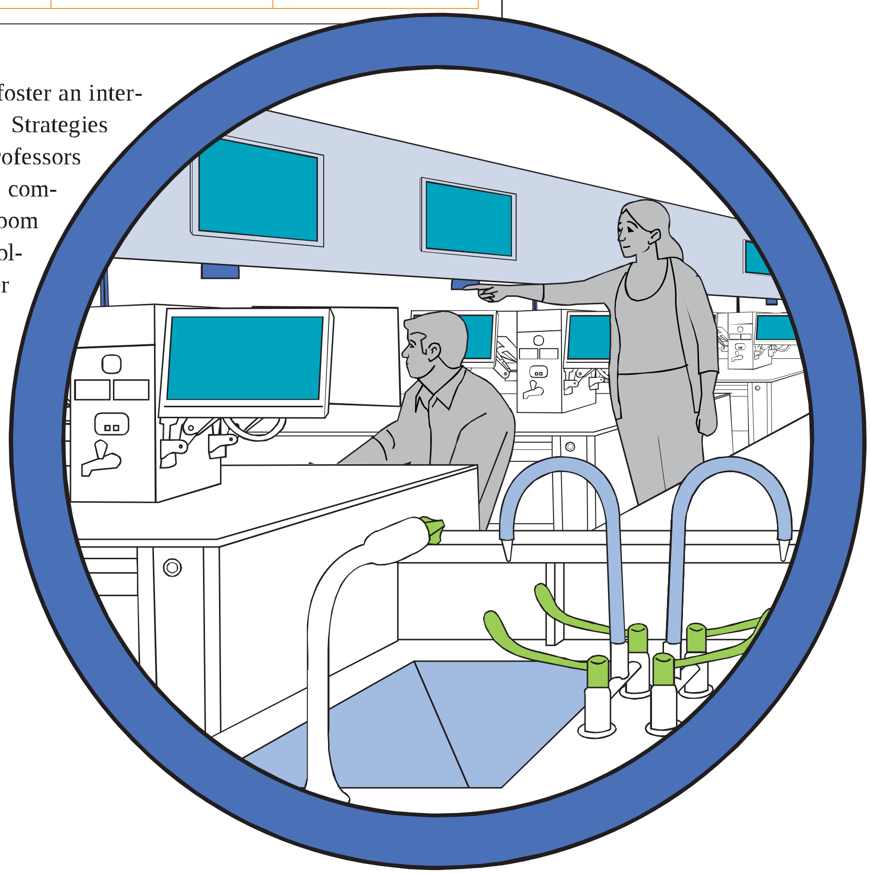
Courtroom AV is on the rise for documenting proceedings and supporting remote arraignment and testimony. In this scenario, both the audio and video processing are done from the same platform, for both the courtroom and remote arraignment room. Courtroom systems can be standardized and centralized to facilitate level control for speakers and microphones, recording and audio playback from multiple sources including DVDs, MP3 players, recorders, and other devices. The video endpoint enables individuals to appear, testify or interpret without incurring travel costs or increasing logistical coordination; the video endpoint can also service the mic/line inputs. VoIP connectivity enables the capability for remote testimony and interpretation. An AVB/TSN card running court recording software provides seamless capture of audio court proceedings for transcription later.



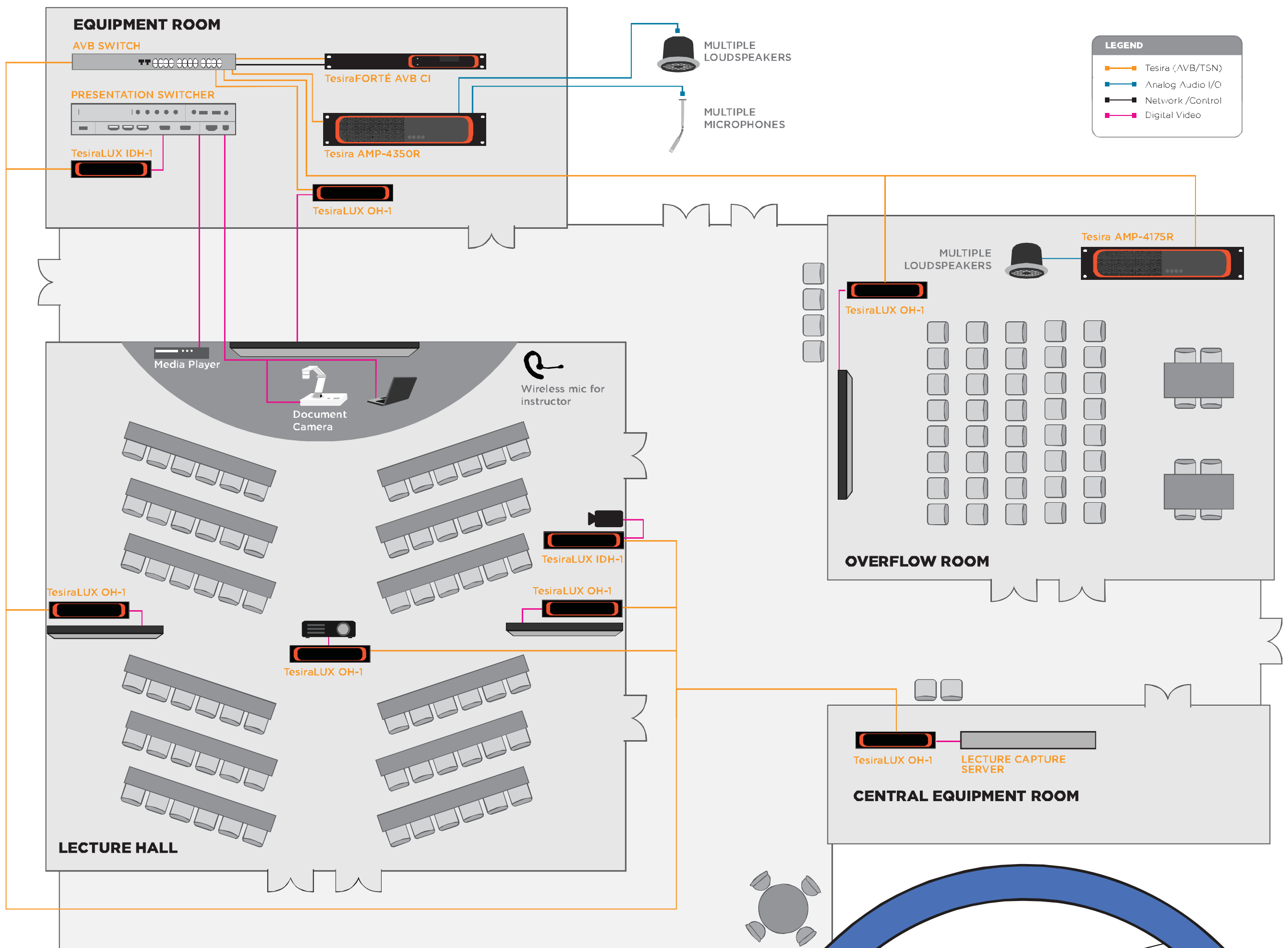
APPLICATION: ACTIVE CLASSROOM

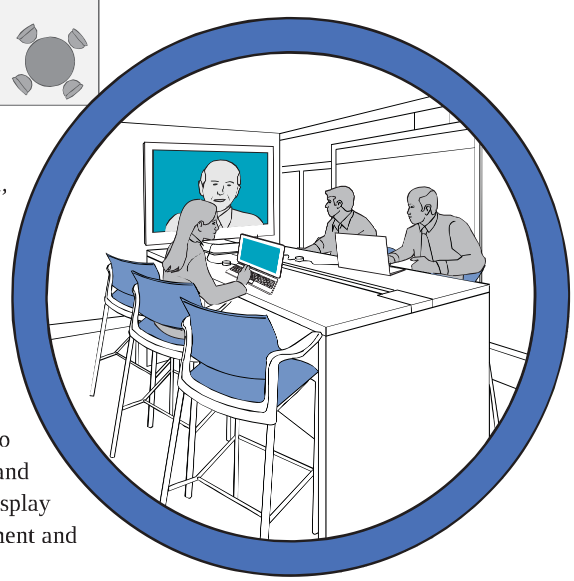


Active Learning Classrooms are designed to foster an interactive, student-centered learning experience. Strategies often involve complex interactions among professors and students, as well as local and even global communities. The physical space of the classroom must encourage these interactions. Technology plays a key role in this support, whether allowing bi-directional sharing between the instructor's station and the student's desks, or supporting Skype or GoToMeeting to extend the lesson outside the walls of the classroom. Having low latency, synced AV and quality sound reinforcement brings these scenarios to life and ensures that students will remain engaged and collaborating, and not fatigued by low quality AV.



APPLICATION: LECTURE CAPTURE





Lecture capture is becoming increasingly important for higher education, both for students who want the flexibility to study on their own schedules, and for institutions to make their valuable educators available to a wider constituency. With competition growing among brick-and-mortar institutions and with online-only alternatives, faculty and administrators need ways to improve value for students attending in person, as well as position themselves to compete virtually with live and on-demand content. In order to serve all these audiences, the audio and video network must be able to accommodate a multitude of input sources—from document cameras, to spreadsheets and live and streamed video and the variations in bandwidth and resolution that go with that. Furthermore, the system must serve a range of display and playback devices, some of which need processing and sound reinforcement and all of which need audio synch.

PRODUCTS

TESIRA PLATFORM

The Tesira platform is Biamp's flagship audio and video platform and a truly networked media system. It gives designers an integrated and scalable way to meet the demand for high quality, synced audio and video over enterprise-wide media networks.

The Tesira platform is loaded with audio and video processing capabilities, including Biamp's sophisticated, adaptive DSP, responsive AEC for clarity and intelligibility, and soft codec support. The entire platform and all its elements and features can be designed, commissioned, and managed from a single software platform.

The proven combination of the Tesira SERVER and SERVER-IO with Tesira amplifiers, expanders, and controls, is deployed in custom systems all over the world. The TesiraFORTÉ line of fixed audio I/O devices, expands the reach of the platform into systems and applications of all sizes. Whether deployed over networks employing AVB/TSN, Dante, CobraNet or a combination, Tesira delivers a scalable professional grade media network that can be perfectly tailored to applications and end user workflow, across a range of budgets. For mission-critical applications, Tesira SERVER can be deployed in redundant pairs.

With an AVB/TSN backbone and the provision for bandwidth reservation it provides, Tesira media streams can travel over a converged corporate network; Tesira does not require a separate network to operate (though it can be deployed separately if that is the customer's preference). As needed the network can scale up with I/O devices and out across the enterprise or facility—to auditoriums, conference rooms, work areas and between campus buildings. Its low-latency and time synchronization ensure that both audio and video elements can be managed as one system and are guaranteed to sync without time-consuming workarounds. Tesira audio devices are AVnu certified. This is a significant milestone, achieved after rigorous testing by AVnu.

SUPPORTED SWITCHES

- **Extreme Networks** AVB-enabled switches include select Summit series switches, and scale from Gigabit to 10/40GbE, copper/fiber, with or without PoE+.
- Select models of the **Netgear** GS7-series and S3300-series support AVB functionality.
- **MOTU** offers a 5-port AVB switch that has been confirmed to work with AVB-enabled Biamp Tesira devices.
- **Cisco** NX-OS Software Release 7.3 supports the standard on Cisco Nexus 7700 platform switches, Cisco C3850 MultiGigabit, C3850 10G SFP+ and C3860mini support the standard.

CONTROL AND EXPANSION

Control options for the Tesira platform include Oreno mobile control software, Biamp Canvas control software, the Tesira HD-1 hardware dialer, EX-LOGIC half-rack logic box, and the TEC-1 wall controls. Advanced networking tools include selectable clocks and nameable network. The platform allows you to add endpoints and I/O as needed, including PoE expanders and controls.

Oreno mobile control software offers room control options including microphone and loudspeaker levels, as well as conference calling, all from a straightforward user interface accessed via web browser or nearly any mobile device. Pre-designed with a professional UI, it requires minimal design work to hand off to the client, no client software to install, and comes with integrated LDAP to manage access and credentials.

Biamp Canvas design and control software supports the efficient creation of customized control screens with a flexible graphic control interface that can be tailored exactly to the installation environment using a drag-and-drop GUI. A group of drawing tools supports customized controls, backgrounds and labeling.

TESIRALUX

The V in AVB is here. With the addition of TesiraLUX, Tesira now supports real-time video distribution over the network, with unmatched lip sync capabilities. Since Tesira manages the entire audio and video signal path, Tesira processing recognizes how long it takes for each signal to pass over the network, allowing it to accurately synchronize everything.

TesiraLUX supports High Dynamic Range (HDR), can accept up to 4K60 resolution, 16-bit color depth and 4:4:4 chroma sub-sampling, and it supports the Rec. 2020 color space. It also supports 8-channel PCM audio for embedding and de-embedding, as well as managing EDID automatically between the TesiraLUX device and the input source/output display thanks to scaling in both the encoder and decoder.

AVB/TSN's deterministic nature allows networked media systems such as TesiraLUX to provide end-to-end system latency of under two frames, including scaling, compression and network transit. Content and conversations are both visually lossless and perfectly in time.

REC. 2020

ITU-R Recommendation BT.2020, more commonly known by the abbreviations Rec. 2020 or BT.2020, defines various aspects of UHD TV such as display resolution, frame rate, chroma sub-sampling, bit depth, and color space.

COMMISSIONING AND CONTROL

TesiraLUX is fully integrated with the Tesira platform. This lets system designers use a single software environment for both their audio and video installations. Video I/O blocks—similar to their audio counterparts—are available and since Tesira coordinates signal distribution there's no need to manually add audio delays for lip sync, saving significant design time. The new video partitions behave just like their audio cousins, allowing a modular approach to system design and commissioning. With partitions you can configure distinct areas and add, maintain, or update them separately while other areas remain up and running. These software-only boundaries mean elements can be grouped by function, location, or a mix of criteria, making it easy to integrate and control both audio and now video.

For ease of install and commissioning, Tesira supports automatic device discovery, enabling rapid configuration and commissioning. In addition, TesiraLUX allows the integrator to make intelligent decisions about what to send over the network and to treat various content types appropriately, managing bandwidth for maximum efficiency and lossless transmissions. Multiple software-based options are available for managing bandwidth, including setting maximum resolution, frame rate floor, and/or a rate of compression. The software will even indicate when a stream may be too large for the media port capacity. Transmission options include both 1Gb (RJ-45) and 10Gb (SFP+).

Once the system is laid out, Biamp's unique configuration engine allows you to click "compile" to validate your design and confirm the most efficient hardware scenario, as well as establish the necessary AVB streams and connect and manage connections without manual intervention required.

TesiraLUX will be primarily controlled via the Oreno mobile control suite.