AES67-2013

The New Networked Audio-Over-IP (AoIP) Interoperability Standard

By
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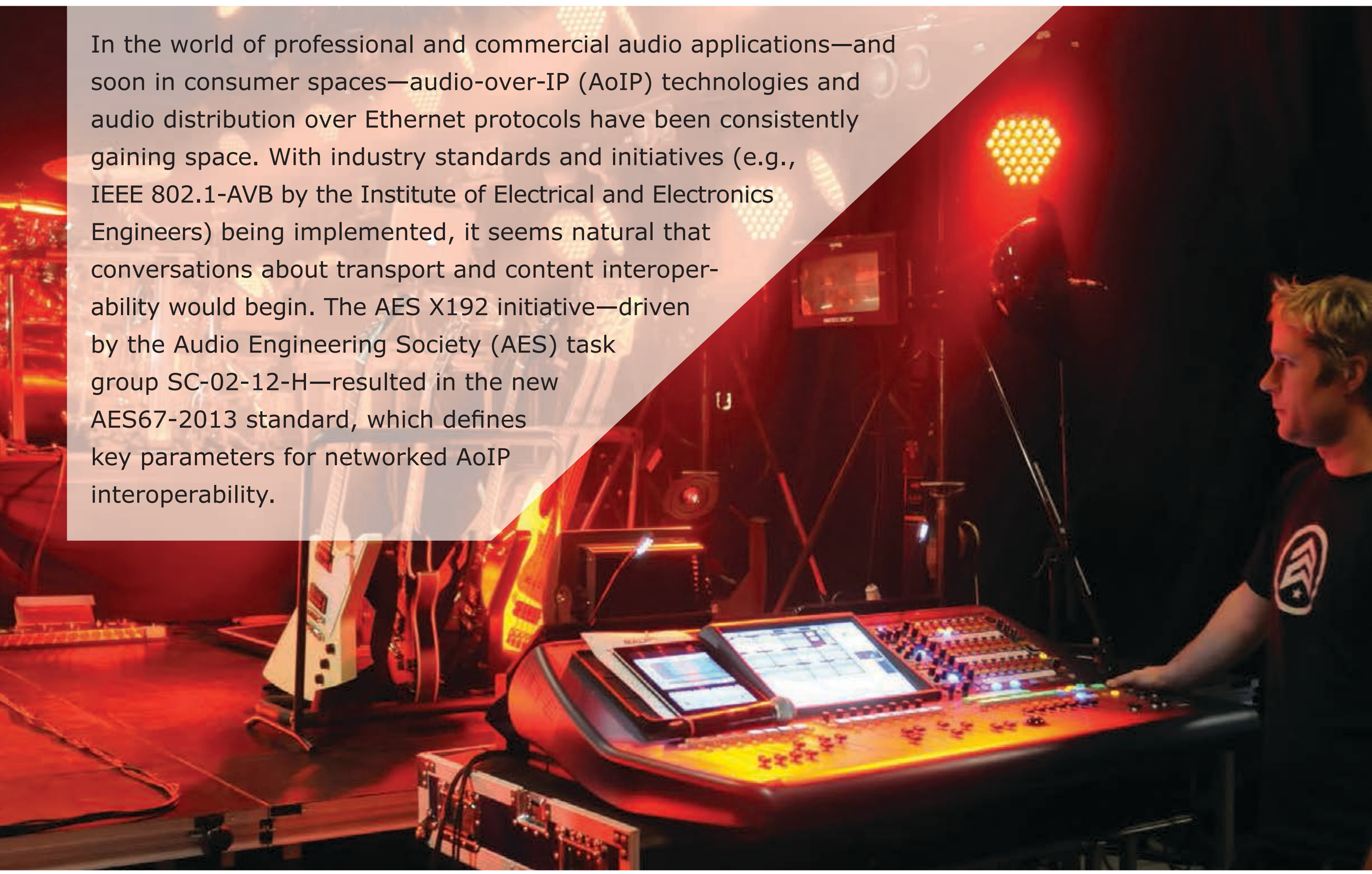
In the world of professional and commercial audio applications—and soon in consumer spaces—audio-over-IP (AoIP) technologies and audio distribution over Ethernet protocols have been consistently gaining space. With industry standards and initiatives (e.g., IEEE 802.1-AVB by the Institute of Electrical and Electronics Engineers) being implemented, it seems natural that conversations about transport and content interoperability would begin. The AES X192 initiative—driven by the Audio Engineering Society (AES) task group SC-02-12-H—resulted in the new AES67-2013 standard, which defines key parameters for networked AoIP interoperability.



The AES X192 project identified the commonalities between current proprietary and open-standard technologies on high-performance media networks supporting professional quality audio. The networks were primarily adopted for live sound applications.

For the last 10 years, the audio industry has been increasingly using IT network interfaces to handle audio distribution. Proprietary solutions and protocols include Roland Ethernet Audio Communication (REAC) and the SuperMAC/HyperMAC AES50 technology. This technology was originally developed by Sony Oxford and later sold to Klark Teknik/Midas. It has been adopted on all MUSIC Group (created by Behringer) digital solutions.

In other industry segments (e.g., broadcast radio) AoIP efforts started in the late 1990s, because requirements were usually limited to stereo signals and the use of audio compression was accepted. Slowly, Livewire, the Axia/Telos audio transport solution, was adopted by almost all radio equipment manufacturers. The same can be said with commercial audio installations, where Cobranet—developed in the 1990s by Peak Audio and later acquired by Cirrus Logic—was the first commercially successful implementation of audio over Ethernet (AoE) and is still being used.

Other technologies using Ethernet Layer 1 and Layer 2 for audio transport include Digigram's EtherSound, Harman's HiQ-net/BLU Link, Aviom's A-Net, and Riedel Communication's Rocknet, among others.

Later, more broadly adopted solutions started to emerge, with Dante, developed by Australian company Audinate, almost becoming a "de facto" standard, transmitting audio data on Layer 3 in UDP/IP packages in a 100-Mbps or 1-Gbps Ethernet.

Other increasingly important technologies include QSC QLAN, a proprietary network audio protocol used by QSC Audio in its Q-Sys product line, which incorporates a collection of open standards and binds them together into a Layer 3 Ethernet transport solution.

Another emerging effort is Ravenna, an open, license-free technology, developed by ALC NetworX, a subsidiary company of Lawo. The technology addresses specific needs of broadcast environments and studio production. Ravenna is fundamentally a Layer 3 approach resulting from the evolution of several previous efforts. It uses a collection of standardized network protocols for audio and proprietary control protocols, similar to QSC QLAN and Audinate Dante. The protocols focus on the more demanding requirements of the professional recording and broadcast markets, including in-house signal distribution for broadcasting, outside broadcast (OB) van support, and inter-studio links across WAN links and production facilities.

Recently, Audio Video Bridging (AVB)—still a Layer 2 Ethernet protocol—was standardized as IEEE 802.1-AVB. The protocol includes several different modules that address many industry requirements and is expected to also evolve into a Layer 3 implementation, according to the IEEE 1733 standard.

AES67—The Next Logical Step

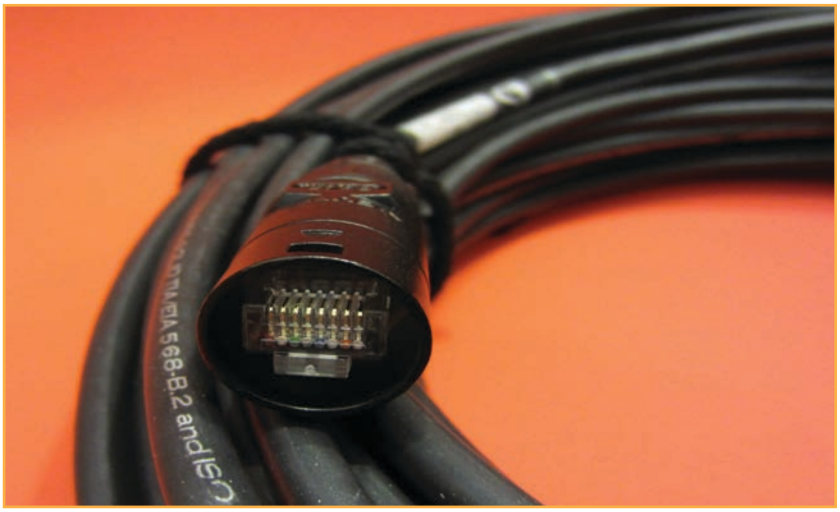
In December 2010, the AES initiated its AES-X192 project. The project's goal was to identify the commonalities among all the current proprietary and open-standard technologies and define a common interoperability mode with recommendations regarding synchronization, media clock identification, network transport, encoding and streaming, session description and connection management for operation of those systems.

The X192 task group focused on high-performance media networks supporting professional quality audio (16 bit, 44.1 kHz and higher) with low latencies (less than 10 ms), available on LANs. It attempted to define methods for interconnection between devices built on otherwise-incompatible transports that manufacturers could adopt.

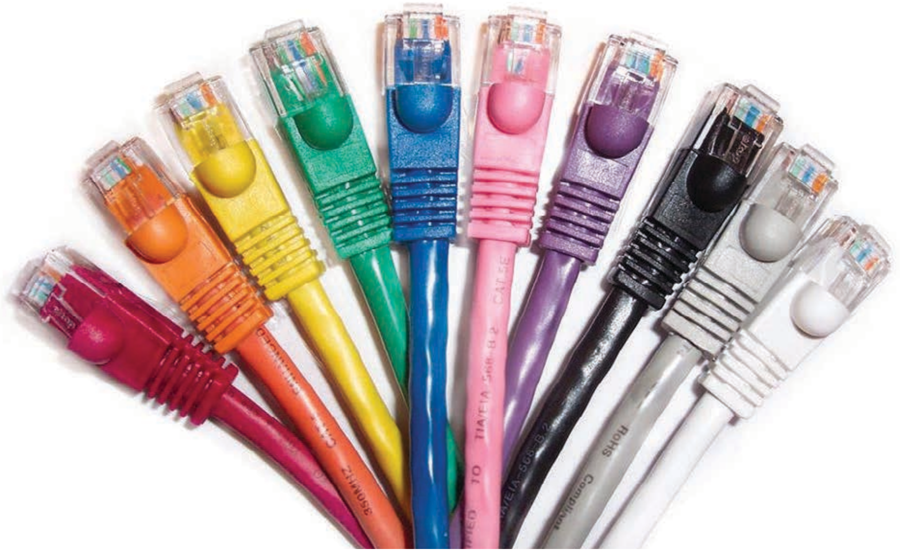
In August 2012, the AES and the European Broadcasting Union (EBU) jointly announced a collaboration to achieve interoperability of networked audio, reaching out to the more "broadcast-oriented" companies. The intent was not to invent new technology, but to identify an interoperable subset of existing technologies to achieve this goal. Task Group SC-02-12-H, under the leadership of Kevin Gross, used web conferencing and e-mail to collaborate, refine, and clarify the necessary parameters. The group used the European and North American AES conventions for formal meetings. The main technical work and standard draft development was completed in April 2013, with the approval for publication granted by the AES Standards Committee following a six-week public comment period.

On September 11, 2013, the AES officially announced the publication of its new engineering standard AES67 for "networked/streaming audio-over-IP interoperability."

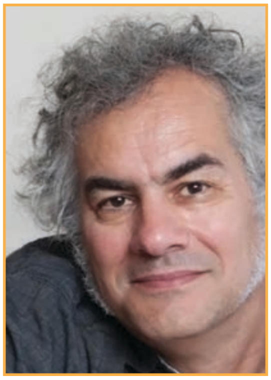
The resulting AES67-2013 document describes an interoperability mode between systems supporting high-performance AoIP networks, focusing on



The AES67-2013 document describes an interoperability mode between systems supporting high-performance audio-over-IP (AoIP) networks, recommending practices for different networked audio systems in studio, broadcast, and live sound applications.



AES67 promises to create interoperability between audio networks, especially those operating under various proprietary Layer-3 protocols, including the IEEE 1733 variant of AVB, Dante, Livewire, Q-LAN, and Ravenna.



Kevin Gross describes the genesis of the AES67 standard: "When you're working in the IP environment there are a limited number of ways to mix and match existing pieces to implement an audio network. So it's inevitable that IP-based solutions will have similarities. As I surveyed various implementations it became apparent that these similarities provided an opportunity for interoperability."

defining requirements for network performance and latency depending on the type of application. It also recommends practices for different networked audio systems in studio, broadcast, and live sound applications to interoperate in the critical areas of synchronization, media clock identification, network transport, encoding and streaming, session description, and connection management.

The Task Group, under Gross's leadership, carried out this critical effort, identifying an interoperable subset of existing technologies to achieve this goal. Gross was also part of the team that developed the original CobraNet system and Peavey's MediaMatrix digital signal processing system. Gross is also an active contributor to the AVB standards efforts and has helped QSC Audio deploy the audio networking component of its Q-LAN technology. So far, it is the only audio network solution fully certified by Cisco Systems, one of the founders of the AVB initiative. "The purpose of AES67 is to create a place where several existing protocols can be tied together. If the standard is successful, we may eventually reach a point where the original protocols are less frequently used," explained Gross.

Setting a Unified Standard

The AES67 recommendations are now being implemented within the different industry efforts, starting with those companies whose employees were directly involved in the X192 group's work. The X192 Task Group consisted of more than 100 members from a variety of equipment manufacturers—including some direct competitors but also many of the main promoters of the most important technology efforts.

Companies contributing to the AES X192 effort, such as QSC Audio and Telos Systems (Axia) already publicly stated their commitment to answer the challenge. There were also positive reactions to the standard from those who already supported various proprietary Layer-3 protocols, including the IEEE 1733 variant of AVB, Dante, Livewire, Q-LAN, and Ravenna.

Axia's Livewire technology is a good demonstration of implementation. It is already being fully integrated in the Ravenna consortium specifications. As the engineering team behind it explains on its website: "We'd like to point out (modestly, of course), that the AES67 specification is a subset of the many functions that Livewire performs. When we developed Livewire, we had to invent a lot of the crucial technology, because a standard didn't exist—and earlier networked audio systems lacked critical functionality. So we developed a way to make GPIO logic 'ride along' with the audio streams, and a way of having available sources 'advertise' their availability to all the networked devices. We also recruited partner companies whose products are respected and widely used in the radio industry. Then we shared our technology with them, so that station engineers could connect as many audio devices as possible directly to their audio network. Not only is native connectivity an elegant solution, it reduces total system costs by removing the need for those extra interface boxes.

"Ten years later, the industry has finally adopted a standard for AoIP audio transport in AES67, with the goal that every studio audio device can eventually click together with CAT-5 and share audio."

ALCNetworX, Ravenna's parent company, was also a member of the X192 committee and it has stated plans to fully embrace the new standard, implementing a protocol that supports AES67 interoperation. "AES67 is finally setting a standard for high-performance streaming AoIP interoperability. AES67 will become an operating profile for Ravenna devices," said Andreas Hildebrand, senior product manager at ALC NetworX.

An important contribution may result from the already announced collaboration between Digigram (former promoter of EtherSound) and ALC NetworX, within the framework of the Ravenna alliance, further implementing AES67-2013-compatible solutions.

As Philippe Delacroix, CEO at Digigram stated, "As the industry continues to evolve, we are confident that Ravenna and the AES67 standard will be employed widely by the broadcast industry to replace AES and MADI. For this reason, we have made the strategic decision to implement Ravenna into all of our existing products, such as our AoIP codecs, as well as new products under development."

The Next Steps

As with every standard, the results will reveal if this was an effective initiative. One of the key aspects of the AES67 implementation is that there will be no compliance organization associated with AES67. As Gross explained, "Many standards interoperate well without such initiatives. Since AES67 is a standard based on existing standards, there is considerable experience amassed and engineered already completed that should serve to ease interoperability issues."

Under AES67, connection management is implemented in two different ways depending on the nature of the connection. All that is required is a means of distributing a description of the stream—in Session Description Protocol (SDP) format—to potential receivers. Under AES67, Session Initiation

Protocol (SIP) can be used in a peer-to-peer mode or through SIP servers.

AES67 does not include specific requirements for discovery and control functions. Companies can choose solutions for discovery and control. Interoperability without discovery or control is ensured by mandating use of SIP for connection management and designating the SIP Uniform Resource Identifier (URI) or SDP description as the information that needs to be distributed through a discovery system. Standard use of a few discovery systems including Bonjour and SAP is discussed in the standard.

The AES67 standard also uses existing standard protocols and technology from the IEEE, the Internet Engineering Task Force (IETF), and other standards developing organizations. It is not inventing new protocols or technologies rather it is defining how to use existing protocols as a system in an interoperable manner. That means that all protocols used by AES67 are routable over standard IP networks and Ethernet networks of any size.

The AES67's most relevant contribution will probably be within the framework of the AVB standards, since AES67 is compatible with and receives performance benefits from the synchronization, QoS, and control behavior capabilities existing on an AVB infrastructure.

AVB defines two types of transport protocol for media data. IEEE 1722 is an Ethernet-only transport and is incompatible with the AES67's defined scope. IEEE 1733 defines an IP transport for AVB based on RTP. This "flavor" of AVB is compatible with the AES67's scope and goals. Interoperability with this type of AVB is described in annexes C and D of the standard. AES67 enables AVB implementations to reach beyond Ethernet into wider-area applications. The role of the AVnu Alliance, the industry forum dedicated to promote the adoption of the IEEE 802.1 AVB will be critical in this area.

Gross already stated publicly, "We really should try to get a point where we have media networking devices and users don't have to worry about whether they're AVB or Dante or something else. All manner of things now connect to cellular, Wi-Fi, Ethernet, and the Internet and we've reached the point where if the jack fits in the socket or you can pick up a radio signal, you can connect and do useful stuff. Behind the scenes there's a surprising amount of engineering required to make this go smoothly. But let's pull our heads out of our respective technology camps and work on making this happen. It's what networking is all about."

Gross also states that the AES67 standard will enable manufacturers to continue offering products that provide what they believe to be the best solutions for their users. "For system integrators and end users, the benefits are clear. They will be able to select and interface the products that best meet their design goals with confidence that the devices work and play well together."

Meanwhile, other relevant AES task groups are addressing other aspects of interoperability, such as the AES X-210 project, which is currently working to standardize the Open Control Architecture (OCA), created by the OCA Alliance.

The Alliance was formed by a key group of professional audio companies to create an open public control standard for professional media network systems and to ensure a wide interoperability of professional audio equipment. The work of AES X-210 largely complements many of the AES67's key aspects.

Resources

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