AES67 AND RAVENNA IN A NUTSHELL

Content

Abstract

The aim of this short article, without going into the level of technical detail already described in the related White Paper[1], is to demonstrate that since RAVENNA's fundamental operational principles, protocols and formats are all in line with what has been defined in AES67 - **RAVENNA is *already* fully compatible with AES67**. Indeed, not only is RAVENNA AES67 compatible, but largely exceeds AES67's recommendations at every level.

1 What is AES67 and why is it so important?

AES67 is the published standard which resulted from the AES-X192 project to develop audio network interoperability, because until now no such standard existed. Headed up by respected industry veteran of media networking and the father of CobraNet, Kevin Gross of AVA Networks, the stated goals of the project were to develop an interoperability standard for high performance professional digital IP networking, by addressing synchronisation mechanism, encoding format and QoS provision for delivering audio data as well as connection management functions associated with audio delivery. AES67 uses existing and standard protocols and technology from the IEEE, IETF and other standards developing organizations. It does not invent new protocols or technologies; rather, AES67 defines how to use existing protocols as a system in an interoperable manner.

The technical scope of the project focused on higher performing networks which enable high-quality (16 bit/48 kHz and higher), high-capacity (up to several hundred channels) and low-latency (less than 10 milliseconds) digital audio transport. The level of network performance required to meet these demands is typically available on local area networks and achievable on enterprise-scale networks. Because IP protocols are readily carried over Ethernet networks, the standard is also fully applicable to Ethernet networks of any size.

Since its inauguration at the end of 2010, the AES-X192 task group membership list has grown to more than 100 individuals, representing a prestigious spectrum of companies and organizations

[1] RAVENNA & AES67 – available on the RAVENNA web site (www.ravenna-network.com)

from the professional audio community. Through bi-weekly web conferences and several face-to-face meetings, the task group produced a 40+ pages draft, which on September 11th, 2013 was finally published as ***AES67-2013 standard for audio applications of networks - High-performance streaming audio-over-IP interoperability.***

AES67 is expected to be useful for interoperability scenarios within broadcast, music production and post-production facilities as well as for commercial audio applications including fixed and touring live sound reinforcement.

AES67 is not intended to be a solution on its own, but rather providing means for exchanging audio streams between areas with different networking solutions or technologies already in place. It can be expected that the various IP-based solutions will enhance their capabilities in order to adopt an AES67-compliant stream mode to facilitate inter-system interoperability. It is expected that the various solutions will remain on the market as their individual features exceed the commonalities defined by AES67. In this respect, AES67 may be seen as the "0-negative of audio networking" - in analogy to the blood group "0" which is the universal donor. However, the AES has stated that, given the current state of the market where we have reached saturation point with the number of standards and protocols available, if the standard is successful, we may eventually reach a point where the original protocols are less frequently used.

2 What is RAVENNA and how does it relate to AES67?

RAVENNA is an open technology for real-time distribution of audio and other media content in IP-based network environments. Utilizing standardized network protocols and technologies, RAVENNA can integrate and operate on existing network infrastructures. Performance and capacity scale with the capabilities of the underlying network architecture. Emphasis is placed on data transparency, tight synchronization, low latency and reliability. It is aimed at applications in professional environments where networks are planned and managed, and where performance has to surpass the requirements of consumer applications.

As an open technology, the functional principles are publically available and RAVENNA technology can be freely implemented and used without any proprietary licensing policy. Numerous industry partners are already supporting the RAVENNA technology and a variety of RAVENNA-enabled devices are already commercially available.

Since all relevant standard ingredients of AES67 are either identical or very similar to RAVENNA's operating principles, RAVENNA can naturally fully support interoperability as defined within AES67. However, since the RAVENNA technology framework offers performance and functionality superior to the AES67 interoperability specification, AES67 can be seen as one of many possible operational profiles for RAVENNA:

	AES67	**RAVENNA**
Synchronization	IEEE1588-2008	IEEE1588-2008
Network transport	IPv4	IPv4
Streaming protocol	RTP/UDP, multicast & unicast	RTP/UDP, multicast & unicast

Payload format	L16 & L24 48 kHz (44.1 / 96 kHz optional) 1 … 8 channels/stream	L16 / L24 / AM824 (AES/EBU transparent) 44.1 … 192 kHz (384 kHz w/ DSD/DXD) 1 … 512+ channels/stream
Connection management	Unicast: SIP Multicast: IGMP	Unicast: RTSP (+ SIP for AES67) Multicast: RTSP / IGMP
Advertisement & discovery	None	DNS-SD (Bonjour / mDNS)
Min. latency:	> 2 ms	< 100 µs

2.1 Profiles as a means for Interoperability

A potential issue with RAVENNA is that the full breadth and flexibility it offers might be intimidating, especially for newcomers. This is true for both users and manufacturers. In such a situation, incompatibility may result if all individual parties exercise their freedom of choice independently, and arrive at sets of choices which do not overlap.

Profiles are a way around this. They apply to a certain range of applications, and collect a minimum set of features these applications are likely to require from devices and from the network. Thereby they establish a baseline of compatibility the user can rely upon without having to check the details.

RAVENNA defines a set of profiles for application areas which are regarded as important. Manufactures have the freedom to implement these profiles in their devices as appropriate for their designated use cases. Of course devices can support multiple profiles concurrently, thus allowing a wider field of application and increased interoperability.

A generic operating profile has been defined to describe a base line of features considered to be indispensable for most devices; it contains a small set of requirements almost every device should be able to meet, and can therefore be expected by the user to be available in most RAVENNA devices. This is enough for some common use cases where particularly stringent requirements are not present, and can also serve as the default setting in more capable devices. Examples of commonly used stream formats being covered under the *RAVENNA Generic Profile* include:

- Low-latency stereo stream: 16 or 24 bit, 48 kHz sampling rate, 1 ms packet time
- surround stream: 16 or 24 bits, 48 kHz, 1 ms packet time
- standard stereo stream: 16 or 24 bits, 48 kHz, 4 ms packet time

Other profiles cover high-performance operation with MADI-like channel assembly and sub-milliseconds latencies or backbone interconnectivity with ultra-low latencies in the microseconds range and channel counts beyond 256. More profiles can be defined as application requirements demand. And manufacturers have the freedom of adding their own formats and profiles for their individual needs (i.e. DSD/DXD audio transport with 384 kHz as supported by Merging Technologies' Horus & Pyramix devices).

2.2 The RAVENNA AES67 Profile

As previously stated, since all relevant standard ingredients of AES67 are either identical or very similar to RAVENNA's operating principles, RAVENNA can naturally fully support interoperability as

defined within AES67 – in fact, AES67 is one of many possible operational profiles for RAVENNA. Since the AES67 specification is very close to the *RAVENNA Generic Profile*, it can be expected that all RAVENNA-enabled devices supporting the *RAVENNA Generic Profile* can also support AES67.

While the fundamental mechanisms and protocols for synchronization, transport and payload formats of AES67 are identical to RAVENNA's operating principles, AES67 calls for SIP connection management for unicast stream operation. SIP is not specified for RAVENNA as RAVENNA uses RTSP/SDP for connection management. RTSP/SDP is a standardized, widely supported mechanism for internet stream connection management and is used and understood by most media servers and players (i.e. Windows Media Player, VLC media player et al). SIP is widely used with VoIP telephony, but also within the ACIP protocol specification for codec-based audio contribution in broadcast applications. Since the RAVENNA framework allows for extensions and protocol variations beyond its core definition, SIP can easily be added as an ingredient for the RAVENNA AES67 operating profile. In other words, RAVENNA devices continue to use RTSP/SDP connection management, while SIP will be used when communicating to other devices under the AES67 operating profile.

While service advertisement and discovery are not defined within AES67, RAVENNA devices continue to use their advertisement and discovery mechanism based on Zeroconf, offering automatic discovery even when operating under the AES67 profile. However, since all RAVENNA devices also support manual configuration for stream setup, connections to other AES67-compatible devices not supporting Zeroconf-based discovery can of course also be established.

3 Assessment and Outlook

RAVENNA is a technology framework based on well-known and widely supported mechanisms. All employed protocols are based on IP and conform to established industry standards. The operating principles are fully published and implementation is license-free. Consequently, RAVENNA is well-accepted and can be enhanced and extended as application requirements demand.

Other IP-based technologies were in existence prior to RAVENNA, but – although featuring some commonalities – were not able to interoperate with each other. The motivation for AES67 was to define interoperability guidelines to which existing solutions can be adapted with reasonable effort in order to facilitate synchronized inter-system stream exchange.

AES67 and RAVENNA share the same fundamental principles for synchronization and transport, while AES67 packet setup and payload formats are functional subsets of RAVENNA. Minor differences exist with stream connection management, which can easily be adopted by the RAVENNA technology framework. Consequently, AES67 will be supported by RAVENNA devices as an operational profile. RAVENNA is currently the *only* IP audio distribution technology to offer such complete AES67 compatibility "out of the box".

Other audio-over-IP solutions will most probably continue to exist, as most of them already have a significantly large installed base. Most of them also offer application-specific functionality beyond the scope of AES67. Following X192 Task Group participation and contribution, it can be expected

that several other existing solutions will be modified or enhanced to support AES67 in the future. This will open up the landscape of product diversity and widen the field of application for AES67-capable devices. Limited interoperability can also be expected with devices compliant to the next revision of the EBU Tech 3326 protocol suite, which is currently work in progress in the EBU ACIP2 Work Group.

This all will help in broadening the basis of acceptance for high-performance network-based media distribution systems like RAVENNA.