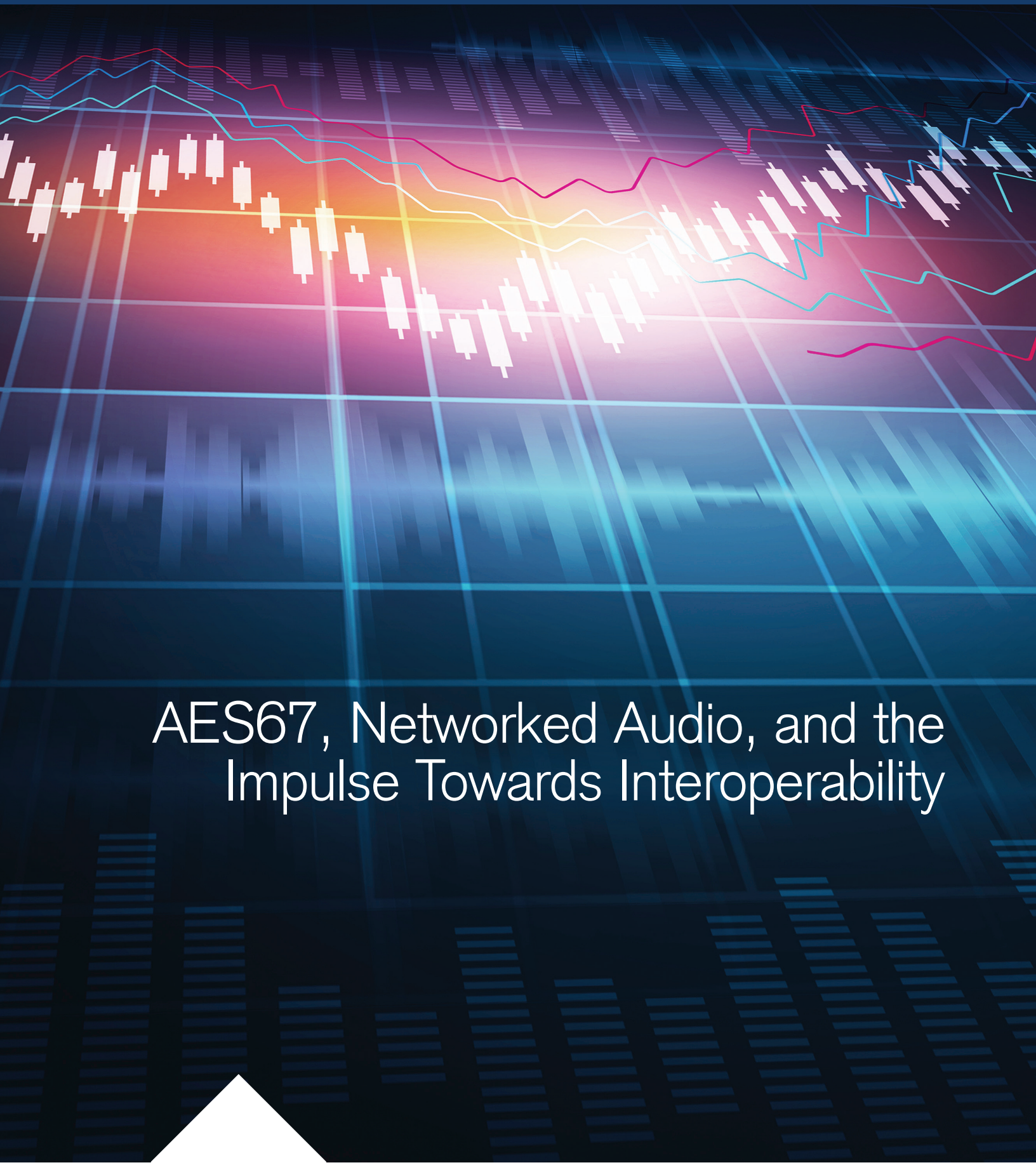

AES67, Networked Audio, and the Impulse Towards Interoperability

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PART I
CONTEXT

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While the core principles of IP-based networking have been in existence for much longer thanks to their early adoption in the IT world, it is only in the last 15 years that they have begun to be deployed extensively in professional audio applications such as fixed install, live sound and broadcast. With each passing year, Audio over IP (AoIP) and its ability to deliver fast and flexible networked audio over existing infrastructures has resonated more strongly with customers seeking to work efficiently and cost-effectively.

The result has been a gradual expansion of the variety and availability of networked audio technologies and solutions. Developed in the 1990s but still prevalent today, CobraNet and EtherSound were the trailblazers for digital audio networking. More recently, the practicality of audio over IP networking has in many cases outpaced the marketing efforts of the AVB manufacturers. Technologies built on IP have taken center stage since they are able to operate over existing networked infrastructures and therefore do not require substantial investment to be realized.

In particular, Audinate's Dante is now by some distance the world's fastest growing media networking technology. To a lesser extent, ALC NetworX's Ravenna has also achieved traction, although primarily in broadcast to the present time.

Inevitably given the existence of multiple protocols, one result of the last decade's worth of development has been the creation of 'islands' of products that support the use of one or more AoIP technology. In fixed install, where one protocol-based solutions are more common, this has been less of an issue. But in broadcast and live, where a greater variety of products is likely to be required to work together seamlessly, there has been a more obvious need for interoperability. As well as removing any lingering doubt on the part of the end-user that product A will work with product B and so on, despite which networking technologies are being used, there has also been a growing awareness that proven interoperability would help encourage the overall move towards IP.

Published in 2013 after several years in development, the AES67 standard is a response to these issues and is designed to provide a guaranteed level of interoperability between existing AoIP technologies. Dante and Ravenna both now offer compatibility with the standard. In 2016, it is increasingly evident that AES67 is contributing usefully to the accelerating adoption of IP-based audio.

AES67 is not a networking solution in and of itself, but rather a group of interoperability specifications for connecting the lower level media streams and therefore has many limitations when it comes to implementation in complex networked environments. Some existing AoIP solutions already provide a level of functionality and features that is above the transport layers and beyond those of AES67 – and is also likely to surpass those offered by future prospective related standards.

In addition to outlining the strengths and limitations of AES67, this White Paper will consider the future of standards more generally in pro-audio as one or two established media technologies continue to grow their market presence. ■

Whereas the pricing and availability of dedicated switches has undoubtedly slowed the adoption of AVB-based solutions, and the rather limited interoperability between various AVB implementations, the rise of IP-centric networked audio has progressed largely without interruption for more than a decade now. The ability for end-users to deploy AoIP via existing IT infrastructures has an obvious positive implication for end-users in terms of set-up costs and subsequent support and maintenance. Simultaneously, there has been a gradual awakening – particularly within the broadcast community – of AoIP's potential to enable faster and more efficient delivery and production of audio in OB facilities and broadcast centers, as well as the opportunities it can provide for monetized content-sharing.

Fixed installation has been another notable beneficiary, especially for venues such as conference centers and entertainment complexes where flexible distribution of audio between different rooms and external facilities is increasingly essential. With Dante, in particular, achieving sustained market growth, AoIP has now moved emphatically from "the invention stage to be big enough to create ecosystems", as RH Consulting wrote in their widely-reported January 2015 paper, 'The Death of Analogue and the Rise of Audio Networking'.

But as the take-up of individual networked audio technologies has accelerated, so has uncertainty about whether they can be used together successfully in complex integrated environments. It is within this context that the AES began to work on an interoperability standard for existing IP audio technologies towards the end of 2010, with publication of AES67 eventually taking place in September 2013.

Shortly after the standard was published, its promotion began in earnest, as underlined by the creation of the Media Networking Alliance (MNA) to encourage the adoption of AES67. Speaking to SVG Europe at the AES Convention in 2015, MNA Marketing Working Group chair Will Hoult placed AES67 in the context of the general acceptance of AoIP:

"We see many different implementations of [AoIP], but essentially what the customer wants to be able to do is take product A and connect it to product B – whether those products are using Dante, Ravenna or whatever – and know that they are going to work together. That factor has really helped to drive the conversation about AES67."

PART II

THE OBJECTIVES AND BENEFITS OF AES67

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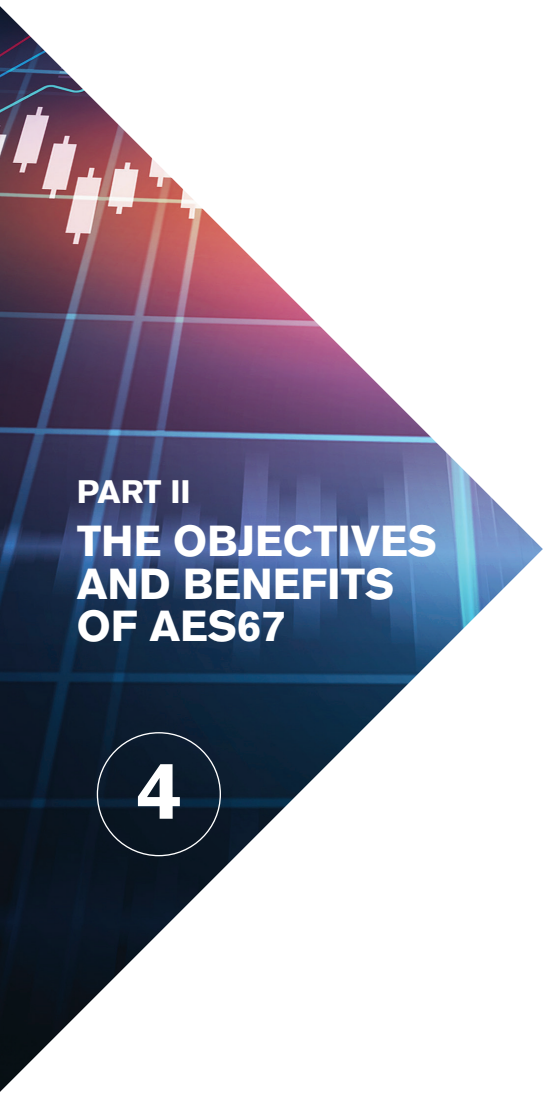
– Will Hoult

Product Manager, Focusrite/RedNet



PART II

THE OBJECTIVES AND BENEFITS OF AES67

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The desire to provide this level of assurance was undoubtedly a primary impetus behind the entire AES67 project. But the standards team and its supporters have also been assisted by the ability to provide concise outlines of AES67. In summary, its interoperability features cover the following areas:

Synchronization: whereby the mechanism for a common clock system is defined.

Media Clocks: whereby the media clocks that have to be supported are defined, as is the way in which they relate to the common clock system.

Transportation: providing a description for the way in which media data is transported across the network.

Encoding and Streaming: providing a description for the way in which audio is digitised and formatted into the sequence of packets comprising a stream.

Streaming Description: this specifies the information that is necessary for connection management, including network address mechanisms, encoding formats and origination details.

Connection Management: in other words, the procedure and protocols used to establish a media stream connection between the sender and one or more receivers.

As will be highlighted in the next section, AES67 excludes a host of features that can be said to contribute to the creation of a comprehensive networked audio environment. But for its ability to guarantee a certain level of interoperability, AES67 has resonated with pro-audio vendors and integrators alike. Dante and Ravenna, as well as Livewire and Q-LAN, are all now able to deliver AES67 compatibility, and at AES 2015 in New York a large-scale public demo featured no fewer than 22 networked audio devices.

Devised to highlight the benefits of AoIP interoperability, the showcase featured all four of the above-mentioned technologies, with products from Genelec, Lawo, Merging, Yamaha, ALC NetworX, Archwave, Digigram, Focusrite, Meinberg, QSC, Solid State Logic, Telos/Axia and Telos/Linear Acoustic all residing on the same networked infrastructure. ■

The basic interoperability guaranteed by AES67 has made it a 'hot topic' in pro-audio for the past few years. But increasingly there is an awareness that AES67 should not be misconstrued as a panacea for all ills. Above all, it should not be regarded as an audio networking solution in and of itself, given that it is concerned primarily with transportation and is therefore lacking multiple other key components required to competently implement an IP audio network.

The limitations of AES67 were examined in some depth during several recent extended conversations with leading audio technology developers and consultants. These included two principal members of the R&D team at Dante developer Audinate – CTO Aidan Williams and VP of Engineering Chris Ware – as well as: Darryl Bryans, Product Line Manager, DSP, Bose Corporation; Trent Wagner, Senior Product Manager, Symetrix; and Ethan Wetzell, Platform Strategist, Bosch Communications Systems.

Above all others, the main limitation of AES67 cited by those interviewed for this White Paper is that the standard's scope is more or less entirely restricted to basic audio transportation only. For example, it does not prescribe control or device management requirements. Bryans remarks:

"What we have with AES67 is essentially a very low level compatibility standard. It allows for the sharing of audio around disparate systems. There is no control, there is no device management or discovery."

PART III

THE LIMITATIONS - AND STRENGTHS - OF AES67

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What is included in the AES67 Specification

INCLUDED	NOT INCLUDED
Synchronization	No Discovery
Media Clocks	No Control Mechanism
Transportation	No Stream Description
Encoding and Streaming	No Device Management
Streaming Description	
Connection Management	

PART III

THE LIMITATIONS - AND STRENGTHS - OF AES67

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This observation underlines the fact that any 'pure' comparisons between AES67 and existing AoIP technologies are bound to be bogus. Wetzell outlines the substantial difference that exists between the specification of AES67 and existing AoIP solutions, such as Dante:

"It should not be regarded as an 'apples to apples' comparison. To put it in audio terms, comparing AES67 to a fully architected solution like Dante or Ravenna is a bit like comparing a raw frame woofer to a two-way loudspeaker system; they share characteristics, of course, but they are not at all the same thing."

So whilst AES67 means that it is possible to put a compliant device onto any participating network, it does not contain many of the other elements required for successful networked audio, namely:

There is no single, prescribed discovery mechanism (several options are listed in the standard, but no single approach is mandatory).

There is no prescribed control mechanism.

There is no prescribed means of distributing a description of the stream: this is required for successful point-to-point transmission and point-to-point unicast transmission.

There is no prescribed method of device management.

As a bridging method between existing AoIP technologies, AES67 has undoubted value. But for the reasons cited above, it cannot and will supplant the likes of Dante. While further standards efforts may fill in some of the other gaps, the reality is that existing solutions are already able to deliver feature-sets that are unlikely to be surpassed in the medium- to long-term future. ■

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- Ethan Wetzell

Platform Strategist
Bosch Communications Systems

The value of basic standards in supporting an industry as it moves from one distinct phase of development to another is well-established at this point. But they always need to be viewed in a broader context, as Wetzell points out:

"Standards can be used together or individually within a given solution. This provides a great opportunity for manufacturers to build solutions that are interoperable but still add value in unique ways. When you think about it, this is what the IT world has known for ages. A network switch is an implementation that supports a huge number of standards while also providing for interoperability. I can certainly get some unique stuff if I build my IT infrastructure around one manufacturer, but if I mix and match switch vendors things still work and I can choose features based on the product benefits to me as a user. There is no need for this to be a win or lose situation for anybody."

Gaining agreement on basic features is fundamental to the progress of any standards project coming to fruition, but it stands to reason that there will be more scope for debate as one goes higher up the stack. Of course, this also allows vendors to differentiate their networking solutions, and therefore establish a credible commercial profile for their offerings.

Nonetheless, despite the standard's limitations, Audinate was quick to recognize the value of AES67 in encouraging the adoption of IP-based audio, and thus signaled its intention to support AES67 networking. This was delivered via a firmware update to OEM partners in the closing months of 2015. With Dante, it is therefore possible to operate as part of multi-AoIP networks and 'pure' Dante network configurations.

At the time of writing, Dante has recorded in excess of 300 vendor partners and 800 Dante-enabled products. At this point the ecosystem has assumed its own significant momentum and as such specifiers and end-users preferring to work in a Dante-only environment are spoilt for choice at the product level.

> ***"If you have a Dante-based network everything works fine, and that is easy to achieve as there are now so many Dante-supporting products available."***
>
> **– Trent Wagner**
> **Senior Product Manager at Symetrix**

PART IV

GOING BEYOND STANDARDS

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PART IV

GOING BEYOND STANDARDS

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Dante's ability to provide high channel counts, superlative audio quality, and ease of installation have been well-documented elsewhere. But what is worth reiterating in this context is Dante's support for flexible signal routing and system configuration, via the Dante Controller software application that is purpose-designed to manage devices on a network. As a result, setting up a Dante network is typically just a matter of plugging devices into an Ethernet switch and connecting a computer to the network. All Dante devices are automatically discovered and displayed in Dante Controller.

There are also long-term benefits for the health of the network thanks to the inclusion of a suite of diagnostic tools within Dante Controller. Among other advantages, this suite enables visibility into the network health status through features such as device latency monitoring, active clock health monitoring, packet error reporting, and bandwidth usage statistics.

"If you have a Dante-based network everything works fine, and that is easy to achieve as there are now so many Dante-supporting products available," says Wagner.

The comprehensive feature-sets of solutions such as Dante underline why, for many consultants and specifiers, AES67 is not a priority concern. When there is a solution whose ecosystem supports extensive, multi-vendor-based system designs, it can make both practical and economic sense to remain within that one ecosystem for a given configuration. And as the RH Consulting report, and many other recent analyses published in the pro-audio trade press, indicate quite overwhelmingly, that solution now – and for the foreseeable future – is set to be Dante. ■

Although by no means comprehensive, the degree of discussion – if not actual product-level implementation at this stage – pertaining to AES67 indicates that standards will continue to play a role in IP-based audio networking. For the late adopters, in particular, they may help smooth the passage into a realm of operation that is certain to determine audio workflows for the coming decades.

But it is the features offered above and beyond the provisions of a standard that really help people to build AV systems – and thus different specifications will invariably appeal to different users, working in contrasting environments and applications.

One of the great strengths of pro-audio since its real emergence in the immediate post-war period has been a friendly competition between vendors and technology developers that has frequently had the effect of pushing R&D to new heights. If anything, this looks set to accelerate in the networked audio era as solutions providers work to deliver features that ensure users can benefit from every possible advantage of fully integrated IP-based infrastructures. ■

PART V

CONCLUSION: PUSHING R&D TO NEW HEIGHTS

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