CHANNEL OPPORTUNITY
The Way to Play in a Digital World

NABSHOW
Where Content Comes to Life

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AES67-2013 Standard for audio applications of networks:

*High-performance streaming audio-over-IP interoperability*

published on September, 11th, 2013

Andreas Hildebrand, Senior Product Manager
ALC NetworX GmbH, Munich
**Scope:**

- Interoperability guidelines for professional, low-latency audio over campus and local area IP networks using existing protocols wherever possible.

**Justification:**

- Recent generation of networked audio technology uses a diversity of proprietary and standard protocols.
- Despite a common basis in IP, none of the systems were interoperable.
- The latest crop of networking technology has not yet reached a level of maturity precluding changes to improve interoperability.
**Existing Audio-over-IP solutions / technologies / initiatives:**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Purveyor</th>
<th>Date introduced</th>
<th>Synchronization</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livewire</td>
<td>Telos/Axia</td>
<td>2003</td>
<td>Proprietary</td>
<td>RTP</td>
</tr>
<tr>
<td>Wheatnet-IP</td>
<td>Wheatstone</td>
<td>2005</td>
<td>Proprietary</td>
<td>RTP</td>
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<tr>
<td>Dante</td>
<td>Audinate</td>
<td>2006</td>
<td>IEEE 1588-2002</td>
<td>UDP</td>
</tr>
<tr>
<td>N/ACIP</td>
<td>EBU</td>
<td>2007</td>
<td>Adaptive (per stream)</td>
<td>RTP</td>
</tr>
<tr>
<td>Q-LAN</td>
<td>QSC Audio Products</td>
<td>2009</td>
<td>IEEE 1588-2002</td>
<td>UDP</td>
</tr>
<tr>
<td>RAVENNA</td>
<td>ALC NetworX</td>
<td>2010</td>
<td>IEEE 1588-2008</td>
<td>RTP</td>
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<tr>
<td>AVB</td>
<td>IEEE, AVnu</td>
<td>2011</td>
<td>IEEE 802.1AS</td>
<td>Ethernet, RTP</td>
</tr>
</tbody>
</table>
TG Work:

- AES Task Group X192 initiated late 2010
- Task Group Leader: Kevin Gross, AVA Networks, Boulder, CO.
- Members:
  - ~ 100 experts from the professional audio community
  - manufacturers, system architects, consultants, professional end users
  - US / Canada, Europe (+ South Africa, South America, Australia)
- Main contributors: ALC NetworX, Axia, QSC, Wheatstone, Nine Tiles, BBC, SR, Clair Brothers, ...
- Bi-weekly web conferences & several F2F meetings
- Standard published on September, 11th, 2013
AES67 technology components:

- **Synchronization**: IEEE 1588-2008, default profile (media profile suggested)
- **local media clock generation**
AES67 technology components
– time synch & media clock generation:

- Master Clock
- Slave Clocks (nodes)
- Media Clocks

GPS
PTP
AES67 technology components:

- **Synchronization**: IEEE 1588-2008, default profile (media profile suggested)
- **Local media clock generation**
- **Network**: IPv4 (IPv6), unicast / multicast & IGMPv2
- **Transport**: RTP/AVC (RFC 3550 & 3551) / UDP / IP
### Selected solutions / technologies compared to OSI layer model:

<table>
<thead>
<tr>
<th>OSI Layer</th>
<th>A-Net</th>
<th>EtherSound</th>
<th>CobraNet</th>
<th>Livewire, Dante &amp; …</th>
<th>AVB</th>
<th>AES67 &amp; RAVENNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
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<tr>
<td>Presentation</td>
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<td>Session</td>
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<tr>
<td>Transport</td>
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<tr>
<td>Network</td>
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<tr>
<td>Data Link</td>
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<td>Ethernet</td>
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<tr>
<td>Physical</td>
<td>Copper</td>
<td>Copper / Fiber</td>
<td>Copper / Fiber</td>
<td>Copper / Fiber</td>
<td>Copper / Fiber</td>
<td>Copper / Fiber</td>
</tr>
</tbody>
</table>

**Legend:**
- Ethernet
- Copper
- Copper / Fiber
- RTP
- UDP
- IP
- Ethernet
AES67 technology components:

- **Synchronization**: IEEE 1588-2008, default profile (media profile suggested)
- **Local media clock generation**
- **Network**: IPv4 (IPv6), unicast / multicast & IGMPv2
- **Transport**: RTP/AVC (RFC 3550 & 3551) / UDP / IP
- **Encoding**: 16 / 24 bit linear, 48 (44.1 / 96) kHz, channel count: 1..8
- **Packet Setup**: 48 samples (6 / 12 / 16 / 192), max. payload size: 1440 bytes
- **Quality of service**: DiffServ w/ 3 suggested traffic classes (DSCP)
- **Connection management**: SDP (dependency on draft-ietf-avtcore-clksrc), SIP (unicast)
- **Discovery**: excluded, but several recommendations given (i.e. ZeroConf, SAP and others)
Applications:

- Commercial audio applications:
  - Installed sound: theaters, stadiums, theme parks, cruise ships
  - Live sound (fixed and touring)
- Professional broadcast
  - In-house distribution
  - Inter-facility links on corporate networks
  - OB vans
- Music production
- Post-production
AES67 – the “O negative” of audio networking

(Roland Hemming, Independent Audio Consultant)
AES67 – the “O negative” of audio networking

AES67 – the "O negative" of audio networking
AES67 – the “O negative” of audio networking

When will it be available?
### AES67 compliant technologies / solutions:

<table>
<thead>
<tr>
<th>Technology</th>
<th>AES67 support</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAVENNA</td>
<td>yes</td>
<td>Full support through operational profiles (Generic Profile covers most mandatory requirements)</td>
</tr>
<tr>
<td>Livewire</td>
<td>(no)</td>
<td>Livewire “new”: yes (RAVENNA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Livewire “legacy”: no, but technology bridging possible</td>
</tr>
<tr>
<td>Q-LAN</td>
<td>announced for next fw version</td>
<td>Requires some protocol &amp; packetization adaption</td>
</tr>
<tr>
<td>Dante Wheatstone</td>
<td>“within 12 month” ?</td>
<td>Depends on company strategy, modifications required (synchronization &amp; transport)</td>
</tr>
<tr>
<td>N/ACIP</td>
<td>(no)</td>
<td>ACIP2 working on extensions for limited stream exchange</td>
</tr>
<tr>
<td>AVB</td>
<td>(no)</td>
<td>AVB devices may use gPTP, but need to add layer 3 transport</td>
</tr>
</tbody>
</table>
AES67 – the “O negative” of audio networking

When will it be available?
An “Open Technology” platform:

- Based on **technology publicly available**
  - No proprietary “black box” design
- Utilizes **standard protocols**
  - Proven technology, widely supported
- Designed to work on **existing networks**
  - No new network equipment required
- **No** proprietary **licensing** policy
  - No cost per channel, suits all performance needs

- Draft on operating principles **published** since June 10th, 2011
  - Anybody can implement / support RAVENNA technology
- **Supported** by renowned companies from the ProAudio industry
  - Broad market acceptance
- Active participation in AES X192 standardization TG
  - **RAVENNA supports AES67 standard**
RAVENNA & AES67:

More options for:

- Media clocks
- Media formats
- Packet setup
- Latency
- QoS

Plus:

- Discovery
- Redundancy

Synchronization
- Media clock generation
- Network & transport
- Encoding & packet setup
- QoS
- Connection management

Profiles:

- Generic
- High-performance
- AES67

Legacy
- MADI

Channels Opportunity

A. Hildebrand: AES67 & beyond  Broadcast Engineering Conference, Apr. 6th, NAB 2014
RAVENNA & AES67:

More options for:
- Media clocks
- Media formats
- Packet setup
- Latency
- Qos

Plus:
- Discovery
- Redundancy
- Synchronization
- Media clock generation
- Network & transport
- Encoding & packet setup
- QoS
- Connection management
- SIP (w/ unicast)

Profiles
- Generic
- High-performance
- Legacy
- MADI

Audio Engineering Society

AES67
What is RAVENNA?

RAVENNA Draft on Operational Principles

Ingredients:
- 20 ml PTPv2
- 500 g RTP
- 1 pkt multicast
- 1 pinch of Bonjour

Cooking order:
1. Stew PTP to order
2. Add RTP
3. Mingle with multicast
4. Add Bonjour on top

Serve hot and Enjoy!
RAVENNA supporters:
AES TG SC-02-12-M: AES67 Development

• Outlining AES67 compliance test guidelines
• Specifying and engineering the compliance tests
• Planning and organizing plug-fests
• Improving the standard specification where necessary
• Participants:
  – anyone implementing AES67
  – parties / individuals with strong interest in AES67 interoperability
Questions?
Contact information:

ALC NetworX GmbH
Am Loferfeld 58
81249 Munich
Germany

ravenna@alcnetworx.de

Booth C1311

ravenna.alcnetworx.com