RAVENNA and AES67 by DIGIGRAM
Summary

What is AES 67?
What is Ravenna?
What for?
Ravenna by Digigram

Addendum
Comparison with audio networks
AES vision

Conventional digital audio

- Synchronous
- Close to real-time
- Direct hardware interfaces
- Traditional connectors (XLR, BNC)
- Specialist cables (110-Ohm bal., or 75-Ohm coax)
- Point-to-point infrastructure topology similar to analogue audio

Source = Mark Younge, EBU NTS 2014
Towards the IT studio

Traditional dedicated hardware has been replaced by generalised computers!

- Recording
- Editing
- Processing
- Mixing
- Playback

Source = Mark Younge, EBU NTS 2014
An ineluctable business trend

Simpler infrastructures

• IT-style networking is simpler and cheaper to install;
• IT-style networking is faster to install;
• IT-cabled buildings & trucks could be used more flexibly

Source = Mark Younge, EBU NTS 2014
IT = IP!

- Currently, IT networks imply Internet Protocol (IP)
- Other network technologies available (see AES47)
- But, IP networks over Ethernet are universally available!
- So, that’s what people want to use unless there’s a strong business case for an alternative.

Source = Mark Younge, EBU NTS 2014
Finally, what is AES 67?

- An AES 2013 « recommendation » …
  … applicable on « Systems built on high performance media networks supporting professional quality audio »

- AES 67 provides
  « comprehensive interoperability recommendations for operating these systems in an interoperable manner »

- AES 67 does **not** provide
  Discovery
  Control

- **Interoperability plug-fest in October 2014**
AES67 in a nutshell

**Headline features**
- NOT inventing new technology
- identifying interoperable technologies in existing networking standards.
- >44.1 kHz (normally 48 kHz)
- >16 bits
- Linear coded PCM
- Low latency (worst case 10ms, typically 1ms)
- Routable Layer 3 protocol

**Timing**
- IEEE 1588 Precision Clock Synchronization Protocol (PTP)
- No master clock PULSE distribution
- Master TIME distribution
  - with local media clock creation

Source = Mark Younge, EBU NTS 2014
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Comparison with audio networks
Ravenna vision = AES vision!

Replacing **expensive, proprietary** audio & video routing infrastructure ("audio / video switchers / routers") by **off-the-shelf, standardized** network infrastructure.
What is Ravenna?

- A manufacturers consortium launched by LAWO in 2010
- Devoted to proliferation of an “IP-based real-time Media network“
- Intends to replace legacy Digital audio
  
  AES/EBU (AES 3)
  MADI (AES 10)

- Ravenna assets:
  
  Time-critical distribution of media data
  IP-based networks
  Ultra-Low latency / High channel count
  Synchronous (clock and phase as per AES11)
  Bit-transparent

- Targets:
  
  Infrastructure networks based on managed LANs and WANs
The Ravenna consortium

- Technology lead by ALC Networx, a Lawo subsidiary
- ~33 partners
  Last = Riedel, Gates Air, NEUMANN, Orban, CALREC
- All audio Broadcast represented
  - Terminals (Microphones, monitors…)
  - Audio codecs
  - Small studio systems
  - Large mixers
  - Management Systems
  - DAWs
  - Radio automation
  - Video transcoders
  - IP Switch & routers
Based on IT standards

Source: EBU Networks Seminar 2014
What is not Ravenna?

- **Ravenna is**
  - A media transport solution
    - Comprehensive
    - Coherent
  - Based on well established standards & protocols (RFCs)
    - like ACIP also is
    - Unlike DANTE, WHEATNET, LIVEWIRE and other proprietary protocols

- **Ravenna is not**
  - A Control and Monitoring solution
  - A Connection management protocol
AES67 / RAVENNA TRIO

- **CARRY**
  - (RTP/UDP/IP)

- **EXCHANGE**
  - (SDP/RTSP/Bonjour)

- **SYNCHRONISE**
  - (PTPv2)
RAVENNA vs AES67?

Basically, AES 67 is a subset of RAVENNA

- RAVENNA actively engaged from the very beginning in AES67 working group
- AES 67 is included in RAVENNA operational profiles
- RAVENNA offers more options:
  - Ultra-low Latency (eg down to 1 sample / packet)
  - Media clock and media format
  - Discovery protocol
  - Redundancy schemes, QoS, different profiles …
- AES 67 uses SIP for Unicast connections
  - In RAVENNA roadmap
# AES67 support

<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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Generic Profile covers most mandatory requirements)</td>
</tr>
<tr>
<td>Livewire</td>
<td>Yes (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>Yes Yes</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>

*Source: EBU Networks Seminar 2014*
RAVENNA vs DANTE?

RAVENNA driven by Broadcast needs

Broadcast performance
  - High channel count, Ultra-low latency, Precise phase management
  - Large number of simultaneous heterogeneous streams
AES67 included in RAVENNA operational profiles

DANTE

Audinate is a proprietary Technology provider
Driven by Installed Sound / Commercial Audio markets
AES67 profile announced at NAB 2015
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Target segments

▪ Broadcasting applications
  – In-house signal distribution in central facilities and regional studios
  – Inter-facility links across corporate networks
  – WAN connections (managed WANs, eg Contribution networks)
  – OB vans

▪ Secondary focus
  – Live entertainment
  – Installed Sound (Sport, venues…)
  – MI
Broadcast use cases

In-house applications
- Signal management in central facilities
- Production studios
- Internal distribution between studios & production areas
- Feed distribution to journalist desktops and DSNG actors
- Connection with Intercom

SSL applications
- Contribution networks between regional studios
- Inter-facility links across corporate networks

Mobile studio applications / OB vans
- Hook-up to venue / event installation (sports, live concerts, etc.)
- Integration with un-managed contribution links (3G, xDSL, codecs…)
- Connection with Intercom
Radio automation
Production
On-Air production

AES 67 – enabled mixer

STL / SSL codec

Editor, Media Asset Management…
MADI migration & hook-up

Embedded 128/64/64 routing matrix

AES 67
remote studio

MAM, DAW, Automation…

OB-Van

AES 67
remote studio

MADI

OB-Van

SDI-MADI

Digigram confidential
RAVENNA / AES67-to-Livewire®

- Using Axia’s xNode as a bridge
- IQOYA provide Livewire® connectivity
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Digigram Strategy

Digigram started in 2014 to integrate RAVENNA, hence AES 67 in most of its Solutions

RAVENNA / AES67 is integrated

  at HW level (FPGA, for highest performances) in new products (eg LX-IP RAVENNA)

  at SW level in current products or software applications (eg IQOYA)

RAVENNA / AES67 is one step necessary to enter into the production infrastructure.
Digigram in the Ravenna consortium?

Digigram has been promoting AoIP for Broadcast architecture since 2005.

Ravenna fits market needs for Low latency Synchronous audio distribution over LAN.

Digigram wants to be a technology integrator focusing on solutions and systems, no longer a technology provider as for EtherSound.

Ravenna is compliant with AES67.

Axia, Wheatstone and even DANTE are moving toward AES67.
RAVENNA by Digigram - 2015

Radio Automation bridges

64/64 to 128/128 channels: LX-IP RAVENNA
- Full RAVENNA / AES67 compliance,
- High channel count,
- Ultra-low latency
- MADI bridge 64/64 through embedded routing matrix

Audio-over-IP stereo and multi-codecs equipment / applications

IQOYA *LINK, *CALL
- “AES67 generic” packet time
- Low/medium channel count
- Based on SW

IQOYA *SERV/LINK
- Based on LX-IP RAVENNA (w or w/ MADI)
IBC 2014: interop. demo

RAVENNA by Digigram
Discovery and Interoperability with profiles
LX-IP RAVENNA
IQOYA
Interop. with RAVENNA/AES67-enabled devices

Digigram confidential
NAB 2015: automation demo

Radio Automation

RAVENNA / AES67 console

LX-IP RAVENNA

IP Switch

IQOYA *LINK

Digigram confidential
Thank you for your attention !
Addendum

- AES recommendations
- Comparison with audio networks
AES67 recommendations

- Media clock = PTP v2
- Audio = Linear PCM
- Transport = RTP and RTCP with QoS
- Discovery of potential Unicast connections = SIP
- Session description = SDP
- « Packet time » = 6 / 12 / 16 / 48 (1 ms) / 192
- Stream channel count
# Ravenna vs EtherSound

<table>
<thead>
<tr>
<th></th>
<th>Ethersound</th>
<th>Ravenna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated network for ultra low controlled latency</td>
<td>Non dedicated network (but recommended )</td>
<td></td>
</tr>
<tr>
<td>Layer 2</td>
<td>Routable</td>
<td></td>
</tr>
<tr>
<td>Mixed topology (ring, daisy chain, star with limitations)</td>
<td>Standard IP network topology</td>
<td></td>
</tr>
<tr>
<td>Ethersound® proprietary with Licenses to pay</td>
<td>No licenses to pay (standard protocols)</td>
<td></td>
</tr>
<tr>
<td>Well established in Live Sound</td>
<td>« Ravenna brand » focused on Broadcast business</td>
<td></td>
</tr>
</tbody>
</table>
# Ravenna vs DANTE

<table>
<thead>
<tr>
<th>Ravenna</th>
<th>DANTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potentially Routable</td>
<td>Non routable</td>
</tr>
<tr>
<td>High clock precision in sample AND phase on large networks</td>
<td>Focus on small &amp; medium installations using LAN</td>
</tr>
<tr>
<td>Can run on platforms without specialized HW</td>
<td>Can run on platforms without specialized HW</td>
</tr>
<tr>
<td>Open standard built on non-proprietary protocols</td>
<td>Strong Ind. Property, built on HW modules</td>
</tr>
<tr>
<td>Start of life in Broadcast products among consortium members</td>
<td>More than 200 partners include DANTE in their interface list</td>
</tr>
<tr>
<td>Driven by Broadcast professionals</td>
<td>Driven by Commercial Audio professionals</td>
</tr>
<tr>
<td>Target market: Broadcast</td>
<td>Target market: Sound Installations to replace Cobranet</td>
</tr>
</tbody>
</table>
## Ravenna vs AVB*

<table>
<thead>
<tr>
<th>Ravenna</th>
<th>AVB*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routable</td>
<td>AVB defined at level 2 only (non routable)</td>
</tr>
<tr>
<td>Can run on an IP legacy environment</td>
<td>AVB needs a new IP environment (AVB enabled switches &amp; routers)</td>
</tr>
<tr>
<td>Can run on platforms without specialized HW</td>
<td>AVB needs specific LAN platforms components</td>
</tr>
<tr>
<td>Failover/ redundancy is specifically addressed</td>
<td></td>
</tr>
<tr>
<td>Driven by Broadcast professionals</td>
<td>Driven by Consumer, Automotive and (new) industrial markets</td>
</tr>
<tr>
<td>Target market : Broadcast</td>
<td>Targer market : Automotive and Sound Installations to replace Cobranet &amp; Dante</td>
</tr>
</tbody>
</table>

(*) AVB = Audio Video Bridging defining IEEE standards:
- IEEE 802.1 AS (synchro), BA (System), Qat (Bandwidth reservation) and Qav (priority management)
## Overall comparison vs Ethernet real-time media networks

<table>
<thead>
<tr>
<th></th>
<th>A-Net</th>
<th>EtherSound</th>
<th>CobraNet</th>
<th>Livewire</th>
<th>Dante</th>
<th>AVB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Layer</strong></td>
<td>1</td>
<td>2a</td>
<td>2b</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>P-2-P (Star)</td>
<td>Daisy Chain</td>
<td>Structured</td>
<td>Structured</td>
<td>Structured</td>
<td>Structured</td>
</tr>
<tr>
<td><strong>Routable</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Potentially</td>
<td>No</td>
</tr>
<tr>
<td><strong>Network equipment</strong></td>
<td>Cat 5</td>
<td>Ethernet</td>
<td>Ethernet</td>
<td>LAN</td>
<td>LAN</td>
<td>Ethernet AVB</td>
</tr>
<tr>
<td><strong>Shared network</strong></td>
<td>No</td>
<td>No</td>
<td>(yes)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Scalable</strong></td>
<td>No (64 ch)</td>
<td>No (64 ch)</td>
<td>No (64 ch)</td>
<td>Yes (32767 ch)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Latency</strong></td>
<td>Low (800 µs)</td>
<td>Very low (125 µs)</td>
<td>Medium (1.3 ~ 5.3 ms)</td>
<td>Medium (&gt; 1 ms)</td>
<td>Low / variable (&lt; 1 ms)</td>
<td>Medium (Low)</td>
</tr>
<tr>
<td><strong>Sample rates</strong></td>
<td>1 common</td>
<td>48 / 96 kHz</td>
<td>48 / 96 kHz</td>
<td>48 kHz (linear)</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td><strong>Data format</strong></td>
<td>24 bit</td>
<td>24 bit</td>
<td>16 / 20 / 24 bit</td>
<td>24 bit</td>
<td>Variable</td>
<td>16 / 24 bit</td>
</tr>
<tr>
<td><strong>Redundancy</strong></td>
<td>No</td>
<td>Ring</td>
<td>STP</td>
<td>STP</td>
<td>Dual NIC</td>
<td>STP</td>
</tr>
<tr>
<td><strong>PC support</strong></td>
<td>No</td>
<td>PCI card</td>
<td>PCI card</td>
<td>Virtual / PCI</td>
<td>Virtual / PCI</td>
<td>No</td>
</tr>
<tr>
<td><strong>Transport protocol</strong></td>
<td>Proprietary</td>
<td>Proprietary</td>
<td>Proprietary</td>
<td>RTP</td>
<td>RTP</td>
<td>P1722</td>
</tr>
<tr>
<td><strong>Open Standard</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>