



# The Audio Parts of ST 2110 Explained

- Andreas Hildebrand –  
RAVENNA Technology Evangelist  
ALC NetworX, Munich



IP SHOWCASE THEATRE AT IBC – SEPT. 14-18, 2018  
A. Hildebrand: The Audio Parts of ST 2110 Explained



**Andreas Hildebrand**, RAVENNA Technology Evangelist

- more than 25 years in the professional audio / broadcasting industry
- graduate diploma in computer science
- R&D, project & product management experience
- member of AES67 TG and ST2110 DG



**ALC NetworX GmbH**, Munich / Germany

- established 2008
- R&D center
- developing & promoting RAVENNA
- Partnerships with > 40 manufacturers

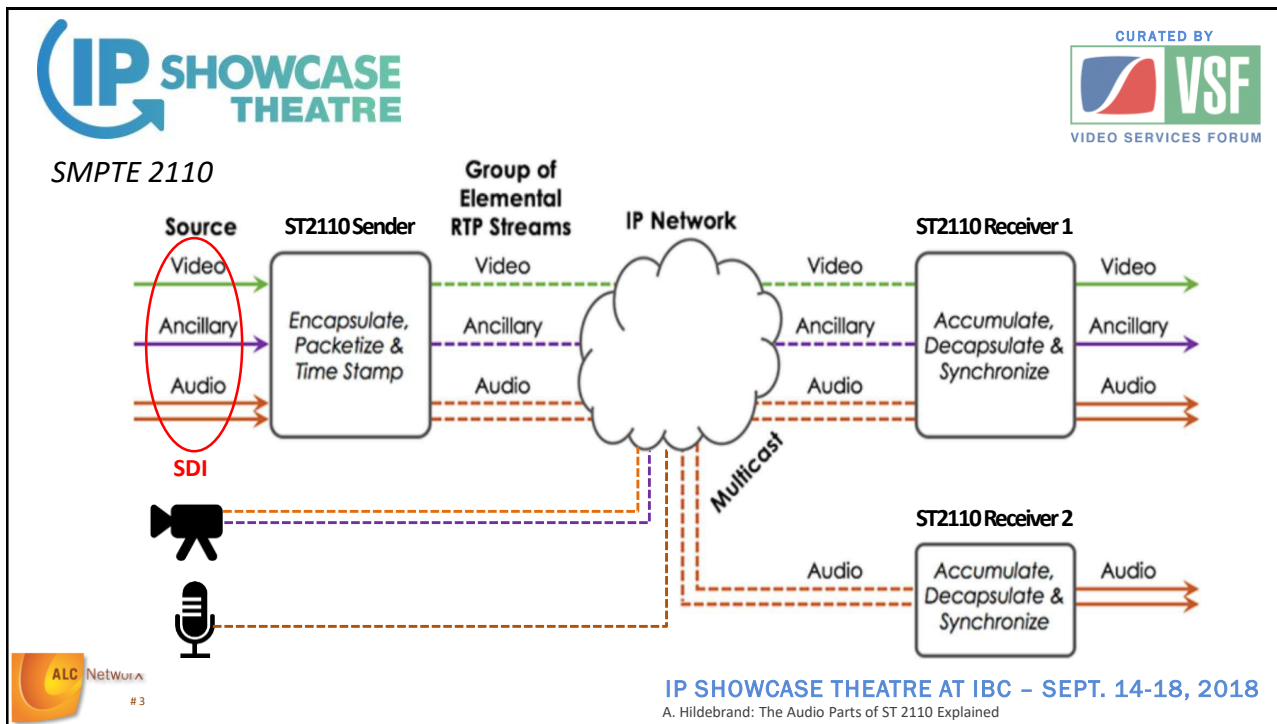


**RAVENNA**

- IP media networking technology
- designed to meet requirements of professional audio / broadcasting applications
- open technology approach, license-free
- fully AES67-compliant (*built-in*)



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**IP SHOWCASE THEATRE**

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VIDEO SERVICES FORUM

**SMPTE 2110 - Professional Media over Managed IP Networks**

**Document structure:**

- **2110-10: System Timing & Definitions**  
– defines transport layer and synchronization (SMPTE2059, clocks, RTP, SDP etc.)
- **2110-20: Uncompressed Active Video**  
– defines payload format for raw video (RFC4175, RTP, SDP, constraints)
- **2110-21: Traffic Shaping and Delivery Timing for Uncompressed Active Video**  
– defines timing model for senders and receivers (traffic shaping requirements)

**ALC NetworX #5**

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## *SMPTE 2110 - Professional Media over Managed IP Networks*

### **Document structure:**

- 2110-30: PCM Digital Audio
  - defines payload format for linear audio (AES67, constraints)
- 2110-31: AES3 Transparent Transport
  - defines payload format for non-linear audio (RAVENNA AM824)
- 2110-40: Transport of SMPTE Ancillary Data
  - defines RTP payload format for SDI ancillary data (new IETF draft)



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## *SMPTE 2110 - Professional Media over Managed IP Networks*

### **Document structure (audio):**

- 2110-**10**: System Timing & Definitions
  - defines transport layer and synchronization (SMPTE2059, clocks, RTP, SDP etc.)
- 2110-**30**: PCM Digital Audio
  - defines payload format for linear audio (AES67, constraints)
- 2110-**31**: AES3 Transparent Transport
  - defines payload format for non-linear audio (RAVENNA AM824)



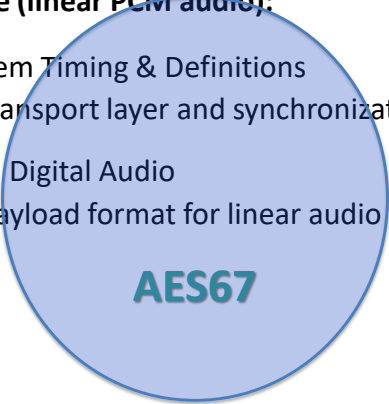
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### SMPTE 2110 - Professional Media over Managed IP Networks

#### Document structure (linear PCM audio):

- 2110-10: System Timing & Definitions
  - defines transport layer and synchronization (SMPTE2059, clocks, RTP, SDP etc.)
- 2110-30: PCM Digital Audio
  - defines payload format for linear audio (AES67, constraints)



**AES67**



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**AES67**

## AES67-~~2018~~ Standard for Audio Applications of Networks:

### *High-performance Streaming Audio-over-IP Interoperability*

published on September, 11th, 2013



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Scope:

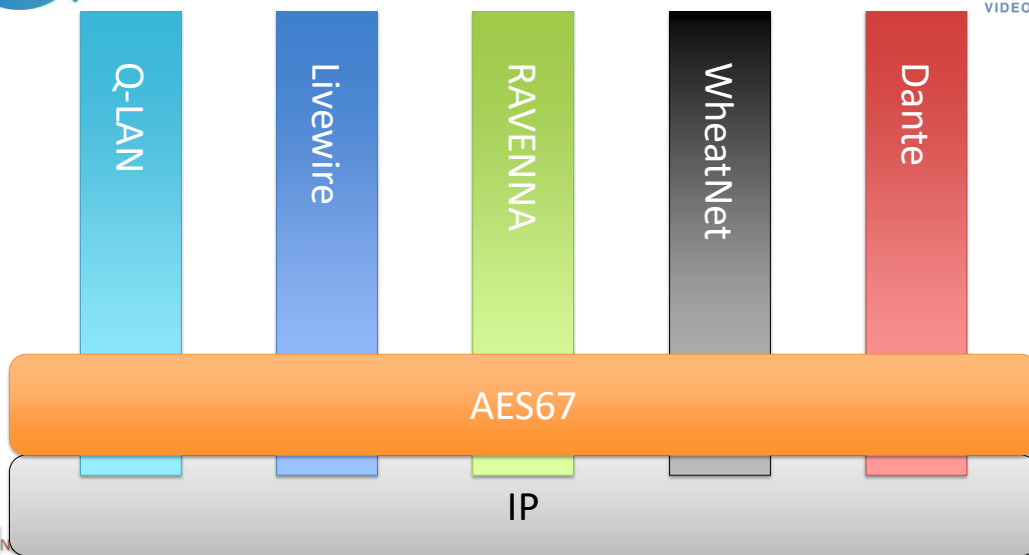
- **Interoperability guidelines** for professional, low-latency audio over campus and local area IP networks **using existing protocols wherever possible.**
- Excludes:
  - Non-IP networking
  - Low-bandwidth media
  - Data compression
  - Low-performance WANs and public Internet
  - Video (should provide good basis for follow-on video project)

Goal:

- Technology providers may choose to implement interoperability as a special mode, or transition to it as their native mode



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### AES67 technology components

Discovery	Not specified (NMOS IS-04/05)
Connection Management	SIP (unicast), IGMP (multicast)
Session Description	SDP (RFC4566, RFC7273)
Encoding	L16/L24, 1..8 ch, 48 samples
QoS	Differentiated Services (DiffServ w/ 3 CoS)
Transport	RTP / UDP / IP, unicast & multicast
Media Clock	48 kHz
Synchronisation	IEEE 1588-2008 (PTPv2)

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### SMPT E 2110 - Professional Media over Managed IP Networks

#### Document structure:

- 2110-10: System Timing & Definitions
  - defines transport layer and synchronization (SMPT E2059, clocks, RTP, SDP etc.)
- 2110-30: PCM Digital Audio
  - defines payload format for linear audio (AES67, constraints)



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### SMPTE 2110 - Professional Media over Managed IP Networks

#### Constraints of 2110-10 & -30 w/ respect to AES67

**- Synchronisation & Timing -**

- PTP:
  - support of SMPTE 2059-2 required
  - message rate according to AES-R16-2016 (AES67 PTP Media profile)
  - default `DS.slaveOnly=true` to intentionally prevent devices from entering PTP master state
  - `a=ts-refclk:ptp=traceable` and `a=tsrefclks-refclk:localmac=<mac_addr>` allowed
- RTP clock: `offset= 0` w/ respect to media clock / reference clock
  - `a=mediack:direct=0`

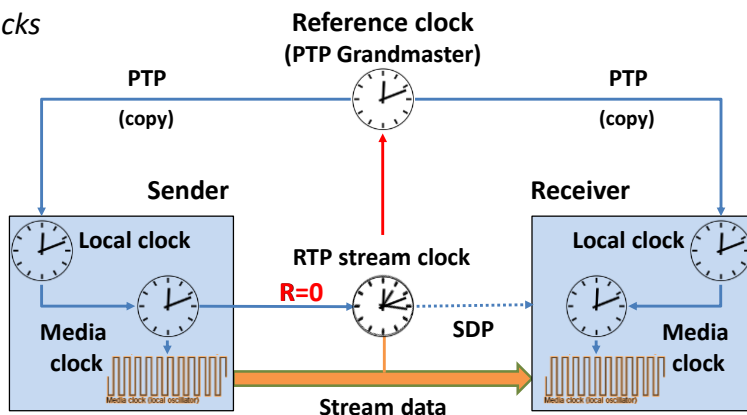


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### AES67 synchronization & media clocks

- Offset **R** is established on stream start-up
- **R** may be random to defeat crypto-text attacks
- This offset will be constant throughout the stream's lifetime



- The offset (**R**) will be conveyed via SDP (`a=mediack:direct=<offset>`) – **must be "0" in ST2110**



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## *SMPTE 2110 - Professional Media over Managed IP Networks*

### **Constraints of 2110-10 & -30 w/ respect to AES67**

#### **- Protocols -**

- Support of RTCP not required (but must be tolerated)
- Support of SIP (or any other connection management protocol) not required
- Redundancy (optional): SMPTE 2022-7
  - no identical IP source and destination addresses
- Channel assignment map (SDP attributes - optional)
  - `a=fmtp:<payload type> channel-order=<convention>.<order>`
  - **Example:** `a=fmtp:101 channel-order=SMPTE2110.(51,ST)`



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## *SMPTE 2110 - Professional Media over Managed IP Networks*

### **Constraints of 2110-10 & -30 w/ respect to AES67**

- 6 conformance levels:



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**Constraints of 2110-10 & -30 w/ respect to AES67**

- 6 conformance levels:

Level	Supported by the Receiver
<b>A (mandatory)</b>	<b>Reception of 48 kHz streams with 1 to 8 audio channels at packet times of 1 ms</b>

**AES67 compliant**



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**Constraints of 2110-10 & -30 w/ respect to AES67**

- 6 conformance levels:

Level	Supported by the Receiver
<b>A (mandatory)</b>	<b>Reception of 48 kHz streams with 1 to 8 audio channels at packet times of 1 ms</b>
<b>B</b>	Level A + 1 to 8 channels at packet times of <b>125 μs</b>

**AES67 compliant**



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**Constraints of 2110-10 & -30 w/ respect to AES67**

- 6 conformance levels:

Level	Supported by the Receiver
<b>A (mandatory)</b>	<b>Reception of 48 kHz streams with 1 to 8 audio channels at packet times of 1 ms</b>
B	Level A + 1 to 8 channels at packet times of <b>125</b> μs
C	Level A + 1 to <b>64</b> channels at packet times of <b>125</b> μs

**AES67 compliant**



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**Constraints of 2110-10 & -30 w/ respect to AES67**

- 6 conformance levels:

Level	Supported by the Receiver
<b>AX</b>	Level A (⇒ 48 kHz) + Reception of <b>96 kHz</b> streams with 1 to <b>4</b> audio channels at packet times of 1 ms
<b>BX</b>	Level B + AX + 1 to <b>8</b> channels at packet times of <b>125</b> μs
<b>CX</b>	Level C + AX + 1 to <b>32</b> channels at packet times of <b>125</b> μs

**96 kHz**

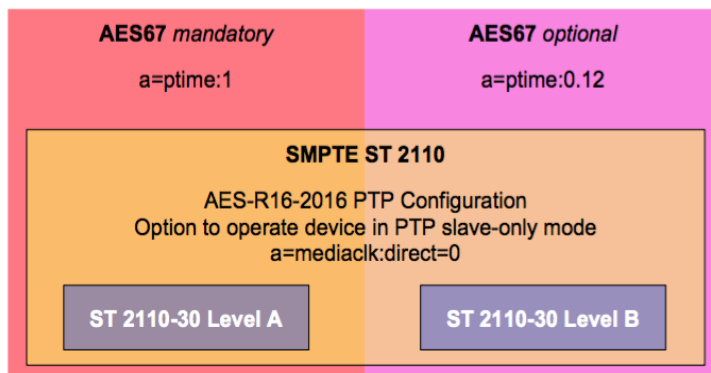


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SMPTE ST 2110-30 is a subset of AES67, adding constraints to clocking and streaming



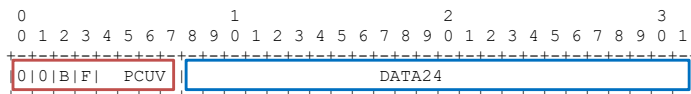
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**2110-31 – transparent transport of AES3 audio data**

- Builds on RAVENNA's AM824 (IEC 61883-6) payload definition:
  - retains AES67 definitions for synchronization and RTP usage
  - uses **3 bytes** for PCM24 + **1 byte** for AES3 meta data



- RTP payload format signaled in SDP:
 

```
a=rtpmap:<pt> AM824/48000/<nchan>
```
- retains all other SDP parms



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**2110-31 – transparent transport of AES3 audio data**

- Can transport any format which can be encapsulated in AES3
  - L24 PCM w/ AES3 subframe meta data (PCUV bits)
  - non-PCM audio and data formats as defined by SMPTE ST 337 / 338 (i.e. Dolby®E etc.)

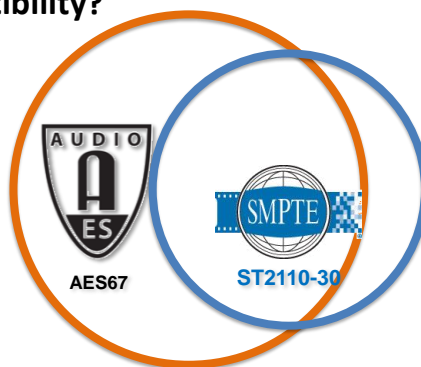


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**AES67 / ST2110 audio compatibility?**

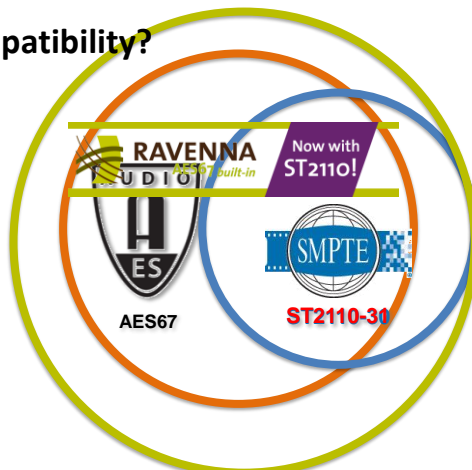


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**Thank you for your attention!**

Contact information:

Andreas Hildebrand  
Technology Evangelist  
ravenna@alcnetworx.de

ALC NetworX GmbH  
Am Loferfeld 58  
81249 Munich  
Germany

**RAVENNA booth Hall 8  
#8F57**



[www.ravenna-network.com](http://www.ravenna-network.com)



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