SMPTE ST2110 & NMOS IS-08: Audio Transport and Routing

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

- Defines transport and synchronization of elementary essence streams (video, audio, ancillary data)
- Primarily targeting at live production applications
- References / builds on existing standards:
  - Timing: SMPTE 2059 (SMPTE PTP Profile)
  - Video: RFC 4175 (RTP Payload Format for Uncompressed Video)
  - Audio: AES67 & RAVENNA
  - Ancillary data: RFC 8331 (RTP Payload for SMPTE ST 291-1 Ancillary Data)
SMPT 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)

- 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)

- ... more in the works ...
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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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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)
AES67-2013 Standard for Audio Applications of Networks:

High-performance Streaming Audio-over-IP Interoperability

published on September, 11th, 2013
AES67 technology components

- Discovery
- Connection Management
- Session Description
- Encoding
- QoS
- Transport
- Media Clock
- Synchronisation

Not specified (NMOS IS-04/05)
SIP (unicast), IGMP (multicast)
SDP (RFC4566, RFC7273)
L16/L24, 1..8 ch, 48 samples
Differentiated Services (DiffServ w/ 3 CoS)
RTP / UDP / IP, unicast & multicast
48 kHz
IEEE 1588-2008 (PTPv2)

SMPT 2110 - Professional Media over Managed IP Networks

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AIMS WP on AES67 / ST2110 Commonalities & Constraints
SMPTE 2110 - Professional Media over Managed IP Networks

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.)

- 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

  a=rtpmap:<pt> AM824/48000/<nchan> - with <nchan> always being an equal number (stereo channels)

  - retains all other SDP parms
SMPT 2110 - Professional Media over Managed IP Networks

What else is required for a working system?

- Establishing connections!
- Not covered by SMPTE 2110

- AMWA: Advanced Media Workflow Association
- NMOS: “A growing family of specifications [...] which are complementary to and co-exist with industry specifications like ST2110 and AES67”
AMWA NMOS - Networked Media Open Specifications

NMOS specifications:

- IS-04: Discovery & Registration
  - enumeration and registration of available system resources
- IS-05: Connection Management
  - connecting receivers to available streams
- IS-08: Audio Channel Mapping
  - patching flow channels to inputs / outputs

Key elements
AMWA NMOS - Networked Media Open Specifications

Identity

Node

Device

Source

Flow

Receiver

Sender

IS-04

Discovery & Registration

Ensure that parts of a networked media system can find each other
AMWA NMOS - Networked Media Open Specifications

IS-05
Connection Management

Make it simple for applications to (dis)connect flows
AMWA NMOS - Networked Media Open Specifications

Challenge:

6 channel surround audio
**AMWA NMOS - Networked Media Open Specifications**

**Challenge:**

Option 1:
- 6 unicast streams with individual channels

มวล коло
- not very efficient

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**AMWA NMOS - Networked Media Open Specifications**

**Challenge:**

Option 1:
- 6 unicast streams with individual channels

มวล коло
- not very efficient
AMWA NMOS - Networked Media Open Specifications

Challenge:

Option 2:
1 multicast stream w/ all 6 channels
AMWA NMOS - Networked Media Open Specifications

IS-08

Audio Channel Mapping

Map flow channels (tracks) to device I/O channels

AMWA NMOS IS-08 - Audio Channel Mapping

[Diagram showing audio channel mapping]
AMWA NMOS IS-08 - Audio Channel Mapping

- Interaction with NMOS IS-05 – connecting incoming stream channels to device output channels

```
x-nmos/channelmapping/v1.0/io
```
AMWA NMOS IS-08 - Audio Channel Mapping

Controller  -->  Client

NMOS IS-05

IP SHOWCASE THEATRE AT IBC 2019 : 13–17 SEPT 2019
A. Hildebrand: SMPTE ST2110 & NMOS IS-08 – Audio Transport & Routing

IP SHOWCASE THEATRE AT NAB – APR. 8-11, 2019
A. Hildebrand: SMPTE ST2110 & NMOS IS-08 – Audio Transport & Routing

IP-SDI Gateway
AMWA NMOS - Networked Media Open Specifications

More information on
NMOS wiki on Github:

https://github.com/AMWA-TV/nmos/wiki

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