Streaming Ahead

- Henry Goodman
- Calrec Audio Ltd
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ST 2110 – IP Transport “Done”

- SMPTE ST 2110 suite of standards
- Codifies all transport and timing protocols required for the JT-NM (AIMS) roadmap.

- ST2110-10: Rules for the use of RTP, system timing using ST2059 and the use of SDP.
- ST2110-20: Transport of Uncompressed Video (TR03) using RFC4175
- ST2110-30: PCM Audio. This is nearly AES67, with minor restrictions.
- ST2110-31: AES3 Transparent Transport (An adaptation of AES67).
- ST2110-40: Ancillary Data (what used to be in SDI VANC and HANC space – ID, timecode, range of metadata).
- ST2110-50: Integration with ST 2022-6 (TR04).
Today’s Session

• Synchronisation and PTP Clocks
  • A Look at different PTP clock types

• Working with Streams
  • Discovery/Registration
  • Connection Management
Synchronisation and PTP Clocks
PTP (IEEE 1588-2008)

- ST2059 – IEEE 1588-2008 profile
  - Defines a set of PTP options focused for broadcast environment

- OC “Ordinary Clock” – endpoints run local clocks that are slaved to a master clock and used to provide ‘time of day’ and media sampling clocks

- GM ‘Grand Master’ node provides corrective sync messages to all slaves.

- BMCA “Best Master Clock Algorithm”
  - Manages which clock is Master
  - Multiple clocks may be capable of becoming a master
  - Only one master chosen
  - All use same algorithm - uses defined set of clock properties to elect Master
PTP (IEEE 1588-2008)

- PTP Sync Correction

![Diagram of PTP synchronization](image)

Offset from Master = \( t_2 - t_1 \) - Mean Path Delay

Mean Path Delay = \( \frac{[(t_2 - t_1) + (t_4 - t_3)]}{2} \)

Slave adjusts its clock until offset from the master is zero.
PTP (IEEE 1588-2008)

- Assumes Path Delay MS and SM is same
- Great if point to point
- Switches introduce PDV Packet Delay Variation due to queuing in buffers
TC “Transparent Clock”

- No requirement to sync with GM
- Measures Packet Delay through switch
- Modifies Follow-Up packet time correction field
• Clock synced to GM
• Slave on one port – Master on all other ports
• Becomes Master for downstream endpoints (scrubs any PDV)
# Transparent verses Boundary Clocks

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<th>PROS</th>
<th>CONS</th>
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<tbody>
<tr>
<td>TC “Transparent Clock”</td>
<td>• Reduces PDV</td>
<td>• Increases packet load on GM</td>
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<td>• End to End delay correction</td>
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<tr>
<td>BC “Boundary Clock”</td>
<td>• Reduces packet load on GM</td>
<td>• Cascaded BC’s can accumulate greater errors</td>
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<td>• Scrubs PDV</td>
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<td>(acts like Master clock)</td>
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Working with Streams

• What Streams are available - Discovery

• Flexible Audio Stream characteristics
  • What is the audio format (L24, L16)?
  • How many channels are there?
  • What is the packet time?
  • What is the sample rate of the stream?
  • Where is it coming from?

• Receiver
  • Needs to be aware of Stream Characteristics to register for a stream - SDP
SDP (Session Description Protocol)

- Example multicast SDP
- 8 channel, 24-bit, 48kHz, 1ms packet time

```
v=0
o=- 1311738121 1311738121 IN IP4 192.168.1.1
s=Stage left I/O
c=IN IP4 239.0.0.1/32
t=0 0
m=audio 5004 RTP/AVP 96
i=Channels 1-8
a=rtpmap:96 L24/48000/8
a=recvonly
a=ptime:1
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:0
a=mediaclk:direct=0
```
Discovery

• Methods for Exchanging SDP data

  • Sneakernet – Manual SDP exchange

  • RTSP - Ravenna - automatic within own domain
    - Livewire - automatic within own domain

  • SAP - Dante AES67 - automatic within own domain

  • SIP - Unicast AES67

  • AMWA IS-04 (NMOS) - framework for Devices/Streams to be Discovered and Registered as they are connected to the network
AMWA APIs

- AMWA IS-04 (NMOS) - ST2110 framework for Devices/Streams to be Discovered and Registered as they are connected to the network

- AMWA IS-05 (NMOS) - ST2110 framework for Connection Management - allows the configuration of connections between Senders and Receivers

- AMWA IS-06 (NMOS) - ST2110 framework NMOS IS-06 Network Control – “in progress” - viewable network topology, allows creation/retrieval/update/deletion of flows in the network between endpoints. Includes monitoring and diagnostics.
Stream Manager Applications

- APIs for Manufacturers
- Manufacturer agnostic management of Streams
- Centralised Stream Management server
- Practical system wide approach to Managing Streams across a broadcast infrastructure.