Audio in an all-IP production facility

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About me!
Audio – the most important bit!

‘Most of the complexity of a production environment is the audio’

The Audio folks did IP first!
Lots of different audio interfaces and formats!

Standardized Audio interfaces:
- Analogue
- AES3
- SDI embedded
- IP 2022-6 embedded
- IP - 3326
- IP - AES67
- AES10 MADI
- AES50 AoE

Standardised IP formats:
- EBU 3326
- AES67
- ST2110-30

Proprietary IP formats:
- Livewire
- DANTE
- RAVENNA
- WheatNet
- Q-LAN
The expanding SMPTE ST2110 family

- System -10
- Video -20
- Audio -30
- Ancillary Data -40
- Timing -21
- Compressed Video -22
- AES3-32 bit Audio -31
- 2022-8 Composite
- Multi-Part Video -23
- Future: Fast Metadata -41
- Future: FMX -42
Standardized data plane mature, control plane recently proven.

Audio data stream

Controller

VIP

Audio data stream

Audio data stream

IS-04, IS-05, IS-07, IS-08
Audio manipulation requirements

- Keep it all-IP – don’t go back to baseband!
- Gain and delay control still needed
- Asynchronous (external) sources timing reconciliation (SRC)
- Flexible ST2110-30 channel density (1 – 64 channels)
- Full (per mono channel) shuffling capability
- Fully Orchestration (e.g. VideoIPath) configurable
- NMOS compliant
- All-IP processing
Controller NMOS registry
Video-associated audio format interfacing

Diagram showing interfacing between SDI, ST 2022-6, and ST2110-30 audio formats in a network configuration.
Audio facility interconnects

Event location

Remote commentary location

Production Center

Re-sync

Re-sync

Audio

ON AIR

MASTER

Production Center

nevron
Moving outside campus based audio production islands

- WAN connectivity involved
- Longer latencies
- (Potentially) Asynchronous sources
- Layer 2 too limiting
- Layer 3 (routed) needed for larger and multi-campus networks
From link-based IP systems to end-to-end IP systems
Absolute time of origination is captured in AES67/ST2110-30

...but quickly lost as it is treated as a transport timestamp
Reconciling essence timings for use

Origination time

Processing time

Processing time

Use time

link time

link time

link time

link time

Processing time

link time
Why are we in the current approach?

- ST2110 doesn’t (yet) actually specify using timing for end2end 😞
Device internal architecture tracking moments of time through a system

Internal real-time timing distribution

Processing functions

Analogy: PTP transparent clock handling in switches
AES67 – defines link offset
PTP holdover is capable of being very long – let’s make it so!
Going off-campus – the IP facility media edge

PTP TIMING

DEVICE DISCOVERY & CTL

MEDIA FLOW IP ADDRESSING

ESSENCE FLOWS

PROTECTION TERMINATION

ALTERNATIVE TIMING DOMAINS

RESTRICTED/PROXY DISCOVERY & CTL

DIFFERENT IP ADDRESSING (NAT)

ESSENCE OR COMPOSITE FLOWS

PROTECTION TERMINATION
Protection – on and off campus

Spatial

SOURCE

flow A

flow B

DESTINATION

Spatial + temporal

SOURCE

delay

flow A

flow B

DESTINATION

FEC

1 2 3 4 5 6 7 8 9 10 11

n n+1 n+2 n+3

n+4 n+5 n+6 n+7

n+8 n+9 n+10 n+11

n+12 n+13 n+14 n+15

n+16 n+17 n+18 n+19

n+20 n+21 n+22 n+23

n+24 n+25 n+26 n+27

n+28 n+29 n+30 n+31

n+32 n+33 n+34 n+35

n+36 n+37 n+38 n+39

n+40 n+41 n+42 n+43
Plug for current VSF Activity Group

"To enable effective transport of ST2110 media flows and associated control data across Wide Area Networks in an interoperable manner."

Phase 1: NAB 2019
Phase 2: IBC 2019
ST2110 over WAN for inter-facility & OBs

- Flow protection ✓
- Flow trunking ✓
- Essence alignment ✓
- Low latency handling
- Format conversion
- Compression ✓

- Protection of other data flows ✓
- Security
- PTP trunking
- Wan timing
- Associated control (NMOS) filtering and border proxying

Next topic
Trunking 2110 essences
Conclusions

• Audio is incredibly important
• Audio is often the most complex part of the system
• Full standards compliance is essential
• The standardised control layer is less mature – but all the parts are now there
• Standards now provide capability for L3 wide-area data & control planes
• Keeping the audio signal flow All-IP is crucial to gain full benefit
Thank You
Do come and see us SU5510
We do a nice cup of tea!

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