Monitoring audio streams in the IP network-based workflow

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Why Audio Networking?
Higher quality signal

Analogue
Continuous voltage describes the audio signal

Digital
PCM STREAM
Sample values describes the audio signal

Networked
Packetized Audio over IP
Sample values in a sequence of packets describe the audio signal
Networking simplifies systems

- Audio over IP is the modern alternative to large multi-channel digital audio interconnections.
- Protocols such as RAVENNA, Dante and AVB are increasingly being used.
- IP connection directly on devices simplifies system design.
Increasing flexibility

- Effectively unlimited number of audio channels – high channel count into one (low cost) cable
- Make signal run long distances
- Minimise end-to-end delay: latency 1ms or less
- Co-existing protocols: control + device monitoring + system management + other data on the same cable
Increasing bandwidth, standard CAT cabling

Category cabling is designed for high signal integrity and is used for structured cabling for computer and voice networks. It’s everywhere!

- CAT7 – 10 Gbps
- CAT6 – 1 Gbps
- CAT5E – 350 Mbps
- CAT5e – 150 Mbps
- CAT 5 – 100 Mbps
We have redundancy…
With the spanning tree protocol (STP), switched networks can connect switches using multiple paths for redundancy without causing a network loop.
Networking Standards
The Alliance for IP Media Solutions (AIMS), is a non-profit trade alliance that promotes the open standards that broadcast and media companies use to move from legacy SDI systems to a virtualized, IP-based future.

https://www.aimsalliance.org/
AES67 – AES Standard for Interoperability in High-performance Audio-over-IP Streaming
AES67 - RAVENNA

- QoS three classes
- Media Format L16/L24 PCM
- 48 Samples per packet
- 1-8 Audio channels
- Encoding 48kHz

+ Discovery
+ Redundancy
+ classes adjustable
+ AES/EBU, DSD/DXD…
+ 1, 6, 12, 64…
+ 64, 128…
+ 44.1, 96, 192, 384kHz…
+ classes adjustable
+ Discovery
+ Redundancy
+ classes adjustable
+ AES/EBU, DSD/DXD…
+ 1, 6, 12, 64…
+ 64, 128…
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+ 1, 6, 12, 64…
+ 64, 128…
+ 44.1, 96, 192, 384kHz…
Some RAVENNA Partners
Monitoring Networked Audio
Connectivity, good old days

Batch bay, one-to-one physical links between devices in studio

Expensive, custom cabling requiring experts to build
Connectivity – IP Networking Simplicity

• Physical cable layout uses standard CAT cabling. This makes installations easy and low-cost.

• Physical cable layout does not limit routing to devices, such as monitor loudspeakers.

• Routing is defined on logical (software) level.

• Physical cabling does not change when signal routings change.
Genelec 8430A IP

- Direct monitoring of audio-over-IP streams
- Ravenna and AES67 compatible up to 96 kHz and 8 channel streams
- Smart Active Monitor (SAM™) compensates for room acoustics
- 1 x XLR analog input, 1 x RJ45 (etherCON) for AES67, 2 x RJ45 GLM control network
- 45 Hz – 23 kHz (-6 dB), ±1.5 dB (58 Hz - 20 kHz)
- HWD 299 x 189 x 178 mm, (12 x 7 x 7 in), with Iso-Pod™
Device-to-device IP networking

- Maximum flexibility:
  - Keep the signal on the IP network as long as possible
  - Every monitor is a separate destination, instant reconfiguration of source
- Accurate synchronised playback across multiple devices
- Reduces costs – network is the router
- SAM™ and GLM™ enable every monitor to reproduce acoustically accurately the original source
Flexibility of Monitoring

- Audio-over-IP enables the monitor to tap to any audio stream and channel in the stream

Assignable console or workstation monitoring

Flexible continuity monitoring
High Channel Count

- Audio-over-IP does not limit the channel count, format mix, presentation resolution, or sample rate (bandwidth).

- No limit to the channel count. Audio-over-IP can support all current and future immersive formats, for example.
Broadcast Case Examples
Virtual Radio Studio (2017)

Axia Audio IP-Tablet Virtual Radio software, designed by IP-Studio

https://www.telosalliance.com/Axia/ip-tablet-virtual-radio-software

RadioMan® ACCESS On-Air tablet interface

https://jutel.fi/products/jutel-radioman-access/
Hogeschool, Utrecht
CCTV EFP system in Djakarta, control room 1
CCTV EFP system in Djakarta, control room 2
CCTV EFP system in Djakarta, control room 3
AV Install Case Examples
Maaninka Church, Finland
Summary

- standard Ethernet hardware
  - running on standard IP networks keeps operation simple and cost down
- AES67 and RAVENNA for audio-over-IP
  - open system designs and standard protocols, part of ST2110
  - uncompromised quality
- direct monitoring of AES67 compliant streams
  - simplifies system design, build, and operation
  - keeps the system cost and complexity down
  - has great flexibility: direct access to any channel, in any stream, by only logical configuration
the sonic reference