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CONFERENCES: APRIL 11-16, 2015 • EXHIBITS: APRIL 13-16
LAS VEGAS CONVENTION CENTER • LAS VEGAS, NEVADA USA
Rolling Out AES67 Into Real-world Applications

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Topics:

• Recap: What is AES67?
• Prerequisites: general network requirements
• AES67 in the lab: plug-fest
• AES67 in the real world: sample applications
• Beyond: AES67 development
AES67-2013 Standard for Audio Applications of Networks:

High-performance Streaming Audio-over-IP Interoperability

published on September, 11th, 2013
**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)
AES67 technology components:

- **Synchronization**: IEEE 1588-2008, default profile (media profile suggested)
- **local media clock generation**
- **Network**: IPv4 (IPv6), unicast / multicast & IGMPv2
- **Transport**: RTP/AVC (RFC 3550 & 3551) / UDP / IP
- **Encoding**: 16 / 24 bit linear, 48 (44.1 / 96) kHz, channel count: 1..8
- **Packet setup**: 48 samples (6 / 12 / 16 / 192), max. payload size: 1440 bytes
- **Quality of Service**: DiffServ w/ 3 suggested traffic classes (DSCP)
- **Connection management**: SIP (unicast), SDP
- **Discovery**: excluded, but several recommendations given (i.e. ZeroConf, SAP and others)
AES67 – the “O negative”
of audio networking

(Roland Hemming,
Independent Audio Consultant, UK)
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When will it be available?
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When will it be available?
Network requirements for AES67:

- Single LAN required for optimal performance, but segment bridging (including WAN) possible
- Network infrastructure must provide sufficient bandwidth on all potential links (no UDP packet loss, full switching capacity)
- Managed switches with adjustment capabilities for operational parameters required
- Support for QoS (DiffServ) mandatory – especially in routed & mixed traffic environment
- Multicast / IGMPv2 support
- Native support for IEEE 1588-2008 (PTP) optional (in larger or routed environment)
- Add’l operational parameters may also need attention (e.g. traffic shaping)
Network requirements – potential issues:

• PTP: sync quality in larger LANs + routed environments / WAN
  → PTP support in switches / routers
  → local PTP distribution of traceable time (i.e. GPS)

• QoS: leveling against other services requiring QoS
  → Video + VoIP need lower prioritization
  → Traffic shaping (strict priority)

• Multicast: switch-individual configuration
  → IGMP configuration (protocol, querier)
  → Avoid flooding (of unknown / unregistered multicast)
First AES67 plug-fest October 2014 @ IRT in Munich!

- 3.5 days of plugging
  - 22 participants (10 manufacturers, IRT, EBU, SR)
  - 16 products (15 were based on RAVENNA)
  - Lots of streams – millions of packets!
First AES67 plug-fest October 2014 @ IRT in Munich!

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Tests included:

- Synchronization (PTP)
- Concurrent multicast streaming between all nodes w/ mandatory stream formats
- Unicast streams and SIP connection setup

☑ AES67 interoperability successfully demonstrated!
AES Standard for Audio Applications of Networks - High-performance Streaming Audio-over-IP Interoperability

Lessons learned:

• Careful planning (IP address ranges, PTP setting)
• Multicast configuration (IGMP querier configuration)
• Improvements on SIP specifications req’d
• Service advertising eases operation (stream connection)

Further plug-tests @ next plug-fests:

• Non-PTP-aware switches, more hops
• Unicast / SIP
• GM change
• Routed environment
AES67 “real-world” example applications:

- FIFA Championship 2014 Brasil:
  - Live commentary system w/ 240 LCUs
  - ARD / ZDF remote production studio Copacabana ⇔ IBC
  - Various OB vans
- ARD Hauptstadtstudio:
  - 35 journalists edit suites, ea. w/ 2 JADE PCs and 1 Lawo Crystal
- Numerous mobile + fixed recording installations from Merging Technologies:
  - Pyramix DAW, Horus + HAPI IO
- Commercial restaurant installation Finland:
  - Jutel HIPman system w/ RVSC + 30 Genelec IP speakers
RAVENNA  The IP-based Real-Time Media Network

RAVENNA @ FIFA WORLD CUP 2014

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Las Vegas, April 12th, 2015
RAVENNA The IP-based Real-Time Media Network

Commentary System

@ FIFA WORLD CUP 2014

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Las Vegas, April 12th, 2015
Brazilian Telco to IBC in Rio

RAVENNA @ FIFA WORLD CUP 2014
RAVENNA The IP-based Real-Time Media Network

@ ASIAN GAMES 2014
Conventional system setup:
The IP-based Real-Time Media Network

IP-based setup:

RAVENNA @ ASIAN GAMES 2014

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Las Vegas, April 12th, 2015
AES67 Installed Sound Pilot: Nallikari restaurant complex, Oulu, Finland:

- Multi-zone restaurant environment with programmable background music
- Audio processing, playout, routing and remote control functions
- Wireless user control via Android tablets
AES67 Installed Sound Pilot: Nallikari restaurant complex, Oulu, Finland:

- Jutel HIPman audio management, processing & play-out system w/ RAVENNA Virtual Sound Card
- 30 IP-driven Genelec speakers
- Axia xNode for PTP GM and utility audio I/O (mic, monitoring)
- Android tabs for wireless control
- Remote maintenance access
- Common network for all services
- RAVENNA/AES67 audio streaming
Lessons learned - project difficulties / problems (technical):

- Careful planning / documentation required:
  - Network infrastructure, IP addresses, port assignments
  - PTP parameters
  - Switch configuration: QoS & multicast (flooding, IGMP querier)
  - Stream configuration: packet setup, multicast addresses

- Device configuration / operation:
  - UIs look different
  - Divergent parameter names / values

- Physical setup:
  - Unlocked BNC connectors, broken RJ45 connectors
Potential difficulties in corporate environment (the technical challenge):

- Traffic situation in larger LANs
  - Bandwidth (stream accumulation): mean packet delay, PDV, packet loss
- Synchronization & stream service spanning multiple subnets
  - Router configuration: multicast forwarding rules, prioritization etc.
  - PTP infrastructure: boundary clocks, local PTP traffic distribution etc.
  - WAN: behavior of WAN infrastructure, balancing against other traffic, multicast, max. PDV (SLAs often relate to mean values!)
- Access control & access rights
  - Integration with corporate directory services (LDAP etc.)
Potential difficulties in corporate environment (the “human” challenge):

- Operations staff not familiar w/ specifics of IT world
- IT staff not familiar w/ requirements of “real-time” media
  - Mean delay + packet jitter (PDV)
  - UDP / packet loss
  - Lack of experience w/ concepts & switch / router configuration of
    - QoS (telephones use “auto VoIP”)
    - Multicast (IGMP / RGMP / PIM, multicast router-port, flooding, well-known multicast addresses)
    - PTP (general requirements, PTP-aware network equipment)

⇒ **IT & Operations staff need to work hand-in-hand!**
Beyond?! 

AES TG SC-02-12-M: AES67 Development

- Outlining AES67 compliance test guidelines
- Specifying and engineering the compliance tests
- Planning and organizing plug-fests
- Improving the standard specification where necessary

Participants:
- anyone implementing AES67
- parties / individuals with strong interest in AES67 interoperability
Beyond?!

MNA – Media Networking Alliance

- Non-profit organization to promote AES67 adoption
- Marketing work group - mainly covering marketing activities (web site, white papers, education, trade shows etc.)
- Intention to also work on technical issues (develop implementation guide lines & reference designs, establish test procedures organize plug-fests) → technical work group
- Founding members: Bosch, Lawo, QSC, Telos, Yamaha
- 18 members total (and growing), including broadcasters (BBC + Sveriges Radio)
- Annual full membership: 10k USD, supporting membership: 1k USD
Today, 3 pm, room N202LMR:

Introduction to AES67 & How to get it into your Products

RAVENNA booth in Central Hall # C2218

AES Standard for Audio Applications of Networks - High-performance Streaming Audio-over-IP Interoperability
Thank you for your attention!

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