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CONFERENCES: APRIL 11-16, 2015 • EXHIBITS: APRIL 13-16
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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

**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)*

AES67 – the “O negative” of audio networking



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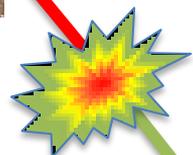


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*AES67 – the “O negative”
of audio networking*





*AES67 – the “O negative”
of audio networking*



AES67

AES67



AES67

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*AES67 – the “O negative”
of audio networking*

When will it be available?

AES67 – the “O negative” of audio networking

When will it be available?



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*AES67 – the “O negative”
of audio networking*

When will it be available?



connecting audio



RAVENNA



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!



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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!



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 @ FIFA WORLD CUP 2014

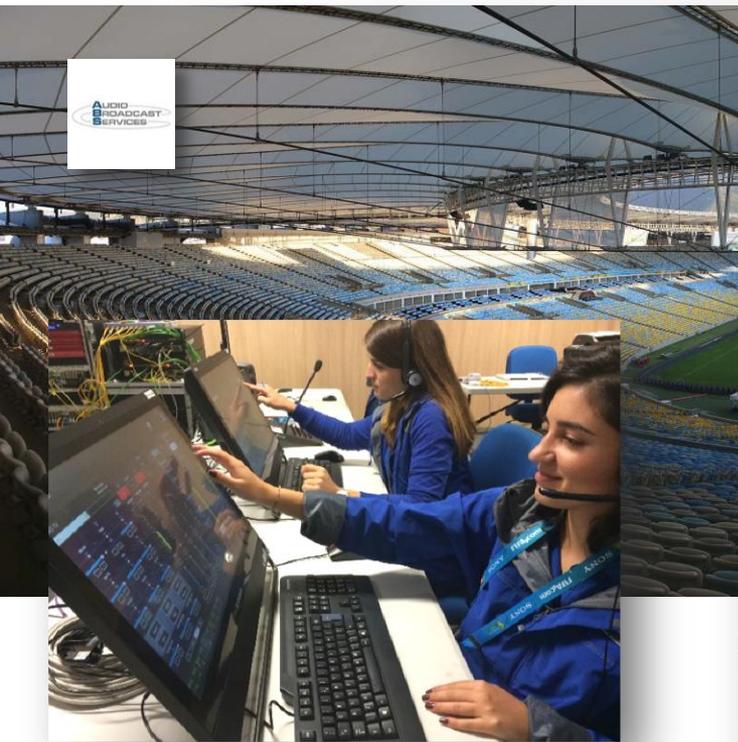
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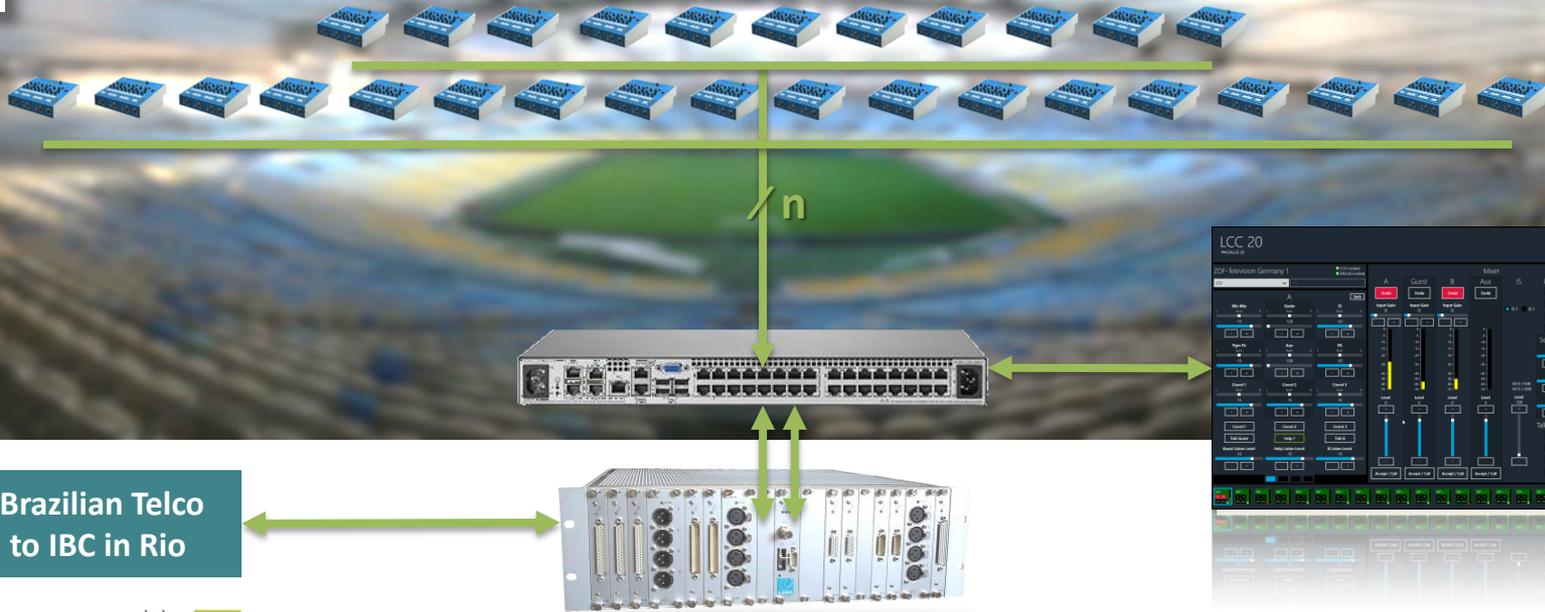
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Las Vegas, April 12th, 2015





RAVENNA @ FIFA WORLD CUP 2014



Brazilian Telco
to IBC in Rio



RAVENNA @ FIFA WORLD CUP 2014





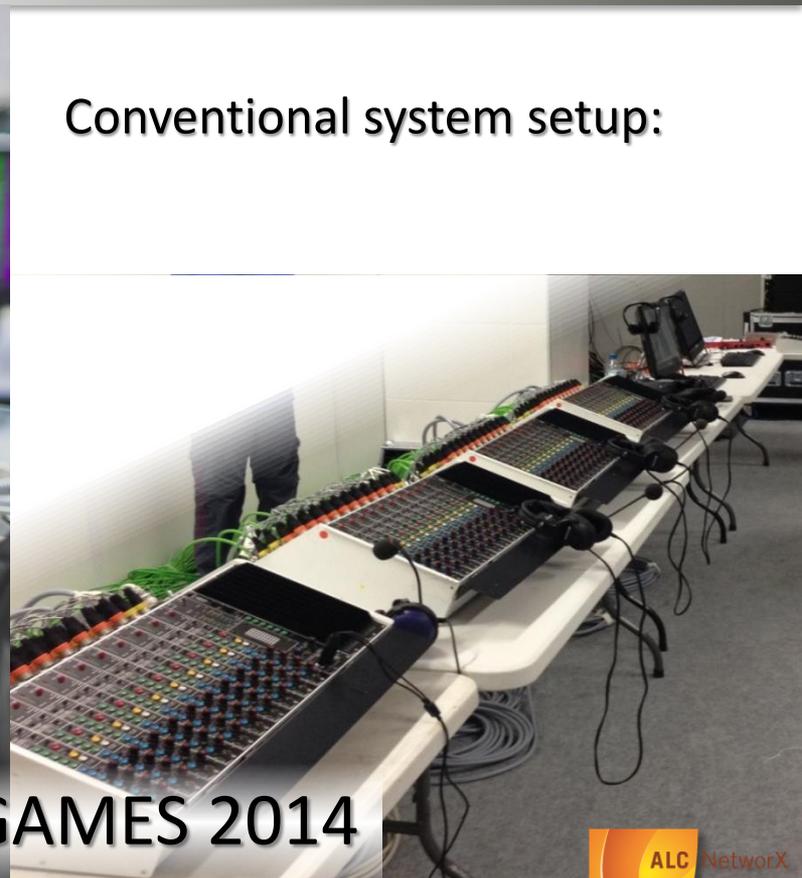
RAVENNA @ ASIAN GAMES 2014





RAVENNA @ ASIAN GAMES 2014





Conventional system setup:

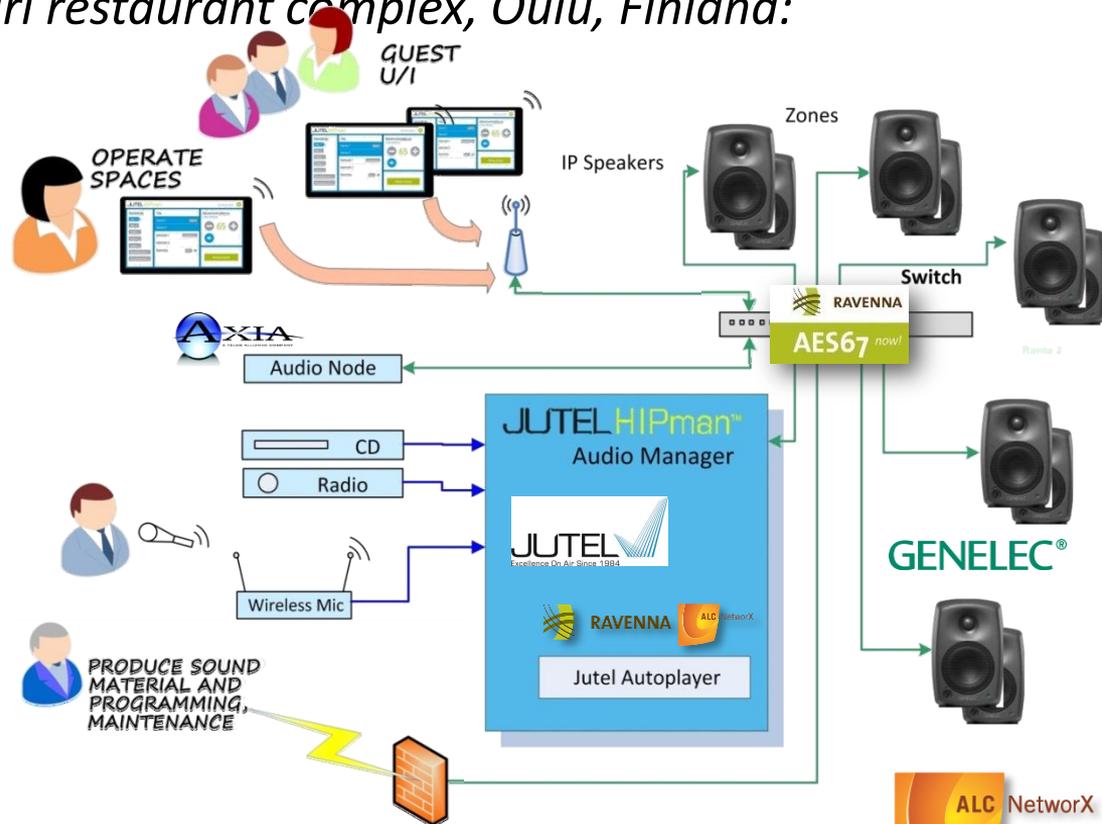
 **RAVENNA @ ASIAN GAMES 2014**



RAVENNA @ ASIAN GAMES 2014

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 N2o2LMR:



Media
Networking
Alliance

Introduction to AES67 & How to get it into your Products



AES67



RAVENNA booth in Central Hall

C2218

Thank you for your attention!

**RAVENNA booth in Central Hall
C2218**

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