

AES67 and ST2110-30 Interoperability in Real Life

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What this session is about

- Brief introduction of AES67 and ST2110
- Closer look into AES67 mandatory and extended features
- What information do I need to configure my streams
- Tools for Stream Setup
- Tools for Troubleshooting
- AES67 and Dante

AES67



AES67

AES67-2018 Standard for Audio Applications of Networks:
High-performance Streaming Audio-over-IP Interoperability

- Goal: Find a common ground to exchange audio (media) between devices of different brands with proprietary IP implementations
- Out of Scope: discovery and connection management



SMPTE ST2110



Professional Media Over Managed IP Networks Suite

- -10 – System Timing and Synchronisation
- -20 / -21 – Video
- -30 / -31 – Audio
- -40 – Ancillary Data
- ...

ST2110 -30

- Audio Transport over IP
- Synchronised with Video via PTPv2
- Refers to AES67-2018 as format to transmit PCM audio
- A few constraints apply
 - See AIMS Whitepaper „AES67 / ST 2110 Commonalities and Constraints“
<https://www.aimsalliance.org/white-papers/>

AES67 Recap

- What does the standard mandate?
- What has been implemented?

AES67 – What is mandatory?

- Samplerate: 48kHz
- Packet time: 1ms
- PTP v2 Synchronisation
- IGMP v2 (v3 for ST2110)
- QoS DSCP Markings
 - Clock: EF
 - Media: AF41
 - Anything else: DF (Best Effort)
- Audio Encoding: 16 and 24 Bit
- Channel Count: 1-8 Channels per stream
- Multicast and Unicast
- SDP
- SIP (Unicast)

AES67 – What else is possible?

- Samplerates: 96 kHz, 44.1 kHz
- Packet times: 125μs, 250μs, 333μs, 4ms
- More than 8 audio channels per stream (e.g. 64ch)
- IGMP v3 (automatic fall-back to v2)
- Discovery (RTSP, Bonjour, SAP) not scope of the standard but can be added on top of AES67

Format, sampling rate	Packet time	Maximum channels per stream
L24, 48kHz	125 microseconds	80
L16, 48kHz	250 microseconds	60
L24, 48kHz	250 microseconds	40
L24, 48kHz	333-1/3 microseconds	30
L24, 96kHz	250 microseconds	20
L24, 48kHz	1 millisecond	10
L24, 48kHz	4 milliseconds	2

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L24, 96kHz	250 microseconds	20
L24, 48kHz	1 millisecond	10
L24, 48kHz	4 milliseconds	2

AES67 – What do I need to set up a stream?

```
v=0  
o=- 1 2832056294 IN IP4 192.168.1.210  
s=AES67 1  
t=0 0  
m=audio 5004 RTP/AVP 97  
i=Stream 1  
c=IN IP4 239.69.0.1/128  
a=rtpmap:97 L24/48000/8  
a=sync-time:0  
a=clock-domain:PTPv2 0  
a=framecount:48  
a=recvonly  
a=mediaclock:direct=0  
a=ts-refclk:ptp=IEEE1588-2008:00-1D-C1-FF-FE-0E-67-16:0  
a=ptime:1  
a=maxptime:1
```

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a=ts-refclk:ptp=IEEE1588-2008:00-1D-C1-FF-FE-0E-67-16:0
a=ptime:1
a=maxptime:1
```

- Multicast IP: 239.69.0.1
- Destination Port: 5004
- Encoding: L24 (24 Bit)
- Samplerate: 48000 (48kHz)
- Channel Count: 8
- Payload ID: 97
- Packet time: 48

AES67 – How do I get the SDP into my device?

- Manually
- RTSP (e.g. RAVENNA)
- SAP (e.g. Dante)
 - Dante Controller does not provide means to manually enter stream information
- NMOS

RAV2SAP

RAVENNA-2-SAP CONVERTER

RAVENNA					SAP				LOCAL						
Streamname	Origin	Multicast	SAP	RTSP	AUTO	Streamname	Origin	Multicast	RAI	AUTO	Streamname	Multicast	Source	RAV	SAP
AE567 1	192.168.1.210	239.69.0.1/128	W	rtsp://192.168.1.210:80/ty-ravna/A...		AE567 1	192.168.1.210	239.69.0.1/128	W						
AE567 2	192.168.1.210	239.69.0.2/128	W	rtsp://192.168.1.210:80/ty-ravna/A...		AE567 2	192.168.1.210	239.69.0.2/128	W						
AE567 3	192.168.1.210	239.1.0.3/128	W	rtsp://192.168.1.210:80/ty-ravna/A...		AE567 3	192.168.1.210	239.1.0.3/128	W						
						EXX04-MD-Wall : 25	192.168.1.70	239.69.104.133/32	W						
						EXX04-MD-Wall : 26	192.168.1.70	239.69.227.227/32	W						
						EXX04-MD-Wall : 27	192.168.1.70	239.69.63.136/32	W						
						EXX04-MD-Wall : 28	192.168.1.70	239.69.99.87/32	W						
						EXX04-MD-Wall : 29	192.168.1.70	239.69.46.199/32	W						
						EXX04-MD-Wall : 30	192.168.1.70	239.69.95.432	W						
						EXX04-MD-Wall : 31	192.168.1.70	239.69.75.133/32	W						
						EXX04-MD-Wall : 32	192.168.1.70	239.69.121.57/32	W						

08-04-2018 16:35:11,138 Received SDP for: RESET 3
 08-04-2018 16:35:11,311 Received SAP announce for: RESET 3
 08-04-2018 16:35:32,015 Received SAP announce for: EXX04-MD-Wall : 25
 08-04-2018 16:35:32,023 Received SAP announce for: EXX04-MD-Wall : 26
 08-04-2018 16:35:32,030 Received SAP announce for: EXX04-MD-Wall : 27
 08-04-2018 16:35:32,032 Received SAP announce for: EXX04-MD-Wall : 28
 08-04-2018 16:35:32,044 Received SAP announce for: EXX04-MD-Wall : 29
 08-04-2018 16:35:32,053 Received SAP announce for: EXX04-MD-Wall : 30
 08-04-2018 16:35:32,060 Received SAP announce for: EXX04-MD-Wall : 31
 08-04-2018 16:35:32,105 Received SAP announce for: EXX04-MD-Wall : 32

RAVENNA
AES67 built-in

The RAVENNA-2-SAP Converter software developed by ALC Networks to help connecting AES67

RAV2SAP – SDP view

RAVENNA-2-SAP CONVERTER

RAVENNA					SAP					LOCAL					
Streamname	Origin	Hubcast	SAP	RTSP	AUTO	Streamname	Origin	Hubcast	RAV	AUTO	Streamname	Hubcast	Source	RAV	SAP
AE567 1	192.168.1.210	239.69.0.1/128	W	rtsp://192.168.1.210/80by/ravenna/...		AE567 1	192.168.1.210	239.69.0.1/128	W						
AE567 2	192.168.1.210	239.69.0.2/128	W	rtsp://192.168.1.210/80by/ravenna/...		AE567 2	192.168.1.210	239.69.0.2/128	W						
AE567 3	192.168.1.210	239.1.0.3/128	W	rtsp://192.168.1.210/80by/ravenna/...		AE567 3	192.168.1.210	239.1.0.3/128	W						
						EXX0X-HD-Wall : 25	192.168.1.70	239.69.0.1/128	W						
						EXX0X-HD-Wall : 26	192.168.1.70	239.69.0.2/128	W						

Stream: AE567 1

```


SDP:
v=0
o=- 1 2832056294 IN IP4 192.168.1.210
s=AE567 1
t=0 0
#include:SDP4RTSP(AVP 97
r=Stream 1
c=IP IP4 239.69.0.1/128
a=rtptime:97124/48000/b
a=rtptime:0
a=local-domain:PP=2 0
a=framesize:4E
a=rtt:only
a=video:direct=0
a=video:copy=IEEE1588-2008:00-ID-C1-PP-PE-DE-67-16:0
a=video:1
a=audio:1

```

```

09.06.2018 14:35:11,130 Received SDP for: AE567 1
09.06.2018 14:35:11,312 Received SAP announce for: AE567 2
09.06.2018 14:35:12,015 Received SAP announce for: EXX0X-HD-Wall : 25
09.06.2018 14:35:12,023 Received SAP announce for: EXX0X-HD-Wall : 26
09.06.2018 14:35:12,030 Received SAP announce for: EXX0X-HD-Wall : 27
09.06.2018 14:35:12,052 Received SAP announce for: EXX0X-HD-Wall : 28
09.06.2018 14:35:12,066 Received SAP announce for: EXX0X-HD-Wall : 29
09.06.2018 14:35:12,083 Received SAP announce for: EXX0X-HD-Wall : 30
09.06.2018 14:35:12,096 Received SAP announce for: EXX0X-HD-Wall : 31
09.06.2018 14:35:12,105 Received SAP announce for: EXX0X-HD-Wall : 32

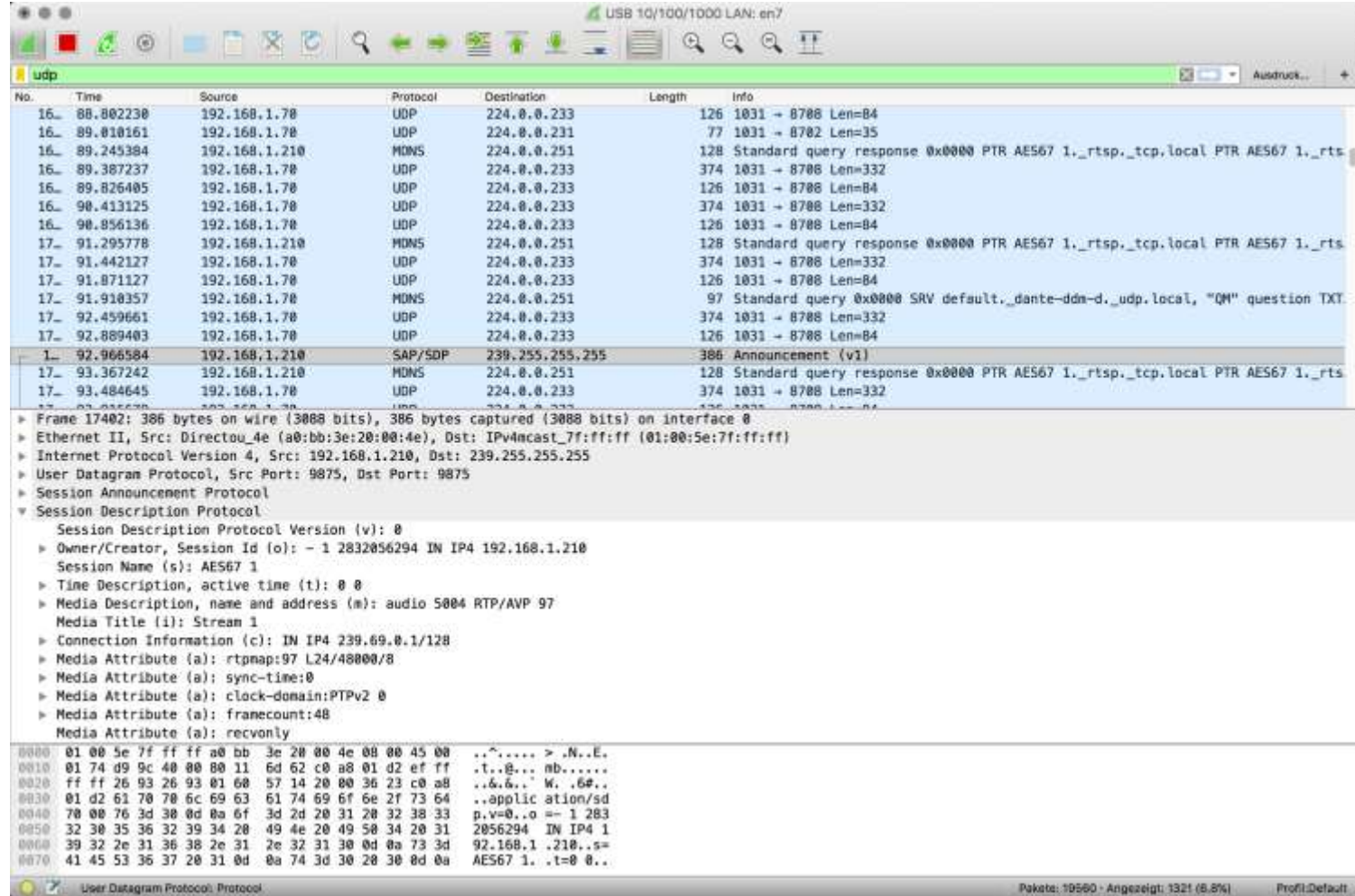
```



The RAVENNA-2-SAP Converter is firmware developed by ALC Networks to help connecting AES67

Troubleshooting – What, if it does not work?

- Check stream configuration
 - Is it really AES67 compliant?
 - If it is different from the mandatory set, does the device support it?
- Check Multicast IP
- Check Destination Port
- Check Payload ID
- Check Stream Delay
- If it still doesn't work -> Wireshark!



The screenshot shows a Wireshark capture of network traffic on interface en7. The selected packet is a Session Announcement Protocol (SAP) announcement. The packet list pane shows the following details:

No.	Time	Source	Protocol	Destination	Length	Info
16.	88.802230	192.168.1.70	UDP	224.0.0.233	126	1031 → 8700 Len=04
16.	89.010161	192.168.1.70	UDP	224.0.0.231	77	1031 → 8702 Len=35
16.	89.245384	192.168.1.210	MDNS	224.0.0.251	128	Standard query response 0x0000 PTR AES67 1._rtsp_tcp.local PTR AES67 1._rts
16.	89.387237	192.168.1.70	UDP	224.0.0.233	374	1031 → 8700 Len=332
16.	89.826405	192.168.1.70	UDP	224.0.0.233	126	1031 → 8700 Len=04
16.	90.413125	192.168.1.70	UDP	224.0.0.233	374	1031 → 8700 Len=332
16.	90.856136	192.168.1.70	UDP	224.0.0.233	126	1031 → 8700 Len=04
17.	91.295778	192.168.1.210	MDNS	224.0.0.251	128	Standard query response 0x0000 PTR AES67 1._rtsp_tcp.local PTR AES67 1._rts
17.	91.442127	192.168.1.70	UDP	224.0.0.233	374	1031 → 8700 Len=332
17.	91.871127	192.168.1.70	UDP	224.0.0.233	126	1031 → 8700 Len=04
17.	91.910357	192.168.1.70	MDNS	224.0.0.251	97	Standard query 0x0000 SRV default._dante-ddn-d_udp.local, "QM" question TXT
17.	92.459661	192.168.1.70	UDP	224.0.0.233	374	1031 → 8700 Len=332
17.	92.889403	192.168.1.70	UDP	224.0.0.233	126	1031 → 8700 Len=04
1.	92.966584	192.168.1.210	SAP/SDP	239.255.255.255	386	Announcement (v1)
17.	93.367242	192.168.1.210	MDNS	224.0.0.251	128	Standard query response 0x0000 PTR AES67 1._rtsp_tcp.local PTR AES67 1._rts
17.	93.484645	192.168.1.70	UDP	224.0.0.233	374	1031 → 8700 Len=332

The packet details pane for the selected packet (No. 1) shows the following structure:

- Frame 17402: 386 bytes on wire (3088 bits), 386 bytes captured (3088 bits) on interface 0
- Ethernet II, Src: Directou_4e (a0:bb:3e:20:00:4e), Dst: IPv4mcast_7f:ff:ff (01:00:5e:7f:ff:ff)
- Internet Protocol Version 4, Src: 192.168.1.210, Dst: 239.255.255.255
- User Datagram Protocol, Src Port: 9875, Dst Port: 9875
- Session Announcement Protocol
- Session Description Protocol
 - Session Description Protocol Version (v): 0
 - Owner/Creator, Session Id (o): - 1 2832056294 IN IP4 192.168.1.210
 - Session Name (s): AES67 1
 - Time Description, active time (t): 0 0
 - Media Description, name and address (m): audio 5004 RTP/AVP 97
 - Media Title (i): Stream 1
 - Connection Information (c): IN IP4 239.255.255.255
 - Media Attribute (a): rtpmap:97 L24/48000/8
 - Media Attribute (a): sync-time:0
 - Media Attribute (a): clock-domain:PTPv2 0
 - Media Attribute (a): framecount:48
 - Media Attribute (a): recvonly

The packet bytes pane shows the raw hex and ASCII data of the announcement.

PTP Troubleshooting

Messages

No.	Interface	Time	Msg. Type	Dom.	Seq. ID	Source	Destination	Device
4625	eno1	2017-06-07, 08:24:29	Sync	2	7803	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4626	eno1	2017-06-07, 08:24:29	Follow Up	2	7803	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4660	eno1	2017-06-07, 08:24:30	Announce	2	7816	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4671	eno1	2017-06-07, 08:24:30	Sync	2	7804	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4672	eno1	2017-06-07, 08:24:30	Follow Up	2	7804	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4687	eno1	2017-06-07, 08:24:30	Delay Req.	2	44967	172.27.19.91	224.0.1.129	Meinberg_FFFE004247
4688	eno1	2017-06-07, 08:24:30	Delay Resp.	2	44967	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4915	eno1	2017-06-07, 08:24:31	Announce	2	7817	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4929	eno1	2017-06-07, 08:24:31	Sync	2	7805	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4930	eno1	2017-06-07, 08:24:31	Follow Up	2	7805	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4939	eno1	2017-06-07, 08:24:31	Delay Req.	2	44968	172.27.19.91	224.0.1.129	Meinberg_FFFE004247
4940	eno1	2017-06-07, 08:24:31	Delay Resp.	2	44968	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4966	eno1	2017-06-07, 08:24:32	Announce	2	7818	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4677	eno1	2017-06-07, 08:24:32	Sync	2	7806	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4678	eno1	2017-06-07, 08:24:32	Follow Up	2	7806	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9
4861	eno1	2017-06-07, 08:24:32	Delay Req.	2	44969	172.27.19.91	224.0.1.129	Meinberg_FFFE004247
4862	eno1	2017-06-07, 08:24:32	Delay Resp.	2	44969	172.27.19.91	224.0.1.129	Meinberg_FFFE008FC9

Devices

Type	Identity	Interface	Protocol	Dom.	ANN	SYN	FUP	RSQ	RES
GM (1)	Meinberg_FFFE008FC9	eno1	Pv4	2	89	86	88	0	86
Slave	Meinberg_FFFE004247	eno1	Pv4	2	0	0	0	0	0
Monitor	Meinberg_FFFE008FB5	eno1	IPv4	Any	0	0	0	0	0
Monitor	Meinberg_FFFE008FB0	eno1	IPv4	Any	0	0	0	0	0

Device Details (Grandmaster, Network: eno1, PTPv2, IPv4, Domain 2)

Port Identity: 0xEC4670FFE008FC9:0001 Port State: Master
 Address: 172.27.19.91 Delay Mech.: E2E
 Vendor: Meinberg Ann. Rate: 1/s
 Device: - Sync Rate: 1/s
 Management: - Req. Rate: -
 GM Clock Quality: P1 128, CC 5, CA 0x21 (WIRn 100 ns), CV 12563, P2 128, SR 0



www.ptprackhound.com

AES67 and Dante

- Multicast only (no Unicast)
- Restricted Multicast IP-Range: 239.p.x.x
Default Prefix: 239.**69**.x.x
- Encoding: L24 (24 Bit)
- Packet time: 1ms TX / 1ms, 125µs, 250µs, 333µs RX
- Non-Standard DSCP Markings
- Dante Redundancy mode not available

Implementation dependent peculiarities and pitfalls

- SDP Distribution
- Multicast Prefix
- Dynamic Payload IDs
- DSCP Markings for QoS

Standard
Clock: EF
Media: AF41



Dante AES67
Clock: CS7
Media: EF

JT-NM Tested

- Program initiated by JT-NM, EBU and IRT
- To give documented insight into how vendor equipment aligns to ST2110
- Check out the JT-NM Tested Program on www.jt-nm.org and on the Show Floor





Thank You

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