Setting up and Making an AES67 Network Coexist with Standard Network Traffic

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ABSTRACT: We will show how an AES67 network can coexist within a standard non-audio network. We will detail the difficulties usually encountered when setting up and using AES67 networks. We will analyse the utility of the network protocols required by AES67: (i) IGMP and its impact on devices features, (ii) PTP and the clock recovery performance when using PTP-enabled switches and (iii) QoS and the impact of non-audio traffic such as web and corporate traffic. We will use a set-up of ten different AES67 compliant devices from many manufacturers and supporting various AoIP protocols all compliant to AES67. We will provide recommendations in order to provide proper quality of experience while making networks coexist.

Context

Can audio and non-audio traffic coexist ?

What are the difficulties encountered ?

Is specific hardware required ?

Can glitche free audio signal be guaranteed ?

Reminder

- **AES67** [1]: standard to make easier interoperability;
- **Non-audio traffic**: Web, IT, Corporate traffic;
- **IGMP** [2]: Internet Group Management Protocol, which regulates and manages multicast subscription for each equipment;
- **PTP** [3]: Precision Time Protocol, that allows fine synchronisation between devices by distributing time on the network;
- **Boundary Clock**: Clock is regenerated at the switch;
- **QoS** [4]: Quality of Service, which manages packet prioritisation based on a specific field in the IP header;
- **Jitter:** Maximum excursion of a given value from a reference;

Setup
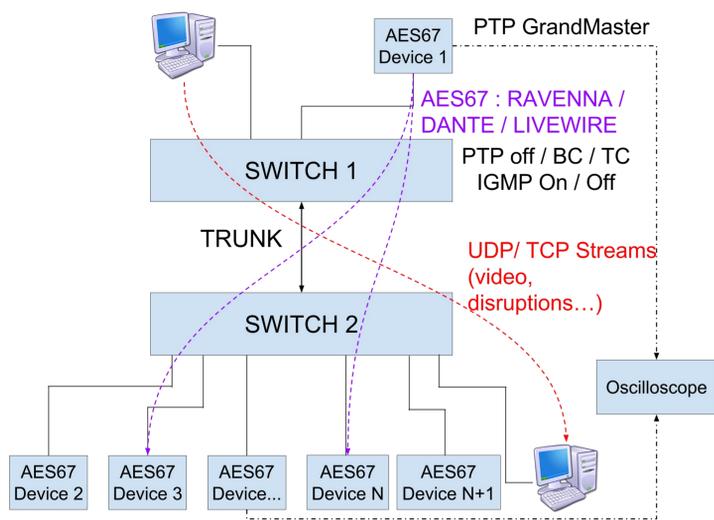
PTP

* Clock jitter measured.

* Two PTP modes on switches (OFF and Boundary Clock) tested.

* With Boundary Clock mode, curves are low.

* Without PTP support on switches and audio only, curve approximates the threshold above 120 channels.

* Without PTP support on swithes and both traffics, clock jitter was high above 240 channels.
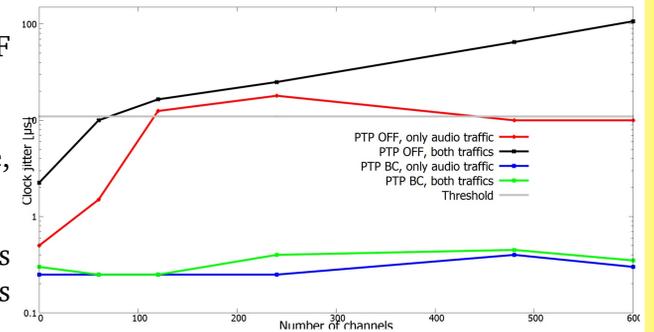
Clock jitter over the number of channels (logscale)

Useful Data

	Useful Data
Switch	1Gbps ports - 8 priorities queues - Supporting BC and OFF PTP Mode -
Devices	~10 devices - AES67 standard - Sample Rate at 48kHz Axia Xnode, IQOYA *LINK, LAWO Amic 8, Archwave uNet Mini, uNet Base V2, Comi Mx, NetBox 8 AD, LX-IP MADI
Audio source	60 channels - 8 samples per channel (⅛ ms packet time) - 69.12Mbps/source - 1.2Mbps/channel
Non-Audio stream	Two FTP servers, speed rate was limited to 350Mbps
GbE limits	780 channels ⇒ 13 audio sources

QoS

* Clock jitter measured.

* QoS enable.

* QoS efficiency is insignificant for three tests.

*Both traffics and no PTP support on switches: QoS efficiency is revealed above 240 channels.
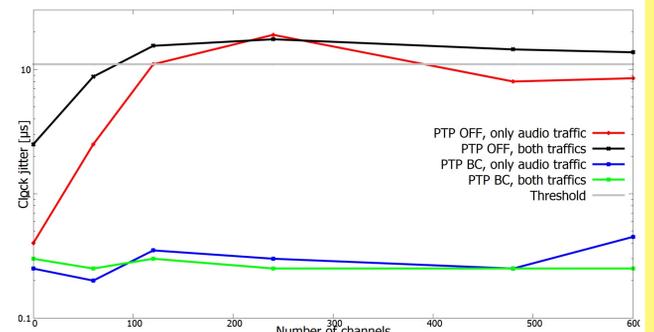
Clock jitter over the number of channels (logscale)

Conditions

Protocol	Conditions Tested
IGMP Snooping	With and Without
PTP	With and Without support
QoS	With (following AES67 reco.) and Without

CONCLUSION

Priority	Setup
High	IGMP Snooping on
Medium	BC PTP mode
Low	QoS on

Setup for long term test
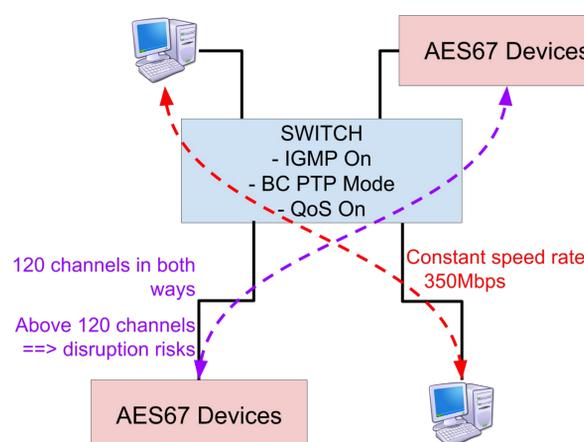
Results
after a 24h test, with 120 channels in both ways
Clock jitter < 2.4us (Threshold = 11us)
Audio jitter = 192us
Non-audio speed rate at 350Mbps and 2.54TB transited on the network
Digital audio integrity test

Results long term test

Recommended setup

To make coexist both traffics :

* Use **IGMP Snooping** protocol for a high number of streams.

* **BC PTP** mode on switches, if available, should be used to minimise the clock jitter.
If not available, it is advise to limit at 60 audio channels

* **QoS** should be activated to limit disruptions and avoid audio glitches.

IGMP Snooping

* IGMP snooping disabled.

* Audio streams.

* 100Mbps devices not reachable on their web page.

IGMP Snooping must be activated

REFERENCES

[1] AES, "AES standard for audio applications of networks - High-performance streaming audio-over-IP interoperability," 2013.

[2] Fenner, W., "Internet Group Management Protocol, Version 2," RFC 2236 (Proposed Standard), 1997, updated by RFC 3376.

[3] IEEE, "1588-2008: IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems," 2008.

[4] Nichols, K., Blake, S., Baker, F., and Black, D.,"Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers," RFC 2474 (Proposed Standard), 1998, updated by RFCs 3168, 3260.