RAVENNA 2020 Webinar Series

(The "Remote" Sessions)

AES67 over WAN

Tue, Nov 10, 2020
15:00 h (CET)

Presenter: Nicolas Sturmel, Merging Technologies

MERGING
AUDIO FOR THE NETWORKING AGE

ALC NetworX

Andreas Hildebrand, RAVENNA Technology Evangelist
- more than 25 years in the professional audio / broadcasting industry
- graduate diploma in computer science
- R&D, project & product management experience
- member of AES67 TG and ST2110 DG

ALC NetworX GmbH, Munich / Germany
- established 2008
- R&D center
- developing & promoting RAVENNA
- Partnerships with > 40 manufacturers

RAVENNA
- IP media networking technology
- designed to meet requirements of professional audio / broadcasting applications
- open technology approach, license-free
- fully AES67-compliant (*built-in*)

Nicolas Sturmel, PhD

- ENS Cachan, IRCAM, Paris VI and XI universities graduate
- Passionate on both audio and network
- Member of the SC-02-12 (Audio Network) standard committee
- Especially active on AES67 testing, plug fests, dirty hands events
- Currently leading SC-02-12-M activities on AES67 over WAN
- Media Network and Interoperability expert at Merging Technologies
- ANEMAN product owner

@nicolassturmel, www.linkedin.com/in/nicolassturmel

Merging Technologies

- Designer of some of the best Analog to AES67 converters
- Developer of the Pyramix DAW
- Celebrating 30 years in 2020!

RAVENNA Fall Webinar series („The Remote Sessions")

- Series of 6 webinars with focus on remote production
- Covers fundamental basics and educates on theoretical principles
- Provides practical experience, spiced up with valuable tips & tricks
- One webinar will touch on applications for SMPTE ST 2110-31 (RAVENNA AM824), namely NGA
- One webinar is covering aspects of PTP in remote productions, includes overview on PTPv2.1
- Webinars take place every Tuesday through Dec. 15th, starting at 1500 CET
- Videos and slides will be available 1 ~ 2 days after webinar on RAVENNA web site

RAVENNA Fall Webinar series („The Remote Sessions")

AES67 over WAN

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MERGING

ALC NetworX

Lockdown Rock

Tue, Dec 01, 2020
15:00 h (CET)

Presenter: Luca Giaroli, DirectOut

DirectOut TECHNOLOGIES

ALC NetworX

Remote Production

Tue, Dec 08, 2020
15:00 h (CET)

Presenter: Dirk Sykora, Lawo

LAWO

ALC NetworX
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Remote Production using the Cloud

Tue, Dec 15, 2020
15:00 h (CET)

Presenter: Bill Rounopoulos, Ross Video

ROSS Living Live!

ALC NetworX
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ALC NetworX

RAVENNA Fall Webinar series („The Remote Sessions")

SMPTE ST 2110-31 Applications

Tue, Nov 17, 2020
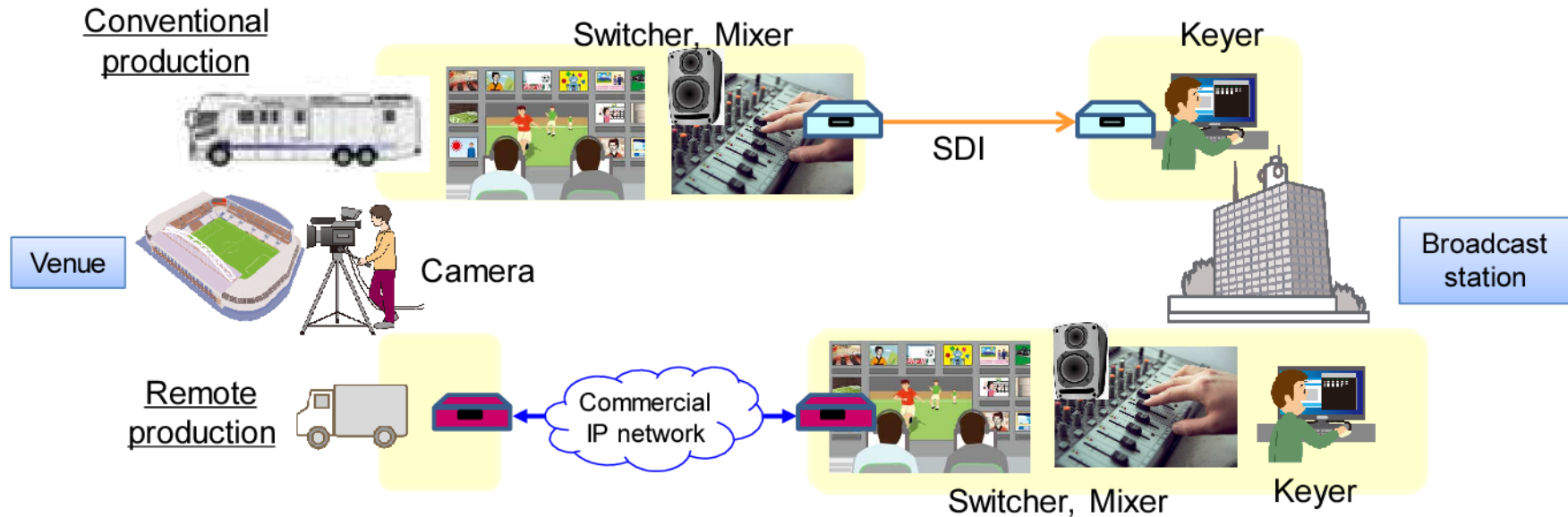**16:00 h (CET)**

Presenter: James Cowdery, Dolby Labs

Update on IEEE 1588-2019
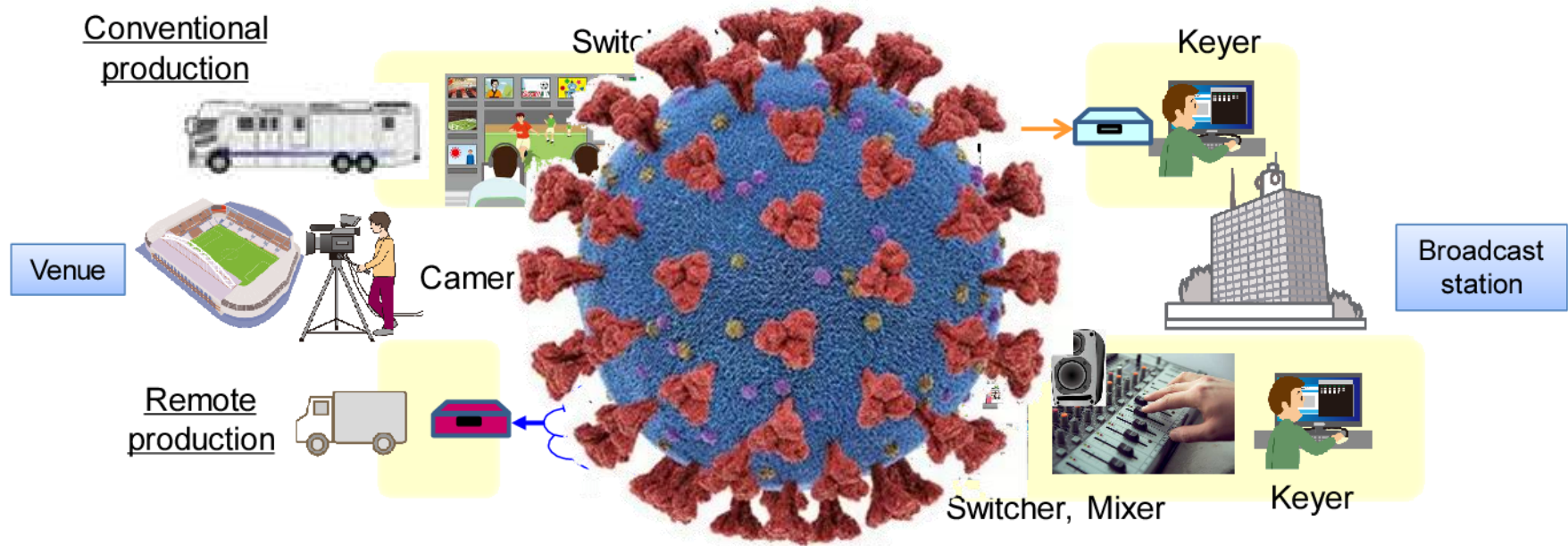### &
PTP in WAN Applications

Tue, Nov 24, 2020
15:00 h (CET)

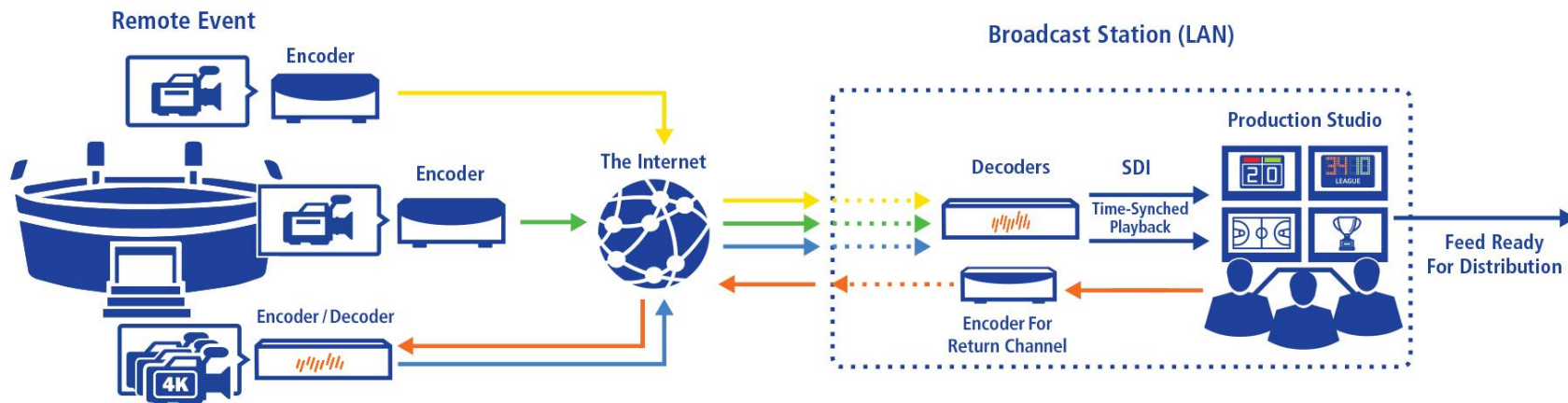**Presenter: Andreas Hildebrand, ALC NetworX**
Daniel Boldt, Meinberg

Starts at 16:00 h (CET),
allowing James to wake up and
grab a good cup of strong coffee!

Conventional production

Switcher, Mixer

Keyer

SDI

Venue

Camera

Broadcast station

Remote production

Commercial IP network

Switcher, Mixer

Keyer

Conventional production

Venue

Remote production

Switcher

Camera

Keyer

Broadcast station
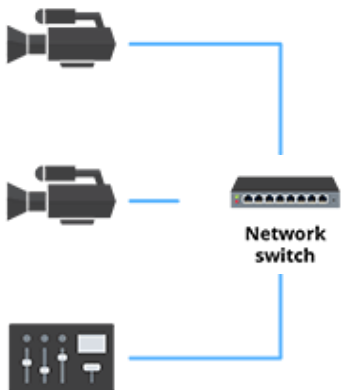
Switcher, Mixer

Keyer

IP-based signal transport

- i.e. SMPTE ST 2022-6

Uncompressed all IP-based signal transport

- i.e. SMPTE ST 2110

Audio and video sources, meta, and control data

Network switch

Ethernet
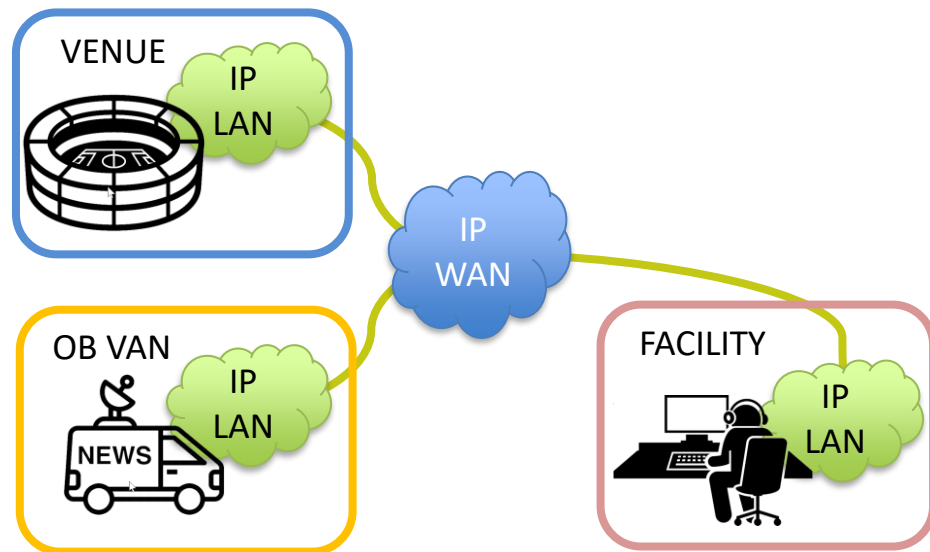
IP router

LAN, WAN, Internet

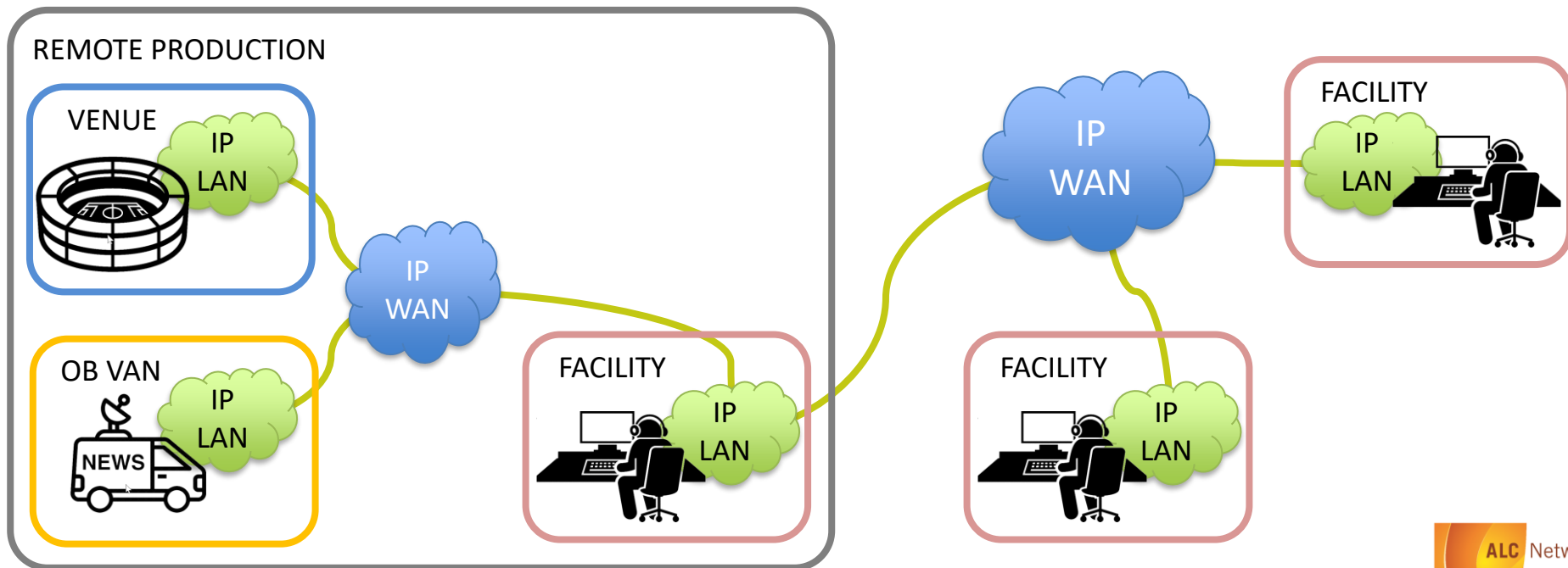Remote production studio

Final streaming destination
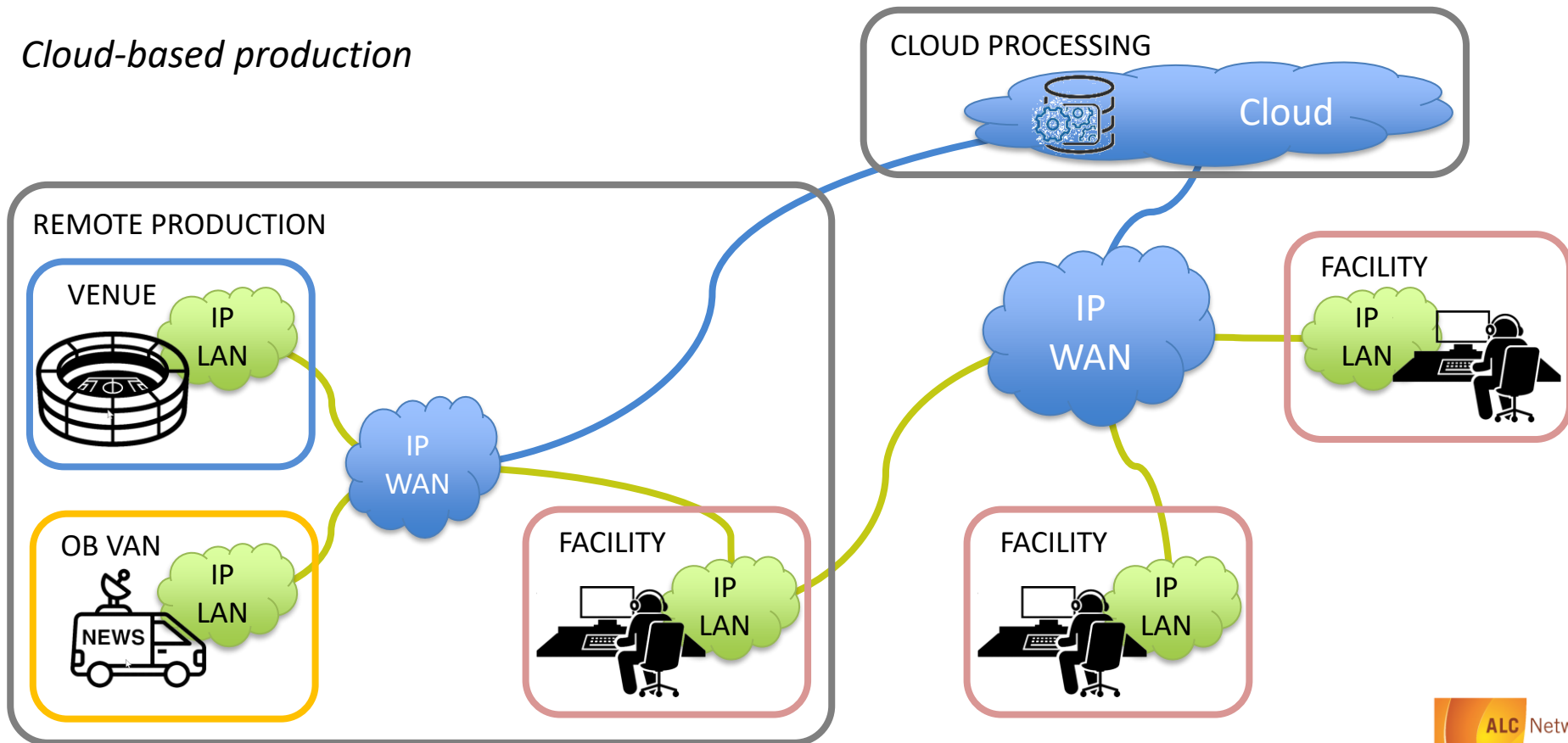
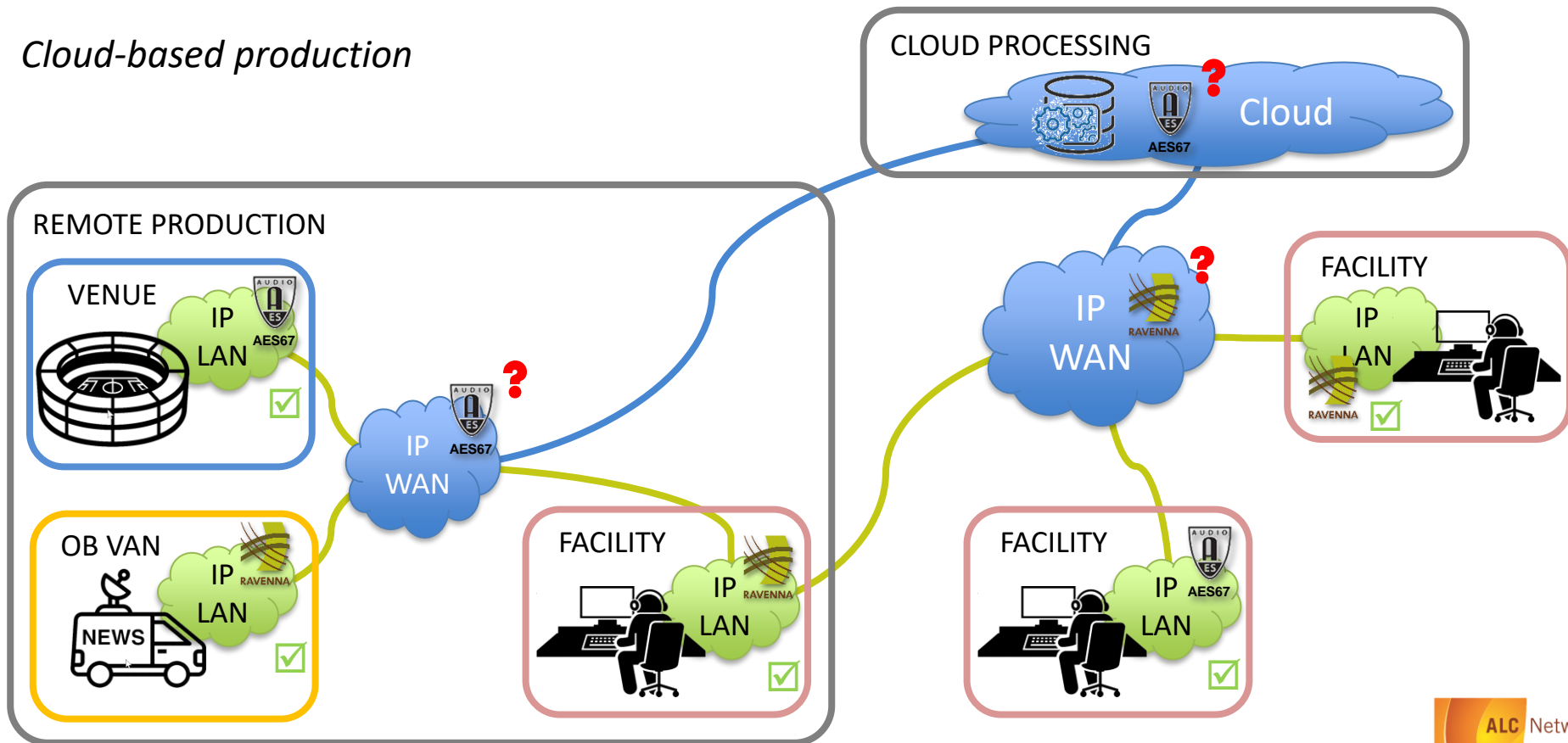TV station, Private CDN, YouTube, Facebook, etc.

Remote production scenario

Distributed production scenario

Cloud-based production

Cloud-based production

Network classification

LAN

Inhouse networks
- copper / fiber
- switched / non-blocking
- high bandwidth
- no packet loss
- short distance
- low latency
- small PDV
- QoS
- PTP-aware (optional)
- redundancy

WAN (managed)

Corporate networks
- fiber (leased)
- routed (non-blocking)
- medium to high bandwidth
- rare packet loss
- medium distance
- medium latency
- medium PDV
- QoS
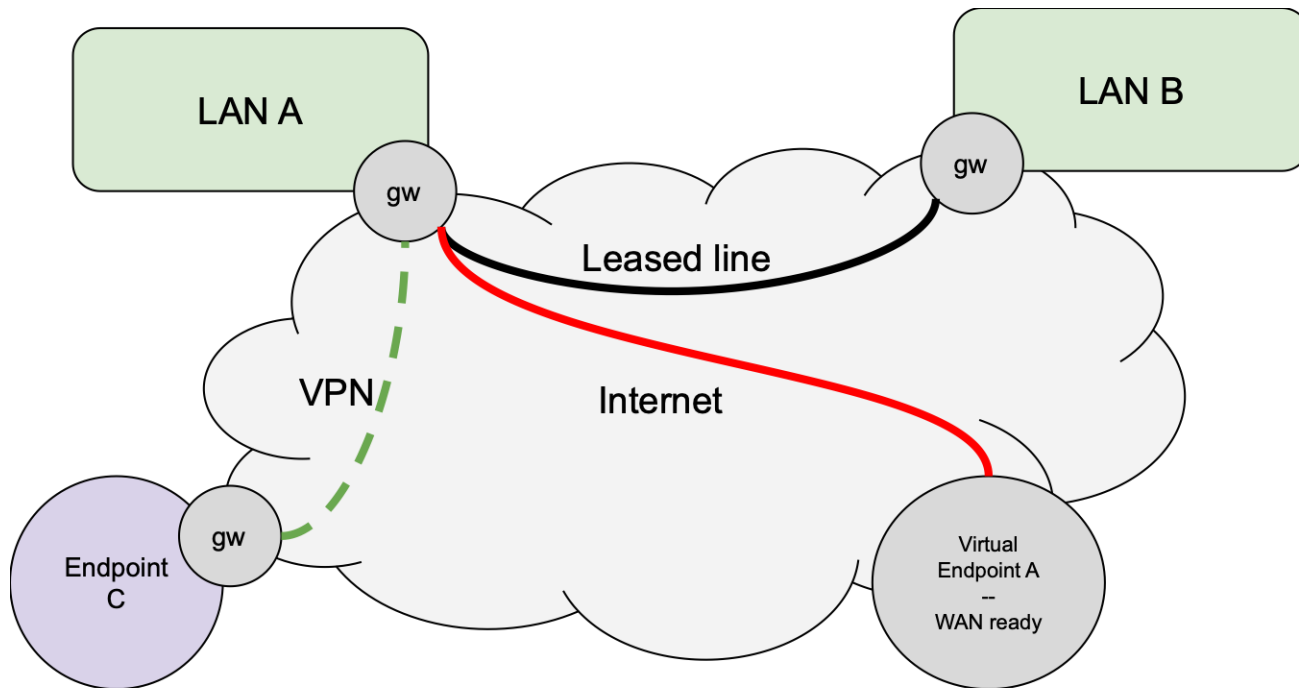- PTP-aware (optional)
- redundancy (or FEC etc.)
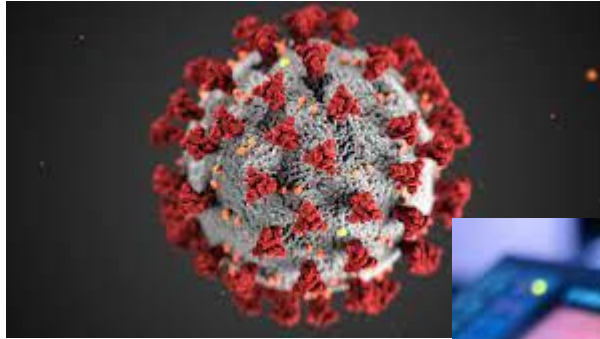
WAN (unmanaged)

Internet
- uncontrolled
- routed (blocking)
- uncertain bandwidth
- packet loss common
- long distance
- large latency
- high PDV
- no QoS
- PTP not available
- no inherent redundancy

AES67 over WAN

Nicolas Sturmel
Merging Technologies

Wide Area Network

Why would I need AES67 on WAN

With the increasing demand of WAN communications in AES67/ST2110-30 networks, mostly due to COVID-19, the AES SC-02-12-M, standard commitee group on AES67 development started a project over the summer to issue recommendations:

• What can I do with my AES67 devices?

• What can I add to my network to strengthen the connection?

• What should manufacturers add to their equipment?

Ongoing Work from SC-02-12-M

With the increasing demand [obscured] [communi]cations in AES67/ST2110-30 netw[obscured] [CO]VID-19, the AES SC-02-12-M, standard co[obscured] [de]velopment started a project over the sur[obscured]

• What can I do with m[obscured]

• What can I add to my ne[obscured] the connection?

• What should manufacturers [obscured] equipment?

Internet is IP, so is AoIP
-
Isn't AES67 WAN ready by design ?

What is a WAN, compared to LAN

LAN

- Small distances
- Private and controlled network
- Few restrictions

AES67/ST2110-30 was built with LAN constraints in mind

WAN

- Long distances
- Leased or public network
- Limitations in terms of protocols, bandwidth

Typically, real-time audio is transported using ACIP
(EBU Tech 3326)

Wide Area Network

- The WAN you own (then you have a dedicated team for that)
- The WAN you borrow (then you have a SLA)
- The Internet (then you are on your own)

And the Cloud?

- The virtualisation software can be seen as an other layer of WAN
- So all in all, telling about WAN is telling a bit about cloud

—-> But only when talking transport

Time in VM is very complex, but some times the time stamps are enough

- Do I need precise timing on my streams? (e.g. Lip sync)
- Do I need PCM quality?
- Do I need low latency, real time operations? (e.g: 5-250ms)

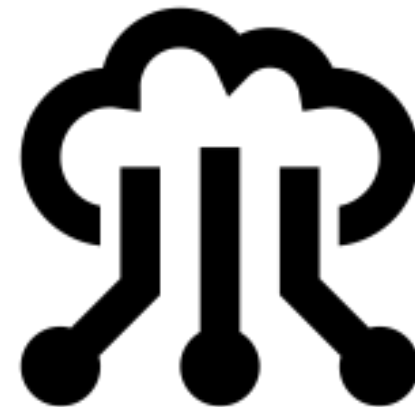If I don't need ALL of the above, it might be easier to use other protocols.

ACIP
Audio Contribution over IP

I don't want to have a new tech, I want to expand the tech I already have chosen and my staff can manage.

Well ok, RAVENNA is definitely simpler to use than ACIP codecs… but you have drawbacks !

- What is the workflow?
- Can I compensate for latency?
- Do I need precise timing?
- Are the timestamps enough?
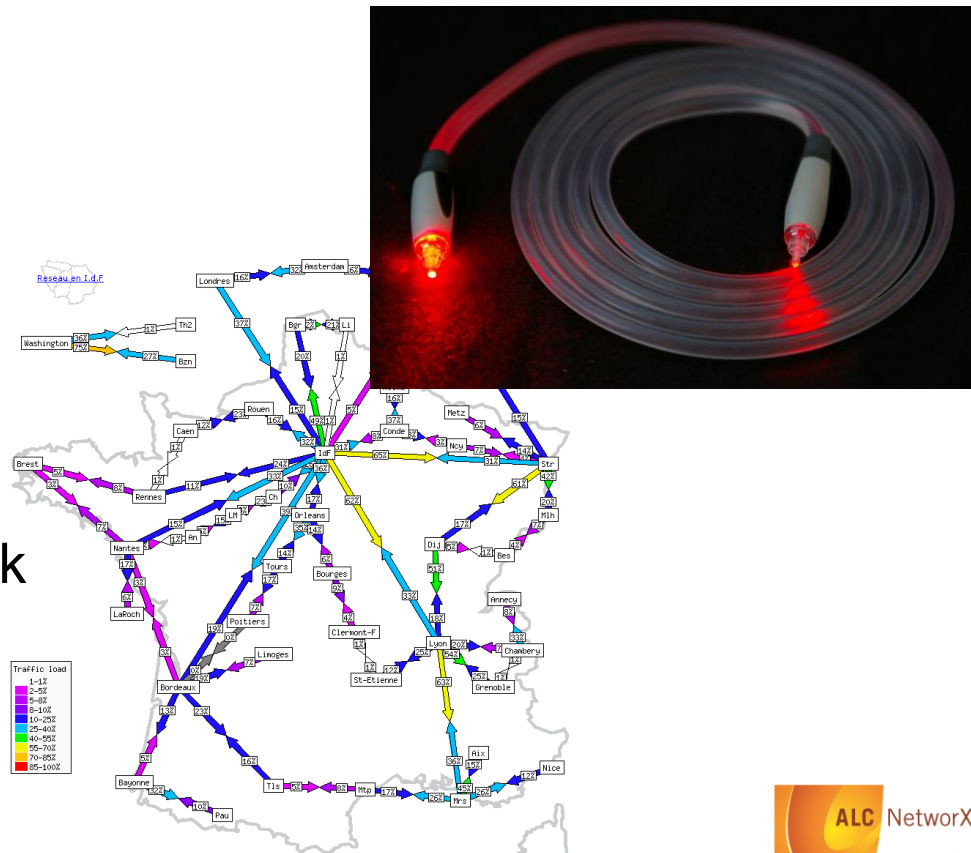- Do I need to share everything from site A to B?
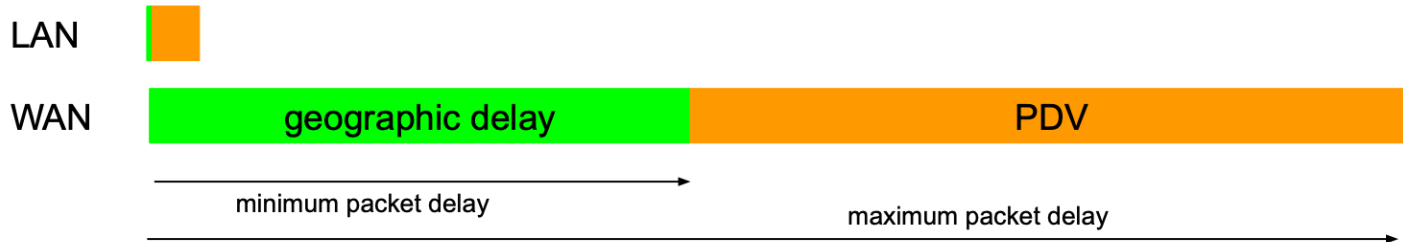
The problems associated with WAN

And some solutions, just examples... it's a work in progress !

Delay and Jitter

- Light travels at approximately 200 000 km/s in a fiber

- That's 5ms for 1000km !

- On top of that, account for network topology

- WAN means long distances up to the point where data travel time on line becomes significative.
- Grenoble, FR to Lausanne, CH —> 200km but

      --- *****.com ping statistics ---
      271 packets transmitted, 271 received, 0% packet loss, time 680ms
      rtt min/avg/max/mdev = 16.196/18.048/42.771/2.350 ms

- More over, WAN usually means IT equipments that will convert from one media or speed to the other, route paquets and so on...

LAN

WAN   geographic delay   PDV

minimum packet delay

maximum packet delay

—> greater buffer beyond the AES67 recommendation will be needed

Delay and Jitter

Configuration

IO	AES 3 ▼
Label	
Description	
Source	sap://ForTheWan-SRT:35002 ▼ ☐ Manual
Delay (samples)	16000 ▼ (~333.3 ms)
Ignore refclk GMID	☑ accept source locked to any PTP Master
Relaxed check	☐ accept source with lower channel count

Channels

Channel count	8 ▲▼
Count adapted	☐

1 - 8 ▼

Session Info

Session status	Connected
RTP status	Receiving
Session name	ForTheWan-SRT:35002
Playout delay	16000 (~333.3 ms)
RTSP Host	

Interface 1

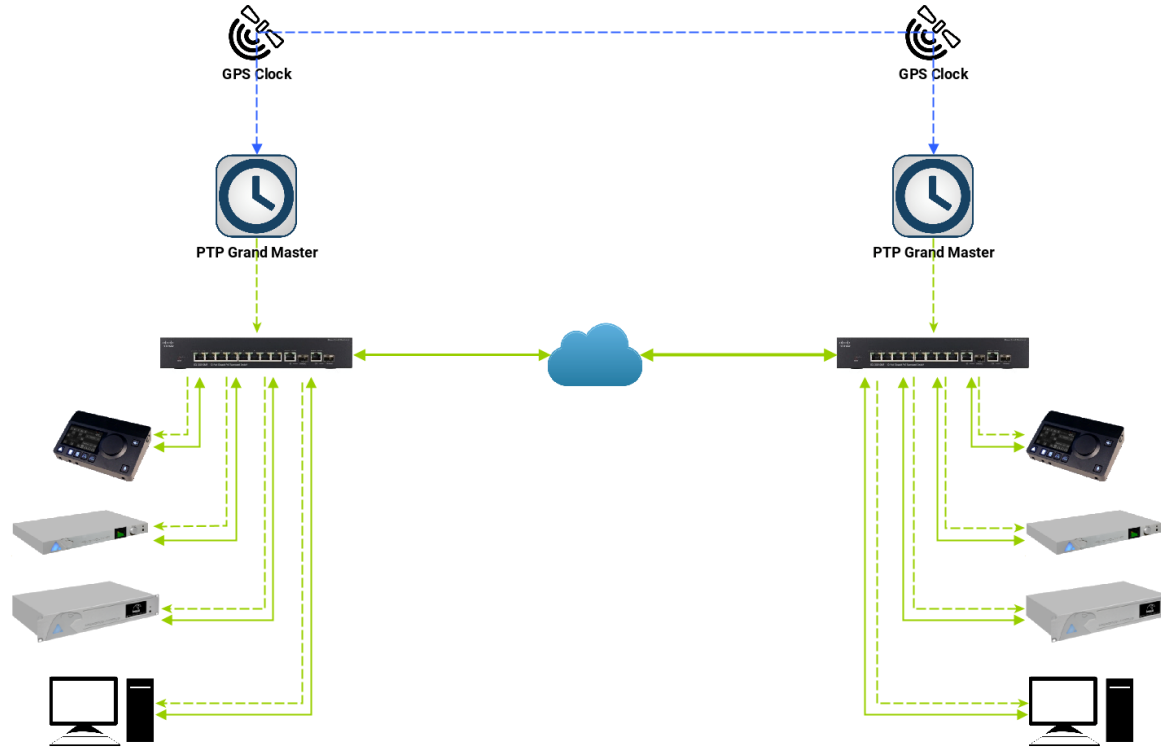|	
RTP status	0x10: receiving RTP packets
Clock domain	PTPv2 0
Address	239.88.88.88/1
Payload	98 L24/48000/8

▶ SDP

Timing and Sync

AES67 is based on the PTP time scale (TAI + Jan 1st 1970 epoch)

Running AES67 over the WAN means sharing this timescale
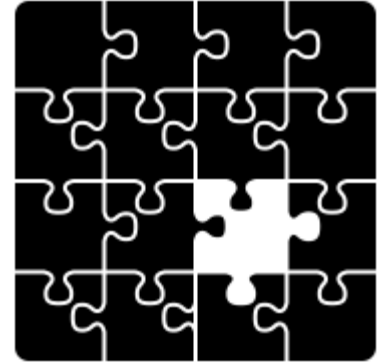
• PTP synced over GNSS (expensive, may be unpractical)

• PTP over the WAN (unprecise: jitter, asymmetry)

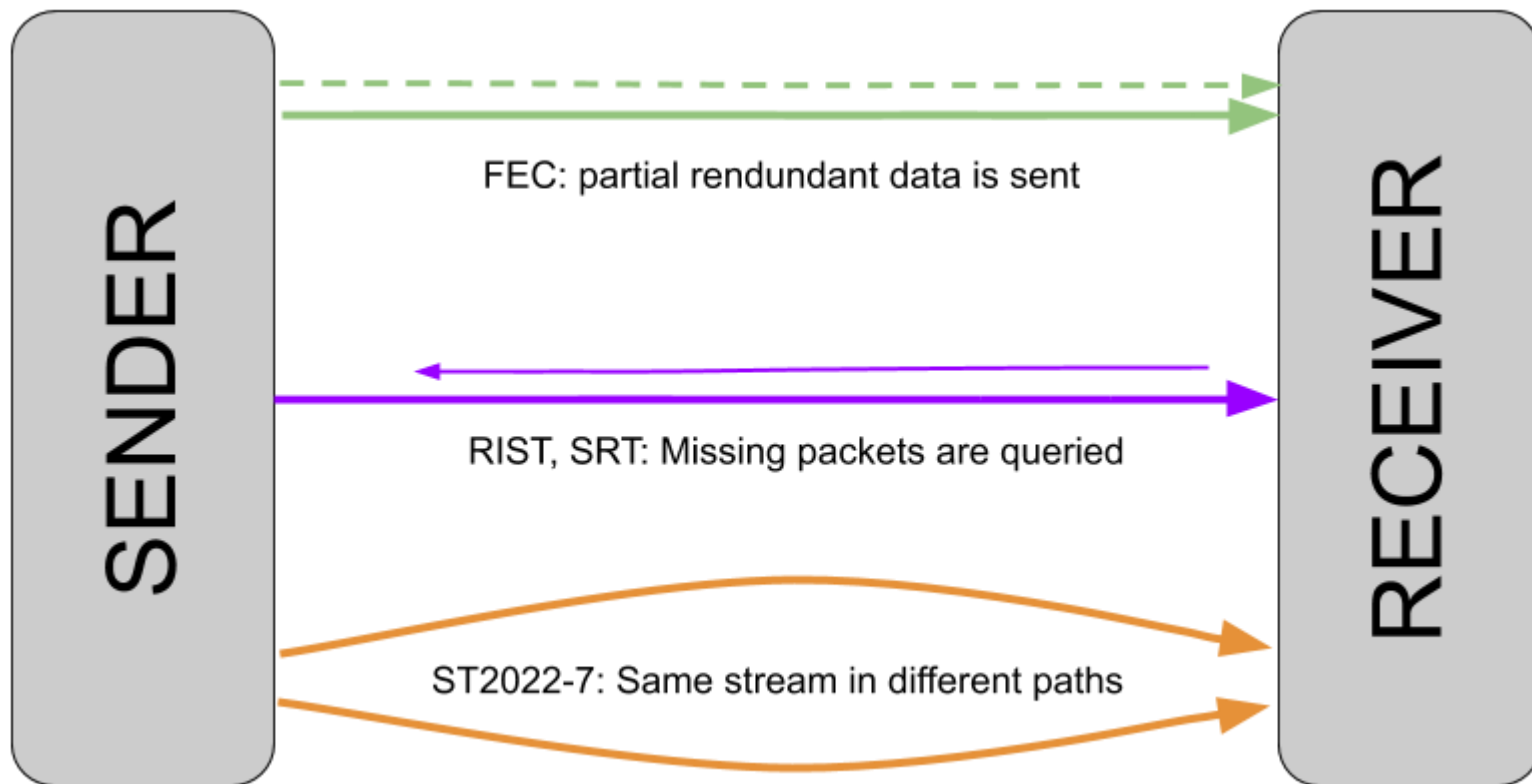• Other means, just be creative !

Timing and Sync

- This is why RAVENNA uses the domain parameter instead of the GM-ID for reference clock identification in the SDP
- In AES67 you can use the parameter «traceable»

Stream Reliability

- Loosing a packet (or having it delayed over the configured link offset) is very rare on a LAN, but not an a WAN: network congestion, link failure... are bound to happen.

- Here, AES67-2018 does not provide any answer, but ST2110-10 does by citing ST2022-7, a multi-path redundancy scheme.

- Other techniques such as FEC, SRT or RIST can also be used.

Stream Reliability

SENDER

FEC: partial rendundant data is sent

RIST, SRT: Missing packets are queried

ST2022-7: Same stream in different paths

RECEIVER

Some companies are specialised in providing edge devides that will take RAVENNA streams and ensure that they arrive safely on the other end of the pipe

Tunneling

And more…

It depends on the WAN techniques,
the use case, the expected performance…

AES67 is based on IT Standards

- RTP is widely used over the Internet
- AES67 does not **require** any specific transport equipment

- PTP is not designed for WANs, but it depends on the available network performance
- Multicast support is rare, but can be avoided by using unicast

So what can I expect?

- With care, AES67 can travel across any IP network!
- Link offsets quite often exceed 20ms
- Noticable clock offset, depending on employed method
- Dropped packets, if no redundancy is used
- Using gateways may be a good idea

System design is key, and it takes time

Questions?

More answers...

RAVENNA / AES67 / SMPTE ST 2110 Resources:

www.ravenna-network.com/resources

You've made it!

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