

AES67 beyond the LAN

Nicolas Sturmel, Merging Technologies

Usecases



- High quality contribution
- Live concerts with musicians apart
- Monitoring
- Voice over in multiple languages
- Because the cloud may be cheaper ?

Usecases

- High quality contribution
- Live concerts with musicians apart
- Monitoring
- Voice over in multiple languages
- Because the cloud may be cheaper ?



With the increasing demand of WAN communications in AES67/ST2110-30 networks, mostly due to COVID-19, the AES SC-02-12M, standard comité group on AES67 development started a project 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 the equipments ?

The report was published September 25th 2021

A lot of contributions from:

- Academics
- Manufacturers
- System integrators
- Users

15 months, 60 calls, and a lot of discussion on what the best practices may be.

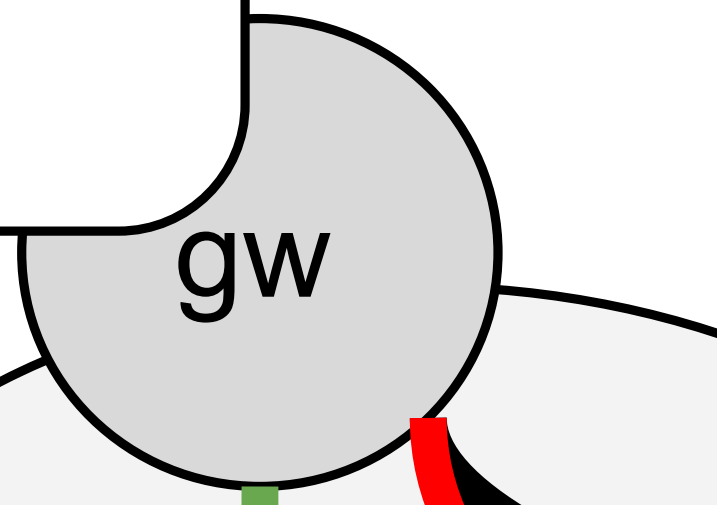
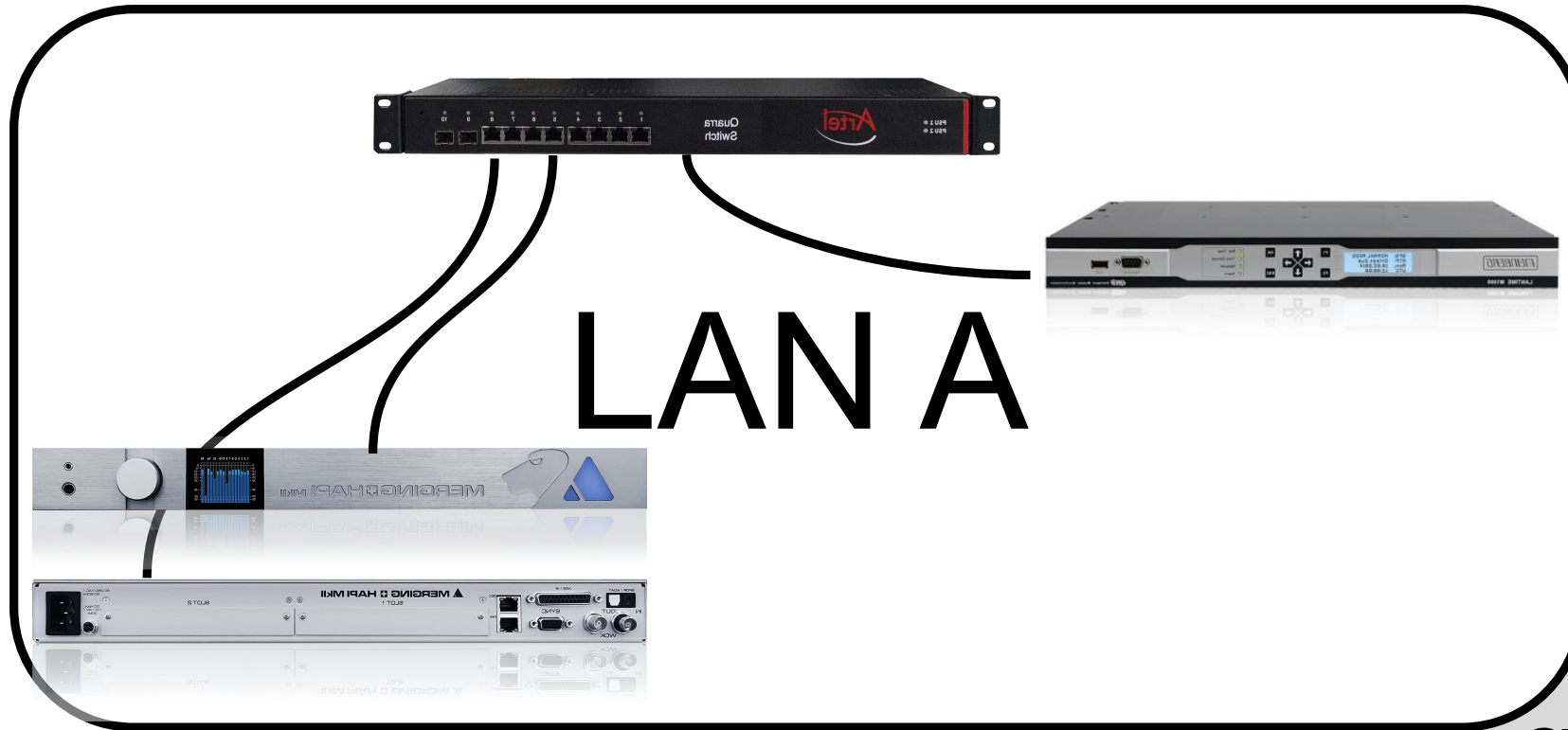
A lot of contributions from:

- Academics
- Manufacturers
- System integrators
- Users

15 months, 60 calls, and a lot of discussion on what the best practices may be.

Best Practices

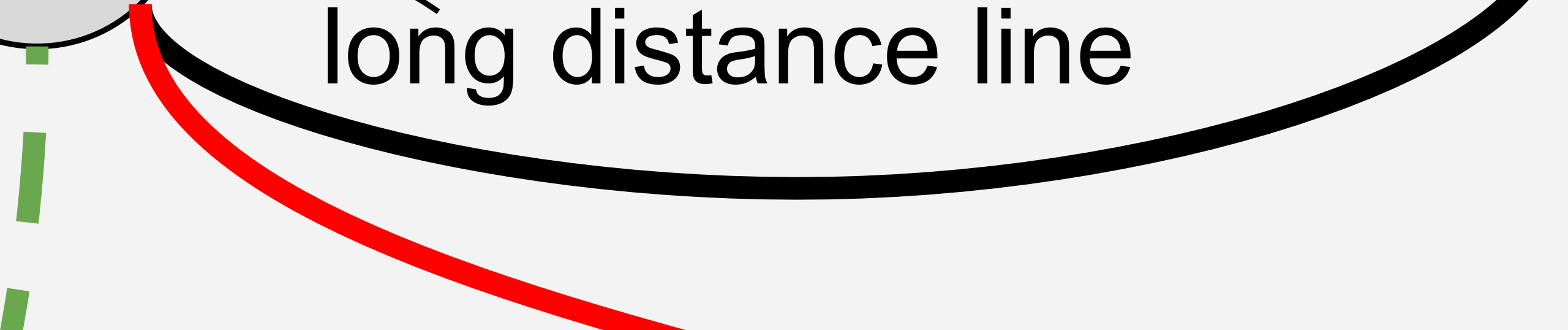
What is beyond the LAN ?



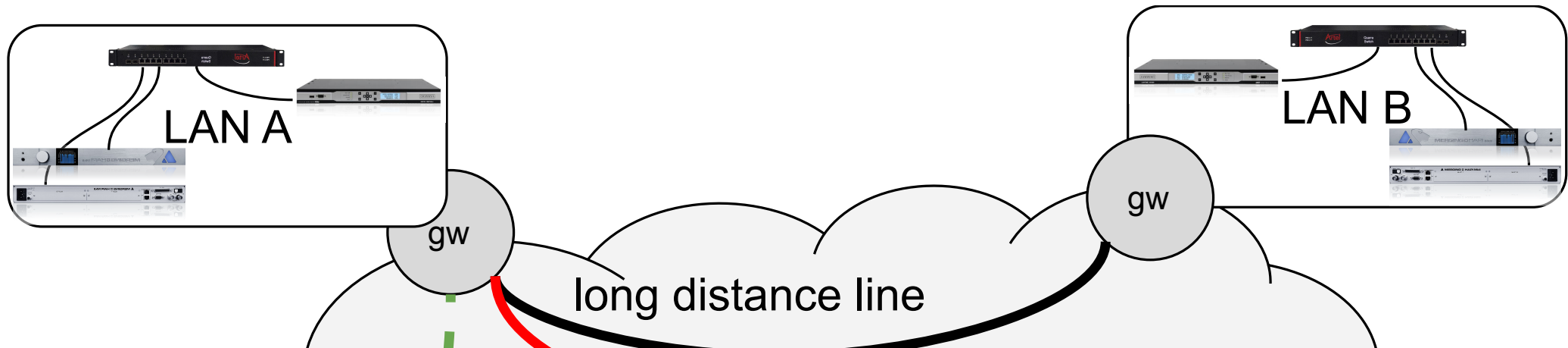
What is beyond the LAN ?



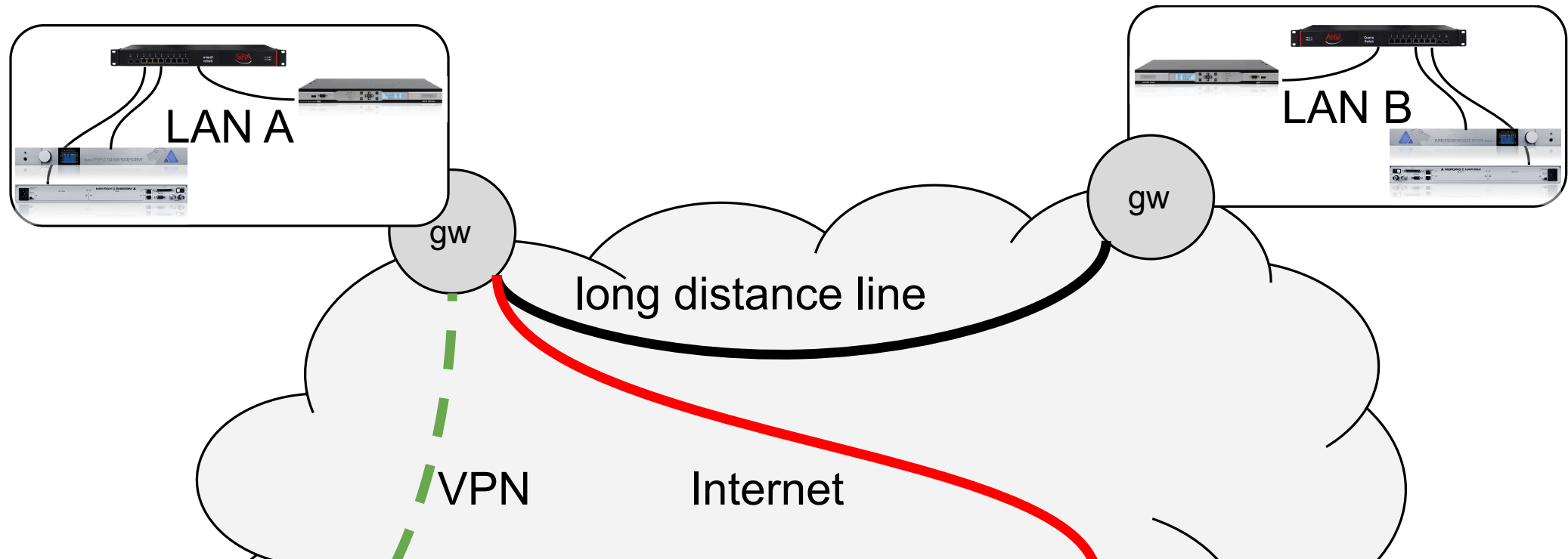
long distance line



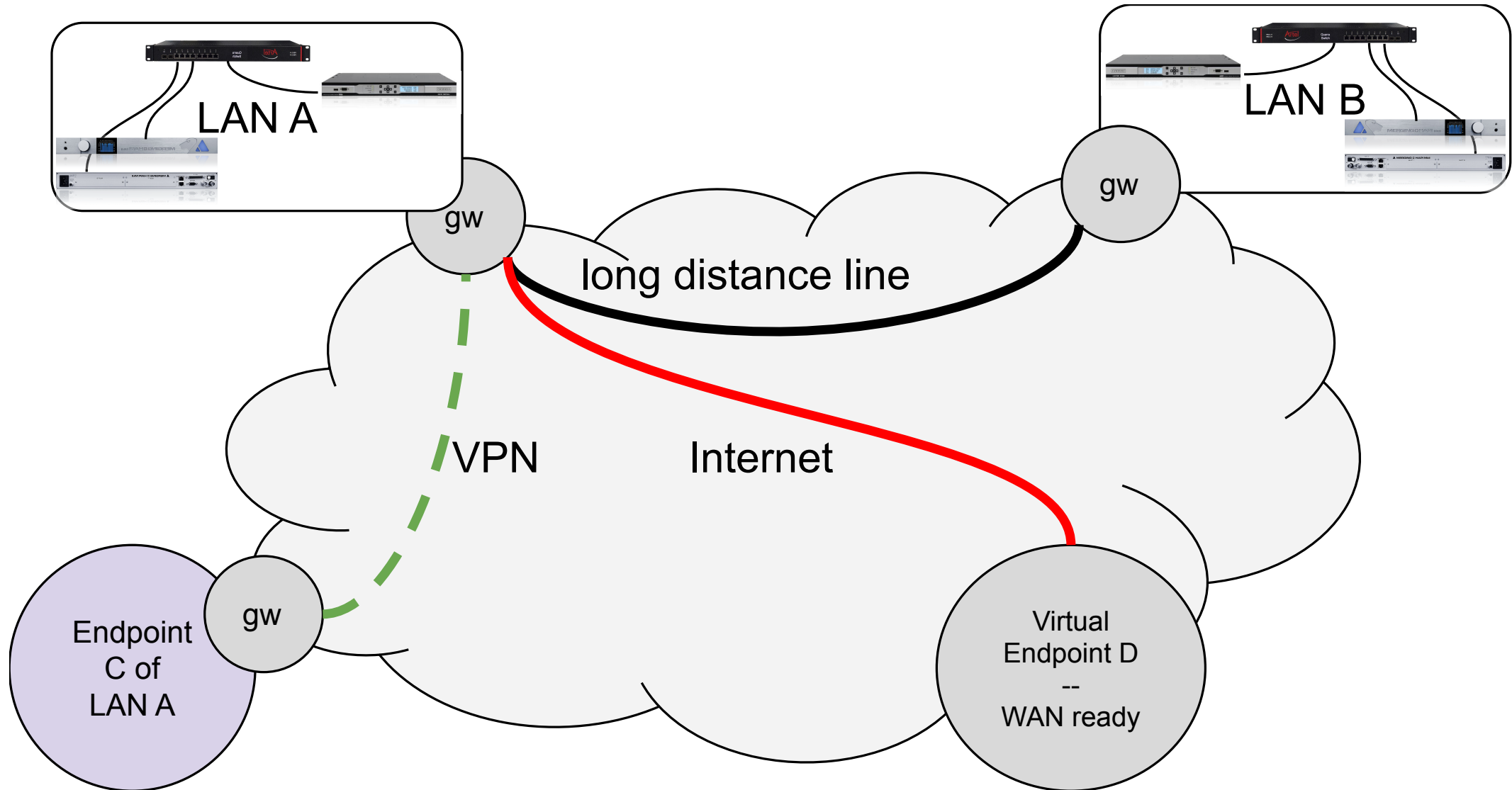
What is beyond the LAN ?



What is beyond the LAN ?



What is beyond the LAN ?



What is beyond the LAN



- LAN
 - Mostly L2
 - Fast
 - Small (10-100m)
 - Self administrated

Self Administrability



What is beyond the LAN



■ LAN

- Mostly L2
- Fast
- Small (10-100m)
- Self administrated

■ WAN

- L3
- Speeds varies
- Long distances (10-10,000km)
- Protocol limitations

Self Administrability



What is beyond the LAN



■ LAN

- Mostly L2
- Fast
- Small (10-100m)
- Self administrated

■ WAN

- L3
- Speeds varies
- Long distances (10-10,000km)
- Protocol limitations

■ Cloud

- L3++
- Fast
- Small
- Very few control on infrastructure
- Sharing traffic
- Sharing platforms (VM)

Self Administrability



Size matters



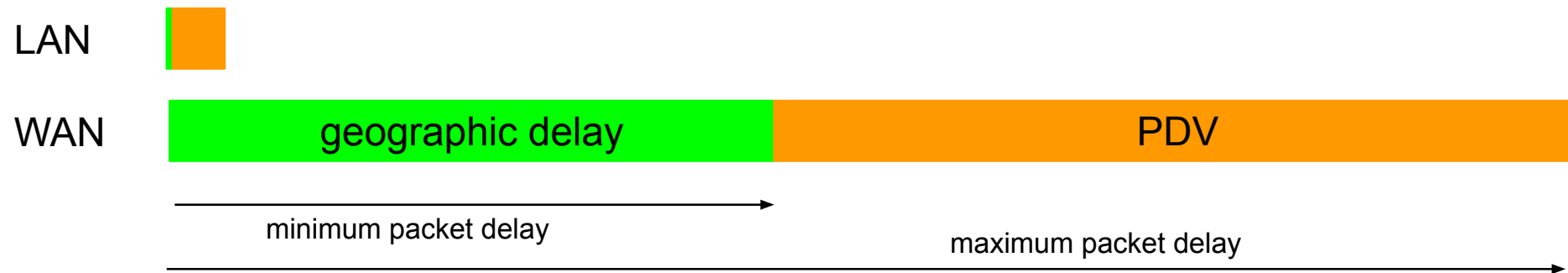
- Scale of the network can be 10,000 times bigger or even more.
- New it equipments will a role in the network, and they may not be designed for high real time traffic
 - Packets can be delayed or sent out of order (jitter)
 - Packets can be lost
- « I know when data enters my ethernet network but not when (and if) i gets out »

Delay and jitter

Geographic delay vs Variable delay



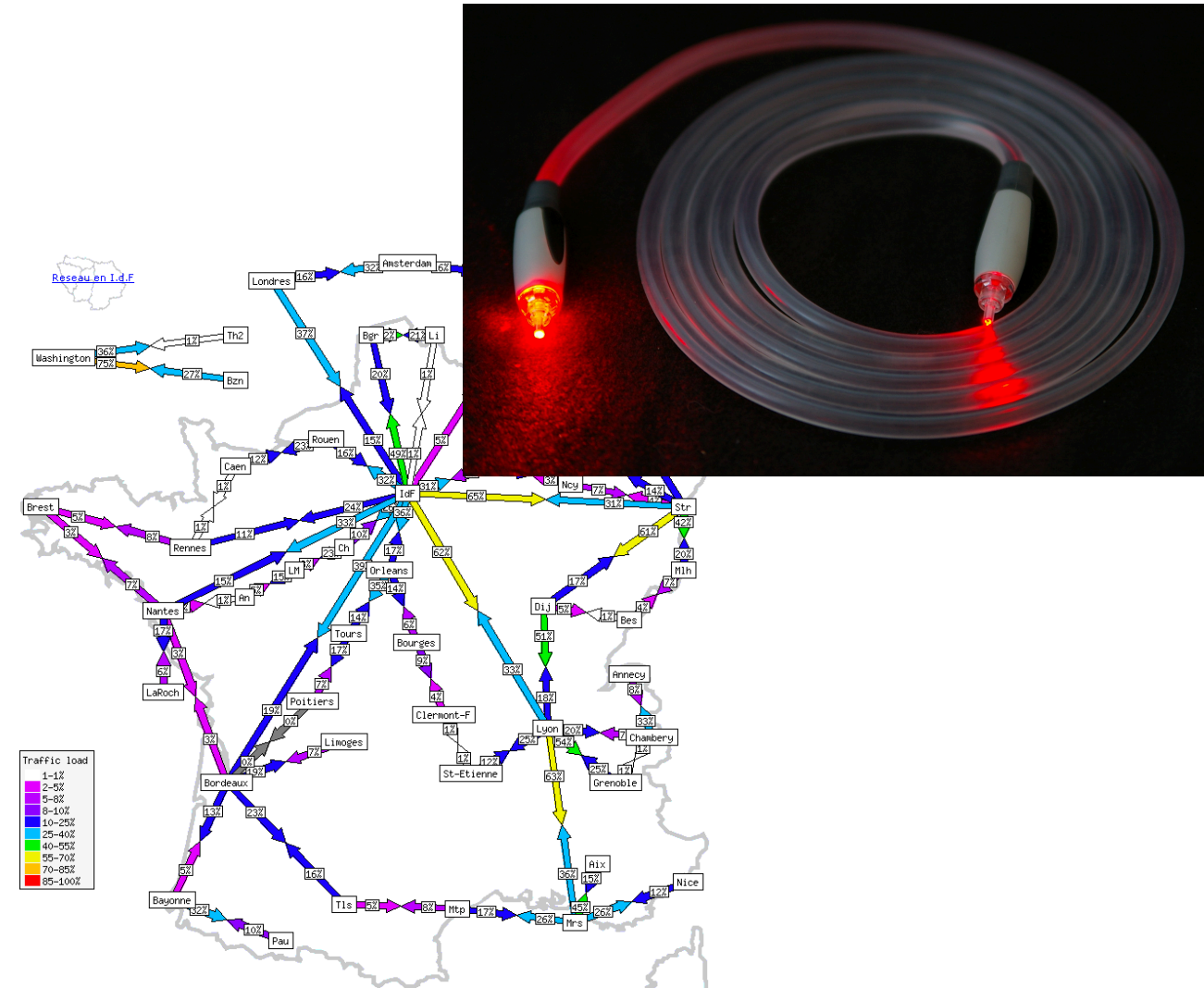
- 100000 times 125us is 12,5 seconds
- it does not mean you have 12,5 seconds (one trip) of latency.
- While on the LAN, 90% of the delay is due to PDV (jitter), on the WAN it is much less (down to a few % on awesome networks)
- However, the geographic delay will be noticeable very quickly and will require mitigation.



At least 5ms every 1000km



- Light travels at approximately 200 000 km/s in a fiber
- That's 5ms for 1000km !
- On top of that, account for network topology



Example, through the internet from the cloud



Configuration

IO	AES 3
Label	
Description	
Source	sap://ForTheWan-SRT:35002 <input type="checkbox"/> Manual
Delay (samples)	16000 (~333.3 ms)
Ignore refclk GMID	<input checked="" type="checkbox"/> accept source locked to any PTP Master
Relaxed check	<input type="checkbox"/> accept source with lower channel count
Channels	Channel count: 8 Count adapted: <input type="checkbox"/> 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

PTP and Synchronisation



- Synchronisation between nodes using PTPv2 is a key feature of AES67 and ST2110
 - Node can create the media clock (sampling frequency) with high phase accuracy
 - Node know when a received sample has been sent on the network and can estimate latency
- However, classic PTP algorithm are not designed to handle large jitter. And PTP follower will hardly lock to the follower.

Synchronisation: solutions



- Use the synchronized mode (frequency only), who cares about phase anyway ?
- Relax the expected accuracy (do you really need sub-millisecond sync when you are kilometers away ?)
 - Use NTP or any other clock
- Use special boundary clocks with jitter rejection (👏 Meinberg)
- Use synchronisation out of the network, like GNSS-PTP leaders.

timing and sync



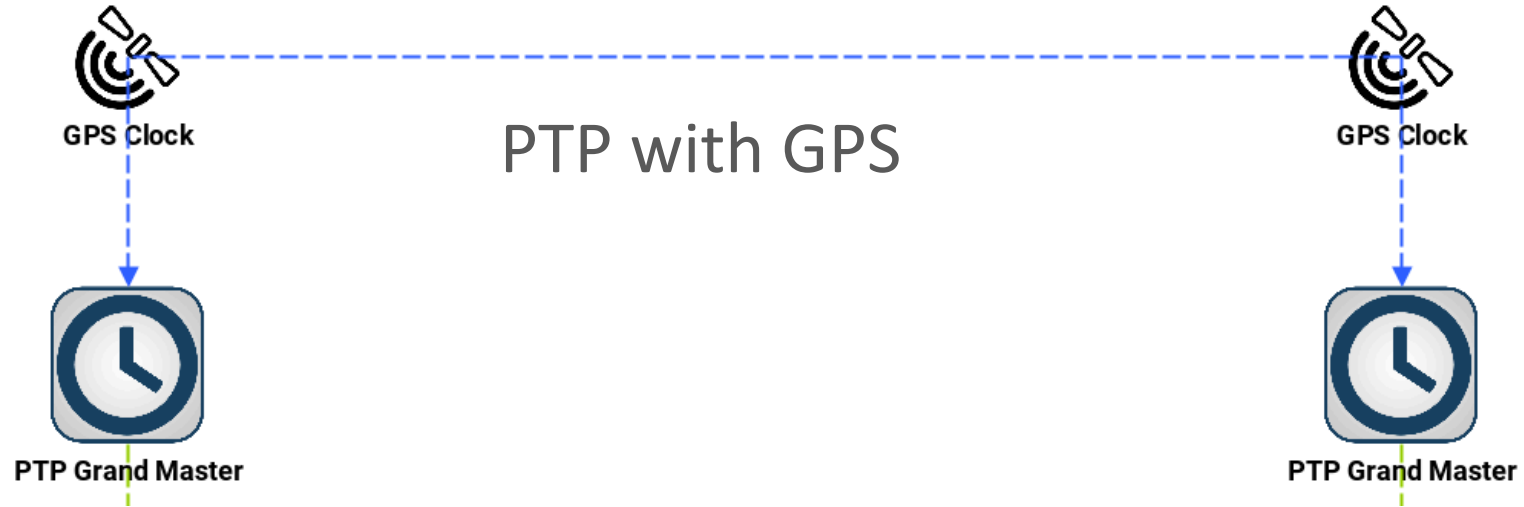
timing and sync



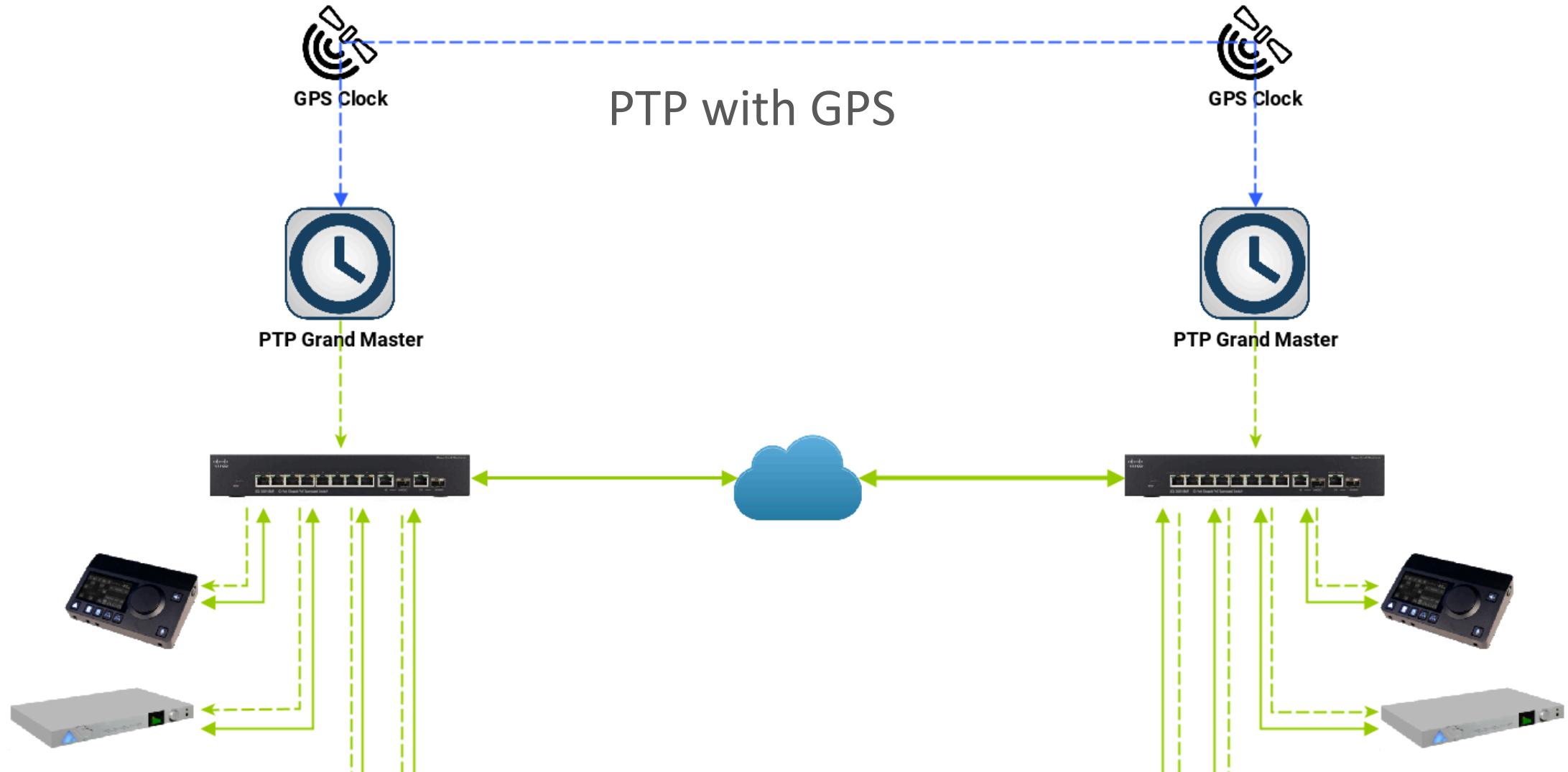
PTP with GPS



timing and sync

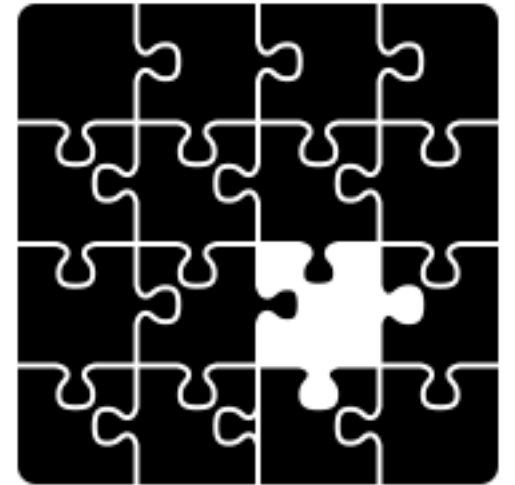


timing and sync

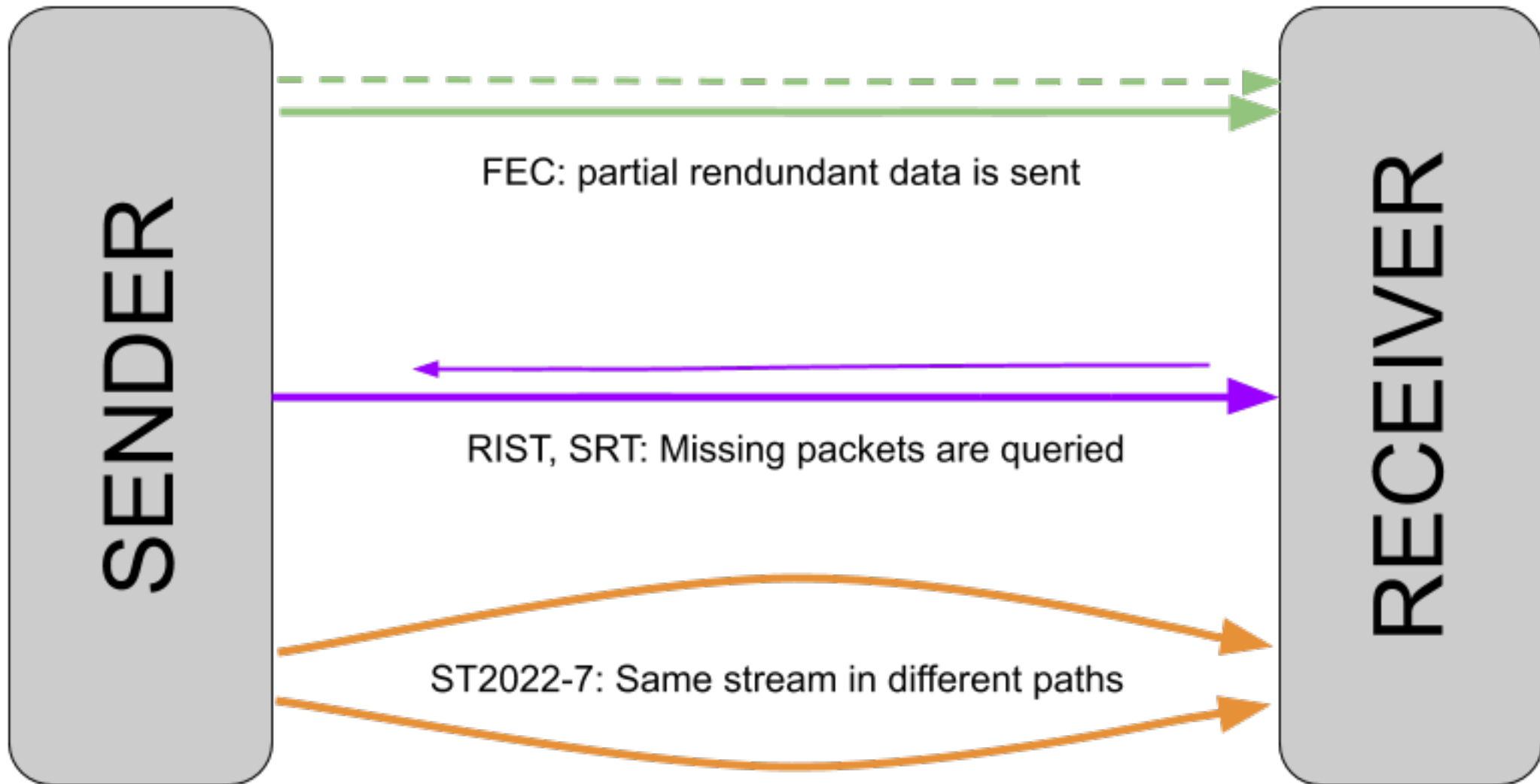


Loosing packets

- Loosing a packet (or having it delayed over the configured link offset) is rare on a LAN, 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 using ST2022-7, a multi-path redundancy.
- Other techniques such as FEC, SRT or RIST can also be used



stream reliability



Using a gateway

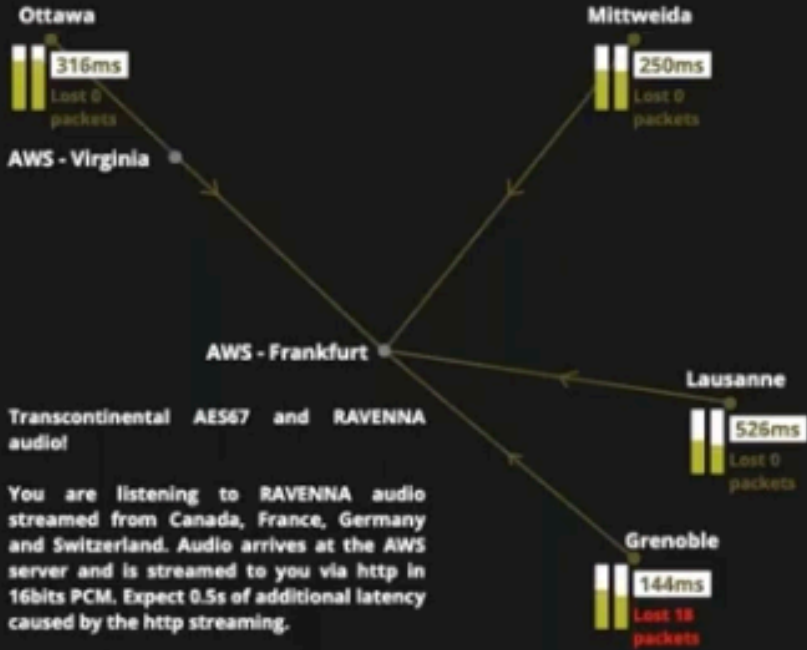
Some companies are specialised in providing edge devices that will take RAVENNA streams and make sure that arrive safely on the other end of the pipe.



Tunneling

A practical proof on concept (Dec 2020)

Click on a city name to play PCM audio transported via SRT to an AWS server in Frankfurt



Ottawa
316ms
Lost 0 packets

Mittweida
250ms
Lost 0 packets

AWS - Virginia

AWS - Frankfurt





Lausanne
526ms
Lost 0 packets

Grenoble
144ms
Lost 18 packets

Transcontinental AES67 and RAVENNA audio!

You are listening to RAVENNA audio streamed from Canada, France, Germany and Switzerland. Audio arrives at the AWS server and is streamed to you via http in 16bits PCM. Expect 0.5s of additional latency caused by the http streaming.

The number shown (in ms) is the AES67 delay measured on the AWS server and

Stream transport via a SRT Gateway.

The Cloud and network constraints



- Using gateways to embed the media streams (e.g.: VPN)
- Using SIP with the classical NAT traversal technique
- Using unicast vs multicast (for both PTP and media)
- VXLAN, LAG, Encryption, QoS...

Widely used protocols like RTP and SDP allow AES67 and ST2110 to be easily transported on a large network.

But achieving high performance (low latency, high quality) requires care.

Often, the solution depends on the performances of the underlying infrastructures

Thank you

nsturmel@merging.com