Audio in IP production

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IP SHOWCASE™

Come and catch up on the Sony stand in Hall 13

Audio Engineering Society · AIMS Alliance for IP Media Solutions · AMWA Networked Media. Working. · EBU · SMPTE · VSF Video Services Forum

Queen Elizabeth II 1926-2022

The Queen and I

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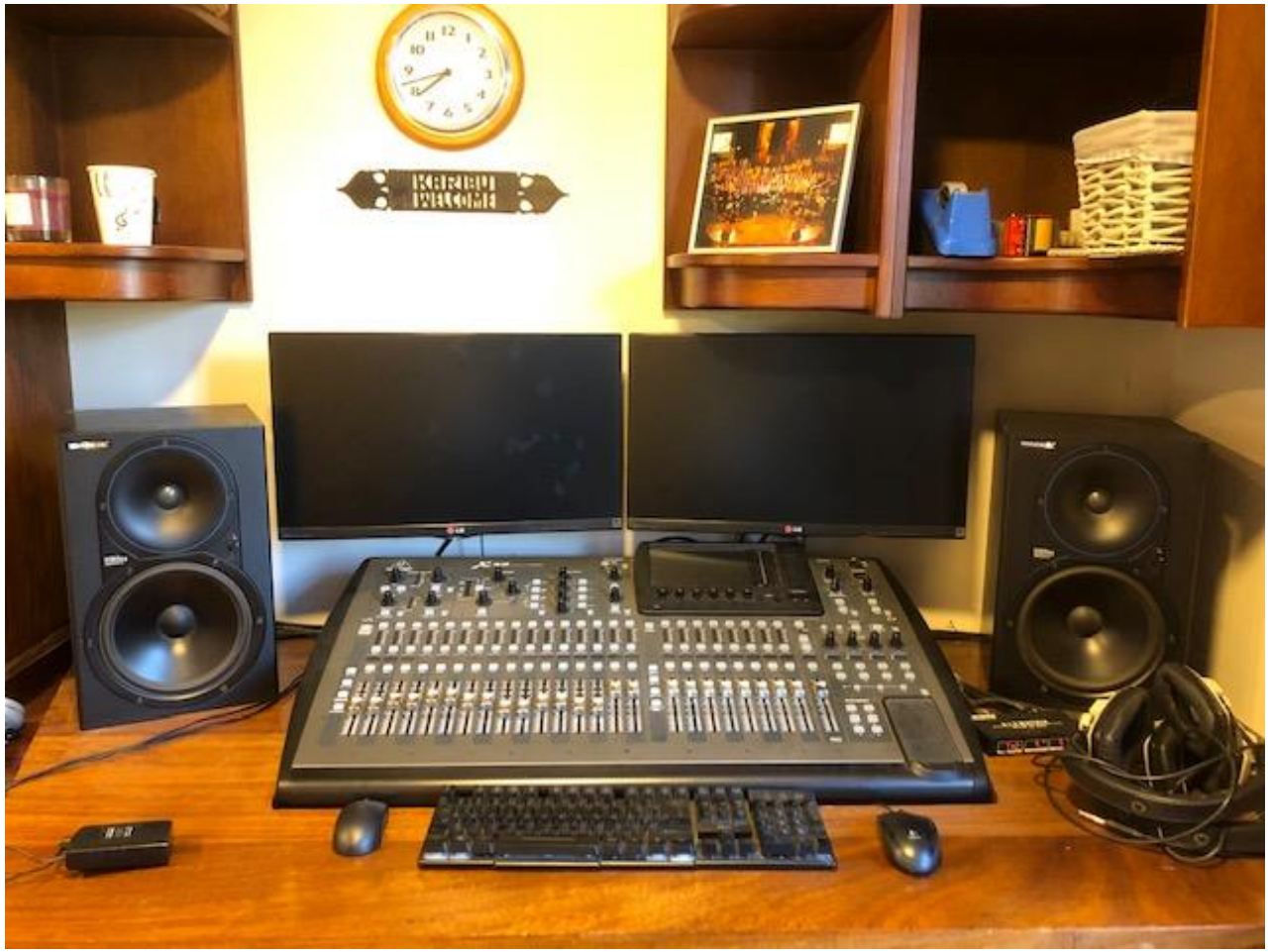
Don’t forget the audio- I am an sound guy!



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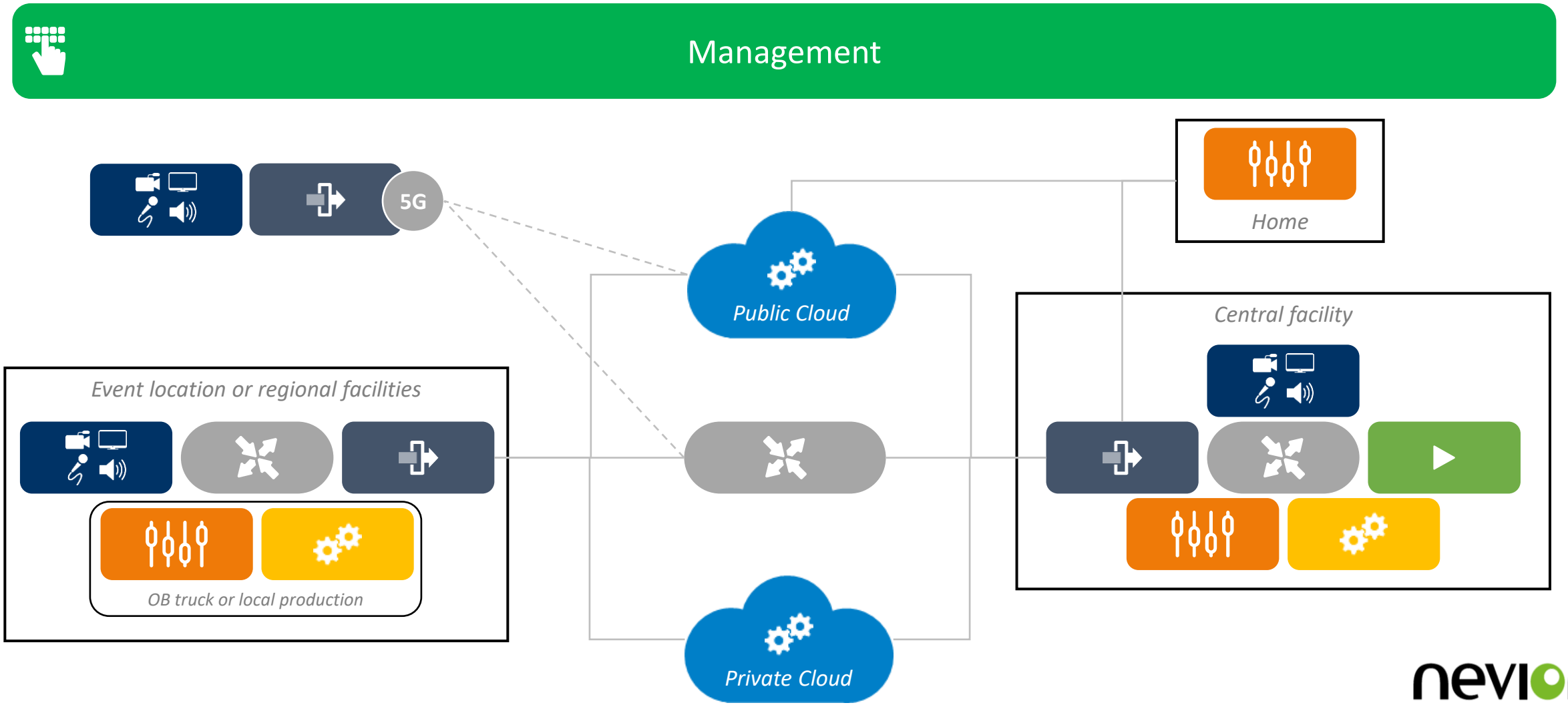
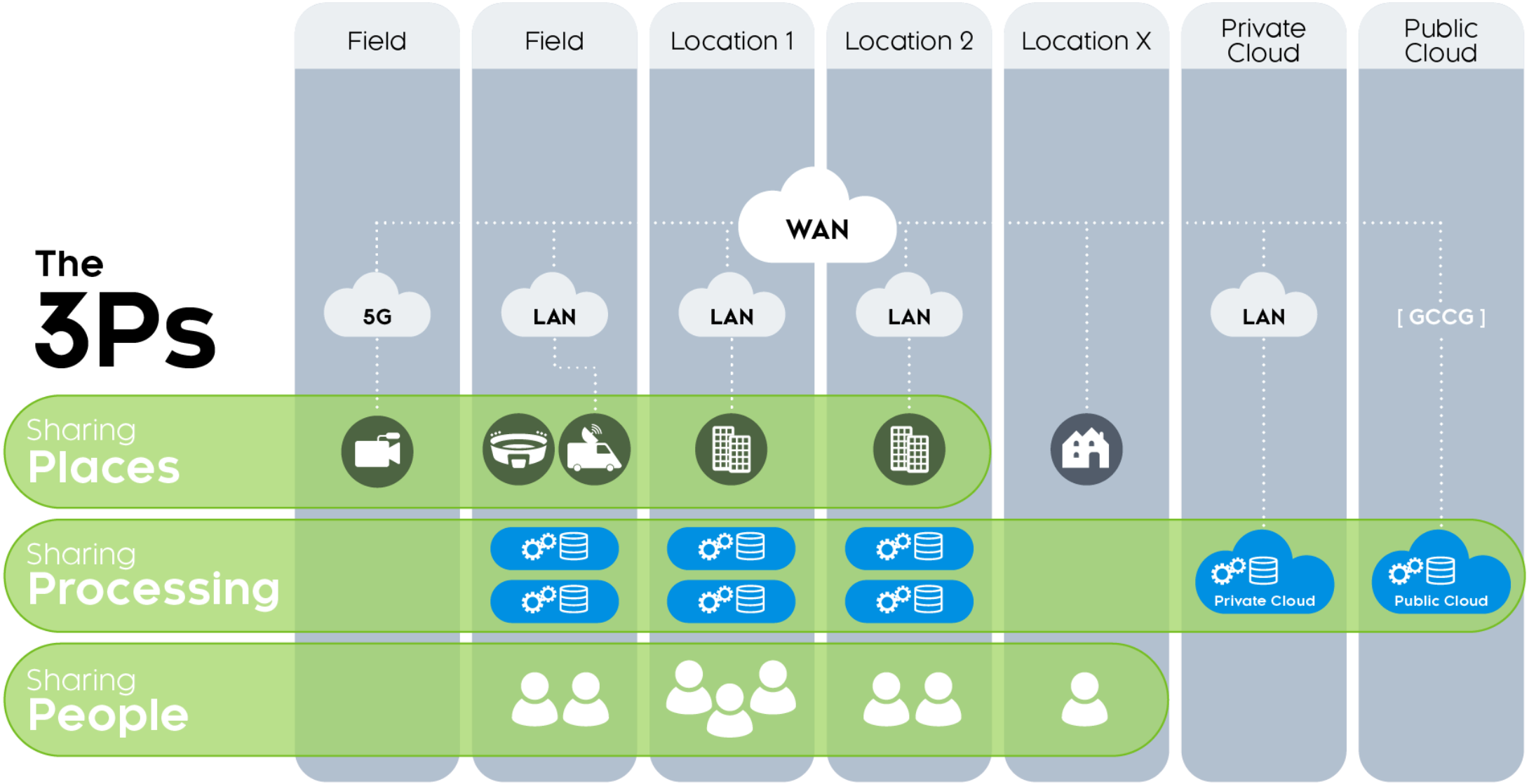
Distributed production



IP transformation - Places, Processing & People



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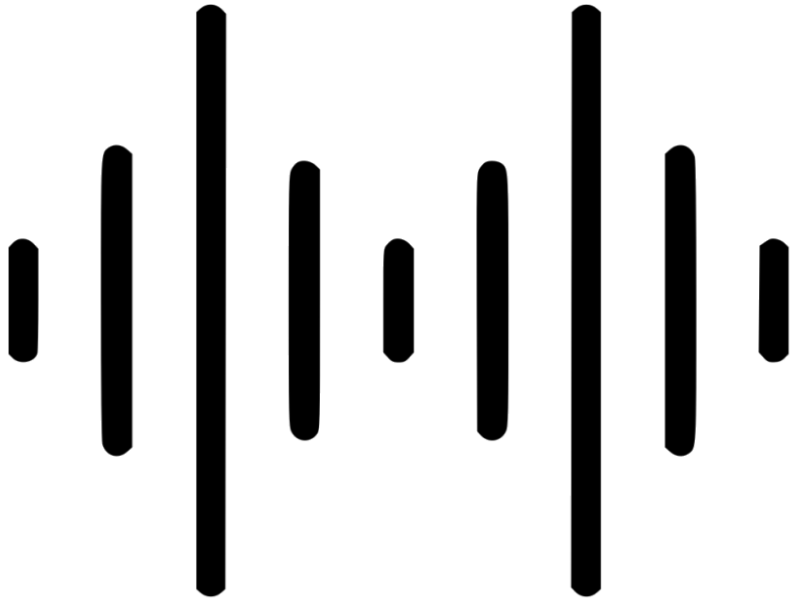
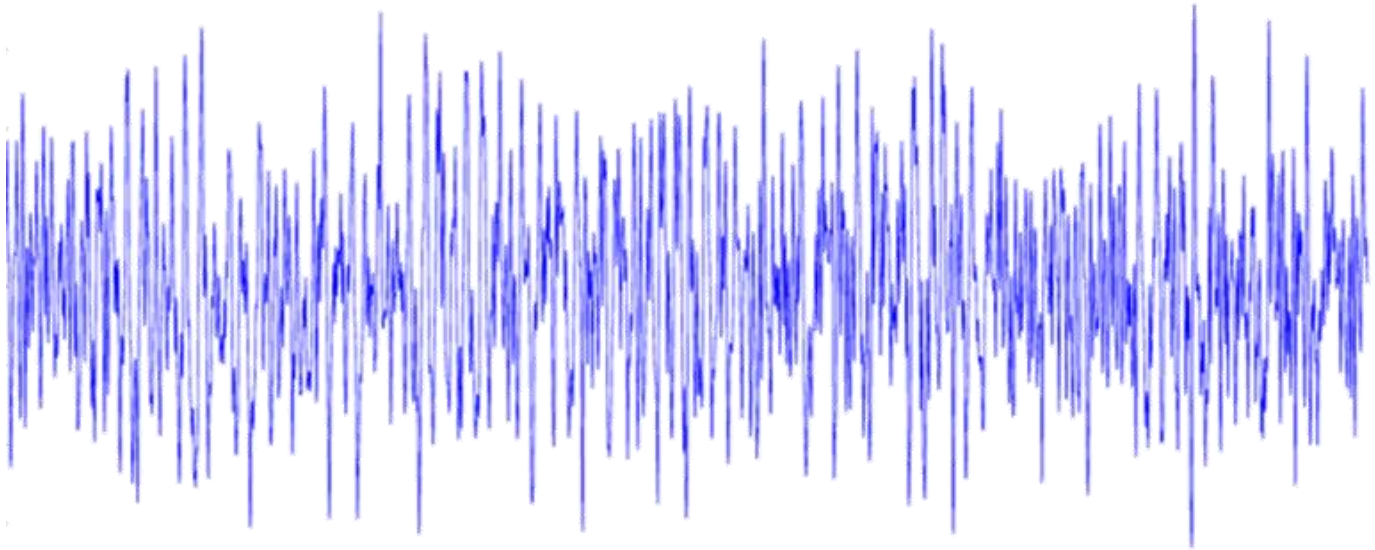
Audio requirements drive scale in facilities



The Audio folks did facility IP first!

‘Most of the complexity of a production environment is the audio’



Dante 2006 Ravenna 2010

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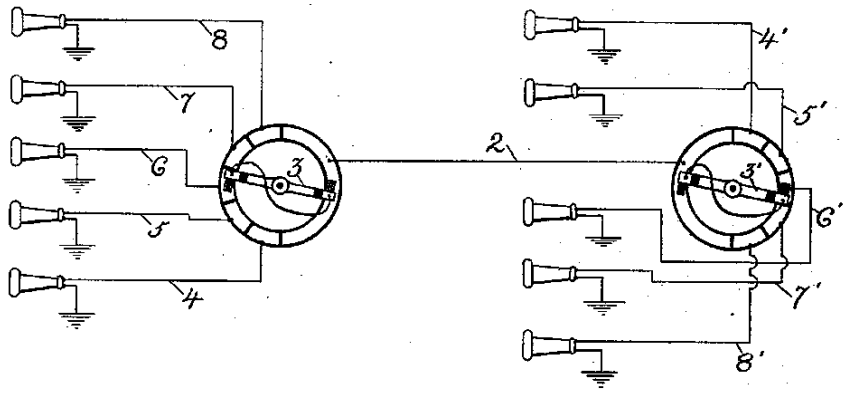
Audio facility interconnects

History of sampling - PCM is 100 years old!

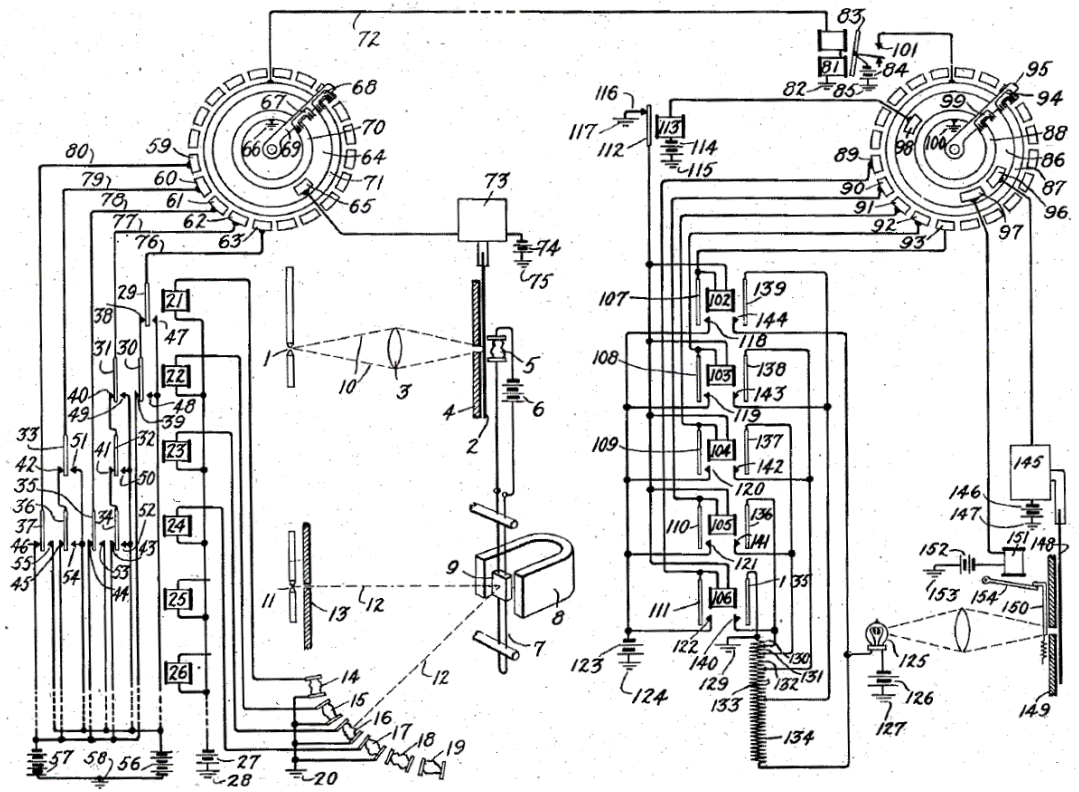


Determining sampling rate

Williard M. Miner, "Multiplex Telephony," *U.S. Patent 745,734,*

Filed February 26, 1903

Then Nyquist in 1924



The First Disclosure of PCM: Paul M. Rainey,

"Facimile Telegraph System," U.S. Patent 1,608,527,

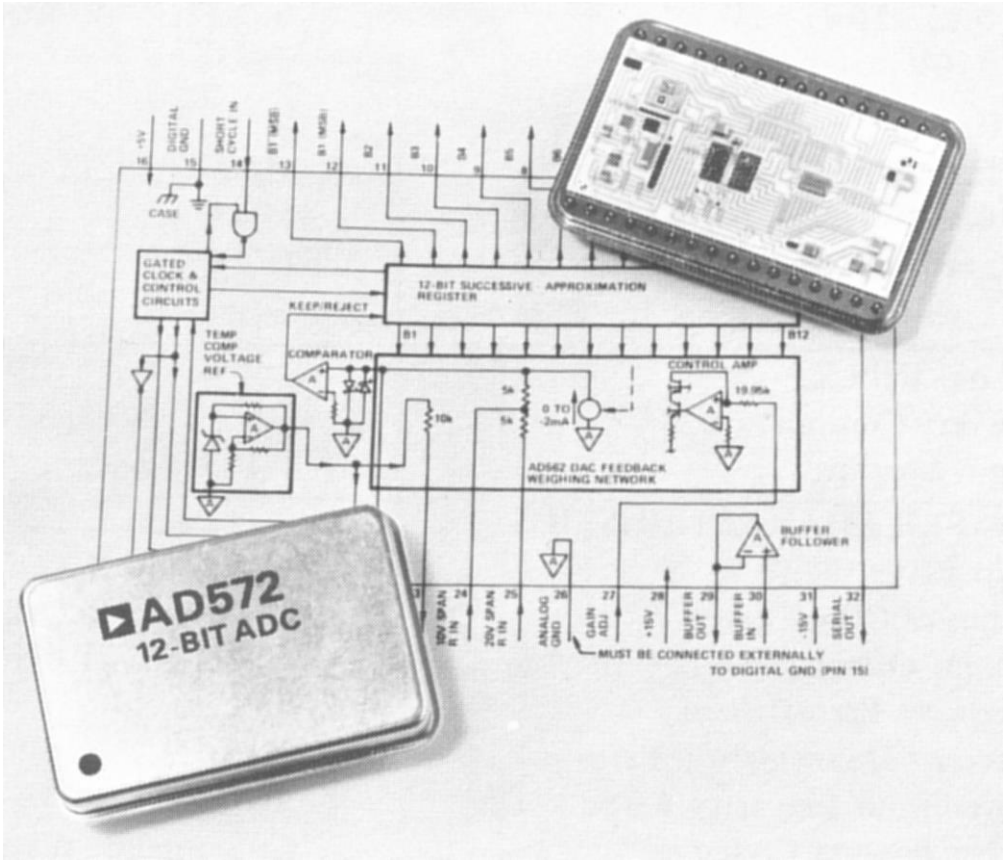
Filed July 20, 1921,

A-D conversion!

1954 "DATRAC" 11-bit, 50-kSPS Vacuum Tube ADC

Designed by Bernard M. Gordon at EPSCO

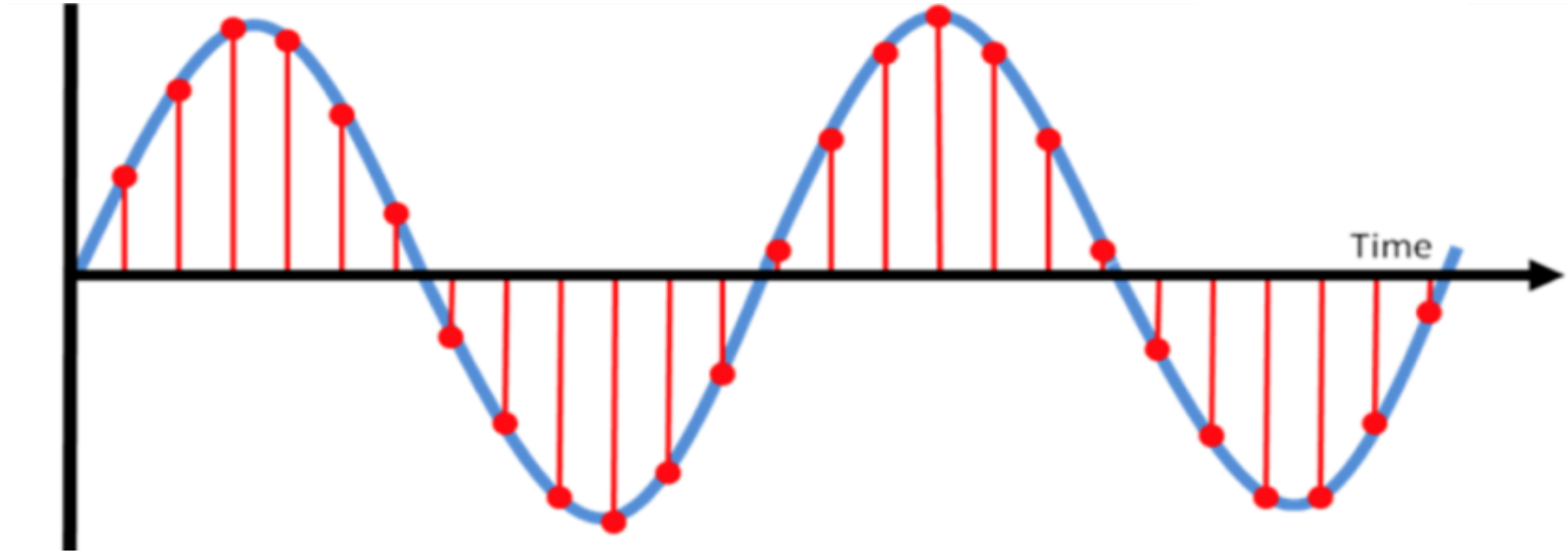
500watts, 150lbs, $8500



AD572 12-Bit, 25-µs Mil

Hybrid ADC, 1977

Audio acquisition

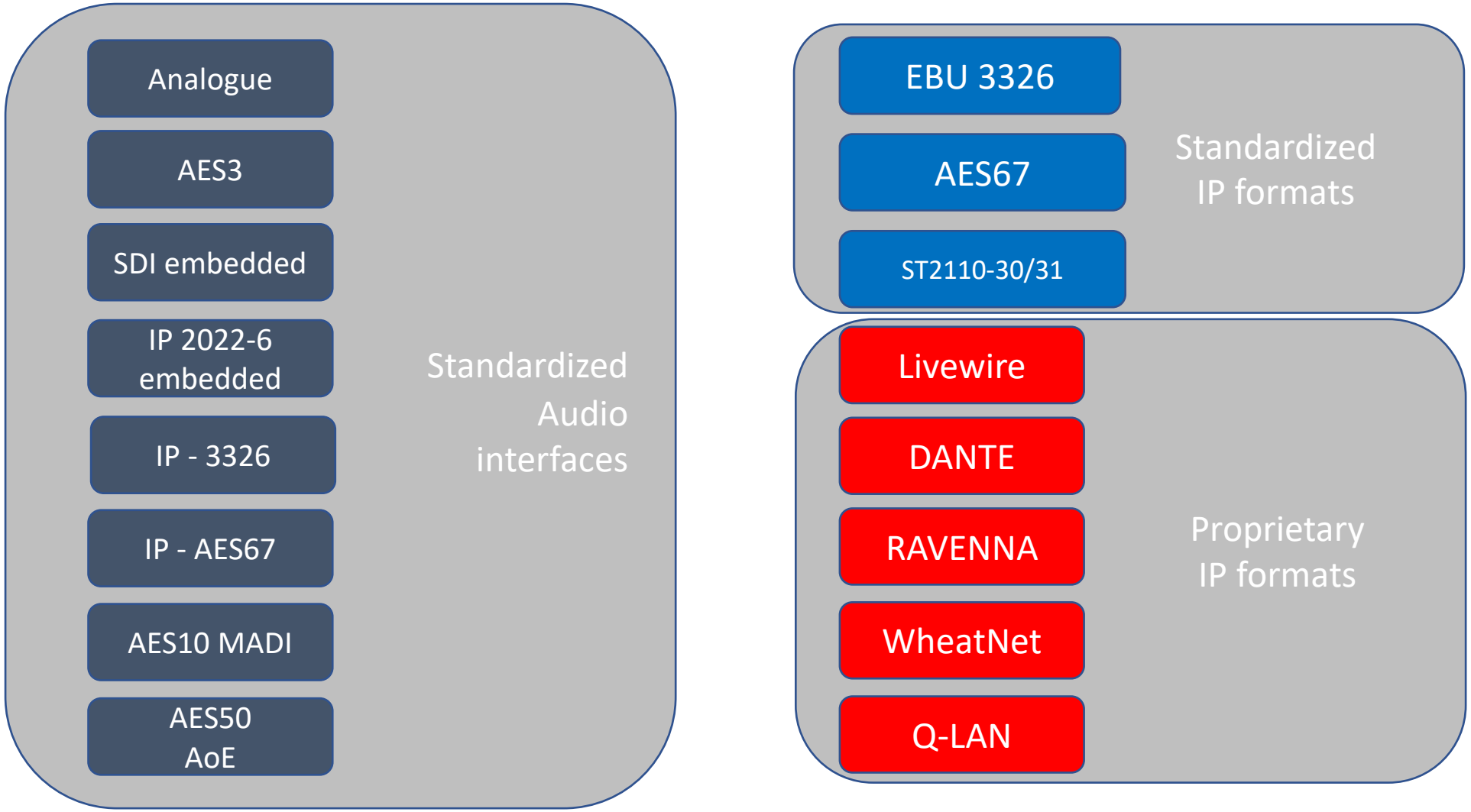


- Sample frequency
- Bit depth

+

Time of capture

Lots of different audio interfaces and formats!



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Audio production interoperability

Audio data flows – almost identical

Audio control plane – very different

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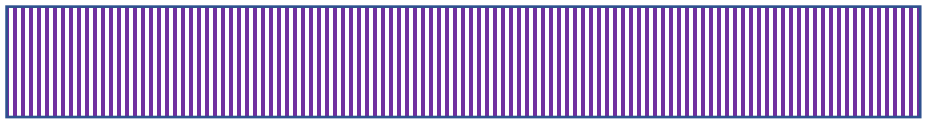
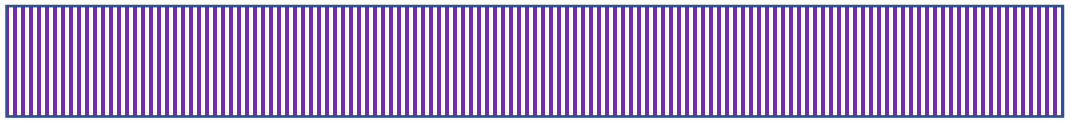
Audio parameters……lots of choices

AES3: 2 channels
Sample rate: 16kHz, 22kHz,32kHz,44.1kHz,48kHz,88.1kHz,96kHz,192kHz
Bit depth: 16bit, 20bit, 24bit
AES3 frame period: 1ms – 12ms

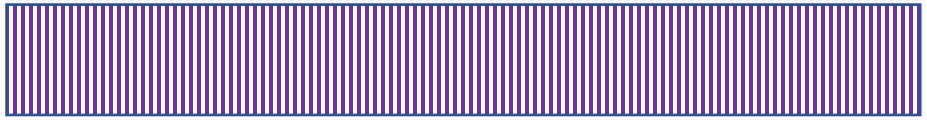
AES10 - MADI: 28, 56, 64 channels
Sample rate: 32kHz - 96kHz
Bit depth: 16bit, 20bit, 24bit



AES67: 1 - 120 channels (***1-8***)
Sample rate: 44.1kHz, **48kHz**, 96kHz
Bit depth: 16bit, 24bit
IP Packet period: 125us, 250us, 333⅓us, **1ms**, 4ms



ST2110-30: **1-8** channels (1-64 channels Level C)
Sample rate: **48kHz (level A)**, 96kHz (level –x)
Bit depth: 16bit, 24bit
IP Packet period: **1ms (level A)**125us (level B),



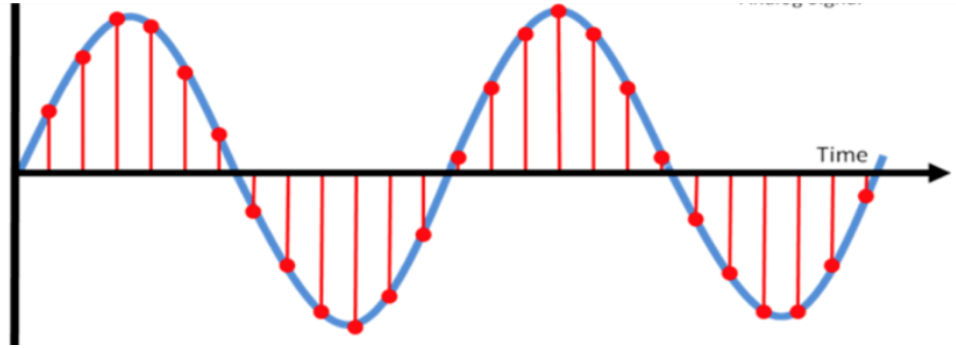
The ST2110 suite & NMOS

Handling ‘other’ audio: the ST2110-31 bits

Timing and referencing

SMPTE

ST2059 – applying PTP IEEE1588 to media



GNSS

GPS

GALILEO

GLONASS

TaaS

NTP

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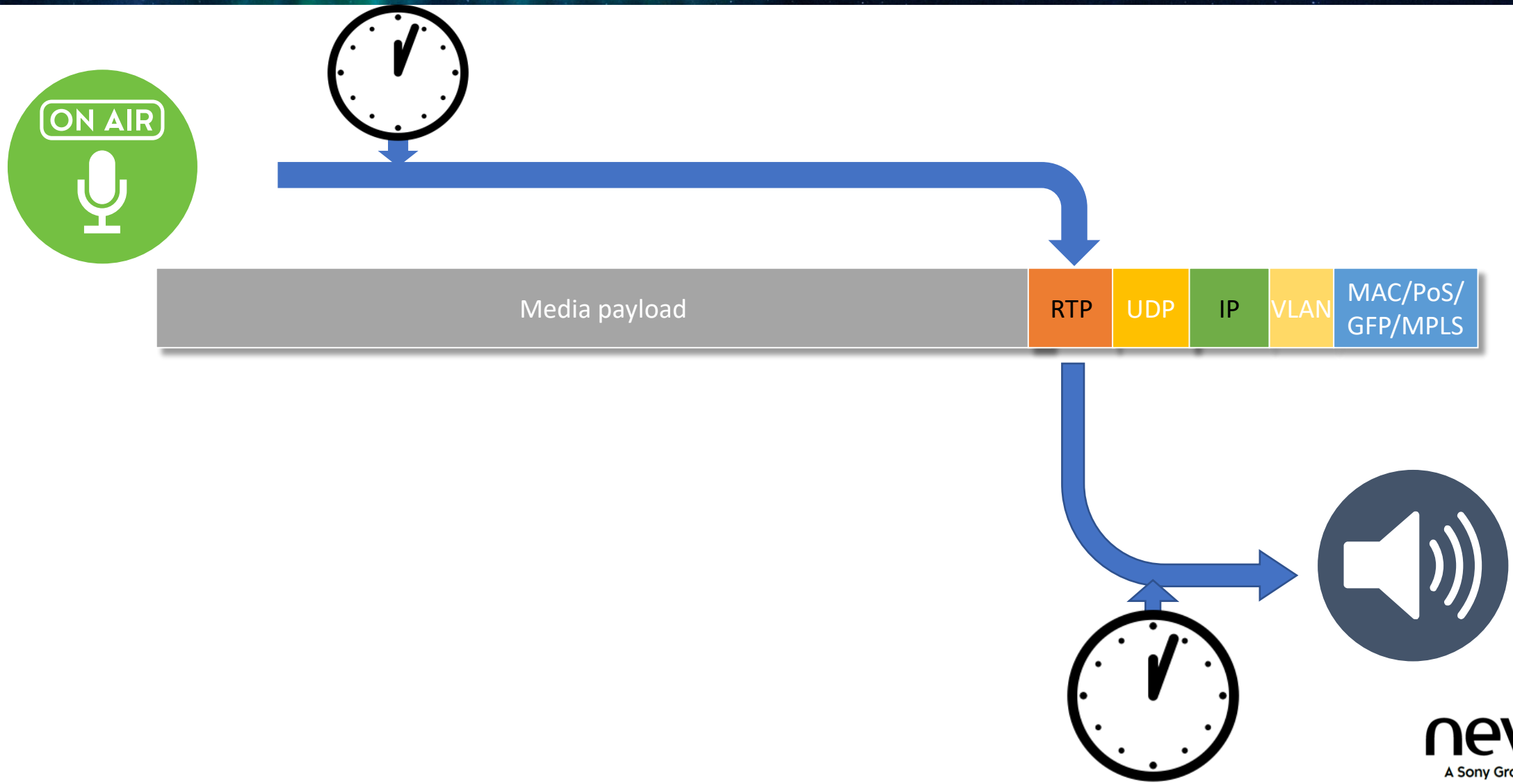
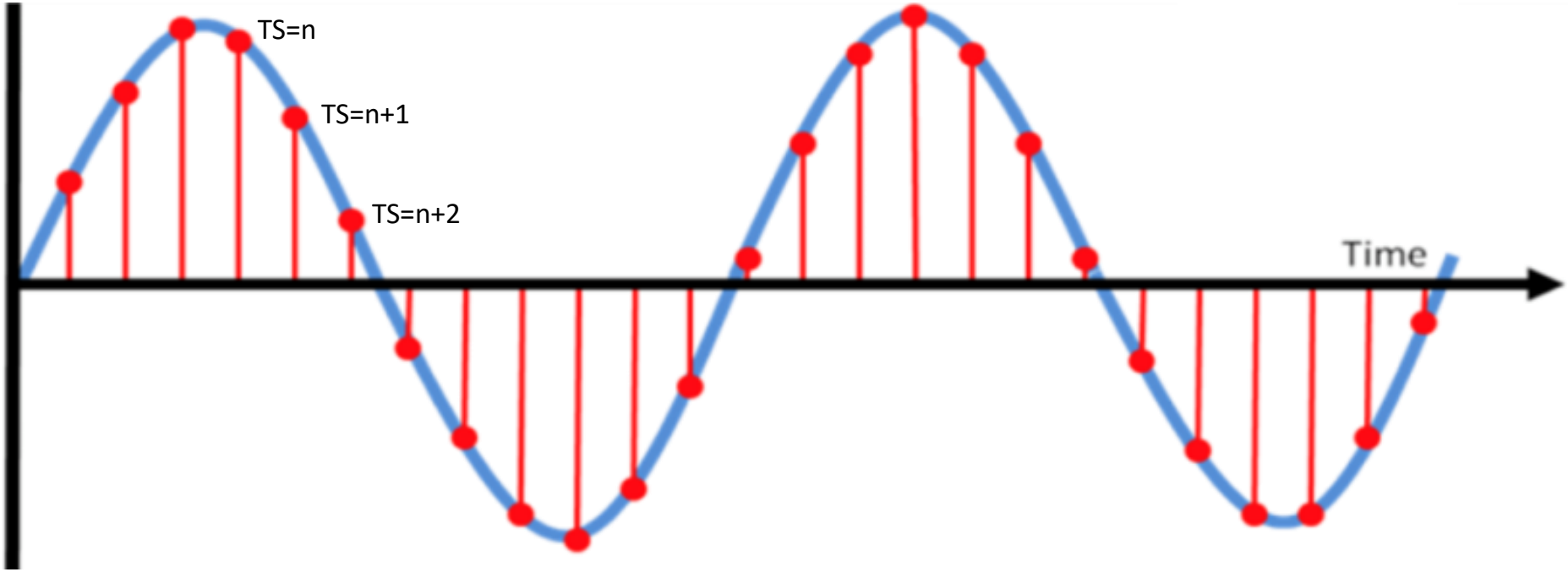
Origination time stamping in RTP



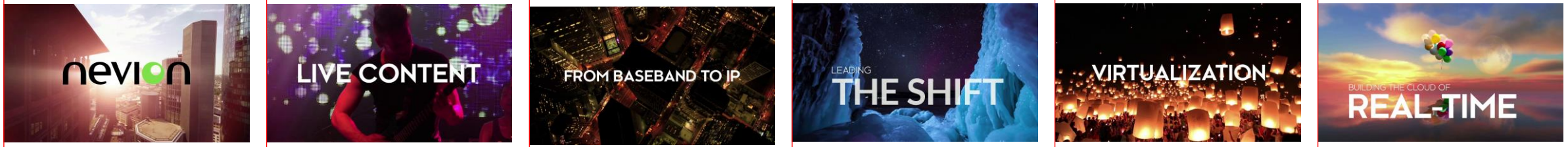
Audio per-sample timing



Video – per-frame sampling timing

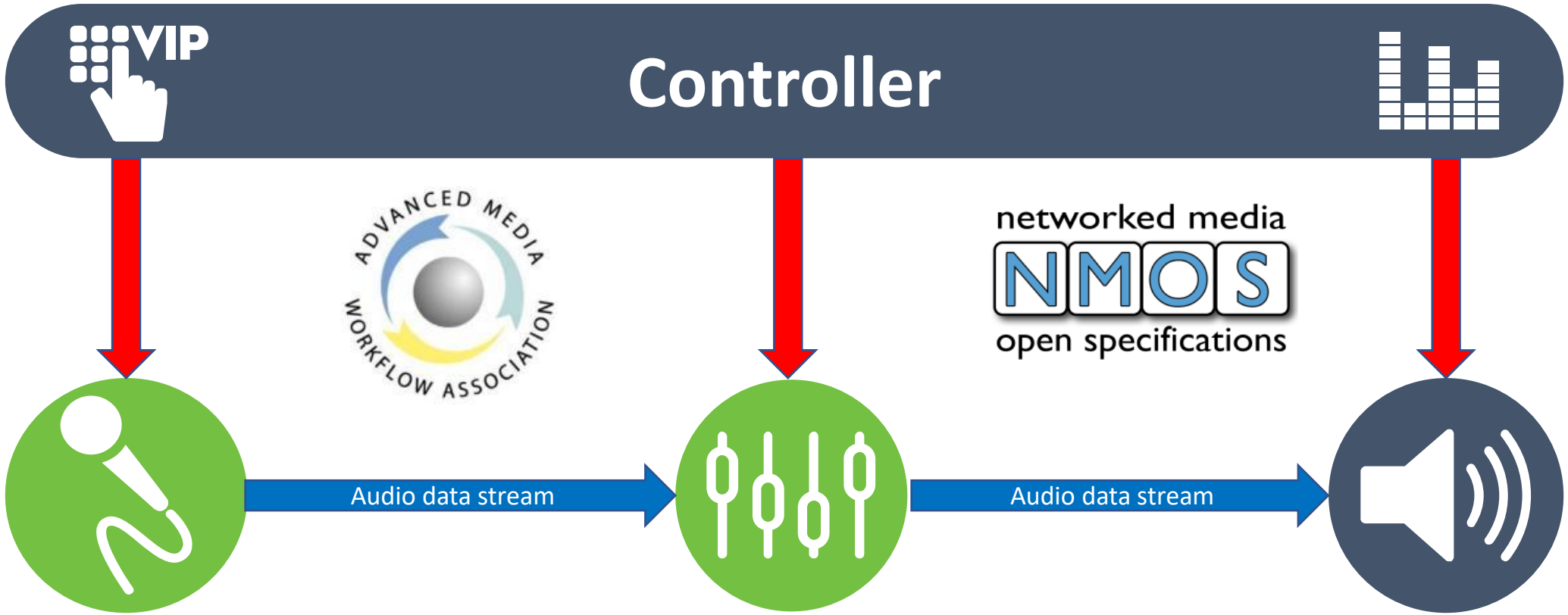
e.g. 20ms

ST2110-20 freezes
RTP timestamp!



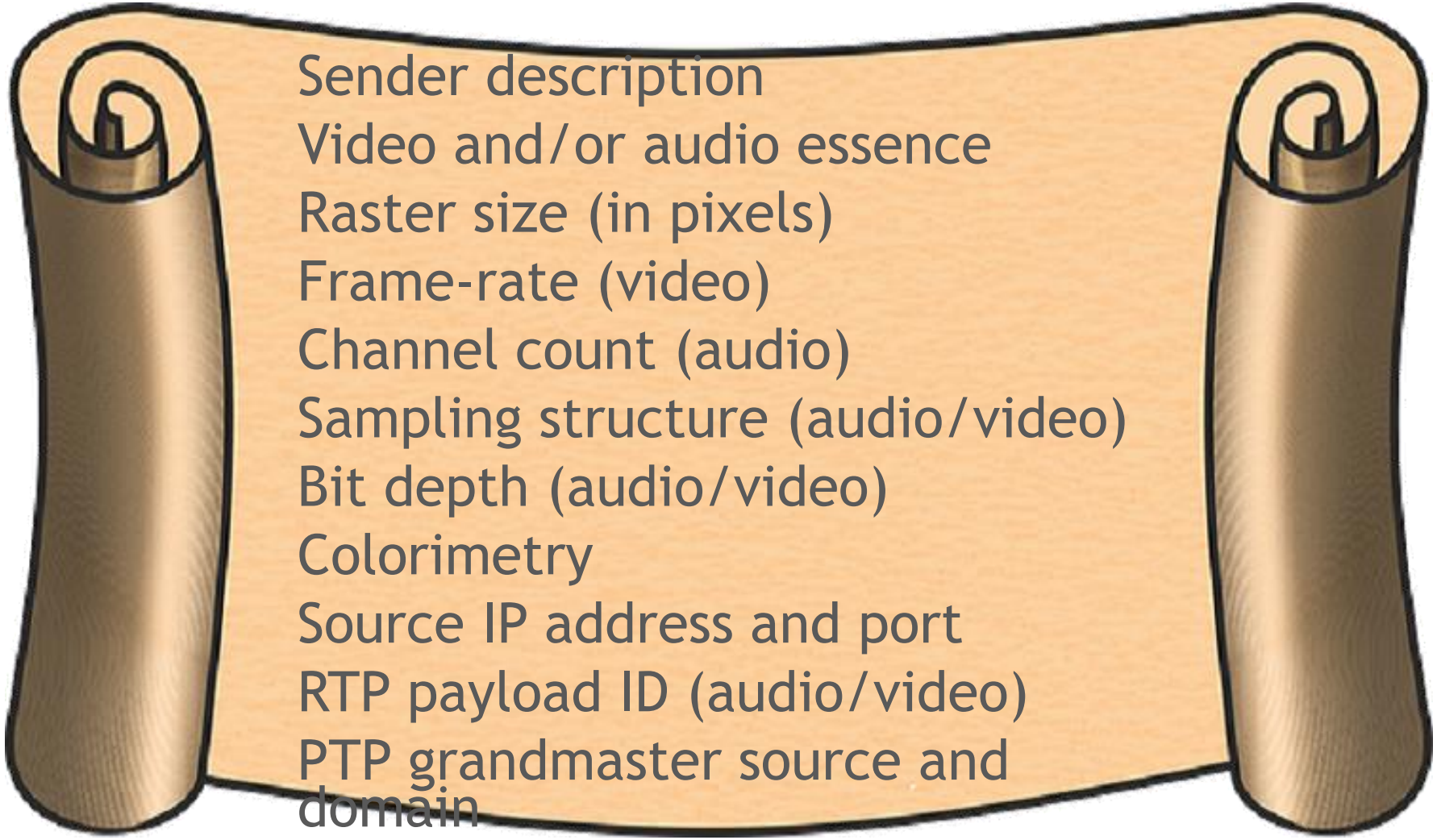
Time

What about the standardized control plane?

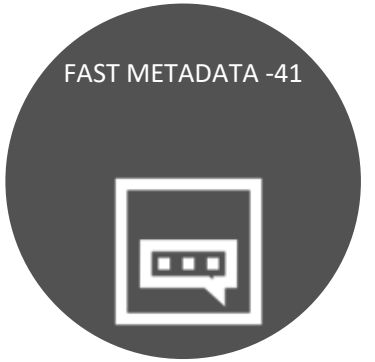


IS-04, IS-05, IS-08

The SDP - RFC 4566 – used in ST2110



Sender description
Video and/or audio essence
Raster size (in pixels)
Frame-rate (video)
Channel count (audio)
Sampling structure (audio/video)
Bit depth (audio/video)
Colorimetry
Source IP address and port
RTP payload ID (audio/video)
PTP grandmaster source and domain



Coming soon

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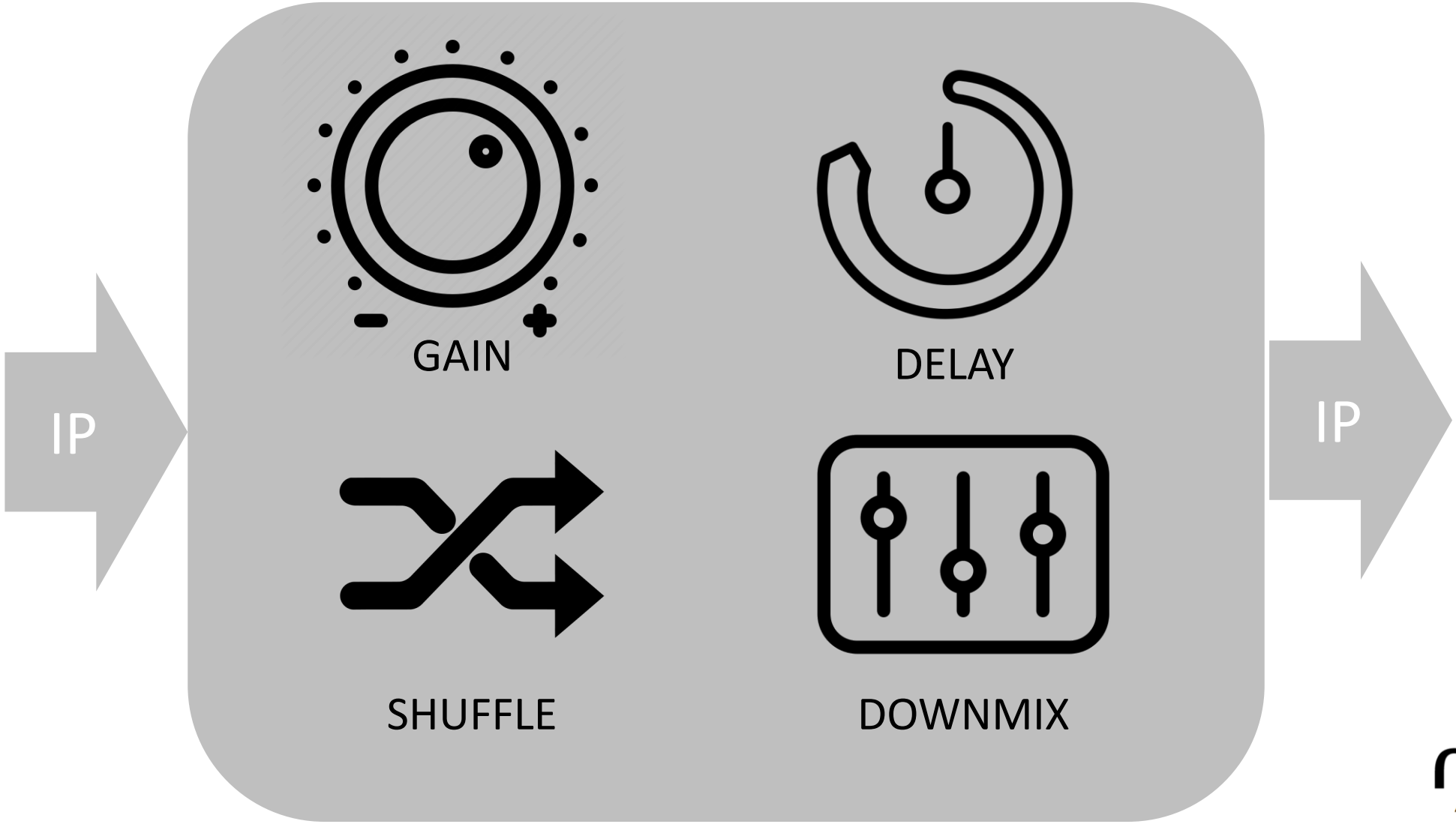
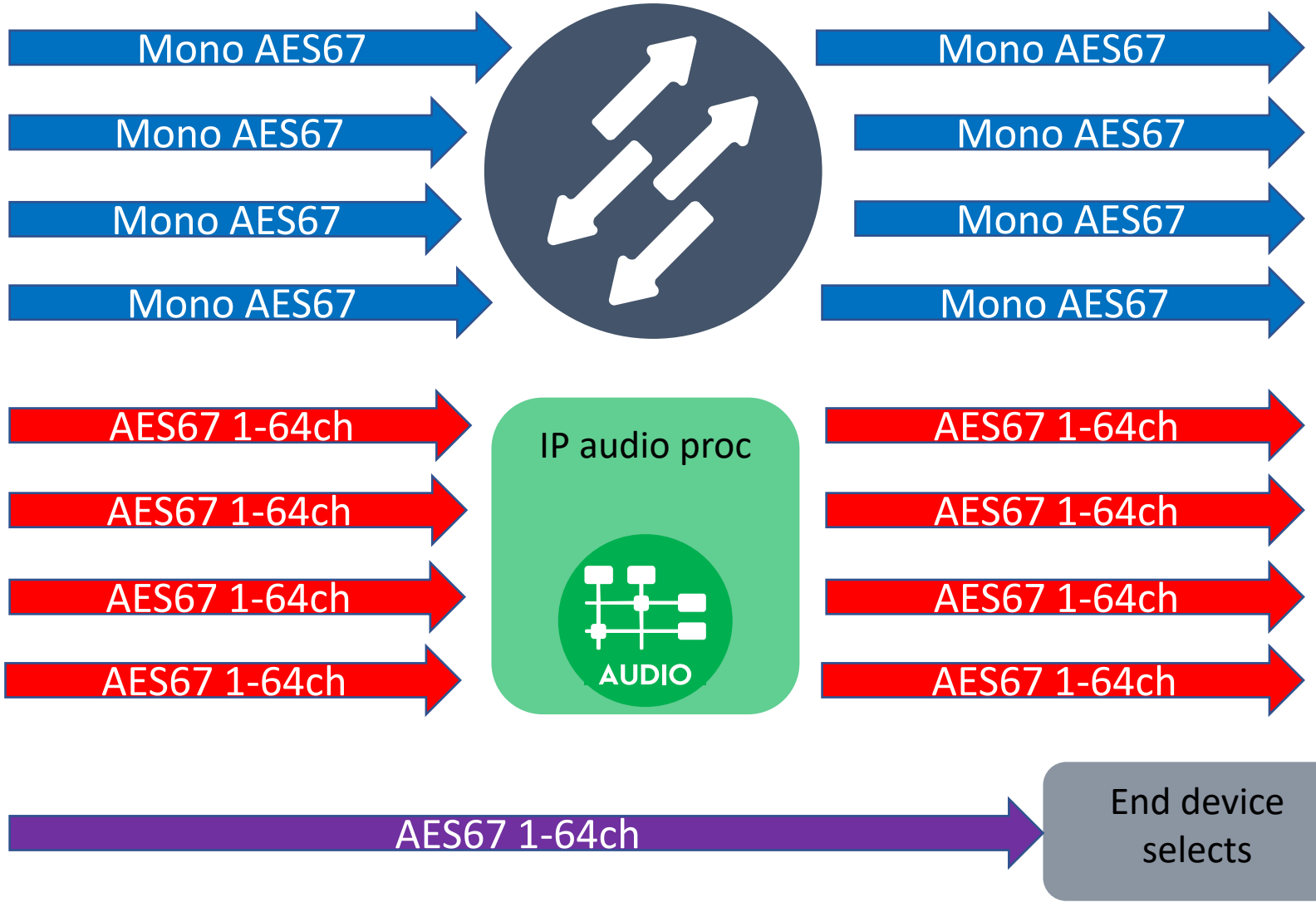
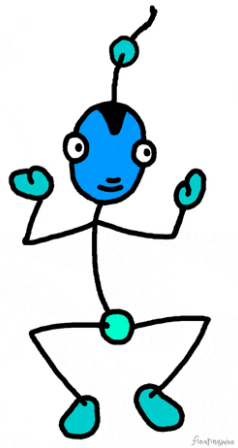
Audio manipulation required in IP domain



How to shuffle in the modern world





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Audio templates – a few practical options

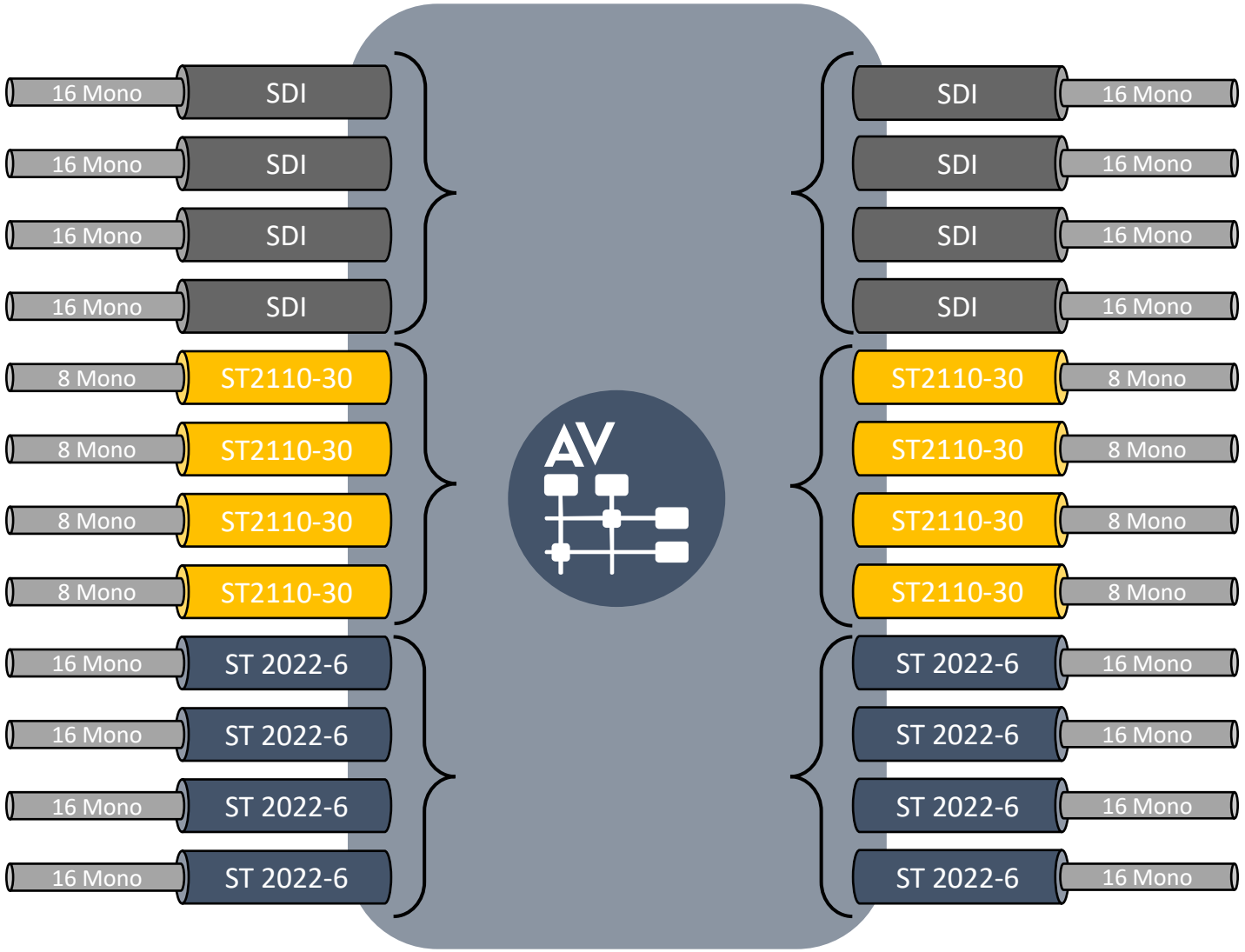
One channel - mono

Two channels - stereo

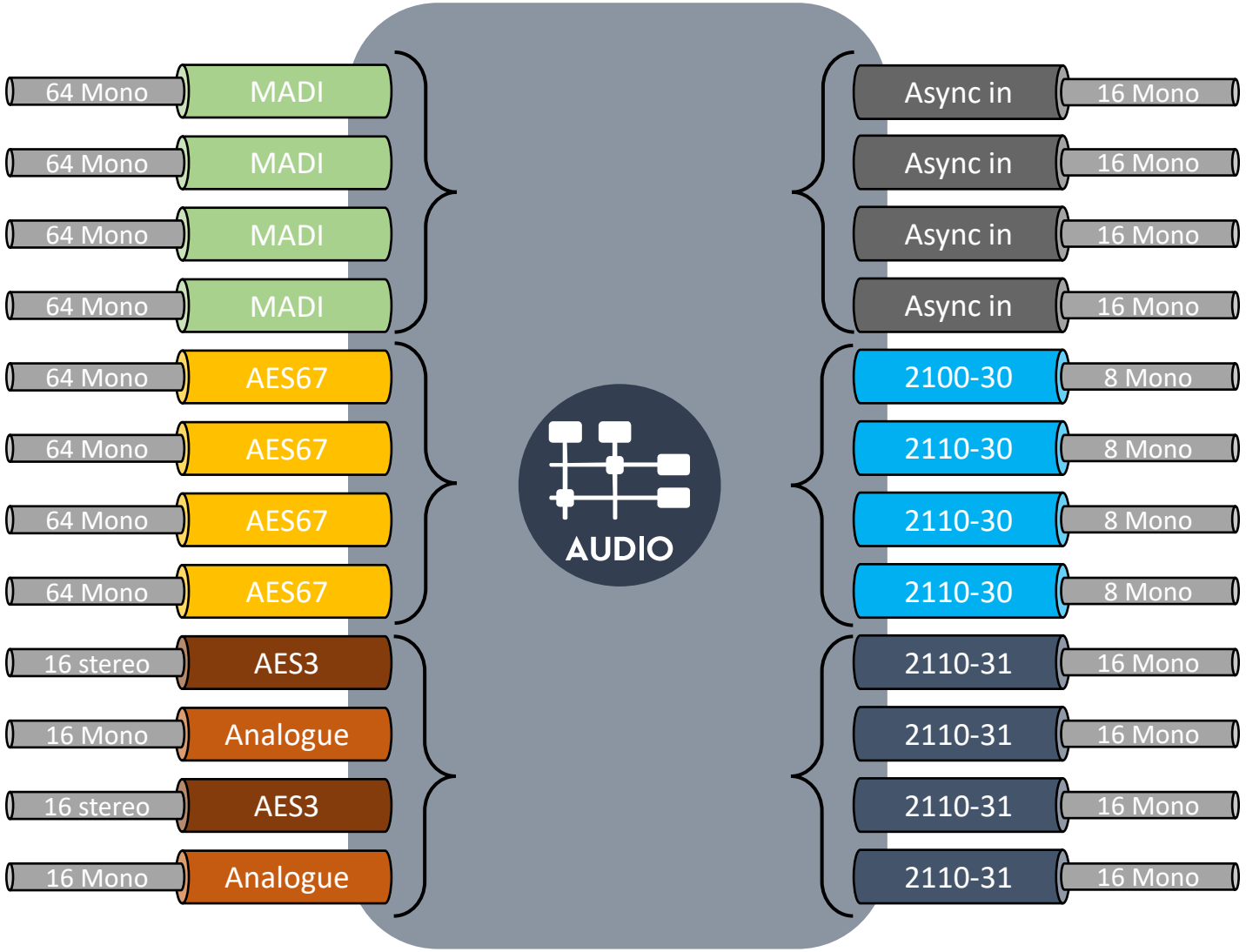
Six channels – 5.1

Eight channels – 4 x stereo

Video-associated audio format interfacing

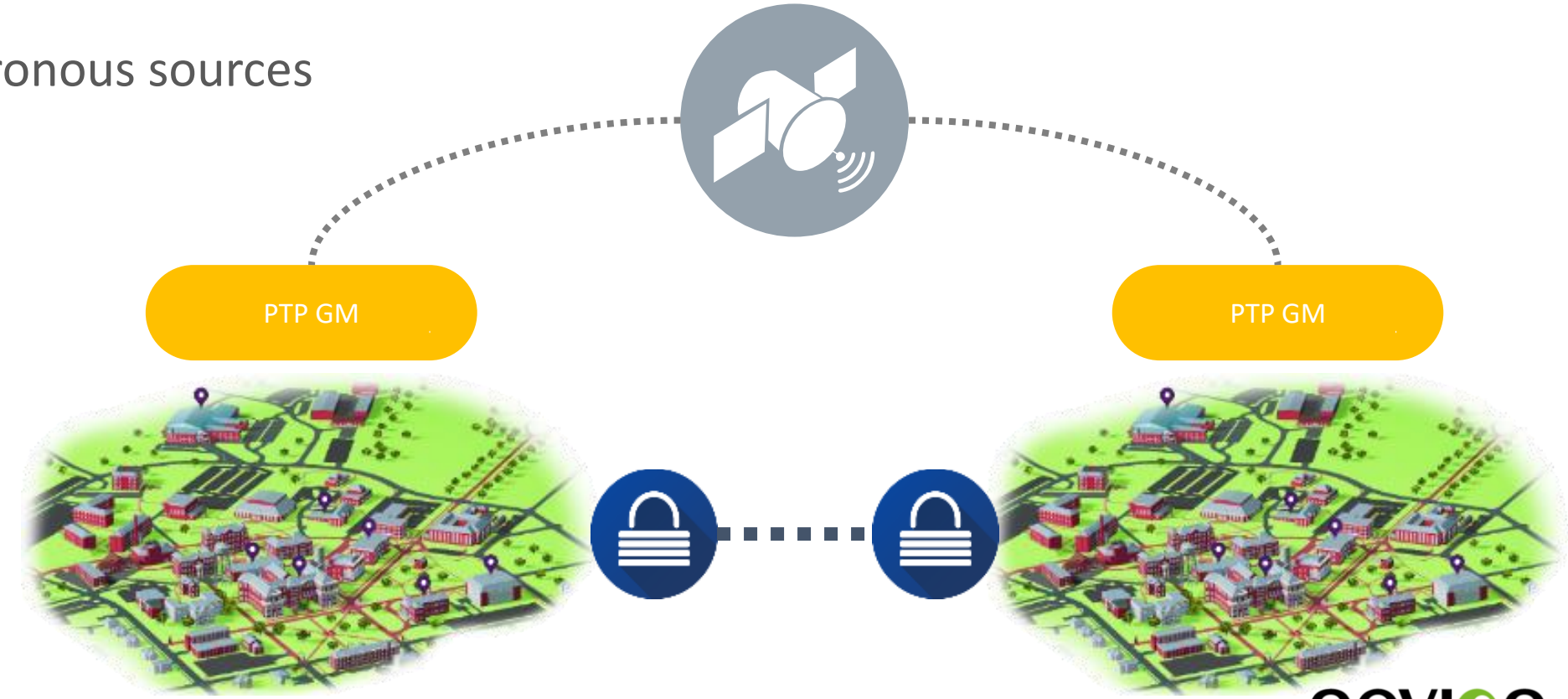


Audio-only format interfacing

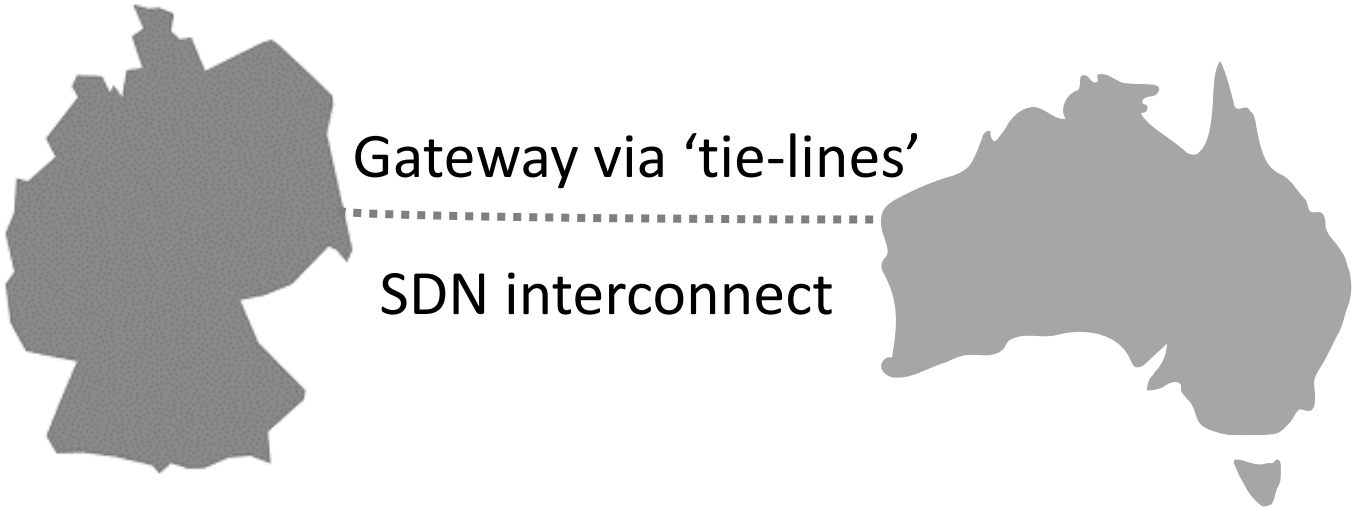


Moving outside the campus – distributed production

- WAN connectivity involved
- Longer latencies
- (Potentially) Asynchronous sources
- Layer 2 too limiting
- Layer 3 (routed) needed for larger and multi-campus networks



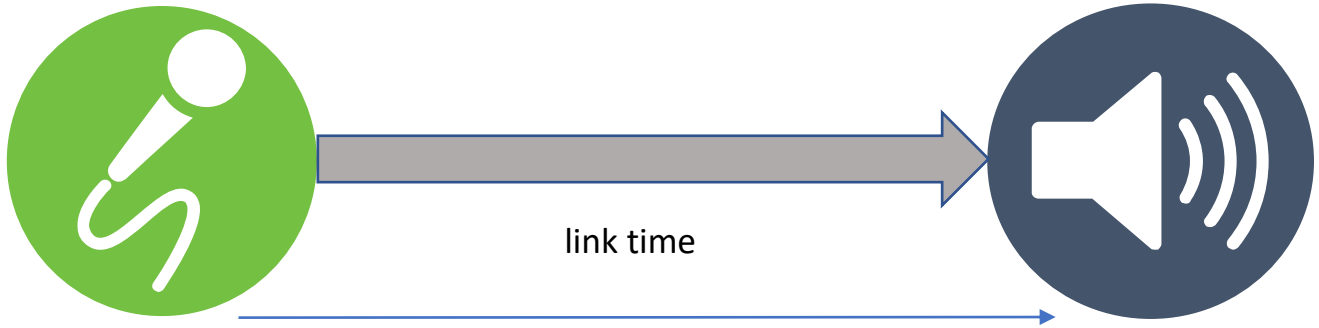
Interconnecting proprietary audio Islands

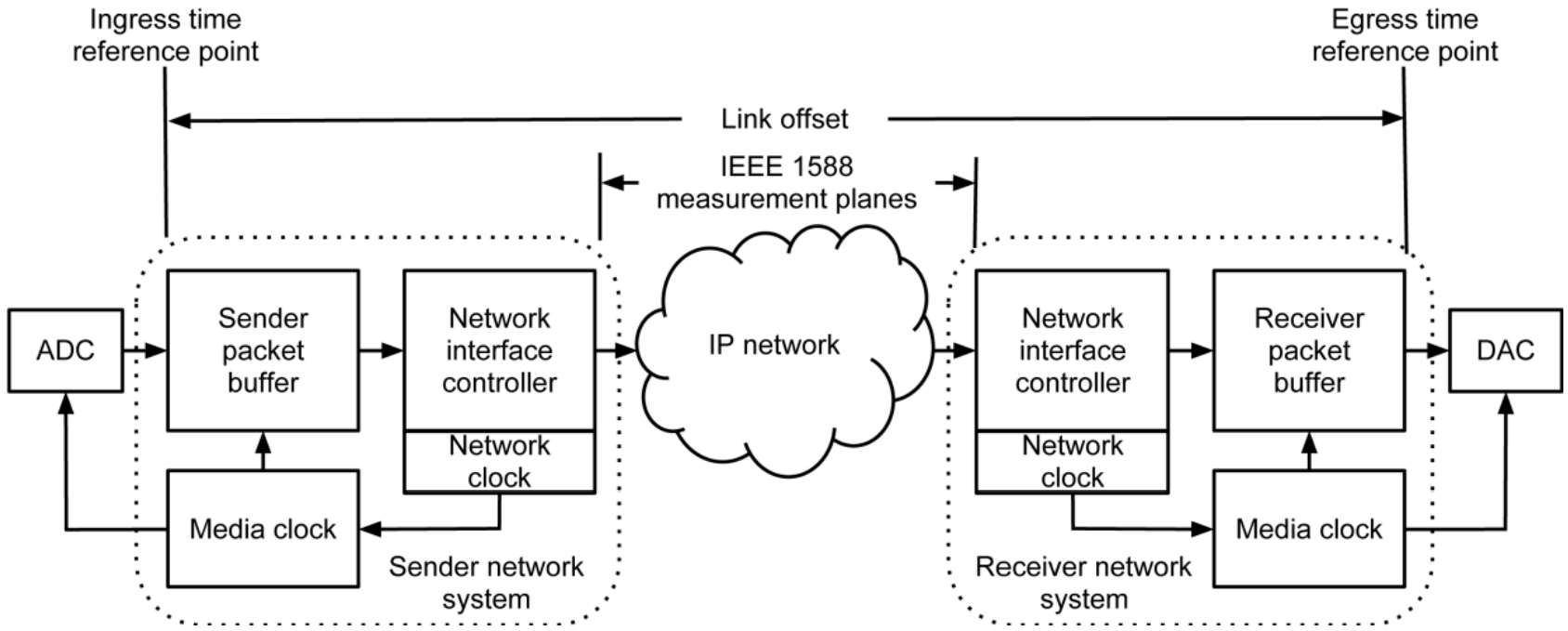


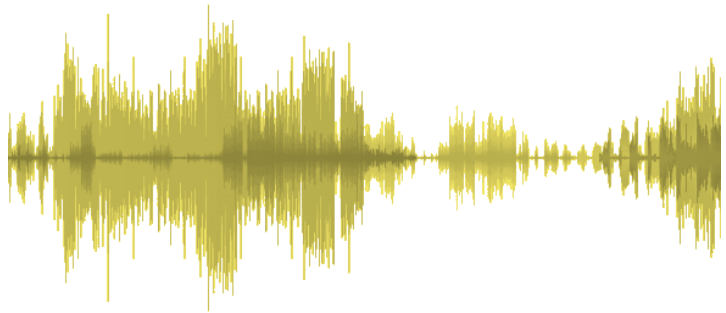
Plug and play ‘toolkit’ needed to transition to standardised formats

29

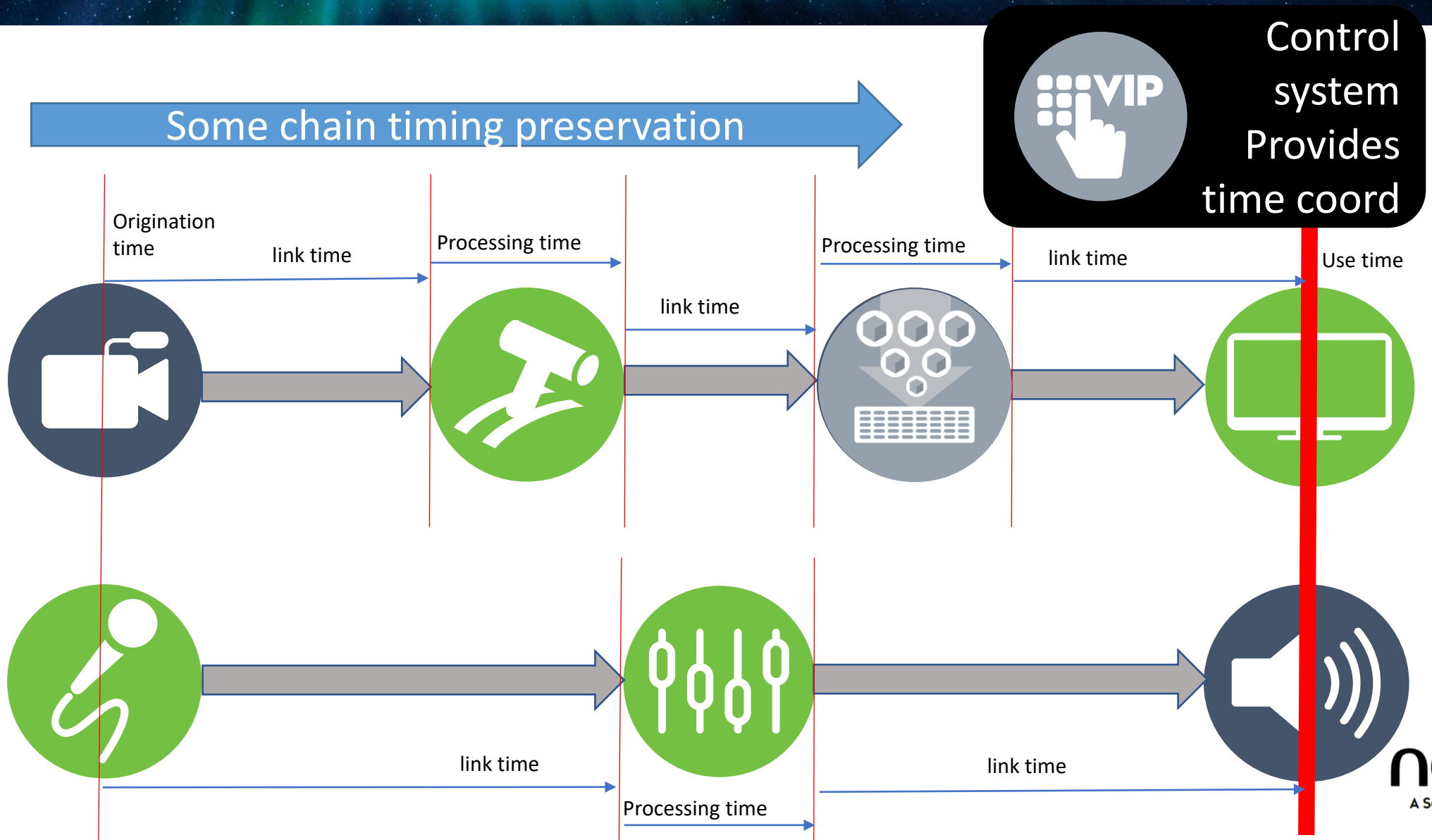
AES67 – defines link offset





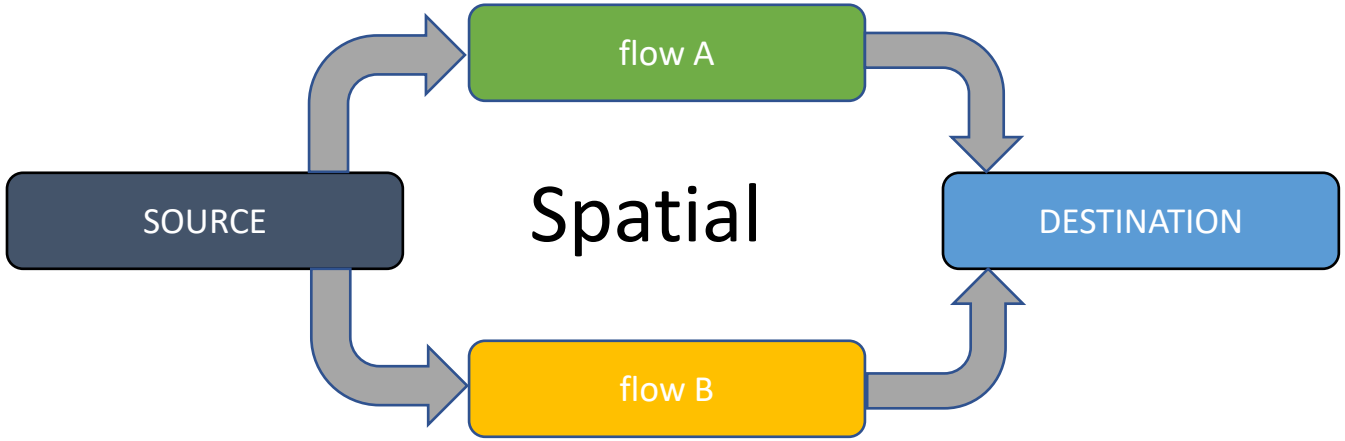


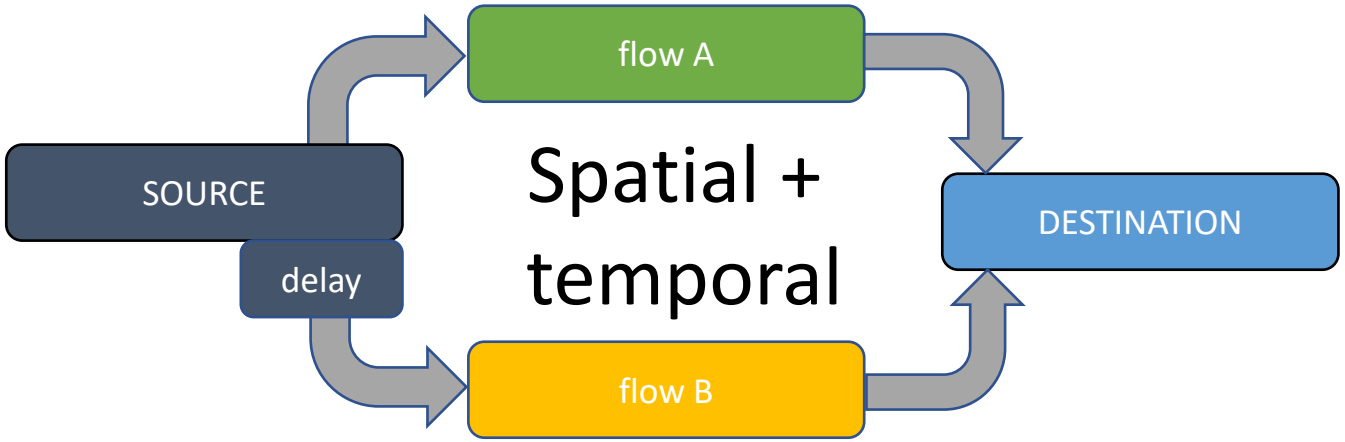
Hybrid timing reconciliation

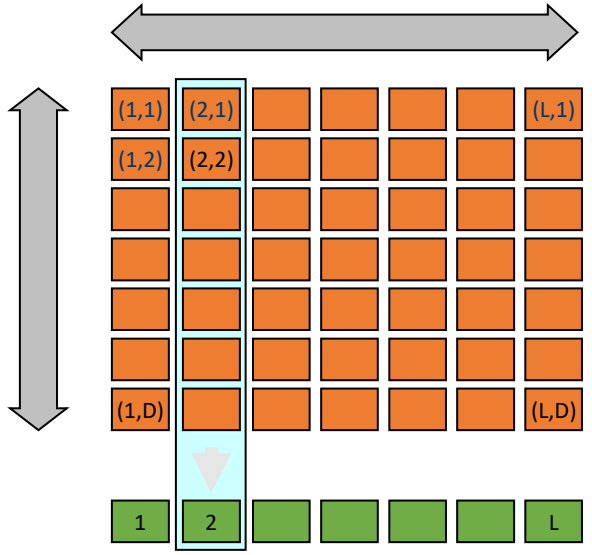


PTP holdover is capable of being very long – let's make it so!

Protection – on and off campus – video & audio



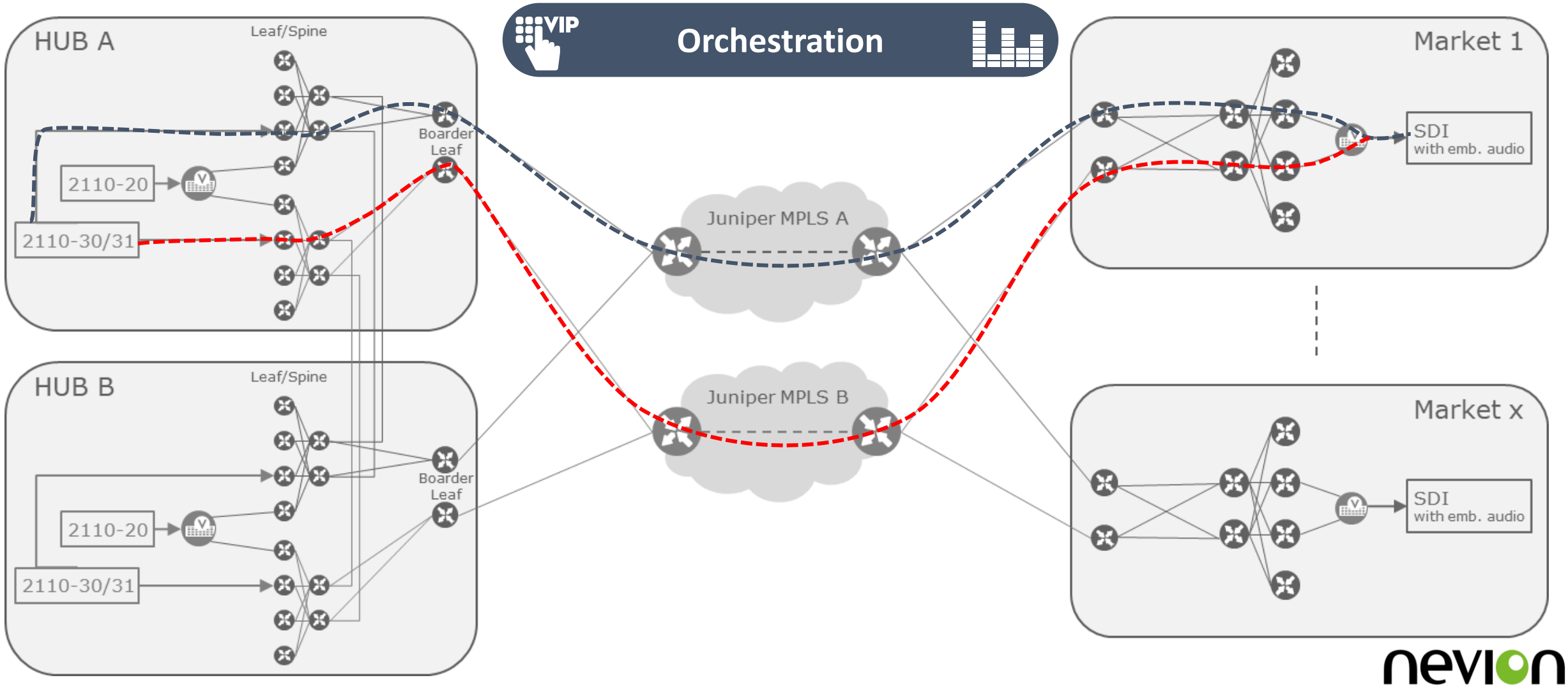




FEC

n	n+1	n+2	n+3
n+4	n+5	n+6	n+7
n+8	n+9	n+10	n+11
n+12	n+13	n+14	n+15
n+16	n+17	n+18	n+19
n+20	n+21	n+22	n+23
n+24	n+25	n+26	n+27
n+28	n+29	n+30	n+31
n+32	n+33	n+34	n+35
n+36	n+37	n+38	n+39
n+40	n+41	n+42	n+43

International use case - Audio signal flows



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Secure networks need managed networks

VIP SDN control

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Going off-campus – the IP facility media edge

PTP TIMING

DEVICE DISCOVERY & CTL

MEDIA FLOW IP ADDRESSING

UNCOMPRESSED ESSENCE FLOWS

PROTECTION TERMINATION

'EXOTIC' PROTOCOLS

ALTERNATIVE TIMING DOMAINS

RESTRICTED/PROXY DISCOVERY & CTL

DIFFERENT IP ADDRESSING (NAT)

ESSENCE/COMPOSITE UN/COMPRESSED FLOWS

PROTECTION TERMINATION

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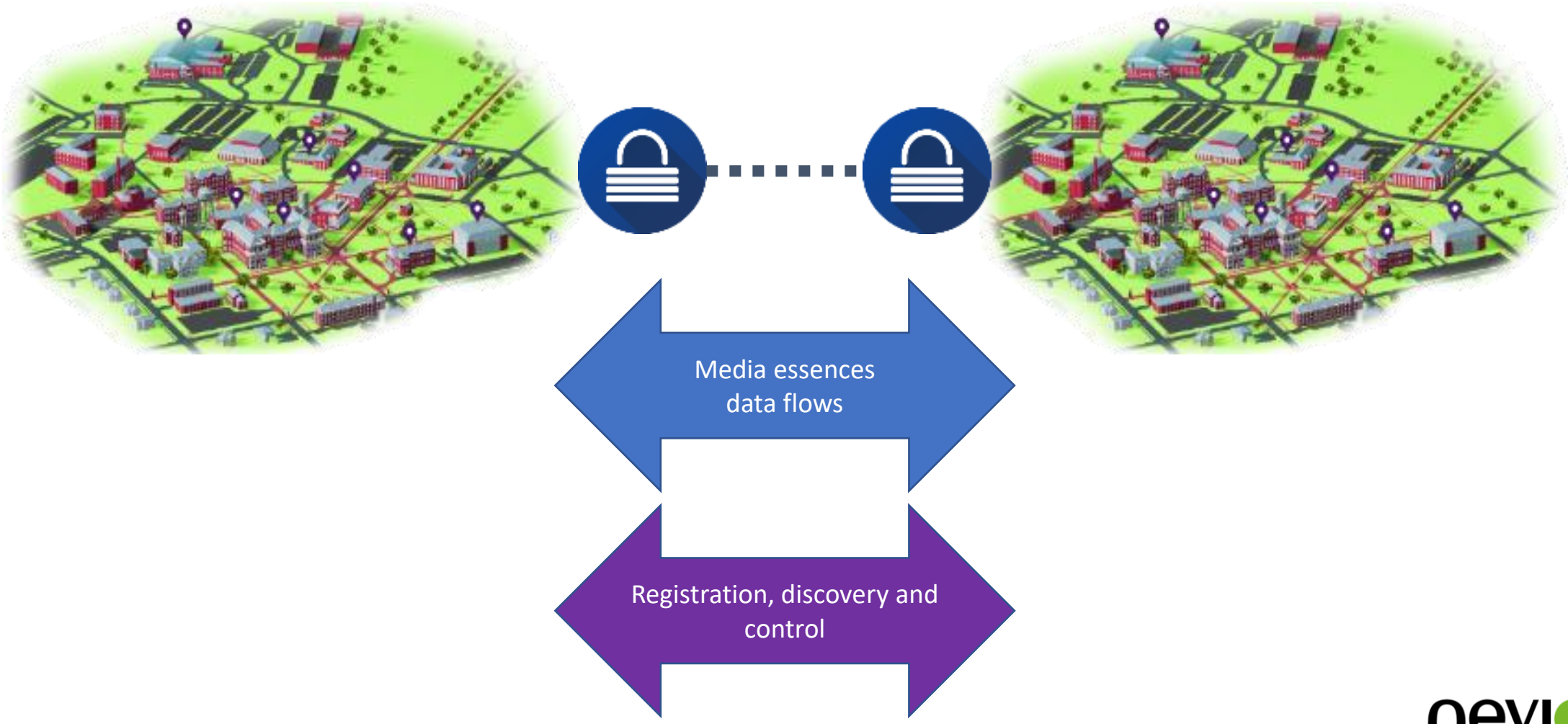
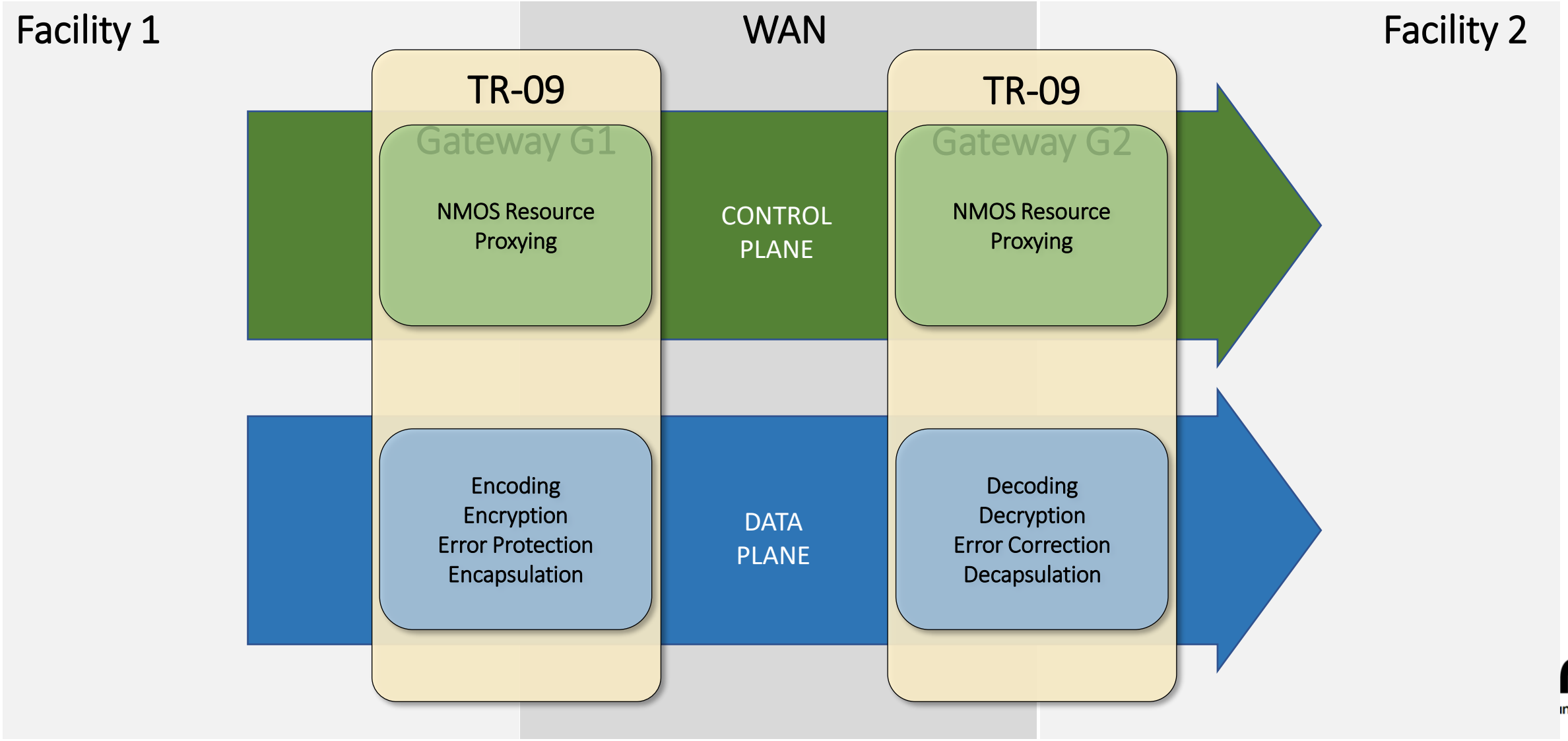
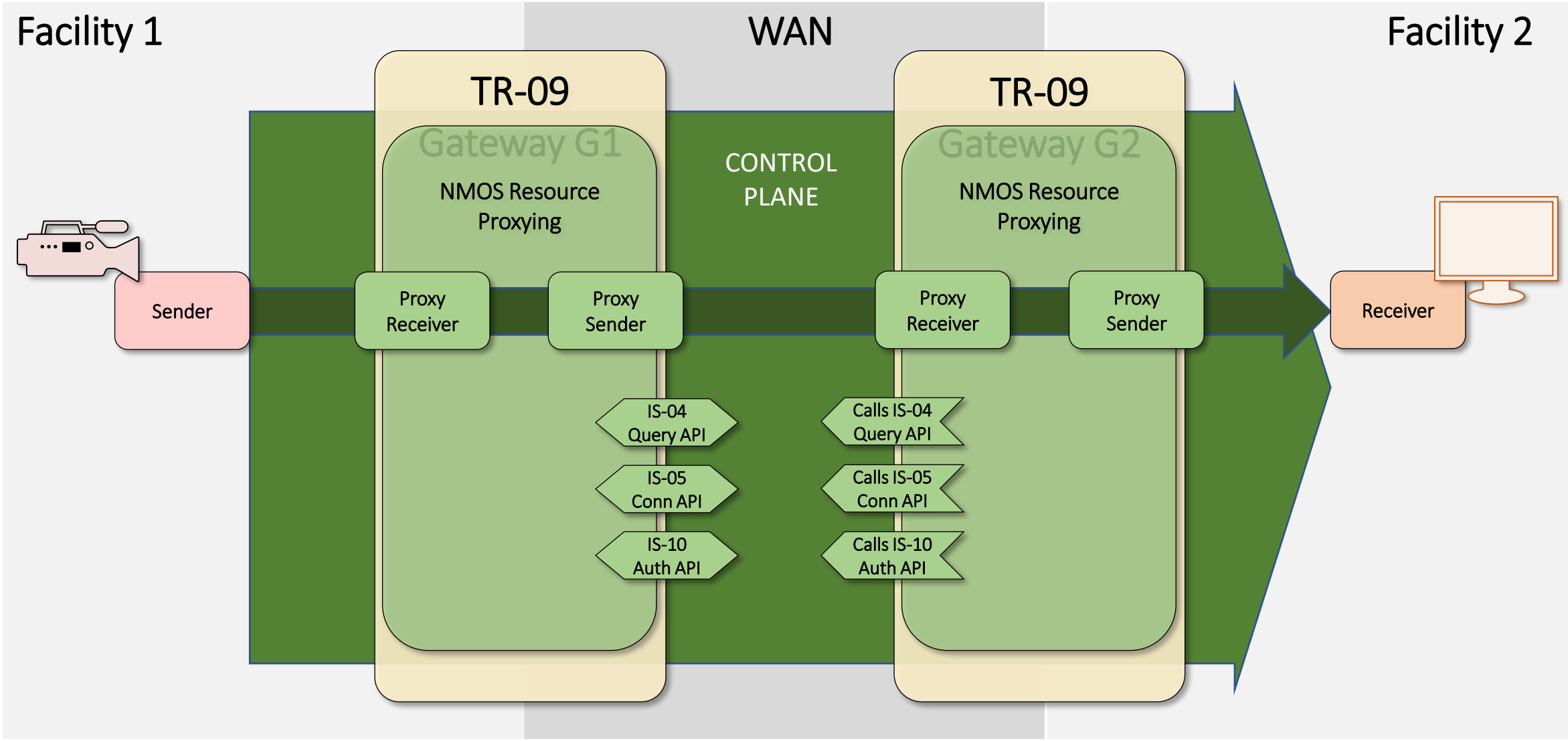
ST2110-WAN AG - two layers of focus – data and control



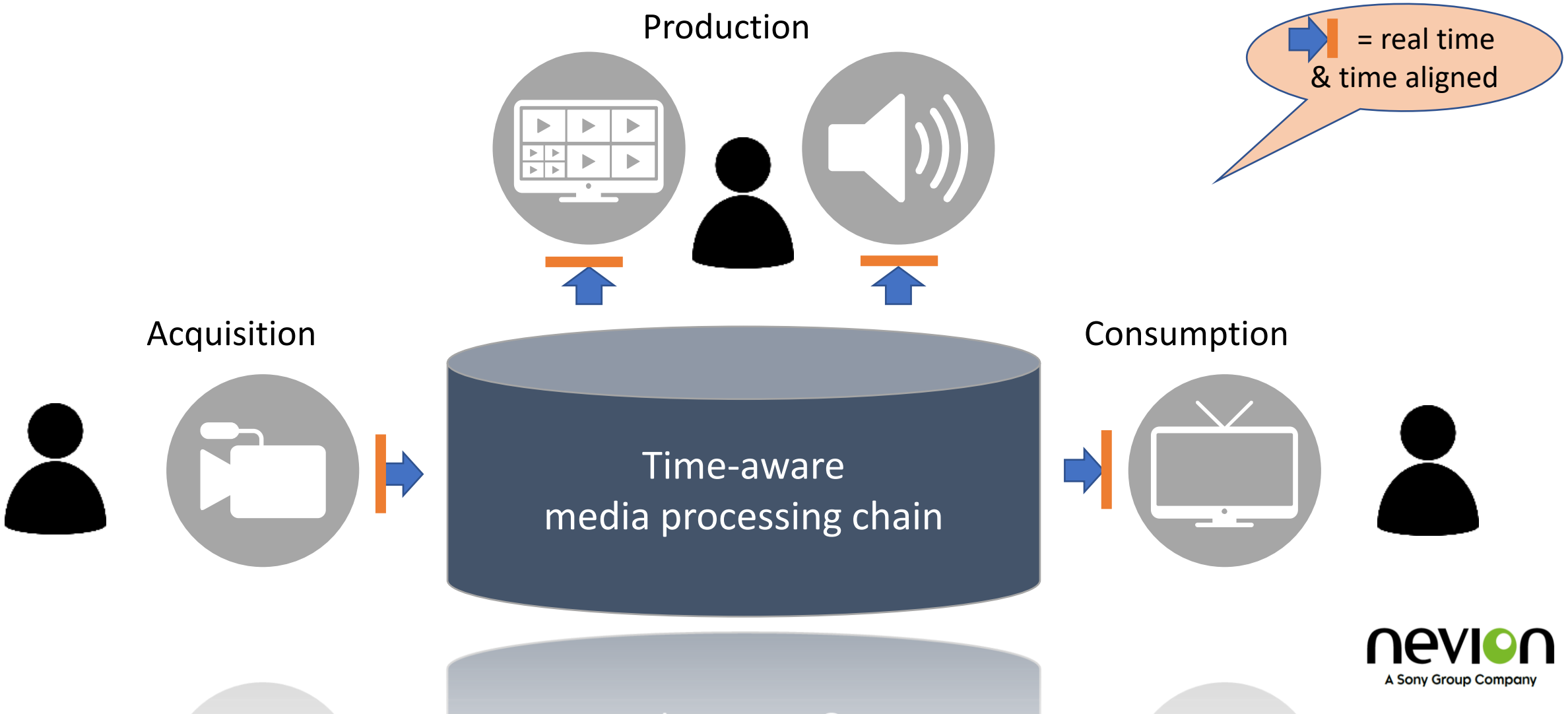
ST2110-WAN


Facility 1
WAN
Facility 2
TR-09
Gateway G1
NMOS Resource Proxying
TR-09
Gateway G2
NMOS Resource Proxying
CONTROL PLANE
Encoding
Encryption
Error Protection
Encapsulation
DATA PLANE
Decoding
Decryption
Error Correction
Decapsulation

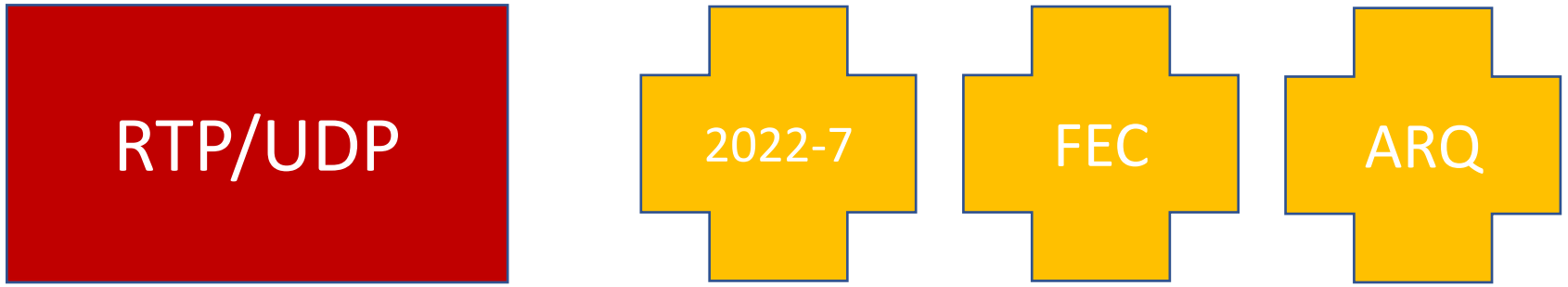
2110-WAN control plane



The broadcast end game



Deterministic data transfer
Linear and non-linear



In conclusion

Thank you!

Andy Rayner Chief Technologist

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Any Questions?

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