End to end timing update

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Time flies!

Andy: 41 billion frames (25fps) since his epoch! [52 years]

Esther: 260 million frames! [4 months]

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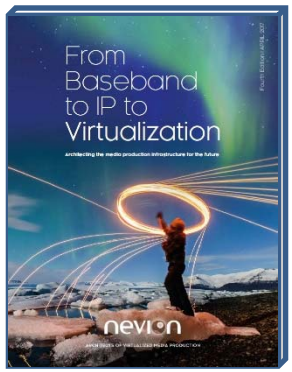
Esther Naomi Joy Rayner

Nevion – our key focus:



VideoIPath

Management & Orchestration

Virtuoso

Software-defined media node

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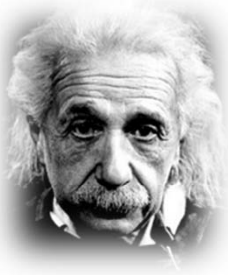
“How did it get so late so soon?”
— Dr. Seuss



“Time is an illusion.”
— Albert Einstein

“You may delay, but time will not.”
—Benjamin Franklin

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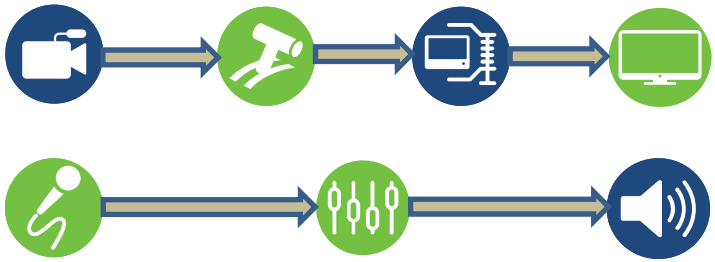
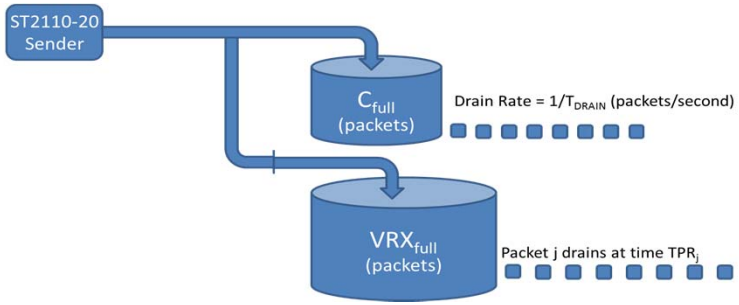
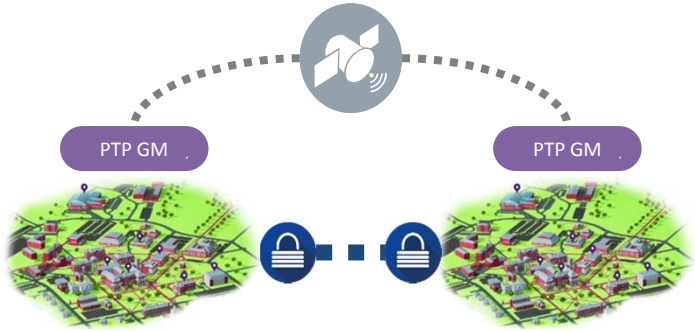
time updates







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IP advantages (just a few of them)

- Video spatial resolution agnostic
- Video temporal resolution agnostic
- Video bit depth agnostic
- Audio sample rate agnostic
- Audio bit depth
- Audio channel count agnostic
- Leverages IT industry equipment, solutions and best practices

We should also be able to handle timing very well

Flexibility

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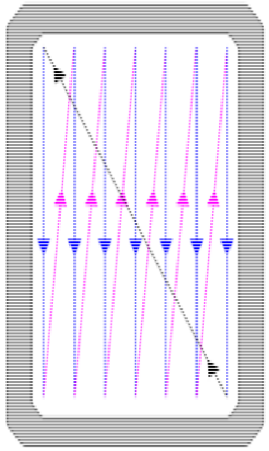
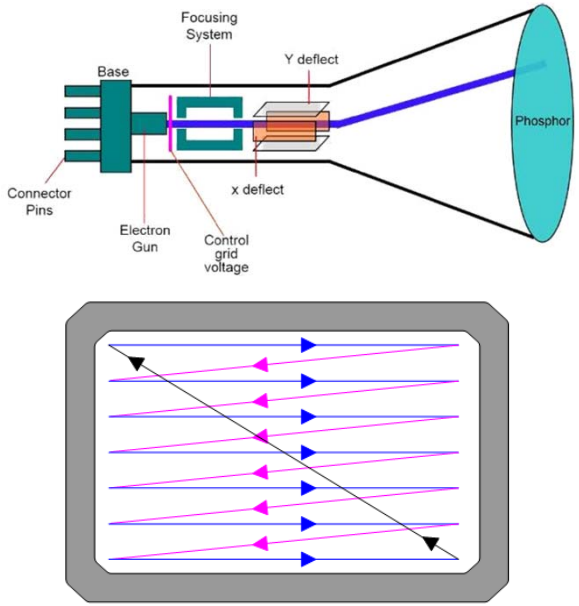
Spread image time (CRT, CMOS RS)
→ point image time (CCD, CMOS GS)





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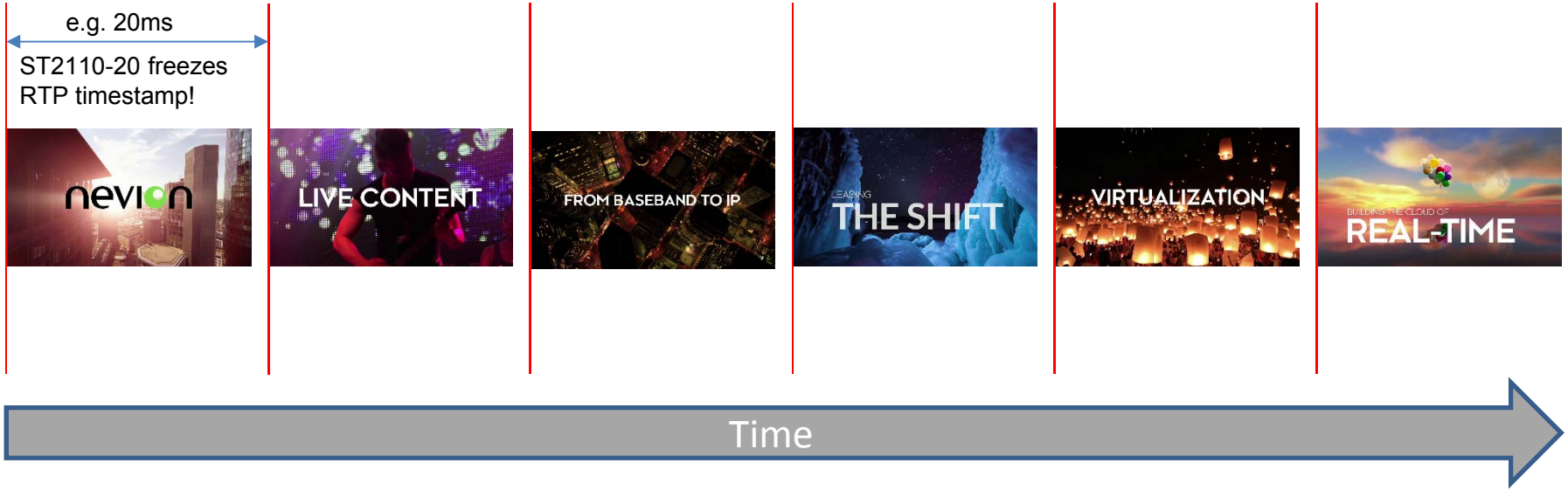
An image at a moment in time



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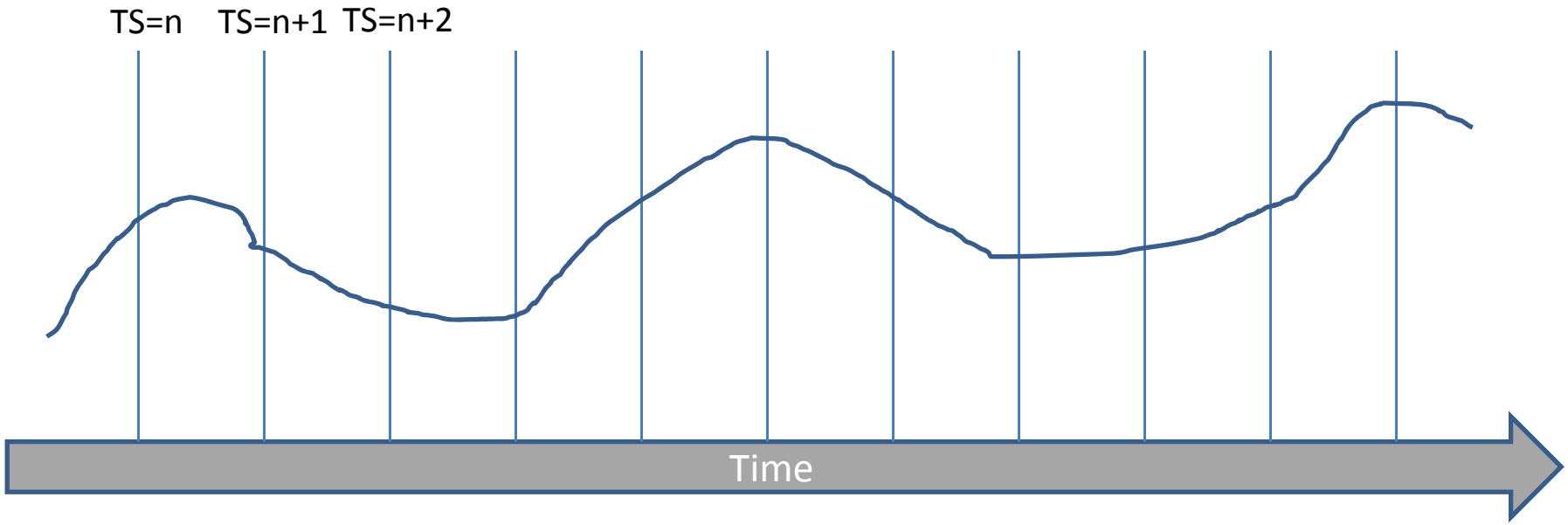
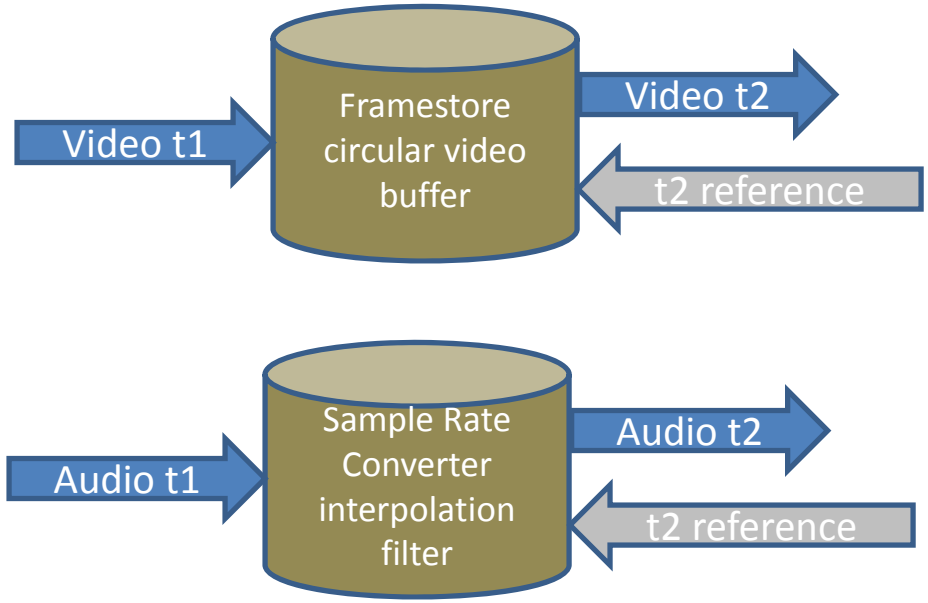
Audio per-sample timing



Reconciling timing (frequency & phase) in the baseband world



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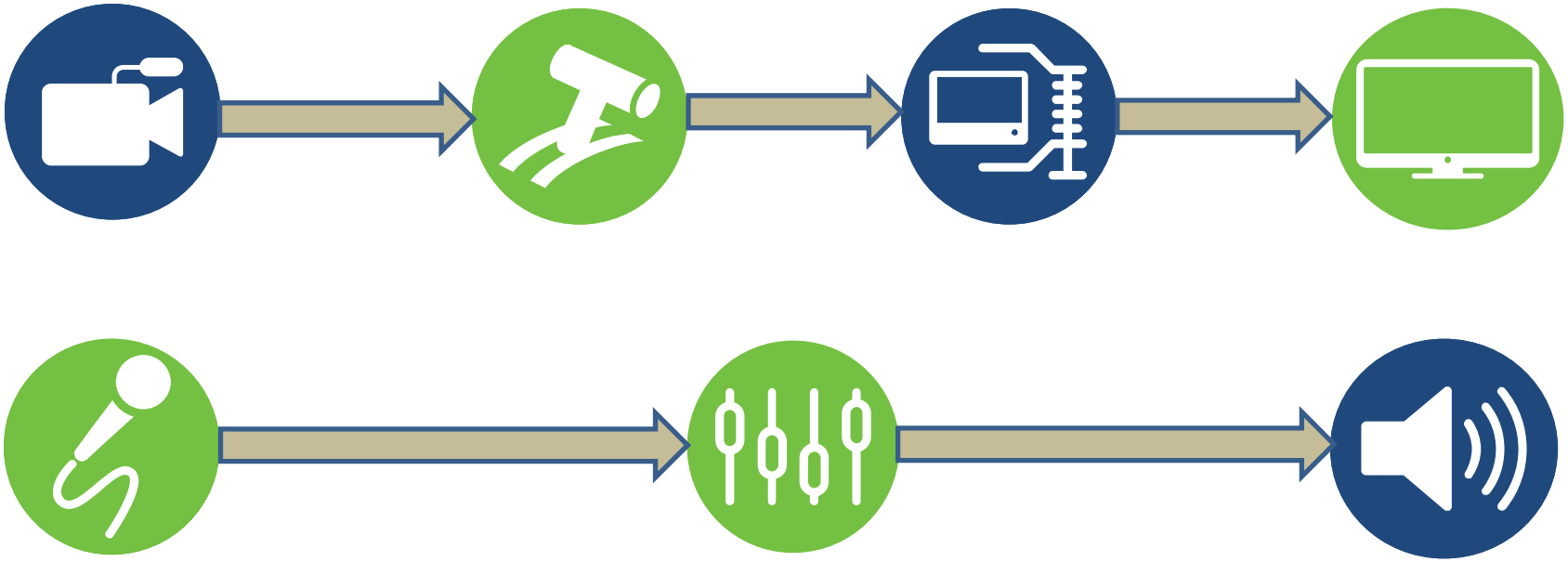
From link-based IP systems to end-to-end IP systems



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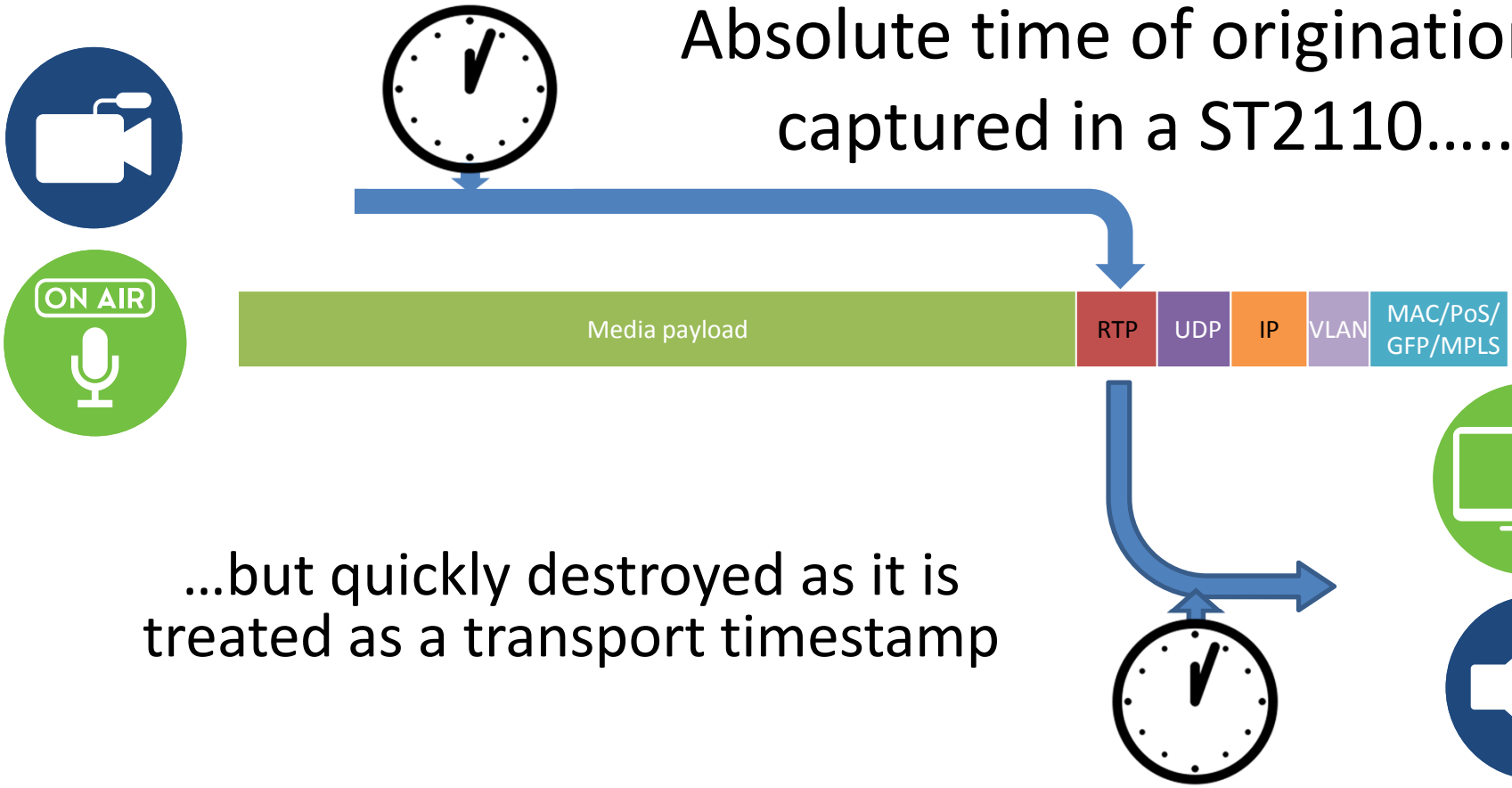
Absolute time of origination is captured in a ST2110…..



…but quickly destroyed as it is treated as a transport timestamp

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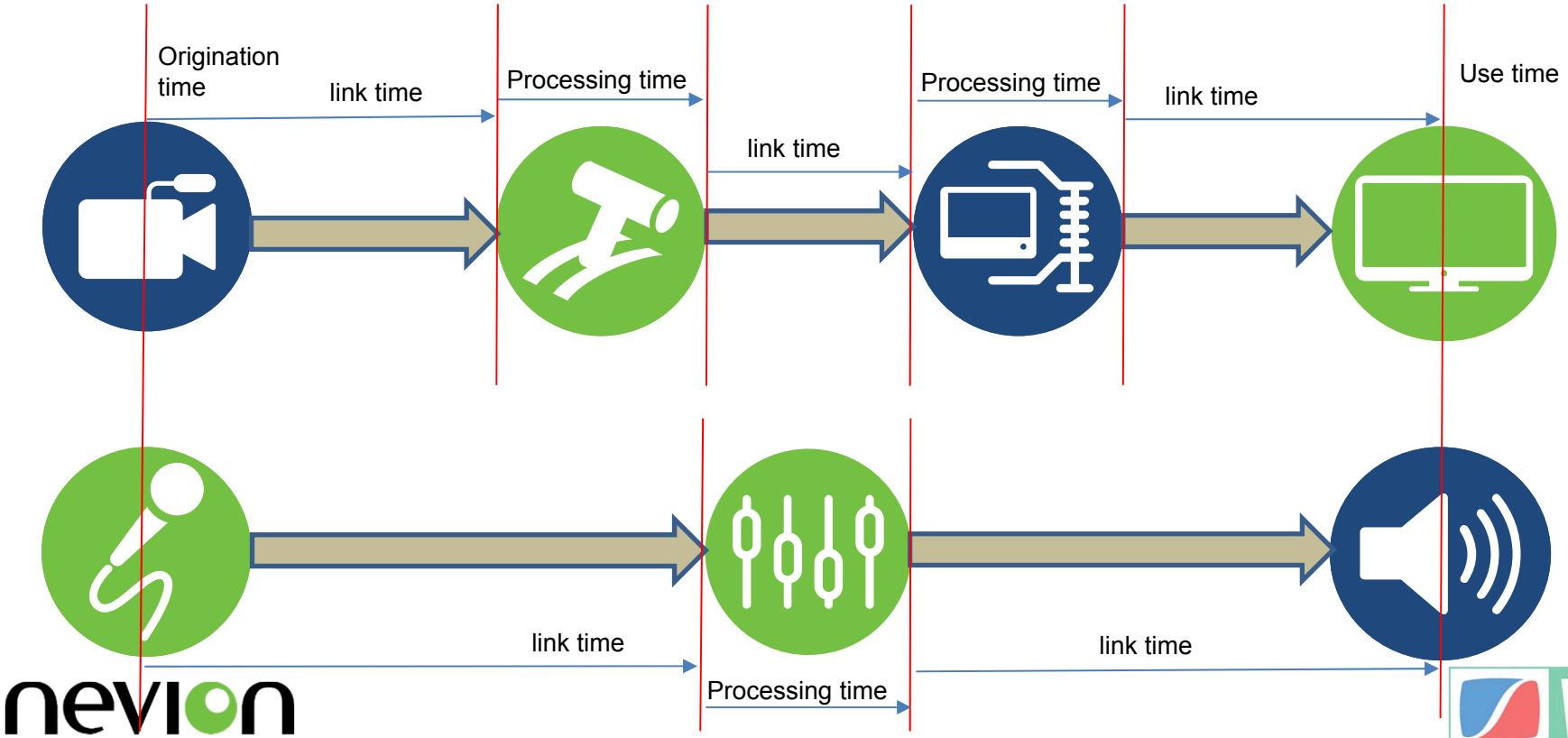
The production workflow timing



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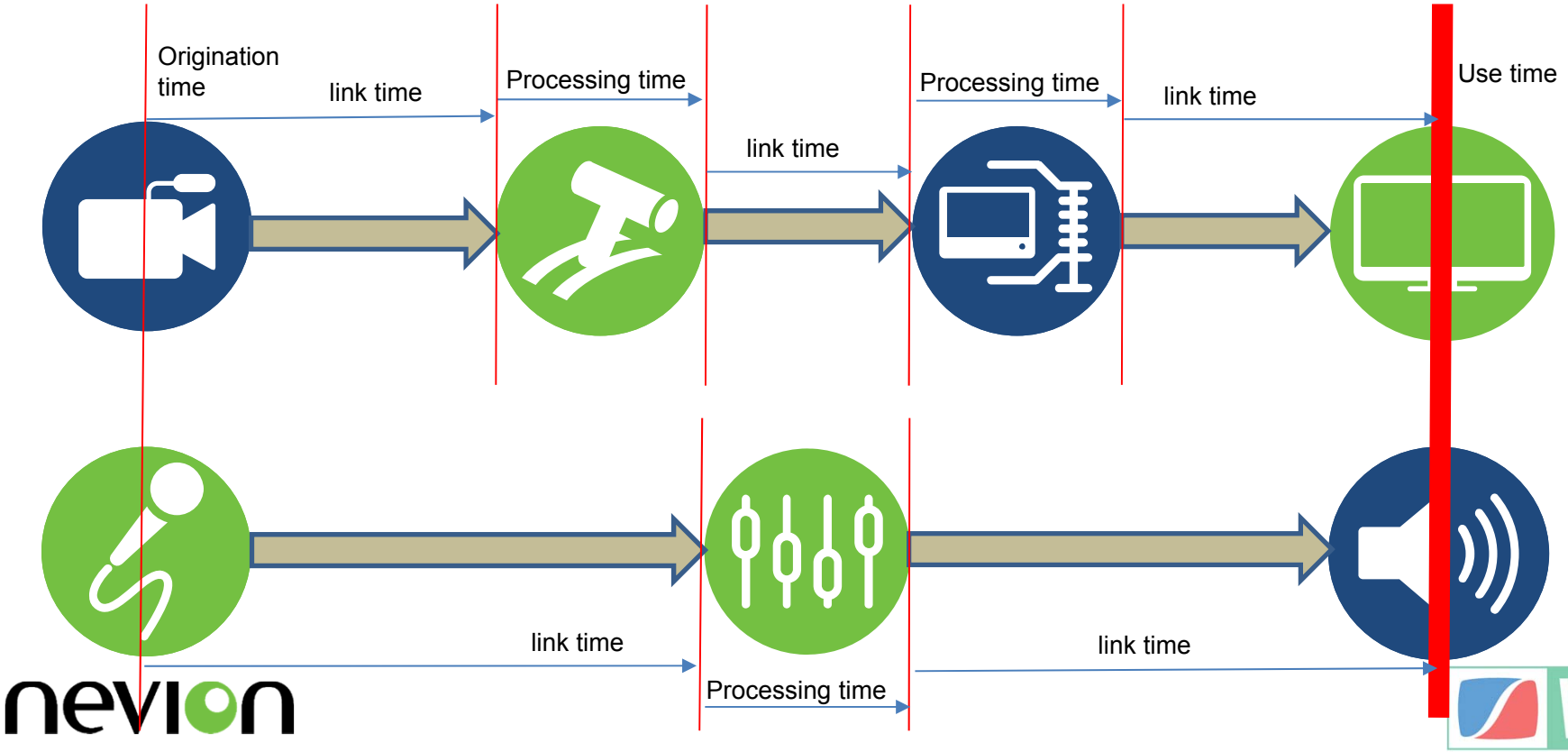
Reconciling essence timings for use



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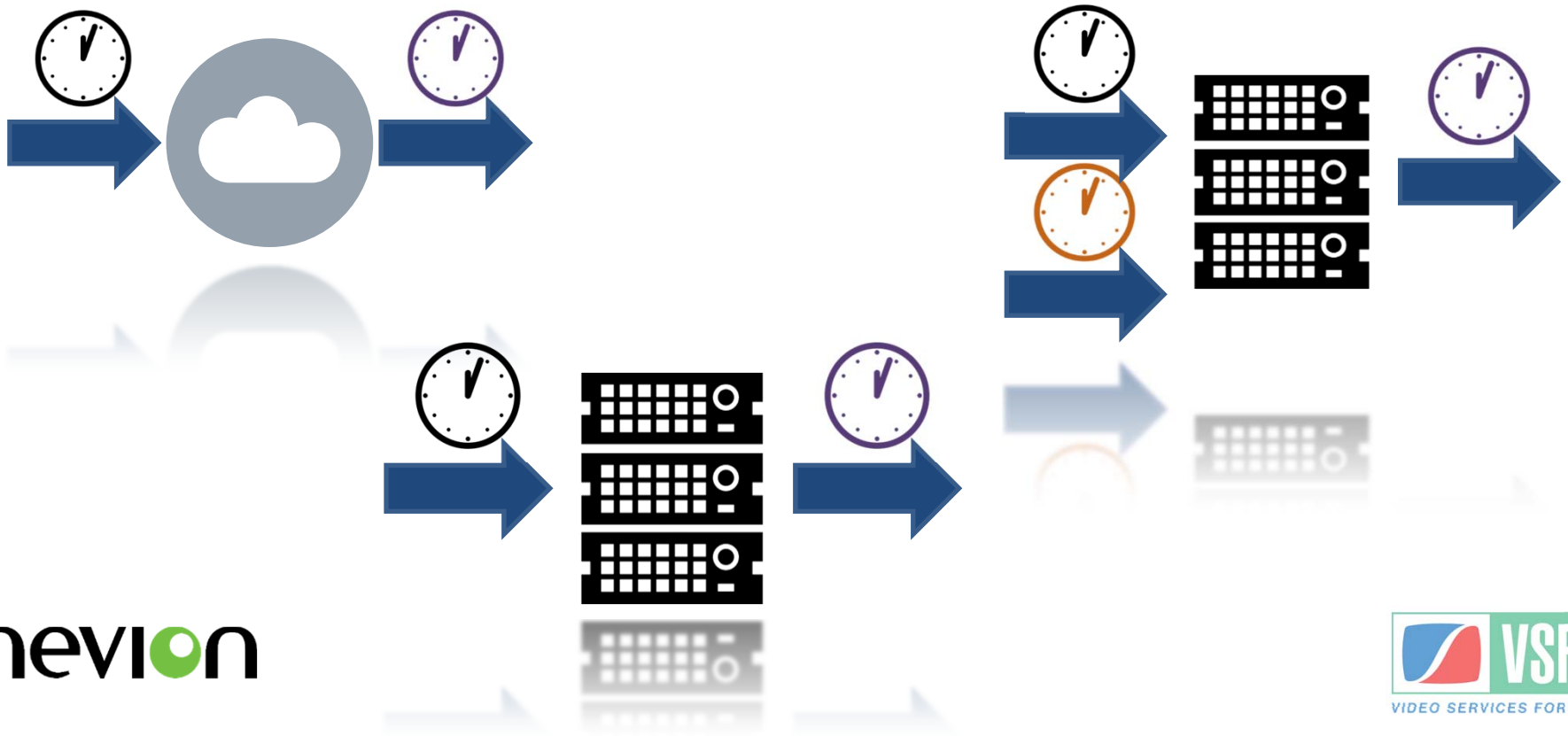
Transit & processing time through system



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Why are we in the current approach?

- ST2110 doesn't actually specify using timing for end2end ☹
- Disconnect between ingress and egress IP on some kit?

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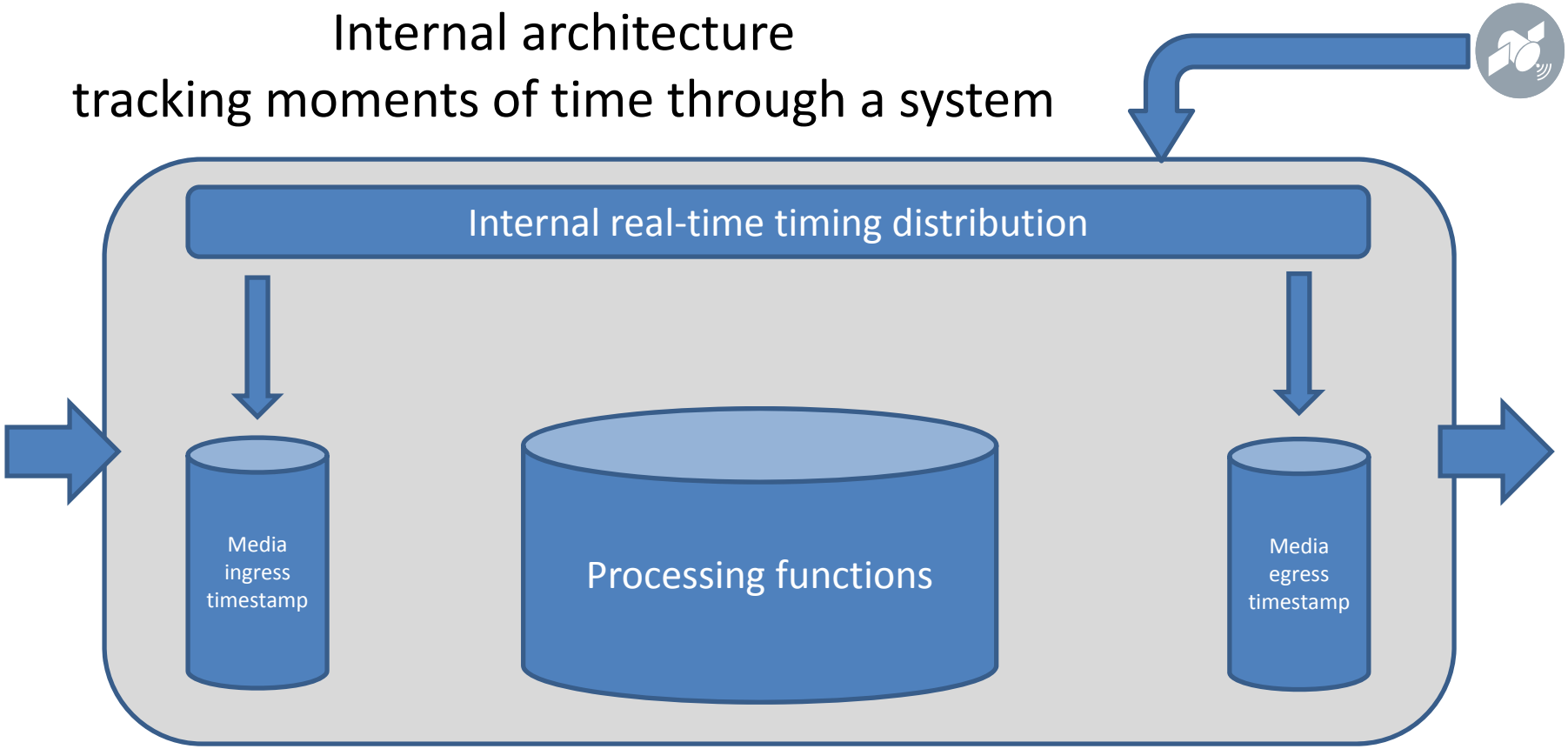
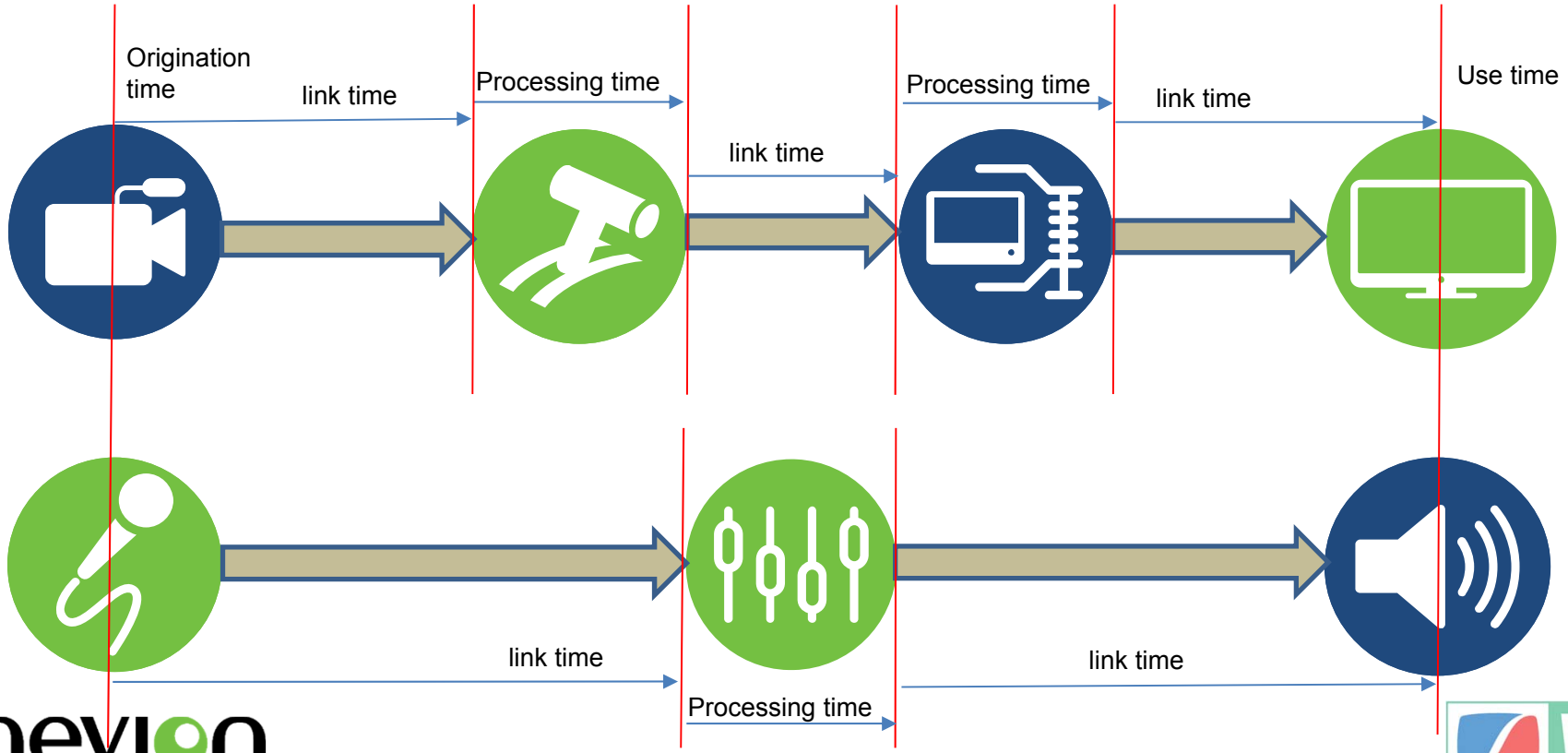
Internal architecture
tracking moments of time through a system



Analogy: PTP transparent clock handling in switches

Tracking time through a production workflow



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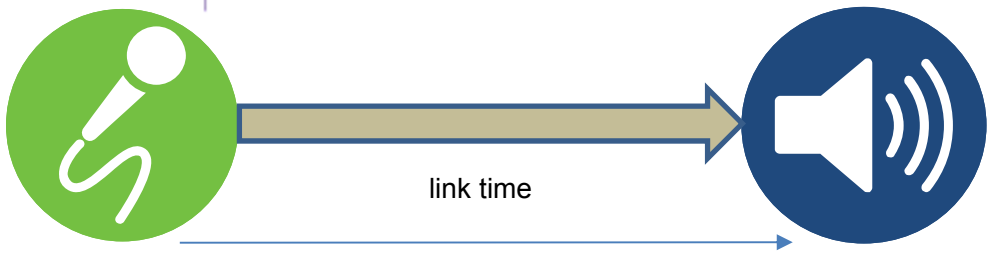
AES67 – defines link offset



VSF TR-03 defined a link offset!(informative)

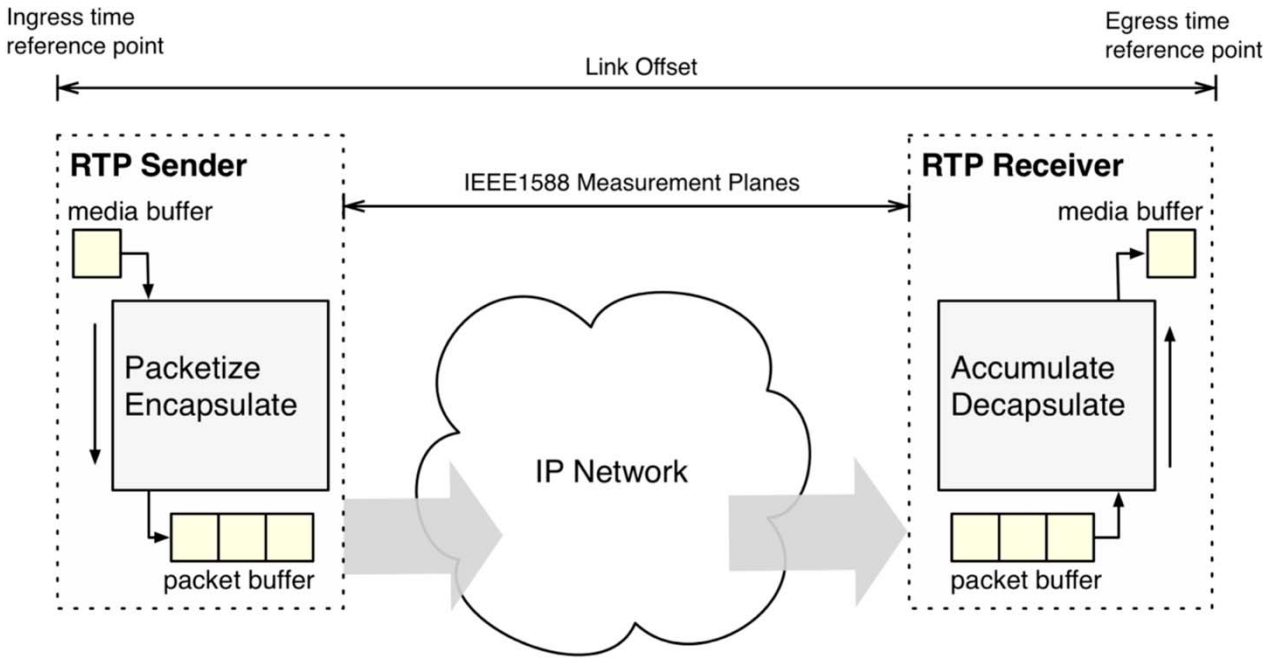


Figure 1: Example of Link Offset and Reference Points (Informative)

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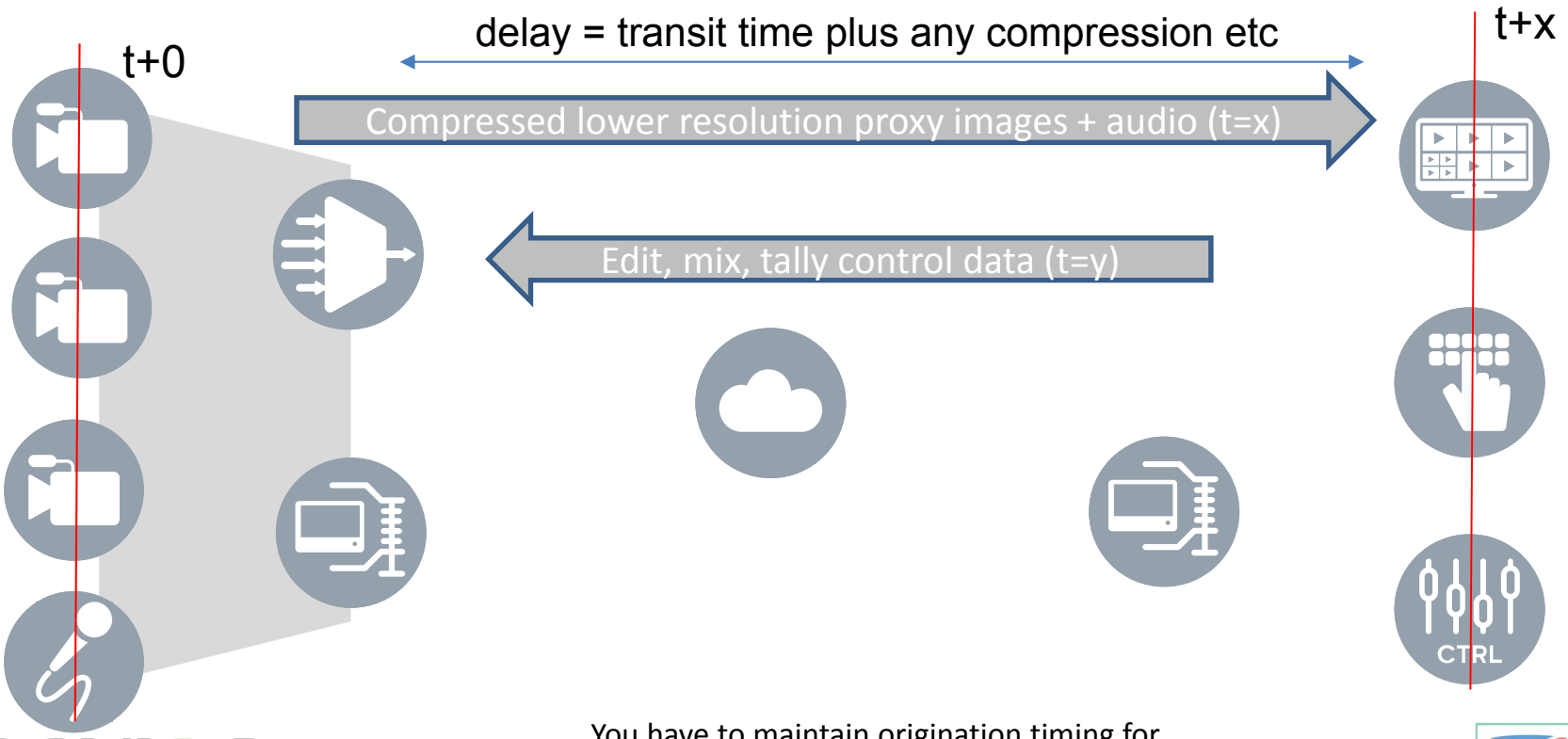
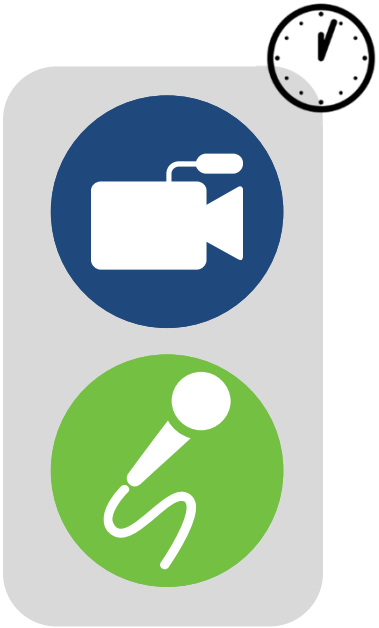
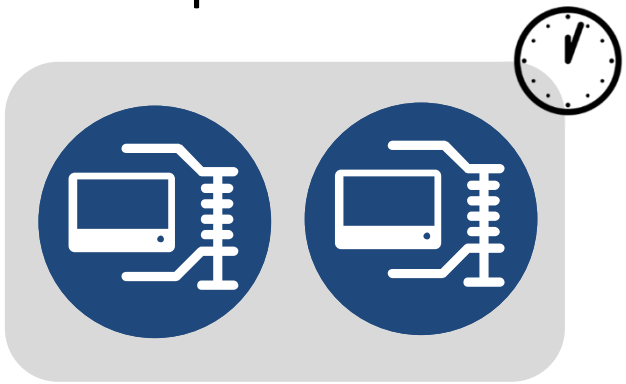
Proxy remote production timing

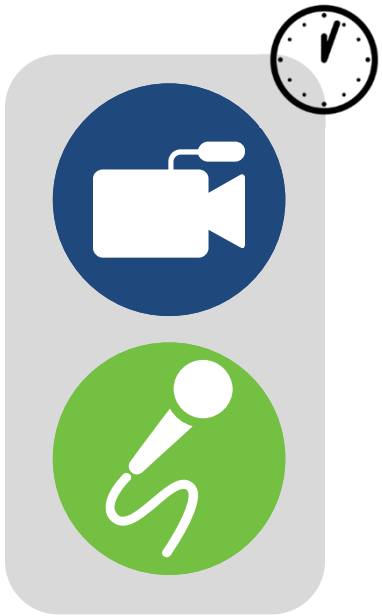


You have to maintain origination timing for all elements for this to solution to work

Distributed production timing







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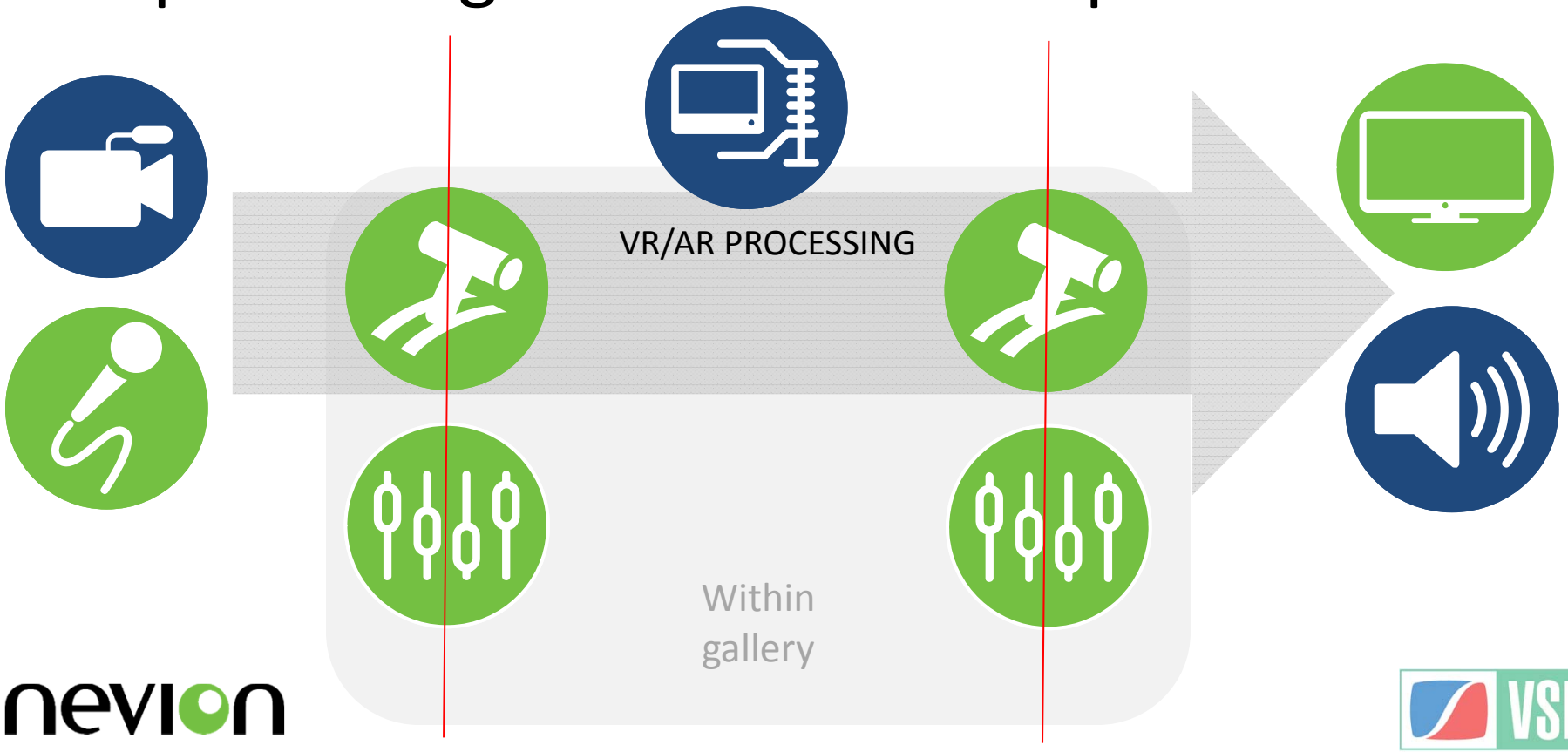
Split timing domains in local production



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Graceful performance
with PTP timing reference

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ST2110 over WAN – update tomorrow ☺

- WA[illegible]tion (FEC / ST2022-7)
- W[illegible]trun[illegible]NA[illegible]
- WAN ti[illegible]
- WAN signallin[illegible]
- WAN 'transcaps[illegible]or
- Latency of low bit rat[illegible]a'[illegible]ows
- WAN transport of other IP data

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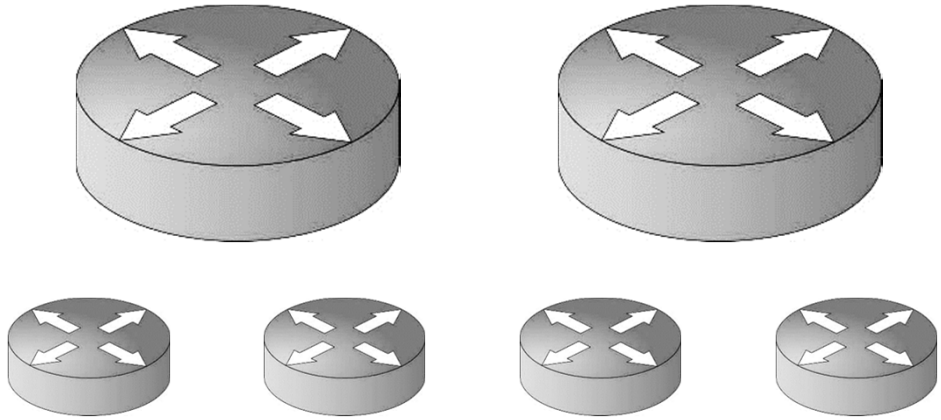
Real time aware media switch timing



Wire-speed

Non-blocking

Coordinated media-time execution

Flow density

PTP support

Port density

Buffer memory

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Making use of the relationship between absolute time and media?

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The IP domain RP168 behaviour equivalence challenges with non media aware switches (P4?)

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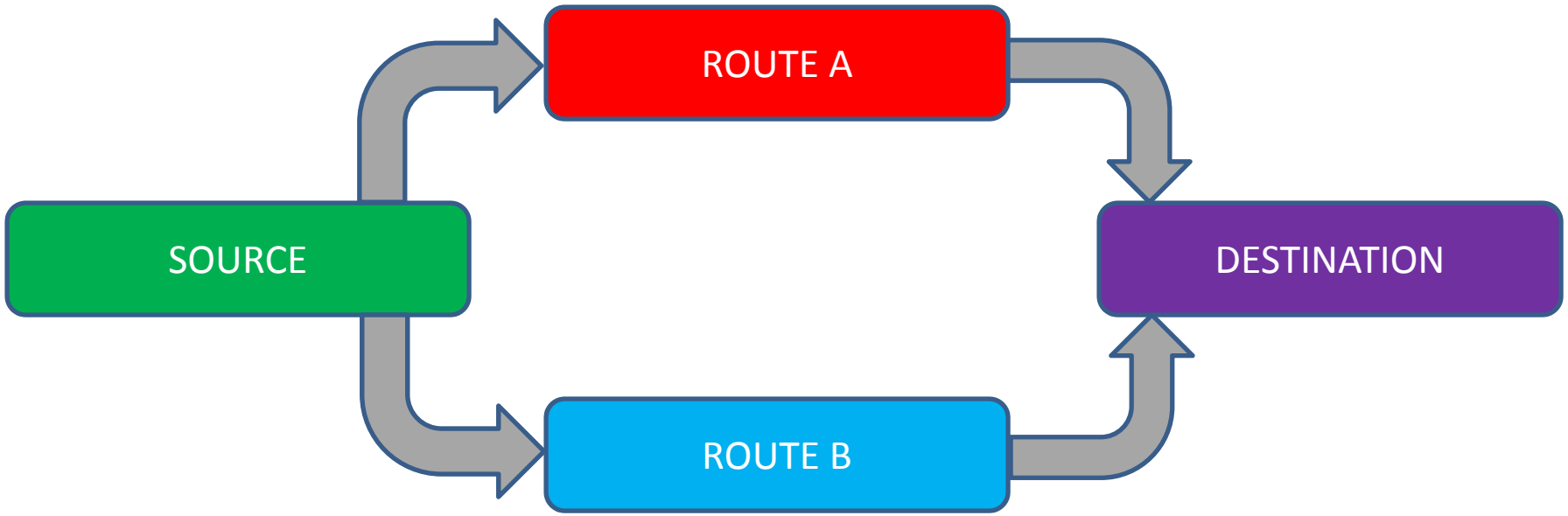
SMPTE2022-7 offset switching



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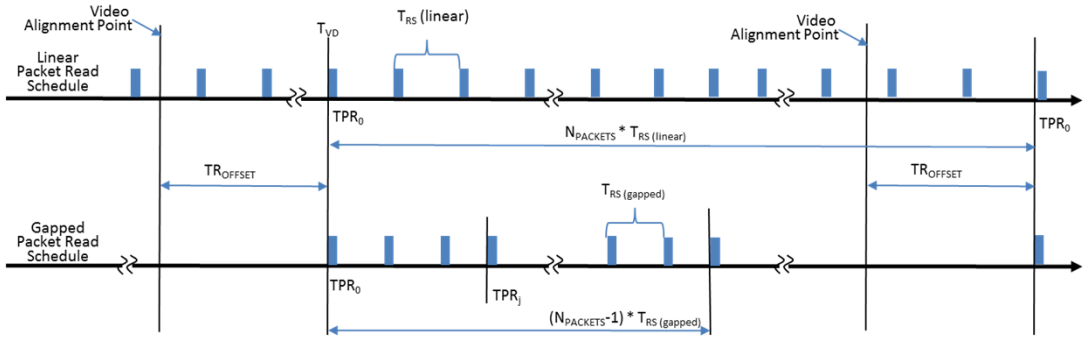
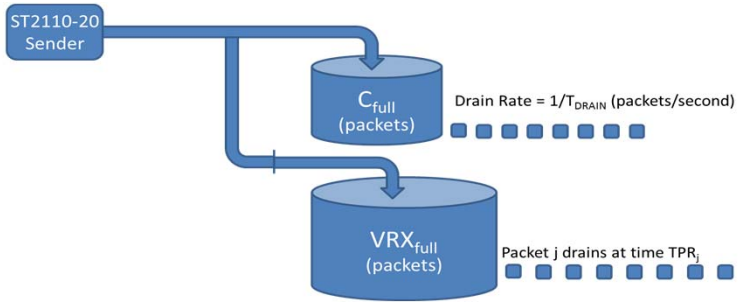
ST2110-21



- When I need to send the IP packet data
- How I need to send IP packet data



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IP from linear SDI
vs server source - results

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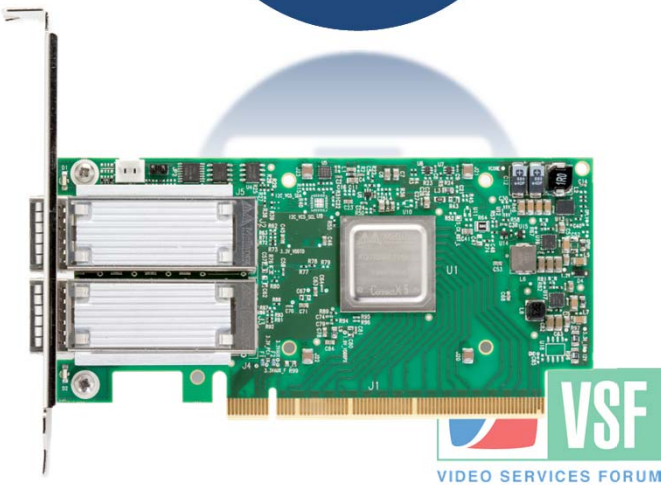

ST2110 containerized soft source performance

Router
Port
Ingress &
Egress

ge-0/0/0	Up	31998101	(16720)	318152300	(24256)
ge-0/0/1	Up	1459002619	(0)	537062711	(3512)
ge-0/0/2	Up	1378090947	(0)	134912514	(1376)
ge-0/0/3	Up	5370585142	(0)	992760300	(3512)
xe-0/0/4	Down	0	(0)	0	(0)
ge-0/0/5	Down	0	(0)	0	(0)
xe-0/0/6	Up	119270799133446	(0)	142109035801206	(3121507328)
xe-0/0/7	Up	158188041037410	(3121486592)	136346854402665	(1128)
ge-0/0/8	Up	293503120	(2680)	2872300654	(29384)
xe-0/0/10	Down	0	(0)	0	(0)
xe-0/0/11	Down	0	(0)	0	(0)
ge-0/0/12	Down	0	(0)	0	(0)
ge-0/0/14	Down	0	(0)	0	(0)
ge-0/0/15	Down	0	(0)	0	(0)
xe-0/0/16	Up	49350888471894	(856)	414280967112367	(4695156224)
xe-0/0/17	Up	0	(0)	81617091	(1128)
xe-0/0/18	Up	7637140	(0)	341594015996061	(4389047808)
xe-0/0/19	Up	7637140	(0)	75031065	(0)
ge-0/0/20	Up	17616847431768	(161783872)	14672888	(0)
ge-0/0/22	Up	6570904	(0)	17615765870279	(161776448)
xe-0/0/24	Up	14507001	(0)	23442241	(0)
xe-0/0/25	Up	14459344	(0)	16661665	(0)
xe-0/0/26	Up	4983927	(0)	136393340887458	(0)
xe-0/0/27	Up	6607287	(0)	16657326	(0)
ge-0/0/28	Up	136385225401	(36544)	76783723839	(42608)
ge-0/0/29	Up	35958945139	(20168)	14580667506	(1670856)
ge-0/0/30	Up	4741331563	(0)	8479625783	(8888)
ge-0/0/31	Up	97134116960	(1661784)	184167616895	(62912)
et-0/1/0	Up	704439434067088	(9057968128)	16637308	(0)
et-0/1/1	Up	5189708112024	(0)	2453488638	(1224)
bme0	Up	0		1629103828	

3 x 2022-6 egress
4 x 2110-20 egress

4 x ST2110-20
+ 3 x 2022-6 ingress

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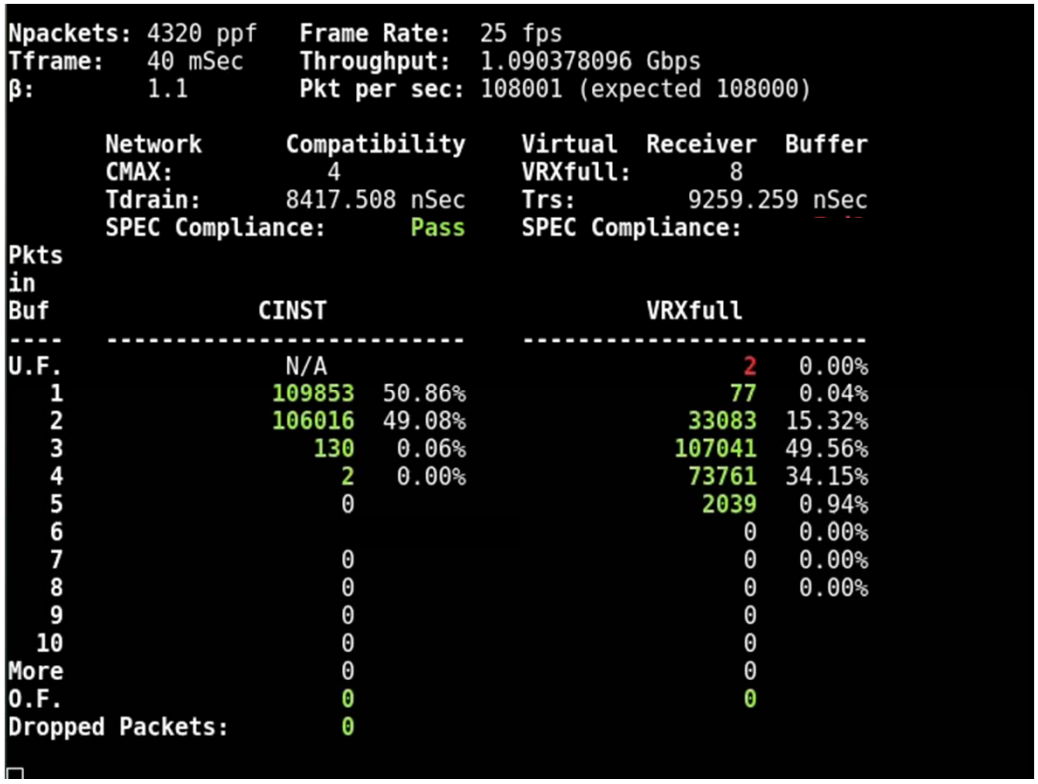
Soft Stream 1

tested using
Mellanox
AnalyzeX

It works well!



```
Npackets: 4320 ppf    Frame Rate:  25 fps
Tframe:   40 mSec     Throughput:  1.090378096 Gbps
β:        1.1         Pkt per sec: 108001 (expected 108000)

      Network      Compatibility    Virtual  Receiver  Buffer
      CMAX:              4          VRXfull:       8
      Tdrain:      8417.508 nSec    Trs:        9259.259 nSec
      SPEC Compliance:      Pass    SPEC Compliance:
Pkts
in
Buf              CINST                      VRXfull
----   -------------------------    -----------------------
U.F.               N/A                        2    0.00%
   1            109853  50.86%                77    0.04%
   2            106016  49.08%             33083   15.32%
   3               130   0.06%            107041   49.56%
   4                 2   0.00%             73761   34.15%
   5                 0                      2039    0.94%
   6                                           0    0.00%
   7                 0                         0    0.00%
   8                 0                         0    0.00%
   9                 0                         0
  10                 0                         0
More                  0                         0
O.F.                  0                         0
Dropped Packets:      0
```

ST2110 senders

N ✓

Narrow
Typically hardware based
Linked to linear active-raster-based video
Small buffering requirement
Capable of low latency chaining

NL ✓

Narrow linear
Image based – not active raster
Small buffering requirement
Low latency when not raster interfaced
Containerised software can achieve this

W ✓

Wide
Typically software based using NIC
Not linear raster related
Larger buffering required
Low latency when not raster interfaced

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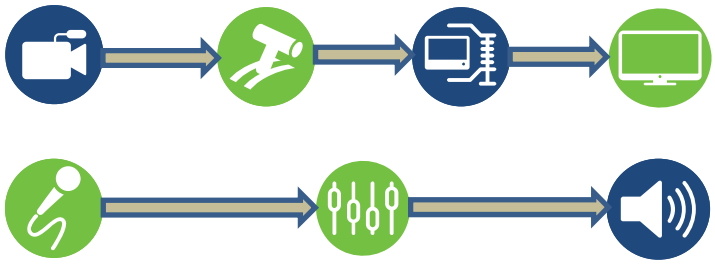
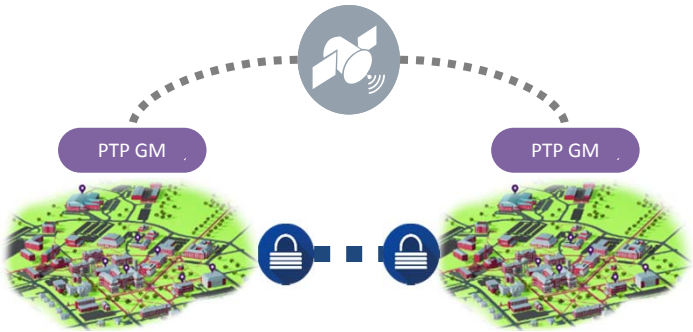
In conclusion…





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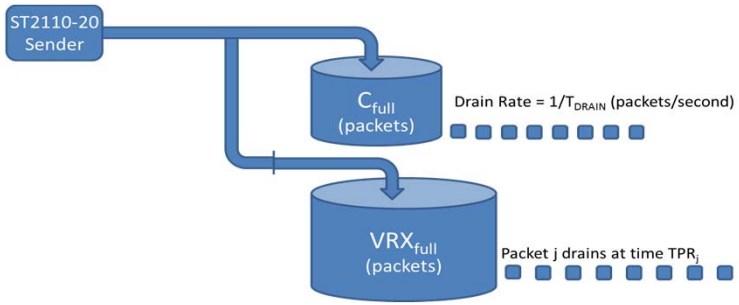

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Friends, when you are next in the UK, a reminder to please come and join me for a lovely cup of tea ☺

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Thank You

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