# SMPTE ST-2110

## In Real World Applications

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# Agenda

- Moving to IT, IP and cloud
- Heritage of standards
- SMPTE ST 2110 essentials

- Design considerations for fixed facilities
- Design considerations for WAN

# Flexible Building Blocks

Video/Audio

Audio/Data

Coax

FST

Cat-5

SDI

Router

IT outpaces Broadcast in scale, investment and developments.

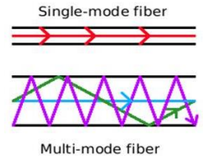
Transport layer scales beyond broadcast bitrates and routing technology scales beyond broadcast routers

IT environments provide high utilization (multi-purpose hw) and open for moving workloads to public cloud

Using software components makes workflows easier to automate.

Connectors and cables are multi-purpose

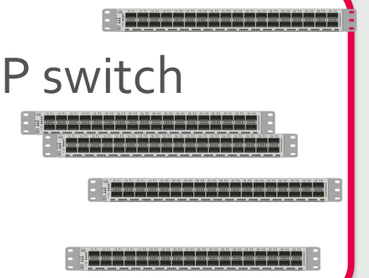
Data




Single

Multi

IP switch



# Comes with new challenges…

## Reliability

- New mechanisms for recovery from glitches, faults and failures
- Guarantee bandwidth
- Isolation to protect against faulty configuration / faulty equipment equipment flooding

## Timing

Synchronize all sources feeding into the same production

## Multicast

IP infrastructure supports multicast, but was never designed for broadcast requirements.

## Security and separation

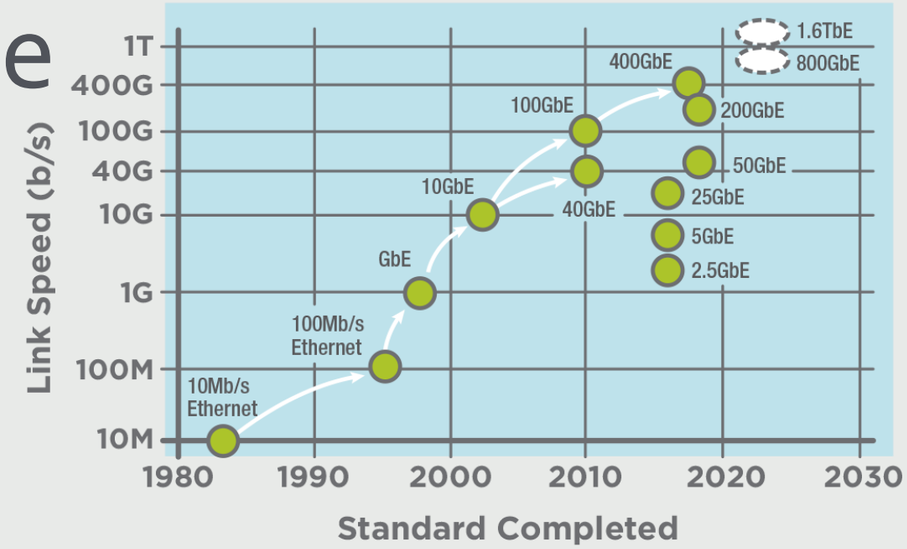
Avoid malicious attacks, faults and misconfiguration

## Cost of ownership

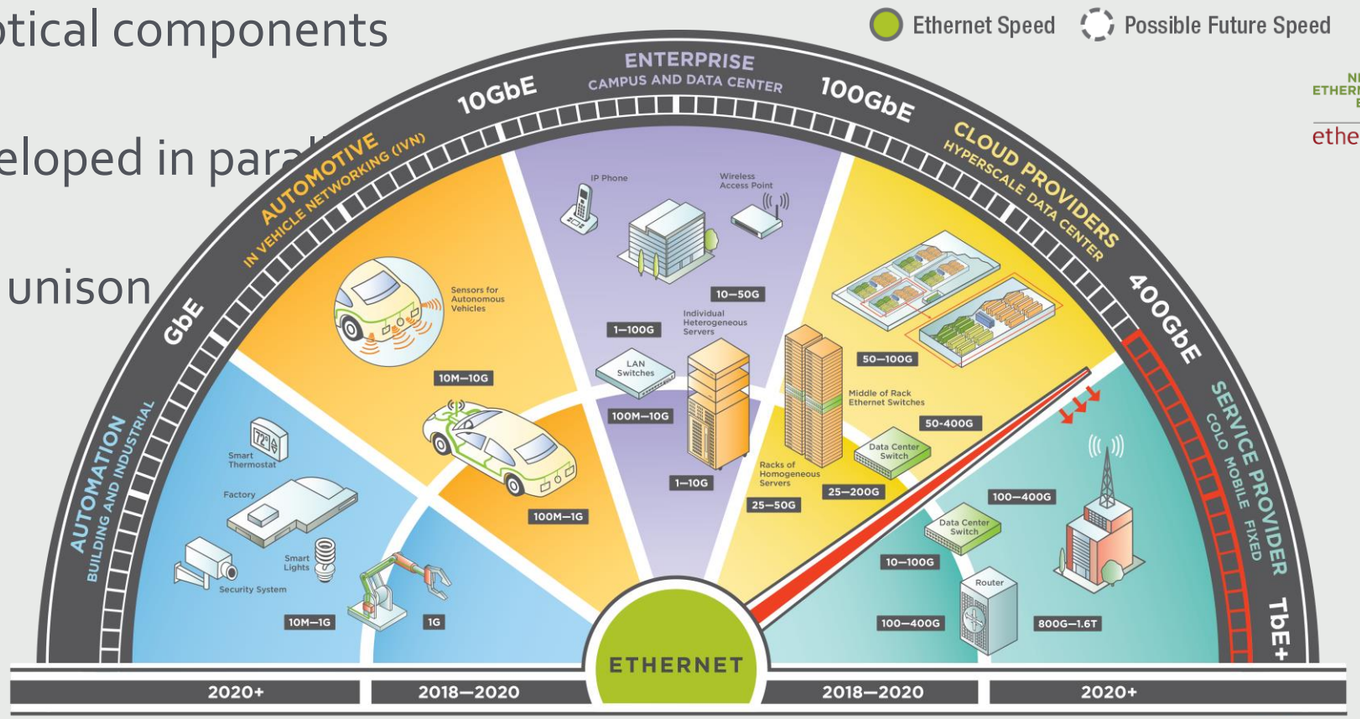
It is not always the right choice

- Smaller scale (sub 500[2] systems)

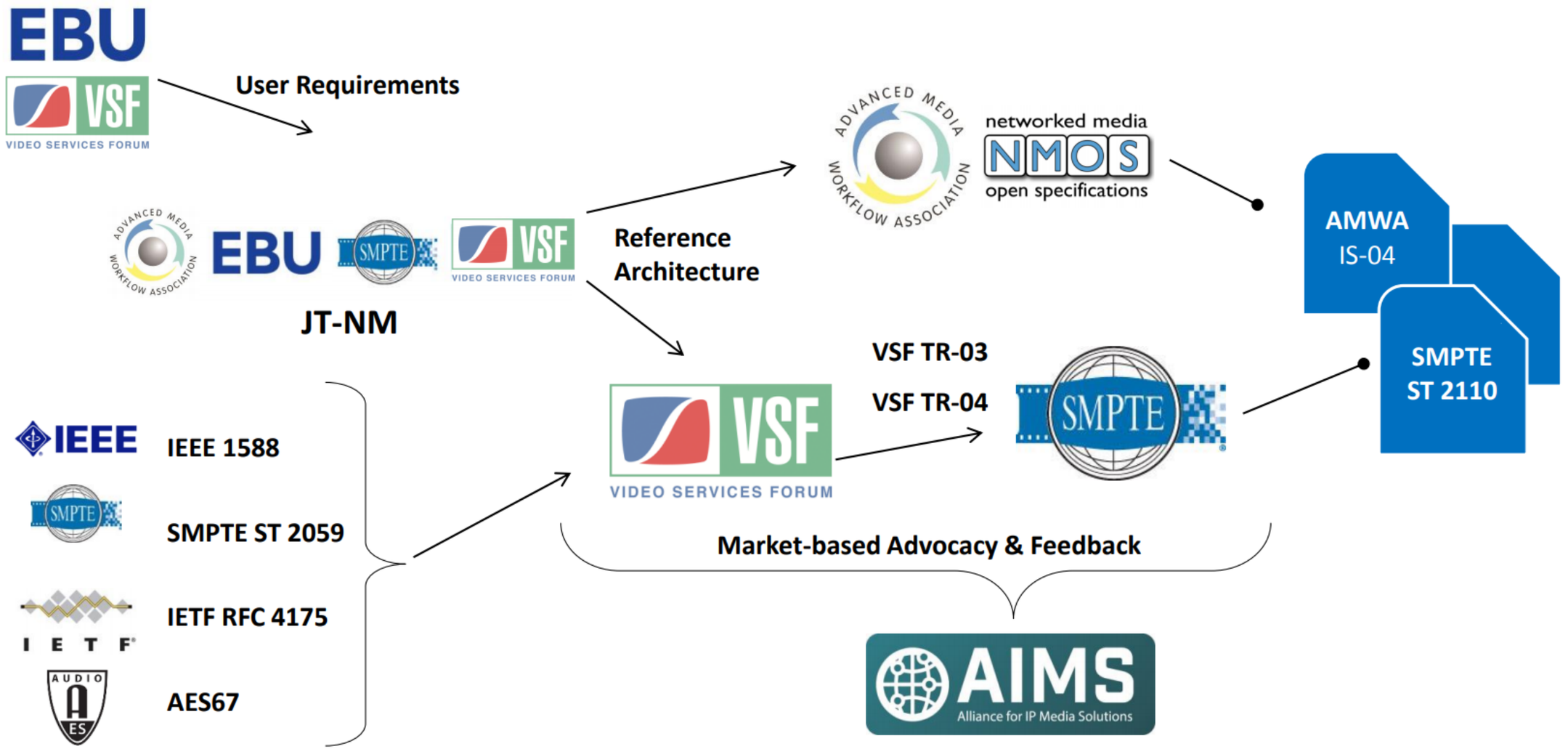
# Ethernet Alliance



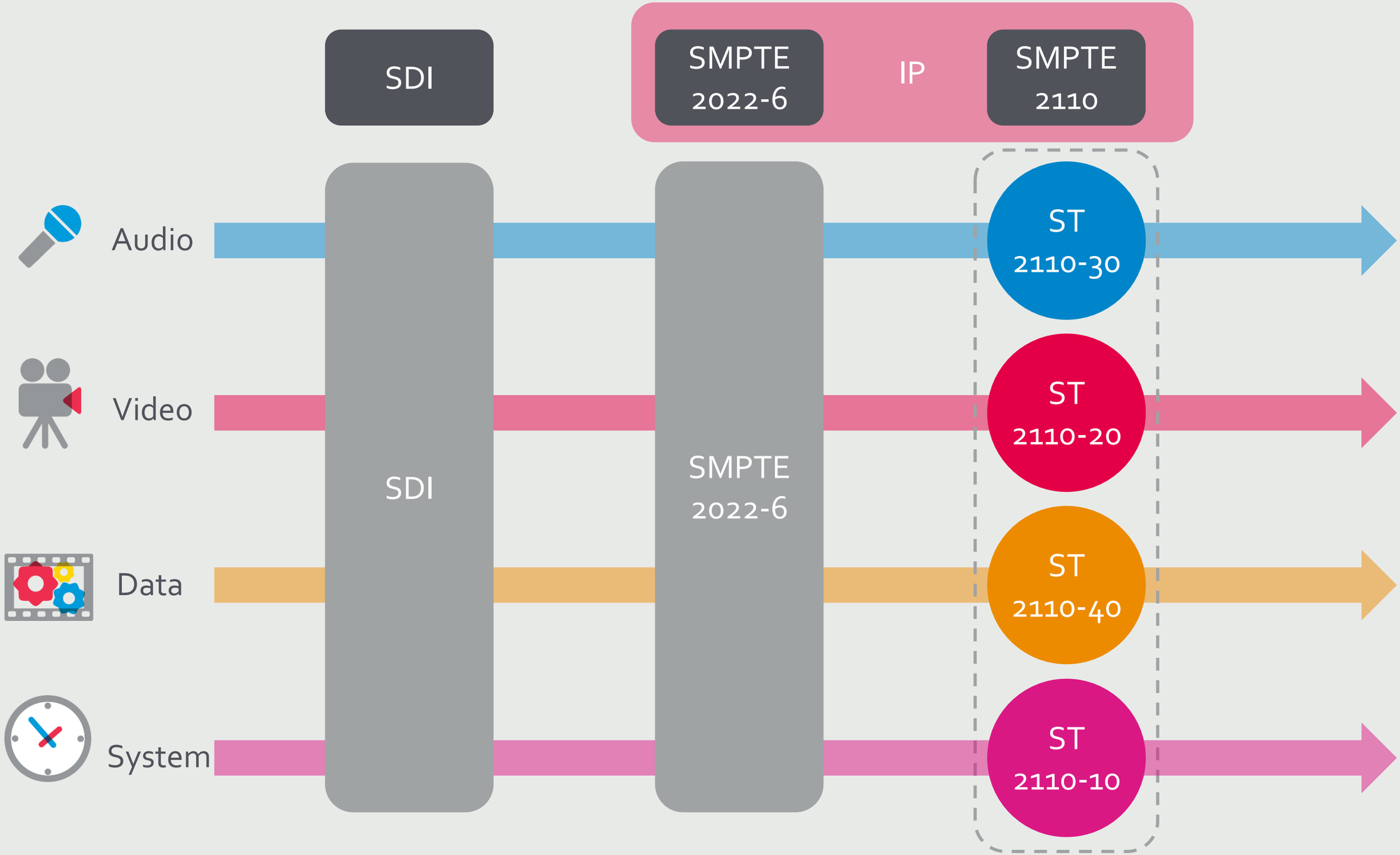

- The Ethernet Alliance roadmap is based on input from users
- It represents current capability and future expectations
- Component manufacturers target the roadmap, working hard to
  deliver the necessary router chips and optical components
- NIC cards, IP Routers and Optics are developed in para
- The entire eco-system moves forward in unison
- Funded for the Global IT Market
  $3.7 Trillion 2018 (gartner.com)
  Broadcast Market $3.3 Billion



# Heritage of IP Standards



# ST-2110 Essentials


SDI
SMPTE
2022-6
IP
SMPTE
2110
Audio
Video
Data
System
SDI
SMPTE
2022-6
ST
2110-30
ST
2110-20
ST
2110-40
ST
2110-10

# ST 2110 Key points

SMPTE ST 2110 – 10
System – RTP, SMPTE ST 2059, SDP

- RTP stream over UDP
- Multicast (IGMPv2/3) or Unicast
- One SDP per RTP Stream
- PTP - SMPTE ST 2059-1&-2

SMPTE ST 2110 – 20
Video - Based on RFC 4175

- Raster size up to 32x32
- Format agnostic (frame, colour space, bit depth, TCS)
- Saves bandwidth

SMPTE ST 2110 – 21
- Traffic shaping - Narrow, Narrow Linear, Wide

SMPTE ST 2110 – 40
Ancillary Data – RFC 8331 which is based on SMPTE ST 2038

- Not strictly "SDI abstracted data" - no audio (HANC)
- VANC data - CC. SCTE, VITC, AF, VChip)
- RTP time stamps for sync with video

SMPTE ST 2110 – 30
Audio - Based on AES67 & RFC 3190

- Uncompressed PCM Audio
- 48KHz Sampling
- 16 - 24 bit depth
- Channel count & timing defined in levels
- A - C

SMPTE ST 2110 – 31
- Future - Compressed Audio

# ST 2110-21 | Traffic Profile

SMPTE ST 2110 – 21 (Traffic Shaping and Delivery Timing)

Specifies the packet emission timing and other network traffic parameters to ensure error free data transmission through an IP network. It provides for 3 traffic profiles: N, NL and W which are suitable for different devices such as pure software senders or FPGA based senders. It sets basic parameters for bandwidth overhead in a network segment and memory capacity in a router.

- Type N Senders ➔ Distribute the pixels of the video raster during the active portion of the frame with nearly zero latency and packet delay variation.
- Type NL Senders ➔ Distribute the pixels of the video raster across the entire duration of the frame with nearly zero latency and packet delay variation
- Type W Senders ➔ Allow for increased variation, or bursts, in packet emission. Care should be taken to ensure that traffic design supports simultaneous peak bursts without packet loss in the router.
- Beta, or Bandwidth overhead is recommend to be 1.1 (10%)
- Cmax, varies by type, and sets the peak rate for packet burst duration

| *Transmitter* \ *Receiver* | N | W |
|---|---|---|
| N | ✓ | ✓ |
| W | X | ✓ |

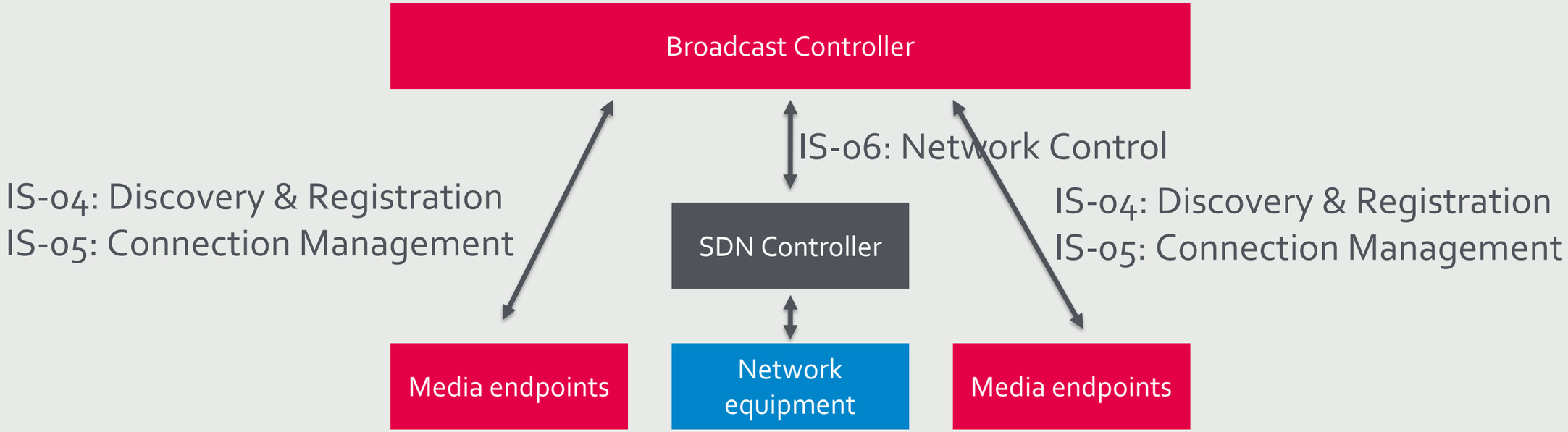
# ST 2110-30 | Audio Levels

SMPTE ST 2110 – 30 (Uncompressed Audio – RFC 3190)

| Level(s) | Supported by the Receiver |
|---|---|
| A | Reception of 48 kHz streams with from 1 to 8 channels at packet times of 1 ms |
| AX | Reception of 48 kHz streams with from 1 to 8 audio channels at packet times of 1 ms. Reception of 96 kHz streams with from 1 to 4 channels at packet times of 1ms |
| B | Reception of 48 kHz streams with from 1 to 8 channels at packet times of 1 ms or 1 to 8 channels at packet times of 125 µs |
| BX | Reception of 48 kHz streams with from 1 to 8 channels at packet times of 1 ms or 1 to 8 channels at packet times of 125 µs. Reception of 96 kHz streams with from 1 to 4 channels at packet times of 1ms or 1 to 8 channels at packet times of 125 µs |
| C | Reception of 48 kHz streams with from 1 to 8 channels at packet times of 1 ms or 1 to 64 channels at packet times of 125 µs |
| CX | Reception of 48 kHz streams with from 1 to 8 channels at packet times of 1 ms or 1 to 64 channels at packet times of 125 µs. Reception of 96 kHz streams with from 1 to 4 channels at packet times of 1ms or 1 to 32 channels at packet times of 125 µs |

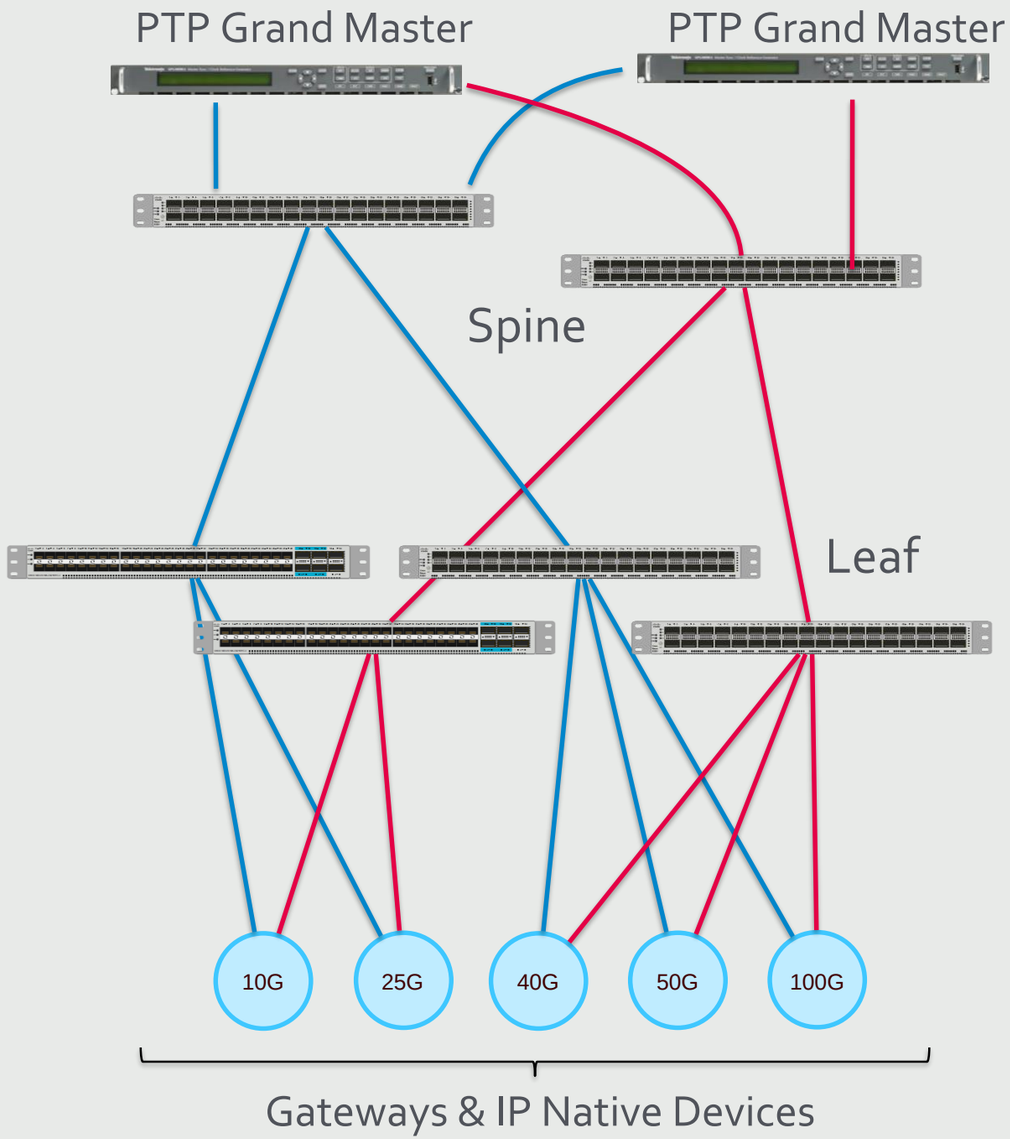
# Network & Resource Control

AMWA NMOS

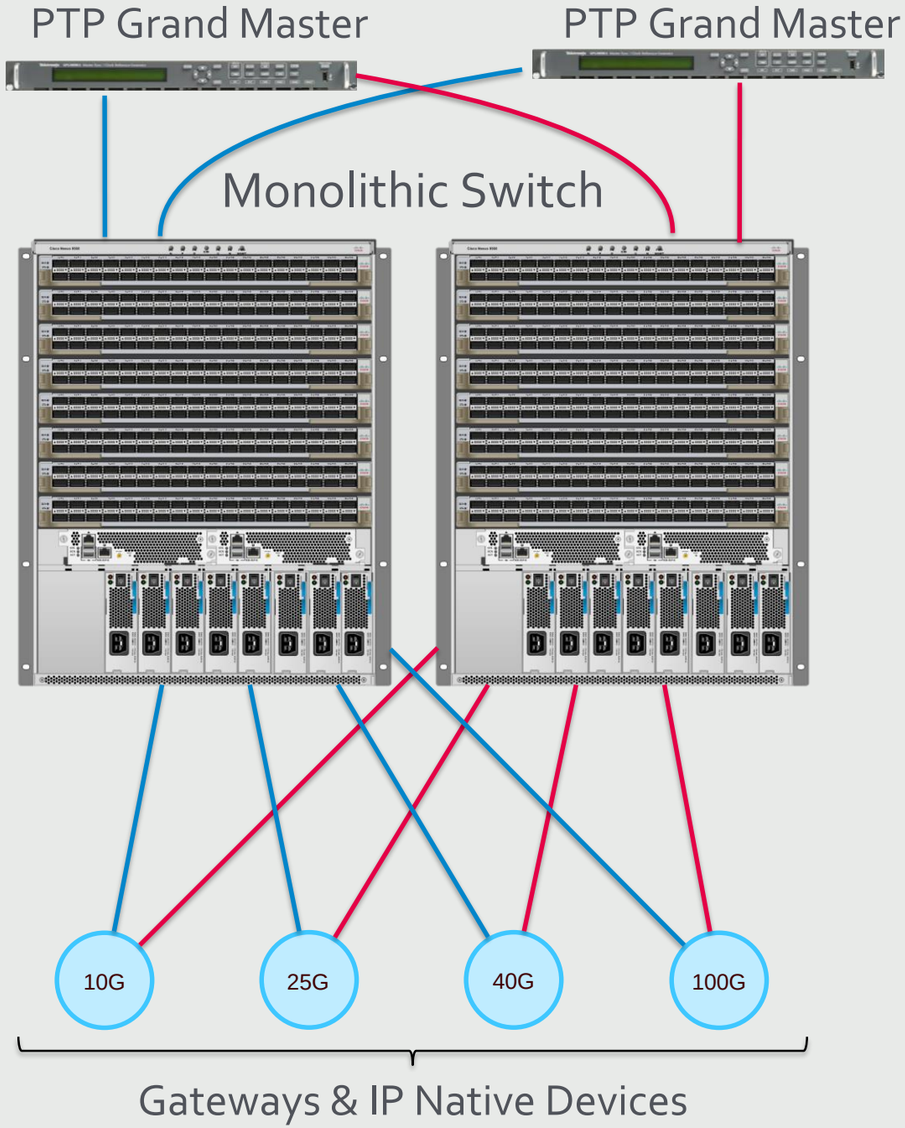


# Design Considerations for Fixed Facilities

# Common Topologies

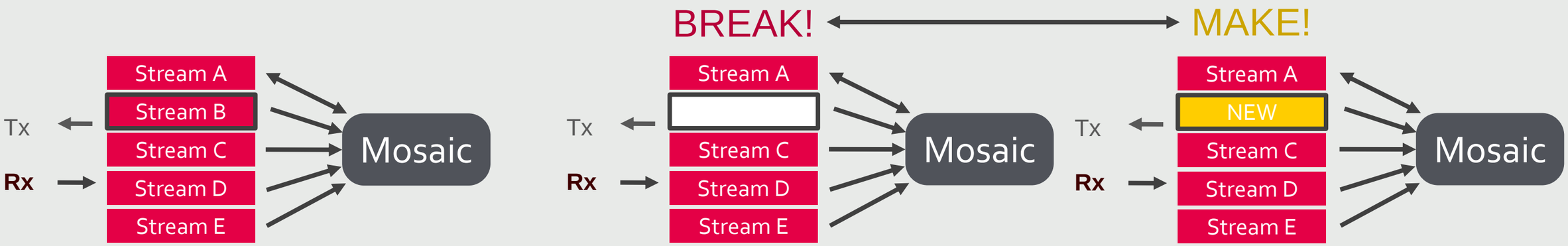



2022-7
Seamless
Switching

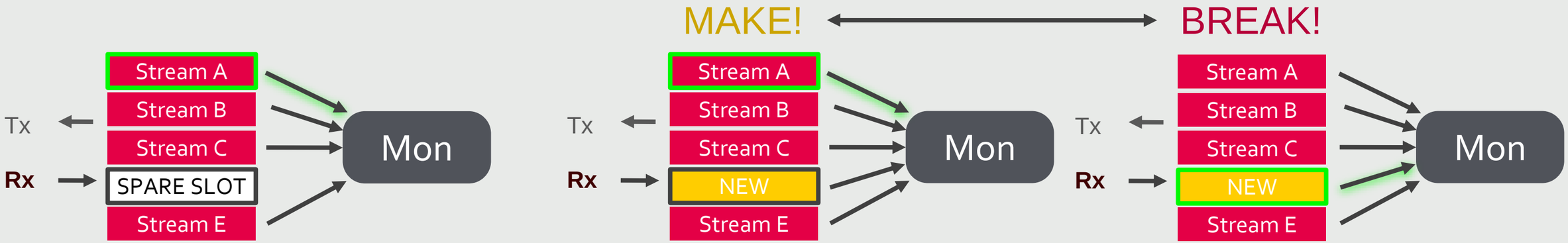


# IP Switching Options

**Break-before-Make (BBM)** Clean, fast, visibly undetectable (One frame buffer & repeat)




**Make-before-Break (MBB)** 'Clean' (Switches on frame boundary)



# Design Considerations

The following considerations apply to any facility switching to IP, these are questions that need to be considered before moving into the design stage.

General
- Scale of system - 500x500 plus?
- Redundancy on all devices?
- Amount of devices?
- Number of clean and dirty switching routes?
- Blocking or non-blocking?

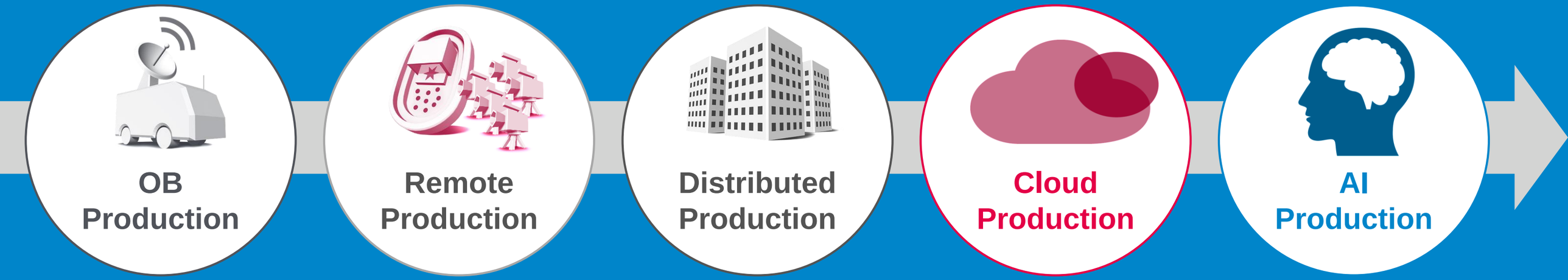
Devices
- Devices Traffic shaping compatibility (N/NL/W)?
- Confirm Audio Levels agreed (A,B,C or Mix)?
- Timing, calculate jitter in signal flow vs receive level A/B/C?
- 2022-7 compatibility on NIC?
- Control - In-bound or Out?

Switch
- Leaf and Spine vs Single Chassis Switch?
- Single Sided or 2022-7?
- Port Speeds - 10G, 25G. 40G, 50G, 100G, 400G?
- Switch Boundary PTP or Transparent?
- Distance between switches and devices?

Control & Monitoring
- Integration with existing systems?
- Switches Managed or Unmanaged (L2/L3 SDN)
- IGMPv2 or v3?
- SNMP, API?
- Hierarchical Software solution or Single Application?

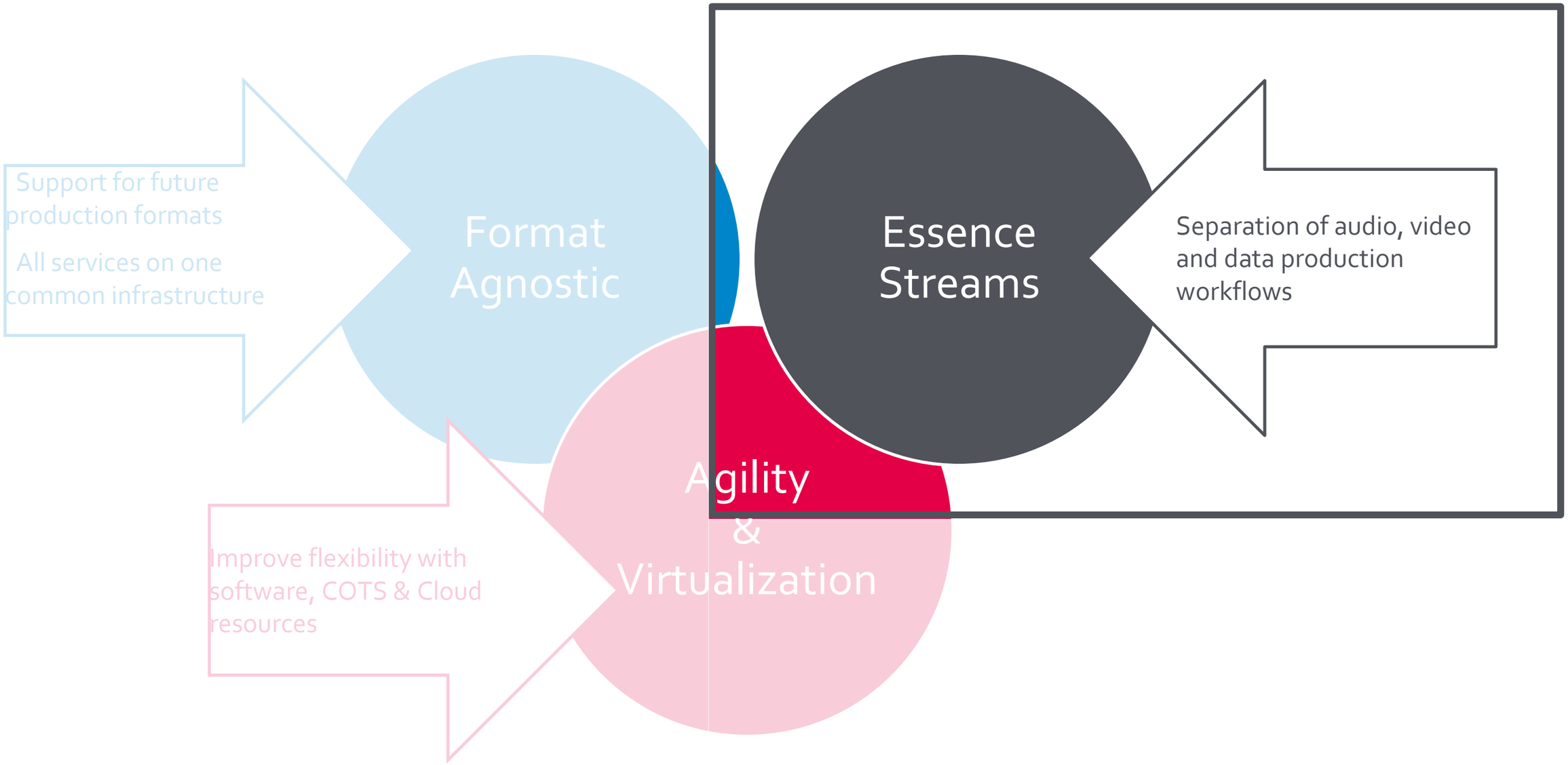
# Design Considerations for WAN

# The shift to SMPTE 2110 is driven by the transformation of live production




*A transformation that is making the WAN the center piece of every single production workflow.*

# How is ST-2110 improving distributed production?



# And what are the challenges of introducing ST-2110 in the WAN?

Retain essence streams

Keep audio, video, data separate

Control traffic

Isolate traffic
Reserve bandwidth
Manage bursts

Manage timing

Transport sync

ON ANY INFRASTRUCTURE

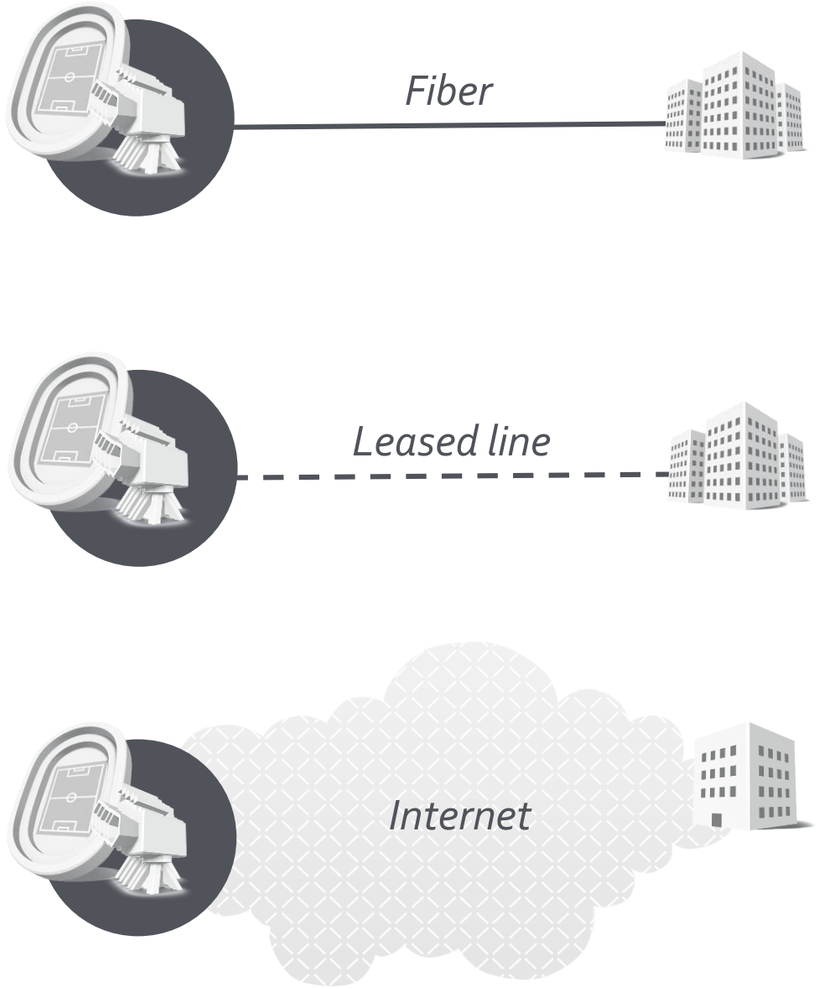
# What do we mean by any infrastructure?

## Workflow consistency
no matter the

- Distance
- Mix of traffic
- Network load

## And no matter the type of connection

- Dedicated Fiber or OTN
- Leased Carrier Ethernet/IP services
- Public infrastructure (internet)
- Wireless (4G/5G/radio links)
- Cloud direct connect services



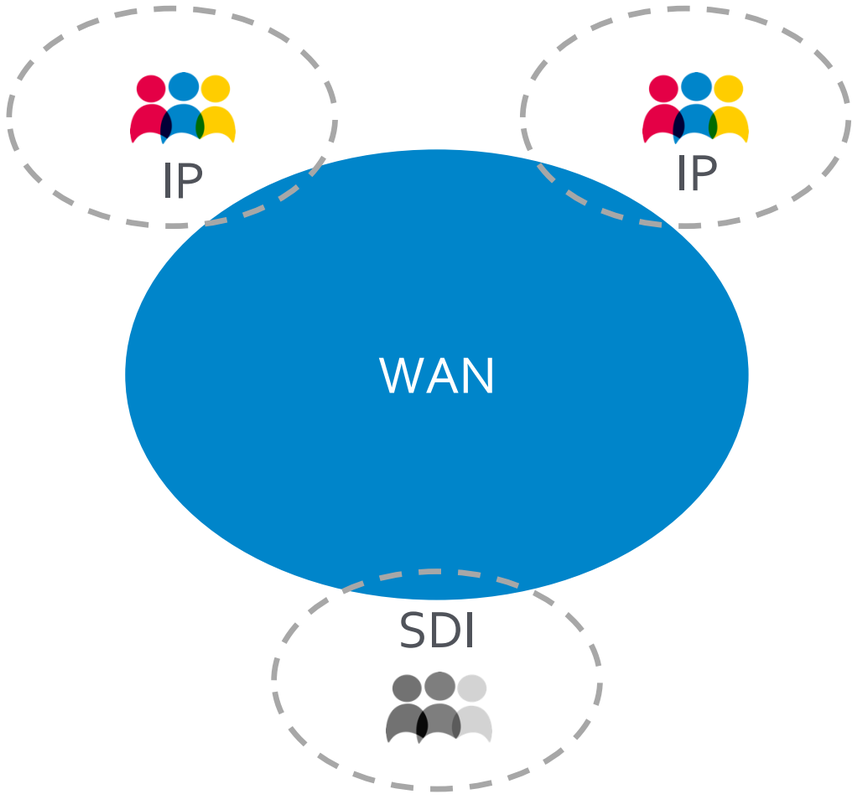
# Hybrid Alternatives

#1 - Convert at the edges to synchronous transport

- IS 04/05 signaling at edge of WAN.
- Conversion of signals to SDI at edge.

#2 - Migrate to broadcast quality Ethernet transport

- IS 04/05 signaling at conversion to legacy.
- Signals are converted to ST 2110 at the edge.
- All transport consolidated to broadcast quality Ethernet with support for strict BW reservation and essence stream transport.



# Thank you!