
Orchestration and SDN control for multi-vendor ST 2110 workflows
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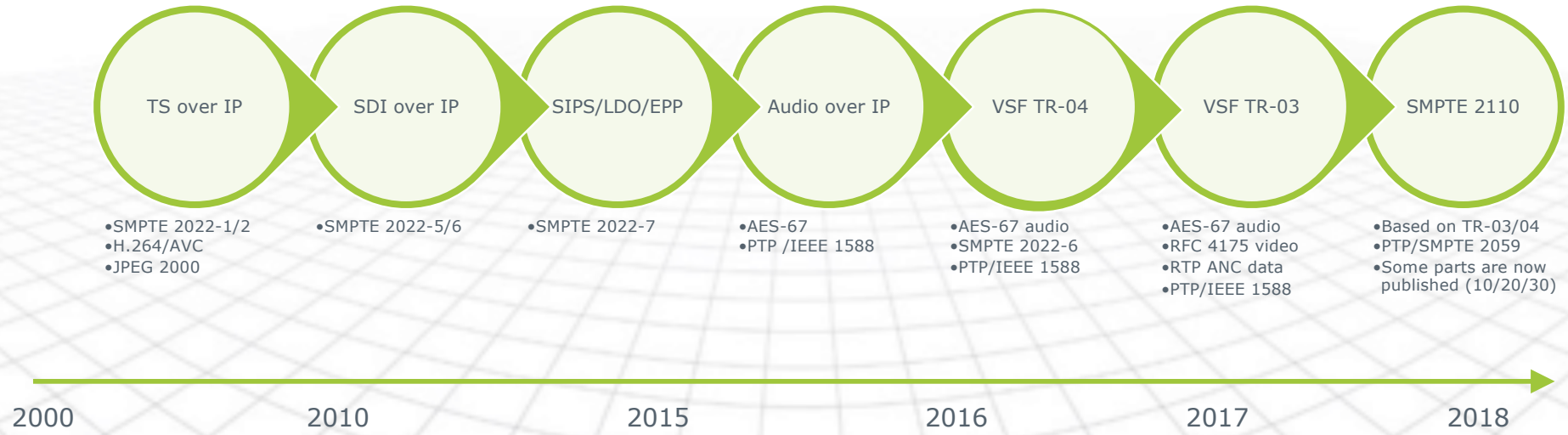
ARCHITECTS OF VIRTUALIZED MEDIA PRODUCTION

Standards evolution for IP production



Open standards

Defining *standards*

Implementing *standards*

Testing *standards*

Promoting *standards*

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Enables certification

http://jt-nm.org/jt-nm_tested/

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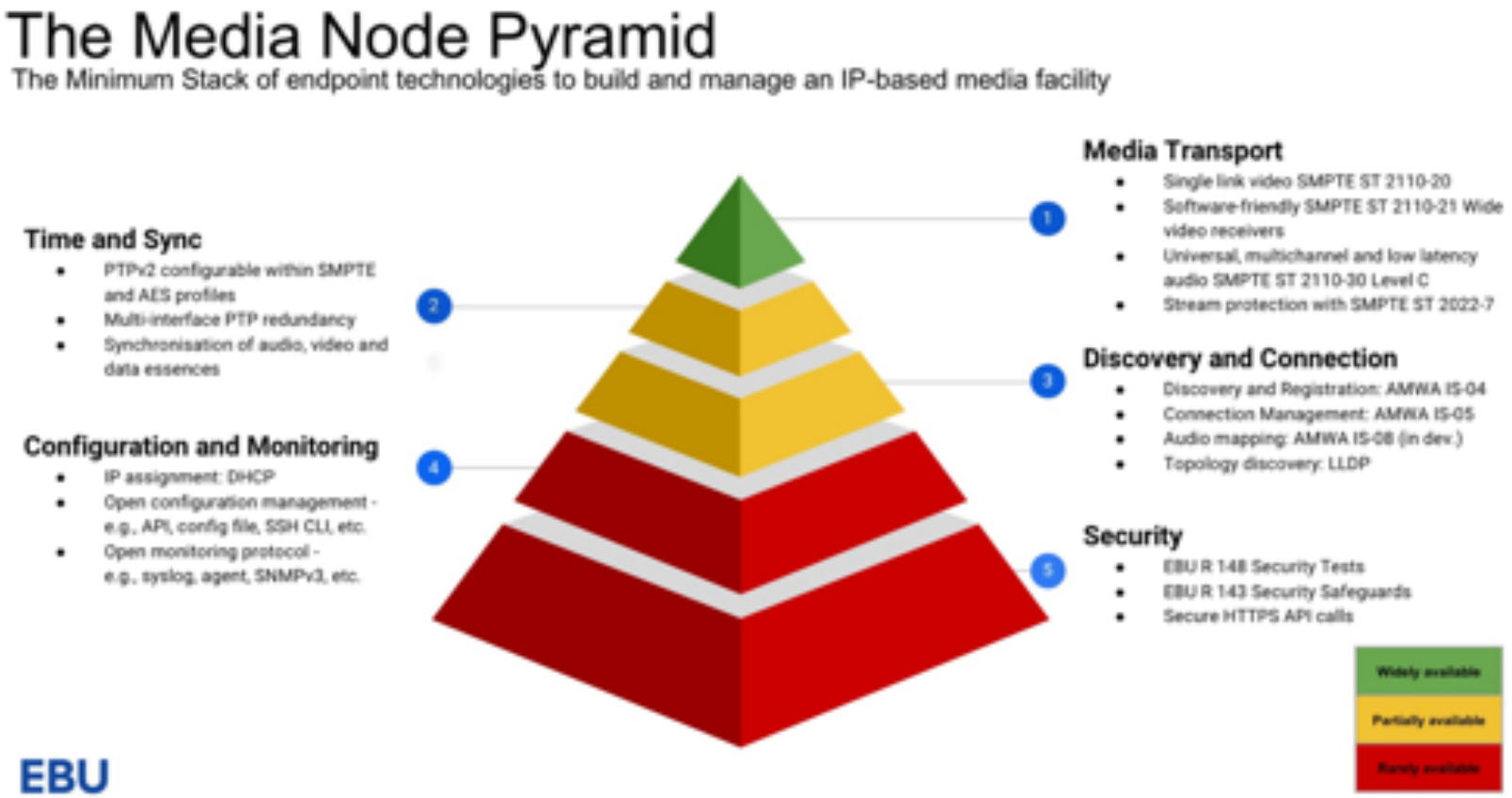
SMPTE ST 2110 suite

Guidance


The Media Node Pyramid
The Minimum Stack of endpoint technologies to build and manage an IP-based media facility
Time and Sync
PTPv2 configurable within SMPTE and AES profiles
Multi-interface PTP redundancy
Synchronisation of audio, video and data essences
Configuration and Monitoring
IP assignment: DHCP
Open configuration management - e.g., API, config file, SSH CLI, etc.
Open monitoring protocol - e.g., syslog, agent, SNMPv3, etc.
1
2
3
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5
Media Transport
Single link video SMPTE ST 2110-20
Software-friendly SMPTE ST 2110-21 Wide video receivers
Universal, multichannel and low latency audio SMPTE ST 2110-30 Level C
Stream protection with SMPTE ST 2022-7
Discovery and Connection
Discovery and Registration: AMWA IS-04
Connection Management: AMWA IS-05
Audio mapping: AMWA IS-08 (in dev.)
Topology discovery: LLDP
Security
EBU R 148 Security Tests
EBU R 143 Security Safeguards
Secure HTTPS API calls
Widely available
Partially available
Rarely available
EBU

Orchestration

Broadcast **media transport**

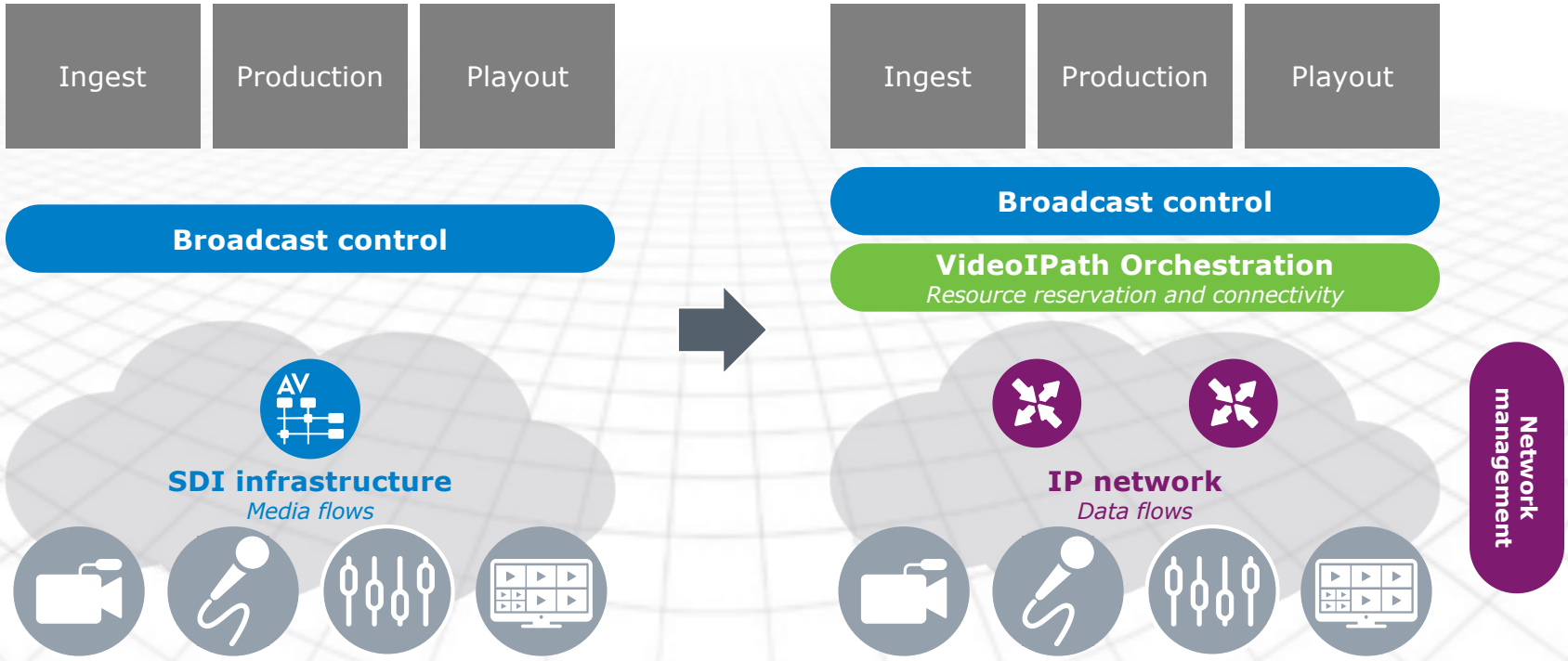
Meeting the **live broadcast challenge**

SDI infrastructure is

optimized for broadcast

Media-centric, high performance, deterministic routing, low latency, fast switching, etc

Orchestration is the key for SDI to IP migration!



Why **Orchestration**?

- **Share** resources between productions
- **Automate** production workflows
- **Schedule** service provisioning
- Adapt to changing needs
- Flexibly utilize **resource pools**
- **Virtualize** resources on-demand

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tpc | Metechno

Real-world deployment

About **tpc**

- Leading broadcast service provider in Switzerland
- Responsible for the production and technology of television, radio and multimedia for national broadcaster Schweizer Radio und Fernsehen (SRF)

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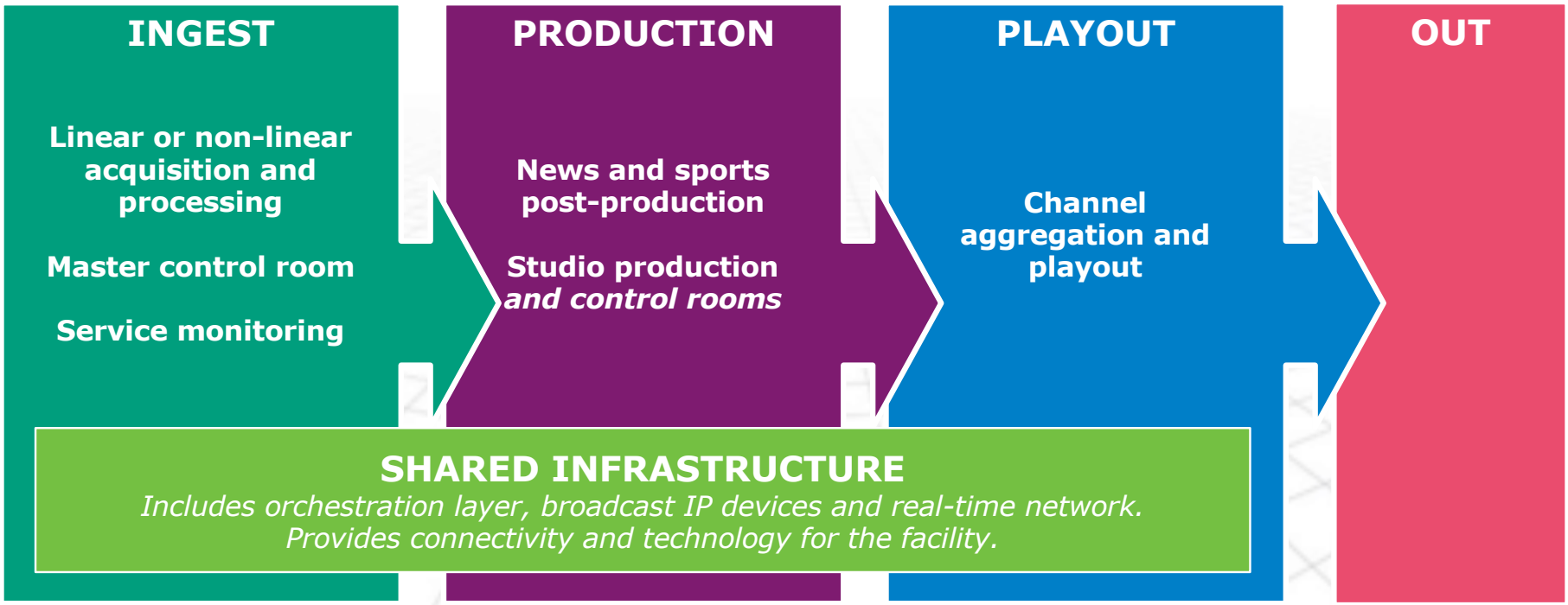
Move to new News, Sports & Technology Center
November 2019

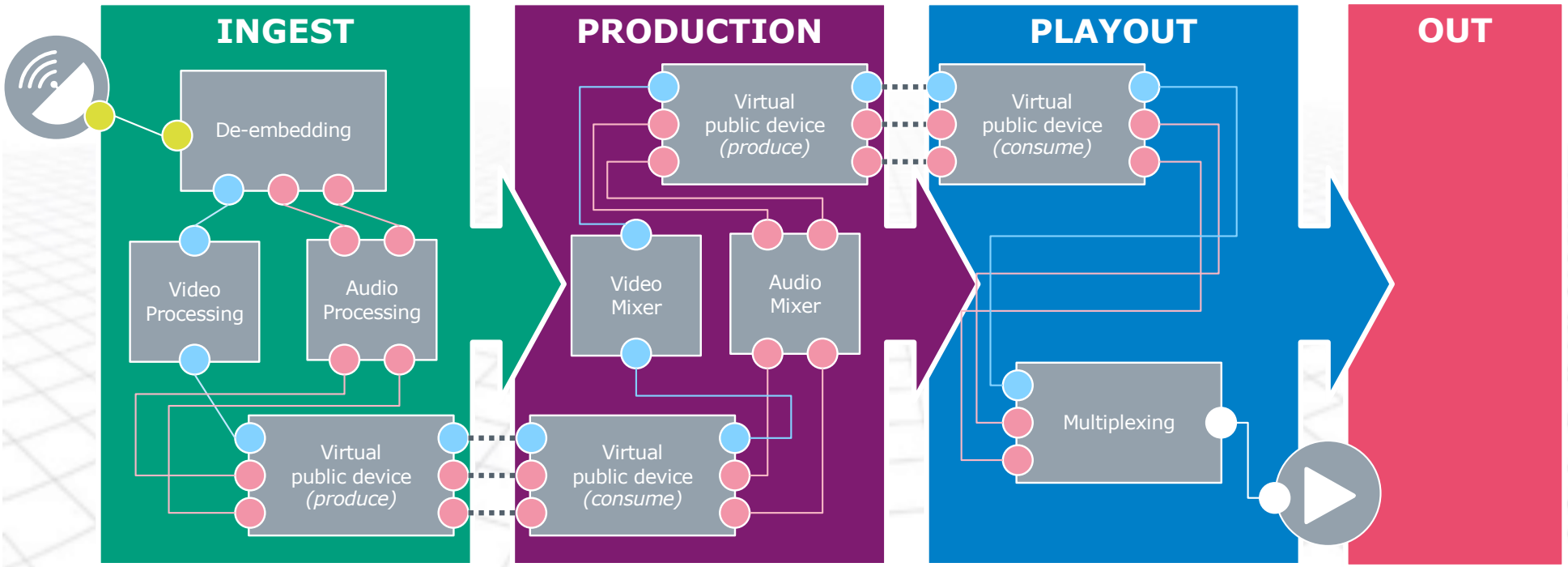
Renew technical infrastructure, based on IP

Rethink and optimize workflows

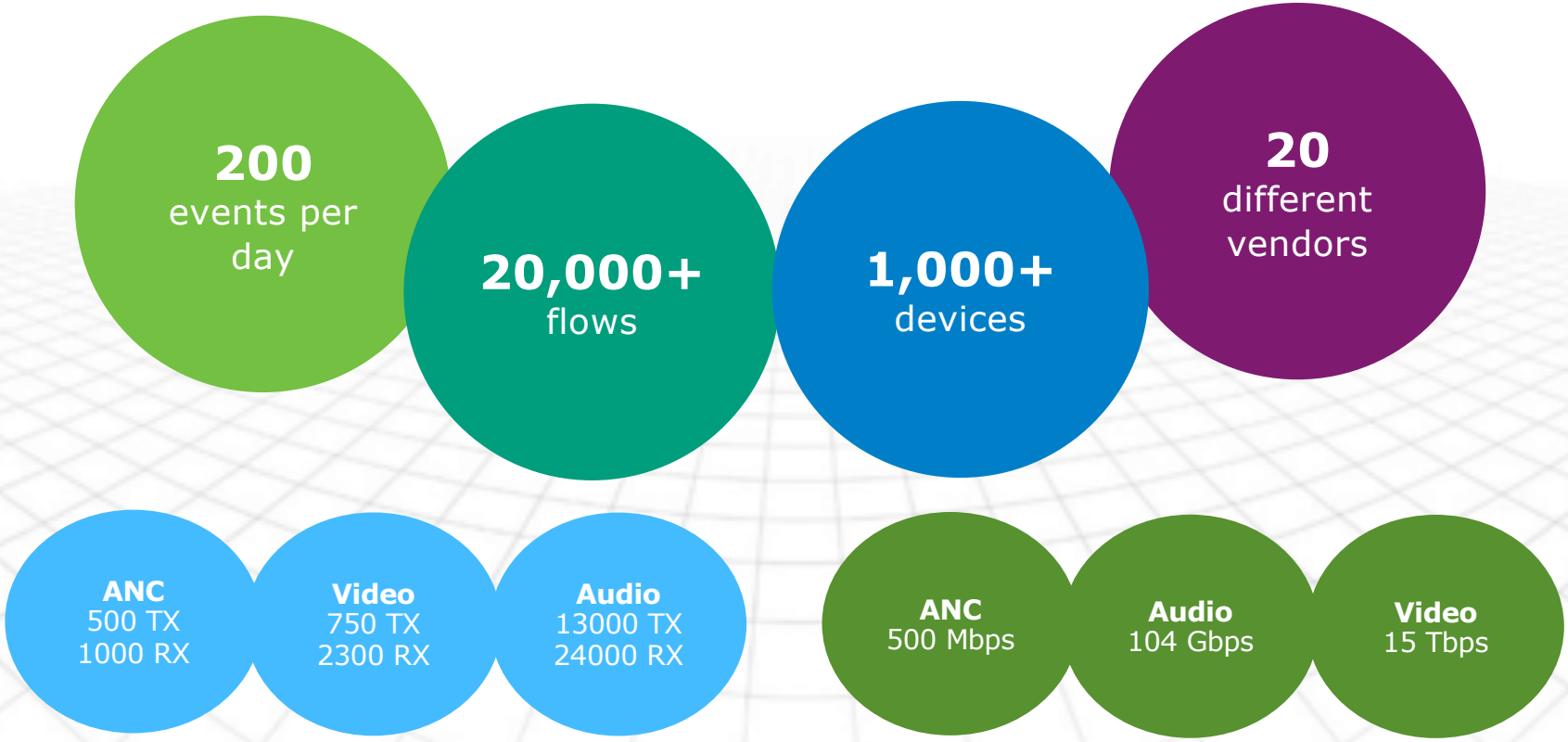
Scope of the project



Key concept: **event-based workflows**



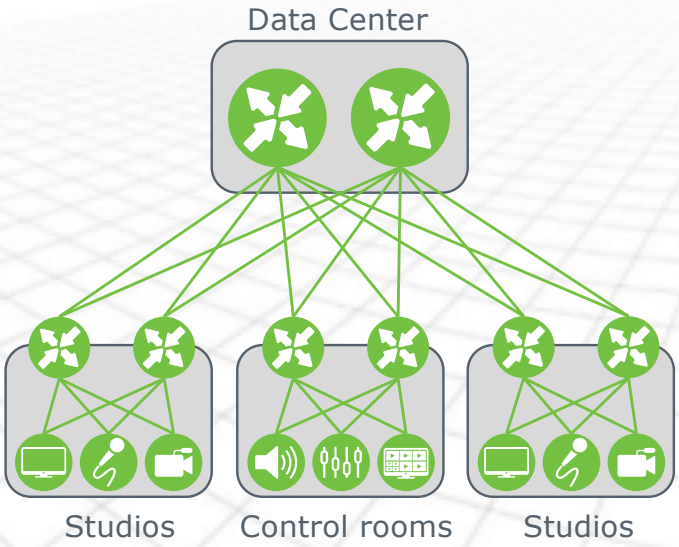
Some **statistics...**



The **technology…**

Chosen **network architecture**

Spine/leaf



Advantages:

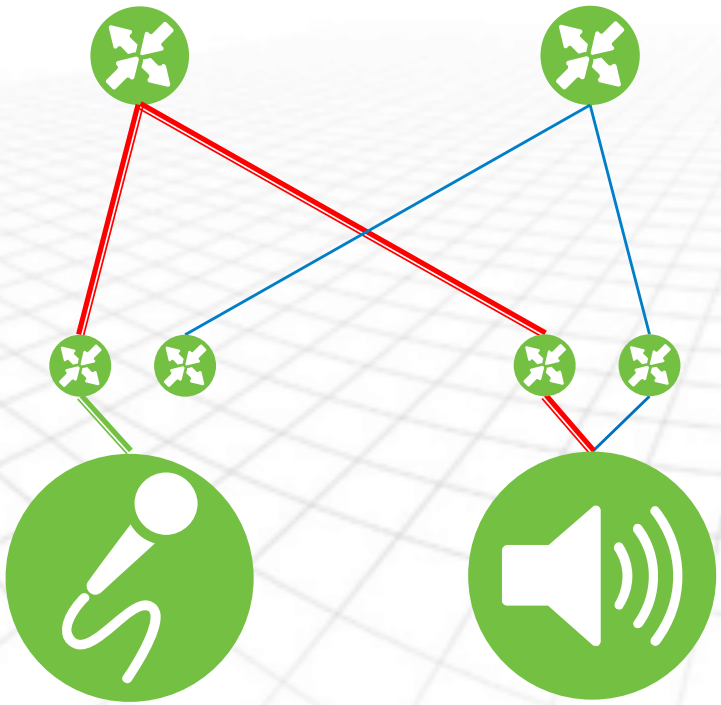
+ Distributed with aggregation at the edge
+ Less cable management
+ Network redundancy
+ Scalable for future growth

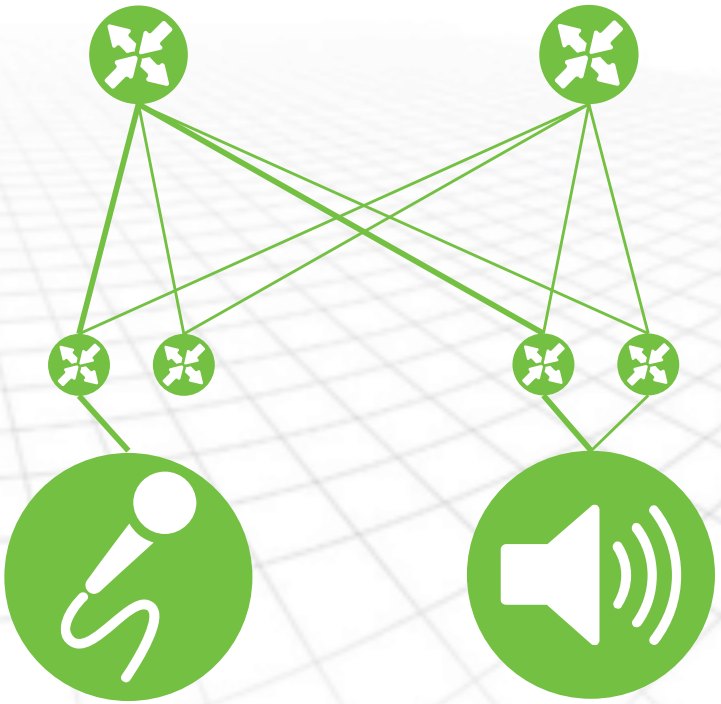
Challenges:

- Blocking or non-blocking depends on number of uplinks
- More complex routing
- Needs bandwidth management

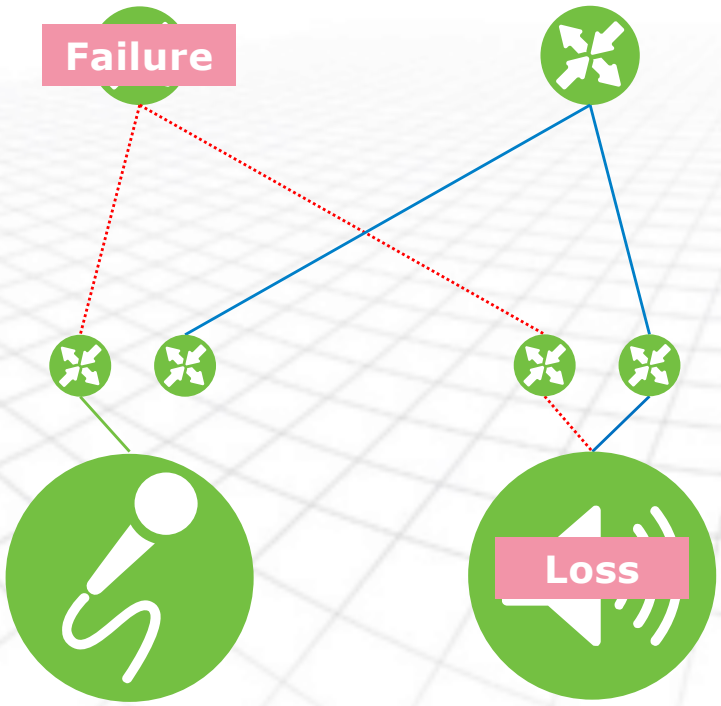
Overcome by using Nevion's VideoIPath

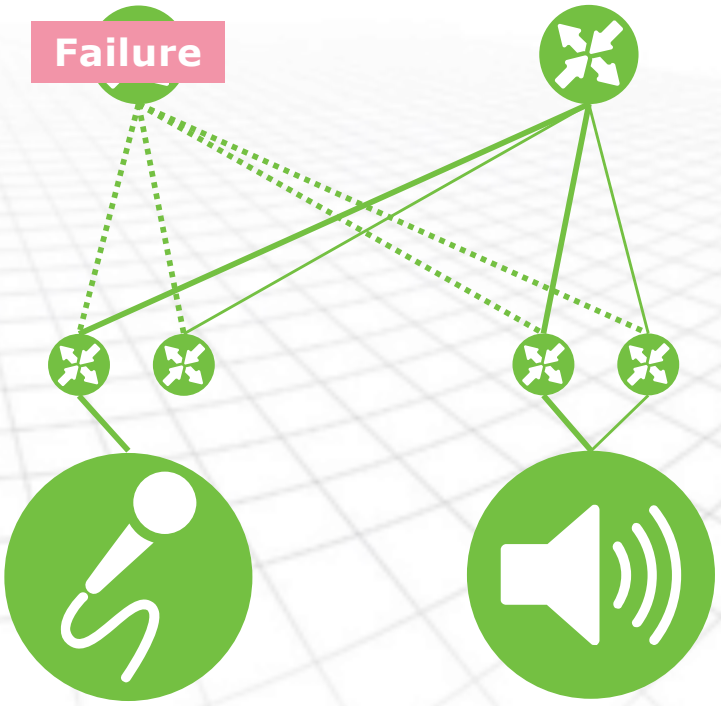
A/B vs Fully Spine-Leaf with SDN





A/B vs Fully Spine-Leaf with SDN

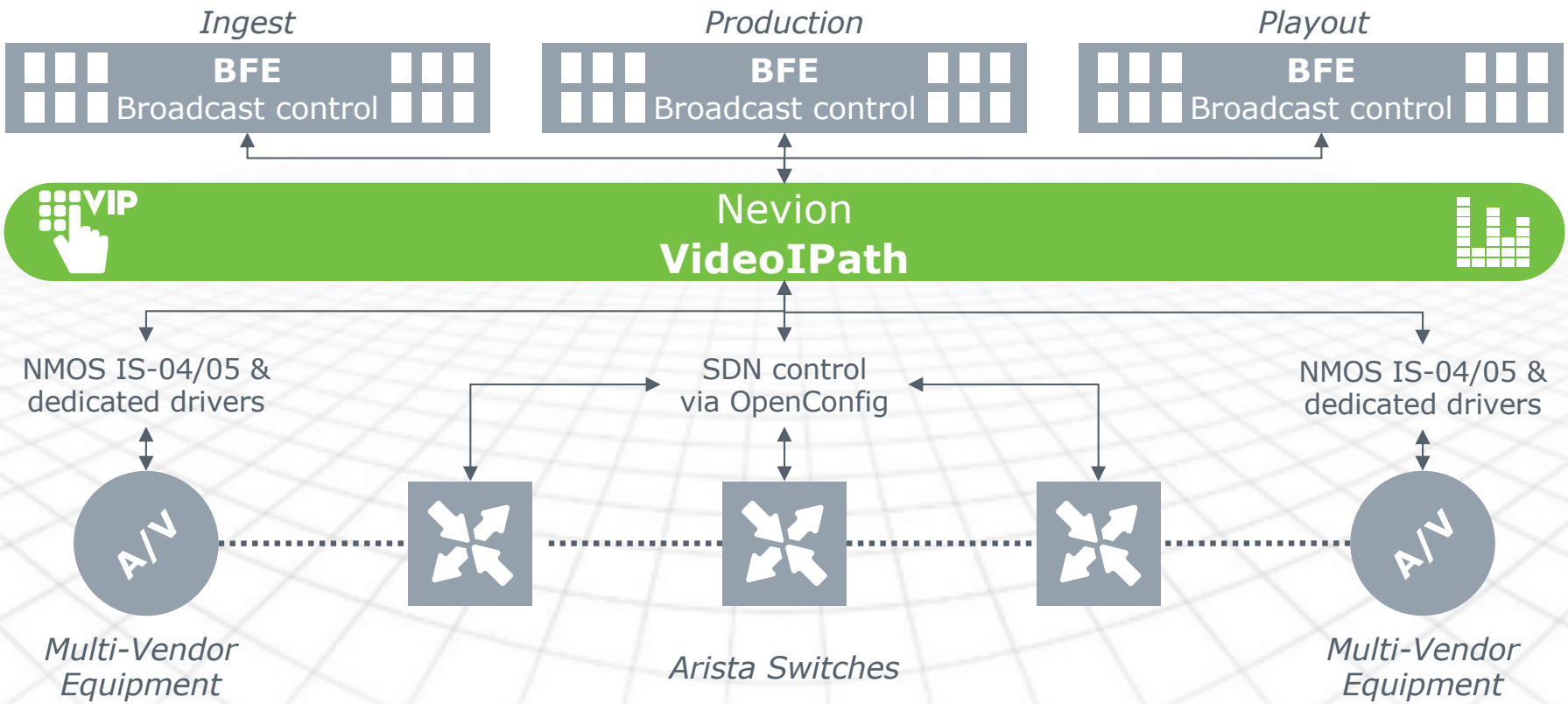




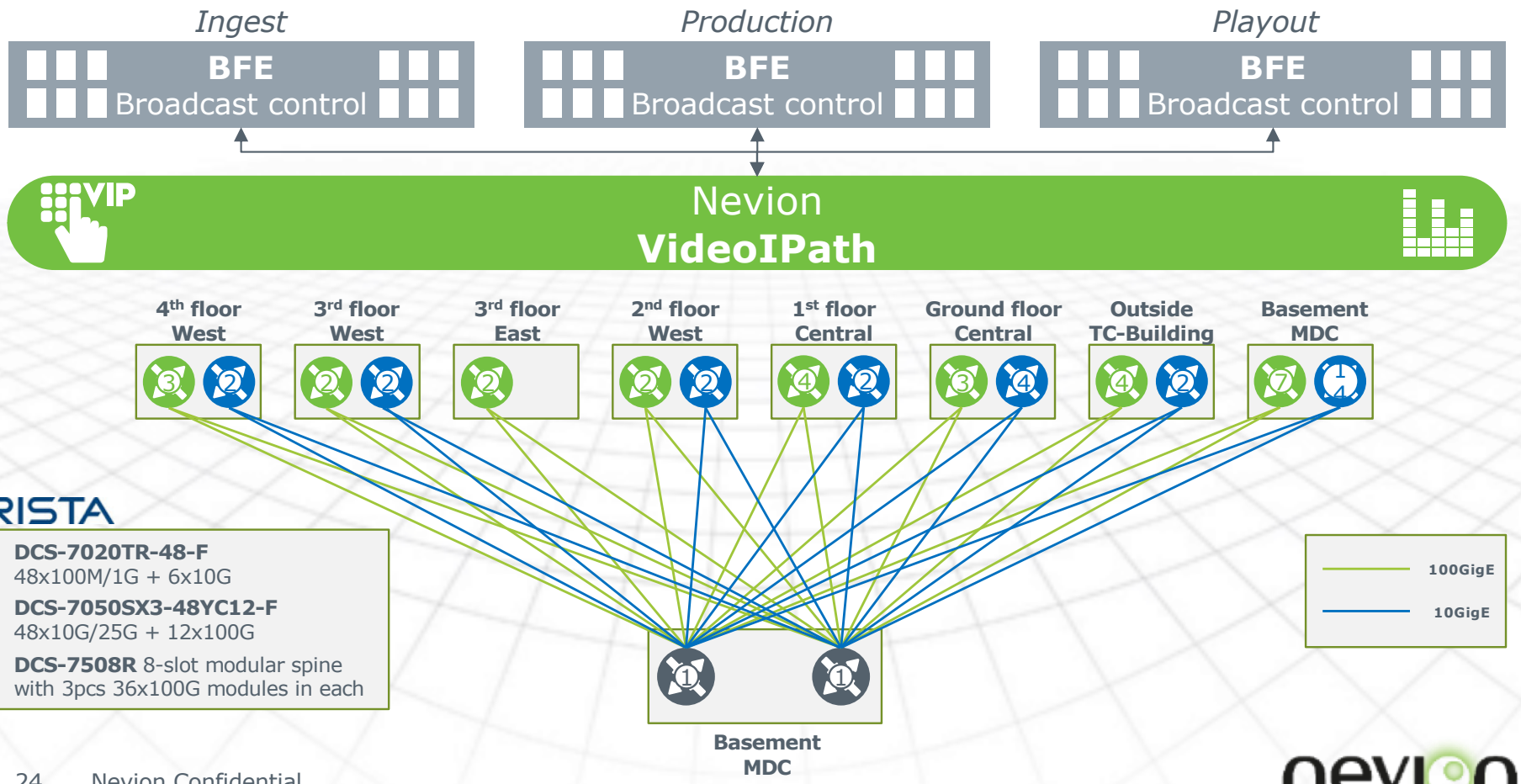
Control architecture – Intent vs Deployment

- Intent
  - NMOS (Config and control)
  - ST2110 (adaptation)
- Deployment is a mixed bag
  - Device specific API (Ember+ 5systems)
  - NMOS (6 systems) (but with parallel API)
  - SDN Orchestrator specific (VideoIPath 8 systems)
  - Web-GUI + SNMP
  - 19 devices with ST2110

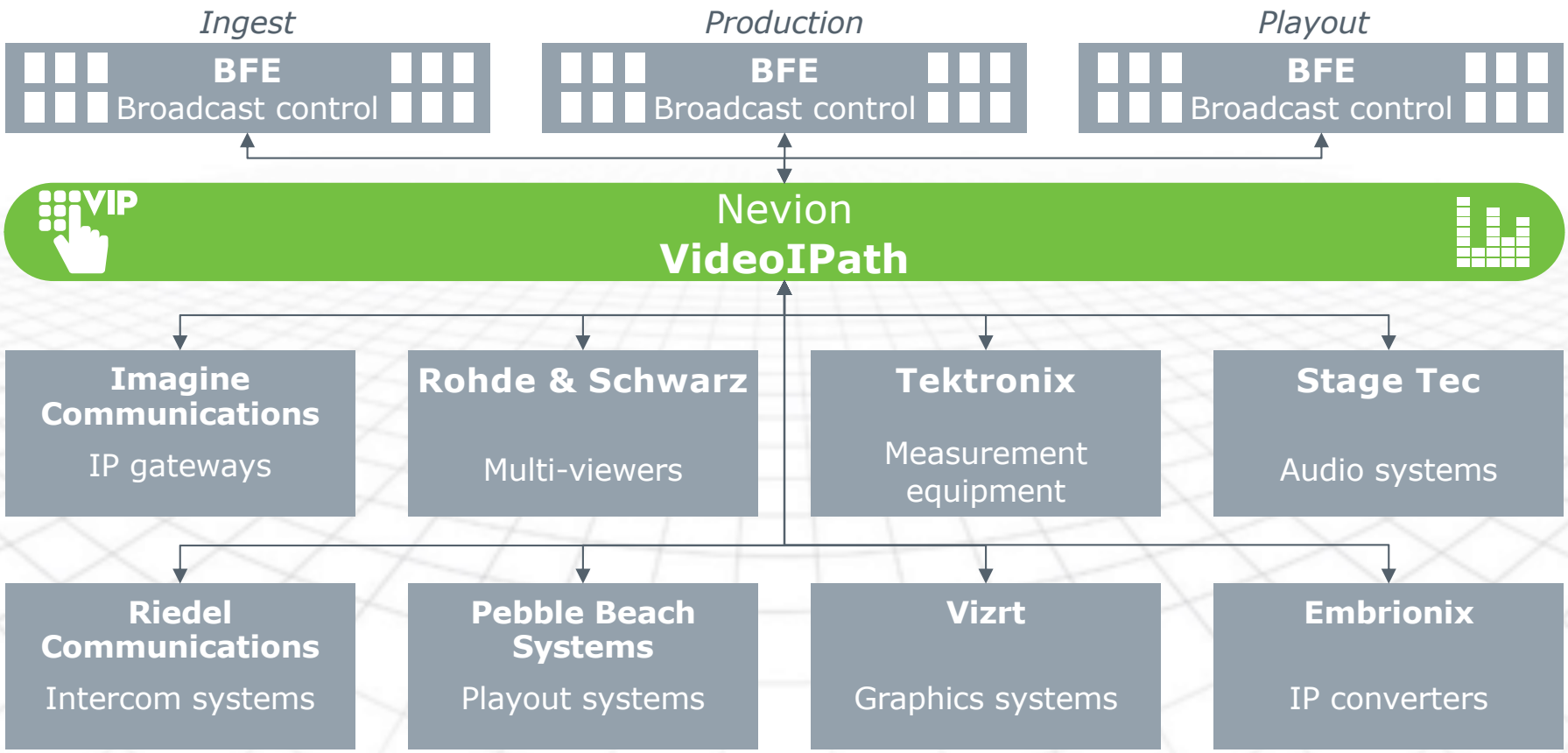
Control architecture



Software defined network (SDN)



Best of Breed Environment



Outside the Facility

Pan-European Broadcast

Overview of customer requirements

- Large sports broadcaster
- Pan-European operation
- Intra-facility (campus) and inter-facility (Wide area) connectivity
- Lowest latency possible
- Optimized use of finite WAN resources
- ST2110 based
- ST2022-7 protection in WAN and LAN

Mezzanine compression options

- JPEG 2000 – TR-01 2013 — 100ms + buffering + transit
- JPEG 2000 ULL – TR-01 2018 — 15ms + buffering + transit
- JPEG XS — <1ms* + buffering + transit

Typical mid-west-European transit delay of 10ms (2000km fibre)

JPEG XS (ISO/IEC 21122)

- Wavelet based
- Intra-frame
- Fixed latency
- Adjustable compression ratio – typically up to 10:1
- CBR (constant bit rate)
- Supports 4:4:4, 4:2:2 & 4:2:0
- Supports any colour space (RGB, YCbCr, YUV, XYZ)
- Supports bit depth: 8, 10, 12
- Supports Interlaced & Progressive frame
- Supports SD, HD, 2K, 4K spatial resolutions
- Supports all main frame rates

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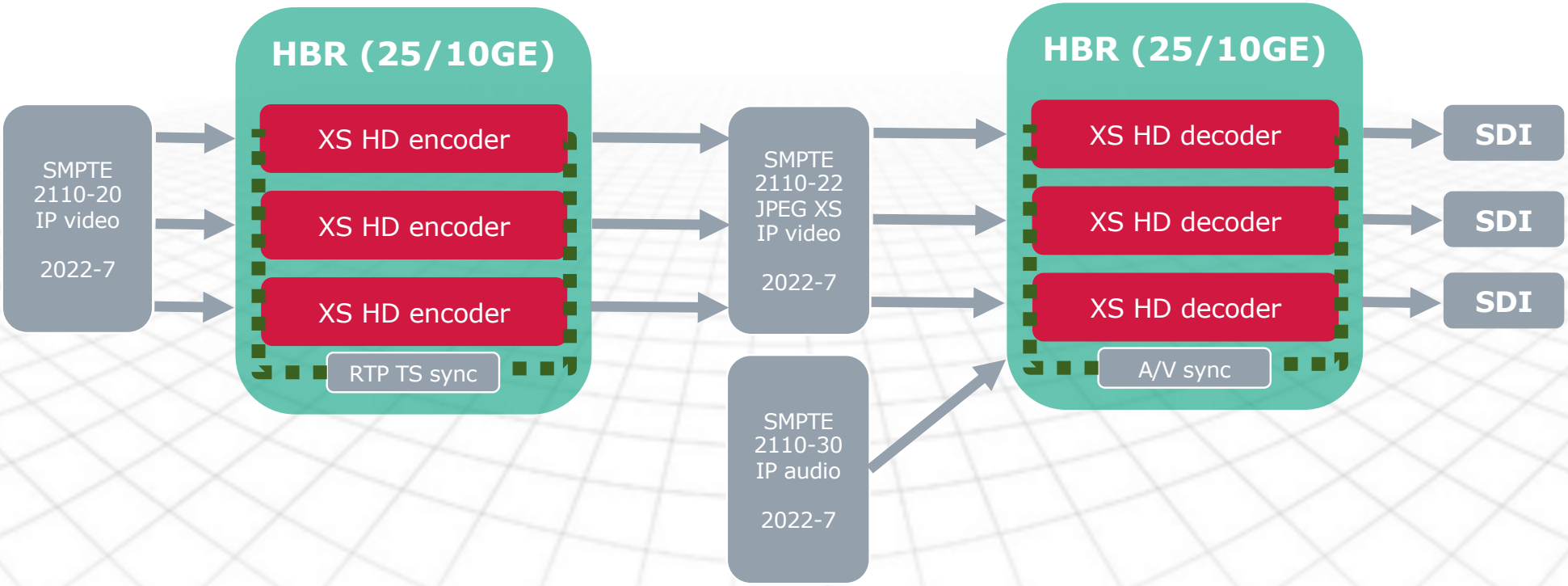
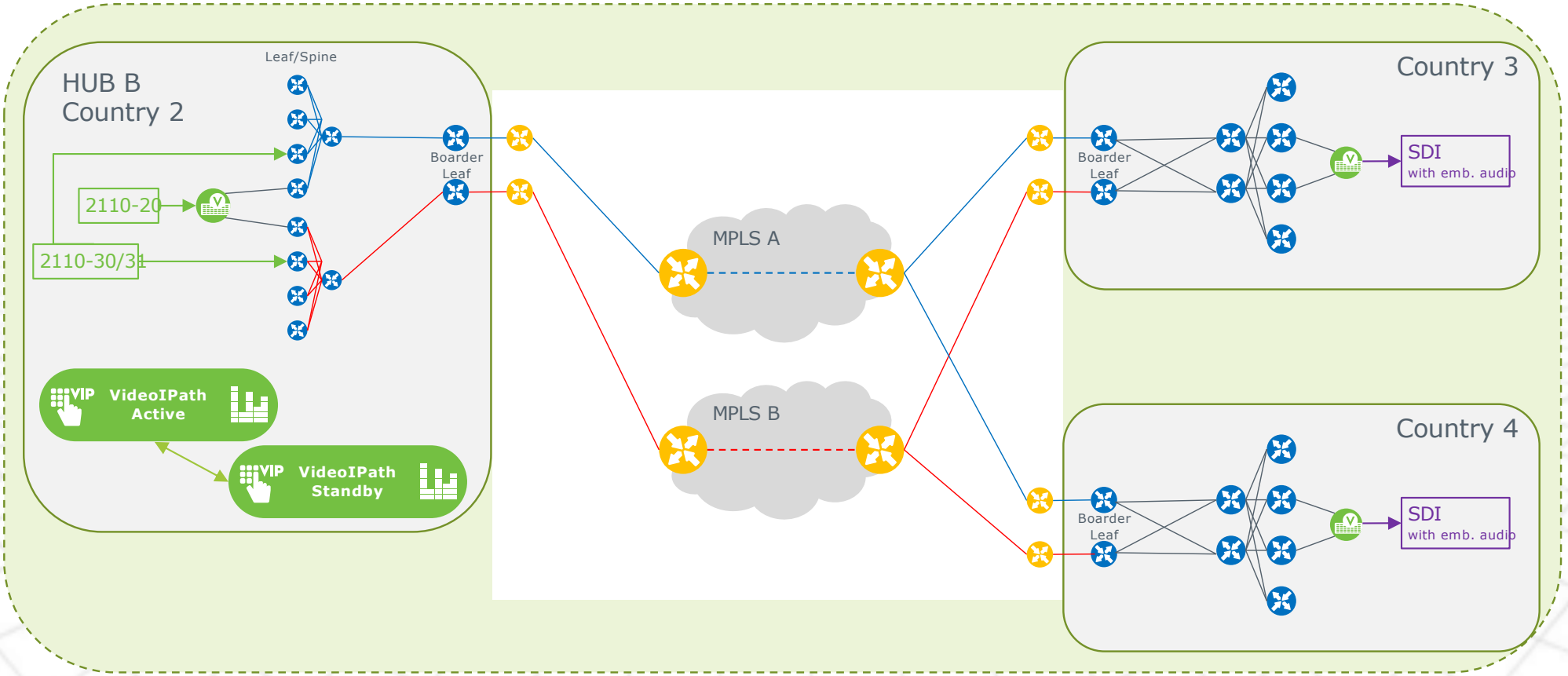
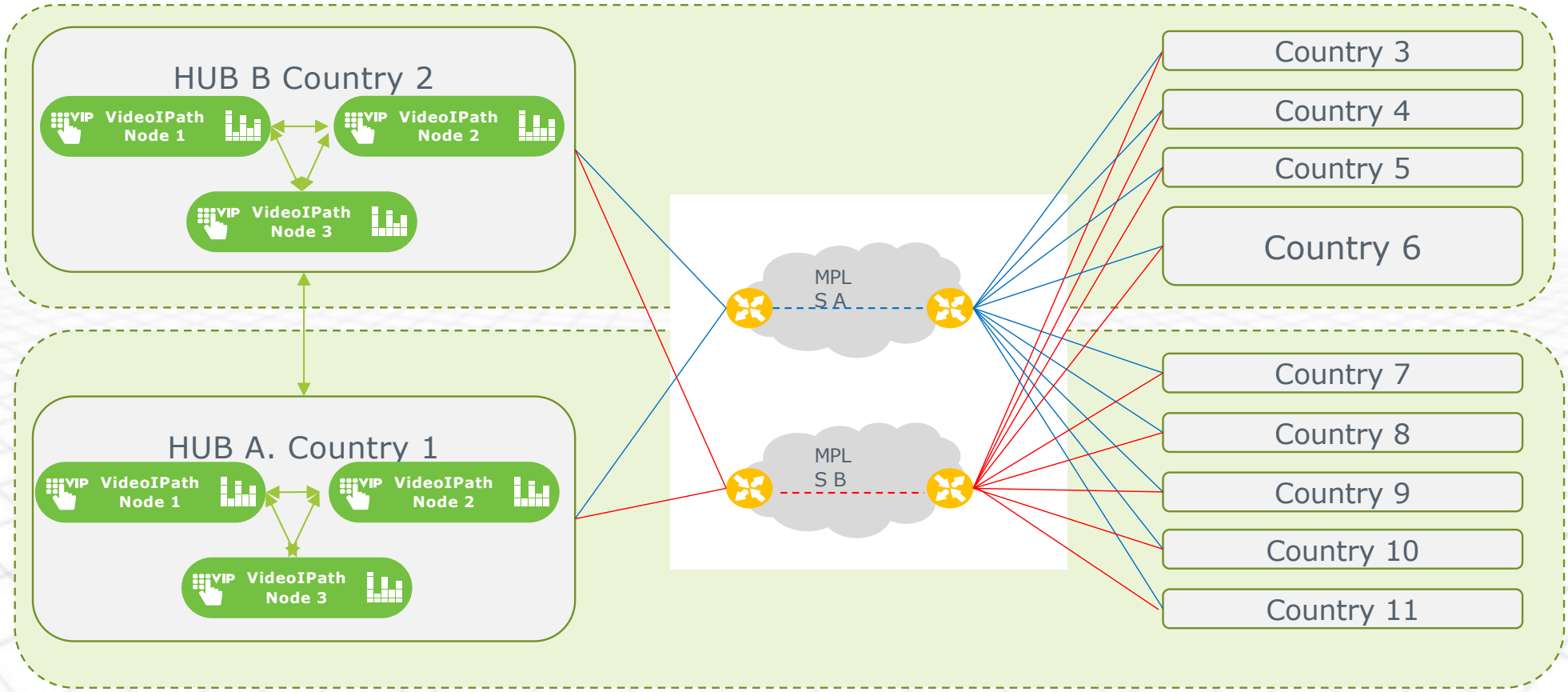
JPEG-XS implementation



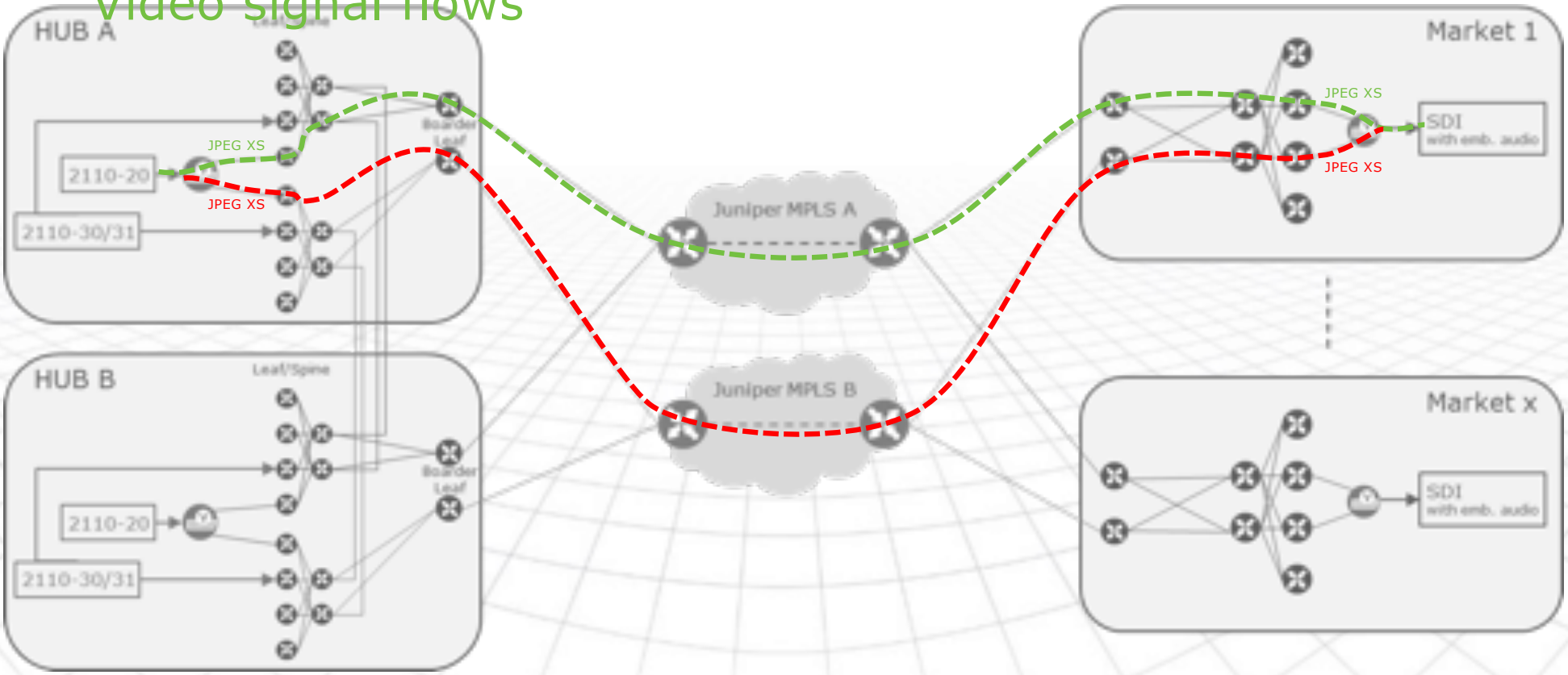
Deployment Phase 1 – July 2019



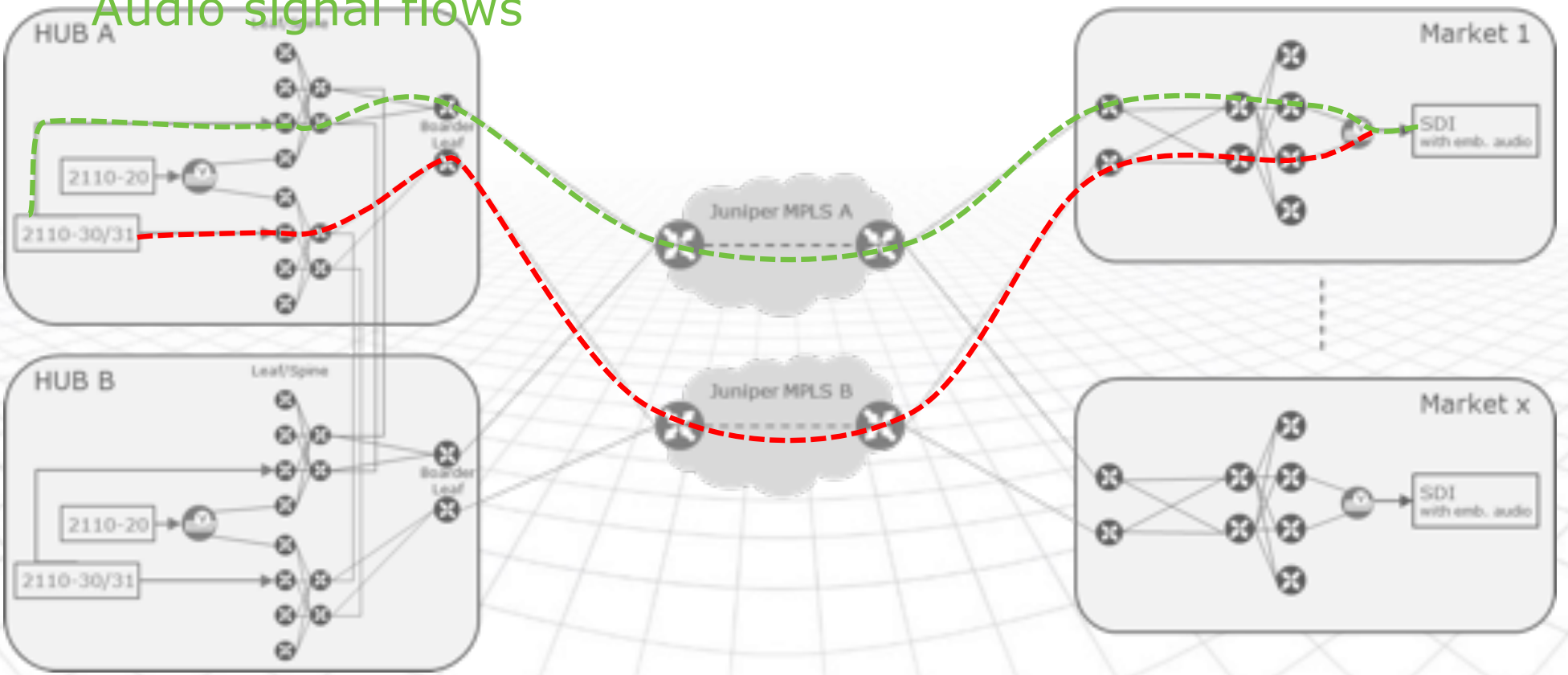
High level architecture



Video signal flows

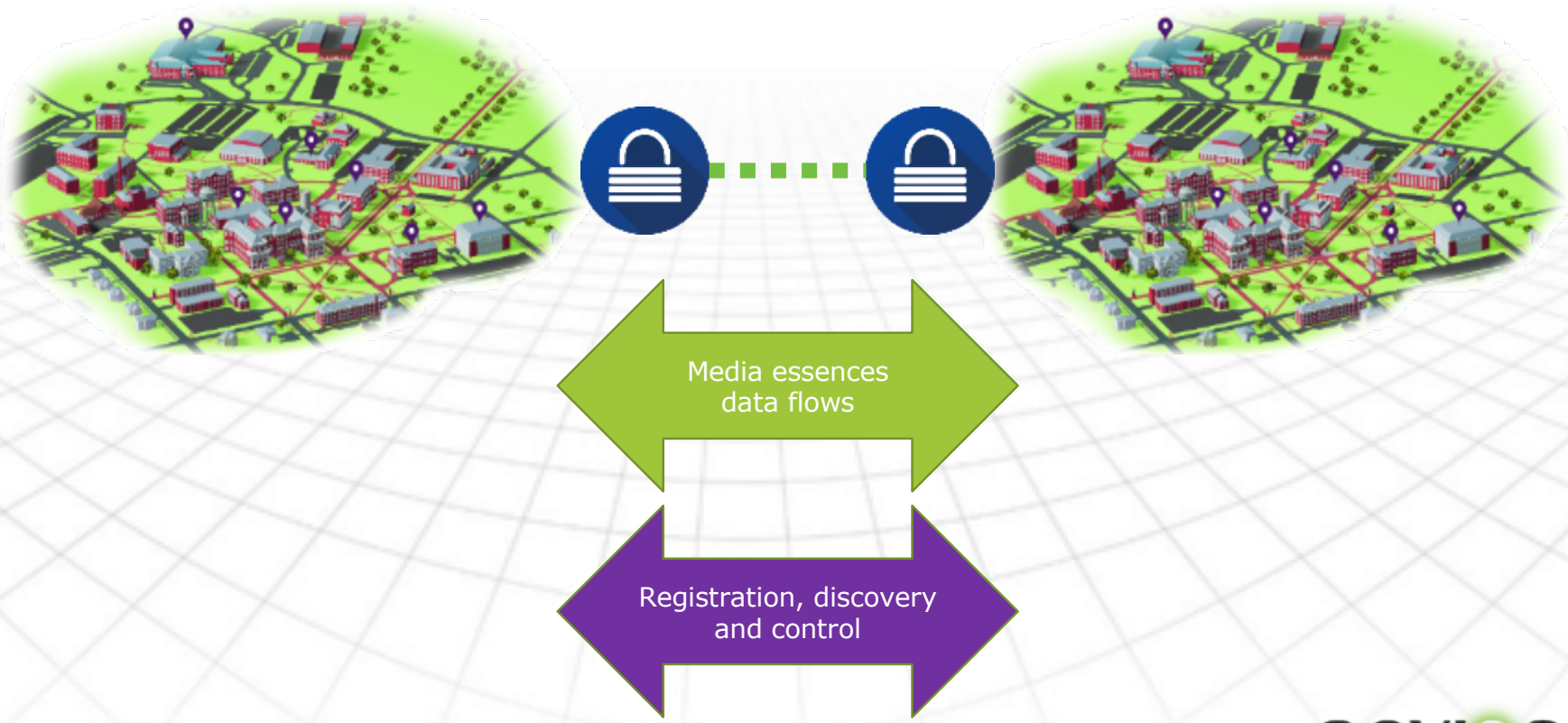


Audio signal flows



ST 2110-WAN

VSF Activity Group on ST2110 over WAN



Differing sizes of system
Differing levels of federation

Media essences
data flows

Registration, discovery
and control

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Areas of interest

- Flow protection ✓
- Flow trunking ✓
- Essence alignment ✓
- Low latency handling ✓
- Format conversion
- Compression ✓

- Protection of other data flows ✓
- Security ✓
- PTP trunking
- Wan timing ✓
- Associated control (NMOS) filtering and border proxying ✓

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Going off-campus – the IP facility media **edge**

PTP TIMING

NMOS IS-04/5/8 DEVICE DISCOVERY & CTL

MEDIA FLOW IP ADDRESSING

ESSENCE FLOWS

PROTECTION TERMINATION

ALTERNATIVE TIMING DOMAINS

RESTRICTED/PROXIED DISCOVERY & CTL

DIFFERENT IP ADDRESSING (NAT)

ESSENCE OR COMPOSITE FLOWS

PROTECTION TERMINATION

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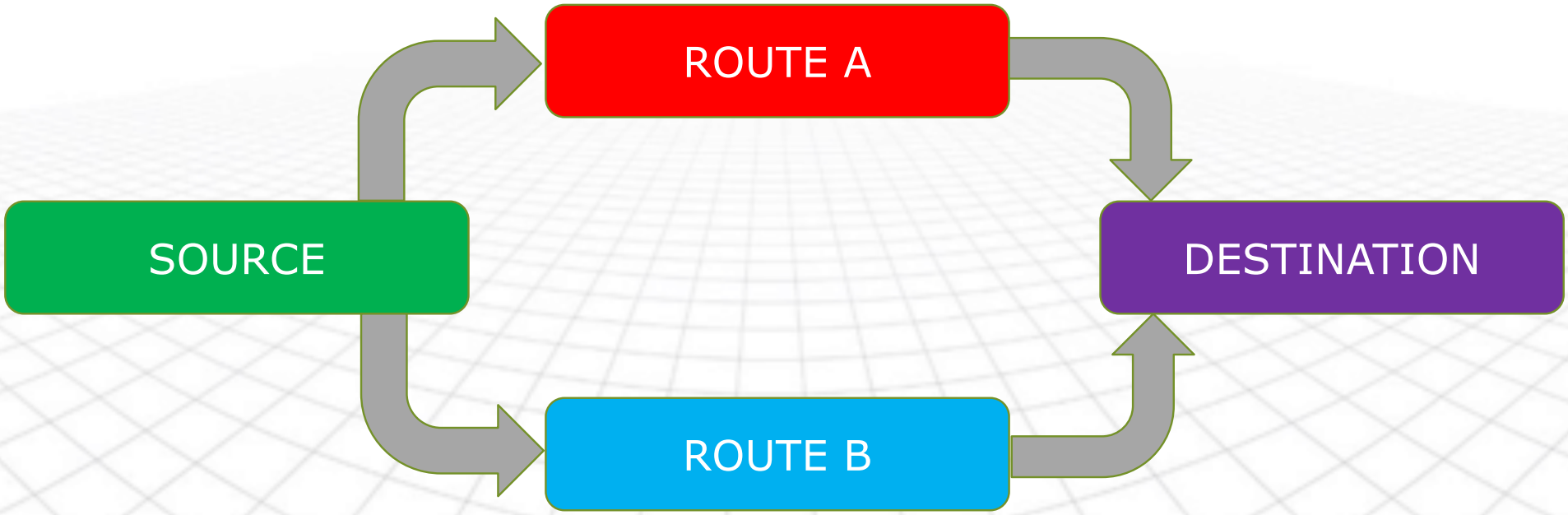
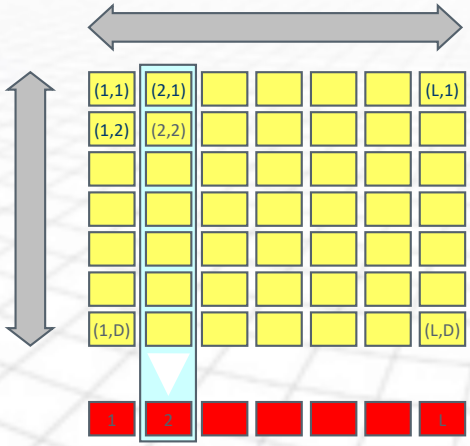
What we are talking about:

Flow protection #1
- SMPTE2022-7 based



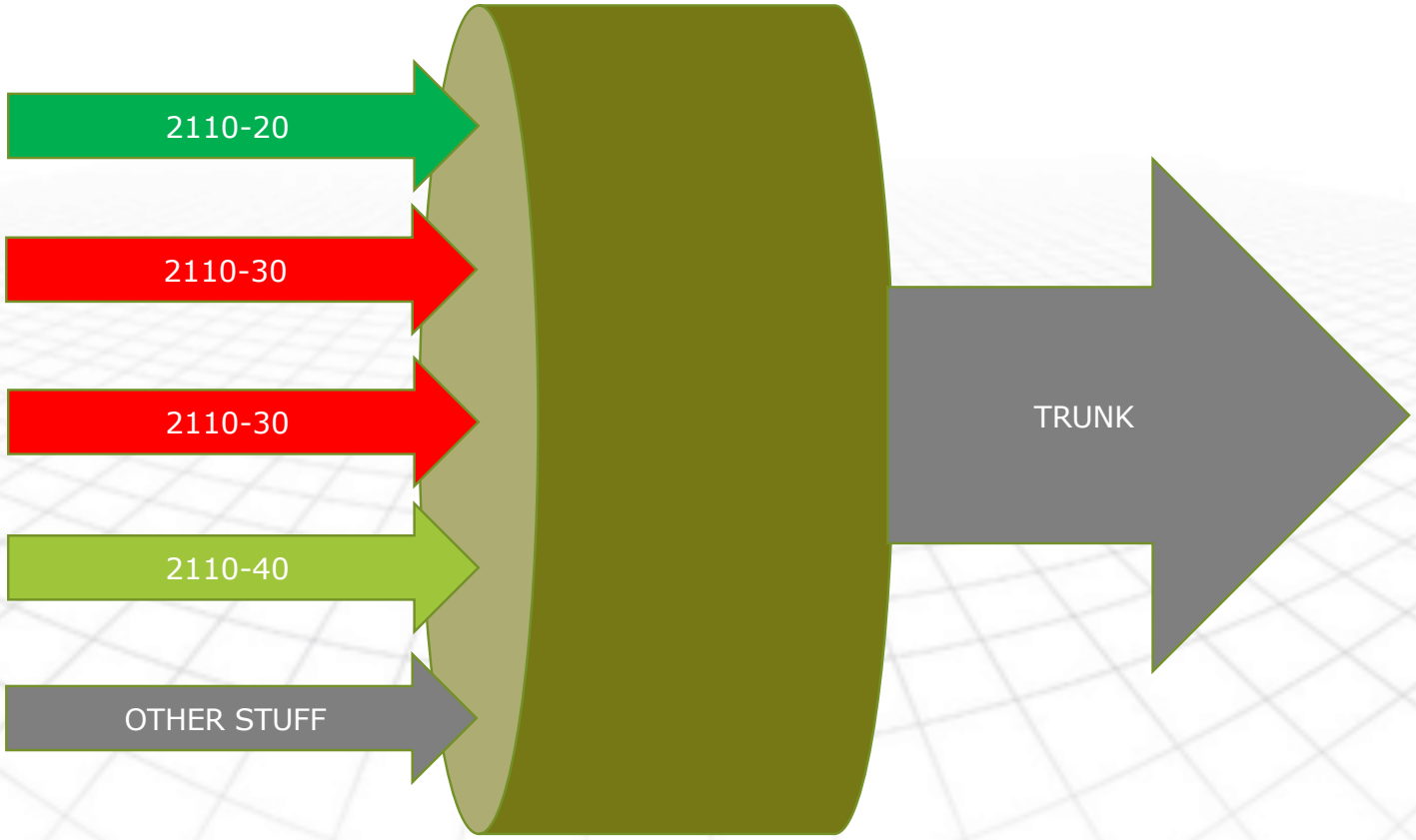
Flow protection #2
FEC – ST2022-5 based constrained to LxD product of 100 maximum



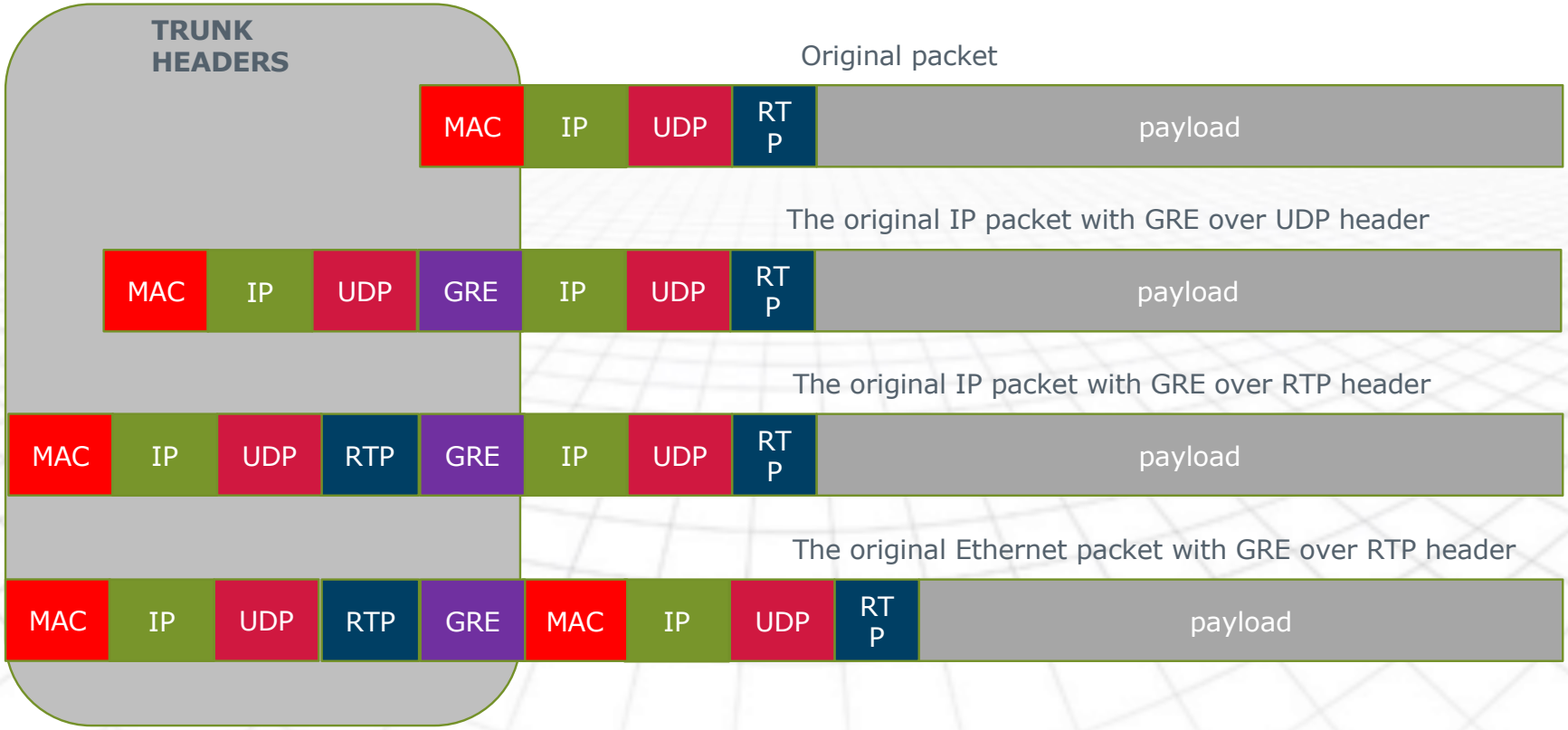
n	n+1	n+2	n+3
n+4	n+5	n+6	n+7
n+8	n+9	n+10	n+11
n+12	n+13	n+14	n+15
n+16	n+17	n+18	n+19
n+20	n+21	n+22	n+23
n+24	n+25	n+26	n+27
n+28	n+29	n+30	n+31
n+32	n+33	n+34	n+35
n+36	n+37	n+38	n+39
n+40	n+41	n+42	n+43

Challenging – Major differences in size resulting in variable delay and buffering needs

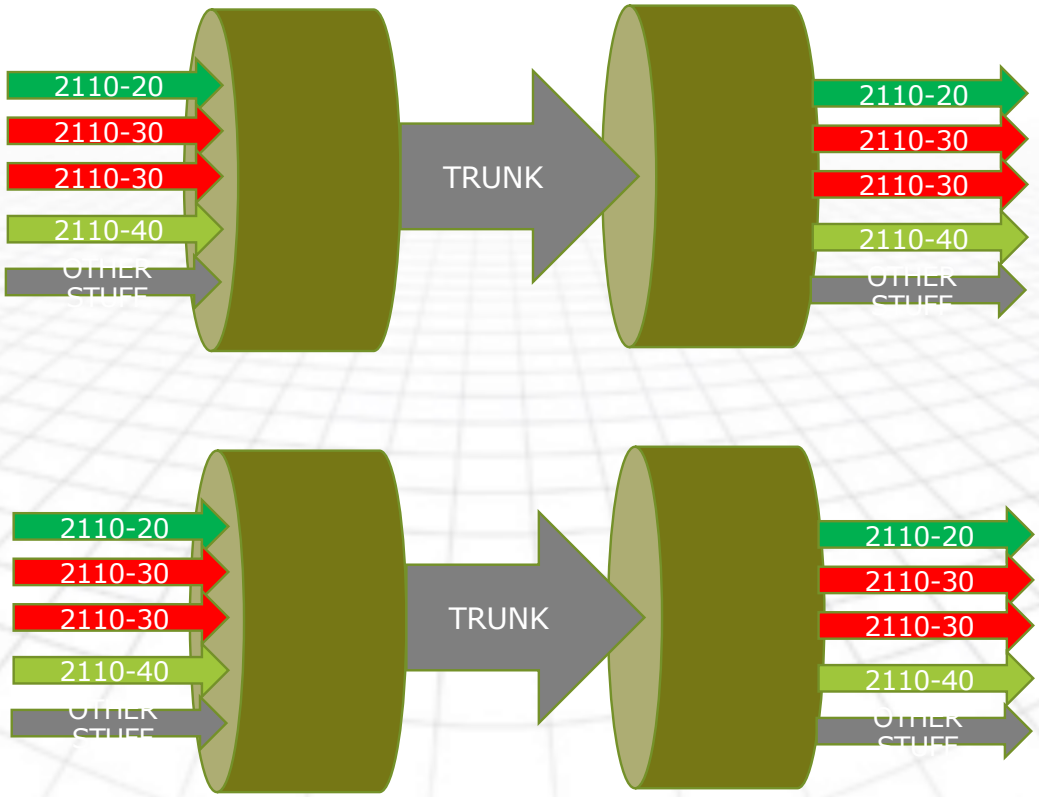
Trunking essences



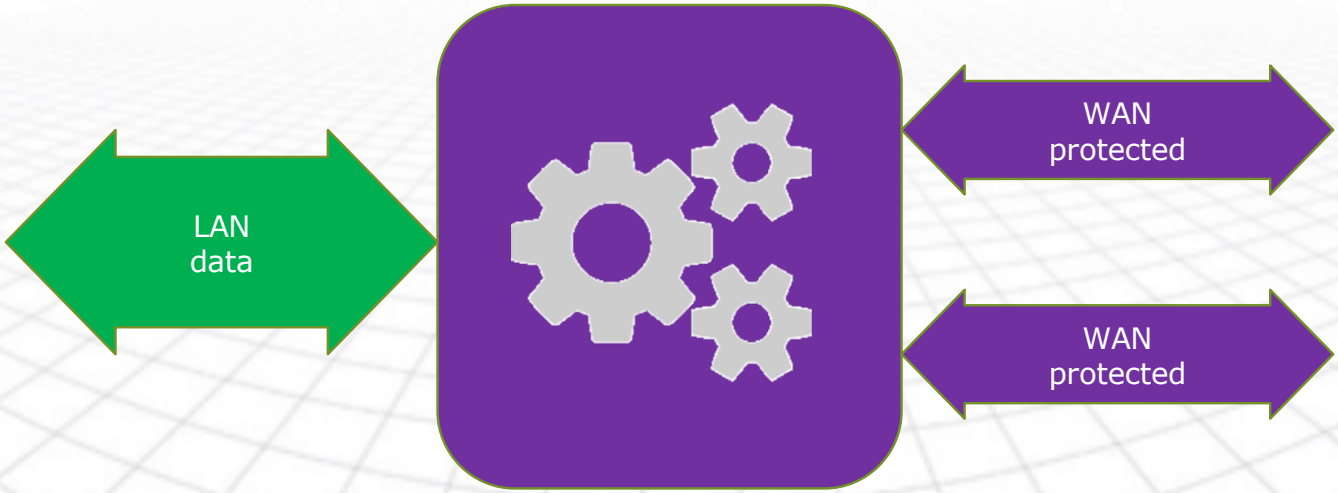
Trunking encapsulation



2022-7 protection at essence or trunk



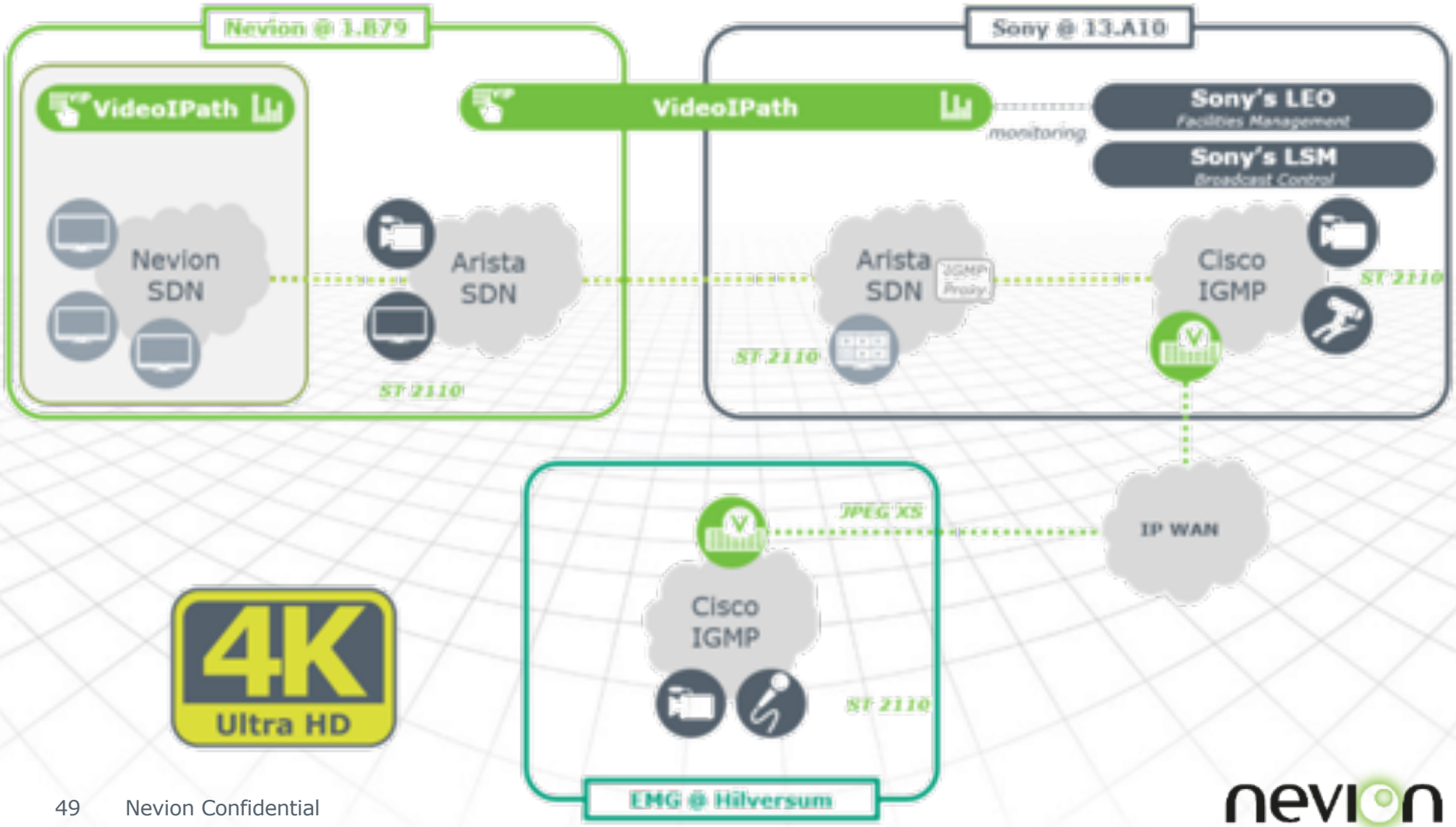
Protection of other data



Sony + Nevion

Overview

- Sony and Nevion announced a strategic partnership in June 2019.
- At IBC, Sony and Nevion demonstrated an IP Intra Facility and remote production set-up
- Nevion@1.B79 over 25G fiber to Sony@13.A10
- Sony@13.A10 over CenturyLink circuit to United-EMG@Hilversum


Nevion @ 1.879
VideoIPath
Nevion SDN
Arista SDN
ST 2110
VideoIPath
Sony @ 13.A10
Sony's LEO
Facilities Management
monitoring
Sony's LSM
Broadcast Control
Arista SDN
IGMP Proxy
ST 2110
Cisco IGMP
ST 2110
JPEG XS
IP WAN
Cisco IGMP
ST 2110
EMG @ Hilversum
4K
Ultra HD

Key Highlights

- Full Management Stack
  - Facility Management (LEO)
  - Broadcast Control (LSM)
  - SDN Orchestration (VideoIPath)
- Multi-vendor Switches – Arista & Cisco
- Hybrid Networks – SDN & Self-routing (IGMP)
- End-to-end ST2110 LAN and WAN routing
- World's first JPEG-XS (REMI) ~1ms back-to-back
- Virtualization of resources (Remote multi-viewer access)

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