Implementation of PTP in a Real Time IP Network

ITSF 2022 | Case Study | Adrian Hilber | Sandro Furter | 08.11.2022

THIS
IS WHO
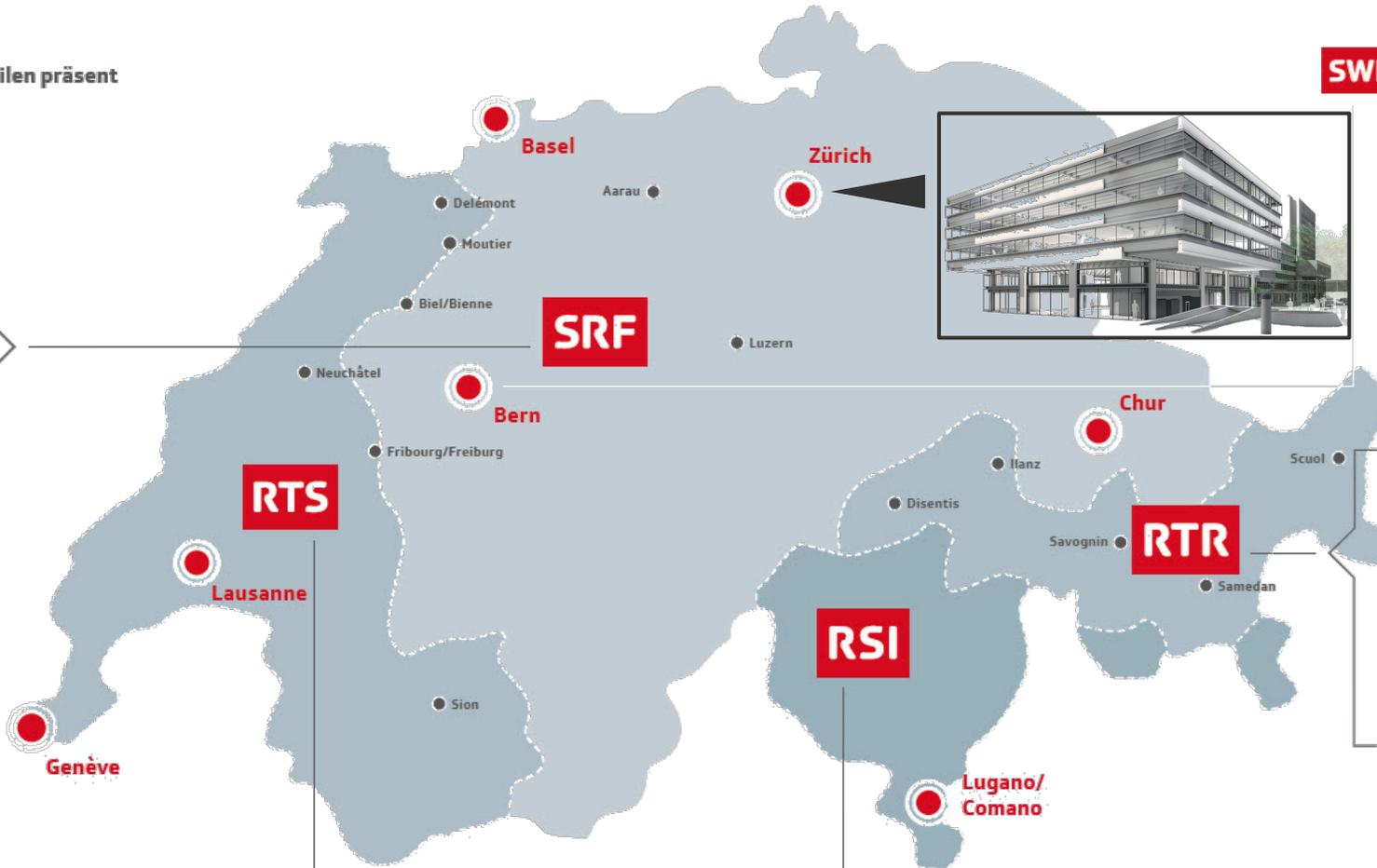I AM

SRG: in allen Landesteilen präsent

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SRG SSR

POP   CLASSIC   JAZZ

SRF

yaPTPd

CORE TECHNOLOGY

TECHNICAL INNOVATION

NETWORK OVERVIEW

PROJECT OVERVIEW

CHALLENGES

What is Metechno?

About the Term

The sub-project Media Technology, in short "Metechno", is part of the SRF site development in Zurich Leutschenbach. The work order for this project is the technical specification and realization of the News- and Sportcenter (NSC).

About the Scope...

The systems must cover technical and operational functionalities for the production chain from acquisition, post-production and studio production up to aggregation for the planned content from SRF. Hereby, innovative technology, including new workflows, shall be implemented to enable new modern ways of working for existing operations.

Newsroom Sports
Presenter Area, 2 Radio Studios, 1 Edit, 1 Voice-over Booth, 1 MPA

Postproduction News & Sports
9 Edits, 2 Voice-over Booths, 1 MPA

Newsroom News
Presenter Area, 2 Edits, 1 Voice-over Booth, 1 MPA

Operations & National Services
MCR, MEX, SeDe, SMC, CCA, SAW

Studio Production
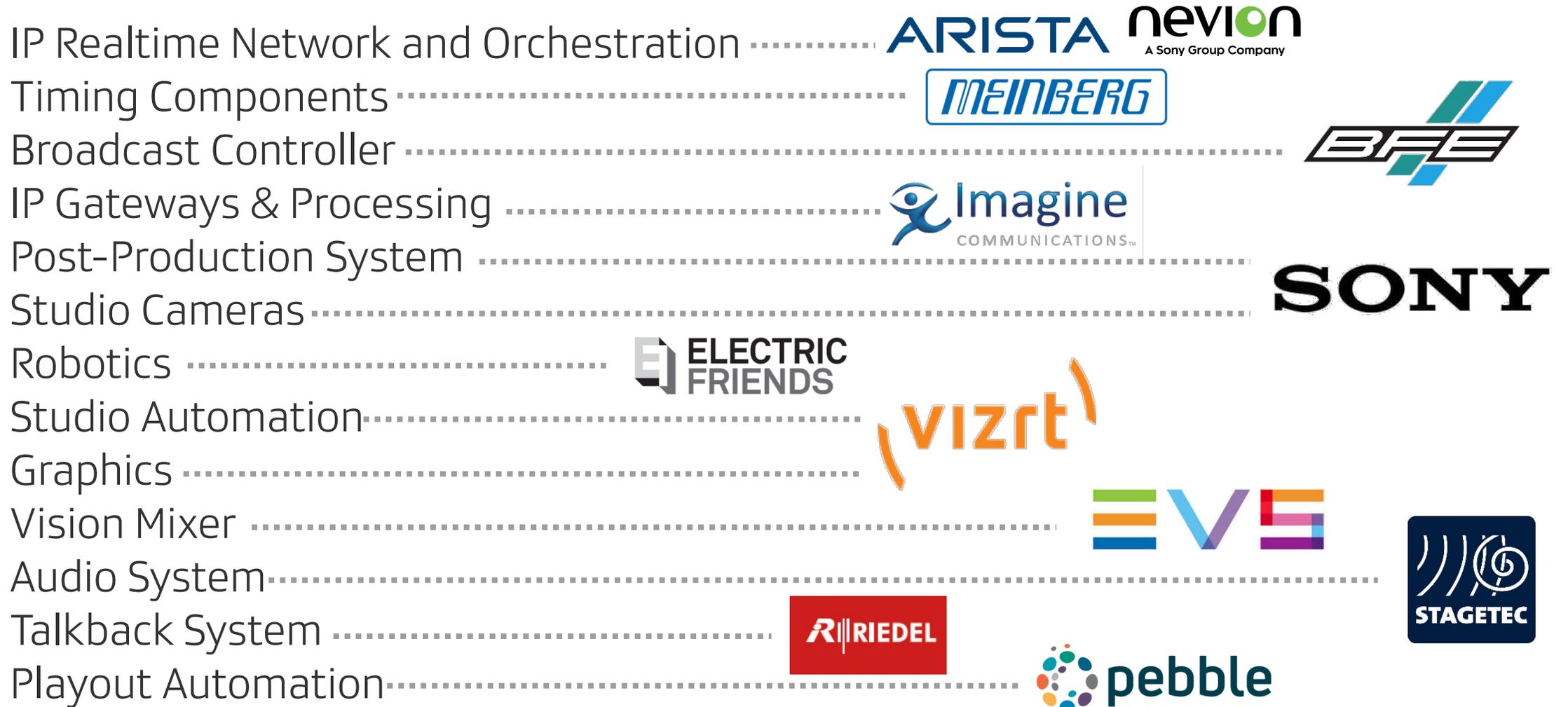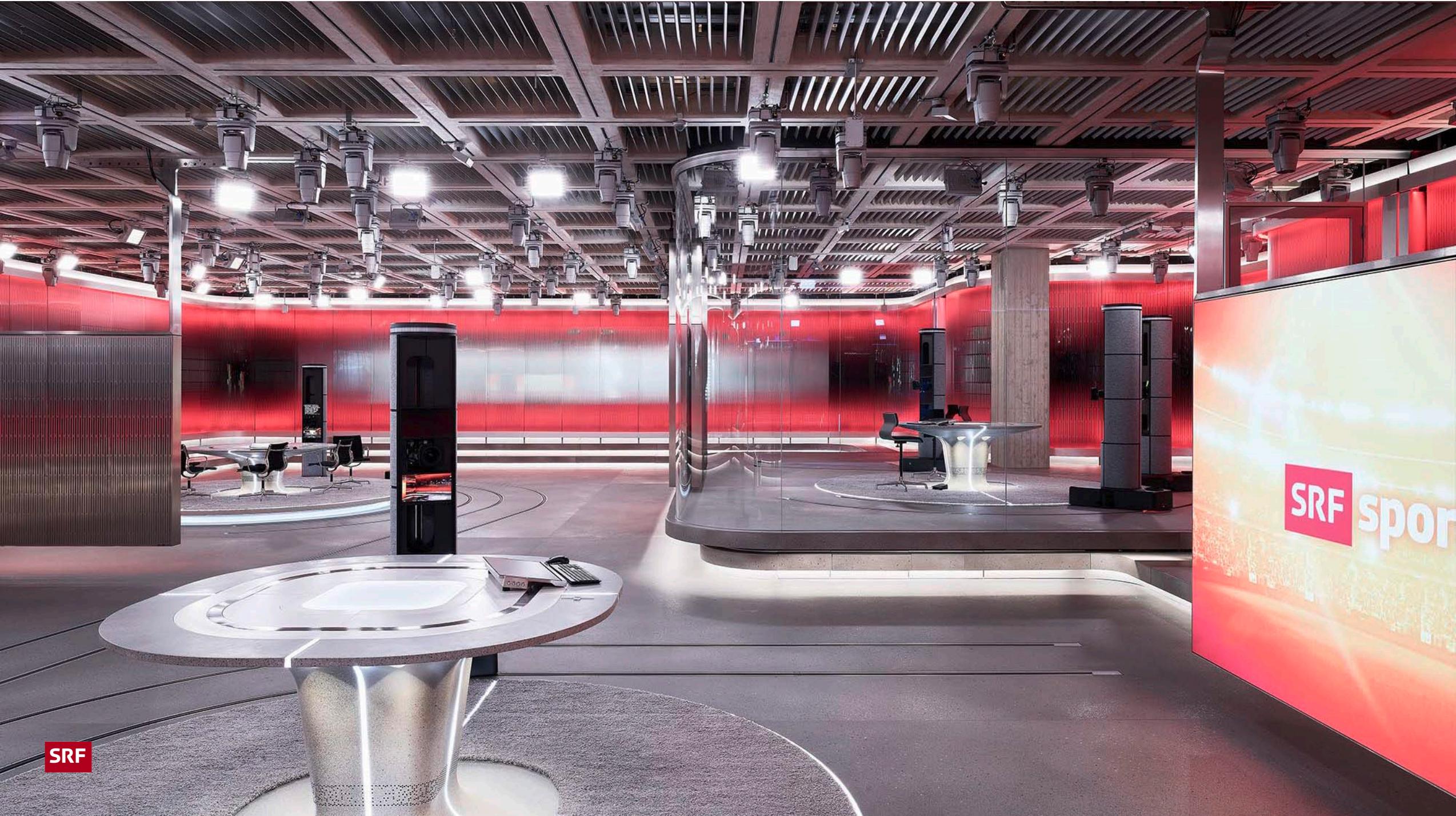3 Studio Floors, 2 Voice-over Booths

SRF

Core Technology

IP Realtime Network and Orchestration $\cdots\cdots\cdots$ **ARISTA** **nevion** A Sony Group Company

Timing Components $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **MEINBERG**

Broadcast Controller $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **BFE**

IP Gateways & Processing $\cdots\cdots\cdots\cdots\cdots\cdots$ **Imagine** COMMUNICATIONS™

Post-Production System $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **SONY**

Studio Cameras $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$

Robotics $\cdots\cdots\cdots\cdots\cdots\cdots$ **ELECTRIC FRIENDS**

Studio Automation $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **vizrt**

Graphics $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$

Vision Mixer $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **EVS**

Audio System $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **STAGETEC**

Talkback System $\cdots\cdots\cdots\cdots$ **RIEDEL**

Playout Automation $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ **pebble**
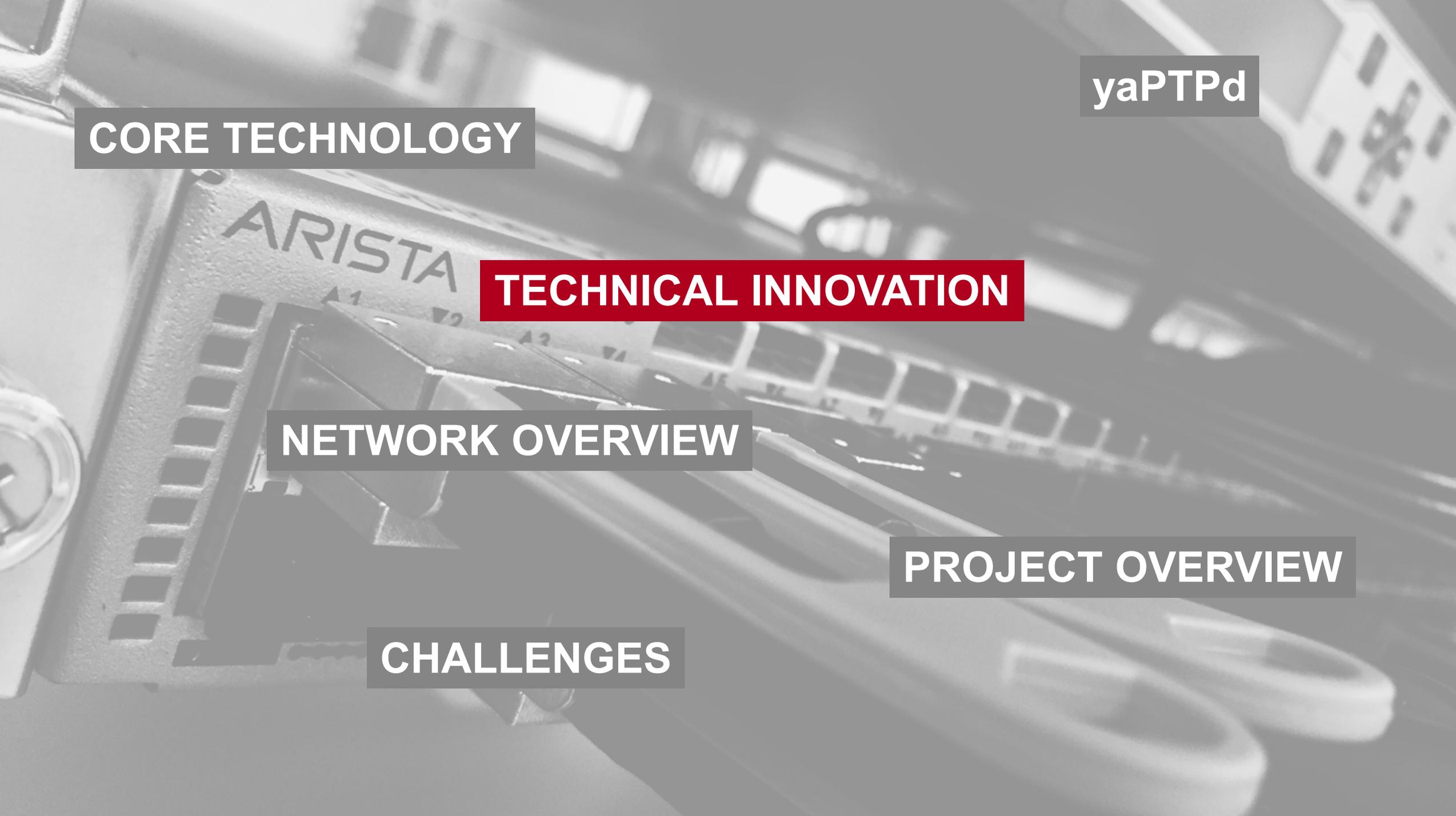
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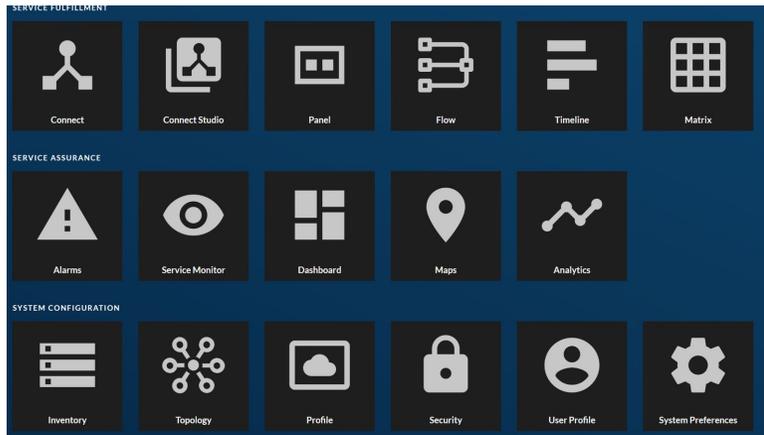
NETWORK OVERVIEW

PROJECT OVERVIEW
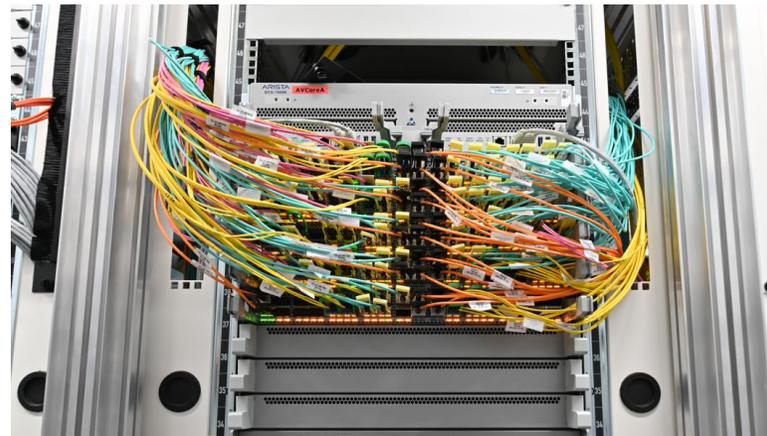
CHALLENGES

SMPTE ST2110 Realtime Network

- 669 native IP End Devices
- 156 Switches
- 4'100 Video Streams
- 55'562 Audio Streams
- 16'254 Ancillary Streams

ON AIR

Nevion VideoIPath (Orchestrator)

Arista Spine Switch

BFE GUI GFX Unit (User Interface)

SRF

Why and how did we Realtime IP?

- Because it fits to project goals Flexibility, Scalability and Future-proof

- Because you get your Signals easier, Technology as Enabler

- Because of Process Optimization and Automation

- With Experiences due to POCs and Pre-Projects like TCS and UHD 1

- With strong Partners and direct Interchange with Committees

- With an IP Lab as Know-how Base and Testing Platform

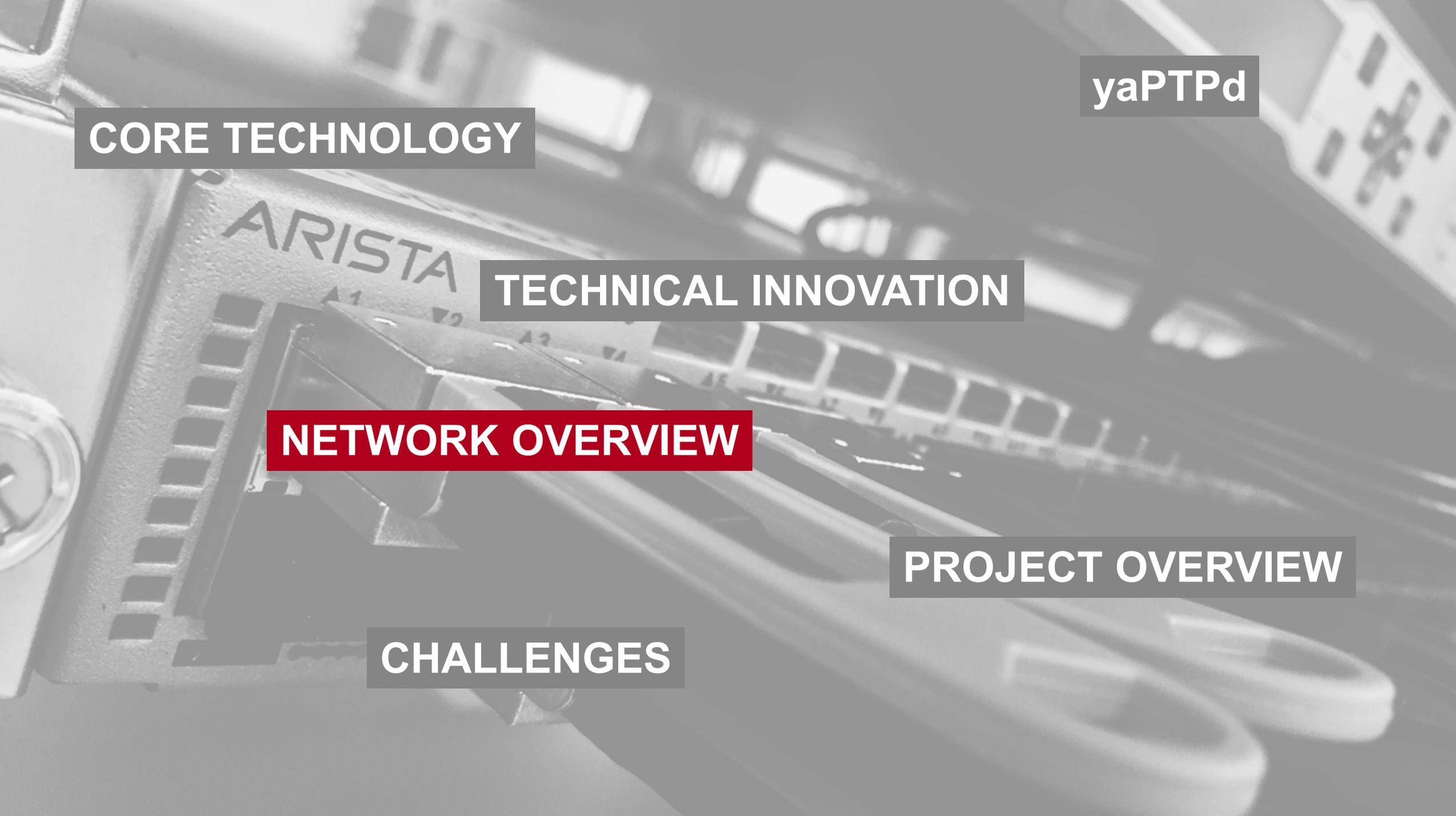- With Gateways to integrate legacy areas

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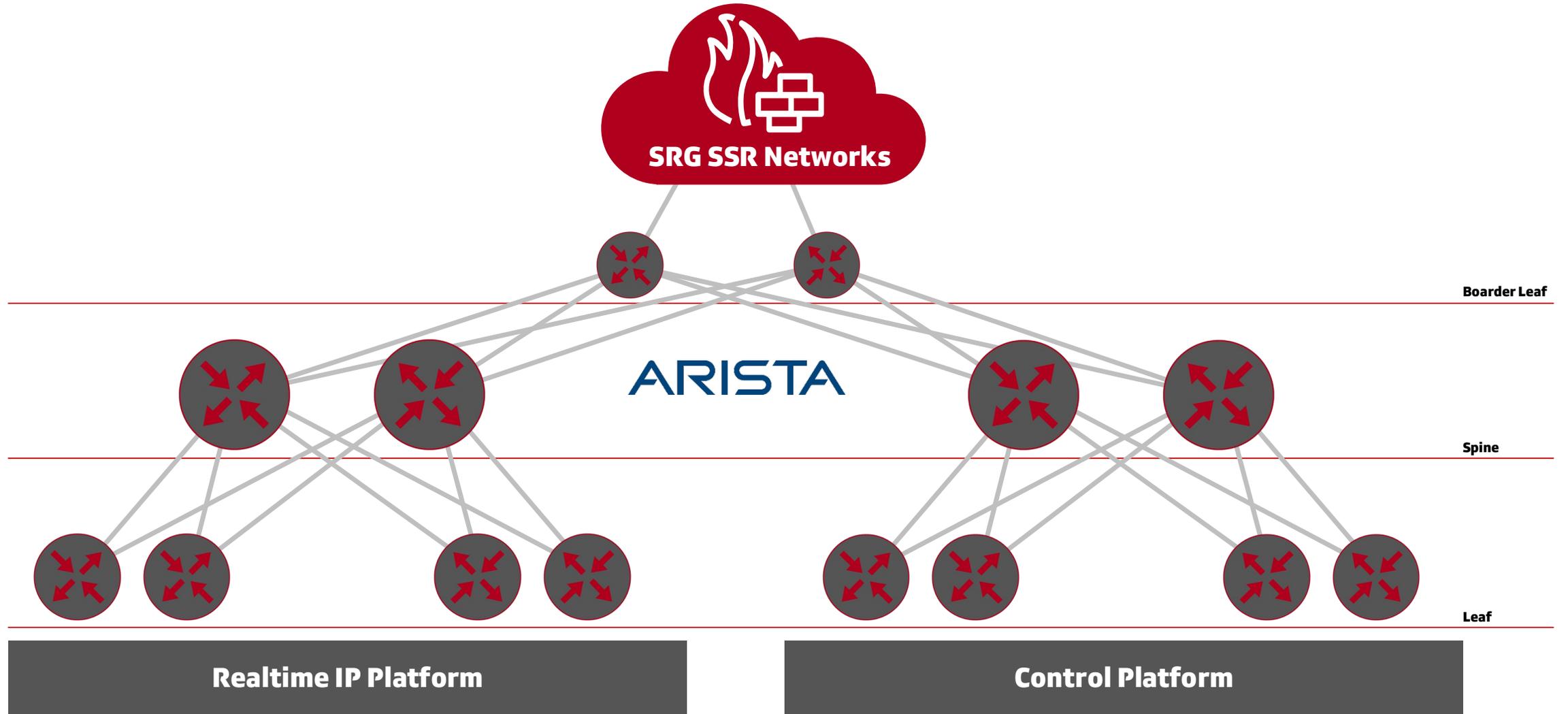CORE TECHNOLOGY

TECHNICAL INNOVATION

NETWORK OVERVIEW

PROJECT OVERVIEW

CHALLENGES

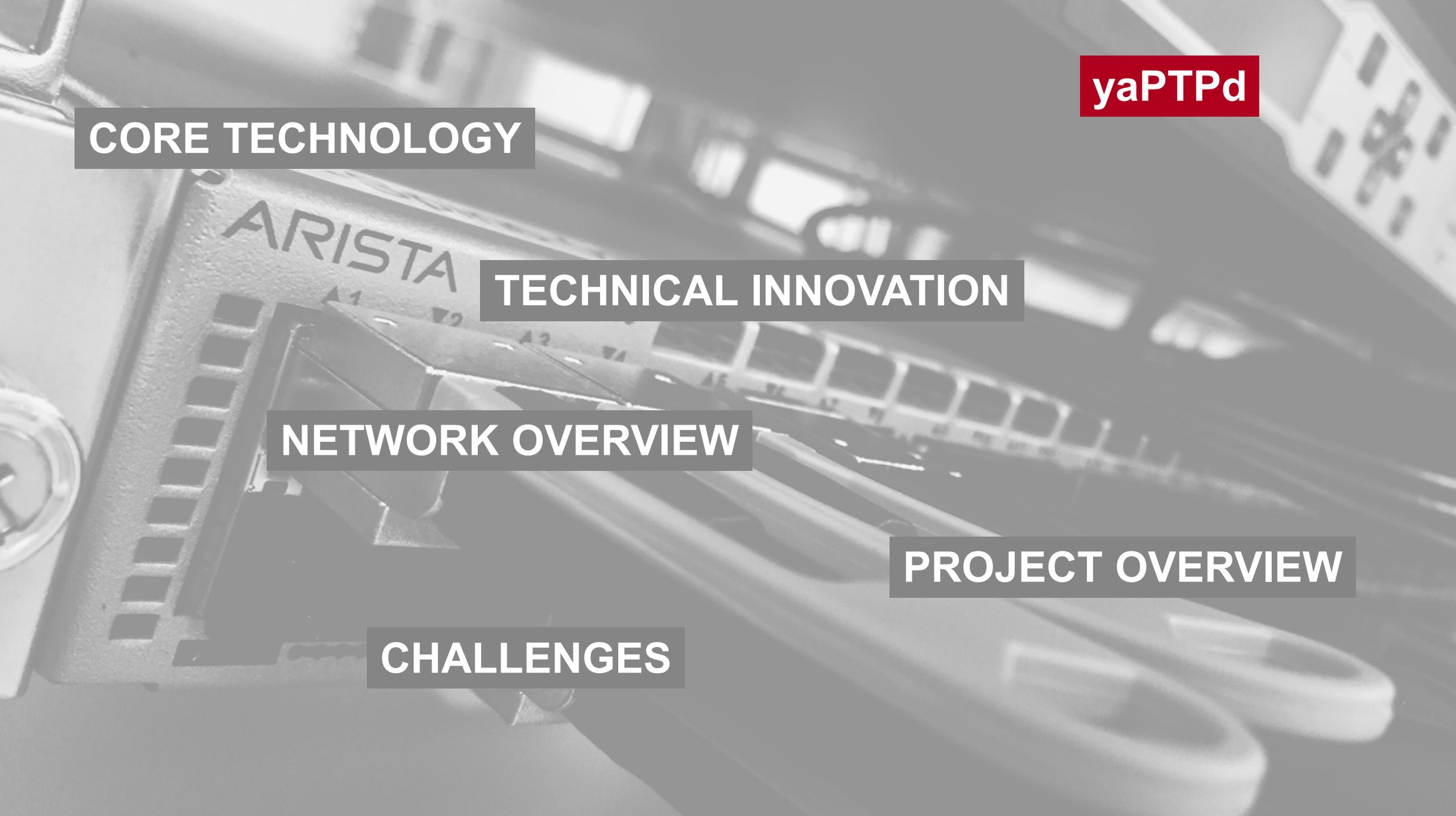# Network Architecture
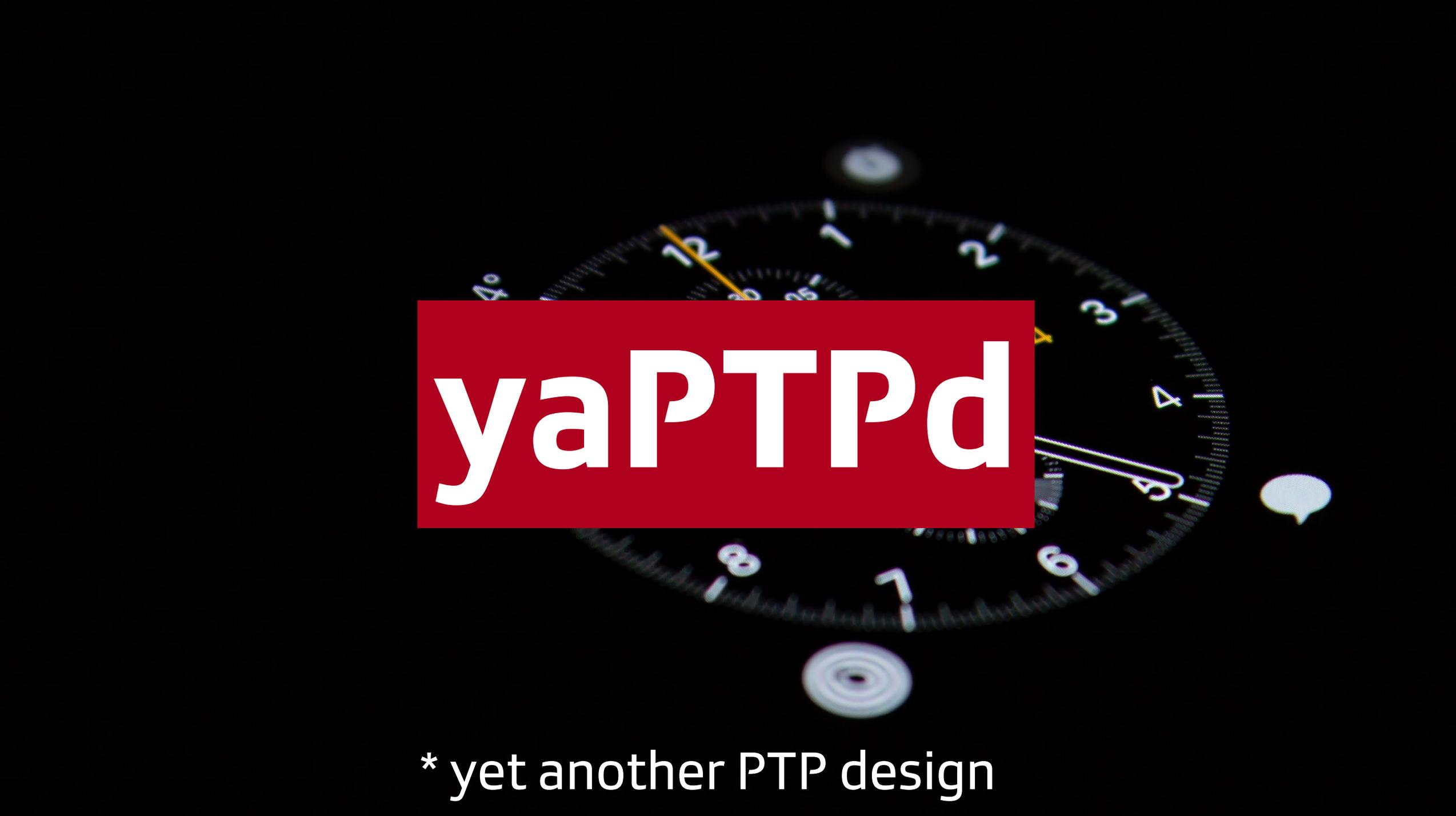
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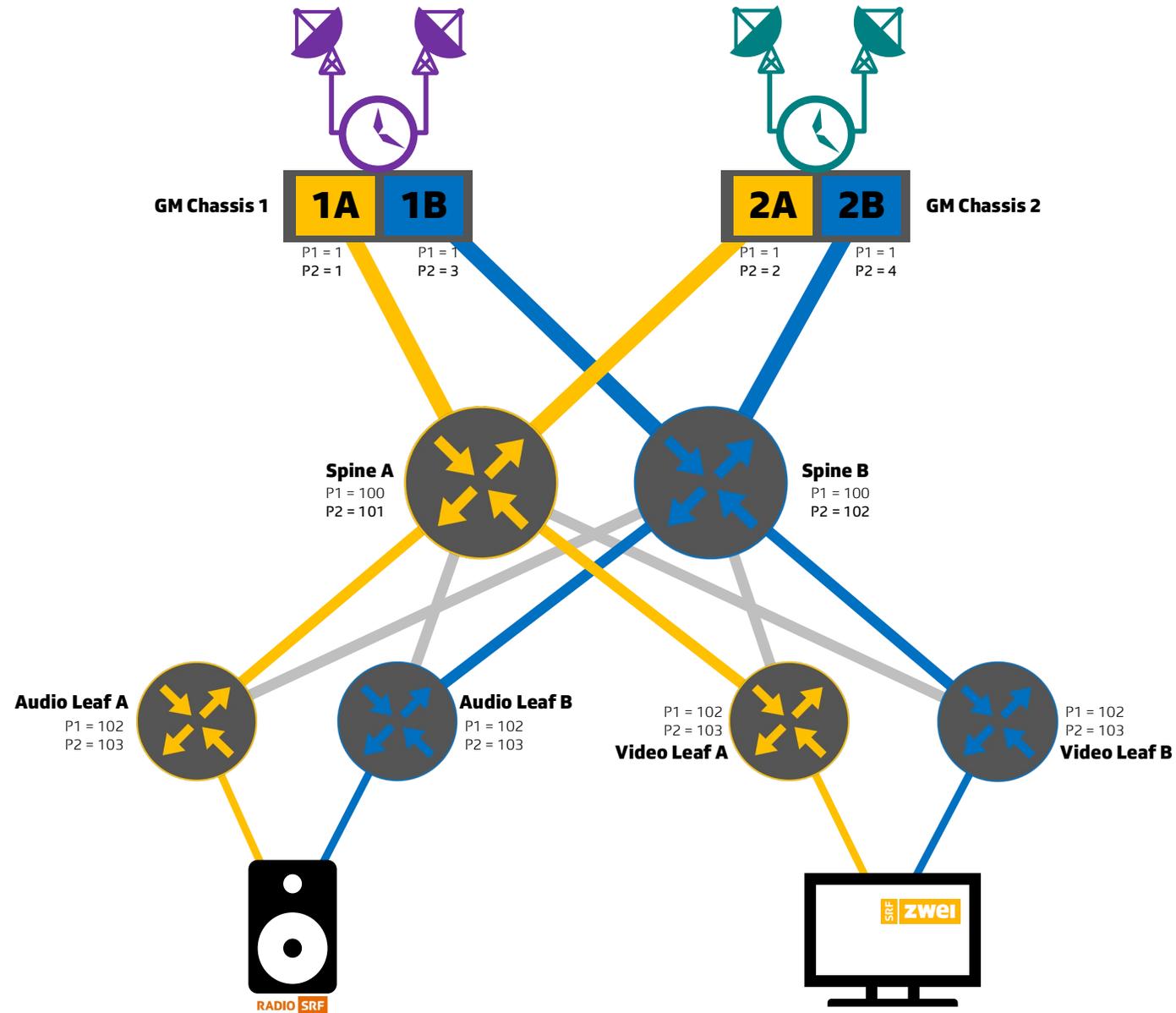
PROJECT OVERVIEW

CHALLENGES

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* yet another PTP design

PTP Design

- All Switches as Boundary Clock

- A- and B-Site separation only for PTP Traffic

- Grey Links not PTP enabled

- Redundant PTP towards end nodes where supported

- Design choice for this PTP Design: PTP amber / blue switchover at end node is faster than BMCA algorithm at switch level
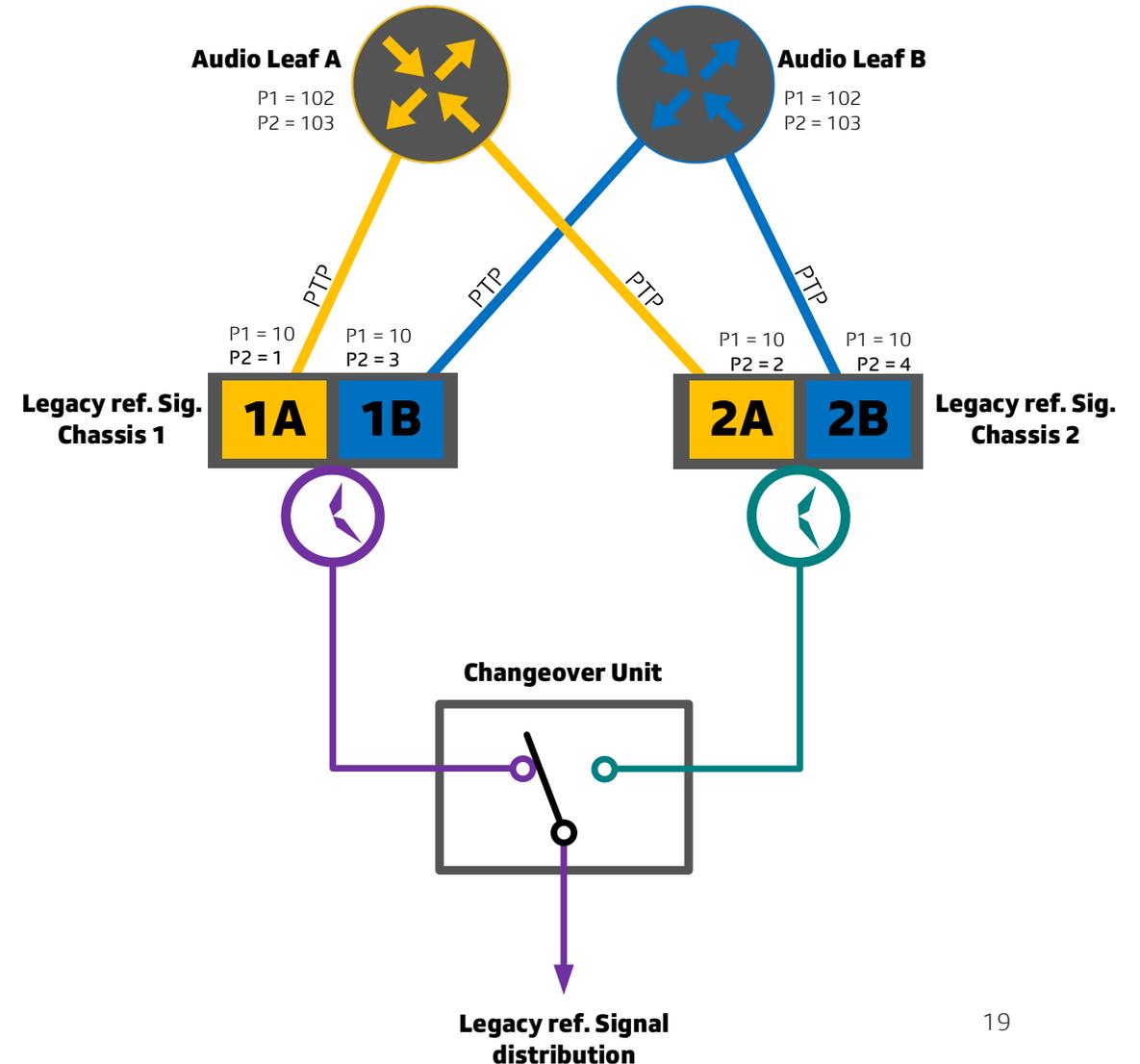
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Challenge 1: Legacy reference Signal integration

- need of legacy (non-PTP) reference Signals for Broadcast operations like 10MHz, Blackburst, Trilevel or Wordclock

- Due to the nature of BMCA, all legacy reference signals have to be driven from PTP

Audio Leaf A
P1 = 102
P2 = 103

Audio Leaf B
P1 = 102
P2 = 103

PTP   PTP   PTP   PTP

P1 = 10
P2 = 1

P1 = 10
P2 = 3

P1 = 10
P2 = 2

P1 = 10
P2 = 4

Legacy ref. Sig. Chassis 1

1A **1B**

2A **2B**

Legacy ref. Sig. Chassis 2

Changeover Unit

Legacy ref. Signal distribution

Challenge 2: PTP Management Messages

- **Enabling ST2059.2 Profile Extension TLV Messages for some Devices necessary**

- **TLV's answered as Multicast results in flooding of all Boundary-Clocks**

- **PTP4L Patch availible but not merged upstream**

- **We rolled back...**

| No.	Time	Source	Destination	Protocol	Length	Info
19	0.194812	10.120.234.134	224.0.1.129	PTPv2	142	Management Message
33843	198.22…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
35129	205.44…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
34278	200.43…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
26651	156.22…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
24690	144.42…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
33259	194.51…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
22114	129.42…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
22457	131.43…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
22635	132.41…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
23402	137.21…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
39932	233.46…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
40182	235.23…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
31958	187.22…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
19361	113.43…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
20732	121.40…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
25287	148.21…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
39321	230.23…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
5611	32.405…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
28801	168.43…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
37791	221.23…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
28629	167.44…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)
38815	227.23…	10.120.101.210	224.0.1.129	PTPv2	102	Management Error Message (NO_SUCH_ID)

```
  organizationId: 68:97:e8 (Society of Motion Pic
  SMPTE SubType: Version (0x000001)
∨ SMPTE Data
  > defaultSystemFramerate: 0000003200000001
    masterLockingStatus: Locked (4)
  > timeAddressFlags: 0x00
    currentLocalOffset: -37
    jumpSeconds: 0
    timeOfNextJump: 0
    timeOfNextJam: 0
    timeOfPreviousJam: 281474976624256
    previousJamLocalOffset: -37
  > daylightSaving: 0x00
  > leapSecondJump: 0x00
```

Challenge 3: Monitoring

- **Monitor the Boundary Clock on many switches is difficult**
- **Probing on each switch not feasible**
- **Some end devices does not report PTP State**
- **Only network monitoring view available**

PTP Offset from Master
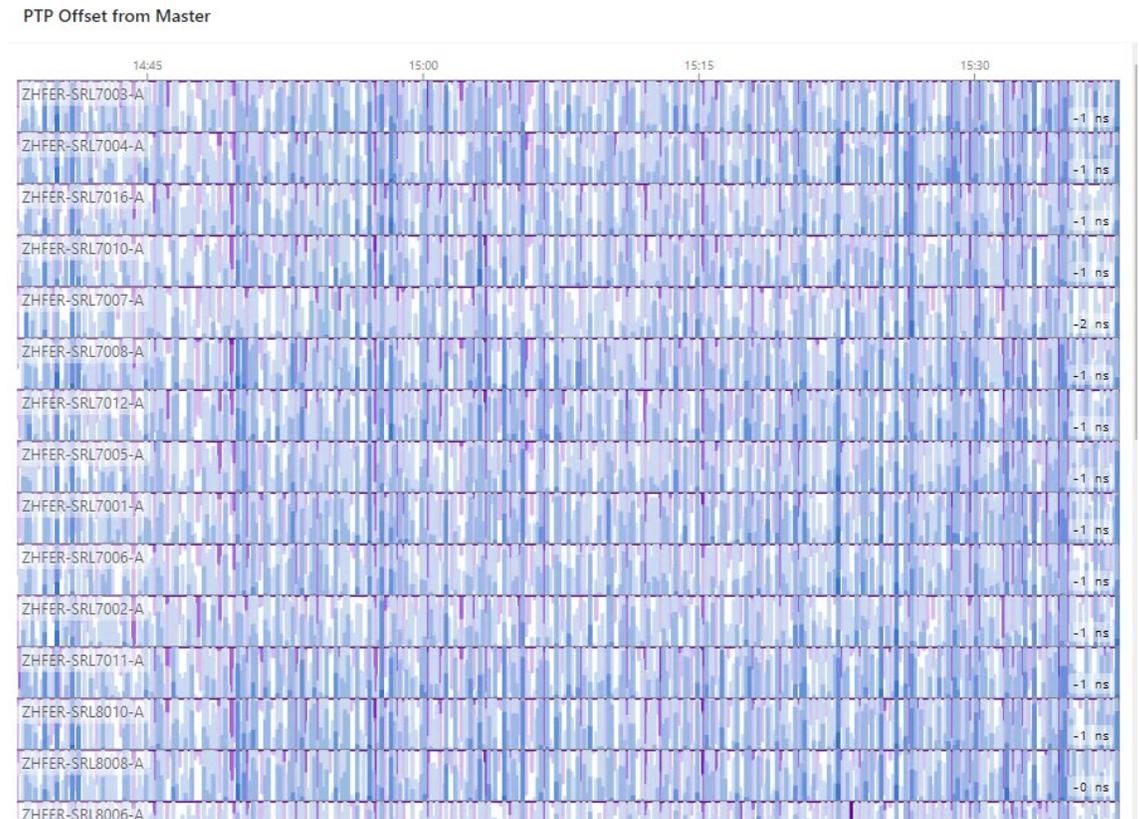
Challenge 4: PTP Experience in Broadcast
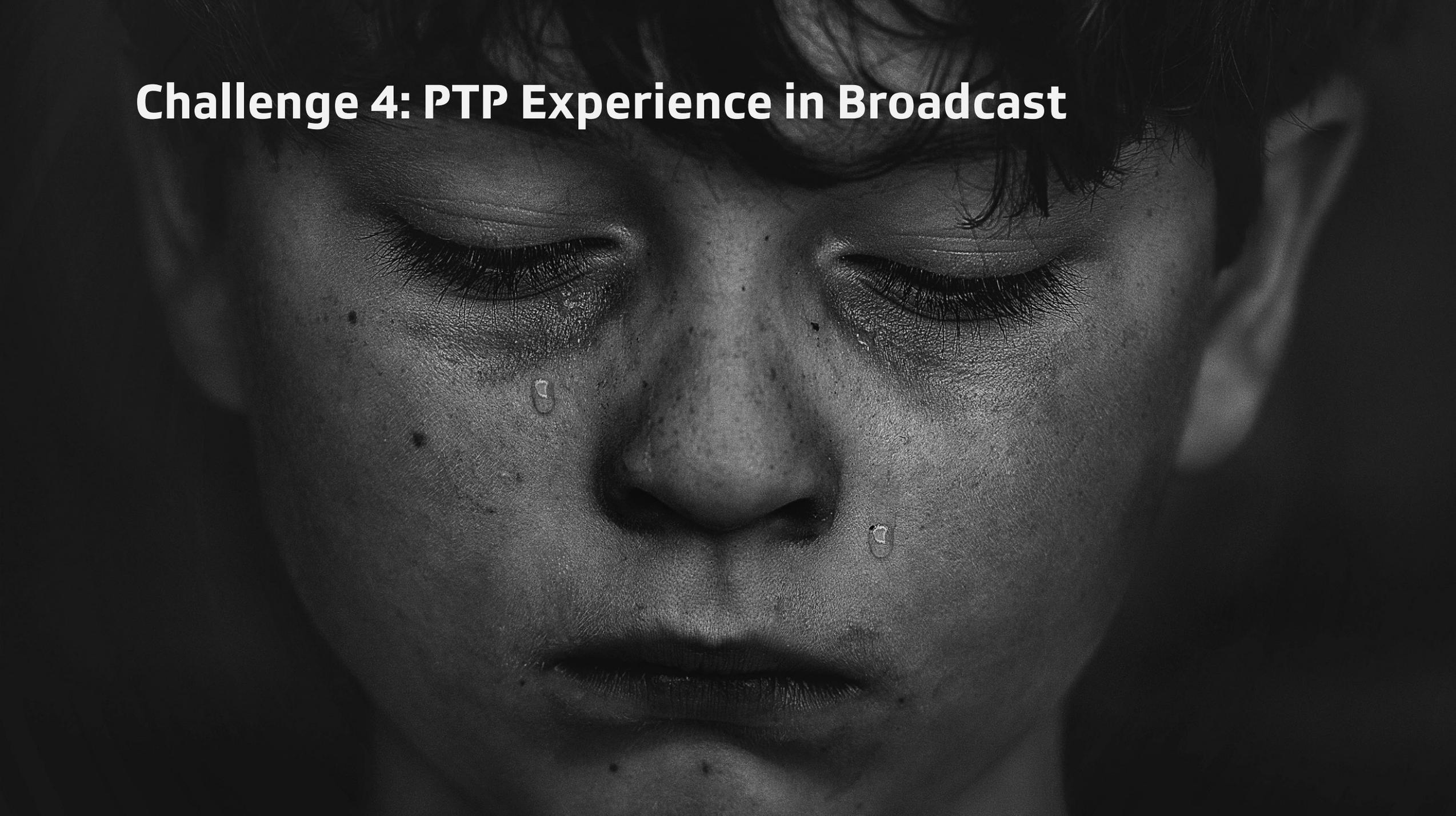
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btw... we are hiring

ADRIAN HILBER
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SANDRO FURTER
Project Manager Media Technology
sandro.furter@srf.ch

stock footage from www.unsplash.com

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