NOKIA

Nagyvállalati adatátviteli hálózatok megoldásai a következő évtizedben

Dániel Beszkid
Network Infrastructure
IP Pre Sales

The world’s most trusted supplier of the most critical networks

Communications services providers

Cloud providers

Digital industry

Government

Service routing portfolio

7220 IXR

Data center

7750 Service Routers

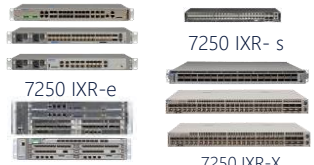
Core and DC gateway routers

7750 SRs (1s/2s/7s/14s) | 7750 SR-12e | 7750 SR-12/7/1 | 7750 SR-e | 7750 SR-a

FP4 | FP3

7250-IXR

Aggregation switches



7250 IXR-e | 7250 IXR- s | 7250 IXR-R6/R4 | 7250 IXR-X

VSR

Central network functions

NFV (RR, ePC, vSIMs, Sec gateway…) over x86

SR OS

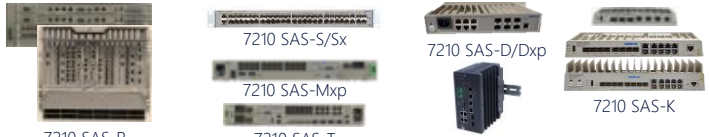
7705 Service Aggregation Routers

Compact platforms for legacy to IP/packet network transformation

7705 SAR-18 | 7705 SAR-8 | 7705 SAR-X | 7705 SAR-M/Ax | 7705 SAR-H/Hc/Hm/Hmc | 7705 SAR-W/Wx

7210 Service Access Switches

Access and aggregation devices



7210 SAS-R | 7210 SAS-S/Sx | 7210 SAS-Mxp | 7210 SAS-T | 7210 SAS-D/Dxp | 7210 SAS-K

Network and Service Management with Network Automation

Network Services Platform

- Network Operations: Network infrastructure management - Service activation and configuration - Service assurance
- Resource Control: Path control and optimization- Simulation - Multilayer control coordination
- Network Programing: Intent-based networking framework - Workflow automation engine - Pluggable network adaptation toolkit

How must networks adapt to upcoming technologies ?

Higher Bandwidth

More and more local compute

More flexibility

Higher Control

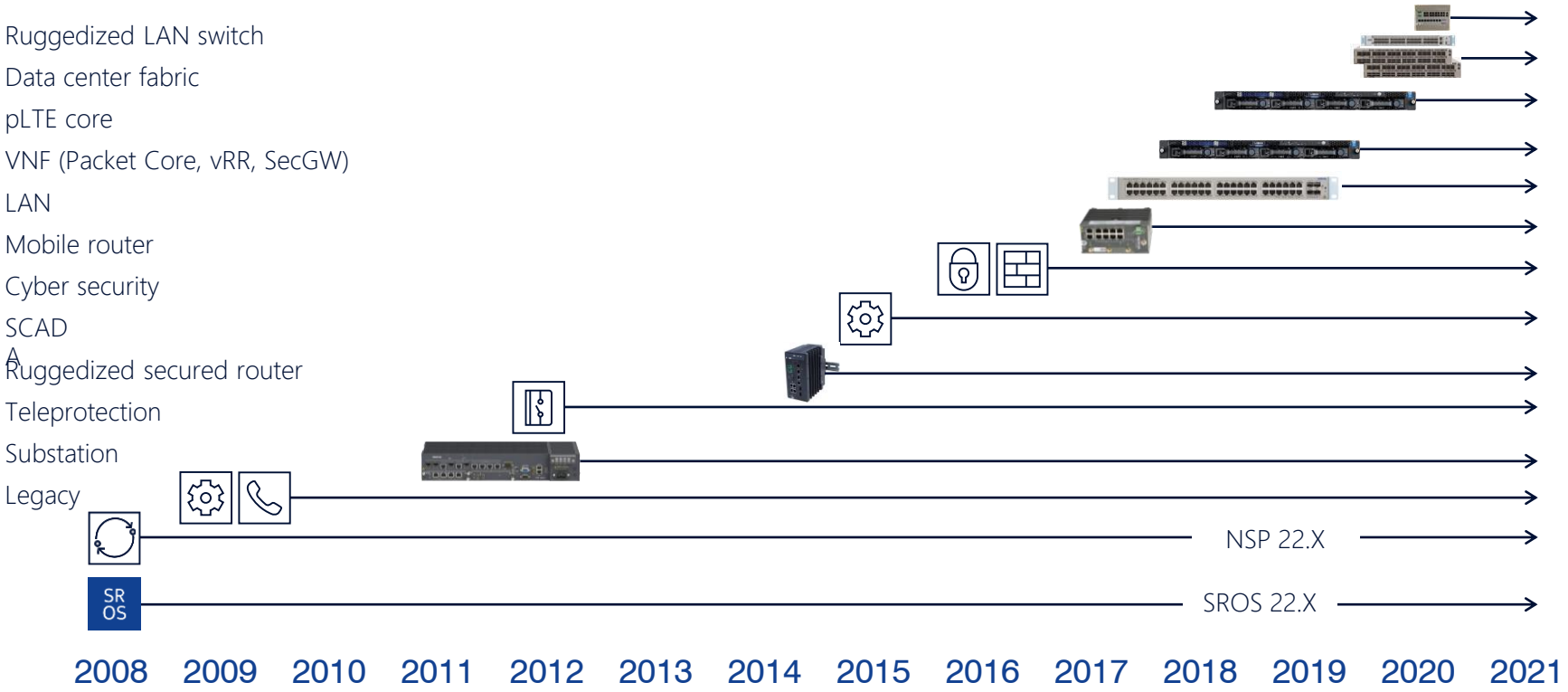
Higher Safety and Cybersecurity requirements

Network trends by segment

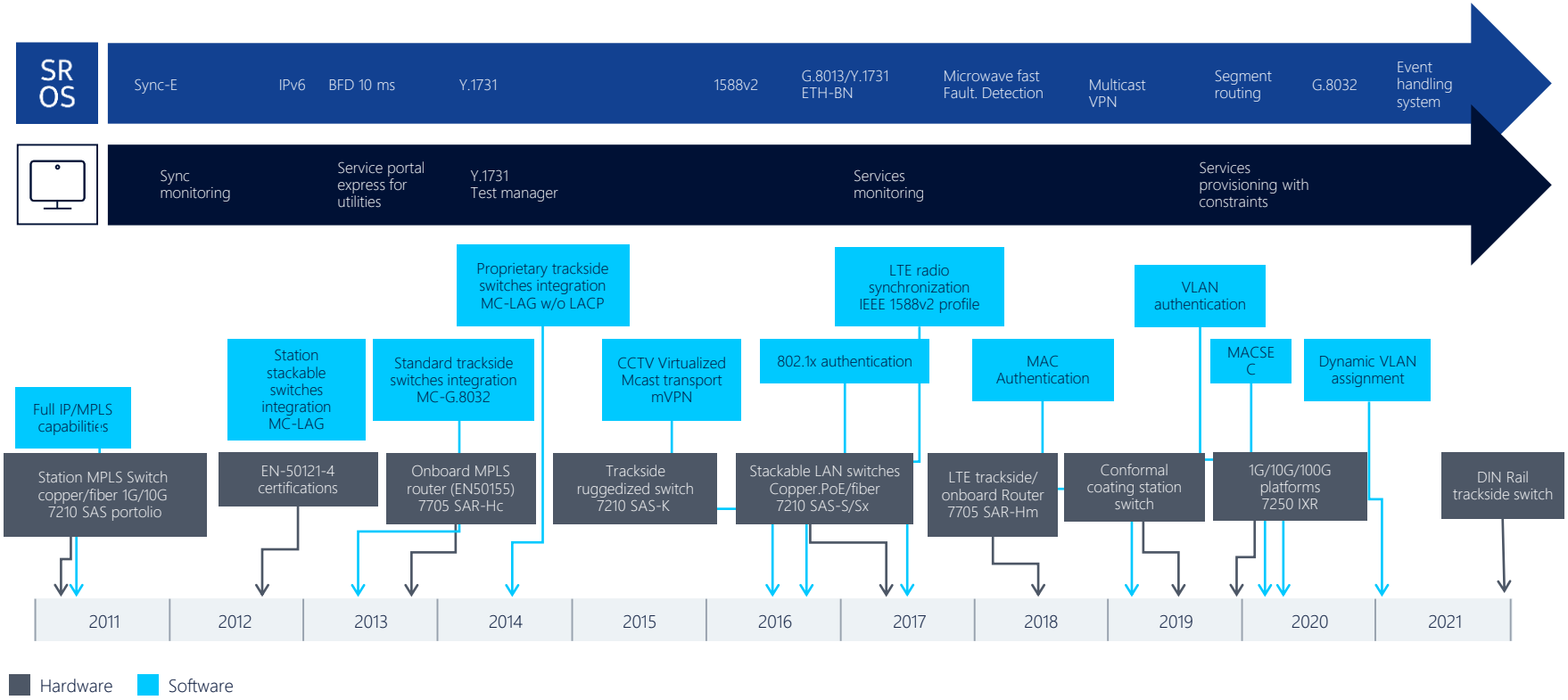
Improved communication – efficiency and productivity gains

Power Utilities	Still a lot of TDM migration projects to remove SDH networks Substation Automation projects
Railways	Still a lot of TDM migration projects to remove SDH networks. All customers haven’ t conducted a strategic project pLTE and FRMCS require adaptation of networks
Smart Cities	Leverage Deployment of fiber networks for open access, but also internal needs (video protection, IOT, …)
Defense	Refresh of existing networks to higher speeds, with still some TDM transformation underway
Research / Education	Building 400G networks, Moving very large data files at 100Gb/s Large DC creation
Government	Replace dependency on carrier services to lower costs Large DC creation

A specific focus on mission critical and enterprise IP/MPLS



Continuous investment and innovation for urban railways



Nokia IP solutions for transportation

Mainline railways

- Migrating SDH networks to robust flexible IP/MPLS without changing applications

Nokia's values

- Natively integrating any application including TDM over IP/MPLS
- Scalable and robust Architecture and products
- Fully sync portfolio for GSM-R and FRCMS

Solutions

- 7705 SAR-8 TDM to IP
- 7750 SR in core
- 7210 SAS for trackside applications

Urban rail projects

- Multi-service backbone for all applications (CBTC, PA/PI, CCTV, …)

Nokia's values

- Scalable architecture leveraging IP/MPLS for secured transport of applications
- High availability network compatible with short maintenance windows

Solutions

- 7210 SAS as station router and trackside switch
- 7750 SR or 7250 IXR for core and aggregation

Air traffic control

- Multi-service backbone for G2G and A2G applications

Nokia's values

- High control on network behavior leveraging programable network processor
- High stability and flexibility SR OS

Solutions

- 7705 SAR-8 or 7750 SR as transport routers

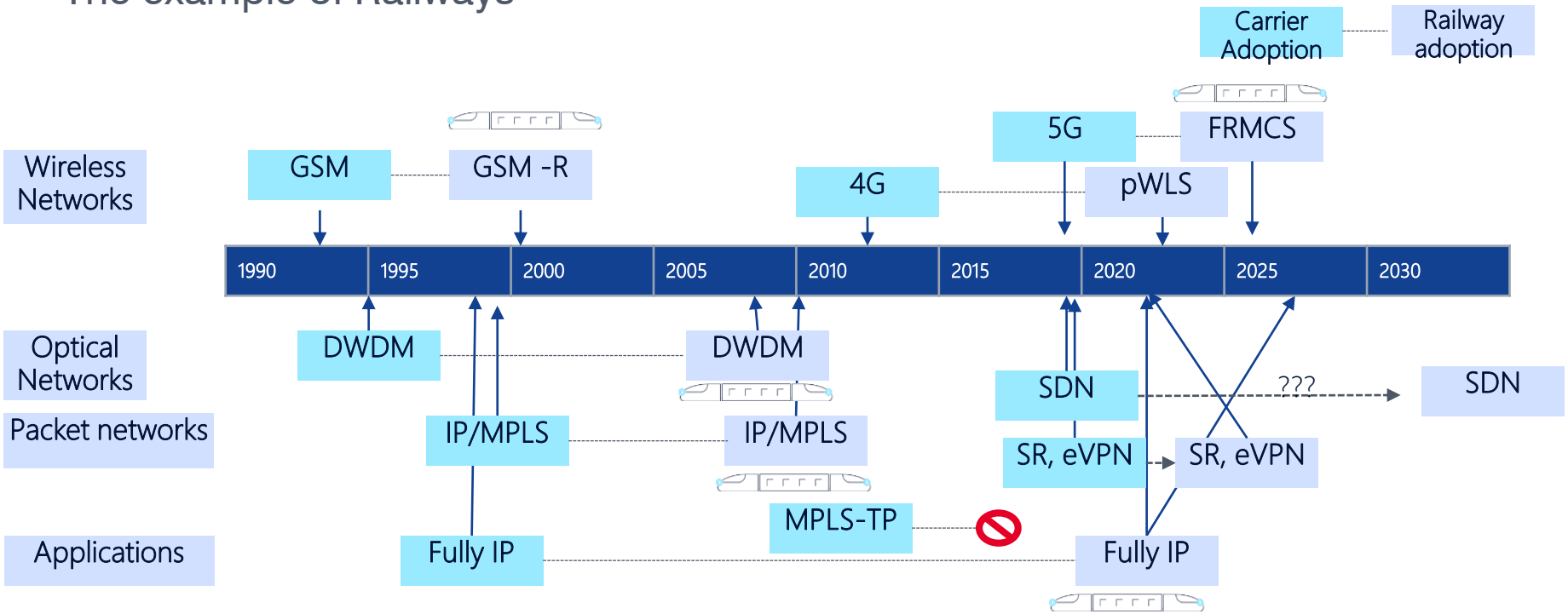
Other transport markets

- Highways roadside networks
- Port infrastructure network and mobile router

NOKIA

Telecoms technology adoption in critical networks

The example of Railways



IP vision 2022-24

Critical objectives in Nokia IP networks for 2022-24

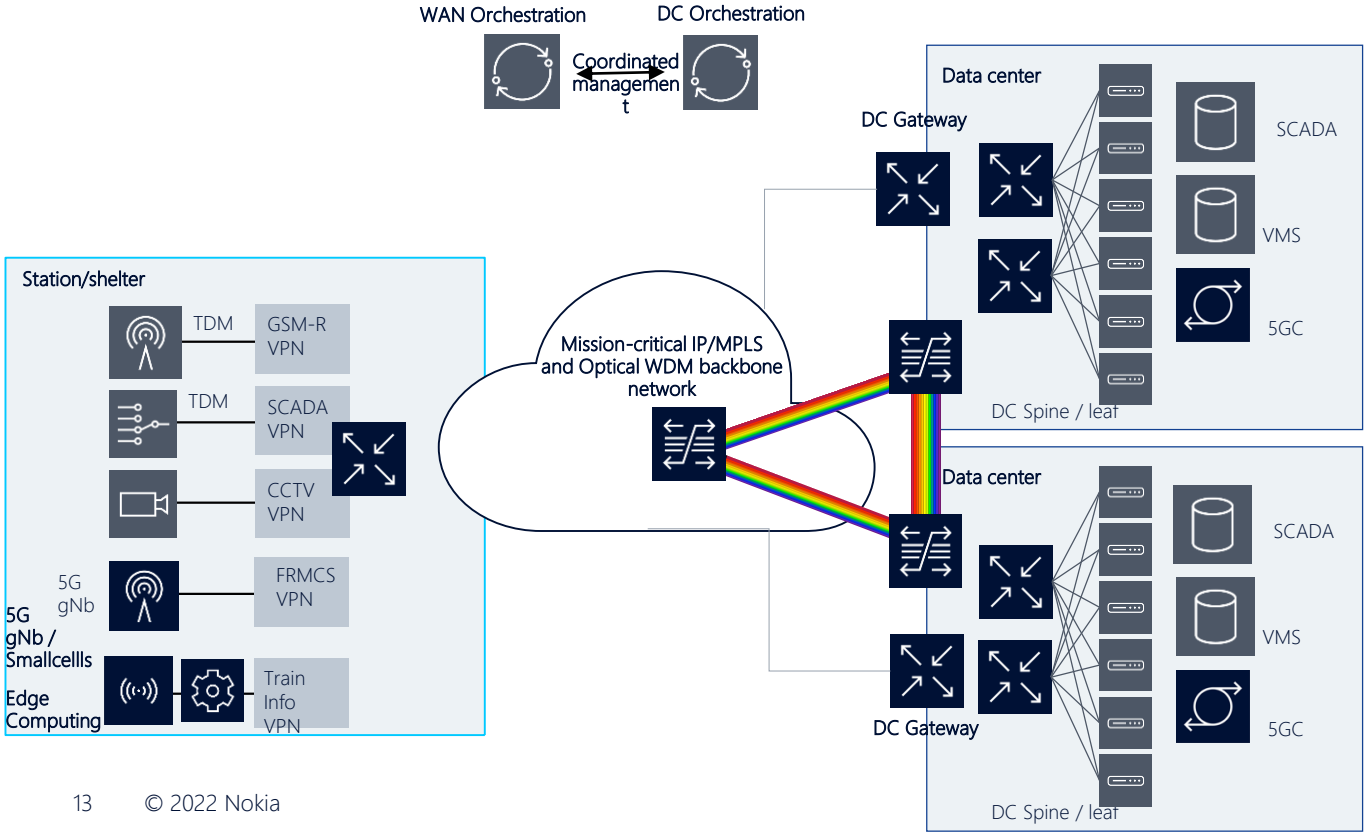
- Performance without penalty
- Coherent routing
- Security by design
- Green focus
- Automation and Infrastructure as Code
- Digitalization of key industries (Industry 4.0)
- Software architectural initiatives

Data Center evolution

NOKIA

Providing an agile data center infrastructure

From static to programmable Private Data Centers



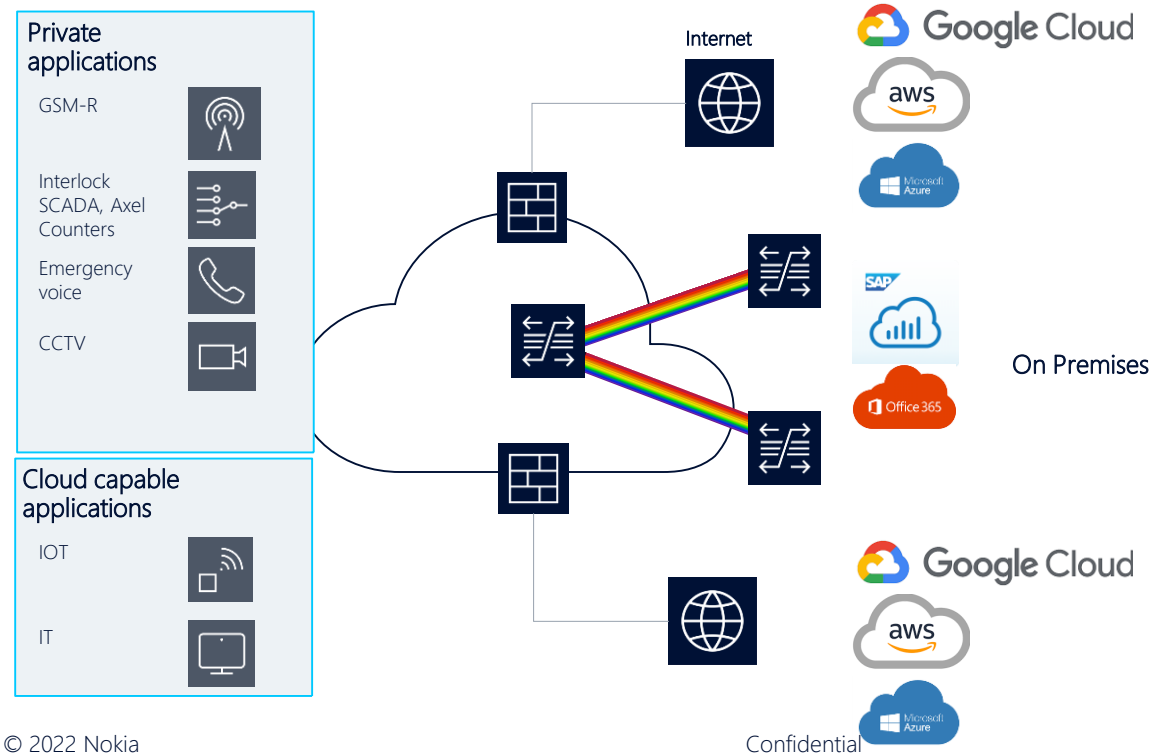
Highlights

- Build a solid Data Center foundation to prepare for DevOps model
- Bring flexibility to the infrastructure in order to leverage virtualization environment
- Joined orchestration to build end to end services stitched by DC Gateway

Benefits

- Scalable reliable redundant DC architecture to cope with critical application and growth
- Programmable fabric to adopt a NETOps model
- Sandbox model for safer simpler operations

Leveraging public clouds
Secured connection to public clouds



Highlights

- IT applications already available from the Cloud
- Some OT applications leverage some Cloud services
- Centralized access to avoid local breakout
- Connection over Internet can be secured using IPSEC or application encryption (SSL).

Benefits

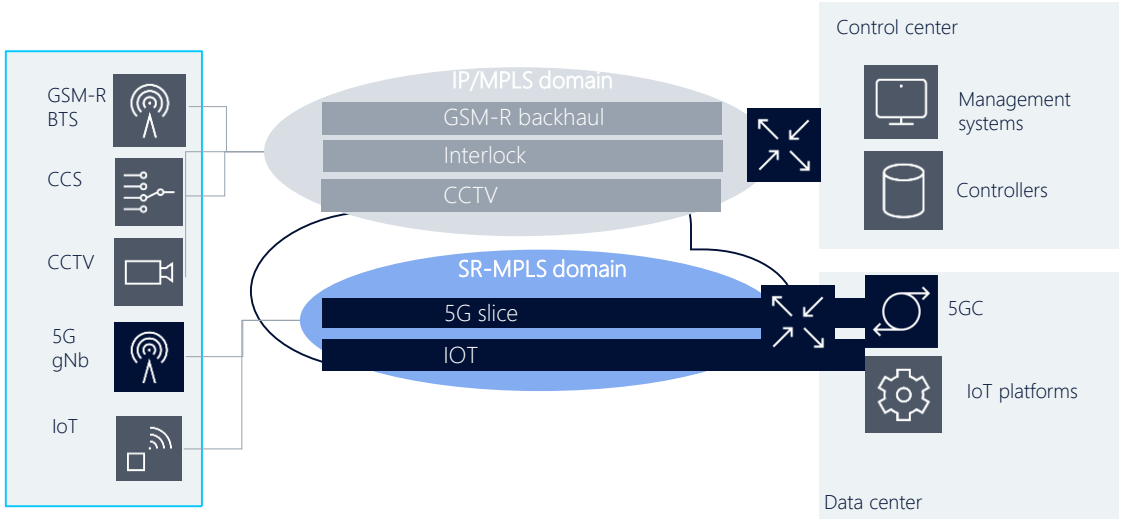
- Allows secured control and separation of cloud access on a per VPN basis.
- Leverages best in class application without compromise on security and network performance

Wireless Everywhere

NOKIA

Converged network embracing 5G

Unleash Segment Routing for 5G backhaul … and other



Highlights

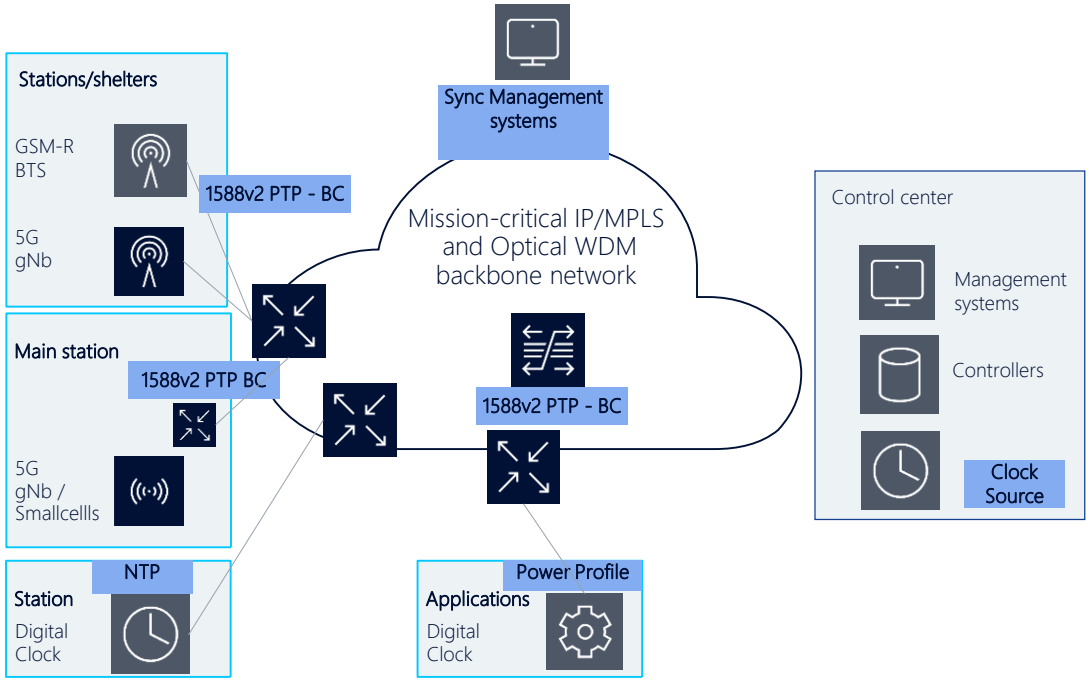
- Segment Routing harness the power of network slicing in backhaul to deliver 5G
- Segment routing provides rich Traffic Engineering scenario, along with high resiliency and high scalability
- Segment Routing does not require extensive hardware resources (versus SRv6)

Benefits

- No disruption to existing network services and applications for existing Nokia IP/MPLS customers
- Future proof and flexible technology

End to end architecture for synchronization

Requirements of new applications : accurate clocking



Highlights

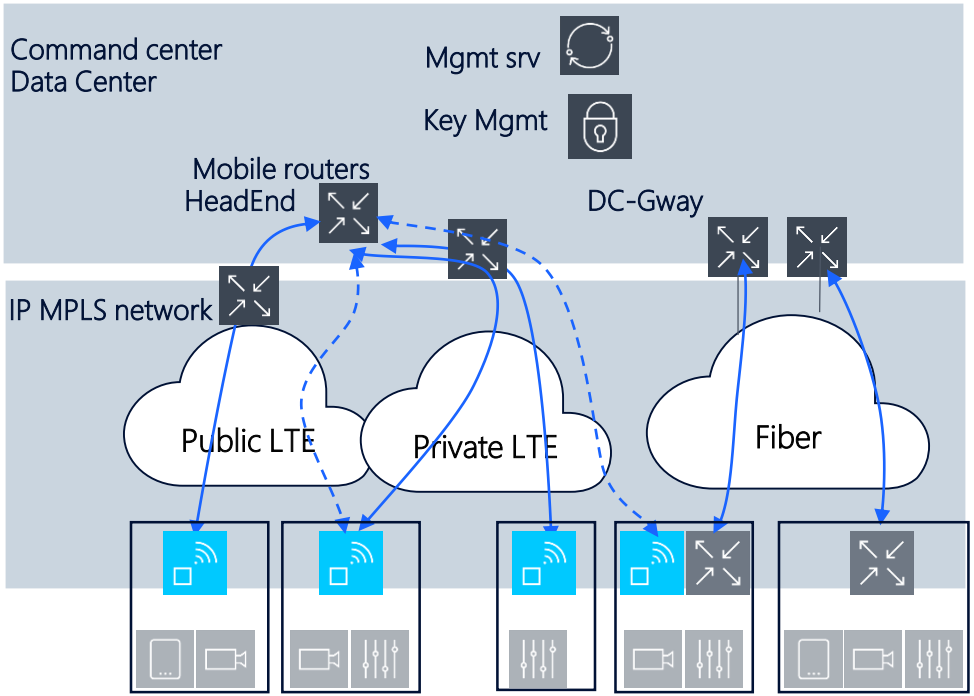
- High Precision Phase and Frequency distribution are mandatory for 4G/5G
- Hardware assisted synchronization
- Interaction of sync. at IP and WDM layer
- NTP with high precision for railway applications
- Some applications leverage sync (Utilities power profile)
- Synchronization is an application as well

Benefits

- Allows handover at train speed
- Allows distribution of clocking to Small Cells in underground networks
- Avoids GPS issues (costs, security)
- Avoids NTP Scalability issues

Leveraging LTE for branch site connectivity

What if LTE transport was just another transport ?



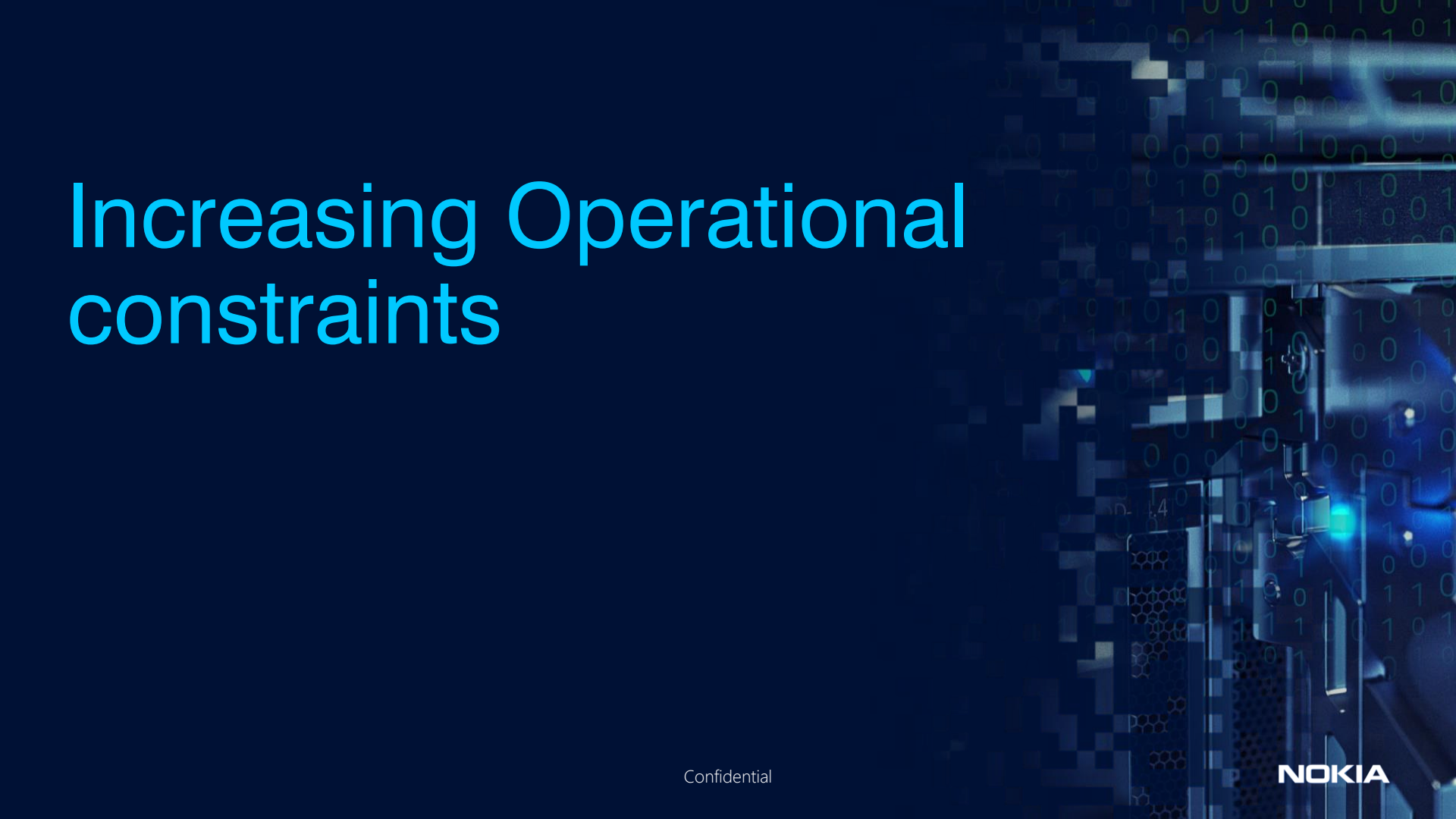
Highlights

- IOT multiplies the number of sites to connect, and makes LTE an ideal technology
- Remote sites should be treated as an extension of the network rather than a set of boxes being deployed
- If backup required, many options available
- Use of IP/MPLS VPNs end to end is possible to facilitate L2, L3 and any to any as well as VPN isolation.

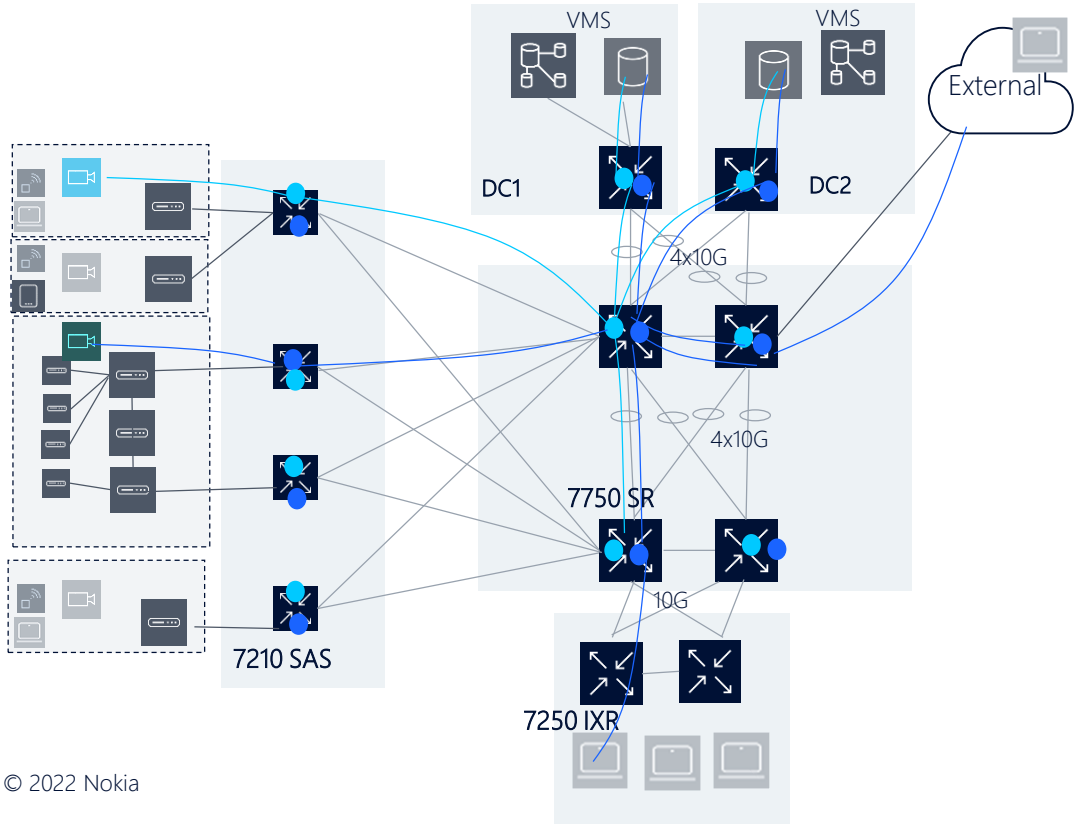
Benefits

- Single technology end to end with similar provisioning
- Flexibility of evolution from LTE to fiber if applications require it
- Flexibility to run MPLS backup over LTE

Increasing Operational constraints



Smart Territory
The CCTV Challenges



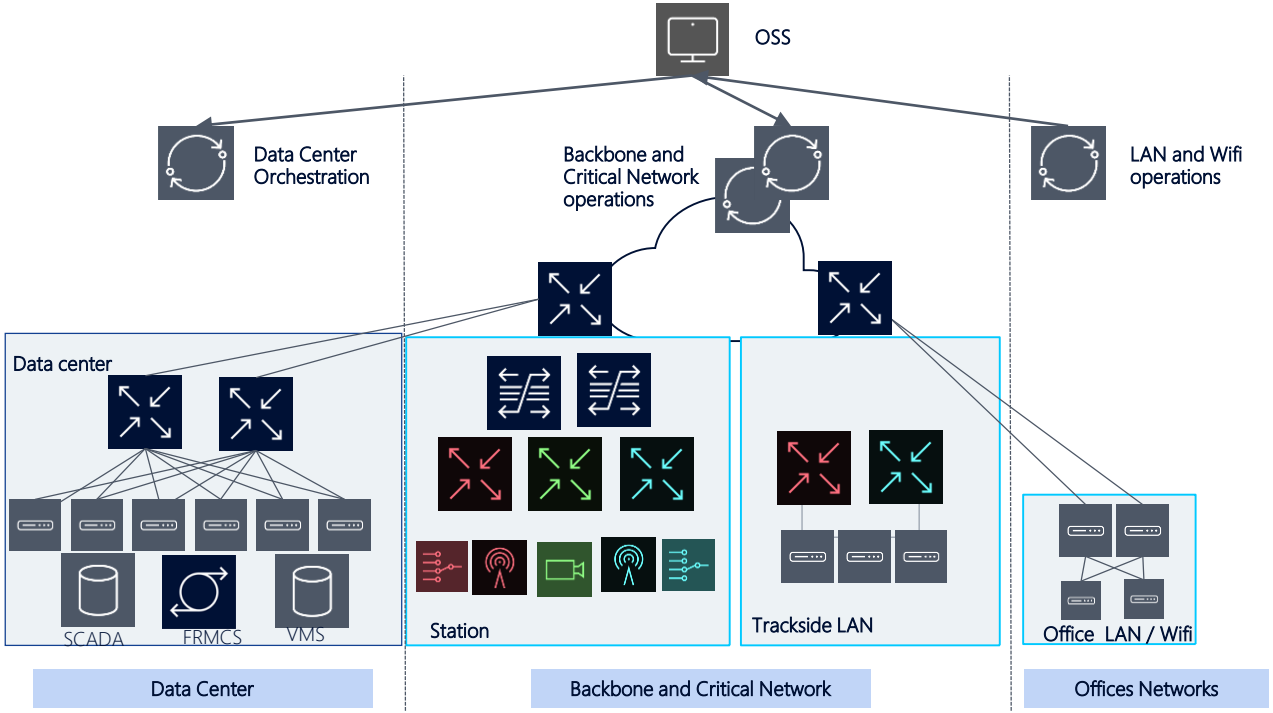
Highlights

- Networks of >1000 cameras with redundant storage and multiple monitoring sites are common.
- A camera needs to send a minimum of 3 streams
- Use of MPLS Multicast VPNs allows traffic optimization
- High scaling of core routers required to replicate traffic

Benefits

- Optimized delivery of multicast minimizes bandwidth requirements
- Flexible architectures (VMS, monitoring centers,)
- Centralized, simplified and controlled interaction with external agencies.

Increasing pressure of Safety
Segregating domains



Highlights

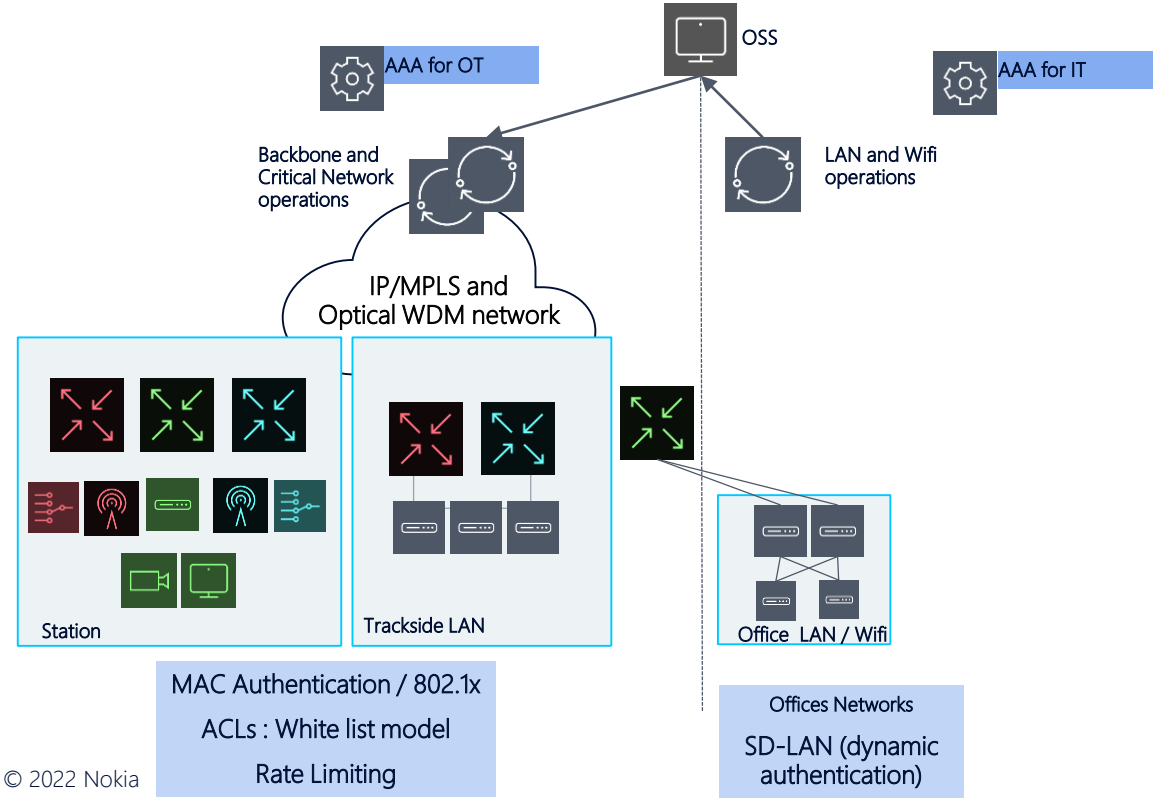
- Critical networks cover WAN and critical LANs (trackside and stations). This provides end to end control on services.
- Office LAN / Wifi do not require end to end service definition (security, control, redundancy).
- Office LAN do require a clear interface with critical WAN (PE-CE model)
- Data Center Orchestration requires different set of technologies

Benefits

- Simplifies service definition
- Simplifies management life cycle
- Simplifies safety related constraints by removing adherence between domains

Increasing pressure of Cyber Security

Secured zero trust network

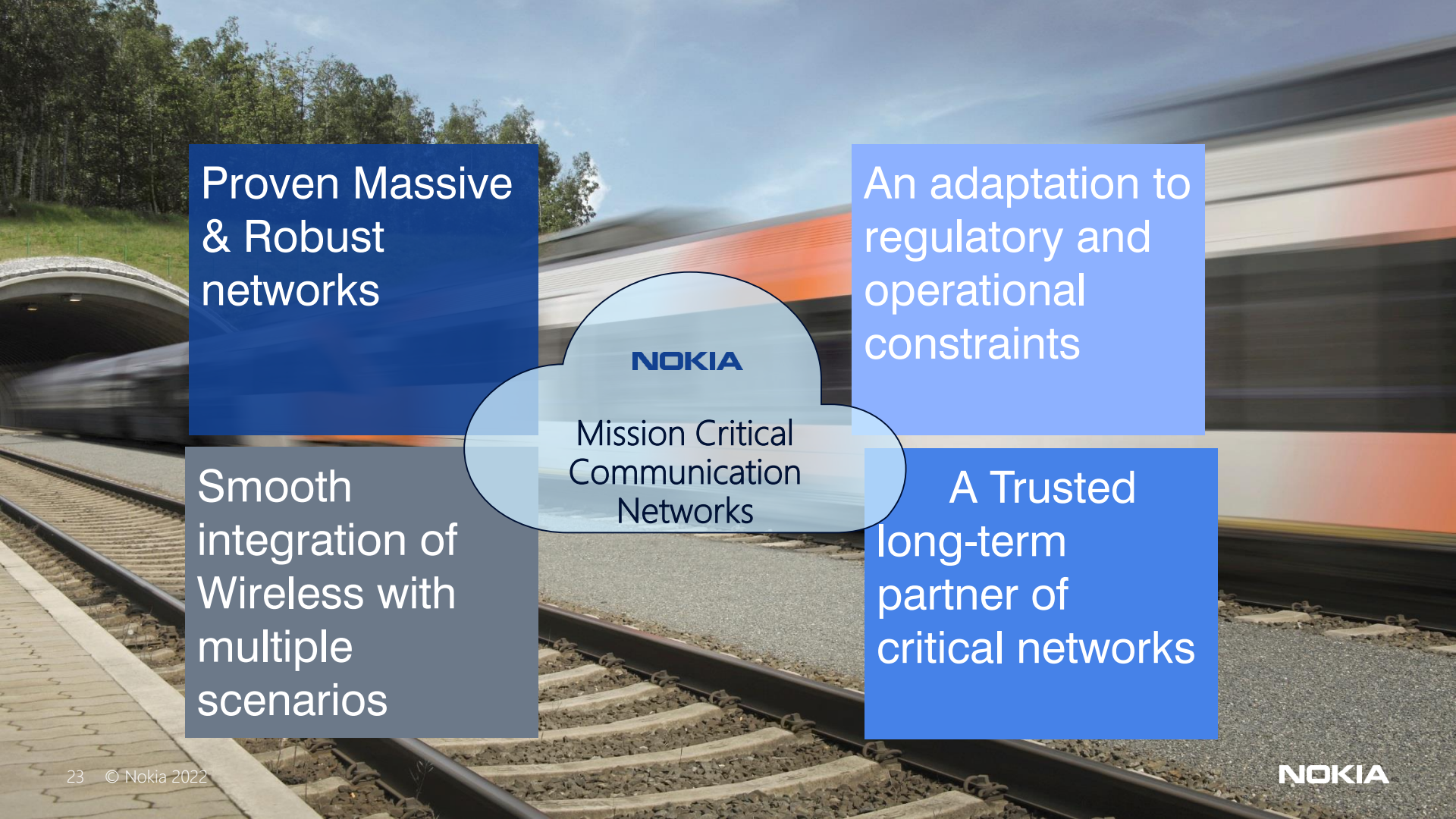


Highlights

- Network Authentication along trackside requires life cycle management (not all have 802.1x)
- Trackside applications are more static. White-list and rate limiting can be managed.
- Office LAN do require a dynamic operation (SD-LAN) to adapt to new way of working

Benefits

- Secured authentication in all network
- Adapts security to network life cycle, reality and constraints
- ACL and Rate limiting protect against network DDoS attacks



NOKIA

Copyright and confidentiality