Next-gen data center switching for the AI era

Carlos Neves

Europe IP Enterprise DC Business Lead

What customers expect?

What they are saying*

"It just works and its simple"

"Simple, easily scalable easily operable"

"Everything keeps working during upgrades"

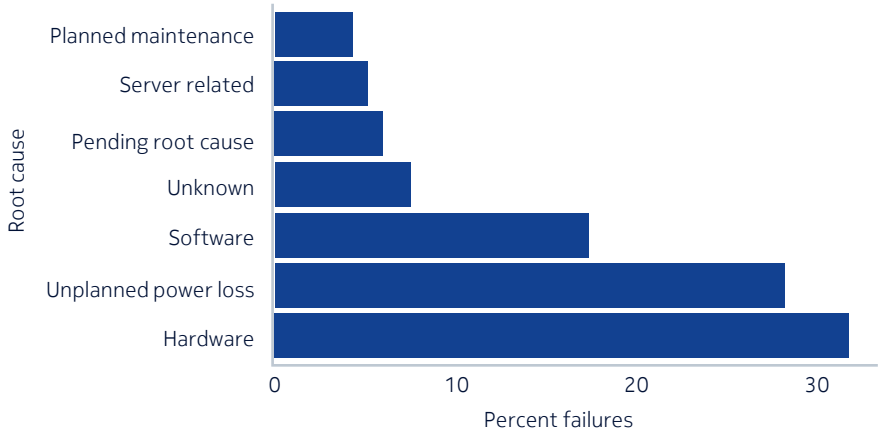
"Resilient, secure products that perform well"

*Derived from Nokia discussions with data center design, deployment and operations staff

Preventing outages in scaled data centers

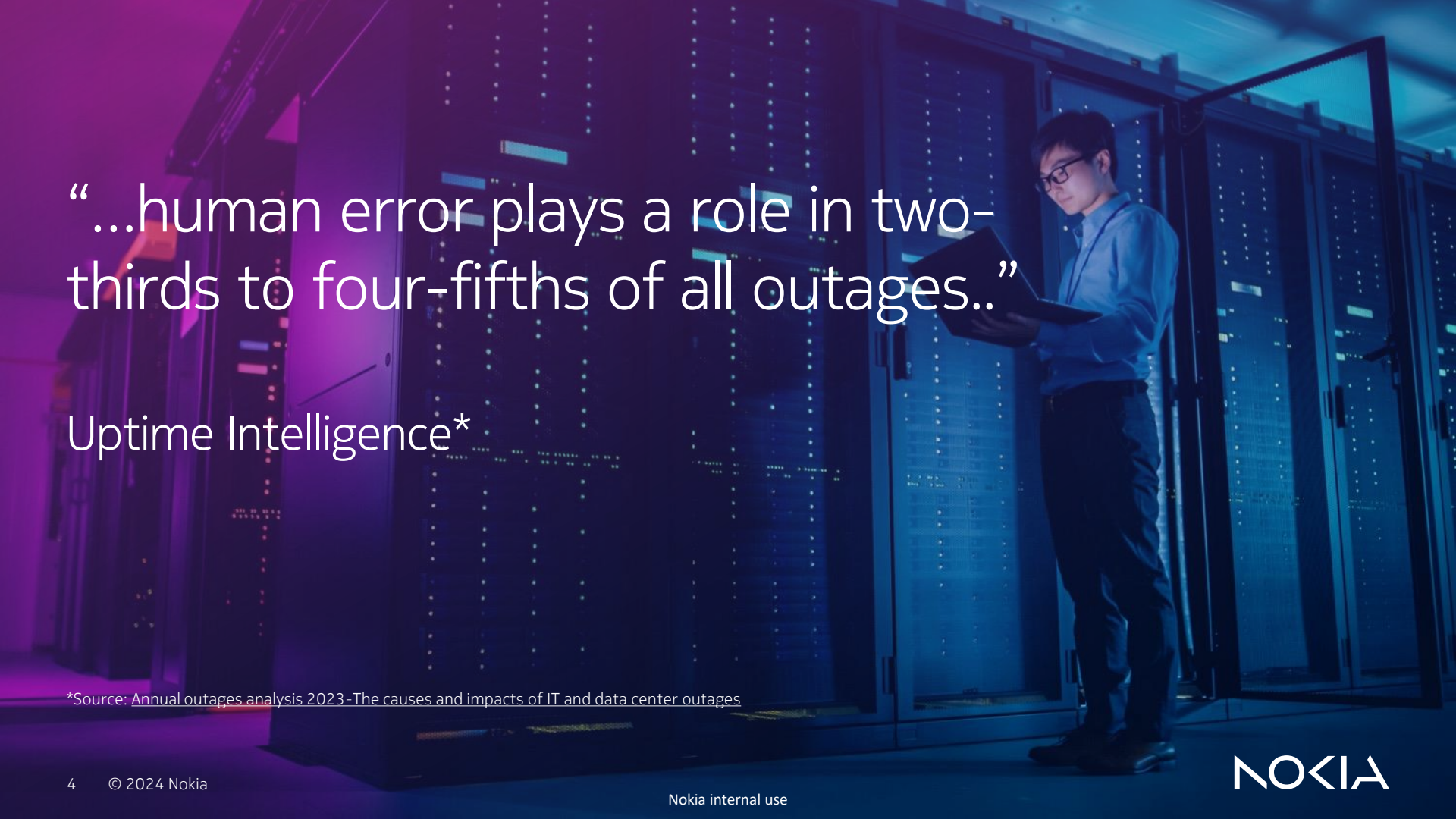
Means understanding what causes them

- Microsoft conducted research over 3 months near the end of 2020 with the goal to understand outage durations and their causes
- Research conducted across >180,000 switches deployed in Azure data centers across 130 regions
- Mostly static, controller driven architecture
- The whitepaper published articulates that 32% of outages were hardware related, and 17% software bug related – with configuration static



Source: Paper: "Surviving switch failures in cloud datacenters" ACM SIGCOMM Computer Communications Review - Rachee Singh, Muqeet Mukhtar, Ashay Krishna, Aniruddha Parkhi, Jitendra Padhye, David Maltz

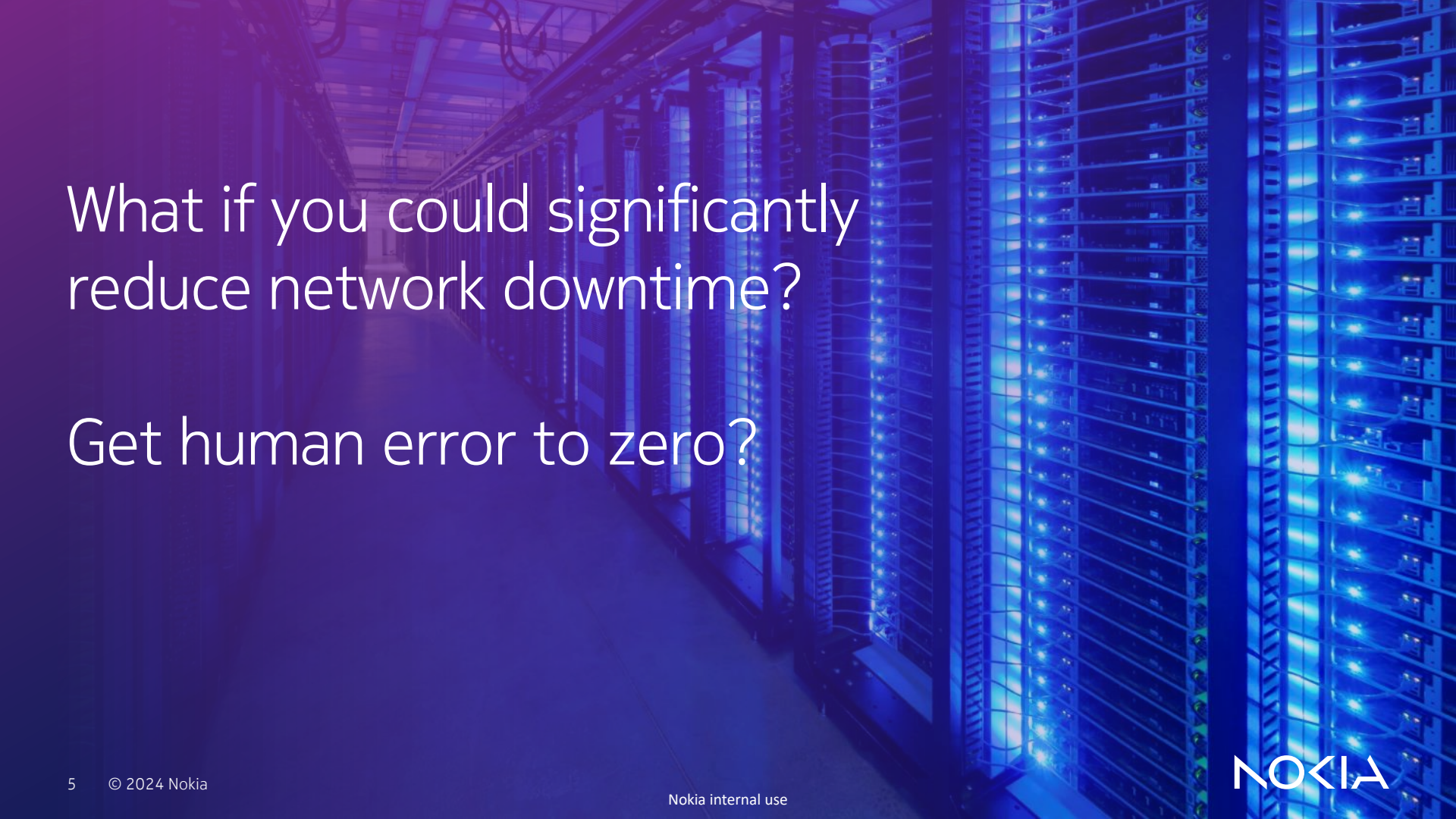
How much worse does this get in a non-cookie cutter, constantly changing data center?



“...human error plays a role in two-thirds to four-fifths of all outages..”

Uptime Intelligence*

*Source: Annual outages analysis 2023-The causes and impacts of IT and data center outages



What if you could significantly reduce network downtime?

Get human error to zero?

Nokia Data Center Fabric solution

Reliable and simplified data center fabrics for your environment

Reliable networking

- Quality-first approach to system design
- Built-in reliability for all solution elements

Enhanced operations

- Reliable and predictable operations
- Simple to use and easy to operate and maintain

For your environment

- Supporting your staff and your processes
- Eases integration with related ecosystems

Nokia Data Center Fabric solution

Reliable networking

Reliable networking

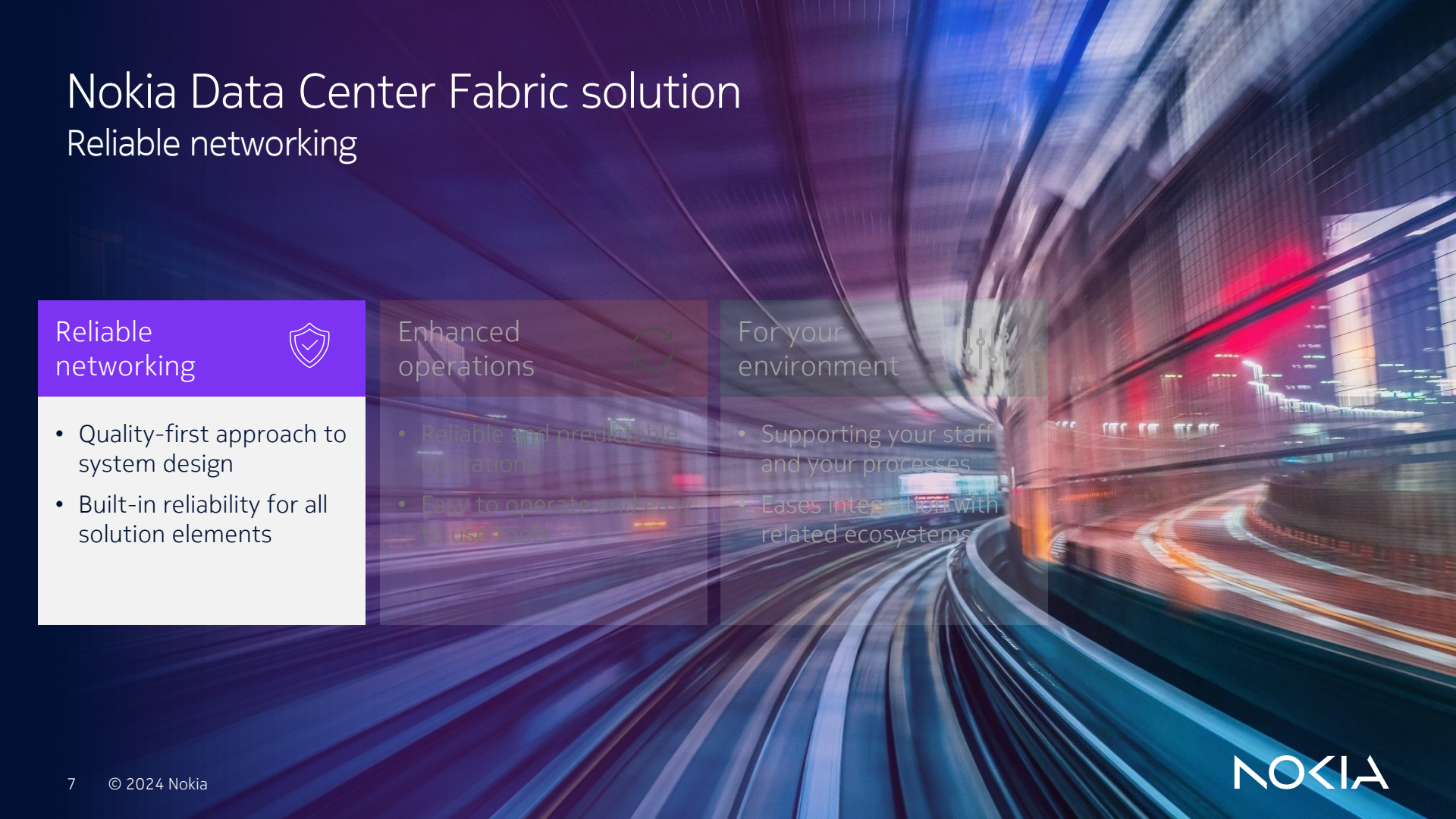
- Quality-first approach to system design
- Built-in reliability for all solution elements

Enhanced operations

- Reliable and predictable operations
- Easy to operate and easy to use tools

For your environment

- Supporting your staff and your processes
- Eases integration with related ecosystems



Nokia Data Center Fabric solution

Next-gen data center switching for the AI era

Event-Driven Automation (EDA)

SR Linux
Network Operating System

7220 IXR, 7250 IXR
Switches & routers

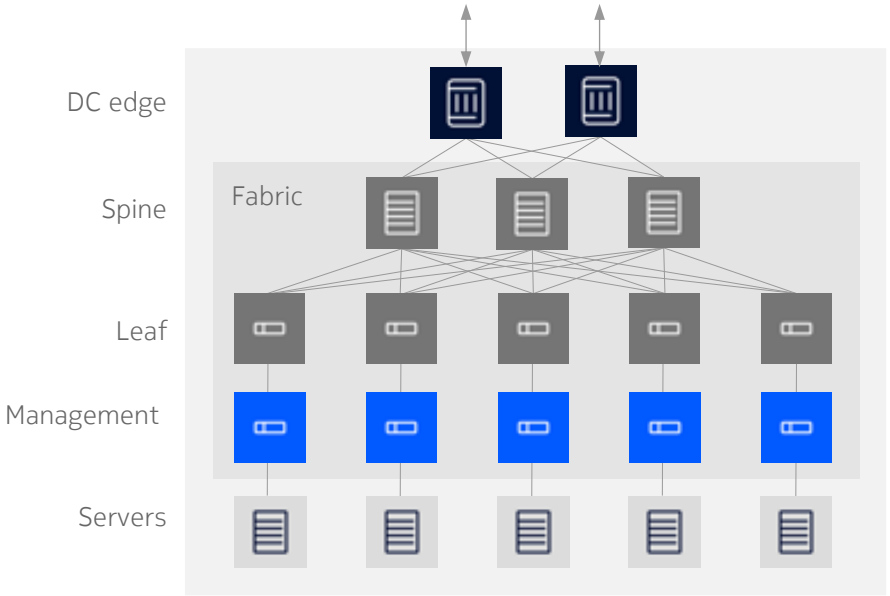
Reliable, simplified and adaptable data center operations

Open, extensible and resilient NOS with proven routing capabilities

High-capacity, energy efficient leaf, spine platforms

Data center network architectures

The industry has converged



Non-blocking fabrics

- IP and EVPN fabrics
- DC gateway or border leaf derivatives
- Collapsed core for edge DC
- Scale via super spines / pods

Merchant silicon (Broadcom)

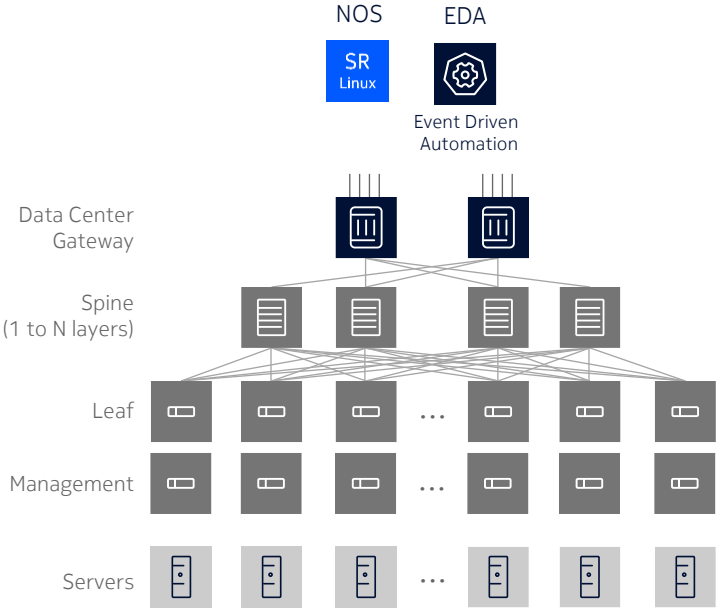
- Tomahawk for shallow buffer IP fabrics
- Trident for shallow buffer EVPN fabrics
- Jericho for deep buffer requirements

OOB management

- Merchant silicon
- 1G/10G port speeds

Nokia Data Center Fabric solution

Network connectivity for all workloads (AI and general-purpose)



Back-end networks	Front-end networks
7750 SR/7250 IXR	7750 SR/7250 IXR
7250 IXR-6e/10e/18e 7250 IXR-X1b/X3b 7220 IXR-H4	7250 IXR-6e/10e/18e 7250 IXR-X1b/X3b 7220 IXR-H2/H3/H4 7220 IXR-D3L/D4/D5
7250 IXR-6e/10e/18e 7250 IXR-X1b/X3b 7220 IXR-H4/D4/D5	7220 IXR-D1/D2L/D3L 7220 IXR-D4/D5
7220 IXR-D1 7215 IXS-A1	7220 IXR-D1 7215 IXS-A1

- **Back-end networks** deliver lossless, low latency interconnect for high-value GPU resources required for AI training, AI inference or other HPC workloads
- **Front-end networks** deliver connectivity for AI workloads, general-purpose workloads (non-AI compute) and management of AI workloads

Nokia Data Center Fabric hardware portfolio

Ready for the AI era

7215 IXS-A1

7220 IXR-D series

7220 IXR-H series

7250 IXR-X1b/X3b

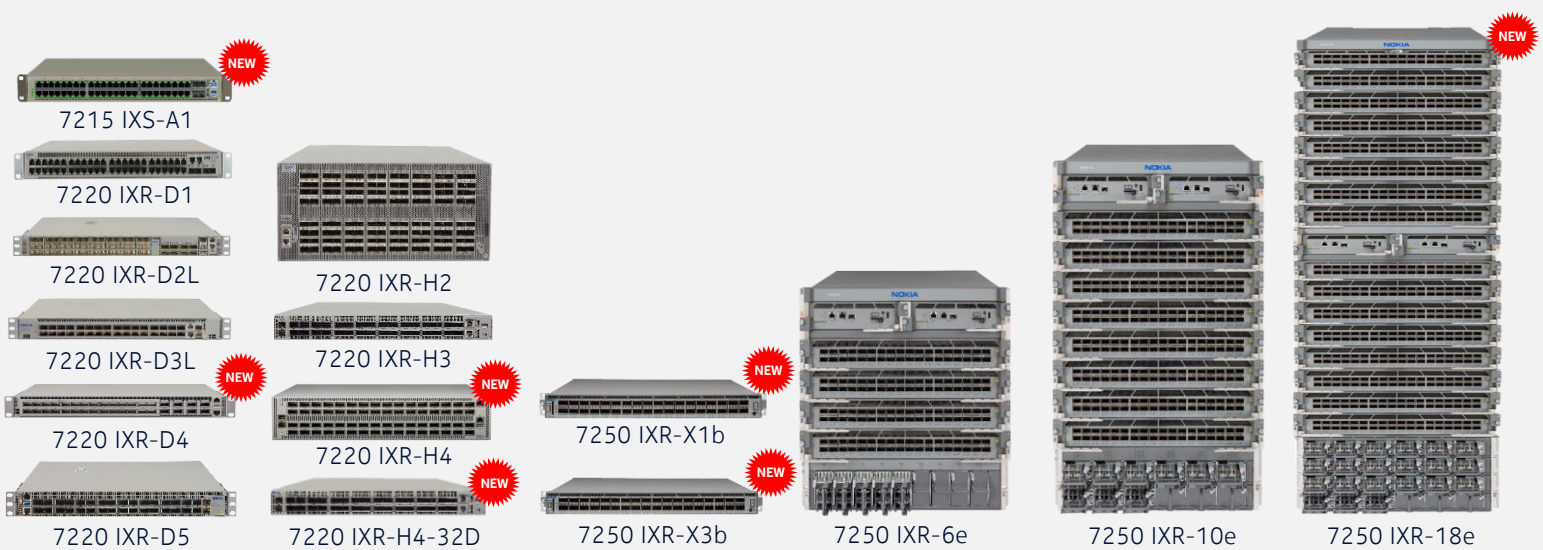
7250 IXR-6e/10e/18e

- Merchant silicon-based platforms for back-end and front-end networks
- Proven hardware design practices and track record
- Unique design innovations in modular platforms
- Lowest power super-spine platforms in the industry
- Designed for scale and future expansion
- Power and cooling optimized

SR Linux

7220 and 7250 IXR Product Portfolio

Power-efficient solutions for cost-effective network applications



Based on merchant silicon

Versatile design

Full range of DC applications

- Broadcom based with Nokia differentiation
- Highest 100GE density in the industry
- Power and cooling optimized
- Designed for scale and performance with big buffers where needed

7250 IXR

Modular & fixed configuration platforms

SR Linux

	7250 IXR-X1b	7250 IXR-X3b	7250 IXR-6e	7250 IXR-10e	7250 IXR-18e
Size/Depth	1RU / 546mm	1RU / 647mm	10RU / 813mm	16RU / 813mm	35RU / 1062mm
Switch Cap.	7.2T FD	14.4T FD	57.6T → 115.2T (J3)	115.2T → 230.4T (J3)	460.8T (J3)
Slot Cap.	-	-	14.4T → 28.8T FD		28.8T FD
Interfaces	24 x QSFP28, 12 x 400G QSFP-DD	36 x 400G QSFP-DD	60 x QSFP28, 36 x 400G QSFP-DD, 36 x 800G QSFP-DD		36 x 800G QSFP-DD
	Fixed	Fixed	4 slots	8 slots	16 slots
Fabric	-	-	8 SFMs → 7 SFMs (J3)		14 SFMs (J3)
CPU, DRAM	8-core x86, 32GB	8-core x86, 32GB	8-core x86, 32GB: CPM 4-core x86, 16GB: 60p100 IMM. 36p400 IMM		
SSD	80GB	80GB	240GB		

SR Linux

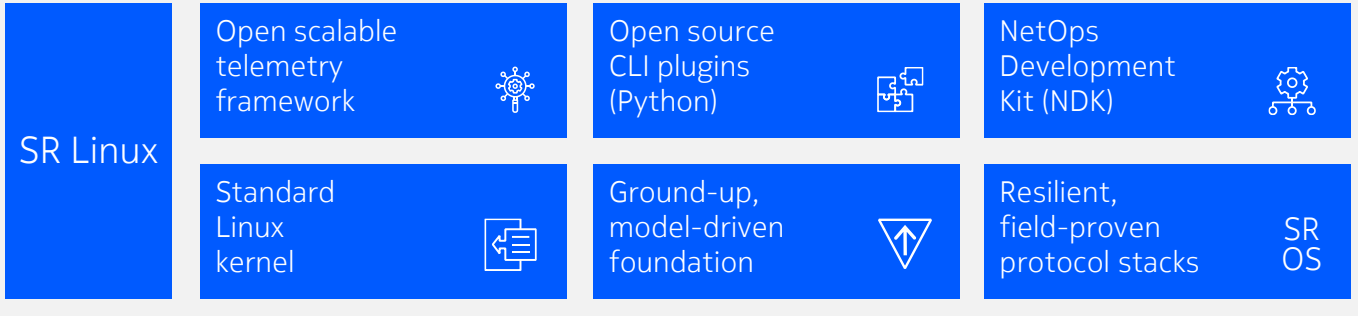
7215 / 7220 for data center fabrics

Fixed configuration platforms

	7215 IXS-A1 7220 IXR-D1	7220 IXR-D2L	7220 IXR-D3L	7220 IXR-D4	7220 IXR-D5	7220 IXR-H2	7220 IXR-H3	7220 IXR-H4-32D	7220 IXR-H4
Height / Depth	1RU (1.75 in)	1RU (1.75 in)	1RU (1.75 in)	1RU (1.75 in)	1RU (1.75in)	4RU (7 in)	1RU (1.75 in)	1RU (1.75 in)	2RU (1.75 in)
System throughput (HD)	176 Gb/s	4 Tb/s	6.4 Tb/s	12.0T	25.6 Tb/s	25.6 Tb/s	25.6 Tb/s	25.6 Tb/s	51.2 Tb/s
Interfaces	48x1GbaseT +4xSFP+	48xSFP28 +8xQSFP28 +2xSFP+ (D2L)	32xQSFP28 +2xSFP+	28xQSFP28 8xQSFPDD	32xQSFP56-DD +2xSFP+	128xQSFP28	32xQSFP56-DD +2xSFP+	32xQSFP56-DD +1xSFP+	64xQSFP56-DD
Fan modules	Integrated (A1) Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable
Power supplies	Integrated dual Redundant (A1) Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable	Redundant Hot-swappable
Available	24.7.2 (A1) 21.3.1	21.11.2	21.11.2	23.3.1	22.6.3	22.3.2	22.3.1	25.3.1	23.3.1

Nokia SR Linux

Open, extensible and resilient NOS

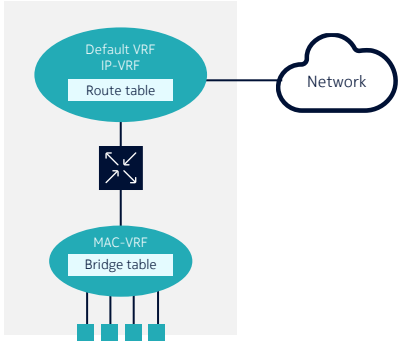


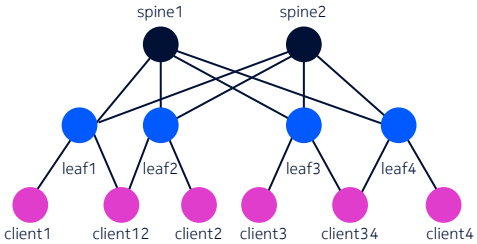
Proven routing stacks for IP and EVPN data center fabrics

IP FABRIC

SR Linux builds on industry's leading routing stack for IP fabrics:

- IP routing stack deployed in 2850+ mission critical CSP, cloud provider and enterprise networks
- Over 1.8M routers shipped
- #1 in IP edge routing* (EMEA, Global)
- Delivers unmatched scale with performance for IP/MPLS and segment routing feature sets –
- Most complete IP aggregation and edge services feature set





EVPN FABRIC

SR Linux provides the industry's leading EVPN implementation featuring:

- 10+ years of EVPN feature development
- 30+ EVPN IETF standards (co-) authored by Nokia
- Most complete EVPN feature-set in the market
- Nokia led IETF team addressing IXP requirements

Source: Revenue figures for FY2023, [1]Dell'Oro 1Q24, [2]As of 1Q24

Networking for AI workloads

High-capacity networking fabrics and data center interconnects

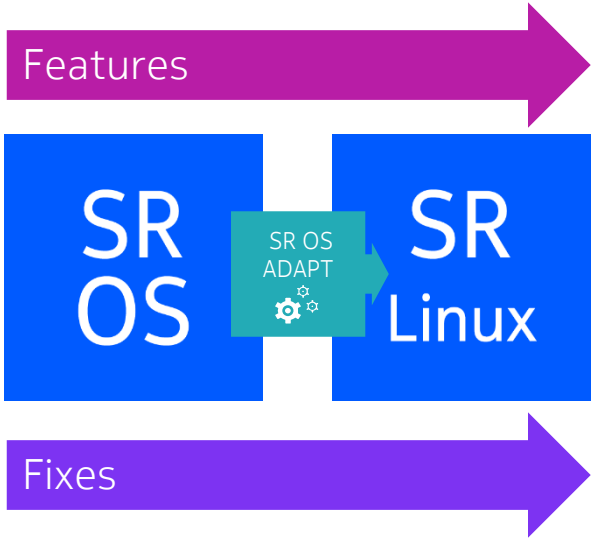
- High-Capacity and reliable data center fabric platforms for back-end and front-end networks
  - Support for RoCe - InfiniBand over Ethernet deployment models
  - Essential NOS features including
    - Congestion management features - Priority Flow Control (PFC) and Explicit Congestion Notification (ECN)
    - Superior telemetry, manageability, ease of automation and resiliency features
- Network automation features for
  - Designing, deploying and operating AI network fabrics
  - Simple and easy management and operations

Read the
“Networking for AI workloads”
Application note

Software reliability

Driven by a quality-first approach

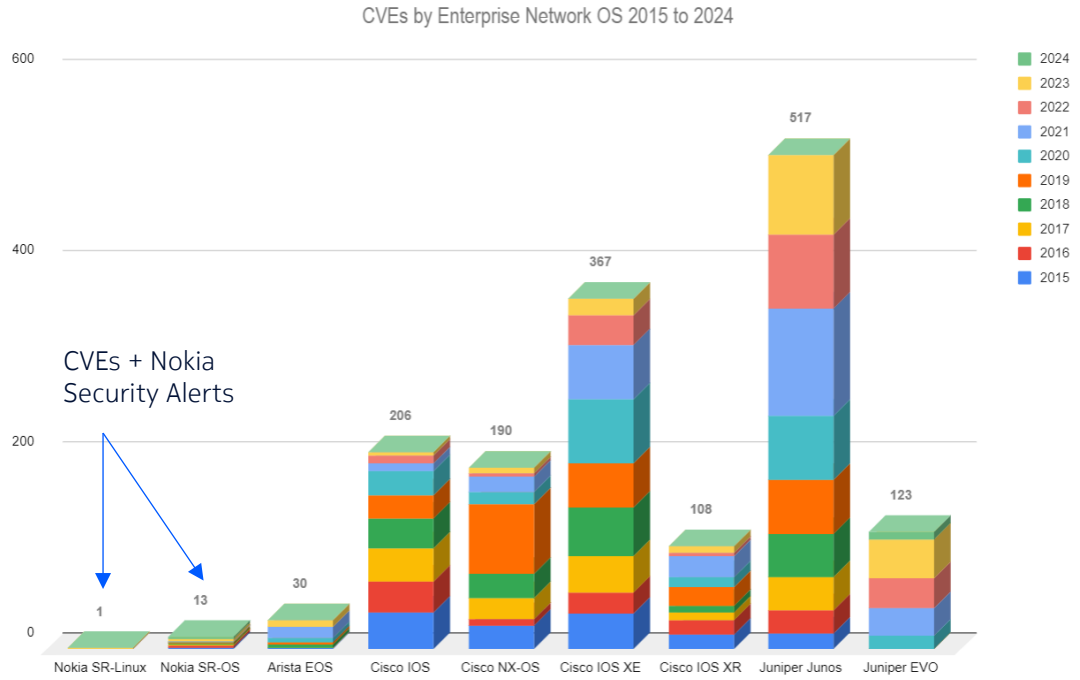
- One engineering and product management team
- One development process
- One code base for protocols & networking applications



- Industry unique, 1:1 ratio of developers to test engineers
- 350K+ shared test cases
- Features/fixes delivered in SR OS first and merged into SR Linux nightly

Best-in-class quality for DC fabrics

CVEs as a proxy for quality*



* Above graph is adapted from the source graphs to include Nokia operating systems information

- CVEs as a proxy for quality is being used by a key vendor in the data center switching segment
- Their reporting, currently excludes Nokia data
- Nokia Operating systems have the lowest CVEs compared to other vendors
- We bring this best-in-class quality approach to our Data Center Fabric solution

Nokia Data Center Fabric solution

Reliable and simplified operations

Reliable networking

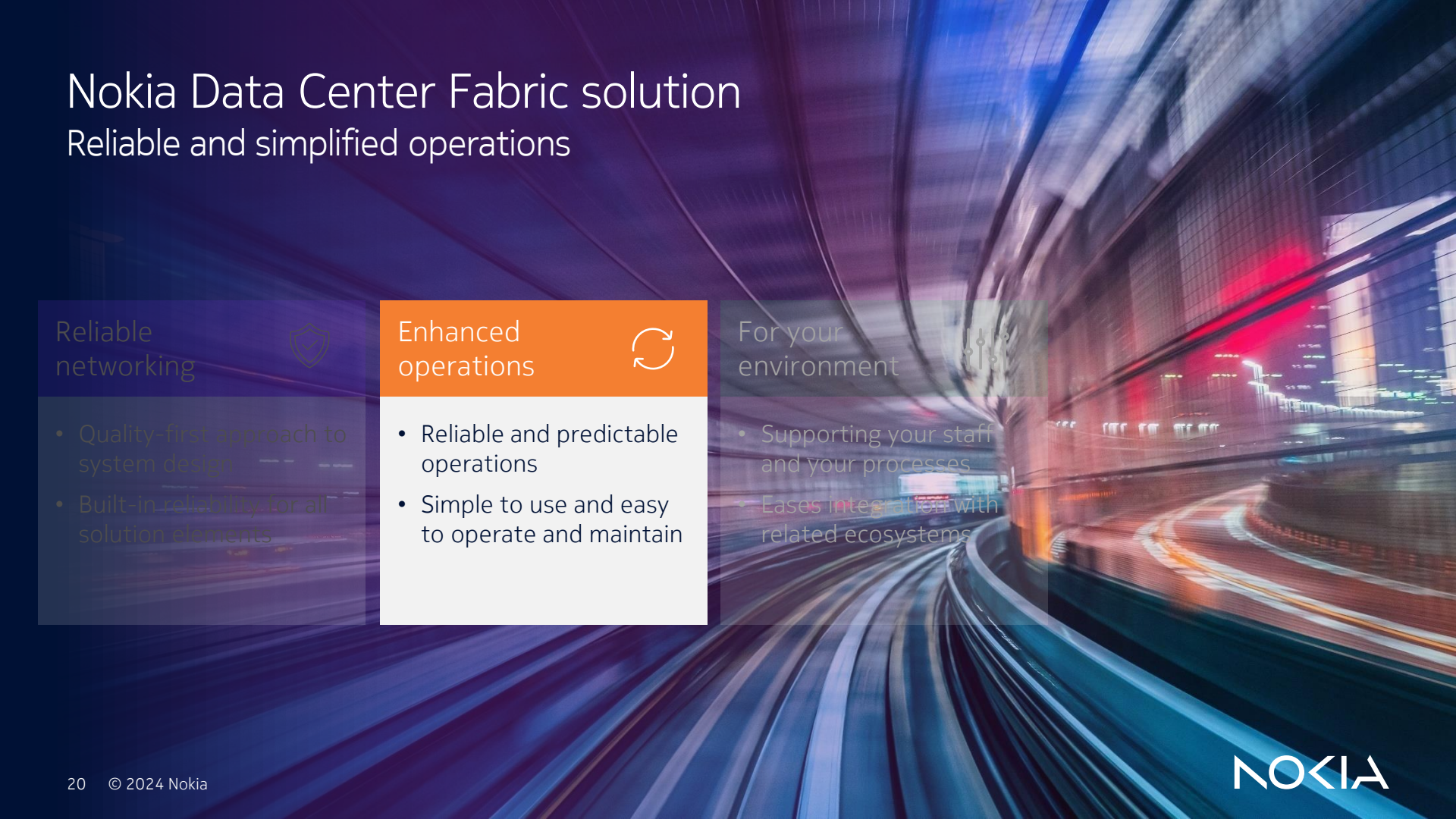
- Quality-first approach to system design
- Built-in reliability for all solution elements

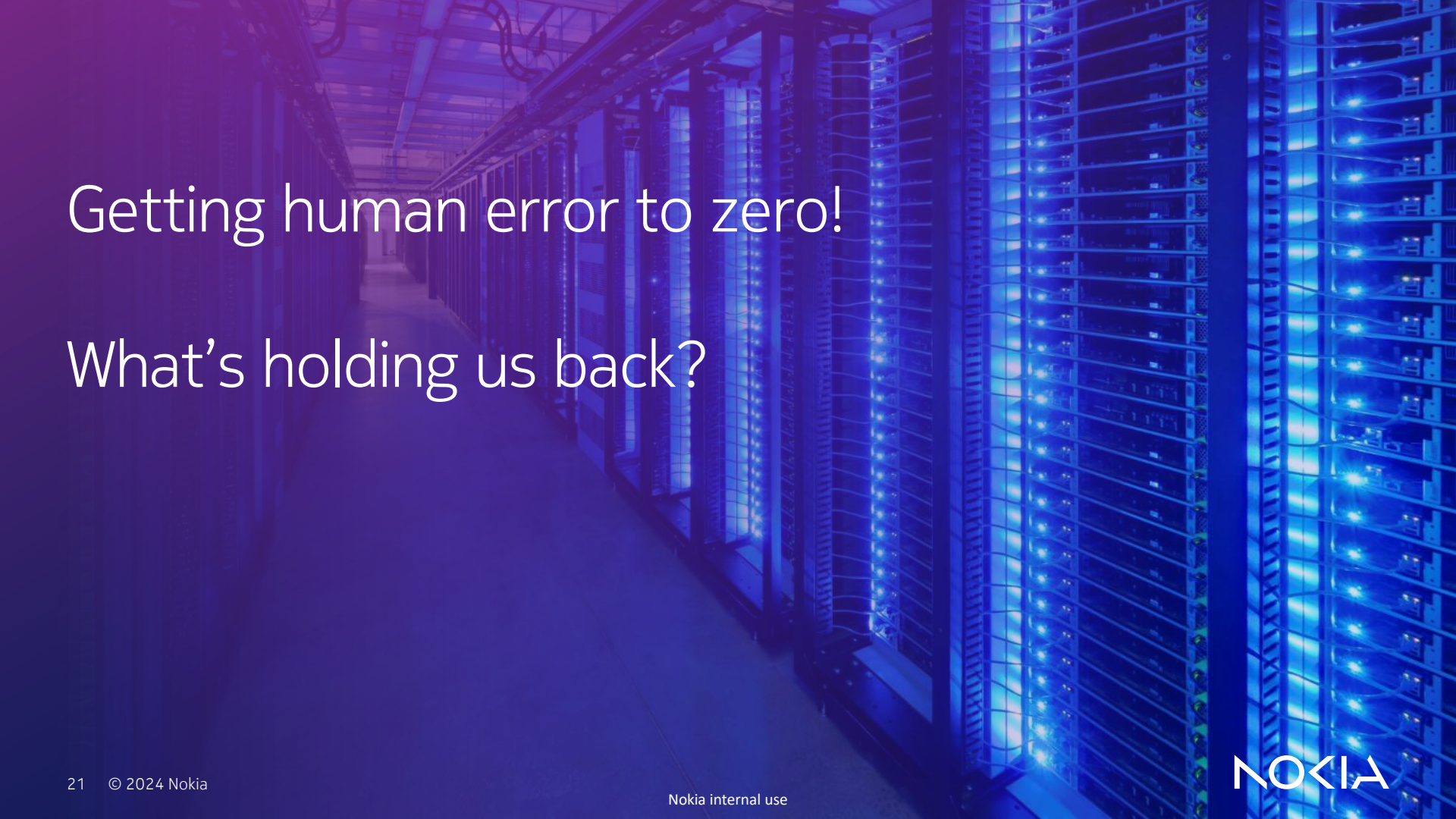
Enhanced operations

- Reliable and predictable operations
- Simple to use and easy to operate and maintain

For your environment

- Supporting your staff and your processes
- Eases integration with related ecosystems

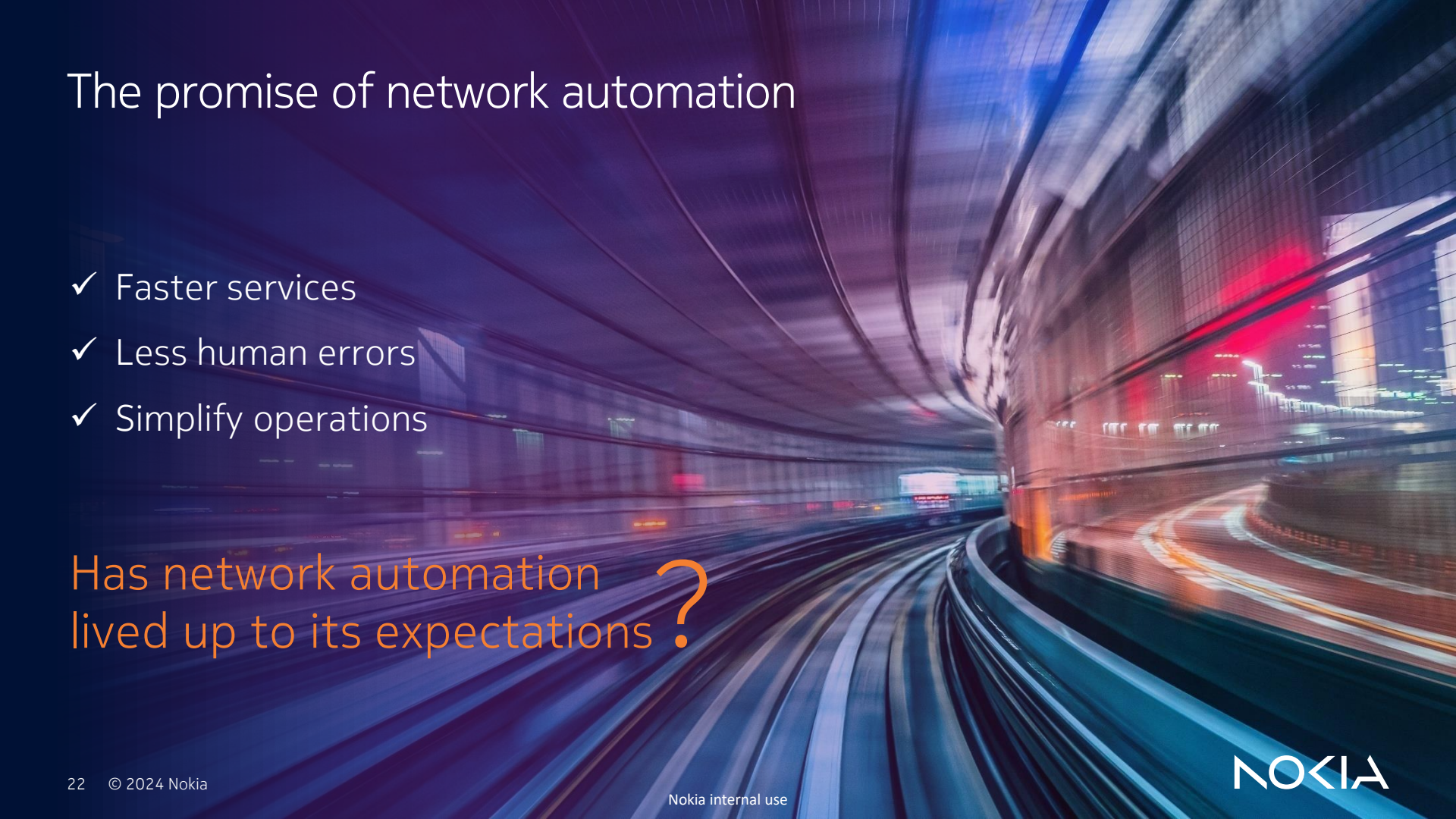




Getting human error to zero!

What’s holding us back?

The promise of network automation



- ✓ Faster services
- ✓ Less human errors
- ✓ Simplify operations

Has network automation lived up to its expectations ?

Nokia Event-Driven Automation (EDA) platform

Move fast with confidence

Nokia Event-Driven Automation (EDA)

Enablers

A modern approach to making network automation more

- ✓ Predictable
- ✓ Consumable

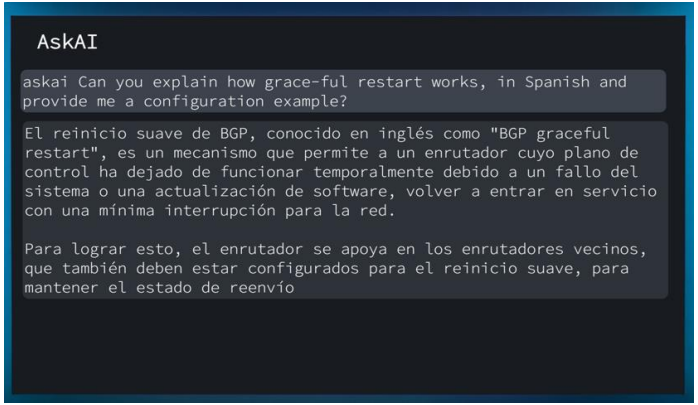
Outcomes

- Deliver reliable operations
- Simplify lifecycle management
- Easily adapt to evolving environments

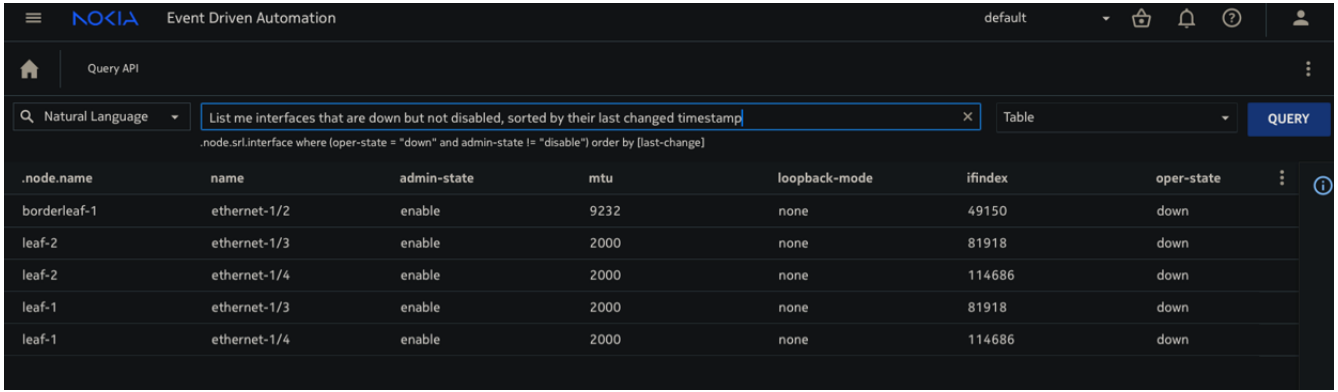
Builds on and leverages **kubernetes**

AIOps for data center networks

Networks that understand your language



- SR Linux supports a "GenAI assistant" app
- With Nokia EDA , you can query functionalities, verify device and network states, troubleshoot issues, fetch configuration examples and much more.



Nokia Data Center Fabric solution

For your environment

Reliable networking

- Quality-first approach to system design
- Built-in reliability for all solution elements

Enhanced operations

- Reliable and predictable operations
- Simple to use and easy to operate and maintain

For your environment

- Supporting your staff and your processes
- Eases integration with related ecosystems

Remove the barriers to testing

With open source, multivendor virtual labs

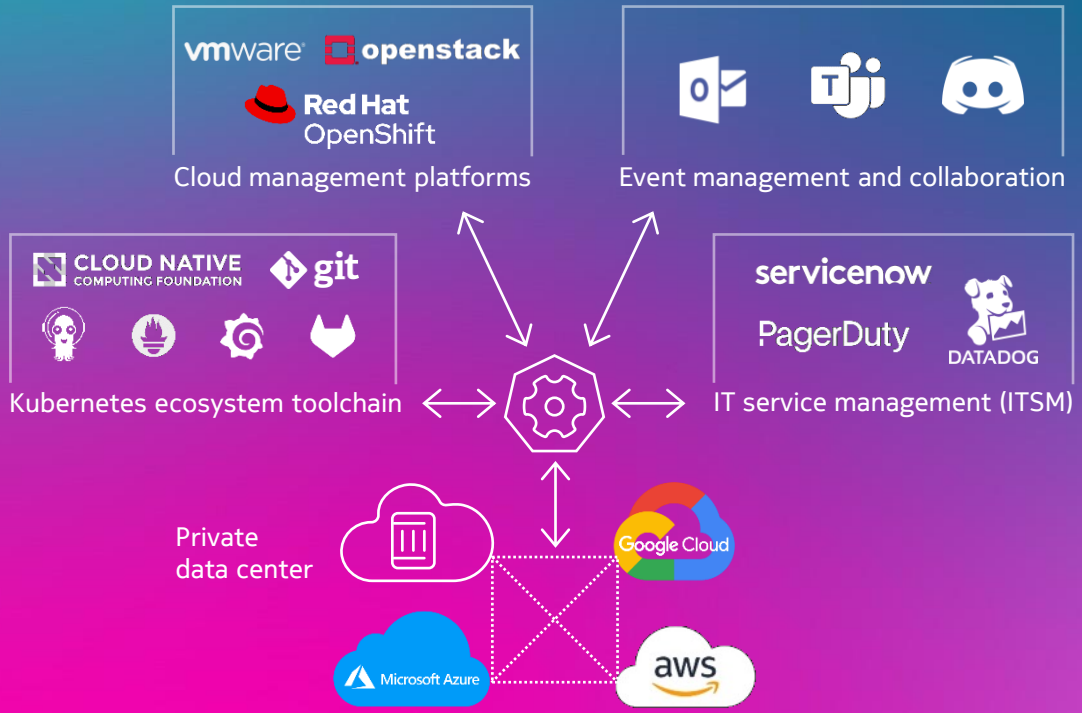
- Fast to spin up
- Small footprint
- Multivendor support
  - Containerized and VM-based NOS's
  - Network focused software for telemetry, logging stacks, flow collectors

- More and more of our customers are using containerlab to test and validate multivendor network setups
- With containerlab, any subsequent lab setup time is reduced dramatically, often by 80%.
- In general, containerlab also increases cross-team collaboration through a centralized lab-as-code repository sharing infrastructure

CONTAINERlab

https://containerlab.dev/

Quickly adapt to evolving demand

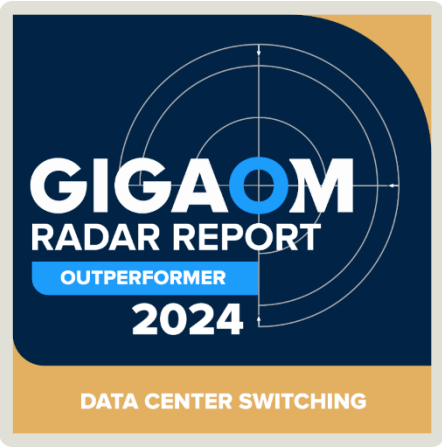


Agility in operations is achieved by easing the integration with a rich ecosystem of tools and clouds

- ✓ Seamless integrations
- ✓ Multivendor
- ✓ Multidomain
- ✓ Multicloud

Nokia ranked as “Leader” & “Outperformer”

For three straight years



Read the report to learn why GigaOm puts our **Data Center Fabric** solution in the leader’s circle. And find out how our high-performance hardware, next-gen NOS and operational toolkit earned high rankings for metrics related to automation and support for Day 0 design, Day 1 deployment and Day 2+ operations.

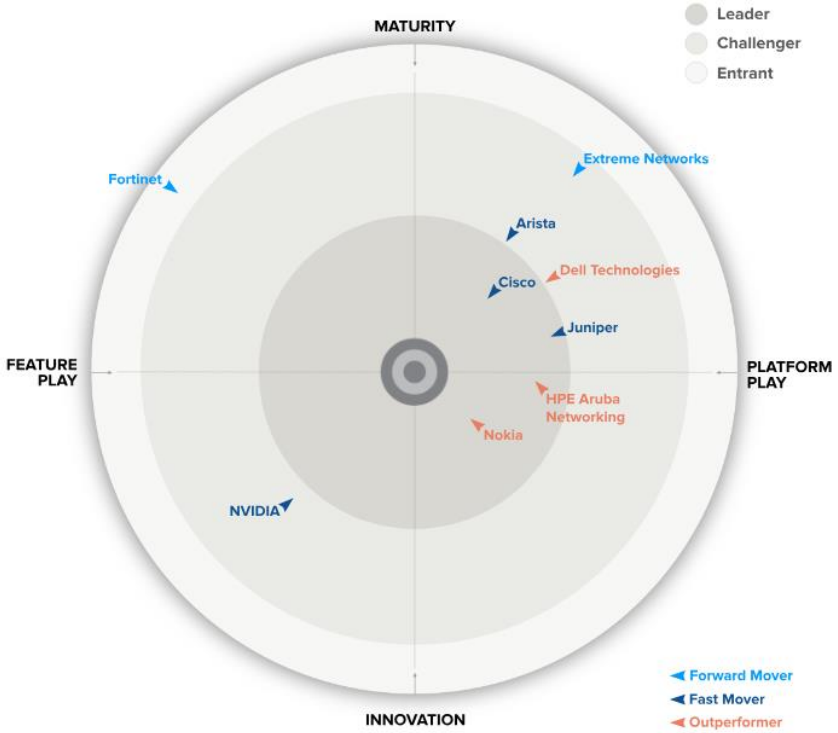
GigaOm has identified Nokia as a data center switching leader and outperformer

in a radar report that weighs each vendor’s execution, roadmap, and ability to innovate

READ THE REPORT

GigaOm radar

Nokia recognized for innovation and differentiation



Maturity:
Emphasis on stability and continuity; may be slower to innovate

Innovation:
Flexible and responsive to market; may invite disruption

Feature Play:
Offers specific functionality and use case support; may lack broad capability

Platform Play:
Offers broad functionality and use case support; may heighten complexity.

Radar Chart Overview:

Nokia is an Outperformer positioned in the Innovation/Platform Play quadrant because its data center switching solution is newer on the market and many of its capabilities, including the SR Linux operating system, have been built from scratch using a modern architecture.

READ THE REPORT

DC Fabric - Europe Enterprise (New Logos)

2022

1ST European Finance Bank

Crèdit Andorrà

NCBR National Centre for Research and Development

Vatican

Department for Digital, Culture Media & Sport

Santa Monica Networks

2023

1st Global Transportation & Logistics

MAERSK

Valoo

2024

Ongoing

2nd NREN in Europe

RENATER CONNECTEUR DE SAVOIRS

UNIVERSITÉ DE FRANCHE-COMTÉ

Ibermática

Cinia

fortum

FICIX

TREX REGIONAL EXCHANGES

!!! Nokia DC Fabric GTM – indirect model via Partners !!!

Customer momentum

Public references

65+
Customer wins

Tier 1 cloud provider

"We regularly upgrade our data center equipment with technology to increase efficiency and reduce energy consumption. Using Nokia's new system will enable better networking and routing capabilities in our Viborg, Denmark facility"

Adam Bechtel, Vice President and Networking lead at Apple

Microsoft

"Nokia brings density, performance and flexibility to Microsoft's data center networks and cloud environments and is partnering with Microsoft to deliver chassis switches running the open-source networking operating system SONiC."

David Maltz, Technical Fellow and Corporate Vice President, Microsoft Azure Networking

OpenColo

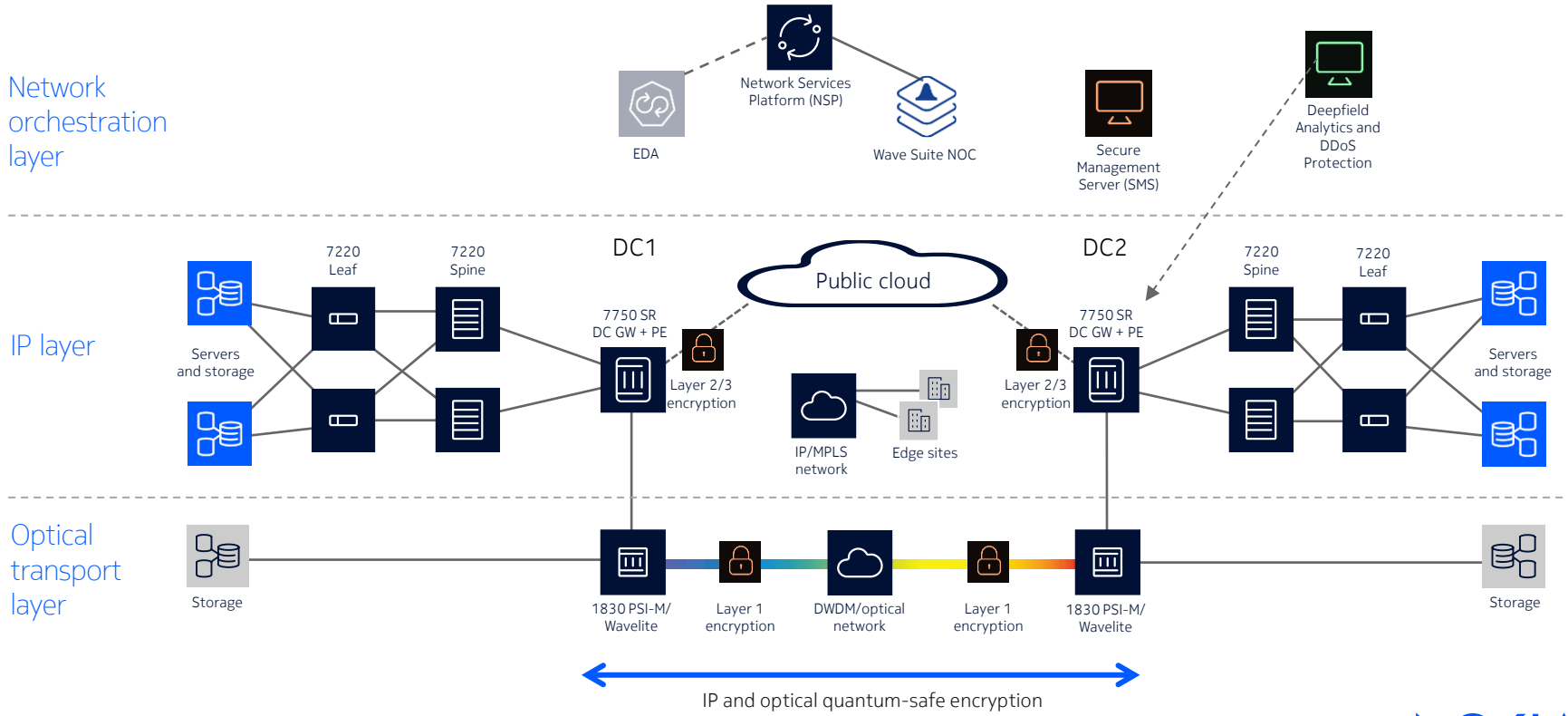
"Nokia and its SR Linux was an easy choice. We wanted a solution that was extensible, open, supported telemetry and gNMI, and was provided by a company that transforms networking both on the hardware and software side"

Scott Brookshire, CTO of Energy Group Networks, parent company of OpenColo

Microsoft
LASER LIGHT
atnorth
Tier 1 cloud provider
Stealth COMMUNICATIONS
NAVER Cloud
DCspine
OpenColo
Public Transport Authority
SHINSEGAE
everyWAN
eurofiber
RENATER
UNIVERSITÉ DE FRANCHE-COMTÉ

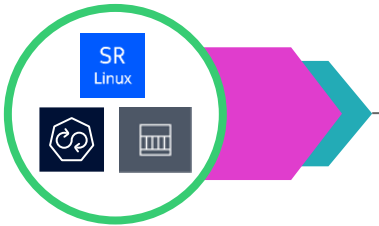
Key takeaways

DCFI - Integrated end-to-end IP + optical architecture



Key differentiators to select the Nokia DC fabric solution

6 reasons to pick
Nokia DC fabric solution



- Intent-based management
- Sandbox enables a change management and CI/CD based operations, reduces risk
- Software quality – proven R&D processes and routing stacks with standards-based EVPN protocols
- Native Yang-based model-driven management/telemetry NetOps-friendly
- Open, customizable CLI and NDK, avoiding lock-in
- DCF Interconnect: Quantum-safe encryption, best-in-class Optics solution, embedded line-rate DDoS protection

Essentially it comes down to **operational efficiency** and a most **future safe** architecture


NOKIA