NOKIA | RONOG MEETING 9

Selecting the right network processor and software for your network

Lucian Popa,
IP Sales Engineer

2 October 2024

Agenda

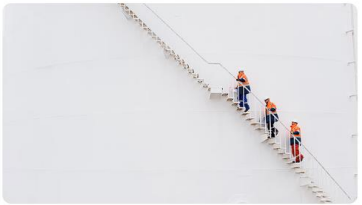
1. **B2B technologies**
2. Network processors
3. Software quality
4. Discover some of the latest IP innovations

B2B technologies

IP networks

Data center

Security



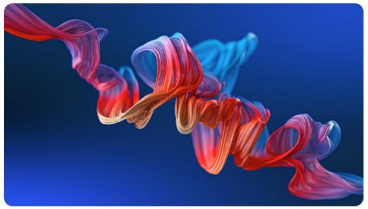
Solutions for industry

Optical networks

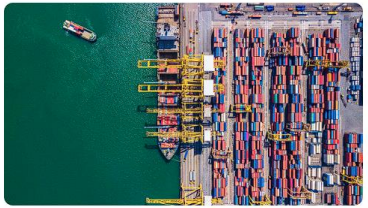
Fixed networks

https://www.nokia.com/networks/

Mobile networks



Core networks



Private networks

Fundamentals of IP technical innovation

Network Services Platform (NSP)

Next-generation DDoS protection

Event-Driven Automation (EDA)

Insight and Analytics

Automation and tools

Network operating systems (SR-OS, SR-Linux)

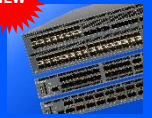
Software excellence

7705 SAR

7210 SAS

7250 IXR/ 7220 IXR

NEW



7730 SXR

7750 SR

7750 SR-s

Virtualized service router

Silicon and systems

Merchant silicon

Custom-developed silicon (FP, FPcx)

x86

IP routing portfolio poster

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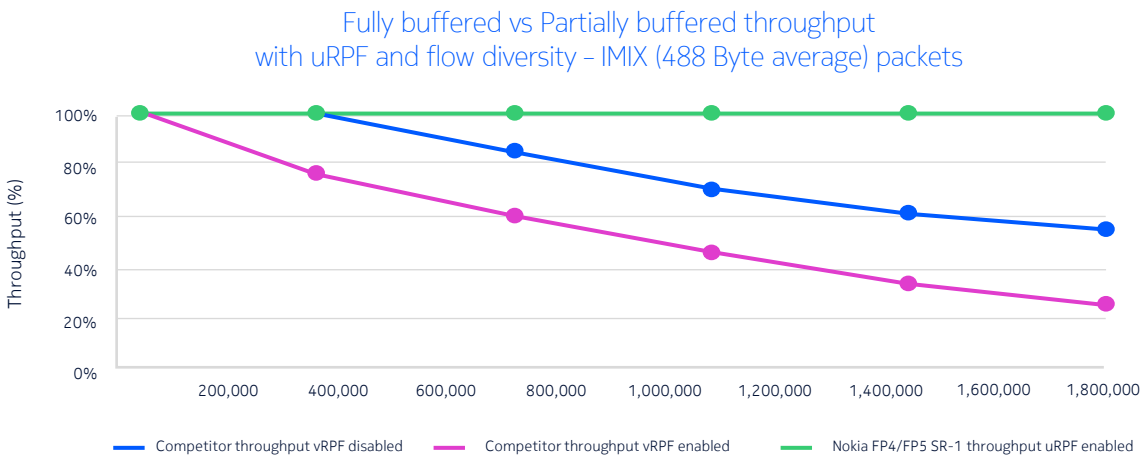
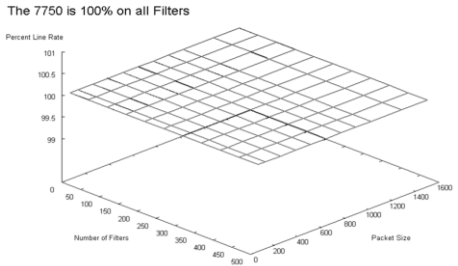
Fully buffered vs Partially buffered

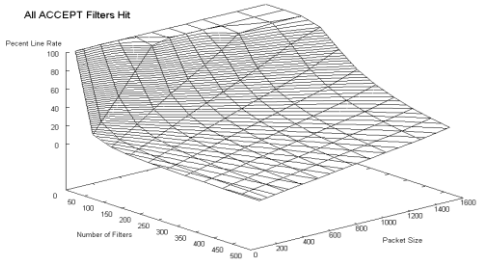
Deterministic performance for real world use case



Real world performance:
routes, labels, QoS, ACLs, services



ASIC/NP without real world capabilities:



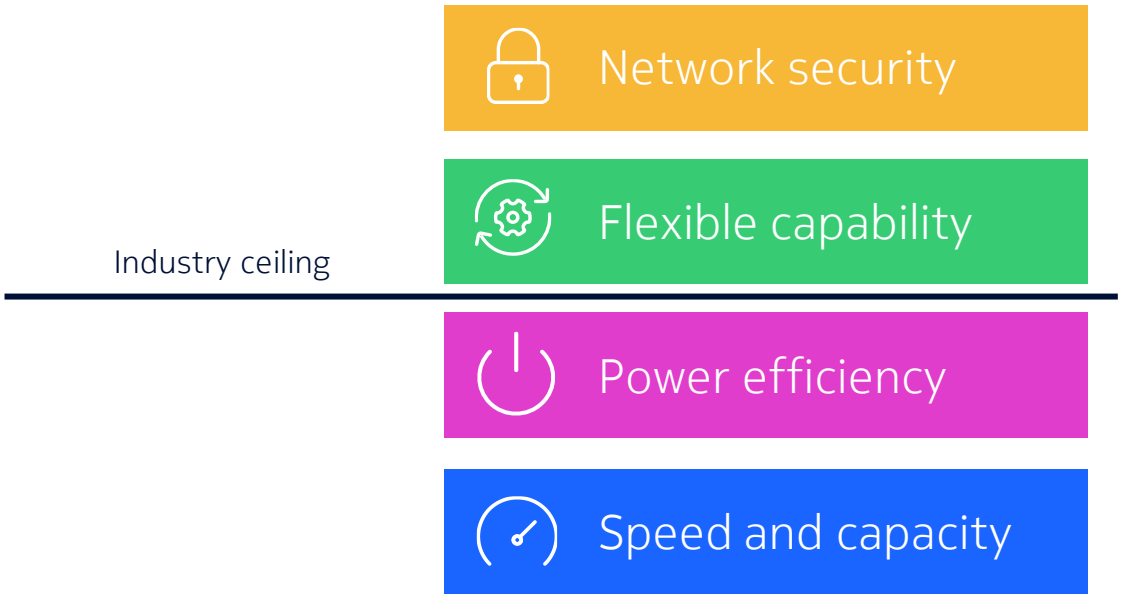
Partially buffered:

- Up to 50% performance degradation when processing high number of flows, due to cache miss
- Further ~25% decline in throughput for IMIX traffic when Enabling uRPF (loose mode)
- Packet drops for microburst traffic

Fully buffered:

- Determinist performance
- Multi-dimensional scale

Network processors



- DDoS mitigation in-line
- Large scale ACLs
- ANYsec/MACsec on NPU

- NPU:100% programmable
- Fully buffered
- Advanced QoS: H-QoS, 256K queues
- Multi-dimensional scale

- ~0.1W/gig typical
- Right-sized capacity and interface speeds

- 56G and 112G SERDES
- 1GE to 400GE; full breakout

Fit for purpose solutions

7705 SAR

7210 SAS

7250 IXR

7730 SXR

7750 SR

7750 SR-s

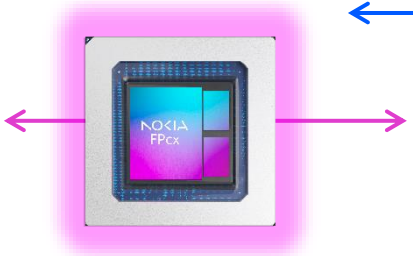
Access

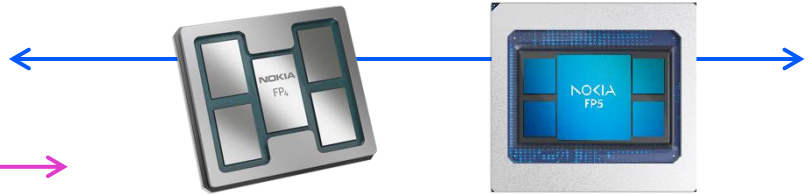
Aggregation

Edge

Peer

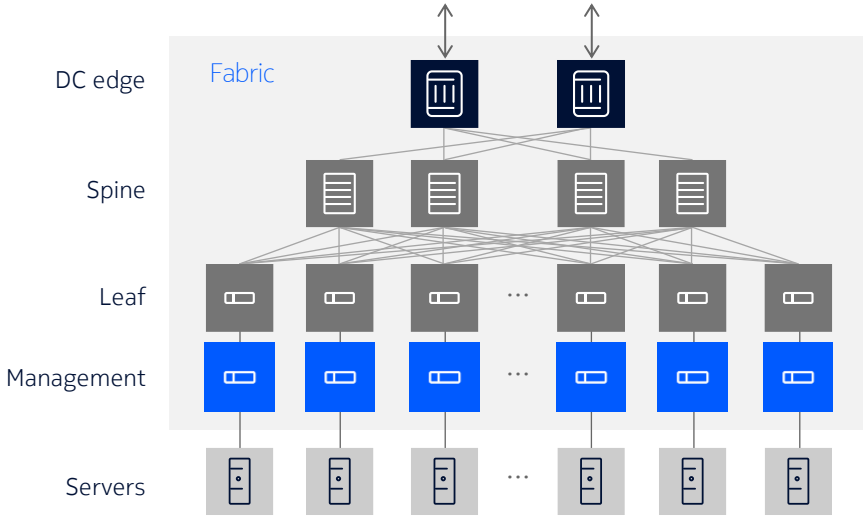
Core

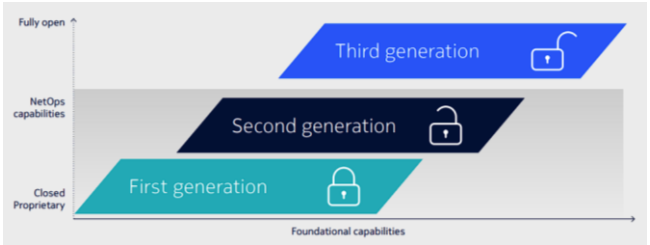




Data center network architectures

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)

- Jericho for deep buffer requirements
- Tomahawk for shallow buffer IP fabrics
- Trident for shallow buffer EVPN fabrics (VXLAN VTEP)

OOB management

- Merchant silicon
- 1G/10G port speeds

Data Center Fabric (DCF)

Silicon

- FP — Nokia FP
- J — Jericho
- TD — Trident
- TH — Tomahawk
- M — Marvell

Fabric automation

Fabric intent, observability, operations, and integrations

Network emulation and modeling

Open OS

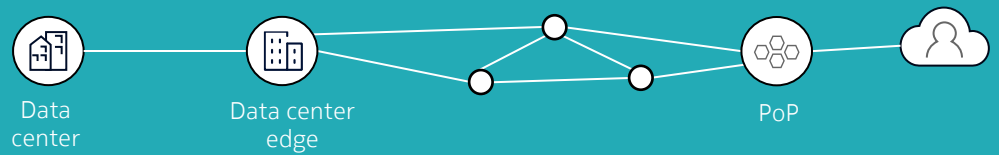
SR Linux

SR Linux (SRL)
Purpose built, scalable, model driven architecture

Hardware platforms

IXR

7250, 7220 and 7215
Chassis and fixed platforms



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4. Discover some of the latest IP innovations

How do we measure quality?

How to ensure quality?

Reliability

Uptime and crash frequency
Number of high-priority bugs
Mean time between failures

Performance

Speed and latency metrics
Packet loss
Resource usage

Maintainability

Code readability and modularity
A comprehensive tests suite
Ease of updates and fixes

Security

Vulnerability prevention
Number and severity of CVEs
Incident response plan

Software 100% developed in house for total control

A uniquely balanced team for quality

Development engineers

Test engineers

Permanent quality testing

350 000+ test cases

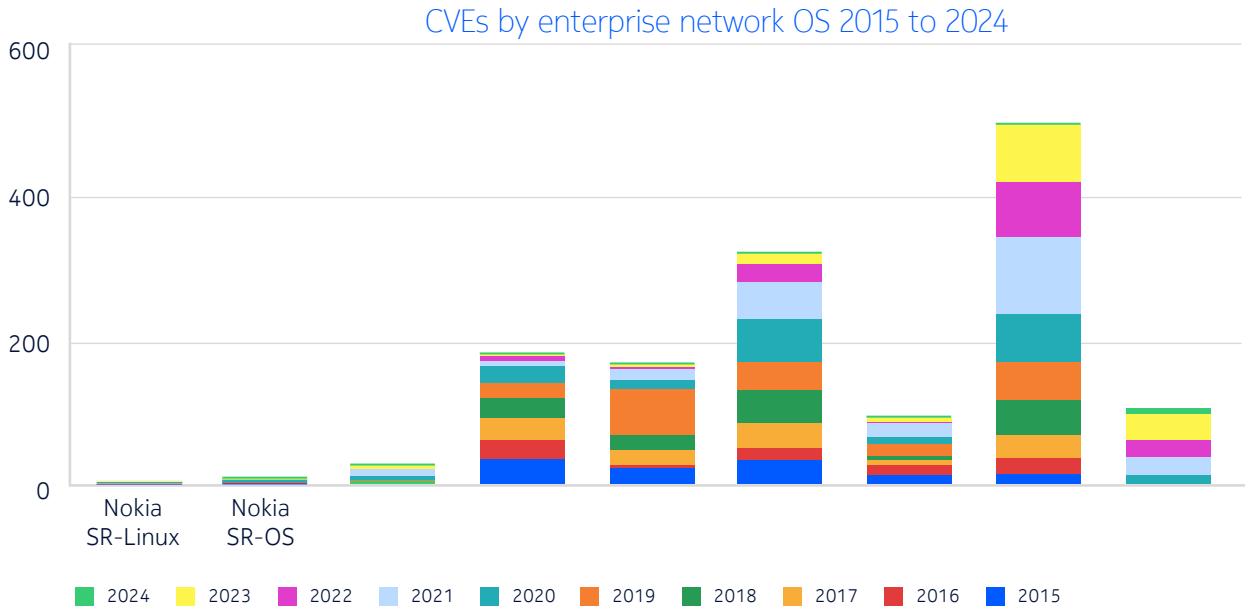
3+ years test hours run in **2** weeks

Proven quality in 20+ years

No major network outages requiring emergency patches in **>15** years

Commitment to ultra-reliable software gives you peace of mind

You can focus on innovation and growth



Nokia CVEs and PSIRT extract as of 3/5/2024

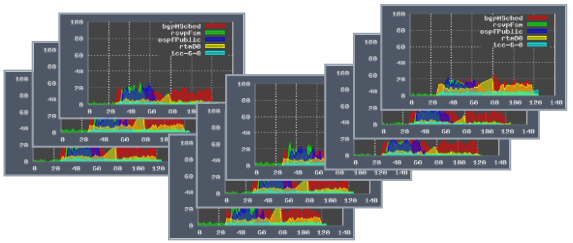
- Security alerts timely communication on known issues to minimize disruptions
- This graph excludes vulnerabilities found in open-source and third-party software

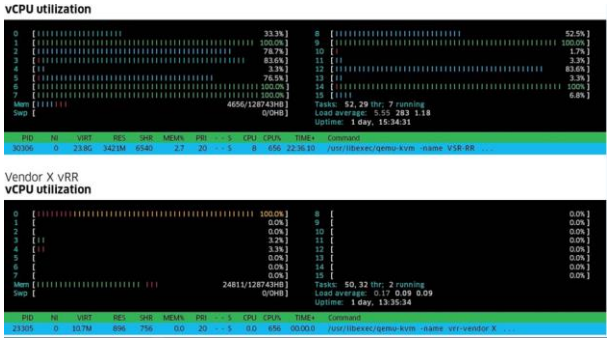
Symmetric Multiprocessing (SMP)

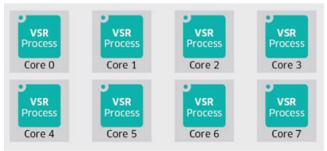
Control Plane performance

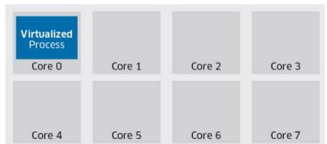
SMP allows tasks to be scheduled in and out of different CPU cores and for different tasks to run concurrently, unleashing the power of the multi-core processing complex

- High-performance routing and OAM requires more processing capability than can be delivered on single core
- Deliver highly scalable processing power
- Significantly improved routing protocol convergence times
- VSR Route Reflector (Control Plane intensive) can processes more route updates per second for real world prefixes with significant lower convergence times

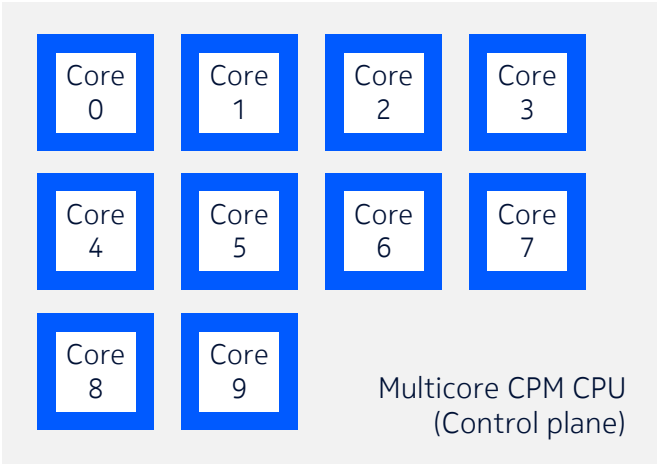








Single processor implementation with "Vendor X"



Software

Development areas

Security

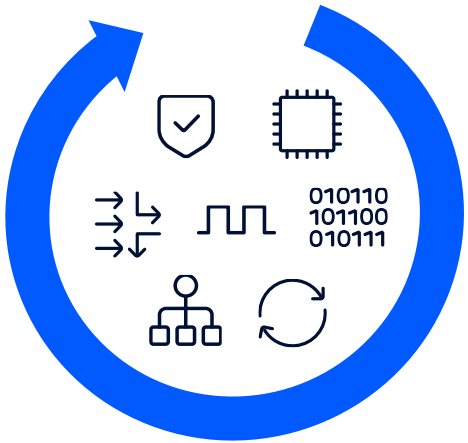
DDoS mitigation, ANYsec,
Secure boot

Next-Gen services

EVPN, FWA, MAP-T BR

Fabric protocols evolution

Segment Routing, SRv6, Flex-Algo,
BIER, TreeSID, TreeSIDv6



Platform coverage

Full feature support for new HW

Programmability

Model-driven, NetConf/YANG, OpenConfig,
MD-CLI, Telemetry, gRPC, RIB API, Python 3

Centralized network optimization

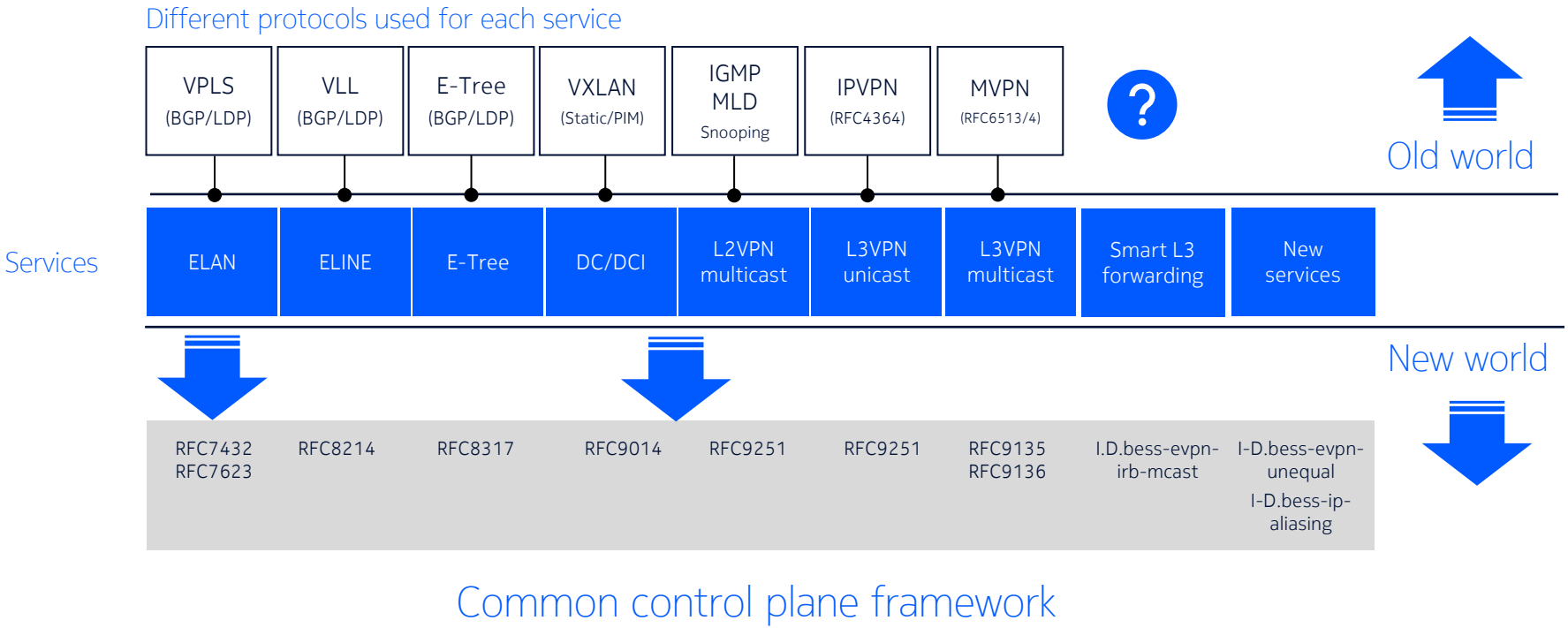
PCEP, BGP-LS, BNG CUPS/MAG-c

Simplified, scalable networking

Satellites, ESA, ZTP,
IP Optical convergence

EVPN reduces operational complexity, increases profitability

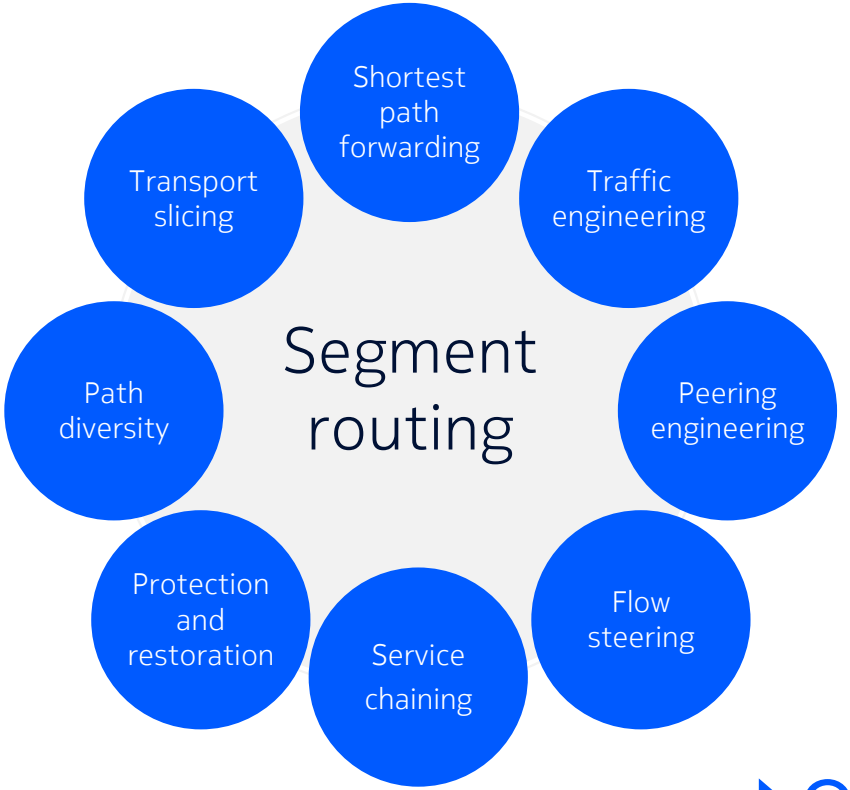
Adds new capabilities through a unified control plane framework



Segment routing (SR-MPLS and SRv6)

Could influence the ASIC/NPU selection

- Reduce control plane protocols
- Improve scale/optimize state
- Ease IPv6 migration
- Enhance programmability and SDN control



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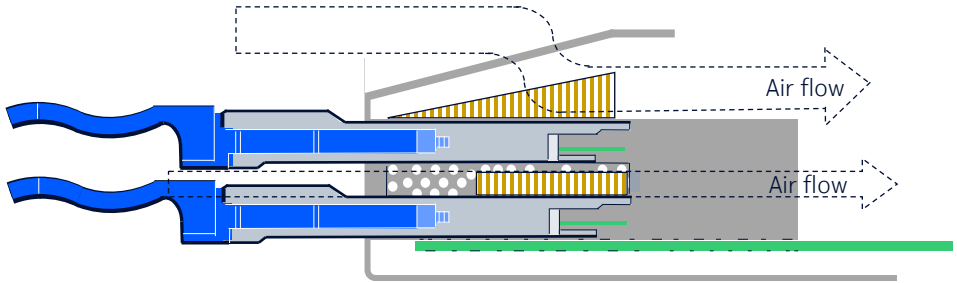
Design choices

Optics cooling

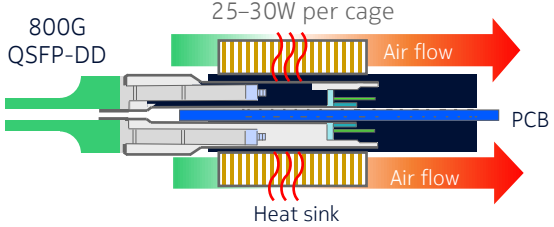


Dual sided PCB

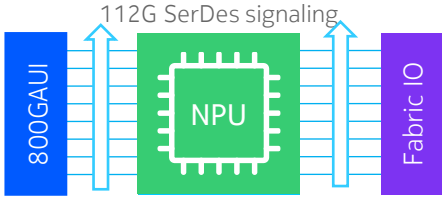
FP4 FP5

800GE line cards

25–30W per cage



Routing silicon



Stacked SFP cages

- Classic DC design
- Heat sink on top, IRHS on bottom
- Bottom cage always hotter - imbalanced optical performance
- DD Design point ~13W optics in all cages at 40°C
- Limits applicability to future optics
- Fans run @ 75-80% max rate at room temp with 400GZR/ZR+: major power and service impact

Belly-to-belly SFP cages

- Large dedicated heat sink per cage
- Even cooling to all cages
- Cooling to 30W in all cages at 40C with margin to spare
- 800G enabled → Up to 40% power savings vs. 400G optics

Faraday cage design

- Honeycomb mesh to maximize air flow
- Minimize power consumption

Brief history of DDoS

2000 – 2020
Spoofed

Small number of compromised machines generating spoofed traffic to victim or via misconfigured DNS, NTP, Memcache servers

Blocked on scrubber using SYN-cookie, port / protocol / packet size access control lists (ACLs) or policers

Mostly amateur / script-based and commercial booter web sites

2020 – 2024
Botnet

Thousands of compromised IoT botnet devices generating traffic floods or sending realistic HTTP/DNS/VoIP requests to servers. GigE symmetric rollouts.

Difficult to mitigate using traditional DDoS mitigation appliances

Criminal gangs / state-affiliated actors

2024+
AI

Millions or hundreds of thousands of residential proxies, compromised IoT sending realistic HTTP/DNS/VoIP requests to servers

High automation and attack variability. Both microburst and long-lived.

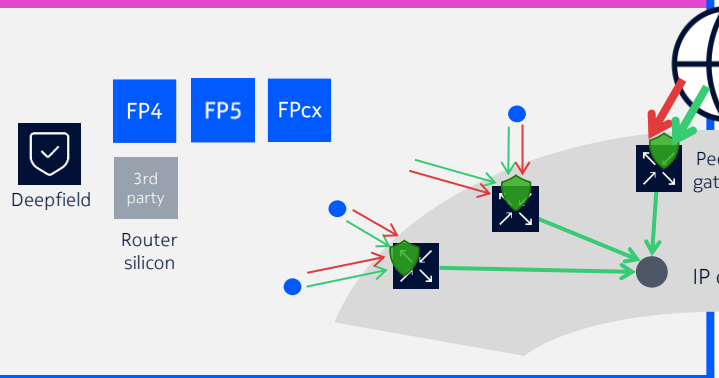
Criminal gangs / state-affiliated actors

NOKIA

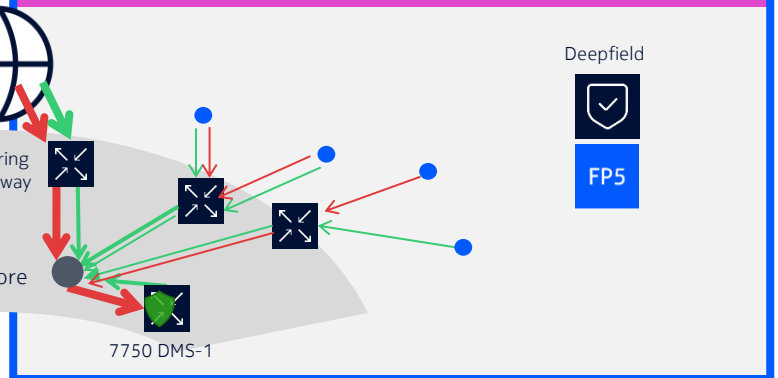
DDoS mitigation options

Two-layer DDoS protection

Edge router-based mitigation



Off-ramp to Scrubber / DMS



Mitigate on edge when you can...

Leveraging network processor edge routers capable of: Large filter scale (256k filter entries), fast programming of filters, without impacting router-scaling and performance

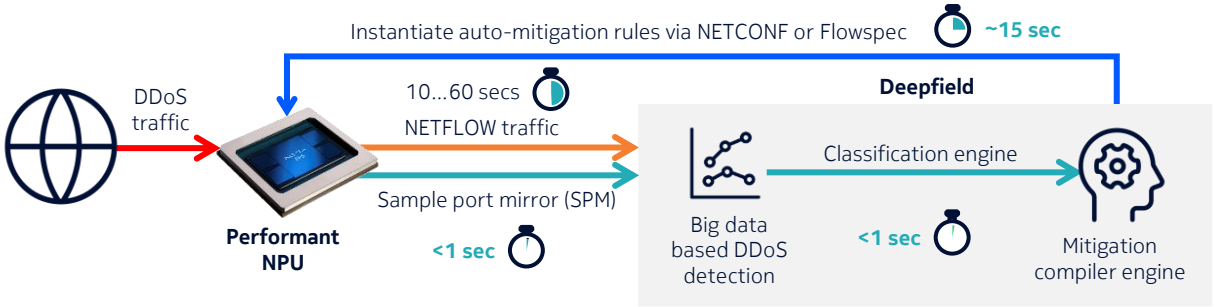
Fastest mitigation | Highest scale | Cost efficient

Mitigate on DMS appliance if you must

- If no FP4/FP5 /FPcx edge routers, or
- when needing strict separation peering <-> DDoS protection
- or for attack-types that cannot be mitigated on routers...

Using network processor ACL power to protect against DDoS

Combined forces for cost-effective DDoS protection



NL-ix deploy IXP-based anti-DDoS protection for enterprises across Europe (Sept 16, 2024)

Total time to mitigate
1st byte < 30 seconds

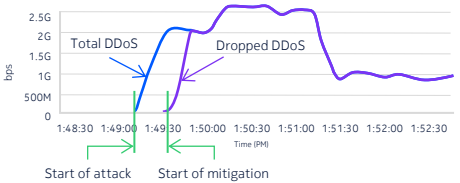
AI-powered intelligence

- Zero-touch big-data based DDoS detection
- Real-time compilation of optimal filter list

Performant silicon

- Large-scale ACLs to block large/complex DDoS attacks
- Line-rate filtering with no performance impact
- Fast filter-population for fastest possible mitigation

Mitigation started within <25 sec after start of attack



Next-generation platform for DDoS mitigation

FPGA vs Network Processor

	Leading scrubber	Next-generation platform for DDoS mitigation
Scale	• 800 Gb/s per appliance	• 2.8 Tb/s per system
Performance	• Variable throughput	• Always at line speed
Detection	• Manual (thresholds)	• Automated
Time to mitigate	• Minutes	• Seconds
Cost	• FPGA cost points ($$$)	• FP5 cost points ($$)

Best-in-class accuracy, scale and economics.
Inline surgical filtering capabilities at scale

The threat of quantum computers for the world's digital economy

Quantum computing in threat actors' hands pose an immediate threat to infrastructure, commerce and society

Quantum computers are expected to soon be powerful enough to break commonly used data encryption

Unauthorized collection of encrypted data today could be decrypted in the future

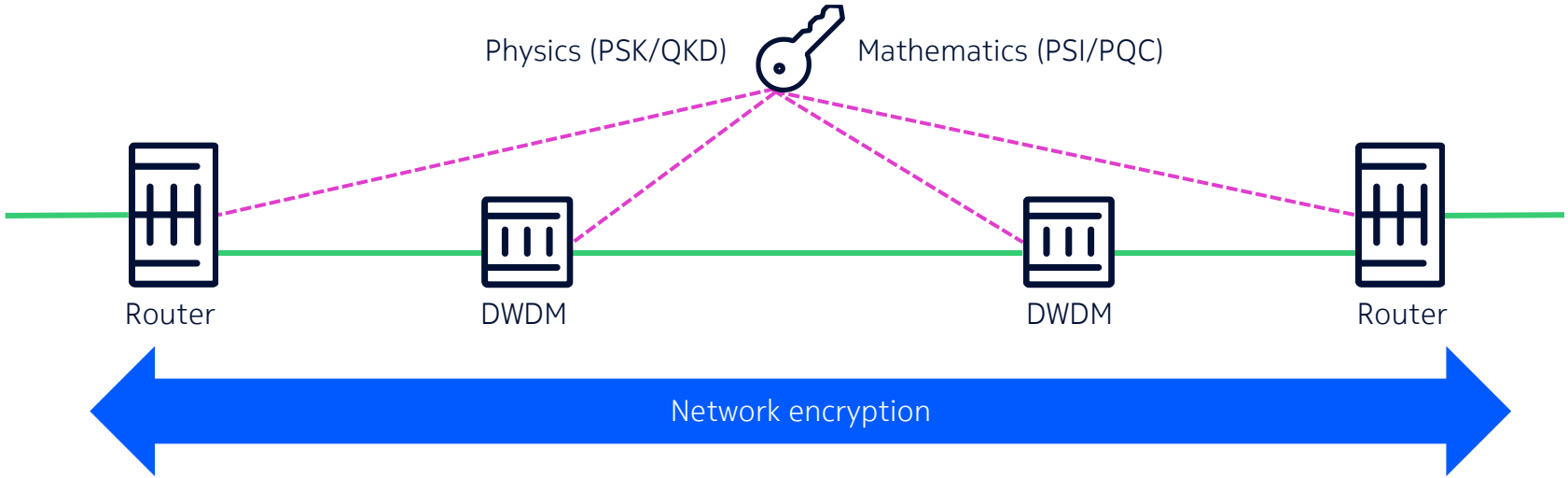
Defense, government, corporate, industrial communications today at risk, demand immediate quantum-resistant encryption

Network operators need to act now - take steps - to immediately negate the threat

Quantum safe networks

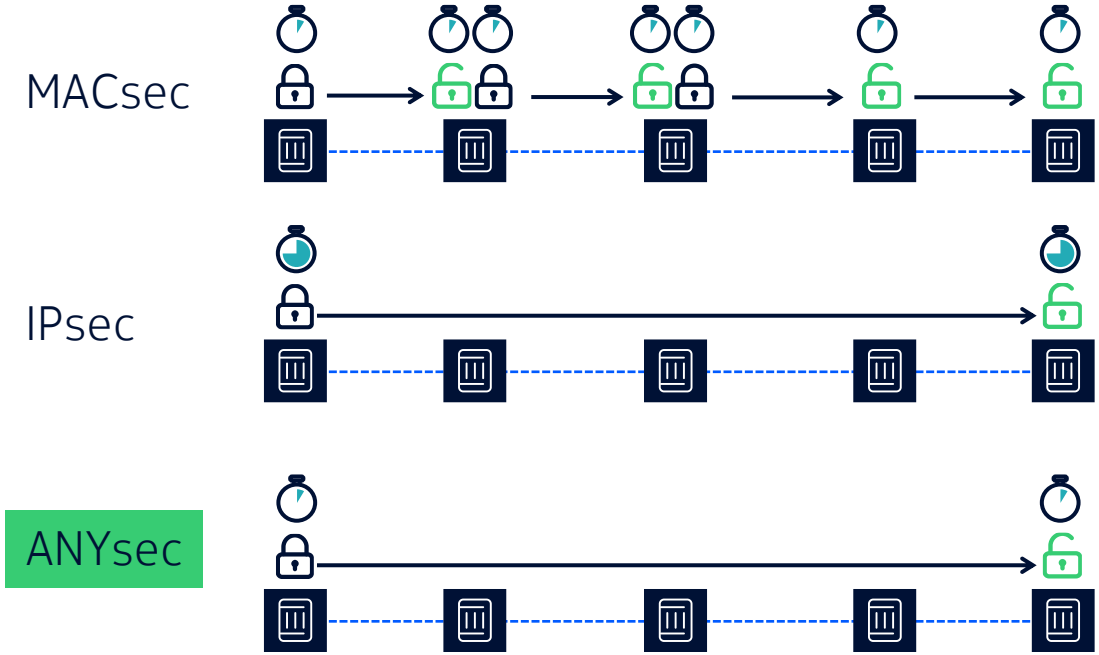
Transport (IP ANYsec + DWDM Layer 1) Quantum safe encryption and Key management

Adapt	Scale	Evolve
to your business needs	your Quantum-safe deployment	with the Quantum landscape



Quantum-safe networks (ANYsec)

Low-latency, hardware-based line-rate encryption for service providers



- Low latency
- Simple, silicon-based
- Line-rate
- Ethernet, hop-by-hop

- High latency
- Complex, CPU-based
- Not line-rate
- IP only

- Low latency
- Simple, **silicon-based (NPU)**
- Line-rate
- **L2, L2.5, L3**

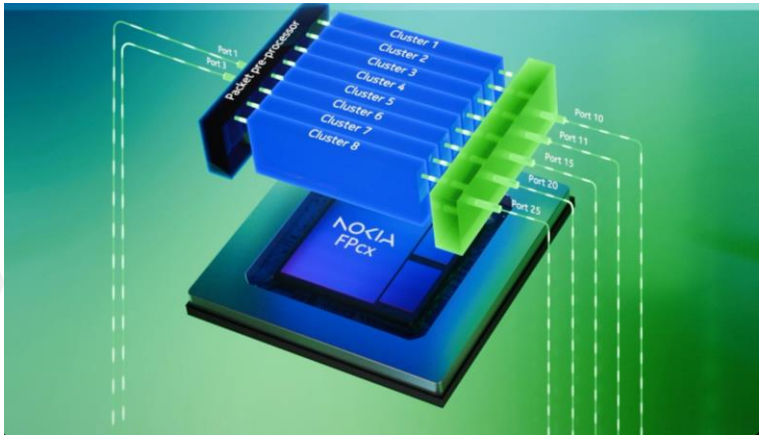
(Ethernet or VLAN, MPLS, Segment Routing, IP)

IEEE802.1AE (MACsec) Datapath encryption engine
IEEE802.1x (dot1x/MKA) Control plane signaling protocol

Simplex platform innovation

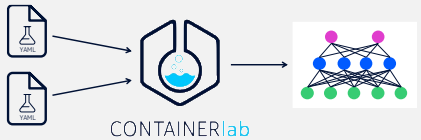
Application warm restart and hitless upgrades per cluster

Software (SR Linux)	Modular, state efficient design	Application warm restart	Per app hitless upgrades
+			
Network Processor (FPcx)	Independent data plane processing clusters	Traffic load-balancing across clusters	Independent data plane code and upgrade per cluster



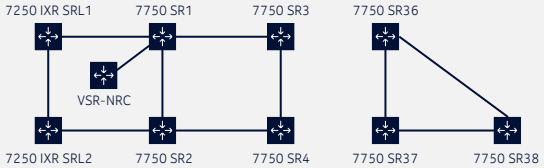
DevOps for networking labs

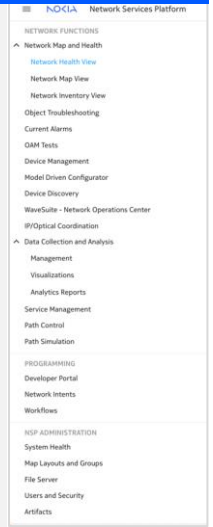
ContainerLab
(DC fabric, Telemetry (CodeSpace), ANYsec, GPT AskAI)



- First class support for containerized NOSes
- Transparent datapath
- Git friendly and better image sharing and handling
- Repeatable lab builds and CI friendly (declarative Lab)
- Small footprint, open, free and fast

NSP DevOps Lab





Provides you a quick access to an NSP lab that allows for exploration of NSP functions from NSP Web applications and APIs

This lab consists of the NFM-P, an NSP Cluster. It supports IP/MPLS network management fault management, baseline analytics, network supervision, service fulfillment, telemetry monitoring, Analyze-Calculate-Transform (ACT), intent-based programmable automation

RONOG8: ContainerLab. Free and opensource networking lab environment for the modern age - Roman Dodin (NOKIA)

https://containerlab.dev/
https://containerlab.dev/lab-examples/lab-examples/

https://network.developer.nokia.com/cloudlab/lab-catalog/private-labs/IP/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