

Selecting the right network processor and software for your network

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Agenda

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

B2B technologies



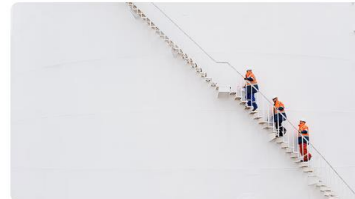
IP networks



Data center



Security



Solutions for industry



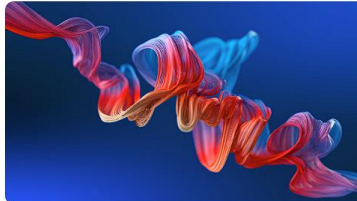
Optical networks



Fixed networks



Mobile networks



Core networks



Private networks

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

Fundamentals of IP technical innovation

Network Services Platform (NSP)
Event-Driven Automation (EDA)

Next-generation DDoS protection
Insight and Analytics



Automation
and tools

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



7705 SAR



7210 SAS



7250 IXR/
7220 IXR



7730 SXR



7750 SR



7750 SR-s



Virtualized
service router



Software
excellence



Silicon and
systems

Merchant silicon

Custom-developed silicon (FP, FPcx)

x86

[IP routing portfolio poster](#)

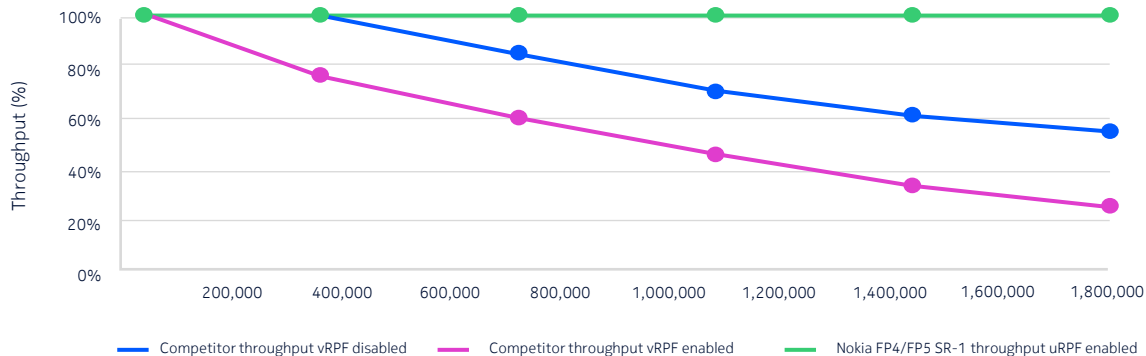
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Fully buffered vs Partially buffered

Deterministic performance for real world use case

Fully buffered vs Partially buffered throughput
with uRPF and flow diversity - IMIX (488 Byte average) packets



Partially buffered:

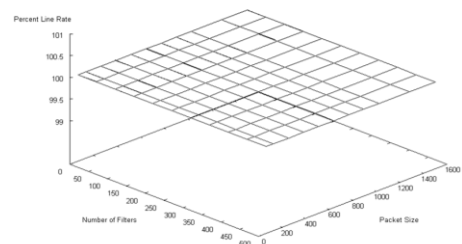
- Up to 50% performance degradation when processing high number of flows, due to cache miss
- Further ~25% decline in throughput for IMIX traffic when Enabling uRPF (loose mode)
- Packet drops for microburst traffic

Fully buffered:

- Determinist performance
- Multi-dimensional scale

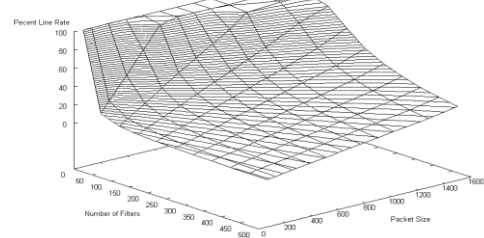
Real world performance:
routes, labels, QoS, ACLs, services

The 7750 is 100% on all Filters



ASIC/NP without real world capabilities:

All ACCEPT Filters Hit



Network processors

Industry ceiling



Network security

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



Flexible capability

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



Power efficiency

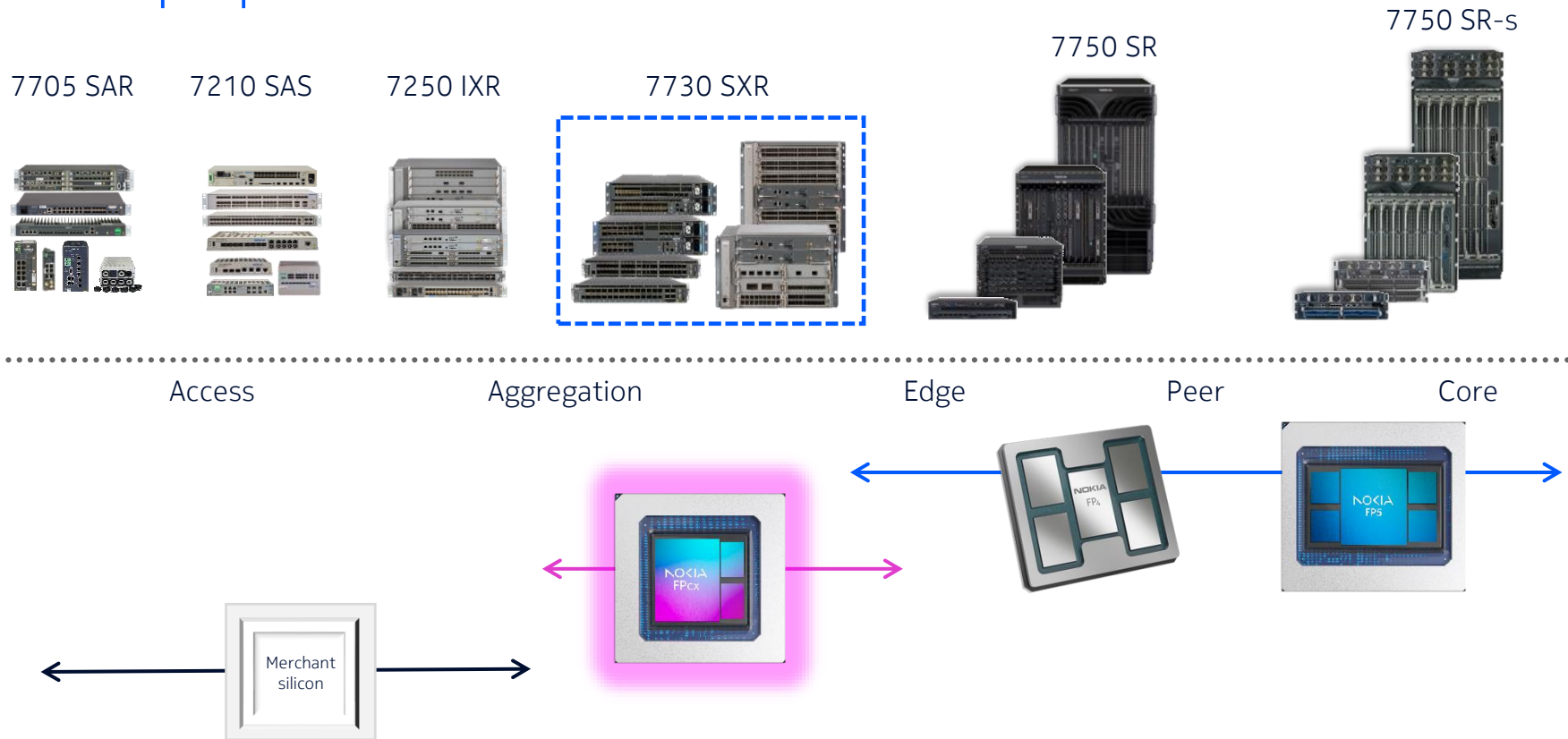
- ~0.1W/gig typical
- Right-sized capacity and interface speeds



Speed and capacity

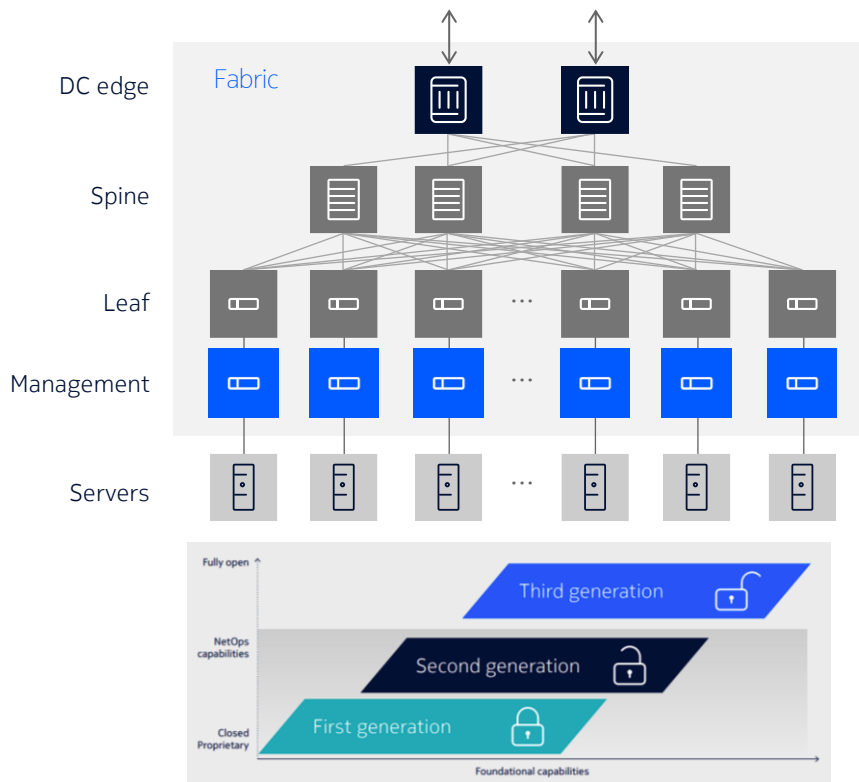
- 56G and 112G SERDES
- 1GE to 400GE; full breakout

Fit for purpose solutions



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



Data center



Data center edge



PoP



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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

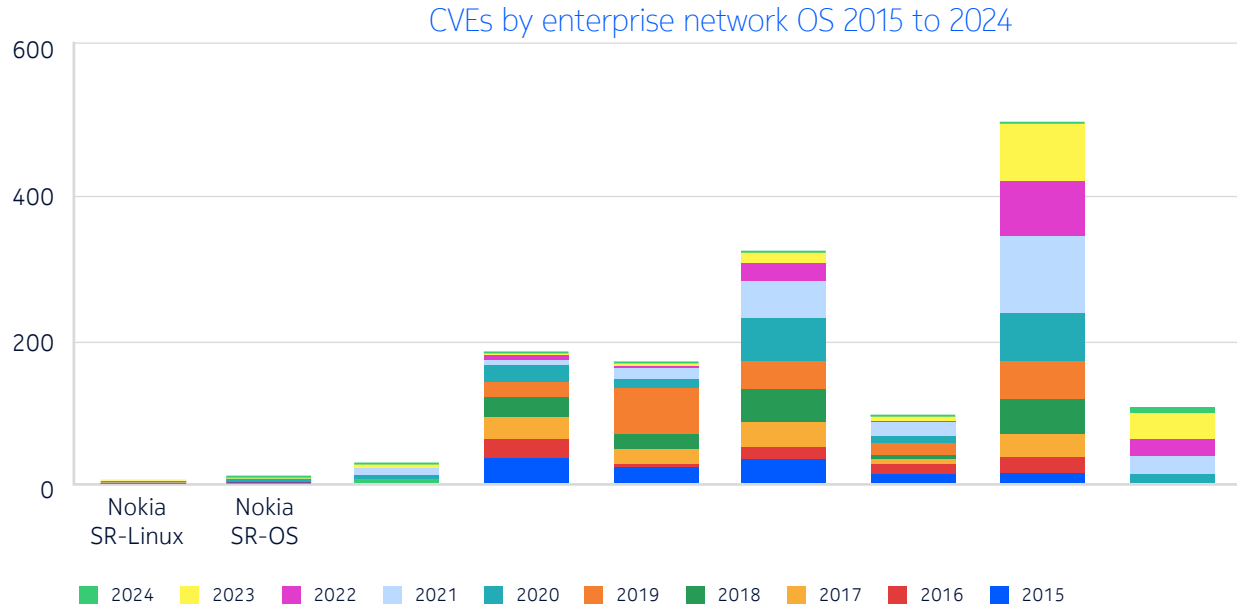
3+ years
test hours
run in **2** weeks

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



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

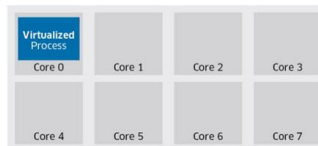
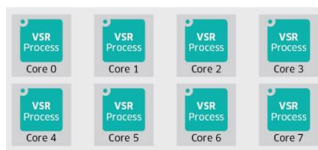
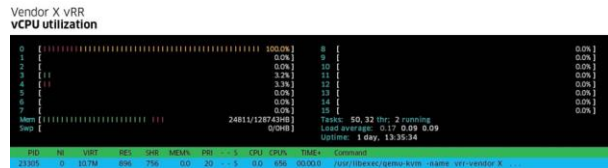
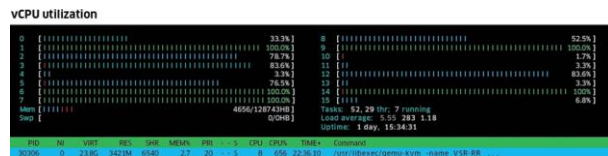
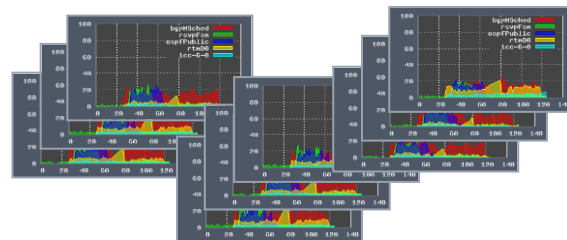
Nokia CVEs and PSIRT extract as of 3/5/2024

Symmetric Multiprocessing (SMP)

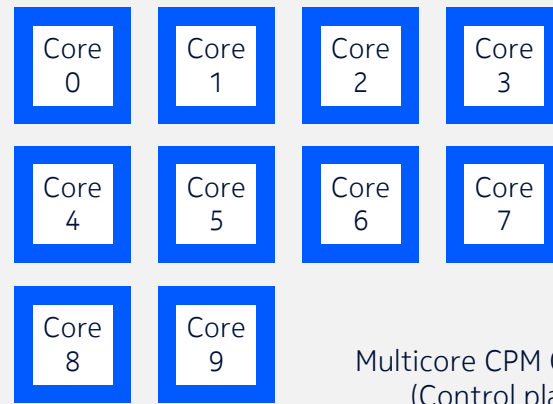
Control Plane performance

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 process more route updates per second for real world prefixes with significant lower convergence times



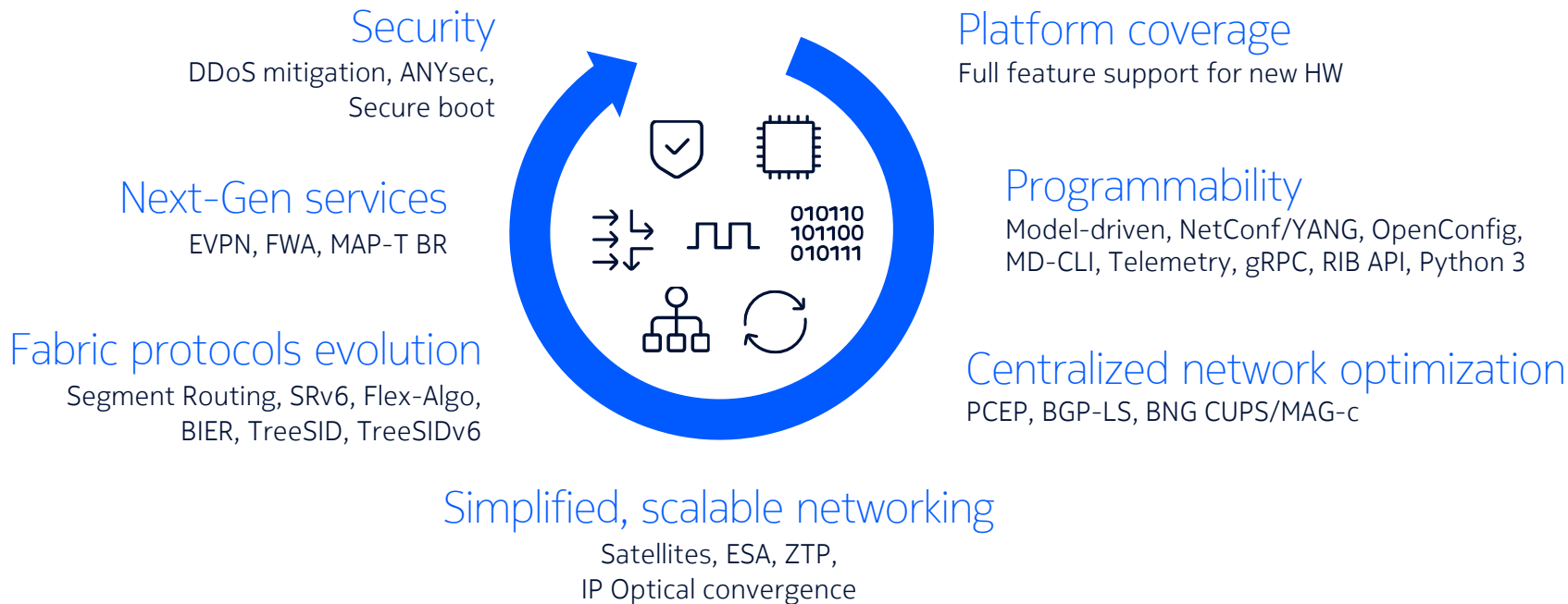
Single processor implementation with "Vendor X"



Multicore CPM CPU
(Control plane)

Software

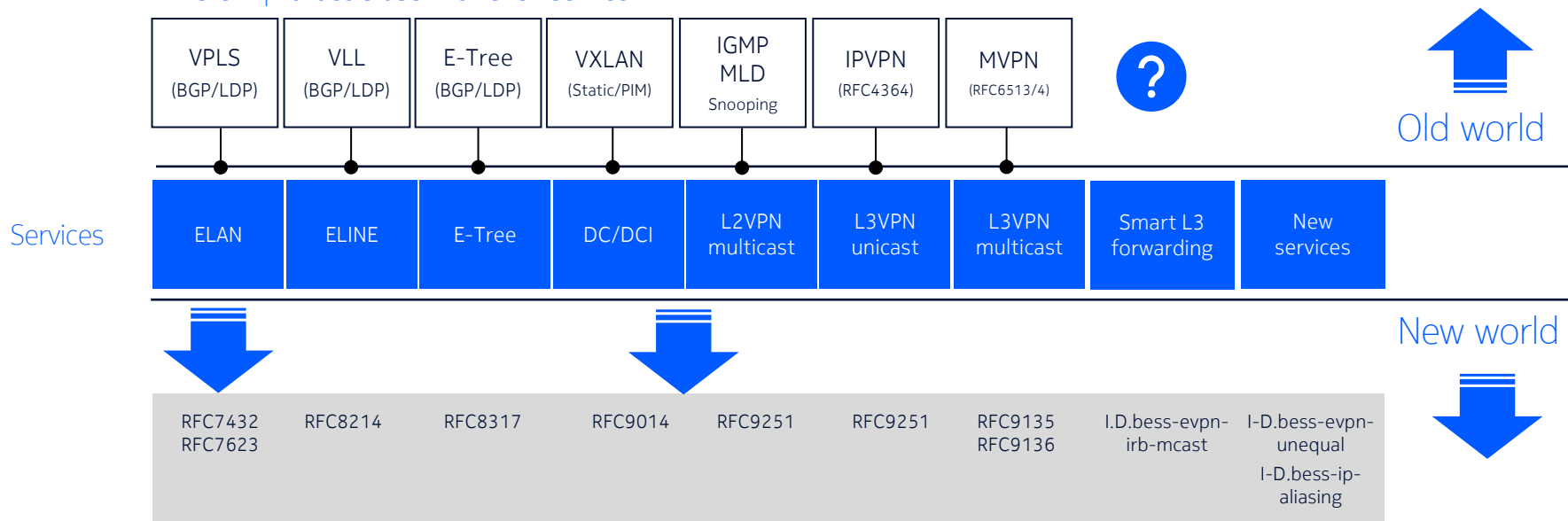
Development areas



EVPN reduces operational complexity, increases profitability

Adds new capabilities through a unified control plane framework

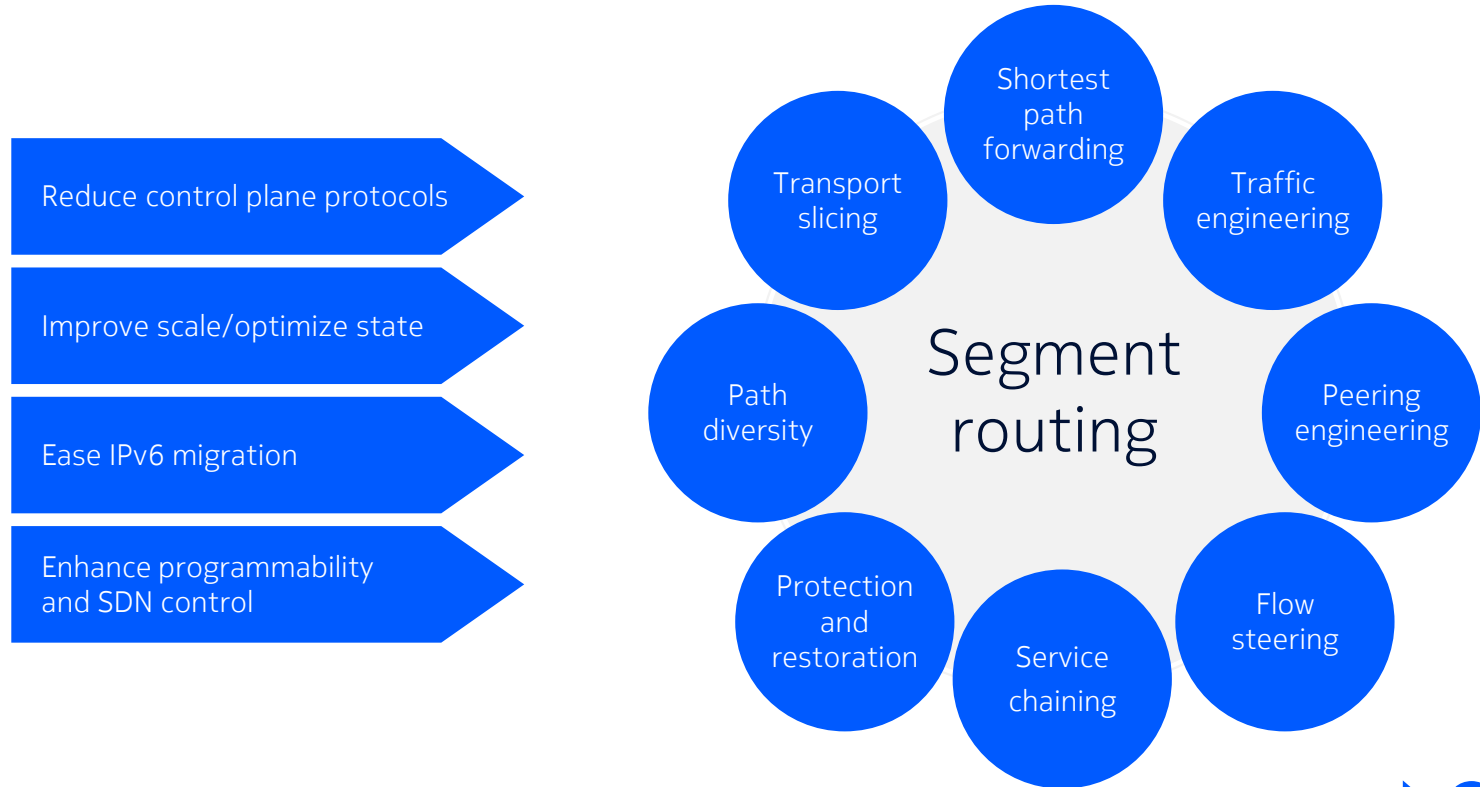
Different protocols used for each service



Common control plane framework

Segment routing (SR-MPLS and SRv6)

Could influence the ASIC/NPU selection

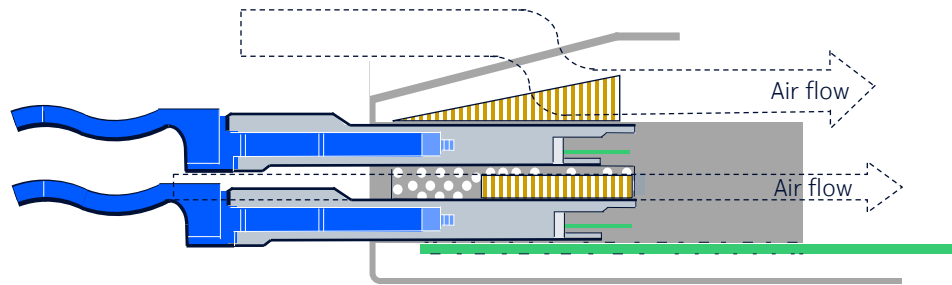


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Design choices

Optics cooling

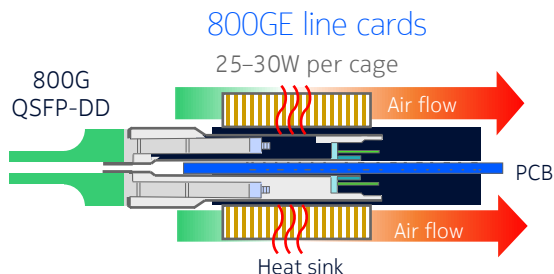


Stacked SFP cages

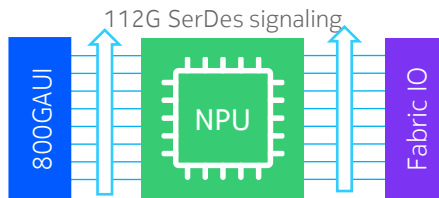
- Classic DC design
- Heat sink on top, IRHS on bottom
- Bottom cage always hotter - imbalanced optical performance
- DD Design point ~13W optics in all cages at 40°C
- Limits applicability to future optics
- Fans run @ 75-80% max rate at room temp with 400GZR/ZR+: major power and service impact



Dual sided PCB



Routing silicon



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.

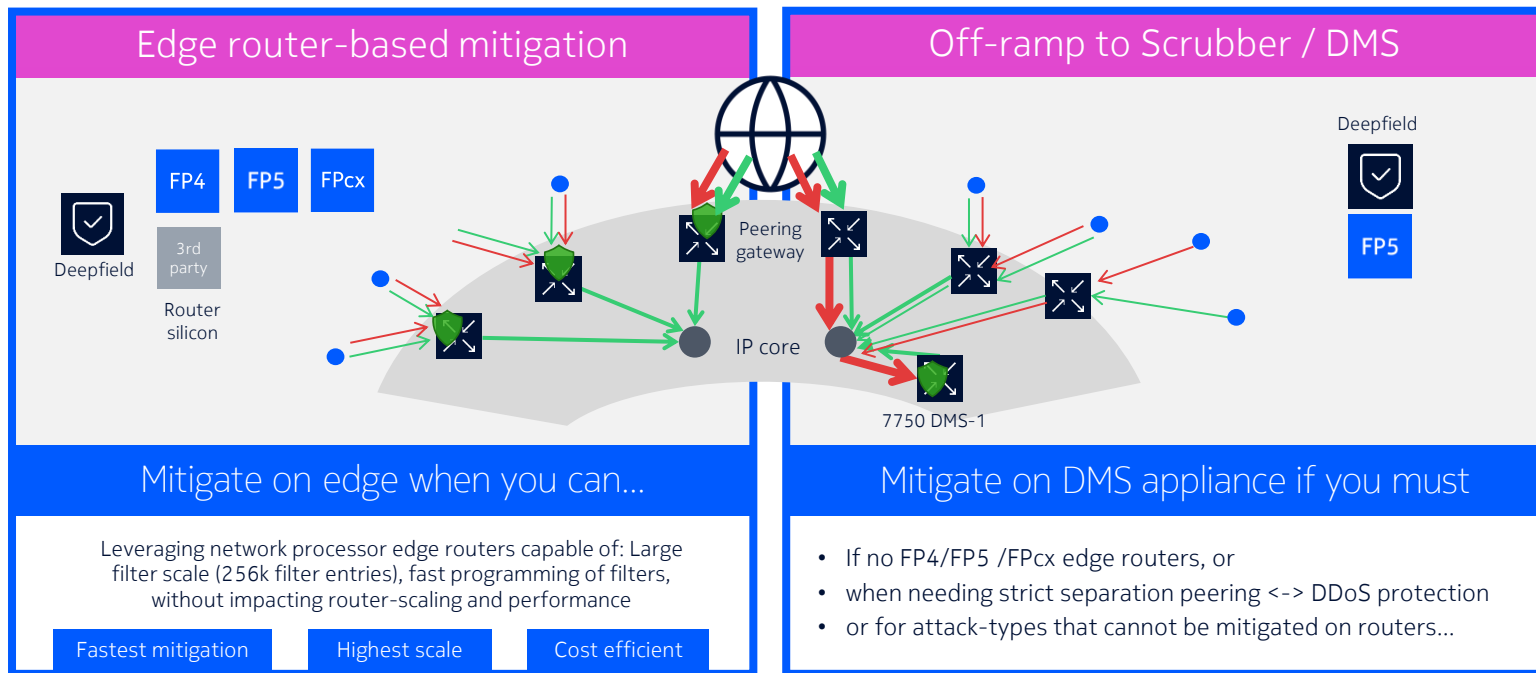
Criminal gangs / state-affiliated actors



Successful attacks

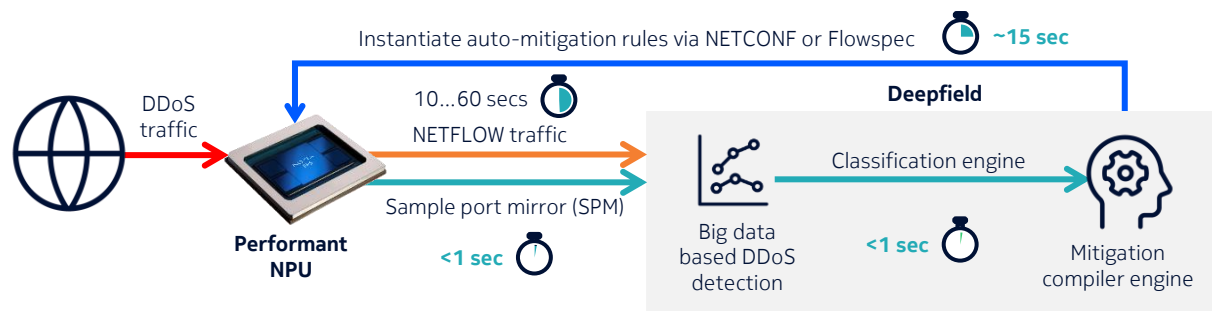
DDoS mitigation options

Two-layer DDoS protection



Using network processor ACL power to protect against DDoS

Combined forces for cost-effective DDoS protection



AI-powered intelligence

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



Performant silicon

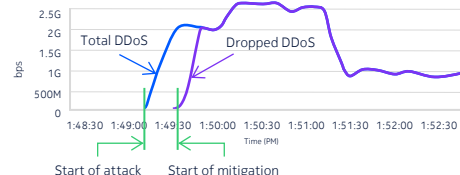
- Large-scale ACLs to block large/complex DDoS attacks
- Line-rate filtering with no performance impact
- Fast filter-population for fastest possible mitigation

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



**Total time to mitigate
1st byte < 30 seconds**

Mitigation started within
<25 sec after start of attack



Next-generation platform for DDoS mitigation

FPGA vs Network Processor

Leading scrubber

Scale
Performance
Detection
Time to mitigate
Cost

- 800 Gb/s per appliance
- Variable throughput
- Manual (thresholds)
- Minutes
- FPGA cost points (\$\$\$)

Next-generation platform for DDoS mitigation

- 2.8 Tb/s per system
- Always at line speed
- Automated
- Seconds
- 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



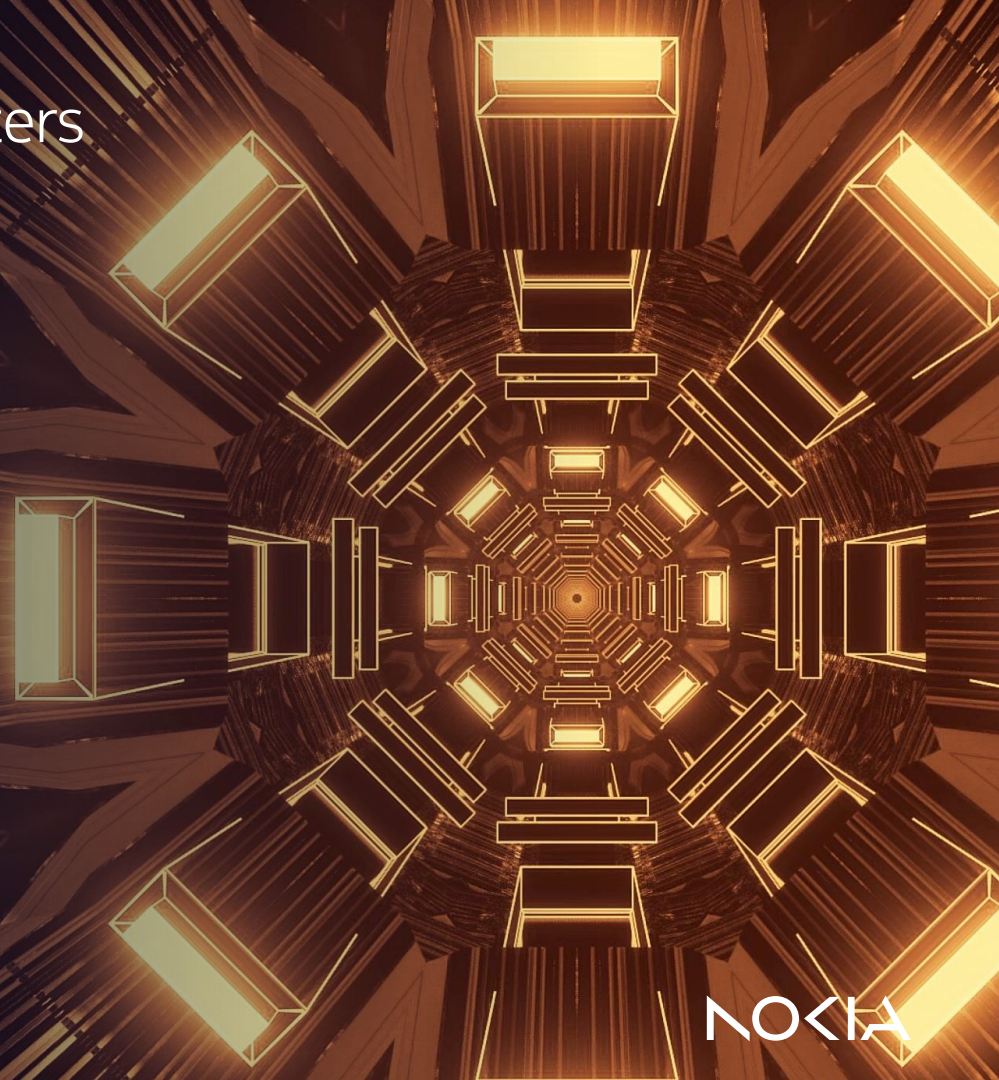
Unauthorized collection of encrypted data today could be decrypted in the future



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



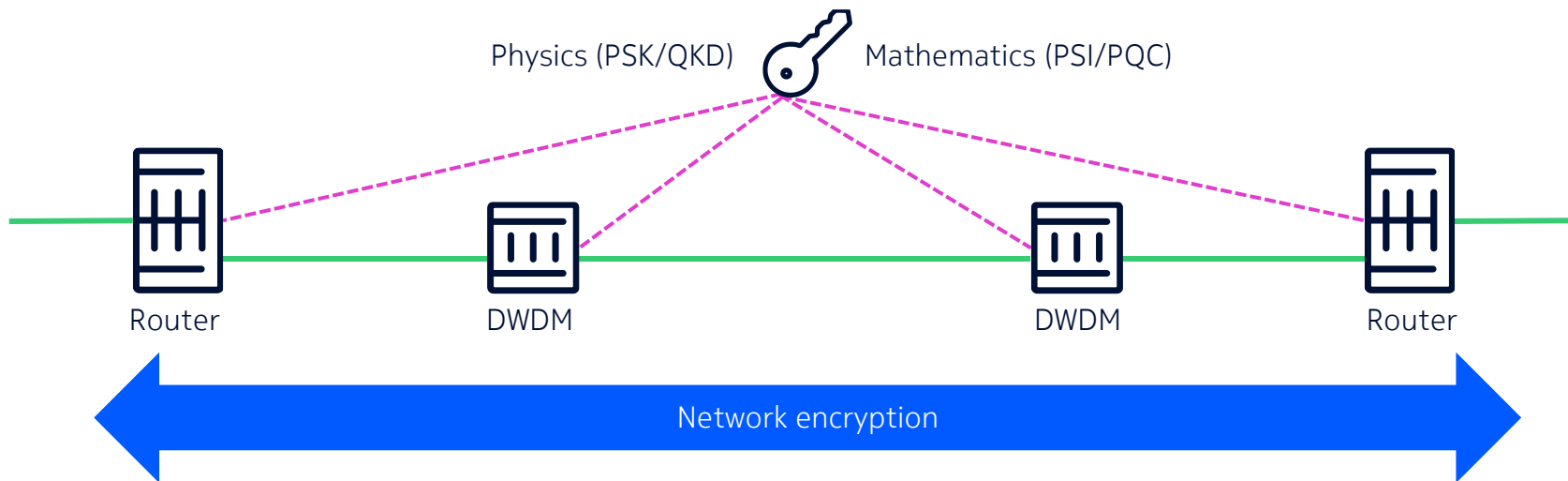
Quantum safe networks

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

Adapt
to your business needs

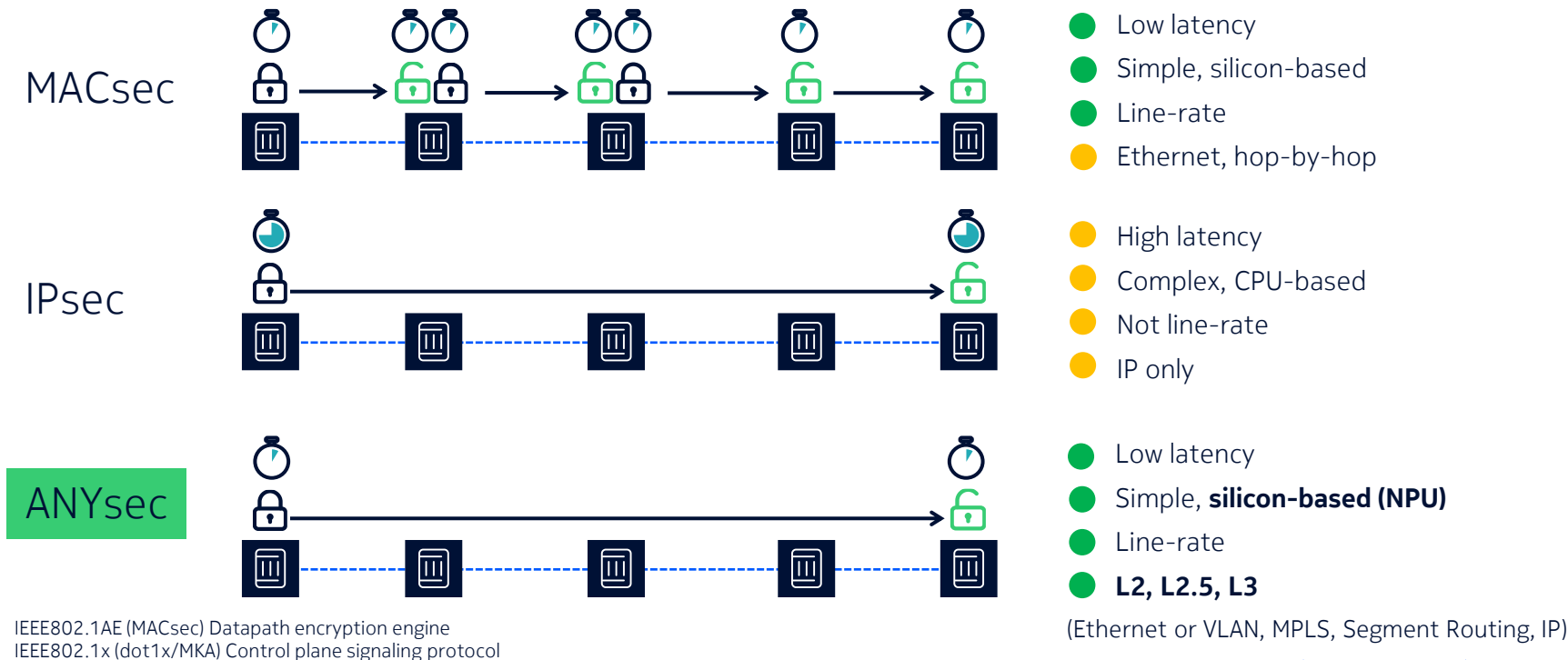
Scale
your Quantum-safe deployment

Evolve
with the Quantum landscape



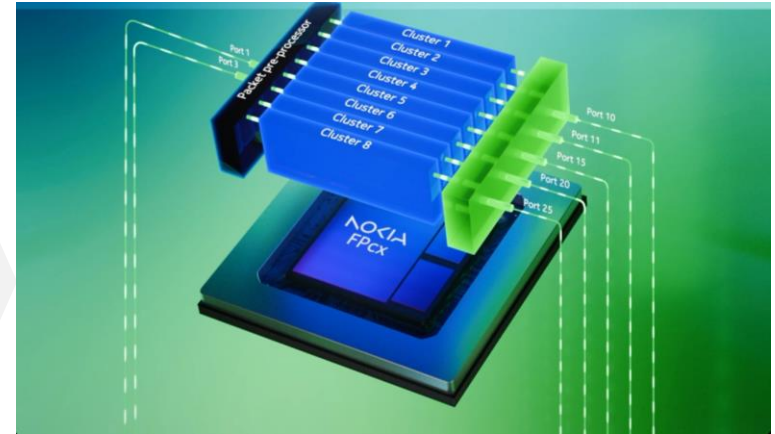
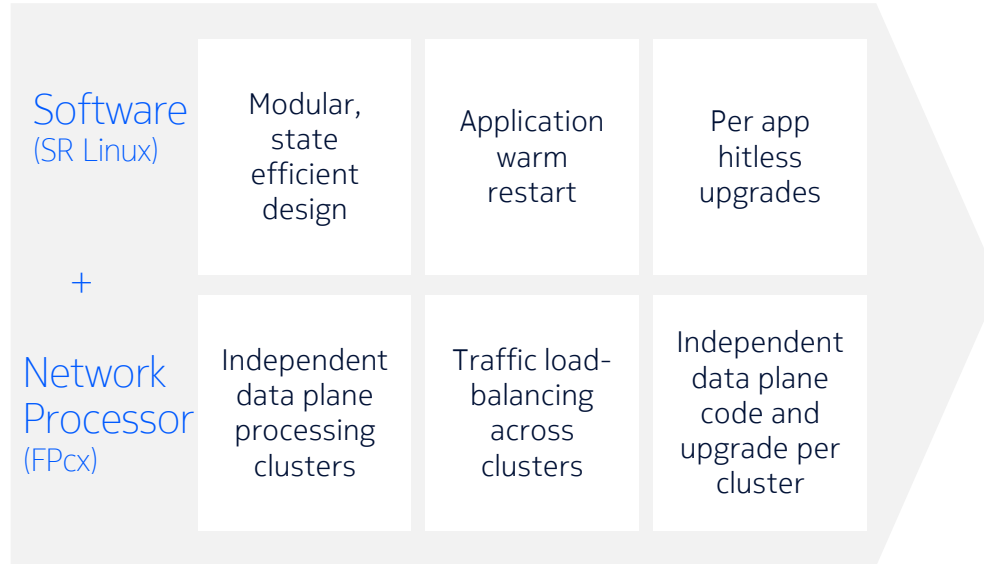
Quantum-safe networks (ANYsec)

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



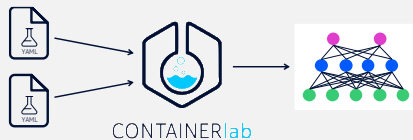
Simplex platform innovation

Application warm restart and hitless upgrades per cluster



DevOps for networking labs

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

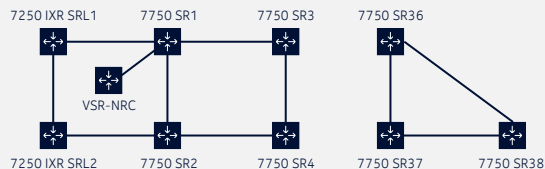


- + First class support for containerized NOSes
- + Transparent datapath
- + Git friendly and better image sharing and handling
- + Repeatable lab builds and CI friendly (declarative Lab)
- + Small footprint, open, free and fast

RONOG8: [ContainerLab](https://containerlab.dev/). Free and opensource networking lab environment for the modern age - Roman Dodin (NOKIA)

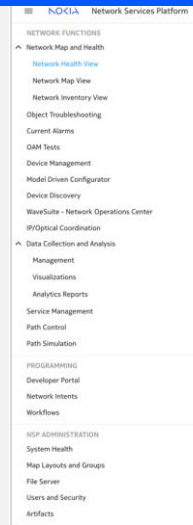
<https://containerlab.dev/>
<https://containerlab.dev/lab-examples/lab-examples/>

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



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

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