

Powering Research and Education Networks with High-performance, Scalable and Secure IP Networks

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NOKIA

REN's networking challenges, present and ahead...

Network complexity

Many networks supporting different organizations

Interconnectivity (WAN, data center, cloud) poses significant network complexity.

Scalability and capacity

Advances in Quantum computing and network applications will drive **massive data** transfers

Across **distributed** network domains and areas

400G/**800G** demand

Security

Given the complexity and scale of the network, the security **perimeter is vast.**

Securing data against **multiple attack vectors** requires defense-in-depth solutions.

Automation

Complexity and scale of the networks can result in **management** and **provisioning challenges.**

Network automation as an enabler of operational **simplification.**

SUSTAINABILITY

Addressing those challenges

EVPN, Segment Routing, Flex-Algo

EVPN is the **unified service layer**

The next-generation full-service VPN solution segment routing is the **unified transport layer**

Deterministic network at scale

Purpose-built silicon

Built-in hardware **security** capabilities

112 SerDes technology driving **800G** interfaces

Security

Visibility through network **telemetry**

Protection through scalable **Quantum-safe** technology

Attack mitigation through **line-rate** and **highly-scalable** FP5

IP/Optical Coordination

Simplify operations by coordinating IP routing and optical domains through **automation**

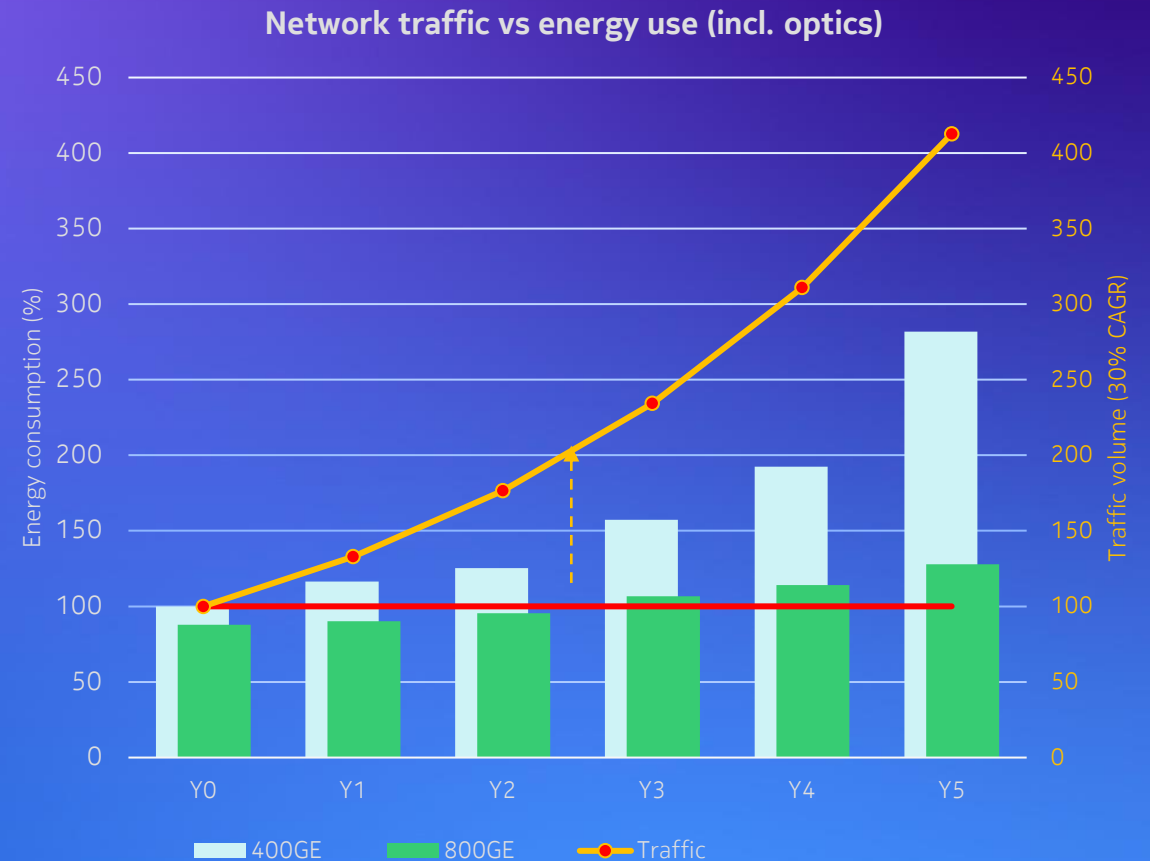
SUSTAINABILITY

Moving more bits using less energy Powered by Nokia FP5 silicon



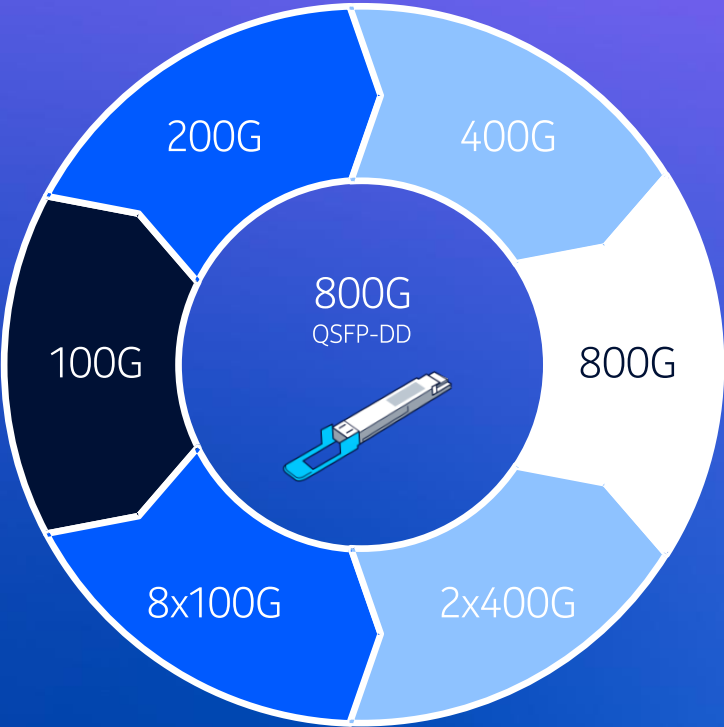
800GE Routing

Double up IP network capacity
Double down on sustainability

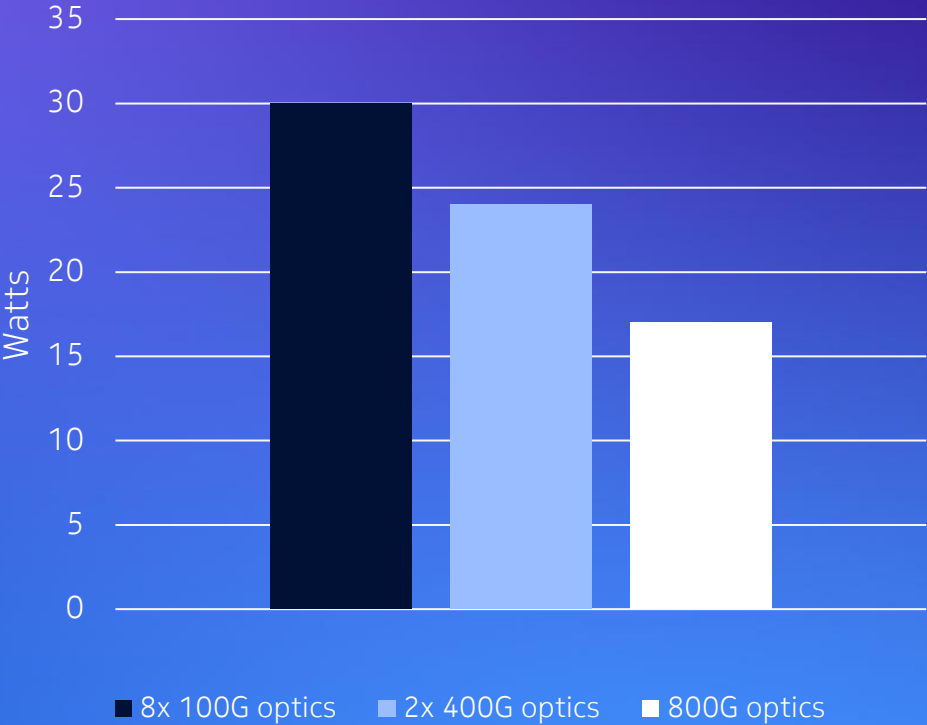


Flexible scaling from 100 to 800G speeds

More capacity and connectivity

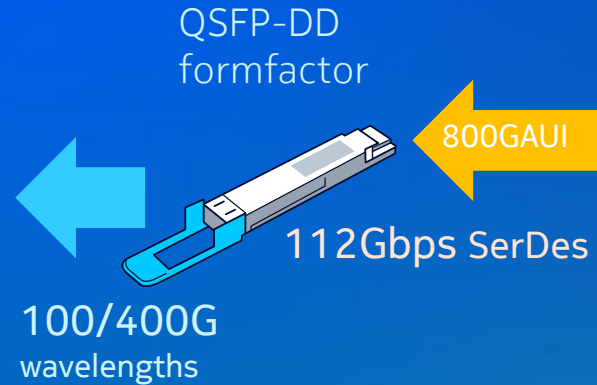


Less energy and space

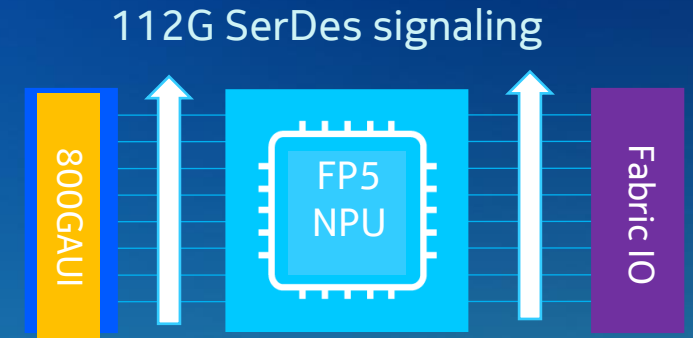


800G routing enablers

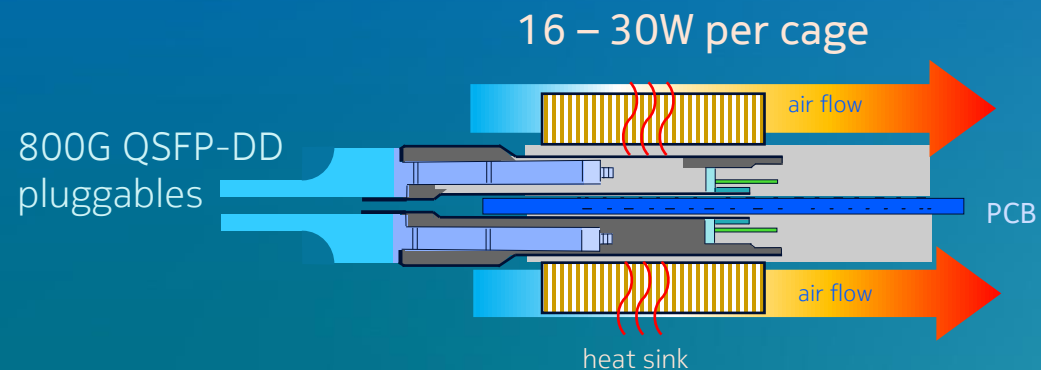
800G transceivers



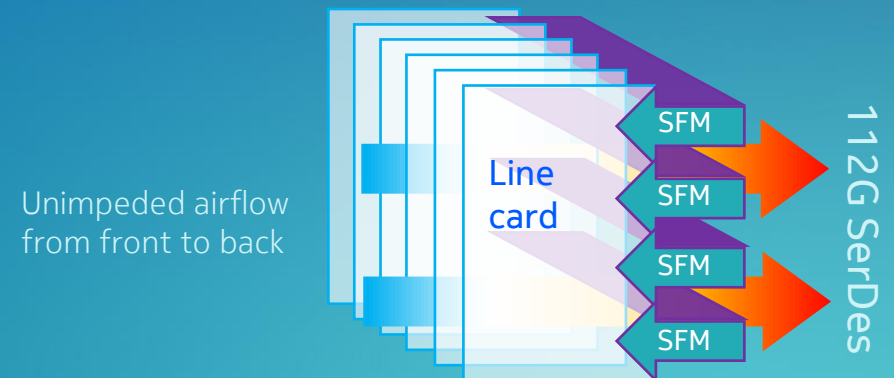
Routing silicon



800GE line cards

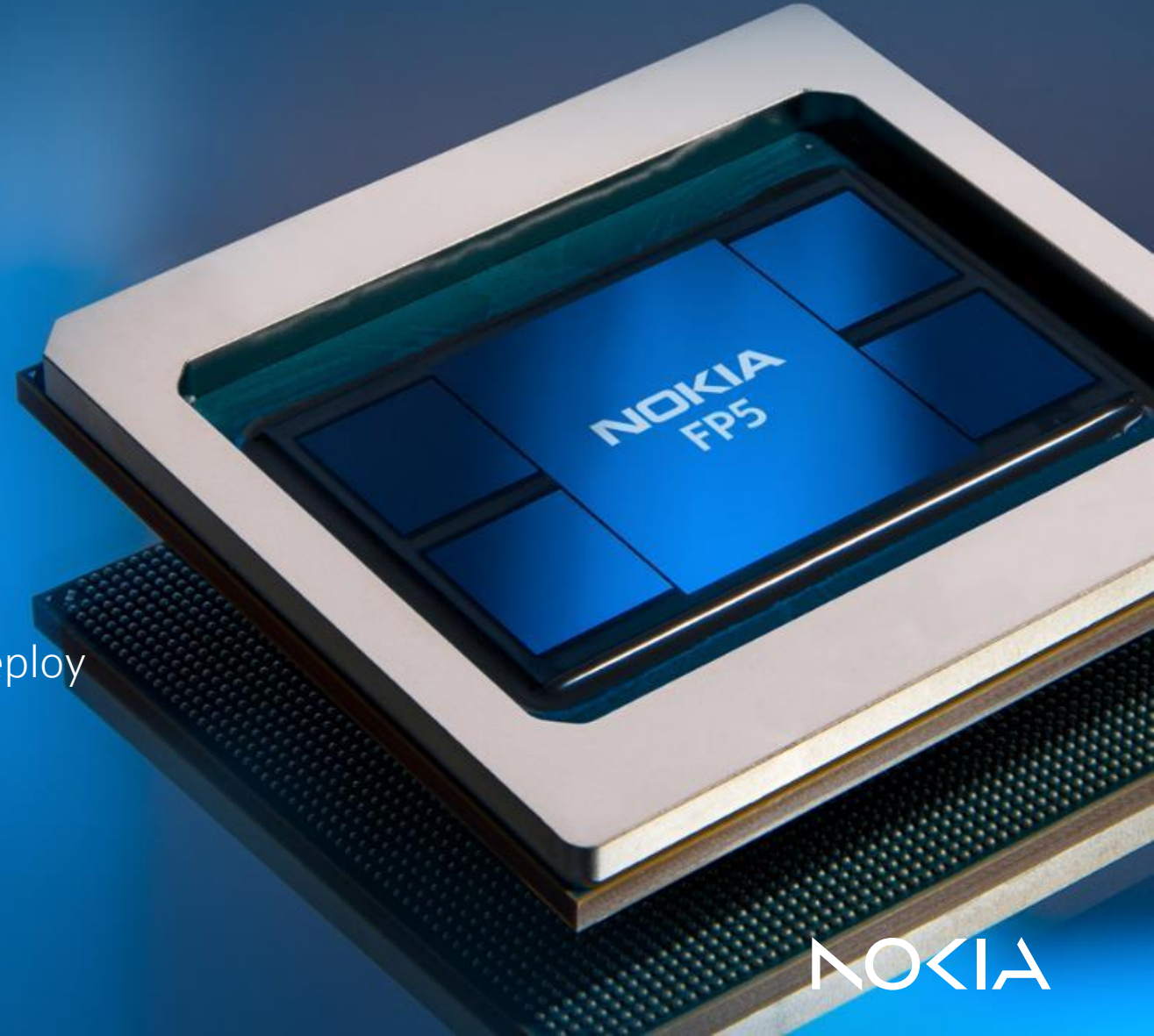


Switch fabric



Nokia's 5th generation FP5 IP routing silicon

- 6.0 Tb/s NP
- Always **deterministic**
- Fully programmable
- Drives >3x capacity increase over FP4
- **75% reduction** in power consumption vs FP4
- 1st to support **800GE** and 1.6Tb/s IP interfaces
- Seamless backwards compatibility with FP4
- Flexible licensing enables **800GE now or later** (deploy with 400GE)
- IP network security: **DDoS protection, ANYsec**



Nokia IP network security

A multilayer embedded approach to IP network security

Big-data security analytics

- Deepfield Defender
- Deepfield Secure Genome™



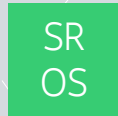
Router Net OS apps and tools

- Nokia security gateway • CG-NAT
- SR OS firewalls • ESM security



Router Net OS

- SR OS self-defending network OS



IP silicon

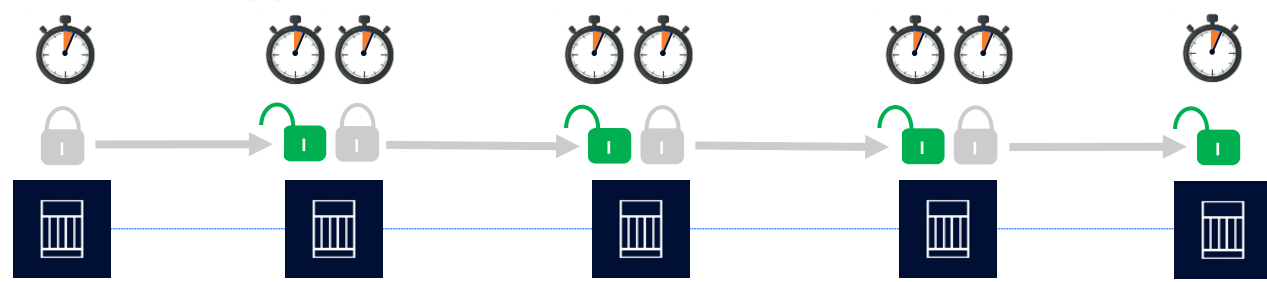
- High-performance DDoS filtering (FP4, FP5)
- ANYsec line-rate encryption (FP5)



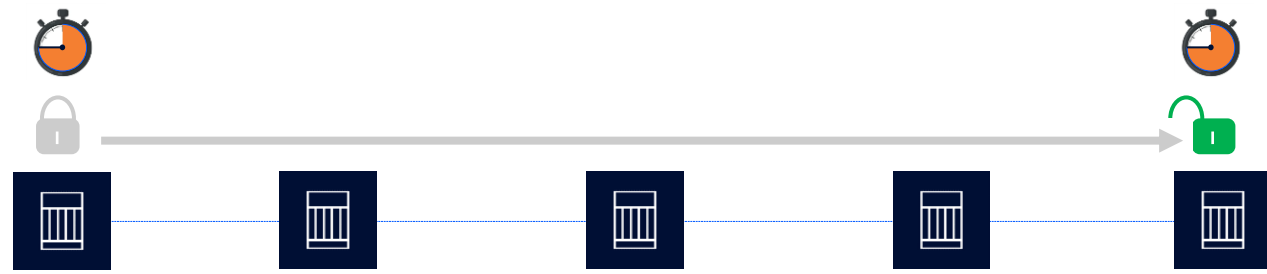
Nokia IP network security

ANYsec network encryption

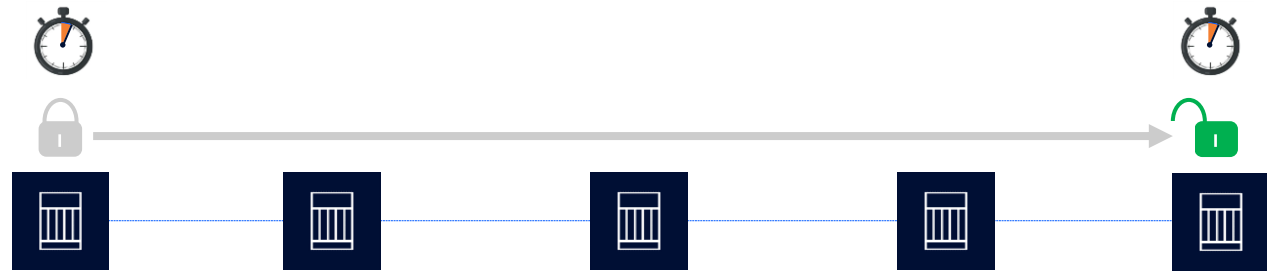
MACsec



IPsec



ANYsec

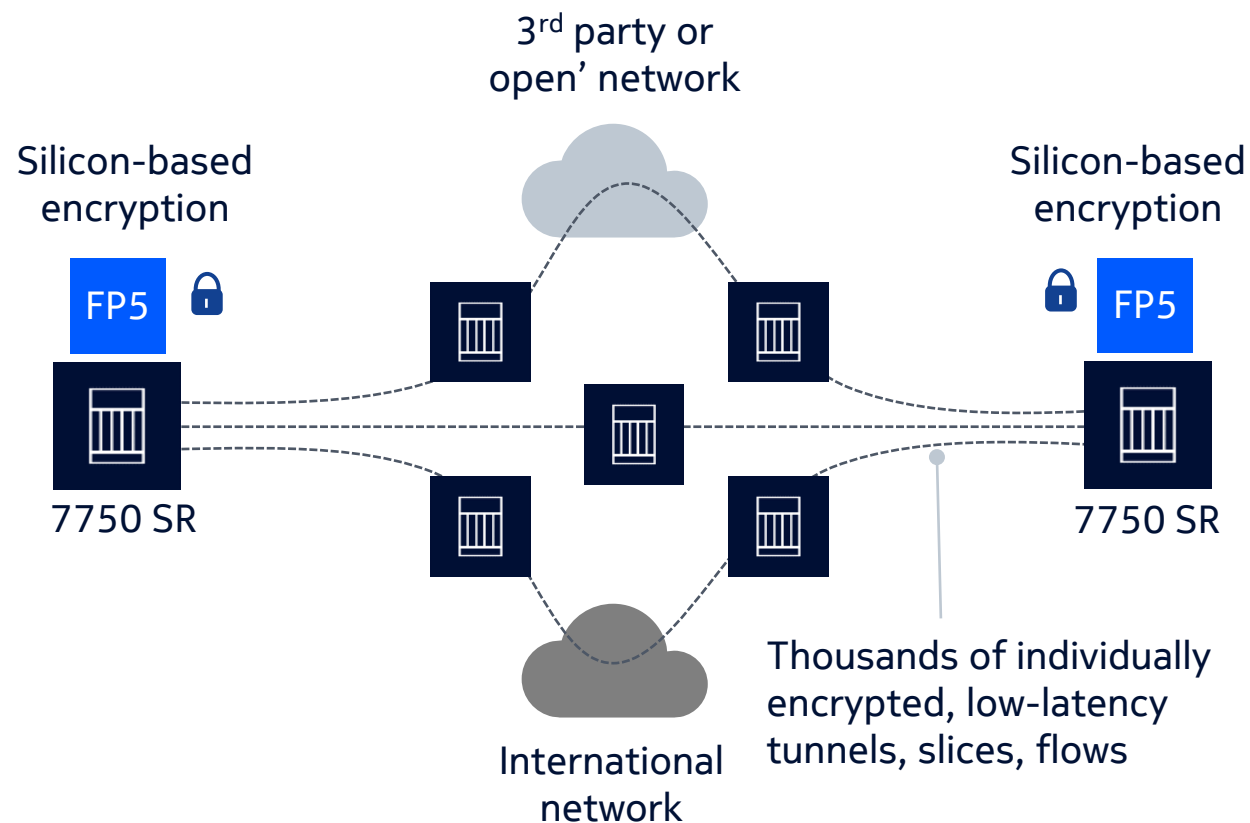


- Low latency
- Simple, silicon based
- Line-rate
- Ethernet, hop-by-hop
- High latency
- Complex, CPU based
- Not line-rate
- IP only
- Low latency
- Simple, silicon based
- Line-rate
- **L2, L2.5, L3**

Nokia IP network security

ANYsec network encryption - Line-rate, highly secure, low-latency transport services

- Any client interface
 - IP, SR, MPLS, Ethernet/VLAN
 - MACsec, IPsec*, unencrypted
- Any transport network
 - IP, SR, MPLS, Ethernet/VLAN
- E2e encryption of all flows, tunnels, slices
- Ushers in a new age of highly-secure, low-latency
 - Wholesale and internal transport services
 - 4G/5G transport networks and services
 - Managed VPN services

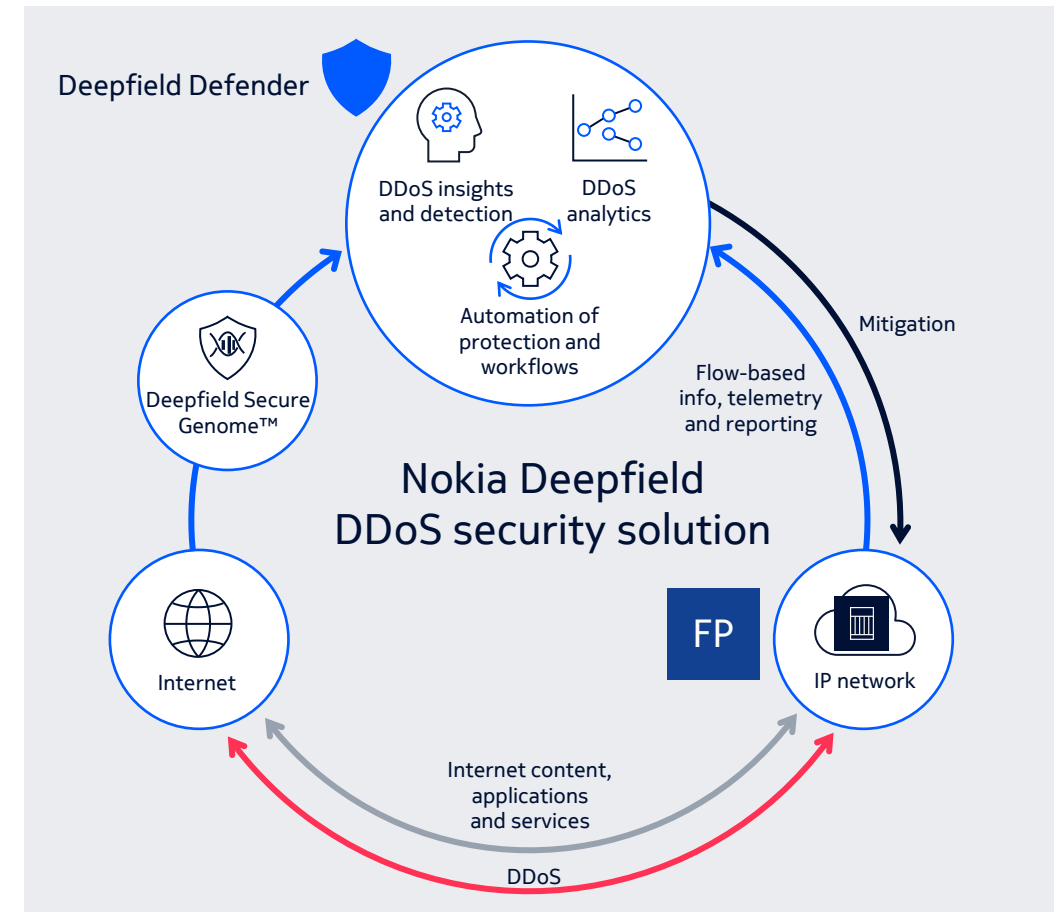


* Requires Nokia SeGW (ESA/ISA) to terminate

Nokia IP network security

360-degree, next gen DDoS protection

- **Identify and neutralize volumetric DDoS attacks automatically**
- 7750 SR can be combined with Nokia Deepfield Defender software analytics
- **FP5/FP4 silicon enables massive DDoS filtering**
- Allows the 7750 SR to act as highly precise attack sensor and mitigation element
- No impact to 7750 SR performance
- Savings on backhaul cost and security appliances



Key takeaways

800G IP interfaces unlocking **sustainable network capacity**

Security built-in natively in the network for **line-rate, highly secure, low-latency** transport services

Purpose-built silicon enabling **deterministic network** behavior

The background features a dynamic, abstract composition of numerous thin, flowing lines. These lines are primarily red and orange, with some blue lines interspersed, creating a sense of movement and depth. The lines swirl and loop around the central text, adding a complex, organic feel to the overall design.

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