IP networks reimagined
Challenges for network operators

Users have an insatiable demand for personalized content and immersive multimedia. The cloud has sparked the imagination of a new generation of entertainment, business and commercial communities. 5G will only accelerate a whole new array of machine communications applications as meaningful Internet of Things (IoT) scenarios emerge, sharing the common goal of transforming business and enhancing the way we live, work and play.

Networks of the future must be ready to handle hundreds of new and life-changing applications and services for millions of users.

As humans and devices consume rapidly growing volumes of cloud-based content and services in a variety of ways, the interplay between networks and the cloud becomes more critical. The ability to adjust network resources in real time based on changes in demand or placement of content is vital to deliver the highest quality of experience (QoE) while making the best use of resources. Security is already a primary concern, and the scale of threats will only increase as the number of endpoints multiply. Networks must meet these challenges—and this will require innovation and imagination.
The IP network of the future

Nokia strives to evolve and transform modern networks to enable the next phase of the cloud and machine era of communications. Users expect high QoE regardless of the type of content they consume or how they access it. As a result, modern networks must be highly adaptable and ideally suited to deliver superior service experiences with better security and real-time optimization. This forces network operators to reimagine their infrastructure as they strive to keep up with its expansion.

A new operating model of insight-driven automated networking is required. In this model, modern IP networks must excel in scale, efficiency, adaptability, security and longevity.

The network change that often comes to mind first is sheer scale. The routers that are at the heart of networks must simply be much bigger to handle unrelenting traffic growth.
FP4 silicon
Powers unprecedented scale

- First 2.4Tb/s network processor
- Up to 6x better performance relative to alternatives
- Supports 100GE at massive scale as well as 400G and terabit speeds
- Enables a unique, network-integrated approach to DDoS mitigation
- Massive capacity upgrade for existing platforms
- Silicon advances and integration cut power consumption in half (per Tb)
- Supports deterministic performance under stringent traffic loads

7750 SR-s
Taking router performance to new heights

- Designed for massive scalability up to 288 Tbps
- Highest density platform on the market, supporting up to 1,440 100GE interfaces in a compact 24RU form factor
- Supports up to 12 Tbps of intelligent fan-in/fan-out per slot
- Evolves datacenter networking for service provider and webscale using FP-based system design concepts

7950 XRS-XC
Paves the path to petabit routing

- Most scalable, versatile and efficient core routing platform on the market
- Unique chassis extension design eliminates the need for switching shelves, dramatically reducing the cost, complexity, space and power footprint of achieving massive scale and throughput
- Industry-leading wire speed port densities in a single system: 720 400G, 2,880 100GE or 28,800 10GE ports
Tradeoffs in other systems often include port-level limitations, buffering constraints and performance degradation at scale or anomalies in service consistency that result in the need for more complex network engineering and high-touch operations. Eliminating such compromises ensures better performance, improved customer satisfaction, and cost optimizations over time.

Nokia’s groundbreaking FP silicon is the first and only multiterabit network processor chipset to deliver intelligence at scale and provide visibility with control to ensure that networks are more powerful, agile and secure. To do so, Nokia has scaled key attributes such as classification, buffering, enforcement and fine-grained statistics to ensure deterministic performance and intelligence across millions of flows as systems expand and new services are developed.
As service providers and leading webscale operators build out their infrastructure, waste is the enemy and customer reach is critical. Delivering the highest quality user experience with the lowest cost and complexity is a major design objective for both service provider and webscale operator environments.

In service provider environments, customer reach requires that networks span a wide area and provide coverage with optimal user experience delivered across diverse access means. Many links are significantly underutilized, necessitating an additional layer of aggregation.

In highly concentrated datacenter networks, too many links run underutilized. This forces additional layers of aggregation to ensure that webscale operators can run their network links as hot as possible.

A more modern design would provide intelligent fan-in/fan-out of ports. In this way, a single router could accommodate significantly more users. Doing so intelligently ensures that buffering and classification are in place at a granular level to ensure QoE even as the network runs hotter and leaner.

In developing the latest FP₄-powered routing platforms, Nokia provides up to 250 percent greater port fan-in/fan-out. This capability dramatically enhances resource utilization while also reducing the cost and complexity of adding extra aggregation nodes.

Nokia silicon innovation also drives other fundamental benefits in system efficiency. As the industry’s first multiterabit network processor silicon, FP₄ reduces the cost and complexity of circuit boards that would otherwise need multiple NPU complexes to provide only a fraction of the capacity. The higher programmable capacity per FP₄ ensures better small packet performance, provides better buffering, and delivers higher efficiency compared to implementations that resort to multiple smaller network processors.

Through a high degree of integration and the introduction of intelligent memories, the FP₄ chipset also subsumes entire collections of supporting memory chips that would surround the processor, and integrates them onto the same die. This innovation provides another dimension of space and power savings, and further reduces the complexity of the boards. The end result is far simpler boards that are far more powerful in a much smaller footprint and consume half the power (per Tb) than before.

Boosting the number of ports that can be accommodated through intelligent fan-in/fan-out and dramatically reducing the footprint, complexity and power consumption through silicon innovation provides critical benefits for leading service providers and webscale operators striving to achieve the highest levels of network and asset efficiency.
Nokia takes adaptability to a new level with our latest FP4+-based routing platforms. The virtuous operations loop is fueled by extensive amounts of fine-grained data, collected and streamed to feed big-data analytics engines that can apply broader knowledge of application and network conditions to translate that information to insights. The Nokia Network Services Platform (NSP) carrier SDN platform then programs the network with enhancements that can optimize performance. Flow optimization and bulk traffic steering are scenarios that benefit dramatically from such an automated, adaptable framework.

Change is the norm. In the era of the cloud, new content and applications are always emerging, and they are consumed voraciously by users everywhere on a range of devices. Content is easily moved to optimal locations as required, independent of the network infrastructure. The interplay of cloud services and the underlying infrastructure is of paramount importance if we are to ensure the delivery of superior customer experiences.

The new operational model is fundamentally based on awareness and agility. The network must observe and adapt intelligently and with minimal intervention. A virtuous operations loop is required so the network can gather tremendous volumes of information about what is happening, translate that information to insights, then apply those insights through automated action that enhances network performance and service quality. In doing so, an automated, intent-based networking paradigm ensures that the network continually operates at the highest and most efficient level.
Security is a vital consideration for both users and network operators as we move beyond content and apps and into the hyper-connected world of IoT and machine communications. Distributed denial of service (DDoS) attacks and worm attacks are regular occurrences, with terabit-scale attacks happening more and more often.

While there are multiple layers of security in any infrastructure, the modern network can play an important role in ensuring the integrity of user experiences and network assets. The virtuous operations cycle that adapted network behavior can also be applied to identify and mitigate network security threats.

When a threat is suspected by a cloud analytics engine such as the Nokia Deepfield solution, the engine can program threat signatures into the powerful FP4 silicon. Traffic flows traversing the router can then be scanned, using the signatures to detect malicious traffic. Once detected, the engine can programmatically discard the DDoS traffic to thwart the attack and minimize the impact on the network infrastructure and on users. Using the power of FP4 and the Deepfield solution, this happens more quickly and more cost-effectively than possible before. As a result, the network is safer and its resources are best utilized. The network becomes an effective part of the security strategy.
Designed for longevity

Given the wide reach and scope of service provider and webscale networks, superior return on investment depends on operational efficiency. Enhancements that can be made through software upgrades and designs that can last longer in place provide significant cost benefits. Truck rolls and forklifts are the enemy of efficient network infrastructure.

With 15 years of experience delivering some of the world’s largest IP and Ethernet services networks on a single consistent network operating system, Nokia clearly understands the value of designing systems for longevity. New capabilities are added continuously through software updates without necessitating field swaps.

Unlike datacenter fabrics, which are concentrated in a relatively small number of massive datacenters, networks that reach millions of users span hundreds of points of presence. If additional capability requires new silicon, a 3-5 year life cycle (and wait) is standard. For modern networks that strive to deliver the most innovative service experiences and to do so most efficiently, that is simply not an ideal design choice—especially not when a strong alternative exists that delivers flexibility and longevity with compelling economics.

The extensible design of Nokia FP4 silicon ensures that new feature capabilities can be added continuously and seamlessly through software upgrades to existing FP4-based hardware, for years in systems that are proven to last a decade or longer in the most demanding networks worldwide.
Nokia believes that the networks of the future must deliver insight-driven, automated networking with greater visibility, finer control and intelligence at scale. As leading service providers and webscale operators expand their network infrastructure, they should not need to sacrifice capability to achieve boundless and cost-effective scaling.

Nokia delivers breakthrough FP4 silicon innovation that powers the industry’s most powerful, scalable, adaptable and efficient petabit-class routers. We deliver massive capacity upgrades to existing systems while introducing the biggest and densest IP routing platforms in the industry. Our solutions provide the insight and control to power the new model of network operations, which is aligned with cloud models and the DevOps mantra. A virtuous operations loop ensures intent-based, automated optimization of the infrastructure. All of this ensures that the best user experiences are delivered efficiently, securely and cost-effectively for years to come.

To learn more about Nokia insight-driven, automated networking for the evolution of your IP network, visit networks.nokia.com/ip-networks-reimagined.

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