

# Nokia FPcx routing silicon

Raise your Xpectations with breakthrough  
custom silicon innovation

Application note

The Nokia logo is displayed in a blue, sans-serif font. It is positioned in the lower right quadrant of the page. A large, solid blue diagonal shape, resembling a stylized 'N' or a thick line, runs from the top left towards the bottom right, partially overlapping the logo area.

NOKIA

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## IP networks today

The acceleration of broadband access deployments – including fixed, fixed-wireless, 5G, and cloud – have driven the need for more capacity in IP access and aggregation networks. In today’s environment, however, capacity alone is no longer enough. There are now several other factors to consider:

- Digital transformation, along with the shift of critical enterprise applications to the cloud (and edge cloud), has driven the need for more deterministic connectivity.
- The proliferation of IoT devices has increased the global network threat landscape, driving the need for advanced network security capabilities in all areas of the network.
- The recognition of global networks as business- and society-critical infrastructure now drives the expectation that IP connectivity and infrastructure services must be highly reliable, resilient, and always on.
- Global sustainability initiatives, combined with the increasing cost of energy, have driven the need for reduced equipment footprints and energy consumption.

Maintaining growth, delivering new network expansion, and providing the best user experience while maximizing network resource utilization can be a daunting task for operators. Addressing these demanding realities while maximizing a return on investment is the goal of highly capable silicon and platforms from Nokia.

## Raise your expectations

With the correct foundational elements, operators can raise their expectations. They can build networks their customers trust, deliver secure and assured services with certainty, and scale networks efficiently and reliably without compromises. Breakthrough silicon innovation from Nokia has consistently changed the trajectory for building and expanding IP networks.

FPcx routing silicon is Nokia’s newest family of fully programmable network processors that bring the value of [Nokia’s high-performance and feature-rich FP silicon](#) into a compact and extensible package. It is purpose-built for Communication Service Provider (CSP) and mission-critical enterprise networks, and is optimized for IP access, aggregation and edge applications.

FPcx provides silicon diversity for the Nokia IP Routing portfolio and is designed to bring the value of FP silicon to a new range of smaller capacity routing applications. It delivers performance certainty and highly reliable network services. Full programmability enables a quick pivot to new protocols and maximizes ROI through extended equipment network lifespan.

FPcx sets the benchmark for sustainability, minimizing energy consumption without impacting performance. Its rich array of industry-leading capabilities enables assured services, demanding network applications, and secure connectivity with support for DDoS mitigation along with MACsec and ANYsec (on select platforms and adapters) to protect against rising security threats.

FPcx enables network designs without trade-offs in performance, capacity, scalability, or energy consumption. With its proven and no-compromise design, operators aren’t forced to choose between services or settle for a reduced feature set and unpredictable performance.

As the foundation of a new generation of IP routers, FPcx is optimized to meet speed and capacity demands while extending routing capabilities at the right economics into access, aggregation, and distributed edge networks.

# Design requirements for critical IP networks

When addressing the design challenges operators face with their critical IP networks, understanding the capabilities of routing silicon is crucial. Routing silicon is a fundamental element of highly capable IP routing platforms, defining performance, scale, energy consumption, quality of service, interface speed, longevity, and network role. It also has a direct impact on network efficiency, reliability, sustainability, and TCO.

Performance must be deterministic and predictable under real-world network conditions which means avoiding the pitfalls of partial buffering and the use of HBM for tables as required. Scalability must be multi-dimensional, moving beyond router capacity and density, ensuring the silicon can also scale access control lists (ACLs), Multiprotocol Label Switching (MPLS), IP, and MAC addresses concurrently. Energy efficiency considerations need to consider not just the silicon but also the line card design, upgradability, and mechanical innovations to support a full density of interfaces in the router.

Assured services require silicon with multi-layer hierarchical QoS, deep buffers, an industry-leading scale of queues, policers, and granular counters. Enhanced analytics and real-time telemetry providing network visibility and control requires silicon housing a large number of statistical counters for all networking requirements. Network security requires a silicon-based approach to protect the IP network without impacting router performance, while also providing new service opportunities. Silicon must be designed to enable new performance features and meet future hardware requirements without a silicon upgrade.

Nokia's FPcx custom routing silicon is designed to address all these essential design requirements.

## FPcx routing silicon innovations

With FPcx silicon, Nokia continues to build on our history of superior in-house routing silicon innovation. It delivers flexible capabilities, energy efficiency, and network security attributes similar to [Nokia FP5 routing silicon](#). It powers a new family of IP routers, the [Nokia 7730 Service Interconnect Router \(SXR\)](#) to bring service routing to a new range of applications at the right economics for CSP and mission-critical enterprise networks.

FPcx silicon's details include:

- 5 Tb/s full duplex network processor (NP)
- 7nm geometry
- NP architecture with 8 independent clusters – each cluster can run its own code
- First NP to support both 112G and 56G SERDES for unmatched flexibility
- Integrated packet fabric interface that can be line-side or fabric facing to enable flexible back-to-back ASIC configurations without a fabric
- Energy efficiency equivalent to merchant silicon with far greater capabilities
- Hierarchical memory structure with on-chip flat cache memory, on-package HBM2, with option to expand tables to HBM when higher scale is required
- 7-level H-QoS with deep buffers and massive queue scalability
- Interface breadth 1GE to 400GE with full breakout
- Fully programmable routing silicon to support enhanced packet intelligence and control technology for a silicon-based approach to IP network security
- Support for ANYsec/MACsec on select platforms/MDAs
- Designed to perform deterministically.

FPcx silicon's benefits include:

- 100% programmable NP to maximize network lifespan and minimize TCO
- Multi-dimensional scale
- Enabling technology for ISSU on platforms with a single NP (I.e. simplex platforms) with no packet loss
- DDoS mitigation with large scale ACLs providing extensive match criteria flexibility to make the network part of the solution to DDoS; in-line with FP4/FP5 functions and integrated with Deepfield Defender.
- Line-rate MACsec/ANYsec encryption services with no performance penalty
- Mission critical focus with H-QoS, counters and capabilities
- Delivers capability + capacity + power efficiency without compromise.

# Flexible capability

## Highly programmable

FPcx silicon is highly programmable and can deliver major new features and support new protocols through microcode updates rather than hardware replacements. This extends product life for highly sustainable networking with the lowest TCO of any silicon in the industry.

The NP architecture of FPcx has a fully programmable data path with no hardcoded forwarding logic. There are no special engines per logic core, and cores can be rearranged in different configurations to add or enhance performance logic. This makes FPcx extremely adaptable and upgradable to future networking requirements without the need for hardware swap-outs. G-SID compression for SRv6 and slicing ID are two evolving network standards where a programmable pipeline can benefit. These functions can be enabled in hardware with a simple microcode upgrade performed via software download.

## Performance certainty

IP networks are critical. With continued year-on-year traffic growth and unpredictable loads, they are under continual pressure to perform. To ensure network reliability and service quality, operators must be certain of a router's throughput – even under harsh conditions.

Like its [Nokia FP predecessors](#), FPcx silicon provides deterministic performance. It ensures router throughput certainty, giving operators the confidence to deliver assured services backed by stringent SLAs. Nokia in-house silicon is the only routing silicon in the industry that continues to deliver on deterministic performance. Every other routing silicon available in the industry, in-house and merchant alike, can degrade under a number of basic loading conditions.

## Assured services and network applications

With FPcx silicon operators can provide innovative services with confidence, ensuring customer retention while attracting new customers. It combines tremendous service capabilities with a rich array of features to deliver secure and assured services with demanding SLAs for a wide range of use cases and traffic types.

To differentiate services, FPcx supports seven-layer, hardware-enforced hierarchical QoS (H-QoS) with up to 16 queues per service, deep buffers, and a leading number of queues, policers and counters. A large number of granular counters enables enhanced telemetry and uncompromising network visibility. For demanding SLA enforcement, it provides fine granular QoS capabilities with flexible traffic classification, marking and buffer pool management, and a large scale of policers and queues with associated statistic counters.

FPcx also supports demanding network roles, enabling operators to move network applications closer to the user in distributed edge network locations. These rich features combined with deterministic performance enable a broad range of network application use cases, including IP aggregation, mobile backhaul, IP edge, and as a multi-access gateway for broadband services.

## Superior network visibility and control

To support enhanced analytics and real-time telemetry, FPcx silicon provides a leading number of granular counters. When combined with software-defined networking (SDN) control from the [Nokia NSP](#) and IP network intelligence and analytics from [Deepfield](#), this solution provides operators with real-time insights into network trends for superior network visibility and control. This empowers operators to make more informed decisions, troubleshoot anomalies, and improve network performance, reliability, and end-user experience.

## Energy efficiency

With the rise in popularity of non-line-rate systems, many operators believe that to be energy efficient a system must sacrifice capability. Within these systems, scale, statistics, network visibility, buffering, QoS, and deterministic performance must all be sacrificed to save energy while concurrently increasing throughput. But for critical IP networks, energy efficiency without high performance is meaningless.

That's why FPcx silicon raises the bar when it comes to energy efficiency by providing leading energy-saving capabilities without sacrificing performance. It delivers typical energy consumption on the order of 0.1W/Gig while also concurrently being fully featured. Energy-saving attributes include clock gating, 112G SerDes to drive higher density more energy efficient optics (including coherent pluggable optics) and simplex ISSU with zero packet loss to drive simpler and less complex network designs.

## Network security

### Multi-level DDoS mitigation

FPcx silicon has advanced filtering capabilities to mitigate the growing threat of DDoS attacks in-band at the edge of the network. When used in conjunction with [Nokia Deepfield Defender](#), the FPcx-based [7730 SXR series](#) can be utilized as a precise instrument to efficiently mitigate DDoS attacks without compromising router performance with its granular, large-scale ACL filtering provides extensive match criteria flexibility, to deliver advanced IP network security to mitigate against DDoS attacks.

### ANYsec line-rate encryption

ANYsec provides native encryption for any transport (IP, MPLS, segment routing, Ethernet VPN, or VLAN) at any speed (10 Gb/s, 25 Gb/s, 100 Gb/s, 200 Gb/s, 400 Gb/s), on any service, for any loading condition. It is supported on select 7730 SXR platforms (using E5-based adapters) and goes beyond MACsec and IPsec to provide MPLS-, segment routing- and IP-level line-rate encryption in a low-latency, service-oriented fashion. It can be delivered either hop-by-hop or end-to-end as a security overlay. It is fully interoperable with all network legacy equipment, allowing for secure transport via any FPcx-to-FPcx or FPcx-to-FP5 path.

ANYsec offers a truly unifying capability to not only secure internal links within a network against bad actors or man-in-the-middle attacks, but also to enable new services and revenue generation around the secure transport of data.



# Speed and interfaces

FPcx is optimized to meet speed and capacity demands efficiently while extending routing capabilities deeper in the network at an attractive TCO. FPcx powers the 7730 SXR, a new family of highly capable routers, and is ideally dimensioned for access, aggregation, and distributed edge applications along with mission-critical applications.

Available in two modular and four fixed configuration systems, the 7730 SXR portfolio supports high density GE to 400GE via SFP+/SFP, SFP56/SFP28/SFP+, QSFP28/QSFP+, 100G SFP-DD, and 400G QSFP-DD optics. Flexible optical break-out options include 4x10G, 4x25G, 2x100G, and 4x100G to meet a wide range of interfaces and density requirements.

The 7730 SXR offers superior scale with many enhancements including advanced traffic engineering and OAM, full synchronization support, resilient design, a broad range of services, and extensive model-driven management capabilities.

## Summary

IP networks are critical resources. Recognizing this reality, Nokia FPcx delivers breakthrough silicon with flexible capabilities, energy efficiency, network security and speed while managing the bottom line. It is the industry's only fully programmable IP routing silicon purpose-built for CSPs and optimized for IP access, aggregation, and edge networks.

With FPcx, operators can raise their expectations. It can be used to:

- Build reliable, trusted networks that perform with certainty.
- Deliver secure and assured services that differentiate and provide tangible network value.
- Ensure sustainable, fully-featured networking in a completely upgradable NP package.
- Built-in security to protect services and infrastructure links for secured connectivity.

With FPcx Nokia reaffirms our focus on addressing the needs of CSPs and mission-critical IP networks globally, with continued silicon innovations that provide deterministic performance, energy efficiency, flexible capability, and network security.

### About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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