5G CORE

What does the next generation
of networks look like?

A cloud-native 5G architecture will dominate the next generation of networks. Companies must adopt cloud-enabled 5G Core technologies to keep up with the massive amount of data exchanged between consumers and service providers.

Unabated broadband growth is fueled by a growing demand for ubiquitous and interactive multimedia services. Technologies such as the IoT, machine-to-machine communication, AI, robotics, and virtual reality are expected to generate trillions of bytes of data every year. **Next-generation networks will be required to adapt to these growing needs**.

The **LTE Evolved Packet Core (EPC)** is going to undergo a number of changes as it slowly moves to a new 5G architecture that is expected to handle the proliferation of wireless devices and data. This will require a fundamental change to the core architecture. The core architecture forms the backbone of the network and acts as an anchor point for multiaccess technologies. By creating value through visibility and control of traffic and applications, the core network establishes reliable connectivity in a standard telecommunication network. At the center of the core network, an enabling and emerging architecture is expected to dominate next-generation telecommunication networks: **A Cloud-Native 5G Architecture**.

This report focuses on recent advances in the 5G core network, and in particular highlights three technological platforms that have helped to achieve market dominance in the development of the 5G core by using cloud-based architectures.

The core network is the backbone of the 5G architecture.

A core network is a back-end network of computers, routers, and switches that serves as an interface between the ISPs (Internet Service Providers) and the Radio Access Networks (RANs).

In 4G, this core network was called the EPC (Embedded Packet-Core) network. Today, new 5G architectures are employing cloud-based techniques to make the next-gen (5G) Core **more efficient** and able to **handle much larger data throughputs**.

> Rather than physical network elements, the 5G Core comprises pure, virtualized, software-based network functions (or services) and can therefore be instantiated within Multi-access Edge Computing (MEC) cloud infrastructures.
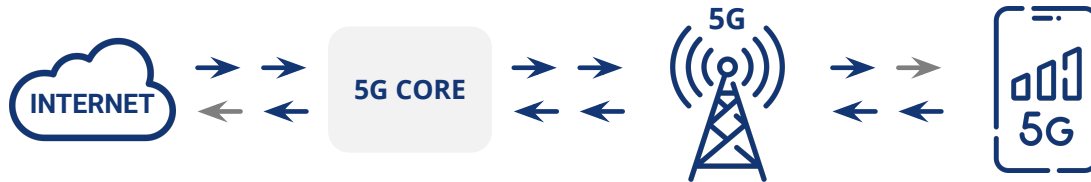
The core network

Aggregates data traffic from end devices

Applies personalized policies

Authenticates subscribers and devices

Manages the mobility of the devices

Routes traffic to operator services or the Internet

What technical aspects are relevant to a cloud-native 5G Core architecture?

Containerized: Each back-end 5G application is packed in its own container to facilitate reproducibility and resource isolation.

Dynamically Orchestrated: Containers are actively scheduled and managed to optimize resource utilization for smart traffic allocation and redirection.

Microservice Oriented: By segmenting applications to 3GPP defined microservices, the agility and manageability of the cloud-native architecture and 5G core networks improves significantly.

These three critical features enable loosely coupled systems that are modular, manageable, and observable. Therefore this architecture is **most suited to handle the back-end core operation of 5G networks** that require significant bandwidth, ultra-low latency, and the need to connect to billions of devices.

What is cloud computing?

Cloud computing, or distributed computing, is an approach of software development to design, build, and run highly scalable applications in dynamic environments such as public, private, enterprise, and hybrid, as well as multi clouds.

What is cloud native?

Cloud native is a term that can describe the patterns of organizations, architectures, and technologies that consistently, reliably, and at scale fully take advantage of the possibilities of the cloud to support cloud-oriented business models. *This is fundamentally different from developing applications offline and deploying on the cloud.*

An upgraded 5G Core architecture offers significant benefits to telecommunication providers.

AUTOMATION

Provides the flexibility and automation to manage increasingly complex networks

EFFICIENCY

Makes LTE and 5G more efficient and innovative, by deploying integrated core solutions that can manage traffic assets and databases dynamically.

UNIVERSAL ADAPTABILITY

Supports a wide variety of business models using multiple fixed and mobile access technologies, meeting the needs of new industry and enterprise customers.

TRAFFIC EFFICIENCY

Efficiently deals with unpredictable demand by adapting instantly to traffic fluctuations and cost-effectively shaping and scaling network resources to match different service needs.

SECURITY

Enables extreme network security to prevent attacks by implementing continuously improving automated telecom security infrastructure.

SERVICE INNOVATION

Introduces new services more easily, bringing innovation rapidly to market.

For telecom customer service providers to maximize profitability and take advantage of the wide range of business opportunities, flexibility in balancing cost-optimized versus performance-optimized network deployment is crucial.

New technologies, including but not limited to 5G New Radio (NR), Standalone (SA), 5G Core (5GC), network slicing, automation, and cloud native are needed to meet the needs of an efficient, flexible, and programmable network.

Here are some leading market-ready 5G Core solutions.

Ericsson's dual-mode 5G Core combines Evolved Packet Core (EPC) and 5G Core (5GC) network functions into a common cloud-native platform.

✔ Delivers a programmable core network, based on cloud-native design principles
✔ A combination of NFs and a multiaccess core solution
✔ Includes support for 5G NR (NSA and SA)
✔ Secure and efficient evolution of existing networks

Nokia's new AirGile 5G Core uses a cloud-aligned Service Based Architecture (SBA) that supports control plane function interaction, reusability, flexible connections, and service discovery that spans all functions.

✔ Cloud-aligned core network with a modular software architecture built with cloud capabilities
✔ Deploys separate IMS-based core networks VoLTE and Vo5G

With a unique interworking function, **Metaswitch's 5G Fusion Core** brings multiaccess support on a single 5G Core architecture instead of a complex and costly dual-core approach.

✔ A 100% cloud-native 5G core solution, and fully container-based and stateless architectural solution
✔ Built using microservices, and the highest performance UPF data plane
✔ Addresses a wide range of 5G use cases with a much smaller footprint and lower cost

Ericsson's Dual Mode 5G Core: A Smooth Combination of EPC and 5GC

ERICSSON

The Ericsson 5G core has proven very successful in a myriad of telecom-related use cases.

5
1
9
10
TRL

The cloud-based core network is ready to be deployed and has already seen wide-scale application.

The Ericsson Cloud-Native Infrastructure is specifically optimized for hosting cloud-native 5G applications.

TECHNICAL DESCRIPTION

Ericsson's Dual-Mode 5G Core combines Evolved Packet Core (EPC) and 5G Core (5GC) network functions into a common cloud-native platform that supports 5G NR Stand-Alone (SA) and Non-Standalone (NSA), 4G, 3G, and 2G access technologies. The Dual-Mode Core also includes service exposure capabilities to explore new business opportunities in the industry and in-build software probes to increase 5G network security.

SOLUTION HIGHLIGHTS

- Single platform for (5G) EPC and 5GC functionalities
- Cloud-native/microservice architecture
- Automated and simplified O&M
- High user plane performance and scalability
- Network exposure capabilities for programmability
- Flexible allocation and control of network resources

Ericsson's Dual Mode 5G Core: A Smooth Combination of EPC and 5GC

Source: Ericsson
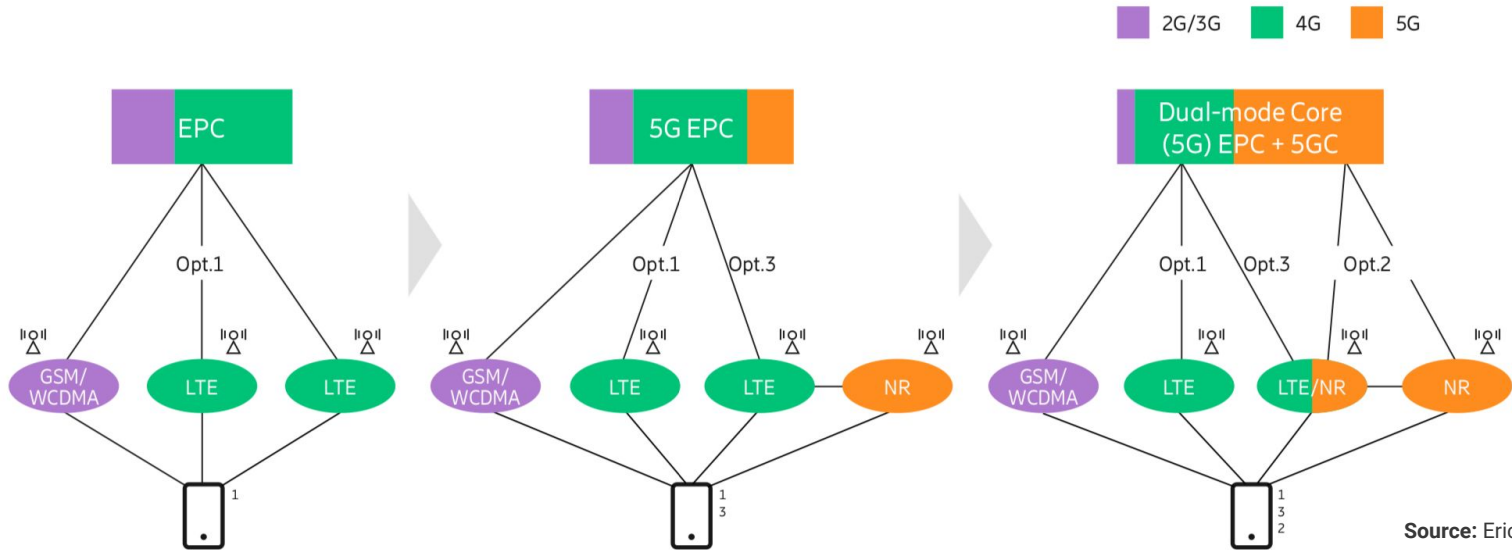
Ericsson's dual-mode 5G Core solution is fully based on cloud native principles, with a software architecture based on the microservice technology. It ensures capacity, elasticity, and agnosticity to underlying infrastructure and high levels of orchestration and automation for operational efficiency. Providing the capability to deploy containers as a service (CaaS) over bare metal servers without the need for a virtualization layer, the infrastructure solution delivers a radically simplified architecture compared to running containers in virtual machines. **By removing the virtualization layer from the cloud infrastructure, more efficiency as well as improved automation and performance can be achieved.**

Ericsson's Dual Mode 5G Core: A Smooth Combination of EPC and 5GC

A RECAP OF THE TECHNOLOGY & ITS KEY BENEFITS:

Ericsson's dual-mode 5G Core solution delivers a programmable core network for a secure and cost-efficient evolution of your existing networks.

It is based on cloud-native design principles, a flexible combination of NFs, and a multiaccess core solution that includes support for 5G NR (NSA and SA).
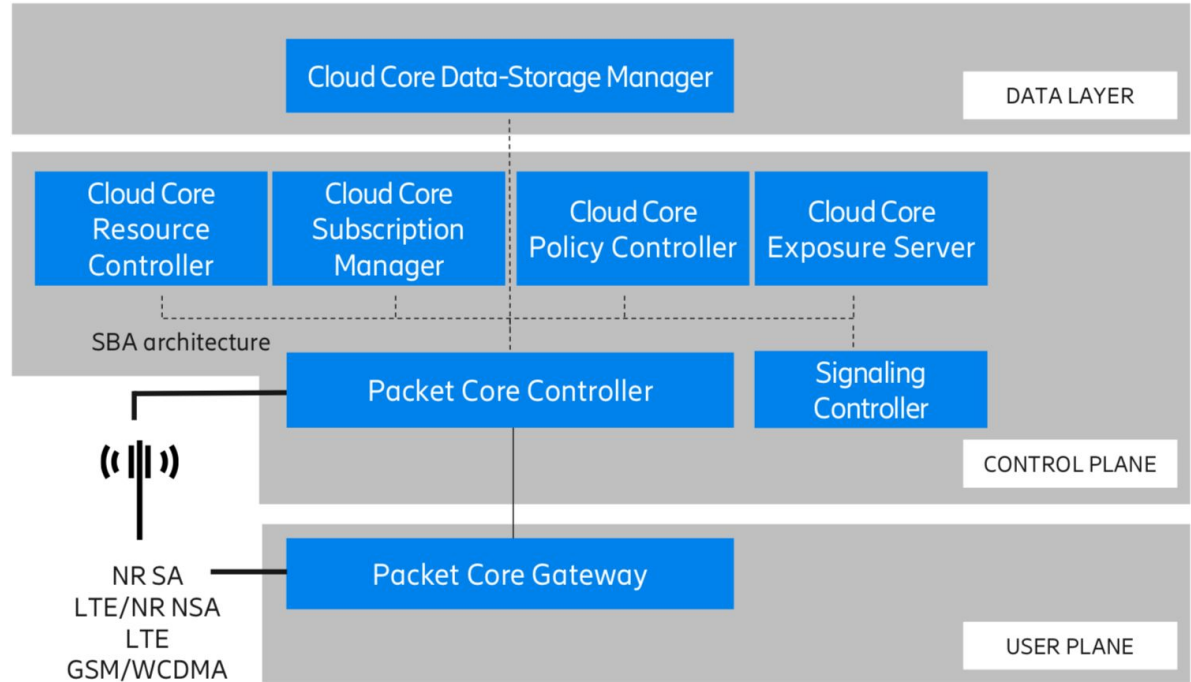
Source: Ericsson

Who is using Ericsson's Dual Mode 5G Core?

In November 2019, SK Telecom entered a commercial agreement with Ericsson, turning on a Cloud Packet Core in the operator's commercial 5G Core network. The deal expands on an existing 5G Core network transformation project and will help SK Telecom improve network performance and user experience.

Jung Chang-kwan, Vice President and Head of Infra Engineering Group, SK Telecom, says: "By utilizing Ericsson's Cloud Packet Core network solution, which realizes simplified network operations, we will unleash the full potential of new 5G-enabled use cases with greater efficiency."

Verizon chose Ericsson to provide networking equipment for their commercial 5G launch. Verizon promised to deploy the prestandard 5G commercial radio network and the 5G Core network in select markets in the second half of 2018.

In a proof-of-concept trial in a live network environment, Verizon and Ericsson introduced a cloud-native, container-based technology on the core of Verizon's active network. This trial was the first container-based wireless EPC technology deployment in a live network in the world. It introduced a much more efficient way to deliver operational applications that run the network. This solution will increase agility and enable deployment at scale for new services in 4G and 5G.

On July 20, 2020, SoftBank chose Ericsson to help launch its standalone 5G services by deploying a cloud-native, dual-mode 5G Core. The dual-mode 5G Core enables SoftBank to develop new 5G use cases towards consumer, enterprise, and industry partners.

The network offers zero-touch operation, including continuous delivery and integration processes (CI/CD), made possible through a container-based microservice architecture and its automation capabilities.

Ericsson and SoftBank have been continuously collaborating in developing and deploying 5G technologies throughout the Japanese market, including 5G RAN and 5G EPC.

Nokia AirGile 5G Core: A Service-Based Modular Architecture

NOKIA

Nokia's AirGile 5G Core uses a cloud-aligned service-based architecture (SBA) that supports control plane function interaction, reusability, flexibility, and service discovery that spans all functions.

TRL

5 • 1 • 9 • 10

Nokia has a comprehensive portfolio that supports the 5G Core with expanded service capabilities, scalability, agility, and new core network functions.

Nokia's Airgile 5G Core supports the full range of 3GPP Release 15 5G Core functions and eases migration to the SBA

TECHNICAL DESCRIPTION

Nokia's core is designed with inherent cloud-native capabilities. Software applications are deployed as microservices, where tasks are broken down into modular stateless services. Network functions can be moved to the edge of the network to meet the low latency demands of critical machine-type communication.

Nokia has applied an SBA to the 5G control plane, moving control functions completely into a cloud-based environment that provides operators with improved scalability, velocity, and flexibility.

SOLUTION HIGHLIGHTS

- The modular structure of Nokia's cloud-native core, coupled with 5G's SBA and a service mesh, make it easy to introduce future network functions and allow any function to be implemented and scaled rapidly, whenever required.
- The AirGile cloud-native core network delivers the flexibility, scalability, and performance needed for mobile broadband, IoT/MTC services, and the 5G programmable world.

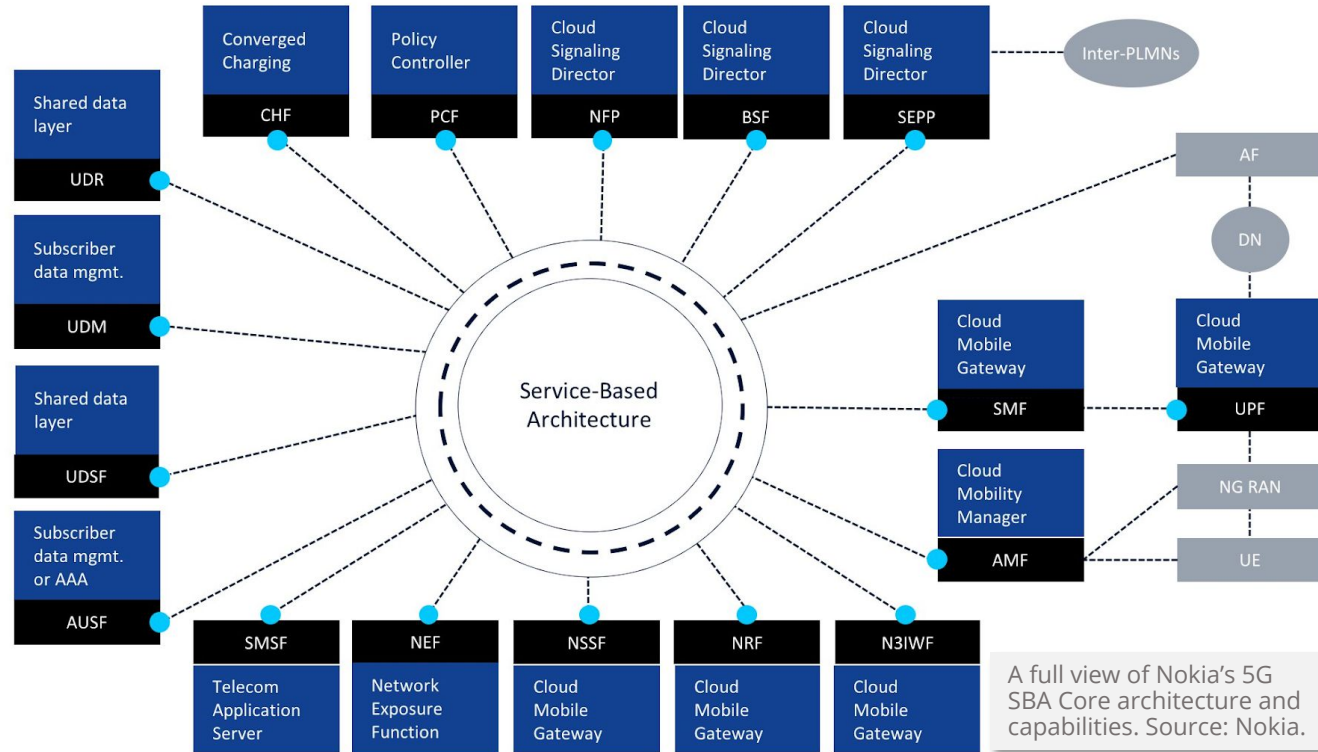# Nokia AirGile 5G Core: A Service-Based Modular Architecture

A RECAP OF THE TECHNOLOGY & ITS KEY BENEFITS:

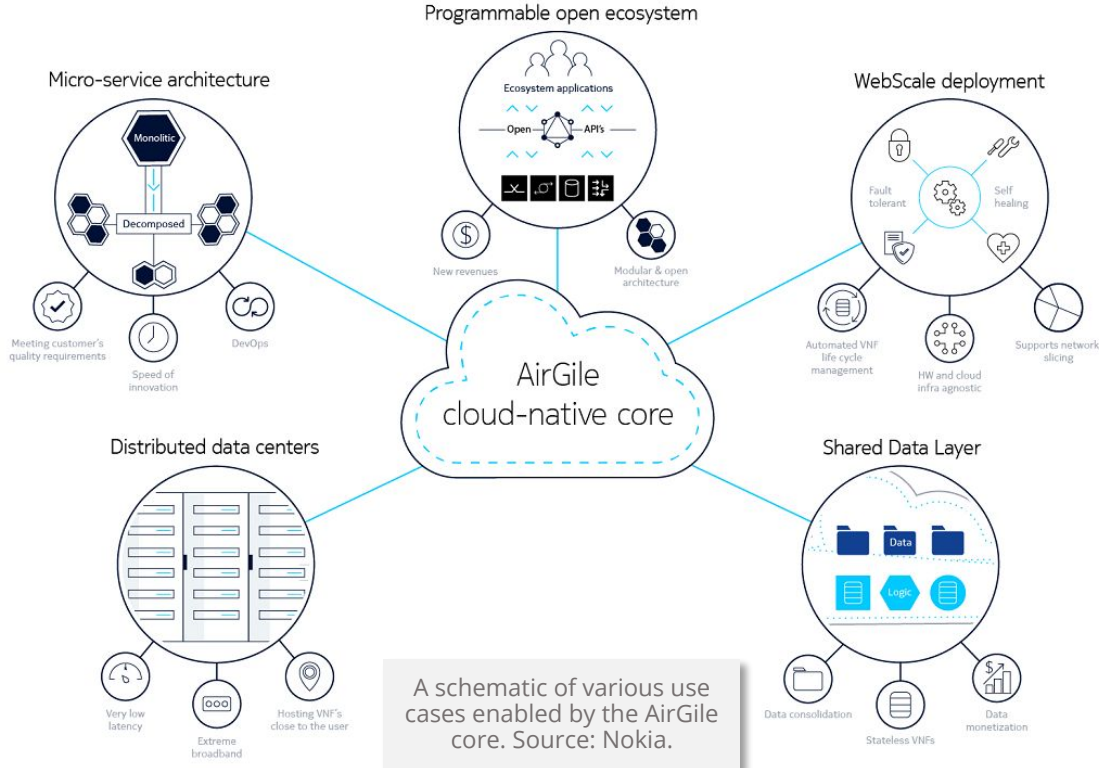Improved **cloud redundancy** and software overload protection.

Delivers **new services** that depend on extremely low latency, massive connectivity, full mobility, and high service availability, bringing **innovation** rapidly to market.

Energy efficient & eco-friendly

Provides the **flexibility and automation** to manage increasingly complex networks.

A full view of Nokia's 5G SBA Core architecture and capabilities. Source: Nokia.

Nokia AirGile 5G Core: A Service-Based Modular Architecture

A schematic of various use cases enabled by the AirGile core. Source: Nokia.

© 2017 Nokia

Who is using Nokia's AirGile 5G Core?

vodafone

Nokia supplied and integrated a 5G network for Vodafone New Zealand that was launched in Auckland, Wellington, Christchurch, and Queenstown in late 2019. The deal, including Nokia's AirScale radio access network, cloud-native core, and design services, provides further proof of the strength of Nokia's end-to-end portfolio.

"We are excited to be working with Nokia to deliver a commercial 5G network for Vodafone and New Zealand, building on our proud heritage of being first to deliver to Kiwis, the best mobile technology available at the time, including 2G, 3G, 4G and now 5G."- Tony Baird, Technology Director, Vodafone New Zealand.

telenor group

On Feb. 25, 2019, Telenor Group and Nokia entered into an agreement to deliver AirGile cloud-native core solutions in a modernization effort of the core mobile networks in Sweden, Norway, and Denmark. The enhancement of the core solution will support the 5G radio access network and will prepare Telenor to further scale across Telenor Group's Scandinavian operations.

The trials, which started in Q2 2019, will support 5G use cases such as robotics control, industrial automation, 5G/LTE dual connectivity, and fixed wireless access for high-performance last-mile connectivity.

T-Mobile

Nokia's largest 5G agreement globally will provide end-to-end 5G solutions for T-Mobile's nationwide 5G network.

As part of the agreement, Nokia will help build T-Mobile's nationwide 5G network with 600 MHz and 28 GHz millimeter wave 5G capabilities compliant with 3GPP 5G New Radio (NR) standards.

Using 5G, Nokia and T-Mobile will develop, test, and launch the next generation of connectivity services that will cover a wide range of industries, including enterprise, smart cities, utilities, transportation, health, manufacturing, retail, agriculture, and government agencies.

Metaswitch's 5G Fusion Core: A Complete Cloud-Native 5G Core Solution

Metaswitch has garnered a lot of attention with their 100% cloud-native 5G Core implementation with advanced user plane processing.

8
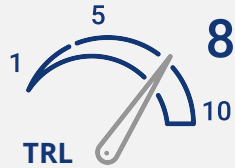
Metaswitch's 5G Fusion Core is relatively new and technologically ready, but the lack of wide-scale deployment puts it at a TRL of 8.

Metaswitch was recently acquired by Microsoft in July 2020. Therefore, Metaswitch combines the best attributes of a nimble startup and a seasoned market leader.

TECHNICAL DESCRIPTION

Metaswitch Fusion Core covers four key 5G technical areas: The user plane, control plane, service-based architecture, and management.

Each individual function has been architected to exceed the stringent demands that will be placed on them and can be instantiated within compute clouds with diverse virtual machine, container, and serverless architectures that span from large centralized data centers to small edge application delivery locations.

SOLUTION HIGHLIGHTS

- A complete cloud-native 5G core solution
- Runs on any public, private, or hybrid cloud
- Built using microservices methodologies
- The highest performance UPF data plane
- Exclusive support for 4G and broadband
- Powerful orchestration using Kubernetes

# Metaswitch's 5G Fusion Core: A Complete Cloud-Native 5G Core Solution

A RECAP OF THE TECHNOLOGY & ITS KEY BENEFITS:

Fast path to 5G: With a unique interworking function, Metaswitch brings multiaccess support on a single 5G Core architecture instead of a complex and costly dual-core approach.

Low cost per bit: Fusion Core delivers disruptive 5G core user plane performance with industry-leading compute resource utilization on both control and user plane functions.

Massive scale/any cloud: Complete containerization of core while leveraging Kubernetes. Orchestration enables to deploy and dynamically scale the core on any cloud infrastructure.

The network effect: Infrastructure-first initiatives ensure networks can meet all future service demands.
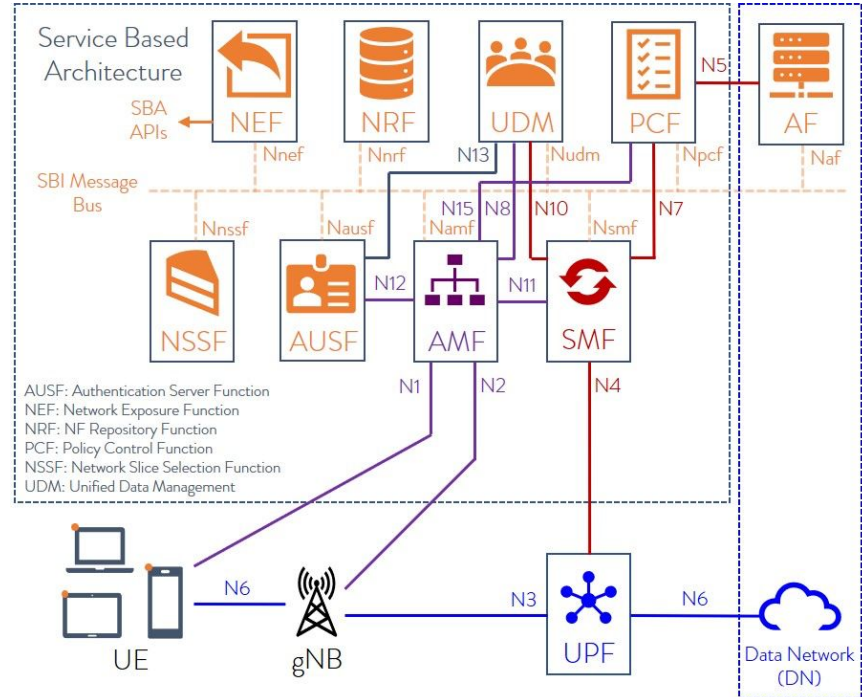
Similar to Nokia, the SBAs provide a modular framework from which common applications can be deployed using components of varying sources and suppliers. Source: Metaswitch.

Who is using Metaswitch's 5G Fusion Core?

Sprint is deploying a suite of fully virtualized products from Metaswitch, including SBCs and call session control functions, as part of their VoLTE rollout.

Metaswitch's focus on cloud-native technologies and architectures – turning a "software telco strategy" into a portfolio that is mostly virtualized along with a cloud-based IMS offer – aligned with Sprint's requirements for a flexible, scalable service core and the cost efficiencies that follow.

Metaswitch's IMS licensing model includes support for network-wide, subscriber-based licensing, distributed capacity management, and logically centralized license tracking.

vodafone

Metaswitch announced that its Access Gateway Function (AGF) solution has been successfully tested by Vodafone for the industry's first implementation of the 5G Wireless Wireline Convergence (WWC) AGF standard. The AGF in Metaswitch's 5G Fusion Core solution was tested in Vodafone Group labs in the UK.

5G Wireless Wireline Convergence offers a path to a fully converged broadband access network that serves both wireline and mobile subscribers from a single technology stack. When fully implemented, WWC seamlessly integrates fixed and wireless services, simplifying offerings, reducing complexity of subscriber and service management, and promoting always-on services through converged connectivity.

Choosing an implementation partner can be difficult - but not with PreScouter.

As seen in this report, multiple companies provide 5G Core solutions, each with different technical specs.

Which is right for your business?

PreScouter's vast network of experts can evaluate your business challenge and recommend an appropriate system, help you manage the development and deployment of a system or troubleshoot an existing system that is not performing.

"We have actually started speaking with a few potential collaborators - all within 12 weeks of working with PreScouter. So to me, the investment was incredibly well-spent."

Naveen Nair, Director of Engineering, Strategic Partnerships

"Once we started the project, we realized that we were learning a lot of interesting things. PreScouter produced very valuable results."

Gary Click, Technical Director

ABOUT THE AUTHORS

Sofiane Boukhalfa, PhD

PreScouter Technical Director

Sofiane leads the high-tech, aerospace & defense, automotive, and logistics practices at PreScouter. Sofiane earned his BS in Materials Science and Engineering from The University of Illinois at Urbana-Champaign, and his PhD in Materials Science and Engineering from the Georgia Institute of Technology, where his research focused on nanotechnology and energy storage. Since graduating from Georgia Tech, he has worked as an emerging technology and business strategy consultant at several firms and for his own clients.

Gursimran Singh Sethi

Co-Founder and Technical Lead, LATYS Intelligence

Gursimran Singh is the Co-Founder and Technical Lead of Montreal-based startup LATYS Intelligence, which develops novel reconfigurable metasurfaces for IoT and 5G applications. Gursimran earned his BEng (Hons) degree from the Hong Kong University of Science and Technology and his MASc degree from the University of Toronto in 2019.

His research has been focused on developing novel microwave and mm-wave antennas for Satellite, IoT and 5G applications. He has held prestigious research and work positions at Princeton University and Apple and has been a recipient of multiple Canadian awards and international grants by the Antennas and Propagation Society of the IEEE.

Gursimran is an active member of the IEEE, and regularly contributes to academic conferences and journal articles pertaining to next-generation reconfigurable antennas. Gursimran has also filed for two US patents with General Electric and Thales Alenia Space for his work in the area of reconfigurable antennas.

ABOUT PRESCOUTER

PRESCOUTER PROVIDES CUSTOMIZED RESEARCH AND ANALYSIS

PreScouter helps clients gain competitive advantage by providing customized global research. We act as an extension to your in-house research and business data teams in order to provide you with a holistic view of trends, technologies, and markets.

Our model leverages a network of 3,000+ advanced degree researchers at tier 1 institutions across the globe to tap into information from small businesses, national labs, markets, universities, patents, startups, and entrepreneurs.

CLIENTS RELY ON US FOR:

Innovation Discovery: PreScouter provides clients with a constant flow of high-value opportunities and ideas by keeping you up to date on new and emerging technologies and businesses.

Privileged Information: PreScouter interviews innovators to uncover emerging trends and non-public information.

Customized Insights: PreScouter finds and makes sense of technology and market information in order to help you make informed decisions.

500+
CLIENTS
WORLDWIDE

4,000+
RESEARCH
REPORTS CREATED

150,000+
HOURS OF RESEARCH
COMPLETED FOR CLIENTS