

Case study

SK Telecom's world-first bare-metal cloud-native 5G Core solution

How SK Telecom is leading
the way for consumers
and enterprises



ERICSSON

In partnership with



A 5G world-first for SK Telecom

How SK Telecom deployed the world's first bare-metal dual-mode cloud-native 5G Core solution.

Executive summary

At the beginning of 2019, Ericsson and SK Telecom broke new ground by starting a cloud-native 5G Core collaboration. In July 2022, they went live with a bare-metal cloud-native 5G Core which enabled SK Telecom to continue its track record of innovation in the mobile industry, securing another "world-first" for South Korea. This follows the world's first and fastest 5G-based connected car trial in 2016, and the world's first 5G NSA service launch in 2019.

The result is a highly capable and reliable 5G Core network, ready to run one core for several generations of mobile networks, deployed over bare-metal infrastructure. This allows for the rapid introduction of new functions and services, greatly improving network performance, enabling SK Telecom to better harness the full potential of 5G by using a simplified architecture, without the need for a virtualized layer. This result is testament to the planning and implementation of a journey that began several years ago in partnership with Ericsson.

About SK Telecom

SK Telecom is the largest communications service provider in South Korea. As of June 2022 they had 32.6 million subscribers, equating to 44 percent of the market share. A pioneer in all generations of mobile networks, including launching the world's first 5G service in 2019, the company also

commercialized its 5G NSA network with virtualized packet core in 2019, evolving to cloud-native dual-mode 5G Core over bare metal in 2022. With its innovative 5G offering, SK Telecom is set to realize the Age of Hyper-Innovation by transforming the way its customers work, live and play.

Figure 1: The largest service provider in South Korea

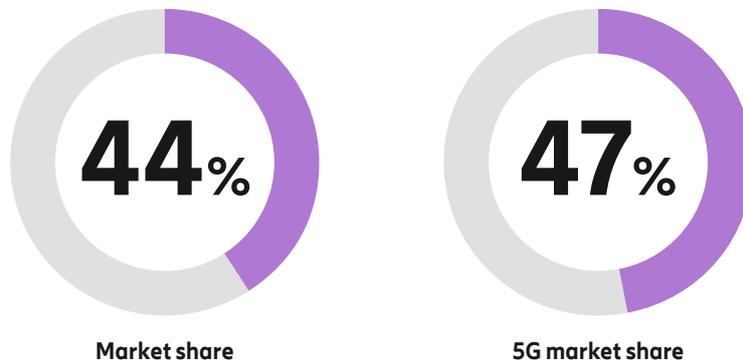
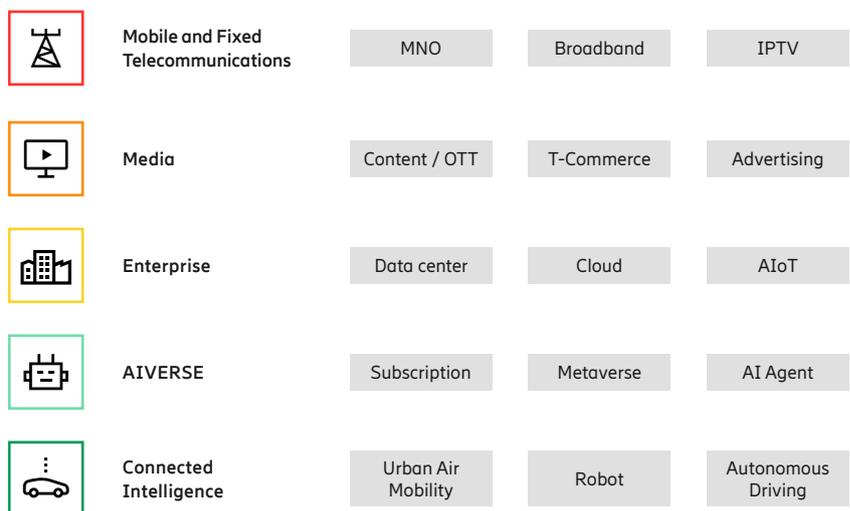


Figure 2: SK Telecom's main business areas



As Ericsson's dual-mode 5G Core supports multiple generations of technologies, it enables SK Telecom to handle traffic with a single system. The management of the virtualized network is improved with a bare-metal infrastructure; the deployment and change of equipment is easier in a container environment with no hardware dependency. As Ericsson fulfilled the expectation of the highly demanding Korean market, we selected Ericsson again as our partner for future technology.

Jong-Kwan Park
VP and Head of Infra Technology,
SK Telecom



The leap towards live

SK Telecom and Ericsson's goals were to strengthen the 5G network operation capabilities, significantly improving traffic processing efficiency compared to the existing network, as well as evolving the network to provide a basis for 5G service growth.

The benefits that SK Telecom was looking to achieve as part of this partnership with Ericsson included:

- efficiency in life cycle management and troubleshooting from the end-to-end verified solution
- fast deployment of cloud infrastructure and easy onboarding of applications
- leading a network evolution path in line with global needs and technology trends. Specifically, 5G SA is standardized with the cloud-native environment and many of the cutting-edge technologies in the ecosystem are easily enabled by the container technology
- trust, and a stronger partnership for the journey beyond 5G
- a stable, high-performance system in commercial operation
- efficiency with total cost of ownership (TCO) savings

In Korea the competition for better quality is fierce. Through such partnership with Ericsson, SK Telecom has been able to maintain a competitive network infrastructure and provide quality services to customers.

Jong-Kwan Park
VP and Head of Infra Technology,
SK Telecom

Stronger together

Building on the strong foundations of the existing partnership and the technological advancements already in place, Ericsson's approach was already aligned with SK Telecom's goal of pursuing technology leadership in the mobile telecommunications market.

The journey to bare-metal cloud

To complement the existing network environment, the decision was made to deploy a leading-edge telecommunications technology: A cloud-native dual-mode 5G Core over a bare-metal infrastructure solution. With advantages such as opex optimization and a cloud-based automation journey, the proposal more than measured up to SK Telecom's needs: to improve the life cycle management process at software upgrades and scaling out, as well as an auto-healing approach to risk management.

From the core network applications perspective, SK Telecom's journey to a cloud-native 5G Core started with the deployment of a cloud-native 5G Evolved Packet Core (EPC) network to support 5G NSA, following the existing virtual EPC network for 5G NSA.

The first phase of 5G deployment laid the foundations for a high-end flexibility, cloud-native solution. It began with the introduction of the cloud-native dual-mode 5G Core, initially deployed with EPC network functions: control and user plane for Serving Gateway (SGW) and Packet Data Network Gateway (PGW) (Phase 1, Figure 3).

As SK Telecom's journey into a one-core solution to serve all its different access types continues, the Ericsson cloud-native 5G Core solution will gradually expand.

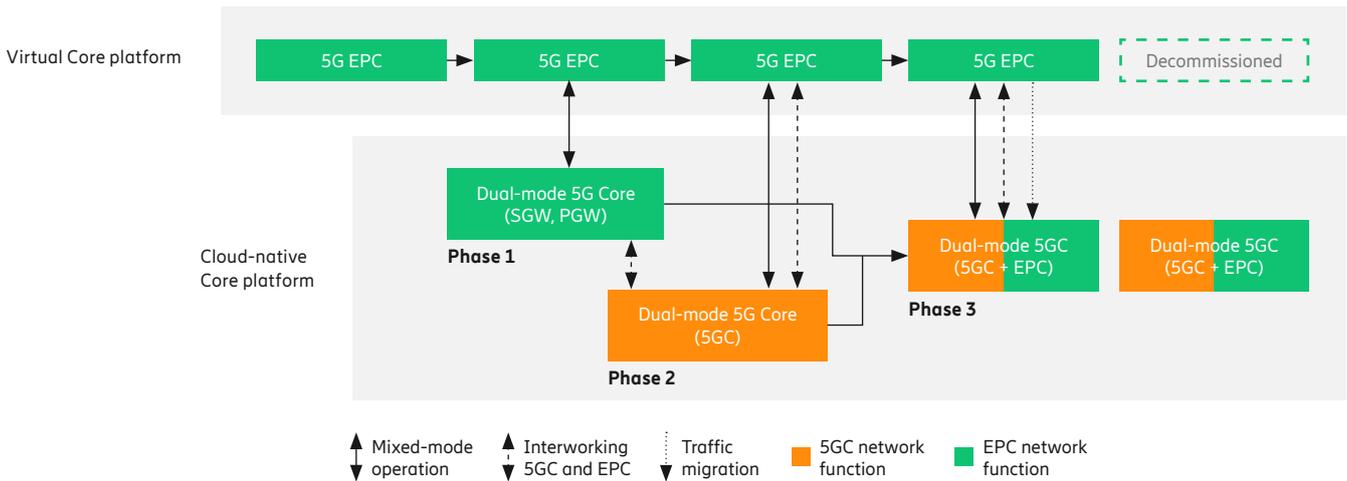
In the next phase, 5G Core CNFs to support 5G SA will be deployed as an overlay to the cloud-native 5G EPC network (Phase 2, Figure 3) and finally, in the future all cloud-native EPC and 5G Core NFs are to be merged into a common 5G Core platform with dual-mode operation,

to serve both 5G NSA and 5G SA (Phase 3, Figure 3).

Moving from the application-level perspective to the cloud-infrastructure perspective, the journey encompassed the evolution to the Ericsson Cloud Native Infrastructure Solution, which enables elimination of the virtualization layer, delivering greater efficiency as well as improved automation and performance, as shown in Figure 4.

Instead of introducing a Kubernetes-based container as a service (CaaS) platform over the existing OpenStack-based infrastructure as a service (IaaS) platform, as in Figure 4, SK Telecom deployed a simplified bare-metal deployment where a CaaS platform runs directly on the underlying hardware, as in Figure 5.

Figure 3: SK Telecom's Core evolution journey – application view



Ericsson proposed an end-to-end solution featuring a full-stack cloud-infrastructure solution, based on Kubernetes over bare-metal infrastructure.

The result was an entirely new solution. Following a detailed analysis with focus on performance application on-boarding, and proof-of-concept iterations demonstrating the TCO effectiveness of the solution, SK Telecom decided to introduce dual-mode 5G Core and Ericsson Cloud Native Infrastructure – system-verified bare-metal CaaS infrastructure for cloud-native applications.

Figure 4: General virtualization infrastructure

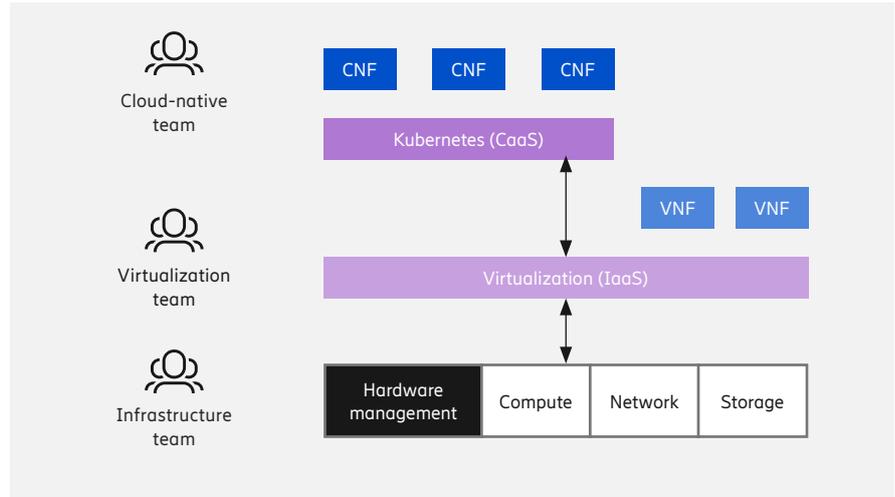
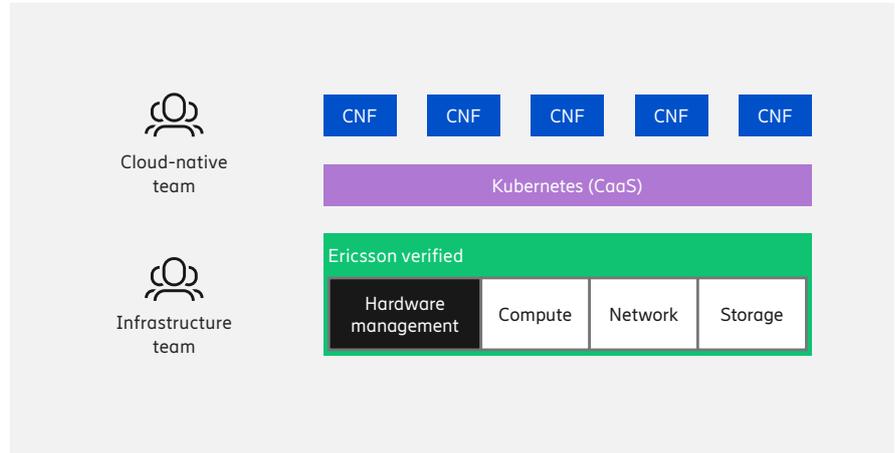


Figure 5: SK Telecom's core evolution journey infrastructure view: From virtualization infrastructure to Kubernetes over bare-metal infrastructure

We selected Ericsson for its outstanding technology. As a long-time business partner since CDMA, we have made significant achievements through close cooperation in South Korea. Based on its leading technology, Ericsson has supported many of the demanding requirements in the South Korean market.

Jong-Kwan Park
VP and Head of Infra Technology,
SK Telecom



Unpacking the cloud

In the existing virtualized network, the software upgrades – especially for IaaS – required a lot of effort, for example at network function or cluster evacuation. In addition to that, in a multi-vendor environment making upgrades is made more complicated when taking into account version compatibility for all components, with consequent troubleshooting inefficiency. That issue was addressed by a full stack from CNF to CaaS as an Ericsson-verified solution. Agility increase at scaling in/out and more efficient in-service software upgrades (ISSU) per release update were other drivers to move to the cloud-native life cycle management, with better capabilities provided through Kubernetes technology. With IaaS removal – so without any complicated combination between IaaS and CaaS – these capabilities were maximized, therefore also simplifying the operational organization.

A live network story

After a software upgrade in the live network, all the key members from SK Telecom and Ericsson gathered together to act as a task force to monitor the system, ready for immediate analysis and action in case there were any issues arising that could potentially impact the service for consumers. A high CPU load on a specific container system was detected by the monitoring system, and the task force members had an immediate deep-dive discussion. They concluded that it was normal behavior from a Kubernetes characteristics point of view, with no impact to service: the CPU load threshold of the monitoring system for the specific container pod type was adjusted accordingly.

SK Telecom and Ericsson continue to work together to evolve this telco-grade cloud-native solution.

SK Telecom has five key business areas that are MNO, media, enterprise, AIVERSE and connected intelligence. With those five key business areas in mind, we've been looking into best ways to pioneer business models, and 5G is indeed the key infrastructure that supports those five key business areas.

Jong-Kwan Park
VP and Head of Infra Technology,
SK Telecom



Ericsson virtual Cloud Packet Core

- Virtual network for 5G NSA

Ericsson's cloud-native dual-mode 5G Core, in three phases

- 5G NSA services on a dedicated cloud-native platform:
 - Phase 1: Both control and user plane for SGW and PGW network functions
- 5G SA services (planned):
 - Phase 2: AMF, SMF control plane functions and UPF user plane function
 - Phase 3: Dual-mode operation supporting both 5G NSA and 5G SA

Ericsson Cloud Native Infrastructure

- System-verified bare-metal CaaS infrastructure for cloud-native applications, offering higher resource utilization and simplified operations

Ericsson 5G mid-band RAN

- Radios, baseband (RAN compute), and RAN software to enable incredible speeds, mobility and low energy consumption

Ericsson mmWave:

- Enhanced mmWave capacity – smoothest and lowest footprint small cell deployment with 28 GHz Streetmacro 6701
- Used for pilot smart factory application

Key learnings and insights

The live SK Telecom 5G network allows for the rapid introduction of new functions and services to users, and greatly improves network performance, increasing efficiency through faster responses to changes in traffic volume. The performance improvement was mainly from Control Plane and User Plane Separation (CUPS) architecture of the Ericsson cloud-native dual-mode 5G Core, with specific control plane-user plane ratio model dimensioning. Preparation was key for the success of the project, and many changes were made. As Core Development Team Leader Joong-Gunn Park said, "While preparing for cloud-native equipment, enormous efforts were made in OSS to monitor the container virtual environment."

A container-based solution in a telco network is new and needs to establish criteria regarding what is to be monitored and what should be considered as a critical event from a risk or service quality perspective. In addition to criteria set-up, relevant tools and proper solutions were developed in tandem with SK Telecom. Huge preparatory activities were also undertaken, including developing security and operations-related tools and manuals in the event of system failure.

The project not only provided many new capabilities, but it also broke several milestones for SK Telecom – the most significant is that it is the only bare-metal-based 5G Packet Core solution for NSA services, without a virtualized infrastructure. This new ground was navigated through establishing a three-year memorandum of understanding (MOU) and conducting many workshops and proof of concept iterations.

Following this combined effort, the value of cloud-native flexibility through the dual-mode 5G Core and the full-stack power of the Cloud Native Infrastructure Solution was clear and obvious.

The success of the project relied on a trusted partnership and shared understanding. In order to deliver an all-new solution of this kind, it was vital that Ericsson understood SK Telecom's needs and the existing environment. It was only because of the many years of fruitful collaboration that it was possible to deliver this world-first solution for SK Telecom.

Ericsson has never stopped its efforts with full responsibility, and through continued cooperation between the two companies we finally came to commercialize the solution, which I am truly grateful for.

Joong-Gunn Park
Core Development Team Leader,
SK Telecom



What's next for Ericsson and SK Telecom?

Following the successful introduction of the dual-mode 5G Core with Cloud Native Infrastructure Solution in the session and traffic application area, SK Telecom is looking to expand capacity and reach into the mobility application area. To meet market demands, the partners will also work together to introduce the SA service and a full automation, not only for infrastructure, but up to application level as well.

SK Telecom are looking forward to delivering ongoing service continuity as a result of the cloud-native core; as Core Development Team Leader Joong-Gunn Park says, it will enable a quick response in the event of a system failure, but also allow the delivery of new features seamlessly and without service interruption.

After the successful launch of 5G Core and Cloud Native Infrastructure, SK Telecom and Ericsson have already met to discuss the next steps in the evolution of cloud-native networks.

Jong-Kwan Park, VP and Head of Infra Technology, confirms that SK Telecom is in discussion with Ericsson to find ways to improve the software package release at upgrades, and verification through automation solutions in the cloud-native area, as well as further developing cooperation in the new system that best suits for enterprise and edge.

About Ericsson

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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