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# Ericsson Dual-mode 5G Core

May 11, 2020

## PRODUCT ASSESSMENT REPORT - 5G MOBILE CORE

### REPORT SUMMARY

Ericsson reports 64+ 5G core contracts, 33+ live NSA deployments and 100+ SA active trials for its Dual-mode 5G Core, which is helping operators monetize new use cases and facilitate 5G transition; however, uncertain global market conditions loom.

### SUMMARY

Product Ratings



Ericsson Dual-mode 5G Core

Product Class Average

## WHAT'S NEW

- **May 2020:** Telstra has upgraded its 5G radio access network (RAN) connecting a Cloud Native 5G Core network to handle new 5G Standalone (SA) traffic, this follows Ericsson's selection announcement in December 2019 and represents Australia's first 5G SA network.
- **April 2020:** Ericsson has been awarded a 5G contract from China Mobile for its 5G core (covering two major regions and five provinces) for the second phase of its nationwide NR standalone rollout.
- **April 2020:** BT signed a deal to deploy Ericsson's Dual-mode 5G Core, to support 4G, 5G non-standalone (NSA), and SA services. The solution, delivered on BT's Network Cloud, forms a key component in BT's move to a single converged IP network.
- **March 2020:** Ericsson and SmarTone have agreed to a five-year contract with Ericsson as its sole 5G supplier, thereby extending 28 years of partnership.
- **February 2020:** Ericsson and KDDI demonstrated a cloud-native CI/CD pipeline delivery for KDDI's standalone 5G Core network- enabling automatic deployment of new software and functionalities, while maintaining high network quality and availability.

## PRODUCT OVERVIEW

<b>Product Name</b>	Dual-mode 5G Core
<b>Description</b>	Ericsson's dual-mode 5G Core solution combines 3GPP network functions from EPC and 5GC architectures into a common cloud-native software platform to support 5G NR SA and NSA, 4G, 3G, and 2G access technologies. The dual-mode 5G Core is managed as a single solution and can be deployed and operated as a state-of-art cloud-native implementation.
<b>Components</b>	<ul style="list-style-type: none"> <li>• The Dual-mode 5G Core solution consists of several Ericsson products providing the combined EPC and 5GC functionality based on 3GPP Rel-15 specifications.</li> <li>• The solution includes the following products: <ul style="list-style-type: none"> <li>• Packet Core Controller (PCC)</li> <li>• Packet Core Gateway (PCG)</li> <li>• Data-Storage Manager (CCDM)</li> <li>• Subscription Manager (CCSM)</li> <li>• Resource Controller (CCRC)</li> <li>• Policy Controller (CCPC)</li> <li>• Ericsson Signaling Controller (ESC)</li> </ul> </li> </ul>

**Key Customers**

- Ericsson reports having a total of 64+ 5G customers.
- Publically announced operators include:
- Batelco, BT, China Mobile, Chunghwa Telecom, EIR, Elisa, Etisalat UAE, FarEasTone, KDDI, MTN South Africa, Nex-Tech, O2, Polkomtel, RINA, SK Telecom, SmarTone, STC, Softbank, Sprint, Swisscom, TDC, Telenor Sweden, Telenor Norway, Telenor Denmark, Telstra, TIM, Verizon, Vodafone Germany, Wind/3, Zain Bahrain

**Key Rivals****Key Competitors**

- Cisco
- Huawei
- Nokia
- ZTE

**Additional Competitors:**

- Affirmed Networks/Microsoft
- Casa Systems
- Metaswitch
- Samsung
- Mavenir

**ESSENTIAL ANALYSIS****Strengths**

- **Market Momentum:** Ericsson announced 64+ 5G core contracts, 33+ live NSA deployments and 100+ SA trials for its cloud-native microservice-based Dual-mode 5G Core. Ericsson also has live commercial cloud-native container-based deployments together with leading operators like Verizon and Telstra.
- **Flexible 5GC Introduction and Insights:** Ericsson's Dual-mode 5G Core solution offers a variety of deployment options to introduce 5GC. Built-in software probes, and pre-integrated expert analytics help accelerate 5G adoption and provide end-to-end insights extendable to the RAN.
- **5G Monetization:** Ericsson's Digital BSS helps CSPs monetize new use cases with 5G network capabilities; its 5G charging solutions supports evolution plans and program execution; and a network exposure server function exposes 4G and 5G Core network capabilities towards application developers and enterprises through easy-to-use and standard APIs.
- **Webscale Automation and Performance:** Ericsson's Dual-mode 5G core together with its Software Delivery Pipeline (SWDP), provide automation capabilities that help operators reduce time-to-market. Its high performance cloud-native user plane is capable of managing individual peak rate demands from new 5G services.

**Limitations**

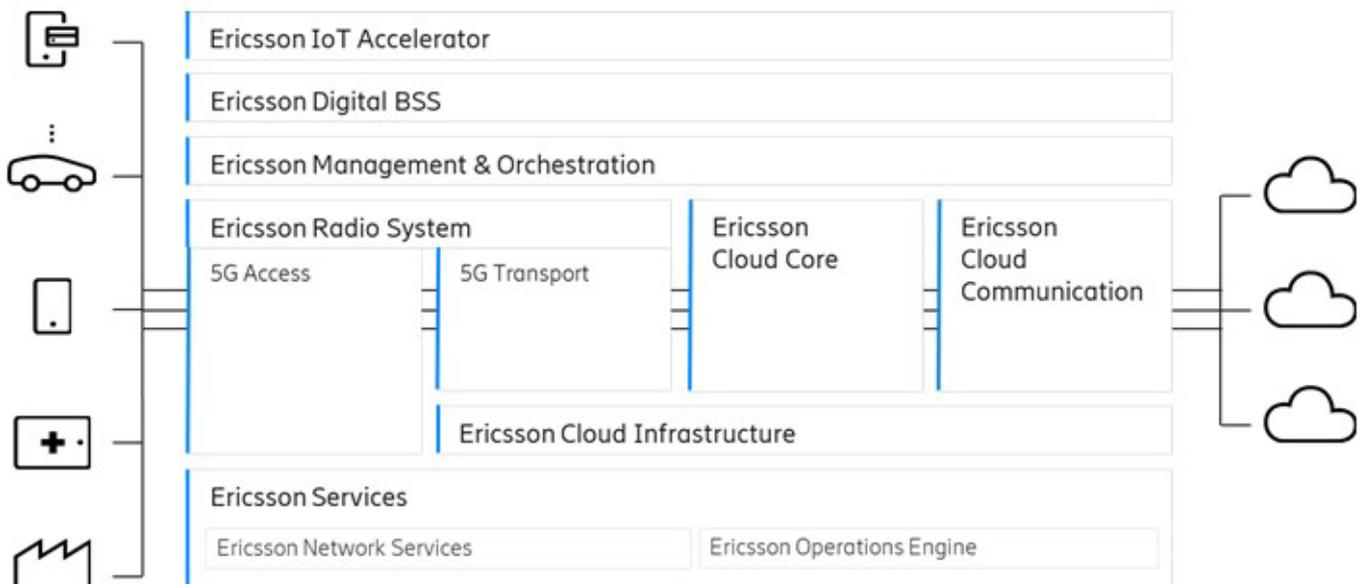
- **Emerging IT Competitors:** Ericsson faces competition from traditional IT giants such as VMware and Microsoft (with Affirmed) who leverage their BSS, enterprise, and cloud-based technologies to press further into the mobile network domain.
- **Market Disruptors:** Ericsson faces competition from emerging competitors focused on private networks for enterprises, utilities, mining, and others. Emerging software innovators can leverage the large body of open source software combined with their respective strengths (i.e., edge presence, analytics, cloud solutions, etc.) to compete.

## CURRENT PERSPECTIVE

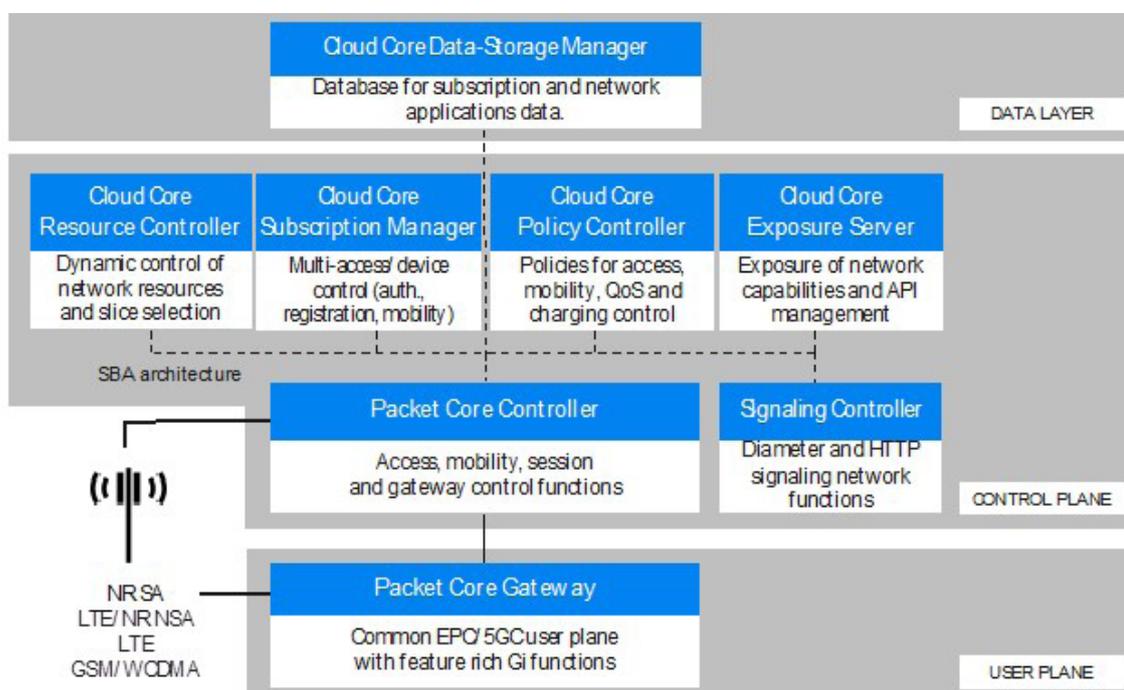
### LEADER

Ericsson’s 5G Core solution is a leader in the mobile core market and is deployed in major mobile operator networks alongside the company’s RAN, mobile transport, and OSS products. The solution has gained significant market momentum, which currently includes 64+ 5G contracts, 33+ live Non-Standalone (NSA) deployments, and 100+ Standalone (SA) trials in the planning or execution stages. Publicly announced wins include: China Mobile, BT, Verizon, Telstra, Vodafone, SKT, Swisscom, and SmarTone.

The dual-mode 5G Core solution combines 3GPP network functions from EPC and 5GC architectures into a common cloud-native software platform to support 5G NR SA and NSA, 4G, 3G and 2G access technologies. The solution delivers orchestration and automation for operational efficiency, enabled by its cloud-native microservices architecture and other Ericsson products (e.g., Ericsson SWDP and Ericsson Orchestrator). The solution can be deployed on an Ericsson Cloud Container Distribution (CCD) or on a third-party NFVI that is aligned with Cloud-native Computing Foundation (CNCF) principles. The end-to-end solution is shown below:



Source: Ericsson



Source: Ericsson

The dual-mode 5G Core is powered by the cloud-native control plane signaling processing function (Packet Core Controller), which reduces cost per connection and improves cost-efficiency per end point (MSAU). The Packet Core Gateway reduces cost per bit with high throughput per CPU and can be hosted on standard Intel processors. The Packet Core Gateway provides the needed latency, jitter, footprint and security capabilities required by vertical applications. The Cloud-native Subscriber Data Management solution allows the expansion of legacy systems and/or their evolution into a unified 5G data layer, capable to store network data, and to manage and authenticate all access technologies and devices. Advanced interworking mechanisms are supported to minimize risks and costs in the transition towards 5G. Centralized control of policies, network functions and APIs enable network automation and flexible and granular service differentiation.

For migration, multiple deployment paths as defined by 3GPP are supported, giving operators the flexibility to transition based on service needs. The dual-mode 5G Core solution supports 5GC-EPC interworking, 5G EPC mode and full 5GC-EPC deployment. Apart from 3GPP-related migration, the dual-mode 5G Core supports mixed deployment alternatives consisting of PNF/VNF/CNF. Software tools and a common set of processes support “zero touch”, continuous integration (CI) and continuous deployment (CD) cycles to reduce time to deploy new services.

## COMPETITIVE RECOMMENDATIONS

### Provider

- **Pursue B2B Opportunities:** Ericsson should use its strengths in networking to engage in adjacent markets, where it can leverage its networking pedigree and edge/cloud capabilities, to help operators extend new services to enterprises and private network operators.
- **Capitalize on Common Operational Model:** Ericsson should highlight the capabilities of its Dual-mode 5G Cloud Core to support continued growth in 4G/LTE services and new 5G services using a common operational model. This simplifies operations and reduces TCO without the complexity of supporting separate SA and NSA deployment models, as well as earlier generations.
- **Drive Early IoT Momentum:** Ericsson should highlight its selection by Mobily in Saudi Arabia and MTS in Russia to transform their networks to support 5G and IoT applications. Ericsson should also stress its flexible support of NB-IoT, Cat-M1, and Cat-M1+NB-IoT applications and highlight Cat-M1 and NB-IoT synergies at Telstra and Verizon.

### Competitors

- **Nokia:** Nokia should highlight its 32 5G core contracts, and multiple early SA deployments, and highlight its end-to-end mobile capabilities including its in-house IP transport and optical transport, radio, microwave, data center, and virtual infrastructure solutions.
- **Huawei and ZTE:** These vendors should stress recent wins in China as well as strong penetration in the global markets with Tier 1 telcos and smaller operators. With cloud technology and reduced entry costs, operators will be looking to suppliers capable of supporting their needs. Both have messaged the value of a converged mobile core and the efficiency of delivering a full stack end-to-end mobile network solution to facilitate 5G adoption.
- **Affirmed, Mavenir, and Others:** These vendors should encourage operators using their solutions to help them publicize any successes. Affirmed (soon to be part of Microsoft) supports cloud-based deployment options (Azure, and others), network slicing and automation tools. Mavenir, in particular, must leverage its mobile core capabilities (with EPC acquired from Brocade) to bolster its presence in the evolving 5G and disaggregated RAN markets.

## Buyers

- **Established Mobile Operators:** Operators should consider migrating or augmenting their mobile core infrastructures with the dual-mode core to integrate all of their mobile service capabilities under a common operational model to better address growing 5G/IoT and vertical market services.
- **Small and Private Mobile Operators:** Private network operators should consider Ericsson's Cloud Packet Core to deliver dedicated network slices and pre-integrated mobile core solution to support smaller network opportunities. They should leverage Ericsson's pre-integrated and tested solutions to help reduce time to deployment and lower key barriers to entry such as cost and scale.
- **Beyond the Mobile Core:** Operators should tap into Ericsson's ability to deliver an end-to-end network solution, which not only includes the dual-mode core solution and related infrastructure components, but also addresses the need for automation, business case support, and vertical market expertise (via Ericsson's professional services team).

## Metrics

### MARKET MOMENTUM

<b>Rating:</b>	Leader
<b>5G Partnerships, Telcos:</b>	70+ unique 5G partners in 35+ countries. Operator partners (not exclusive list) include KDDI, Telefonica Germany, Vodafone group, Deutsche Telekom, European Commission, Fujitsu, STC Saudi and IIT Delhi (first 5G innovation lab in India)
<b>5G Partnerships, non-telco:</b>	Driverless trucks with Einride, 5G12 (5G Innovators Initiative in the US), 5G-Connected mobility (Consortium), GO Mobile AG and Vodafone Germany for automotive 5G manufacturing production.
<b>5G Contracts:</b>	<b>64 5G Core contracts.</b> Publicly announced operators include: China Mobile, Verizon, Swisscom, TDC, STC, Batelco, Telstra, Telenor Sweden, Telenor Norway, Telenor Denmark, Wind/3, and Sprint.
<b>5G Deployments/ NSA:</b>	33+ live NSA core deployments, with 64+ 5G customers
<b>5G Deployments/ SA:</b>	100+ SA trials in planning or execution including: China Mobile, Verizon, KDDI, and TIM, SKT and China Telecom.
<b>5G Trials - other:</b>	-

## SOLUTION ARCHITECTURE

<b>Rating:</b>	Leader
<b>Service Based (SBA):</b>	<p>Combines 3GPP EPC and 5G Core into a common platform supporting 5G NR SA and NSA, 4G, 3G and 2G.</p> <p>Cloud-native, microservice-based architecture, automated administrative processes and simplified O&amp;M across all components. Implements a network exposure function for programmability and business innovation.</p>
<b>Distributed User and control planes:</b>	<p>User plane (GW-U or UPF) and control plane (GW-C or SMF) scale independently. CP functionality can be centralized, while the UP functions can be distributed to support efficient traffic offload and low latency services. One CP instance can control multiple distributed UP instances.</p> <p>Dual-mode 5G Core supports MEC for high bandwidth and low latency and can break out the user traffic close to the access network.</p>
<b>Service Granularity:</b>	<p>Provides common management models and interfaces scaling and lifecycle management of VNFs with granularity to the VNFC level, and can be instantiated driven by specific needs.</p> <p>The Kubernetes CaaS layer (Ericsson Container Cloud Distribution (CCD), runs on bare metal or VMs realized by the IaaS layer, provides multiple ways to introduce the CaaS layer in an existing NFVI environment.</p>
<b>Slicing Support:</b>	<p>Supports automated and scalable slices for new business opportunities in addition to eMBB. The 5GC + NG-RAN can be a separate network slice in addition to the existing legacy network.</p> <p>The NSSF supports selection assistance parameter based on user subscription to provide end-to-end NF resources within each slice, includes resources specific to manage users and support slice re-direction.</p>
<b>Performance Metrics:</b>	<p>Handles high throughput rates for instance and UE level, supports direct I/O - measured to process 193 Gbps of subscriber traffic on a standard Intel x86 dual-socket server.</p> <p>Supports OVS with re-architected I/O handling to forward 25 Gbps subscriber traffic on a single socket with 44 vCPUs can saturate 25 GE NICs.</p> <p>High performing user plane (up to 200 Gbps per node) capable of managing the high peak rate demands (up to 20Gbps user peak rates) from new 5G services.</p>
<b>Analytics Support:</b>	<p>Supports real-time and non-real-time analytics via software probing, shaping and filtering of streaming data interface to various consumers (e.g. Ericsson Expert Analytics) or 3PP applications for statistics or troubleshooting.</p> <p>Provides event logging and customer tracing which are evolved with container based products: Event Based Monitoring (EBM), Integrated Traffic Capture (ITC) and a UE Trace feature. This supports troubleshooting, analyses and optimization and drives accurate and detailed information.</p>

**Resiliency:** Service resiliency leverages cloud-native concept of services and automated traffic steering combined with auto-healing to provide services resilient to failure in both application and underlying infrastructure, in addition, to expand on existing application level resilience features.

**Traffic Management:** Adaptive paging, UE signaling control, attach rate control, signaling load/congestion Control, NAS mobility congestion control, IMS/Voice/E911 restoration procedures, which all support network resilience.

## STANDARDS AND LEADERSHIP

**Rating:** Leader

**Supported standards and release level:** 3GPP Rel. 15. Stage 2 specifications: TS 23.501 /502 /503 Policy, TS 33.501 Security architecture and procedures. Stage 3 specifications: TS 29.500 /501 /510.

Non-3GPP standards include IETF standards are referred to by 3GPP Stage 3 standards for specific protocols to be used.

**Participation industry forums, contributions:** Contributor for all 3GPP Release 16 study items in SA2 and will assure in its product support Rel-16 additions in an agile manner. This will imply that upgrade from Rel-15 to Rel-16 will be software only, and that backward compatibility from Rel-16 is assured with full interoperability. Rel-15 and Rel-16 specs will affect UEs/terminals. Ericsson is a member of and often contributor to OpenStack, LF Networking, CNCF and s other open source bodies.

**Participation IoT, MEC, others beyond major Telco:** Co-founder of 5G-ACIA. Member of the German Research Center for Artificial Intelligence, Industrial-IoT (FS\_5G\_Vertical\_LAN, FS\_5GURLLC, FS\_eLCS), Automotive (FS\_eV2XARC), Massive IoT (FS\_C-IoT\_5G), Fixed Mobile Convergence (FS\_5WWC).

## VOICE AND VIDEO SUPPORT

**Rating:** Leader

**IMS:** IMS based services supported: QoS levels for bearers and flows for IMS control, voice, video calling, messaging, and IMS data channel, Emergency calls, Handover and Fallback to EPS, Supplementary services and forking, Voice performance optimizations, Access restriction, Video rate limit control

**VoLTE:** Supports Voice in 5G smartphones through E-UTRA/NR Dual-Connectivity (EN-DC), EPC enables direct connection of 5G base stations and a smooth introduction of the service for operators through individual subscriber activation.

**CSFB/ EPS Fallback:** EPS Fallback is supported to enable early 5G voice deployments on high 5G frequencies with limited coverage, interworking between EPC and 5GC handles fallback, users don't see a difference compared to intra-EPS or intra-5GS mobility; Seamless handover from 5G to 4G and 2G/3G (via 4G) is supported.

**Converged Communication Services:** Both SMS over IP (SMSoIP) via IMS and native SMS over 5GS NAS (SMSoNAS) is supported. SMSoIP is more suitable for end-user messaging while SMSoNAS may be used for over-the-air device configuration etc.

## MIGRATION SUPPORT

**Rating:** Leader

**Stand Alone (SA) options supported:** Supports SA and NSA NR deployments covering all UE-RAN-Core network connectivity options: 1) 5GC SA when wide area NG-RAN coverage is available, 2) deploy 5GC with tight EPC interworking, 3) deploy with full EPC and 5GC functionality, with all access combinations from a single core for optimized OPEX with cloud-native implementation.

**Non Standalone (NSA) options supported:** 5GC-EPC interworking, 1) Tight interworking with EPC, 2)5GC-EPC interworking, alternative b) 5GC with EPC interworking w/SGW functionality in dual-mode 5G Core solution, 3)5G EPC mode for NR NSA (Option 3) devices as well as legacy LTE only devices (option 1), 4) 5GC and EPC deployment, provides the full functionality of both managed as a single core network.

**Converged Core:** Consolidated EPC and 5GC, all network functions are managed as one solution, with a common interface to the management domain, including HSS+UDM. A full cloud native combined UDM/HSS manages 5GC enabled subscriptions regardless of UE access. When a 5GC enabled user attaches via an MME in EPC, S6a diameter requests are translated to REST/http.

**Investment Protection provided:** Service continuity is achieved by interworking with the EPC functionality, includes the PGW-C, PGW-U, HSS and PCRF. For mobility between 5GC and EPC, procedures such as handover or idle mode are used, UE context is exchanged between 5GC and EPC. With this functionality, service continuity is reached.

**5G Migration Tools and Tools, processes, services provided:** Provides Management and Automation via various Ericsson components including: Network Manager (ENM), Network Intelligence (ENIQ) and SON Optimization Manager (SON-OM), Dynamic Orchestration w/Ericsson Orchestrator (EO), Adaptive Inventory (EAI), Catalog Manager (ECM) and Order Care (EOC), Evolved Virtual Network Function Manager (E-VNFM), VNF onboarding and lifecycle management processes, Automated Acceptance Testing (AAT), Continuous Delivery of software (Software Delivery Pipeline, SWDP).

## WEBSCALE AND AUTOMATION SUPPORT

<b>Rating:</b>	Leader
<b>Automation Methodology:</b>	Ericsson's portfolio of EPC software has gone through a transformation beyond mere virtualization and in the dual-mode 5G Core solution is deployed in cloud execution environments and managed by associated orchestration systems.
<b>Cloud Support:</b>	Developed as cloud-native, delivered and executed as containers to run on a Kubernetes container orchestration platform (CaaS). Applications are lightweight, modular, scalable and highly automated based on CNCF guidelines. They can run on private and public clouds for deployment flexibility.
<b>VNF Lifecycle support:</b>	Provides advanced lifecycle management features and supports deployment and upgrade on common cloud infrastructures. The CCD product is validated as software components and the underlying infrastructures evolve. It is also continuously validated to conform to the Cloud Native Computing Foundation (CNCF)-defined Kubernetes distribution requirements.
<b>Lifecycle Management Features:</b>	Supported by the VNFM application, provided by either Ericsson Network Manager (ENM) or Ericsson Orchestrator (EO) to enable efficient operations through VNF life-cycle management- instantiation, termination, SW upgrade and resiliency. Supports the container deployment through VNFM integration with the Kubernetes CaaS management. Cloud-native execution environment supported by Ericsson Cloud Container Distribution (CCD) .
<b>Operations Automation:</b>	Uses AI and ML to reduce signaling and time to find UEs. The NFs provide data sources for monitoring and general logging. For each data source the NFs allow a choice of interface format to use in the management layer per use case, with a choice between Ericsson OSS products, 3PP products, ONAP, and cloud native open source SW.
<b>Analytics/Machine Learning:</b>	Ericsson's dual-mode 5G core has built-in software probes to provide data for AI-powered insights. This includes open APIs to support network slicing and edge computing.
<b>Vendor Miscellaneous:</b>	-