SAMSUNG

Technical Report

# 5G Core Vision

## Revolutionary changes in core with the arrival of 5G

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# Introduction

Until now, mobile communication technologies have evolved to focus on accelerating radio data rate while mobile communication networks acted as dummy pipes to deliver user data securely and quickly. 5G network provides radio connections enabling not only ultra-high speed but also lower latency, higher reliability and massive connectivity, transforming into a platform integrating various services beyond a transport pipe by connecting mobile phones, sensors, autonomous robots and automobiles.

As of February 2019, Korea has LTE penetration rate of over 80%, and its total traffic volume reached 373.PB, or 7.6 GB per individual user. With a cell capacity ten times more than LTE, the continued construction of more cell sites and the acceleration of the Internet of Small Things, the total volume of data traffic for 5G is expected to increase exponentially.

5G networks should be able to process an ever-increasing volume of data more cost-effectively, and at the same time provide various services on a single infrastructure with high reliability at a faster speed. As such, IT technologies such as Network Function Virtualization (NFV) and cloud have been introduced into 5G Core, which completely overhauled the way of creating, deploying, operating and managing of network services. In particular, cloud native architecture based on micro-services and containers is considered as the most attractive technology best suited to support faster service launch and network operation automation.

Korea commenced the 5G era with the launch of the world's first mobile 5G network in December 2018, and commercialization of the world's first smartphone-based mobile 5G service in April 2019. Samsung has introduced 5G Non-Standalone (NSA) Core with Control and User Plane Separation (CUPS)-based vEPC in Korea, and is concentrating on the development of cloud native 5G Core for 5G Standalone (SA) commercialization.

This white paper will review the vision and strategy of Samsung 5G Core, the architecture of Samsung Cloud Native 5G Core, and Samsung Network Automation Platform that automatically serves to create, deploy, operate and manage network services. Network slicing that provides dedicated networks according to service characteristics and Multi-access Edge Computing (MEC) that processes application services at the edge of a network are becoming new revenue streams for telecom operators. So, we will discuss Samsung network slicing and MEC solutions that Samsung Cloud Native 5G Core supports.

# Samsung 5G Core Vision

5G networks, with its implementation of network services as software, need to be optimized for NFV and cloud. Samsung 5G Core, with its cloud native core, is designed to take full advantage of the cloud, acting as the key enabler for the rapid realization of 5G innovation. Figure 1-1 shows the vision of Samsung 5G Core. Defined as 'FAST', the vision of Samsung 5G Core aims to be a Flexible, Agile, Scalable and Tunable network.

**Flexible**
Samsung 5G Core flexibly adds new services and configures the network on a shared infrastructure. It also allows an elastic scalability of network functions at CP/UP and micro-service level according to the 5G service profiles.

**Agile**
Samsung 5G Core shortens the service implementation time from hours to minutes and delivers faster time-to-market (TTM) for new services from months to days.

**Scalable**
Samsung 5G Core is scalable rapidly and highly with telco-grade reliability. This further improves the performance of the distributed user plane and provides telco-grade cloud native control plane performance.

**Tunable**
Samsung 5G Core not only provides both customized and optimized networks for various 5G services but also quickly adapts and optimizes the network according to operation conditions. It also supports cost-efficient migration from 4G to 5G based on access agnostic common core.


- Flexibly add new service and configure network on a shared infrastructure
- Elastically scale (CP/UP, Micro-service level) according to 5G service profiles

- Reduced service implementation Time (Hours → Minutes)
- Faster TTM for new service (Months → Days)

- Rapidly & highly scalable with telco-grade reliability
- Higher UP performance
- Telco-grade cloud native CP Performance

- Network tailored & optimized for a wide range of 5G services
- Fast adaptation & optimization according to operation conditions
- Cost efficient 4G to 5G migration based on common core

Figure 1. Samsung 5G Core Vision : FAST

# 3GPP 5G Standard

## 5G Core Network Design Principle

The emergence of cloud forced the architecture of 5G Core to undergo revolutionary changes. The underlying drivers behind 5G Core innovation are SBA, Stateless, Network Slicing and Common Core.

**Service-Based Architecture (SBA)**
The SBA architecture, fundamental in 5G's move towards the cloudization, is adopted by the control plane of 5G Core. A network function (NF) constitutes of small service units called NF services (micro-services). Adding a new service will not impact existing ones, making scalability simple. The interaction between two NFs depends on how a service is processed. Unlike the traditional architecture where different point-to-point (P2P) interfaces are defined between network entities, in the SBA architecture, NFs can request and provide a service using a Service-Based Interface (SBI), a uniform interface based on HTTP/2. Services can be reused among NFs, and new features can be introduced easily using the uniform interface. NRF is used when an NF registers its NF profile or discovers services. The interactions between the control plane and user plane will use traditional P2P interface.

**Stateless**
Existing NE sustains its UE context information (state) as long as the user session is established. 5G Core NFs do not keep UE context but store it in a separate DB defined as a standard NF. Any NF can store unstructured data in UDSF, and structured data from UDM, PCF and NEF is saved in UDR. 'Stateless' stems from the cloud concept that process and storage are separated, which simplifies NF functions and boots scalability.

**Network slicing**
Network slicing is a technology that separates a shared physical network infrastructure into multiple logical networks with different service characteristics, known as slices. Each slice would group the needed NFs for a particular service to offer a dedicated network. This allows fast buildup of a network for a new service without impacting the existing services, reducing time-to-market and improving operational efficiency. Network Slice Selection Function (NSSF), known as a new NF, is added to provide network slicing in 5G Core.

**Common Core**
In 5G Core, 3GPP access such as LTE and NR and non-3GPP access including Wi-Fi and fixed broadband can be integrated via a common interface. A unified authentication process is supported for multi-RAT access.

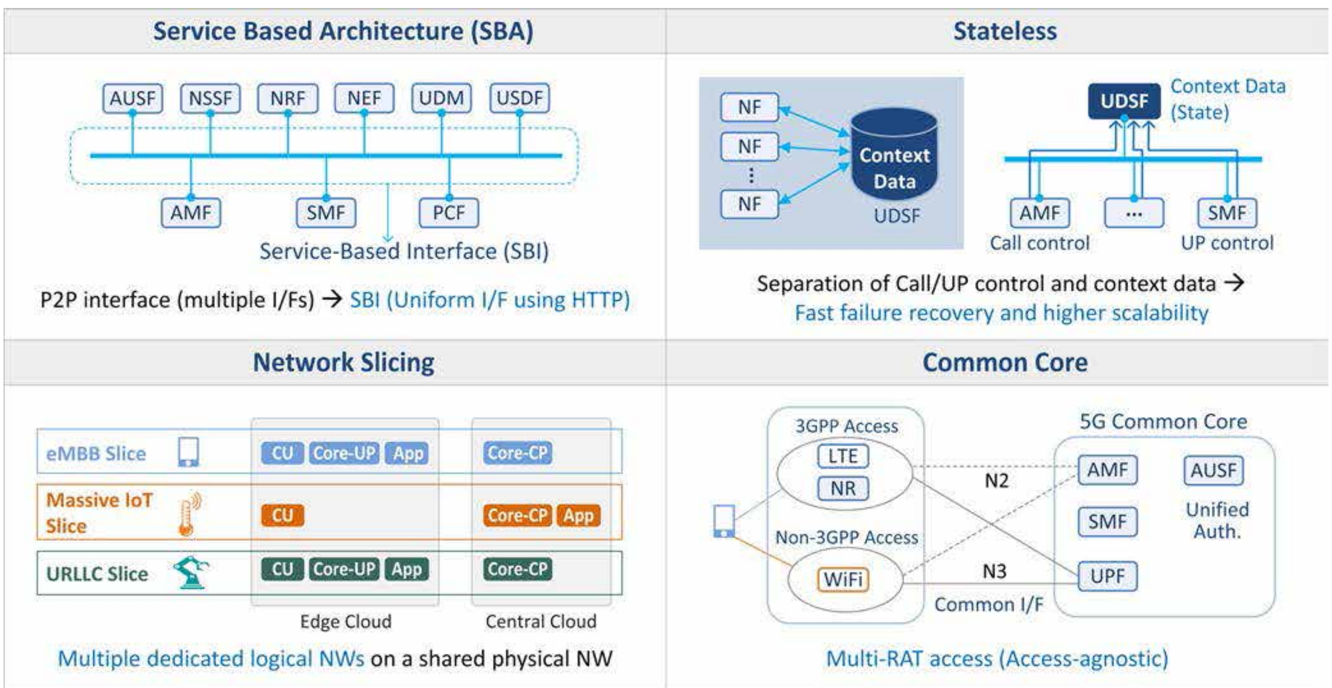



Figure 2-1. 5G Core Network Design Principle

## 5G Deployment Options

The evolution from LTE to 5G can vary depending on the mobile operator's network status and strategy. Figure 2-2 depicts the 5G deployment options.

UE signaling is processed by LTE in New Radio (NR) NSA and by 5G NR in NR SA. Since 5G coverage is very limited in the initial stage of 5G deployment, the UE signaling is processed by LTE with nationwide coverage, and as 5G coverage expands, the UE signaling is processed by NR. Therefore, existing LTE networks will evolve into NR SA through NR NSA.

NR NSA has Option 3 that re-uses EPC, and Option 7, which introduces 5G Core. Option 3 can quickly commercialize 5G by adopting NR.Because the NR characteristics are limited, the 5G use cases are not fully exploitable, but the user throughput can be greatly improved.

Option 7 upgrades LTE to eLTE and introduces 5G Core. The NR characteristics are also limited, but it can support network slicing and deploy hot spot with above 6GHz (A6G) NR.

Option 4 will be possible as the coverage of below 6GHz (B6G) NR expands nationwide, allowing the full feature set of NR as well as 5G specific services such as low latency services.

Samsung 5G Networks support NSA Option 3 family and Option 4/7 family co-existence and can support optimal 5G deployment for mobile operators.

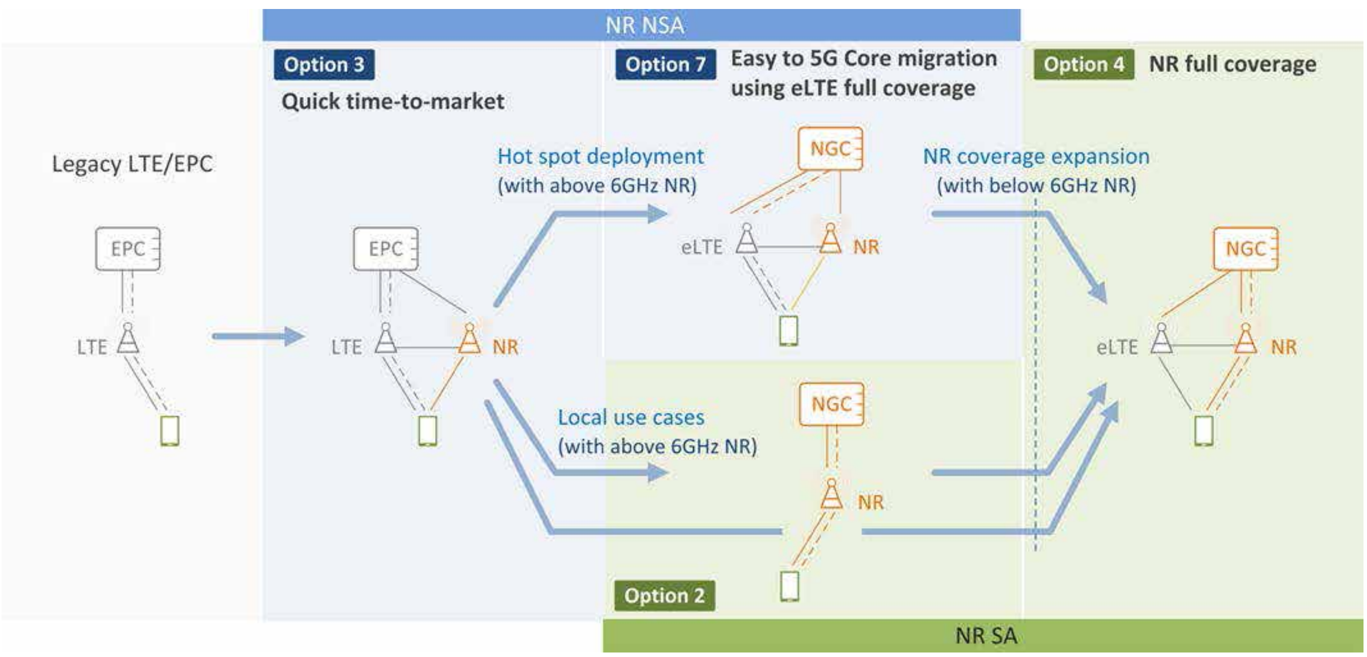



Figure 2-2. 4G to 5G Deployment Options

# Samsung 5G Core Overview

## Samsung 5G Core Strategy

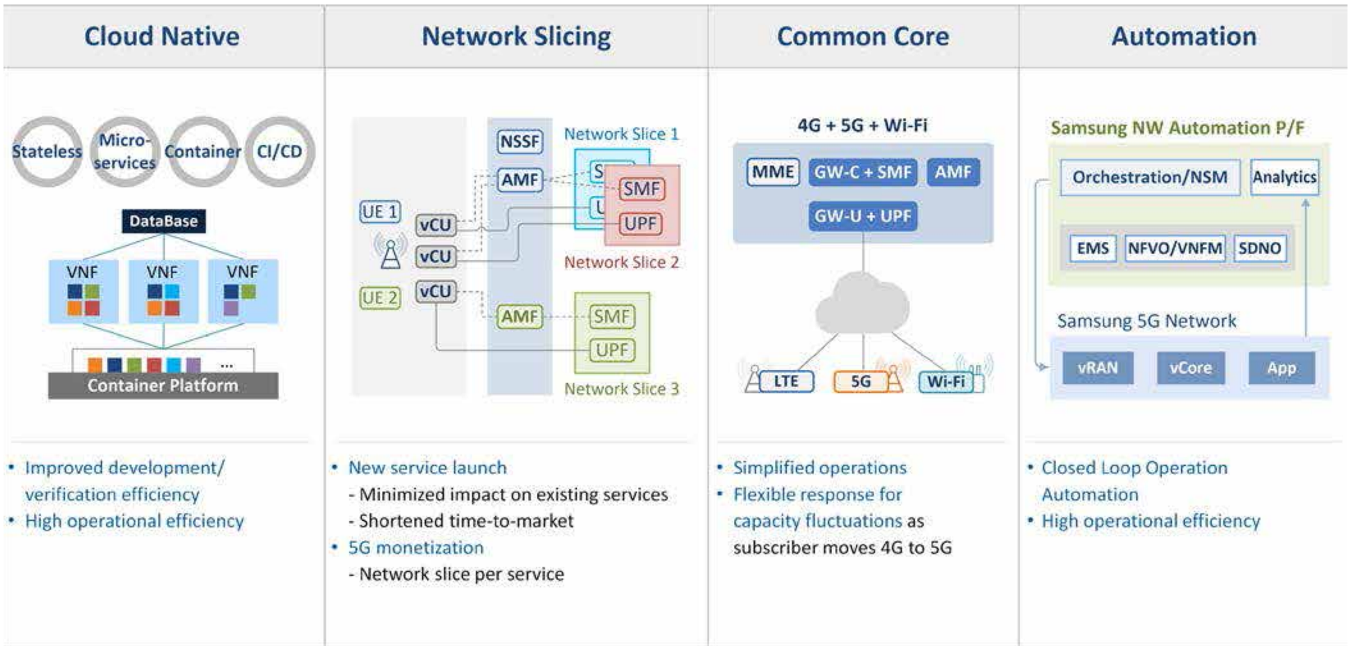



Figure 3-1. Samsung 5G Core Strategy

Figure 3-1 illustrates the Samsung 5G Core strategy. The key strategy for achieving the vision of Samsung 5G Core is defined as Cloud Native, Network Slicing, Common Core and Automation.

**Cloud Native**
Samsung 5G Core is developed and verified in a cloud native environment. A cloud native environment based on micro-services, containers and stateless architectures will boost the efficiency of development and verification of 5G Core NF, and automate service upgrades and deployments for better operational efficiency.

**Network Slicing**
Network slicing feature will allocate dedicated resources and network for each service, which will minimize the impact on the existing services while accelerating the launch of a new service. It allows a flexible response to the changes in service demand and acquisition of new userbase through adoption across vertical industries.

**Common Core**
Samsung 5G Core enables the integration of various types of access networks.

**Automation**
Samsung 5G Core provides a Network Automation Platform, which automatically responds to any changes in 5G Network such as operation, upgrades and monitoring, thereby boosting operational efficiency. The Platform is also able to automatically create 5G services, such as network services and network slices.

# 4G to 5G Migration Plan

An LTE network operator will be able to choose from various migration paths to the 5G network depending on the network configuration of the operator, 5G network construction plan, 5G subscriber penetration, etc. Figure 3-2 outlines the smooth migration plan from 4G to 5G by Samsung 5G Core.

**5G Ready EPC**

Samsung LTE Core is already virtualized and provides a CUPS architecture with separate CP and UP, a basic feature of 5G, for quick and easy support of the introduction of 5G network.

**Introduction of 5G NSA Core**

The initial stage of 5G network will be 5G NSA, where 5G base stations are introduced to the existing LTE network. The 5G NSA Core can be implemented by partially upgrading existing EPC SWs to support LTE-NR dual connectivity and charging for 5G base stations. In NSA mode, LTE base stations operate as the signaling anchors, and 5G base stations are used only as data paths. Therefore, although 5G use cases are limited, the introduction of 5G base stations can achieve significant user throughput enhancement. Thanks to its CUPS architecture, Samsung EPC is easy to evolve into 5G SA Core.

**Introduction of 5G SA Core**

5G SA will adopt 5G Core, which consists of new 5G Core NFs and supports SBA architecture. The existing EPC NEs such as GW-C, GW-U, HSS and PCRP will be upgraded to 5G Core NFs, SMF, UPF, UDM and PCF, respectively, while AMF, NRF, NSSF, NEF and UDF will be newly introduced. With the introduction of 5G Core and 5G base stations as signaling anchors, 5G use cases can take full advantage of 5G characteristics. Interworking/integration between 5G Core and existing EPC is affected by factors like 5G subscriber growth, service proliferation and operator policies. Samsung 5G Core provides a comprehensive migration plan, including (i) separate operation of 5G Core from the existing EPC, (ii) interworking via N26 interface, and (iii) common core that integrates both 4G, 5G (NSA and SA) and even Wi-Fi.

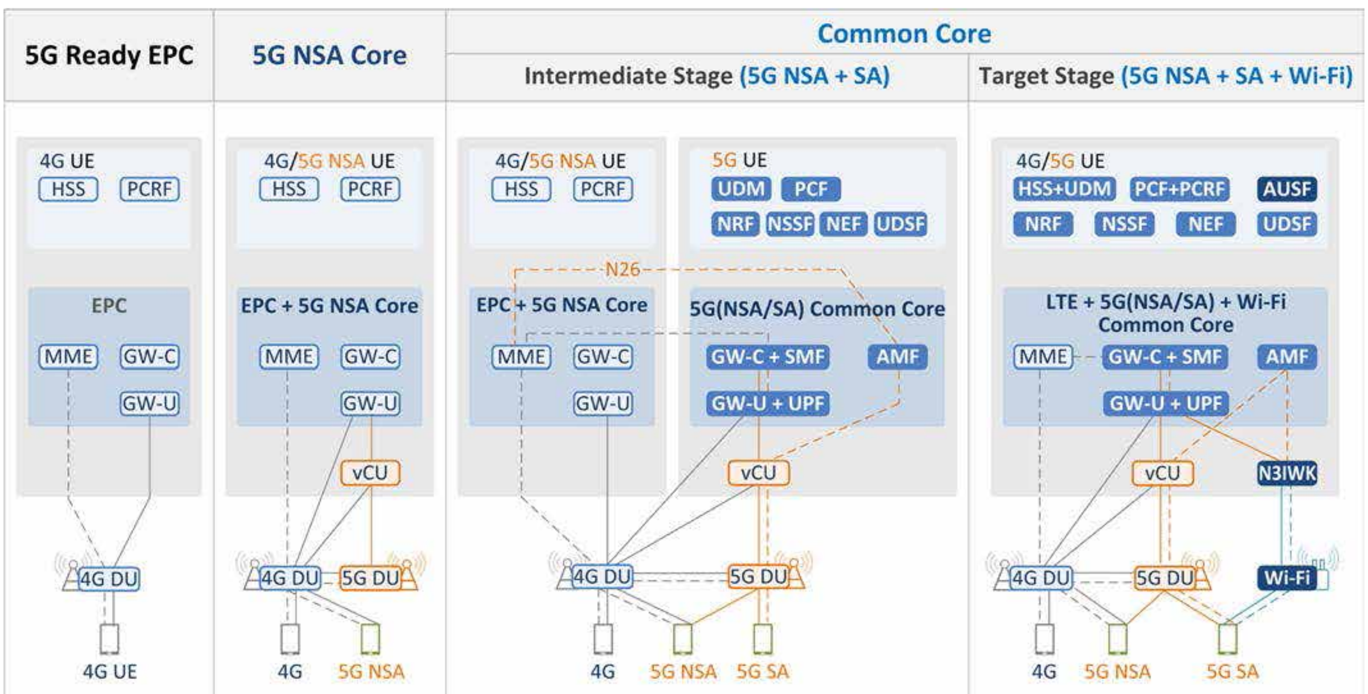



Figure 3-2. 4G to 5G Migration Plan

## Samsung 5G Common Core Portfolio

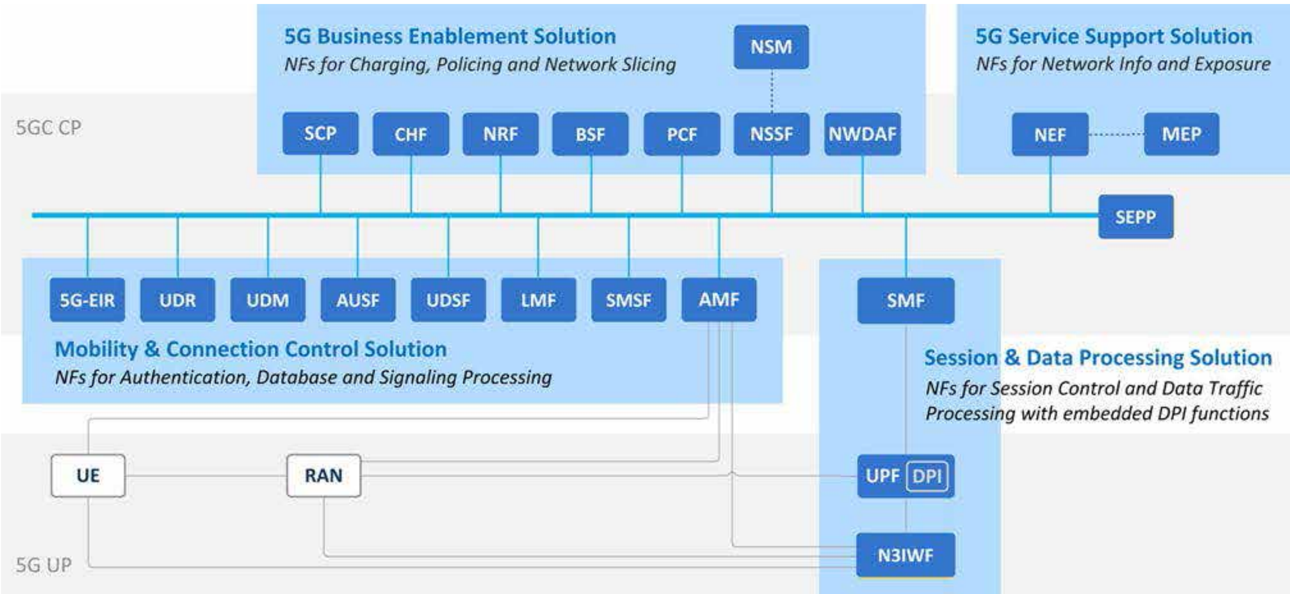



Figure 3-3. Samsung 5G Common Core Portfolio

Samsung 5G common core portfolio constitutes four solutions, as shown in Figure 3-3 below. Each solution supports tightly-coupled feature set and telco-grade reliability.

**5G Business Enablement** supports NFs for charging, policing and network slicing

**5G Service Support** supports NFs for network information and exposure

**Mobility & Connection Control** supports NFs for authentication, database and signaling processing

**Session & Data Processing** supports NFs for session control and data traffic processingwith embedded DPI functions

# Samsung Cloud Native 5G Core

## Samsung 5G Network Automation Architecture

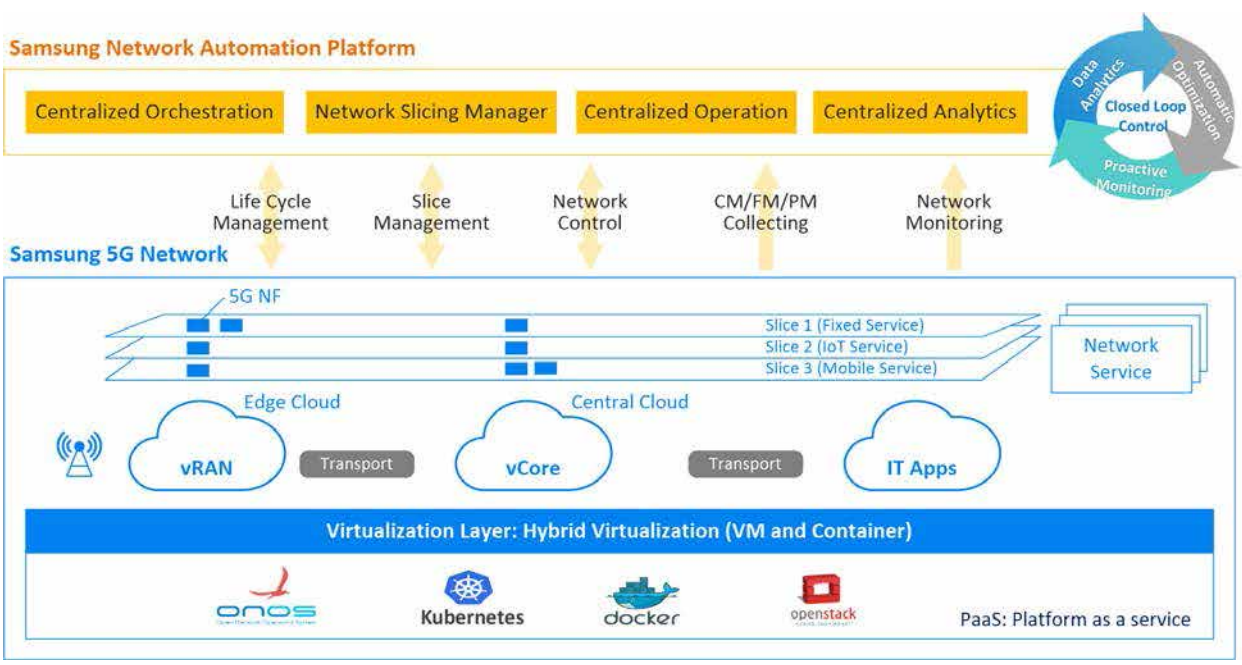



Figure 4-1. Samsung 5G Network Automation Architecture

Telco's infrastructure has evolved to consist embedded HWs, which are individual NEs. With the adoption of NFV and cloud, it is shifting to virtualized cloud infrastructure where network services are created automatically on a general-purpose server at a low cost. Furthermore, the infrastructure is evolving into a cloud native architecture as virtualization technology moves away from heavyweight virtual machine (VM) to lightweight containers. In a cloud native architecture, automatic creation and deployment of network services will warrant more efficient network operation and management.

Figure 4-1 illustrates Samsung 5G Network Automation architecture based on the Samsung Network Automation Platform and Samsung 5G Network. Samsung Network Automation Platform consists of four key components: a Centralized Orchestration for E2E orchestration, a Network Slice Manager (NSM) for network slice management, a Centralized Operation for EMS management, and a Centralized Analytics for data collection and analysis. Samsung 5G Network supports hybrid virtualization using both VM and container and provides network slices depending on service characteristics. Samsung 5G Network Automation architecture provides 5G services by integrating RAN, Core and MEC centering on Samsung Network Automation Platform. The architecture also simplifies and automates the operation of Samsung 5G Network by minimizing operator intervention through its closed-loop control that constantly repeats data collection from the 5G network, followed by analysis, optimization, control and monitoring.

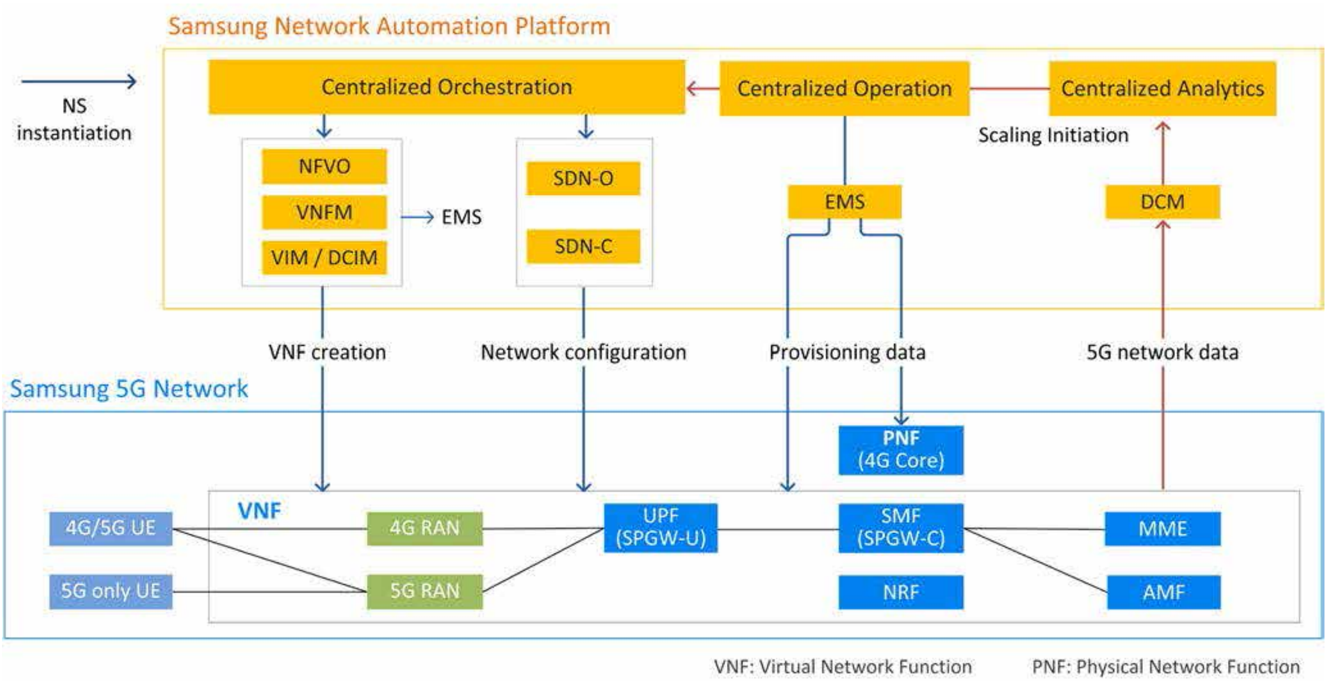



Figure 4-2. Zero-touch Service Creation

Figure 4-2 defines the automatic service creation process in Samsung 5G Network Automation architecture. For every request for network service creation, the E2E orchestrator instantiates VNFs, the EMS configures VNFs and PNFs with provisioning data, and the SDN-O/C executes networking for NFs. Data from Samsung 5G Network is collected and analyzed to be used in auto-scaling for the network service.

# Samsung Cloud Native 5G Core

Samsung 5G Core NFs are cloud native NFs, which consist of container-based micro-services to enable flexible scaling and upgrade to meet telecom operators' requirements. Figure 4-4 outlines the cloud native architecture of Samsung 5G Core. The fundamental concepts of the cloud native 5G Core are defined as Stateless, Micro-services and Container-based.

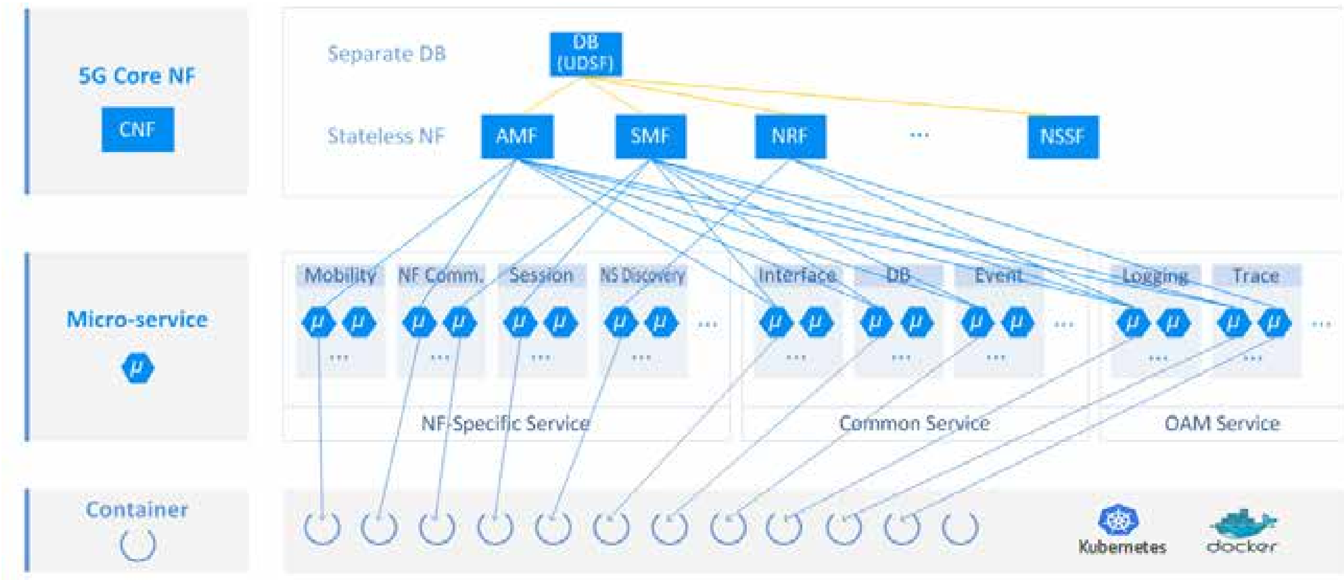



Figure 4-3. Samsung 5G Core : Cloud Native Architecture

**Stateless**
State information is stored centrally in UDSF by separating NF's operation and DB. Stateless NFs can be scaled separately from the application, and a specific NF can be isolated in case of the NF failover, enabling service continuity.

**Micro-services architecture**
5G Core NFs consist of micro-services. The types of micro-services constituting an NF are classified as follows.

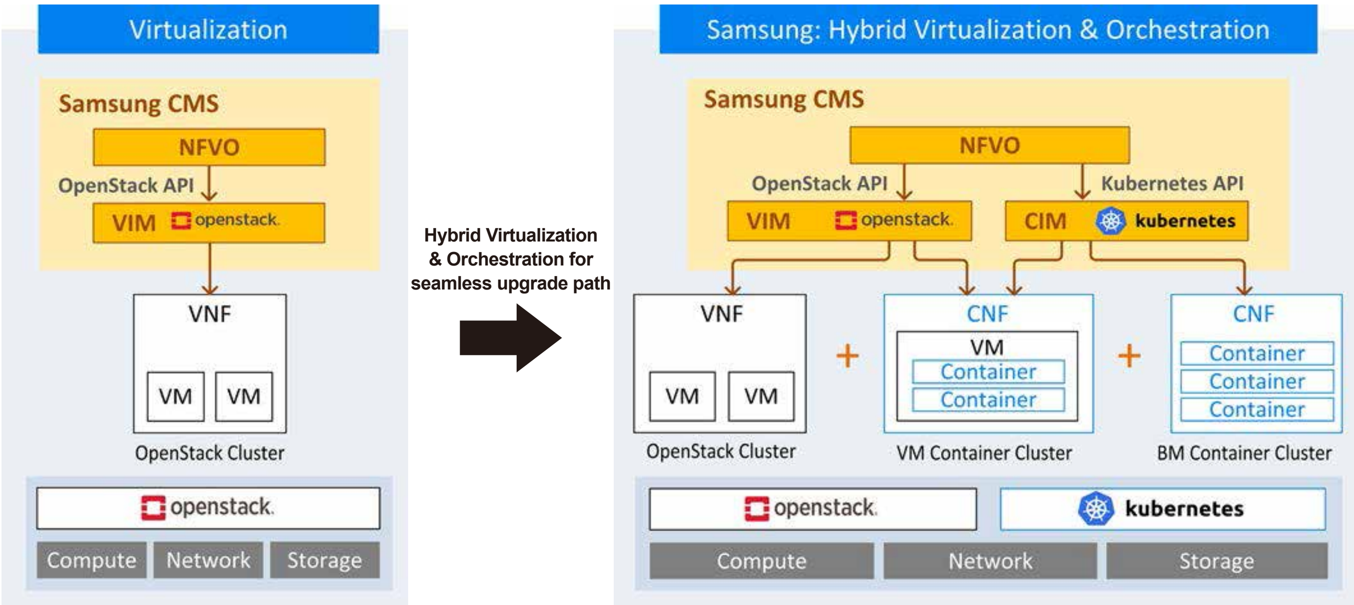
- **NF-specific micro-services:** services specific to an NF; e.g., AMF-specific micro-services (N1/N2 communication, mobile termination, N1/N2 interface, etc)
- **Common micro-services:** services commonly used by all NF; e.g., interface, DB, event, etc
- **OAM micro-services:** services for OAM; e.g., logging, trace, etc.

5G Core NFs are created by combining the necessary micro-services, NF-specific, common and OAM micro-services. Each micro-service runs in a container, independently scalable and re-usable, which enables the flexible launch of new services, faster time-to-market and offers enhanced scalability.

**Container-based architecture**
Containers have low overheads, which allows quick and easy installation of micro-services, enabling rapid service deployment.

### Hybrid virtualization and hybrid cloud orchestration

Current 5G network virtualization environment moved away from existing VMs to more lightweight containers. Sometimes, however, telco environments require VMs due to performance or I/O bandwidth issues. Thus, a hybrid virtualization environment where micro-services can run in VMs and containers is required. Hybrid virtualization is executed through hybrid cloud orchestration. Samsung Cloud Management System (CMS) offers comprehensive management of physical, virtual and containerized resources, and automatically manages the life-cycle of VNFs/CNFs to support seamless migration from VNFs to CNFs. Figure 4-4  highlights the hybrid virtualization environment and hybrid cloud orchestration in Samsung 5G Core.



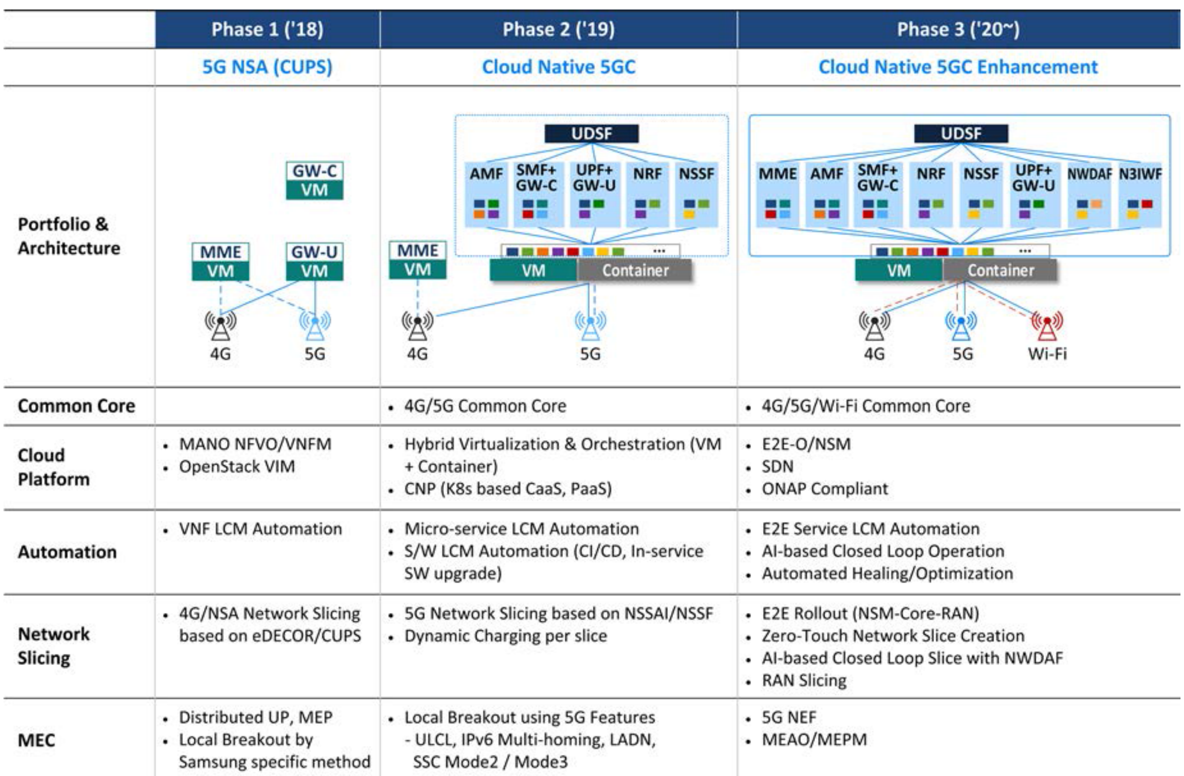

Past

- Consolidated management of physical, virtualized and containerized resources
- Automated life cycle management of VNF and CNF
- Seamless migration form VNF to CNF

Figure 4-4. Hybrid Virtualization and Hybrid Cloud Orchestration

### Samsung 5G Core Evolution

Lastly, Figure 4-5 summarizes the evolutionary path of Samsung 5G Core.



| | Phase 1 ('18) | Phase 2 ('19) | Phase 3 ('20~) |
|---|---|---|---|
| | 5G NSA (CUPS) | Cloud Native 5GC | Cloud Native 5GC Enhancement |
| Portfolio & Architecture | GW-C VM, MME VM, GW-U VM, 4G, 5G | UDSF, AMF, SMF+ GW-C, UPF+ GW-U, NRF, NSSF, MME VM, VM, Container, 4G, 5G | UDSF, MME, AMF, SMF+ GW-C, NRF, NSSF, UPF+ GW-U, NWDAF, N3IWF, VM, Container, 4G, 5G, Wi-Fi |
| Common Core | | • 4G/5G Common Core | • 4G/5G/Wi-Fi Common Core |
| Cloud Platform | • MANO NFVO/VNFM<br>• OpenStack VIM | • Hybrid Virtualization & Orchestration (VM + Container)<br>• CNP (K8s based CaaS, PaaS) | • E2E-O/NSM<br>• SDN<br>• ONAP Compliant |
| Automation | • VNF LCM Automation | • Micro-service LCM Automation<br>• S/W LCM Automation (CI/CD, In-service SW upgrade) | • E2E Service LCM Automation<br>• AI-based Closed Loop Operation<br>• Automated Healing/Optimization |
| Network Slicing | • 4G/NSA Network Slicing based on eDECOR/CUPS | • 5G Network Slicing based on NSSAI/NSSF<br>• Dynamic Charging per slice | • E2E Rollout (NSM-Core-RAN)<br>• Zero-Touch Network Slice Creation<br>• AI-based Closed Loop Slice with NWDAF<br>• RAN Slicing |
| MEC | • Distributed UP, MEP<br>• Local Breakout by Samsung specific method | • Local Breakout using 5G Features<br>- ULCL, IPv6 Multi-homing, LADN, SSC Mode2 / Mode3 | • 5G NEF<br>• MEAO/MEPM |

Figure 4-5. Samsung 5G Core Evolution

# Key Features
# Supporting Various 5G Use Cases

As telco business shifts to be more service-focused, the paradigm of 5G network infrastructure is also moving away from phones to business. Samsung Cloud Native 5G Core provides network slicing and MEC for mobile operators to acquire new revenue and business opportunities.

## Network Slicing

Samsung 5G Network Slicing solution creates independent slices according to service characteristics (throughput, voice, low latency, etc.), and maintains a stable quality of service by providing E2E Network Slice across not only Core but also Transport and RAN.

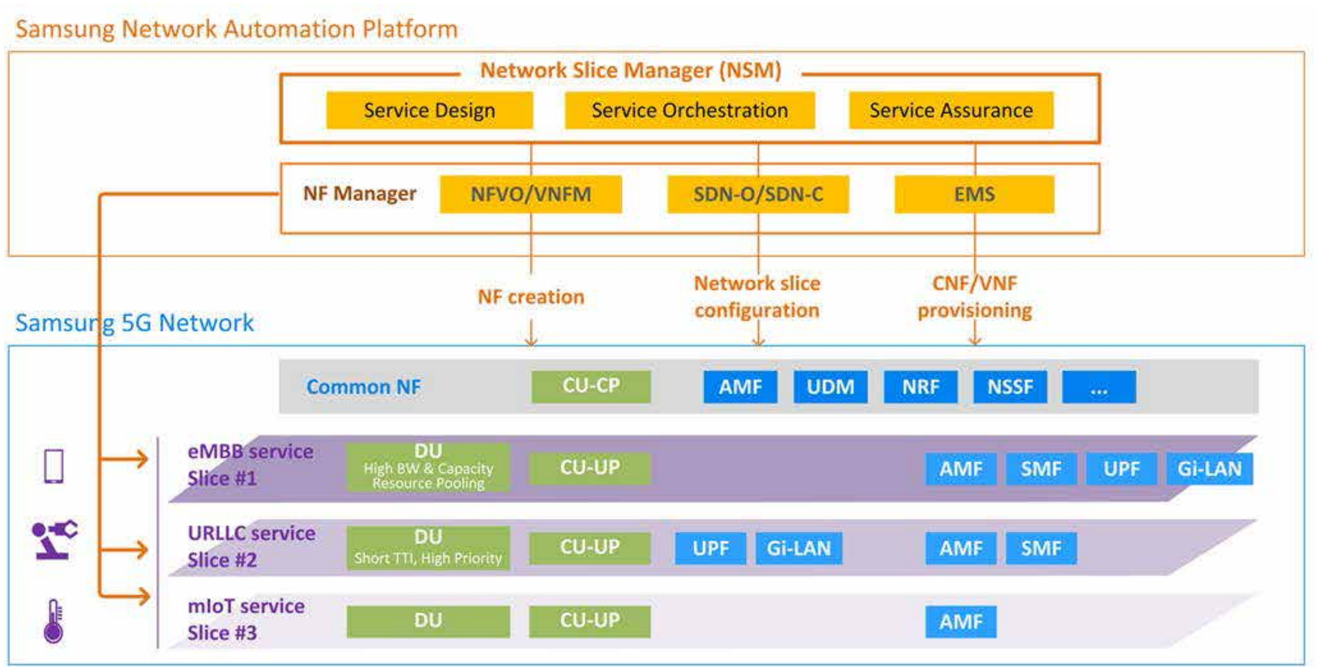



Figure 5-1. Network Slice Creation by Operator

### Samsung Network Slicing Solution 1
### Slice Creation by Operator

The Network Slice Manager (NSM) is an E2E network slice orchestrator that creates slices by dynamically grouping a set of NFs according to service characteristics. Creating a network slice involves (i) deciding the needed NFs, allocating resources then creating the NFs, and (ii) determining the locations of NFs (core, edge, etc.) and connecting them. Figure 5-1 demonstrates how an E2E Network Slice is created in Samsung 5G Core.
Once the NSM notifies the creation of a network slice instance (e.g., slice for eMBB), NFVO/VNFM will determine which NFs (e.g. DU, CU-UP, AMF, SMF, UPF, application server) will provide the service, then allocate physical resources for DU and virtual resources (VM/Container) for the remaining NFs, and then instantiate the NFs. The EMS offers provisioning data to be configured to the instantiated NFs, and SDN-O/SDN-C connects them. The network slice instance information is provisioned in NSSF. Later, when a UE requests the service, the NSSF will deliver the target AMF and Network Slice Selection Assistance Information (NSSAI) for the service. In addition, the NSM optimizes network resources by supporting auto-scaling, which flexibly scales in and out the network slice resources according to the traffic fluctuation in the network slice.

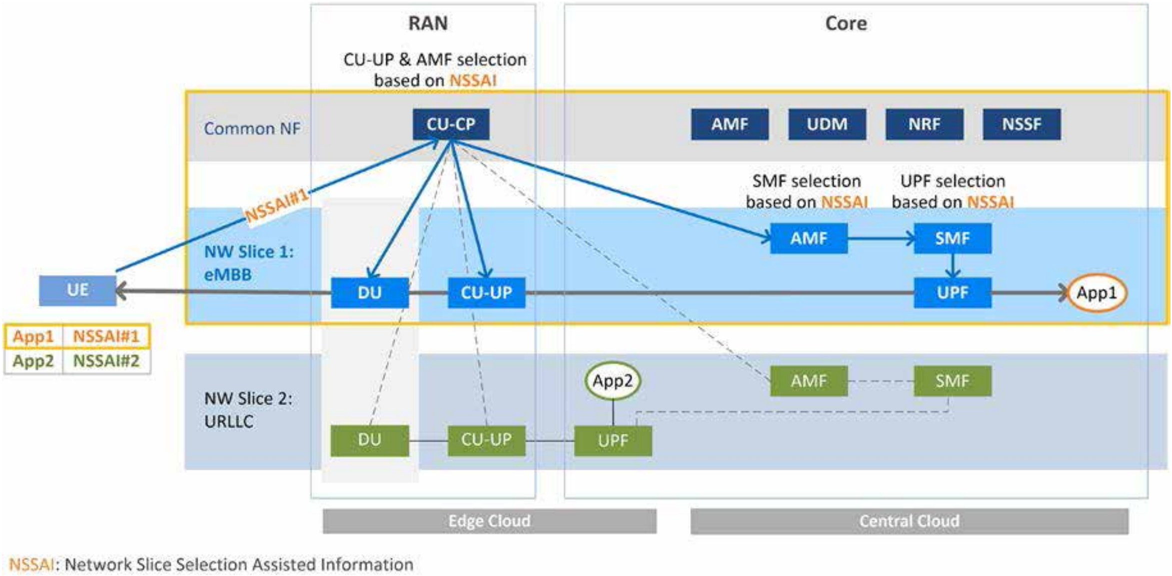



Figure 5-2. Network Slice Allocation to UE

### Samsung Network Slicing Solution 2
### Slice Allocation to UE

Figure 5-2 details the process of how a UE intended to use a specific service (e.g., eMBB) is allocated an eMBB slice.

Once the UE runs the application, a NSSAI (NSSAI#1) for eMBB is delivered to the 5G network, then the 5G network creates an eMBB slice based on the NSSAI to alloc ate to the UE. Central Unit Control Plane (CU-CP) that acquires the NSSAI from the UE recognizes it as an eMBB service, selects an eMBB-specific Central Unit User Plane (CU-UP) and AMF. Then the AMF selects an eMBB-specific SMF, and the SMF selects eMBB-specific UPF(s). DU acquires the NSSAI from the CU-CP and allocates dedicated air resources to the slice, such as high BW and capacity resource pooling. This completes a dedicated E2E eMBB slice for the UE across RAN and Core.

# MEC

Samsung MEC solution consists of a Multi-access Edge Platform (MEP), a Multi-Access Edge Platform Manager (MEPM) and Multi-Access Edge Orchestrator (MEAO). As 5G just began to define the standard for the interworking between MEC and 3GPP Core, the interworking between MEC and EPC in 5G NSA is based on Samsung-specific solutions, and the interworking between MEC and 5G Core in 5G SA will follow the 3GPP 5G standard.The interworking between MEP and MEC App server is based on the ETSI standard. Figure 5-3 shows Samsung MEC solutions.

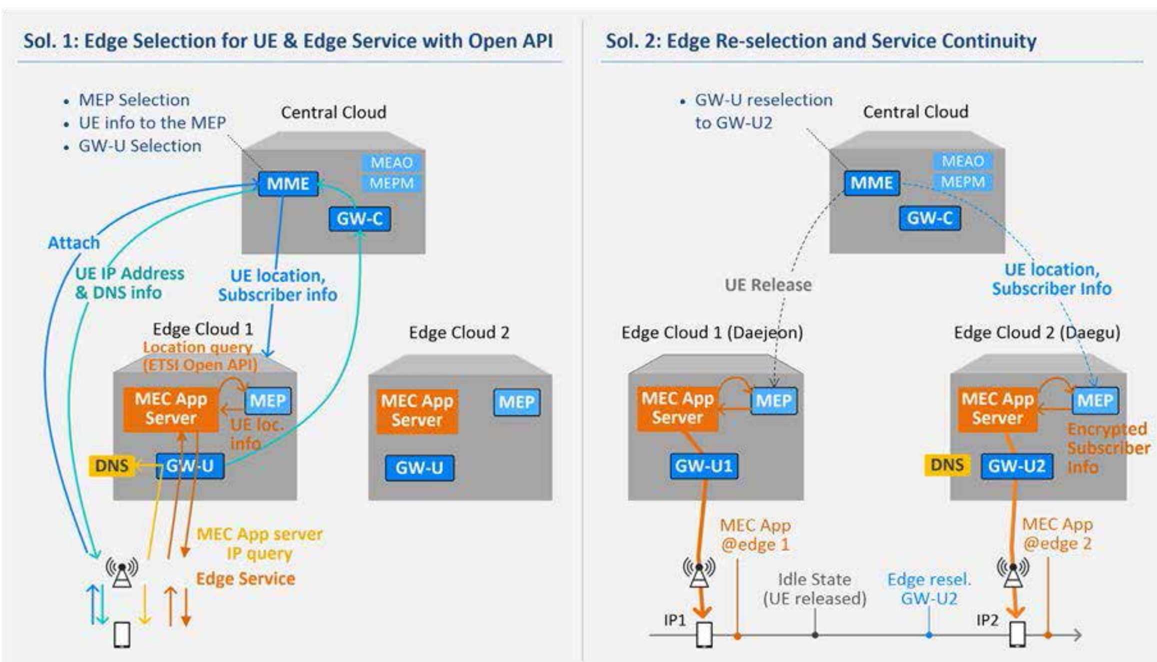



Figure 5-3. MEC Solutions

**Samsung MEC Solution 1**
**Edge Selection for UE and Edge Service with Open API**

The left side of Figure 5-3 explains how Samsung 5G NSA Core connects a 5G UE to the closest edge to provide services.

• Edge Selection – When a 5G UE accesses a 5G network, the MME located in the central cloud selects a MEP that is geographically closest to the UE, delivers subscriber information to the MEP, and forwards the UE's IP address and DNS information to the UE. Through a DNS query, the UE acquires the IP address of the MEC App server at the edge, connects to the MEC App server and uses the service from the edge.

• Edge Service with Open Application Programming Interface (API) – MEP and MEC App server interwork with ETSI Open API. According to the query of the MEC App, the MEP provides information on the UE location and subscriber identification, which is encrypted and delivered securely.

**Samsung MEC Solution 2**
**Edge Re-selection and Samsung-Specific Service Continuity**

The right side of Figure 5-3 explains how Samsung 5G NSA Core supports edge re-selection and local service continuity. Samsung MEC solution ensures that an idle state UE can execute edge reselection to use the MEC App from the geographically closest edge. For any changes in the UE IP address, the MEC App from the new edge will be able to utilize Subscriber ID to support local service continuity. In addition, each MEP interworks with operators' LBS platform to periodically update cell configuration information to reflect any cell configuration changes instantly.

Based on the 3GPP standard, 5G SA Core will interwork with MEP to provide local break functions such as Uplink Classifiers (UL-CL), IPv6 Multi-homing and Local Area Data Network (LADN). Session and Service Continuity (SSC) Mode 2 and Mode 3 will also be supported.

# Samsung's 5G Innovation Continues

In April 2019, the era of 5G officially commenced with the launch of 5G smartphones. Although the current focus is on LTE-dependent 5G NSA, soon, 5G SA with full 5G Core features will trigger more innovative 5G services that encompass ultra-high speed, low latency and massive connectivity. Cloud native 5G gained traction as the answer to such exponential increase in data traffic as well as new services that will emerge in the 5G era.

Samsung cloud native 5G Core that is based on containers can provide hybrid cloud orchestration and support seamless migration from VNF to CNF. In addition, its network slicing and MEC solutions will empower telecom operators to expand business opportunities and gain better profit. Samsung network slicing solution slices even DU resources to provide a genuine E2E network slicing, and MEC solution provides subscriber information to MEC applications, allowing the MEC applications to offer a higher degree of customization.

Samsung Network Automation solution consists of Samsung 5G Network with cloud native 5G Core and Samsung Network Automation Platform utilizing big data analysis, enabling telecom operators to build a 5G service enabler platform in the upcoming 5G era. In this ever-changing SW-based telecom network market triggered by the introduction of NFV and cloud technologies, Samsung's efforts for innovation to become the dominant player in the market will always continue.

# Abbreviations

**AMF** Access and Mobility Management Function
**AUSF** Authentication Server Function
**CIoT** Cellular IoT
**CNF** Cloud Native Network Function
**C-RAN** Centralized RAN
**CO** Central Office
**CU** Central Unit
**CUPS** Control and User Plane Separation
**DECOR** Dedicated Core
**DN** Data Network
**DU** Digital Unit
**DU** Distributed Unit
**eNB** Evolved Node B
**eMBB** Enhanced Mobile Brodaband
**EMS** Element Management System
**EPC** Evolved Packet Core
**gNB** Next generation Node B
**GW-C** Gateway Control Plane
**GW-U** Gateway User Plane
**HSS** Home Subscriber Server
**LTE** Long Term Evolution
**MEAO** Multi-access Edge Application Orchestrator
**MEC** Multi-access Edge Computing
**MEP** Multi-access Edge Platform
**MEPM** MEP Manager
**MME** Mobility Management Entity
**NEF** Network Exposure Function
**NF** Network Function
**NFV** Network Functions Virtualization
**NFVI** NFV Infrastructure
**NFVO** NFV Orchestrator
**NR** New Radio
**NRF** Network Repository Function
**NSA** Non-Standalone
**NSM** Network Slice Manager
**NSSAI** Network Slice Selection Assistance Information
**NSSF** Network Slice Selection Function
**PCF** Policy Control Function
**PCRF** Policy and Charging Rules Function
**PGW** PDN Gateway
**PNF** Physical Network Function
**RAN** Radio Access Network
**RAT** Radio Access Technology
**RRC** Radio Resource Control
**RU** Radio Unit
**SA** Standalone
**SBA** Service Based Architecture
**SBI** Service Based Interface
**SDN** Software Defined Networking
**SDNC** SDN Controller
**SDNO** SDN Orchestrator
**SGW** Serving Gateway
**SMF** Session Management Function
**UDM** Unified Data Management
**UDR** Unified Data Repository
**UDSF** Unstructured Data Storage Function
**UE** User Equipment
**UPF** User Plane Function
**vCore** Virtualized Core
**vEPC** Virtualized EPC
**VM** Virtual Machine
**VNF** Virtual Network Function
**VNFM** VNF Manager
**vRAN** Virtualized RAN

## About Samsung Electronics Co., Ltd.

Samsung inspires the world and shapes the future with transformative ideas and technologies. The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, and memory, system LSI, foundry and LED solutions.

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