5G Network Architecture and FMC

Joe Wilke, Ericsson

July 2017

Ericsson 5G core system

Key system areas

Automation
Actionable insights

Service optimized
connectivity

Agility
Efficiency

Efficiency
Agility
Scale

Devices /
Local NW

Access sites

Distributed sites

National sites

Global sites

Application Cloud

Management & Monetization

Network Slices

Mobile

Access, Mobility, Network applications

Fixed

Cloud Infrastructure

Transport
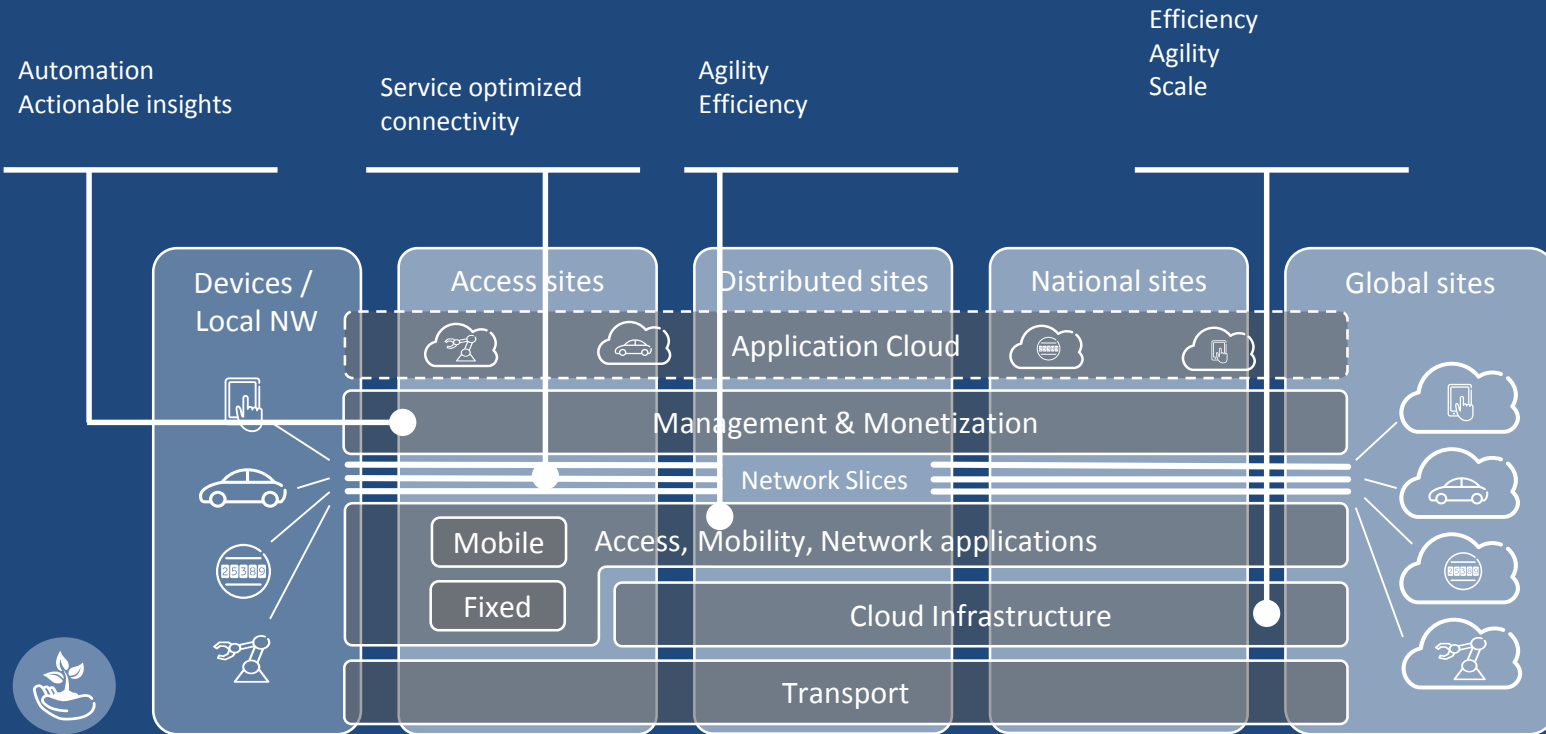
Overall 5G Core Architecture Strategy

- Network Slicing is a key enabler supporting
  - Separation of concern
  - Diverging Use Cases and Requirement
  - Multiple instantiations of same functionality
  - Reduced TTM
- 5G Mobile Broadband is an evolution of current 4G MBB, but using the Service Based architecture as basis
- Support possibility for diverging architectures for new services
- Automation and programmability important part of target architecture
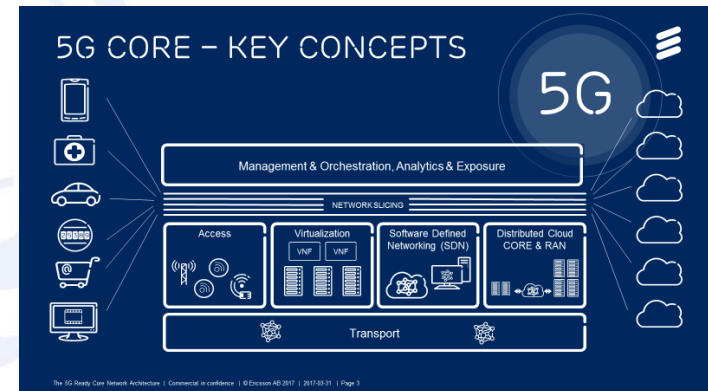
5G Core Network Architecture
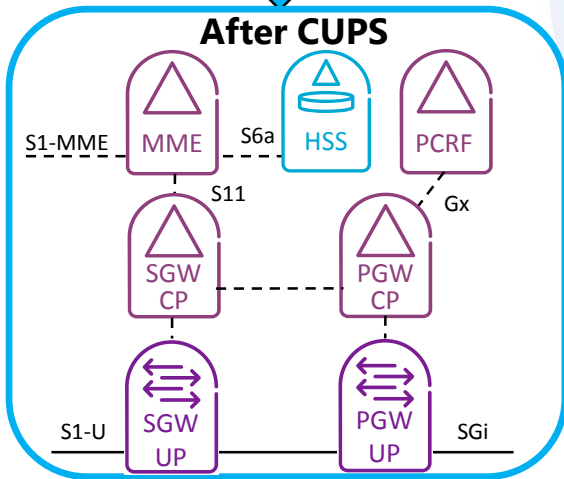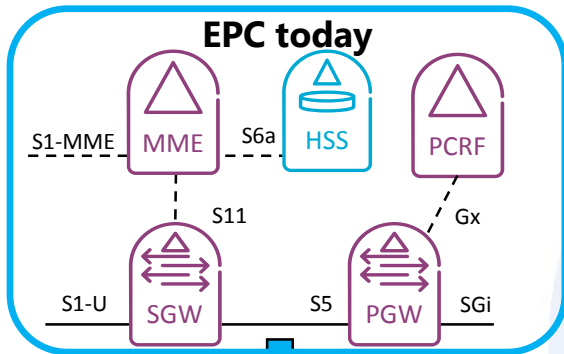
Key Principles

- The 5G core standardization should define a functional architecture where implementation technologies can be evolved and replaced over time

- Key principles:
  - Prioritize **interfaces to support Multi-vendor** integration
  - **Scale UP and CP** functionality **independently**
  - Allow for a **flexible deployment of UP** separate from the CP
  - Supporting authentication for **both IMSI-based and non IMSI-based** identities
  - Allows for **different network configurations** in different network slices
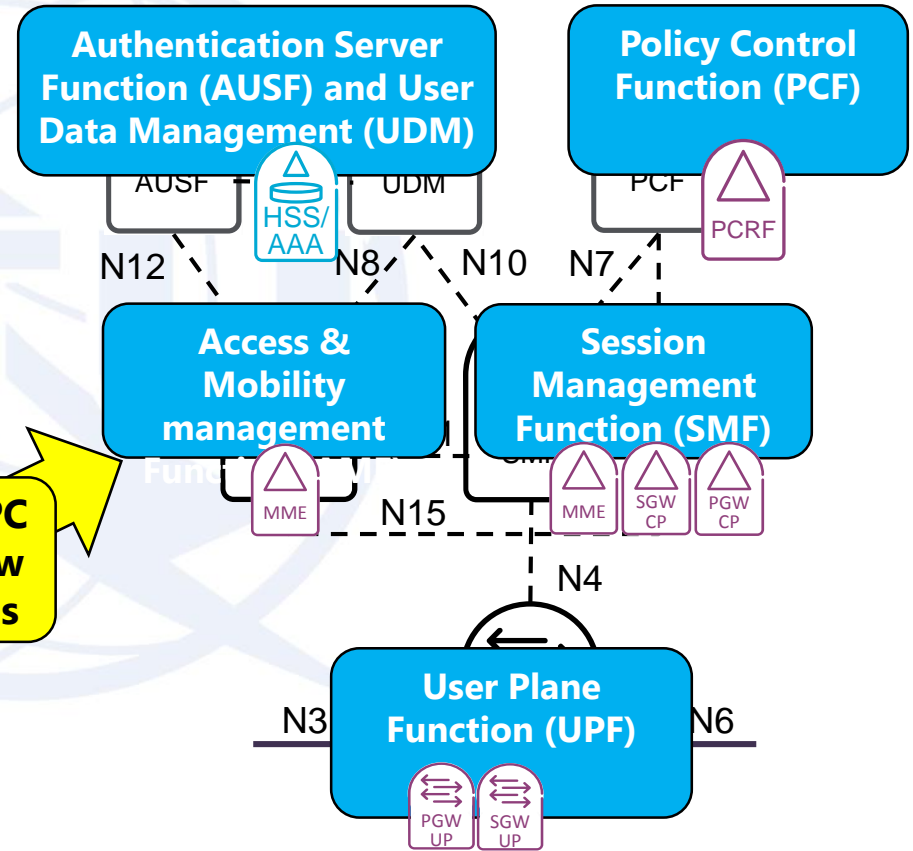 - **Abstract transport layer** from 3GPP NFs

5G – New Concepts

- CP/UP Split
- NW slicing
- Service Based Architecture SBA

5G CORE architecture overview

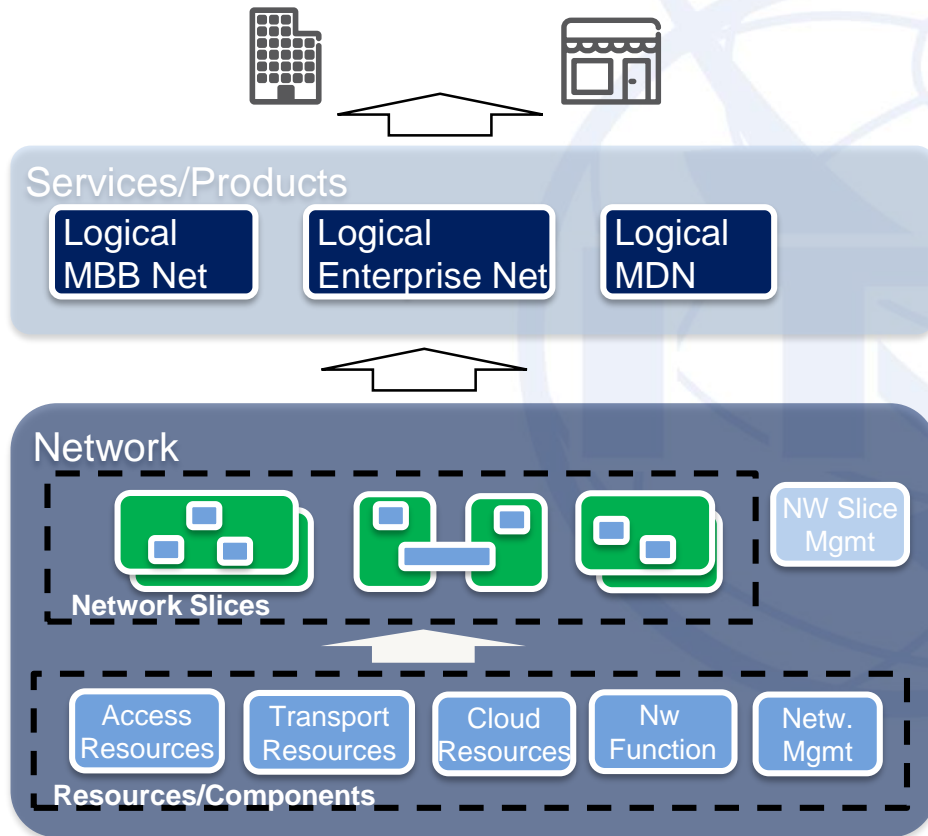## Changes and improvements compared to 4G

Network Slice Definition
One Network – Multiple Industries

Services/Products

Logical MBB Net	Logical Enterprise Net	Logical MDN

Network

Network Slices

NW Slice Mgmt

Resources/Components

| Access Resources	Transport Resources	Cloud Resources	Nw Function	Netw. Mgmt

Network slice is a **logical network** serving a defined **business purpose** or **customer**, consisting of **all** required network resources **configured** together. It is created, changed and removed by management functions.

- Logical network managed by a provider

- Enabler for services, not a service

- Mobile and fixed

- Resources may be physical or virtual, dedicated or shared

- Independent/"Isolated" but may share resources

- May integrate services from other providers, facilitating e.g. aggregation and roaming

- May include management functions and possible exposure of control/management to customer

Federated Network Slicing

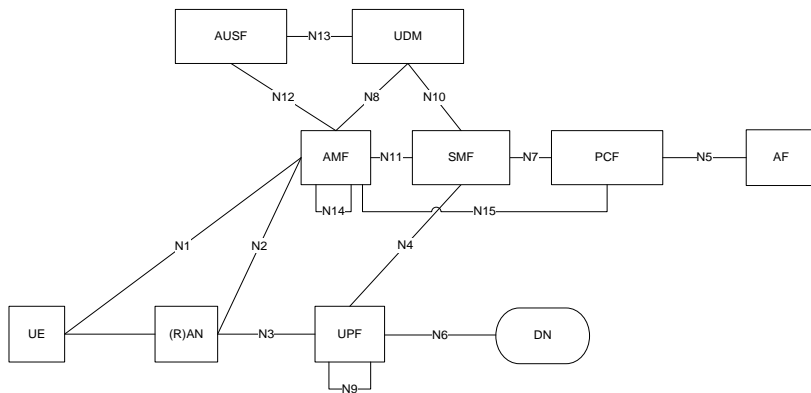Enable seamless service experience and service control
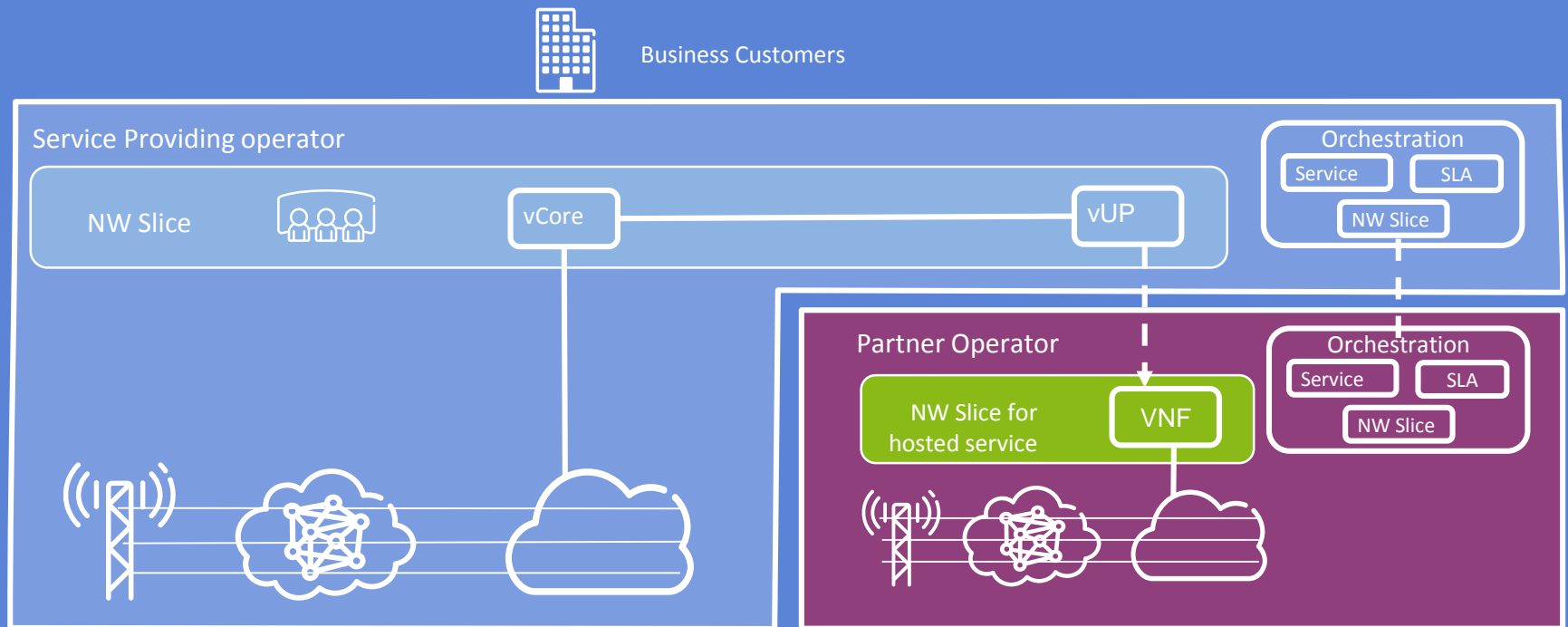
Service Based Architecture

3GPP TS 23.501 V1.0.0 (2017-06)

The 5G architecture is defined as service-based and the interaction between network functions is represented in two ways. Network functions within the 5GC Control Plane shall only use service-based interfaces for their interactions.

Reference point representation.

shows the *interaction that exist between the NF services* in the network functions described by point-to-point reference point (e.g. N11) between any two network functions (e.g. AMF and SMF).

Service-based representation,

where network functions (e.g. AMF) within the control plane enables other authorized network functions to access their services

Authentication Server Function (AUSF)

Core Access and Mobility Management Function (AMF)

Data network (DN), e.g. operator services, Internet access or 3rd party services
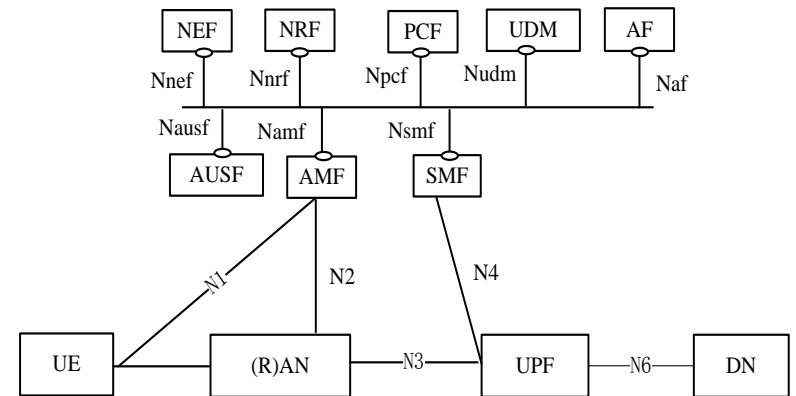
Network Exposure Function (NEF)

NF Repository Function (NRF)

Policy Control function (PCF)

Session Management Function (SMF)

Unified Data Management (UDM)

User plane Function (UPF)

Application Function (AF)

User Equipment (UE)

5G CORE architecture

Functional view – service-based representation

› Network Functions within the 5GC Control Plane (CP) use Service-Based Interfaces (SBI) for their interactions:

› A CP NF can provide one or more NF Services

AF	Application Function
AMF	Access and Mobility Management Function
AUSF	Authentication Server Function
NEF	Network Exposure Function
NRF	Network Repository Function
PCF	Policy Control Function
SMF	Session Management Function
UDM	Unified Data Management
UPF	User Plane Function
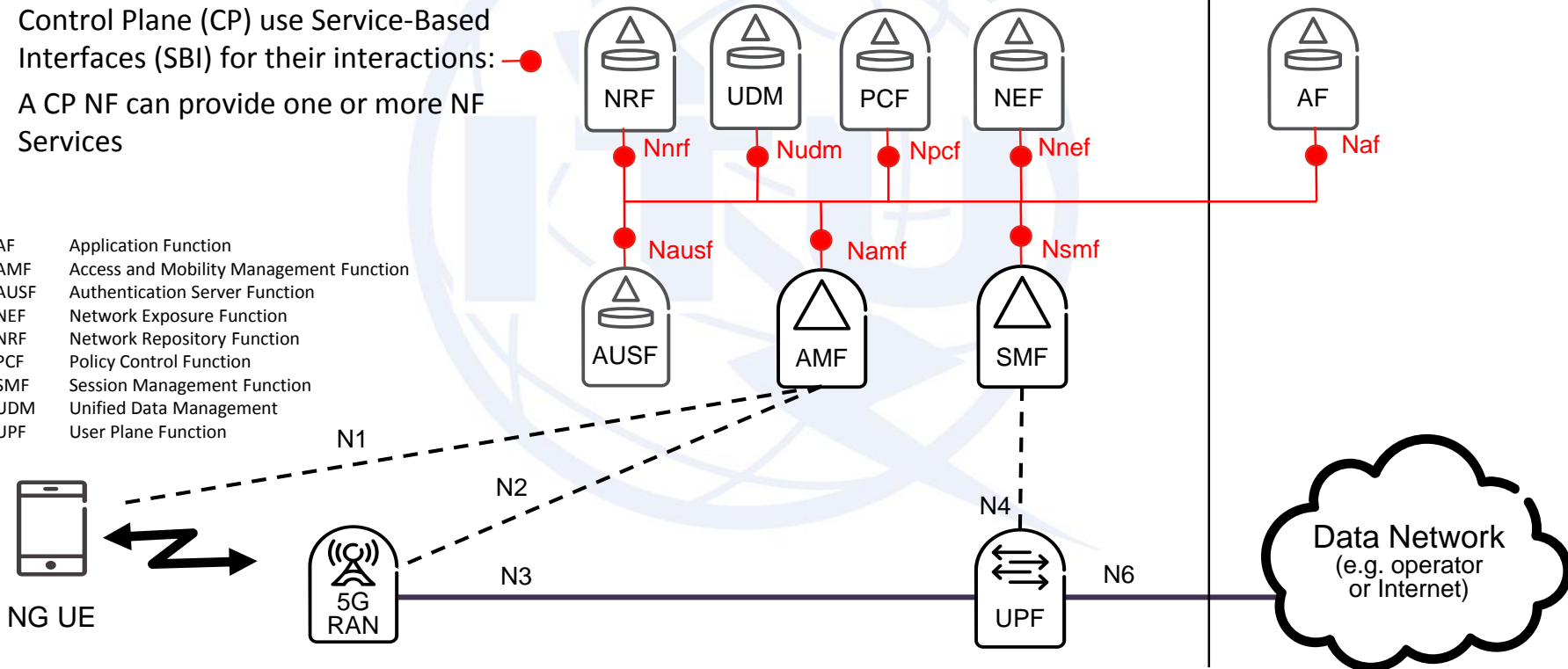
Service-based interface in 5GC

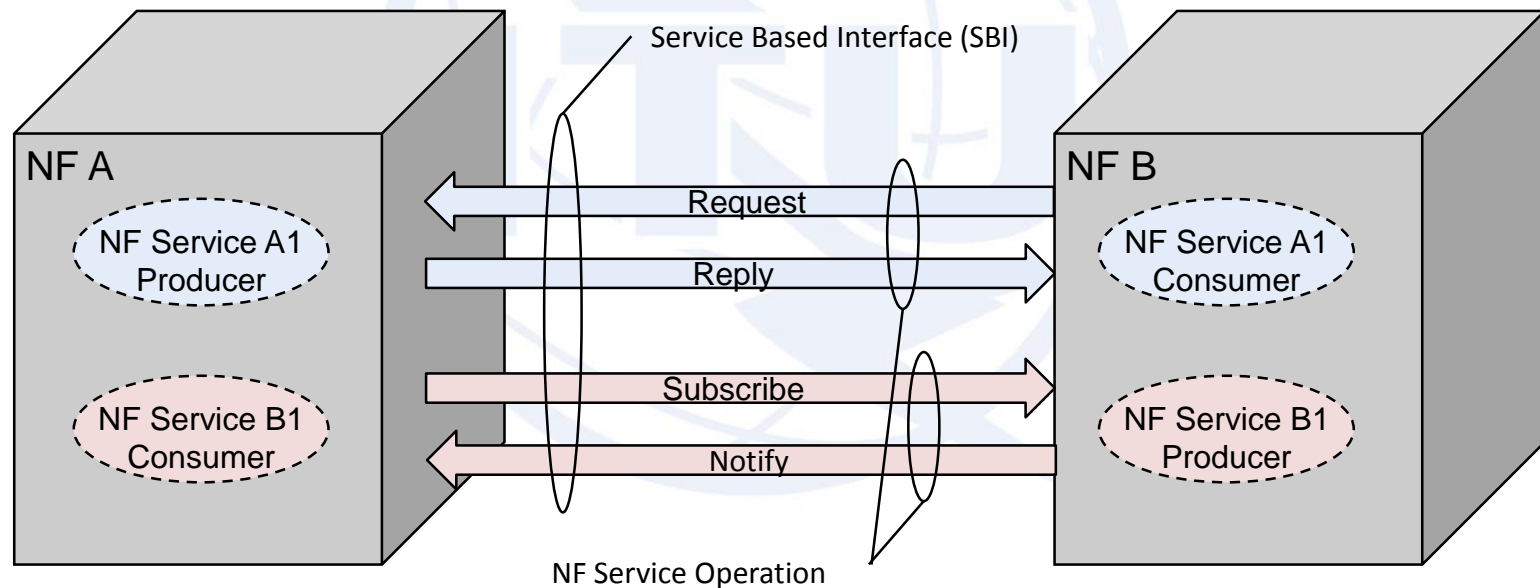## Services and Operations

› A Control Plane Network Function can provide one or more NF Services

› A NF Service consist of operations based on either a request-response or a subscribe-notify model

› Common control protocol using e.g. HTTP based API, replacing protocols like e.g. Diameter

Service Based Interface (SBI)

NF A

NF Service A1 Producer

NF Service B1 Consumer

Request

Reply

Subscribe

Notify

NF B

NF Service A1 Consumer

NF Service B1 Producer

NF Service Operation

5G EPC architecture overview

Functional view – non-roaming RAN-CN interaction

› Enables early introduction of NR through connectivity Option 3

› UE anchored to network over LTE/EPC control plane

› Wide area coverage through LTE with NR as capacity boost

HSS

PCRF

S6a

Gx

Rx

EPC NAS

S10

MME

S11

SGW/ PGW CP

S5

S1-MME

Sx

LTE RRC
LTE PDCP
LTE Uu

LTE + NR RAN

S1-U

SGW/ PGW UP

SGi

Data Network
(e.g. operator
or Internet)

LTE/EPC UE
NR/EPC UE

5G Standards plan

	2015	2016	2017	2018	2019	2020

ITU

IMT-2020 Evaluation

IMT-2020 Requirements | WS | IMT-2020 Proposals | IMT-2020 Specs

WRC — WRC

Rel-13 | Rel-14 | Rel-15 | Rel-16 | Rel-17, ...

3GPP

Study on next generation network (technical realization, self evaluation)

5G/NR Phase 1 | 5G/NR Phase 2

LTE evo | LTE evo | LTE evo

Phase 1: Rel-15 RAN + Core targeting first phase of deployments 2020

Phase 2: Rel-16 targeting ITU IMT-2020 submission