3GPP SA6
Accelerating 5G Application Standards!

Suresh CHITTURI

3GPP SA6 Chairman

SAMSUNG

Outline

- Introduction to 3GPP SA6

- 5G Service Frameworks
  - CAPIF
  - SEAL
  - EDGEAPP

- Vertical Application Enablers
  - V2XAPP

- Mapping of OPG to 3GPP SA6

- Conclusion

Introduction to 3GPP SA6

SA6 Leadership
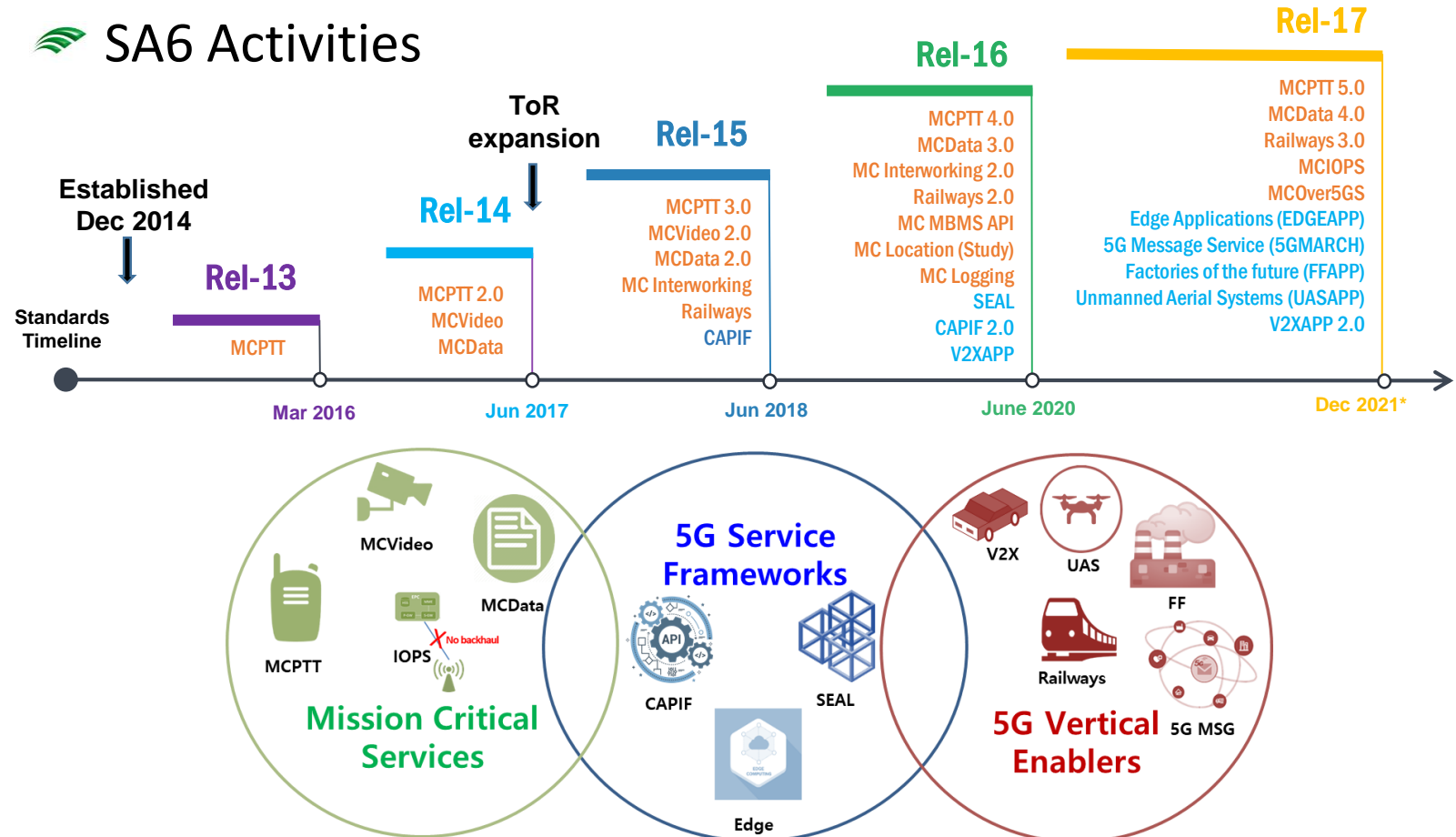
Suresh Chitturi
SA6 Chairman
TTA
s.chitturi@samsung.com

Alan Soloway
SA6 Vice-Chairman
ATIS
asoloway@qti.qualcomm.com

Jukka Vialen
SA6 Vice-Chairman
ETSI
jukka.vialen@airbus.com

SA6 Activities

Standards Timeline

Established Dec 2014

ToR expansion

Rel-13
MCPTT

Rel-14
MCPTT 2.0
MCVideo
MCData

Rel-15
MCPTT 3.0
MCVideo 2.0
MCData 2.0
MC Interworking
Railways
CAPIF

Rel-16
MCPTT 4.0
MCData 3.0
MC Interworking 2.0
Railways 2.0
MC MBMS API
MC Location (Study)
MC Logging
SEAL
CAPIF 2.0
V2XAPP

Rel-17
MCPTT 5.0
MCData 4.0
Railways 3.0
MCIOPS
MCOver5GS
Edge Applications (EDGEAPP)
5G Message Service (5GMARCH)
Factories of the future (FFAPP)
Unmanned Aerial Systems (UASAPP)
V2XAPP 2.0

Mar 2016 | Jun 2017 | Jun 2018 | June 2020 | Dec 2021*

Mission Critical Services — MCVideo, MCData, MCPTT, IOPS (No backhaul)

5G Service Frameworks — CAPIF, SEAL, API, Edge

5G Vertical Enablers — V2X, UAS, FF, Railways, 5G MSG

3GPP SA6 Participation

Agencies

astrid
BDBOS) digital . sicher . bundesweit
FirstNet
ERILLISVERKOT
Home Office
SBB CFF FFS
MINISTÈRE DE L'INTÉRIEUR
UIC POLITIE

Operators

at&t
kt
SK telecom
中国移动 China Mobile
TELECOM ITALIA
China unicom 中国联通
SYSOCO Wireless technology
Deutsche Telekom
Telefónica
TELSTRA
verizon
kapsch >>>
vodafone

Vendors

AIRBUS
interdigital
Apple
SOFTIL INNOVATIVE COMMUNICATIONS
kontron S&T Group
GENERAL DYNAMICS United Kingdom Limited
BlackBerry
CONVIDA WIRELESS
NOKIA
SONY
ZTE中兴
vivo
ONE2MANY
TD Tech
L3HARRIS
Southern Linc
Tencent 腾讯
sepura
SAMSUNG
tait communications
LG
ENENSYS EXPWAY
Qualcomm
Alibaba Group
PHILIPS
ERICSSON
HUAWEI
intel
BULL

Researchers

CATT
KRI
ETRI
Fraunhofer
Department of Telecommunications
한성대학교 HANSUNG UNIVERSITY
iit delhi
IIT Hyderabad
nomor research novel mobile radio

5G Service Frameworks

CAPIF (Common API Framework)

3GPP Architecture for Northbound APIs

API Set1: Capabilities of 5G network functions

3GPP Architecture for Northbound APIs (with CAPIF)
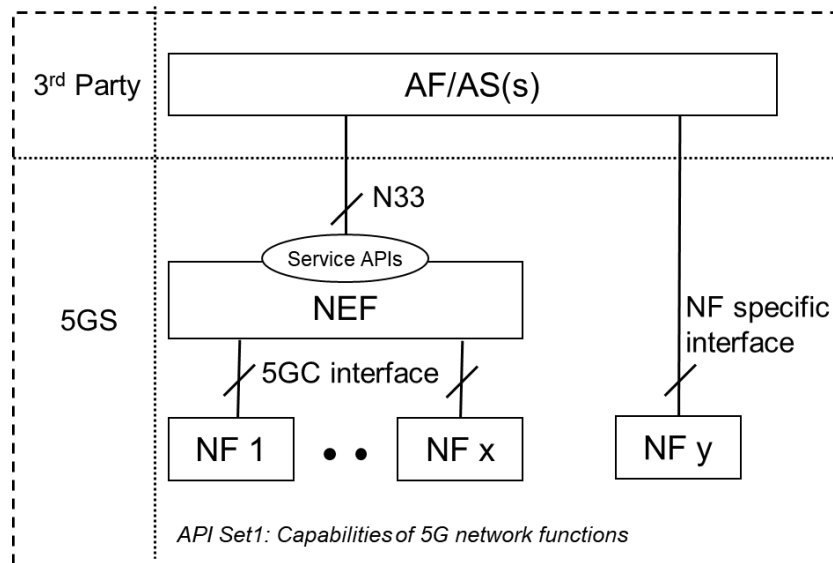
NEF – Network Exposure Function
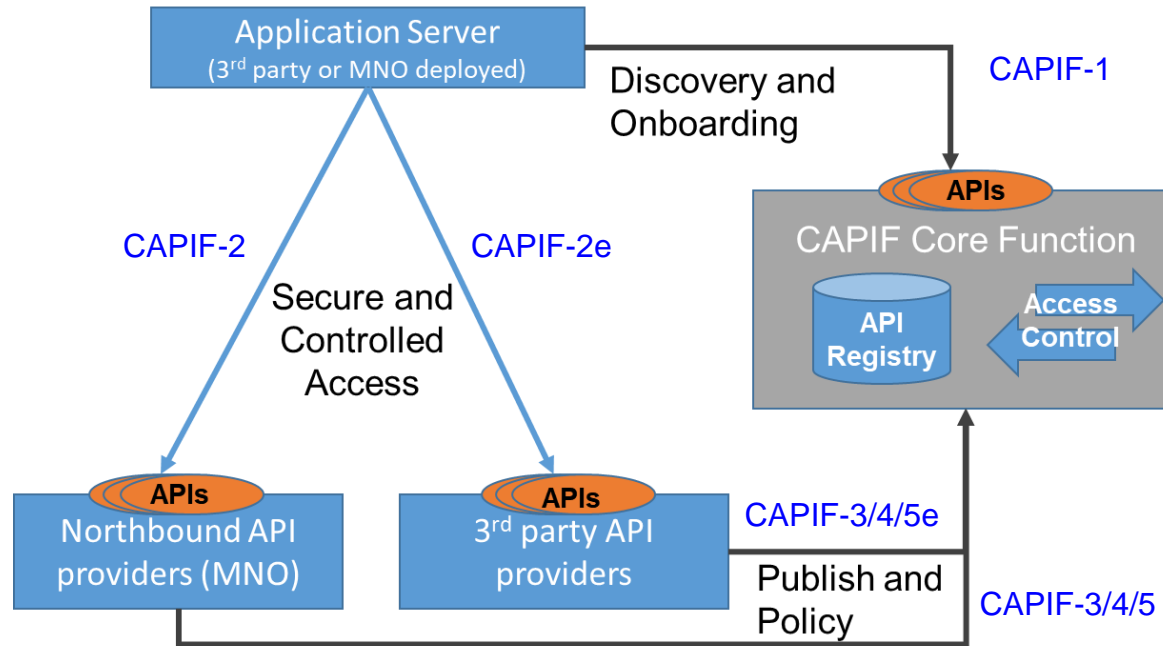*Service APIs = NB APIs*
Framework APIs = CAPIF APIs
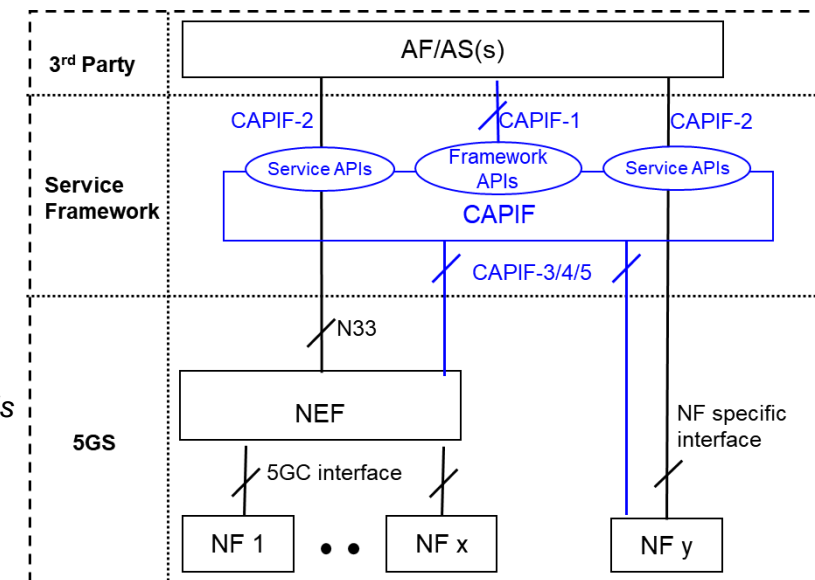
- ☙ 3GPP Core Network Capabilities are exposed as Northbound APIs, for consumption by the 3rd Parties outside MNO domain

- ☙ Northbound APIs are **configured offline** i.e. API discovery not supported, **dissimilar** security mechanisms, etc., **leading to fragmentation**

- ☙ Common API Framework (CAPIF) defines a framework to establish a **single and harmonized platform** (both EPS and 5GS) for all 3GPP Northbound APIs
  - On-boarding of API Invokers online is addressed
  - CAPIF provides common API registry on which unified discovery is supported
  - Common authentication and authorization mechanisms – so no fragmentation
  - Policy enforcement, auditing, accounting, support 3rd party domain, interconnection

CAPIF – Architecture and Adoption

Application Server
(3rd party or MNO deployed)

Discovery and Onboarding

CAPIF-1

CAPIF-2

CAPIF-2e

Secure and Controlled Access

APIs

CAPIF Core Function

API Registry

Access Control

APIs

Northbound API providers (MNO)

APIs

3rd party API providers
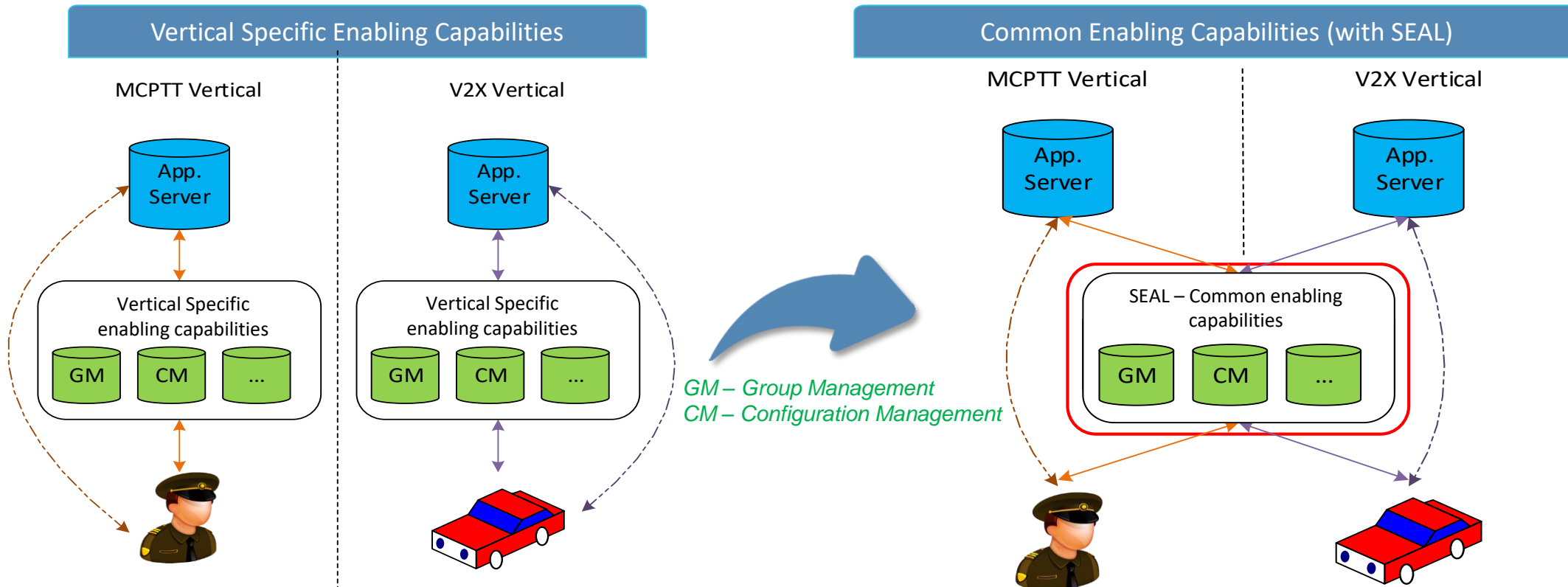
CAPIF-3/4/5e

Publish and Policy

CAPIF-3/4/5

Standard API Framework

- Service Oriented Access
- IT/Web style API integration
- Controlled access to APIs

Business acceleration

- Unified API Gateway
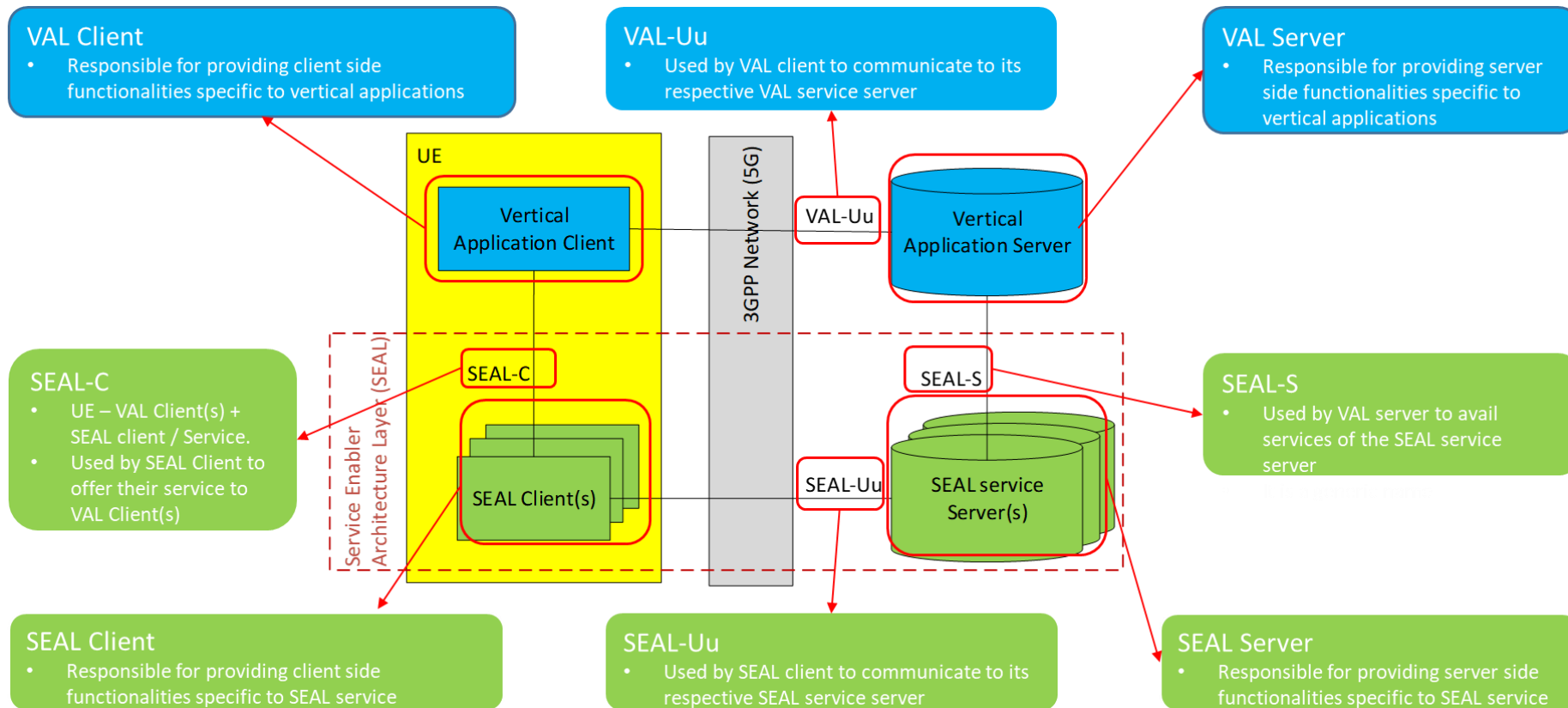- Supports API aggregation or API cloud

Adoption in 3GPP

Core Network Exposure

SCEF Implements CAPIF (EPC)	NEF Implements CAPIF (5GC)
• **3GPP TS 23.682**	• **3GPP TS 23.501**
• Network APIs over T8 interface.	• Network APIs over N33 interface.
• SCEF implements CAPIF API provider domain functions.	• NEF implements CAPIF API provider domain functions.
• T8 implements CAPIF-2e interface.	• N33 implements CAPIF-2e interface.

Enabler Layer Exposure

Enabling EDGEAPP	Enabling MBMS	Enabling V2XAPP
• **3GPP TS 23.558 (in progress)**	• **3GPP TS 26.348**	• **3GPP TS 23.286**
• Edge Enabler Server, supports exposure of its service APIs and 3GPP network service APIs.	• xMB reference point between BM-SC and content provider supports CAPIF	• Application Layer architecture for enabling V2X services.
• Edge Enabler Server implements API Provider domain functions.	• BM-SC implements CAPIF API provider domain functions	• V2XAPP supports SEAL (Services Enabler Architecture Layer)
• Edge Application Server implements API Invoker	• Content Provider implements API Invoker	• SEAL supports CAPIF.

SEAL (Service Enabler Architecture Layer)

Vertical Specific Enabling Capabilities

Common Enabling Capabilities (with SEAL)

Verticals

MCPTT Vertical   V2X Vertical

MCPTT Vertical   V2X Vertical

App. Server

App. Server

App. Server

App. Server

Vertical Specific enabling capabilities

Vertical Specific enabling capabilities

SEAL – Common enabling capabilities

GM   CM   ...

GM   CM   ...

GM   CM   ...

GM – Group Management
CM – Configuration Management

Mission Critical

Railways

Aviation

Manufacturing

Automotive

Gaming

Internet of Things

📶 ***Common set of capabilities for 5G Verticals -> Reducing time-to-market!***

SEAL – Architecture and Capabilities

VAL Client
- Responsible for providing client side functionalities specific to vertical applications

VAL-Uu
- Used by VAL client to communicate to its respective VAL service server

VAL Server
- Responsible for providing server side functionalities specific to vertical applications

UE

Vertical Application Client

3GPP Network (5G)

VAL-Uu

Vertical Application Server

Service Enabler Architecture Layer (SEAL)

SEAL-C

SEAL Client(s)

SEAL-Uu

SEAL-S

SEAL service Server(s)

SEAL-C
- UE – VAL Client(s) + SEAL client / Service.
- Used by SEAL Client to offer their service to VAL Client(s)

SEAL-S
- Used by VAL server to avail services of the SEAL service server

SEAL Client
- Responsible for providing client side functionalities specific to SEAL service

SEAL-Uu
- Used by SEAL client to communicate to its respective SEAL service server

SEAL Server
- Responsible for providing server side functionalities specific to SEAL service

SEAL Capabilities

- Group Management
- Configuration Management
- Location reporting
- UE configuration
- Identities
- Key management
- Network resource mgmt.

3GPP Edge Computing

☞ Edge Computing is a major focus area in 3GPP Rel-17

- **SA6**: Application layer architecture, and deployment scenarios (FS_EDGEAPP, EDGEAPP)
- **SA2**: System Architecture enhancement for supporting Edge Computing (enh_EC)
- **SA3**: Security aspects for supporting SA2 enh_EC and SA6 EDGEAPP
- **SA5**: Management aspects on Edge Computing (e.g. Lifecycle Management)

☞ 3GPP Rel-17 Timeline
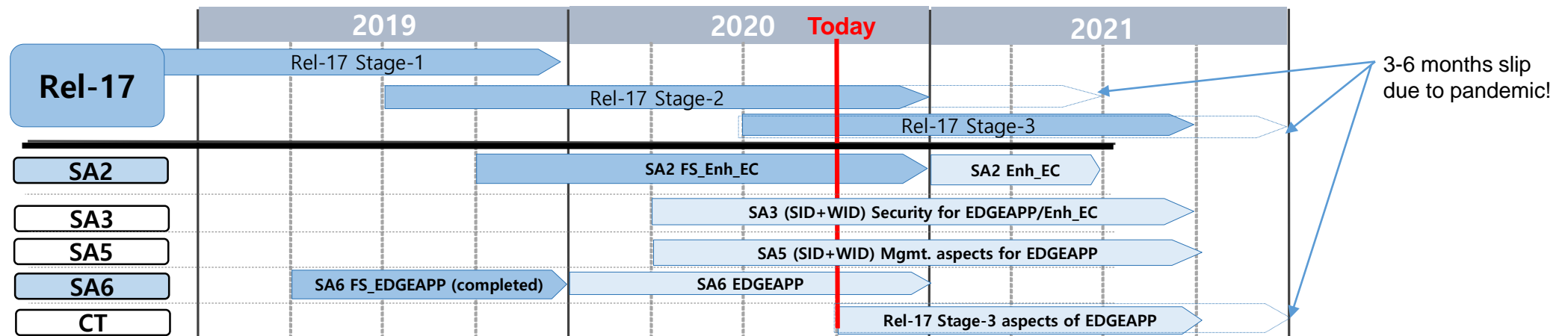
EDGEAPP – Introduction

☞ Architecture Principles

- **Application Portability**: Minimize changes to the Application Client logic and Edge Application Server compared to existing cloud environment

- **Service differentiation**: The MNO should be able to provide service differentiation (e.g. by enabling/disabling the Edge Computing features).

- **Flexible deployment**: The MNO should be able to support multiple ECSPs within its network. Also, the MNO should be able to selectively enable the service in a subarea of the MNO network.

- **Interworking with 3GPP network**: Provide access to 3GPP network capabilities (such as location service, QoS management, AF traffic influence) to the Edge Application Servers.

☞ Business Relationships
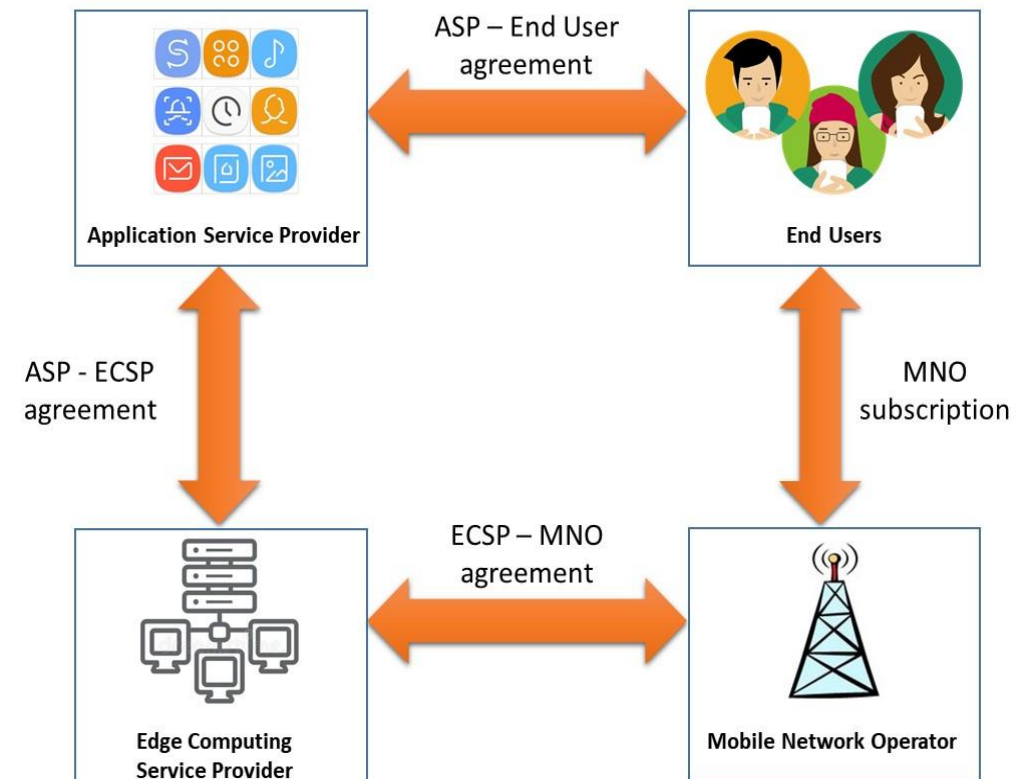
EDGEAPP – Application Architecture
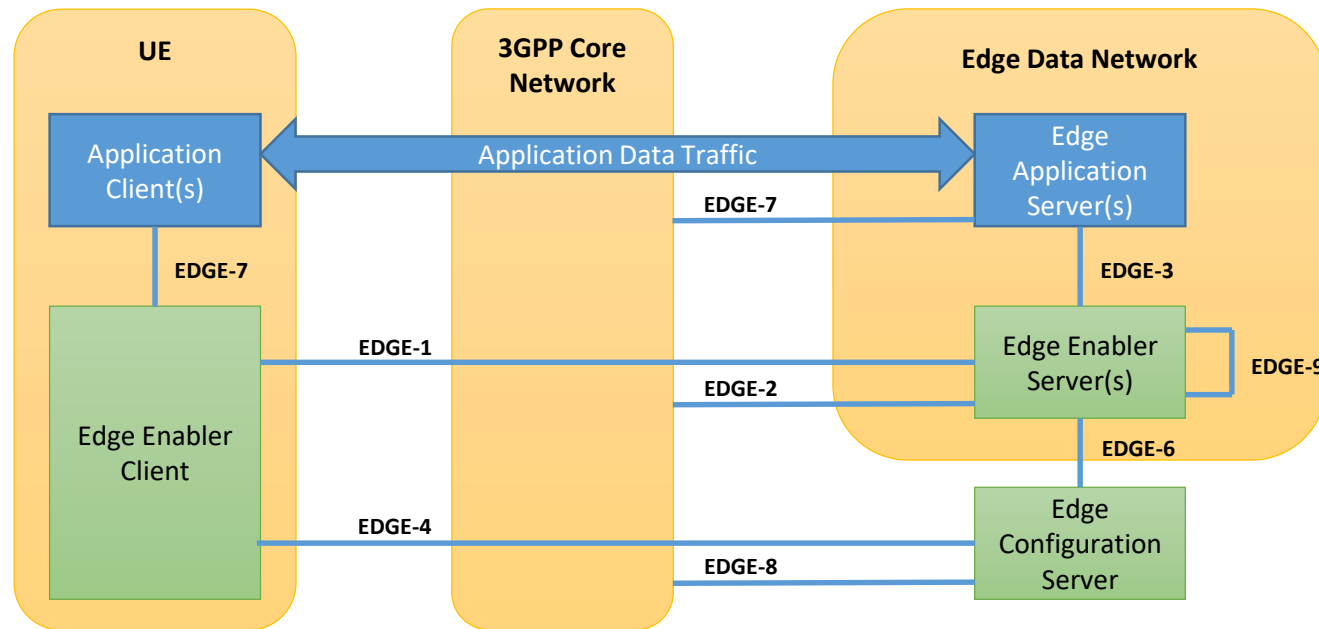
Edge Enabler Layer: 3GPP TS 23.558

- The **Edge Data Network (EDN)** is a local Data Network.
- **Edge Application Servers (EASs)** and the **Edge Enabler Server (EES)** are contained within the EDN.
- The **Edge Configuration Server (ECS)** provides configurations related to the EES, including details of the EDN hosting the EES.
- The **UE** contains **Application Client(s)** and the **Edge Enabler Client (EEC)**. EEC provides enabling functions to ACs.
- The EASs, the EES and the ECS may interact with the **3GPP Core Network**.

EDGEAPP – Key Features

- **Service Provisioning**: Enabling a UE with an Edge Enabler Client to find and connect to available Edge Data Networks with appropriate NW configurations.
- **EAS Discovery**: Enable rich discovery of EAS (discovery beyond IP address; such as server capacity, operation characteristics, support for service continuity, service area, schedule etc.).
- **EES capability exposure**: Provide value added services to the Edge Application Servers as APIs exposed by the Edge Enabler Server (UE Location, UE ID, QoS, UP events, AC information, etc.)
- **Network capability exposure**: Provide Edge Application Servers and enabling layer with access to capability APIs exposed by the Core Network (NEF/SCEF, AF Traffic Influence)
- **Service Continuity**: Support Edge Application Server and the Application Clients in transfer of application context from one Edge Application Server to another, while minimizing service interruption
- **Security**: 3GPP credentials based authentication and authorization for Edge Computing services.

Relationship with ETSI MEC
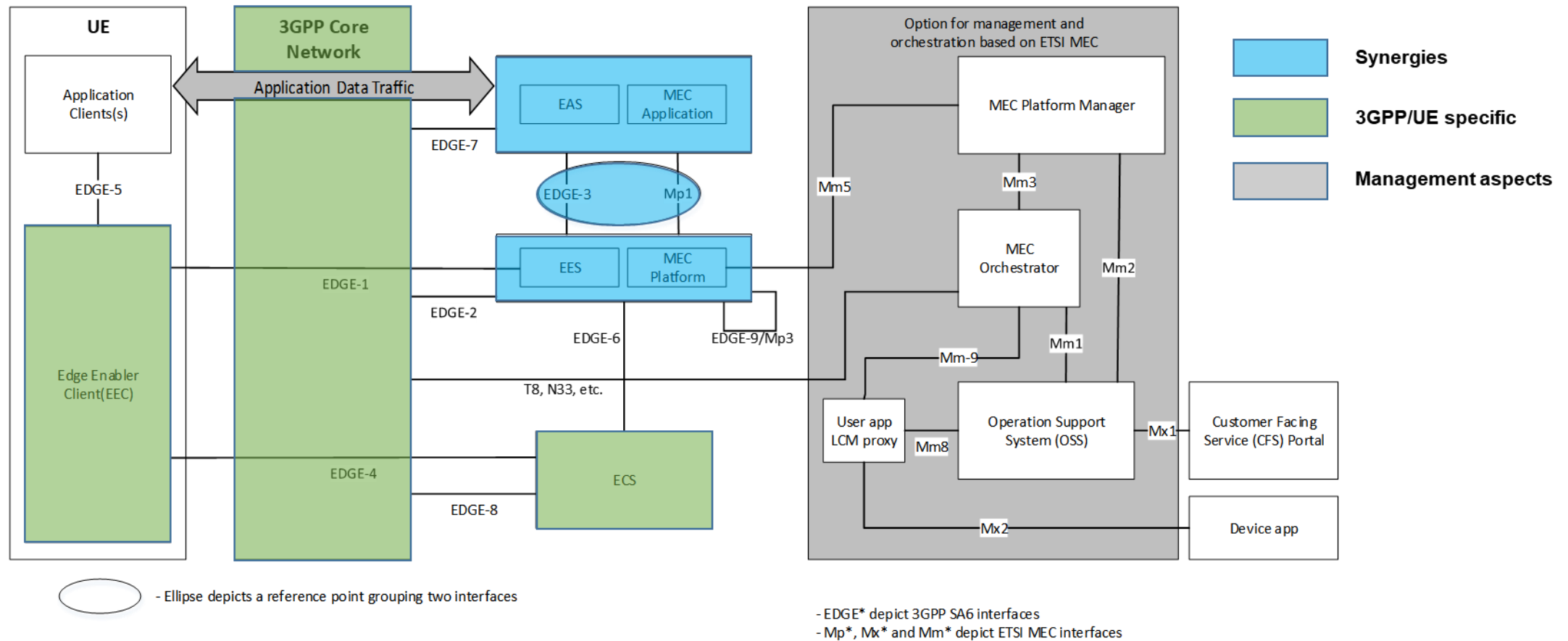
EDGEAPP - Summary

- **3GPP Rel-17:** Edge Computing is a major feature of Rel-17 (5G Phase 3)
- **Edge-native capabilities:** Enables native support to Edge computing within 3GPP Networks, including tight integration with core network, USIM-based authentication
- **Flexible Architecture**: Allows flexible deployment models and business relationships e.g. multiple Edge computing service providers
- **Advanced application features**: Application context relocation/service continuity, EES capability exposure/APIs
- **Synergies with ETSI MEC**: Commonalities may be exploited on application enablement

Vertical Application Enablers

V2XAPP – V2X Application Enabler Layer
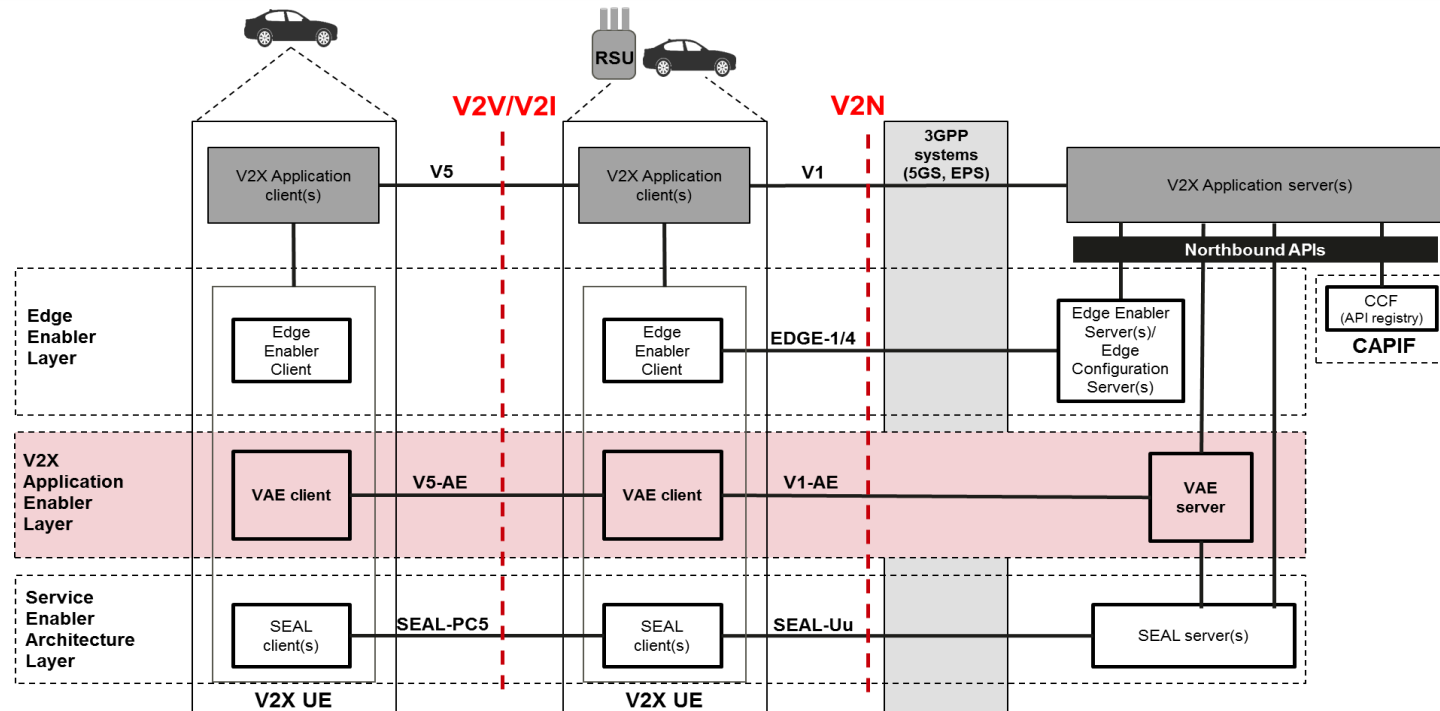
Features

- Generic Capabilities (Pre-established sessions, Dynamic groups) to support V2X applications e.g. Tele-operated service, Platooning

- V2X messages delivery capabilities (uplink, geo area, group)

- Value added capabilities - Network monitoring, Service requirement (QoS) negotiation, Application resource adaptation, File distribution (MBMS)

- Service Continuity support

- VAE Server APIs

- Multi PLMN and Multi-V2X service provider support

- More features in Rel-17 – eV2XAPP (TR 23.764)

Benefits

- Abstract and Simplify usage of 3GPP network systems (EPS and 5GS)

- Support simplification of V2X application development with value-added capabilities

- API based integration with V2X Application layer

V2XAPP – Example Deployment models
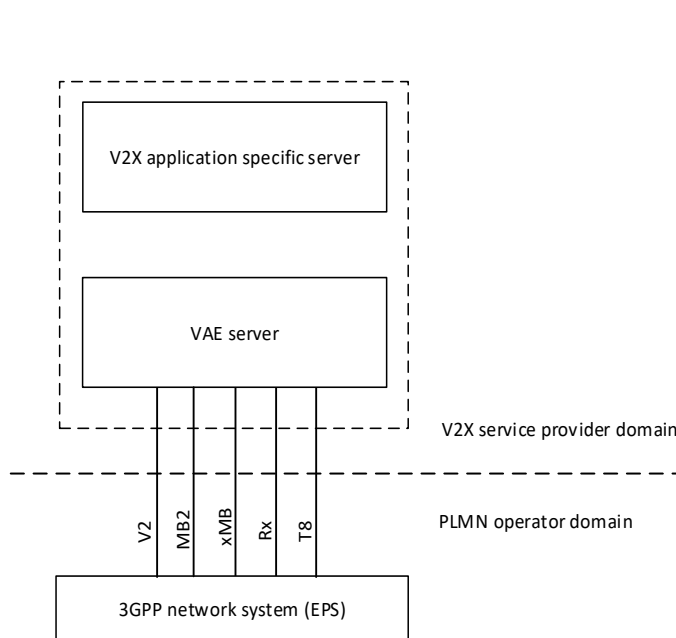
🌿 **VAE co-located with V2X applications in the V2X service provider domain**
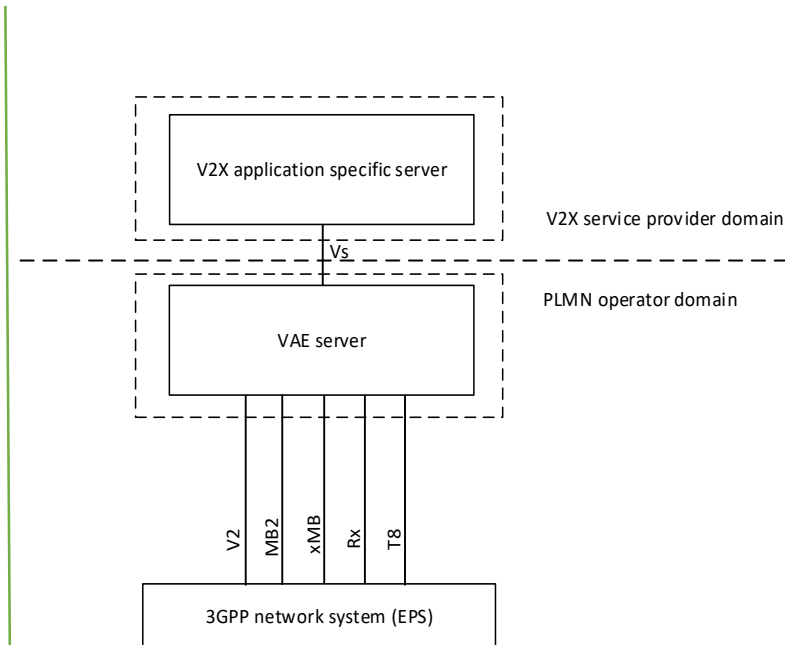
🌿 **VAE deployed in the PLMN operator domain**
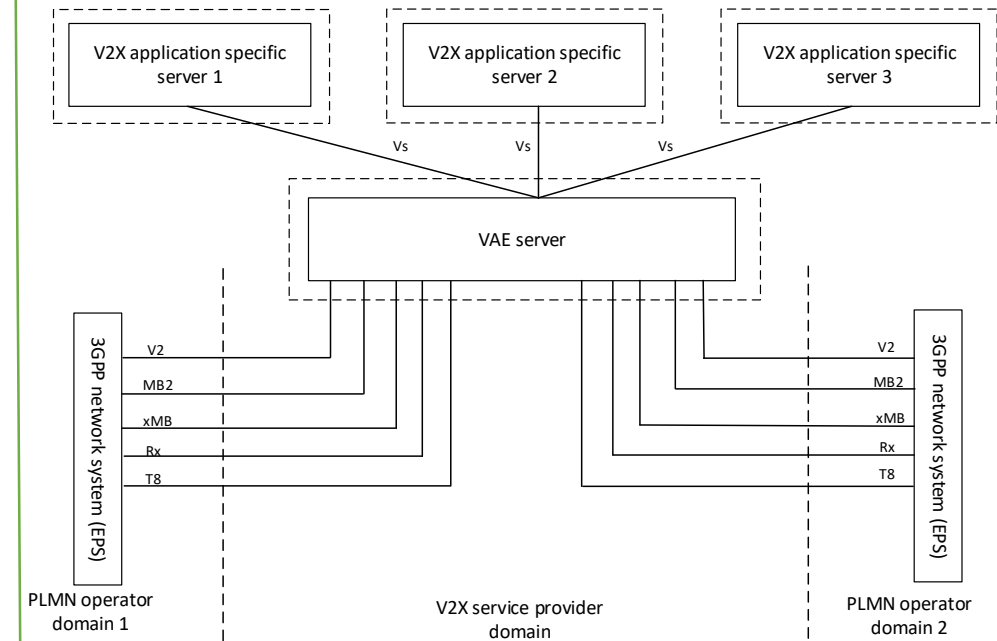
🌿 **VAE as "middleware" to support several V2X applications serving multiple PLMNs**

Mapping of OPG to 3GPP SA6

OP four-sided-approach & EDGEAPP
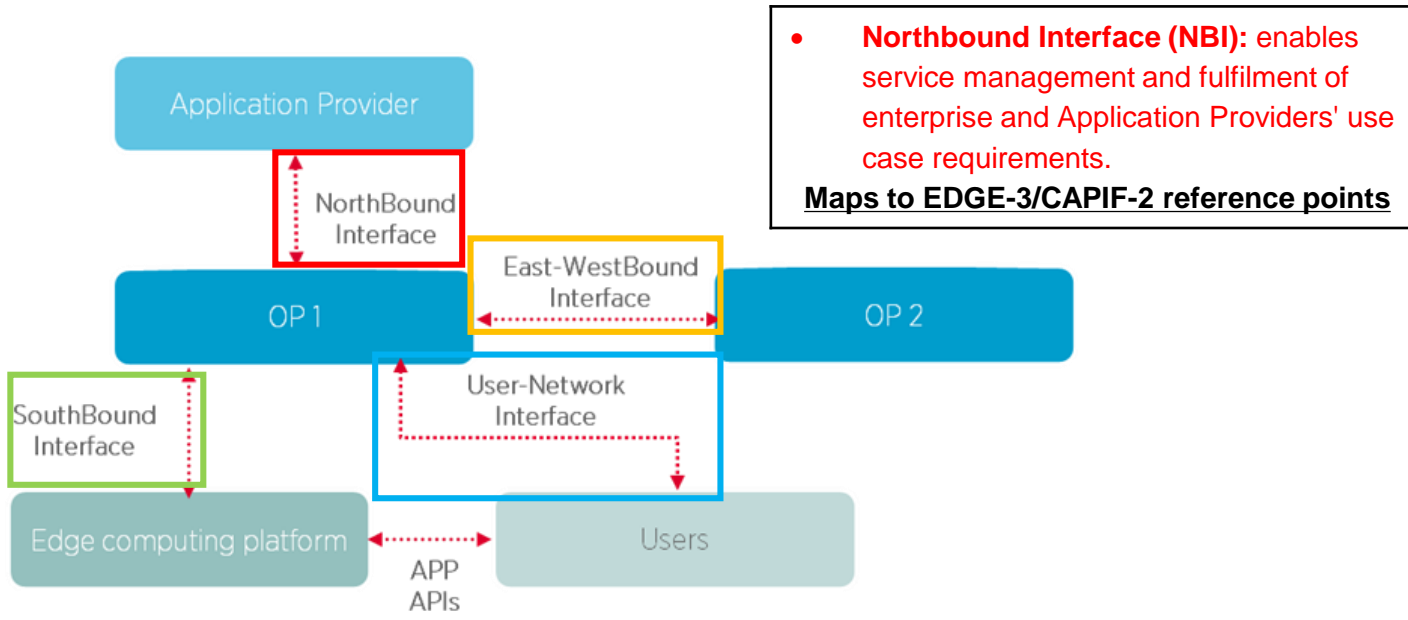
- **Northbound Interface (NBI):** enables service management and fulfilment of enterprise and Application Providers' use case requirements.
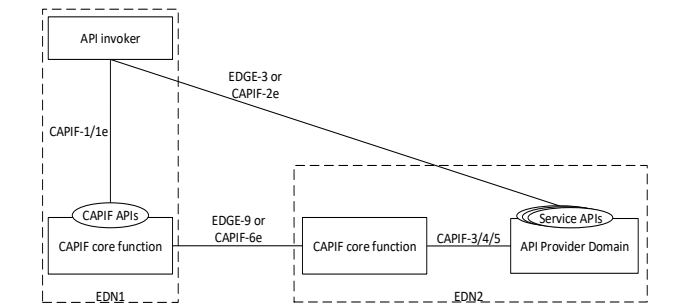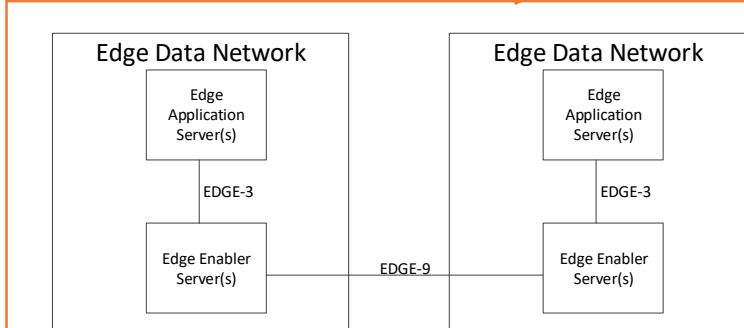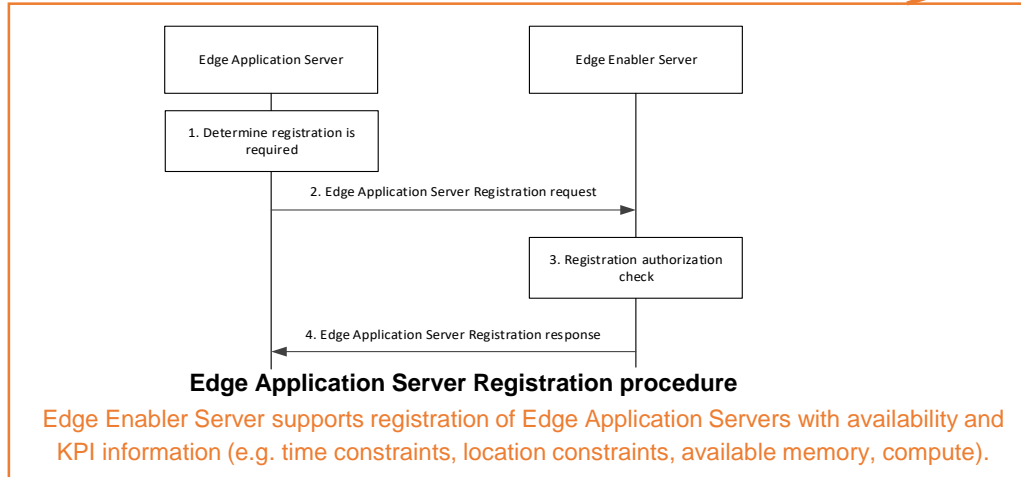 **Maps to EDGE-3/CAPIF-2 reference points**

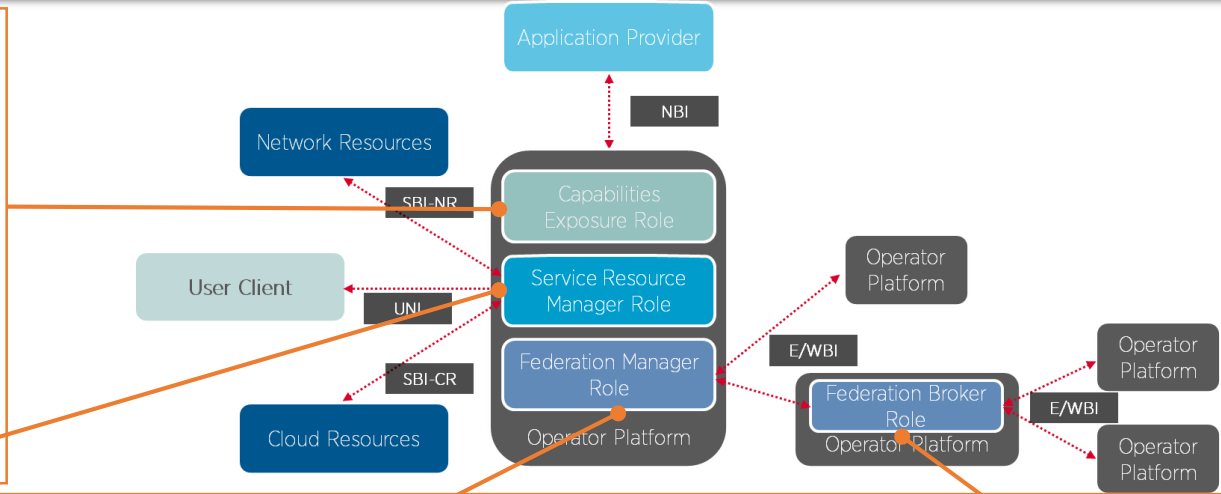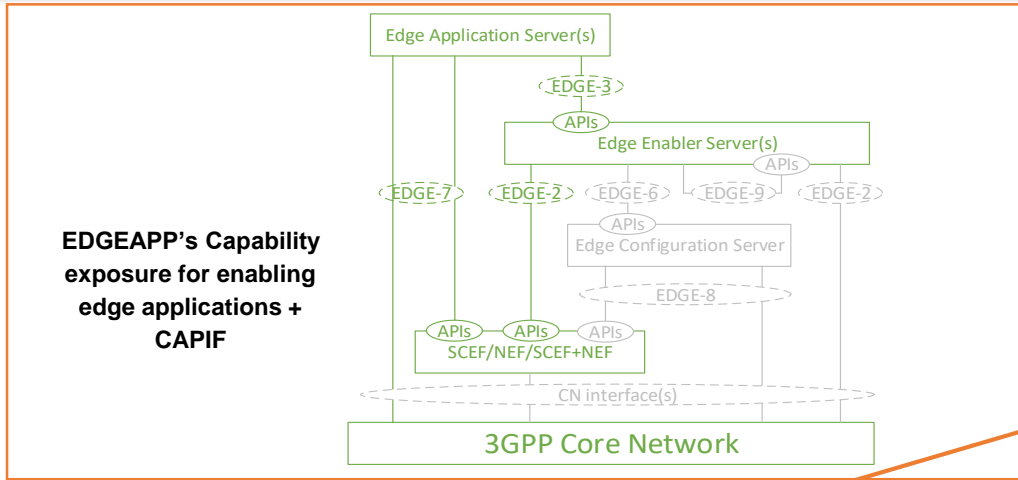OP: High-Level Reference Architecture
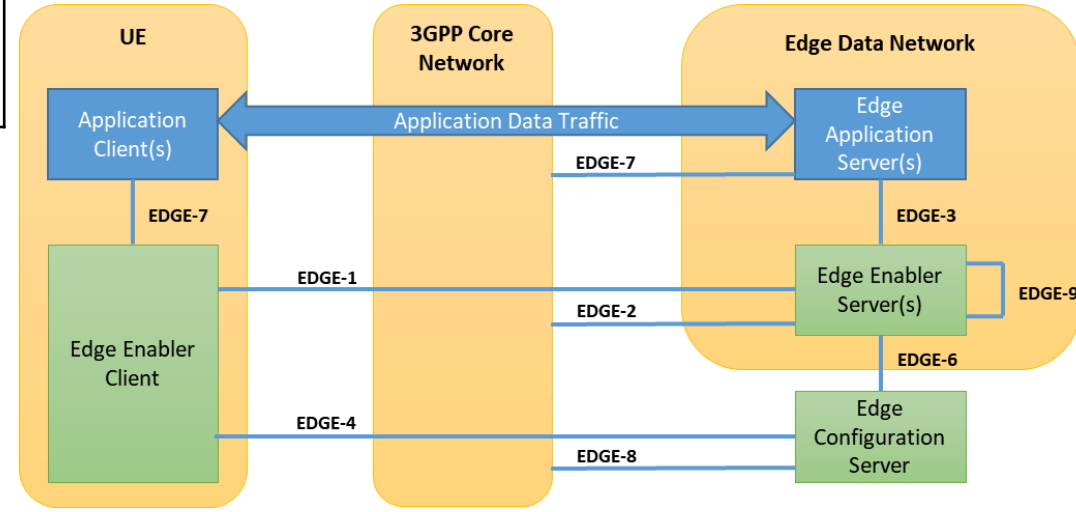
3GPP SA6: EDGEAPP Architecture

- **East/Westbound Interface (E/WBI):** the interface between instances of the OP that extend an operator's reach beyond their footprint.
  Maps to EDGE-9 reference point

- **User-Network Interface (UNI):** enables the User Client (UC) hosted in the user equipment to communicate with the OP.
 **Maps to EDGE-1/4 reference point**

- **Southbound Interface (SBI):** connecting the OP with the specific operator infrastructure that will deliver the network services and capabilities to the user.
  Maps to EDGE-2/7/8 reference points

OP Target Architecture & 3GPP SA6

EDGEAPP's Capability exposure for enabling edge applications + CAPIF

Edge Application Server Registration procedure

Edge Enabler Server supports registration of Edge Application Servers with availability and KPI information (e.g. time constraints, location constraints, available memory, compute).

Inter Edge Data Network interface

CAPIF interconnection with multiple CAPIF providers

- CAPIF interconnection allows API invokers of a CAPIF provider to utilize the service APIs from the 3rd party CAPIF provider.

- EDGE-9 reference point enables interactions between two Edge Enabler Servers that can be provided within different EDNs.

Conclusion – Big Picture!
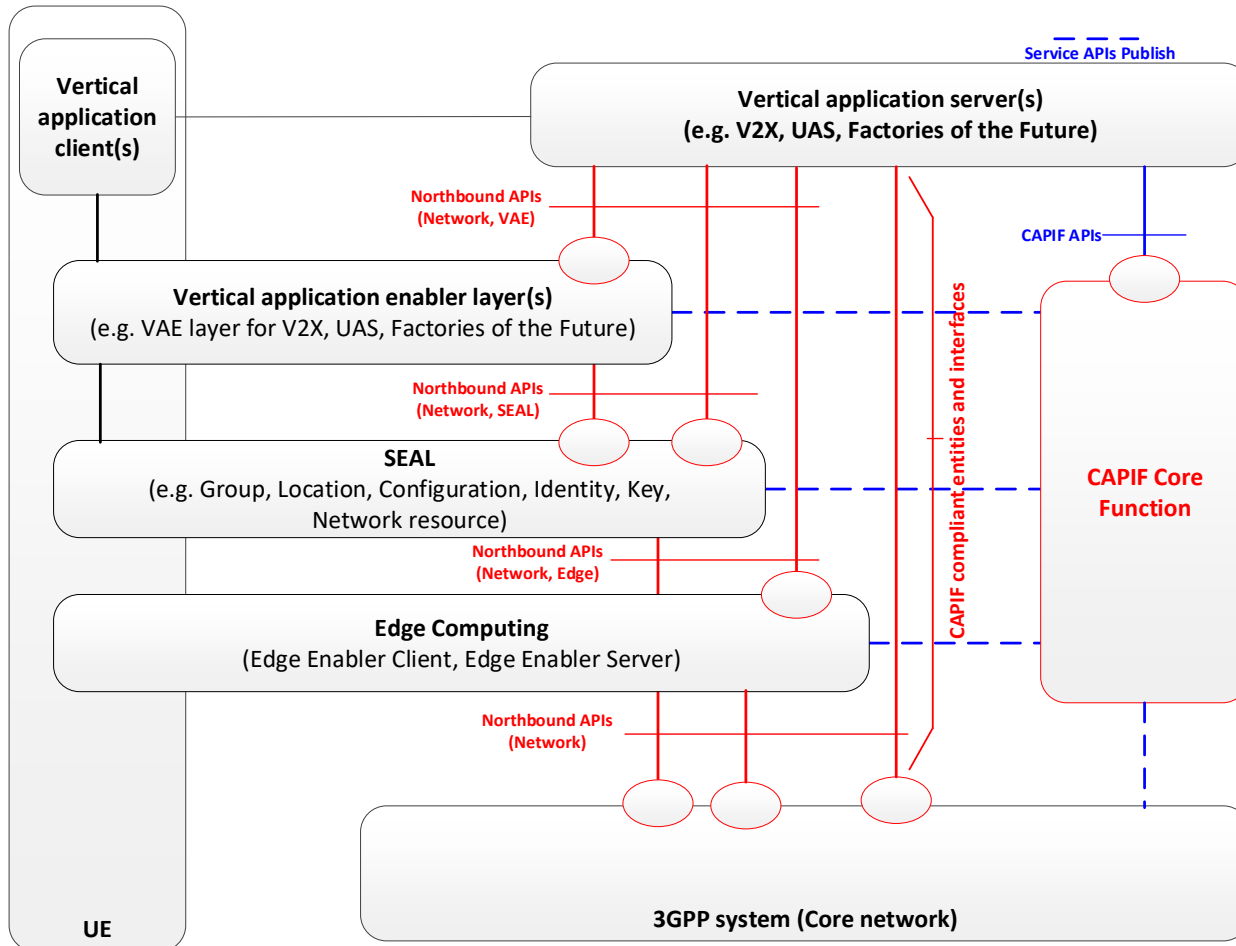
- SA6 membership and activities is increasing, thanks to the expansion of ToR

- 5G service framework initiatives (CAPIF, SEAL and EDGEAPP) has led to the rise of interest in SA6 within 3GPP community

- Ongoing focus on new vertical application enablers e.g. V2X, UAS, Factories of Future, MSGin5G

- SA6 activities map naturally to GSMA OPG efforts!

Thank You!

Suresh Chitturi
SA6 Chairman
s.chitturi@samsung.com