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Multi-access Edge Computing (MEC)
MEC 5G Integration

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Foreword

This Group Report (GR) has been produced by ETSI Industry Specification Group (ISG) Multi-access Edge Computing (MEC).

Modal verbs terminology

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1 Scope

The present document describes the key issues, solution proposals and recommendations for MEC integration into 3GPP 5G system. The following aspects are addressed: MEC System interactions with the 5G System, including the correspondence of the current MEC procedures to procedures available in 3GPP 5G system specification, options for the functional split between MEC and 5G Common API framework, realization of MEC as 5G Application Function(s).

In addition the present document addresses the scope and the preferred way of proceeding with the identified future technical work, as well as the identification of any missing 5G system functionality for MEC integration.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 123 501: "5G; System architecture for the 5G System (5GS) (3GPP TS 23.501 Release 16)".

[i.2] ETSI TS 123 502: "5G; Procedures for the 5G System (5GS) (3GPP TS 23.502 Release 16)".

[i.3] ETSI TS 129 522: "5G; 5G System; Network Exposure Function Northbound APIs; Stage 3 (3GPP TS 29.522 Release 16)".

[i.4] ETSI TS 123 222: "LTE; 5G; Common API Framework for 3GPP Northbound APIs (3GPP TS 23.222 Release 16)".

[i.5] ETSI GS MEC 003: "Multi-access Edge Computing (MEC); Framework and Reference Architecture".

[i.6] ETSI White Paper No. 28: "MEC in 5G networks".

[i.7] ETSI GR MEC 018: "Mobile Edge Computing (MEC); End to End Mobility Aspects".

[i.8] ETSI GS MEC 012: "Multi-access Edge Computing (MEC); Radio Network Information API".

[i.9] ETSI TS 129 571: "5G; 5G System; Common Data Types for Service Based Interfaces; Stage 3 (3GPP TS 29.571 Release 16)".

[i.10] ETSI GS MEC 011: "Multi-access Edge Computing (MEC); Edge Platform Application Enablement".

[i.11] ETSI TS 129 222: "5G; LTE; Common API Framework for 3GPP Northbound APIs (3GPP TS 29.222 Release 16)".

[i.12] ETSI GS MEC 001: "Multi-access Edge Computing (MEC); Terminology".

[i.13] ETSI GS MEC 016: "Multi-access Edge Computing (MEC); Device application interface".

[i.14] ETSI GS MEC 021: "Multi-access Edge Computing (MEC); Application Mobility Service API".

[i.15] ETSI TS 129 501: "5G; 5G System; Principles and Guidelines for Services Definition; Stage 3 (3GPP TS 29.501 Release 16)".

[i.16] ETSI GS MEC 009: "Multi-access Edge Computing (MEC); General principles, patterns and common aspects of MEC Service APIs".

[i.17] RIC Measurement Campaign application.

NOTE: Available at https://docs.o-ran-sc.org/projects/o-ran-sc-ric-app-mc/en/latest/overview.html.

[i.18] RIC Application Architecture.

NOTE: Available at https://wiki.o-ran-sc.org/display/RICA/Architecture.

[i.19] ETSI TS 129 514: "5G; 5G System; Policy Authorization Service; Stage 3 (Release 16)"5G; 5G System; Policy Authorization Service; Stage 3 (3GPP TS 29.514 Release 16)".

[i.20] ETSI TS 129 500: "5G; 5G System; Technical Realization of Service Based Architecture; Stage 3 (3GPP TS 29.500 Release 16)".

[i.21] ETSI TS 129 523: "5G; 5G System; Policy Control Event Exposure Service; Stage 3 (3GPP TS 29.523 Release 16)".

[i.22] IETF RFC 4122: "A Universally Unique IDentifier (UUID) URN Namespace".

NOTE: Available at https://tools.ietf.org/html/rfc4122.

[i.23] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".

NOTE: Available at https://tools.ietf.org/html/rfc3986.

[i.24] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

NOTE: Available at https://tools.ietf.org/html/rfc6749.

[i.25] ETSI GS MEC 002: "Multi-access Edge Computing (MEC); Phase 2: Use Cases and Requirements".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GS MEC 001 [i.12] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS MEC 001 [i.12] and the following apply:

5GC	5G Core network
5GS	5G System
AF	Application Function
AMF	Access and Mobility management Function
AS	Application Server
BM-SC	Broadcast Multicast-Service Center

BSF	Binding Support Function
CAPIF	Common API Framework for 3GPP northbound APIs
CCF	CAPIF Core Function
CU	Central Unit
DN	Data Network
DNAI	Data Network Access Identifier
DNN	Data Network Name
GPSI	Generic Public Subscription Identifier
LADN	Local Area Data Network
LBO	Local Break Out
MBMS	Multimedia Broadcast Multicast Service
NEF	Network Exposure Function
NF	Network Function
NRF	Network Repository Function
NSSAI	Network Slice Selection Assistance Information
PCC	Policy and Charging Control
PCF	Policy Control Function
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
R-NIB	Radio-Network Information Base
RIC	RAN Intelligent Controller
RNIS	Radio Network Information Service
RRM	Radio Resource Management
RSRP	Reference Signal Receive Power
RT	Real Time
RU	Radio Unit
SCEF	Service Capability Exposure Function
SMF	Session Management Function
SRv6	Segment Routing over IPv6
UDR	Unified Data Repository
UE	User Equipment
UL	UpLink
UL CL	UpLink CLassifier
UPF	User Plane Function

4 Overview

4.1 Introduction

The present document describes the key study areas in the MEC 5G integration.

Clause 4 provides the description of each identified study area.

Clause 5 contains all identified key issues and their related solution proposals.

Clause 6 contains evaluation of proposed solutions. Based on identified gaps, recommendations for further work are provided.

4.2 MEC interactions with 5GS

3GPP 5G system supports the exposure of network information and capabilities to external consumers. MEC as an Application Function (AF) may interact with the 5G system for the following reasons as specified in ETSI TS 123 501 [i.1], clause 6.2.10:

- to influence the application traffic routing decisions, including User Plane Function (UPF) (re)selections;
- to access the Network Exposure Function (NEF) for network capabilities;
- to interact with the policy framework for policy control.

AFs that are not allowed by the operator to access directly the target Network Functions (NFs) use the NEF for their interactions. These AFs can be termed as an untrusted AF, outside the trust domain of a network operator, as compared to a trusted AF or trusted Network Functions (NFs) that is inside the trust domain, e.g. owned or operated by a network operator. An untrusted AF may be owned and operated by operator external entities such as a cloud or edge service provider, a gaming service provider, etc. It is out of scope of the present document to define which kind of information may be exposed to MEC, as an untrusted AF, to support better operation while maintaining security and privacy of operator's network. While the NEF is used for untrusted AFs, a trusted AF may interface with the 5GS via NEF or interface directly with 5GS functions, such as SMF, etc.

The NEF is the 5G NF in charge of securely exposing the network capabilities and events to AFs and other consumers as defined in ETSI TS 123 501 [i.1], clause 6.2.5. External exposure can be categorized as monitoring capability, provisioning capability, and policy/charging capability. The details of the external exposure of the capabilities are defined in ETSI TS 123 502 [i.2]. The Restful APIs for capability exposure are defined in ETSI TS 129 522 [i.3].

An AF can get services from multiple NEFs and an NEF can provide service to multiple AFs. Any instance of an NEF may support only a subset or all of the available NEF functionality.

An NEF may support Common API Framework (CAPIF) functionality, and more specifically the CAPIF API provider domain functions, for external exposure ETSI TS 123 222 [i.4].

4.3 MEC platform in 5G common API framework

4.3.1 Integrating MEC and CAPIF

In 3GPP, there are multiple northbound API-related specifications (e.g. APIs for SCEF, API for the interface between MBMS service provider and BM-SC, and also the current most important APIs for NEF). To avoid duplication and inconsistency of approach between different API specifications, 3GPP has considered the development of a common API framework for 3GPP northbound APIs (CAPIF) that includes common aspects applicable to any northbound service APIs.

The functional model for the common API framework (CAPIF) is organized into functional entities to describe a functional architecture which enables an API invoker to access and invoke service APIs and supports API exposing functions in publishing the API towards the API invokers. The CAPIF functional model can be adopted by any 3GPP functionality providing service APIs.

The relationship between the MEC API framework and the CAPIF is shown in figure 4.3.1-1.

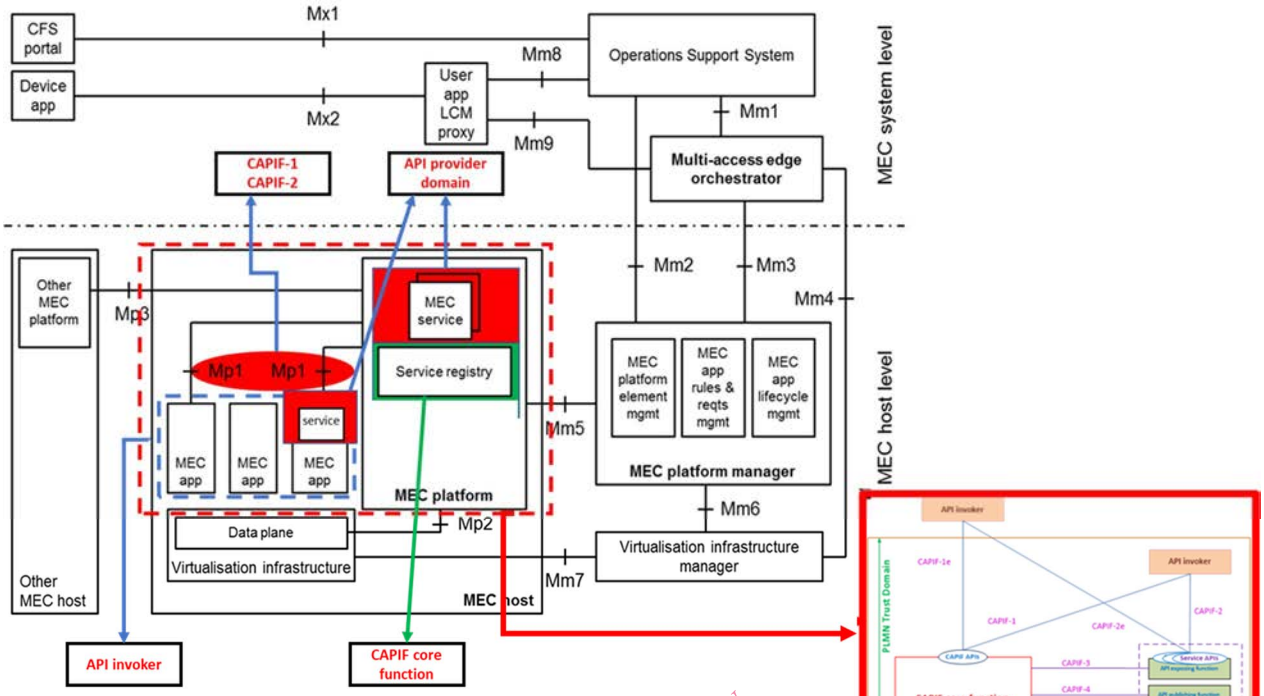

Figure 4.3.1-1: Relationship between MEC and 5G common API framework

MEC platform includes API-related platform functionality such as service registry. In addition the MEC platform can also expose MEC service APIs for consumption by MEC applications.

The API provider domain in CAPIF collectively represents the service APIs available for consumption in any 5G NF and any trusted 3rd party AF. A MEC service produced by a MEC application or the MEC platform can be mapped into the API provider domain in CAPIF.

A MEC application or MEC platform consuming a service is an API invoker in CAPIF.

The existing MEC platform functionality related to API enablement, can be mapped into the CAPIF core function.

The MEC platform also supports traffic rules control and DNS handling. These functionalities are outside the scope of CAPIF. Instead in 5GS the traffic rules control by an AF has been defined as a procedure between the AF and the SMF, possibly involving the NEF, as defined in ETSI TS 123 502 [i.2], clause 4.3.6.

4.3.2 Option #1: Providing access to MEC APIs via an external CAPIF instance

In this option, it is assumed that a MEC platform and a CAPIF deployment co-exist in the network, and that CAPIF API invokers want to access MEC services provided by the MEC platform or by MEC applications via the RESTful MEC service APIs.

In that case, the following applies:

- It needs to be possible to announce MEC APIs in CAPIF registry.
- It needs to be possible to use the CAPIF flavour of authorization when accessing MEC APIs. This might be realized via a gateway, or by updating the MEC API exposing functions to understand the CAPIF flavour of authorization.

This use case can be fulfilled by announcing the same service API redundantly in both the registry of the CAPIF core function in the network, and in the MP1 registries in the MEC platform(s).

NOTE 1: In MEC, location of the API producer matters. It has not been elaborated in the present document how to signal multiple instances of the same service available at different locations (e.g. different MEC platforms) when using CAPIF.

The following figure 4.3.2-1 illustrates the loosely coupled deployment.

The MEC reference point Mp1 supports publication of MEC services ("M-Publication"), discovery/announcement of MEC services ("M-Discovery") and further MEC application support ("Support") such as activation of traffic rules. The CAPIF core function supports publication ("C-Publication") and discovery ("C-Discovery") of CAPIF APIs.

The simplest integration possibility is to re-publish the MEC service APIs via CAPIF.

NOTE 2: Consumption/invocation of APIs is out of scope in this figure, but would need to be addressed separately.

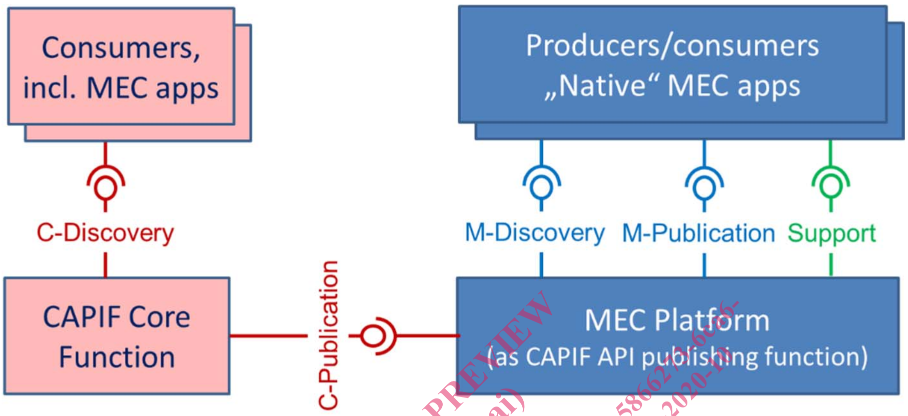

Figure 4.3.2-1: Loosely-coupled deployment of CAPIF and MEC

4.3.3 Option #2: CAPIF and MEC unified

In this option, it is assumed that a deployment exists that unifies MEC and CAPIF.

In such realization, CAPIF replaces those Mp1 parts that are overlapping with CAPIF (such as the MEC service registry of RESTful MEC services). The registry for the MEC services will be based on CAPIF; the same applies to authorization. The MEC platform can benefit from further CAPIF core function (CCF) support such as logging.

All invocations of RESTful APIs will be facilitated using CAPIF. This means that MEC applications would need to consume MEC APIs using CAPIF support and would need to support CAPIF's authorization. In addition, further MEC application support ("Support") is still provided. Figure 4.3.3-1 illustrates this option. The entity that exposes the interfaces is a deployment that combines capabilities defined for the MEC platform and capabilities defined for the CAPIF core function.

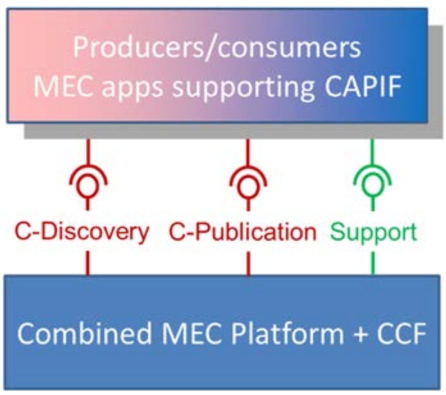

Figure 4.3.3-1: Fully-integrated hybrid deployment of CAPIF and MEC

Such a fully-integrated deployment would however not support the MEC concept of alternative transports; it would only apply to RESTful APIs. For additional support of alternative transports, a MEC service registry would still need to be supported. There is no need for redundancy, however, unlike in option #1 (clause 4.3.2), all RESTful service APIs are published and discovered via CAPIF; those services that are accessed via alternative transports are part of the MEC service registry.

Figure 4.3.3-2 illustrates a hybrid deployment.

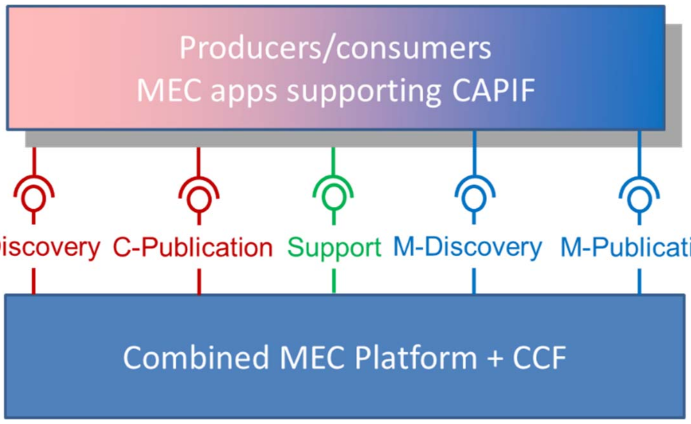

Figure 4.3.3-2: Hybrid deployment of CAPIF and MEC with support for MEC alternative transports

An alternative is the evolution of CAPIF by adding an extension mechanism, which would enable MEC to specify alternative transports as a MEC-specific CAPIF extension. Interaction with 3GPP is required for this.

4.4 MEC as Application Function(s) of 5G system

MEC system appears as an Application Function or Application Functions to a 5G system. This clause describes the study area for the MEC as an Application Function(s) of 5G system.

The MEC reference architecture is defined in ETSI GS MEC 003 [i.5]. MEC consists of functions at host level and system level. Host level functions include MEC Platform, MEC apps, and Virtualization Infrastructure. Host level management functions include MEC Platform Manager and Virtualization Infrastructure Manager. System level functions include MEC Orchestrator and OSS function. When MEC is integrated into the 5G system, the key definitions of MEC in ETSI GS MEC 003 [i.5] should be maintained.

The following examples illustrate the principle of MEC integration in the 5G system. An individual MEC application may appear as an AF to the 5G system. Similarly, a MEC platform that influences the traffic routing of the MEC application's traffic would appear as an AF to the 5G system. In yet another example the MEC orchestrator being notified of a UPF change would appear as an AF to the 5G system. These examples illustrate the principle of MEC as an AF; the 5G system exposes capabilities and information through a set of APIs to the AFs. Depending on the API in question the MEC AF may be represented by a different functional entities of the MEC system.

The MEC system has been defined and is deployed to enable application hosting in a secure, managed environment in the network. The impacts from the integration of MEC into a 5G system on MEC applications should be minimized. That is, the same functionality and APIs should be available for the application irrespective of the way how MEC has been deployed to avoid the need for deployment specific implementations of the same application.

Clause 5 of the present document contains the related key issues and proposed solutions.

4.5 Management of MEC applications in a 5G data network

The management of the MEC specific functionality of a particular MEC host and the applications running on it may be handled by the MEC management.