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Multi-access Edge Computing (MEC); Federation enablement APIs

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Foreword

This Group Specification (GS) 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 focuses on the functionalities enabled over the relevant reference points (i.e. Mfm and Mff) to support MEC federation. It describes the information flows, required information, and specifies the necessary operations, data models and API definitions. The present document carefully considers the relevant work of other industry bodies relating to MEC federation (e.g. GSMA OPG, 5GAA, etc.) and all relevant work done in ETSI.

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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 necessary for the application of the present document.

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

[2] IETF RFC 5246: "The Transport Layer Security (TLS) Protocol Version 1.2".

NOTE: Available at RFC 5246: The Transport Layer Security (TLS) Protocol Version 1.2 (rfc-editor.org).

[3] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3".

NOTE: Available at RFC 8446: The Transport Layer Security (TLS) Protocol Version 1.3 (rfc-editor.org).

[4] ETSI TS 133 210: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Network Domain Security (NDS); IP network layer security (3GPP TS 33.210)".

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] GSMA Permanent Reference Document: "Operator Platform Telco Edge Requirements", v1.0, June 2021.

NOTE: Available at https://www.gsma.com/futurenetworks/wp-content/uploads/2021/06/OPG-Telco-Edge-Requirements-2021.pdf.

[i.2] ETSI GR MEC 035: "Multi-access Edge Computing (MEC); Study on Inter-MEC systems and MEC-Cloud systems coordination".

[i.3] ETSI GS MEC 002: "Multi-access Edge Computing (MEC); Use Cases and Requirements".

[i.4] ETSI GS MEC 003: "Multi-access Edge Computing (MEC); Framework and Reference Architecture".

[i.5] ETSI GS MEC 011: "Multi-access Edge Computing (MEC); Edge Platform Application Enablement".

[i.6] ETSI GS MEC 010-2: "Multi-access Edge Computing (MEC); MEC Management; Part 2: Application lifecycle, rules and requirements management".

[i.7] OpenAPI™ Specification.

NOTE: Available at https://github.com/OAI/OpenAPI-Specification.

[i.8] ETSI GS MEC 009: "Multi-access Edge Computing (MEC); General principles, patterns and common aspects of MEC Service APIs".

[i.9] IETF RFC 4122: "A Universally Unique IDentifier (UUID) URN Namespace".

NOTE: Available at RFC 4122: A Universally Unique IDentifier (UUID) URN Namespace (rfc-editor.org).

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS MEC 001 [1] and the following apply:

App	Application
CHF	Charging Functions
CR	Cloud Resources
E/WBI	East/West Bound Interface
GSMA	GSM Association
MEF	MEC Federator
NBI	NorthBound Interface
NR	Network Resources
OP	Operator Platform
SBI	SouthBound Interface
UNI	User Network Interface

4 Overview

4.1 Introduction

The present document specifies Federation enablement APIs that enable the shared usage of MEC services and applications across different systems (e.g. MEC system, Cloud system).

Clause 4 introduces the relevant work of other industry bodies (e.g. GSMA OPG).

Clause 5 presents the reference scenarios for the MEC federation, and introduces the functionalities enabled via the relevant reference points (i.e. Mfm and Mff). It provides the high-level information flows and describes the necessary operations.

Clause 6 describes the data models that can be exchanged over the Federation enablement APIs, which provide detailed descriptions of all information elements used for MEC federation.

Clause 7 defines the actual Federation enablement APIs providing detailed information of how information elements are mapped into a RESTful API design.

4.2 GSMA Operator Platform and its interfaces

According to the GSMA Permanent Reference Document (PRD), "Operator Platform Telco Edge Requirements" [i.1], an Operator Platform (OP) is a facilitator of subscribers' seamless access to edge applications instantiated within a federation of edge networks involving multiple owners. Such seamless access is needed either when subscribers roam to visited networks or when a partner network is a better choice for edge application instantiation.

The objective of the OP concept is to guide the industry ecosystem, i.e. MNOs, vendors, OEMs and service providers towards shaping a common solution for the exposure of network capabilities. As an initial step, [i.1] provides both an end-to-end definition and requirements of the OP for the support of edge computing. In further details, the GSMA defines OP requirements as well as OP architecture and functional modules. Therefore, aim of GSMA is to engage with standardization and open source communities that will undertake the standard definition of the OP. As depicted in Figure 4.2-1, the following OP interfaces have been defined [i.1]:

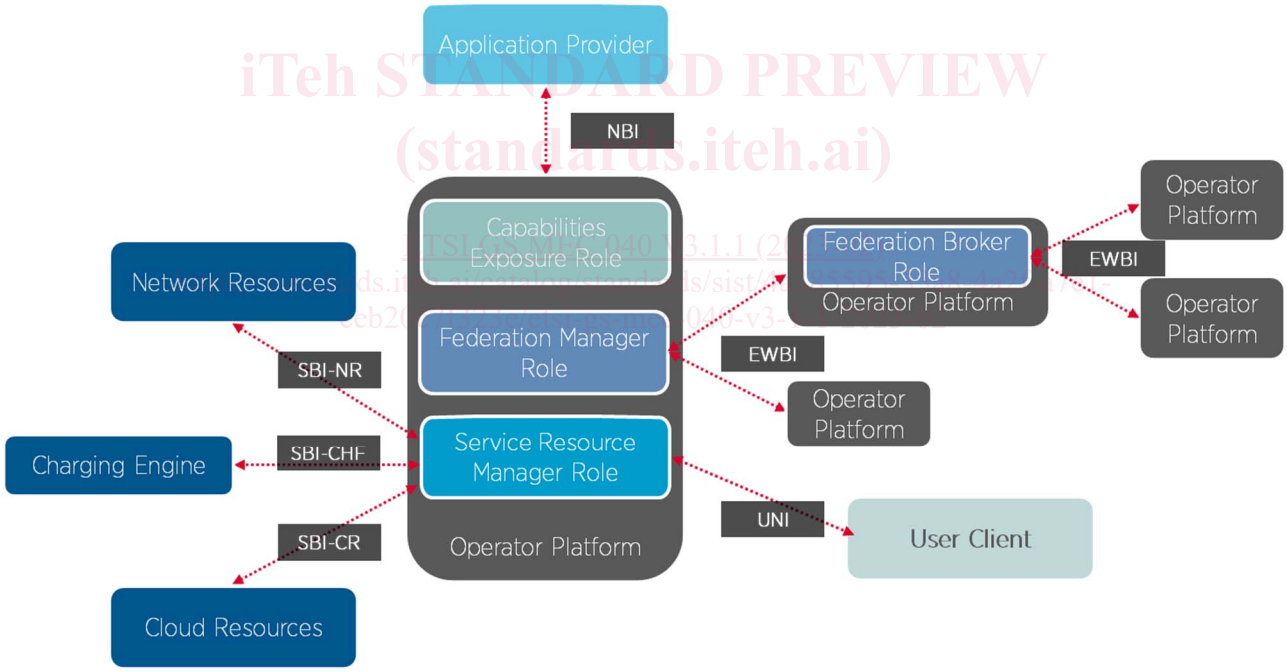

Figure 4.2-1: High-level OP reference architecture (source: [i.1])

- Northbound Interface (NBI)
- Southbound Interface (SBI); Cloud Resources (SBI-CR)
- Southbound Interface (SBI); Network Resources (SBI-NR)
- Southbound Interface (SBI); Charging Functions (SBI-CHF)
- User Network Interface (UNI)
- East/West Bound Interface (E/WBI)

5 Description of the services (informative)

5.1 Federation enablement service introduction

Federation enablement APIs offer services such as discovery, information exchange and application life cycle management to enable the inter-work of one MEC system with another MEC system. The related requirements were carefully studied and extracted from various use cases in ETSI GR MEC 035 [i.2] including V2X services scenario, multi-operator environment, Application instance transfer between a MEC system and a MEC/Cloud system, connecting different services, immersive AR game scenario, edge service delivery through visited network and edge node sharing.

The extracted requirements are listed as follows, summarized from ETSI GS MEC 002 [i.3].

- MEC system discovery ([Federation-02])
- MEC platform discovery ([Federation-03])
- Information exchange between MEC systems ([Federation-04])
- Information exchange between MEC platforms ([Federation-05])
- Support handling direct/indirect MEC system communication ([Federation-06])
- MEC application discovery ([Federation-07])
- MEC application on-boarding/instantiation ([Federation-08])
- Information exchange among MEC applications ([Federation-09])
- MEC service discovery ([Federation-10])

NOTE: Reusing the data models and APIs for MEC-Cloud coordination is considered if applicable, but its information flow is out of scope of the present document.

5.2 Sequence diagrams

5.2.1 Introduction

The rest of clause 5.2 introduces the following sequence diagrams based on the extracted requirements.

- Registration of MEC system(s) to the federation (clause 5.2.2.1)
- Discovery:
  - MEC system discovery (clause 5.2.2.2)
  - MEC application discovery (clause 5.2.2.3)
  - MEC service discovery (clause 5.2.2.4)
- Application package management and Application instance lifecycle management (clause 5.2.2.5)

NOTE 1: Support handling direct/indirect MEC system communication is satisfied by MEC Federator as defined in ETSI GS MEC 003 [i.4].

NOTE 2: The requirement for registration is based on the premise that multiple MEOs can register to a single MEF.

5.2.2 Request/Response model

5.2.2.1 Registration/Update/Deregistration of MEC system to the MEC federator

5.2.2.1.1 Registration

The registration information flow is used for enabling a MEO to register its MEC system information with a MEC Federator over Mfm reference point, as depicted in Figure 5.2.2.1.1-1.

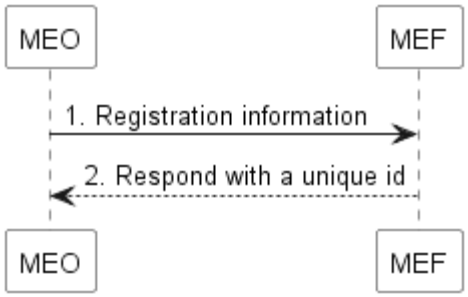

Figure 5.2.2.1.1-1: Information flow of Registration

Registration procedure consists of the following steps:

1) The MEO sends a registration request to the MEC federator.
2) The MEC federator responds with a unique ID among federation members.

5.2.2.1.2 Update

Information flow of update of MEC system(s) to the federation is depicted in Figure 5.2.2.1.2-1.

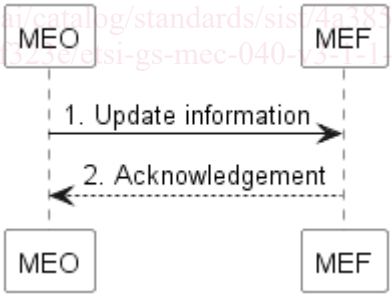

Figure 5.2.2.1.2-1: Information flow of Update

Update procedure consists of the following steps:

1) The MEO sends an update request to MEC Federator.
2) MEC Federator returns an acknowledgement to MEO.

5.2.2.1.3 Deregistration

Information flow of deregistration of MEC system(s) from the federation is depicted in Figure 5.2.2.1.3-1.

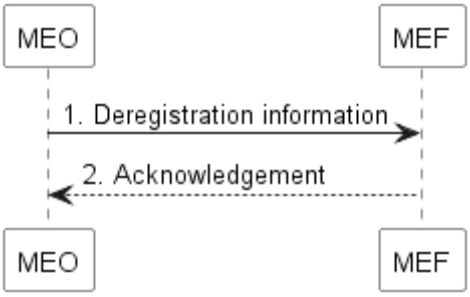

Figure 5.2.2.1.3-1: Information flow of Deregistration

Deregistration procedure consists of the following steps:

1) The MEO sends an update request to MEC Federator.

2) MEC Federator returns an acknowledgement to MEO.

5.2.2.2 MEC system discovery

Information flow of MEC system discovery is used for enabling MEO to be aware of another MEC system. MEC system discovery is the primitive and essential procedure for enabling the other functionalities relating to Feature MEC Federation. The information flow is depicted in Figure 5.2.2.2-1.

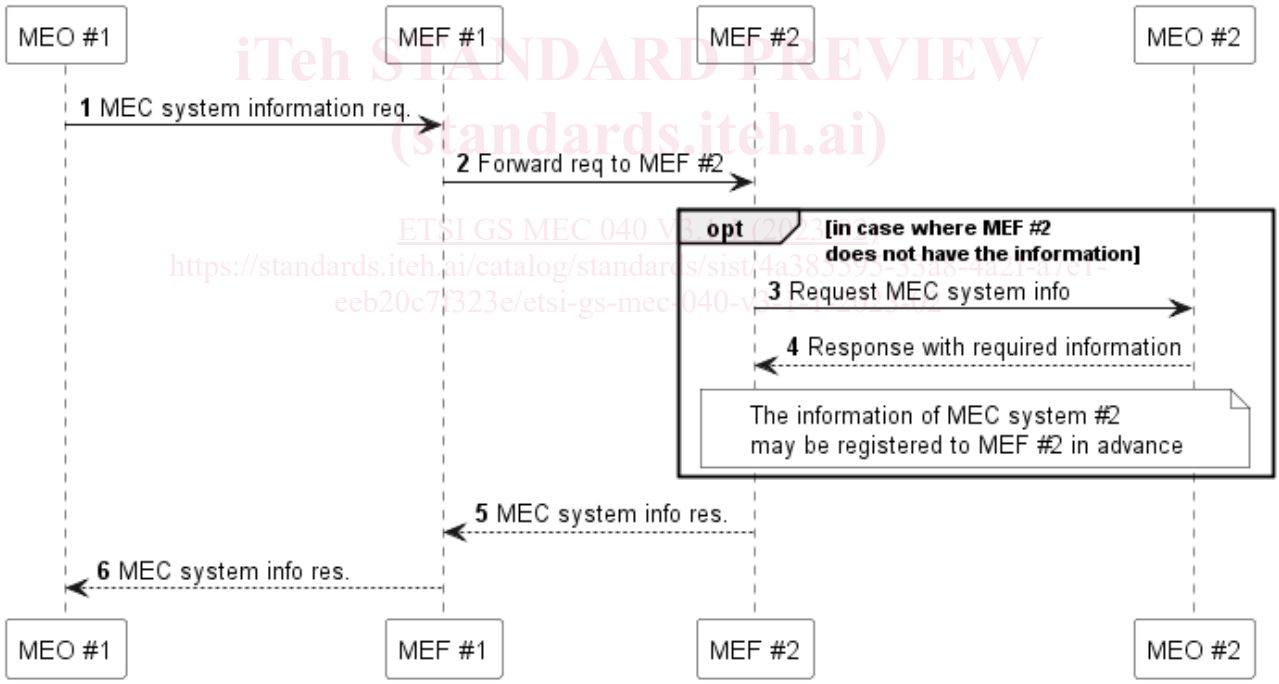

Figure 5.2.2.2-1: Information flow of MEC system discovery

As a prerequisite of this flow, MEC Federator Discovery is conducted among MEC Federators, which means MEC Federators are aware of each other in advance:

1) The MEO #1 sends a MEC system information request to MEC Federator #1 over Mfm reference point. This request is triggered by MEC platform or MEC Application instance.

2) MEC Federator #1 forwards the request to MEC Federator #2.

3) In case where MEC Federator #2 does not have the desired information (which means MEO #2 does not register its own information in advance), MEC Federator #2 sends a MEC system information request to MEO #2 over Mfm reference point.

4) MEO #2 responds with the information of its own system to MEC Federator #2.

5) MEC Federator #2 forwards the response to MEC Federator #1.

6) MEC Federator #1 forwards the response to MEO #1.

5.2.2.3 MEC application instance discovery

MEC application instance discovery refers to a process triggered by a MEC application instance, which discovers one or more MEC application instances in the MEC federation of the application from which it was instantiated. For example, the discovery may be based on information of a specific MEC application instance or of the corresponding application descriptor. This process is triggered, for instance, in the cases calling for MEC application instance-to-instance communication (e.g. neighbouring vehicles communicating with different MEC application instances may need to cooperate via those MEC application instances. grouped users communicating with different MEC application instances may need to communicate with each other via those MEC application instances, or grouped users may be gathered from different MEC systems and served by a single MEC application instance). The information flow is depicted in Figure 5.2.2.3-1.

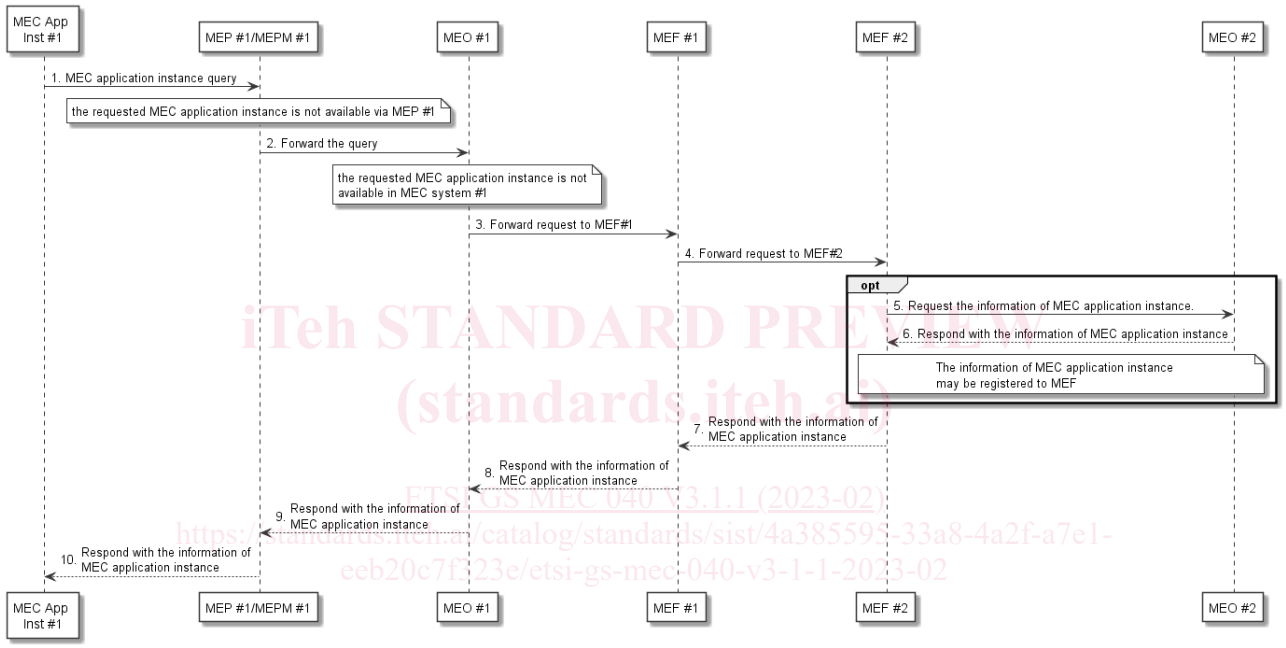

Figure 5.2.2.3-1: Information flow of MEC application discovery

Procedure of MEC application instance discovery consists of the following steps:

1) MEC application instance #1 sends a query to MEP #1 to discover a MEC application instance.

NOTE 1: MEC application instance #1 may know either the identifier of the requested application instance or identifier of application descriptor.

2) In the case where the desired MEC application instance is not available via MEP #1, MEP #1 forwards the query to MEO #1 via MEPM #1.

NOTE 2: How to handle the query between MEP #1 and MEO #1 is not further specified in the present document.

3) MEO #1 examines if the requested MEC application instance is available in MEC system #1. In case where the MEC application instance is not available in MEC system #1, MEO #1 forwards the query to MEF #1. Otherwise, go to step 9).

4) MEF #1 forwards the query to MEF #2.

5) If the information of MEC application instance, i.e. the list of active MEC application instances, is not registered to MEF #2, MEF #2 forwards the query to MEO #2.