



Mobile Edge Computing (MEC); Deployment of Mobile Edge Computing in an NFV environment

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Reference

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

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

Modal verbs terminology

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1 Scope

The present document describes solutions that allow the deployment of MEC in a NFV environment. For each solution, it describes the motivation for the solution, its architectural impacts and the necessary work to enable it. The document provides recommendations as for where the specification work needs to be done.

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 GS NFV-MAN 001: "Network Functions Virtualisation (NFV); Management and Orchestration".
- [i.2] ETSI GS NFV-INF 003: "Network Functions Virtualisation (NFV); Infrastructure; Compute Domain".
- [i.3] ETSI GS NFV-INF 004: "Network Functions Virtualisation (NFV); Infrastructure; Hypervisor Domain".
- [i.4] ETSI GS NFV-INF 005: "Network Functions Virtualisation (NFV); Infrastructure; Network Domain".
- [i.5] ETSI GS MEC 003: "Mobile Edge Computing (MEC); Framework and Reference Architecture".
- [i.6] ETSI GS NFV-IFA 013: "Network Functions Virtualisation (NFV); Management and Orchestration; Os-Ma-Nfvo reference point - Interface and Information Model Specification".
- [i.7] ETSI GS NFV-IFA 011: "Network Functions Virtualisation (NFV); Management and Orchestration; VNF Packaging Specification".
- [i.8] 3GPP TR 32.842: "Telecommunication management; Study on network management of virtualised networks".
- [i.9] ETSI GS NFV-IFA 009: "Network Functions Virtualisation (NFV); Management and Orchestration; Report on Architectural Options".
- [i.10] ETSI GS MEC 010-2: "Mobile Edge Computing (MEC); Mobile Edge Management; Part 2: Application lifecycle, rules and requirements management".
- [i.11] ETSI GS NFV-IFA 014: "Network Functions Virtualisation (NFV); Management and Orchestration; Network Service Templates Specification".
- [i.12] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

- [i.13] ETSI GS MEC 010-1: "Mobile Edge Computing (MEC); Mobile Edge Management; Part 1: System, host and platform management".
- [i.14] ETSI GS NFV-SOL 002: "Network Functions Virtualisation (NFV); Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point".
- [i.15] IETF RFC 6241: "Network Configuration Protocol (NETCONF)".
- [i.16] IETF RFC 8040: "RESTCONF Protocol".
- [i.17] ETSI GS MEC 002: "Mobile Edge Computing (MEC); Technical Requirements".
- [i.18] ETSI GS NFV-IFA 006: "Network Functions Virtualisation (NFV); Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification".
- [i.19] ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV); Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".
- [i.20] ETSI GS NFV-IFA 018: "Network Functions Virtualisation (NFV); Acceleration Technologies; Network Acceleration Interface Specification; Release 3".
- [i.21] OpenStack documentation, Service function chaining.
- NOTE: Available at: <https://docs.openstack.org/newton/networking-guide/config-sfc.html>.
- [i.22] ETSI GS NFV-SOL 005: "Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfvo Reference Point".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

ME app VNF: mobile edge application that appears like a VNF towards the ETSI NFV MANO components

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

DNS	Domain Name System
DOPFR	Dynamic Optimization of Packet Flow Routing
EM	Element Manager
ETSI	European Telecommunications Standards Institute
GS	Group Specification
GTP	GPRS Tunnelling Protocol
HOT	Heat Orchestration Template
IP	Internet Protocol
LCM	Life Cycle Management
MANO	Management and Orchestration
ME	Mobile Edge
MEAO	Mobile Edge Application Orchestrator
MEC	Mobile Edge Computing
MEO	Mobile Edge Orchestrator
MEPM	Mobile Edge Platform Manager
MEPM-V	Mobile Edge Platform Manager - NFV
NFP	Network Forwarding Path
NFV	Network Functions Virtualisation
NFVI	Network Functions Virtualisation Infrastructure
NFVO	Network Functions Virtualisation Orchestrator

NS	Network Service
NSD	Network Service Descriptor
OASIS	Organization for the Advancement of Structured Information Standards
OSS	Operations Support System
PM	Performance Management
PNF	Physical Network Function
PNFD	Physical Network Function Descriptor
PoP	Point of Presence
QCI	Quality Class Indicator
SFC	Service Function Chaining
SPID	Subscriber Profile ID
TEID	Tunnel Endpoint ID
TOSCA	Topology and Orchestration Specification for Cloud Applications
UE	User Equipment
VIM	Virtualised Infrastructure Manager
VL	Virtual Link
VM	Virtual Machine
VNF	Virtualised Network Function
VNFC	VNF Component
VNFD	VNF Descriptor
VNFFG	VNF Forwarding Graph
VNFM	Virtual Network Function Manager
YAML	YAML Ain't Markup Language

4 Introduction

Mobile network operators are expected to virtualise their networks using Network Functions Virtualisation (NFV), and want to use the introduced virtualisation infrastructure to consolidate network elements (Virtualised Network Functions - VNFs), Mobile Edge Computing (MEC) components and Mobile Edge (ME) applications on top of that infrastructure. Sharing the introduced elements (infrastructure, but also management functions) to the maximum possible degree allows to make maximum use of the investments into virtualisation. The present document will analyse different scenarios of MEC deployments in NFV environments w.r.t. their architectural impact and the needed specification work. The present document will help to identify normative specification work to enable MEC deployments in NFV environments. It will also help operators that plan to deploy MEC and NFV feature at the same time, to make the right decision by providing detailed information around solution aspects.

5 Reference Architecture

5.1 Overview and assumptions

This clause defines a reference architecture of how ETSI MEC can be deployed in a NFV environment. The basic assumptions are:

- 1) The ME platform is deployed as a VNF. For that purpose, the procedures defined by ETSI NFV are used. It is not expected that these procedures need to be modified for use with ETSI MEC. Clause 5.2 further elaborates on this.
- 2) The ME applications appear like VNFs towards the ETSI NFV MANO components. This allows re-use of ETSI NFV MANO functionality. It is, however, expected that ETSI MEC might not use the full set of MANO functionality, and requires certain additional functionality. Such a specific ME application is denoted by the name "ME app VNF" in the remainder of the present document.
- 3) The virtualisation infrastructure is deployed as a NFVI and its virtualised resources are managed by the VIM. For that purpose, the procedures defined by ETSI NFV Infrastructure specifications, i.e. ETSI GS NFV-INF 003 [i.2], ETSI GS NFV-INF 004 [i.3], ETSI GS NFV-INF 005 [i.4], can be used. It is not expected that these procedures need to be modified for use with ETSI MEC.

NOTE 2: The Mp1 reference point between an ME application and the ME platform is optional for the ME application, unless it is an application that provides and/or consumes a ME service (ETSI GS MEC 003 [i.5], Figure 6-1).

NOTE 3: The Mm3* reference point between MEAO and MEPM-V is based on the Mm3 reference point, as defined by ETSI GS MEC 003 [i.5]. Changes will be needed to this reference point to cater for the split between MEPM-V and VNFM (ME applications LCM).

The following new reference points (Mv1, Mv2 and Mv3) are introduced between elements of the ETSI MEC architecture and the ETSI NFV architecture to support the management of ME app VNFs. These are related to existing NFV reference points, but it is expected that only a subset of the functionality will be used for ETSI MEC, and that extensions may be necessary:

- **Mv1:** This reference point connects the MEAO and the NFVO. It is related to the Os-Ma-nfvo reference point, as defined in ETSI NFV.
- **Mv2:** This reference point connects the VNF Manager that performs the LCM of the ME app VNFs with the MEPM-V to allow LCM related notifications to be exchanged between these entities. It is related to the Ve-Vnfm-em reference point as defined in ETSI NFV, but will possibly include additions, and might not use all functionality offered by Ve-Vnfm-em.
- **Mv3:** This reference point connects the VNF Manager with the ME app VNF instance, to allow the exchange of messages e.g. related to ME application LCM or initial deployment-specific configuration. It is related to the Ve-Vnfm-vnf reference point, as defined in ETSI NFV, but will possibly include additions, and might not use all functionality offered by Ve-Vnfm-vnf.

The following reference points are used as they are defined by ETSI NFV:

- **Nf-Vn:** This reference point connects each ME app VNF with the NFVI.
- **Nf-Vi:** This reference point connects the NFVI and the VIM.
- **Os-Ma-nfvo:** This reference point connects the OSS and the NFVO. It is primarily used to manage NSs, i.e. a number of VNFs connected and orchestrated to deliver a service.
- **Or-Vnfm:** This reference point connects the NFVO and the VNFM. It is primarily used for the NFVO to invoke VNF LCM operations.
- **Vi-Vnfm:** This reference point connects the VIM and the VNFM. It is primarily used by the VNFM to invoke resource management operations to manage the cloud resources that are needed by the VNF. It is assumed in a NFV-based MEC deployment that this reference point corresponds 1:1 to Mm6.
- **Or-Vi:** This reference point connects the NFVO and the VIM. It is primarily used by the NFVO to manage cloud resources capacity.

5.3 Realization of the mobile edge platform as a VNF

It is assumed that the ME platform will be realized as a VNF and will be managed according to ETSI NFV procedures. It is not assumed that ETSI MEC needs to define any modification to this.

This means:

- the MEPM-V will act as the Element Manager (EM) of the ME platform VNF;
- a VNF Manager, according to ETSI NFV (e.g. Specific VNFM, Generic VNFM), is used to perform LCM of the ME platform VNF;
- the scope of the Mp2 reference point will need to be redefined. ETSI GS MEC 003 [i.5] states that this reference point is considered outside the scope of standardization but the introduction of the ME platform as a VNF introduces a potential multivendor deployment of the ME Platform VNF and the NFVI, which contains the Data Plane.

Figure 5.3-1 illustrates this set-up, mapping the applicable components into the ETSI NFV MANO architecture defined in ETSI GS NFV-MAN 001 [i.1].

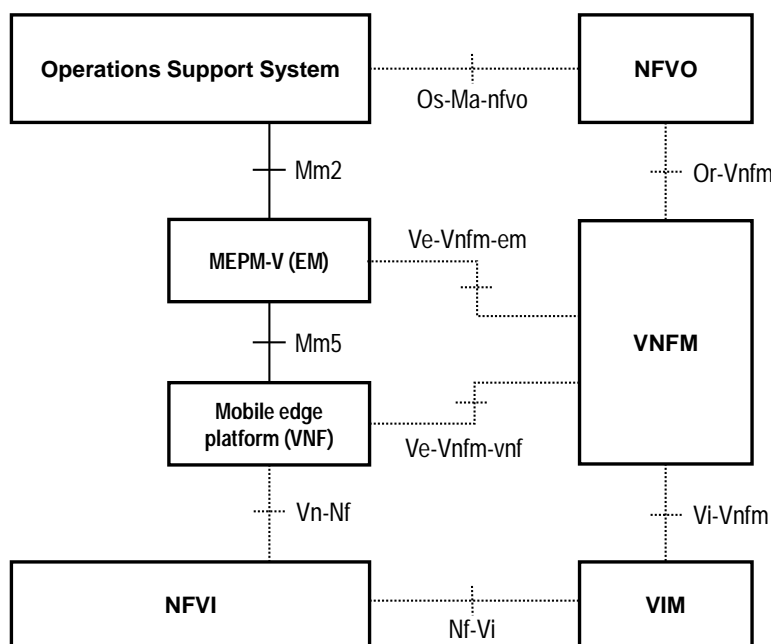


Figure 5.3-1: Management of the ME platform as a VNF

The following reference points are used as they are defined by ETSI NFV:

- **Ve-Vnfm-em:** This reference point connects the VNF Manager (VNFM) that manages the lifecycle of the ME platform with the Mobile Edge Platform Manager - NFV (MEPM-V). It is the Ve-Vnfm-em reference point as defined in ETSI NFV. Since the Mobile Edge Platform VNF is considered as a network function, it is not expected that there are any impacts to the Ve-Vnfm-em procedures as defined by ETSI NFV.
- **Ve-Vnfm-vnf:** This reference point connects the VNFM that manages the lifecycle of the ME platform with the Mobile Edge Platform VNF. It is the Ve-Vnfm-vnf reference point as defined in ETSI NFV. Since the Mobile Edge Platform VNF is considered as a network function, it is not expected that there are any impacts to the Ve-Vnfm-vnf procedures as defined by ETSI NFV.
- **Nf-Vn:** This reference point connects the Mobile Edge Platform VNF and the NFVI.
- **Nf-Vi:** This reference point connects the NFVI and the VIM.
- **Os-Ma-nfvo:** This reference point connects the OSS and the NFVO. It is primarily used to manage NSs, i.e. a number of VNFs connected and orchestrated to deliver a service.
- **Or-Vnfm:** This reference point connects the NFVO and the VNFM that manages the lifecycle of the ME platform. It is primarily used for the NFVO to invoke VNF LCM operations.
- **Vi-Vnfm:** This reference point connects the VIM and the VNFM that manages the lifecycle of the ME platform. It is primarily used by the VNFM to invoke resource management operations to manage the cloud resources that are needed by the VNF.
- **Or-Vi:** This reference point connects the NFVO and the VIM. It is primarily used by the NFVO to manage cloud resources capacity.

5.4 Realization of the Data Plane

When MEC is deployed in a NFV environment, there are two different possibilities to realize the Data Plane, both are valid and need to be supported.

Option 1: Realize the Data Plane as a PNF or VNF or combination thereof, and connect it to the NS that contains the ME app VNFs. In this option, Mp2 is kept as a MEC-internal reference point also in the NFV-based deployment of MEC; the option is agnostic to the way MEC is deployed.