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Mobile Edge Computing (MEC); Technical Requirements

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Foreword

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document specifies the requirements for Mobile Edge Computing with the aim of promoting interoperability and deployments. It contains normative and informative parts.

The present document also contains an annex describing example use cases and their technical benefits, for the purpose of deriving requirements.

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.

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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 MEC 001: "Mobile Edge Computing (MEC); Terminology".

[i.2] Mobile-Edge Computing - Introductory Technical White Paper. Sept. 2014.

NOTE: Available at https://portal.etsi.org/Portals/0/TBpages/MEC/Docs/Mobile-edge_Computing_-_Introductory_Technical_White_Paper_V1%2018-09-14.pdf.

[i.3] Flinck H. et al. (September 2015): "Mobile Throughput Guidance Inband Signaling Protocol, Internet draft, Internet Engineering Task Force".

NOTE: Available at <https://tools.ietf.org/html/draft-flinck-mobile-throughput-guidance-03> (Work in progress).

[i.4] ETSI GS NFV 002: "Network Functions Virtualisation (NFV); Architectural Framework".

[i.5] Byte Caching in Wireless Networks.

NOTE: Available at <http://researcher.ibm.com/researcher/files/us-aruni/ByteCachingicdcs2012.pdf>.

[i.6] A Protocol-Independent Technique for Eliminating Redundant Network Traffic.

NOTE: Available at <https://djw.cs.washington.edu/papers/spring-sigcomm00.pdf>.

[i.7] Sprecher N. et al.: "Requirements and reference architecture for Mobile Throughput Guidance Exposure, Internet draft, Internet Engineering Task Force", September 2015.

NOTE: Available at <https://tools.ietf.org/html/draft-sprecher-mobile-tg-exposure-req-arch-02> (Work in progress).

[i.8] Small Cells Forum White Paper SCF081: "Enterprise unified communications services with small cells".

NOTE: Available at http://www.scf.io/en/documents/081-Enterprise_unified_communications_services_with_small_cells.php.

[i.9] IEEE 1588™: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI GS MEC 001 [i.1] apply.

3.2 Abbreviations

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

API	Application Programming Interface
BYO	Bring Your Own
DSRC	Digital Short-Range Communications
EAB	Edge Accelerated Browser
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GTP	GPRS Tunnelling Protocol
HTTP	Hyper Text Transfer Protocol
IM	Instant Messaging
LAN	Local Area Network
NTP	Network Time Protocol
PBX	Private Branch Exchange
PTP	Precision Time Protocol
QCI	Quality Class Indicator
QoE	Quality of Experience
RAT	Radio Access Technology
SLA	Service Level Agreement
SMS	Short Message Service
SPID	Subscriber Profile ID
TCP	Transmission Control Protocol
TEID	Tunnel Endpoint ID
VNF	Virtualised Network Function

4 Generic principles

4.1 Introduction

The following principles are important to understand in the context of Mobile Edge Computing.

4.2 NFV alignment

Mobile Edge Computing uses a virtualisation platform for running applications at the mobile network edge. Network Functions Virtualisation (NFV) provides a virtualisation platform to network functions. The infrastructure that hosts their respective applications or network functions is quite similar.

In order to allow operators to benefit as much as possible from their investment, it would be beneficial to reuse the infrastructure and infrastructure management of NFV to the largest extent possible, by hosting both VNFs (Virtual Network Functions) and mobile edge applications on the same or similar infrastructure. Subject to gap analysis, this might require a number of enhancements (e.g. regarding the sharing of resources with NFV Management and Orchestration, etc.).

4.3 Mobility support

Mobility is an essential functionality of 3GPP networks. Most devices connected to a 3GPP network are moving around within the mobile network. Even fixed devices can "move", especially when located at cell edge, but also when changing RATs, etc., or during exceptional events (e.g. power cut from a base station, etc.).

Some mobile edge applications are state-independent and do not need to keep state information related to the UEs they are serving. For example, an application in the category "network performance and QoE improvements" will only improve the performance of the UE traffic when the traffic goes through that mobile edge host. When the UE moves to a different location covered by another mobile edge host, it will be the application hosted on that mobile edge host that will take care of the UE after a brief transition period. Past interaction is not useful for the application.

Other mobile edge applications, notably in the category "consumer-oriented services", are specifically related to the user activity. Either the whole application is specific to the user, or at least it needs to maintain some application-specific user-related information that needs to be provided to the instance of that application running on another mobile edge host.

As a consequence of UE mobility, the mobile edge system needs to support the following:

- continuity of the service;
- mobility of application (VM); and
- mobility of application-specific user-related information.

4.4 Deployment independence

For reasons of performance, costs, scalability, operator preferred deployments, etc., different deployment scenarios need to be supported:

- deployment at the radio node;
- deployment at an aggregation point;
- deployment at the edge of the Core Network (e.g. in a distributed data centre, at a gateway);
- etc.

In order to fulfil all these deployment options, the framework of the MEC architecture needs to allow all these scenarios and the requirements need to be able to address all these deployment options. Requirements that cannot be fulfilled for all deployment options cannot be made mandatory, but might be conditional or optional.

When a mobile edge platform is deployed on a host located in a cell aggregation site, mobile edge services running on that platform might need to retrieve information from the radio node(s), for instance, to readout the traffic load and resource block usage of a specific cell.

In order to prevent the illegal access from dishonest terminals and mobile edge application developers, authentication and secure tunnel communication are necessary between the radio node(s) and the mobile edge service.

NOTE: The interface between the radio node(s) and the mobile edge service is not specified in Mobile Edge Computing Group Specifications.

4.5 Simple and controllable APIs

In order to enable the development of a strong ecosystem for Mobile Edge Computing, it is very important to develop APIs that are as simple as possible and are directly answering the needs of applications. To the extent this is possible, Mobile Edge Computing specifications need to reuse existing APIs that fulfil the requirements.

In particular circumstances, operators might need to be able to control dynamically the access to certain APIs by a mobile edge application. Examples include the mitigation of high load of a radio node or mobile edge host, or when the information of a specific radio node or cell cannot be provided.

4.6 Smart application location

Mobile edge applications have a number of requirements, in terms of computing, storage and network resources. More importantly, some applications might have requirements in terms of latency (including latency fairness), etc.

For a certain number of mobile edge applications, the conditions might evolve over time and require the mobile edge system to change the location of the application, e.g. as the UEs are moving from cell to cell.

Also, different locations may have different "costs" (in terms of resource availability, etc.), and it might not be always the best choice to run a mobile edge application at the "best" location (to the detriment of other applications).

For these reasons, mobile edge applications need to run "at the right place" at the right moment, and might have to move when the conditions evolve. In order to support this, the mobile edge system needs to provide a system-wide lifecycle management of applications.

4.7 Representation of features

The present document describes requirements towards the framework and architecture of Mobile Edge Computing.

In addition to the definition of requirements applicable to all deployments, this specification introduces the concept of features in order to cater for the different needs of different deployments. A feature is defined as a group of related requirements and is assigned a unique name.

Support for a feature can be mandatory, optional or conditional. Where feature level support is optional or conditional, all other requirements (mandatory or optional) related to that feature are themselves dependent upon support for the feature itself.

The following example illustrates an optional feature with a conditional mandatory and a conditional optional requirement.

EXAMPLE: [Req-1] The Mobile edge system may support a feature called XYZ.
 [Req-2] When the Mobile edge system supports the feature XYZ, the system shall...
 [Req-3] When the Mobile edge system supports the feature XYZ, the system may...

The architectural framework needs to support mechanisms to identify whether a specific feature is supported. Such information might need to be considered when executing certain tasks, such as the instantiation of an application.

5 Generic requirements

5.1 Requirements on the framework

[Framework-01] The design of the mobile edge system should attempt to reuse the NFV virtualisation infrastructure and its management functionality, as described in the NFV architecture framework in ETSI GS NFV 002 [i.4], possibly with some enhancements. Concepts that have been developed or studied in NFV Group Specifications and that are needed for Mobile Edge Computing should be reused whenever possible. This might require some enhancements specific to Mobile Edge Computing.

[Framework-02] It shall be possible to enable the deployment of mobile edge applications on the same infrastructure as ETSI NFV-based VNFs.

[Framework-03] It shall be possible to deploy the mobile edge platform on mobile edge hosts in various locations, including radio nodes, aggregation points, gateways, and in a distributed data centre at the edge of the Core Network.

NOTE: Some requirements might not be fulfilled by certain deployment options.

5.2 Application lifecycle

[Lifecycle-01] The mobile edge host shall be available for the hosting of mobile edge applications.

[Lifecycle-02] The mobile edge management shall support the instantiation of an application on a mobile edge host within the mobile edge system.

[Lifecycle-03] The mobile edge management shall support the instantiation of an application on a mobile edge host when required by the operator. This may be in response to a request by an authorized third-party.

[Lifecycle-04] The mobile edge management shall support the termination of a running application when required by the operator. This may be in response to a request by an authorized third-party.

[Lifecycle-05] The mobile edge management shall be able to identify which features and mobile edge services a mobile edge application requires to run, and which additional features and mobile edge services it can use if available.

NOTE 1: This allows the mobile edge system to decide whether and on which mobile edge host to instantiate the application.

[Lifecycle-06] The mobile edge management shall be able to identify which features and mobile edge services are available on a particular mobile edge host.

NOTE 2: This allows the mobile edge management to decide whether a particular application can be instantiated on that host.

5.3 Applications environment

The applications environment describes the security, packaging and run-time environment models for hosting mobile edge applications on the mobile edge host.

[AppEnvironment-01] It shall be possible to deploy mobile edge applications on different mobile edge hosts in a seamless manner, without a specific adaptation to the application.

[AppEnvironment-02] The mobile edge management shall be able to verify the authenticity of a mobile edge application.

[AppEnvironment-03] The mobile edge management shall be able to verify the integrity of a mobile edge application (integrity protection).

5.4 Support of mobility

[Mobility-01] The mobile edge system shall be able to maintain connectivity between a UE and an application instance when the UE performs a handover to another cell associated with the same mobile edge host.

[Mobility-02] The mobile edge system shall be able to maintain connectivity between a UE and an application instance when the UE performs a handover to another cell not associated with the same mobile edge host.

[Mobility-03] The mobile edge platform may use available radio network information to optimize the mobility procedures required to support service continuity.

EXAMPLE: Using UE mobility information to optimize the handling of mobility events by the application (see clause 6.2.2, Connectivity) and of application mobility (see clause 6.3.2, Feature *SmartRelocation*).

6 Services requirements

6.1 General

The mobile edge platform on a mobile edge host provides a framework for delivering mobile edge services and platform essential functionality to mobile edge applications running on the mobile edge host.

A mobile edge service is provided and consumed. Both the mobile edge platform itself and authorized mobile edge applications can provide services. Similarly, both the mobile edge platform itself and authorized mobile edge applications can consume services.

In some cases, and especially in a multi-vendor environment, the service can be provided concurrently by multiple sources. This allows the platform or the applications consuming the service to receive all information required for executing their tasks.

Many of the applications require accurate time information synchronized to the time domain of the operator or application provider. Such applications require exact time of specific events occurrence for analytics information collection and pre-processing, time tagging of the location information, synchronized time intervals for the SLA throughput reports, platform performance monitoring for latency and response times and many others.

Since the platform is located in the synchronized environment required for the mobile network operation, accurate time of day information can be delivered to the platform by the same means as it is provided to the mobile Base Stations. Known techniques include usage of GNSS receivers, running IEEE 1588™ [i.9] PTP protocol, NTP protocol or a combination of the above.

The mobile edge platform will have a means to acquire accurate Time of Day information and make this information available to the hosted applications.

6.2 Platform essential functionality

6.2.1 Mobile edge services

[Services-01] The mobile edge platform shall have the capability to provide mobile edge services that can be consumed by authorized mobile edge applications.

[Services-02] The mobile edge platform shall allow authorized mobile edge applications to provide services that can be consumed by the platform or by authorized mobile edge applications running on the mobile edge host.

NOTE 1: Providing a service by an application to the mobile edge platform includes that the platform can receive information from that application. This information can be used by the mobile edge platform to provide other services.

[Services-03] The mobile edge platform shall provide functionality to allow authorized mobile edge applications to communicate with mobile edge services provided by the platform.

[Services-04] The mobile edge platform shall allow authentication and authorization of providers and consumers of mobile edge services.