ETSI GR MEC-DEC 025 V2.1.1 (2019-06)

Multi-access Edge Computing (MEC); MEC Testing Framework

Disclaimer

The present document has been produced and approved by the Multi-access Edge Computing (MEC) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG.
It does not necessarily represent the views of the entire ETSI membership.

Reference
DGR/MEC-DEC25TestingFramework

Keywords
MEC, testing

ETSI

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
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Copyright Notification

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

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

Modal verbs terminology

In the present document "**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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document lists the functionalities and capabilities required by a MEC compliant implementation. In addition, the present document specifies a testing framework defining a methodology for development of interoperability and/or conformance test strategies, test systems and the resulting test specifications for MEC standards. In additional, the testable requirements are listed and prioritized.

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 MEC 012: "Multi-access Edge Computing (MEC); Radio Network Information API".

[i.2] ETSI GS NFV-TST 002: "Network Functions Virtualisation (NFV); Testing Methodology; Report on NFV Interoperability Testing Methodology".

[i.3] ETSI GS MEC 003: "Multi-access Edge Computing (MEC); Framework and Reference Architecture".

[i.4] ISO/IEC 9646-7:1995: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".

NOTE: Available at https://www.iso.org/standard/3084.html.

[i.5] ISO/IEC 9646-1:1994: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 1: General concepts".

NOTE: Available at https://www.iso.org/standard/17473.html.

[i.6] TTCN-3 abstract test language.

NOTE: Available at http://www.ttcn-3.org/index.php/downloads/standards.

[i.7] ETSI GS MEC 002: "Multi-access Edge Computing (MEC); Phase 2: Use Cases and Requirements".

[i.8] ETSI GS MEC 010-1: "Mobile Edge Computing (MEC); Mobile Edge Management; Part 1: System, host and platform management".

[i.9] ETSI GS MEC 010-2: "Multi-access Edge Computing (MEC); MEC Management; Part 2: Application lifecycle, rules and requirements management".

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

[i.11] ETSI GS MEC 013: "Multi-access Edge Computing (MEC); Location API".

[i.12] ETSI GS MEC 014: "Mobile Edge Computing (MEC); UE Identity API".

[i.13] ETSI GS MEC 015: "Mobile Edge Computing (MEC); Bandwidth Management API".

[i.14] ETSI GS MEC 016: "Multi-access Edge Computing (MEC); UE application interface".

[i.15] ETSI Test Description Language.

NOTE: Available at https://tdl.etsi.org/index.php/downloads.

[i.16] ETSI GS MEC 001: "Multi-access Edge Computing (MEC); Terminology".

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.16] and the following apply:

certification/compliance assessment: major goal of a compliance assessment is to ensure the interoperability of implementations, and the conformance of implementations to the standard

conformance testing: purpose of conformance testing is to determine to what extent a single implementation of a particular standard conforms to the individual requirements of that standard

interoperability testing: purpose of interoperability testing is to prove that end-to-end functionality between (at least) two communicating systems is as required by the standard(s) on which those systems are based

Test Case (TC): complete and independent specification of the actions required to achieve a specific Test Purpose

NOTE: TCs are written in testing languages, e.g. TTCN-3.

Test Descriptions (TD): specify the sequence of actions required to realize the verdict identified in the TP and are primarily intended for use in interoperability test specifications

NOTE: However, in some instances, particularly where there is a considerable difference in complexity between the TPs and the TCs, it is worthwhile adding TDs as an extra design stage in a conformance test specification.

Test Purpose (TP): should be written for each potential test of each identified requirement

NOTE: A TP defines in broad terms what the goal of a particular test should be. A TP is defined in prose.

test suite: collection of Test Cases

testing framework: provides guidance for development of conformance and interoperability test strategies, test systems and the resulting test specifications

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS MEC 001 [i.16] and the following apply:

API	Application Programming Interface
ATM	Abstract Test Method
ATS	Abstract Test Suite
BWMS	BandWidth Management Service
CON	CONformance

CRS	Conformance Requirement Statements
DUT	Device Under Test
FUT	Function Under Test
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
ICS	Implementation Conformance Statement
IFS	Interoperability Feature Statement
IOP	InterOPerability
IUT	Implementation Under Test
MEH	MEC Host
OAM	Operations And Maintaince
PDU	Packet Data Unit
PICS	Protocol Implementation Conformance Statement
PLMN	Public Land Mobile Network
RAB	Radio Access Bearer
RNI	Radio Network Information
RNIS	RNI Service
RP	Reference Point
SAQ	Service Availability Query
SUT	System Under Test
TC	Test Case
TCP	Transmission Control Protocol
TDL	Test Description Lanaguage
TP	Test Purpose
TSS	Test Suite Structure
TTCN	Testing and Test Control Notation
URI	Uniform Resource Identifier

4 Testing Methodology Guidelines for MEC

4.1 Introduction

Clause 4 provides:

- Identification of the implementations under test (IUT) for conformance testing and the device under test (DUTs) for interoperability, i.e. answering the question "what is to be tested".
- Definition of the applicable test procedures, i.e. answering the question "how is it to be tested".
- Definition of the procedure for development of test specifications and deliverables (for instance: Test Purposes (TP) in case of conformance testing and Test Descriptions (TD) in case of interoperability testing, documentation, etc.).

The MEC testing framework contains:

- a documentation structure:
  - catalogue of capabilities/features/functions (PICS or IFS);
  - Test Suite Structure (TSS);
  - individual tests in the form of TPs (Conformance) or TDs (Interoperability);
- a methodology linking the individual elements of a test specification together:
  - style guidelines and examples;
  - naming conventions;
  - a structured notation for TPs or TDs.

4.2 Basic concepts for conformance and interoperability testing

Conformance Testing and Interoperability Testing are the two main and complementary testing methodologies to test devices implementing standardized services [i.2]. These two testing methodologies also apply to MEC.

The basic concepts for Conformance Testing and Interoperability Testing are defined as follows:

- **Conformance Testing** can show that a product correctly implements and meets the requirements in the ETSI ISG MEC standards, which will include testing protocol message contents and formats as well as the permitted sequence of messages for the interfaces defined by ETSI ISG MEC standards.

- **Interoperability Testing** can demonstrate that a product will work with other alike products. It proves that **end-to-end functionality** between (at least) two functional elements is as required by the ETSI MEC standards on which those functions are based.

For more details about the basic concepts for conformance and interoperability testing, please refer to clause 4.1 of ETSI GS NFV-TST 002 [i.2].

4.3 Conformance Test Specifications

4.3.1 Introduction

Clause 4.3 explains how to apply the MEC conformance testing methodology in order to properly produce MEC conformance test specifications.

The conformance testing can show that a product correctly implements a particular standardized protocol, that is, it establishes whether or not the implementation under test meets the requirements specified for the protocol itself.

EXAMPLE: The scope of the testing is on protocol message content, format as well as the permitted sequences of messages. In that context, tests are performed at open standardized interfaces that are not (usually) accessible to an end user, and executed by a dedicated test system that has full control of the system under test and the ability to observe all incoming and out coming communications; the high degree of control of the test system over the sequence and contents of the protocol messages allows to test both valid and invalid behaviour.

Figure 4.3.1-1: Conformance testing

Conformance test specifications should be produced following the methodology described in ISO/IEC 9646-1 [i.5]. In summary, this methodology begins with the collation and categorization of the features and options to be tested into a tabular form which is normally referred to as the "Implementation Conformance Statement" (ICS). All implemented capabilities supported by the Implementation Under Test (IUT) are listed by the implementer in the ICS, so that the tester knows which options have to be tested. This ensures that complete coverage is obtained.

The next step is to collect the requirements from the specification that is tested. For each requirement, one or more tests should be identified and classified into a number of groups which will provide a structure to the overall test suite (TSS).

A brief Test Purpose (TP) should then be written for each identified test and this should make it clear what is to be tested but not how this should be done. Finally, a detailed Test Case (TC) is written for each TP. In the interests of test automation, TCs are usually combined into an Abstract Test Suite (ATS) using a specific testing language such as TTCN-3 or others. The TCs in the ATS are then "Verified" against a number of IUTs for correct operation according to some agreed procedures, before being released for use by the industry.

In summary, the MEC Conformance Testing methodology consists of:

- Selection of Implementations Under Test (IUT).
- Identification of reference points.

- Development of test specifications, which includes:
  - Development of "Implementation Conformance Statements" (ICS).
  - Development of "Test Suite Structure and Test Purposes" (TSS&TP).
  - Development of "Abstract Test Suite" (ATS).

4.3.2 Test architecture

4.3.2.1 Selection of Implementation Under Test

4.3.2.1.1 Definition

The "Implementation Under Test" (IUT) is a protocol implementation considered as an object for testing. This means that the test process will focus on verifying the compliance of this protocol implementation (IUT) with requirements set up in the related base standard. An IUT normally is implemented in a "System Under Test" (SUT). For testing, a SUT is connected to a test system over at least a single interface. Such an interface is identified as "Reference Point" (RP) in the present document. Further details on RPs are presented in clause 6.

NOTE: Other interfaces between the test system and the IUT may be used to control the behaviour of the IUT during the test process.

Figure 4.3.2.1.1-1 shows the multi-access edge system reference architecture, see also clause 6 of ETSI GS MEC 003 [i.3].

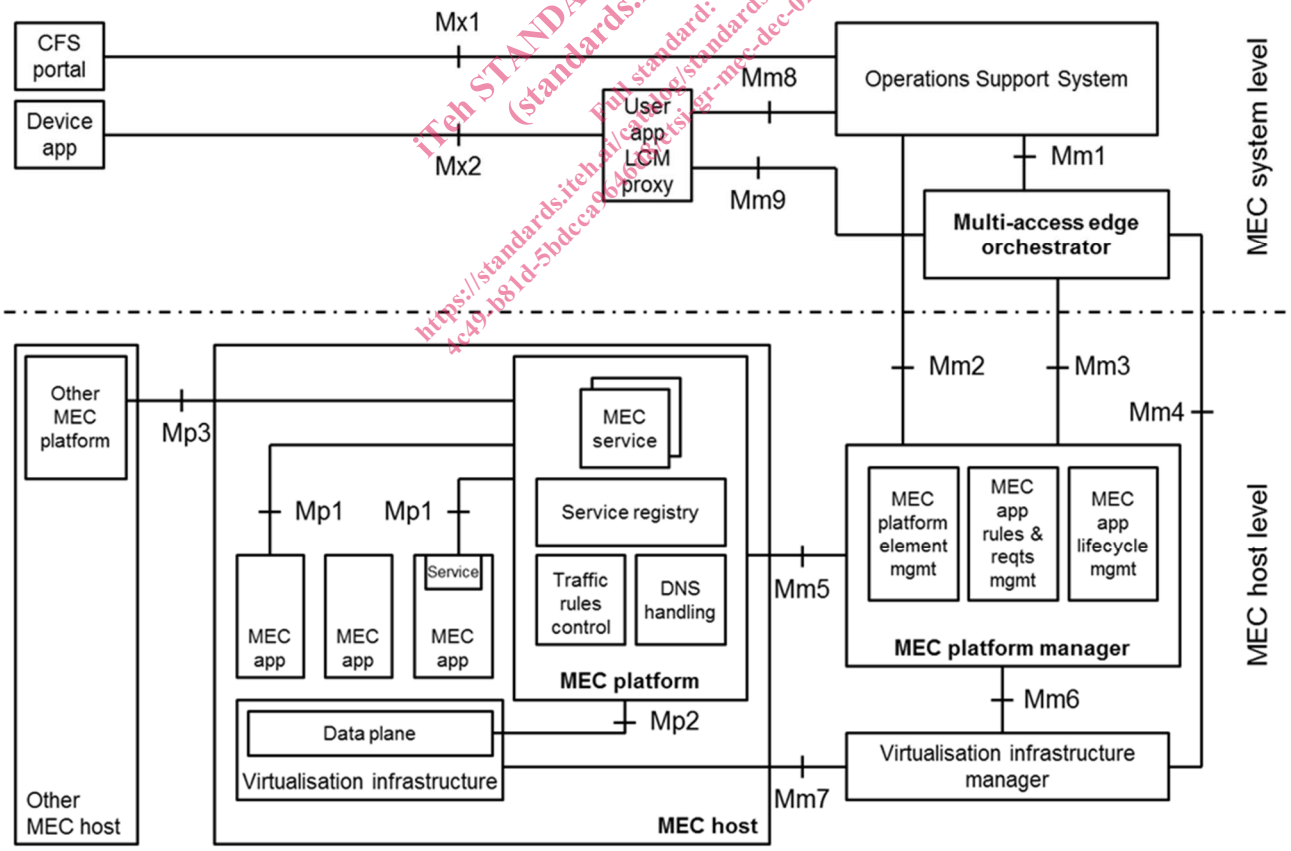

Figure 4.3.2.1.1-1: Multi-access edge system reference architecture

4.3.2.1.2 MEC IUTs and Reference Points

MEC IUTs and Reference Points are collected in tables as shown in the example below.

Table 4.3.2.1.2-1: Example of MEC IUT assessment

IUT	Reference	Reference Points	Notes
Multi-access edge application (MEC app)	Clause 6 of ETSI GS MEC 003 [i.3]	Mp1	
Multi-access platform (MEC plat)	Clause 6 of ETSI GS MEC 003 [i.3]	Mp1, Mp2, Mm5	Mp2 and Mm5 out of scope of testing

These tables need to be amended in the following cases:

- A new node or entity is defined in the base specifications.
- A new interface is defined in the base specifications between any of the existing nodes or entities.

4.3.3 Development of Conformance Test Specifications

4.3.3.1 Implementation Conformance Statement (ICS)

The purpose of an ICS is to identify those standardized functions which an IUT is required to support, those which are optional and those which are conditional on the presence of other functions. It helps to provide a means for selection of the suite of tests which will subsequently be developed.

In addition, the ICS can be used as a proforma for identifying which functions an IUT will support when performing conformance testing. The purpose of this ICS proforma is to provide a mechanism whereby a MEC implementation supplier may provide information about the implementation in a standardized manner. The information in an ICS is usually presented in tabular form as recommended in ISO/IEC 9646-7 [i.4].

The ICS can be considered as a set of "switches" which specify the capability of supporting the requirement in base standards to be tested. It is possible that with different choices in an ICS proforma, several different set of TPs will be necessary.

In clauses 5 "Requirement assessment" and 6 "Architecture assessment" assessments are made on whether requirements, features, components and other capabilities are required according to a referenced GS, or in order to achieve compliance. This assessment provides the following options:

m mandatory - the capability is required to be supported.

o optional - the capability may, or may not, be supported.

c.i conditional - the requirement on the capability ("m", "o", "x" or "n/a") depends on the support of other optional or conditional items. "i" is an integer identifying a unique conditional status expression which is defined immediately following the table.

n/a not applicable - in the given context, it is not possible to use the capability.

x prohibited (excluded) - there is a requirement not to use this capability in the given context.

o.i qualified optional - for mutually exclusive or selectable options from a set: "i" is an integer which identifies a unique group of related optional items and the logic of their selection which is defined immediately following the table.

An example is shown in the Table 4.3.3.1-1.