



Multi-access Edge Computing (MEC); Guidelines on Interoperability testing

(standards.iteh.ai)

ETSI GR MEC-DEC 042 V3.1.1 (2022-11)

<https://standards.iteh.ai/catalog/standards/sist/6192ce4e-e2fa-4888-96e9-3580741e2f1b/etsi-gr-mec-dec-042-v3-1-1-2022-11>

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-DEC42InteropTests

Keywords

API, interoperability, MEC, service, 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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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://standards-portal.etsi.org/People/CommitteeSupportStaff.aspx> 4888-96e9-

If you find a security vulnerability in the present document, please report it through our

Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2022.

All rights reserved.

Contents

Intellectual Property Rights	6
Foreword.....	6
Modal verbs terminology.....	6
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	7
3 Definition of terms, symbols and abbreviations.....	8
3.1 Terms.....	8
3.2 Symbols.....	8
3.3 Abbreviations	8
4 Test Structure	9
4.1 Conventions.....	9
4.2 Test Description pro forma.....	9
4.3 Interoperability Feature Statement (IFS).....	10
5 Architecture.....	10
6 Configurations.....	11
6.1 SUT_MEC_BASIC.....	11
6.2 SUT_MEC_SERVICES_SINGLE_APP.....	11
6.3 SUT_MEC_SERVICES_MULTI_APP.....	12
6.4 SUT_MEC_NFVI	12
6.5 SUT_MEC_MANO.....	13
7 Test Summary	13
7.1 Test group 1 - MEC Application lifecycle	13
7.1.1 Applicable configurations.....	13
7.1.2 List of objectives.....	14
7.2 Test group 2 - MEC Services	14
7.2.1 Applicable configurations.....	14
7.2.2 List of objectives.....	14
7.3 Test group 3 - MEC Traffic.....	14
7.3.1 Applicable configurations.....	14
7.3.2 List of objectives.....	15
7.4 Test group 4 - MEC Location API	15
7.4.1 Applicable configurations.....	15
7.4.2 List of objectives.....	16
7.5 Test group 5 - MEC RNI API.....	16
7.5.1 Applicable configurations.....	16
7.5.2 List of objectives.....	17
7.6 Test group 6 - MEC WAI API	17
7.6.1 Applicable configurations.....	17
7.6.2 List of objectives.....	18
7.7 Test group 7 - MEC VIS API.....	18
7.7.1 Applicable configurations.....	18
7.7.2 List of objectives.....	19
7.8 Test group 8 - MEC TM API	19
7.8.1 Applicable configurations.....	19
7.8.2 List of objectives.....	19
8 Test Descriptions MEC	20
8.0 Pre-conditions.....	20
8.0.1 Security.....	20
8.0.2 Existence of resource	20
8.1 Test group 1- MEC Application Lifecycle Management	20

8.1.1	Onboard an application	20
8.1.2	Start an application instance	21
8.1.3	Stop an application instance.....	22
8.1.4	Retrieve application instance status	23
8.1.5	Change application instance status	24
8.2	Test group 2 - MEC Services	24
8.2.1	Query existing services.....	24
8.2.2	Register a new service	25
8.2.3	Update an existing service	26
8.2.4	Deregister a service.....	27
8.2.5	Consume a service	28
8.2.6	Query time service	29
8.2.7	Transport information query	29
8.3	Test group 3 - MEC Traffic.....	30
8.3.1	Traffic rule activation	30
8.3.2	Traffic rule update	31
8.3.3	Traffic rule deactivation.....	32
8.3.4	DNS rule activation	33
8.3.5	DNS rule deactivation.....	34
8.4	Test group 4 - MEC-013	35
8.4.1	UE Location Lookup	35
8.4.2	UE Information Lookup.....	37
8.4.3	UE Location Subscribe	38
8.4.4	UE Information Subscribe	40
8.4.5	Radio Node Location Lookup.....	42
8.4.6	UE Tracking Subscribe	43
8.4.7	UE Distance Lookup.....	45
8.4.8	UE Distance Subscribe	47
8.4.9	UE Area Subscribe.....	50
8.5	Test group 5 - MEC-012	53
8.5.1	RAB information	53
8.5.2	PLMN information	54
8.5.3	S1 bearer information	55
8.5.4	Layer 2 measurements information	56
8.5.5	Subscription and notification (generic tests).....	57
8.6	Test group 6 - MEC-028	65
8.6.1	Access Point information.....	65
8.6.2	Station information	67
8.6.3	Subscription and notification	70
8.6.4	Measurement Configuration	80
8.7	Test group 7 - MEC-030	83
8.7.1	Provisioning information for V2X communication over Uu unicast	83
8.7.2	Provisioning information for V2X communication over Uu MBMS	84
8.7.3	Provisioning information for V2X communication over PC5	85
8.7.4	Journey-specific QoS predictions	86
8.7.5	Subscription and notification	87
8.8	Test group 8 - MEC-015	96
8.8.1	Register to Bandwidth Management Service.....	96
8.8.2	Unregister from Bandwidth Management Service.....	97
8.8.3	Update requested bandwidth requirements on BWM Service	98
8.8.4	Get the list of bandwidth allocation resources from BWM Service.....	99
8.8.5	Get configured bandwidth allocation from BWM Service	100
8.8.6	Get MTS service Info from the MTS Service.....	101
8.8.7	Register to the MTS service.....	102
8.8.8	Unregister from the MTS service	103
8.8.9	Update requested requirements on the MTS service.....	104
8.8.10	Get configured MTS session from the MTS service.....	105

Annex A: Interoperability Feature Statement.....106

A.1	Entities.....	106
A.2	MEC App	106

A.3	MEC Platform	107
A.4	NFV Platform	107
A.5	MANO	107
Annex B:	FUT Specific Information Pro forma.....	108
B.0	Introduction	108
B.0.1	The right to copy	108
B.1	MEC App	108
B.2	MEC Platform	108
B.3	NFV Platform	108
B.4	MANO	108
Annex C:	Change History	109
	History	110

i T h S T A N D A R D P R E
(s t a n d a r d s . i t

E T S I G R M E C - 1 D) E C 0
h t t p s : / / s t a n d a r d s . i t e h . a
3 5 8 0 7 4 1 e n 2 e f c 1 - b d / e e c t - s l 0 i 4 - 2 g -

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are 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 Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, 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.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword

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

<https://standards.iteh.ai/catalog/standards/sist/6192ce4e-e2fa-4888-96e9-3580741e2f1b/etsi-gr-mec-dec-042-v3-1-1-2022-11>

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 defines guidelines with the purpose of supporting the MEC Interoperability testing. It contains:

- conventions summarizing all pro formas and common rules for conduction Interoperability testing activities like done at the ETSI Plugtests™ events;
- the overall architecture describing the network including controllers, interfaces and applications;
- the configurations (CFG) summarizing the valid configurations derived from the overall architecture. A valid configuration is a specific subset of the overall architecture to which a given group of test descriptions applies used during test sessions;
- the Test Summary listing all test objectives. A Test Description (TD) will be developed for each test objective;
- the Test Descriptions (TDs) compiling all the information required to execute a test. They describe all the steps required to achieve a test objective;
- the Interoperability Feature Statement (IFS) identifying the features which a Function Under Test (FUT) supports, including those which are optional and those which are conditional on the support of other features. The IFS are used to select applicable TDs for each test session.

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 001 (V2.1.1) (01-2019): "Multi-access Edge Computing (MEC); Terminology".
- [i.2] ETSI GS MEC 010-2 (V2.1.1) (11-2019): "Multi-access Edge Computing (MEC); Application lifecycle, rules and requirements management".
- [i.3] ETSI GR MEC-DEC 025 (V2.1.1) (06-2019): "Multi-access Edge Computing (MEC); MEC Testing Framework".
- [i.4] ETSI GS MEC 011 (V2.2.1) (12-2020): "Multi-access Edge Computing (MEC); Edge Platform Application Enablement".
- [i.5] ETSI GS MEC 013 (V2.2.1) (01-2022): "Multi-access Edge Computing (MEC); Location API".
- [i.6] ETSI GS MEC 012 (V3.0.0) (05-2021): "Multi-access Edge Computing (MEC); Radio Network Information API".
- [i.7] ETSI GS MEC 028 (V2.3.1) (05-2022): "Multi-access Edge Computing (MEC); WLAN Access Information API".

- [i.8] ETSI GS MEC 030 (V2.2.1) (06-2022): "Multi-access Edge Computing (MEC); V2X Information API".
- [i.9] ETSI GS MEC 015 (V2.1.1) (06-2020): "Multi-access Edge Computing (MEC); Traffic Management APIs".

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.1] apply.

3.2 Symbols

Void.

3.3 Abbreviations

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

AP	Access Point
authN/Z	Authentication/Authorization
BSS	Basic Service Set
BSSID	Basic Service Set Identifier
BW	BandWidth
BWM	BandWidth Management
BWMS	BandWidth Management Service
DNS	Domain Name System
eNB	eNodeB
FUT	Function Under Test
IFS	Interoperability Feature Statement
IOP	InterOPerability
KVM	Kernel-based Virtual Machine
MBMS	Multimedia Broadcast Multicast Service
MEAO	MEC Application Orchestrator
MEO	MEC Orchestrator
MEPM	MEC Platform Manager
MTS	Multi-access Traffic Steering
NFV	Network Functions Virtualisation
NFVI	Network Functions Virtualisation Infrastructure
NSD	Network Scenario Descriptor
OBSS	Overlapping Basic Service Set
OSS	Operation Support Systems
PLMN	Public Land Mobile Network
QCI	QoS Class Identifier
QoS	Quality of Service
RAB	Radio Access Bearer
RNI	Radio Network Information
RNIS	Radio Network Information Service
RSSI	Receive Signal Strength Indicator
STA	Station
SUT	System Under Test
TD	Test Description
TM	Traffic Management
UE	User Equipment
V2X	Vehicle-to-everything
VIM	Virtual Infrastructure Manager

VIS	V2X Information Service
VNF	Virtual Network Function
VNFD	Virtual Network Function Descriptor
VNFM	Virtual Network Functions Manager
WAI	WLAN Access Information
WAIS	WLAN Access Information Service
WAN	Wireless Access Network
WLAN	Wireless Local Area Network

4 Test Structure

4.1 Conventions

The Tests Ids of this Test Plan have been created as per the following naming convention:

TEST ID = TD_<ROOT>_<GROUP>_<OPERATION>

Where <ROOT> is "MEC".

4.2 Test Description pro forma

Test Descriptions compile all the information required to execute a test. They describe all the steps required to achieve a test objective. The following information is provided with each Test Description:

- Identifier: A unique identifier is assigned to each Test Description. The usage of a well-defined naming convention allowing to put the TD into context (Functional Group, Feature, etc.) is recommended.
- Test Objective: Description of the objective of the TD (what).
- Configuration: Reference to the applicable configuration(s).
- References: References to the base specification(s) which describe the feature being tested.
- Applicability: List of items in the IFS that need to be supported by the FUTs in order to be able to execute the test.
- Pre-test conditions: Specific conditions that need to be met by the FUT prior to start executing the test sequence. It can include information about configuration, and/or initial state of the FUT.
- Test Sequence: Detailed description of the steps that are to be followed in order to achieve the stated test purpose. These steps are specified in a clear and unambiguous way but without placing unreasonable restrictions on how the step is performed. Clarity and precision are important to ensure that the step can be followed exactly. The lack of restrictions is necessary to ensure that the test can apply to a range of different types of implementation.

Table 4.2-1: Test Description pro forma

Interoperability Test Description			
Identifier	Unique test description ID: TD_AB_XXX_00. Follows the naming convention as per clause 4.1		
Test Purpose	A concise summary of the test reflecting its purpose and allowing readers to easily distinguish this test from any other test in the present document		
Configuration	Reference to the applicable configuration(s)		
References	List of references to the base specification clause(s), use case(s), requirement(s), etc. which are either used in the test or define the functionality being tested		
Applicability	List of features and capabilities in the IFS which are required to be supported by the FUTs in order to execute this test		
Pre-test conditions	List of test specific pre-conditions that need to be met by the FUT including information about configuration, i.e. precise description of the initial state of the FUTs prior to start executing the test sequence		
Test Sequence	Step	Type	Description
	1	<Request>	Step description
	2		
	3		
	4		
	5		
	6		
IOP Verdict			

The Steps in the Test Sequence can be of different type, depending on their purpose:

- A stimulus corresponds to an event that triggers a specific action on a FUT, like sending a message for instance.
- A configure corresponds to an action to modify the FUT or SUT configuration.
- An IOP check consists of observing that one FUT behaves as described in the standard: i.e. resource creation, update, deletion, etc. For each IOP check in the Test Sequence, a result can be recorded.
- The overall IOP Verdict will be considered OK if all the IOP checks in the sequence are OK.

4.3 Interoperability Feature Statement (IFS)

The Interoperable Feature Statement (IFS) identifies the standardized features of a FUT. These features can be mandatory, optional or conditional (depending on other features), and depend on the role played by the FUT. The IFS can also be used as a pro forma by a vendor to identify the features that its FUT will support when interoperating with corresponding features from other vendors. Annex A of the present document defines the IFS.

5 Architecture

The generic Interoperability Test Architecture follows recommendations contained in ETSI GR MEC-DEC 025 [i.3].

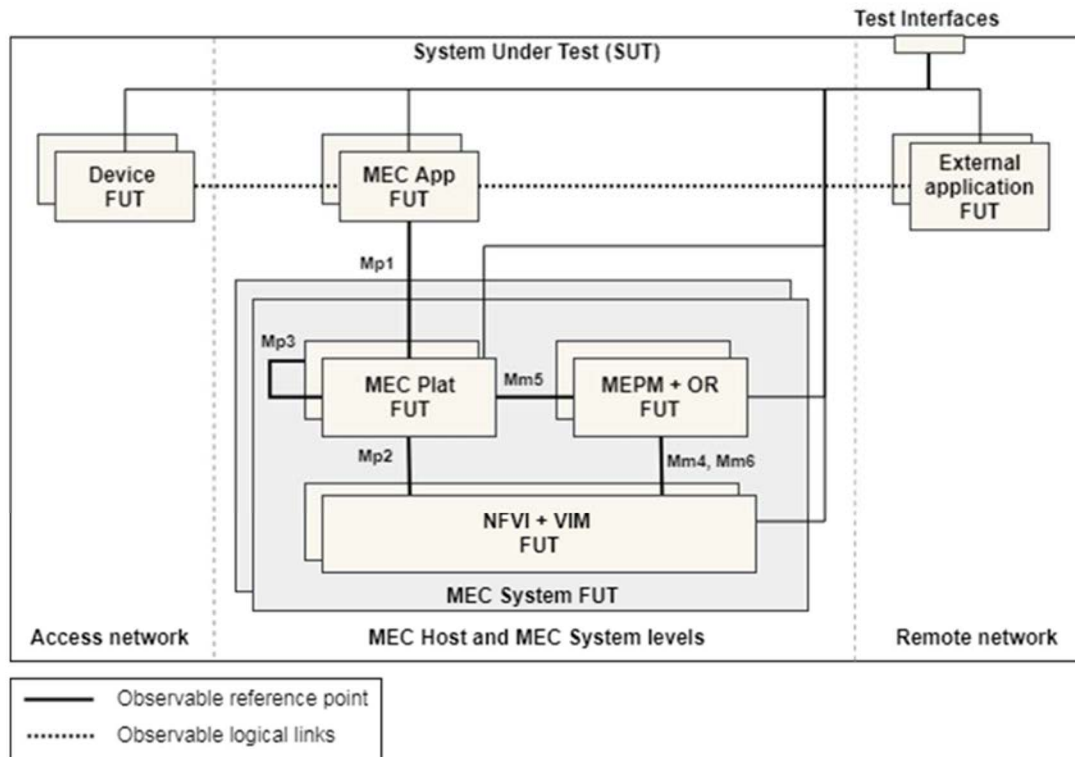


Figure 5-1: Generic Interoperability testing architecture as reported in ETSI GR MEC-DEC 025 [i.3]

6 Configurations

6.1 SUT_MEC_BASIC

The SUT_MEC_BASIC test configuration includes a single MEC application along with a MEC platform. In this configuration, the term "MEC Platform" is used to indicate any of the following components: MEC platform, MEC orchestrator or MEC platform manager. The providers of other components of the MEC system such as MEO or MEPM are out of scope. The MEC application runs - together with the MEC Platform - on the MEC host or the NFVI.

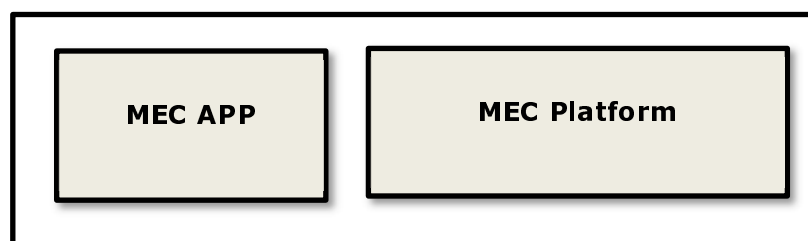


Figure 6.1-1: SUT_MEC_BASIC test configuration

6.2 SUT_MEC_SERVICES_SINGLE_APP

The SUT_MEC_SERVICES_SINGLE_APP test configuration is similar to the configuration SUT_MEC_BASIC, with a difference on the integration between the two elements. In this configuration, one (1) MEC application runs with in the MEC Host alongside the MEC platform. The configuration focuses on the capabilities around MEC Services such as the capability of applications and the platform to provide and register. The service is registered and available for discovery through the service registry in the MEC platform.

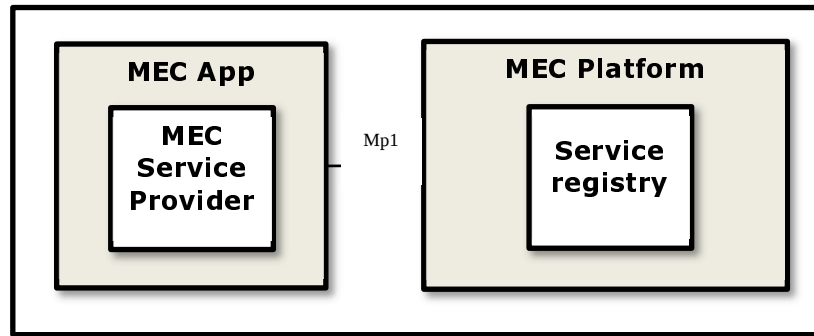


Figure 6.2-1: SUT_MEC_SERVICES_SINGLE_APP test configuration

6.3 SUT_MEC_SERVICES_MULTI_APP

The SUT_MEC_SERVICES_MULTI_APP configuration is similar to the configuration SUT_MEC_SERVICES_SINGLE_APP, with a difference on the integration between both elements. In this configuration, two (2) MEC applications run together alongside the MEC Platform. The configuration focuses on the capabilities around MEC Services such as the capability of applications and the platform to provide, discover or consume MEC services.

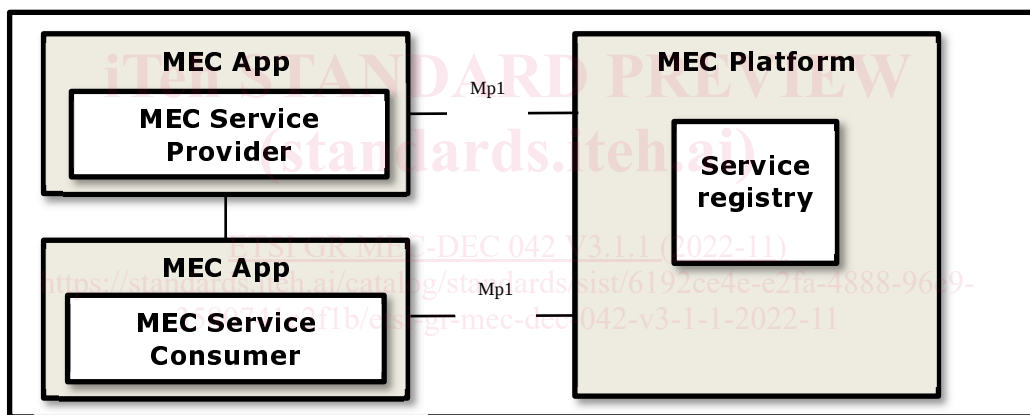


Figure 6.3-1: SUT_MEC_SERVICES_MULTI_APP test configuration

6.4 SUT_MEC_NFVI

The SUT_MEC_NFVI configuration, the MEC platform and the MEC application(s) are hosted and executed by a third party NFV Infrastructure. The focus is on interoperability of virtualization technologies and VIM APIs in a multivendor scenario.

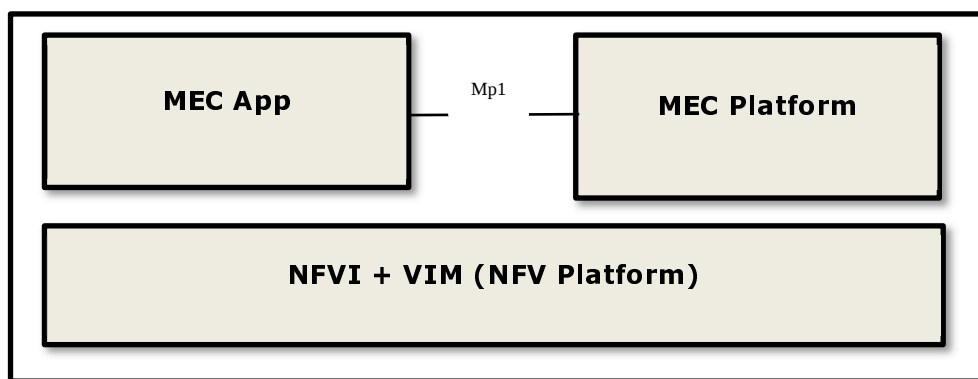


Figure 6.4-1: SUT_MEC_NFVI test configuration

6.5 SUT_MEC_MANO

The SUT_MEC_MANO focuses on the MEC-in-NFV scenario. In this scenario the MEC application(s) and the MEC platform are packaged as VNFs and are managed by a third-party MANO platform in an NFV infrastructure. The availability of other components of the MEC system (such as MEAO, MEPM and specific VNFM) is out of scope.

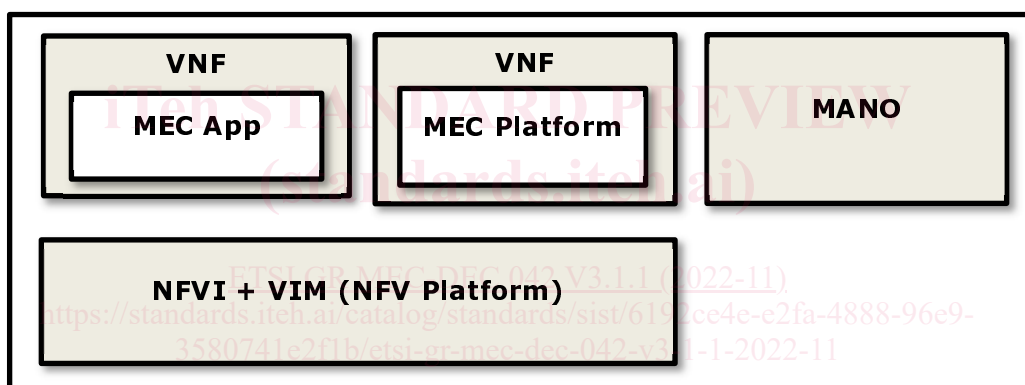


Figure 6.5-1: SUT_MEC_MANO test configuration

7 Test Summary

7.1 Test group 1 - MEC Application lifecycle

7.1.1 Applicable configurations

The configurations applicable to the test group 1 are:

- SUT_MEC_BASIC
- SUT_MEC_SERVICES_SINGLE_APP
- SUT_MEC_NFVI
- SUT_MEC_MANO

7.1.2 List of objectives

Table 7.1.2-1: Test Objectives for Group 1 - MEC Application lifecycle

Test ID	Objective
TD_MEC_APP_ONBOARD	Verify that a MEC application can be successfully onboarded in a MEC System.
TD_MEC_APP_START	Verify that a MEC application can be successfully started in a MEC Host.
TD_MEC_APP_STOP	Verify that a MEC application running in a MEC Host can be stopped.
TD_MEC_APP_STATUS	Verify that the status of a MEC application running in a MEC Host can be queried.
TD_MEC_APP_CHANGE	Verify that the status of a MEC application running in a MEC Host may be changed.

7.2 Test group 2 - MEC Services

7.2.1 Applicable configurations

The configurations applicable to the Services tests are:

- SUT_MEC_SERVICES_SINGLE_APP
- SUT_MEC_SERVICES_MULTI_APP

7.2.2 List of objectives

Table 7.2.2-1: Test objectives for Group 2 - MEC Services

Test ID	Objective
TD_MEC_SVC_QUERY	Verify that a MEC App successfully retrieves the list of available services from the MEC Platform.
TD_MEC_SVC_REGISTER	Verify that a MEC App successfully registers a new service in the MEC Platform Service Registry.
TD_MEC_SVC_UPDATE	Verify that a MEC App successfully updates an existing service in the MEC Platform Service Registry.
TD_MEC_SVC_DEREGISTER	Verify that a MEC App successfully deregisters a service existing in the MEC Platform Service Registry.
TD_MEC_SVC_CONSUME	Verify that a MEC App successfully consumes a service exposed by a different MEC App and registered in the MEC Platform Service Registry.
TD_MEC_SVC_TRANSPORTS	Verify that a MEC App successfully queries the list of available transports from the MEC Platform.
TD_MEC_SVC_QUERYTIME	Verify that a MEC App successfully queries the time information from the MEC Platform.

7.3 Test group 3 - MEC Traffic

7.3.1 Applicable configurations

The configurations applicable to the Network tests are:

- SUT_MEC_BASIC
- SUT_MEC_SERVICES_SINGLE_APP
- SUT_MEC_NFVI
- SUT_MEC_MANO

7.3.2 List of objectives

Table 7.3.2-1: Test Objectives for Group 3 - Traffic and DNS rules

Test ID	Objective
TD_MEC_NTW_ACTIVATE	Verify that a MEC application successfully requests a rule to be activated in the MEC Platform.
TD_MEC_NTW_UPDATE	Verify that a MEC application successfully requests an update to an existing rule in the MEC Platform.
TD_MEC_NTW_DEACTIVATE	Verify that a MEC application successfully requests a rule to be deactivated in the MEC Platform.
TD_MEC_NTW_DNS_ACTIVATE	Verify that a MEC application successfully requests a DNS rule to be activated in the MEC Platform.
TD_MEC_NTW_DNS_DEACTIVATE	Verify that a MEC application successfully requests a DNS rule to be deactivated in the MEC Platform.

7.4 Test group 4 - MEC Location API

7.4.1 Applicable configurations

The configurations applicable to the Network tests are:

- SUT_MEC_SERVICES_SINGLE_APP
- SUT_MEC_SERVICES_MULTI_APP

STANDARD PREVIEW
(standards.iteh.ai)

ETSI GR MEC-DEC 042 V3.1.1 (2022-11)

<https://standards.iteh.ai/catalog/standards/sist/6192ce4e-e2fa-4888-96e9-3580741e2f1b/etsi-gr-mec-dec-042-v3-1-1-2022-11>