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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the management aspects of edge computing including concepts, use cases, requirements and procedural flows that covers lifecycle management, provisioning, performance assurance and fault supervision for edge computing.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[3] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[4] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[5] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[6] ETSI GS NFV-IFA 013 V3.4.1 "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Os-Ma-nfvo reference point -Interface and Information Model Specification".

[7] ETSI GS NFV-IFA 011 (V3.3.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; VNF Descriptor and Packaging Specification".

[8] 3GPP TS 28.550: "Management and orchestration; Performance assurance".

[9] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[10] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[11] 3GPP TS 23.501: "System architecture for the 5G System (5GS); Stage 2".

[12] 3GPP TS 28.658: "Telecommunications management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)".

[13] 3GPP TS 38.300: "NR; Overall description; Stage-2".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

Edge Computing: A concept, as described in 3GPP TS 23.501 [4], that enables operator and 3rd party services to be hosted close to the UE's access point of attachment, to achieve an efficient service delivery through the reduced end-to-end latency and load on the transport network.

Edge Computing Service Provider: A mobile network operator offering Edge Computing service.

Edge Data Network: A local Data Network that supports the architecture for enabling edge applications.

ECSP Management System: is a part of 3GPP management system that utilizes 3GPP defined management services to enable consumers (e.g., ASP. ECSP) to orchestrate and manage the EDN.

PLMN Management System: is a part of 3GPP Management System that utilizes 3GPP defined management services to enable consumers (e.g., PLMN operator) to orchestrate and manage the mobile networks.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ASP	Application Service Provider
DN	Data Network
DNAI	Data Network Access Identifier
DNN	Data Network Name
EAS	Edge Application Server
ECS	Edge Configuration Server
ECSP	Edge Computing Service Provider
EDN	Edge Data Network
FQDN	Fully Qualified Domain Name
GSM	Global System for Mobile Communications
GSMA	GSM Association

4 Concepts and overview

4.1 Concept of edge computing management

The edge computing services are provided by edge computing service providers (ECSP), application service providers (ASP), and PLMN operators (see annex B in TS 23.558 [1]), where ASP is responsible for the creation of edge application servers (EAS) and application clients (AC), ECSP is responsible for the deployment of edge data networks (EDN) that contain EAS and EES, and PLMN operator is responsible for the deployment of 5G network functions, such as 5GC and 5G NR.

Figure 4.1-1 describes the edge computing management framework that contains PLMN management system and ECSP management system. ECSP management system, as the producer, provides management services enabling ASP and ECSP consumers to orchestrate and manage EDN NFs (e.g., EAS, EES, and ECS). PLMN management system, as the producer, provides management services enabling ECSP management system to interconnect EDN NFs with 5GC NFs (e.g., PCF, UPF, NEF). Both ECSP management system and PLMN management system communicate with ETSI NFV MANO to perform lifecycle management functions.

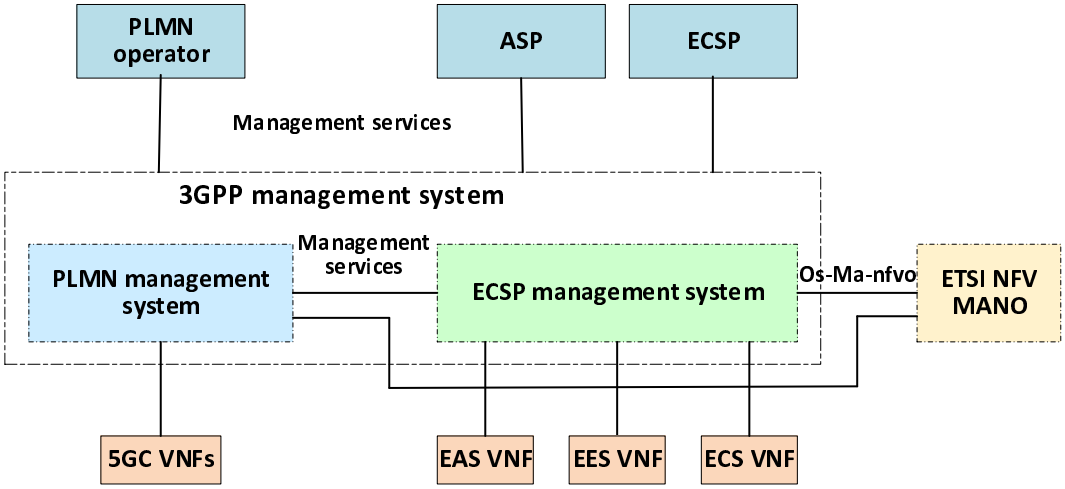

Figure 4.1-1: Edge computing management framework

5 Edge Computing Management (ECM) capabilities

5.1 Lifecycle management

5.1.1 Description

The lifecycle management of the edge components is to be enabled by the 3GPP Management System. The lifecycle management includes instantiation, termination, modification and query of the edge components.

5.1.2 EAS deployment

The goal of this use case is to enable ASP to deploy the EAS in the EDN, by requesting the provisioning MnS producer with the deployment requirements (e.g. the topological or geographical service areas, software image information, QoS, affinity/anti-affinity with other EAS, etc.) to deploy the EAS. The provisioning MnS producer returns a response indicating the operation is in progress to prevent the consumer from waiting, as the deployment in the edge cloud may take a while. Since, there can be multiple Edge Data Network (EDN) present/serving a particular edge location. This makes it critical for application service provider to have their EAS deployed at appropriate EDN(s) to provide high performance services for the UE. Therefore, provisioning MnS producer analyses the deployment requirements to determine where (i.e. on which EDN) and how many EAS VNF instance(s) should be instantiated, and requests the NFVO in ETSI NFV MANO to instantiate the EAS VNF instance(s). The provisioning MnS producer sends a notification to ASP indicating the result of instantiation (e.g. success, failure) when a notification is received from NFVO indicating the result of instantiation operation.

5.1.3 EAS termination

The goal of this use case is to enable ASP to terminate the EAS in the EDN, by requesting the provisioning MnS producer to terminate the EAS VNF instance. The provisioning MnS producer requests the NFVO in ETSI NFV MANO to terminate the EAS VNF instances. The provisioning MnS producer sends a notification to ASP indicating the termination is in progress when a notification is received from NFVO indicating the start of termination operation. The provisioning MnS producer sends another notification to ASP indicating the result of termination (e.g. success, failure) when a notification is received from NFVO indicating the result of termination operation.

5.1.4 Query EAS information

The goal of this use case is to enable ASP to query the EAS information in the EDN, by requesting the provisioning MnS producer to query the EAS instance. Upon receiving the query request, the provisioning MnS producer sends the EAS instance information to ASP.

5.1.5 EAS modification

The goal of this use case is to enable ASP to modify the EAS in the EDN, by requesting the provisioning MnS producer to modify the EAS instance. If the modification requires the change (e.g. scale) for the virtualized resource of the EAS VNF instance, the provisioning MnS producer requests the NFVO in ETSI NFV MANO for the appropriate operation of the EAS VNF instances. The provisioning MnS producer sends a notification to ASP indicating the attribute(s) change of the EAS instance.

5.1.6 EES Deployment

The provisioning MnS producer is requested to instantiate the EES, as 3GPP network functions, aiming to server the particular location. The instantiated EES may serve one or multiple EAS.

A consumer request for EES(s) instantiation providing EES deployment requirements. The provisioning MnS producer determines the EDN where the EES(s) will be instantiated, instantiate the EES VNF and establish the connection with 5GC network functions. The provisioning MnS producer will accept the request and notify the consumer about the instantiation in-progress. Thereafter, the notification will be sent to indicate the successful EES instantiation.

5.1.7 EES Termination

The goal is to enable the termination of one or more EES(s) on the EDN. A consumer consumes the provisioning MnS to terminate the EES with the EES identifier. The provisioning MnS producer terminates the EES VNF based on the EES identifier, and disconnects the EES from the 5GC network functions. The provisioning MnS producer will accept the request and notify the consumer about the termination in-progress. Thereafter, the notification will be sent to indicate that the EES has been terminated successfully.

5.1.8 Query EES information

The goal of this use case is to enable a consumer to query the EES information in the EDN, by requesting the provisioning MnS producer to query the EES instance. Upon receiving the query request, the provisioning MnS producer sends the EES instance information to the consumer.

5.1.9 EES Modification

The goal of this use case is to enable a consumer to modify the EES in the EDN, by requesting the provisioning MnS producer to modify the EES instance. If the modification requires the change (e.g. scale) for the virtualized resource of the EES VNF instance, the provisioning MnS producer requests the NFVO in ETSI NFV MANO for the appropriate operation of the EES VNF instances. The provisioning MnS producer sends a notification to the consumer indicating the attribute(s) change of the EES instance.

5.1.10 ECS Deployment

The goal is to enable the instantiation of one or more ECS. To support deployed EDN, operator will deploy ECS serving one or multiple EES. A consumer request for ECS(s) instantiation providing ECS deployment requirements. The provisioning MnS producer instantiate the ECS VNF and establish the required connection with 5GC network functions. The notifications will be sent to indicate that the ECS has been instantiated successfully.

5.1.11 ECS Termination

The goal is to enable the termination of one or more ECS. A consumer consumes the provisioning service to terminate the ECS with the ECS identifier. The provisioning MnS producer terminates the ECS VNF based on the ECS identifier, and disconnects the ECS from the 5GC network functions. The notification will be sent to indicate that the ECS has been terminated successfully.

5.1.12 Query ECS information

The goal of this use case is to enable a consumer to query the ECS instance information, by requesting the provisioning MnS producer to query the ECS instance. Upon receiving the query request, the provisioning MnS producer sends the ECS instance information to the consumer.

5.1.13 ECS Modification

The goal of this use case is to enable a consumer to modify the ECS instance, by requesting the provisioning MnS producer to modify the ECS instance. If the modification requires the change (e.g. scale) for the virtualized resource of the ECS VNF instance, the provisioning MnS producer requests the NFVO in ETSI NFV MANO for the appropriate operation of the ECS VNF instances. The provisioning MnS producer sends a notification to the consumer indicating the attribute(s) change of the ECS instance.

5.1.14 Requirements

Requirement label	Description	Related use case(s)
REQ-EAS-INST-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to request the deployment of EAS based on the given deployment requirements.	EAS Deployment
REQ-EAS-INST-FUN-2	Generic Provisioning MnS Producer should have the capability to deploy EAS at a suitable EDN which can support the EAS requirements e.g. serving location, required latency, affinity/anti-affinity with other EAS, service continuity.	EAS Deployment
REQ-EAS-INST-FUN-3	Generic provisioning MnS producer should have a capability to inform the authorized consumer about the progress of instantiation as the response to the deployment request.	EAS Deployment
REQ-EAS-INST-FUN-4	Generic provisioning MnS producer should have a capability to notify the authorized consumer the result (e.g. success, failure) of instantiation operation.	EAS Deployment
REQ-EAS-TERM-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to request the termination of the EAS VNF instance.	EAS Termination
REQ-EAS-TERM-FUN-2	Generic provisioning MnS producer should have a capability to inform the authorized consumer about the progress of termination as the response to the termination request.	EAS Termination
REQ-EAS-TERM-FUN-3	Generic provisioning MnS producer should have a capability to notify the authorized consumer the result (e.g. success, failure) of termination operation.	EAS Termination
REQ-EAS-QUERY-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to obtain the EAS instance information.	Query EAS information
REQ-EAS-MOD-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to request the modification of the EAS instance.	EAS Modification
REQ-EES-INST-FUN-1	Generic provisioning MnS producer should have the capability to instantiate the EES, as per request from authorized consumers.	EES Deployment
REQ-EES-INST-FUN-2	Generic provisioning MnS producer should have the capability to send the notification indicating the status of EES instantiation	EES Deployment
REQ-EES-INST-FUN-3	Generic provisioning MnS producer should have the capability to relate instantiated EES with one or multiple served EAS(s).	EES Deployment
REQ-EES-TERM-FUN-1	Generic provisioning MnS producer should have the capability to terminate the EES with the EES identifier, as per request from authorized consumers	EES Termination
REQ-EES-TERM-FUN-2	Generic provisioning MnS producer should have the capability to send the notification indicating the status of EES termination	EES Termination
REQ-EES-QUERY-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to obtain the EES instance information.	Query EES information
REQ-EES-MOD-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to request the modification of the EES instance.	EES Modification
REQ-EES-TERM-FUN-3	Generic provisioning MnS producer should have a capability to inform the authorized consumer about the progress of EES instantiation as the response to the deployment request.	EES Deployment

Requirement label	Description	Related use case(s)
REQ-EES-TERM-FUN-4	Generic provisioning MnS producer should have a capability to inform the authorized consumer about the progress of EES termination as the response to the termination request.	EES Termination
REQ-ECS-INST-FUN-1	Generic provisioning MnS producer should have the capability to instantiate the ECS, as per request from authorized consumers.	ECS Deployment
REQ-ECS-INST-FUN-2	Generic provisioning MnS producer should have the capability to send the notification indicating the status of ECS Instantiation.	ECS Deployment
REQ-ECS-INST-FUN-3	Generic provisioning MnS producer should have the capability to relate instantiated ECS with one or multiple served EES(s).	ECS Deployment
REQ-ECS-TERM-FUN-1	Generic provisioning MnS producer should have the capability to terminate the ECS with the ECS identifier, as per request from authorized consumers.	ECS Termination
REQ-ECS-TERM-FUN-2	Generic provisioning MnS producer should have the capability to send the notification indicating the status of ECS termination.	ECS Termination
REQ-ECS-TERM-FUN-3	Generic provisioning MnS producer should have a capability to inform the authorized consumer about the progress of ECS instantiation as the response to the deployment request.	ECS Termination
REQ-ECS-TERM-FUN-4	Generic provisioning MnS producer should have a capability to inform the authorized consumer about the progress of ECS termination as the response to the termination request.	ECS Termination
REQ-ECS-QUERY-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to obtain the ECS instance information.	Query ECS information
REQ-ECS-MOD-FUN-1	Generic provisioning MnS producer should have a capability allowing an authorized consumer to request the modification of the ECS instance.	ECS Modification

5.2 Performance assurance

5.2.1 Description

The clause contains use cases associated with performance assurance.

5.2.2 EAS performance assurance

The goal of this use case is to provide a mechanism for EAS to publish KPIs or measurements, as per requirements shown in Table 5.2.2-1 (see clause 5.2.10.2 in TS 23.558 [2]).

Table 5.2.2-1: Edge Application Server Service KPIs

Information element	Status	Description
Maximum Request rate	O	Maximum request rate from the Application Client supported by the server.
Maximum Response time	O	The maximum response time advertised for the Application Client's service requests.
Availability	O	Advertised percentage of time the server is available for the Application Client's use.
Available Compute	O	The maximum compute resource available for the Application Client.
Available Graphical Compute	O	The maximum graphical compute resource available for the Application Client.
Available Memory	O	The maximum memory resource available for the Application Client.
Available Storage	O	The maximum storage resource available for the Application Client.
Connection Bandwidth	O	The connection bandwidth in Kbit/s advertised for the Application Client's use.
NOTE: The maximum response time includes the round-trip time of the request and response packet, the processing time at the server and the time required by the server to consume 3GPP Core Network capabilities, if any.		