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Contents

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

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1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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.

Introduction

3GPP has defined a common API framework (CAPIF) that includes common aspects applicable to any northbound service APIs in TS 23.222 [3].

Operators can use CAPIF to allow external consumers (e.g. 3rd party applications) to gain access to service APIs, including 3GPP APIs. The operator can configure aspects related to publication, discovery and access control of such service APIs.

The present document specifies use cases, requirements and solutions for the exposure of management services using CAPIF. CAPIF is an optional feature in 3GPP management system.

1 Scope

The present document specifies use cases, requirements and solutions for exposing management services to external consumers through the CAPIF.

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 28.533: " Management and orchestration; Architecture framework".

[3] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[4] 3GPP TS 29.222: "Common API Framework for 3GPP Northbound APIs; stage 3".

[5] 3GPP TS 28.622: “Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)”.

[6] TS 32.158: "Management and orchestration; Design rules for REpresentational State Transfer (REST) Solution Sets (SS)".

[7] Void.

[8] IETF RFC 7231: “Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content”.

[9] 3GPP TS 29.501: "5G System; Principles and Guidelines for Service Definition; stage 3".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 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 TR 21.905 [1].

External MnS consumer: an MnS consumer outside the PLMN trust domain.

NOTE 1: The concept of MnS consumer is defined in 3GPP TS 28.533 [2].

NOTE 2: The concept of PLMN trust domain is defined in TS 23.222 [3].

3.2 Symbols

Void

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 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 TR 21.905 [1].

4 Concepts and overview

4.1 Exposure of management services

4.1.1 Overview

Common API Framework (CAPIF) is a framework comprising common API aspects (e.g., publishing, discovery, access control) that are required to support service APIs (see TS 23.222 [3]). Service APIs are produced by API provider domain and consumed by API invokers. An external MnS consumer consuming management services using CAPIF is equivalent to an API invoker consuming the CAPIF-1e and CAPIF-2e interfaces (i.e. API invoker outside PLMN operator trust domain (see NOTE)).

NOTE: The concept of the API invoker is defined in TS 23.222 [3].

A management service (MnS) is identified by different component types, i.e. MnS component type A (management operations and/or notifications), MnS component type B (managed objects), and MnS component type C (performance and fault information) (as defined in clause 4.2 of 3GPP TS 28.533 [2]). Accordingly, in order for the external MnS consumer to consume management services through CAPIF, the appropriate access rights have to be configured for the external MnS consumer within the management system. These access rights determine which MnS resources (i.e. component type B and component type C) can be accessed. In addition, the access rights determine what operations (i.e., MnS component A) can or cannot be performed on the MnS resources by the external MnS consumer.

To provide a MnS to be consumed by the external MnS consumer through CAPIF, first the network operator determines what MnS APIs will be published into CAPIF. Next, these MnS APIs are published into CAPIF as service APIs. The network operator needs to configure the required access control information within the CAPIF core function (CCF) to ensure that the external MnS consumers can only discover the MnS APIs that they can be able to successfully invoke within the management system. Upon completion of the above procedures, external MnS consumers can discover and invoke the MnS APIs that are exposed using CAPIF.

5 Specification level requirements

5.1 General

5.1.1 Introduction

To expose management services to external MnS consumers using CAPIF, there is a need to define the functional entity responsible for providing the CAPIF API provider domain functions defined in clause 6 of TS 23.222[3]. These functions include the API Exposing Function (AEF), API management function (AMF) and the API publishing function (APF). For the present document, the functional entity responsible for providing these API provider domain functions is referred to as the Management Services Exposure Domain (MSED).

5.1.2 Management Services Exposure Domain (MSED)

MSED provides the API provider domains by consuming the CAPIF-3, CAPIF-4 and CAPIF-5 interfaces as shown in Figure 5.1.2-1. The API invoker shown in Figure 5.1.2-1 outside the PLMN trust domain is the external MnS consumer. To enable the exposure of management services using CAPIF, the 3GPP management system is responsible for providing the mapping logic between the management service information and the CAPIF-defined information elements (defined in TS 29.222 [4]) exchanged on the CAPIF-3, CAPIF-4 and CAPIF-5 interfaces (defined in TS 23.222 [3]).

The MSED publishes the service APIs (as a result of mapping the management service information to the CAPIF-defined service API information) to the CAPIF core function (CCF) using the CAPIF-4 interface. The API invokers can discover the published service APIs via the CAPIF-1e interface. The AEF of the MSED enables the API invokers to consume the published management services as service APIs via the CAPIF-2e interface as shown in Figure 5.1.2-1.

NOTE: The interactions or relation between the AEF of the MSED and the MnS producers is not addressedin the present document.

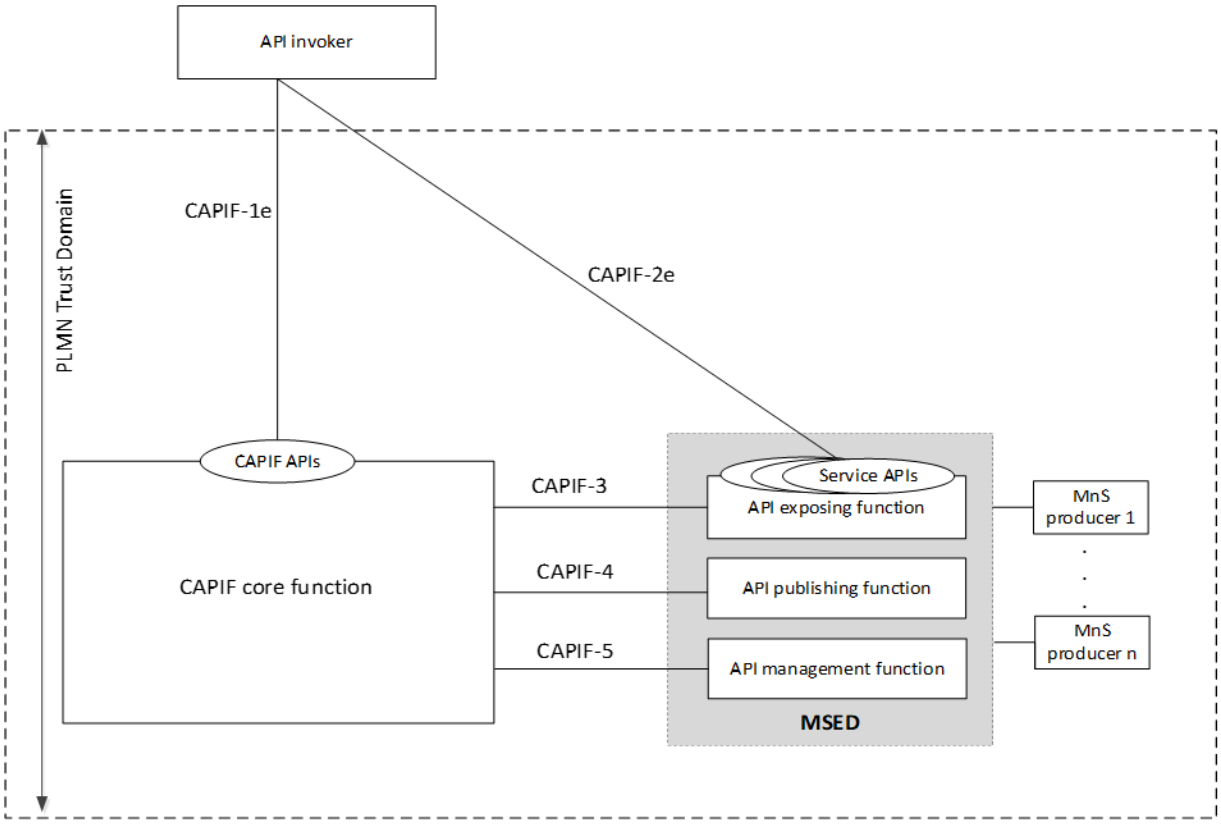

Figure 5.1.2-1: MSED interactions with the CCF and the API invokers (i.e., the external MnS consumers)

As shown in Figure 5.1.2-1, MSED does not implement the CAPIF core function(CCF) but is a consumer of the CAPIF-3, CAPIF-4 and CAPIF-5 interfaces, which are defined outside the 3GPP management system.

Traceability: REQ-MEXPO-FUN-01

5.2 Use cases

5.2.1 Registration of the MSED into the CCF

5.2.1.1 Definition

For MSED to enable the exposure of the management services using CAPIF, MSED has to be registered as a recognized API provider domain at the CCF. The MSED registration procedure ensures that the constituent API provider domain functions (i.e., API Exposing Function (AEF), the API Publishing Function (APF) and the API Management Function (AMF) are recognized users of the CCF and can support the use cases and functionalities described in clause 5.2.

Traceability: **REQ-MEXPO-REG-01**, **REQ-MEXPO-REG-02, REQ-MEXPO-REG-03, REQ-MEXPO-REG-04**

5.2.2 Publishing of management services into the CCF

5.2.2.1 Definition

This use case describes how to publish management services to the CAPIF core function (CCF) to be exposed to the external MnS consumers. Before publishing management services to the CCF, the operator shall determine, subject to the network operator policy, regulatory requirements or contractual obligations the following:

- The management services to be published
- The specific set of resources and corresponding operations of the management services to be published
- Whether the specific set of resources and corresponding operations of the management service will be published as one or more service APIs to the CCF.
- Optionally, the performance and fault data associated to the management service (referred to as MnS component C) to be published.

Traceability: REQ-MEXPO-PUB-01, REQ-MEXPO-PUB-02, REQ-MEXPO-PUB-03, REQ-MEXPO-PUB-04, REQ-MEXPO-PUB-05.

5.2.3 Logging the management service API invocations to the CCF

5.2.3.1 Definition

When exposing service APIs to external MnS consumers, the operator can benefit from monitoring information related to the service API invocations. The logs of the service API invocations can be consumed by authorized consumers (e.g., the AMF of the MSED or auditing purposes and the charging functions). The monitoring information can include:

- The invoked service API details (e.g., the name, resource(s), and operations)
- The identity of the external MnS consumer who performed the service API invocation (i.e., the API invoker ID)
- The result of the service API invocation (e.g., success or failure)
- The time and duration of the service API invocation

Traceability: REQ-MEXPO-LOG-01, REQ-MEXPO-LOG-02.

5.3 Requirements

REQ-MEXPO-FUN-01: 3GPP management system should support the capability to expose management services to external MnS consumers using CAPIF.

REQ-MEXPO-REG-01: The exposure of management services using CAPIF shall have the capability to provide the required mappings between the management service-related information and the CAPIF-defined API provider enrolment related information to enable the registration of MSED to the CCF.

REQ-MEXPO-REG-02: The exposure of management services using CAPIF shall provide the capability to register MSED to the CCF.

REQ-MEXPO-REG-03: The exposure of management services using CAPIF shall provide the capability to deregister MSED from the CCF.

REQ-MEXPO-REG-04: The exposure of management services using CAPIF shall provide the capability to update the registration details of MSED at the CCF.

REQ-MEXPO-PUB-01: The exposure of management services using CAPIF shall have the capability to map the management service-related information into the service API related information to enable the publishing of management services to the CCF.

REQ-MEXPO-PUB-02: The exposure of management services using CAPIF shall have the capability to publish the service APIs to the CCF.

REQ-MEXPO-PUB-03: The exposure of management services using CAPIF shall have the capability to retrieve the published service APIs at the CCF.

REQ-MEXPO-PUB-04: The exposure of management services using CAPIF shall have the capability to update the published service APIs at the CCF.

REQ-MEXPO-PUB-05: The exposure of management services using CAPIF shall have the capability to unpublish the service APIs from the CCF.

REQ-MEXPO-LOG-01: The exposure of management services using CAPIF shall support the capability to create logs based on the service API invocations by the external MnS consumers.

REQ-MEXPO-LOG-02: The exposure of management services using CAPIF shall support the capability to log the service API invocations to the CCF.

6 Solutions for exposing management services using CAPIF

6.1 Registration of the MSED into the CCF

6.1.1 Introduction

In CAPIF, the registration of MSED as a recognized API provider domain in CAPIF is initiated by the AMF of the MSED. To register, unregister or update MSED, the AMF of MSED invokes the CAPIF_API_Provider_Management API service (see clause 5.11 of TS 29.222 [4]) over the CAPIF-5 interface. As part of the registration process (i.e., registration and update registration), the AMF of the MSED sends HTTP requests to the CCF whose request body includes the APIProviderEnrolmentDetails data type (see clause 8.9.4.2.2 of TS 29.222 [4]).

Clause 6.1.2 describes how to map MSED registration information to the APIProviderEnrolmentDetails data type and clause 6.1.3 indicates the service operations that need to be supported by the AMF of the MSED to enable the registration procedures (i.e., registration, update registration and deregistration) of MSED.

6.1.2 Mapping of MSED information into APIProviderEnrolmentDetails

Table 6.1.2-1 presents the attributes of the APIProviderEnrolmentDetails data type (see clause 8.9.4.2.2 of TS 29.222 [4]) and provides information on how this data type can be populated with the MSED registration information. Refer to Table 8.9.4.2.2-1 of TS 29.222 [4] for detailed information on the attributes of APIProviderEnrolmentDetails data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.1.2-1: Mapping of MSED registration information to APIProviderEnrolmentDetails data type attributes

Attribute name	Attribute additional information	Related MSED registration information/Comments
apiProvDomId	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	Assigned by the CCF to the AMF of the MSED during the registration procedure of the MSED at the CCF (see clause 6.1.3).
regSec	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	It can be used to store the security credentials of the MSED. NOTE: The security credentials of MSED are provided to the AMF of MSED by means outside the scope of the present document.
apiProvFuncs	The data type of this attribute is defined as "array (APIProviderFunctionDetails)" and presence qualifier is defined as "O".	See Table 6.1.2-2.
apiProvDomInfo	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	
suppFeat	The data type of this attribute is defined as "SupportedFeatures" and presence qualifier is defined as "C".	N/A
failReason	The data type of this attribute is defined as "string" and presence qualifier is defined as "C".	
apiProvName	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	Applicable in RNAA scenarios.

Table 6.1.2-2 presents the attributes of the APIProviderFunctionDetails data type (see clause 8.9.4.2.3 of TS 29.222 [4]) and provides information on how this data type can be populated with the MSED related information. See table 8.9.4.2.3-1 of TS 29.222 [4] for detailed information on the attributes of APIProviderFunctionDetails data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.1.2-2: Mapping MSED registration information to APIProviderFunctionDetails attributes

Attribute name	Attribute additional information	Related MSED registration information/Comments
apiProvFuncId	The data type of this attribute is defined as "string" and presence qualifier is defined as "C".	The API provider function id is assigned to each function composing the MSED (i.e., AEF, APF or the AMF) by the CCF as part of the MSED registration procedure. The assigned ids of the API provider domain functions are used in the use case clauses 5.2.1 and 5.2.2.
regInfo	The data type of this attribute is defined as "RegistrationInformation" and presence qualifier is defined as "M".	See Table 6.1.2-3.
apiProvFuncRole	The data type of this attribute is defined as "ApiProviderFuncRole" and presence qualifier is defined as "M".	This data type serves to specify, for the MSED to be registered, which CAPIF API provider domain function(s) will be supported. Allowed values are AEF, AMF, APF.
apiProvFuncInfo	See clause 8.9.4.3.3 of TS 29.222 [4] for the enumeration values and description of type ApiProviderFuncRole.	General information related to the specific MSED function (e.g., AEF, AMF or APF)

Table 6.1.2-3 presents the attributes of the RegistrationInformation data type (see clause 8.9.4.2.4 of TS 29.222 [4]) and provides information on how this data type can be populated with the MSED related information. See table 8.9.4.2.4-1 of TS 29.222 [4] for detailed information on the attributes of RegistrationInformation data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.1.2-3: Representing MSED registration information with RegistrationInformation attributes

Attribute name	Attribute additional information	Related MSED registration information/Comments
apiProvPubKey	The data type of this attribute is defined as "string" and presence qualifier is defined as "M" (see table 8.9.4.2.4-1 of TS 29.222 [4]).	It can be used to store the public key of the MSED function(s). NOTE: The public key(s) of the MSED function(s) are provided to the AMF of MSED by means outside the scope of the present document.
apiProvCert	The data type of this attribute is defined as "string" and presence qualifier is defined as "O" (see table 8.9.4.2.4-1 of TS 29.222 [4]).	It can be used to store the client certificate of the MSED function(s), if existing. NOTE: The client certificate of the MSED function(s) can be provided to the AMF of MSED by means outside the scope of the present document.

6.1.3 Service operations supported by the AMF of the MSED to enable the MSED registration functionality

To register MSED as the API provider domain for management services at the CCF, the AMF of the MSED invokes the Register_API_Provider service operation as described in clause 5.11.2.2 of TS 29.222 [4] via the CAPIF-5 interface. The body of the HTTP POST request shall include the API provider enrolment details as described in clause 6.1.2.

To update the registration details of MSED at the CCF, the AMF of the MSED invokes the Update_API_Provider service operation as described in clause 5.11.2.3 of TS 29.222 [4] via the CAPIF-5 interface. The body of the HTTP PUT request shall contain the updated API provider enrolment details as described in clause 6.1.2.

To unregister MSED as the API provider domain for management services from the CCF, the AMF of the MSED invokes the Deregister_API_Provider service operation as described in clause 5.11.2.4 of TS 29.222 [4] via the CAPIF-5 interface.

6.2 Publishing of management services into the CCF

6.2.1 Introduction

To publish management services to the CCF, the following steps occur :

- The management service APIs shall be mapped into service APIs, since CAPIF publishes service APIs and not management service APIs. The management service information (described by the MnSInfo IOC (see clause 4.3.42 of TS 28.622[5])) is mapped into the service API information using the "ServiceAPIDescription" data type (see clause 8.2.4.2.2 in TS 29.222 [4]). The "ServiceAPIDescription" data type describes a service API, and the network operator can decide to publish a single management service as one or more service APIs at the CCF.

- The service APIs are published to the CCF using the Publish_Service_API (see clause 5.3 of TS 29.222 [4]) over the CAPIF-4 interface. The APF of the MSED performs the publishing functionality.

6.2.2 Mapping of management service information into service API information

Table 6.2.2-1 presents the attributes of the ServiceAPIDescription data type (see clause 8.2.4.2.2-1 of TS 29.222 [4]) and clarifies which attributes (of the ServiceAPIDescription data type) can be mapped from management service information. Refer to Table 8.2.4.2.2-1 of TS 29.222 [4] for detailed information on the attributes of ServiceAPIDescription data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.2.2-1: Mapping of management service information into ServiceAPIDescription data type attributes

Attribute name	Attribute additional information	Equivalent MnSInfo IOC attribute/comments
apiName	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Corresponds to the following MnSInfo IOC attribute: mnsType
apiId	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	N/A
aefProfiles	The data type of this attribute is defined as " array(AefProfile)" and presence qualifier is defined as "C".	See Table 6.2.2-2
description	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	N/A
supportedFeatures	The data type of this attribute is defined as "SupportedFeatures" and presence qualifier is defined as "O".	N/A
shareableInfo	The data type of this attribute is defined as "ShareableInformation" and presence qualifier is defined as "O".	N/A
serviceAPICategory	The data type of this attribute is defined as "string" and presence qualifier is defined as "C".	
ccfId	The data type of this attribute is defined as "string" and presence qualifier is defined as "C".	N/A
apiSuppFeats	The data type of this attribute is defined as "SupportedFeatures" and presence qualifier is defined as "O".	N/A
pubApiPath	The data type of this attribute is defined as "PublishedApiPath" and presence qualifier is defined as "C".	N/A
apiProvName	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	N/A
netSliceInfo	The data type of this attribute is defined as "array(NetSliceId)" and presence qualifier is defined as "O".	N/A

Table 6.2.2-2 presents the attributes contained in the AefProfile data type (see clause 8.2.4.2.4 of TS 29.222 [4]) and clarifies which attributes (of the AefProfile data type) can be mapped from the management service information. See Table 8.2.4.2.4-1 of TS 29.222 [4] for detailed information on the attributes of the AefProfile data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.2.2-2: Mapping of management service information into AefProfile data type attributes

Attribute name	Attribute additional information	Equivalent MnSInfo IOC attribute/comments
aefId	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Corresponds to the AEF identifier provided by the CCF upon MSED registration (see “registration of MSED to the CCF” use case).
versions	The data type of this attribute is defined as "array(Version)" and presence qualifier is defined as "M".	See Table 6.2.2-3.
protocol	The data type of this attribute is defined as "Protocol" and presence qualifier is defined as "O".	Only "HTTP_1_1" and "HTTP_2" values are applicable.
dataFormat	The data type of this attribute is defined as "DataFormat" and presence qualifier is defined as "O".	Only applicable value is “JSON”.
securityMethods	The data type of this attribute is defined as "array(SecurityMethod)" and presence qualifier is defined as "O".	Only applicable value is "OAUTH" (i.e. TLS with OAuth token).
grantTypes	The data type of this attribute is defined as "array(OAuthGrantType)" and presence qualifier is defined as "C".	N/A
domainName	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	N/A
interfaceDescriptions	The data type of this attribute is defined as "array (InterfaceDescription)" and presence qualifier is defined as "O".	See Table 6.2.2-5.
aefLocation	The data type of this attribute is defined as "AefLocation" and presence qualifier is defined as "O".	N/A
serviceKpis	The data type of this attribute is defined as "ServiceKpis" and presence qualifier is defined as "O".	N/A
ueIpRange	The data type of this attribute is defined as "IpAddrRange" and presence qualifier is defined as "O".	N/A

Table 6.2.2-3 presents the attributes of the Version data type (see clause 8.2.4.2.5 of TS 29.222 [4]) and clarifies which attributes (of the Version data type) can be mapped from management service information. See Table 8.2.4.2.5-1 of TS 29.222 [4] for detailed information on the attributes of the Version data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.2.2-3: Mapping of management service information into Version datatype attributes

Attribute name	Attribute additional information	Equivalent MnSInfo IOC attribute/comments
apiVersion	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Corresponds to the following `MnSInfo` IOC attribute: `mnsVersion`
expiry	The data type of this attribute is defined as "DateTime" and presence qualifier is defined as "O".	N/A.
resources	The data type of this attribute is defined as "array(Resource)" and presence qualifier is defined as "O".	See Table 6.2.2-4. Each Resource corresponds to an MOI accessed through this MnS. It is up to the network operator’s discretion to determine the managed objects (represented by their IOCs/MOIs) to be published.
custOperations	The data type of this attribute is defined as "array(CustomOperation)" and presence qualifier is defined as "O".	N/A

Table 6.2.2-4 presents the attributes of the Resource data type (see clause 8.2.4.2.6 of TS 29.222 [4]) and clarifies which attributes (of the Resource data type) can be mapped from management service information. See Table 8.2.4.2.6-1 of TS 29.222 [4] for detailed information on the attributes of the Resource data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.2.2-4: Mapping of management service information into Resource data type attributes

Attribute name	Attribute additional information	Equivalent MnSInfo IOC attribute/comments
resourceName	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	IOC name of the MOI.
commType	The data type of this attribute is defined as "CommunicationType" and presence qualifier is defined as "M".	Only "REQUEST_RESPONSE" value is applicable for SA5 MnS of type Provisioning.
uri	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Corresponds to the URI LDN of the MOI to be published (see clause 4.4.2 of TS 32.158[6]).
custOpName	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	N/A
custOperations	The data type of this attribute is defined as "array(CustomOperation)" and presence qualifier is defined as "O".	N/A
operations	The data type of this attribute is defined as "array(Operation)" and presence qualifier is defined as "C".	This attribute represents an array of HTTP methods applicable for the published MOI. It is up to the network operator's discretion to determine the allowable HTTP operations on an MOI to be published.
description	The data type of this attribute is defined as "string" and presence qualifier is defined as "O" (see table 8.2.4.2.6-1 of TS 29.222 [4]).	N/A

Table 6.2.2-5 presents the attributes of the InterfaceDescription data type (see clause 8.2.4.2.3 of TS 29.222 [4]) and clarifies which attributes (of the InterfaceDescription data type) can be mapped from the management service information. See Table 8.2.4.2.3-1 of TS 29.222 [4] for the data type, presence indicator, cardinality, description and applicability information for attributes of InterfaceDescription.

Table 6.2.2-5: Mapping of management service information into InterfaceDescription datatype attributes

Attribute name	Attribute additional information	Equivalent MnSInfo IOC attribute/comments
ipv4Addr	The data type of this attribute is defined as "Ipv4Addr" and presence qualifier is defined as "C".	N/A
ipv6Addr	The data type of this attribute is defined as "Ipv6Addr" and presence qualifier is defined as "C".	N/A
fqdn	The data type of this attribute is defined as "Fqdn" and presence qualifier is defined as "C".	Corresponds to the URI-DN-prefix of the MOI to be published. The FQDN of the MOI can be constructed from the DN prefix as detailed in clause 4.2.3 of TS 32.158 [6].
port	The data type of this attribute is defined as "Port" and presence qualifier is defined as "O".	N/A
apiPrefix	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	Corresponds to the optional "root" path component of the MOI to be published (see clause 4.4.2 of TS 32.158[6]).
securityMethods	The data type of this attribute is defined as "array(SecurityMethod)" and presence qualifier is defined as "O".	Only applicable value is "OAUTH" (i.e. TLS with OAuth token).
grantTypes	The data type of this attribute is defined as "array(OAuthGrantType)" and presence qualifier is defined as "O".	N/A

With this mapping, management service(s) can be published as service API(s) described by the corresponding ServiceAPIDescription datatype(s).

6.2.3 Service operations supported by the APF of MSED to enable the publishing functionality

To publish the service APIs (from clause 6.2.2) to the CCF, the APF functionality of MSED invokes the Publish_Service_API service operation as described in clause 5.3.2.2 of TS 29.222 [4] via the CAPIF-4 interface. The body of the HTTP POST request shall include the Service API description details as described in clause 6.2.2.

To retrieve the published service APIs from the CCF, the APF functionality of MSED invokes the Get_Service_API service operation as described in clause 5.3.2.4 of TS 29.222 [4] via the CAPIF-4 interface.

To update the published service APIs from the CCF, the APF functionality of MSED invokes the Update_Service_API service operation as described in clause 5.3.2.5 of TS 29.222 [4] via the CAPIF-4 interface. The body of the HTTP PUT request shall include the updated Service API description details as described in clause 6.2.2.

To unpublish the published service APIs from the CCF, the APF functionality of MSED invokes the Unpublish_Service_API service operation as described in clause 5.3.2.3 of TS 29.222 [4] via the CAPIF-4 interface.

6.3 Logging the management service API invocations to the CCF

6.3.1 Introduction

To monitor the service API invocations by the external MnS consumers, the following steps shall occur:

- The creation of the service API invocation log(s) using the “CAPIF_Logging_API_Invocation_API” data type (see clause 8.7 of 3GPP TS 29.222 [4]) by the AEF of the MSED.
- Sending the created service API invocation log(s) to the CCF via the CAPIF-3 interface by the AEF of the MSED.

Authorized consumers of the service API invocation logs (e.g., the AMF of the MSED and the charging function (CHF)) can access the logs for auditing and charging purposes.

Clause 6.3.2 describes how the AEF of MSED can create the service invocation logs. Clause 6.3.3 describes the service operations to be supported by the AEF of MSED to enable the logging of the service API invocations by the external MnS consumers.

6.3.2 Creation of the service API invocation logs

Table 6.3.2-1 presents the attributes of the InvocationLog data type (see clause 8.7.4.2.2 of TS 29.222 [4]) and clarifies which attributes (of the InvocationLog data type) can be mapped from the published service API information (see clause 6.2.2). Refer to Table 8.7.4.2.2-1 of TS 29.222 [4] for detailed information on the attributes of the InvocationLog data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.3.2-1: Mapping of CAPIF InvocationLog data type with the published service API information

Attribute name	Attribute additional information	Equivalent published ServiceAPIDescription data type attribute/comments
aefId	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	The AEF identifier provided by the CCF upon MSED registration. Corresponds to the “aefId” attribute of the AefProfile data type (see Table 6.2.2-2).
apiInvokerId	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Provided by the external MnS consumer to the AEF during the service API invocation request via the CAPIF-2e interface.
logs	The data type of this attribute is defined as "array (Log)" and presence qualifier is defined as "M".	See Table 6.3.2-2
supportedFeatures	The data type of this attribute is defined as "SupportedFeatures" and presence qualifier is defined as "O".	N/A

Table 6.3.2-2 presents the attributes of the Log data type (see clause 8.7.4.2.3 of TS 29.222 [4]) and clarifies which attributes (of the Log data type) can be mapped from the published service API information (see clause 6.2.2). Refer to table 8.7.4.2.3-1 of TS 29.222 [4] for detailed information on the attributes of the Log data type (e.g., the attribute data type, presence indicator, cardinality, description and applicability information).

Table 6.3.2-2: Mapping of CAPIF Log data type with the published service API information

Attribute name	Attribute additional information	Equivalent published ServiceAPIDescription data type attribute/comments
apiId	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	The id of the service API that was invoked by the external MnS consumer. This attribute corresponds to the “apiId” attribute of the serviceAPIDescription data type (see Table 6.2.2-1).
apiName	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Name of the service API that was invoked. This attribute corresponds to the “apiName” attribute of the serviceAPIDescription data type (see Table 6.2.2-1).
apiVersion	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	Version of the service API that was invoked by the external MnS consumer. This attribute corresponds to the “apiVersion” attribute of the Version data type (see Table 6.2.2-3).
resourceName	The data type of this attribute is defined as "String" and presence qualifier is defined as "M".	The name of the resource that was invoked by the external MnS consumer. This attribute corresponds to the “resourceName” attribute of the Resource data type (see Table 6.2.2-4).
uri	The data type of this attribute is defined as "Uri" and presence qualifier is defined as "O".	The URI of the resource that was invoked by the external MnS consumer. This attribute corresponds to the “uri” attribute of the Resource data type (see Table 6.2.2-4).
protocol	The data type of this attribute is defined as "Protocol" and presence qualifier is defined as "M".	Represents the protocol used by the service API that was invoked by the external MnS consumer. This attribute corresponds to the “protocol;” attribute of the AefProfile data type (see Table 6.2.2-2).
operation	The data type of this attribute is defined as "Operation" and presence qualifier is defined as "C".	The HTTP method that was invoked on the resource by the external MnS consumer. Corresponds to one of the HTTP methods listed in the "operations" attribute of the Resource data type (see Table 6.2.2-4).
result	The data type of this attribute is defined as "string" and presence qualifier is defined as "M".	The result of the service API invocation request by the external MnS consumer at the AEF. Allowed values are the HTTP status codes defined in clause 6 of IETF RFC 7231[8].

Attribute name	Attribute additional information	Equivalent published ServiceAPIDescription data type attribute/comments
invocationTime	The data type of this attribute is defined as "DateTime", and presence qualifier is defined as "O".	Date and time at which the service API invocation request from the external MnS consumer is received at the AEF of the MSED.
invocationLatency	The data type of this attribute is defined as "DurationMs", and presence qualifier is defined as "O".	The time interval between the reception of the service API invocation request and the sending of the service API invocation response at the AEF of the MSED.
inputParameters	The data type of this attribute is defined as "ANY TYPE" and presence qualifier is defined as "O".	
OutputParameters	The data type of this attribute is defined as "ANY TYPE" and presence qualifier is defined as "O".	
srcInterface	The data type of this attribute is defined as "InterfaceDescription" and presence qualifier is defined as "O".	
destInterface	The data type of this attribute is defined as "InterfaceDescription" and presence qualifier is defined as "O".	
fwdInterface	The data type of this attribute is defined as "string" and presence qualifier is defined as "O".	

6.3.3 Service operation supported by the AEF of MSED to enable the logging functionality

To log the service API invocations (from clause 6.3.2) to the CCF, the AEF of MSED invokes the Log_API_Invocation_API service operation as described in clause 5.8.2.2 of TS 29.222 [4] via the CAPIF-3 interface. The body of the HTTP POST request shall include the invocation log details provided in clause 6.3.2.

Annex A (informative): Discovery of the published service APIs at the CCF by the external MnS consumers

After publishing management services (now published service APIs) to the CCF as described in clause 6.2, the published service APIs are available for discovery by the external MnS consumers via the CAPIF-1e interface. To discover the published service APIs, the external MnS consumer invokes the GET request operation of the CAPIF_Discover_Service_API service (see clause 8.1 of TS 29.222 [4]). The response body of the GET request returns the DiscoveredAPIs datatype (see Table 8.1.4.2.2-1 of TS 29.222 [4]). The DiscoveredAPIs data type consists of an array of the published service APIs that the external MnS consumer is authorized to discover, each represented by the corresponding serviceAPIDescription data type (see clause 6.2.2). The CCF is configured with a discovery policy information, see clause 8.7.3 of TS 23.222 [3], this is needed for CCF to perform filtering on service APIs information which matches the discovery criteria.

On discovering the service APIs, the external MnS consumer can use the discovered service API information to construct the URI of the service API that will be invoked at the AEF of the MSED (via the CAPIF-2e interface).

The structure of the constructed service API URI shall follow the specifications provided in clause 4.4.1 of 3GPP 29.501 [9].

Annex B (informative): MSED Deployment options

B.1 General

Depending on the needs of the network operator, e.g., if the network operator wants to share some of the API provider domain functions of MSED (i.e., the AEF, APF and AMF) with other network domains (e.g., the core network), different MSED deployment options are possible. This annex describes the potential MSED deployment options.

B.2 MSED deployment option#1: AEF, AMF and APF of MSED are dedicated to the 3GPP management system

In this deployment option, the API provider domain functions (i.e., AEF, AMF and APF) of MSED are dedicated to the 3GPP management system (i.e., managing service APIs related to MnSs only) and are not shared (i.e., not managing service APIs related to both MnSs and NFServices). This deployment option is shown in Figure B.2.1.

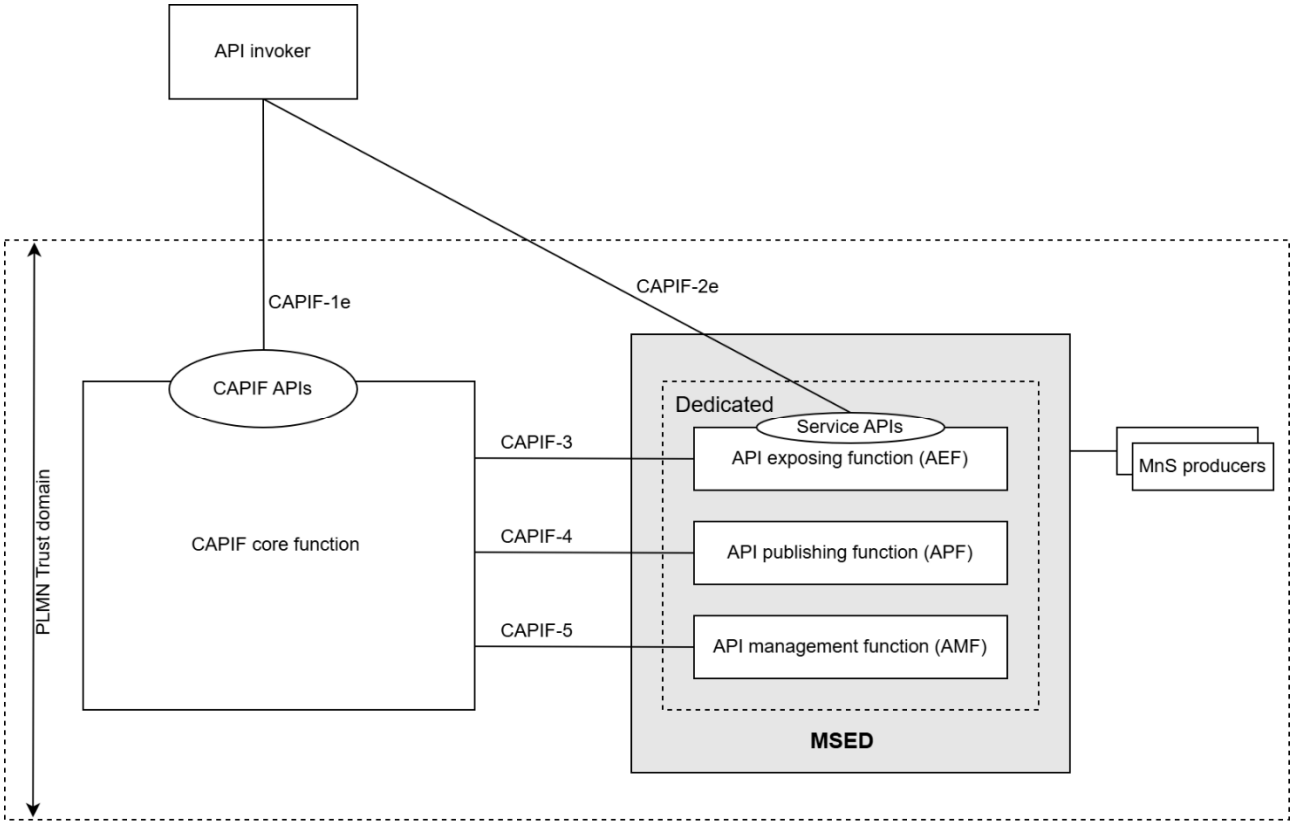

Figure B.2.1: MSED deployment option#1

B.3 MSED deployment option#2: AEF and APF of MSED are dedicated to the 3GPP management system

In this deployment option, the AEF and APF of MSED are dedicated to the 3GPP management system (i.e., managing service APIs related to MnSs only) whereas the AMF of MSED is shared (i.e., managing service APIs related to both MnSs and NFServices). This deployment option is shown in Figure B.3.1.

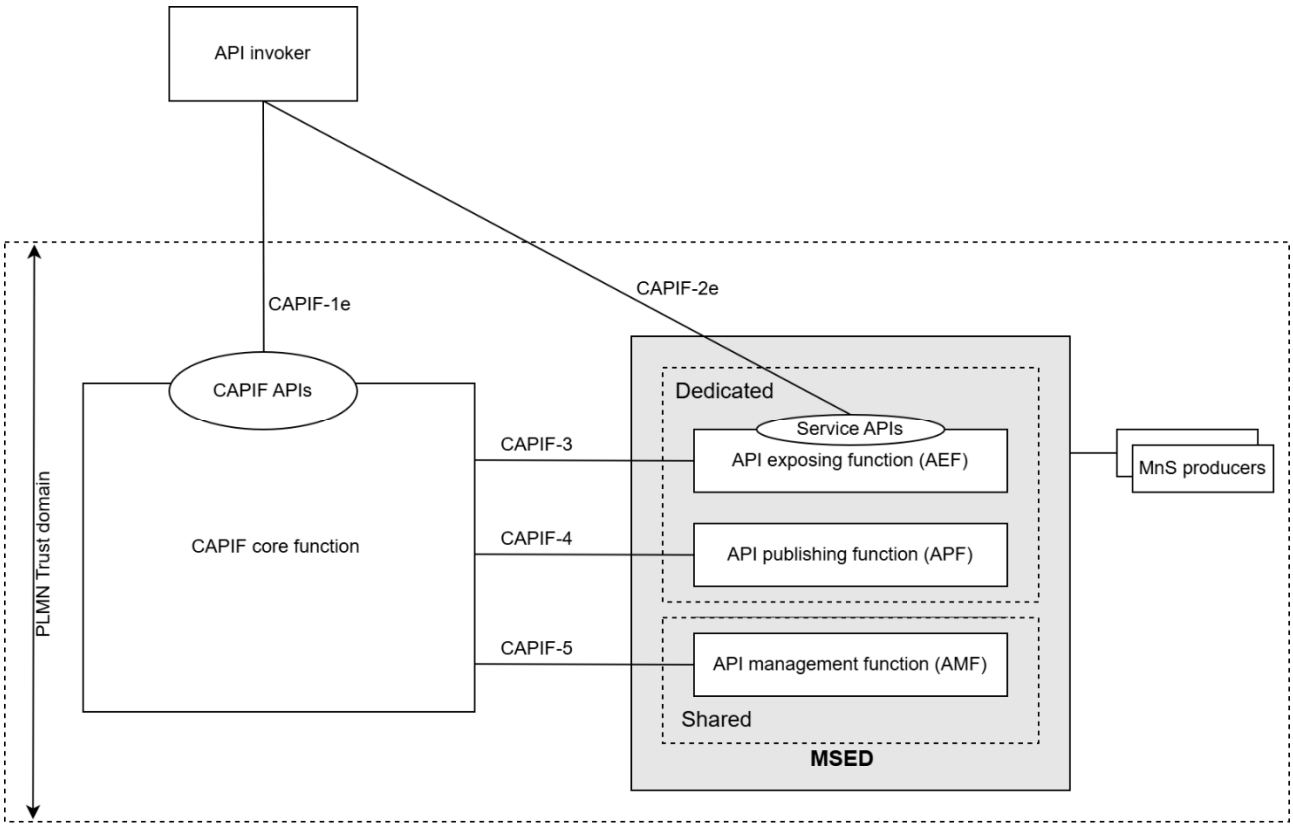

Figure B.3.1: MSED deployment option#2

B.4 MSED deployment option#3: AEF of MSED is dedicated to the 3GPP management system

In this deployment option, only the AEF of MSED is dedicated to the 3GPP management system (i.e., managing service APIs related to MnSs only) whereas the other API provider domain functions of MSED (i.e., the APF and the AMF) are shared (i.e., managing service APIs related to both MnSs and NFServices). This deployment option is shown in Figure B.4.1.

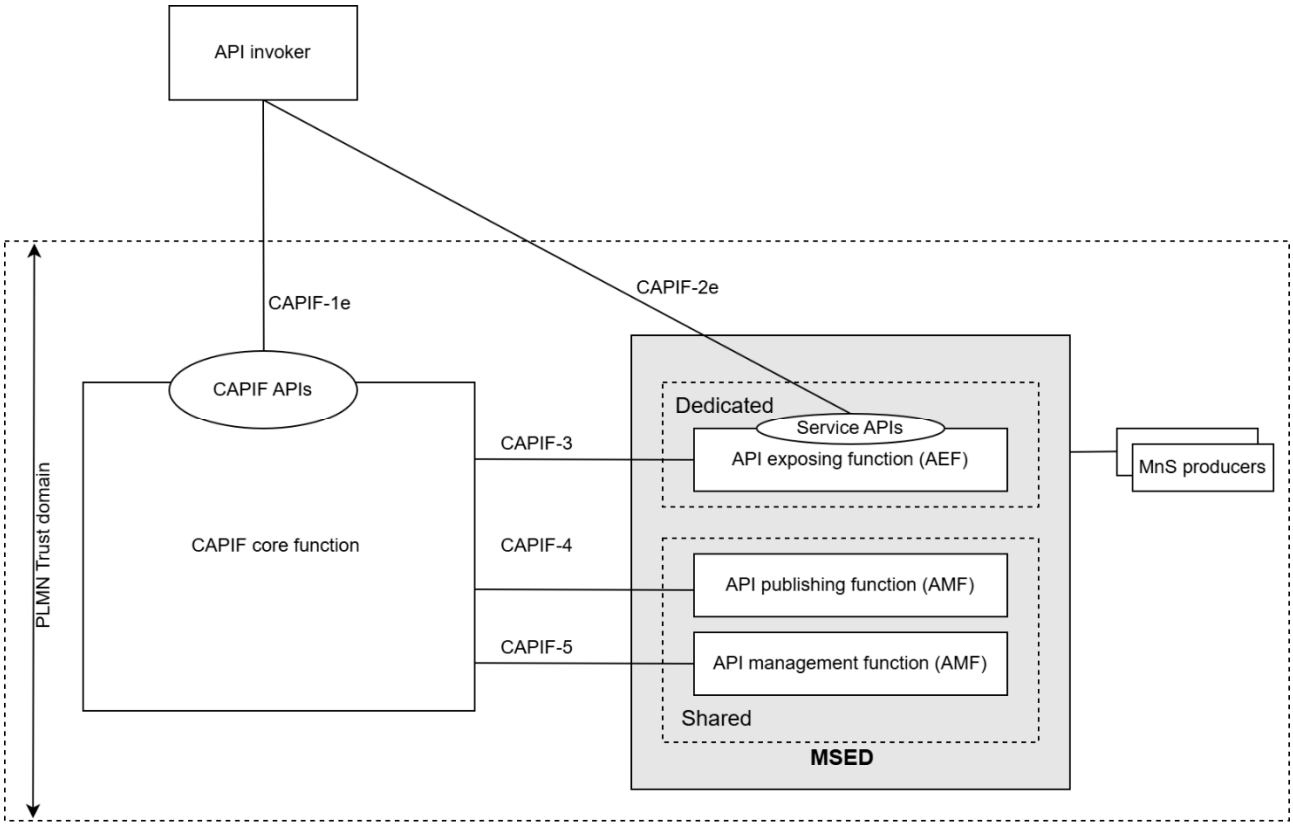

Figure B.4.1: MSED deployment option#3

Annex C (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2025-02	SA5 #159	S5-250903 S5-250905 S5-250906 S5-250907				Add scope content. Add definition for the API provider domain for management services and the corresponding requirements. Add use case for publishing of management services to the CCF. Add use case for logging the management service API invocations to the CCF.	0.1.0
2025-04	SA5 #160	S5-252126 S5-251947 S5-252127 S5-252128 S5-252129 S5-252130 S5-252131 S5-252132				Introduce definition of External MnS consumer Add concepts content Add use case and requirements for registration of the MSED into the CCF Add use case solution for registration of the MSED into the CCF Add use case requirements for publishing of management services to the CCF Add use case solution to enable the publishing management services to the CCF Add use case requirements for logging of management service APIs invocations to the CCF Add use case solution for logging the management service API invocations to the CCF	0.2.0
2025-03	SA5#161	S5-252947 S5-252655 S5-252948				Add introduction content Fix wrong reference Add MSED deployment options	0.3.0
2025-03	SA#108	SP-250494				Presentation to TSG SA for Information	1.0.0
2025-08	SA5#162	S5-253540 S5-254027 S5-254028 S5-254029 S5-254030 S5-254031				Fix wrong reference Resolve Editor's notes Add explanation on discovery policy Update mapping of management service information into service API information Update Annex A Update use case of logging the management service API invocations to the CCF	1.1.0
2025-09	SA#109	SP-251038				Presented for approval	2.0.0
2025-09	SA#109					Upgrade to change control version	19.0.0

History

Document history		
V19.0.0	October 2025	Publication