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**LTE;  
Telecommunication management;  
Configuration Management (CM)  
for mobile networks that include virtualized network functions;  
Requirements  
(3GPP TS 28.510 version 18.0.0 Release 18)**



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# Foreword

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

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# Introduction

The present document is part of a TS-family covering the 3<sup>rd</sup> Generation Partnership Project Technical Specification Group Services and System Aspects, Telecommunication Management; as identified below:

**TS 28.510: Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Requirements.**

TS 28.511: Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Procedures.

TS 28.512: Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 2.

TS 28.513: Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 3.

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# 1 Scope

The present document (together with the relevant requirements described in [1], [2], [3] and [4]) specifies the requirements applicable to Configuration Management (CM) of virtualized network functions.

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## 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 32.102: "Telecommunication management; Architecture".
- [3] 3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".
- [4] 3GPP TS 28.500: "Telecommunication management; Management concept, architecture and requirements for mobile networks that include virtualized network functions".
- [5] ETSI GS NFV-IFA 008 (V2.1.1): "Network Function Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".
- [6] ETSI GS NFV-IFA 010 (V2.1.1): "Network Functions Virtualisation (NFV); Management and Orchestration; Functional requirements specification".
- [7] ETSI GS NFV-IFA 013 (V2.1.1): "Network Function Virtualisation (NFV); Management and Orchestration; Os-Ma-nfvo reference point - Interface and Information Model Specification".
- [8] 3GPP TS 28.525: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Requirements".
- [9] 3GPP TS 32.612: "Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): Information Service (IS)"

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and in 3GPP TS 28.500 [4] 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] or in 3GPP TS 28.500 [4].

**VNF application specific parameters:** parameters for realizing the network element function.

NOTE: VNF application specific parameters are defined by 3GPP. Examples can be network element name, network element address, etc.

**VNF non-application specific parameters:** parameters for instantiating/scaling/terminating a VNF instance.

NOTE: VNF non-application specific parameters are defined by ETSI NFV ISG and are related to the VNF deployment on virtualized infrastructure. An example can be VM parameters.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and in 3GPP TS 28.500 [4] 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] or in 3GPP TS 28.500 [4].

MO	Managed Object
MOI	Managed Object Instance

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# 4 Background and concepts

## 4.1 Configuration management in the context of NFV

3GPP Configuration Management (CM) has system modification functions and system monitoring functions (as described in [3]).

The decoupling of software and hardware in NFV gives rise to the need to model the VNF application specific parameters (i.e. 3GPP service related) by 3GPP whilst modelling the VNF non-application specific parameters (i.e. non-3GPP service related) in ETSI GS NFV-IFA 008 [5].

For Configuration Management, NM and EM manage NEs and NRs and the related configuration parameters (e.g. identification, port, neighbour relation) which are modelled as the MO(s) and MO attributes. The MO attributes, which are defined by 3GPP, typically are VNF application specific parameters.

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# 5 Business level requirements

## 5.1 Requirements

**REQ-NFV\_CM-CON-1** EM shall be able to perform necessary virtualized network function configuration due to the VNF lifecycle management from VNFM:

- Add the VNF as managed node after VNF instantiation.
- Remove the VNF from managed nodes after VNF termination.
- Configure the VNF after some VNF LCM operations (i.e. instantiation).
- Re-configure the VNF after some VNF LCM operations (e.g. scaling, update/upgrade, etc.).

**REQ-NFV\_CM-CON-2** 3GPP management system shall have a capability to create MO(s) corresponding to a VNF instance.

**REQ-NFV\_CM-CON-3** 3GPP management system shall have a capability to configure the MO(s) corresponding to a VNF instance.

**REQ-NFV\_CM-CON-4** Void

**REQ-NFV\_CM-CON-5** Void

**REQ-NFV\_CM-CON-6** Void

**REQ-NFV\_CM-CON-7** Void

**REQ-NFV\_CM-CON-8** 3GPP management system shall have a capability to delete MOI(s) related to a VNF instance.



**REQ-NFV\_CM-CON-9** NM shall have a capability retrieving views of virtualized NEs from various management systems (e.g. EM, NFVO).

**REQ-NFV\_CM-CON-10** 3GPP management system shall have a capability to manage bulk creation of MOIs representing NEs whose software components are designed to run on NFVI.

## 5.2 Actor roles

See detailed actors and roles for each use case in clause 5.4.

## 5.3 Telecommunications resources

See detailed telecommunication resources for each use case in clause 5.4.

## 5.4 High-level use cases

### 5.4.1 Create Managed Object for Network Element in the context of NFV

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal	To create Managed Object (MO) for a new NE that includes virtualized network functions.	
Actors and Roles	3GPP management system (EM, NM) creates MO for NE. NFV MANO system instantiates VNF instance and configures VNF non-application specific parameters for VNF instance.	
Telecom resources	NFV MANO system (NFVO, VNFM), 3GPP management system (EM, NM)	
Assumptions	NFV MANO system has already instantiated a VNF instance using the related VNF Package.	
Pre conditions	N/A	
Begins when	Operator has decided to create MO for a new NE.	
Step 1 (M)	3GPP management system adds the VNF instance as a NE MO. 3GPP management system can configure the VNF instance with application specific parameters during the creation process of NE MO.	
Ends when	Ends when all mandatory steps identified above are successfully completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post Conditions	The MO for a new NE is added into 3GPP management system and is ready for further configuration management (e.g. new or additional application-specific parameters configuration can happen).	
Traceability	REQ-NFV_CM-CON-2, REQ-NFV_CM-CON-3	

### 5.4.2 Delete MOI(s) for Network Element in the context of NFV

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal	To delete MOI(s) for a NE that includes virtualized network function.	
Actors and Roles	3GPP management system (EM, NM) deletes MOI(s) for NE.	
Telecom resources	3GPP management system (EM, NM).	
Assumptions	The MOI(s) for the NE to be deleted has been created.	
Pre conditions	The NE services have been released.	
Begins when	Operator has decided to delete the MOI(s) for a NE.	
Step 1 (M)	3GPP management system deletes the MOI(s) for the subject NE.	
Ends when	Ends when all mandatory steps identified above are successfully completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post Conditions	The MOI(s) for the NE are deleted.	
Traceability	REQ-NFV_CM-CON-8	

### 5.4.3 Update the configuration parameters corresponding to the subject VNF instance (application part) after a VNF instance is scaled

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Update the configuration parameters corresponding to the subject VNF instance (application part) after the VNF is scaled.	
Actors and Roles	3GPP management system (EM, NM).	
Telecom resources	NFV MANO (NFVO, VNFM), 3GPP management system (EM, NM)	
Assumptions		
Pre-conditions		
Begins when	3GPP management system is aware that the VNF instance has been scaled and determines the configuration parameters need to be updated.	
Step 1 (M)	3GPP management system updates the configuration parameters corresponding to the subject VNF instance (application part).	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The configuration parameters corresponding to the subject VNF instance (application part) are updated.	
Traceability	REQ-NFV_CM-CON-3	

### 5.4.4 Retrieve virtualized NE information by NM

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	NM updates its view of its managed virtualized NEs.	
Actors and Roles	NM	
Telecom resources	EM, NFVO.	
Assumptions	None	
Pre-conditions	None	
Begins when	NM determines a need to update its view of its managed VNFs.	
Step 1 (M)	NM requests NFVO to provide information of VNFs (see clause 7.3.6 in ETSI GS NFV-IFA 013 [7]).  NM requests EM to provide information of virtualized NEs. This information is VNF application-specific.	
Step 2 (M)	NFVO responds with the information requested. NM updates its view of its managed virtualized NE,  EM responds to NM with the information requested.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	NM has the information to update its view of its managed virtualized NEs.	
Traceability	REQ-NFV_CM-CON-9,	

## 6 Specification level requirements

### 6.1 Requirements

#### 6.1.1 Requirements for Itf-N

**REQ-NFV\_CM\_Itf-N-FUN-1** The IRPAgent shall support the capability allowing IRPManager to manage the mobile networks that include virtualized network functions.

**REQ-NFV\_CM\_Itf-N-FUN-2** The IRPAgent shall support the capability allowing IRPManager to differentiate the virtualized and non-virtualized network functions.

**REQ-NFV\_CM\_Itf-N-FUN-3** IRPAgent shall support the capability to allow IRPManager to create the MOI(s) corresponding to a VNF instance (application part) and configure the attribute(s) of the MOI(s).

**REQ-NFV\_CM\_Itf-N-FUN-4** IRPAgent shall support the capability to notify IRPManager of the completion of the MOI(s) creation and configuration.

**REQ-NFV\_CM\_Itf-N-FUN-5** IRPAgent shall support the capability to allow IRPManager to delete the MOI(s) corresponding to a VNF instance (application part).

**REQ-NFV\_CM\_Itf-N-FUN-6** IRPAgent shall support the capability to allow IRPManager to update the Managed Object instance(s) corresponding to a VNF instance (application part).

**REQ-NFV\_CM\_Itf-N-FUN-7** IRPAgent shall support the capability to notify IRPManager the change of the Managed Object instance(s) corresponding to a VNF instance (application part).

**REQ-NFV\_CM\_Itf-N-FUN-8** IRPAgent shall support the capability to allow IRPManager to set the MOI(s) to associate with a VNF instance (application part) and configure the attribute(s) of the MOI(s).

**REQ-NFV\_CM\_Itf-N-FUN-9** IRPAgent shall support a capability allowing IRPManager to request enabling/disabling the auto-scaling of the VNF instance(s) corresponding to an NE.

## 6.1.2 Requirements for Os-Ma-nfvo

None.

## 6.1.3 Requirements for Ve-Vnfm-em

None.

## 6.1.4 Requirements for Ve-Vnfm-vnf

None.

## 6.2 Actor roles

See detailed actors and roles for each use case in clause 6.4.

## 6.3 Telecommunication resources

See detailed telecommunication resources for each use case in clause 6.4.

## 6.4 Use cases

### 6.4.1 MOI creation related use cases

#### 6.4.1.1 Introduction

The MO instance and VNF instance can exist independently. The 3GPP management system maintains the unidirectional relationships (MOI points to VNF instance) between MO instances and the corresponding VNF instances.

There are following potential scenarios to maintain the relationship between MO instances and VNF instances.

Scenario 1: The NM initiated MO instance creation operation (a new version of create MO operation) over Itf-N provides the available VNF instance identifier as an input parameter. The created MO instance representing vNE has the relationship with the selected VNF instance.

Scenario 2: The NM initiated MO instance creation operation (a new version of create MO operation) over Itf-N has a parameter indicating whether a new VNF needs to be instantiated by EM. The presence of the indicator triggers the

VNF instantiation request from EM to VNFM. The created MO instance representing vNE has the relationship with the new created VNF instance.

Scenario 3: NM initiates MO instance creation operation using existing create MO operation over Itf-N. NM initiates the VNF instantiation operation via Os-Ma-nfvo. NM sets the relationship between MO instance representing vNE and VNF instance by SetMOAttribute operation (in Bulk or Basic CM IRP).

Scenario 4: NM initiates the VNF instantiation operation via Os-Ma-nfvo. After the VNF instantiation is complete, the vNE starts execution and informs its presence to EM.

EM would then create the MOI(s) representing the vNE. EM populates this newly created MOI with VNF identifier received from vNE. EM then notifies NM that the MOI(s) representing the newly installed vNE is created. NM can now exercise CM related operations on the said MOI from now on.

Scenario 5: NM requests (conveyed via the Bulk CM IRP file) EM to create a set of MOI(s) representing a set of vNE.

EM would initiate necessary VNF instantiation operations towards VNFM. After a VNF instantiation is complete, the vNE starts execution and informs its presence to EM.

EM would then create the MOI(s) representing the vNE. EM populates this newly created MOI with VNF identifier received from vNE. EM then notifies NM that the MOI(s) representing the newly installed vNE is created. NM can now exercise CM related operations on the said MOI from now on.

Editor's note: given that there can be multiple number of NMs, VNFMs, EMs, NFVOs in an operator network and that there are five scenarios (UCs) documented to relate MOI(s) creation and VNF instance instantiation, there is a need to analyse if NM (or EM) can correctly determine which scenario will be selected.

#### 6.4.1.2 Create MOI(s) after a VNF is instantiated (Triggered by NM)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Create the MOI(s) corresponding to a VNF instance (application part) and configure the attribute(s) of the MOI(s) after the VNF is instantiated.	
Actors and Roles	3GPP NM.	
Telecom resources	3GPP NM, 3GPP EM, NFVO	
Assumptions		
Pre-conditions	The MOI(s) for the subject VNF instance have not been created.	
Begins when	NM receives the message indicating the subject VNF has been instantiated from NFVO or EM.	
Step 1 (M)	NM sends a request to EM to create the MOI(s) corresponding to the subject VNF instance (application part) and configure the attribute(s) of the MOI(s).	
Step 2 (M)	EM creates the MOI(s) corresponding to the subject VNF instance (application part).	
Step 3 (M)	EM configures the attribute(s) of the created MOI(s).	
Step 4 (M)	EM notifies NM of the completion of the MOI(s) creation and configuration.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to a VNF instance (application part) is/are created and configured.	
Traceability	REQ-NFV_CM_Itf-N-FUN-3, REQ-NFV_CM_Itf-N-FUN-4	

## 6.4.1.3 Create MOI(s) after a VNF is instantiated (Triggered by EM)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Create the MOI(s) corresponding to a VNF instance (application part) and configure the attribute(s) of the MOI(s) after the VNF is instantiated.	
Actors and Roles	3GPP EM.	
Telecom resources	3GPP EM, VNFM	
Assumptions		
Pre-conditions	The MOI(s) for the subject VNF instance have not been created.	
Begins when	EM receives the message indicating the VNF has been instantiated from VNFM;	
Step 1 (M)	EM creates the MOI(s) corresponding to the subject VNF instance (application part).	
Step 2 (M)	EM configures the attribute(s) of the created MOI(s).	
Step 3 (M)	EM notifies NM of the completion of the MOI(s) creation and the VNF configuration.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to a VNF instance (application part) is/are created and configured.	
Traceability	REQ-NFV_CM_Itf-N-FUN-4	

## 6.4.1.4 Create MOI(s) for a specified VNF instance (Triggered by NM)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Create the MOI(s) corresponding to an existing VNF instance (application part) and configure the attribute(s) of the MOI(s) after the VNF is instantiated if needed.	
Actors and Roles	3GPP NM.	
Telecom resources	3GPP NM, 3GPP EM, NFVO	
Assumptions		
Pre-conditions	The MOI(s) for the subject specified VNF instance have not been created. NM receives the message indicating the subject VNF has been instantiated.	
Begins when	Operator decides to create MOI(s) for an existing VNF instance.	
Step 1 (M)	NM sends a request to EM to create the MOI(s) with the VNF instance identifier and configure the attribute(s) of the MOI(s).	
Step 2 (M)	EM creates the MOI(s) and sets the relevant MOI(s) attributes with the VNF instance identifier.	
Step 3 (O)	EM may configure other attribute(s) of the created MOI(s) if needed.	
Step 4 (M)	EM notifies NM of the completion of the MOI(s) creation and configuration.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to an existing VNF instance (application part) is/are created and configured.	
Traceability	REQ-NFV_CM_Itf-N-FUN-3, REQ-NFV_CM_Itf-N-FUN-4	

## 6.4.1.5 Associate MOI(s) with a VNF instance (Triggered by NM)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Associate MOI(s) with a VNF instance and configure the attribute(s) of the MOI(s) if needed.	
Actors and Roles	3GPP NM.	
Telecom resources	3GPP NM, 3GPP EM	
Assumptions	NM has subscribed to the <code>attributeValueChange</code> notification.	
Pre-conditions	The corresponding VNF instance has been instantiated and the VNF instance identifier has been notified to NM. The MOI(s) has been created.	
Begins when	Operator decides to associate MOI(s) with an existing VNF instance.	
Step 1 (M)	NM sends a request with the VNF instance identifier to EM to associate MOI(s) with the VNF instance identified by the identifier. The other configuration parameters are also included in the request if needed.	
Step 2 (M)	EM sets the attributes of the created MOI(s) with the VNF instance Identifier.	
Step 3 (M)	EM responds NM of the completion of the association of MOI(s) and VNF instance.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to the specified VNF instance is/are created.	
Traceability	REQ-NFV_CM_Itf-N-FUN-8	

6.4.1.6 Bulk MOIs creation

Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	To deploy large number of network elements whose software components are designed to run on NFVI.  (The term NE used in this UC refers to network elements whose software components are designed to run on NFVI.)	
<b>Actors and Roles</b>	NM	
<b>Telecom resources</b>	EM, NFVO, network planned data.	
<b>Assumptions</b>	Operator has the network planned data for NEs and is ready for their deployment. The planned data contains information about the to-be-deployed NEs.  During the VNF instantiation process, the VNF: <ul style="list-style-type: none"> <li>a) is given the managing EM IP address, or;</li> <li>b) is given the managing EM name and sufficient information to access a directory server that can resolve the EM name to IP address – such that VNF can request the directory server to resolve the EM name to EM IP address, or;</li> <li>c) uses MvPnP (see requirements in clause 5.2 of [9]) to establish connection to its managing EM.</li> </ul>	
<b>Pre-conditions</b>	For each wanted NE, operator knows the number and the types of VNFs needed. EM would keep records of all incoming messages that bear VNF ID and the VNF address (see Step 6).	
<b>Begins when</b>	Operator decides to deploy the NEs of specified types.  Operator constructs a “Bulk Configuration Data File” (File) [see clause 10 of [9]] that captures <ul style="list-style-type: none"> <li>• the number of NEs (and types) wanted where one or more MOI(s) are representing software components designed to run on NFVI.</li> </ul>	
<b>Step 1 (M)</b>	Operator instructs NM to deploy the planned NEs using information of the File.	
<b>Step 2 (M)</b>	NM, based on information in the File and the knowledge described in Pre-conditions, requests NFVO to instantiate all VNF(s) required for the deployment of all NEs wanted [Note 1.] NFVO, using VNF/M/VIM, instantiates the VNFs requested for instantiation and responds to NM with the VNF IDs of the successfully instantiated VNFs [Note 1].	
<b>Step 3 (M)</b>	NM updates the File by capturing: <ul style="list-style-type: none"> <li>• the received VNF ID(s) in MOI's vnfIdList [Note 2] attribute.</li> </ul>	
<b>Step 4 (M)</b>	NM transfers the File (see procedure in [9]) to EM to deploy the planned network in accordance to the File information.	
<b>Step 5 (M)</b>	EM creates sets of MOIs (where one set corresponds to one NE) in its Management Information Base (MIB) in accordance to the File information.  The MOIs' vnfIdList attributes has the corresponding VNF IDs as values.  The NE attribute operation state is set to Disabled.	
<b>Step 6 (M)</b>	When a VNF is instantiated, it knows its managing EM address (because of assumption a, b or c). VNF sends a message that bear its VNF ID and its VNF address, to its managing EM.	



Use case stage	Evolution/Specification	<<Uses>> Related use
<b>Step 7 (M)</b>	EM examines its records (see Pre-condition) or on reception of message from VNF that bears the VNF ID and the VNF address, will try to identify if the MOI(s) whose vnflidList has an vnflid that is same as the VNF ID received. When found, the EM considers that the VNF is running on NFVI.  When all VNF instance(s) of a NE are running on NFVI, the operation state of the NE is changed to Enabled.  EM notifies NM of the NE whose operation state is Enabled.	
<b>Ends when</b>	The above steps have successfully completed.	
<b>Exceptions</b>	--	
<b>Post-conditions</b>	The network resource model instance tree, maintained by EM, corresponding to the information of the File is created and the state of all NE(s) are Enabled.	
<b>Traceability</b>	REQ-NFV_CM-CON-10	
	Note 1: NM may issue InstantiateNsRequest (clause 7.3.3. [8]) to NFVO or issue UpdateNsRequest to NFVO with input parameter updateType==instantiateVnf (clause 7.3.5 of [8]), based on his knowledge of NS instances in existence.  Note 2: It is assumed that MOIs would have an attribute called vnflid whose elements are identifier of VNF instance involved.	

## 6.4.2 Configure VNF instance with Managed Object attributes

Use Case Stage	Evolution / Specification	<<Uses>> Related use
<b>Goal</b>	Configure an existing VNF instance with Managed Object attributes.	
<b>Actors and Roles</b>	IRPManager	
<b>Telecom resources</b>		
<b>Assumptions</b>		
<b>Pre conditions</b>	The MOI(s) for the NE have been created.	
<b>Begins when</b>	Operator decides to configure Managed Object attributes for an existing VNF instance.	
<b>Step 1 (M)</b>	IRPManager sends a request to IRPAgent to configure the VNF instance over Itf-N.	
<b>Step 2 (M)</b>	IRPAgent configures the VNF instance with Managed Object attributes.	
<b>Step 3 (M)</b>	IRPAgent returns the result of the VNF instance configuration to IRPManager over Itf-N.	
<b>Ends when</b>	Ends when all mandatory steps identified above are successfully completed or when an exception occurs.	
<b>Exceptions</b>	One of the steps identified above fails.	
<b>Post Conditions</b>	The VNF instance has been configured with Managed Object attributes.	
<b>Traceability</b>	REQ-NFV_CM_Itf-N-FUN-6	

### 6.4.3 Delete the MOI(s) corresponding to a VNF instance (application part)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Delete the MOI(s) corresponding to the subject VNF instance (application part).	
Actors and Roles	3GPP NM	
Telecom resources	3GPP NM, 3GPP EM	
Assumptions		
Pre-conditions	The 3GPP services provided by the VNF instance where its relevant MOI(s) are to be deleted have been released	
Begins when	The operator decides to delete the MOI(s) corresponding to a VNF instance (application part).	
Step 1 (M)	NM sends a request to EM to delete the MOI(s) corresponding to the subject VNF instance (application part).	
Step 2 (M)	EM deletes the MOI(s) corresponding to the subject VNF instance (application part).	
Step 3 (M)	EM notifies NM of the completion of the MOI(s) deletion.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to the subject VNF instance (application part) are deleted.	
Traceability	REQ-NFV_CM_Itf-N-FUN-5.	

### 6.4.4 Update the MOI(s) corresponding to the subject VNF instance (application part) after a VNF instance is scaled (Triggered by NM)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Update the attributes of the MOI(s) corresponding to the subject VNF instance (application part) after a VNF has been scaled.	
Actors and Roles	3GPP NM	
Telecom resources	3GPP NM, 3GPP EM	
Assumptions		
Pre-conditions	The MOI(s) for the subject VNF instance have not been updated.	
Begins when	NM learns that the VNF instance has been scaled, and decides the MOI(s) corresponding to the subject VNF instance (application part) need to be updated.	See use case in clause 6.4.3.4 in TS 28.525 [8]
Step 1 (M)	NM sends a request to EM to update the MOI(s) corresponding to the subject VNF instance (application part).	
Step 2 (M)	EM updates the attributes of the MOI(s) corresponding to the subject VNF instance (application part).	
Step 3 (M)	EM sends the notifications to NM about the update of the MOI(s).	
Ends when (*)	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to the subject VNF instance (application part) are updated.	
Traceability (*)	REQ-NFV_CM_Itf-N-FUN-6, REQ-NFV_CM_Itf-N-FUN-7	

### 6.4.5 Update the MOI(s) corresponding to the subject VNF instance (application part) after a VNF instance is scaled (Triggered by EM)

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Update the attributes of the MOI(s) corresponding to the subject VNF instance (application part) after a VNF instance is scaled.	
Actors and Roles	3GPP NM	
Telecom resources	3GPP NM, 3GPP EM, VNFM	
Assumptions		
Pre-conditions	The MOI(s) for the subject VNF instance have not been updated.	
Begins when	EM receives the message indicating the VNF has been scaled from VNFM and decides the MOI(s) corresponding to the subject VNF instance (application part) need to be updated.	
Step 1 (M)	EM updates the attributes of the MOI(s) corresponding to the subject VNF instance (application part).	
Step 2 (M)	EM sends the notifications to NM about the update of the MOI(s).	
Ends when (*)	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The MOI(s) corresponding to the subject VNF instance (application part) are updated.	
Traceability (*)	REQ-NFV_CM_Itf-N-FUN-7	

6.4.6 Void

6.4.7 Void

6.4.8 Void

### 6.4.9 Enable/disable the auto-scaling of the VNF instance(s) corresponding to an NE

Use Case	Evolution/Specification	<<Uses>> Related use
Goal	Enable/Disable the auto-scaling of the VNF instance(s) corresponding to an NE.	
Actors and Roles	IRPManager	
Telecom resources	IRPAgent, VNFM	
Assumptions		
Pre-conditions		
Begins when	The operator decides to enable/disable the auto-scaling of the VNF instance(s) corresponding to an NE.	
Step 1 (M)	IRPManager requests IRPAgent to change the value of the auto-scaling attribute on VNF instance(s) corresponding to an NE.	
Step 2 (M)	EM requests VNFM to enable/disable the auto-scaling of the subject VNF instance(s).	Use case defined in clause 6.4.1.6 of [8].
Step 3 (M)	IRPAgent notifies IRPManager of the completion result of enabling/disabling the auto-scaling of the VNF instance(s) corresponding to an NE.	
Ends when	Ends when all steps identified above are completed or when an exception occurs.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The auto-scaling of the VNF instance(s) corresponding to an NE is enabled/disabled.	
Traceability	REQ-NFV_CM_Itf-N-FUN-9	

## 6.4.10 VNF instance information synchronization

Use Case	Evolution/Specification	<<Uses>> Related use
<b>Goal</b>	Synchronize the VNF related information in a ManagedFunction instance with the corresponding VNF information in MANO side.	
<b>Actors and Roles</b>	IRPAgent	
<b>Telecom resources</b>	IRPManager, VNFM	
<b>Assumptions</b>		
<b>Pre-conditions</b>	EM has subscribed the VnfLifecycleChangeNotification and VnfInfoAttributeValueChangeNotification (see clause 7.3.3 of [5]).	
<b>Begins when</b>	EM receives VnfLifecycleChangeNotification or VnfInfoAttributeValueChangeNotification (see clause 7.3.3 of [5]) from VNFM.	
<b>Step 1 (O)</b>	EM performs QueryVNF operation (see clause 7.2.9 of [5]) and obtains the current information of the corresponding VnfInfo object.	
<b>Step 2 (O)</b>	If the attribute values on EM do not match those of the current VnfInfo, EM updates these values.	
<b>Step 3 (O)</b>	If the attribute values of MOI(s) exposed to IRPManager are changed, IPRAgent notifies IPRManager about the attribute value changes.	
<b>Ends when</b>	Ends when all steps identified above are completed or when an exception occurs.	
<b>Exceptions</b>	One of the steps identified above fails.	
<b>Post-conditions</b>	The VNF related information in the ManagedFunction instance is synchronized with the corresponding VNF information in MANO side.	
<b>Traceability</b>		

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## Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-09	SA#77	SP-170651	0001	-	F	Remove the duplicated use cases and requirements	14.1.0
2018-03	SA#79	SP-180058	0003	1	F	Scope extension	14.2.0
2018-06	-	-	-	-	-	Update to Rel-15 version (MCC)	<b>15.0.0</b>
2020-07	-	-	-	-	-	Update to Rel-16 version (MCC)	<b>16.0.0</b>
2022-03	-	-	-	-	-	Update to Rel-17 version (MCC)	<b>17.0.0</b>
2024-04	-	-	-	-	-	Update to Rel-18 version (MCC)	<b>18.0.0</b>

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# History

<b>Document history</b>		
V18.0.0	May 2024	Publication