**3GPP TSG-SA5 Meeting #130-e *S5-202145***

**Online, , 20th Apr 2020 - 28th Apr 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **28.531** | **CR** | **0043** | **rev** | **-** | **Current version:** | **16.5.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network | **x** |

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| ***Title:***  | Fix inconsistencies |
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| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | S5 |
|  |  |
| ***Work item code:*** | eNRM |  | ***Date:*** | 2020-04-10 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | There are three concepts which need clarifications:- Network Slice- Network Slice Instance- NSI ID1. "Network Slice" term/definition: The definition of “Network Slice” (defined in TS 23.501) is conceptually aligned between SA2 and SA5. "NetworkSlice" IOC represents the SA2 defined "Network Slice" for the management purpose. This is the general network slicing management approach as we did for management of other network elements.
2. "Network Slice Instance" term/defintion: The definition of "Network Slice Instance" (defined in TS 23.501) is conceptually aligned between SA2 and SA5. It focuses on the depolyment aspect and composition of Network Slice (defined in TS 23.501). In SA5 understanding, the Network Slice Instance contains the related resources which are needed to compose a network slice including both 3GPP defined Core network and RAN.
3. "NSI ID" term: The term "NSI ID" might lead to conslusion that it is the identifier of NSI, which is actually DN of NSI. In the context of SA2, the NSI ID usage is optional and for the purpose to identify the core network part of NSI using NRF discovery mechanism.

Potential confusion is mainly caused by the use of "NSI ID" term. |
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| ***Summary of change:*** | Fix inconsistencies related to "Network Slice instance (NSI)" term usage. |
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| ***Consequences if not approved:*** | Inconsistent term usage may lead to incorrect implementation. |
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| ***Clauses affected:*** | 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.6, 5.1.7, 5.1.8, 5.1.9, 5.1.10, 5.1.12, 5.1.13, 5.1.14, 5.1.15, 5.1.16, 5.1.21, 5.1.22, 5.1.23 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| **1st change** |

# 4 General

## 4.1 Overview

A 5G system consists of a 5G Access Network (AN), and a 5G Core Network (5GC). Network slicing is one of the key 5G features.

The management aspects of an network sliceNS instance are described by the four phases shown in Figure 4.3.1.1 of TS 28.530 [4].

The provisioning of network slicing includes the four phases which are preparation, commissioning, operation and decommissioning:

- In the preparation phase the NS instance does not exist. The preparation phase includes network slice design, on-boarding, evaluation of the network slice requirements, preparing the network environment and other necessary preparations required to be done before the creation of an NS instance.

- During the NS instance lifecycle stage which include commissioning phase, operation phase and decommissioning phase, the NS instance provisioning operations include:

- Create an NS instance;

- Activate an NS instance;

- De-active an NS instance;

- Modify an NS instance;

- Terminate an NS instance.

The operations of the provisioning of an NS instance occurs during different phases of a NS instance:

a) During the commissioning phase:

- Create an NS instance.

During NS instance creation all resources to the NS instance have been created and configured to satisfy the network slice requirements. NS instance creation may trigger NSS instance(s) creation or using existing NSS instance(s) and setting up the corresponding associations.

b) During the operation phase:

- Activate an NS instance;

- Modify an NS instance;

- De-active an NS instance.

 NS instance activation includes any actions that make the NS instance active to provide communication services. NS instance activation may trigger NSS instance activation.

 NS instance modification in operation phase could map to several workflows, e.g. changes of NS instance capacity, changes of NS instance topology, NS instance reconfiguration. NS instance modification can be triggered by receiving new network slice related requirements, new communication service requirements, or the result of NS instance supervision automatically. NS instance modification may trigger NSS instance modification.

 The NS instance deactivation operation may be needed before NS instance modification operation and the NS instance activation operation may be needed after the NS instance modification operation. NS instance deactivation includes any actions that make the NS instance inactive and not providing any communication services. NS instance deactivation trigger NSS instance deactivation to deactivate constituent NSS instance(s) which is not used by other NS instance(s). Operator may decide to keep the NS instance without termination after deactivation and reactivate it when receives new communication service request.

c) During the decommissioning phase:

- Terminate an NS instance.

NS instance termination step includes any action that make the NS instance does not exist anymore and release resources that are not used by other NS instance(s). NS instance termination may trigger NSS instance termination to terminate constituent NSS instance(s) which is not used by other NS instance(s).

Similarly, provisioning for NSS instance includes the following operations:

- Create an NSS instance;

- Activate an NSS instance and associate it with certain NS instance to be used by the NS instance;

- Disassociate the NSS instance with certain NS instance and de-active the NSS instance if it’s not associated with any NS instance;

- Modify an NSS instance;

- Terminate an NSS instance.

## 4.2 Configuration information for the constituents of an NS instance

To use network slice to support communication service or deliver a network slice as a service, the 3GPP defined constituents of the NS instance should be configured by 3GPP management system according to the types and requirements of the network slice so that the NS instance can be operated and maintained.

The configuration information of these components may include:

*- Information on the requirements to be applied to every NS instance constituent to satisfy the requirements of multiple NS instances* if the constituent is shared by multiple NS instances;

*- Network function selection information:* Information on the selection of the NFs (e.g., AMF) according to the requirements of this NS instance;

*- Connection information*: The information of the logical links to carry the NS instance’s CP and UP data between the component and other NFs and NSS instances belonging to the NS instance.

NOTE 1: The list of information above is not exhaustive.

NOTE 2: The list of information above is not all necessary for an NS instance.

## 4.3 General information for NS instance

The general information used to describe an NS instance may include:

- Resource model information, which describes the static parameters and functional components of network slice, includes service profile, network slice type (e.g. eMBB), additional system feature (e.g. multicast, Edge Computing), priority.

- Management model information, which describes the information model that is used for network slice lifecycle management, includes configuration profile (e.g. application configuration parameters).

- Capability model information, which describes the capability including supported communication service characteristic information (e.g. service type, UE mobility level, density of users, traffic density), QoS attributes (e.g. bandwidth, latency, throughput and so on) and capacity (e.g. maximum number of UEs), can be exposed to CSC .

## 4.4 General information for NSS instance

The general information used to describe an NSS instance may include:

- Resource model information, which describes the static parameters and functional component of network slice subnet, includes slice profile, network slice subnet type (e.g. RAN eMBB, CN eMBB), additional system feature (e.g. multicast, Edge Computing), priority, QoS attributes (e.g. bandwidth, latency, number of subscribers and so on), NSD ID.

- Management model information, which describes the information model that is used for network slice subnet lifecycle management, includes configuration profile (e.g. application configuration parameters).

- Capability model information, which describes the capability including supported communication service characteristic information (e.g. service type, UE mobility level, density of users, traffic density), QoS attributes (e.g. bandwidth, latency, throughput and so on) and capacity (e.g. maximum number of UEs).

## 4.5 General information for service profile

Depending on industry requirements and operator’s design requirements, different service profiles may be used to represent SLS associated with instances of Network Slice IOC.

The following are examples for service profiles:

- A service profile is used to capture a set of requirements for the new network slice such as (eMBB, MIoT, URLLC).

- A service profile is used to capture a set of specific industry requirements for creation of network slice such as V2X, smart grid, Remote Healthcare.

## 4.6 General information for network slice related identifiers

There are following network slice related identifiers which serve different purposes:

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| --- | --- |
| **Identifier** | **Description** |
| **Identifiers for network slice management purpose** |
| NetworkSlice identifier | Represent the management identifier of NS instance. Management identifier of NS instance is defined in TS 28.541[6] as objectinstance attribute of NetworkSlice IOC. |
| NetworkSliceSubnet identifier | Represent the management identifier for an NSS instance. Management identifier of NSS instance is defined in TS 28.541[6] as objectinstance attribute of NetworkSliceSubnet IOC. |
| **Identifiers for network slice selection purpose** |
| NS instance ID | Represent Core Network part of a Network Slice instance when multiple Network Slice instances of the same Network Slice are deployed, and there is a need to differentiate between them in the 5GC. Referred to TS 23.501[10]. |
| S-NSSAI | Represent network slice. Referred to TS 23.501[10] and TS 38.300[11]. |
| PLMN ID | Represent PLMN identifier.  |

The NS instance ID and S-NSSAI are configured by the management system.

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## 5.1 Use cases

### 5.1.1 NS instance creation

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To satisfy request for allocation of an NS instance with certain characteristics, by creation of new or using existing NS instance; the request includes the network slice related requirements. |  |
| **Actors and Roles** | A network slice provisioniong management service consumer.NOP (Network Operator) |  |
| **Telecom resources** | NS instanceNSS instanceTransport networkA network slice provisioning management service provider.A network slice subnet provisioning management service provider. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | N/A |  |
| **Begins when**  | The network slice provisioning management service provider receives the request for allocation of the NS instance with certain characteristics; the request contains network slice related requirements and the information indicating whether the requested NS instance could be shared with other consumers. |  |
| **Step 1 (M)** | If the requested NS instance can be shared and if an existing NS instance can be used, the network slice provisioning management service provider decides to use the existing NS instance.Modification of the existing NS instance may be needed to satisfy the NS instance related requirements. Use case is completed go to “Step 8".Otherwise, the network slice provisioning management service provider triggers to create a new NS instance, for which the following steps 2 – 8 are needed.  |  |
| **Step 2 (M)** | The network slice provisioning management service provider decides on the constituent NSS instances and the topology of the NS instance to be created using the information from service profile [6]. For the constituent NSS instances, the network slice provisioning management service provider derives network slice subnet related requirements from the network slice related requirements. If reconfiguration of the transport network is needed, the network slice provisioning management service provider derives transport network related requirements (e.g. latency, bandwidth) from the network slice related requirements.  |  |
| **Step 3 (M)** | For the required NSS instance(s), the network slice provisioning management service provider sends network slice subnet related requirements to the network slice subnet provisioning management service provider to request allocation of the required NSS instance(s). | NSS instance creation use case |
| **Step 4 (M)** | The network slice provisioning management service provider receives the information of the allocated NSS instance(s) (e.g. the management identifier of NSS instance, service access point information of NSS instance, external connection point information of NSS instance) from NSSMF. |  |
| **Step 5 (M)** | The network slice provisioning management service provider, via the network slice subnet provisioning management service provider, sends the transport network related requirements (e.g. external connection point, latency and bandwidth) to the TN Manager. The TN manager reconfigures the TN accordingly and responds to the network slice provisioning management service provider via the network slice subnet provisioning management service provider. |  |
| **Step 6 (M)** | The network slice provisioning management service provider receives the response from TN Manager via the network slice subnet provisioning management service provider. |  |
| **Step 7 (M)** | The network slice provisioning management service provider associates the NSS instance(s) with the corresponding NS instance (e.g. allocation of the management identifier of NS instance and mapping the management identifier of NS instance with the received management Identifier of NSS instance(s)) and triggers to establish the links between the service access points of the NSS instance(s).  |  |
| **Step 8 (M)** | The network slice provisioning management service provider notifies the NS instance information of NS instance (e.g., the management identifier of NS instance). |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | An NS instance is ready to satisfy the network slice related requirements. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-1, REQ-PRO\_NS instance-FUN-3. |  |

### 5.1.2 NSS instance creation

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | Create a new NSS instance or use an existing NSS instance to satisfy the network slice subnet related requirements; provide the provisioning service consumer with identity of the NFVO which the consumer can use for further access to the information of the involved VNFs, PNFs and NSs. |  |
| **Actors and Roles** | A network slice subnet provisioning management service consumer. |  |
| **Telecom resources** | NSS instanceNS instanceA network slice subnet provisioning management service provider.The operator deployed NFVO to manage the lifecycle of VNFs and interconnection between the VNFs and PNFs in terms of the NS instances. |  |
| **Assumptions** | NSS instance may include network functions which are virtualized. |  |
| **Pre-conditions** | VNF Packages for virtualized network functions to be included in the NSS instance have been already on-boarded. |  |
| **Begins when**  | The network slice provisioning management service provider sends to the network slice subnet provisioning management service provider a request for a NSS instance to be associated with the NS instance; the request contains network slice subnet related requirements including the SliceProfile [6].The network slice subnet provisioning management service provider receives request for an NSS instance. The request contains network slice subnet related requirements. The request may include guidance for use of particular NFVO(s) when VNFs and PNFs in certain part of the network are involved. The request may also include query of the identity of the NFVO to be used. |  |
| **Step 1 (M)** | Based on the network slice subnet related requirements received, the network slice subnet provisioning management service provider decides to create a new NSS instance or use an existing NSS instance. |  |
| **Step 2 (M)** | If an existing NSS instance is decided to be used, the network slice subnet provisioning management service provider may trigger to modify the existing NSS instance to satisfy the network slice subnet related requirements. Go to “Step 8”.Otherwise, the network slice subnet provisioning management service provider triggers to create a new NSS instance, the following steps are needed. |  |
| **Step 3 (O)** | If the required NSS instance contains constituent NSS instance(s) managed by other network slice subnet provisioning management service provider (s), the first network slice subnet provisioning management service provider derives the requirements for the constituent NSS instance(s) and sends those requirements to the corresponding network slice subnet provisioning management service provider (s) which manages the constituent NSS instance(s).The first network slice subnet provisioning management service provider receives the constituent NSS instance information from the other network slice subnet provisioning management service provider (s) and associates the constituent NSS instance(s) with the required NSS instance. |  |
| **Step 4 (M)** | Based on the network slice subnet related requirements received and SliceProfile [6], the network slice subnet provisioning management service provider decides that to satisfy the NSS instance requirements, the part of the network controlled by certain NFVO should be involved. The network slice subnet provisioning management service provider determines the NS related requirements (i.e. information about the target NSD and additional parameterization for the specific NS to instantiate, see clause 7.3.3 in ETSI GS NFV-IFA013 [3]). |  |
| **Step 5 (M)** | Based on the NS related requirements, the network slice subnet provisioning management service provider triggers corresponding NS instantiation request to NFVO via Os-Ma-nfvo interface as described in clause 6.4.3 in TS 28.525 [2], and the NFVO performs NS instantiation. (see note) | TS 28.525 [2] Clause 6.4.3 NS instance use cases |
| **Step 6 (M)** | The network slice subnet provisioning management service provider associates the NS instance with corresponding NSS instance (e.g. allocation of the management identifier of NSS instance and mapping with the corresponding identifiers). |  |
| **Step 7 (M)** | The network slice subnet provisioning management service provider is using the NF provisioning service to configure the NSS instance constituents.In case of RAN NSS instance, the configuration contains RRM policy information for individual Radio cells. In the cells shared by multiple NSS instances such policy includes guidance for split of Radio resources between the NSS instances. | NF provisioning service |
| **Step 8 (M)** | The network slice subnet provisioning management service provider notifies the provisioning service consumer with the NSS instance information (e.g. the management identifier of NSS instance) and the NFVO identity when relevant. The network slice provisioning management service provider associates the NSS instance with the NS instance. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | A NSS instance is ready to satisfy the network slice subnet related requirements. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-2, REQ-PRO\_NSS instance-FUN-3, REQ-PRO\_NSS instance-FUN-4, REQ-PRO\_NSS instance-FUN-5, REQ-PRO\_NSS instance-FUN-6, REQ-PRO\_NSS instance-FUN-14. |  |
| NOTE: According to the TS 28.525 [2], for the PNFs, NS instantiation includes only establishment of interconnection with other NFs. |

### 5.1.3 NS instance termination

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To terminate an existing NS instance in case it is no longer needed. |  |
| **Actors and Roles** | A network slice provisioning management service consumer.NOP Operator |  |
| **Telecom resources** | NS instanceNSS instanceA network slice provisioning management service provider.A network slice subnet provisioning management service provider. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | N/A |  |
| **Begins when**  | The network slice provisioning management service provider receives the request indicating that an existing NS instance is no longer needed to support particular service. The NS instance identification is included in the request. |  |
| **Step 1 (M)** | Based on the request, the network slice provisioning management service provider checks if there are no other services to be supported by the NS instance. If there are none the network slice provisioning management service provider may decide to terminate the NS instance; then proceed to Step 2.Otherwise, the network slice provisioning management service provider may decide to trigger to modify the NS instance or to do nothing.The use case is completed; skip the remaining steps. | NS instance modification use case |
| **Step 2 (M)** | If the NS instance to be terminated is in active state, the network slice provisioning management service provider de-activates the NS instance. Then, the NS instance to be terminated is inactive. | NS instance de-activation use case |
| **Step 3 (M)** | The network slice provisioning management service provider identifies the NSS instance used by the NS instance, and for every such NSS instance sends the request to the corresponding network slice subnet provisioning management service provider (s) indicating that the NSS instance(s) are no longer needed for the NS instance. The network slice subnet provisioning management service provider (s) may decide to terminate or modify the NSS instance(s) based on the request and disassociates them with the NS instance. |  |
| **Step 4 (M)** | The network slice provisioning management service provider receives the response from the network slice subnet provisioning management service provider (s) and terminates the NS instance. |  |
| **Step 5 (M)** | The network slice provisioning management service provider notifies its consumer of the NS instance termination. |  |
| **Ends when**  | All the steps identified above are successfully completed or skipped per condition in the Step 1. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NS instance has been terminated. |  |
| **Traceability**  | REQ-PRO\_NS instance-FUN-3 |  |

### 5.1.4 NSS instance termination

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To terminate or disassociate an existing NSS instance which was used by the NS instance or NSS instance, but is no longer needed |  |
| **Actors and Roles** | Network slice subnet provisioning management service consumer.  |  |
| **Telecom resources** | NSS instanceNetwork slice subnet provisioning management service provider.  |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | N/A |  |
| **Begins when**  | The network slice subnet provisioning management service provider receives network slice subnet related request from its authorized consumer indicating that an existing NSS instance is no longer needed. |  |
| **Step 1 (M)** | Based on the request, the network slice subnet provisioning management service provider decides whether the NSS instance should be terminated. If the decision is the NSS instance should be terminated, go to the Step 2.If the decision is the NSS instance is not terminated (e.g., the NSS instance is shared or the network slice subnet provisioning management service provider decides to keep the NSS instance for later use), the network slice subnet provisioning management service provider disassociates the NSS instance from its consumer and provides feedback to the authorized consumer, maybe with removing its consumer’s configuration or not. Go to Step 5. |  |
| **Step 2 (M)** | If the NSS instance consists of constituent NSS instances that are not managed directly by the network slice subnet provisioning management service provider, the network slice subnet provisioning management service provider sends a request to other network slice subnet provisioning management service provider(s) indicating that the constituent NSS instances are no longer needed for the NSS instance. |  |
| **Step 3 (M)** | If the NSS instance is associated with NS instance, the network slice subnet provisioning management service provider disassociates the NS instance with the NSS instance to be terminated, and the network slice subnet provisioning management service provider may trigger corresponding NS instance related request to NFVO indicating that the NS instance is no longer needed for the NSS instance. |  |
| **Step 4 (M)** | If there exists a transport network segment used by the NSS instance, the network slice subnet provisioning management service provider may indicate that the transport network segment is no longer needed to support the NSS instance. |  |
| **Step 5 (M)** | The network slice subnet provisioning management service provider sends response to its consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NSS instance has been terminated. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-8, REQ-PRO\_NSS instance-FUN-11 |  |

### 5.1.5 Obtaining NSS instance information

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | Enable the network slice subnet provisioning management service consumer to obtain NSS instance information (e.g. Slice/Service type, network slice subnet capability information). |  |
| **Actors and Roles** | Network slice subnet provisioning management service consumer.  |  |
| **Telecom resources** | NSS instanceNetwork slice subnet provisioning management service provider.  |  |
| **Assumptions** | The network slice subnet provisioning management service consumer is authorized to obtain the NSS instance information from the network slice subnet provisioning management service provider. |  |
| **Pre-conditions** | NSS instance is created. |  |
| **Begins when**  | The network slice subnet provisioning management service consumer wants to obtain the NSS instance information. |  |
| **Step 1 (M)** | The network slice subnet provisioning management service consumer sends a request to the network slice subnet provisioning management service provider to obtain the NSS instance information.The indication on which information needs to be obtained may be included in the request. |  |
| **Step 2 (M)** | The network slice subnet provisioning management service provider processes this request. |  |
| **Step 3 (M)** | The network slice subnet provisioning management service provider sends the result of NSS instance information to the network slice subnet provisioning management service consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The network slice subnet provisioning management service consumer has obtained the NSS instance information. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-7. |  |

### 5.1.6 Network slice feasibility check

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To check the feasibility of provisioning a network slice to determine whether the network slice requirements can be satisfied at a particular point in time (e.g., in terms of resources) |  |
| **Actors and Roles** | Network slice management service consumer. For example, CSP providing NSaaS plays the role of network slice management service consumer. |  |
| **Telecom resources** | Network slice management service provider.  |  |
| **Assumptions** | Network slice management service consumer has decided to check the feasibility of provisioning a network slice based on, for example, internal decision or to facilitate an external service requests. |  |
| **Pre-conditions** | Network slice requirements have been derived or received by network slice management service consumer. |  |
| **Begins when**  | Network slice management service provider receives the request to evaluate the feasibility of provisioning a network slice according to the network slice requirements at a particular point in time. |  |
| **Step 1 (M)** | Network slice management service provider identifies the network slice subnets according to the requirements.  |  |
| **Step 2 (M)** | Network slice management service provider obtains the information necessary to evaluate the feasibility of provisioning a network slice by requesting the network slice subnet service provider(s) to evaluate the availability of resources under their contol. |  |
| **Step 3 (M)** | Network slice subnet management service provider(s) checks the feasibility of provisioning a slice subnet(s) by analysing network constituents to ensure that their capabilities, e.g., resources, management services, etc. are (or will be) adequate to provision a network slice , satisfying all requirements without impacting existing services. For the purpose of checking the feasibility of provisioning a network slice subnet(s) of the network slice, network slice subnet management service provider(s) may obtain information from the network (e.g., current or predicted load level information from the NWDAF).  | 5.1.21 Network slice subnet feasibility check |
| **Ends when**  | Feasibility check results have been provided to network slice management service consumer. |  |
| **Exceptions** | One of the mandatory steps fails. |  |
| **Post-conditions** | N/A |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-12, REQ-PRO\_NSS instance-FUN-13, REQ-PRO\_NS instance-FUN-8. |  |

### 5.1.7 NS instance activation

| **Use case stage** | **Evolution/Specification** | **<<Uses>>Related use** |
| --- | --- | --- |
| **Goal**  | To activate an existing NS instance which is in inactive state |  |
| **Actors and Roles** | Network slice provisioning management service consumer. For example, CSP providing NSaaS plays the role of Network slice management service consumer. |  |
| **Telecom resources** | NS instanceNetwork slice provisioning management service provider.  |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NS instance has already been created and it is inactive. |  |
| **Begins when**  | The network slice provisioning management service provider decides to activate an NS instance based on the received network slice related request from its authorized consumer. |  |
| **Step 1 (M)** | The network slice provisioning management service provider checks whether NSS instances associated with the NS instance are all in active state, if there is an inactive NSS instance, the network slice provisioning management service provider requests the network slice provisioning management service provider to activate the corresponding NSS instance.  | NSS instance activation use case |
| **Step 2 (M)** | The network slice provisioning management service provider receives response from the network slice provisioning management service provider indicating that the NSS instance is active. |  |
| **Step 3 (M)** | The network slice provisioning management service provider sets the state of the NS instance as active and sends response to the requesting consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | An NS instance has been activated. |  |
| **Traceability**  | REQ-PRO\_NS instance–FUN-4 |  |

### 5.1.8 NS instance deactivation

| **Use case stage** | **Evolution/Specification** | **<<Uses>>Related use** |
| --- | --- | --- |
| **Goal**  | To deactivate an existing NS instance which is in active state.  |  |
| **Actors and Roles** | Network slice provisioning management service consumer. For example, CSP providing NSaaS plays the role of network slice provisioning management service consumer. |  |
| **Telecom resources** | NS instanceNetwork slice provisioning management service provider.  |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | NS instance has already been created and it is active.  |  |
| **Begins when**  | The network slice provisioning management service provider decides to deactivate an NS instance based on the received network slice related request from its authorized consumer. |  |
| **Step 1 (M)** | The network slice provisioning management service provider stops the NS instance serving its subscribers.  |  |
| **Step 2 (M)** | The network slice provisioning management service provider checks whether NSS instances associated with the NS instance are all in inactive state. If there is an active NSS instance, the network slice provisioning management service provider requests the network slice provisioning management service provider to deactivate the corresponding NSS instance.The network slice provisioning management service provider receives the request and decides if the NSS instance will be disassociated and deactivated. | NSS instance deactivation use case |
| **Step 3 (M)** | The network slice provisioning management service provider receives response from the network slice provisioning management service provider that the NSS instance deactivation request has been processed.  |  |
| **Step 4 (M)** | The network slice provisioning management service provider sets the NS instance state as inactive and sends response to its authorized consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | An NS instance has been deactivated. |  |
| **Traceability**  | REQ-PRO\_NS instance–FUN-5 |  |

### 5.1.9 NS instancemodification

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To modify an existing NS instance |  |
| **Actors and Roles** | Network slice provisioning management service consumer. For example, CSP providing NSaaS plays the role of network slice provisioning management service consumer. |  |
| **Telecom resources** | NS instanceNetwork slice provisioning management service provider.  |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | N/A.  |  |
| **Begins when**  | The network slice provisioning management service provider receives request from its authorized customer with new set of network slice related requirements and decides to modify an existing NS instance. |  |
| **Step 1 (M)** | The network slice provisioning management service provider identifies the NSS instance(s) associated with the NS instance to be modified and generates network slice subnet related requirements for the NSS instance(s).  |  |
| **Step 2 (M)** | The network slice provisioning management service provider sends requests to the network slice subnet provisioning management service provider with new sets of network slice subnet related requirements.The network slice provisioning management service provider receives request and decides whether the NSS instance needs to be modified. | NSS instance modification use case |
| **Step 3 (M)** | The network slice provisioning management service provider receives the response from the network slice subnet provisioning management service provider. If the NSS instance modification request cannot be satisfied by the network slice subnet provisioning management service provider, the network slice provisioning management service provider may re-generate the network slice subnet related requirements for the NSS instance and go to step 2, or the network slice provisioning management service provider may decide the modification request cannot be satisfied. |  |
| **Step 4 (M)** | The network slice provisioning management service provider sends response to its authorized consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NS instance is modified. |  |
| **Traceability**  | REQ-PRO\_NS instance-FUN-6 |  |

### 5.1.10 NSS instanceactivation

| **Use case stage** | **Evolution/Specification** | **<<Uses>>Related use** |
| --- | --- | --- |
| **Goal**  | To activate an existing NSS instance which is in inactive state. |  |
| **Actors and Roles** | Network slice subnet provisioning management service consumer.  |  |
| **Telecom resources** | NSS instanceNetwork slice subnet provisioning management service provider.  |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NSS instance has already been created and it is inactive. |  |
| **Begins when**  | The network slice subnet provisioning management service provider decides to activate an NSS instance based on the received network slice subnet related request from its authorized consumer. |  |
| **Step 1 (M)** | The network slice subnet provisioning management service provider identifies inactive constituents (e.g. NSS instance, NF) of the NSS instance and decides to activate those constituents.  |  |
| **Step 2 (M)** | If the constituent of NSS instance is managed directly by the the network slice subnet provisioning management service provider, the network slice subnet provisioning management service provider activates the NSS instance constituent directly. |  |
| **Step 3 (M)** | If an NSS instance constituent is managed by other network slice subnet provisioning management service provider, the network slice subnet provisioning management service provider requests other network slice subnet provisioning management service provider to activate the constituent NSS instance. |  |
| **Step 4 (M)** | If an NSS instance constituent is an NF managed by NF related provisioning management service provider, the network slice subnet provisioning management service provider request the NF related provisioning management service provider to activate the NF (e.g., activate the NF in sleep mode, turn on the ports).  |  |
| **Step 5 (M)** | The network slice subnet provisioning management service provider receives response indicating that NSS instance constituents are all activated. |  |
| **Step 6 (M)** | The network slice subnet provisioning management service provider sets the state of the NSS instance as active and sends response to its authorized consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | An NSS instance has been activated. |  |
| **Traceability**  | REQ-PRO\_NSS instance–FUN-9 |  |

### 5.1.11 NSS instance deactivation

| **Use case stage** | **Evolution/Specification** | **<<Uses>>Related use** |
| --- | --- | --- |
| **Goal**  | To deactivate an existing NSS instance which is in active state. |  |
| **Actors and Roles** | Network slice subnet provisioning management service consumer.  |  |
| **Telecom resources** | NSS instance.Network slice subnet provisioning management service provider.  |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NSS instance has already been created and is in active state. |  |
| **Begins when**  | The network slice subnet provisioning management service provider decides to deactivate an NSS instance based on the received network slice subnet related request from its authorized customer. |  |
| **Step 1 (M)** | The network slice subnet provisioning management service provider identifies the NSS instance constituents that need to be deactivated. |  |
| **Step 2 (M)** | If the constituent of NSS instance is managed directly by the network slice subnet provisioning management service provider, the network slice subnet provisioning management service provider deactivates the NSS instance constituent directly. |  |
| **Step 3 (M)** | If an NSS instance constituent is managed by other network slice subnet provisioning management service provider, the network slice subnet provisioning management service provider requests other network slice subnet provisioning management service provider to deactivate the constituent NSS instance. |  |
| **Step 4 (M)** | If an NSS instance constituent is managed by the NF related provisioning management service provider, the network slice subnet provisioning management service provider requests the NF related provisioning management service provider to deactivate the NF. |  |
| **Step 5 (M)** | The network slice subnet provisioning management service provider receives response indicating that corresponding NSS instance constituents are deactivated or not deactivated (e.g., shared constituents cannot be deactivated). |  |
| **Step 6 (M)** | The network slice subnet provisioning management service provider sets the state of the NSS instance as inactive and send response to its authorized consumer.  |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | A NSS instance has been deactivated. |  |
| **Traceability**  | REQ-PRO\_NSS instance–FUN-10 |  |

### 5.1.12 NSS instance modification

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To modify an existing NSS instance. |  |
| **Actors and Roles** | Network slice subnet provisioning NetworkSliceSubnet management service consumer. For example, NSMF or NSSMF plays the role of NetworkSliceSubnet management service consumer. |  |
| **Telecom resources** | NSS instanceNetwork SliceSubnet slice subnet provisioning management service provider. For example, NSSMF plays the role of NetworkSliceSubnetmanagement service provider. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | N/A  |  |
| **Begins when**  | The network slice subnet provisioning management service provider receives request from its authorized consumer with new sets of network slice subnet related requirements and decides to modify an existing NSS instance. |  |
| **Step 1 (M)** | The network slice subnet provisioning management service provider identifies the NSS instance constituents as well as the transport network (TN) part within the NSS instance that needs to be modified, and generates new sets of requirements for the NSS instance constituents and transport network if needed. |  |
| **Step 2 (M)** | The network slice subnet provisioning management service provider checks whether the requirements for the identified NSS instance constituents managed by itself could be satisfied, and then triggers the modification of the corresponding NSS instance constituents if needed.  |  |
| **Step 3 (M)** | If the NSS instance consists of constituent NSS instance managed by other network slice subnet provisioning management service provider, and the constituent NSS instance is identified to be modified, the network slice subnet provisioning management service provider sends modification request to other network slice subnet provisioning management service provider which manages the constituent NSS instance with new sets of constituent NSS instance requirements. | NSS instance modification use case |
| **Step 4 (M)** | If the NS instance associated with the NSS instance needs to be modified, the network slice subnet provisioning management service provider derives the new sets of NS related requirements and triggers corresponding NS instance request to NFVO with Os-Ma-nfvo interface as described in clause 6.4.3 in TS 28.525 [2]. | TS 28.525 [2] Clause 6.4.3 NS instance use cases |
| **Step 5 (M)** | If the related TN part of the NSS instance is identified to be modified, the network slice subnet provisioning management service provider derives new sets of requirements for the TN part and coordinates with the corresponding TN management system. |  |
| **Step 6 (M)** | The network slice subnet provisioning management service provider generates the modification result based on the received response and send response to its authorized consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NSS instance is modified. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-11 |  |

### 5.1.13 Network slice subnet configuration

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To provide service for slice-specific (re)configuration of network slice subnetNSS instance.  |  |
| **Actors and Roles** | NSS Network slice subnet provisioning management service consumer (e.g., the operator or NSMF) |  |
| **Telecom resources** | Network slice subnet provisioning NSS management service provider (e.g., NSSMF)Network slice subnetNF(s) |  |
| **Assumptions** | Authorized network slice subnet provisioning NSS management service consumer provide slice operation information (see 4.2) for (re-)configuring NSS instance constituents. |  |
| **Pre-conditions** | NSS instance exists. |  |
| **Begins when**  | The network slice subnet provisioning NSS management service consumer wants to (re-)configure the constituents of a network slice subnetNSS instance. |  |
| **Step 1 (M)** | The network slice subnet provisioning NSS management service consumer sends requests to the network slice subnet provisioning NSS management service provider with slice operation information for (re-)configuring a network slice subnet. |  |
| **Step 2 (M)** | The network slice subnet provisioning NSS management service provider (derives and) decomposes the received slice operation information, and then makes them as separate CM requests for each constituent if necessary and applicable. These (decomposed) requests may be delegated to other CM provisioning management service providers (e.g., other network slice subnet provisioning NSS service providers, CM of NFsNF provisioning management service providers) with corresponding slice operation information.These requests may contain configuration for specific NFs such as 1) *Configuration of dedicated NFs* (e.g., configure the SMF with the information of new instantiated UPFs, see 6.3.2, 6.3.3 in [3]) and 2) *Configuration of shared NFs* (see 4.2 so that this information can be accessed by other constituents of the NSS (e.g., NSSF, AMF, SMF). |  |
| **Step 3 (M)** | The network slice subnet provisioning NSS management service provider sends the processing result to the network slice subnet provisioning NSS management service consumer (might be based on applicable processing results from other CM service providers). |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The required (re)configuration is configured at the corresponding constituent(s).  |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-16 |  |

### 5.1.14 Exposure of network slice management data

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | Enable network slice management service consumer to obtain network slice management data (e.g. PM data, FM data). |  |
| **Actors and Roles** | Network slice management service consumer. For example, CSMF plays the role of network slice management service consumer.Network slice management service provider. For example, NSMF plays the role of network slice management service provider. |  |
| **Telecom resources** | Network slice |  |
| **Assumptions** | Network The network slice management service consumer is authorized to obtain the network slice management data from the network slice management service provider. |  |
| **Pre-conditions** | NS instance is created. |  |
| **Begins when**  | Network The network slice management service consumer wants to obtain the network slice management data. |  |
| **Step 1 (M)** | Network The network slice management service consumer sends a request to the network slice management service provider to obtain the network slice management data. |  |
| **Step 2 (M)** | Network The network slice management service provider provides the network slice management service consumer with the network slice management data. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | Network The network slice management service consumer obtained the network slice management data. |  |
| **Traceability**  | REQ-PRO\_NS instance-FUN-7 |  |

### 5.1.15 Exposure of network slice management capability

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal** | Enable authorized network slice management service consumer to obtain certain management capability to manage the network slice (e.g., provisioning) through the exposure interface. |  |
| **Actors and Roles** | Network slice management service consumer. For example, CSP providing NSaaS plays the role of network slice management service consumer. |  |
| **Telecom resources** | NS instanceNetwork slice management service provider. For example, NSMF plays the role of network slice management service provider. |  |
| **Assumptions** | The network slice management service consumer is authorized to obtain the allowed management capability from the network slice management service provider according to the pre-defined agreements. |  |
| **Pre-conditions** | Level of management exposure has been agreed upon between the network slice management service provider and the network slice management service consumer.  |  |
| **Begins when**  | The network slice management service consumer wants to obtain the network slice management capability. |  |
| **Step 1 (M)** | The network slice management service consumer sends a request to the network slice management service provider to obtain the network slice management capability.The information indicating which specific management capability needs to be obtained may be included in the request. |  |
| **Step 2 (M)** | The network slice management service provider provides the required management capability to the network slice management service consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The network slice management service consumer obtained the allowed network slice management capability. |  |
| **Traceability**  | REQ-PRO\_NS instance-FUN-1, REQ-PRO\_NS instance-FUN-3, REQ-PRO\_NS instance-FUN-6 |  |

### 5.1.16 Network slice subnet management capability exposure

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | Enable authorized NSS management service consumer to obtain network slice subnet management capability (e.g. obtaining measurement, updating resource allocations).  |  |
| **Actors and Roles** | NSS management service consumer (e.g., the operator) |  |
| **Telecom resources** | NSS management service provider NSS instanceNF(s) |  |
| **Assumptions** | The NSS management service consumer is authorized to obtain the allowed management capability from NSS management service provider. |  |
| **Pre-conditions** | NSS instance is created. |  |
| **Begins when**  | The NSS management service consumer wants to obtain the network slice subnet management capability. |  |
| **Step 1 (M)** | The NSS management service consumer sends a request to NSS management service provider to obtain the NSS instance management capability.The information indicating which specific management capability need to be obtained may be included in the request. |  |
| **Step 2 (M)** | The NSS management service provider processes this request. |  |
| **Step 3 (M)** | The NSS management service provider provides the required exposure interfaces to the NSS management service consumer. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NSS management service consumer obtained the allowed NSS instance management capability. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-15 |  |

### 5.1.17 Creation of a 3GPP NF

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To enable the authorized consumer to request creation of an instance of 3GPP NF. |  |
| **Actors and Roles** | An authorized consumer of the NF creation provisioning management service. |  |
| **Telecom resources** | VNF package(s) of the virtualized part of 3GPP NF;ETSI NFV MANO system;NF provisioning management creation service producer. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The VNF package(s) of the virtualized part of 3GPP NF have been on-boarded to ETSI NFV MANO system. |  |
| **Begins when**  | The authorized consumer needs to create a new instance of 3GPP NF. |  |
| **Step 1 (M)** | The authorized consumer requests the NF provisioning management creation service producer to create a new instance of 3GPP NF. |  |
| **Step 2 (M)** | The NF provisioning management creation service producer checks the subject 3GPP NF contains virtualized part and/or non-virtualized part. If it contains virtualized part, then the NF instantiation service producer performs the step 3 and 4 to instantiate the virtualized part of the subject 3GPP NF.How to instantiate the non-virtualized part of the subject 3GPP NF is out of scope of present specification.  |  |
| **Step 3 (M)** | The NF provisioning management creation service producer interacts, or requests another NF provisioning management creation service producer to interact, with ETSI NFV MANO system to instantiate the VNF(s) that are realizing the virtualized part of subject 3GPP NF. |  |
| **Step 4 (M)** | If all of the contained parts (i.e., virtualized part and non-virtualized part if any) of the 3GPP NF have been successfully instantiated, the NF provisioning management creation service producer informs the consumer(s) (who have subscribed to the notifications for NF creation) that the instance of 3GPP NF has been created, and creates the MOI(s) for the subject 3GPP NF. |  |
| **Step 5 (M)** | Created MOI(s) may be maintained by a Management Function which has the NF provisioning management creation service or the 3GPP NF. When the MOI(s) is maintained by the 3GPP NF, the NF provisioning management creation service producer sends a request of creating the MOI(s) to the corresponding NF provisioning management service producers in the created NF.  |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The instance of 3GPP NF has been created, and the MOI(s) of the 3GPP NF have been created. |  |
| **Traceability**  | REQ-PRO\_NF-FUN-1, REQ-PRO\_NF-FUN-2, REQ-PRO\_NF-FUN-7 |  |

### 5.1.18 Configuration of a 3GPP NF instance

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To enable the authorized consumer to request configuration of a 3GPP NF instance. |  |
| **Actors and Roles** | An authorized consumer of the NF provisioning management service. |  |
| **Telecom resources** | ETSI NFV MANO system;NF provisioning management service producer. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The NF to be configured has been instantiated;The MOI of the NF has been created. |  |
| **Begins when**  | The authorized consumer needs to configure a 3GPP NF instance. |  |
|  |  |  |
| **Step 1 (M)** | The consumer requests the NF provisioning management service producer to modify the attribute(s) of the MOI of the 3GPP NF instance. |  |
| **Step 2 (O)** | If the 3GPP NF contains virtualized part and the corresponding VNF instance(s) need to be updated, the NF provisioning management service producer interacts, or requests another NF provisioning management service producer to interact, with ETSI NFV MANO system to update the corresponding VNF instance(s). |  |
| **Step 3 (M)** | The NF provisioning management service producer configures the 3GPP NF instance, per the MOI attribute modification request received from the consumer. |  |
| **Step 4 (M)** | The NF provisioning management service producer modifies the attributes of the MOI and informs the consumer that the 3GPP NF instance has been configured successfully. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The 3GPP NF instance has been configured. |  |
| **Traceability**  | REQ-PRO\_NF-FUN-4, REQ-PRO\_NF-FUN-5, REQ-PRO\_NF-FUN-6, REQ-PRO\_NF-FUN-3 |  |

### 5.1.19 Creation of a 3GPP sub-network

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To enable the authorized consumer to request creation of a 3GPP sub-network. |  |
| **Actors and Roles** | An authorized consumer of the sub-network provisioning managementcreation service. |  |
| **Telecom resources** | VNF package(s) of the virtualized part of 3GPP NF(s);NSD(s) of the NS(s);ETSI NFV MANO system;Network creation provisioning service producer;NF provisioningconfiguration service producer. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The non-virtualized part of the NFs (including completely non-virtualized NFs) constituting the 3GPP sub-network have been deployed;The VNF package(s) of the virtualized part of 3GPP NF(s) have been on-boarded to ETSI NFV MANO system;The NSD(s) of the NS realizing the 3GPP sub-network have been on-boarded to ETSI NFV MANO system. |  |
| **Begins when**  | The authorized consumer needs to create a 3GPP sub-network. |  |
| **Step 1 (M)** | The authorized consumer requests the sub-network provisioning creation management service producer to create a 3GPP sub-network. The request needs to indicate the network capacity (e.g., the number of instances of each kind of NFs, and the capacity of each NF instance, for example, number of flows with certain QoS attributes to be supported), network topology information (e.g., the connections between NF instances), and the network QoS requirements (e.g., bandwidth and latency requirements of the interface between two NF instances). |  |
| **Step 2 (M)** | The network provisioning management creation service producer interacts, or requests another network provisioning managementcreation service producer to interact, with ETSI NFV MANO system to instantiate the NS(s) realizing the sub-network. |  |
| **Step 3 (M)** | ETSI NFV MANO system informs the NF provisioning managementconfiguration service producer about the instantiation of the NSs and the new VNFs. |  |
| **Step 4 (M)** | The NF provisioning management configuration service producer creates the MOI(s) of the 3GPP NFs that are realized by the newly instantiated VNF(s); there may be MOI(s) that specify the topology of the instantiated NSs. |  |
| **Step 5 (M)** | The sub-network provisioning managementcreation service producer is using the NF provisioning managementconfiguration service to configure the 3GPP NF instance(s) that are constituting the subject 3GPP sub-network. | NF configuration service |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The 3GPP sub-network has been created. |  |
| **Traceability**  | REQ-PRO\_NW-FUN-1, REQ-PRO\_NW-FUN-2 |  |

### 5.1.20 Configuration of a 3GPP sub-network

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To enable the authorized consumer to request configuration of a 3GPP sub-network. |  |
| **Actors and Roles** | An authorized consumer of the network provisioning managementconfiguration service. |  |
| **Telecom resources** | 3GPP network;3GPP NFs;ETSI NFG MANO system;Network provisioning management service producer. |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The 3GPP sub-network has been created;The MOI(s) related to the sub-network has been created. |  |
| **Begins when**  | The authorized consumer needs to configure a 3GPP sub-network. |  |
| **Step 1 (M)** | The authorized consumer requests to configure a 3GPP sub-network. |  |
| **Step 2 (M)** | The consumer requests the network provisioning management management service producer to modify the attribute of the MOI(s) related to the 3GPP sub-network. |  |
| **Step 3 (O)** | If the 3GPP network is realized by NS(s) (ETSI ISG NFV concept), the network provisioning management service producer requests (directly or indirectly via another) ETSI NFV MANO system to update the NS(s) realizing the 3GPP sub-network. |  |
| **Step 4 (O)** | If there are new VNFs instantiated by the NS update, ETSI NFV MANO system informs the NF provisioning management service producer about the instantiation of VNFs. |  |
| **Step 5 (O)** | The NF provisioning management service producer creates the MOI(s) of the 3GPP NFs that are realized by the newly instantiated VNF(s). |  |
| **Step 6 (M)** | The network provisioning management service producer consumes the NF provisioning management service to configure the impacted 3GPP NF instance(s). | NF configuration service |
| **Step 7 (M)** | The network provisioning management service producer configures the 3GPP sub-network, per the MOI attribute modification request received from the consumer. |  |
| **Step 8 (M)** | The NF provisioning management service producer modifies the attributes of the MOI(s) of the 3GPP network and informs the consumer that the 3GPP sub-network has been configured successfully. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The 3GPP network has been configured. |  |
| **Traceability**  | REQ-PRO\_NW-FUN-3, REQ-PRO\_NW-FUN-4 |  |

### 5.1.21 Network slice subnet feasibility check

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal** | To check the feasibility of provisioning a network slice subnet to determine whether network slice subnet requirements can be satisfied at a particular point of time (e.g., in terms of resources) |  |
| **Actors and Roles** | Network slice subnet management service consumer. |  |
| **Telecom resources** | NSS instanceNetwork slice management service provider. For example, a management function that plays the role of network slice management service provider. |  |
| **Assumptions** | Network slice subnet management service consumer has decided to check the feasibility of provisioning a network slice subnet based on, for example, internal decision or to facilitate an external service requests. |  |
| **Pre-conditions** | Network slice subnet requirements have been derived or received by network slice subnet management service consumer. |  |
| **Begins when**  | Network slice subnet management service provider receives the request to evaluate the feasibility of provisioning a network slice subnet according to the network slice requirements at a particular point in time. |  |
| **Step 1 (M)** | Network slice subnet management service provider identifies the network slice subnets constituents according to the requirements, e.g., network services to be requested from MANO.  |  |
| **Step 2 (O)** | For the purpose of checking the feasibility of provisioning a network slice subnet(s) of the network slice, network slice subnet management service provider(s) may obtain information from the network (e.g., current or predicted load level information, current or predicted resource usage information from management data analytics services). |  |
| **Step 3 (M)** | Network slice subnet management service provider sends enquiries with reservation requests to other management providers (e.g., MANO) to determine availability of network constituents, e.g., network services, network functions. If some of the responses are negative, network slice subnet management service provider may send enquiries to different management providers.  |  |
| **Ends when**  | Feasibility check results have been provided to network slice subnet management service consumer.  |  |
| **Exceptions** | One of the mandatory steps fails. |  |
| **Post-conditions** | N/A |  |
| **Traceability**  |  |  |

### 5.1.22 Network slice resource capacity planning

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To calculate capacity of network slice and network slice subnet. |  |
| **Actors and Roles** | Network slice management service consumer. For example, NSMF or NSSMF plays the role of network slice management service consumer. |  |
| **Telecom resources** | NS instanceNSS instanceNetwork slice management service provider. For example, NSMF or NSSMF plays the role of network slice management service provider. |  |
| **Assumptions** | The Network network slice management service consumer has decided to perform network slice resource capacity optimization process.  |  |
| **Pre-conditions** | Network slice resource capacity optimization objectives are set by the network slice management service consumer.  |  |
| **Begins when**  | Network The network slice management service consumer requests resource capacity planning of the NS instances and/or NSS instances when the pre-set resource optimization objectives need to be satisfied. |  |
| **Step 1 (M)** | Network The network slice management service provider obtains information needed for the optimization process such as slice provisioning requirements, existing active or non-active NS instance and/or NSS instance resource information, and performance measurement data by requesting feasibility check operation.  |  |
| **Step 2 (M)** | Network The network slice management service provider performs resource optimization process based on the information obtained in Step 1. The goal of the process is to find an optimal capacity availability against the target objective  |  |
| **Step 3 (M)** | Network The network slice management service provider proceeds with network slice (NS instance and/or NSS instance) provisioning or modification processes until it meets the resource capacity optimization objective. | NS instance creation or modification/network NSS instance creation or modification use cases |
| **Step 4 (M)** | Network The network slice management service provider updates capacity availability information after provisioning or modification processes. |  |
| **Ends when**  | The capacity resource planning ends when it meets the optimization objective. |  |
| **Exceptions** | One of the mandatory steps fails. |  |
| **Post-conditions** | Capacity planning policy for either provisioning or modification is generated. |  |
| **Traceability**  | REQ-PRO\_NSS instance-FUN-3, REQ-PRO\_NS instance-FUN-9 |  |

### 5.1.23 Network slice subnet management with assigned priority

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To assign priority on existing NSS instance(s). |  |
| **Actors and Roles** | Network slice subnet provisioning management service consumer. Network slice subnet provisioning management service provider (e.g. NSSMF) |  |
| **Telecom resources** | NSS instanceNSS instanceNetwork slice subnet provisioning management service provider  |  |
| **Assumptions** | Network slice subnet is deployed to support a communication service with priority, set by the operator. |  |
| **Pre-conditions** | This use case is based on the condition that operator requires a priority assigned to network slice subnet.  |  |
| **Begins when**  | The NSS instance(s) should have been assigned with priority set by the operator.  |  |
| **Step 1 (M)** | The network slice provisioning management service provider identifies the NSS instance(s) that needs to be associated with the priority, requested by authorized network slice subnet provisioning management service consumer.The network slice provisioning management service provider assigns priority to the identified NSS instance(s) | NSS instance modification use case |
| **Step 2 (M)** | The network slice provisioning management service provider sends response to its authorized consumer about assigned priority on identified NSS instance(s). |  |
| **Ends when**  | All the steps identified above are successfully completed. Network slice subnet priority was assigned by the network slice subnet management service provider. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** |  |  |
| **Traceability**  | REQ-PRO\_NS instance-FUN-x |  |

### 5.1.24 Management interaction with NFV MANO for network service priority

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To enable the authorized consumer to request creation of a 3GPP sub-network, management interactions with NFV MANO is needed. This management interaction will assign priority on NFV NS(s). |  |
| **Actors and Roles** | An authorized consumer of 3GPP sub-network creation. |  |
| **Telecom resources** | VNF package(s) of the virtualized part of 3GPP NF(s);NSD(s) of the NS(s);ETSI NFV MANO system; |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The ETSI NFV VNF package(s) of the virtualized part of 3GPP NF(s) have been on-boarded to ETSI NFV MANO system;The ETSI NFV NSD(s) used to instantiate NS(s) for realizing the 3GPP sub-network have been on-boarded to ETSI NFV MANO system. |  |
| **Begins when**  | The authorized consumer needs to create a 3GPP sub-network. This creation operation also needs to assign priority on 3GPP sub-network and on related ETSI NFV NS(s). |  |
| **Step 1 (M)** | The authorized consumer requests the 3GPP sub-network creation service producer to create a 3GPP sub-network.  |  |
| **Step 2 (M)** | The sub-network creation service producer interacts, or requests another sub-network creation service producer to interact, with ETSI NFV MANO system to instantiate the NS(s) realizing the 3GPP sub-network.  |  |
| **Step 3 (M)** | ETSI NFV MANO is informed about NS priority.  |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The 3GPP sub-network has been created. Network service priority is identified by NFVO to support the 3GPP sub-network. |  |
| **Traceability**  | REQ-PRO\_NW-FUN-1, REQ-PRO\_NW-FUN-2 |  |

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| **4th change** |

### 5.2.1 Requirements for network slice provisioning service

**REQ-PRO\_NS instance-FUN-1** The network slice provisioning service provider shall have the capability allowing its authorized consumer to request an NS instance.

**REQ-PRO\_NS instance-FUN-2** The network slice provisioning service provider shall have the capability allowing its authorized consumer to send the network slice related requirements.

NOTE: The network slice related requirements include requirements such as area traffic capacity, charging, coverage area, isolation, end-to-end latency, mobility, overall user density, priority, service availability, service reliability, UE speed; see TS 22.261 [5] where these parameters are defined for end user services.

**REQ-PRO\_NS instance-FUN-3** The network slice provisioning service provider shall have the capability allowing its authorized consumer to request the deallocation of an NS instance.

**REQ-PRO\_NS instance–FUN-4** The network slice provisioning service provider shall have the capability allowing its authorized consumer to request activation of an NS instance.

**REQ-PRO\_NS instance–FUN-5** The network slice provisioning service provider shall have the capability allowing its authorized consumer to request deactivation of an NS instance.

**REQ-PRO\_NS instance-FUN-6** The network slice provisioning service provider shall have the capability allowing its authorized consumer to request the modification of an NS instance.

**REQ-PRO\_NS instance-FUN-7** The network slice provisioning service provider shall have the capability allowing its consumer to obtain the network slice management data.

**REQ-PRO\_NS instance-FUN-8** The network slice provisioning service provider shall have the capability allowing its authorized consumer to obtain the feasibility of provisioning the requested NS instance at a particular point of time.

**REQ-PRO\_NS instance-FUN-9** The network slice management service provider shall have the capability allowing its authorized consumer to request the capacity planning of an NS instance.

### 5.2.2 Requirements for network slice subnet provisioning service

**REQ-PRO\_NSS instance-FUN-1** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request an NSS instance.

**REQ-PRO\_NSS instance-FUN-2** The network slice subnet provisioning service provider shall have the capability of interaction with NFVO via the NS lifecycle management interface.

**REQ-PRO\_NSS instance-FUN-3** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to send network slice subnet related requirements.

**REQ-PRO\_NSS instance-FUN-4** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request to create a new NSS instance or use an existing NSS instance based on the network slice subnet related requirements.

**REQ-PRO\_NSS instance-FUN-5** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request to associate the NS instance with corresponding NSS instance.

**REQ-PRO\_NSS instance-FUN-6** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request the configuration of the RAN NSS instance constituents with the RRM policy information for simultaneous support of multiple NS instances.

**REQ-PRO\_NSS instance-FUN-7** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to obtain NSS instance information.

**REQ-PRO\_NSS instance-FUN-8** The network slice subnet provisioning service provider shall have the capability of allowing its authorized consumer to request the deallocation of an NSS instance.

**REQ-PRO\_NSS instance-FUN-9** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request activation of an NSS instance.

**REQ-PRO\_NSS instance-FUN-10** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request deactivation of an NSS instance.

**REQ-PRO\_NSS instance-FUN-11** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to request modification of an NSS instance.

**REQ-PRO\_NSS instance-FUN-12** The network slice subnet provisioning service provider shall have the capability allowing its consumer to obtain information regarding available network slice subnet resources.

**REQ-PRO\_NSS instance-FUN-13** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to obtain the feasibility of provisioning an NSS instance at a particular point of time.

**REQ-PRO\_NSS instance-FUN-14** The network slice subnet provisioning service provider shall have the capability to satisfy the request to consume the NF provisioning service.

**REQ-PRO\_NSS instance-FUN-15** The network slice subnet provisioning service provider shall have the capability to expose limited management capability to its consumer according to mutual agreement.

**REQ-PRO\_NSS instance-FUN-16** The network slice subnet provisioning service provider shall have the capability allowing its consumer to provide slice specific operation information for the (re)configuration to a NSS instance.

**REQ-PRO\_NS instance-FUN-x** The network slice subnet provisioning service provider shall have the capability allowing its authorized consumer to assign priority of a network slice subnet.

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| **5th change** |

### 6.5.1 AllocateNsi operation

#### 6.5.1.1 Description

This operation is invoked by allocateNsi operation service consumer to request the provider to allocate an NS instance to satisfy network slice related requirements. The provider may create a new NS instance or using existing NS instance to satisfy the request.

#### 6.5.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
| attributeListIn | M | LIST OF SEQUENCE< attribute name, attribute value> | This parameter specifies the network slice related requirements defined in ServiceProfile in Clause 6.3.3 in TS 28.541 [6]. |

#### 6.5.1.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | Support Qualifier | Matching Information / Legal Values | Comment |
| attributeListOut | M | LIST OF SEQUENCE< attribute name, attribute value> | This list of name/value pairs contains the attributes of the NS instance which has been allocated and the actual value assigned to each.  |
| status | M | ENUM (OperationSucceeded, OperationFailed) | An operation may fail because of a specified or unspecified reason. |
| nSId | M | An attribute uniquely identifies theNS instance. | It specifies the unifique identifier of the NS instance which has been allocated. |

### 6.5.2 AllocateNssi operation

#### 6.5.2.1 Description

This operation is invoked by allocateNssi operation service consumer to request the provider to allocate an NSS instance to satisfy the network slice subnet related requirements. The provider may create a new NSS instance or using existing NSS instance to satisfy the request.

#### 6.5.2.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
| attributeListIn | M | LIST OF SEQUENCE< attribute name, attribute value> | This parameter specifies the network slice subnet related requirements defined in SliceProfile in Clause 6.3.4 in TS 28.541 [6]. |

#### 6.5.2.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | Support Qualifier | Matching Information / Legal Values | Comment |
| attributeListOut | M | LIST OF SEQUENCE< attribute name, attribute value> | This list of name/value pairs contains the attributes of the NSS instance which has been allocated and the actual value assigned to each.  |
| status | M | ENUM (OperationSucceeded, OperationFailed) | An operation may fail because of a specified or unspecified reason. |
| nSSId | M | An attribute uniquely identifies the NSS instance.  | It specifies the unifique identifier of the NSS instance which has been allocated. |

### 6.5.3 DeallocateNsi operation

#### 6.5.3.1 Description

This operation is invoked by deallocateNsi operation service consumer to request the provider to deallocate an NS instance since the NS instance is no longer needed for the consumer. The provider may terminate the requested NS instance or modify the requested NS instance without termination to satisfy the request.

#### 6.5.3.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
| nSId | M | An attribute uniquely identifies the NS instance. | It specifies the unifique identifier of the NS instance which need to be deallocated. |

#### 6.5.3.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | Support Qualifier | Matching Information / Legal Values | Comment |
| status | M | ENUM (OperationSucceeded, OperationFailed) | An operation may fail because of a specified or unspecified reason. |

### 6.5.4 DeallocateNssi operation

#### 6.5.4.1 Description

This operation is invoked by deallocateNssi operation service consumer to request the provider to deallocate an NSS instance since the NSS instance is no longer needed for the consumer. The provider may terminate the requested NSS instance or modify the requested NSS instance without termination to satisfy the request.

#### 6.5.4.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
| nSSId | M | An attribute uniquely identifies the NSS instance. | It specifies the unifique identifier of the NSS instance which need to be deallocated. |

#### 6.5.4.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | Support Qualifier | Matching Information / Legal Values | Comment |
| status | M | ENUM (OperationSucceeded, OperationFailed) | An operation may fail because of a specified or unspecified reason. |

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| --- |
| **6th change** |

## 7.2 Procedure of NS instance Allocation

The Figure 7.2-1 illustrates the procedure of creating a new NS instance or using an existing NS instance to satisfy the required network slice related requirements.



Figure 7.2-1: NS instance Allocation Request procedure

1) Network Slice Management Service Provider (NSMS\_Provider) receives an AllocateNsi request (see AllocateNsi operation defined in clause 6.5.1) from Network Slice Management Service Consumer (NSMS\_Consumer) with network slice related requirements (see ServiceProfile defined in claue 6.3.3 in TS 28.541[6]).

2) Based on the network slice related requirements, the NSMS\_Provider decides whether to use an existing NS instance or create a new NS instance. If the network slice related requirements allow the requested NS instance to be shared and if an existing suitable NS instance can be reused, the NSMS\_Provider may decide to use the existing NS instance.

3a) If using an existing NS instance and the existing NS instance needs to be modified to satisfy the network slice related requirements, the NSMS\_Provider invokes the procedure to modify the existing NS instance as described in clause 7.6.

3b-1) If creating a new NS instance, the NSMS\_Provider derives the network slice subnet related requirements from the received network slice related requirements. Before NSMS\_Provider derives the network slice subnet related requirements, NSMS\_Provider may invoke corresponding network slice subnet capability information querying procedure as descried in clause 7.8.

3b-2) The NSMS\_Provider invokes the NSS instance allocation procedure as described in clause 7.3.

3b-3) The NSMS\_Provider creates the MOI for NS instance and configures the MOI with the DN of MOI for the NSS instance, other configuration information may be configured for the created MOI.

Note: The detailed configuration information is described in network slice NRM (see NetworkSlice IOC defined in clause 6.3.1 in TS 28.541 [6]).

4) The NSMS\_Provider sends NS instance allocation result (see AllocateNsi operation defined in clause 6.5.1) to the NSMS\_Consumer. If an existing NS instance is modified or a new NS instance is created successfully to satisfy the network slice related requirements, the result includes the relevant NS instance information (see NetworkSlice IOC defined in clause 6.3.1 in TS 28.541 [6]):

- DN of the MOI for NS instance.

Otherwise the result may include the reason of failure, for example, the required latency or user number cannot be satisfied, or the physical resource is not enough.

## 7.3 Procedure of NSS instanceAllocation

The Figure 7.3-1 illustrates the procedure of creating a new NSS instance or using an existing NSS instance to satisfy the required network slice subnet related requirements.



Figure 7.3-1: NSS instance Allocation Request procedure

1) Network Slice Subnet Management Service Provider (NSSMS\_P) receives an AllocateNssi request (see AllocateNssi operation defined in clause 6.5.2) from Network Slice Subnet Management Service Consumer (NSSMS\_C) with network slice subnet related requirements (see SliceProfile defined in claue 6.3.4 in TS 28.541[6]).

2) NSSMS\_P check the feasibility of network slice subnet related requirements. If the network slice subnet related requirements can be satisfied, the following step 3) are needed, else go to step 5).

3) Based on the network slice subnet related requirements, NSSMS\_P decides whether to use an existing NSS instance or create a new NSS instance. If the network slice subnet related requirements allow the requested NSS instance to be shared and if an existing suitable NSS instance can be reused, the NSSMS\_P decides to use the existing NSS instance.

4.1a) If using an existing NSS instance and the existing NSS instance needs to be modified to satisfy the network slice subnet related requirements, the NSSMS\_P invokes the procedure to modify the existing NSS instance as described in clause 7.7.

4.1b.1) If creating a new NSS instance, the NSSMS\_P creates the MOI for the NSS instance to be created. NSSMS\_P derives the corresponding network slice subnet constituent (i.e. NF, constituent NSS) related requirements and transport network related requirements (e.g. 3GPP endpoint information, latency requirements, bandwidth requirements, isolation requirements) from the received network slice subnet related requirements. Before NSSMS\_Provider derives the constituent network slice subnet related requirements, NSMS\_Provider may invoke corresponding network slice subnet capability information querying procedure as described in clause 7.8.2.

4.1b.2) If the NSS instance to be created contains virtualisation part (i.e. VNF or VL), NSSMS\_P derives the NS instance instantiation information (the NS instance instantiation information is described in clause 7.3.2.2 and clause 7.3.3.2 [3]) based on network slice subnet related requirements. NSSMS\_P determines VNF instance(s) that need to be deployed according to the necessary network function(s) and then derives the profile of virtual link(s) according to the connection requirements between the network functions. NSSMS\_P chooses a proper NSD deployment flavour and creates data concerning the SAPs of the NS instance. NSSMS\_P invokes the NS instantiation procedures to create a NS instance. NSSMS\_P configures the NSS MOI with the NS instance identifier.

Note: NS instantiation procedure is described in TS 28.526 [7].

4.1b.3) For each required NSS instance constituent, the following step 4.1b.3a) and 4.1b.3b) are needed:

4.1b.3a) If the required NSS instance constituent is constituent NSS instance, NSSMS\_P invokes NSS instance Allocation Procedure.

4.1b.3b) If the required NSS instance constituent is NF instance, NSSMS\_P invokes NF Creation Procedure as described in clause 7.10 or NF Modification Procedure as described in clause 7.11.

4.1b.4) NSSMS\_P configures the MOI for NSS instance with the DN of the MOI for NSS instance constituent (i.e. NF, constituent NSS instance).

4.1b.5) For each required transport network related requirements, NSSMS\_P invokes corresponding procedure of coordination with relevant TN Manager to handle the TN part as described in clause 7.9.

5) The NSSMS\_P sends the NSS instance allocation result (see AllocateNssi operation defined in clause 6.5.2) to the NSSMS\_C. If the NSS instance is created successfully, the result includes the relevant constituent NSS instance information (see NetworkSliceSubnet IOC defined in clause 6.3.2 in TS 28.541 [6]):

- DN of the MOI for NSS instance.

- NS instance Info (e.g. NSinstanceId)

Otherwise the result may include the reason of failure, for example, the required latency or user Number cannot be satisfied, or the physical resource is not enough.

## 7.4 Procedure of NS instance Deallocation

Figure 7.4-1 depicts the procedure of deallocating an NS instance by the network slice management service provider to satisfy the NS instance deallocation request received from an authorized consumer.



Figure 7.4-1: NS instance deallocation procedure

1) The network slice management service provider (NSMS\_P) receives a NS instance deallocation request (see DeallocateNsi operation defined in clause 6.5.3) from network slice management service consumer (NSMS\_C) indicating that the NS instance is no longer needed for the consumer.

2) The NSMS\_P sends the NS instance deallocation response (see DeallocateNsi operation defined in clause 6.5.3) to NSMS\_C.

3) The NSMS\_P may decide to terminate the NS instance, then it invokes the NSS instance deallocation procedure as described in clause 7.5.

4) The NSMS\_P may decide not to terminate the NS instance but to modify the NS instance, then it invokes the NS instance modification procedure as described in clause 7.6.

## 7.5 Procedure of NSS instance deallocation

Figure 7.5-1 depicts the procedure of deallocating an NSS instance by the network slice subnet management service provider to satisfy the NSS instance deallocation request received from an authorized consumer.



Figure 7.5-1: NSS instance deallocation procedure

1) The network slice subnet management service provider (NSSMS\_P) receives NSS instance deallocation request (see DeallocateNssi operation defined in clause 6.5.4) from network slice subnet management service consumer (NSSMS\_C).

2) NSSMS\_P sends response (see DeallocateNssi operation defined in clause 6.5.4) of NSS instance deallocation service to NSSMS\_C.

3-a) NSSMS\_P may decide to terminate the NSS instance, it invokes (constituent) NSS instance deallocation procedure as described in clause 7.5 if the NSS instance consists of constituent NSS instance.

3-b) NSSMS\_P invokes NF deletion procedure as described in clause 7.12 or NF modification procedure as described in clause 7.11 if the NSS instance consists of NFs.

3-c) NSSMS\_P invokes TN related coordination procedure with responsible manager as described in clause 7.9 if the NSS instance consists of TN part.

3-d) NSSMS\_P invokes NS termination procedure if the NSS instance contains virtualized part.

Note: NS termination procedure is described in TS 28.526 [7].

4) NSSMS\_P may decide not to terminate the NSS instance, it invokes NSS instance modification procedure as described in clause 7.7.

## 7.6 Procedure of NS instance Modification

The Figure 7.6-1 illustrates the procedure of modifying an existing NS instance.



Figure 7.6-1: NS instance Modification Request procedure

1) Network Slice Management Service Provider (NSMS\_P) receives a ModifyNsi request (see modifyMOIAttributes operation defined in TS 28.532 [8]) from Network Slice Management Service Consumer (NSMS\_C) with the management identifier of NS instance and the new network slice related requirements (see ServiceProfile defined in clause 6.3.3 in TS 28.541[6]).

2) Based on the new network slice related requirements, NSMS\_P invokes the feasibility check procedure. If the modification requirements can be satisfied, go to step 3), else go to step 5).

3) NSMS\_P decomposes the NS instance modification request into NSS instance modification request(s), i.e., generating the new network slice subnet related requirements for each NSS instance if needed.

4) NSMS\_P, as the role of Network Slice Subnet Management Service Consumer (NSSMS\_C), invokes the NSS instance modification procedure.

5) NSMS\_P sends NS instance modification result (see modifyMOIAttributes operation defined in TS 28.532 [8]) to NSMS\_C.

## 7.7 Procedure of NSS instance Modification

The Figure 7.7-1 illustrates the procedure of modifying an existing NSS instance.



Figure 7.7-1: NSS instance Modification Request procedure

1) Network Slice Subnet Management Service Provider (NSSM\_SP) receives a ModifyNssi request (see modifyMOIAttributes operation defined in TS 28.532 [8]) from Network Slice Subnet Management Service Consumer (NSSM\_SC) with the management identifier of NSS instance and the new network slice subnet related requirements (see SliceProfile defined in clause 6.3.3 in TS 28.541[6]).

2) Based on the new network slice subnet related requirements, NSSM\_SP invokes the feasibility check procedure. If the modification requirements can be satisfied, go to step 3), else go to step 5).

3) NSSM\_SP decomposes the NSS instance modification request into modification requests for each NSS instance constituent.

4a) If the requested NSS instance constituent is constituent NSS instance, NSSM\_SP invokes NSS instance modification procedure as described in clause 7.7.

4b) If the requested NSS instance constituent is NF instance, NSSM\_SP invokes NF creation procedure as described in clause 7.10 or NF modification procedure as described in clause 7.11.

4c) If the NSS instance contains the virtualized part, NSSM\_SP invokes the NS instance scaling and/or NS instance updating and/or NS instance instantiation procedure as described in TS 28.526 [7].

4d) If the NSS instance contains the TN part, NSSM\_SP invokes the TN related coordination procedure as described in clause 7.9.

5) NSSM\_SP sends NSS instance modification results (see modifyMOIAttributes operation defined in TS 28.532 [8]) to NSSM\_SC.

## 7.8 Procedure of Obtaining Network Slice Subnet Capability

### 7.8.1 Introduction

The clause illustrates possible procedures of obtaining network slice subnet capability information (e.g. supported maximum latency, supported capacity (e.g. maximum user number)) of NSS instance(s) which can be provided by network slice subnet management service provider.

### 7.8.2 Querying Network Slice Subnet Capability Information



Figure 7.8-2: Procedure of querying network slice subnet capability information

1) Network Slice Subnet Management Service Consumer (NSSMS\_C) wants to query the NSS capability information of the NSS instance(s) which can be provided by corresponding Network Slice Subnet Management Service Consumer (NSSMS\_P), NSSMS\_C sends NSS capability querying request (see getMOIAttributes operation defined in TS 28.532 [8]) to NSSMS\_P to obtain the NSS capability information of the NSS instance(s) which can be provided by corresponding NSSMS\_P.

2) NSSMS\_P processes the NSS capability information querying request.

3) NSSMS\_P sends the NSS capability information (e.g. supported maximum latency, supported capacity (e.g. user number)) of NSS instance(s) that can be provided by itself (see getMOIAttributes operation defined in TS 28.532 [8]) to NSSMS\_C.

|  |
| --- |
| **7th change** |

## 7.13 Procedure of reservation and checking feasibility of NS instancenetwork slice



Figure 7.13-1 Network slice feasibility check procedure

1) Network Slice Management Service Provider (NSMS\_Provider) receives a provisioning NS instance request (e.g., AllocateNsi request (see AllocateNsi operation defined in clause 6.5.1), ModifyNsi request (see modifyMOIAttributes operation defined in TS 28.532 [8])) from Network Slice Management Service Consumer (NSMS\_Consumer) with network slice related requirements (e.g. Area information, User Number, traffic demand, QoS Quality, whether the requested network slice could be shared).

2) [Optional] NSMS\_Provider may request information and updates from NSSMS\_Provider and Other\_MS\_Provider regarding the resources.

3) NSMS\_Provider sends reservation requests to Network Slice Subnet Management Service Provider (NSSMS\_Provider) and (if needed) Other Management Service Providers (Other\_MS\_Provider), e.g., MANO, TN manager. NSMS\_Provider receives responses with information regarding allocated resources, e.g., their availability, identification information of reserved resources and so on.

4) A reservation request to NSSMS\_Provider can trigger NSS instance feasibility checking.

5) NSMS\_Provider evaluates the responses to determine if the network slice requirements can be satisfied.

6) If feasible,

6.a) NSMS\_Provider is ready for provisioning.

6.b) [Optional] Acknowledgement regarding reservation check results can be sent to NSMS\_Customer.

7) If not feasible,

7.a) NSMS\_Provider cancels reservations, optionally may receive acknowledgement.

7.b) NSMS\_Provider is not ready for provisioning.

7.c) NSMS\_Provider may send negative acknowledgement regarding results of reservation check to NSMS\_Customer.

## 7.14 Procedure of reservation and checking feasibility of network slice subnet



Figure 7.14-2 Network slice subnet feasibility check procedure

1) Network Slice Subnet Management Service Provider (NSSMS\_Provider) receives a provisioning NSS instance request (e.g., AllocateNssi request (see AllocateNssi operation defined in clause 6.5.2), ModifyNssi request (see modifyMOIAttributes operation defined in TS 28.532 [8])) from Network Slice Subnet Management Service Consumer (NSSMS\_Consumer) with network slice subnet related requirements (e.g. Area information, User Number, traffic demand, QoS Quality, whether the requested network slice could be shared). The request is evaluated and initial resources to be allocated are identified.

2) [Optional] NSSMS\_Provider may request information and updates from NSSMS\_Provider and Other\_MS\_Provider regarding the resources.

3) NSSMS\_Provider sends reservation requests to Other Management Service Providers (Other\_MS\_Provider), e.g., MANO, TN manager. NSSMS\_Provider receives responses with information regarding reserved resources, e.g., their availability, identification information of reserved resources and so on.

4) NSSMS\_Provider evaluates the responses to determine if the network slice subnet requirements can be satisfied.

5) If feasible:

5.a) NSSMS\_Provider is ready for provisioning.

5.b) [Optional] Acknowledgement regarding reservation check results can be sent to NSSMS\_Customer.

6) If not feasible,

6.a) NSSMS\_Provider cancels reservations, optionally may receive acknowledgement.

6.b) NSSMS\_Provider is not ready for provisioning.

6.c) NSSMS\_Provider may send negative acknowledgement regarding results of reservation check to NSSMS\_Customer.

## 7.15 Procedure of network slice capacity planning

The Figure 7.15-1 illustrates the procedure of capacity planning of network slices (including both NS instances and NSS instances).



Figure 7.15-1: Network slice resource capacity planning procedure

1) Network Slice Management Service Provider (NSMS\_P) receives CapacityPlanningRequest from Network Slice Management Service Consumer (NSMS\_C).

2a) NSMS\_P checks feasibility.

2b) NSMS\_P obtains slice provisioning requirements, existing active or non-active NS instance and/or NSS instance resource information, and performance measurement data.

3a) NSMS\_P requests network resource capacity optimization calculation to the Other\_MS\_Provider.

3b) Other\_MS\_Provider performs network resource capacity planning process based on the information obtained from step 2.

Other\_MS\_Provider can be a capability of NSMS\_Provider or external management entities.

3c) Other\_MS\_Provider replies the result of network resource capacity optimization calculation in the form of the network resource capacity optimization objective. The result includes a set of NS instance and/or NSS instance provisioning and modification requirements.

4) NSMS\_P proceeds with network slice (NS instance and/or NSS instance) provisioning or modification processes (loop of 4a – 4d) until it meets the network resource capacity optimization objective.

5) NSMS\_P updates network capacity availability information after provisioning or modification processes.

6) NSMS\_P returns the network resource capacity planning results to NSMS\_C.

## 7.16 Procedure of allocating network with or without slicing for communication services

The Figure 7.16-1 illustrates the procedure of allocating network with or without slicing for communication services.

 

Figure 7.16-1 Allocating network with or without slicing for communication services

1) Network Service Provider (NS\_Provider) receives AllocateNetwork request (see AllocateNetwork operation defined in clause 6.5.5) from Network Service Consumer (NS\_Consumer). The received request includes network related service requirements (e.g. isolation, latency, coverage).

2) NS\_Provider decides to use the network with or without slicing depending on these network related service requirements based on some internal admission control.

3) Based on the decision by NS\_Provider:

3a) If NS\_Provider decides to use a network with slicing, network slice allocation procedures in clause 7.2 follows. These procedures may result a new network slice to be created, or use an existing network slice with modification.

3b) If NS\_Provider decides to use network without slicing, the network without slicing is utilized to satisfy the network related service requirements, there may be modification of the existing network or creation of a new network.

4) NS\_Provider sends the AllocateNetwork response (see AllocateNetwork operation defined in clause 6.5.5) to NS\_Consumer.

|  |
| --- |
| **8th change** |

### .1.2 Operation AllocateNsi

This operation is to allocate an NS instance provided by the service provider, the NS instance may be new or existing.

Table 8.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **Qualifier** |
| attributeListIn | request body | attributeListIn | LIST OF SEQUENCE< attribute name, attribute value > | M |

Table 8.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **Qualifier** |
| attributeListOut | response body | attributeListOut | LIST OF SEQUENCE< attribute name, attribute value > | M |
| status | response status codes | n/a | n/a | M |
| nSIId | response body | href | type:string, format: uri | M |

### 8.1.3 Operation AllocateNssi

This operation is to allocate an NS instance provided by the service provider, the NSS instance may be new or existing.

Table 8.1.3-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **Qualifier** |
| attributeListIn | request body | attributeListIn | LIST OF SEQUENCE< attribute name, attribute value > | O |

Table 8.1.3-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **Qualifier** |
| attributeListOut | response body | attributeListOut | LIST OF SEQUENCE< attribute name, attribute value > | M |
| status | response status codes | n/a | n/a | M |
| nSSIId | response body | href | type:string, format: uri | M |

### 8.1.4 Operation DeallocateNsi

This operation is to deallocate an NS instance provided by the service provider, the NS instance may be terminated or modified.

This operation does not support any input parameters.

Table 8.1.4-1: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **Qualifier** |
| status | response status codes | n/a | n/a | M |

### 8.1.5 Operation DeallocateNssi

This operation is to deallocate an NSS instance provided by the service provider, the NSS instance may be terminated or modified.

This operation does not support any input parameters.

Table 8.1.5-1: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IS operation parameter name** | **SS parameter location** | **SS parameter name** | **SS parameter type** | **Qualifier** |
| status | response status codes | n/a | n/a | M |

|  |
| --- |
| **8th change** |

Annex A (informative):
A network slice journey example

The Generic Slice Template (GST) ([9]) provides a standardized list of attributes that can be used to characterise different types of network slice. GST is generic and is not tied to any:

- Type of network slice

- Agreement between a Network Slice Customer (NSC) and a Network Slice Provider (NSP).

A Network Slice Type (NEST) is a GST filled with (ranges of) values. There may be two kinds of NESTs:

- Standardized NESTs (S-NEST), i.e. NESTs which character attributes are assigned (ranges of) values by SDOs, working groups, foras, etc. such as e.g. 3GPP, GSMA, 5GAA, 5G-ACIA, etc.;

- Private NESTs (P-NEST), i.e. NESTs which character attributes are assigned (ranges of) values by the Network Slice Providers, which are different from those assigned in S-NESTs.

Network Slice Providers can build their network slice product offering based on S-NESTs and/or their P-NESTs. For example, a Standardized Network Slice Type (S-NEST) NST-A, for which the attribute ‘Packet delay budget’ (see [x] – clause 3.4.26) value range is between 1 ms and 100 ms, is specified by 3GPP. Netwok Slice Provider Y may offer e.g. 3 products based on NST-A:

- Platinum NST-A based network slice product, where the attribute ‘Packet delay budget’ (see [x] – clause 3.4.26) value range is between 1 ms and 10 ms;

- Gold NST-A based network slice product, where the attribute ‘Packet delay budget’ (see [x] – clause 3.4.26) value range is between 11 ms and 50 ms;

- Silver NST-A based network slice product, where the attribute ‘Packet delay budget’ (see [x] – clause 3.4.26) value range is between 51 ms and 100 ms.

NSP Y’s customers can then order NS instancesfrom Y’s product catalog, as depicted by Figure A.1.



Figure A.1: From GST to S-(/P-)NEST based product ordering

1) A Network Slice Customer orders NS instanceto a Network Slice Provider, based on NSP’s product offering, by sending a request to NSP’ BSS

2) NSP’s BSS receives the request from NSC and translates NSC requirements into NSP technical parameter values

3) NSP’s BSS sends a request to NSP’s OSS to provide a network slice which fits NSC’s requirements (see Table 6.1-1)

4) NSP’s Network Slice Provisioning MnS either creates a new NS instance or assigns an already existing NS instance to NSC’s request

5) NSP’s Network Slice Provisioning MnS may have to request the Network Slice Subnet Provisioning MnS to provide a network slice subnet instance corresponding to the NS instance (see Table 6.2-1)

6) NSP’s Network Slice Subnet Provisioning MnS may have to create one or more inner network slice subnet instances

7) NSP’s Network Function Provisioning MnS configures VNFs and/or PNFs (see Table 6.3-1).



Figure A.2: Network Slice journey (NSaaS model) – high-level call flow

Depending on NSP’s product offering, NSC can order network slices spanning one or more network domains, e.g.:

- NS instancecomposed of a RAN-only NSS instance



Figure A.3: RAN-only network slice subnet exposed as network slice

- NS instancescomposed of a CN-only network slice subnet instance

- NS instancecomposed of a RAN network slice subnet instance + Transport network slice subnet + CN NSS instance



Figure A.4: RAN+TN+CN network slice subnets exposed as network slice

- NSSs composed of a RAN network slice subnet instance + CN NSS instance + IMS NSS instance

- or more, as shown below..



Figure A.5: RAN+TN+CN+TN+IMS+TN+AS network slice subnets exposed as network slice

|  |
| --- |
|  **End of changes** |