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**5G;
Management and orchestration;
Provisioning
(3GPP TS 28.531 version 15.13.0 Release 15)**

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1 Scope

The present document specifies use cases, requirements, management services and procedures for provisioning of 5G networks.

2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 28.525: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Requirements".
- [3] ETSI GS NFV-IFA 013 (V2.4.1) (2018-02): "Network Function Virtualisation (NFV); Release 2; Management and Orchestration; Os-Ma-nfvo reference point - Interface and Information Model Specification".
- [4] 3GPP TS 28.530: "Management and orchestration; Concepts, use cases and requirements".
- [5] 3GPP TS 22.261 "Service requirements for next generation new services and markets".
- [6] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".
- [7] 3GPP TS 28.526: "Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures".
- [8] 3GPP TS 28.532: "Management and orchestration; Generic management services".
- [9] 3GPP TS 23.501: "Technical Specification Group Services and System Aspects;System Architecture for the 5G System;Stage 2".
- [10] 3GPP TS 38.300: "Technical Specification Group Radio Access Network;NR; NR and NG-RAN Overall Description;Stage 2".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], TS 28.530 [4] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 28.530 [4].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], TS 28.530 [4] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

5GC	5G Core Network
AMF	Access and Mobility Management Function
CSC	Communication Service Customer
CSMF	Communication Service Management Function
CSP	Communication Service Provider
CP	Control Plane
IOC	Information Object Class
MANO	Management and Orchestration
MnS	Management Service
NF	Network Function
NFV	Network Functions Virtualisation
NRM	Network Resource Model
NSaaS	Network Slice as a Service
NSI	Network Slice Instance
NSMF	Network Slice Management Function
NSSI	Network Slice Subnet Instance
NSSMF	Network Slice Subnet Management Function
TN	Transport Network
VNF	Virtualized Network Function
UP	User Plane

4 General

4.1 Overview

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

The management aspects of a Network Slice Instance (NSI) 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 NSI does not exist. The preparation phase includes network slice design, onboarding, evaluation of the network slice requirements, preparing the network environment and other necessary preparations required to be done before the creation of an NSI.
- During the NSI lifecycle stage which include commissioning phase, operation phase and decommissioning phase, the NSI provisioning operations include:
 - Create an NSI;
 - Activate an NSI;
 - Deactivate an NSI;
 - Modify an NSI;
 - Terminate an NSI.

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

- a) During the commissioning phase:

- Create an NSI.

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

b) During the operation phase:

- Activate an NSI;
- Modify an NSI;
- Deactivate an NSI.

NSI activation includes any actions that make the NSI active to provide communication services. NSI activation may trigger NSSI activation.

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

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

c) During the decommissioning phase:

- Terminate an NSI.

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

Similarly, provisioning for network slice subnet instance includes the following operations:

- Create an NSSI;
- Activate an NSSI and associate it with certain NSI to be used by the NSI;
- Disassociate the NSSI with certain NSI and deactivate the NSSI if it's not associated with any NSI;
- Modify an NSSI;
- Terminate an NSSI.

The following are NSSI states:

NSSI_NULL – the NSSI does not exist

NSSI_NOT_IN_USE – the NSSI exists, but is not used by (associated with) any NSI or NSSI

NSSI_IN_USE – the NSSI is used by (associated with) at least one NSI or at least one NSSI

The following is the state diagram:

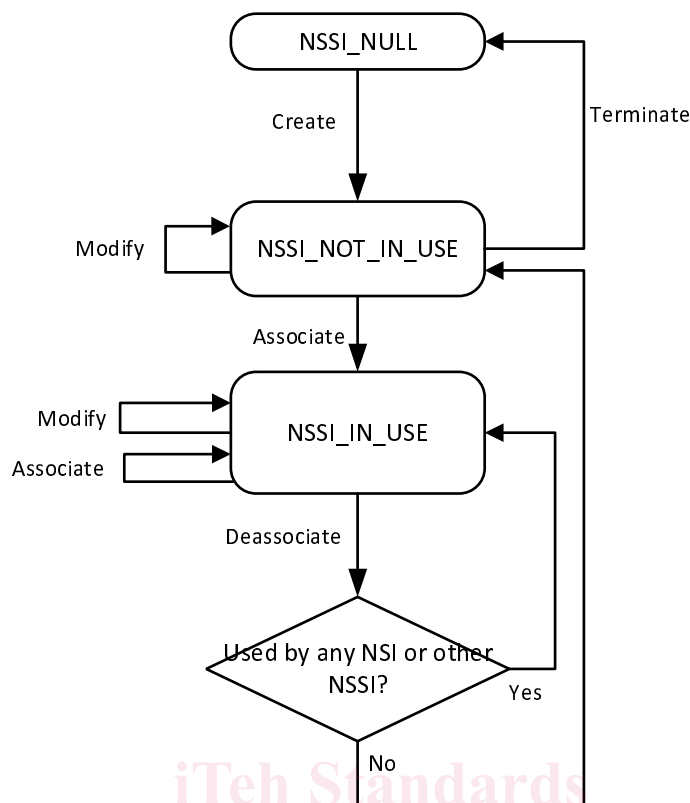


Figure 4.1-1

4.2 Configuration information for the constituents of an NSI

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

The configuration information of these components may include:

- *Information on the requirements to be applied to every NSI constituent to satisfy the requirements of multiple NSIs* if the constituent is shared by multiple NSIs;
- *Network function selection information*: Information on the selection of the NFs (e.g., AMF) according to the requirements of this NSI;
- *Connection information*: The information of the logical links to carry the NSI's CP and UP data between the component and other NFs and NSSIs belonging to the NSI.

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

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

4.3 General information for network slice instance

The general information used to describe network slice 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 via CSMF.

4.4 General information for network slice subnet instance

The general information used to describe network slice subnet 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 profile:

- A service profile is used to capture a set of requirements for the new network slice instance such as (i.e. eMBB, MIoT, URLLC).
- A service profile is used to capture a set of specific industry requirements for creation of network slice instance such as (e.g. 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:

Identifier	Description
Identifiers for network slice management purpose	
NetworkSlice identifier	Represent the management identifier of network slice instance. Management identifier of network slice instance is defined in TS 28.541[6] as objectinstance attribute of NetworkSlice IOC.
NetworkSliceSubnet identifier	Represent the management identifier for a network slice subnet instance. Management identifier of network slice subnet instance is defined in TS 28.541[6] as objectinstance attribute of NetworkSliceSubnet IOC.
Identifiers for network slice selection purpose	
NSI 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[9].
S-NSSAI	Represent network slice. Referred to TS 23.501[9] and TS 38.300[10].

PLMN ID	Represent PLMN identifier.
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The NSI ID and S-NSSAI are configured by the management system.

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5 Specification level requirements

5.1 Use cases

5.1.1 Network slice instance allocation

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To satisfy request for allocation of a network slice instance with certain characteristics, by creation of new or using existing network slice instance.	
Actors and Roles	CSMF, who acts as an example of network slice management service consumer. NOP operator	
Telecom resources	Network slice instance Network slice subnet instance Transport network NSMF, who acts as an example of network slice management service provider. NSSMF, who acts as an example of network slice subnet management service provider.	
Assumptions	N/A	
Pre-conditions	N/A	
Begins when	NSMF receives the request for allocation of the network slice instance with network slice related requirements.	
Step 1 (M)	If the requested NSI can be shared and if an existing NSI can be used, the NSMF decides to use the existing NSI. Modification of the existing NSI may be needed to satisfy the network slice instance related requirements. Use case is completed go to "Step 8". Otherwise, the NSMF triggers to create a new NSI, for which the following steps 2 – 8 are needed.	
Step 2 (M)	NSMF decides on the constituent NSSIs and the topology of the NSI to be created using the information from service profile [6]. For the constituent NSSIs, the NSMF derives network slice subnet related requirements from the network slice related requirements. If reconfiguration of the transport network is needed, the NSMF derives transport network related requirements (e.g., latency, bandwidth) from the network slice related requirements.	
Step 3 (M)	For the required NSSI(s), the NSMF sends network slice subnet related requirements to the NSSMF to request allocation of the required NSSI(s).	Network slice subnet instance allocation use case
Step 4 (M)	NSMF receives the information of the allocated NSSI(s) (e.g. the management identifier of NSSI, service access point information of NSSI, external connection point information of NSSI) from NSSMF.	
Step 5 (M)	NSMF, via NSSMF, 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 NSMF via NSSMF.	
Step 6 (M)	NSMF receives the response from TN Manager via NSSMF.	
Step 7 (M)	NSMF associates the NSSI(s) with the corresponding NSI (e.g, allocation of the management identifier of NSI and mapping the management identifier of NSI with the received management Identifier of NSSI(s)) and triggers to establish the links between the service access points of the NSSI(s).	
Step 8 (M)	NSMF notifies the network slice instance information of NSI (e.g., the management identifier of NSI).	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	An NSI is ready to satisfy the network slice related requirements.	
Traceability	REQ-PRO_NSSI-FUN-1, REQ-PRO_NSI-FUN-3.	