**3GPP TSG-SA5 Meeting #130-e *S5-202146***

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

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **28.530** | **CR** | **0021** | **rev** | **-** | **Current version:** | **16.1.0** |  |
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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 | | | | | | | | | |
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| ***Work item code:*** | eNRM | | | | |  | ***Date:*** | | | 2020-04-10 |
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| ***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 can be 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 ID   1. "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:*** | | 4.1.1, 4.1.3, 4.1.8, 4.4., 4.5, 4.6, 4.7, 5.1.1, 5.1.2, 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.4.5, 5.4.6, 5.4.7, 5.4.9, 5.4.10, 5.4.11, 5.4.12, 5.4.13, 5.4.14, 5.4.15 | | | | | | | | |
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|  | | **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:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

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| **1st change** |

### 4.1.1 Management of 5G networks and network slicing

5G system consists of 5G Access Network (AN), 5G Core Network and UE, see TS 23.501 [3].

5G system is expected to be able to provide optimized support for a variety of different communication services, different traffic loads, and different end user communities, see clause 4 of TS 22.261 [2]. For example, the communication services using network slicing may include:

- V2X services

The 5G system aims to enhance its capability to meet KPIs that emerging V2X applications require. For these advanced applications, the requirements, such as data rate, reliability, latency, communication range and speed, are made more stringent, see clause 4 of TS 22.261 [2].

- 5G seamless eMBB service with FMC

As one of the key technologies to enable network slicing, fixed mobile convergence (FMC) which includes wireless-to-the-everything (WTTx) and fibre-to-the-everything (FTTx), is expected to provide native support for network slicing. For optimization and resource efficiency, the 5G system will select the most appropriate 3GPP or non-3GPP access technology for a communication service, potentially allowing multiple access technologies to be used simultaneously for one or more services active on a UE, see clause 6.3 of TS 22.261 [2].

- massive IoT connections

Support for massive Internet of Things (mIoT) brings many new requirements in addition to MBB enhancements, see clause 4 of TS 22.261 [2]. Communication services with massive IoT connections such as smart households, smart grid, smart agriculture and smart meter will require the support of a large number and high density IoT devices to be efficient and cost effective, see TS 23.501 [3]. Operators can use one or more network slices to provide these communication services, which require similar network characteristics, to different vertical industries.

The next generation 3GPP management system is expected to support the management of 3GPP 5G system and 3GPP legacy systems.

3GPP management system directly manages 3GPP managed network components (e.g. 5G RAN, 5G CN). For non-3GPP domains (e.g. DCN, TN), 3GPP management system needs to coordinate with the corresponding management systems of the non-3GPP domains.

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| **2nd change** |

### 4.1.3 Communication services using network slices s

As an example, a variety of communication services instances provided by multiple NSI(s) are illustrated in the figure 4.1.3.1. Figure 4.1.3.1 is only for illustrative purposes to highlight the combination and relationship of Communication Services to Network Slices without depicting any UE. An actual network slice deployment offering communication services to UEs will need to comply with the 5G system architecture defined in TS 23.501 [3] and TS 38.401 [4].



Figure 4.1.3.1: A variety of communication services instances provided by multiple NSIs

Figure 4.1.3.1 illustrates the relationship between Communication Service Instances, NSIs, and NSSIs:

- NSSI AN-1 and NSSI AN-2 each contain distinct sets of instances of AN NFs. NSSI CN-1, NSSI CN-2 and NSSI CN-3 each contain distinct sets of instances of CN NFs. The TN supporting connectivity facilitates the communication between CN and AN NFs. NSSI A combines NSSI AN-1 with NSSI CN-1 and corresponding TN connectivity. NSSI B combines NSSI AN-2 and NSSI CN-2 and corresponding TN connectivity. NSSI C combines NSSI AN-2 with NSSI CN-3 and corresponding TN connectivity. The NSSI AN-2 is shared between NSSI B and NSSI C, while NSSI AN-1 is dedicated to NSSI A.

- NOP offers NSSI A as a NSI A, in this relationship NSI A represents NSSI A with associated Service Level Specification (SLS). NOP also offers NSSI B as NSI B and NSSI C as NSI C. The SLS of NSI A satisfies the service requirements of Communication Service Instance 1 and Communication Service Instance 2. The SLS of NSI B satisfies the service requirements of Communication Service Instance 2. The SLS of NSI C satisfies the service requirements of Communication Service Instance 3.

- The Communication Service Instance 1 is supported by NSI A. The Communication Service Instance 2 may be supported by either NSI A or NSI B. The Communication Service Instance 3 is supported by NSI C.

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| **5th change** |

### 4.1.6 Network Slice as a Service (NSaaS)

Network Slice as a Service (NSaaS) can be offered by a CSP to its CSC in the form of a service. This service allows CSC to use the network slice as the end user or optionally allows CSC to manage the network slice as manager via management interface exposed by the CSP. In turn, these CSC can play the role of CSP and offer their own services (e.g. communication services) on top of the network slice obtained from the CSP. For example, a network slice customer can also play the role of NOP and could build their own network containing the network slice obtained from the CSP as a "building block". In this model, both CSP offering NSaaS and CSC consuming NSaaS have the knowledge of the existence of NSIs. Depending on service offering, CSP offering NSaaS may impose limits on the NSaaS management capabilities exposure to the CSC, and the CSC can manage the network slice according to NSaaS management capabilities exposed and agreed upon limited level of management by the CSP.

The NSaaS offered by the CSP could be characterized by certain properties (capabilities to satisfy service level requirements), e.g.

- radio access technology,

- bandwidth,

- end-to-end latency,

- reliability,

- guaranteed / non-guaranteed QoS,

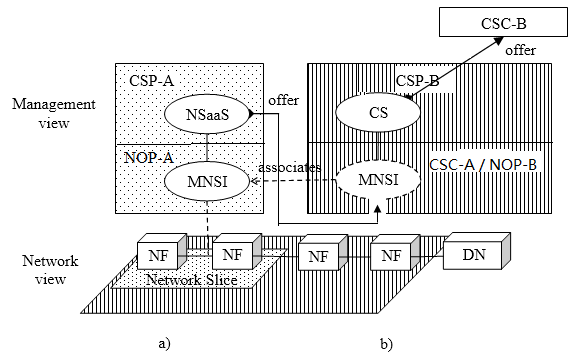
- security level, etc.

Figure 4.1.6.1 illustrates some examples on how network slices can be utilized to deliver communication services, including Network Slice as a Service. For simplicity this figure omits the details of how NFs are being managed and does not show their groupings into NSSI:

a) A Network Slice as a Service is provided to CSC-A by CSP-A. Unlike the communication service delivered to end customers, in NSaaS, the offered service is the actual network slice.

b) CSC-A can use the network slice obtained from CSP-A to support own Communication Services or may add additional network functions to the obtained NSaaS and offer the resulting combination as a new network slice to CSP-B. In this case, CSC-A plays the role of NOP-B and builds his own network. The Network Slice obtained by CSC-A from CSP-A becomes a "building block" or an NSSI of CSC-A in its role of NOP-B. The NOP-B (a.k.a. CSC-A) combines this NSSI with other NSSIs and offers the new NSSI as Network Slice to CSP-B.

c) CSP-B can use the network slice obtained from CSC-A / NOP-B to deliver Communication Services to its end customers (as CSC-B).



NSI

NSI

Figure 4.1.6.1: Examples of Network Slice as a Service being utilized to deliver communication services to end customers

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| **6th change** |

### 4.1.8 Network slice delivery concepts

Network slices are provided in different compositions to the customer which may include access to different management capabilities and network slice provisioning procedures for the customer.

For example, a network slice may be delivered

a) to meet customer's communication service requirements without any exposure of internal structures (applicable to both individual subscribers and NSaaS); or

b) to meet the network slice requirements, with some exposure of the internal structures (e.g. NFs, topology, etc.) and with some network monitoring capability as enabled by the provider; or

c) to meet the network slice requirements with some exposure of the internal structures (e.g. NFs) with some management capabilities as enabled by the provider.

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| **7th change** |

## 4.4 Network slice management concepts

### 4.4.1 General

From a management point of view a network slice is complete in the sense that it includes all the managed function instances, with their supporting resources, to provide a certain set of communication services to serve a certain business purpose. In other words, the network slice is complete because it completely satisfies the associated SLS.

The following concepts are related to network slicing management:

a. Services which are supported by NSI (services whose service level requirements are satisfied by the SLS associated with the NSIs).

b. NSSIs and networks composed of PNF, VNF or both and offered as NSIs.

c. Network function (PNFs, VNFs) grouped into NSSIs.

d. Resources which support the network (e.g. virtualized resource, non-virtualized resource)

The management aspects of the network slice are represented by management of the CN part, and AN part which are directly managed by the 3GPP management system, and management of non-3GPP part which is not directly managed by the 3GPP management system. The non-3GPP part includes TN parts. The 3GPP management system provides the network slice requirements to the corresponding management systems of those non-3GPP parts, e.g. the TN part supports connectivity within and between CN and AN parts. For the TN part, the 3GPP management system provides the TN topology requirements and individual TN links' QoS attributes requirements to the TN management system.

The 3GPP management system maintains the network topology and the related QOS requirements.



Figure 4.4.1.1: Example of an NSI

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| **8th change** |

## 4.5 Network slice subnet concepts

The NSSI represents a group of network function instances (including their corresponding resources) that form part or complete constituents of anNSI. The grouping of the network functions allows the management of each group of network functions to be conducted independently of the NSI.

The Network Slice Subnet concepts include the following aspects:

- An NSSI constituent may include Managed Function(s) and other constituent NSSI(s).

- An NSSI may be shared by two or more NSIs, this is called a shared constituent of NSI. This sharing may be direct or indirect. The direct sharing implies that the NSSI is offered as NSI multiple times. The indirect sharing implies that the NSSI is either a constituent of a NSSI shared by two or more NSIs, or is shared by two or more NSSI(s) which are in turn offered as different NSIs.

- An NSSI may be shared by two or more NSSI(s), this is also called a shared constituent of NSSI. The sharing may be direct or indirect. The direct sharing implies that NSSI is a constituent of two or more NSSIs. The indirect sharing implies that NSSI is a constituent of a shared NSSI.

- An NSSI that is dedicated to one NSI and is not shared as a constituent by two or more NSSI(s) is called a non-shared NSSI.

- An NSSI may contain instances of CN Managed Functions only, or instances of AN Managed Functions only, or any combination thereof.

- An NSSI may additionally have information representing a set of links with capacities to provide connection between managed functions. This information is also known as TN requirements of the NSSI.

- The resources used, and whose management aspects are represented by an NSSI comprise physical and logical resources. In case of virtualization, virtualized resources may be used.

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| **9th change** |

## 4.6 Slice profile concepts

The NSSI has an associated set of requirements (e.g. those derived from communication service requirements) that are applicable to the NSSI constituents, such set is called Slice Profile. TN requirements (e.g. set of QoS attributes for the links interconnecting NSSI constituent MFs) is an example of requirements that may be included in the Slice Profile. The slice profile may be common (applicable to all NSSI constituents, regardless of their types) or specific (applicable to only AN MF or only to CN MF NSSI constituents).

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| **10th change** |

## 4.7 Coordination with management systems of non-3GPP parts

When providing an end to end communication service, the network may use non-3GPP parts (e.g. Data centre network (DCN), Transport network (TN)) in addition to the network components defined in 3GPP. Therefore, in order to ensure the performance of a communication service according to the business requirements, the 3GPP management system has to coordinate with the management systems of the non-3GPP parts (e.g., MANO system) when preparing a network slice for this service. This coordination may include obtaining capabilities of the non-3GPP parts and providing the slice specific requirements and other requirements on the non-3GPP parts. Figure 4.7.1 illustrates an example for the coordination with management of TN part (e.g., directly or via MANO system).

The 3GPP management system identifies the requirements on involved network domains, such as RAN, CN and non-3GPP parts of a slice by deriving them from the customer requirements to the services supported by the network slice. The derived requirements are sent to the corresponding management systems. The coordination may also include related management data exchange between those management systems and the 3GPP management system.



Figure 4.7.1: Example of coordination between 3GPP and TN management systems

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| **11th change** |

### 5.1.1 General requirements

**REQ-5GNS-CON-01** The network slicing management architecture shall allow any deployment options within the Network Operator's domain.

**REQ-5GNS-CON-02** The set of network slicing management functions shall be generic to all kinds of network function and network function provider.

**REQ-5GNS-CON-05** The network slicing management architecture shall provide capabilities to manage the total view of all created NSIs.

**REQ-5GNS-CON-06** The network slicing management architecture should provide management capabilities that are dedicated to each NSI. The instance management dedicated to an NSI shall work independently from the instance management dedicated to another NSI.

**REQ-5GNS-CON-07** The network slicing management architecture shall allow managing multiple network slices simultaneously or independently along with their lifecycle.

**REQ-5GNS-CON-08** The 3GPP management system shall have the capability to determine to use network with or without slicing based on network related requirements.

**REQ-5GNS-CON-09** The 3GPP management system shall, when given the capacity increase or decrease of an NSI, be able to calculate the capacity increase or decrease of a RAN slice subnet, CN slice subnet and derive corresponding requirements for the TN part that support the NSI.

**REQ-5GNS-CON-10** The 3GPP management system shall be able to modify the capacity of a RAN slice subnet to a given value.

**REQ-5GNS-CON-11** The 3GPP management system shall be able to modify the capacity of a CN slice subnet to a given value.

**REQ-5GNS-CON-12** The 3GPP management system shall be able to communicate the TN requirements corresponding to the network slice capacity change.

**REQ-5GNS-CON-13** The 3GPP management system shall be able to provide management data analytics to authorized consumers.

**REQ-5GNS-CON-14** The 3GPP management system shall be able to collect and analyse relevant management data.

### 5.1.2 Network slicing management

**REQ-3GPPMS-CON-01** The 3GPP management system shall have the capability to create a new or use an existing NSI according to the communication service requirements.

**REQ-3GPPMS-CON-02** The 3GPP management system shall have the capability to translate the communication service requirements to network slice related requirements.

**REQ-3GPPMS-CON-**03 The 3GPP management system shall have the capability to create a new or use an existing NSI according to the network slice related requirements.

NOTE: The network slice related requirements include requirements such as: area traffic capacity, charging, coverage area, degree of isolation, end-to-end latency, mobility, overall user density, priority, service availability, service reliability, UE speed.

**REQ-3GPPMS -CON-04** The 3GPP management system shall be able to create an NSI.

**REQ-3GPPMS -CON-05** The 3GPP management system shall have the capability to monitor the network slice related data and provide the agreed data to an authorized consumer.

**REQ-3GPPMS -CON-06** The 3GPP management system shall be able to create an NSSI.

**REQ-3GPPMS-CON-07** The 3GPP management system shall be able to evaluate the feasibility of providing a new NSI which does not impact with the existing NSI(s).

**REQ-3GPPMS-CON-07a** The 3GPP management system should have the capability of allocating the resources of NSIs according to the priority.

**REQ-3GPPMS-CON-08** The 3GPP management system should have the capability of re-allocating the resources of NSIs according to the priority.

**REQ-3GPPMS-CON-09** The 3GPP management system shall be able to manage the NSI lifecycle.

**REQ-3GPPMS-CON-10** The 3GPP management system shall be able to provide link requirements related to the network slice (e.g. topology, QOS parameters) to the appropriate management system that handles the TN part related to the slice (e.g. via NFV MANO).

**REQ-3GPPMS-CON-11** The 3GPP management system shall be able to report performance measurement data of an NSI to the NOP.

**REQ-3GPPMS-CON-12** The 3GPP management system shall be able to report performance measurement data of an NSSI to the NOP.

**REQ-3GPPMS-CON-13** The 3GPP management system shall be able to report fault management data of an NSI.

**REQ-3GPPMS-CON-14** The 3GPP management system shall be able to report fault management data of an NSSI.

**REQ-3GPPMS-CON-15** The 3GPP management system shall be able to activate an NSI.

**REQ-3GPPMS-CON-16** The 3GPP management system shall be able to de-activate an NSI.

**REQ-3GPPMS-CON-17** The 3GPP management system shall be able to modify an NSI.

**REQ-3GPPMS-CON-18** The 3GPP management system shall be able to terminate an NSI.

**REQ-3GPPMS-CON-19** The 3GPP management system shall be able to activate an NSSI.

**REQ-3GPPMS-CON-20** The 3GPP management system shall be able to modify an NSSI.

**REQ-3GPPMS-CON-21** The 3GPP management system shall be able to de-activate an NSSI.

**REQ-3GPPMS-CON-22** The 3GPP management system shall be able to terminate an NSSI.

**REQ-3GPPMS-CON-23** The 3GPP management system shall support slice capacity management.

**REQ-3GPPMS -CON-24** The 3GPP management system shall support inter-slice orchestration (e.g., orchestrated provisioning of multiple slices and resolving issues on quality, fault, and anomaly, among multiple slices).

**REQ-3GPPMS -CON-25** The 3GPP management system shall support collection and analysis of the status and events of the NSI resources for the purpose of fault management.

**REQ-3GPPMS -CON-26** The 3GPP management system shall support collection and analysis of the status and events of the NSI resources for the purpose of performance management.

**REQ-3GPPMS-CON-27** The 3GPP management system shall have the capability of exposing network slice management data for network slice as a service to the authorized consumer.

**REQ-3GPPMS -CON-28** The 3GPP management system shall have the capability to differentiate communication services provided by a single NSI when the NSI is used to support multiple communication services.

**REQ-3GPPMS -CON-29** The 3GPP management system shall have the capability to perform NSI related operations (e.g., performance monitoring) considering requirements for each communication service when the NSI is used to support multiple communication services.

**REQ-3GPPMS-CON-30** The 3GPP management system shall be able to expose the network slice management services such as performance management, fault supervision and provisioning management to the authorized consumer based on the mutual agreement between consumer and operator.

**REQ-3GPPMS-CON-31** The 3GPP management system shall have the capability to expose, based on the mutual agreement between consumer and operator, the network slice assurance services to the authorized consumers.

**REQ-3GPPMS-CON-32** The 3GPP management system shall have the capability to expose, based on the mutual agreement between consumer and operator, the network slice control and configuration services to the authorized consumers and to resolve potential conflicts

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| **11th change** |

### 5.4.1 Network slicing supporting communication services

| Use case stage | Evolution/Specification | <<Uses>> Related use |
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| **Goal** | A communication service provider (CSP) uses the network slicing service provided by operator to offer communication services to end users. |  |
| **Actors and Roles** | A CSP request a NOP to provide a network slice |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The CSP and the operator negotiate and sign the communication service requirements contract a.k.a. Service Level Agreement (SLA). |  |
| **Begins when** | The CSP declares communication service(s) requirements to the operator. These requirements are called Service Level Specification (SLS). The operator triggers the network slice preparation phase which includes the on-boarding and verification of network function products, feasibility check, preparing the necessary network environment, which are used to support the lifecycle of NSIs and any other preparations that are needed in the network. |  |
| **Step 1 (M)** | Based on the SLS (e.g. coverage area, number and distribution of users, traffic demand, mobility, latency, etc.) , the operator prepares the corresponding NSI. |  |
| **Step 2 (M)** | After the network slice preparation phase, the operator triggers the creation of an NSI. 1) If the CSP plans to operate services across multiple operators' administrative domains, this may require cross-country operations. The operator management system will perform cross-domain collaboration with the management systems from other administrative domains for network slice deployment. 2) If customization of TN is required, the operator management system and TN management system will first cooperate on network planning of TN.  3) The operator management system performs overall mapping and coordination among different technical domains in order to provide the end-to-end services via the NSI. If CSP uses the NSaaS provided by operator to offer multiple communication services to end users, related operations (e.g., performance monitoring) are performed considering requirements for each communication service. |  |
| **Step 3 (O)** | If requested, the operator provides management data of the NSI to the authorized CSP according to the communication service requirements.  Examples of management data that could be provided to CSP include service availability and reliability, UE traffic information, etc. |  |
| **Ends when** | The operator maintains the NSI during the lifecycle of the NSI. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NSI(s) is provided by the operator to the CSP to support one or more communication services. |  |
| **Traceability** | REQ-3GPPMS-CON-01, REQ-3GPPMS-CON-02, REQ-3GPPMS-CON-03, REQ-3GPPMS-CON-04, REQ-3GPPMS-CON-05, REQ-3GPPMS-CON-07, REQ-3GPPMS-CON-08, REQ-3GPPMS-CON-09, REQ-3GPPMS-CON-10, REQ-3GPPMS -CON-28, REQ-3GPPMS -CON-29 |  |

### 5.4.2 Provisioning of an NSI

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To perform operations of the provisioning of an NSI. |  |
| **Actors and Roles** | A Network Operator (NOP) plays the role of a Network Slice Provider. |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | None |  |
| **Pre-conditions** | Preparation for the network slice is done.  For creation, NSI is not existing.  For activation, modification, de-activation or termination, the NSI is existing. |  |
| **Begins when** | The 3GPP management system has received a request from the Network Operator. |  |
| **Step 1 (M)** | The 3GPP management system assesses the feasibility of executing the request, e.g., checks the inventory and the required NSI constituents, and reserves available resources. |  |
| **Step 2 (M)** | The 3GPP management system performs the LCM operations required according to the request (create, activate, modify, de-activate, or terminate) on one or more NSSI(s). For shared NSSI(s), the 3GPP management system performs required actions. | 5.4.3 Provisioning of an NSSI |
| **Step 3 (M)** | The 3GPP management system replies to the Network Operator that the requested operation is completed. |  |
| **Ends when** | All the mandatory steps have passed. |  |
| **Exceptions** | In case the feasibility check fails, the use case fails and the 3GPP management system rejects the request with the reason included in the reply.  In case any of the LCM operations fail, the use case fails and the 3GPP management system replies to the Network Operator that the requested operation is failed with the reason included in the reply. |  |
| **Post-conditions** | An NSI has been provisioned. |  |
| **Traceability** | REQ-3GPPMS-CON-04, REQ-3GPPMS-CON-15, REQ-3GPPMS-CON-16, REQ-3GPPMS-CON-17, REQ-3GPPMS-CON-18. |  |

### 5.4.3 Provisioning of an NSSI

| **Use case stage** | **Evolution/Specification** | **<<Uses>> Related use** |
| --- | --- | --- |
| **Goal** | To perform operations of the provisioning of an NSSI. |  |
| **Actors and Roles** | A Network Operator (NOP) plays the role of a Network Slice Provider responsible for the network slice subnet. |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | None |  |
| **Pre-conditions** | Preparation for the NSSI is completed.  For the creation use case an NSSI does not exist.  For activation, modification, de-activation or termination use cases, the NSSI exists. |  |
| **Begins when** | The 3GPP management system has received a request from the Network Operator. |  |
| **Step 1 (M)** | The 3GPP management system assesses the feasibility of executing the request, e.g., checks the inventory and the required NSSI constituents, and reserves available resources. |  |
| **Step 2 (M)** | The 3GPP management system performs the LCM operations required according to the request (activate, modify, de-activate, or terminate) on one or more NSSI(s) constituents. In case the required LCM operation is create a new NSSI constituent is created. |  |
| **Step 3 (M)** | The 3GPP management system replies to the Network Operator that the requested operation is completed. |  |
| **Ends when** | All the mandatory steps have passed. |  |
| **Exceptions** | In case the feasibility check fail, the use case fails and the 3GPP management system rejects the request with the reason included in the reply.  In case any of the LCM operations fail, the use case fails and the 3GPP management system replies to the Network Operator that the requested operation has failed with the reason included in the reply. |  |
| **Post-conditions** | An NSSI has been provisioned. |  |
| **Traceability** | REQ-3GPPMS-CON-06, REQ-3GPPMS-19, REQ-3GPPMS-CON-20, REQ-3GPPMS-CON-21, REQ-3GPPMS-CON-22 |  |

### 5.4.4 Performance management of an NSI

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To report performance measurement data of an NSI to the NOP. |  |
| **Actors and Roles** | A Network Operator (NOP) plays the role of a Network Slice Provider |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NSI has been activated. |  |
| **Begins when** | The NOP requests performance measurement and monitoring on the NSI. |  |
| **Step 1 (M)** | For each NSSI associated with the NSI the 3GPP management system fetches NSSI-level performance measurement data. | Performance management of an NSSI |
| **Step 2 (M)** | The 3GPP management system generates the NSI-level performance measurement data and sends the NSI-level performance measurement data to the NOP. |  |
| **Ends when** | The performance measurement and monitoring ends as scheduled or when requested by the NOP. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NOP receives the NSI-level performance measurement data from the 3GPP management system. |  |
| **Traceability** | REQ-3GPPMS-CON-11 |  |

NOTE: Steps 1 and 2 may be executed on demand, or repeatedly according to a schedule.

### 5.4.5 Performance management of an NSSI

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To report performance measurement data of an NSSI to the NOP. |  |
| **Actors and Roles** | A Network Operator (NOP) plays the role of a Network Slice Provider responsible for the network slice subnet. |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NSSI has been activated. |  |
| **Begins when** | The NOP requests performance measurement and monitoring on the NSSI. |  |
| **Step 1 (M)** | For each component of the NSSI the 3GPP management system fetches performance measurement data on the components of the NSSI. |  |
| **Step 2 (M)** | The 3GPP management system generates the NSSI-level performance measurement data and sends the NSSI-level performance measurement data to the NOP. |  |
| **Ends when** | The performance measurement and monitoring ends as scheduled or when requested by the NOP. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NOP receives the NSSI-level performance measurement data from the 3GPP management system. |  |
| **Traceability** | REQ-3GPPMS-CON-12 |  |

NOTE: Steps 1 and 2 may be executed on demand, or repeatedly according to a schedule.

### 5.4.6 Report fault management data of an NSI

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To report fault management data of an NSI to the NOP. |  |
| **Actors and Roles** | Network Operator (NOP) |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NSI is created. |  |
| **Begins when** | The 3GPP management system detects a fault on the NSI that needs NOP intervention. |  |
| **Step 1 (M)** | The 3GPP management system generates fault management data of the NSI and reports the fault management data to the NOP. |  |
| **Step 2 (M)** | When the fault is recovered, the 3GPP management system updates the fault management data of the NSI to the NOP. |  |
| **Ends when** | The NOP has the fault management data of NSI. |  |
| **Exceptions** | In case any of the mandatory steps fail, the use case fails. |  |
| **Post-conditions** | N/A |  |
| **Traceability** | REQ-3GPPMS-CON-13 |  |

### 5.4.7 Report fault management data of an NSSI

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To report fault management data of an NSSI to the NOP. |  |
| **Actors and Roles** | Network Operator (NOP) |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | An NSSI is created. |  |
| **Begins when** | The 3GPP management system detects a fault on the NSSI that needs operator intervention. |  |
| **Step 1 (M)** | The 3GPP management system generates fault management data of the NSSI and reports to the NOP. |  |
| **Step 2 (M)** | When the fault is recovered, the 3GPP management system updates the fault management data of the NSSI to the NOP. |  |
| **Ends when** | The NOP has the fault management data of NSSI. |  |
| **Exceptions** | In case any of the mandatory steps fail, the use case fails. |  |
| **Post-conditions** | N/A |  |
| **Traceability** | REQ-3GPPMS-CON-14 |  |

### 5.4.8 Multiple operator support for network slicing

| Use Case | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | Create a communication service spanning multiple NSI hosted across multiple operators |  |
| **Actors and Roles** | Communication service provider (CSP)  Network Operator (NOP) A, Network Operator (NOP) B |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | The business level agreement(s) between CSP and NOPs to support the management system interaction is done |  |
| **Pre-conditions** | None |  |
| **Begins when** | Communication service provider receives a request to deploy a 5G Communication service |  |
| **Step 1 (M)** | The CSP requests NOP A to create the NSI and NOP B to create another NSI to support the communication service |  |
| **Step 2 (M)** | NOP A and NOP B's 3GPP management system evaluates if they can support the respective NSIs, and, if they can, the 3GPP management systems create the corresponding NSI and respond positively to the CSP |  |
| **Step 3 (M)** | The communication services provider instantiates the service over the multiple NSIs |  |
| **Ends when** | Ends when all mandatory steps identified above are successfully completed or when an exception occurs. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | A communication service across multiple operators is created |  |
| **Traceability** | REQ-3GPPMS-CON-01, REQ-3GPPMS-CON-02 |  |

### 5.4.9 Network slice management with agreed performance

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To manage a network slice with agreed performance to CSP |  |
| **Actors and Roles** | A Communication Service Provider (CSP) requests the Network Operator (NOP) to provide a network slice |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** |  |  |
| **Pre-conditions** | The NOP has the capability to manage network slices. |  |
| **Begins when** | A set of service requirements (e.g. business scenario, isolation, throughput, latency, coverage, etc.) have been provided by the CSP. |  |
| **Step 1 (M)** | NOP creates a customized NSI with performance that meet CSP's requirements. |  |
| **Step 2 (M)** | NOP make use of 3GPP management system to monitor the NSI performance. |  |
| **Step 3 (M)** | When NOP detects that the monitored NSI performance does not meet the agreed performance requirement, the NOP requests the 3GPP management system to executes some actions (e.g. scale in/out, modification, etc.), so that the NSI performance requirements are fulfilled.  NOTE: The step 2 and 3 are executed continuously until the "ends when". |  |
| **Ends when** | The NSI is terminated. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The network slice performance requirements requested by CSP are fulfilled. |  |
| **Traceability** |  |  |

### 5.4.10 Communication services using network with or without slicing

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | A communication service provider (CSP) uses the 5G network and network slicing service provided by operator to offer communication services to end users. |  |
| **Actors and Roles** | Communication Service Provider (CSP) requests the Network Operator (NOP) to support its network requirements |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | CSP derives the network related requirements (e.g. isolation, latency, coverage) from the communication service related requirements. |  |
| **Begins when** | CSP provides the network related requirements to the NOP. |  |
| **Step 1 (M)** | NOP decides to use network with or without slicing based on the network related requirements received and/or pre-configured network planning or optimization policies. For example, If CSP requires an isolated network, NOP may decide to use a network slice. |  |
| **Step 2 (M)** | In case of using network with slicing, NOP create a new NSI or reuse an existing NSI to satisfy the network related requirements.  Otherwise, NOP deploys a new network without slicing or utilize the existing network without slicing to satisfy the network related requirements. |  |
| **Step 3 (M)** | NOP notifies CSP that the network is ready. |  |
| **Ends when** | Ends when all mandatory steps identified above are successfully completed or when an exception occurs. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | Network with or without slicing can be utilized to provide communication service. |  |
| **Traceability** | REQ-5GNS-CON-08 |  |

### 5.4.11 Exposure of network slice management data for network slice as a service case

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To expose network slice management data to a Communication Service Provider (CSP) consuming Network Slice as a Service (NSaaS) based on mutual agreement. |  |
| **Actors and Roles** | A Communication Service Provider (CSP) provides limited management data to a Communication Service Customer (CSC) |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | Network slice management data of NSI can be exposed to the CSP consuming NSaaS according to the pre-defined agreements. |  |
| **Pre-conditions** | 1. NSaaS level exposure has been agreed upon and the CSP offering the NSaaS is aware of it.  2. An NSI used for NSaaS is created. |  |
| **Begins when** | The CSP consuming NSaaS wants to get the management data of the network slice. |  |
| **Step 1 (M)** | The CSP consuming NSaaS sends requests to the 3GPP management system for the exposure management data of network slice. |  |
| **Step 2 (M)** | The 3GPP management system provides the CSP consuming NSaaS of exposed management data for the NSaaS scenario. |  |
| **Ends when** | The network slice management data is provided. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The CSP consuming NSaaS is aware of the management data of the network slice. |  |
| **Traceability** | REQ-3GPPMS-CON-27 |  |

### 5.4.12 Exposure of network slice management capability

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To expose limited network slice management capability to a Communication Service Customer (CSC) consuming Network Slice as a Service (NSaaS) based on mutual agreement. |  |
| **Actors and Roles** | A Communication Service Provider (CSP) provides limited management capability to a Communication Service Customer (CSC) |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | Network slice management capability of 3GPP management system can be partially exposed to the CSC consuming NSaaS according to the pre-defined agreements. |  |
| **Pre-conditions** | Level of management exposure has been agreed upon and the CSP offering the NSaaS service is aware of it. |  |
| **Begins when** | The CSC consuming NSaaS wants to get certain management capability to manage the network slice, e.g., PM, FM, CM, based on the mutual agreement between CSC and CSP. |  |
| **Step 1 (M)** | The CSC consuming NSaaS sends requests to the 3GPP management system for the exposure of management capability of network slice. |  |
| **Step 2 (M)** | The 3GPP management system provides the CSC consuming NSaaS with the requested capability via appropriate methods, e.g., exposing network slice management service to the CSC. |  |
| **Ends when** | The network slice management capability is provided. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The limited network slice management capability has been exposed to the CSC consuming NSaaS. |  |
| **Traceability** | REQ-3GPPMS -CON-30, REQ-3GPPMS -CON-31, REQ-3GPPMS -CON-32 |  |

### 5.4.13 To modify an NSI due to changed demand

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To modify an NSI due to changed demand |  |
| **Actors and Roles** | A Network Operator (NOP) plays the role of a Network Slice Provider |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | None |  |
| **Pre-conditions** | A network slice is activated |  |
| **Begins when** | The NOP has received a request to modify the capacity of an NSI. For example, in case there is an increased demand in call capacity in specific geographical area, the request indicates the needed capacity increase amount in that specific geographical area |  |
| **Step 1 (M)** | The NOP initiates the 3GPP management system to process the request |  |
| **Step 2 (M)** | The 3GPP management system analyses the request and identifies that one or more supporting network slice subnets need to be modified with X1 amount, X2 amount, X3 amount etc. |  |
| **Step 3 (M)** | 3GPP system derives new TN requirements |  |
| **Step 4 (M)** | The 3GPP management system initiates modification of the capacity of the identified supporting network slice subnets with X1 amount, X2 amount, X3 amount etc |  |
| **Step 5 (M)** | 3GPP system communicates new TN requirements |  |
| **Ends when** | All capacity modification activities (of step 3) have been completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NSI capacity is modified according to demand. |  |
| **Traceability** | REQ-3GPPMS-CON-17, REQ-3GPPMS-CON-20, REQ-5GNS-CON-9, REQ-5GNS-CON-10, REQ-5GNS-CON-11, REQ-5GNS-CON-12 |  |

### 5.4.14 Management data analytics for 5G networks

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To provide management data analytics services to authorized customers (e.g., re-configuring for more efficient operation and maintenance) |  |
| **Actors and Roles** | Network Operator (NOP) |  |
| **Telecom resources** | NSI  3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The 3GPP management system has the capability to collect the related network data for analysis. |  |
| **Begins when** | The 3GPP management system receives network data analytics request. |  |
| **Step 1 (M)** | The 3GPP management system checks if the existing management data is sufficient to generate the network data analytics information.3GPP management system may trigger to obtain more network data for analytics purpose, such as new measurement jobs, subscriptions to alarm notifications. |  |
| **Step 2 (M)** | For management data analytics purposes, 3GPP management system may request services (e.g., management data analytics, PM, FM) from the related NSI constituents. |  |
| **Step 3 (M)** | 3GPP management system sends the analytics results to the NOP. |  |
| **Ends when** | NOP has the required network data analytics information. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NOP receives network data analytics information from the 3GPP management system, the information could be utilized for optimizing the network. |  |
| **Traceability** | REQ-5GNS-CON-13,REQ-5GNS-CON-14 |  |

### 5.4.15 Capacity management of Network Slice and Network Slice Subnet

| Use case stage | Evolution/Specification | <<Uses>> Related use |
| --- | --- | --- |
| **Goal** | To support capacity management of network slice and network slice subnets. |  |
| **Actors and Roles** | A Network Operator (NOP) plays the role of a Network Slice Provider responsible for the network slice capacity management. |  |
| **Telecom resources** | 3GPP management system |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | The capacity optimization objectives have been set by the NOP |  |
| **Begins when** | The NOP requests capacity management process of the NSIs and NSSIs when the pre-set resource optimization objectives need to be satisfied. |  |
| **Step 1 (M)** | The 3GPP management system obtains information needed for the optimization process such as network slice provisioning requirements, existing active or non-active NSI and/or NSSI resource information, and performance measurement data by requesting the feasibility check operation. | Feasibility check |
| **Step 2 (M)** | The 3GPP management system performs resource optimization process based on the information obtained in Step 1. The goal of the process is to find an optimal resource capacity availability against the target objective. |  |
| **Step 3 (M)** | The 3GPP management system proceeds with network slice (NSI and/or NSSI) provisioning or modification processes until it meets the resource capacity optimization objective. |  |
| **Step 4 (M)** | The 3GPP management system updates capacity availability information after provisioning or modification processes. |  |
| **Ends when** | The capacity management ends as it meets the optimization objective. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The NOP receives the updated capacity management information from the 3GPP management system. |  |
| **Traceability** | REQ-3GPPMS-CON-23 |  |

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