**3GPP TSG-SA5 Meeting #143-e *S5-223452***

e-meeting, 9 - 17 May 2022

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **28.531** | **CR** | **0116** | **rev** | 1 | **Current version:** |  |  |
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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:***  | Update procedures for asynchronous mode of operations for Network Slice and Network Slice Subnet LCM |
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| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | S5 |
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| ***Work item code:*** | eNETSLICE\_PRO |  | ***Date:*** | 2022-05-12 |
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| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | The procedure of allocation of an instance of NetworkSlice and NetworkSliceSubnet described in Section 7.2 and 7.3 in TS 28.531 is not detailed and missing the corresponding notifications for object creation and attribute value change. Since neither NetworkSlice nor NetworkSliceSubnet have the attributes availability status and lifecycle state as of ITU-T X.731, the consumer is not able to follow the status of NetworkSlice and NetworkSliceSubnet during its creation. |
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| ***Summary of change:*** | Update the description of the procedure of allocateNSI and allocateNSSI by the corresponding notifications of object creation and attribute value change, Include messages that refer to changes of availability status and lifecycle state. |
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| ***Consequences if not approved:*** | Allocation of NetworkSlice and NetworkSliceSubnet are not clearly described including corresponding messages. Without proper usage ot state information the consumer is not able to follow the status of objects and subordinated ubjects. |
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| ***Clauses affected:*** | 7.2, 7.3, |
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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 28.541 CR0725 |
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| ***Other comments:*** | This CR refers to lifecycleState and availabilityStatus attributes in NetworkSlice and NetworkSliceSubnet IOC in TS 28.541 proposed by CR0725, with tDoc# S5-223453 for TS28.541  |
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| ***This CR's revision history:*** | Corrected reason, summary, consequences, and clauses affected.Clauses 7.4 – 7.7 erroneously appeard as deleted. In fact this CR did not intent to touch these clauses, they should not be part of the docuemt at all but unfortunately got deleted with “revision on”. Not able to show by revision marks the “revertion of deletion”. 7.4 – 7.7 show now as not modified. |

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| **1st Change** |

7.2 Procedure of Network Slice Instance Allocation

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



**Figure 7.2-1: Network Slice 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 (the network slice related requirements are defined as the attributes in the ServiceProfile see clause 6.3.3 in TS 28.541 [6]).

2) Based on the network slice related requirement and the knowledge of the capabilities of existing deployed network slices, the NSMS\_Provider compare/match the provided requirements against all the candidate NetworkSlice instances, and then decides whether to use an existing NSI or create a new NSI. If the network slice related requirements allow the requested NSI to be shared and if an existing suitable NSI can be reused, the NSMS\_Provider may decide to use the existing NSI.

3a-1) If using an existing NSI, the NSMS\_Provider identifies the existing NetworkSlice MOI.

3a-2) The NSMS\_Provider sends AllocateNsi response to the NSMS\_Consumer with the DN of the NetworkSlice MOI, identified in step 3a-1.

3a-3) The identified NetworkSlice MOI needs to be modified to satisfy the network slice related requirements and the NSMS\_Provider invokes the procedure to modify the existing NSI as described in clause 7.6.

3a-4) The NSMS\_Provider associates the received ServiceProfile with the identified existing NetworkSlice MOI. Additionally, the NSMS\_Provider may configure other configuration information for the NetworkSlice MOI. The NSMS\_Provider notifies the updated NetworkSlice MOI attributes to NSMS\_Consumer.

NOTE: The already running services of the re-used slice must not be impacted. Therefore neither the allocateNSI nor any of its side effects are allowed to cause: operationalState=disabled, lifecycleState=planned, or any non-empty availability status.

3b-1) If creating a new NSI, the NSMS\_Provider creates the MOI NetworkSlice instance.

3b-2) The NSMS\_Provider sends AllocateNsi response to the NSMS\_Consumer with the DN of the NetworkSlice MOI, created in step 3b-1.

3b-3) The NSMS\_Provider updates the NetworkSlice MOI instance states. Additionally, the NSMS\_Provider may configure other configuration information for the NetworkSlice MOI.

The NSMS\_Provider sends notification notifyMOICreation (defined in clause 6.5.2 in TS 28.541 [6] and clause 11.1.1.7 in TS 28.532 [8]) with the following attributes to NSMS\_Consumer:

- DN of the NetworkSlice MOI in attribute objectInstance.

- The following NetworkSlice instance states in attributeList:

- operationalState=disabled

- lifecycleState=planned

- availabilityStatus=[not\_installed, dependency]

NOTE: The NetworkSlice instance states indicate that the MOI has been created, but corresponding network slice subnets are not created.

- lifecycleState=planned: The NetworkSlice object has been created, but the resources are not yet created

 - availabilityStatus=not installed: Parts needed for the NetworkSlice are still missing

 - availabilityStatus=dependency: Dependencies for the NetworkSlice are not working

3b-4) When the Network Slice is created, the NSMS\_Provider updates the NetworkSlice MOI instance states.

The NSMS\_Provider sends notification notifyMOIAttributeValueChanges (defined in clause 6.5.2 in TS 28.541 [6] and clause 11.1.1.7 in TS 28.532 [8]) with the following attributes to NSMS\_Consumer:

- DN of the NetworkSlice MOI in attribute objectInstance.

- The following NetworkSlice instance states in attributeList:

- lifecycleState=installed

NOTE: The NetworkSlice instance states indicate that the MOI has been created.

- lifecycleState=installed: The NetworkSlice as such has been created

 - availabilityStatus=not installed: Parts needed for the NetworkSlice are still missing

 - availabilityStatus=dependency: Dependencies for the NetworkSlice are not working

3b-5) 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 described in clause 7.8.

3b-6) The NSMS\_Provider invokes the NSSI allocation procedure, by sending AllocateNssi request to NSSMS\_Provider, as described in clause 7.3.

3b-7) The NSMS\_Provider configures the NetworkSlice MOI with the DN of MOI for the NetworkSliceSubnet.

3b-8) The NSMS\_Provider and send notification notifyMOIAttributeValueChanges (defined in clause 6.5.2 in TS 28.541 [6], clause 11.1.1.9 in TS 28.532 [8]) with the following attributes to NSMS\_Consumer:

- DN of the NetworkSlice MOI in attribute objectInstance.

- The following NetworkSlice instance states in attributeValueChange:

- updated networkSliceSubnetRef

3b-9) When allocation of NetworkSlice and all its constituents is completed, the NSMS\_Provider updates the NetworkSlice MOI instance states. Additionally, the NSMS\_Provider may configure other configuration information for the NetworkSlice MOI. The NSMS\_Provider sends notification notifyMOIAttributeValueChanges (defined in clause 6.5.2 in TS 28.541 [6], clause 11.1.1.9 in TS 28.532 [8]) with the following attributes to NSMS\_Consumer:

- DN of the NetworkSlice MOI in attribute objectInstance.

- The following NetworkSlice instance states in attributeValueChange:

- operationalState=enabled

- availabilityStatus=null

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]).

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 Network Slice Subnet Instance Allocation

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



**Figure 7.3-1: Network Slice Subnet Instance Allocation Request procedure**

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

2) NSSMS\_Provider checks 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 and the existing NSSI capabilities, NSSMS\_Provider decides whether to use an existing NSSI or create a new NSSI. If the network slice subnet related requirements allow the requested NSSI to be shared and if an existing suitable NSSI can be reused, the NSSMS\_Provider decides to use the existing NSSI.

4a-1) If using an existing NSI, the NDSMS\_Provider identifies the existing NetworkSliceSubnet MOI.

4a-2) The NSSMS\_Provider sends AllocateNssi response to the NSSMS\_Consumer with the DN of the NetworkSliceSubnet MOI, identified in step 4a-1.

4a-3) The identified NetworkSliceSubnet MOI needs to be modified to satisfy the network slice related requirements and the NSMS\_Provider invokes the procedure to modify the existing NSSI as described in clause 7.7.

4a-4) The NSSMS\_Provider associates the received SliceProfile with the identified existing NetworkSliceSubnet MOI. Additionally, the NSSMS\_Provider may configure other configuration information for the NetworkSliceSubnet MOI. The NSSMS\_Provider notifies the updated NetworkSliceSubnet MOI attributes to NSSMS\_Consumer.

NOTE: The already running services of the re-used slice must not be impacted. Therefore neither the allocateNssi nor any of its side effects are allowed to cause: operationalState=disabled, lifecycleState=planned, or any non-empty availability status.

4b-1) If creating a new NSSI, the NSSMS\_P creates the NetworkSliceSubnet MOI.

4b-2) The NSSMS\_Provider sends AllocateNssi response to the NSSMS\_Consumer with the DN of the NetworkSliceSubnet MOI, created in step 3b-1.

4b-3) The NSSMS\_Provider updates the NetworkSliceSubnet MOI instance states. Additionally, the NSMS\_Provider may configure other configuration information for the NetworkSliceSubnet MOI.

The NSSMS\_Provider sends notification notifyMOICreation (defined in clause 6.5.2 in TS 28.541 [6] and clause 11.1.1.7 in TS 28.532 [8]) with the following attributes to NSSMS\_Consumer:

- DN of the NetworkSliceSubnet MOI in attribute objectInstance.

- The following NetworkSliceSubnet instance states in attributeList:

- operationalState=disabled

- lifecycleState=planned

- availabilityStatus=[not\_installed, dependency]

NOTE: The NetworkSliceSubnet instance states indicate that the MOI has been created, but corresponding network slice subnets are not created.

- lifecycleState=planned: The NetworkSliceSubnet object has been created, but the resources are not yet created

 - availabilityStatus=not installed: Parts needed for the NetworkSliceSubnet are still missing

 - availabilityStatus=dependency: Dependencies for the NetworkSliceSubnet are not working

4b-4) When the Network Slice Subnet is created, the NSSMS\_Provider updates the NetworkSliceSubnet MOI instance states.

The NSSMS\_Provider sends notification notifyMOIAttributeValueChanges (defined in clause 6.5.2 in TS 28.541 [6] and clause 11.1.1.7 in TS 28.532 [8]) with the following attributes to NSSMS\_Consumer:

- DN of the NetworkSliceSubnet MOI in attribute objectInstance.

- The following NetworkSliceSubnet instance states in attributeList:

- lifecycleState=installed

NOTE: The NetworkSliceSubnet instance states indicate that the MOI has been created.

- lifecycleState=installed: The NetworkSliceSubnet as such has been created

 - availabilityStatus=not installed: Parts needed for the NetworkSliceSubnet are still missing

 - availabilityStatus=dependency: Dependencies for the NetworkSliceSubnet are not working

4b-5) NSSMS\_Provider 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 and isolation requirements) from the received network slice subnet related requirements. Part of these requirements may be referenced by attribute "epTransportRef" as defined in clause 6.3.2.2 in TS 28.541[6]. 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.

4b-6) If the NSSI to be created contains virtualisation part (i.e. VNF or VL), NSSMS\_Provider 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\_Provider determines new VNF instance(s) that need to be deployed and the existing VNF instance(s) that need to be reused 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\_Provider chooses a proper NSD deployment flavour and creates data concerning the SAPs of the NS instance. NSSMS\_Provider invokes the NS instantiation procedures to create a NS instance. NSSMS\_Provider configures the NSS MOI with the NS instance identifier.

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

4b-7) For each required NSSI constituent, the following step 4b-7a) and 4b-7b) are needed:

4b-7a) If the required NSSI constituent is constituent NSSI, NSSMS\_Provider invokes NSSI Allocation Procedure.

4b-7b) If the required NSSI constituent is NF instance, NSSMS\_Provider invokes NF Creation Procedure as described in clause 7.10 or NF Modification Procedure as described in clause 7.11.

4b-8) NSSMS\_Provider configures the NetworkSliceSubnet MOI with the DN of the MOI for NSSI constituent (i.e. ManagedFunction MOI, NetworkSliceSubnet MOI).

4b-9) For each required transport network related requirements, NSSMS\_Provider invokes corresponding procedure of coordination with relevant TN Manager to handle the TN part as described in clause 7.9.

4b-10) When allocation of NetworkSliceSubnet and all its constituents is completed, the NSSMS\_Provider updates the NetworkSliceSubnet MOI instance states. Additionally, the NSSMS\_Provider may configure other configuration information for the NetworkSliceSubnet MOI. The NSSMS\_Provider sends notification notifyMOIAttributeValueChanges (defined in clause 6.5.2 in TS 28.541 [6], clause 11.1.1.9 in TS 28.532 [8]) with the following attributes to NSSMS\_Consumer:

- The following NetworkSlice instance states in attributeValueChange:

- operationalState=enabled

- availabilityStatus=null

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 Network Slice Instance Deallocation

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

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**Figure 7.4-1: Network slice instance deallocation procedure**

1) The network slice management service provider (NSMS\_P) receives a NSI deallocation request (see DeallocateNsi operation defined in clause 6.5.3) from network slice management service consumer (NSMS\_C) indicating that the NetworkSlice MOI is no longer needed for the given requirements i.e ServiceProfile.

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

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

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

7.5 Procedure of network slice subnet instance deallocation

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

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**Figure 7.5-1: Network slice subnet instance deallocation procedure**

1) The network slice subnet management service provider (NSSMS\_P) receives NSSI deallocation request (see DeallocateNssi operation defined in clause 6.5.4) from network slice subnet management service consumer (NSSMS\_C) indicating that the NetworkSliceSubnet MOI is no longer needed for the given requirements i.e SliceProfile.

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

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

3-b) NSSMS\_P invokes NF deletion procedure as described in clause 7.12 only if the NF is dedicated for this NSSI and not being used by any other NSSI in the network, otherwise, NSSMS\_P invokes NF modification procedure as described in clause 7.11.

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

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

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

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

7.6 Procedure of Network Slice Instance Modification

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

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**Figure 7.6-1: Network Slice Instance Modification Request procedure**

1) Network Slice Management Service Provider (NSMS\_P) receives a modifyMOIAttributes operation defined in TS 28.532 [8] from Network Slice Management Service Consumer (NSMS\_C) with the DN of NetworkSlice MOI 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 NetworkSlice MOI modification request into NSSI modification request(s), i.e., generating the new network slice subnet related requirements for each NSSI if needed.

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

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

7.7 Procedure of Network Slice Subnet Instance Modification

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

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**Figure 7.7-1: Network Slice Subnet Instance Modification Request procedure**

1) Network Slice Subnet Management Service Provider (NSSM\_SP) receives a modifyMOIAttributes operation defined in TS 28.532 [8] from Network Slice Subnet Management Service Consumer (NSSM\_SC) with the DN of NetworkSliceSubnet MOI 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 NetworkSliceSubnet MOI modification request into modification requests for each NSSI constituent.

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

4b) If the requested NSSI 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 NSSI 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 NSSI contains the TN part, NSSM\_SP invokes the TN related coordination procedure as described in clause 7.9.

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

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| **End of change** |