**3GPP TSG-SA5 Meeting #139-eS5-215272**

**e-meeting, 11 - 20 October 2021**

**Source: Huawei, Ericsson**

**Title: RAN sharing solutions**

**Document for: Approval**

**Agenda Item: 6.5.2**

# 1 Decision/action requested

***The group is asked to approve the proposal***

# 2 References

[1] 3GPP TR 28.811 v0.6.0: “Management and orchestration; Network Slice Management Enhancement”

# 3 Rationale

TR 28.811 v0.6.0 [1] describes possible alternative solutions for RAN sharing which depend on direct associations between managed network models in the management systems of multiple companies. During SA5#138e, it became clear that these solutions are not viable.

Therefore, new proposed alternative solutions describe the services that could be used and how the necessary associations could be modelled.

# 4 Detailed proposal

This contribution proposes to make the following changes in [1].

|  |
| --- |
| **1st change** |

### 5.1.2 Identified problems and general issues

There is no guidance for a RAN service provider on the management capabilities that should be exposed to allow different management levels for resources related to the RAN service.

Network slicing scenarios where one or more network slice constituents are provided by a second operator are new and raise a number of issues related to terminology, modelling, APIs, abstraction level and security. Possible solutions together with a more detailed analysis can be found in clause 7.2.

In the scenario description, it is indicated that BSS of Company-NA interacts with BSS of Company-NB. Also it is indicated that BSS of Company-NB in turn can use 3GPP management APIs towards its own management system as part of handling requests from Company-NA. This should be viewed as a simplified description of the interaction:

* In Company-NB, service access may under certain circumstances be delegated to separate service exposure function and enabled for use by Company-NA based on BSS level agreement. But as for BSS level, even in this case details of exposed APIs are currently outside scope of 3GPP standardization. Exposure of management capabilities and interaction between companies is further studied in SI FS\_NSCE.
* There may be additional service management layers between system handling external request and the 3GPP management system.

|  |
| --- |
| **Next change** |

## 7.2 Possible solutions for network slice covering multiple networks

Editor’s note: Both solution alternatives described below for the RAN sharing scenario may require updates to existing specifications if pursued. Detailed analysis of potential specification impact, comparison of solution alternatives and recommendations are for further study.

### 7.2.1 Alternative 1: solution based on Network Slice as a Service

#### 7.2.1.1 Description

This clause describes how the existing concept of Network Slice as a Service may be used to allow Company-NA to manage a network slice service which is provided by Company-NB.

Company-NA sends a request to Company-NB BSS for Network Slice as a Service (NSaaS) to satisfy the requirements for RAN coverage. When receiving request for RAN coverage service, Company-NB BSS can issue a corresponding allocateNsi request to its own 3GPP management system.

The allocateNsi request contains the parameters to create a ServiceProfile for RAN based on service parameters received from Company-NA, also taking into account any existing agreements. The pLMNInfoList of the ServiceProfile will capture PLMN ID of NOP-A as well as S-NSSAI within that PLMN selected by Company-NA/NOP-A. If successful, relevant and needed identifiers associated with the provided service are returned to Company-NA. Company-NA/NOP-A can then include this information as part of network slice representation in its own management system. This high-level ordering and provisioning procedure is illustrated in figure 7.2.1.1-1.

NOTE: The NetworkSlice instance allocated in NOP-B’s management system can be newly created or an existing instance can be used following procedure for allocateNsi, see TS 28.531 [3] clause 6.5.1 and clause 7.2.

Company-NA

Company-NB

BSS

Company-NB

Network manager

*Request for RAN coverage*

*allocateNsi operation*

External interface

Internal interface

Figure 7.2.1.1-1 Alt 1 Provisioning phase

For basic support of the RAN sharing use case, it is not necessary for Company-NB to expose any capabilities beyond service lifecycle operations. But based on agreement, Company-NB may expose additional management capabilities in provisioning or monitoring areas. This is illustrated in figure 7.2.1.1-2.

Such exposure should be setup to ensure that only capabilities related to the service provided to Company-NA are exposed. And if any provisioning operations are allowed, these must not interfere with use of network resources by other users.

Company-NA

Company-NB

BSS

Company-NB

Network manager

*Request for Management operations*

*modifyNsi operation*

External interface

Internal interface

*Service alarms,*

*Service measurements,*

*Service KPIs*

*Nsi alarms,*

*Nsi measurements,*

*Nsi KPIs*

Figure 7.2.1.1-2 Alt 1 Operation phase

If Company-NB wishes to allow Company-NA to view operationalState or administrativeState of the NetworkSlice instance, Company-NB may allow Company-NA to interact with the BSS, the BSS (acting as a Provisioning MnS consumer) must have read access to the NetworkSlice MOI via the getMOIAttributes operation, defined in 28.532 [5].

If Company-NB wishes to allow Company-NA to control the adminstrativeState of the NetworkSlice instance, Company-NB’s BSS may allow Company-NA to interact with the BSS, the BSS (acting as a Provisioning MnS consumer) must have write access to the NetworkSlice MOI via the modifyMOIAttributes operation, defined in 28.532 [5].

If Company-NB wishes to allow Company-NA to view alarms related to the RAN coverage service, Company-NB’s BSS may expose management capabilities corresponding to the “FS Data Report for NSI” Service, as described in 28.545 [6]. Company-NB should only allow operations by Company-NA that are within scope of the provided RAN service.

If Company-NB wishes to allow Company-NA to manage alarms related to the RAN coverage service, Company-NB’s BSS may expose management capabilities corresponding to the “FS Control for NSI” Service, as described in 28.545 [6]. Company-NB should only allow operations by Company-NA that are within scope of the provided RAN service.

If Company-NB wishes to allow Company-NA to view performance measurements related to the RAN coverage service, Company-NB’s BSS may expose management capabilities corresponding to the operations and notifications described in 28.550 [7]. Company-NB should only expose measurements related to the S-NSSAI of the ServiceProfile associated with the RAN service.

If Company-NB wishes to allow Company-NA to view KPIs related to the RAN coverage service, Company-NB’s BSS may expose the KPIs as described in 28.554 [8]. Company-NB should only expose KPIs related to the S-NSSAI of the ServiceProfile associated with the RAN service.

#### 7.2.1.2 Modelling options

##### 7.2.1.2.1 Overview

This solution proposes that the E2E network slice in Company-NA’s management system should have a reference to the consumed NSaaS. The BSS of Company-NB maps this association to the RAN network slice.

Figure 7.2.1.2.1-1 shows a scenario where Company-NA consumes NSaaS from Company-NB and wishes to build a relation from networkSlice-A in Company-NA Management System to Company-NB Network Management System (via Company-NB Service Ordering).

serviceProfile-A

networkSlice-A

Company-NA Network Management

Company-NB Network Management

networkSlice-B

serviceProfile-B

Company-NB Service Ordering

Network Slice Ordering

Service Order

Network Slice Allocation

Figure 7.2.1.2.1-1 Scenario of NSaaS consumption

In this case, the Company-NA Management System needs a management view to represent the consumed service:

* The identity of the consumed service
* The status of the consumed service
* The applicable requirements for the consumed service

##### 7.2.1.2.2 Alternative 1A: solution based on the existing NetworkSlice IOC

This alternative proposes to use an existing NetworkSlice IOC to represent the consumed NSaaS.

serviceProfile-A

networkSlice-A

Company-NA Network Management

Company-NB Network Management

networkSlice-B

serviceProfile-B

Company-NB Service Ordering

Network Slice Ordering

Service Order

Network Slice Allocation

serviceProfile-X

networkSlice-X

Figure 7.2.1.2.2-1 Alt 1A Modelling of NSaaS consumption

However, the current definition of NetworkSlice definition includes a mandatory reference to a NetworkSliceSubnet IOC, which is intended to represent the resource view of the network slice. In this case, the NSC may not be allowed to have any knowledge of the NSP resources, therefore the reference to a NetworkSliceSubnet IOC is invalid. A possible solution is to make optional the reference to a NetworkSliceSubnet IOC.

This proposed solution may cause confusion because the same IOC is used to represent a network slice which is managed by the 3GPP Management System and also to represent a network slice which is managed by an external 3GPP Management System. In these two cases, the allowed management actions on the IOC are very different.

##### 7.2.1.2.3 Alternative 1B: solution based on new ExternalNetworkSlice IOC

This alternative proposes to create a new ExternalNetworkSlice IOC to represent the consumed NSaaS. This is similar in style to the External*xxx*Function IOCs and External*xxx*Cell IOCs in 28.541 [2] which are used to represent network functions and cells that are managed by another party.

serviceProfile-A

networkSlice-A

Company-NA Network Management

Company-NB Network Management

networkSlice-B

serviceProfile-B

Company-NB Service Ordering

Network Slice Ordering

Service Order

Network Slice Allocation

serviceProfile-X

externalNetworkSlice

Figure 7.2.1.2.3-1 Alt 1B Modelling of NSaaS consumption

This proposed solution has the advantage that it clearly separates the representation of a network slice which is managed by the 3GPP Management System from the representation of a network slice which is managed by an external 3GPP Management System.

### 7.2.2 Alternative 2: solution based on Network Slice Subnet as a Service

#### 7.2.2.1 Description

This clause describes how a new concept of Network Slice Subnet as a Service may be used to allow Company-NA to manage a network slice subnet service which is provided by Company-NB.

When receiving request for RAN coverage service, Company-NB BSS can issue a corresponding allocateNssi request to its own 3GPP management system with SliceProfile for RAN based on based on parameters received from Company-NA, also taking into account any existing agreements. The pLMNInfoList of the SliceProfile will capture PLMN ID of NOP-A as well as S-NSSAI within that PLMN selected by Company-NA/NOP-A. If successful, relevant and needed identifiers associated with the provided service are returned to Company-NA. Company-NA/NOP-A can then include this information as part of network slice representation in its own management system. This high-level ordering and provisioning procedure is illustrated in figure 7.2.2.1-1.

NOTE: The NetworkSliceSubnet instance allocated in NOP-B’s management system can be newly created or an existing instance can be used following procedure for allocateNssi, see TS 28.531 [3] clause 6.5.2 and clause 7.3. Compared to use cases without sharing, it is possible that for some NetworkSliceSubnet instances there will be no reference from other NetworkSliceSubnet instance or indirectly any NetworkSlice instance within NOP-B’s management system.

Company-NA

Company-NB

BSS

Company-NB

Network manager

*Request for RAN coverage*

*allocateNssi operation*

External interface

Internal interface

Figure 7.2.2.1-1 Alt 2 Provisioning phase

For basic support of the RAN sharing use case, it is not necessary for Company-NB to expose any capabilities beyond service lifecycle operations. But based on agreement Company-NB may expose additional management capabilities in provisioning or monitoring areas. This is illustrated in figure 7.2.2.1-2.

Such exposure should be setup to ensure that only capabilities related to the service provided to Company-NA are exposed. And if any provisioning operations are allowed, these must not interfere with use of network resources by other users.

Company-NA

Company-NB

BSS

Company-NB

Network manager

*Request for Management operations*

*modifyNssi operation*

External interface

Internal interface

*Service alarms,*

*Service measurements,*

*Service KPIs*

*Nssi alarms,*

*Nssi measurements,*

*Nssi KPIs*

Figure 7.2.2.1-2 Alt 2 Operation phase

If Company-NB wishes to allow Company-NA to view operationalState or administrativeState of the NetworkSliceSubnet instance, Company-NB may allow Company-NA to interact with the BSS, the BSS (acting as a Provisioning MnS consumer) must have read access to the NetworkSliceSubnet MOI via the getMOIAttributes operation, defined in 28.532 [5].

If Company-NB wishes to allow Company-NA to control the adminstrativeState of the NetworkSliceSubnet instance, Company-NB’s BSS may allow Company-NA to interact with the BSS, the BSS (acting as a Provisioning MnS consumer)must have write access to the NetworkSliceSubnet MOI via the modifyMOIAttributes operation, defined in 28.532 [5].

If Company-NB wishes to allow Company-NA to view alarms related to the RAN coverage service, Company-NB’s BSS may expose management capabilities corresponding to the “FS Data Report for NSSI” Service, as described in 28.545 [6]. Company-NB should only allow operations by Company-NA that are within scope of the provided RAN service.

If Company-NB wishes to allow Company-NA to manage alarms related to the RAN coverage service, Company-NB’s BSS may expose management capabilities corresponding to the “FS Control for NSSI” Service, as described in 28.545 [6]. Company-NB should only allow operations by Company-NA that are within scope of the provided RAN service.

If Company-NB wishes to allow Company-NA to view performance measurements related to the RAN coverage service, Company-NB’s BSS may expose management capabilities corresponding to the operations and notifications described in 28.550 [7]. Company-NB should only expose measurements related to the S-NSSAI of the SliceProfile associated with the RAN service.

If Company-NB wishes to allow Company-NA to view KPIs related to the RAN coverage service, Company-NB’s BSS may expose the KPIs as described in 28.554 [8]. Company-NB should only expose KPIs related to the NetworkSliceSubnet instance or KPIs related to the S-NSSAI of the SliceProfile associated with the RAN service.

#### 7.2.2.2 Modelling options

##### 7.2.2.2.1 Overview

This solution proposes that the E2E network slice subnet in Company-NA’s management system should have a reference to the consumed NSSaaS. The BSS of Company-NB maps this association to the RAN network slice subnet.

Figure 7.2.2.2.1-1 shows a scenario where Company-NA consumes NSSaaS from Company-NB and wishes to build a relation from networkSlice-A in Company-NA Management System to Company-NB Network Management System (via Company-NB Service Ordering).

serviceProfile-A

networkSlice-A

Company-NA Network Management

Company-NB Network Management

networkSliceSubnet-B

sliceProfile-B

Company-NB Service Ordering

Network Slice Subnet Ordering

Service Order

Network Slice Subnet Allocation

networkSliceSubnet-A

sliceProfile-A

Figure 7.2.2.2.1-1 Scenario of NSSaaS consumption

In this case, the Company-NA Management System needs a management view to represent the consumed service:

* The identity of the consumed service
* The status of the consumed service
* The applicable requirements for the consumed service

#### 7.2.2.2.2 Alternative 2A: solution based on the existing NetworkSliceSubnet IOC

This alternative proposes to use an existing NetworkSliceSubnet IOC to represent the consumed NSSaaS.

serviceProfile-A

networkSlice-A

Company-NA Network Management

Company-NB Network Management

networkSliceSubnet-B

sliceProfile-B

Company-NB Service Ordering

Network Slice Subnet Ordering

Service Order

Network Slice Subnet Allocation

sliceProfile-X

networkSliceSubnet-X

networkSliceSubnet-A

sliceProfile-A

Figure 7.2.2.2.2-1 Alt 2A Modelling of NSSaaS consumption

This proposed solution may cause confusion because the same IOC is used to represent a network slice subnet which is managed by the 3GPP Management System and also to represent a network slice subnet which is managed by an external 3GPP Management System. In these two cases, the allowed management actions on the IOC are very different.

#### 7.2.2.2.3 Alternative 2B: solution based on new ExternalNetworkSliceSubnet IOC

This alternative proposes to create a new ExternalNetworkSliceSubnet IOC to represent the consumed NSSaaS. This is similar in style to the External*xxx*Function IOCs and External*xxx*Cell IOCs in 28.541 [2] which are used to represent network functions and cells that are managed by another party.

serviceProfile-A

networkSlice-A

Company-NA Network Management

Company-NB Network Management

networkSliceSubnet-B

sliceProfile-B

Company-NB Service Ordering

Network Slice Subnet Ordering

Service Order

Network Slice Subnet Allocation

sliceProfile-X

externalNetworkSliceSubnet

networkSliceSubnet-A

sliceProfile-A

Figure 7.2.2.2.3-1 Alt 2B Modelling of NSSaaS consumption

This proposed solution has the advantage that it clearly separates the representation of a network slice subnet which is managed by the 3GPP Management System from the representation of a network slice subnet which is managed by an external 3GPP Management System.

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