Source: Samsung Electronics Co. Ltd

**Title: [FS\_MS\_NS\_Ph2] Network Slice Service Continuity**

**Agenda Item: 8.10**

**Document for: Discussion and Agreement**

# **Introduction**

3GPP SA5 and SA2 groups have extensively studied and specified normative work related to orchestration and management, and control plane aspects related to network slicing respectively. This contribution discusses two studies conducted in SA5 and SA2 groups and identifies a topic for network slice service continuity in clause 2. The relevance of this topic for our work in SA4 is presented in clause 3. Finally, this contribution proposes to add some background information from the above studies into TR 26.941 as an informative material.

# **Network Slice Service Continuity**

TR 28.801[1] is a result of an 3GPP SA5 study that looked into aspects of management data analytics. As part of this study, SA5 looked into and documented use cases, potential requirements and possible solutions in clause of TR 28.809. One the SLS (service level specifications) related issues documented in clause 6.3.2 of TR 28.809[1] is the issue of network slice load analysis. An excerpt from this clause is give below:

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| --- |
| 6.3.2 Network slice load analysis6.3.2.1 Use case *Network slice load may vary over time. Therefore, network resources allocated initially could not always satisfy the traffic requirements, for example, the network slice may be overloaded or underutilized. Various factors may impact the network slice load, e.g. number of UEs accessing the network, number of PDU sessions, service types and the end users distribution. Overload of signalling in control plane and/or user data congestion in user plane will lead underperforming network. Besides, allocating excessive resources for network slice with light load will decrease resource efficiency.* |

3GPP SA5, the primary group specifying the management and orchestration of network slicing in their specification documents TS 28.530 [3], TS 28.531[4], has studied and identified that network slices could be overloaded from time to time, and that the slices cannot satisfy the traffic requirements, and therefore may fail to meet the SLA.

3GPP TS 29.520[5] describes stage-3 APIs using which NF consumers can get slice load level information and network slice instance load level information from NWDAF

3GPP SA2 recently conducted a Rel-18 study on “Enhancement of Network Slicing Phase 3” (UID 940063). As part of this, 3GPP SA2 studied a key issue “Key Issue#1: Support of Network Slice Service Continuity” and the findings are documented in TR 23700-41[2]. Clause 5.1 in this TR describes the use case of slice service continuity as documented below

|  |
| --- |
| **“5.1 Key Issue #1: Support of Network Slice Service continuity**5.1.1 Description *This Key issues is aiming to address WT#1. The following scenarios can happen:*  ***1) No mobility scenario:***  *Scenario 1a): network slice is overloaded in NG-RAN.*  *Scenario 1b): network slice or network slice instance is overloaded or undergoing planned maintenance in CN (e.g. network slice termination).*  *Scenario 1c): network performance of the network slice cannot meet the SLA.*  ***2) Inter RA Mobility scenario:***  *..*  *Scenario 2d): network slice or network slice instance is overloaded in the target CN.*  *This key issue is to study whether and how to provide service continuity for PDU sessions in network slices in the above scenarios 1b), 1c) and 2d).*” |

The key issue above documents the agreements that the network slices can be overloaded from time to time, they can undergo planned maintenance, and the performance of the network slice cannot meet the SLA. These agreements are very similar to the agreements documented by 3GPP SA5 in TR 28.809.

For this key issue in SA2 study, 11 solutions are documented in TR 23700-41:

* Solution #1: Additional S-NSSAI associated with the PDU session
* Solution #2: Slice Re-mapping Capabilities for Network Slice Service Continuity
* Solution #3: Support of Network Slice Service continuity using SSC mode 3
* Solution #4: PDU Session on compatible network slice
* Solution #5: PDU session handover to a target CN with an alternative S-NSSAI support
* Solution #15: Service continuity in case of Network Slice instance overload
* Solution #32: Solution for Network Control for UE Slice Use
* Solution #40: S-NSSAI change decided by PCF
* Solution #41: Network Slice change without service interruption
* Solution #42: Network controlled change to an alternative S-NSSAI
* Solution #43: Allowed NSSAI Determination in Initial Registration to Support Network Slice Service Continuity

Review of the solutions show the following:

1. All the solutions propose methods where an ‘alternative slice’ is identified to move the traffic from the PDU session in current slice to a PDU session in that alternative slice
2. Number of solutions based on which entity identifies the alternate slice information: AMF (7), UE (2), SMF (1), PCF (1). It is not clear how each of these entities are configured with such alternate slice information.

As of the latest version of this TR 23700-41 (v18.0.0 of Rel-18):

* Clause 7.1 documents different evaluation points about each of the above 11 candidate solutions
* Clause 8.1 documents five interim conclusion points based on the evaluation of above solutions. There is still work to be done to have a clear conclusion on this topic

2.1 Support for moving flows to different slices

There is generic support for moving flows to different slices in 3GPP SA2 specifications. An extract from clause 5.15.5.2.2 of TS 23.501 on determining whether ongoing traffic can be routed over other existing PDU Sessions in other slices is as follows:

*“The UE uses either the URSP rules (which includes the NSSP) or the UE Local Configuration as defined in clause 6.1.2.2.1 of TS 23.503 [45] to determine whether ongoing traffic can be routed over existing PDU Sessions belonging to other Network Slices or establish new PDU Session(s) associated with same/other Network Slice.”*

From the above extract, it is either the URSP rules delivered to the UE or the UE local configuration that defines how ongoing traffic can be routed over existing PDU Sessions belonging to other network slices.

Clause 6.6.2 of TS 23.503 describes URSP (UE Route Selection Policy) information. As part of URSP, a set of traffic descriptors that help identifying application flows are specified. Also specified are a list of route selection descriptors that define how the identified flows to be routed through the 5G system. Below is an extract from Table 6.6.2.1-3 of TS 23.503 about slicing related entries in the Route Selection Descriptor of URSP.

*Table 6.6.2.1-3: Route Selection Descriptor*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Information name* | *Description* | *Category* | *PCF permitted to modify in URSP* | *Scope* |
| ***Route selection components*** | *This part defines the route selection components* | *Mandatory (NOTE 2)* |  |  |
| *Network Slice Selection* | *Either a single value or a list of values of S-NSSAI(s).* | *Optional*  *(NOTE 3)* | *Yes* | *UE context* |
| *DNN Selection* | *Either a single value or a list of values of DNN(s).* | *Optional* | *Yes* | *UE context* |
| *..*  *NOTE 3: When the Subscription Information contains only one S-NSSAI in UDR, the PCF needs not provision the UE with S-NSSAI in the Network Slice Selection information. The "match all" URSP rule has one S-NSSAI at most.*  *..* | | | | |

From the table above, one of the route selection components is the network slice selection information which is either a single value or a list of values of S-NSSAIs, and this defines the NSSP (Network Slice Selection Policy). When this information is present in the URSP rules delivered to the UE by the PCF, the UE routes the identified application traffic through the slices identified by the NSSP.

For UE Local Configuration, clause 6.1.2.2.1 of TS 23.503 describes UE policy control, and specifies that among the four policy objects – Access Network Discovery & Selection Policy (ANDSP), UE Route Selection Policy (URSP), V2X Policy (V2XP), and ProSe Policy (ProSeP), two policy objects – ANDSP and URSP may be pre-configured in the UE.

# **Relevance to FS\_MS\_NS\_Ph2 work in SA4**

We believe the network slice service continuity issue discussed in clause 2 above is relevant to our work in 3GPP SA4 on network slicing extensions for 5G media services. In our current 5G media streaming specifications (TS 26.501 and TS 26.512), described are procedures for provisioning of policy templates (over M1) and dynamic policy requests (over M5). The policy templates provisioning procedure (clause 7.9 of TS 26.512) carries Slice Id and DNN information. There is a need to look into network slice service continuity work in 3GPP SA2 as media flow traffic in PDU sessions may not receive the required QoS for example due to network slice being overloaded or undergoing maintenance. In this case, as proposed in solutions for Key Issue #1 in TR 23700-41, the media flows may have to be migrated to a PDU Session in a different slice. This may impact the service provisioning and dynamic policy procedures specified in TS 26512.

# **References**

[1] 3GPP TR 28.809: “Study on enhancement of management data analytics”

[2] 3GPP TR 23700-41: " Enhancement of Network Slicing Phase 3"

[3] 3GPP TS 28.530: "Management and orchestration; Concepts, use cases and requirements"

[4] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[5] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

# **Proposal**

We propose following change be adopted into TR 26.941.

**===== 1. CHANGE =====**

# 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 TR 26.804: "Study on 5G media streaming extensions".

[3] 3GPP TS 28.530: "Management and orchestration; Concepts, use cases and requirements".

[4] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[5] GSM Association NG.116, “Generic Network Slice Template”,  
<https://www.gsma.com/newsroom/wp-content/uploads//NG.116-v6.0.pdf>

[6] 3GPP TR 23.700-40: “Study on enhancement of network slicing; Phase 2”

[7] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[8] 3GPP TS 23.700‑99: "Study in Network slice capability exposure for application layer enablement (NSCALE)".

[9] 3GPP TS 23.435: "Procedures for Network Slice Capability Exposure for Application Layer Enablement Service".

[10] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[11] 3GPP TS 28.542: "Management and orchestration of networks and network slicing; 5G Core Network (5GC) Network Resource Model (NRM); Stage 1".

[12] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[13] 3GPP TS 28.545: "Management and orchestration; Fault Supervision (FS)".

[14] 3GPP TS 28.546: "Management and orchestration of networks and network slicing; Fault Supervision (FS); Stage 2 and stage 3".

[15] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".

[16] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[17] 3GPP TS 23.434: "Service Enabler Architecture Layer for Verticals (SEAL); Functional architecture and information flows ".

[18] 3GPP TS 27.007: "AT command set for User Equipment (UE)".

[19] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

[20] 3GPP TS 26501: "5G Media Streaming (5GMS); General description and architecture".

[21] 3GPP TS 26512: "5G Media Streaming (5GMS); Protocols".

[22] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[23] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[24] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[A] 3GPP TR 28.809: "Study on enhancement of management data analytics".

[B] 3GPP TR 23700-41: "Enhancement of Network Slicing Phase 3".

**===== 2. CHANGE =====**

## 4.X Service continuity for media streaming sessions migrated between Network Slices

### 4.X.1 Background

TR 28.809 [A] is the result of a feasibility study that looked into aspects of management data analytics. Clause 6 of [A] specifies use cases, potential requirements and possible solutions for management data analytics. One of the issues relating to service-level specifications documented in clause 6.3.2 of [A] is the issue of network slice load analysis, described as follows:

*"Network slice load may vary over time. Therefore, network resources allocated initially could not always satisfy the traffic requirements, for example, the network slice may be overloaded or underutilized. Various factors may impact the network slice load, e.g. number of UEs accessing the network, number of PDU sessions, service types and the end users distribution. Overload of signalling in control plane and/or user data congestion in user plane will lead underperforming network. Besides, allocating excessive resources for network slice with light load will decrease resource efficiency."*

From the above, it is understood that network slices can become overloaded from time to time, and that consequently the slices cannot satisfy the traffic requirements, and therefore may fail to meet their SLA.

Clause 5.1 of TR 23700-41 [B] describes a related key issue "Key Issue#1: Support of Network Slice Service Continuity" in terms similar to the issue described above in [A] above. Specifically, aspects related to service continuity are being studied for two scenarios – no mobility scenario and inter-RA mobility scenario – in the case when a Network Slice or Network Slice instance in the Core Network (CN) or target CN is overloaded or undergoing planned maintenance (e.g., Network Slice termination), and the network performance of the Network Slice cannot meet the SLA.

A review of the candidate solutions for the above key issue in TR 23700-41 [B] reveals the following:

- All the candidate solutions propose methods where an alternative slice is identified with the aim of migrating the application traffic from the PDU session in the current slice to a PDU session in that alternative slice.

- The entity that identifies the alternate slice information varies between the candidate solutions: AMF (7), UE (2), SMF (1), PCF (1). It is not clear how each of these entities are configured with such alternate slice information.

Editor’s Note: The normative work after the above study is to be monitored, and updated in this Technical Report for information.

### 4.X.2 Moving application flows to different Network Slices

The 5G System provides generic support for moving application flows to different slices. As described in clause 5.15.5.2.2 of TS 23.501 [7] on determining whether ongoing traffic can be routed over existing PDU Sessions in other Network Slices:

*"The UE uses either the URSP rules (which includes the NSSP) or the UE Local Configuration as defined in clause 6.1.2.2.1 of TS 23.503 [45] to determine whether ongoing traffic can be routed over existing PDU Sessions belonging to other Network Slices or establish new PDU Session(s) associated with same/other Network Slice."*

From the above, it is clear that either the URSP rules delivered to the UE or the UE local configuration determine how ongoing application traffic can be routed over existing PDU Sessions belonging to other Network Slices.

Clause 6.6.2 of TS 23.503 [16] describes URSP (UE Route Selection Policy) information. As part of URSP, a set of traffic descriptors that help identifying application flows are specified. Also specified are a list of route selection descriptors that define how the identified flows to be routed through the 5G system. From table 6.6.2.1-3 of [16], a set of slicing-related entries are defined in the route selection components of the URSP Route Selection Descriptor with the following information:

- *Network Slice selection information:* Either a single value of a list of values of S-NSSAIs.

- *DNN selection information:* Either a single value of a list of values of Data Network Name(s).

The above information defines the NSSP (Network Slice Selection Policy) as part of URSP. When this information is present in the URSP rules delivered to the UE by the PCF, the UE routes the identified application traffic through the appropriate Network Slices indicated by the NSSP.

For UE Local Configuration, clause 6.1.2.2.1 of [16] describes UE policy control, and specifies that among the four policy objects – Access Network Discovery & Selection Policy (ANDSP), UE Route Selection Policy (URSP), V2X Policy (V2XP), and ProSe Policy (ProSeP) – only ANDSP and URSP may be pre-configured in the UE.**===== END CHANGES =====**