**TSG SA Rel-18 Prioritization Workshop SP-211170**

**9-10 December 2021, Electronic meeting**

**SA WG2 Meeting #S2-148ES2-2109356**

**15 - 19 Nov, 2021, Electronic meeting** (revision of S2-21yyxxxx)

**Source: ZTE, LG Electronics, Samsung, Alibaba, Apple, AT&T, CATT, China Telecom, China Unicom, Convida Wireless LLC, Ericsson, Intel, InterDigital, KDDI, Lenovo, Matrixx, MITRE, Motorola Mobility, NEC , Nokia, Nokia Shanghai Bell , NTT Docomo, OPPO, Oracle, Orange, Qualcomm, Sanechips, Sharp, T-Mobile USA, Spreadtrum, Tencent, Verizon UK Ltd, Xiaomi**

**Title: Study on Enhancement of Network Slicing Phase 3**

**Document for: Approval**

**Agenda Item: 9.1.3**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on Enhancement of Network Slicing Phase 3

Acronym: FS\_eNS\_Ph3

Unique identifier:

Potential target Release: *Rel-18*

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  | X | X | X |  |
| No |  |  |  |  |  |
| Don't know | X |  |  |  | X |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
|  | Feature |
|  | Building Block |
|  | *Work Task* |
| X | Study Item |

## 2.2 Parent Work Item

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| FS\_EASNS | SA1 | 880035 | Study on Enhanced Access to and Support of Network Slice |
| EASNS | SA1 | 910032 | Enhanced Access to and Support of Network Slice |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 860039 | Study on enhancement of RAN slicing for NR | Enhancements for RAN slicing for NR were studied by RAN3 in Rel-17. The solutions with system impacts should be studied in SA2. |
| 911007 | Enhancement of RAN slicing for NR | The solutions in Enhancements for RAN slicing for NR can be taken into account by this study. |

**Dependency on non-3GPP (draft) specification: None**

# 3 Justification

RAN3 in Rel-17 has studied the scenarios and candidate solutions in TR 38.832 on the support of slice service continuity during UE mobility due to no support of the network slice or resource limitation of the network slice in the target RAN node. SA2 sent LS out in S2-2102068 to confirm that the scenarios described in the TR are valid(i.e. they do happen, due to the fact that network slices are not required to be available in all TAs of a PLMN). However the solutions with CN/UE impacts were discouraged, and before being pursued would require an SA2 study from end to end system point of view. Deployment improvement should be analysed accordingly.

There is a scenario that an S-NSSAI in the Requested NSSAI is rejected as it is not supported in a TA but it may be supported in nearby TAs. The AMF may need to include the nearby TAs in a Registration Area as it is optimal to do so for the S-NSSAIs in the Allowed NSSAIs. So, if this is done and the rejection cause code is "not supported in the RA", the UE cannot attempt to register with the rejected S-NSSAI until the UE moves out of the RA. If this is not desirable, then the AMF can only assign a RA that is limited to the current TA and TAs where the rejected S-NSSAI is not supported, which enable the UE to register with the rejected S-NSSAI when the UE moves into the nearby TA which supports the rejected S-NSSAI. This study should investigate the solutions to improve the ability to select network slices requested by the UE but not available in the TA, and which are available in other TAs of the RA, to be requestable by the UE without forcing the AMF to reduce the size of the RA

SA1 has agreed a new requirement in TS 22.261 clause 6.1.2.1:

For a roaming UE activating a service/application requiring a network slice not offered by the serving network but available in the area from other network(s), the HPLMN shall be able to provide the UE with prioritization information of the VPLMNs with which the UE may register for the network slice.

SA2 should investigate mechanisms to support this new requirement.

When the UE performs registration, the UE generates a Requested NSSAI based on the Configured S-NSSAI, Allowed NSSAI and also may take the URSP rules into account. The UE may register S-NSSAIs which are not going to be used (e.g. establish PDU session in the network slice by running applications) at once, and possibly not while registered in this RA. Similar after the applications is terminated and the PDU session may not be used (e.g. deliver running application traffic via the PDU sessions) by any other applications in the UE. This may be perceived by operator’s customers as an issue, for example when NSAC is deployed this will cause additional UE to fail to register this S-NSSAI and request S-NSSAI for PDU session. Another issue is the operator may have SLAs with customers related to availability of the customer’s service. When the network slice is congested and other network slices can serve the SLA better the network may determine that the UE traffic flow is better served by a different slice. This study should investigate possibility to enhance the system to ensure network controlled behaviour of network slice usage including UE registration and PDU Session establishment (e.g. so that when performing NSAC the network slice can serve UEs/PDU Sessions with actual activity)

Services provided over certain network slices may be limited in area of service (not matching deployed TA boundaries) and/or in time-span of their deployment (e.g. services provided to cover some event). It would be desirable to define mechanisms to support deployments more optimally to minimize operations and disruption to enable such scenarios, with a specific focus on network slice termination.

When the UE in connected state requests new S-NSSAI in registration request and the existing AMF doesn’t support this new requested S-NSSAI, the new requested S-NSSAI will be rejected and the ongoing PDU sessions may be lost as the UE needs to be placed in idle mode and requested to re-register. It would be desired that a new AMF can be select to serve new requested S-NSSAI. This study should investigate how to support AMF re-allocation for the UE in connected state to avoid the connections of the UE to be lost for ongoing PDU sessions

In Release 17 NSACF is defined to perform Network Slice Admission Control (NSAC). There could be multiple NSACFs within the PLMN. The interaction between these NSACFs was not defined in R17. Without this interaction the operator needs to split the maximum value into each NSACF via OAM. In the roaming case there is no support of dynamic NSAC in the home PLMN for number of UE registered in the network slice. This study should investigate whether and how to support dynamic interaction between NSACFs.

In Rel-17 RAN2 has been discussed a Slice Group concept to broadcast over-the-air, where a slice group consists of one or multiple slices, which can avoid publishing slice identities (S-NSSAI) in System Information (security concern and SI size concern). However how to signal such slice groups to the UE has not been defined. This study should discuss how the network can manage and provide slice group information to the UE.

# 4 Objective

The objective of this study is to investigate the feasibility of further enhancement on network slicing.

For the following objectives, it is expected to study the necessity and potential mechanisms identified as gaps to our specifications:

1. Study whether and how to address the following scenario in order to provide service continuity: an existing network slice or network slice instance cannot serve the PDU session in current TA (due to OAM reasons or slice congestion) or target TA (due to mobility), or if the existing network slice instance cannot meet the performance requirements of the applications. The study should investigate whether deployment optimization is sufficient. System optimisations can be considered if valuable.

2. Study whether and how to initiate a registration for a rejected S-NSSAI that was rejected in a first TA of the RA but may be available in another TA of the RA.

3. Study whether and how to support the following stage one Rel-18 EASNS requirements related to roaming specified in TS22.261 clause 6.1.2.1, i.e. Requirement on enhancement the information available to the UE in roaming scenarios regarding the availability of network slices in VPLMNs available in the roaming country, in order to allow the UE to select and obtain services from the VPLMN supporting the network slices which UE may wish to use

4. Study whether and how to enhance the system to ensure network controlled behaviour of network slice usage including UE registration and PDU Session establishment (e.g. so that when performing NSAC the network slice can serve UEs/PDU Sessions with actual activity).

5 Study deployment considerations when a service provided has an area of service that does not overlap with the already deployed Tracking Areas and/or have a limited life time, and how existing mechanisms including network slicing can help support such scenarios. If existing mechanisms are concluded to be not sufficient to achieve the scenarios, study whether and how additional mechanisms can resolve the analysed gap.

6. Study whether and how to support AMF re-allocation due to new S-NSSAI requested by the UE in connected state

7. Study whether and how to enhance support of networks with multiple NSACFs covering different service areas, and enhance Network Slice Admission Control for roaming scenarios.

8. Study how to support the RAN work on enabling Slice Groups for AS and the slice prioritization mechanism

Existing mechanisms shall be reused to the extent possible to resolve the gaps for the scenarios in the objectives above. No new mechanism will be introduced until it is demonstrated that existing mechanisms cannot fulfil the scenarios described in the objectives.

Depending on the deployment guidelines collected during the study, the study will conclude whether and how to document these deployment guidelines in our specifications.

Interaction with RAN working groups is needed on any RAN impact.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Work Task ID** | **TU Estimate****(Study)** | **TU Estimate****(Normative)** | **RAN Dependency****(Yes/No/Maybe)**  | **Inter Work Tasks Dependency**  |
| WT#1(Service continuity) | 2 | 1 | Maybe | WT#1 is self-contained |
| WT#2(TAI slice support of rejected slice  in RA) | 0.5 | 0.25 | No | WT#2 is self-contained |
| WT#3(providing VPLMN network slice info to roaming UE) | 1 | 0.5 | No | WT#3 is self-contained |
| WT#4(Requested slice controlled by network) | 1 | 0.75 | No | WT#4 is self-contained |
| WT#5(Slice Service Area) | 1 | 0.5 | Maybe | WT#5 is self-contained |
| WT#6(Connected mode relocation) | 0.25 | 0.25 | Maybe | WT#6 is self-contained |
| WT#7(multiple NSACF) | 1 | 1 | No | WT#7 is self-contained |
| WT#8(Slice group and priority for RAN) | 1 | 0.5 | Yes | WT#8 is self-contained |

**Total TU estimates for the study phase: 7.75**

**Total TU estimates for the normative phase: 4.25**

**Total TU estimates: 12**

# 5 Expected Output and Time scale

|  |
| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| Internal TR | 23.xxx | Study on Enhancement of Network Slicing Phase 3 | SA#96 | SA#97 | ZHU Jinguo, ZTE, zhu.jinguo@zte.com.cnMyungjune Youn, LGE, m.youn@lge.comThe secondary rapporteur is responsible for TR editing |
|  |  |  |  |  |  |

# 6 Work item Rapporteur(s)

ZHU Jinguo, ZTE, zhu.jinguo@zte.com.cn: Primary Rapporteur

Myungjune Youn, LGE, m.youn@lge.com: Secondary Rapporteur: Responsible for TR editing

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

The following aspects may arise related to this WID:

- Security aspects

- Charging, OAM aspects

- RAN aspects

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Alibaba |
| Apple |
| AT&T |
| CATT  |
| China Telecom |
| China Unicom |
| Convida Wireless LLC |
| DISH Network |
| Ericsson |
| Intel |
| InterDigital  |
| KDDI |
| KPN |
| KT Corp. |
| Lenovo  |
| LG Electronics |
| LG Uplus |
| Matrixx |
| MITRE |
| Motorola Mobility |
| NEC  |
| Nokia |
| Nokia Shanghai Bell  |
| NTT Docomo |
| OPPO |
| Oracle |
| Orange |
| Qualcomm |
| Samsung |
| Sanechips  |
| Sharp |
| SK Telecom |
| T-Mobile USA  |
| Spreadtrum |
| Tencent |
| Verizon UK Ltd  |
| Xiaomi |
| ZTE |