**3GPP TSG-SA2 Meeting #156E**

**E-Meeting April 17 - 21, 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **4234** | **Rev** | **-** | **Current version:** | **18.1.0** |  |
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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 |  | Core Network | **X** |

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|  |
| ***Title:***  | Resolving open issues related to Alternative S-NSSAI |
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| ***Source to WG:*** | Ericsson, ZTE, Lenovo, Apple |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | eNS\_Ph3 |  | ***Date:*** | 2023-04-06 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | The following open issues listed as part of Editor’s notes remains for KI#1.Editor's note: Whether to send the mapping of the S-NSSAI to the Alternative S-NSSAI to the UE when there is no PDU session associated with the S-NSSAI is FFS.When there is no established PDU Session for the S-NSSAI that is to be replaced, then, in principle, the AMF can rely on the logic to trigger a UCU once the UE establishes a PDU Session using the S-NSSAI to be replaced, or the AMF can anyway send a UCU with the mapping of the S-NSSAI to the Alternative S-NSSAI. It can be left to AMF implementation whether to provide mapping of the S-NSSAI to the Alternative S-NSSAI to the UE when there is no PDU session associated with the S-NSSAI.  |
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| ***Summary of change:*** | Clarified that it is up to AMF implementation whether to provide mapping of the S-NSSAI to the Alternative S-NSSAI to the UE when there is no PDU session associated with the S-NSSAI. |
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| ***Consequences if not approved:*** | Open issues remains in the specification. |
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| ***Clauses affected:*** | 5.15.19 |
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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 ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*FIRST CHANGE*

### 5.15.19 Support of Network Slice Replacement

The Network Slice Replacement feature is used to replace an S-NSSAI with an Alternative S-NSSAI when an S-NSSAI becomes unavailable or congested. The Network Slice Replacement may be triggered in the following cases:

- If the NSSF detects that an S-NSSAI becomes unavailable or congested (e.g. based on OAM or NWDAF analytics output), it sends network slice availability notification for the S-NSSAI to the AMF. The notification may include an Alternative S-NSSAI which can be used by the AMF to replace the S-NSSAI. The NSSF notifies the AMF when the S-NSSAI is available again.

- If the PCF detects that an S-NSSAI becomes unavailable or congested for a UE (e.g. based on OAM or NWDAF analytics output), it sends access and mobility related policy notification to the AMF. The notification may include an Alternative S-NSSAI which can be used by the AMF to replace the S-NSSAI. The PCF notifies the AMF when the S-NSSAI is available again for the UE.

- The OAM sends notification to AMF when an S-NSSAI becomes unavailable or congested (and also when this S-NSSAI becomes available again) and provides the Alternative S-NSSAI to AMF.

Based on the notification above from NSSF or PCF or OAM, the AMF may determine that an S-NSSAI is to be replaced with Alternative S-NSSAI. For roaming case, the AMF may receive network slice availability notification of the HPLMN S-NSSAI from NSSF in the HPLMN via NSSF in VPLMN, to trigger the Network Slice Replacement of the HPLMN S-NSSAI as described in clause 5.15.6.

NOTE 1: It is recommended that, the operator configures to use only one mechanism when triggering the Network Slice Replacement for S-NSSAI.

The AMF determines the Alternative S-NSSAI for a UE registered with the S-NSSAI based on the notification from NSSF or PCF, or based on local configuration if the NSSF or PCF do not provide an alternative S-NSSAI. The Alternative S-NSSAI shall be supported in the UE Registration Area. If AMF cannot determine the Alternative S-NSSAI for the S-NSSAI, e.g. PCF or NSSF doesn't provide Alternative S-NSSAI, the AMF may further interact with the PCF to determine the Alternative S-NSSAI. The event trigger in AMF for interacting with PCF is described in clause 6.1.2.5 of TS 23.503 [45].

The UE indicates the support of Network Slice Replacement feature during the UE Registration procedure. For supporting UE in CM-CONNECTED mode, and if there is a PDU Sessions in the UE context associated with the S-NSSAI that needs to be replaced, the AMF provides the Alternative S-NSSAI for this S-NSSAI in the Allowed NSSAI and in the Configured NSSAI, if not included yet, and the mapping between S-NSSAI(s) to Alternative S-NSSAI(s) to the UE in UE Configuration Update message as follows:

- for non-roaming UEs, the AMF provides the mapping of the S-NSSAI to the Alternative S-NSSAI to the UE.

- for roaming UEs when the VPLMN S-NSSAI has to be replaced by a VPLMN Alternative S-NSSAI, the AMF provides the mapping of the VPLMN S-NSSAI to the Alternative VPLMN S-NSSAI to the UE.

- for roaming UEs when the HPLMN S-NSSAI has to be replaced by an Alternative HPLMN S-NSSAI, the AMF provides the mapping of the HPLMN S-NSSAI to the Alternative HPLMN S-NSSAI to the UE.

NOTE 2: The Alternative S-NSSAI or Alternative HPLMN S-NSSAI does not have to be part of the Subscribed S-NSSAI as long as they can be mapped to a HPLMN S-NSSAI that is part of the Subscribed S-NSSAIs.

For the supporting UE in CM-IDLE state, when the UE establishes a NAS signalling connection, e.g. through a Service Request procedure or through a UE registration procedure, if the AMF determines that the S-NSSAI is to be replaced and there is a PDU Session associated with the S-NSSAI in the UE context, the AMF sends the mapping of the S-NSSAI to the Alternative S-NSSAI to the UE in the UE Configuration Update message or in the Registration Accept message.

NOTE X: It is left to AMF local policy whether to send the mapping of the S-NSSAI to the Alternative S-NSSAI to the UE when there is no PDU session associated with the S-NSSAI or wait and send the mapping of the S-NSSAI to the Alternative S-NSSAI to the UE when the UE establishes a PDU Session associated with the S-NSSAI.

During a new PDU Session establishment procedure towards an S-NSSAI,

- if the UE is provided with the mapping of the S-NSSAI to an Alternative S-NSSAI, the UE provides both the Alternative S-NSSAI and the S-NSSAI in the PDU Session Establishment message. When the AMF receives the Alternative S-NSSAI and the S-NSSAI in the PDU Session Establishment message, or when the AMF receives only the S-NSSAI in PDU Session Establishment message the AMF determines that the S-NSSAI is to be replaced with the Alternative S-NSSAI, the AMF includes both the Alternative S-NSSAI and the S-NSSAI to the SMF.

- if the UE is not provided with the mapping of the S-NSSAI to the Alternative S-NSSAI, the UE provides the S-NSSAI in the PDU Session Establishment message. When the AMF determines that the requested S-NSSAI is to be replaced with the Alternative S-NSSAI and if the UE supports Network Slice Replacement, the AMF performs UE Configuration Update procedure to reconfigure the UE with the Alternative S-NSSAI. The AMF continues the PDU Session establishment procedure with the Alternative S-NSSAI and provides both the Alternative S-NSSAI and the S-NSSAI to the SMF.

The SMF proceeds with the PDU Session establishment using the Alternative S-NSSAI. The SMF sends the Alternative S-NSSAI to NG-RAN in N2 SM information and to UE in PDU Session Establishment Accept message.

For existing PDU Session associated with an S-NSSAI that is replaced with the Alternative S-NSSAI, after the AMF sends mapping of the S-NSSAI to the Alternative S-NSSAI to the supporting UE in UE Configuration Update message, the AMF sends updates to the SMF of the PDU Session, e.g. triggering Nsmf\_PDUSession\_UpdateSMContext service operation, that the PDU Session is to be transferred to Alternative S-NSSAI and includes the Alternative S-NSSAI as follows (see details in clause 4.3.5.x of TS 23.502 [3]):

- If the SMF determines that the PDU Session needs to be retained (e.g. if the anchor UPF can be reused with the alternative S-NSSAI and SSC mode 1), the SMF sends the Alternative S-NSSAI to the UPF in the N4 message, to the NG-RAN in N2 message and to the supporting UE in PDU Session Modification Command message.

- If the SMF determines that the PDU Session needs to be re-established, the SMF sends the Alternative S-NSSAI to the supporting UE either in PDU Session Modification Command if the PDU Session is of SSC mode 3, or in PDU Session Release if the PDU Session is of SSC mode 2 or SSC mode 1, to trigger the re-establishment of the PDU Session. The UE includes both, the S-NSSAI and the Alternative S-NSSAI in the PDU Session Establishment message.

Editor's note: How to use the existing NG-RAN resource of the replaced S-NSSAI is for FFS.

When the AMF is notified that the S-NSSAI is available again or the congestion of the S-NSSAI has been mitigated, if the AMF has configured the supporting UE with the Alternative S-NSSAI, and the AMF determines for the UE to use the S-NSSAI again, the AMF reconfigures the supporting UE (e.g. by using UE Configuration Update message) to use the S-NSSAI. If there is an existing PDU Session associated with the Alternative S-NSSAI, the AMF sends updates to the SMF of the PDU Session, e.g. triggering Nsmf\_PDUSession\_UpdateSMContext service operation, that the PDU Session is to be transferred to the S-NSSAI.

Editor's note: How to perform Network Slice Replacement during handover is FFS.

*END CHANGE*