**3GPP SA WG2 Meeting #160-Ad Hoc-e**

**22 - 29 January, 2024, Electronic**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.501** | **CR** | **5277** | **Rev** | **-** | **Current version:** | **18.4.0** |  |
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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:*** | Support of Network Slice Replacement and area restrictions at UE mobility | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | eNS\_Ph3 | | | | |  | ***Date:*** | | | 2024-01-12 |
|  |  | | | |  | |  | | |  |
| ***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 can be 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:*** | | When the AMF adds the Alternative S-NSSAI to the Allowed NSSAI it is not stated what the AMF does with the replaced S-NSSAI as the asumption is that the S-NSSAI is kept in the Allowed NSSAI as per existing logic.  At change of AMF, there is a need for the new AMF to be able to handle Network Slice replacement. | | | | | | | | |
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| ***Summary of change:*** | | Clarified the AMF logic when the UE moves out of the NS-AoS of the replaced S-NSSAI.  Clarified that when the AMF adds the Alternative S-NSSAI to the Alllowed NSSAI the AMF keeps the replaced S-NSSAI in the Allowed NSSAI as per existing logic.  Clarified that at mobility between AMFs the new AMF receives the Alternative S-NSSAI in the UE context | | | | | | | | |
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| ***Consequences if not approved:*** | | The replacement feature does not work during mobility with NS-AoS. | | | | | | | | |
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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 ... | | |
|  | |  | | | | | | | | |
| ***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 temporarily 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.

The network slice associated with the Alternative S-NSSAI is assumed in this specification to have NS-AoS to be covering at least the NS-AoS of the replaced network slice. If the UE moves outside the NS-AoS of the replaced S-NSSAI, but still within the NS-AoS of the Alternative S-NSSAI, the AMF removes the replaced S-NSSAI from the Allowed NSSAI (if the S-NSSAI was in the Allowed NSSAI) and from the Partially Allowed NSSAI (if the UE moves out of the RA also).

NOTE 1: It is recommended to use a network slice associated with the Alternative S-NSSAI that is able to support requirements for the services that the replaced network slice supports.

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 subscribes the network slice availability notification of the HPLMN S-NSSAI from the NSSF in VPLMN and the NSSF in VPLMN subscribes the notification from NSSF in the HPLMN as described in clause 5.15.6.

NOTE 3: It is recommended that, the operator configures to use only one option, i.e. OAM, PCF or NSSF, for determining an Alternative S-NSSAI and triggering the Network Slice Replacement for S-NSSAI.

The AMF uses the Alternative S-NSSAI received in the notification from the NSSF, or from OAM or from the PCF If the NSSF or PCF or OAM do not provide an Alternative S-NSSAI in the notification, the AMF uses an Alternative S-NSSAI based on local configuration. 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. OAM or NSSF doesn't provide Alternative S-NSSAI and there is no Alternative S-NSSAI in the AMF local configuration, 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].

If the Alternative S-NSSAI is subject to NSSAA, the Alternative S-NSSAI shall only be used for UEs for which the Alternative S-NSSAI is included in the Subscribed S-NSSAIs. In this case, the AMF performs the NSSAA procedure for the Alternative S-NSSAI as described in clause 5.15.10 before the AMF triggers Network Slice Replacement as specified below.

The UE indicates the support of Network Slice Replacement feature during the UE Registration procedure. For supporting UE in CM-CONNECTED state and if there is a PDU Sessions in the UE context associated with the S-NSSAI that needs to be replaced, the AMF additionally 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.

NOTE 4: In the non-roaming case, the Alternative S-NSSAI does not have to be a Subscribed S-NSSAIs, as the replaced S-NSSAI is always a subscribed S-NSSAI.

- 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 5: In the roaming cases, the Alternative HPLMN S-NSSAI does not have to be one of the Subscribed S-NSSAIs as the replaced HPLMN S-NSSAI is always part of the Subscribed S-NSSAIs.

If the replaced S-NSSAI cannot be kept in the Allowed NSSAI or Partially Allowed NSSAI, the AMF additionally removes the Alternative S-NSSAI from the Allowed NSSAI or Partially Allowed NSSAI if the Alternative S-NSSAI is only used for Network Slice Replacement.

At mobility between AMFs the new AMF receives the Alternative S-NSSAI and the mapping of the replaced S-NSSAI to the Alternative S-NSSAI in the UE context if old AMF provided the mapping of the replaced S-NSSAI to the Alternative S-NSSAI to the UE. When a S-NSSAI is subject to Network Slice Replacement, the new AMF updates the UE which misses the mapping of the replaced S-NSSAI to the Alternative S-NSSAI e.g. due to no mapping information in the received UE context.

For the supporting UE when the UE has a NAS signalling connection, i.e. it is CM-CONNECTED or it has become CM-CONNECTED, 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 (see also NOTE 3), 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 6: 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 for a S-NSSAI,

- if the UE has received together with the Allowed NSSAI a mapping of the S-NSSAI to an Alternative S-NSSAI, the UE shall provide 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, the AMF includes both the Alternative S-NSSAI and the S-NSSAI to the SMF in Nsmf\_PDUSession\_CreateSMContext service operation.

- if the UE has not yet received with the Allowed NSSAI a mapping of the S-NSSAI to the Alternative S-NSSAI, the UE provides only the S-NSSAI in the PDU Session Establishment message. If 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 in Nsmf\_PDUSession\_CreateSMContext service operation.

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 4.3.3 of TS 23.502 [3]):

- If the SMF determines that the PDU Session is 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. The S-NSSAI provided to the (R)AN and to the UPF is the Alternative S-NSSAI.

- If the SMF determines that the PDU Session is 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.

When the AMF is notified that the S-NSSAI is available again (e.g. 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 replaced S-NSSAI again, the AMF reconfigures the supporting UE (e.g. by using UE Configuration Update procedure or in the next registration procedure) to use the replaced S-NSSAI again by removing the mapping of the replaced S-NSSAI to Alternative S-NSSAI.

If there is an existing PDU Session associated with the Alternative S-NSSAI, the AMF updates the SMF(s) of the PDU Session(s), by Nsmf\_PDUSession\_UpdateSMContext service operation, causing the PDU Session to be transferred to the S-NSSAI. The event trigger in SMF for interacting with PCF is described in clause 6.1.3.5 of TS 23.503 [45].

During a handover procedure, if an S-NSSAI has to be replaced with an Alternative S-NSSAI, the handover procedure (including any PDU session associated with the S-NSSAI to be replaced) shall continue unaffected by the Network Slice Replacement. Any Network Slice Replacement for the S-NSSAI shall not take place during the handover.

During NSSAA re-authentication procedure for an S-NSSAI, if the S-NSSAI has to be replaced with Alternative S-NSSAI, the AMF shall continue with the NSSAA procedure unaffected by the Network Slice Replacement and the AMF executes the Network Slice Replacement after the NSSAA procedure is completed.

*END CHANGE*