**3GPP TSG SA-WG2 Meeting #154AH  *S2-2300871r03***

**Online, 16-20 January 2023 (*revision of*)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.501** | **CR** | **4004** | **rev** | **-** | **Current version:** | **18.0.0** |  |
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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 | **x** | Radio Access Network | **X** | Core Network | **x** |

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| ***Title:***  | Optimizations for the support of time vality policies for a network slice and graceful network slice PDU sessions release. |
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| ***Source to WG:*** | Nokia, Nokia Shanghai Bell, Ericsson, NEC, Apple |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | eNS\_ph3 |  | ***Date:*** | 2023-01-09 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | This CR enables the optimized support of temporary slices, i.e. S-NSSAIs that have a time validity. The RAN impact is limited to an indication to not issue AN-specific signalling to release the PDU session resources to UE when releasing the AN resources for affected PDU sessions of a slice that ceases to be available. |
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| ***Summary of change:*** | Provides the necessary normative text |
| ***--*** |  |
| ***Consequences if not approved:*** | Lack of support of this feature that has been agreed as part of TR 23.700-41 counlcusions for KI#3 |
|  |  |
| ***Clauses affected:*** | 5.15.1, 5.15.x(new), 5.4.4a |
|  |  |
|  | **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**

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5.15.1 General

A Network Slice instance is defined within a PLMN or within an SNPN and shall include:

- the Core Network Control Plane and User Plane Network Functions, as described in clause 4.2,

and, in the serving PLMN, at least one of the following:

- the NG-RAN described in TS 38.300 [27];

- the N3IWF or TNGF functions to the non-3GPP Access Network described in clause 4.2.8.2 or the TWIF functions to the trusted WLAN in the case of support of N5CW devices described in clause 4.2.8.5;

- the W-AGF function to the Wireline Access Network described in clause 4.2.8.4.

The 5G System deployed in a PLMN shall always support the procedures, information and configurations specified to support Network Slice instance selection in the present document, TS 23.502 [3] and TS 23.503 [45].

Network slicing support for roaming is described in clause 5.15.6.

Network slices may differ for supported features and network functions optimisations, in which case such Network Slices may have e.g. different S-NSSAIs with different Slice/Service Types (see clause 5.15.2.1). The operator can deploy multiple Network Slices delivering exactly the same features but for different groups of UEs, e.g. as they deliver a different committed service and/or because they are dedicated to a customer, in which case such Network Slices may have e.g. different S-NSSAIs with the same Slice/Service Type but different Slice Differentiators (see clause 5.15.2.1).

The network may serve a single UE with one or more Network Slice instances simultaneously via a 5G-AN regardless of the access type(s) over which the UE is registered (i.e. 3GPP Access and/or N3GPP Access). The AMF instance serving the UE logically belongs to each of the Network Slice instances serving the UE, i.e. this AMF instance is common to the Network Slice instances serving a UE.

NOTE 1: Number of simultaneous connection of Network Slice instances per UE is limited by the number of S-NSSAIs in the Requested/Allowed NSSAI as described in clause 5.15.2.1.

NOTE 2: In this Release of the specification it is assumed that in any (home or visited) PLMN it is always possible to select an AMF that can serve any combination of S-NSSAIs that will be provided as an Allowed NSSAI.

The selection of the set of Network Slice instances for a UE is triggered by the first contacted AMF in a Registration procedure normally by interacting with the NSSF, and can lead to a change of AMF. This is further described in clause 5.15.5.

A PDU Session belongs to one and only one specific Network Slice instance per PLMN. Different Network Slice instances do not share a PDU Session, though different Network Slice instances may have slice-specific PDU Sessions using the same DNN.

During the Handover procedure the source AMF selects a target AMF by interacting with the NRF as specified in clause 6.3.5.

Network Slice-Specific Authentication and Authorization (NSSAA) enables Network Slice specific authentication as described in clause 5.15.10.

Network Slice Admission Control (NSAC) controls the number of registered UEs per network slice and the number of PDU Sessions per network slice as described in clause 5.15.11.

Support of subscription-based restrictions to simultaneous registration of network slices uses Network Slice Simultaneous Registration Group (NSSRG) information to enable control of which Network Slices that can be registered simultaneously by a UE as described in clause 5.15.12.

Support of data rate limitation per Network Slice for a UE enables enforcement of Maximum Bit Rate per Network Slice for a UE as described in clause 5.15.13.

The selection of N3IWF supporting a set of slice(s) is described in clause 6.3.6.

Support of Optimized handling of temporary network slices is described in clause 5.15.x. It also covers aspects related to graceful release of network slices connectivity during slice decommissioning.

## **More CHANGEs**

### 5.15.x Optimized handling of temporary network slices

A network slice may be available for all UEs or a limited number of UEs only for a limited time that is known at the network in advance e.g. by OAM or subscription. The limited time duration may be due to, for example, the fact that network slice is only temporarily or periodically active in the deployment (e.g. for a limited time to serve an event or a UE may be only authorized to access the network slice for a limited time known in advance), or the network slice is being decommissioned at a known future time. This feature is enabled by S-NSSAI validity time that the network and the UE can handle to reduce the signalling load associated to the transitions in RM and SM states for the network slice.

The UE may indicate its support for temporary network slices in the UE MM Core Network Capability (see clause 5.4.4a) in the Registration Request. The AMF, based on OAM configuration or information received from the UDM or NSSF, may indicate to a supporting UE the validity time for one or more S-NSSAIs in the Configured NSSAI in the Registration Accept message or via the UE Configuration Update procedure. In roaming case, the AMF my include the validity time for an S-NSSAI in the Configured NSSAI either because of limited availability of the VPLMN S-NSSAI or the mapped S-NSSAI of the HPLMN.

NOTE 1: When the validity time changes or a validity time is determined for a S-NSSAI in the configured NSSAI, the PLMN provides the new validity time for the S-NSSAIs in the Configured NSSAI to a supporting UE.

If a supporting UE is configured with validity time for an S-NSSAI:

a) If the validity time indicates the S-NSSAI is available, the UE may request the S-NSSAI in a Requested NSSAI in a Registration request and, if the S-NSSAI is included in the Allowed NSSAI or in the Partially Allowed NSSAI, the UE may establish PDU sessions associated with the S-NSSAI.

b) If the validity time indicates the S-NSSAI is not available and, the UE shall remove the S-NSSAI from the locally stored Configured NSSAI unless the validity time indicates the S-NSSAI is becoming available again, and, if the S-NSSAI is retained in the Configured NSSAI, the UE shall not request the S-NSSAI until the validity time information indicates the S-NSSAI is available. If the S-NSSAI is included in the Allowed NSSAI or Partially Allowed NSSAI, the UE shall remove the S-NSSAI from the locally stored Allowed NSSAI or Partially Allowed NSSAI and the UE shall also locally release any PDU sessions associated with the S-NSSAI. If the validity time indicates that the S-NSSAI will not become available again, the UE shall also remove the S-NSSAI from the locally stored Configured NSSAI.

NOTE 2: Subject to implementation decisions outside 3GPP scope, the UE may also use the validity time information to e.g. attempt to use another PDU sessions to continue supporting the connectivity with a lower precedence connectivity option if possible according to the URSP rules, or, if not possible, e.g. provide implementation-dependent information on the availability of connectivity for specific applications affected by an impending connectivity loss, so the network can let the end user prepare for the loss of connectivity.

For a supporting UE, if validity time applies to an S-NSSAI, an AMF supporting temporary network slices shall:

- If the S-NSSAI is provided in a Requested NSSAI in a Registration Request by the UE and the validity time indicates the S-NSSAI is not available, but it is going to become available again (i.e. the UE is detected as not having up to date validity time), then the AMF sends the Configured NSSAI to the UE including the validity time for the S-NSSAI in the Registration Accept message. If the validity time indicates the S-NSSAI is not available and will not become available again, then the AMF sends the Configured NSSAI to the UE, excluding the S-NSSAI from the Configured NSSAI.

- If the S-NSSAI is in the Allowed NSSAI or the Partially Allowed NSSAI for the UE and the validity time indicates that the S-NSSAI is not available, then locally remove (i.e. without sending any signalling to the UE) the S-NSSAI from the Allowed NSSAI or Partially Allowed NSSAI. If there is any PDU session established for the S-NSSAI, the AMF requests the SMF to release the PDU session:

- If the UE is in CM-CONNECTED state, the AMF releases the PDU session for the S-NSSAI by sending to the SMF, as per step 1f in clause 4.3.4.2 of TS 23.502 [3], a Nsmf\_PDUSession\_UpdateSMContext Request with a release indication to request the release of the PDU Session and then the AMF forwards the N2 SM request to release the AN resources associated with the PDU session with an indication to not generate any AN-specific signalling exchange(s) with the UE to release the corresponding AN resources.

- If the UE is in CM-IDLE state, the AMF locally releases the PDU session without paging the UE and causes the SMF to locally release the SM context for the UE by a Nsmf\_PDUSession\_ReleaseSMContext , as per step 1c in clause 4.3.4.2 of TS 23.502 [3]. The PDU Session status is synchronized at next time when the UE connects to the network.

For a non-supporting UE, if validity time applies to an S-NSSAI, an AMF supporting temporary network slices shall:

- If the validity time indicates the S-NSSAI is available, allow or partially allow the network slice when requested, establish PDU sessions when requested.

- If the S-NSSAI is provided in a Requested NSSAI in a Registration Request by the UE and the validity time indicates the S-NSSAI is not available, reject the registration and remove the S-NSSAI from the Configured NSSAI by providing an updated Configured NSSAI in the Registration Accept message.

- If the S-NSSAI is in the UE in the Allowed NSSAI or Partially Allowed NSSAI and the validity time indicates the S-NSSAI is not available, remove the S-NSSAI from the Configured NSSAI and the Allowed NSSAI or Partially Allowed NSSAI by a UE Configuration Update procedure. If there is any PDU session established for the S-NSSAI, the AMF requests the SMF to release the PDU session in the network:

- If the UE is in CM-CONNECTED state, the AMF releases the PDU session for the S-NSSAI by sending to the SMF, as per step 1f in clause 4.3.4.2 of TS 23.502 [3] , a Nsmf\_PDUSession\_UpdateSMContext Request with a release indication to request the release of the PDU Session and then the AMF forwards the N2 SM request to release the AN resources associated with the PDU session with an indication to not generate any AN-specific signalling exchange(s) with the UE to release the corresponding AN resources.

- If the UE is in CM-IDLE, the AMF locally releases the PDU session without paging the UE and causes the SMF to locally release the SM context for the UE by a Nsmf\_PDUSession\_ReleaseSMContext , as per step 1c in clause 4.3.4.2 of TS 23.502 [3]. The PDU Session status is synchronized at next time when the UE connects to the network

NOTE 3: If the network slice becomes unavailable, and a large number of UEs are impacted, the AMF can send the updated information to the non-supporting UEs in a manner that avoids surge in signalling (e.g next time the UE becomes connected).

- If the AMF detects from the validity time of a S-NSSAI that it is available again, then update the Configured NSSAI to include the S-NSSAI via a UE Configuration Update procedure.

NOTE 4: The AMF, for the case of UE not performing any actions despite the validity timing information provided by the network, can terminate PDU Session(s) associated with S-NSSAI subject to be terminated according to the validity time by explicitly releasing the PDU Sessions associated with the S-NSSAI.

## **MORE CHANGES**

### 5.4.4a UE MM Core Network Capability handling

The UE MM Core Network Capability is split into the S1 UE network capability (mostly for E-UTRAN access related core network parameters) and the UE 5GMM Core Network Capability (mostly to include other UE capabilities related to 5GCN or interworking with EPS) as defined in TS 24.501 [47] and contains non radio-related capabilities, e.g. the NAS security algorithms, etc. The S1 UE network capability is transferred between all CN nodes at AMF to AMF, AMF to MME, MME to MME, and MME to AMF changes. The UE 5GMM Core Network Capability is transferred only at AMF to AMF changes.

In order to ensure that the UE MM Core Network Capability information stored in the AMF is up to date (e.g. to handle the situation when the USIM is moved into a different device while out of coverage, and the old device did not send the Detach message; and the cases of inter-RAT Registration Area Update), the UE shall send the UE MM Core Network Capability information to the AMF during the Initial Registration and Mobility Registration Update procedure within the NAS message.

The AMF shall store always the latest UE MM Core Network Capability received from the UE. Any UE MM Core Network Capability that an AMF receives from an old AMF/MME is replaced when the UE provides the UE MM Core Network Capability with Registration signalling.

If the UE's UE MM Core Network Capability information changes (in either CM-CONNECTED or in CM-IDLE state), the UE shall perform a Mobility Registration Update procedure when it next returns to NG-RAN coverage. See clause 4.2.2 of TS 23.502 [3].

The UE shall indicate in the UE 5GMM Core Network Capability if the UE supports:

- Attach in EPC with Request type "Handover" in PDN CONNECTIVITY Request message (clause 5.3.2.1 of TS 23.401 [26]).

- EPC NAS.

- SMS over NAS.

- LCS.

- 5G SRVCC from NG-RAN to UTRAN, as specified in TS 23.216 [88].

- Radio Capabilities Signalling optimisation (RACS).

- Network Slice-Specific Authentication and Authorization.

- Parameters in Supported Network Behaviour for 5G CIoT as described in clause 5.31.2.

- Receiving WUS Assistance Information (E-UTRA) see clause 5.4.9..

- Paging Subgrouping Support Indication (NR) see clause 5.4.12.

- CAG, see clause 5.30.3.3.

- Subscription-based restrictions to simultaneous registration of network slices (see clause 5.15.12).

- Support of NSAG (see clause 5.15.14).

- Minimization of Service Interruption (MINT), as described in clause 5.40.

- Equivalent SNPNs (see clause 5.30.2.11).

- Unavailability Period, as described in clause 5.4.1.4.

- Temporary network slices (see clause 5.15.x).

If a UE operating two or more USIMs, supports and intends to use one or more Multi-USIM features (see clause 5.38) in a PLMN for a USIM, it shall indicate in the UE 5GMM Core Network Capability for this USIM in this PLMN that it supports these one or more Multi-USIM features with the following indications:

- Connection Release Supported.

- Paging Cause Indication for Voice Service Supported.

- Reject Paging Request Supported.

- Paging Restriction Supported.

Otherwise, the UE with the capabilities of Multi-USIM features but does not intend to use them shall not indicate support of these one or more Multi-USIM features.

A UE not operating two or more USIMs shall indicate the Multi-USIM features are not supported.

NOTE: It is not necessary for a UE operating two or more USIMs to use Multi-USIM features with all USIMs.

## **END of CHANGES**