**3GPP TSG-WG SA2 Meeting #164S2-2xxxxx**

**Maastricht, NL, 19th Aug – 23rd Aug, 2024 (revision of S2-240xxxx)**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.502** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **19.0.0** |  |
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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:*** | MWAB authorization | | | | | | | | | |
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| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | VMR\_Ph2 | | | | |  | ***Date:*** | | | 2024-08-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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:*** | | Based on the KI#2 conclusion of TR 23.700-06 v0.4.0, it is proposed to capture the descriptions of MWAB authorization into TS 23.502. | | | | | | | | |
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| ***Summary of change:*** | | MWAB authorization | | | | | | | | |
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| ***Consequences if not approved:*** | | The feature of MWAB defined in TR 23.700-06 is not implemented in TS 23.502. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.2.2.2.2, 4.2.2.3.3, 4.2.4.2, 4.3.2, 4.3.4.2, 5.2.3.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 \* \* \* \*

##### 4.2.2.2.2 General Registration



Figure 4.2.2.2.2-1: Registration procedure

1. UE to (R)AN: AN message (AN parameters, Registration Request (Registration type, SUCI or 5G-GUTI or PEI, [last visited TAI (if available)], Security parameters, [Requested NSSAI], [Mapping Of Requested NSSAI], [Default Configured NSSAI Indication], [UE Radio Capability Update], [UE MM Core Network Capability], [PDU Session status], [List Of PDU Sessions To Be Activated], [Follow-on request], [MICO Indication], [Requested Active Time], [Requested DRX parameters for E-UTRA and NR], [Requested DRX parameters for NB-IoT], [extended idle mode DRX parameters], [LADN DNN(s) or Indicator Of Requesting LADN Information], [NAS message container], [Support for restriction of use of Enhanced Coverage], [Preferred Network Behaviour], [UE paging probability information], [Paging Subgrouping Support Indication], [UE Policy Container (the list of PSIs, indication of UE support for ANDSP, the operating system identifier, Indication of URSP Provisioning Support in EPS, UE capability of reporting URSP rule enforcement to network, UE capability of supporting VPLMN-specific URSP rules)] and [UE Radio Capability ID], [Release Request indication], [Paging Restriction Information], PEI, [PLMN with Disaster Condition], [Requested Periodic Update time], [Unavailability Period Duration], [Start of Unavailability Period], [Unavailability Type])).

NOTE 1: The UE Policy Container and its usage is defined in TS 23.503 [20].

In the case of NG-RAN, the AN parameters include e.g. 5G-S-TMSI or GUAMI, the Selected PLMN ID (or PLMN ID and NID, see clause 5.30 of TS 23.501 [2]) and NSSAI information, the AN parameters also include Establishment cause. The Establishment cause provides the reason for requesting the establishment of an RRC connection. Whether and how the UE includes the NSSAI information as part of the AN parameters is dependent on the value of the Access Stratum Connection Establishment NSSAI Inclusion Mode parameter, as specified in clause 5.15.9 of TS 23.501 [2].

The AN parameters shall also include an IAB-Indication if the UE is an IAB-node accessing 5GS.

The AN parameters shall also include a MBSR Indication if the UE is part of an MBSR node accessing 5GS attempting MBSR operation in the PLMN as specified in clause 5.35A.1 of TS 23.501 [2].

The Registration type indicates if the UE wants to perform an Initial Registration (i.e. the UE is in RM-DEREGISTERED state), a Mobility Registration Update (i.e. the UE is in RM-REGISTERED state and initiates a Registration procedure due to mobility or due to the UE needs to update its capabilities or protocol parameters, or to request a change of the set of network slices it is allowed to use), a Periodic Registration Update (i.e. the UE is in RM-REGISTERED state and initiates a Registration procedure due to the Periodic Registration Update timer expiry, see clause 4.2.2.2.1), an Emergency Registration (i.e. the UE is in limited service state), a Disaster Roaming Initial Registration, or a Disaster Roaming Mobility Registration Update.

When the UE is using E-UTRA, the UE indicates its support of CIoT 5GS Optimisations, which is relevant for the AMF selection, in the RRC connection establishment signalling associated with the Registration Request.

When the UE is performing an Initial Registration or a Disaster Roaming Registration the UE shall indicate its UE identity in the Registration Request message as follows, listed in decreasing order of preference in the case of registration with a PLMN:

i) a 5G-GUTI mapped from an EPS GUTI, if the UE has a valid EPS GUTI.

ii) a native 5G-GUTI assigned by the PLMN to which the UE is attempting to register, if available;

iii) a native 5G-GUTI assigned by an equivalent PLMN to the PLMN to which the UE is attempting to register, if available;

iv) a native 5G-GUTI assigned by any other PLMN, if available; or

NOTE 2: This can also be a 5G-GUTIs assigned via another access type.

v) Otherwise, the UE shall include its SUCI in the Registration Request as defined in TS 33.501 [15].

If the UE is registering with an SNPN, when the UE is performing an Initial Registration the UE shall indicate its UE identity in the Registration Request message as follows, listed in decreasing order of preference:

i) a native 5G-GUTI assigned by the same SNPN to which the UE is attempting to register, if available;

ii) a native 5G-GUTI assigned by an equivalent SNPN to the SNPN to which the UE is attempting to register along with the NID of the SNPN that assigned the 5G-GUTI, if available;

iii) a native 5G-GUTI assigned by any other SNPN along with the NID of the SNPN that assigned the 5G-GUTI, if available; or

iv) Otherwise, the UE shall include its SUCI in the Registration Request as defined in TS 33.501 [15].

When the UE performing an Initial Registration has both a valid EPS GUTI and a native 5G-GUTI, the UE shall also indicate the native 5G-GUTI as Additional GUTI. If more than one native 5G-GUTIs are available, the UE shall select the 5G-GUTI in decreasing order of preference among items (ii)-(iv) in the list above.

The NAS message container shall be included if the UE is sending a Registration Request message as an Initial NAS message and the UE has a valid 5G NAS security context and the UE needs to send non-cleartext IEs, see clause 4.4.6 of TS 24.501 [25]. If the UE does not need to send non-cleartext IEs, the UE shall send a Registration Request message without including the NAS message container.

If the UE does not have a valid 5G NAS security context, the UE shall send the Registration Request message without including the NAS message container. The UE shall include the entire Registration Request message (i.e. containing cleartext IEs and non-cleartext IEs) in the NAS message container that is sent as part of the Security Mode Complete message in step 9b.

When the UE is performing an Initial Registration (i.e. the UE is in RM-DEREGISTERED state) with a native 5G-GUTI then the UE shall indicate the related GUAMI information in the AN parameters. When the UE is performing an Initial Registration with its SUCI, the UE shall not indicate any GUAMI information in the AN parameters.

When the UE is performing an Initial Registration or a Mobility Registration and if CIoT 5GS Optimisations are supported the UE shall indicate its Preferred Network Behaviour (see clause 5.31.2 of TS 23.501 [2]). If S1 mode is supported the UE's EPC Preferred Network Behaviour is included in the S1 UE network capabilities in the Registration Request message, see clause 8.2.6.1 of TS 24.501 [25].

For an Emergency Registration, the SUCI shall be included if the UE does not have a valid 5G-GUTI available; the PEI shall be included when the UE has no SUPI and no valid 5G-GUTI. In other cases, the 5G-GUTI is included and it indicates the last serving AMF.

The UE may provide the UE's usage setting based on its configuration as defined in clause 5.16.3.7 of TS 23.501 [2]. The UE provides Requested NSSAI (as described in clause 5.15.5.2.1 of TS 23.501 [2] and if the UE supports the subscription-based restrictions to simultaneous registration of network slices, also taking into account the NSSRG Information constraints as described in clause 5.15.12 of TS 23.501 [2] and in the case of Initial Registration or Mobility Registration Update, the UE includes the Mapping Of Requested NSSAI (if available), which is the mapping of each S-NSSAI of the Requested NSSAI to the HPLMN S-NSSAIs, to ensure that the network is able to verify whether the S-NSSAI(s) in the Requested NSSAI are permitted based on the Subscribed S-NSSAIs. If the Network Slice Replacement is used and the UE is configured with Mapping Of Alternative NSSAI, the Requested NSSAI may include Alternative S-NSSAI(s). If the AMF determines that S-NSSAI(s) that the UE requests are not Alternative S-NSSAI(s) in the UE context and not Subscribed S-NSSAIs, the AMF determines to update the UE configuration as described in clause 5.15.19 of TS 23.501 [2]. In the case of inter PLMN mobility, if the serving PLMN S-NSSAI(s) corresponding to the established PDU Session(s) are not present in the UE, the associated HPLMN S-NSSAI(s) associated with the established PDU Session(s) shall be provided in the Mapping Of Requested NSSAI as described in clause 5.15.5.2.1 TS 23.501 [2]. If the UEs supports reconnection to the network due to RAN timing synchronization status change as described in TS 23.501 [2], the UE indicates the support of this capability to the network. If the UE supports UE configuration of network-controlled Slice Usage Policy and the UE stores Slice Usage Policy, the UE shall include an on demand S-NSSAI in the Requested NSSAI only when applications in the UE require data transmission by a PDU session associated with the on demand S-NSSAI as described in clause 5.15.15 of TS 23.501 [2].

The UE includes the Default Configured NSSAI Indication if the UE is using a Default Configured NSSAI, as defined in TS 23.501 [2].

The UE may include UE paging probability information if it supports the assignment of WUS Assistance Information or AMF PEIPS Assistance Information from the AMF (see TS 23.501 [2]).

The UE may include Paging Subgrouping Support Indication as defined in TS 23.501 [2].

In the case of Mobility Registration Update, the UE includes in the List Of PDU Sessions To Be Activated the PDU Sessions for which there are pending uplink data. When the UE includes the List Of PDU Sessions To Be Activated, the UE shall indicate PDU Sessions only associated with the access the Registration Request is related to. As defined in TS 24.501 [25] the UE shall include always-on PDU Sessions which are accepted by the network in the List Of PDU Sessions To Be Activated even if there are no pending uplink data for those PDU Sessions.

NOTE 3: A PDU Session corresponding to a LADN is not included in the List Of PDU Sessions To Be Activated when the UE is outside the area of availability of the LADN.

The UE MM Core Network Capability is provided by the UE and handled by AMF as defined in clause 5.4.4a of TS 23.501 [2]. The UE includes in the UE MM Core Network Capability an indication if it supports Request Type flag "handover" for PDN connectivity request during the attach procedure as defined in clause 5.17.2.3.1 of TS 23.501 [2]. If the UE supports 'Strictly Periodic Registration Timer Indication', the UE indicates its capability of 'Strictly Periodic Registration Timer Indication' in the MICO Indication. If the UE supports CAG, the UE indicates its capability of "CAG supported" in the UE MM Core Network Capability. If the UE operating two or more USIMs, supports and intends to use one or more Multi-USIM feature(s), the UE indicates one or more Multi-USIM specific features described in clause 5.38 of TS 23.501 [2] in the UE MM Core Network Capability. If the UE supports equivalent SNPNs, the UE indicates its capability of "equivalent SNPNs" in the UE MM Core Network Capability. If the UE supports Unavailability Period, the UE indicates its capability of "Unavailability Period Support" in the UE MM Core Network Capability. If the UE supports LADN per DNN and S-NSSAI, the UE indicates its support of LADN per DNN and S-NSSAI in the UE MM Core Network Capability. If the UE supports the Network Slice Replacement feature, the UE indicates support for Network Slice Replacement feature as described in clause 5.15.19 of TS 23.501 [2]. If the UE supports UE configuration of network-controlled Slice Usage Policy, the UE indicates its capability of "UE Configuration of network-controlled Slice Usage Policy" in the UE MM Core Network Capability as described in clause 5.15.15 of TS 23.501 [2].

The UE may provide either the LADN DNN(s) or an Indication Of Requesting LADN Information as described in clause 5.6.5 of TS 23.501 [2].

If available, the last visited TAI shall be included in order to help the AMF produce Registration Area for the UE.

NOTE 4: With NR satellite access, the last visited TAI is determined as specified in clause 5.4.11.6 of TS 23.501 [2].

The Security parameters are used for Authentication and integrity protection, see TS 33.501 [15]. Requested NSSAI indicates the Network Slice Selection Assistance Information (as defined in clause 5.15 of TS 23.501 [2]). The PDU Session status indicates the previously established PDU Sessions in the UE. When the UE is connected to the two AMFs belonging to different PLMN via 3GPP access and non-3GPP access then the PDU Session status indicates the established PDU Session of the current PLMN in the UE.

The Follow-on request is included when the UE has pending uplink signalling and the UE doesn't include List Of PDU Sessions To Be Activated, or the Registration type indicates the UE wants to perform an Emergency Registration. In Initial Registration and Mobility Registration Update, UE provides the UE Requested DRX parameters, as defined in clause 5.4.5 of TS 23.501 [2]. The UE may provide the extended idle mode DRX parameters as defined in clause 5.31.7.2 of TS 23.501 [2] to request extended idle mode DRX.

The UE provides UE Radio Capability Update indication as described in TS 23.501 [2].

The UE includes the MICO Indication and optionally a Requested Active Time value and Requested Periodic Update time value if the UE wants to use MICO Mode with Active Time.

For a UE using NR satellite access that provides discontinuous coverage or an event is triggered in the UE that would make the UE unavailable for a certain period of time, the UE may include an Unavailability Type, an Unavailability Period Duration and/or Start of Unavailability Period as described in clause 5.4.13.1 of TS 23.501 [2].

The UE may indicate its Service Gap Control Capability in the UE MM Core Network Capability, see clause 5.31.16 of TS 23.501 [2].

For a UE with a running Service Gap timer in the UE, the UE shall not set Follow-on Request indication or Uplink data status in the Registration Request message (see clause 5.31.16 of TS 23.501 [2]), except for network access for regulatory prioritized services like Emergency services or exception reporting.

If UE supports RACS and has been assigned UE Radio Capability ID(s), the UE shall indicate a UE Radio Capability ID as defined in clause 5.4.4.1a of TS 23.501 [2] as non-cleartext IE.

The PEI may be retrieved in initial registration from the UE as described in clause 4.2.2.2.1.

If a UE supports the subscription-based restrictions to simultaneous registration of network slices feature, it includes the NSSRG handling support indication in the UE 5GMM Core Network Capability according to clause 5.15.12 of TS 23.501 [2]. The AMF stores whether the UE supports this feature in the UE context.

If a UE supports the temporary available network slices feature, it includes the indication of support for temporary available network slices in the UE 5GMM Network Capability according to clause 5.15.16 of TS 23.501 [2].

When a Multi-USIM UE wants to enter CM-IDLE state immediately e.g. after having performed mobility or periodic registration, it includes the Release Request indication and optionally provides Paging Restriction Information.

When the UE is performing a Disaster Roaming Registration, the UE may indicate the PLMN with Disaster Condition for the cases as defined in TS 24.501 [25].

When the MWAB-UE is performing a Registration, The MWAB-UE provides dedicated S-NSSAI(s) in the Requested NSSAI to indicate the intention for MWAB operation as described in clause 5.X of the TS 23.501 [2].2. If a 5G-S-TMSI or GUAMI is not included or the 5G-S-TMSI or GUAMI does not indicate a valid AMF the (R)AN, based on (R)AT and Requested NSSAI, if available, selects an AMF

The (R)AN selects an AMF as described in clause 6.3.5 of TS 23.501 [2]. If UE is in CM-CONNECTED state, the (R)AN can forward the Registration Request message to the AMF based on the N2 connection of the UE.

If the (R)AN cannot select an appropriate AMF, it forwards the Registration Request to an AMF which has been configured, in (R)AN, to perform AMF selection.

3. (R)AN to new AMF: N2 message (N2 parameters, Registration Request (as described in step 1) and [LTE-M Indication].

When NG-RAN is used, the N2 parameters include the Selected PLMN ID (or PLMN ID and NID, see clause 5.30 of TS 23.501 [2]), Location Information and Cell Identity related to the cell in which the UE is camping, UE Context Request which indicates that a UE context including security information needs to be setup at the NG-RAN.

When NG-RAN is used, the N2 parameters shall also include the Establishment cause and IAB-Indication or MBSR Indication if the indication is received in AN parameters in step 1.

Mapping Of Requested NSSAI is provided only if available.

If the Registration type indicated by the UE is Periodic Registration Update, then steps 4 to 19 may be omitted.

When the Establishment cause is associated with priority services (e.g. MPS, MCS), the AMF includes a Message Priority header to indicate priority information. Other NFs relay the priority information by including the Message Priority header in service-based interfaces, as specified in TS 29.500 [17].

The RAT Type the UE is using is determined (see clause 4.2.2.2.1) and based on it the AMF determines whether the UE is performing Inter-RAT mobility to or from NB-IoT. If the AMF receives the LTE M indication, then it considers that the RAT Type is LTE-M and stores the LTE-M Indication in UE Context.

If a UE includes a Preferred Network Behaviour, this defines the Network Behaviour the UE supports and is expecting to be available in the network as defined in clause 5.31.2 of TS 23.501 [2].

If the UE has included the Preferred Network Behaviour and what the UE indicated it supports in Preferred Network Behaviour is incompatible with the network support, the AMF shall reject the Registration Request with an appropriate cause value (e.g. one that avoids retries on this PLMN).

If there is a Service Gap timer running in the UE Context in AMF for the UE and Follow-on Request indication or Uplink data status is included in the Registration Request message, the AMF shall ignore the Follow-on Request indication and Uplink data status and not perform any of the actions related to the status.

If the UE has included a UE Radio Capability ID in step 1 and the AMF supports RACS, the AMF stores the Radio Capability ID in UE context.

For NR satellite access, the AMF may verify the UE location and determine whether the PLMN is allowed to operate at the UE location, as described in clause 5.4.11.4 of TS 23.501 [2]. If the UE receives a Registration Reject message with cause value indicating that the PLMN is not allowed to operate at the present UE location, the UE shall attempt to select a PLMN as specified in TS 23.122 [22].

For a Disaster Roaming Registration, based on the ULI (including Cell ID) received from the NG-RAN, the PLMN with Disaster Condition derived from the UE's 5G-GUTI, derived from the UE's SUCI or indicated by the UE and the local configuration, the AMF determines if Disaster Roaming service can be provided. If the current location is not subject to Disaster Roaming service or the Disaster Roaming service is not provided to the PLMN with Disaster Condition derived from the UE's 5G-GUTI, derived from the UE's SUCI or indicated by UE, then the AMF should reject the Registration Request indicating a suitable Cause value.

4. [Conditional] new AMF to old AMF: Namf\_Communication\_UEContextTransfer (complete Registration Request) or new AMF to UDSF: Nudsf\_Unstructured Data Management\_Query().

The new AMF determines the old AMF using the UE's 5G-GUTI. If the new AMF received an NID in the Registration request, it determines that the 5G-GUTI was assigned by an SNPN and determines the old AMF using the 5G-GUTI and NID of the SNPN.

(With UDSF Deployment): If the UE's 5G-GUTI was included in the Registration Request and the serving AMF has changed since last Registration procedure, new AMF and old AMF are in the same AMF Set and UDSF is deployed, the new AMF retrieves the stored UE's SUPI and UE context directly from the UDSF using Nudsf\_UnstructuredDataManagement\_Query service operation or they can share stored UE context via implementation specific means if UDSF is not deployed. This includes also event subscription information by each NF consumer for the given UE. In this case, the new AMF uses integrity protected complete Registration request NAS message to perform and verify integrity protection.

(Without UDSF Deployment): If the UE's 5G-GUTI was included in the Registration Request and the serving AMF has changed since last Registration procedure, the new AMF may invoke the Namf\_Communication\_UEContextTransfer service operation on the old AMF including the complete Registration Request NAS message, which may be integrity protected, as well as the Access Type, to request the UE's SUPI and UE Context. See clause 5.2.2.2.2 for details of this service operation. In this case, the old AMF uses either 5G-GUTI and the integrity protected complete Registration request NAS message, or the SUPI and an indication that the UE is validated from the new AMF, to verify integrity protection if the context transfer service operation invocation corresponds to the UE requested. The old AMF also transfers the event subscriptions information by each NF consumer, for the UE, to the new AMF. If the old AMF has not yet reported a non-zero MO Exception Data Counter to the (H-)SMF, the Context Response also includes the MO Exception Data Counter.

If the old AMF has PDU Sessions for another access type (different from the Access Type indicated in this step) and if the old AMF determines that there is no possibility for relocating the N2 interface to the new AMF, the old AMF returns UE's SUPI and indicates that the Registration Request has been validated for integrity protection, but does not include the rest of the UE context.

For inter PLMN mobility, UE Context information includes HPLMN S-NSSAIs corresponding to the Allowed NSSAI for each Access Type and Partially Allowed NSSAI, without Allowed NSSAI and Partially Allowed NSSAI of old PLMN.

NOTE 5: The new AMF Sets the indication that the UE is validated according to step 9a, if the new AMF has performed successful UE authentication after previous integrity check failure in the old AMF.

NOTE 6: The NF consumers do not need to subscribe for the events once again with the new AMF after the UE is successfully registered with the new AMF.

If the new AMF has already received UE contexts from the old AMF during handover procedure, then step 4,5 and 10 shall be skipped.

For an Emergency Registration, if the UE identifies itself with a 5G-GUTI that is not known to the AMF, steps 4 and 5 are skipped and the AMF immediately requests the SUPI from the UE. If the UE identifies itself with PEI, the SUPI request shall be skipped. Allowing Emergency Registration without a user identity is dependent on local regulations.

5. [Conditional] old AMF to new AMF: Response to Namf\_Communication\_UEContextTransfer (SUPI, UE Context in AMF (as per Table 5.2.2.2.2-1)) or UDSF to new AMF: Nudsf\_Unstructured Data Management\_Query(). The old AMF may start an implementation specific (guard) timer for the UE context.

If the UDSF was queried in step 4, the UDSF responds to the new AMF for the Nudsf\_Unstructured Data Management\_Query invocation with the related contexts including established PDU Sessions, the old AMF includes SMF information DNN, S-NSSAI(s) and PDU Session ID, active NGAP UE-TNLA bindings to N3IWF/TNGF/W-AGF, the old AMF includes information about the NGAP UE-TNLA bindings. If the Old AMF was queried in step 4, Old AMF responds to the new AMF for the Namf\_Communication\_UEContextTransfer invocation by including the UE's SUPI and UE Context.

If old AMF holds information about established PDU Session(s) and it is not an Initial Registration, the old AMF includes SMF information, DNN(s), S-NSSAI(s) and PDU Session ID(s).

If old AMF holds UE context established via N3IWF, W-AGF or TNGF, the old AMF includes the CM state via N3IWF, W-AGF or TNGF. If the UE is in CM-CONNECTED state via N3IWF, W-AGF or TNGF, the old AMF includes information about the NGAP UE-TNLA bindings.

If old AMF fails the integrity check of the Registration Request NAS message, the old AMF shall indicate the integrity check failure. If the new AMF is configured to allow emergency services for unauthenticated UE, the new AMF behaves as follows:

- If the UE has only an emergency PDU Session, the AMF either skips the authentication and security procedure or accepts that the authentication may fail and continues the Mobility Registration Update procedure; or

- If the UE has both emergency and non emergency PDU Sessions and authentication fails, the AMF continues the Mobility Registration Update procedure and deactivates all the non-emergency PDU Sessions as specified in clause 4.3.4.2.

NOTE 7: The new AMF can determine if a PDU Session is used for emergency service by checking whether the DNN matches the emergency DNN.

If old AMF holds information about AM Policy Association and the information about UE Policy Association (i.e. the Policy Control Request Trigger for updating UE Policy as defined in TS 23.503 [20]), the old AMF includes the information about the AM Policy Association, the UE Policy Association and PCF ID. In the roaming case, V-PCF ID and H-PCF ID are included.

If old AMF was a consumer of UE related NWDAF services, the old AMF includes information about active analytics subscriptions, i.e. the Subscription Correlation ID, NWDAF identifier (i.e. Instance ID or Set ID), Analytics ID(s) and associated Analytics specific data in the Namf\_Communication\_UEContextTransfer response. Usage of the analytics information by the new AMF is specified in TS 23.288 [50].

During inter PLMN mobility, the handling of the UE Radio Capability ID in the new AMF is as defined in TS 23.501 [2].

NOTE 8: When new AMF uses UDSF for context retrieval, interactions between old AMF, new AMF and UDSF due to UE signalling on old AMF at the same time is implementation issue.

6. [Conditional] new AMF to UE: Identity Request ().

If the SUCI is not provided by the UE nor retrieved from the old AMF the Identity Request procedure is initiated by AMF sending an Identity Request message to the UE requesting the SUCI.

7. [Conditional] UE to new AMF: Identity Response ().

The UE responds with an Identity Response message including the SUCI. The UE derives the SUCI by using the provisioned public key of the HPLMN, as specified in TS 33.501 [15].

8. The AMF may decide to initiate UE authentication by invoking an AUSF. In that case, the AMF selects an AUSF based on SUPI or SUCI, as described in clause 6.3.4 of TS 23.501 [2].

If the AMF is configured to support Emergency Registration for unauthenticated SUPIs and the UE indicated Registration type Emergency Registration, the AMF skips the authentication or the AMF accepts that the authentication may fail and continues the Registration procedure.

9a. If authentication is required, the AMF requests it from the AUSF; if Tracing Requirements about the UE are available at the AMF, the AMF provides Tracing Requirements in its request to AUSF. For a Disaster Roaming Registration, the AMF may provide the indication of Disaster Roaming service in its request to AUSF. Upon request from the AMF, the AUSF shall execute authentication of the UE. The authentication is performed as described in TS 33.501 [15]. The AUSF selects a UDM as described in clause 6.3.8 of TS 23.501 [2] and gets the authentication data from UDM.

The AUSF may provide the indication of Disaster Roaming service to UDM if the indication is received from AMF. For a Disaster Roaming Registration, the AUSF executes authentication of the UE based on the local policy and/or local configuration as specified in clause 5.40.4 of TS 23.501 [2] and in TS 33.501 [15].

Once the UE has been authenticated the AUSF provides relevant security related information to the AMF. If the AMF provided a SUCI to AUSF, the AUSF shall return the SUPI to AMF only after the authentication is successful.

After successful authentication in new AMF, which is triggered by the integrity check failure in old AMF at step 5, the new AMF invokes step 4 above again and indicates that the UE is validated (i.e. through the reason parameter as specified in clause 5.2.2.2.2).

9b If NAS security context does not exist, the NAS security initiation is performed as described in TS 33.501 [15]. If the UE had no NAS security context in step 1, the UE includes the full Registration Request message as defined in TS 24.501 [25].

The AMF decides if the Registration Request needs to be rerouted as described in clause 4.2.2.2.3, where the initial AMF refers to the AMF.

9c. The AMF initiates NGAP procedure to provide the 5G-AN with security context as specified in TS 38.413 [10] if the 5G-AN had requested for UE Context. Also, if the AMF decides that EPS fallback is supported (e.g. based on UE capability to support Request Type flag "handover" for PDN connectivity request during the attach procedure as defined in clause 5.17.2.3.1 of TS 23.501 [2], subscription data and local policy), the AMF shall send an indication "Redirection for EPS fallback for voice is possible" towards 5G-AN as specified in TS 38.413 [10]. Otherwise, the AMF indicates "Redirection for EPS fallback for voice is not possible". In addition, if Tracing Requirements about the UE are available at the AMF, the AMF provides the 5G-AN with Tracing Requirements in the NGAP procedure. If QMC Configuration information is available at the AMF, the AMF provides the 5G-AN with QMC Configuration information in the NGAP procedure.

9d. The 5G-AN stores the security context and acknowledges to the AMF. The 5G-AN uses the security context to protect the messages exchanged with the UE as described in TS 33.501 [15].

10. [Conditional] new AMF to old AMF: Namf\_Communication\_RegistrationStatusUpdate (PDU Session ID(s) to be released e.g. due to slice not supported).

If the AMF has changed the new AMF informs the old AMF that the registration of the UE in the new AMF is completed by invoking the Namf\_Communication\_RegistrationStatusUpdate service operation.

If the authentication/security procedure fails, then the Registration shall be rejected and the new AMF invokes the Namf\_Communication\_RegistrationStatusUpdate service operation with a reject indication towards the old AMF. The old AMF continues as if the UE context transfer service operation was never received.

The new AMF determines the PDU Session(s) that cannot be supported in the new Registration Area in the cases below:

- If one or more of the S-NSSAIs used in the old Registration Area cannot be served in the target Registration Area.

- When continuity of the PDU Session(s) cannot be supported between networks (e.g. SNPN-SNPN mobility, inter-PLMN mobility where no HR agreement exists).

If any of the cases is met, the new AMF invokes the Namf\_Communication\_RegistrationStatusUpdate service operation including the rejected PDU Session ID towards the old AMF. Then the new AMF modifies the PDU Session Status correspondingly. The old AMF informs the corresponding SMF(s) to locally release the UE's SM context by invoking the Nsmf\_PDUSession\_ReleaseSMContext service operation.

If new AMF received in the UE context transfer in step 5 the information about the AM Policy Association and the UE Policy Association and decides, based on local policies, not to use the PCF(s) identified by the PCF ID(s) for the AM Policy Association and the UE Policy Association, then it will inform the old AMF that the AM Policy Association and the UE Policy Association in the UE context is not used any longer and then the PCF selection is performed in step 15.

If the new AMF received in the UE context transfer in step 5 the information about UE related analytics subscription(s), the new AMF may take over the analytics subscription(s) from the old AMF. Otherwise, if the new AMF instead determines to create new analytics subscription(s), it informs the old AMF about the analytics subscriptions (identified by their Subscription Correlation ID) that are not needed any longer and the old AMF may now unsubscribe those NWDAF analytics subscriptions for the UE according to TS 23.288 [50].

11. [Conditional] new AMF to UE: Identity Request/Response (PEI).

If the PEI was not provided by the UE nor retrieved from the old AMF the Identity Request procedure is initiated by AMF sending an Identity Request message to the UE to retrieve the PEI. The PEI shall be transferred encrypted unless the UE performs Emergency Registration and cannot be authenticated.

For an Emergency Registration, the UE may have included the PEI in the Registration Request. If so, the PEI retrieval is skipped.

If the UE supports RACS as indicated in UE MM Core Network Capability, the AMF shall use the PEI of the UE to obtain the IMEI/TAC for the purpose of RACS operation.

12. Optionally the new AMF initiates ME identity check by invoking the N5g-eir\_EquipmentIdentityCheck\_Get service operation (see clause 5.2.4.2.2).

The PEI check is performed as described in clause 4.7.

For an Emergency Registration, if the PEI is blocked, operator policies determine whether the Emergency Registration procedure continues or is stopped.

13. If step 14 is to be performed, the new AMF, based on the SUPI, selects a UDM, then UDM may select a UDR instance. See clause 6.3.9 of TS 23.501 [2].

The AMF selects a UDM as described in clause 6.3.8 of TS 23.501 [2].

14a-c. If the AMF has changed since the last Registration procedure, if UE Registration type is Initial Registration or Emergency Registration, or if the UE provides a SUPI which does not refer to a valid context in the AMF, or if the UE registers to the same AMF it has already registered to a non-3GPP access (i.e. the UE is registered over a non-3GPP access and initiates this Registration procedure to add a 3GPP access), the new AMF registers with the UDM using Nudm\_UECM\_Registration for the access to be registered (and subscribes to be notified when the UDM deregisters this AMF). The UDM based on the "Registration Type" in the Nudm\_UECM\_Registration request, can act on SoR information according to TS 23.122 [22]. In this case, if the AMF does not have event exposure subscription information for this UE, the AMF indicates it to UDM. Then, if the UDM has existing applicable event exposure subscriptions for events detected in AMF for this UE or for any of the groups this UE belongs to (possibly retrieved from UDR), UDM invokes the Namf\_EventExposure\_Subscribe service for recreating the event exposure subscriptions.

The AMF provides the "Homogenous Support of IMS Voice over PS Sessions" indication (see clause 5.16.3.3 of TS 23.501 [2]) to the UDM. The "Homogenous Support of IMS Voice over PS Sessions" indication shall not be included unless the AMF has completed its evaluation of the support of "IMS Voice over PS Session" as specified in clause 5.16.3.2 of TS 23.501 [2].

During initial Registration, if the AMF and UE supports SRVCC from NG-RAN to UTRAN the AMF provides UDM with the UE SRVCC capability.

If the AMF determines that only the UE SRVCC capability has changed, the AMF sends UE SRVCC capability to the UDM.

NOTE 9: At this step, it is possible that the AMF does not have all the information needed to determine the setting of the IMS Voice over PS Session Supported indication for this UE (see clause 5.16.3.2 of TS 23.501 [2]). Hence the AMF can send the "Homogenous Support of IMS Voice over PS Sessions" later on in this procedure.

After AMF has successfully completed the Nudm\_UECM\_Registration operation and if the AMF does not have subscription data for the UE, the AMF retrieves the Access and Mobility Subscription data, SMF Selection Subscription data, UE context in SMF data and LCS mobile origination using Nudm\_SDM\_Get. If the AMF already has subscription data for the UE but the SoR Update Indicator in the UE context requires the AMF to retrieve SoR information depending on the NAS Registration Type ("Initial Registration" or "Emergency Registration") (see Annex C of TS 23.122 [22]), the AMF retrieves the Steering of Roaming information using Nudm\_SDM\_Get. This requires that UDM may retrieve this information from UDR by Nudr\_DM\_Query. After a successful response is received, the AMF subscribes to be notified using Nudm\_SDM\_Subscribe when the data requested is modified, UDM may subscribe to UDR by Nudr\_DM\_Subscribe. The GPSI is provided to the AMF in the Access and Mobility Subscription data from the UDM if the GPSI is available in the UE subscription data. The UDM may provide indication that the subscription data for network slicing is updated for the UE. If the UE is subscribed to MPS in the serving PLMN, "MPS priority" is included in the Access and Mobility Subscription data provided to the AMF. If the UE is subscribed to MCX in the serving PLMN, "MCX priority" is included in the Access and Mobility Subscription data provided to the AMF. The UDM also provides the IAB-Operation allowed indication or MBSR Operation allowed indication to AMF as part of the Access and Mobility Subscription data. The AMF shall trigger the setup of the UE context in NG-RAN, or modification of the UE context in NG-RAN if the initial setup is at step 9c, including an indication that the IAB-node is authorized or MBSR is authorized. If a S-NSSAI in the Subscribed S-NSSAIs is subject to network slice usage control and the S-NSSAI is dedicated to a single AF, the UDM may provide a Slice Usage Policy information including whether a network slice is on demand and a slice deregistration inactivity timer value for the Subscribed S-NSSAIs as described in clause 5.15.15 of TS 23.501 [2].

The UDM may provide the NCR-Operation allowed indication to AMF as part of the Access and Mobility Subscription data. The AMF shall trigger the setup of the UE context in NG-RAN, or modification of the UE context in NG-RAN if the initial setup is at step 9c, including an indication of NCR-MT authorization information.

For a Disaster Roaming Registration, the AMF may provide the indication of Disaster Roaming service to the UDM. The UDM provides the subscription data for a Disaster Roaming service to the AMF based on the local policy and/or the local configuration as specified in clause 5.40.4 of TS 23.501 [2].

The AMF provides MINT support indication via Nudm\_UECM\_Registration towards UDM, if UE includes the MINT support indication in the 5GMM capability as specified in clause 5.40.2 of TS 23.501 [2] or if the MINT support indication in the 5GMM capability is changed.

If the AMF receives a priority indication (e.g. MPS, MCX) as part of the Access and Mobility Subscription data, but the UE did not provide an Establishment cause associated with priority services, the AMF shall include a Message Priority header to indicate priority information for all subsequent messages. Other NFs relay the priority information by including the Message Priority header in service-based interfaces, as specified in TS 29.500 [17].

The new AMF provides the Access Type it serves for the UE to the UDM and the Access Type is set to "3GPP access". The UDM stores the associated Access Type together with the serving AMF and does not remove the AMF identity associated to the other Access Type if any. The UDM may store in UDR information provided at the AMF registration by Nudr\_DM\_Update.

If the UE was registered in the old AMF for an access and the old and the new AMFs are in the same PLMN, the new AMF sends a separate/independent Nudm\_UECM\_Registration to update UDM with Access Type set to access used in the old AMF, after the old AMF relocation is successfully completed.

The new AMF creates an UE context for the UE after getting the Access and Mobility Subscription data from the UDM. The Access and Mobility Subscription data includes whether the UE is allowed to include NSSAI in the 3GPP access RRC Connection Establishment in clear text. The Access and Mobility Subscription data may include Enhanced Coverage Restricted information. If received from the UDM and the UE included support for restriction of use of Enhanced Coverage in step 1, the AMF determines whether Enhanced Coverage is restricted or not for the UE as specified in clause 5.31.12 of TS 23.501 [2] and stores the updated Enhanced Coverage Restricted information in the UE context.

The Access and Mobility Subscription data may include the NB-IoT UE Priority. For subscribed S-NSSAIs subject to NSAC, the AMF stores the corresponding applicable NSAC admission mode.

The subscription data may contain Service Gap Time parameter. If received from the UDM, the AMF stores this Service Gap Time in the UE Context in AMF for the UE.

If the AMF has the LADN service area and UE indication of support for LADN per DNN and S-NSSAI, the AMF applies LADN per DNN and S-NSSAI as described in 5.20b.2 of TS 23.501 [2].

For an Emergency Registration in which the UE was not successfully authenticated, the AMF shall not register with the UDM.

The AMF enforces the Mobility Restrictions as specified in clause 5.3.4.1.1 of TS 23.501 [2]. For an Emergency Registration, the AMF shall not check for Mobility Restrictions, access restrictions, regional restrictions or subscription restrictions. For an Emergency Registration, the AMF shall ignore any unsuccessful registration response from UDM and continue with the Registration procedure.

NOTE 10: The AMF can, instead of the Nudm\_SDM\_Get service operation, use the Nudm\_SDM\_Subscribe service operation with an Immediate Report Indication that triggers the UDM to immediately return the subscribed data if the corresponding feature is supported by both the AMF and the UDM.

The UDM may provide the MWAB Operation allowed indication to AMF as part of the Access and Mobility Subscription data as described in clause 5.X of the TS 23.501 [2].

14d. When the UDM stores the associated Access Type (e.g. 3GPP) together with the serving AMF as indicated in step 14a, it will cause the UDM to initiate a Nudm\_UECM\_DeregistrationNotification (see clause 5.2.3.2.2) to the old AMF corresponding to the same (e.g. 3GPP) access, if one exists. If the timer started in step 5 is not running, the old AMF may remove the UE context for the same Access Type. Otherwise, the AMF may remove UE context for the same Access Type when the timer expires. If the serving NF removal reason indicated by the UDM is Initial Registration, then, as described in clause 4.2.2.3.2, the old AMF invokes the Nsmf\_PDUSession\_ReleaseSMContext (SM Context ID) service operation towards all the associated SMF(s) of the UE to notify that the UE is deregistered from old AMF for the same Access Type. The SMF(s) shall release the PDU Session on getting this notification.

If the old AMF has established an AM Policy Association and a UE Policy Association with the PCF(s) and the old AMF did not transfer the PCF ID(s) to the new AMF (e.g. new AMF is in different PLMN), the old AMF performs an AMF-initiated Policy Association Termination procedure, as defined in clause 4.16.3.2 and performs an AMF-initiated UE Policy Association Termination procedure, as defined in clause 4.16.13.1. In addition, if the old AMF transferred the PCF ID(s) in the UE context but the new AMF informed in step 10 that the AM Policy Association information and UE Policy Association information in the UE context will not be used then the old AMF performs an AMF-initiated Policy Association Termination procedure, as defined in clause 4.16.3.2 and performs an AMF-initiated UE Policy Association Termination procedure, as defined in clause 4.16.13.1.

If the old AMF has an N2 connection for that UE (e.g. because the UE was in RRC\_INACTIVE state but has now moved to E-UTRAN or moved to an area not served by the old AMF), the old AMF shall perform AN Release (see clause 4.2.6) with a cause value that indicates that the UE has already locally released the NG-RAN's RRC Connection.

If the UE context in the old AMF contains an Allowed NSSAI or Partially Allowed NSSAI including one or more S-NSSAI(s) subject to NSAC, the old AMF upon receipt of the Nudm\_UECM\_DeregistrationNotification from the UDM, sends an update request message for each S-NSSAI subject to NSAC to the corresponding NSACF(s) with update flag parameter set to decrease (see clause 4.2.11.2).

At the end of registration procedure, the AMF may initiate synchronization of event exposure subscriptions with the UDM if the AMF does not indicate unavailability of event exposure subscription in step 14a.

NOTE 11: The AMF can initiate synchronization with UDM even if events are available in the UE context (e.g. as received from old AMF) at any given time and based on local policy. This can be done during subscription change related event.

14e. [Conditional] If old AMF does not have UE context for another access type (i.e. non-3GPP access), the Old AMF unsubscribes with the UDM for subscription data using Nudm\_SDM\_unsubscribe.

15. If the AMF decides to initiate PCF communication, the AMF acts as follows.

If the new AMF decides to use the (V-)PCF identified by the (V-)PCF ID included in UE context from the old AMF in step 5, the AMF contacts the (V-)PCF identified by the (V-)PCF ID to obtain policy. If the AMF decides to perform PCF discovery and selection and the AMF selects a (V)-PCF and may select an H-PCF (for roaming scenario) as described in clause 6.3.7.1 of TS 23.501 [2] and according to the V-NRF to H-NRF interaction described in clause 4.3.2.2.3.3.

As described in clause 6.3.7.1 of TS 23.501 [2], if the AMF receives PCF Selection Assistance info from the UDM, the AMF checks if a list of DNN, S-NSSAI combinations are provided in the PCF Selection Assistance Info then the AMF checks local configuration to determine which DNN, S-NSSAI to use then selects the PCF ID included in the corresponding UE Context in the SMF data. If no PCF ID is received, the AMF select the PCF by considering other criteria, defined in clause 6.3.7.1 of TS 23.501 [2].

16. [Optional] new AMF performs an AM Policy Association Establishment/Modification. For an Emergency Registration, this step is skipped.

If the new AMF selects a new (V-)PCF in step 15, the new AMF performs AM Policy Association Establishment with the selected (V-)PCF as defined in clause 4.16.1.2.

If the (V-)PCF identified by the (V-)PCF ID included in UE context from the old AMF is used, the new AMF performs AM Policy Association Modification with the (V-)PCF as defined in clause 4.16.2.1.2.

If the AMF notifies the Mobility Restrictions (e.g. UE location) to the PCF for adjustment, or if the PCF updates the Mobility Restrictions itself due to some conditions (e.g. application in use, time and date), the PCF shall provide the updated Mobility Restrictions to the AMF. If the subscription information includes Tracing Requirements, the AMF provides the PCF with Tracing Requirements.

If the AMF supports DNN replacement, the AMF provides the PCF with the Allowed NSSAI and Partially Allowed NSSAI and if available, the Mapping Of Allowed NSSAI and Mapping Of Partially Allowed NSSAI.

If the PCF supports DNN replacement, the PCF provides the AMF with triggers for DNN replacement.

If the PCF supports the slice replacement, the PCF provides the AMF with triggers for slice replacement.

If a S-NSSAI in subject to network slice usage control, the PCF may provide a Slice Usage Policy information including, whether a network slice is on demand and a slice deregistration inactivity timer value, for the Subscribed S-NSSAIs as described in clause 5.15.15 of TS 23.501 [2].

17. [Conditional] AMF to SMF: Nsmf\_PDUSession\_UpdateSMContext () or Nsmf\_PDUSession\_ReleaseSMContext ().

For an Emergency Registered UE (see TS 23.501 [2]), this step is applied when the Registration Type is Mobility Registration Update.

The AMF invokes the Nsmf\_PDUSession\_UpdateSMContext (see clause 5.2.8.2.6) in the following scenario(s):

- If the List Of PDU Sessions To Be Activated is included in the Registration Request in step 1, the AMF sends Nsmf\_PDUSession\_UpdateSMContext Request to SMF(s) associated with the PDU Session(s) in order to activate User Plane connections of these PDU Session(s). Steps from step 5 onwards described in clause 4.2.3.2 are executed to complete the User Plane connection activation without sending the RRC Inactive Assistance Information and without sending MM NAS Service Accept from the AMF to (R)AN described in step 12 of clause 4.2.3.2. When a User Plane connection for a PDU Session is activated, the AS layer in the UE indicates it to the NAS layer.

- If the AMF has determined in step 3 that the UE is performing Inter-RAT mobility to or from NB-IoT, the AMF sends Nsmf\_PDUSession\_UpdateSMContext Request to SMF(s) associated with the UEs PDU Session(s), so the SMF(s) can update them according to the "PDU Session continuity at inter RAT mobility" subscription data. Steps from step 5 onwards described in clause 4.2.3.2 are executed without sending MM NAS Service Accept from the AMF to (R)AN described in step 12 of clause 4.2.3.2.

When the serving AMF has changed, the new serving AMF notifies the SMF for each PDU Session that it has taken over the responsibility of the signalling path towards the UE: the new serving AMF invokes the Nsmf\_PDUSession\_UpdateSMContext service operation using SMF information received from the old AMF at step 5. It also indicates whether the PDU Session is to be re-activated.

NOTE 12: If the UE moves into a different PLMN, the AMF in the serving PLMN can insert or change the V-SMF(s) in the serving PLMN for Home Routed PDU session(s). In addition, a V-SMF is removed in case the UE moves from a VPLMN into the HPLMN. In these cases, the same procedures described in clause 4.23.3 are applied for the V-SMF change as for the I-SMF change (i.e. by replacing the I-SMF with V-SMF). During inter-PLMN change, if the same SMF is used, session continuity can be supported depending on operator policies.

NOTE 13: In the case of Indirect Network Sharing, when UE of participating operator moves between the shared network area and an area of its home network, a V-SMF can be inserted or removed. In this case, the related procedure of mobility registration update with V-SMF insertion/removal described in clause 4.23.3 is applied.

Steps from step 5 onwards described in clause 4.2.3.2 are executed. In the case that the intermediate UPF insertion, removal, or change is performed for the PDU Session(s) not included in "PDU Session(s) to be re-activated", the procedure is performed without N11 and N2 interactions to update the N3 user plane between (R)AN and 5GC.

The AMF invokes the Nsmf\_PDUSession\_ReleaseSMContext service operation towards the SMF in the following scenario:

- If any PDU Session status indicates that it is released at the UE, the AMF invokes the Nsmf\_PDUSession\_ReleaseSMContext service operation towards the SMF in order to release any network resources related to the PDU Session.

- If the UE has moved into a TA not supporting the S-NSSAI associated with the PDU Session, and the AMF determines to release the PDU Session, and no N2 interaction is needed (i.e. UP connection of the PDU Session is not active), the AMF sets the PDU Session status indicating that the PDU Session is released in the network and the AMF invokes the Nsmf\_PDUSession\_ReleaseSMContext service operation towards the SMF.

If the serving AMF is changed, the new AMF shall wait until step 18 is finished with all the SMFs associated with the UE. Otherwise, steps 19 to 22 can continue in parallel to this step.

18. [Conditional] If the new AMF and the old AMF are in the same PLMN, the new AMF sends a UE Context Modification Request to N3IWF/TNGF/W-AGF as specified in TS 29.413 [64].

If the AMF has changed and the old AMF has indicated that the UE is in CM-CONNECTED state via N3IWF, W-AGF or TNGF and if the new AMF and the old AMF are in the same PLMN, the new AMF creates an NGAP UE association towards the N3IWF/TNGF/W-AGF to which the UE is connected. This automatically releases the existing NGAP UE association between the old AMF and the N3IWF/TNGF/W-AGF.

19. N3IWF/TNGF/W-AGF sends a UE Context Modification Response to the new AMF.

19a. [Conditional] After the new AMF receives the response message from the N3IWF, W-AGF or TNGF in step 19, the new AMF registers with the UDM using Nudm\_UECM\_Registration as step 14a, but with the Access Type set to "non-3GPP access". The UDM stores the associated Access Type together with the serving AMF and does not remove the AMF identity associated to the other Access Type if any. The UDM may store in UDR information provided at the AMF registration by Nudr\_DM\_Update.

19b. [Conditional] When the UDM stores the associated Access Type (i.e. non-3GPP) together with the serving AMF as indicated in step 19a, it will cause the UDM to initiate a Nudm\_UECM\_DeregistrationNotification (see clause 5.2.3.2.2) to the old AMF corresponding to the same (i.e. non-3GPP) access. The old AMF removes the UE context for non-3GPP access.

19c. The Old AMF unsubscribes with the UDM for subscription data using Nudm\_SDM\_unsubscribe.

20a. Void.

21. New AMF to UE: Registration Accept (5G-GUTI, Registration Area, [Mobility restrictions], [PDU Session status], [Allowed NSSAI], [Mapping Of Allowed NSSAI], [Partially Allowed NSSAI], [Mapping Of Partially Allowed NSSAI], [TAI List for S-NSSAIs in Partially Allowed NSSAI], [Configured NSSAI for the Serving PLMN], [Mapping Of Configured NSSAI], [NSSRG Information], [NSAG Information], [rejected S-NSSAIs], [TAI List for any rejected S-NSSAI Partially in the RA], [Pending NSSAI], [Mapping Of Pending NSSAI], [Periodic Registration Update timer], [Active Time], [Strictly Periodic Registration Timer Indication], [LADN Information], [MICO Indication], [IMS Voice over PS session supported Indication], [Emergency Service Support indicator], [Accepted DRX parameters for E-UTRA and NR], [Accepted DRX parameters for NB-IoT], [extended idle mode DRX parameters], [Paging Time Window], [Network support of Interworking without N26], [Access Stratum Connection Establishment NSSAI Inclusion Mode], [Network Slicing Subscription Change Indication], [Operator-defined access category definitions], [List of equivalent PLMNs], [Enhanced Coverage Restricted information], [Supported Network Behaviour], [Service Gap Time], [PLMN-assigned UE Radio Capability ID], [PLMN-assigned UE Radio Capability ID deletion], [WUS Assistance Information], [AMF PEIPS Assistance Information], [Truncated 5G-S-TMSI Configuration], [Connection Release Supported], [Paging Cause Indication for Voice Service Supported], [Paging Restriction Supported], [Reject Paging Request Supported], [Paging Restriction Information acceptance / rejection], ["List of PLMN(s) to be used in Disaster Condition"], [Disaster Roaming wait range information], [Disaster Return wait range information], [Forbidden TAI(s)], [List of equivalent SNPNs], [Registered NID], [Unavailability Period Support], [MBSR authorization information], [Return To Coverage Notification Not Required], [Unavailability Period Duration], [Start of Unavailability Period], [S-NSSAI location availability information], [Mapping Of Alternative NSSAI], [Slice Usage Policy], [Maximum Time Offset]).

If the Requested NSSAI does not include S-NSSAIs which map to S-NSSAIs of the HPLMN subject to Network Slice-Specific Authentication and Authorization and the AMF determines that no S-NSSAI can be provided in the Allowed NSSAI for the UE in the current UE's Tracking Area and if no default S-NSSAI(s) not yet involved in the current UE Registration procedure could be further considered, the AMF shall reject the UE Registration and shall include in the rejection message the list of Rejected S-NSSAIs, each of them with the appropriate rejection cause value.

The Allowed NSSAI for the Access Type for the UE is included in the N2 message carrying the Registration Accept message. The Allowed NSSAI contains only S-NSSAIs that do not require, based on subscription information, Network Slice-Specific Authentication and Authorization and based on the UE Context in the AMF, those S-NSSAIs for which Network Slice-Specific Authentication and Authorization previously succeeded, regardless of the Access Type. The Mapping Of Pending NSSAI is the mapping of each S-NSSAI of the Pending NSSAI for the Serving PLMN to the HPLMN S-NSSAIs.

If the UE has indicated its support for the Partial Network Slice support in a Registration Area (see clause 5.15.17 of TS 23.501 [2]) in the UE MM Core Network Capability in the Registration Request, the AMF may include Partially Allowed NSSAI in the Registration Accept with the related TAI List for S-NSSAIs in Partially allowed NSSAI as per TS 23.501 [2] clause 5.1517 and in the N2 message carrying the Registration Accept message without the TAI List for S-NSSAIs in Partially allowed NSSAI. The Partially Allowed NSSAI contains only S-NSSAIs that do not require, based on subscription information, Network Slice-Specific Authentication and Authorization and based on the UE Context in the AMF, those S-NSSAIs for which Network Slice-Specific Authentication and Authorization previously succeeded, regardless of the Access Type. The Mapping Of Partially Allowed NSSAI is the mapping of each S-NSSAI of the Partially Allowed NSSAI for the Serving PLMN to the HPLMN S-NSSAIs.

If the UE has indicated its support for the Partial Network Slice support in a Registration Area (see clause 5.15.17 of TS 23.501 [2]) in the UE MM Core Network Capability in the Registration Request, the AMF may include S-NSSAI(s) rejected partially in the RA in the Registration Accept with the applicable TAI List for rejected S-NSSAI partially in the RA.

If the UE has indicated its support of the Network Slice-Specific Authentication and Authorization procedure in the UE MM Core Network Capability in the Registration Request, AMF includes in the Pending NSSAI the S-NSSAIs that map to an S-NSSAI of the HPLMN which in the subscription information has indication that it is subject to Network Slice-Specific Authentication and Authorization, as described in clause 4.6.2.4 of TS 24.501 [25]. In such case, the AMF then shall trigger at step 25 the Network Slice-Specific Authentication and Authorization procedure, specified in clause 4.2.9.2, except, based on Network policies, for those S-NSSAIs for which Network Slice-Specific Authentication and Authorization have already been initiated on another Access Type for the same S-NSSAI(s). The UE shall not attempt re-registration with the S-NSSAIs included in the list of Pending NSSAIs until the Network Slice-Specific Authentication and Authorization procedure has been completed, regardless of the Access Type.

If the UE has not indicated its support of the Network Slice-Specific Authentication and Authorization procedure in the UE 5GMM Core Network Capability in the Registration Request and the Requested NSSAI includes S-NSSAIs which map to HPLMN S-NSSAIs subject to Network Slice-Specific Authentication and Authorization, the AMF includes those S-NSSAIs in the Requested NSSAI in the Rejected S-NSSAIs.

If no S-NSSAI can be provided in the Allowed NSSAI because:

- all the S-NSSAI(s) in the Requested NSSAI are to be subject to Network Slice-Specific Authentication and Authorization; or

- no Requested NSSAI was provided or none of the S-NSSAIs in the Requested NSSAI matches any of the Subscribed S-NSSAIs and all the S-NSSAI(s) marked as default in the Subscribed S-NSSAIs are to be subject to Network Slice-Specific Authentication and Authorization.

The AMF shall provide an empty Allowed NSSAI. Upon receiving an empty Allowed NSSAI and a Pending NSSAI, the UE is registered in the PLMN but shall wait for the completion of the Network Slice-Specific Authentication and Authorization procedure without attempting to use any service provided by the PLMN on any access, except e.g. emergency services (see TS 24.501 [25]), until the UE receives an Allowed NSSAI.

The AMF stores the NB-IoT Priority retrieved in Step 14 and associates it to the 5G-S-TMSI allocated to the UE.

If the Registration Request message received over 3GPP access does not include any Paging Restriction Information, the AMF shall delete any stored Paging Restriction Information for this UE and stop restricting paging accordingly.

If the Registration Request message received over 3GPP access includes the Paging Restriction Information, AMF may accept or reject the Paging Restriction Information requested by the UE based on operator policy. If the AMF rejects the Paging Restriction Information, the AMF removes any stored Paging Restriction Information from the UE context and discards the UE requested Paging Restriction Information. If the AMF accepts the Paging Restriction Information from the UE, the AMF stores the Paging Restriction Information from the UE in the UE context and informs the UE about the acceptance/rejection of the requested Paging Restriction Information in the Registration Accept message.

If the Registration Request message received over 3GPP access includes a Release Request indication, then:

- the AMF updates the UE context with any received Paging Restriction Information, then enforces it in the network triggered Service Request procedure as described in clause 4.2.3.3;

- the AMF does not establish User Plane resources and triggers the AN release procedure as described in clause 4.2.6 after the completion of Registration procedure.

The AMF sends a Registration Accept message to the UE indicating that the Registration Request has been accepted. 5G-GUTI is included if the AMF allocates a new 5G-GUTI. Upon receiving a Registration Request message of type "Initial Registration", "mobility registration update", "Disaster Roaming Initial Registration" or "Disaster Roaming Mobility Registration Update" from the UE, the AMF shall include a new 5G-GUTI in the Registration Accept message. Upon receiving a Registration Request message of type "periodic registration update" from the UE, the AMF should include a new 5G-GUTI in the Registration Accept message. If the UE is already in RM-REGISTERED state via another access in the same PLMN, the UE shall use the 5G-GUTI received in the Registration Accept for both registrations. If no 5G-GUTI is included in the Registration Accept, then the UE uses the 5G-GUTI assigned for the existing registration also for the new registration. If the AMF allocates a new Registration area, it shall send the Registration area to the UE via Registration Accept message. For a Disaster Roaming Registration, the AMF allocates the Registration Area limited to the area with Disaster Condition as specified in clause 5.40 of TS 23.501 [2]. If there is no Registration area included in the Registration Accept message, the UE shall consider the old Registration Area as valid. Mobility Restrictions is included if mobility restrictions applies for the UE and Registration Type is not Emergency Registration. The AMF indicates the established PDU Sessions to the UE in the PDU Session status. The UE removes locally any internal resources related to PDU Sessions that are not marked as established in the received PDU Session status. If the AMF invokes the Nsmf\_PDUSession\_UpdateSMContext procedure for UP activation of PDU Session(s) in step 18 and receives rejection from the SMF, then the AMF indicates to the UE the PDU Session ID and the cause why the User Plane resources were not activated. When the UE is connected to the two AMFs belonging to different PLMN via 3GPP access and non-3GPP access then the UE removes locally any internal resources related to the PDU Session of the current PLMN that are not marked as established in received PDU Session status. If the PDU Session status information was in the Registration Request, the AMF shall indicate the PDU Session status to the UE.

If the RAT Type is NB-IoT and the network is configured to use the Control Plane Relocation Indication procedure then the AMF shall include in the Registration Accept message the Truncated 5G-S-TMSI Configuration that the UE using Control Plane CIoT 5GS Optimisation uses to create the Truncated 5G-S-TMSI, see clause 5.31.4.3 of TS 23.501 [2].

The Allowed NSSAI provided in the Registration Accept is valid in the Registration Area and it applies for all the PLMNs which have their Tracking Areas included in the Registration Area. The Mapping Of Allowed NSSAI is the mapping of each S-NSSAI of the Allowed NSSAI to the HPLMN S-NSSAIs. The Mapping Of Configured NSSAI is the mapping of each S-NSSAI of the Configured NSSAI for the Serving PLMN to the HPLMN S-NSSAIs.

For non-roaming UE, if the UE has indicated its support of Slice Usage Policy in the UE 5GMM Core Network Capability, the AMF may include Slice Usage Policies for the slices in the Configured NSSAI as described in clause 5.15.15 of TS 23.501 [2]. In the Slice Usage Policy, the AMF indicates if an S-NSSAI is on demand slice and optionally slice deregistration inactivity timer value. If the AMF includes slice deregistration inactivity timer value, the UE starts any slice deregistration inactivity timer for the on demand S-NSSAIs as described in clause 5.15.15 of TS 23.501 [2]. If the AMF includes updated slice deregistration timer value(s), the UE uses the updated slice deregistration inactivity timer value(s) next time the slice deregistration inactivity timer(s) starts.

If the UE has indicated its support of the subscription-based restrictions to simultaneous registration of network slices feature in the UE 5GMM Core Network Capability, the AMF includes, if available, the NSSRG Information, defined in clause 5.15.12 of TS 23.501 [2].

If the UE has not indicated its support of the subscription-based restrictions to simultaneous registration of network slices feature and the subscription information for the UE includes NSSRG information and the AMF is providing the Configured NSSAI to the UE, the Configured NSSAI shall include the S-NSSAIs according to clause 5.15.12 of TS 23.501 [2].

If the UE has indicated its support for temporary available network slices feature in the UE 5GMM Core Network Capability, the AMF includes validity time defined in clause 5.15.16 of TS 23.501 [2].

If the UE has not indicated its support for temporary available network slices feature in the UE 5GMM Core Network Capability and the AMF is providing the Configured NSSAI to the UE, the Configured NSSAI shall not include the S-NSSAIs if the validity time indicates S-NSSAI is not available according to clause 5.15.16 of TS 23.501 [2].

If the UE has indicated its support of the NSAG feature in the 5GMM Core Network Capability, the AMF includes, if available, the NSAG Information, defined in clause 5.15.14 of TS 23.501 [2].

The AMF shall include in the Registration Accept message the LADN Information for the list of LADNs, described in clause 5.6.5 of TS 23.501 [2], that are available within the Registration area determined by the AMF for the UE. If the UE indicates its support of LADN per DNN and S-NSSAI in the UE MM Core Network Capability, the AMF may include LADN Information per DNN and S-NSSAI. The AMF may include Operator-defined access category definitions to let the UE determinine the applicable Operator-specific access category definitions as described in TS 24.501 [25].

If the UE included MICO Indication in the Registration Request, then AMF responds in the Registration Accept message whether MICO mode should be used in the MICO Indication. When MICO mode is allowed for the UE, the AMF may include an Active Time value and/or Strictly Periodic Registration Timer Indication in the Registration Accept message. The AMF determines the Periodic Registration Update timer value, Active Time value and the Strictly Periodic Registration Timer Indication based on:

- local configuration;

- Expected UE Behaviour if available;

- UE indicated preferences;

- UE capability;

- UE subscription information;

- if using a RAN that provides discontinuous coverage, UE availability (see clause 5.4.13.1 of TS 23.501 [2]); and

- network policies,

or any combination of them so as to enable UE power saving, as described in clause 5.31.7 of TS 23.501 [2]. The AMF determines to apply the Strictly Periodic Registration Timer Indication to the UE if the UE indicates its capability of the Strictly Periodic Registration Timer Indication in the registration request message, as described in step 1. If the AMF provides the Periodic Registration Update timer value with the Strictly Periodic Registration Timer Indication to the UE, the UE and the AMF start the Periodic Registration Update timer after this step, as described in clause 5.31.7.5 of TS 23.501 [2].

In the case of registration over 3GPP access, the AMF Sets the IMS Voice over PS session supported Indication as described in clause 5.16.3.2 of TS 23.501 [2]. In order to set the IMS Voice over PS session supported Indication the AMF may need to perform the UE Capability Match Request procedure in clause 4.2.8a to check the compatibility of the UE and NG-RAN radio capabilities related to IMS Voice over PS. If the AMF hasn't received Voice Support Match Indicator from the NG-RAN on time then, based on implementation, AMF may set IMS Voice over PS session supported Indication and update it at a later stage.

In the case of registration over 3GPP access and the AMF has retrieved or determined according to local configuration a Target NSSAI and a corresponding RFSP Index for the purpose of allowing the NG-RAN to redirect the UE to a cell supporting network slices not available in the current TA as described in clause 5.3.4.3.3 of TS 23.501 [2], the AMF provides the Target NSSAI and the corresponding RFSP Index to the NG-RAN.

In the case of registration over non-3GPP access, the AMF Sets the IMS Voice over PS session supported Indication as described in clause 5.16.3.2a of TS 23.501 [2].

The Emergency Service Support indicator informs the UE that emergency services are supported, i.e. the UE is allowed to request PDU Session for emergency services. If the AMF received "MPS priority" from the UDM as part of Access and Mobility Subscription data, based on operator policy, "MPS priority" is included in the Registration Accept message to the UE to inform the UE whether configuration of Access Identity 1 is valid within the selected PLMN, as specified in TS 24.501 [25]. If the AMF received "MCX priority" from the UDM as part of Access and Mobility Subscription data, based on operator policy and UE subscription to MCX Services, "MCX priority" is included in the Registration Accept message to the UE to inform the UE whether configuration of Access Identity 2 is valid within the selected PLMN, as specified in TS 24.501 [25].

The Accepted DRX parameters are defined in clause 5.4.5 of TS 23.501 [2]. The AMF includes Accepted DRX parameters for NB-IoT, if the UE included Requested DRX parameters for NB-IoT in the Registration Request message. The AMF Sets the Network support of Interworking without N26 parameter as described in clause 5.17.2.3.1 of TS 23.501 [2]. If the AMF accepts the use of extended idle mode DRX, the AMF includes the extended idle mode DRX parameters and Paging Time Window as described in 5.31.7.2 of TS 23.501 [2]. For a UE using NR satellite access that provides discontinuous coverage, the AMF may determine extended idle mode DRX parameters and Paging Time Window considering the Unavailability Period Duration (if available), Start of Unavailability Period (if available) and the UE requested extended idle mode DRX parameters as described in clause 5.4.13.1 of TS 23.501 [2].

If the UDM intends to indicate the UE that subscription has changed, the Network Slicing Subscription Change Indication is included. If the AMF includes Network Slicing Subscription Change Indication, then the UE shall locally erase all the network slicing configuration for all PLMNs and if applicable, update the configuration for the current PLMN based on any received information.

The Access Stratum Connection Establishment NSSAI Inclusion Mode, as specified in clause 5.15.9 of TS 23.501 [2], is included to instruct the UE on what NSSAI, if any, to include in the Access Stratum connection establishment. The AMF can set the value to modes of operation a,b,c defined in clause 5.15.9 of TS 23.501 [2] in the 3GPP Access only if the Inclusion of NSSAI in RRC Connection Establishment Allowed indicates that it is allowed to do so.

For a UE registered in a PLMN, the AMF may provide a List of equivalent PLMNs which is handled as specified in TS 24.501 [25]. The AMF shall not provide a list of equivalent SNPNs to the UE.

For a UE registered in an SNPN and the UE has included support of equivalent SNPNs in step 1, the AMF may provide a List of equivalent SNPNs which is handled as specified in TS 24.501 [25]. The AMF shall not provide a list of equivalent PLMNs to the UE.

If the UE included support for restriction of use of Enhanced Coverage in step 1, the AMF sends the Enhanced Coverage Restricted information to the NG-RAN in N2 message. The AMF also sends Enhanced Coverage Restricted information to the UE in the Registration Accept message.

If the UE receives Enhanced Coverage Restricted information in the Registration Accept message, the UE shall store this information and shall use the value of Enhanced Coverage Restricted information to determine if Enhanced Coverage feature should be used or not.

If the UE and the AMF have negotiated to enable MICO mode via MICO Indication and the AMF uses the Extended connected timer, then the AMF provides the Extended Connected time value to NG-RAN (see clause 5.31.7.3 of TS 23.501 [2]) in this step. The Extended Connected Time value indicates the minimum time the RAN should keep the UE in RRC\_CONNECTED state regardless of inactivity. For a UE using NR satellite access that provides discontinuous coverage, the AMF may determine the Extended Connected Timer value considering the Unavailability Period Duration (if available), Start of Unavailability Period (if available) as described in clause 5.4.13.1 of TS 23.501 [2].

The AMF indicates the CIoT 5GS Optimisations it supports and accepts in the Supported Network Behaviour information (see clause 5.31.2 of TS 23.501 [2]) if the UE included Preferred Network Behaviour in its Registration Request.

The AMF may steer the UE from 5GC by rejecting the Registration Request. The AMF should take into account the Preferred and Supported Network Behaviour (see clause 5.31.2 of TS 23.501 [2]) and availability of EPC to the UE before steering the UE from 5GC.

If the AMF accepts MICO mode as indicated in Registration Accept via MICO Indication and knows there may be mobile terminated data or signalling pending, the AMF maintains the N2 connection for at least the Extended Connected Time as described in clause 5.31.7.3 of TS 23.501 [2] and provides the Extended Connected Time value to the RAN.

The AMF includes Service Gap Time if Service Gap Time is present in the subscription information (steps 14a-c) or the Service Gap Time has been updated by the Subscriber Data Update Notification to AMF procedure (see clause 4.5.1) and the UE has indicated UE Service Gap Control Capability.

If the UE receives a Service Gap Time in the Registration Accept message, the UE shall store this parameter and apply Service Gap Control (see clause 5.31.16 of TS 23.501 [2]).

If the network supports WUS grouping (see TS 23.501 [2]), the AMF shall send the WUS Assistance Information to the UE. If the UE provided the UE paging probability information in Step 1, the AMF takes it into account to determine the WUS Assistance Information.

If the UE provided Paging Subgrouping Support Indication in step 1, a supporting AMF may provide the AMF PEIPS Assistance Information, including the Paging Subgroup ID as defined in TS 23.501 [2].

When the UE and the AMF supports RACS as defined in clause 5.4.4.1a of TS 23.501 [2] and the AMF needs to configure the UE with a UE Radio Capability ID and the AMF already has the UE radio capabilities other than NB-IoT radio capabilities for the UE, the AMF may provide the UE with the UE Radio Capability ID for the UE radio capabilities the UCMF returns to the AMF in a Nucmf\_assign service operation for this UE. Alternatively, when the UE and the AMF support RACS, the AMF may provide the UE with an indication to delete any PLMN-assigned UE Radio Capability ID in this PLMN (see clause 5.4.4.1a of TS 23.501 [2]).

If the UE is "CAG supported" and the AMF needs to update the CAG information of the UE, the AMF may include the CAG information as part of the Mobility Restrictions in the Registration Accept message.

If the UE has indicated the support of Unavailability Period in the UE MM Core Network Capability in the Registration Request, the AMF shall indicate to the UE whether the corresponding feature is supported by providing the "Unavailability Period Support" indication.

If both the UE and the AMF support the Unavailability Period, the AMF may provide an Unavailability Period Duration and/or Start of Unavailability Period determined due to NR satellite access discontinuous coverage during initial registration procedure as described in clause 5.4.1.4 of TS 23.501 [2]. If the UE has provided Unavailability Period Duration and/or Start of Unavailability Period in step 1, the AMF shall store the received Unavailability Period Duration and/or Start of Unavailability Period in UE context. The AMF considers that the UE is unavailable at the start of unavailability period as described in clause 5.4.1.4 of TS 23.501 [2]. The AMF may provide Periodic Registration Update timer based on Unavailability Period Duration and/or Start of Unavailability Period indicated by the UE as described in clause 5.4.1.4 of TS 23.501 [2].

If the Multi-USIM UE has indicated support for one or more Multi-USIM Specific Capabilities in the UE 5GMM Core Network Capability in step 1, the AMF shall indicate to the Multi-USIM UE whether the corresponding one or more Multi-USIM specific features described in clause 5.38 of TS 23.501 [2] are supported, based on network capability and preference by the network (i.e. based on local network policy), by providing one or more of the Connection Release Supported, Paging Cause Indication for Voice Service Supported, Paging Restriction Supported and Reject Paging Request Supported indications. The AMF shall only indicate Paging Restriction Supported together with either Connection Release Supported or Reject Paging Request Supported. The UE shall only use Multi-USIM specific features that the AMF indicated as being supported.

If the NG-RAN provides MBSR indication in step 3 and the subscription data received in step 14 does not allow the MBSR operation, the AMF may either accept the registration with providing the MBSR authorization information to MBSR (IAB-UE), or the AMF may reject the registration if the PLMN does not allow the MBSR (IAB-UE) to be registered to the PLMN as specified in clause 5.35A.4 of TS 23.501 [2].

If the UE and AMF supports Disaster Roaming service, the AMF may include the "list of PLMN(s) to be used in Disaster Condition", Disaster Roaming wait range information and Disaster Return wait range information as specified in TS 23.501 [2].

If AMF receives multiple TAIs from the NG-RAN in step 3 and determines that some, but not all of them are forbidden by subscription or by operator policy, the AMF shall include the forbidden TAI(s) in the Registration Accept message.

In the case of Emergency Registration, the AMF shall not indicate support for any Multi-USIM specific features to the UE.

If the UE has included support of equivalent SNPNs in step 1 and the serving SNPN changes, the AMF shall include the Registered NID in the Registration Accept message as specified in TS 23.501 [2].

For a UE using NR satellite access that provides discontinuous coverage, the AMF may provide Return To Coverage Notification Not Required, which requests the UE in CM-IDLE state to not perform the Mobility Registration Update procedure when it returns to coverage and/or provide the UE with a Unavailability Period Duration and/or Start of Unavailability Period (if available), as described in clause 5.4.13.1 of TS 23.501 [2]. The AMF may determine a Maximum Time Offset and provide it to UE when it is allowed to initiate NAS signalling with the network as described in clause 5.4.13.5 of TS 23.501 [2].

If the UE has indicated the support of S-NSSAI location availability information, the AMF may include S-NSSAI location availability information as described in clause 5.15.18 of TS 23.501 [2].

If the UE indicated a support for the Network Slice Replacement feature in the 5GMM Core Network Capability and the AMF determines that an S-NSSAI from an Allowed NSSAI is to be replaced with an Alternative S-NSSAI (as described in clause 5.15.19 of TS 23.501 [2]), the AMF includes the Mapping Of Alternative NSSAI within the Registration Accept message to the UE and also adds the Alternative S-NSSAI to the Allowed NSSAI and/or Configured NSSAI, if not already included. The Mapping Of Alternative NSSAI is the mapping of each Alternative S-NSSAI, included in the Allowed NSSAI and/or Configured NSSAI, to the corresponding replaced VPLMN S-NSSAI or HPLMN S-NSSAI (as described in clause 5.15.19 of TS 23.501 [2]).

If the UE has indicated a support for reconnection to the network due to RAN timing synchronization status in step 1 as described in TS 23.501 [2], and if the AMF received "clock quality detail level" either as part of an AM Policy Association procedure or from the UDM as part of Clock Quality Reporting Control Information (CQRCI) included in the Access and Mobility Subscription data, "UE reconnection indication" is included in the Registration Accept message to the UE to inform the UE when to connect to the network in case when the UE later detects that the NG-RAN timing synchronization status has changed while the UE is in RRC IDLE or RRC INACTIVE state, as specified in clause 5.27.1.12 of TS 23.501 [2].

21b. [Optional] The new AMF performs a UE Policy Association Establishment as defined in clause 4.16.11. For an Emergency Registration, this step is skipped.

The new AMF sends a Npcf\_UEPolicyControl Create Request to PCF. PCF sends a Npcf\_UEPolicyControl Create Response to the new AMF.

PCF triggers UE Configuration Update Procedure as defined in clause 4.2.4.3.

22. [Conditional] UE to new AMF: Registration Complete ().

The UE sends a Registration Complete message to the AMF when it has successfully updated itself after receiving any of the [Configured NSSAI for the Serving PLMN], [Mapping Of Configured NSSAI], [NSSRG Information], [NSAG Information] and a Network Slicing Subscription Change Indication, or CAG information in step 21.

The UE sends a Registration Complete message to the AMF to acknowledge if a new 5G-GUTI was assigned.

If new 5G-GUTI was assigned, then the UE passes the new 5G-GUTI to its 3GPP access' lower layer when a lower layer (either 3GPP access or non-3GPP access) indicates to the UE's RM layer that the Registration Complete message has been successfully transferred across the radio interface.

NOTE 14: The above is needed because the NG-RAN may use the RRC\_INACTIVE state and a part of the 5G-GUTI is used to calculate the Paging Frame (see TS 38.304 [44] and TS 36.304 [43]). It is assumed that the Registration Complete is reliably delivered to the AMF after the 5G-AN has acknowledged its receipt to the UE.

When the List Of PDU Sessions To Be Activated is not included in the Registration Request and the Registration procedure was not initiated in CM-CONNECTED state, the AMF releases the signalling connection with UE, according to clause 4.2.6.

When the Follow-on request is included in the Registration Request, the AMF should not release the signalling connection after the completion of the Registration procedure.

If the AMF is aware that some signalling is pending in the AMF or between the UE and the 5GC, the AMF should not release the signalling connection immediately after the completion of the Registration procedure.

If the UE has provided Unavailability Period Duration and not included Start of Unavailability Period in step 1, the AMF shall release the signalling connection immediately after the completion of the Registration procedure.

If the UE has indicated Start of Unavailability Period in step 1, the AMF shall release the signalling connection before the start of unavailability period.

If PLMN-assigned UE Radio Capability ID is included in step 21, the AMF stores the PLMN-assigned UE Radio Capability ID in UE context if receiving Registration Complete message.

If the AMF provided updated slice deregistration timer value(s) to the UE in step 21, the AMF uses the corresponding slice deregistration inactivity timer value(s) next time the slice deregistration inactivity timer(s) starts.

If the UE receives PLMN-assigned UE Radio Capability ID deletion indication in step 21, the UE shall delete the PLMN-assigned UE Radio Capability ID(s) for this PLMN.

23. [Conditional] AMF to UDM: If the Access and Mobility Subscription data provided by UDM to AMF in 14b includes Steering of Roaming information with an indication that the UDM requests an acknowledgement of the reception of this information from the UE, the AMF provides the UE acknowledgement to UDM using Nudm\_SDM\_Info. For more details regarding the handling of Steering of Roaming information refer to TS 23.122 [22].

23a. For Registration over 3GPP Access, if the AMF does not release the signalling connection, the AMF sends the RRC Inactive Assistance Information to the NG-RAN.

For Registration over non-3GPP Access, if the UE is also in CM-CONNECTED state on 3GPP access, the AMF sends the RRC Inactive Assistance Information to the NG-RAN. If the Multi-USIM UE has indicated support for the Paging Cause Indication for Voice Service feature and the network supports the Paging Cause Indication for Voice Service, the AMF shall include an indication in the RRC Inactive Assistance Information that the UE supports the Paging Cause Indication for Voice Service to NG-RAN to enable NG-RAN to apply the Paging Cause Indication for Voice Service feature for RAN based paging.

The AMF also uses the Nudm\_SDM\_Info service operation to provide an acknowledgment to UDM that the UE received CAG information, or the Network Slicing Subscription Change Indication (see step 21 and step 22) and acted upon it.

24. [Conditional] AMF to UDM: After step 14a and in parallel to any of the preceding steps, the AMF shall send a "Homogeneous Support of IMS Voice over PS Sessions" indication to the UDM using Nudm\_UECM\_Update:

- If the AMF has evaluated the support of IMS Voice over PS Sessions, see clause 5.16.3.2 of TS 23.501 [2]; and

- If the AMF determines that it needs to update the Homogeneous Support of IMS Voice over PS Sessions, see clause 5.16.3.3 of TS 23.501 [2].

25. [Conditional] If the UE indicates its support for Network Slice-Specific Authentication and Authorization procedure in the UE MM Core Network Capability in Registration Request and any S-NSSAI of the HPLMN is subject to Network Slice-Specific Authentication and Authorization, the related procedure is executed at this step (see clause 4.2.9.1). Once the Network Slice-Specific Authentication and Authorization procedure is completed for all S-NSSAIs, the AMF shall trigger a UE Configuration Update procedure to deliver an Allowed NSSAI (or Partially Allowed NSSAI) containing also the S-NSSAIs for which the Network Slice-Specific Authentication and Authorization was successful and include any rejected NSSAIs with an appropriate rejection cause value.

The AMF stores an indication in the UE context for any S-NSSAI of the HPLMN subject to Network Slice-Specific Authentication and Authorization for which the Network Slice-Specific Authentication and Authorization succeeds.

Once completed the Network Slice-Specific Authentication and Authorization procedure, if the AMF determines that no S-NSSAI can be provided in the Allowed NSSAI for the UE, which is already authenticated and authorized successfully by a PLMN and if no default S-NSSAI(s) could be further considered, the AMF shall execute the Network-initiated Deregistration procedure described in clause 4.2.2.3.3 and shall include in the explicit De-Registration Request message the list of Rejected S-NSSAIs, each of them with the appropriate rejection cause value.

If Unavailability Period Duration is received from the UE and there is "Loss of Connectivity" monitoring event subscription for the UE, the AMF triggers "Loss of Connectivity" monitoring event report and includes the remaining values of the Unavailability Period Duration as described in clause 4.15.

The mobility related event notifications towards the NF consumers are triggered at the end of this procedure for cases as described in clause 4.15.4.

\* \* \* \* Next change \* \* \* \*

##### 4.2.2.3.3 Network-initiated Deregistration

The procedure depicted in Figure 4.2.2.3.3-1 shows Network-initiated Deregistration procedure. The AMF can initiate this procedure for either explicit (e.g. by O&M intervention or if the AMF determines that no S-NSSAI can be provided in the Allowed NSSAI for the UE or the UE's registered PLMN is not allowed to operate in the present UE location or if a disaster condition is no longer being applicable, the AMF initiates Network-initiated Deregistration to trigger the return of UEs to the PLMN that had a Disaster Condition) or implicit (e.g. expiring of Implicit Deregistration timer). The UDM can trigger this procedure for operator-determined purposes (e.g. if a disaster condition is no longer being applicable as specified in clause 5.40.5 of TS 23.501 [2]) to request the removal of a subscriber's RM context and PDU Session(s) of the UE.

If the Network-initiated Deregistration procedure is triggered for MBSR IAB-UE that is registered with authorization to act as MBSR, the AMF behaves as described in clause 5.35A.4 of TS 23.501 [2].

If the Network-initiated Deregistration procedure is triggered for MWAB-UE that is registered with authorization to act as MWAB, the AMF behaves as described in clause 5.X of TS 23.501 [2].



Figure 4.2.2.3.3-1: Network-initiated Deregistration

1. [Conditional] If the UDM wants to request the immediate deletion of a subscriber's RM contexts and PDU Sessions, the UDM shall send a Nudm\_UECM\_DeregistrationNotification (SUPI, Access Type, Removal Reason) message with Removal Reason set to Subscription Withdrawn to the registered AMF. The Access Type may indicate 3GPP Access, non-3GPP Access or both.

2. If the AMF receives Nudm\_UECM\_DeregistrationNotification in Step 1 with Removal Reason as Subscription Withdrawn, the AMF executes Deregistration procedure over the access(es) the Access Type indicates.

The AMF-initiated Deregistration procedure is either explicit (e.g. by O&M intervention or if the AMF determines that no S-NSSAI can be provided in the Allowed NSSAI for the UE) or implicit. The AMF does not send the Deregistration Request message to the UE for Implicit Deregistration. If the UE is in CM-CONNECTED state, the AMF may explicitly deregister the UE by sending a Deregistration Request message (Deregistration type, Access Type, [list of Rejected S-NSSAIs, each of them with the appropriate rejection cause value]) to the UE. The Deregistration type may be set to Re-registration in which case the UE should re-register at the end of the Deregistration procedure. Access Type indicates whether Deregistration procedure applies to the 3GPP access or non-3GPP access, or both. If the Deregistration Request message is sent over 3GPP access and the UE is in CM-IDLE state in 3GPP access, the AMF pages the UE. The list of Rejected S-NSSAIs, each of them with the appropriate rejection cause value, is provided if the AMF determines that no S-NSSAI can be provided to the UE in the Allowed NSSAI.

If the UE has established PDU Session associated with emergency service, the AMF shall not initiate Deregistration procedure. In this case, the AMF performs network requested PDU Session Release for any PDU session associated with non-emergency service as described in clause 4.3.4.

For NR satellite access, the AMF initiates Network-initiated Deregistration if it detects that the UE's registered PLMN is not allowed to operate in the present UE location. In this case, the AMF shall provide the appropriate cause value indicating the PLMN is not allowed to operate in the present UE location, see clause 5.4.11.4 of TS 23.501 [2].

If the network de-registration is triggered for a UE registered for Disaster Roaming due to a disaster condition no longer being applicable, the Deregistration Request shall contain the cause value "PLMN not allowed" and include a disaster return wait range as described in clause 5.5.2.3.1 of TS 24.501 [25] and as specified in clause 5.40.5 of TS 23.501 [2], the network, shall organise the return of the Disaster Roaming UEs in a manner that does not cause overload (e.g. of signalling) in the PLMN that previously had the Disaster Condition.

If the MBSR authorization state changes for a MBSR (IAB-UE) registered in network as specified in clause 5.35A.4 of TS 23.501 [2], based on operator configuration, the AMF triggers Deregistration procedure.

If the MWAB authorization state changes for a MWAB-UE registered in network as specified in clause 5.X of TS 23.501 [2], based on operator configuration, the AMF triggers Deregistration procedure.

3. [Conditional] If the Deregistration procedure is triggered by UDM (Step 1), the AMF acknowledges the Nudm\_UECM\_DeRegistrationNotification to the UDM.

If Access Type indicates 3GPP Access or non-3GPP Access and AMF does not have UE context for another access type, or if Access Type indicates both, the AMF unsubscribes with the UDM using Nudm\_SDM\_Unsubscribe service operation.

4. [Conditional] If the UE has any established PDU Session over the target access for deregistration indicated in step 2, then step 2 ~ step 5 of UE-initiated Deregistration procedure in clause 4.2.2.3.2 is performed.

5. [Conditional] As in step 6 of Figure 4.2.2.3.2-1.

5a. [Conditional] As in step 6a of Figure 4.2.2.3.2-1.

6. [Conditional] If the UE receives the Deregistration Request message from the AMF in step 2, the UE sends a Deregistration Accept message to the AMF any time after step 2. The NG-RAN forwards this NAS message to the AMF along with the TAI+ Cell identity of the cell which the UE is using.

7. [Conditional] AMF to AN: N2 UE Context Release Request (Cause): as in step 8 of Figure 4.2.2.3.2.

If the UE is deregistered over only 3GPP access or non-3GPP access and the AMF does not have UE context for the other, or if the procedure applies to both access types, then at any time, AMF can unsubscribe from the UDM, otherwise the AMF can deregister from UDM using Nudm\_UECM\_Deregistration request by indicating its associating access type.

\* \* \* \* Next change \* \* \* \*

#### 4.2.4.2 UE Configuration Update procedure for access and mobility management related parameters

This procedure is initiated by the AMF when the AMF wants to update access and mobility management related parameters in the UE configuration.

This procedure is also used to trigger UE to perform, based on network indication, either Mobility Registration Update procedure while the UE is in CM-CONNECTED state to modify NAS parameters that require negotiation (e.g. MICO mode) or to steer the UE towards EPC as specified in clause 5.31.3 of TS 23.501 [2], or Mobility Registration Update procedure after the UE enters CM-IDLE state (e.g. for changes to Allowed NSSAI that require re-registration) or to update the UE with the Alternative S-NSSAI. If a Registration procedure is needed, the AMF provides an indication to the UE to initiate a Registration procedure.

UE Configuration Update shall be sent over the Access Type (i.e. 3GPP access or non-3GPP access) the UE Configuration Update is applied to, when applicable. If the AMF wants to update NAS parameters in the UE which require UE acknowledgement, then the AMF provides an indication to the UE of whether the UE shall acknowledge the command or not. The AMF should not request acknowledgement of the NITZ command. The AMF shall request acknowledgement for NSSAI information (e.g. Allowed NSSAI, Partially Allowed NSSAI, S-NSSAI rejected partially in the RA), 5G-GUTI, TAI List, [TAI List for S-NSSAIs in Partially Allowed NSSAI], [TAI List for S-NSSAI(s) rejected partially in RA] and Mobility Restrictions, LADN Information, MICO, Operator-defined access category definitions, PLMN-assigned UE Radio Capability ID, S-NSSAI location availability information and SMS subscription.



Figure 4.2.4.2-1: UE Configuration Update procedure for access and mobility management related parameters

0. AMF determines the necessity of UE configuration change due to various reasons (e.g. UE mobility change, NW policy, reception of Subscriber Data Update Notification from UDM, change of Network Slice configuration (including due to change of the NSSRG information in subscription information as specified in clause 5.15.12 of TS 23.501 [2], or due to change of NSAG Information as specified in clause 5.15.14 of TS 23.501 [2]), or to remove S-NSSAI from the Allowed NSSAI due to expiry of slice deregistration inactivity timer or to provide the UE with updated Slice Usage Policy as specified in clause 5.15.15 of TS 23.501 [2], need to assign PLMN-assigned UE Radio Capability ID, change of Enhanced Coverage Restriction information in the UE context, informing MBSR (IAB-UE) authorization state changes as specified in clause 5.35A.4 of TS 23.501 [2] based on operator configuration, a change related to discontinuous coverage (e.g. out-of-coverage period change), need to notify the UE to reconnect to the network due to NG-RAN timing synchronization status change as specified in clause 4.15.9.4) or that the UE needs to perform a Registration Procedure or need to update the MWAB authorization state changes as specified in clause 5.XX of TS 23.501 [2]. If a UE is in CM-IDLE, the AMF can wait until the UE is in CM-CONNECTED state or triggers Network Triggered Service Request (in clause 4.2.3.3).

NOTE 1: It is up to the network implementation whether the AMF can wait until the UE is in CM-CONNECTED state or trigger the Network Triggered Service Request.

NOTE 2: The AMF can check whether Network Slice configuration needs to be updated by using the Nnssf\_NSSelection\_Get service operation and in such case the AMF compares the stored information with the output from the NSSF to decide whether an update of the UE is required.

The AMF may include Mobility Restriction List in N2 message that delivers UE Configuration Update Command to the UE if the service area restriction for the UE is updated.

1. The AMF sends UE Configuration Update Command containing one or more UE parameters (Configuration Update Indication, 5G-GUTI, TAI List, Allowed NSSAI, Mapping Of Allowed NSSAI, [Partially Allowed NSSAI], [Mapping Of Partially Allowed NSSAI], [TAI List for S-NSSAIs in Partially Allowed NSSAI], Configured NSSAI for the Serving PLMN, Mapping Of Configured NSSAI, [NSSRG Information], rejected S-NSSAIs, [TAI List for S-NSSAI(s) rejected partially in RA], NITZ, Mobility Restrictions, LADN Information, MICO, Operator-defined access category definitions, SMS Subscribed Indication, [PLMN-assigned UE Radio Capability ID], [PLMN-assigned UE Radio Capability ID deletion indication], ["List of PLMN(s) to be used in Disaster Condition"], [Disaster Roaming wait range information], [Disaster Return wait range information], [MPS priority], [MCX priority], [UAS services Indication], MBSR authorization information, [S-NSSAI location availability information], [Mapping Of Alternative NSSAI], UE reconnection indication, [Slice Usage Policy], [Maximum Time Offset]) to the UE. Optionally, the AMF may update the rejected S-NSSAIs in the UE Configuration Update command.

The AMF includes one or more of 5G-GUTI, TAI List, Allowed NSSAI, Mapping Of Allowed NSSAI, Partially Allowed NSSAI, Mapping Of Partially Allowed NSSAI, [TAI List for S-NSSAIs in Partially Allowed NSSAI], Configured NSSAI for the Serving PLMN, Mapping Of Configured NSSAI, rejected S-NSSAIs, [TAI List for S-NSSAI(s) rejected partially in RA], NITZ (Network Identity and Time Zone), Mobility Restrictions parameters, LADN Information, Operator-defined access category definitions, PLMN-assigned UE Radio Capability ID, or SMS Subscribed Indication if the AMF wants to update these NAS parameters without triggering a UE Registration procedure.

The AMF may include in the UE Configuration Update Command also Configuration Update Indication parameters indicating whether:

- Network Slicing Subscription Change has occurred;

- the UE shall acknowledge the command; and

- whether a Registration procedure is requested.

If the AMF indicates Network Slicing Subscription Change, then the UE shall locally erase all the network slicing configuration for all PLMNs and if applicable, update the configuration for the current PLMN based on any received information. If the AMF indicates Network Slicing Subscription Change, the UE shall also be requested to acknowledge in step 2.

If the AMF also includes in the UE Configuration Update Command message a new Configured NSSAI for the Serving PLMN, then the AMF should also include a new Allowed NSSAI with, if available, the associated Mapping Of Allowed NSSAI, unless the AMF cannot determine the new Allowed NSSAI after the Subscribed S-NSSAI(s) are updated, in which case the AMF does not include in the UE Configuration Update Command message any Allowed NSSAI. If the UE has indicated its support of the subscription-based restrictions to simultaneous registration of network slices feature in the UE 5GMM Core Network Capability, the AMF includes, if available, the NSSRG Information, defined in clause 5.15.12 of TS 23.501 [2]. If the UE has not indicated its support of the subscription-based restrictions to simultaneous registration of network slices feature and the subscription information for the UE includes NSSRG information and the AMF is providing the Configured NSSAI to the UE, the Configured NSSAI shall include the S-NSSAIs according to clause 5.15.12 of TS 23.501 [2]. For a non-roaming UE, if the UE has indicated its support of Slice Usage Policy in the UE 5GMM Core Network Capability, the AMF may include Slice Usage Policies for slices in the Configured NSSAI as described in clause 5.15.15 of TS 23.501 [2]. In the Slice Usage Policy, the AMF indicates an S-NSSAI is on demand slice and slice deregistration inactivity timer value. If the AMF includes slice deregistration timer value, the UE starts any slice deregistration inactivity timer for the on demand S-NSSAIs as described in clause 5.15.15 of TS 23.501 [2].

If the UE has indicated its support of NSAG feature in 5GMM Core Network Capability, the AMF includes, if available, the NSAG Information, defined in clause 5.15.14 of TS 23.501 [2] when providing a new Configured NSSAI which includes S-NSSAIs with associated NSAG Value(s) or when the NSAG Information changes for some S-NSSAI in the Configured NSSAI. When NSAG Information is provided to the UE, the AMF requests the UE to acknowledge the UE Configuration Command message.

When the UE and the AMF supports RACS as defined in clause 5.4.4.1a of TS 23.501 [2] and the AMF needs to configure the UE with a UE Radio Capability ID and the AMF already has the UE radio capabilities other than NB-IoT radio capabilities for the UE and the AMF may provide the UE with the UE Radio Capability ID for the UE radio capabilities the UCMF returns to the AMF in a Nucmf\_assign service operation for this UE.

If the UE is needed to be redirected to the dedicated frequency band(s) for S-NSSAI(s), the AMF may determine a Target NSSAI, as described in clause 5.3.4.3.3 of TS 23.501 [2], itself or by interacting with the NSSF using Nnssf\_NSSelection\_Get which includes e.g. the Rejected S-NSSAI(s) for RA and Allowed NSSAI. The AMF may determine RFSP index associated to the Target NSSAI by interacting with the PCF using Npcf\_AMPolicyControl\_Update which includes the Target NSSAI to retrieve a corresponding RFSP index or based on local configuration in case PCF is not deployed. The Target NSSAI and the RFSP index associated with the Target NSSAI are provided to the NG-RAN within the N2 message carrying the UE Configuration Update Command message.

If the UE and AMF supports Disaster Roaming service, the AMF may include the "list of PLMN(s) to be used in Disaster Condition", Disaster Roaming wait range information and Disaster Return wait range information as specified in TS 23.501 [2]. When the disaster condition is no longer applicable, the serving AMF that provides Disaster Roaming service may notify the UE as specified in clause 5.40.5 of TS 23.501 [2].

If the AMF receives a Subscriber Data Update Notification from the UDM that includes MPS priority or MCX priority, the AMF includes MPS priority or MCX priority in the UE Configuration Update Command, respectively, as specified in clause 5.22.2 of TS 23.501 [2].

If UAS service becomes enabled or disabled (e.g. because the aerial subscription is part of the UE subscription data retrieved from UDM changes), the AMF may include an Indication of UAS services being enabled or disabled in the UE Configuration Update Command.

If the UE indicates its support of LADN per DNN and S-NSSAI in the UE MM Core Network Capability during the Registration procedure as specified in clause 4.2.2.2.2, the AMF may include LADN Information per DNN and S-NSSAI.

For MBSR (IAB-UE) registered in AMF, the AMF may update the MBSR authorization information as specified in clause 5.35A.4 of TS 23.501 [2].

If the UE indicated a support for the Network Slice Replacement feature in the 5GMM Core Network Capability and the AMF determines that an S-NSSAI from an Allowed NSSAI is to be replaced with an Alternative S-NSSAI (as described in clause 5.15.19 of TS 23.501 [2]), the AMF includes the Mapping Of Alternative NSSAI within the UE Configuration Update Command to the UE and also adds the Alternative S-NSSAI to the Allowed NSSAI and/or Configured NSSAI, if not already included.

If both the UE and the network support unavailability due to discontinuous coverage, the AMF determines this Maximum Time Offset as described in clause 5.4.13.5 of TS 23.501 [2]. The AMF includes the Maximum Time Offset within the UE Configuration Update Command to the UE.

If the serving AMF determines the MWAB-UE's authorization status changes from "authorized" to "unauthorized", it sends UE Configuration Update message to remove the dedicated S-NSSAI(s) for MWAB operation from the Allowed NSSAI as described in clause 5.xx of TS 23.501 [2].

2a. If the UE Configuration Update Indication requires acknowledgement of the UE Configuration Update Command, then the UE shall send a UE Configuration Update complete message to the AMF. The AMF should request acknowledgement for all UE Configuration Updates, except when only NITZ is provided. If Registration procedure is not required, steps 3a, 3b, 3c and step 4 are skipped. If the Configuration Update Indication is included in the UE Configuration Update Command message and it requires a Registration procedure, depending on the other NAS parameters included in the UE Configuration Update command, the UE shall execute steps 3a or 3b or 3c+4 as applicable.

If the PLMN-assigned UE Radio Capability ID is included in step1, the AMF stores the UE Radio Capability ID in UE context if receiving UE Configuration Update complete message.

If the UE receives PLMN-assigned UE Radio Capability ID deletion indication in step 1, the UE shall delete the PLMN-assigned UE Radio Capability ID(s) for this PLMN. If UE Configuration Update is only for this purpose, the following steps are skipped.

2b. [Conditional] The AMF also uses the Nudm\_SDM\_Info service operation to provide an acknowledgment to UDM that the UE received CAG information as part of the Mobility Restrictions (if the CAG information was updated), or the Network Slicing Subscription Change Indication (if this was indicated in step 1) and acted upon it.

2c. [Conditional] If the AMF has reconfigured the 5G-GUTI over 3GPP access, the AMF informs the NG-RAN of the new UE Identity Index Value (derived from the new 5G-GUTI) when the AMF receives the acknowledgement from the UE in step 2a.

[Conditional] If the UE is registered to the same PLMN via both 3GPP and non-3GPP access and if the AMF has reconfigured the 5G-GUTI over non-3GPP access and the UE is in CM-CONNECTED state over 3GPP access, then the AMF informs the NG-RAN of the new UE Identity Index Value (derived from the new 5G-GUTI) when the AMF receives the acknowledgement from the UE in step 2a.

[Conditional] If the AMF has configured the UE with a PLMN-assigned UE Radio Capability ID, the AMF informs NG-RAN of the UE Radio Capability ID, when it receives the acknowledgement from the UE in step 2a.

[Conditional] If the Mobility Restrictions for the UE were updated and the Mobility Restrictions were not provided in the N2 message that delivers the UE Configuration Update Command, the AMF provides the NG-RAN with updated Mobility Restrictions unless the AMF releases the UE in this step (see below).

If the AMF initiated the UE Configuration Update procedure due to receiving Nudm\_SDM\_Notification and the CAG information has changed such that a CAG Identifier has been removed from the Allowed CAG list or the UE is only allowed to access CAG cells, the AMF shall release the NAS signalling connection by triggering the AN Release procedure for UEs that are not receiving Emergency Services as defined in TS 23.501 [2].

If the AMF need to update Allowed CAG list to the NG-RAN due to change of validity condition as described in TS 23.501 [2], the AMF may either update NG-RAN and keep the NAS signalling connection or release the NAS signalling connection by triggering the AN Release procedure, without updating Allowed CAG list to the NG-RAN, for the UEs that are not receiving Emergency Services as defined in TS 23.501 [2].

NOTE 3: If validity condition needs to be applied immediately before the NG-RAN enforces Allowed CAG list, the AMF can trigger AN Release without sending updated Allowed CAG list to the NG-RAN.

NOTE 4: When the UE is accessing the network for emergency service the conditions in clause 5.16.4.3 of TS 23.501 [2] apply.

2d [Conditional] If the UE is configured with a new 5G-GUTI in step 2a via non-3GPP access and the UE is registered to the same PLMN via both 3GPP and non-3GPP access, then the UE passes the new 5G-GUTI to its 3GPP access' lower layers.

If the UE is configured with a new 5G-GUTI in step 2a over the 3GPP access, the UE passes the new 5G-GUTI to its 3GPP access' lower layers.

NOTE 5: Steps 2c and 2d are needed because the NG-RAN may use the RRC\_INACTIVE state and a part of the 5G-GUTI is used to calculate the Paging Frame (see TS 38.304 [44] and TS 36.304 [43]). It is assumed that the UE Configuration Update Complete is reliably delivered to the AMF after the 5G-AN has acknowledged its receipt to the UE.

3a. [Conditional] If only NAS parameters that can be updated without transition from CM-IDLE are included (e.g. MICO mode, Enhanced Coverage Restricted information) the UE shall initiate a Registration procedure immediately after the acknowledgement to re-negotiate the updated NAS parameter(s) with the network. Steps 3b, 3c and step 4 are skipped.

3b. [Conditional] If a new Allowed NSSAI and/or a new Mapping Of Allowed NSSAI and/or Partially Allowed NSSAI and/or Mapping Of Partially Allowed NSSAI and/or a new Configured NSSAI provided by the AMF to the UE in step 1 does not affect the existing connectivity to AMF, the AMF needs not release the NAS signalling connection for the UE after receiving the acknowledgement in step 2 and immediate registration is not required. The UE can start immediately using the new Allowed NSSAI and/or the new Mapping Of Allowed NSSAI and/or Partially Allowed NSSAI and/or Mapping Of Partially Allowed NSSAI. If one or more PDU Sessions use a S-NSSAI that is not part of the new Allowed NSSAI or Partially Allowed NSSAI, the AMF indicates to the SMF(s) the corresponding PDU Session ID(s) and each SMF releases the PDU Session(s) according to clause 4.3.4.2. The UE cannot connect to an S-NSSAI included in the new Configured NSSAI for the Serving PLMN but not included in the new Allowed NSSAI or Partially Allowed NSSAI until the UE performs a Registration procedure and includes a Requested NSSAI based on the new Configured NSSAI, following the requirements described in clause 5.15.5.2 of TS 23.501 [2]. Steps 3c and 4 are skipped.

The AMF may, based on its policy, provide anyway an indication that a Registration procedure is required even though the UE Configuration Update Command in step 1 does not affect the existing connectivity to Network Slices: in such a case only step 3c is skipped.

3c. [Conditional] If a new Allowed NSSAI and/or a new Mapping Of Allowed NSSAI and/or Partially Allowed NSSAI and/or Mapping Of Partially Allowed NSSAI and/or a new Configured NSSAI provided by the AMF to the UE in step 1 affects ongoing existing connectivity to AMF, then the AMF shall provide an indication that the UE shall initiate a Registration procedure.

4. [Conditional] After receiving the acknowledgement in step 2, the AMF shall release the NAS signalling connection for the UE by triggering the AN Release procedure, unless there is one established PDU Sessions associated with regulatory prioritized services. If there is one established PDU Session associated with regulatory prioritized services, the AMF informs SMFs to release the PDU Session(s) associated with non regulatory prioritized services for this UE (see clause 4.3.4).

The AMF shall reject any NAS Message from the UE carrying PDU Session Establishment Request for a non-emergency PDU Session before the required Registration procedure has been successfully completed by the UE.

The UE initiates a Registration procedure (see clauses 4.2.2.2.2 and 4.13.3.1) with registration type Mobility Registration Update after the UE enters CM-IDLE state and shall not include the 5G-S-TMSI or GUAMI in Access Stratum signalling and shall include, subject to the conditions set out in clause 5.15.9 of TS 23.501 [2], a Requested NSSAI in access stratum signalling. If there is an established PDU Session associated with emergency service and the UE has received an indication to perform the Registration procedure, the UE shall initiate the Registration procedure only after the PDU Session associated with emergency service is released.

NOTE 6: Receiving UE Configuration Update command without an indication requesting to perform re-registration, can still trigger Registration procedure by the UE for other reasons.

\* \* \* \* Next change \* \* \* \*

### 4.3.2 PDU Session Establishment

#### 4.3.2.1 General

A PDU Session establishment may correspond to:

- a UE initiated PDU Session Establishment procedure.

- a UE initiated PDU Session handover between 3GPP and non-3GPP.

- a UE initiated PDU Session handover from EPS to 5GS.

- a Network triggered PDU Session Establishment procedure. In this case the network sends the device trigger message to application(s) on the UE side. The payload included in Device Trigger Request message contains information on which application on the UE side is expected to trigger the PDU Session establishment request. Based on that information, the application(s) on the UE side trigger the PDU Session Establishment procedure. For more detail refer to clause 4.13.2.

If the UE is simultaneously registered to a non-3GPP access via a N3IWF/TNGF/W-AGF located in a PLMN different from the PLMN of the 3GPP access, the functional entities in the following procedures are located in the PLMN of the access used to exchange NAS with the UE for the PDU Session.

As specified in clause 5.6.1 of TS 23.501 [2], a PDU Session may be associated either (a) with a single access type at a given time, i.e. either 3GPP access or non-3GPP access, or (b) simultaneously with multiple access types, i.e. one 3GPP access and one non-3GPP access. A PDU Session associated with multiple access types is referred to as Multi Access-PDU (MA PDU) Session and it may be requested by ATSSS-capable UEs.

The following clause 4.3.2.2 specifies the procedures for establishing PDU Sessions associated with a single access type at a given time. The particular procedures associated with MA PDU Sessions are specified as part of the ATSSS procedures in clause 4.22.

#### 4.3.2.2 UE Requested PDU Session Establishment

##### 4.3.2.2.1 Non-roaming and Roaming with Local Breakout

Clause 4.3.2.2.1 specifies PDU Session establishment in the non-roaming and roaming with local breakout cases. The procedure is used to:

- Establish a new PDU Session;

- Handover a PDN Connection in EPS to PDU Session in 5GS without N26 interface;

- Switching an existing PDU Session between non-3GPP access and 3GPP access. The specific system behaviour in this case is further defined in clauses 4.9.2 and 4.9.3; or

- Request a PDU Session for Emergency services.

In the case of roaming, the AMF determines if a PDU Session is to be established in LBO or Home Routing. In the case of LBO, the procedure is as in the case of non-roaming with the difference that the AMF, the SMF, the UPF and the PCF are located in the visited network. PDU Sessions for Emergency services are never established in Home Routed mode. If Control Plane CIoT 5GS Optimisation is enabled for the PDU session with LBO, the NEF is not used as the anchor of this PDU Session.

NOTE 1: UE provides both the S-NSSAIs of the Home PLMN and Visited PLMN to the network as described in clause 5.15.5.3 of TS 23.501 [2].



Figure 4.3.2.2.1-1: UE-requested PDU Session Establishment for non-roaming and roaming with local breakout

The procedure assumes that the UE has already registered on the AMF thus unless the UE is Emergency Registered the AMF has already retrieved the user subscription data from the UDM.

1. From UE to AMF: NAS Message (S-NSSAI(s), [Alternative S-NSSAI], UE Requested DNN, PDU Session ID, Request type, Old PDU Session ID, N1 SM container (PDU Session Establishment Request, [Port Management Information Container])).

In order to establish a new PDU Session, the UE generates a new PDU Session ID.

The UE initiates the UE Requested PDU Session Establishment procedure by the transmission of a NAS message containing a PDU Session Establishment Request within the N1 SM container. The PDU Session Establishment Request includes a PDU session ID, Requested PDU Session Type, a Requested SSC mode, 5GSM Capability, PCO, SM PDU DN Request Container, [Number Of Packet Filters], [Header Compression Configuration], UE Integrity Protection Maximum Data Rate, [Always-on PDU Session Requested], [RSN], [URSP rule enforcement reports] and [PDU Session Pair ID].

The Request Type indicates "Initial request" if the PDU Session Establishment is a request to establish a new PDU Session and indicates "Existing PDU Session" if the request refers to an existing PDU Session switching between 3GPP access and non-3GPP access or to a PDU Session handover from an existing PDN connection in EPC. If the request refers to an existing PDN connection in EPC, the S-NSSAI is set as described in clause 5.15.7.2 of TS 23.501 [2]

When Emergency service is required and an Emergency PDU Session is not already established, a UE shall initiate the UE Requested PDU Session Establishment procedure with a Request Type indicating "Emergency Request".

The Request Type indicates "Emergency Request" if the PDU Session Establishment is a request to establish a PDU Session for Emergency services. The Request Type indicates "Existing Emergency PDU Session" if the request refers to an existing PDU Session for Emergency services switching between 3GPP access and non-3GPP access or to a PDU Session handover from an existing PDN connection for Emergency services in EPC.

The 5GSM Core Network Capability is provided by the UE and handled by SMF as defined in clause 5.4.4b of TS 23.501 [2].

The Number Of Packet Filters indicates the number of supported packet filters for signalled QoS rules for the PDU Session that is being established. The number of packet filters indicated by the UE is valid for the lifetime of the PDU Session. For presence condition, see TS 24.501 [25].

The UE Integrity Protection Maximum Data Rate indicates the maximum data rate up to which the UE can support UP integrity protection. The UE shall provide the UE Integrity Protection Data Rate capability independently of the Access Type over which the UE sends the PDU Session Establishment Request.

If the use of header compression for Control Plane CIoT 5GS optimisation was negotiated successfully between the UE and the network in the previous registration procedure, the UE shall include the Header Compression Configuration, unless "Unstructured" PDU Session Type is indicated. The Header Compression Configuration includes the information necessary for the header compression channel setup. Optionally, the Header Compression Configuration may include additional header compression context parameters.

The NAS message sent by the UE is encapsulated by the AN in a N2 message towards the AMF that should include User location information and Access Type Information.

The PDU Session Establishment Request message may contain SM PDU DN Request Container containing information for the PDU Session authorization by the external DN.

The UE includes the S-NSSAI from the Allowed NSSAI of the current access type or Partially Allowed NSSAI. If the UE is provided with the mapping of an S-NSSAI that is replaced by an Alternative S-NSSAI, the UE shall provide both the Alternative S-NSSAI and the S-NSSAI that is replaced by it. If the Mapping of Allowed NSSAI or Mapping Of Partially Allowed NSSAI was provided to the UE, the UE shall provide both the S-NSSAI of the VPLMN from the Allowed NSSAI or Partially Allowed NSSAI and the corresponding S-NSSAI of the HPLMN from the Mapping Of Allowed NSSAI or Mapping Of Partially Allowed NSSAI. If the UE is provided with the mapping of the VPLMN S-NSSAI to a VPLMN Alternative S-NSSAI, the UE provides both the VPLMN Alternative S-NSSAI and the VPLMN S-NSSAI in the PDU Session Establishment message. If the UE is provided with the mapping of the HPLMN S-NSSAI to a HPLMN Alternative S-NSSAI, the UE provides both the HPLMN Alternative S-NSSAI and the HPLMN S-NSSAI in the PDU Session Establishment message. The AMF verifies whether the Alternative S-NSSAI and the S-NSSAI provided in the PDU Session Establishment Request message is valid based on the UE context as described in clause 5.15.19 of TS 23.501 [2].

If the procedure is triggered for SSC mode 3 operation, the UE shall also include the Old PDU Session ID which indicates the PDU Session ID of the on-going PDU Session to be released, in NAS message. The Old PDU Session ID is included only in this case.

The AMF receives from the AN the NAS SM message (built in step 1) together with User Location Information (e.g. Cell Id in the case of the NG-RAN).

The UE shall not trigger a PDU Session establishment for a PDU Session corresponding to a LADN when the UE is outside the area of availability of the LADN.

The UE shall not trigger a PDU Session establishment for a PDU Session associated to an S-NSSAI if the S-NSSAI is not valid as per the S-NSSAI location availability information.

If the UE is establishing a PDU session for IMS and the UE is configured to discover the P-CSCF address during connectivity establishment, the UE shall include an indicator that it requests a P‑CSCF IP address(es) within the SM container.

The PS Data Off status is included in the PCO in the PDU Session Establishment Request message.

The UE capability to support Reliable Data Service is included in the PCO in the PDU Session Establishment Request message.

If the UE has indicated that it supports transfer of Port Management Information Containers as per UE 5GSM Core Network Capability and if the PDU session type is Ethernet, then the UE shall include the MAC address of the DS-TT Ethernet port used for this Ethernet PDU session. If the UE is aware of the UE-DS-TT Residence Time, then the UE shall additionally include the UE-DS-TT Residence Time.

If the UE requests to establish always-on PDU session, the UE includes an Always-on PDU Session Requested indication in the PDU Session Establishment Request message.

As described in TS 23.548 [74], a UE that hosts EEC(s) may indicate in the PCO that it supports the ability to receive ECS address(es) via NAS and to transfer the ECS Address(es) to the EEC(s).

A UE that hosts the EDC functionality shall indicate in the PCO its capability to support the EDC functionality (see clause 5.2.1 of TS 23.548 [74]).

The UE may also include PDU Session Pair ID and/or RSN in PDU Session Establishment Request message as described in clause 5.33.2.1 of TS 23.501 [2].

A UE that supports EAS re-discovery as described in clause 6.2.3.3 of TS 23.548 [74], may indicate so in the PCO.

Port Management Information Container may be received from DS-TT and includes port management capabilities, i.e. information indicating which standardized and deployment-specific port management information is supported by DS-TT as defined in clause 5.28.3 of TS 23.501 [2].

If UE supports to report URSP rule enforcement to network and the URSP rule that triggered this PDU Session Establishment Request included the Indication for reporting URSP rule enforcement, the UE may provide URSP rule enforcement report as described in clause 6.6.2.4 of TS 23.503 [20].

2. For NR satellite access, the AMF may decide to verify the UE location as described in clause 5.4.11.4 of TS 23.501 [2].

The AMF determines that the message corresponds to a request for a new PDU Session based on that Request Type indicates "initial request" and that the PDU Session ID is not used for any existing PDU Session of the UE. If the NAS message does not contain an S-NSSAI, the AMF determines an S-NSSAI of the Serving PLMN for the requested PDU Session from the current Allowed NSSAI for the UE. If there is only one S-NSSAI in the Allowed NSSAI, this S-NSSAI shall be used. If there is more than one S-NSSAI in the Allowed NSSAI, the S-NSSAI selected is either according to the UE subscription, if the subscription contains only one default S-NSSAI and the corresponding mapped HPLMN S-NSSAI of the Serving PLMN is included in the Allowed NSSAI, or based on operator policy (e.g. also ensures any UE Requested DNN is allowed for the selected S-NSSAI)). When the NAS Message does not contain a DNN, the AMF determines the DNN for the requested PDU Session by selecting the default DNN for the S-NSSAI (irrespective of whether the S-NSSAI is included in the NAS message or determined by the AMF) if the default DNN is present in the UE's Subscription Information (or for the corresponding S-NSSAI of the HPLMN, in the case of LBO); otherwise the serving AMF selects a locally configured DNN for this S-NSSAI of the Serving PLMN. If the AMF cannot select an SMF (e.g. the UE requested DNN is not supported by the network, or the UE requested DNN is not in the Subscribed DNN List for the S-NSSAI (or its mapped value for the HPLMN in the case of LBO) and wildcard DNN is not included in the Subscribed DNN list), the AMF shall, based on operator policies received from PCF, either reject the NAS Message containing PDU Session Establishment Request from the UE with an appropriate cause or request PCF to replace the UE requested DNN by a selected DNN. If the DNN requested by the UE is present in the UE subscription information but indicated for replacement in the operator policies received from PCF, the AMF shall request the PCF to perform a DNN replacement to a selected DNN. AMF requests DNN replacement as specified in clause 4.16.2.1.1. If the DNN requested by the UE is present in the UE subscription information but not supported by the network and not indicated for replacement in the operator policies received from PCF, the AMF shall reject the NAS Message containing PDU Session Establishment Request from the UE with an appropriate cause value.

The AMF selects an SMF as described in clause 6.3.2 of TS 23.501 [2] and clause 4.3.2.2.3. If the Request Type indicates "Initial request" or the request is due to handover from EPS or from non-3GPP access serving by a different AMF, the AMF stores an association of the S-NSSAI(s), the DNN, the PDU Session ID, the SMF ID as well as the Access Type of the PDU Session. If the AMF determines to replace the S-NSSAI received from the UE with the Alternative S-NSSAI or the AMF receives the Alternative S-NSSAI and the S-NSSAI is by the UE, the AMF selects the SMF based on the Alternative S-NSSAI.

During registration procedures, the AMF determines the use of the Control Plane CIoT 5GS Optimisation or User Plane CIoT 5GS Optimisation based on UEs indications in the 5G Preferred Network Behaviour, the serving operator policies and the network support of CIoT 5GS optimisations. The AMF selects an SMF that supports Control Plane CIoT 5GS optimisation or User Plane CIoT 5GS Optimisation as described in clause 6.3.2 of TS 23.501 [2].

If the Request Type is "initial request" and if the Old PDU Session ID indicating the existing PDU Session is also contained in the message, the AMF selects an SMF as described in clause 4.3.5.2 and stores an association of the new PDU Session ID, the S-NSSAI(s), the selected SMF ID as well as Access Type of the PDU Session.

If the Request Type indicates "Existing PDU Session", the AMF selects the SMF based on SMF-ID received from UDM. The case where the Request Type indicates "Existing PDU Session" and either the AMF does not recognize the PDU Session ID or the subscription context that the AMF received from UDM during the Registration or Subscription Profile Update Notification procedure does not contain an SMF ID corresponding to the PDU Session ID constitutes an error case. The AMF updates the Access Type stored for the PDU Session.

If the Request Type indicates "Existing PDU Session" referring to an existing PDU Session moved between 3GPP access and non-3GPP access, then if the Serving PLMN S-NSSAI of the PDU Session is present in the Allowed NSSAI of the target access type or Partially Allowed NSSAI, the PDU Session Establishment procedure can be performed in the following cases:

- the SMF ID corresponding to the PDU Session ID and the AMF belong to the same PLMN;

- the SMF ID corresponding to the PDU Session ID belongs to the HPLMN;

Otherwise the AMF shall reject the PDU Session Establishment Request with an appropriate reject cause.

NOTE 2: The SMF ID includes the PLMN ID that the SMF belongs to.

The AMF shall reject a request coming from an Emergency Registered UE and the Request Type indicates neither "Emergency Request" nor "Existing Emergency PDU Session". When the Request Type indicates "Emergency Request", the AMF is not expecting any S-NSSAI and DNN value provided by the UE and uses locally configured values instead. The AMF stores the Access Type of the PDU Session.

If the Request Type indicates "Emergency Request" or "Existing Emergency PDU Session", the AMF selects the SMF as described in clause 5.16.4 of TS 23.501 [2].

If the AMF is running a slice deregistration inactivity timer for the S-NSSAI of the PDU Session and the timer is associated with the Access Type over which the PDU Session Establishment Request was received, the AMF stops the timer.

3. From AMF to SMF: Either Nsmf\_PDUSession\_CreateSMContext Request (SUPI, selected DNN, UE requested DNN, S-NSSAI(s), [Alternative S-NSSAI], [Slice Area Restriction indication], PDU Session ID, AMF ID, Request Type, [PCF ID, Same PCF Selection Indication], Priority Access, [Small Data Rate Control Status], N1 SM container (PDU Session Establishment Request), User location information, Access Type, RAT Type, PEI, GPSI, UE presence in LADN service area, Subscription For PDU Session Status Notification, DNN Selection Mode, Trace Requirements, Control Plane CIoT 5GS Optimisation indication, Control Plane Only indicator, Satellite backhaul category, GEO Satellite ID, [PVS FQDN(s) and/or PVS IP address(es), Onboarding Indication], Disaster Roaming service indication) or Nsmf\_PDUSession\_UpdateSMContext Request (SUPI, DNN, S-NSSAI(s), SM Context ID, AMF ID, Request Type, N1 SM container (PDU Session Establishment Request), User location information, Access Type, RAT type, PEI, Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.18 of TS 23.501 [2]), Satellite backhaul category, GEO Satellite ID), [PCF binding information, notification of SM Policy Association establishment Indication].

If the AMF does not have an association with an SMF for the PDU Session ID provided by the UE (e.g. when Request Type indicates "initial request"), the AMF invokes the Nsmf\_PDUSession\_CreateSMContext Request, but if the AMF already has an association with an SMF for the PDU Session ID provided by the UE (e.g. when Request Type indicates "existing PDU Session"), the AMF invokes the Nsmf\_PDUSession\_UpdateSMContext Request.

The AMF sends the S-NSSAI of the Serving PLMN from the Allowed NSSAI or Partially Allowed NSSAI to the SMF. If the AMF determined to replace the S-NSSAI received from the UE with an Alternative S-NSSAI and the AMF selected the SMF based on the Alternative S-NSSAI in step 2, the AMF sends both the S-NSSAI value of the Alternative S-NSSAI and the S-NSSAI value of the S-NSSAI received from the UE to the SMF. If the Alternative S-NSSAI and the S-NSSAI is provided by the UE and the AMF selected the SMF based on the Alternative S-NSSAI in step 2, the AMF sends both the S-NSSAI value of the Alternative S-NSSAI and the S-NSSAI value of the S-NSSAI received from the UE to the SMF. For roaming scenario in local breakout (LBO), the AMF also sends the corresponding S-NSSAI of the HPLMN from the Mapping Of Allowed NSSAI or Mapping Of Partially Allowed NSSAI to the SMF. If the AMF determines to replace the HPLMN S-NSSAI received from the UE with the HPLMN Alternative S-NSSAI or the AMF receives the HPLMN Alternative S-NSSAI and the HPLMN S-NSSAI provided by the UE, the AMF sends both HPLMN S-NSSAI and HPLMN Alternative S-NSSAI to the SMF.

When the AMF determines that the S-NSSAI is subject to area restriction, i.e. the S-NSSAI is configured with an NS-AoS, or the S-NSSAI is present in the Partially Allowed NSSAI, the AMF sends Slice Area Restriction indication to SMF indicating that the PDU Session is subject to area restriction for the S-NSSAI. If the S-NSSAI is replaced with the Alternative S-NSSAI, the AMF checks the area restriction only for the Replaced S-NSSAI.

The AMF ID is the UE's GUAMI which uniquely identifies the AMF serving the UE. The AMF forwards the PDU Session ID together with the N1 SM container containing the PDU Session Establishment Request received from the UE. The GPSI shall be included if available at AMF.

The AMF determines Access Type and RAT Type, see clause 4.2.2.2.1.

The AMF provides the PEI instead of the SUPI when the UE in limited service state has registered for Emergency services (i.e. Emergency Registered) without providing a SUPI. The PEI is defined in clause 5.9.3 of TS 23.501 [2]. If the UE in limited service state has registered for Emergency services (i.e. Emergency Registered) with a SUPI but has not been authenticated the AMF indicates that the SUPI has not been authenticated. The SMF determines that the UE has not been authenticated when it does not receive a SUPI for the UE or when the AMF indicates that the SUPI has not been authenticated.

If the AMF determines that the selected DNN corresponds to an LADN then the AMF provides the "UE presence in LADN service area" that indicates if the UE is IN or OUT of the LADN service area. If the AMF enforces the LADN Service Area per LADN DNN and S-NSSAI, then the AMF also provides an indication that "the PDU Session is subject to LADN per LADN DNN and S-NSSAI".

If the Old PDU Session ID is included in step 1 and if the SMF is not to be reallocated, the AMF also includes Old PDU Session ID in the Nsmf\_PDUSession\_CreateSMContext Request.

DNN Selection Mode is determined by the AMF. It indicates whether an explicitly subscribed DNN has been provided by the UE in its PDU Session Establishment Request.

The SMF may use DNN Selection Mode when deciding whether to accept or reject the UE request.

When the Establishment cause received as part of AN parameters during the Registration procedure or Service Request procedure is associated with priority services (e.g. MPS, MCX), or when the AMF determines the UE has priority subscription (e.g. MPS, MCX) in the UDM, the AMF includes a Message Priority header to indicate priority information. The SMF uses the Message Priority header to determine if the UE request is subject to exemption from NAS level congestion control. Other NFs relay the priority information by including the Message Priority header in service-based interfaces, as specified in TS 29.500 [17].

In the local breakout case, if the SMF (in the VPLMN) is not able to process some part of the N1 SM information that Home Routed Roaming is required and the SMF responds to the AMF that it is not the right SMF to handle the N1 SM message by invoking Nsmf\_PDUSession\_CreateSMContext Response service operation. The SMF includes a proper N11 cause code triggering the AMF to proceed with home routed case. The procedure starts again at step 2 of clause 4.3.2.2.2.

In the non-roaming case, for PDU Session with Request Type "initial request", the AMF checks if the PCF Selection Assistance info from the UDM indicates that the same PCF is required for the requested DNN and S-NSSAI and if required, the AMF includes in Nsmf\_PDUSession\_CreateSMContext Request both the Same PCF Selection Indication and the PCF ID selected by the AMF, this PCF ID identifies the H-PCF,

If PCF Selection Assistance info is not received from the UDM, the AMF may include a PCF ID in the Nsmf\_PDUSession\_CreateSMContext Request based on operator policies. This PCF ID identifies the H-PCF in the non-roaming case and the V-PCF in the local breakout roaming case.

The AMF includes Trace Requirements if Trace Requirements have been received in subscription data.

If the AMF decides to use the Control Plane CIoT 5GS Optimisation or User Plane CIoT 5GS Optimisation as specified in step 2 or to only use Control Plane CIoT 5GS Optimisation for the PDU session as described in clause 5.31.4 of TS 23.501 [2], the AMF sends the Control Plane CIoT 5GS Optimisation indication or Control Plane Only indicator to the SMF.

If the AMF determines that the RAT type is NB-IoT and the number of PDU Sessions with user plane resources activated for the UE has reached the maximum number of supported user plane resources (0, 1 or 2) based on whether the UE supports UP data transfer and the UE's 5GMM Core Network Capability as described in clause 5.31.19 of TS 23.501 [2], the AMF may either reject the PDU Session Establishment Request or continue with the PDU Session establishment and include the Control Plane CIoT 5GS Optimisation indication or Control Plane Only indicator to the SMF.

The AMF includes the latest Small Data Rate Control Status if it has stored it for the PDU Session.

If the RAT type was included in the message, then the SMF stores the RAT type in SM Context.

If the UE supports CE mode B and use of CE mode B is not restricted according to the Enhanced Coverage Restriction information in the UE context in the AMF, then the AMF shall include the extended NAS-SM timer indication. Based on the extended NAS-SM timer indication, the SMF shall use the extended NAS-SM timer setting for the UE as specified in TS 24.501 [25].

If the identity of an NWDAF is available to the AMF, the AMF informs the SMF of the NWDAF ID(s) used for UE related Analytics and corresponding Analytics ID(s).

If the AMF, based on configuration, is aware that the UE is accessing over a gNB using satellite backhaul as defined in clause 5.43.4 of TS 23.501 [2], the AMF determines the type of satellite backhaul category and includes Satellite backhaul category to the SMF.

If the AMF, based on configuration, is aware that the UE is accessing over a gNB using GEO satellite backhaul, the AMF may, based on configuration, include the GEO satellite ID as described in clause 5.43.2 of TS 23.501 [2].

The AMF may provide the Disaster Roaming service indication as specified in TS 23.501 [2].

4. If Session Management Subscription data for corresponding SUPI, DNN and S-NSSAI of the HPLMN is not available, then SMF retrieves the Session Management Subscription data using Nudm\_SDM\_Get (SUPI, Session Management Subscription data, selected DNN, S-NSSAI of the HPLMN, Serving PLMN ID, [NID]) and subscribes to be notified when this subscription data is modified using Nudm\_SDM\_Subscribe (SUPI, Session Management Subscription data, selected DNN, S-NSSAI of the HPLMN, Serving PLMN ID, [NID]). The UDM may get this information from UDR by Nudr\_DM\_Query (SUPI, Subscription Data, Session Management Subscription data, selected DNN, S-NSSAI of the HPLMN, Serving PLMN ID, [NID]) and may subscribe to notifications from UDR for the same data by Nudr\_DM\_subscribe. If a S-NSSAI is subject to network slice usage control and the S-NSSAI is dedicated to a single AF, for a PDU Session for non-roaming subscribers, the UDM may provide a Slice Usage Policy information including whether a network slice is on demand and a PDU Session inactivity timer value as described in clause 5.15.15 of TS 23.501 [2]. If the SMF received Alternative S-NSSAI (for the HPLMN in roaming case) in step 3, the SMF retrieves subscription data as specified in clause 5.15.19 of TS 23.501 [2].

The SMF may use DNN Selection Mode when deciding whether to retrieve the Session Management Subscription data e.g. if the (selected DNN, S-NSSAI of the HPLMN) is not explicitly subscribed, the SMF may use local configuration instead of Session Management Subscription data.

If the Request Type in step 3 indicates "Existing PDU Session" or "Existing Emergency PDU Session" the SMF determines that the request is due to switching between 3GPP access and non-3GPP access or due to handover from EPS. The SMF identifies the existing PDU Session based on the PDU Session ID. In such a case, the SMF does not create a new SM context but instead updates the existing SM context and provides the representation of the updated SM context to the AMF in the response.

If the Request Type is "Initial request" and if the Old PDU Session ID is included in Nsmf\_PDUSession\_CreateSMContext Request, the SMF identifies the existing PDU Session to be released based on the Old PDU Session ID.

The Subscription data includes the Allowed PDU Session Type(s), Allowed SSC mode(s), default 5QI and ARP, subscribed Session-AMBR, SMF-Associated external parameters.

IP Index or Static IP address/prefix may be included in the subscription data if the UE has subscribed to it.

The SMF checks the validity of the UE request: it checks:

- Whether the UE request is compliant with the user subscription and with local policies;

- (If the selected DNN corresponds to an LADN), whether the UE is located within the LADN service area based on the "UE presence in LADN service area" indication from the AMF. If the AMF does not provide the "UE presence in LADN service area" indication and the SMF determines that the selected DNN corresponds to a LADN, then the SMF considers that the UE is OUT of the LADN service area.

The SMF determines whether the PDU Session requires redundancy and the SMF determines the RSN as described in clause 5.33.2.1 of TS 23.501 [2]. If the SMF determines that redundant handling is not allowed or not possible for the given PDU Session, the SMF shall either reject the establishment of the PDU Session or accept the establishment of a PDU session without redundancy handling based on local policy.

If the UE request is considered as not valid, the SMF decides to not accept to establish the PDU Session.

NOTE 3: The SMF can, instead of the Nudm\_SDM\_Get service operation, use the Nudm\_SDM\_Subscribe service operation with an Immediate Report Indication that triggers the UDM to immediately return the subscribed data if the corresponding feature is supported by both the SMF and the UDM.

For a Disaster Roaming service, the UDM provides the Session Management Subscription data to the SMF based on the local policy and/or the local configuration as specified in clause 5.40.4 of TS 23.501 [2].

For an S-NSSAI subject to NSAC and if LBO applies, the SMF in supporting VPLMN stores the applicable NSAC admission mode.

5. From SMF to AMF: Either Nsmf\_PDUSession\_CreateSMContext Response (Cause, SM Context ID or N1 SM container (PDU Session Reject (Cause))) or an Nsmf\_PDUSession\_UpdateSMContext Response depending on the request received in step 3.

If the SMF received Nsmf\_PDUSession\_CreateSMContext Request in step 3 and the SMF is able to process the PDU Session establishment request, the SMF creates an SM context and responds to the AMF by providing an SM Context ID.

If the UP Security Policy for the PDU Session is determined to have Integrity Protection set to "Required", the SMF may, based on local configuration, decide whether to accept or reject the PDU Session request based on the UE Integrity Protection Maximum Data Rate.

NOTE 4: The SMF can e.g. be configured to reject a PDU Session if the UE Integrity Protection Maximum Data Rate has a very low value, if the services provided by the DN would require higher bitrates.

When the SMF decides to not accept to establish a PDU Session, the SMF rejects the UE request via NAS SM signalling including a relevant SM rejection cause by responding to the AMF with Nsmf\_PDUSession\_CreateSMContext Response. The SMF also indicates to the AMF that the PDU Session ID is to be considered as released, the SMF proceeds to step 20 and the PDU Session Establishment procedure is stopped.

6. Optional Secondary authentication/authorization.

If the Request Type in step 3 indicates "Existing PDU Session", the SMF does not perform secondary authentication/authorization.

If the Request Type received in step 3 indicates "Emergency Request" or "Existing Emergency PDU Session", the SMF shall not perform secondary authentication\authorization.

If the SMF needs to perform secondary authentication/authorization during the establishment of the PDU Session by a DN-AAA Server as described in clause 5.6.6 of TS 23.501 [2], the SMF triggers the PDU Session establishment authentication/authorization as described in clause 4.3.2.3.

7a. If dynamic PCC is to be used for the PDU Session, the SMF performs PCF selection as described in clause 6.3.7.1 of TS 23.501 [2]. If the Request Type indicates "Existing PDU Session" or "Existing Emergency PDU Session", the SMF shall use the PCF already selected for the PDU Session.

Otherwise, the SMF may apply local policy.

7b. The SMF may perform an SM Policy Association Establishment procedure as defined in clause 4.16.4 to establish an SM Policy Association with the PCF and get the default PCC Rules for the PDU Session. The SMF shall include the 3GPP Data Off status if received in step 1. The GPSI, PVS FQDN(s) and/or PVS IP address(es) and the Onboarding Indication shall be included if available at SMF in the case of ON-SNPN. The SMF shall include both the S-NSSAI and the Alternative S-NSSAI, if received in step 3. If the Request Type in step 3 indicates "Existing PDU Session", the SMF provides information on the Policy Control Request Trigger condition(s) that have been met by an SMF initiated SM Policy Association Modification procedure as defined in clause 4.16.5.1. The PCF may provide policy information defined in clause 5.2.5.4 (and in TS 23.503 [20]) to SMF.

The PCF for the UE subscribes to notifications of event "UE reporting Connection Capabilities from associated URSP rule" as defined in clause 6.1.3.18 in TS 23.503 [20], using Npcf\_PolicyAuthorization\_Subscribe (EventId set to "UE reporting Connection Capabilities from associated URSP rule", EventFilter set to at least "list of Connection Capabilities") to the PCF for the PDU Session. The PCF for session may notify the PCF for UE about the URSP rule enforcement together with the PDU session parameters that this application associated with by Npcf\_PolicyAuthorization\_Notify.

During the SM Policy Association Establishment procedure, if the PCF detects the request relates to SM Policy Association enabling integration with TSN or TSC or Deterministic Networking (as defined in TS 23.501 [2] clause 5.28) based on local configuration, the PCF may provide policy control request trigger for 5GS Bridge/Router Information as defined in clause 6.1.3.5 of TS 23.503 [20].

The PCF, based on the Emergency DNN, sets the ARP of the PCC rules to a value that is reserved for Emergency services as described in TS 23.503 [20].

NOTE 5: The purpose of step 7 is to receive PCC rules before selecting UPF. If PCC rules are not needed as input for UPF selection, step 7 can be performed after step 8.

- During the SM Policy Association Establishment procedure for PDU Sessions for non-roaming UEs, if a S-NSSAI is subject to network slice usage control, the PCF may provide a Slice Usage Policy information including whether a network slice is on demand and a PDU Session inactivity timer value as described in clause 5.15.15 of TS 23.501 [2].

8. If the Request Type in step 3 indicates "Initial request", the SMF selects an SSC mode for the PDU Session as described in clause 5.6.9.3 of TS 23.501 [2]. The SMF also selects one or more UPFs as needed as described in clause 6.3.3 of TS 23.501 [2]. In the case of PDU Session Type IPv4 or IPv6 or IPv4v6, the SMF allocates an IP address/prefix for the PDU Session (unless configured otherwise) as described in clause 5.8.2 of TS 23.501 [2]. In the case of PDU Session Type IPv6 or IPv4v6, the SMF also allocates an interface identifier to the UE for the UE to build its link-local address. For Unstructured PDU Session Type the SMF may allocate an IPv6 prefix for the PDU Session and N6 point-to-point tunnelling (based on UDP/IPv6) as described in clause 5.6.10.3 of TS 23.501 [2]. For Ethernet PDU Session Type, neither a MAC nor an IP address is allocated by the SMF to the UE for this PDU Session.

If the AMF indicated Control Plane CIoT 5GS Optimisation in step 3 for this PDU session, then,

1) For Unstructured PDU Session Type, the SMF checks whether UE's subscription include a "NEF Identity for NIDD" for the DNN/S-NSSAI combination. When the "NEF Identity for NIDD" is present in the UE's subscription data, the SMF will select the NEF identified for the S-NSSAI and selected DNN in the "NEF Identity for NIDD" as the anchor of this PDU Session. Otherwise, the SMF will select a UPF as the anchor of this PDU Session.

2) For other PDU Session Types, the SMF will perform UPF selection to select a UPF as the anchor of this PDU Session.

If the Request Type in Step 3 is "Existing PDU Session", the SMF maintains the same IP address/prefix that has already been allocated to the UE in the source network.

If the Request Type in step 3 indicates "Existing PDU Session" referring to an existing PDU Session moved between 3GPP access and non-3GPP access the SMF maintains the SSC mode of the PDU Session, the current PDU Session Anchor and IP address.

NOTE 6: The SMF may decide to trigger e.g. new intermediate UPF insertion or allocation of a new UPF as described in step 5 in clause 4.2.3.2.

If the Request Type indicates "Emergency Request", the SMF selects the UPF as described in clause 5.16.4 of TS 23.501 [2] and selects SSC mode 1.

SMF may select a UPF (e.g. based on requested DNN/S-NSSAI) that supports NW-TT functionality.

SMF may select a PSA UPF that supports PDU Set identification and marking for a QoS flow with PDU Set based handling capability.

9. SMF may perform an SMF initiated SM Policy Association Modification procedure as defined in clause 4.16.5.1 to provide information on the Policy Control Request Trigger condition(s) that have been met. If Request Type is "initial request" and dynamic PCC is deployed and PDU Session Type is IPv4 or IPv6 or IPv4v6, SMF notifies the PCF (if the Policy Control Request Trigger condition is met) with the allocated UE IP address/prefix(es).

NOTE 7: If an IP address/prefix has been allocated before step 7 (e.g. subscribed static IP address/prefix in UDM/UDR) or the step 7 is performed after step 8, the IP address/prefix can be provided to PCF in step 7 and the IP address/prefix notification in this step can be skipped.

If the PCF has subscribed to Policy Control Request Trigger for "UE reporting Connection Capabilities from associated URSP rule" and if SMF received the URSP rule enforcement report (i.e. connection capabilities information) from the UE at step 1, then the SMF may include the URSP rule enforcement report as described in clause 6.1.3.5 of TS 23.503 [20] and clause 6.6.2.4 of TS 23.503 [20].

The PCF may provide updated policies to the SMF. The PCF may provide policy information defined in clause 5.2.5.4 (and in TS 23.503 [20]) to SMF.

The PCF may generate SDF Templates in PCC rules based on the reported Connection Capabilities as described in clause 6.1.6 in TS 23.503 [20].

NOTE 8: The mapping between Connection Capability and SDF templates in the PCC rule is implementation specific.

10. If Request Type indicates "initial request", the SMF initiates an N4 Session Establishment procedure with the selected UPF(s), otherwise it initiates an N4 Session Modification procedure with the selected UPF(s):

10a. The SMF sends an N4 Session Establishment/Modification Request to the UPF and provides Packet detection, enforcement and reporting rules to be installed on the UPF for this PDU Session. If the SMF is configured to request IP address allocation from UPF as described in clause 5.8.2 of TS 23.501 [2] then the SMF indicates to the UPF to perform the IP address/prefix allocation and includes the information required for the UPF to perform the allocation. If the selective User Plane deactivation is required for this PDU Session, the SMF determines the inactivity timer and provides it to the UPF. For a PDU Session for non-roaming subscribers, if the S-NSSAI of the PDU Session is subject to network slice usage control, the SMF obtains the PDU Session inactivity timer value for the PDU Session as described in step 4 or step 7 or uses preconfigured value and configures the UPF to run the PDU Session inactivity timer. The SMF provides Trace Requirements to the UPF if it has received Trace Requirements. If the Reliable Data Service is enabled for the PDU Session by the SMF as specified in TS 23.501 [2], the RDS Configuration information is provided to the UPF in this step. The SMF provides Small Data Rate Control parameters to the UPF for the PDU Session, if required. The SMF provides the Small Data Rate Control Status to the UPF, if received from the AMF. If the Serving PLMN intends to enforce Serving PLMN Rate Control (see clause 5.31.14.2 of TS 23.501 [2]) for this PDU session then the SMF shall provide Serving PLMN Rate Control parameters to UPF for limiting the rate of downlink control plane data packets.

For a PDU Session of type Ethernet or IP, the SMF (e.g. for a certain requested DNN/S-NSSAI for which Time Sensitive Networking, Time Sensitive Communications, Time Synchronization and/or Deterministic Networking is applicable) may include an indication to request UPF to provide a port number.

If SMF decides to perform redundant transmission for one or more QoS Flows of the PDU session as described in clause 5.33.1.2 of TS 23.501 [2], two CN Tunnel Info are requested by the SMF from the UPF. The SMF also indicates the UPF to eliminate the duplicated packet for the QoS Flow in uplink direction. The SMF indicates the UPF that one CN Tunnel Info is used as the redundancy tunnel of the PDU session described in clause 5.33.2.2 of TS 23.501 [2].

If SMF decides to insert two I-UPFs between the PSA UPF and the NG-RAN for redundant transmission as described in clause 5.33.1.2 of TS 23.501 [2], the SMF requests the corresponding CN Tunnel Info and provides them to the I-UPFs and PSA UPF respectively. The SMF also indicates the PSA UPF to eliminate the duplicated packet for the QoS Flow in uplink direction. The SMF indicates the PSA UPF that one CN Tunnel Info is used as the redundancy tunnel of the PDU session described in clause 5.33.2.2 of TS 23.501 [2].

NOTE 9: The method to perform elimination and reordering on RAN/UPF based on the packets received from the two GTP-U tunnels is up to RAN/UPF implementation. The two GTP-U tunnels are terminated at the same RAN node and UPF.

If Control Plane CIoT 5GS Optimisation is enabled for this PDU session and the SMF selects the NEF as the anchor of this PDU Session in step 8, the SMF performs SMF-NEF Connection Establishment Procedure as described in clause 4.25.2.

If interworking with TSN deployed in the transport network is supported (see clause 4.4.8 of TS 23.501 [2]) and the UPF supports CN-TL, the SMF includes a TL-Container with a get-request to the N4 Session Establishment/Modification request that is sent to the UPF, as described in clause 5.28a.2 of TS 23.501 [2].

If SMF decides to enable ECN marking for L4S by PSA UPF, a QoS Flow level ECN marking for L4S indicator shall be sent by SMF to PSA UPF over N4 as described in clause 5.37.3.3 of TS 23.501 [2].

If selected PSA UPF supports Nupf\_EventExposure service, the SMF should include DNN and S-NSSAI in the N4 Session Establishment procedure.

NOTE 10: If SMF does not provide DNN and S-NSSAI to UPF it could result in rejections for the Nupf\_EventExposure\_Subscribe service operations, unless UPF is configured with a DNN and S-NSSAI for a specific IP address range.

10b. The UPF acknowledges by sending an N4 Session Establishment/Modification Response.

If the SMF indicates in step 10a that IP address/prefix allocation is to be performed by the UPF then this response contains the requested IP address/prefix. The requested CN Tunnel Info is provided to SMF in this step. If SMF indicated the UPF to perform packet duplication and elimination for the QoS Flow in step 10a, two CN Tunnel Info are allocated by the UPF and provided to the SMF. If SMF decides to insert two I-UPFs between the PSA UPF and the NG-RAN for redundant transmission as described in clause 5.33.1.2 of TS 23.501 [2], CN Tunnel Info of two I-UPFs and the UPF (PSA) are allocated by the UPFs and provided to the SMF. The UPF indicates the SMF that one CN Tunnel Info is used as the redundancy tunnel of the PDU session as described in clause 5.33.2.2 of TS 23.501 [2].

If SMF requested UPF to provide a port number then UPF includes the port number and user-plane Node ID in the response according to TS 23.501 [2]. To support integration with IEEE TSN, the user-plane node ID is Bridge ID. To support integration with IETF DetNet, the user-plane node ID can be Router ID. Besides the network instance, the SMF may also provide DNN/S-NSSAI for the UPF to respond with user-plane Node ID based on pre-configuration information.

If multiple UPFs are selected for the PDU Session, the SMF initiate N4 Session Establishment/Modification procedure with each UPF of the PDU Session in this step.

NOTE 10: If the PCF has subscribed to the UE IP address change Policy Control Trigger (as specified in clause 6.1.3.5 of TS 23.503 [20]) then the SMF notifies the PCF about the IP address/prefix allocated by the UPF. This is not shown in figure 4.3.2.2.1-1.

If interworking with TSN deployed in the transport network is supported and the UPF supports CN-TL and received a TL-Container with a get-request from the SMF/CUC in step 10a (see clause 4.4.8 of TS 23.501 [2]), the UPF/CN-TL includes a TL-Container with a get-response in the N4 Session Establishment/Modification response, as described in clause 5.28a.2 of TS 23.501 [2]. The SMF/CUC stores the information provided in the get-response.

11. SMF to AMF: Namf\_Communication\_N1N2MessageTransfer (PDU Session ID, N2 SM information (PDU Session ID, QFI(s), QoS Profile(s), CN Tunnel Info, S-NSSAI from the Allowed NSSAI or Partially Allowed NSSAI, Session-AMBR, PDU Session Type, User Plane Security Enforcement information, UE Integrity Protection Maximum Data Rate, RSN, PDU Session Pair ID, TL-Container), N1 SM container (PDU Session Establishment Accept ([QoS Rule(s) and associated UL Protocol Description(s) (if available), QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s)], selected SSC mode, S-NSSAI(s), UE Requested DNN, allocated IPv4 address, interface identifier, Session-AMBR, selected PDU Session Type, [Reflective QoS Timer] (if available), [P-CSCF address(es)], [Control Plane Only indicator], [Header Compression Configuration], [Always-on PDU Session Granted], [Small Data Rate Control parameters], [Small Data Rate Control Status], [Serving PLMN Rate Control], [PVS FQDN(s) and/or PVS IP address(es)], [Non-3GPP QoS Assistance Information Container]))). If multiple UPFs are used for the PDU Session, the CN Tunnel Info contains tunnel information related with the UPFs that terminate N3.

The SMF may provide the SMF derived CN assisted RAN parameters tuning to the AMF by invoking Nsmf\_PDUSession\_SMContextStatusNotify (SMF derived CN assisted RAN parameters tuning) service. The AMF stores the SMF derived CN assisted RAN parameters tuning in the associated PDU Session context for this UE.

The N2 SM information carries information that the AMF shall forward to the (R)AN which includes:

- The CN Tunnel Info corresponds to the Core Network address(es) of the N3 tunnel corresponding to the PDU Session. If two CN Tunnel Info are included for the PDU session for redundant transmission, the SMF also indicates the NG-RAN that one of the CN Tunnel Info used as the redundancy tunnel of the PDU session as described in clause 5.33.2.2 of TS 23.501 [2].

- One or multiple QoS profiles and the corresponding QFIs can be provided to the (R)AN. This is further described in clause 5.7 of TS 23.501 [2]. The SMF may indicate for each QoS Flow whether redundant transmission shall be performed by a corresponding redundant transmission indicator.

- The PDU Session ID may be used by AN signalling with the UE to indicate to the UE the association between (R)AN resources and a PDU Session for the UE.

- A PDU Session is associated to an S-NSSAI of the HPLMN and if applicable, to an S-NSSAI of the VPLMN and a DNN. The S-NSSAI provided to the (R)AN, is the S-NSSAI with the value for the Serving PLMN (i.e. the HPLMN S-NSSAI or, in LBO roaming case, the VPLMN S-NSSAI). When Alternative S-NSSAI is received from AMF in step 3, the S-NSSAI provided to the (R)AN is the Alternative S-NSSAI.

- User Plane Security Enforcement information is determined by the SMF as described in clause 5.10.3 of TS 23.501 [2].

- If the User Plane Security Enforcement information indicates that Integrity Protection is "Preferred" or "Required", the SMF also includes the UE Integrity Protection Maximum Data Rate as received in the PDU Session Establishment Request.

- The use of the RSN parameter and the PDU Session Pair ID by NG-RAN are described in clause 5.33.2.1 of TS 23.501 [2].

- For each QoS Flow, the SMF may at most request one of the following to the NG-RAN:

- ECN marking for L4S at NG-RAN in the case of ECN marking for L4S in RAN as described in clause 5.37.3 of TS 23.501 [2]; or

- Congestion information monitoring as described in clauses 5.45.3 and 5.37.4 of TS 23.501 [2]; or

- provide information for ECN marking for L4S at UPF in the case of ECN marking for L4S by PSA UPF as described in clause 5.37.3 of TS 23.501 [2].

- TL-Container as described in clause 5.28a.2 of TS 23.501 [2]. If interworking with TSN deployed in the transport network is supported and the NG-RAN supports AN-TL (see clause 4.4.8 of TS 23.501 [2]), the SMF includes a TL-Container with a get-request to the N2 SM information, as described in clause 5.28a.2 of TS 23.501 [2].

The N1 SM container contains the PDU Session Establishment Accept that the AMF shall provide to the UE. If the UE requested P-CSCF discovery then the message shall also include the P-CSCF IP address(es) as determined by the SMF and as described in clause 5.16.3.4 of TS 23.501 [2]. The PDU Session Establishment Accept includes S-NSSAI from the Allowed NSSAI or Partially Allowed NSSAI. The S-NSSAI value of the Alternative S-NSSAI is included in the PDU session Establishment Accept if the SMF has received the Alternative S-NSSAI from the AMF. For LBO roaming scenario, the PDU Session Establishment Accept includes the S-NSSAI from the Allowed NSSAI or Partially Allowed NSSAI for the VPLMN and also it includes the corresponding S-NSSAI of the HPLMN from the Mapping Of Allowed NSSAI or Mapping Of Partially Allowed NSSAI that SMF received in step 3. If the SMF has received the VPLMN Alternative S-NSSAI from the AMF, the PDU Session Establishment Accept includes the VPLMN Alternative S-NSSAI. If the SMF has received the HPLMN Alternative S-NSSAI from the AMF, the PDU Session Establishment Accept includes the HPLMN Alternative S-NSSAI. If the PCF, based on the local configuration, provides the PCC rules with Protocol Descriptions for UL in step 7b or step 9, the SMF may additionally provide the Protocol Description for UL with the associated QoS rule as described in clause 5.37.5.1 of TS 23.501 [2].

If the PDU Session being established was requested to be an always-on PDU Session, the SMF shall indicate whether the request is accepted by including an Always-on PDU Session Granted indication in the PDU Session Establishment Accept message. If the PDU Session being established was not requested to be an always-on PDU Session but the SMF determines that the PDU Session needs to be established as an always-on PDU Session, the SMF shall include an Always-on PDU Session Granted indication in the PDU Session Establishment Accept message indicating that the PDU session is an always-on PDU Session.

If Control Plane CIoT 5GS Optimisation is enabled for this PDU session, the N2 SM information is not included in this step. If Control Plane CIoT 5GS optimisation is enabled for this PDU session and the UE has sent the Header Compression Configuration in the PDU Session Establishment Request and the SMF supports the header compression parameters, the SMF shall include the Header Compression Configuration in the PDU Session Establishment Accept message. If the UE has included Header Compression context parameters in Header Compression Configuration in the PDU Session Establishment Request, the SMF shall establish the header compression context and may acknowledge the Header Compression context parameters. If the header compression context is not established during the PDU Session Establishment procedure, before using the compressed format for sending the data, the UE and the SMF need to establish the header compression context based on the Header Compression Configuration. If the SMF has received the Control Plane Only Indicator in step 3, the SMF shall include the Control Plane Only Indicator in the PDU Session Establishment Accept message. The SMF shall indicate the use of Control Plane only on its CDR. If the Small Data Rate Control is configured in the SMF, the SMF shall also include Small Data Rate Control parameters and the Small Data Rate Control Status (if received from the AMF) in the PDU Session Establishment Accept message as described in clause 5.31.14.3 of TS 23.501 [2]. If the Serving PLMN intends to enforce Serving PLMN Rate Control (see clause 5.31.14.2 of TS 23.501 [2]) for this PDU session then the SMF shall include the Serving PLMN Rate Control parameters in the PDU Session Establishment Accept message. The UE shall store and use Serving PLMN Rate Control parameters as the maximum allowed limit of uplink control plane user data.

If the UE indicates the support of RDS in the PCO in the PDU Session Establishment Request and RDS is enabled for the PDU Session, the SMF shall inform the UE that RDS is enabled in the PCO in the PDU Session Establishment Accept (see clause 5.31.6 of TS 23.501 [2]).

If the NIDD parameters (e.g. maximum packet size) were received from NEF during the SMF-NEF Connection Establishment procedure in step 10, the SMF shall inform the UE of the NIDD parameters in the PCO in the PDU Session Establishment Accept (see clause 5.31.5 of TS 23.501 [2]).

If the UE indicated in the PCO that it supports the ability to receive ECS address(es) via NAS, the SMF may provide the ECS Address Configuration Information (as described in clause 6.5.2 of TS 23.548 [74]) to the UE in the PCO. The SMF may derive the ECS Address Configuration Information based on local configuration and/or UE subscription information. In non-roaming scenarios, the SMF may also derive the ECS Address Configuration Information based on the UE's location.

If the UE indicated in the PCO that it supports the EDC functionality, the SMF may indicate to the UE either that the use of the EDC functionality is allowed for the PDU Session or that the use of the EDC functionality is required for the PDU Session (see clause 5.2.1 of TS 23.548 [74]).

Multiple QoS Rules, QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with those QoS rule(s) and QoS Profiles may be included in the PDU Session Establishment Accept within the N1 SM and in the N2 SM information.

The Namf\_Communication\_N1N2MessageTransfer contains the PDU Session ID allowing the AMF to know which access towards the UE to use.

If the PDU session establishment failed anywhere between step 5 and step 11, then the Namf\_Communication\_N1N2MessageTransfer request shall include the N1 SM container with a PDU Session Establishment Reject message (see clause 8.3.3 of TS 24.501 [25]) and shall not include any N2 SM container. The (R)AN sends the NAS message containing the PDU Session Establishment Reject to the UE. In this case, steps 12-17 are skipped.

Based on the S-NSSAI and DNN for PIN, the SMF may provide the UE with per QoS-flow Non-3GPP QoS Assistance Information in the N1 SM container as specified in clause 5.44.3.3 of TS 23.501 [2].

12. AMF to (R)AN: N2 PDU Session Request (N2 SM information, NAS message (PDU Session ID, N1 SM container (PDU Session Establishment Accept)), [CN assisted RAN parameters tuning]). If the N2 SM information is not included in the step 11, an N2 Downlink NAS Transport message is used instead.

The AMF sends the NAS message containing PDU Session ID and PDU Session Establishment Accept targeted to the UE and the N2 SM information received from the SMF within the N2 PDU Session Request to the (R)AN.

If the SMF derived CN assisted RAN parameters tuning are stored for the activated PDU Session(s), the AMF may derive updated CN assisted RAN parameters tuning and provide them the (R)AN.

After MWAB-gNB receiving the N2 SM information, the MWAB-UE may initiate a new BH PDU session to access the UPF identified by the CN tunnel information based on local configuration.

Editor's note: If NAT functionality in the UPF of BH PDU Session is used, how to make sure that the NATed address is identifiable by the UPF of UE's serving PLMN should be considered.

13. (R)AN to UE: The (R)AN may issue AN specific signalling exchange with the UE that is related with the information received from SMF. For example, in the case of a NG-RAN, an RRC Connection Reconfiguration may take place with the UE establishing the necessary NG-RAN resources related to the QoS Rules for the PDU Session request received in step 12.

(R)AN also allocates (R)AN Tunnel Info for the PDU Session. In the case of Dual Connectivity, the Master RAN node may assign some (zero or more) QFIs to be setup to a Master RAN node and others to the Secondary RAN node. The AN Tunnel Info includes a tunnel endpoint for each involved (R)AN node and the QFIs assigned to each tunnel endpoint. A QFI can be assigned to either the Master RAN node or the Secondary RAN node and not to both.

If the (R)AN receives two CN Tunnel Info for a PDU session in step 12 for redundant transmission, (R)AN also allocates two AN Tunnel Info correspondingly and indicate to SMF one of the AN Tunnel Info is used as the redundancy tunnel of the PDU session as described in clause 5.33.2.2 of TS 23.501 [2].

(R)AN forwards the NAS message (PDU Session ID, N1 SM container (PDU Session Establishment Accept)) provided in step 12 to the UE. (R)AN shall only provide the NAS message to the UE if the AN specific signalling exchange with the UE includes the (R)AN resource additions associated to the received N2 command.

If MICO mode is active and the NAS message Request Type in step 1 indicated "Emergency Request", then the UE and the AMF shall locally deactivate MICO mode.

If the N2 SM information is not included in the step 11, then the following steps 14 to 16b and step 17 are omitted.

If the UE is running a slice deregistration inactivity timer for the S-NSSAI of the established PDU Session and the timer is associated with the Access Type over which the PDU Session Establishment Request was received, the UE stops the timer as described in clause 5.15.15 of TS 23.501 [2].

14. (R)AN to AMF: N2 PDU Session Response (PDU Session ID, Cause, N2 SM information (PDU Session ID, AN Tunnel Info, List of accepted/rejected QFI(s), User Plane Enforcement Policy Notification, TL-Container, established QoS Flows status (active/not active) (for one of the following: congestion information monitoring, ECN marking for L4S at PSA UPF, ECN marking for L4S at NG-RAN), PDU Set Based Handling Support Indication)).

The AN Tunnel Info corresponds to the Access Network address of the N3 tunnel corresponding to the PDU Session.

The (R)AN may reject the addition or modification of a QoS Flow, e.g. due to handling of the UE-Slice-MBR as described in clause 5.7.1.10 of TS 23.501 [2]. If the (R)AN rejects QFI(s) the SMF is responsible of updating the QoS rules and QoS Flow level QoS parameters associated to the rejected QoS Flow(s) in the UE accordingly.

The NG-RAN rejects the establishment of UP resources for the PDU Session when it cannot fulfil User Plane Security Enforcement information with a value of Required. The NG-RAN notifies the SMF when it cannot fulfil a User Plane Security Enforcement with a value of Preferred.

If the NG-RAN cannot establish redundant user plane for the PDU Session as indicated by the RSN parameter and PDU Session Pair ID, the NG-RAN takes the decision on whether to reject the establishment of RAN resources for the PDU Session based on local policies as described in TS 23.501 [2].

If interworking with TSN deployed in the transport network is supported and the NG-RAN supports AN-TL and received a TL-Container with a get-request from the SMF/CUC in step 12 (see clause 4.4.8 of TS 23.501 [2]), the NG-RAN/AN-TL includes a TL-Container with a get-response to the N2 SM information, as described in clause 5.28a.2 of TS 23.501 [2].

NG-RAN includes the PDU Set Based Handling Support Indication in N2 SM information as defined in clause 5.37.5.3 of TS 23.501 [2].

15. AMF to SMF: Nsmf\_PDUSession\_UpdateSMContext Request (SM Context ID, N2 SM information, Request Type).

The AMF forwards the N2 SM information received from (R)AN to the SMF.

If the list of rejected QFI(s) is included in N2 SM information, the SMF shall release the rejected QFI(s) associated QoS profiles.

If the N2 SM information indicates failure of user plane resource setup, the SMF shall reject the PDU session establishment by including a N1 SM container with a PDU Session Establishment Reject message (see clause 8.3.3 of TS 24.501 [25]) in the Nsmf\_PDUSession\_UpdateSMContext Response in step 17. Step 16 is skipped in this case and instead the SMF releases the N4 Session with UPF.

If the User Plane Enforcement Policy Notification in the N2 SM information indicates that no user plane resources could be established and the User Plane Enforcement Policy indicated "required" as described in clause 5.10.3 of TS 23.501 [2], the SMF shall reject the PDU session establishment by including a N1 SM container with a PDU Session Establishment Reject message (see clause 8.3.3 of TS 24.501 [25]) in the Nsmf\_PDUSession\_UpdateSMContext Response in step 17. Step 16 is skipped in this case.

If the N2 SM information includes a TL-Container with a get-response as described in clause 5.28a.2 of TS 23.501 [2], the SMF/CUC stores the information provided in the get-response.

16a. The SMF initiates an N4 Session Modification procedure with the UPF. The SMF provides AN Tunnel Info to the UPF as well as the corresponding forwarding rules.

If SMF decides to perform redundant transmission for one or more QoS Flows of the PDU, the SMF also indicates the UPF to perform packet duplication for the QoS Flow(s) in downlink direction by forwarding rules.

In the case of redundant transmission with two I-UPFs for one or more QoS Flows of the PDU, the SMF provides AN Tunnel Info to two I-UPFs and also indicates the UPF (PSA) to perform packet duplication for the QoS Flow(s) in downlink direction by forwarding rules. The SMF also provides the UL Tunnel Info of the UPF (PSA) to the two I-UPFs and the DL Tunnel Info of the two I-UPFs to the UPF (PSA).

If the N2 SM information includes the PDU Set Based Handling Support Indication, SMF configures PSA UPF to perform PDU Set information marking for the QoS flow as defined in clause 5.37.5.3 of TS 23.501 [2].

NOTE 11: If the PDU Session Establishment Request was due to mobility between 3GPP and non-3GPP access or mobility from EPC, the downlink data path is switched towards the target access in this step.

16b. The UPF provides an N4 Session Modification Response to the SMF.

If multiple UPFs are used in the PDU Session, the UPF in step 16 refers to the UPF terminating N3.

After this step, the UPF delivers any down-link packets to the UE that may have been buffered for this PDU Session.

16c. If Request Type in step 3 indicates neither "Emergency Request" nor "Existing Emergency PDU Session" and if the SMF has not yet registered for this PDU Session, then the SMF registers with the UDM using Nudm\_UECM\_Registration (SUPI, DNN, S-NSSAI of HPLMN, PDU Session ID, SMF Identity, Serving Node PLMN ID, [NID], PCF ID) for a given PDU Session. As a result, the UDM stores following information: SUPI, SMF identity and the associated DNN, S-NSSAI of HPLMN, PDU Session ID, PCF ID and Serving Network (PLMN ID, [NID], see clause 5.18 of TS 23.501 [2]). The UDM may further store this information in UDR by Nudr\_DM\_Update (SUPI, Subscription Data, UE context in SMF data). If the UDM has existing applicable event exposure subscriptions for events detected in SMF for this UE or any of the groups this UE belongs to (possibly retrieved from UDR), UDM invokes the Nsmf\_EventExposure\_Subscribe service for creating the event exposure subscriptions. If the SMF received Alternative S-NSSAI in step 3, the S-NSSAI provided to the UDM is the replaced S-NSSAI.

If the Request Type received in step 3 indicates "Emergency Request":

- For an authenticated non-roaming UE, based on operator configuration (e.g. related with whether the operator uses a fixed SMF for Emergency calls, etc.), the SMF may register in the UDM using Nudm\_UECM\_Registration (SUPI, PDU Session ID, SMF identity, Indication of Emergency Services) for a given PDU Session that is applicable for emergency services. As a result, the UDM shall store the applicable PDU Session for Emergency services.

- For an unauthenticated UE or a roaming UE, the SMF shall not register in the UDM for a given PDU Session.

17. SMF to AMF: Nsmf\_PDUSession\_UpdateSMContext Response (Cause).

The SMF may subscribe to the UE mobility event notification from the AMF (e.g. location reporting, UE moving into or out of Area Of Interest), after this step by invoking Namf\_EventExposure\_Subscribe service operation as specified in clause 5.2.2.3.2. For LADN, the SMF subscribes to the UE moving into or out of LADN service area event notification by providing the LADN DNN as an indicator for the Area Of Interest (see clause 5.6.5 and 5.6.11 of TS 23.501 [2]).

If SMF receives the indication in step 3 that "the PDU Session is subject to LADN per LADN DNN and S-NSSAI", the SMF subscribes to the UE moving into or out of LADN service area event notification by providing the LADN DNN and S-NSSAI as an indicator for the Area Of Interest.

If SMF receives the indication in step 3 that the PDU Session is subject to area restriction for the S-NSSAI, the SMF subscribe to "UE mobility event notification" event for reporting UE presence in Area of Interest by providing the S-NSSAI as an indicator for the Area Of Interest (see clauses 5.6.11 and 5.3.4.4 of TS 23.501 [2]).

After this step, the AMF forwards relevant events subscribed by the SMF.

For those scenarios where the PCFs serving the AMF and the SMF are different, the SMF informs the AMF of the NWDAF ID(s) used for UE related Analytics and corresponding Analytics ID(s).

18. [Conditional] SMF to AMF: Nsmf\_PDUSession\_SMContextStatusNotify (Release)

If during the procedure, any time after step 5, the PDU Session establishment is not successful, the SMF informs the AMF by invoking Nsmf\_PDUSession\_SMContextStatusNotify (Release). The SMF also releases any N4 session(s) created, any PDU Session address if allocated (e.g. IP address) and releases the association with PCF, if any. In this case, step 19 is skipped.

For a PDU Session for non-roaming subscribers, if the S-NSSAI of the PDU Session is subject to network slice usage control and there is no other PDU Session using the S-NSSAI over the same Access Type, the AMF starts the slice deregistration inactivity timer for the S-NSSAI over this Access Type as described in clause 5.15.15.3 of TS 23.501 [2].

19. SMF to UE: In the case of PDU Session Type IPv6 or IPv4v6, the SMF generates an IPv6 Router Advertisement and sends it to the UE. If Control Plane CIoT 5GS Optimisation is enabled for this PDU Session the SMF sends the IPv6 Router Advertisement via the AMF for transmission to the UE using the Mobile Terminated Data Transport in Control Plane CIoT 5GS Optimisation procedures (see clause 4.24.2), otherwise the SMF sends the IPv6 Router Advertisement via N4 and the UPF.

20. When the trigger for 5GS Bridge/Router information available is armed, then the SMF may initiate the SM Policy Association Modification as described in clause 4.16.5.1.

If the UE has indicated support of transferring Port Management Information Containers, then SMF informs PCF that 5GS Bridge/Router information is available. SMF provides the 5GS Bridge/Router information (e.g. 5GS user-plane Node ID, port number for the PDU session, MAC address of the DS-TT Ethernet port for Ethernet PDU Session type, UE IP address for IP PDU Session type and UE-DS-TT Residence Time (if available) as provided by the UE) to PCF. In the case of Deterministic Networking, the SMF may also provide the MTU size for IPv4 or the MTU size for IPv6. If the SMF received a Port Management Information Container from either the UE or the UPF, then the SMF provides the Port Management Information Container and port number of the related port to the PCF as described in clause 5.28.3.2 of TS 23.501 [2].

If the SMF has received User Plane Node Management Information from the UPF, then the SMF provides the User Plane Node Management Information Container to the PCF as part of 5GS Bridge/Router information and as described in clause 5.28.3.2 of TS 23.501 [2].

To support IEEE TSN, the TSN AF calculates the bridge delay for each port pair, i.e. composed of DS-TT Ethernet port and NW-TT Ethernet port, using the UE-DS-TT Residence Time for all NW-TT Ethernet port(s) serving the 5GS Bridge indicated by the 5GS user-plane Node ID. Additionally, the TSN AF determines the 5GS bridge delay for port pair composed of two DS-TT ports connecting to the same 5GS Bridge as sum of bridge delays related to PDU Sessions of the two DS-TT ports.

21. If the PDU Session establishment failed after step 4, the SMF shall perform the following:

The SMF unsubscribes to the modifications of Session Management Subscription data for the corresponding (SUPI, DNN, S-NSSAI of the HPLMN), using Nudm\_SDM\_Unsubscribe (SUPI, Session Management Subscription data, DNN, S-NSSAI of the HPLMN), if the SMF is no more handling a PDU Session of the UE for this (DNN, S-NSSAI of the HPLMN). The UDM may unsubscribe to the modification notification from UDR by Nudr\_DM\_Unsubscribe (SUPI, Subscription Data, Session Management Subscription data, S-NSSAI of the HPLMN, DNN).

\* \* \* \* Next change \* \* \* \*

#### 4.3.4.2 UE or network requested PDU Session Release for Non-Roaming and Roaming with Local Breakout

Figure 4.3.4.2-1 captures both the UE Requested PDU Session Release procedure and the network requested PDU Session Release procedure. The procedure allows the UE to request the release of one PDU Session. The procedure also allows the AMF, the SMF or the PCF to initiate the release of a PDU Session. In the case of LBO, the procedure is as in the case of non-roaming with the difference that the AMF, the SMF, the UPF and the PCF are located in the visited network.



Figure 4.3.4.2-1: UE or network requested PDU Session Release for non-roaming and roaming with local breakout

1. The procedure is triggered by one of the following events:

1a. (UE requested) The UE initiates the UE Requested PDU Session Release procedure by the transmission of an NAS message (N1 SM container (PDU Session Release Request (PDU session ID)), PDU Session ID). The NAS message is forwarded by the (R)AN to the AMF with an indication of User Location Information. This message is relayed to the SMF corresponding to the PDU Session ID via N2 and the AMF. The AMF invokes the Nsmf\_PDUSession\_UpdateSMContext service operation and provides the N1 SM container to the SMF together with User Location Information (ULI) received from the (R)AN.

NOTE 1: Depending on the Access Type, when the UE is in CM-IDLE state, the UE can trigger a Service Request procedure before being able to release the PDU Session.

1b. (PDU Session Release initiated by the PCF) The PCF may invoke an SM Policy Association Termination procedure as defined in clause 4.16.6 to request the release of the PDU Session.

1c. The AMF may invoke the Nsmf\_PDUSession\_ReleaseSMContext service operation to request the release of the PDU Session in the case of mismatch of PDU Session status between UE and AMF or other cases where neither N1 nor N2 SM signalling is needed before the releasing of SM context.

NOTE 2: The AMF invokes the Nsmf\_PDUSession\_ReleaseSMContext service operation when the AMF determines to release the PDU Session due to S-NSSAI is removed from Allowed NSSAI and the AMF separately updates the UE with a PDU Session status without the PDU Session, in a Registration Accept as specified in clause 4.2.2.2.2.

1d. (R)AN may decide to indicate to the SMF that the PDU Session related resource is released, e.g. when all the QoS Flow(s) of the PDU Session are released.

NOTE 3: In this case, it's up to SMF to decide whether to keep the PDU Session with user plane connection deactivated or release the PDU Session.

1e. (PDU Session Release initiated by the SMF).

The SMF may decide to release a PDU Session under the following scenarios:

- Based on a request from the DN (cancelling the UE authorization to access to the DN);

- Based on a request from the UDM (subscription change) or from the CHF;

- If the SMF received an event notification from the AMF that the UE is out of LADN service area;

- Based on locally configured policy (e.g. the release procedure may be related with the UPF re-allocation for SSC mode 2 / mode 3);

- If the SMF is notified by the (R)AN that the PDU Session resource establishment has failed during mobility procedure;

- The SMF initiates release of an emergency PDU Session when the UPF reports detection of PDU Session inactivity for a specified period as specified in clause 4.4.2.2;

- Based on PDU Session inactivity report from the UPF if the S-NSSAI of a PDU Session for non-roaming subscribers is subject to usage control as described in clause 5.15.15 of TS 23.501 [2]; or

- If the SMF is notified by the AMF that the S-NSSAI of the PDU Session with SSC mode 1 or SSC mode 2 is to be replaced with Alternative S-NSSAI, and if the SMF determines that a new PDU Session is to be established on the Alternative S-NSSAI, the SMF initiates release of the PDU Session, as described in clause 5.15.19 of TS 23.501 [2].

1f. The AMF may invoke the Nsmf\_PDUSession\_UpdateSMContext service operation with a release indication to request the release of the PDU Session where:

- N1 signalling is needed and N2 SM signalling may be needed before releasing the SM context with appropriate cause value (e.g. due to a change of the set of network slices for a UE where a network slice instance is no longer available as described in clause 5.15.5.2.2 of TS 23.501 [2];

- The AAA Server triggered Network Slice-Specific Re-authentication and Re-authorization procedure fails as specified in clause 4.2.9.2;

- The AAA Server triggered Slice-Specific Authorization Revocation takes place as specified in clause 4.2.9.4;

- AMF determines that Control Plane Only indication associated with PDU Session is not applicable any longer as described in clause 5.31.4.1 of TS 23.501 [2]);

- The MBSR authorization state is changed from "authorized" to "not authorized" as described in clause 5.35A.4 of TS 23.501 [2];

- The Network Slice instance is congested or not available as described in clause 5.15.5.3 of TS 23.501 [2].

- There is no LADN service area for the DNN and S-NSSAI of the PDU session and the AMF determines to configure the LADN service area configured per LADN DNN and S-NSSAI for the associated DNN and S-NSSAI (e.g. due to notification from UDM or local configuration update);

- The PDU session is subject to LADN per LADN DNN and S-NSSAI and the AMF determines the LADN service area for the DNN and S-NSSAI is removed (e.g. due to notification from UDM or local configuration update).

- The MWAB authorization state is changed from "authorized" to "not authorized" as described in clause 5.XX of TS 23.501 [2];

If the SMF receives one of the triggers in step 1a, 1b, 1c, 1e, or 1f, the SMF starts PDU Session Release procedure. If the cause value in step 1f indicates the Network Slice instance is congested or not available, the SMF triggers the impacted UE(s) to establish new PDU session(s) associated with the same S-NSSAI by using the procedures for PDU Session(s) of SSC mode 2 or SSC mode 3 as defined in clause 4.3.5.

If interworking with TSN deployed in the transport network is supported the SMF/CUC shall initiate the release of TN streams via UNI.

2. The SMF releases the IP address / Prefix(es) that were allocated to the PDU Session and releases the corresponding User Plane resources:

2a. The SMF sends an N4 Session Release Request (N4 Session ID) message to the UPF(s) of the PDU Session. The UPF(s) shall drop any remaining packets of the PDU Session and release all tunnel resource and contexts associated with the N4 Session.

If interworking with TSN deployed in the transport network is supported and the UPF supports CN-TL and TN streams are associated with the PDU session, the SMF/CUC shall initiate to the CN-TL the deletion of TN stream configurations.

2b. The UPF(s) acknowledges the N4 Session Release Request by the transmission of an N4 Session Release Response (N4 Session ID, [Small Data Rate Control Status], [APN Rate Control Status]) message to the SMF.

If UPF/CN-TL has performed the deletion of TN stream based on the request received from the SMF/CUC in step 2a, the UPF/CN-TL shall confirm the deletion of TN stream configurations.

The UPF includes Small Data Rate Control Status if the PDU Session used Small Data Rate Control.

If a NEF has been selected as anchor of the Control Plane CIoT 5GS Optimisation enabled PDU session which is Unstructured PDU Session Type as described in clause 4.3.2.2 and the SMF-NEF Connection is released for this PDU Session.

If interworking with TSN deployed in the transport network is supported and the NG-RAN supports AN-TL and TN streams are associated with the released PDU session, the SMF/CUC shall initiate to the AN-TL the deletion of TN stream configurations.

NOTE 4: If there are multiple UPFs associated with the PDU Session (e.g. due to the insertion of UL CL or Branching Point, or redundant I-UPFs if the redundant I-UPFs are used for URLLC), the Session Release Request procedure (steps 2a and 2b) is done for each UPF. In order to avoid charging of PDUs that later get dropped, the SMF performs the N4 Session Release first with the UPF(s) performing usage reporting, before releasing the other UPF(s) that forward traffic for the same user plane resources.

3 If the PDU Session Release is initiated by the PCF and SMF and the SMF has been notified by the AMF that UE is unreachable, e.g. due to the UE is in MICO mode or periodical registration failure, the procedure continues in step 11 by SMF notifying the AMF that the PDU Session is released by invoking the Nsmf\_PDUSession\_SMContextStatusNotify. The rest of step 3 and the steps 4-10 are skipped.

If the PDU Session Release procedure was triggered by steps 1a, 1b, 1d or 1e above, the SMF creates an N1 SM including PDU Session Release Command message (PDU Session ID, Cause, Alternative S-NSSAI). The Cause may indicate a trigger to establish a new PDU Session with the same characteristics (e.g. when procedures related with SSC mode 2 are invoked). .If the cause value indicates that a PDU Session re-establishment on the Alternative S-NSSAI is required the PDU Session Release Command message also includes the Alternative S-NSSAI. The UE establishes a new PDU Session on the Alternative S-NSSAI, as described in clause 5.15.19 of TS 23.501 [2].

If the User Plane connection of the PDU Session is activated, the message sent by the SMF to the AMF shall include N2 SM Resource Release request. If the User Plane connection of the PDU Session is not activated, the message sent by the SMF to the AMF shall not include N2 SM Resource Release request.

NOTE 5: SSC modes are defined in clause 5.6.9 of TS 23.501 [2].

3a. (If the PDU Session Release is initiated by the UE in step 1a or has been triggered by (R)AN in step 1d) The SMF responds to the AMF with the Nsmf\_PDUSession\_UpdateSMContext response (N2 SM Resource Release request, N1 SM container (PDU Session Release Command)). N2 SM Resource Release request is included if the PDU Session Release is initiated by the UE and if the UP connection of the PDU Session is active. Neither N2 SM Resource Release request nor N1 SM container is included if the PDU Session Release is triggered by (R)AN and the SMF decides to keep the PDU session with user plane connection deactivated and the subsequent steps are skipped.

3b. If the PDU Session Release is initiated by the SMF or the PCF, the SMF invokes the Namf\_Communication\_N1N2MessageTransfer service operation (N1 SM container (PDU Session Release Command), skip indicator).

If the UP connection of the PDU Session is active, the SMF shall also include the N2 Resource Release request (PDU Session ID) in the Namf\_Communication\_N1N2MessageTransfer, to release the (R)AN resources associated with the PDU Session.

The "skip indicator" tells the AMF whether it may skip sending the N1 SM container to the UE (e.g. when the UE is in CM-IDLE state). SMF includes the "skip indicator" in the Namf\_Communication\_N1N2MessageTransfer except when the procedure is triggered to change PDU Session Anchor of a PDU Session with SSC mode 2.

If the UE is in CM-IDLE state and "skip indicator" is included in the Namf\_Communication\_N1N2MessageTransfer service operation or if the UE is in CM-IDLE state and "skip indicator" is not included in the Namf\_Communication\_N1N2MessageTransfer service operation but the AMF detects that the UE context contains Paging Restriction Information indicating that all paging is restricted, the AMF acknowledges the step 3b by sending an Namf\_Communication\_N1N2MessageTransfer Response message ("N1 SM Message Not Transferred") to SMF and steps 4 to 10 are skipped.

3c. If the PDU Session Release is initiated by the AMF in step 1c, i.e. the SMF received the Nsmf\_PDUSession\_ReleaseSMContext Request from the AMF, the SMF responds to the AMF with the Nsmf\_PDUSession\_ReleaseSMContext response, optionally including the Small Data Rate Control Status and APN Rate Control Status.

If the UPF included APN Rate Control Status and/or Small Data Rate Control Status in step 2 then the SMF includes APN Rate Control and/or Small Data Rate Control Status and the AMF stores the Small Data Rate Control Status and/or the APN Rate Control Status in the UE context in AMF.

The AMF and SMF shall remove all contexts (including the PDU Session ID) associated with the PDU Session which are indicated as released at the UE. The SMF shall remove any event subscriptions on the AMF by the SMF that becomes no more needed due to the PDU Session Release. The steps 4 to 11 are skipped.

3d. If the PDU Session Release is initiated by the AMF in step 1f, i.e. the SMF received the Nsmf\_PDUSession\_UpdateSMContext Request from the AMF with a release indication to request the release of the PDU Session, the SMF responds to the AMF with the Nsmf\_PDUSession\_UpdateSMContext Response which may contain the N1 SM container (PDU Session Release Command) to release the PDU session at the UE.

If the UP connection of the PDU Session is active, the Nsmf\_PDUSession\_UpdateSMContext Response shall also include the N2 Resource Release request (PDU Session ID) to release the (R)AN resources associated with the PDU Session.

4. If the UE is in CM-IDLE state and "N1 SM delivery can be skipped" is not indicated, the AMF initiates the network triggered Service Request procedure to transmit the NAS message (PDU Session ID, N1 SM container) to the UE and the steps 6, 7 are skipped.

If the message received from the SMF in step 3 does not include N2 SM Resource Release request, the AMF transmits the NAS message (PDU Session ID, N1 SM container) to the UE and the steps 6, 7 are skipped.

If the PDU Session is Control Plane CIoT 5GS Optimisation enabled, the SMF shall not include N2 SM Resource Release request in the message sent to the AMF, the AMF transmits the NAS message (PDU Session ID, N1 SM container) to the UE and the steps 6, 7 are skipped.

If the UE is in CM-CONNECTED state and the received message from the SMF in step 3 includes N2 SM Resource Release request, the AMF transfers the SM information received from the SMF in step 4 (N2 SM Resource Release request, N1 SM container) to the (R)AN.

If the message from the SMF includes Small Data Rate Control Status then the AMF stores it in the UE Context in AMF.

5. When the (R)AN has received an N2 SM request to release the AN resources associated with the PDU Session it issues AN specific signalling exchange(s) with the UE to release the corresponding AN resources.

In the case of a NG-RAN, the NAS message is sent to the UE in an RRC message which may take place with the UE releasing the NG-RAN resources related to the PDU Session. If NG-RAN resources do not need to be released (i.e. the User Plane of the PDU Session is deactivated), the NAS message is sent to the UE in an RRC message which does not release the NG-RAN resources related to the PDU Session.

During this procedure, the (R)AN sends any NAS message (N1 SM container (PDU Session Release Command)) received from the AMF in step 4.

For PDU Session for non-roaming subscribers, if the S-NSSAI of the released PDU Session is subject to network slice usage control as described in clause 5.15.15 of TS 23.501 [2] and there is no other PDU Session using the S-NSSAI over which the Access Type the PDU Session was released, the UE starts slice deregistration inactivity timer for the S-NSSAI over the Access Type if the UE received slice deregistration inactivity timer for the S-NSSAI for that the Access Type.

6. [Conditional] If the (R)AN had received a N2 SM request to release the AN resources, the (R)AN acknowledges the N2 SM Resource Release Request by sending an N2 SM Resource Release Ack (User Location Information, Secondary RAT usage data) Message to the AMF.

If the PLMN has configured secondary RAT usage reporting, the NG-RAN node may provide RAN Usage Data Report.

If NG-RAN/AN-TL has performed the deletion of TN stream based on the request received from the SMF/CUC in step 3, the NG-RAN/AN-TL shall confirm the deletion of TN stream configurations.

7a. The AMF invokes the Nsmf\_PDUSession\_UpdateSMContext (N2 SM Resource Release Ack (Secondary RAT usage data), User Location Information) to the SMF.

7b. The SMF responds to the AMF with an Nsmf\_PDUSession\_UpdateSMContext response.

8. The UE acknowledges the PDU Session Release Command by sending a NAS message (PDU Session ID, N1 SM container (PDU Session Release Ack)) over the (R)AN.

9. [Conditional] The (R)AN forwards the NAS message from the UE by sending a N2 NAS uplink transport (NAS message (PDU Session ID, N1 SM container (PDU Session Release Ack)), User Location Information) to the AMF.

10a. The AMF invokes the Nsmf\_PDUSession\_UpdateSMContext (N1 SM container (PDU Session Release Ack, User Location Information) to the SMF.

10b. The SMF responds to the AMF with an Nsmf\_PDUSession\_UpdateSMContext response.

Steps 8-10 may happen before steps 6-7.

11. If steps 3a, 3b or 3d were performed, the SMF waits until it has received replies to the N1 and N2 information provided in step 3, as needed.

The SMF invokes Nsmf\_PDUSession\_SMContextStatusNotify to notify AMF that the SM context for this PDU Session is released. If the UPF included Small Data Rate Control Status and/or APN Rate Control Status in step 2 then the SMF includes Small Data Rate Control Status and/or APN Rate Control Status in its request to the AMF in this step. The AMF releases the association between the SMF ID and the PDU Session ID, DNN, as well as S-NSSAI and stores the Small Data Rate Control Status and/or the APN Rate Control Status in the UE context in AMF. The SMF shall remove any event subscriptions on the AMF that becomes no more needed due to the PDU Session Release.

NOTE 6: The UE and the 5GC will get synchronized about the status of the (released) PDU Session at the next Service Request or Registration procedure.

For PDU Session for non-roaming subscribers, if the S-NSSAI of the released PDU Session is subject to network slice usage control and if the SMF indicates cause of slice inactivity and there is no other PDU Session using the S-NSSAI over which the Access Type the PDU Session was released, then AMF may remove the S-NSSAI from the Allowed NSSAI or start slice deregistration inactivity timer for the S-NSSAI for that Access Type as described in clause 5.15.15.3 of TS 23.501 [2]. If the AMF did not provide slice deregistration inactivity timer of the S-NSSAI to the UE for the Access Type and S-NSSAI is removed from Allowed NSSAI, the AMF triggers UE Configuration Update procedure to provide the new Allowed NSSAI to the UE.

12. If Dynamic PCC applied to this session the SMF invokes an SM Policy Association Termination procedure as defined in clause 4.16.6 to delete the PDU Session.

13. SMF notifies any entity that has subscribed to User Location Information related with PDU Session change.

14. If it is the last PDU Session the SMF is handling for the UE for the associated (DNN, S-NSSAI), the SMF unsubscribes from Session Management Subscription data changes notification with the UDM by means of the Nudm\_SDM\_Unsubscribe (SUPI, DNN, S-NSSAI) service operation. The UDM may unsubscribe the subscription notification from UDR by Nudr\_DM\_Unsubscribe (SUPI, Subscription Data, Session Management Subscription data, DNN, S-NSSAI).

15. The SMF invokes the Nudm\_UECM\_Deregistration service operation including the DNN and the PDU Session ID. The UDM removes the association it had stored between the SMF identity and the associated DNN and PDU Session ID. The UDM may update this information by Nudr\_DM\_Update (SUPI, Subscription Data, UE context in SMF data).

\* \* \* \* Next change \* \* \* \*

#### 5.2.3.3 Nudm\_SubscriberDataManagement (SDM) Service

##### 5.2.3.3.1 General

Subscription data types used in the Nudm\_SubscriberDataManagement Service are defined in Table 5.2.3.3.1-1 below.

Table 5.2.3.3.1-1: UE Subscription data types

| Subscription data type | Field | Description |
| --- | --- | --- |
| Access and Mobility Subscription data (data needed for UE | GPSI List | List of the GPSI (Generic Public Subscription Identifier) used both inside and outside of the 3GPP system to address a 3GPP subscription (see NOTE 9). |
| Registration and Mobility Management) | Internal Group ID-list | List of the subscribed internal group(s) that the UE belongs to. |
|  | Subscribed UE-AMBR | The maximum aggregated uplink and downlink MBRs to be shared across all Non-GBR QoS Flows according to the subscription of the user. |
|  | Subscribed UE-Slice-MBR(s) | List of maximum aggregated uplink and downlink MBRs to be shared across all GBR and Non-GBR QoS Flows related to the same S-NSSAI according to the subscription of the user. There is a single uplink and a single downlink value per S-NSSAI. |
|  | Subscribed S-NSSAIs | The Network Slices that the UE subscribes to. In the roaming case, it indicates the subscribed Network Slices applicable to the Serving PLMN (NOTE 11).  For a subscribed S-NSSAI subject to NSAC for the registered number of UE, the applicable NSAC admission mode is included as described in clause 4.2.11.5.2. |
|  | Default S-NSSAIs | The Subscribed S-NSSAIs marked as default S-NSSAI. In the roaming case, only those applicable to the Serving PLMN (NOTE 12). |
|  | Slice Usage Policy information | Includes:  - indication the S-NSSAI is on demand; and  - slice deregistration inactivity timer value.  The AMF uses this information as described in clause 5.15.15 of TS 23.501 [2].  (NOTE 22) |
|  | S-NSSAIs subject to Network Slice-Specific Authentication and Authorization | The Subscribed S-NSSAIs marked as subject to NSSAA. When present, the GPSI list shall include at least one GPSI. |
|  | Network Slice Simultaneous Registration Group Information | Optionally, for each S-NSSAI in the Subscribed S-NSSAIs, one or more value of Network Slice Simultaneous Registration Group(s) (NOTE 11) associated with the S-NSSAI. |
|  | Network Slice validity time information | Optionally, if the Subscribed S-NSSAI is temporarily available network slice, one validity time is associated with this S-NSSAI. |
|  | UE Usage Type | As defined in clause 5.15.7.2 of TS 23.501 [2]. |
|  | RAT restriction | 3GPP and non-3GPP Radio Access Technology(ies) not allowed the UE to access. |
|  | Forbidden area | Defines areas in which the UE is not permitted to initiate any communication with the network. |
|  | Service Area Restriction | Indicates Allowed Areas in which the UE is permitted to initiate communication with the network and Non-allowed areas in which the UE and the network are not allowed to initiate Service Request or SM signalling to obtain user services. |
|  | Core Network type restriction | Defines whether UE is allowed to connect to 5GC and/or EPC for this PLMN. |
|  | CAG information | The CAG information includes Allowed CAG list and optionally an indication whether the UE is only allowed to access 5GS via CAG cells and each entry in the Allowed CAG list may also be associated with time validity information as defined in clause 5.30.3 of TS 23.501 [2]. |
|  | CAG information Subscription Change Indication | When present, indicates to the serving AMF that the CAG information in the subscription data changed and the UE must be updated. |
|  | RFSP Index | An index to specific RRM configuration in the NG-RAN. |
|  | Subscribed Periodic Registration Timer | Indicates a subscribed Periodic Registration Timer value, which may be influenced by e.g. network configuration parameter as specified in clause 4.15.6.3a. |
|  | Subscribed Active Time | Indicates a subscribed active time value, which may be influenced by e.g. network configuration parameter as specified in clause 4.15.6.3a. |
|  | MPS priority | Indicates the user is subscribed to MPS as indicated in clause 5.16.5 of TS 23.501 [2]. |
|  | MCX priority | Indicates the user is subscribed to MCX as indicated in clause 5.16.6 of TS 23.501 [2]. |
|  | AMF-Associated Expected UE Behaviour parameters | Information on expected UE movement and communication characteristics. See clause 4.15.6.3 |
|  | Steering of Roaming | List of preferred PLMN/access technology combinations and/or Credentials Holder controlled prioritized lists of preferred SNPNs and GINs and/or Credentials Holder controlled prioritized lists of preferred SNPNs and GINs for accessing Localized Services (see NOTE 21) or HPLMN/Credentials Holder indication that no change of the above list(s) stored in the UE is needed (see NOTE 3).  Optionally includes an indication that the UDM requests an acknowledgement of the reception of this information from the UE. |
|  | SoR Update Indicator for Initial Registration | An indication whether the UDM requests the AMF to retrieve SoR information when the UE performs Registration with NAS Registration Type "Initial Registration". |
|  | SoR Update Indicator for Emergency Registration | An indication whether the UDM requests the AMF to retrieve SoR information when the UE performs Registration with NAS Registration Type "Emergency Registration". |
|  | Network Slicing Subscription Change Indicator | When present, indicates to the serving AMF that the subscription data for network slicing changed and the UE configuration must be updated. |
|  | Provide the UE with the full set of subscribed S-NSSAIs | Indicates the AMF to provide the UE with the full set of subscribed S-NSSAIs even if they do not share a common NSSRG. |
|  | Tracing Requirements | Trace requirements about a UE (e.g. trace reference, address of the Trace Collection Entity, etc.) is defined in TS 32.421 [39]. |
|  | Inclusion of NSSAI in RRC Connection Establishment Allowed | When present, it is used to indicate that the UE is allowed to include NSSAI in the RRC connection Establishment in clear text for 3GPP access. |
|  | Service Gap Time | Used to set the Service Gap timer for Service Gap Control (see clause 5.31.16 of TS 23.501 [2]). |
|  | Subscribed DNN list | List of the subscribed DNNs for the UE (NOTE 1). Used to determine the list of LADN available to the UE as defined in clause 5.6.5 of TS 23.501 [2]. |
|  | LADN Service Area | List of Tracking Areas configured per DNN and S-NSSAI within which UE is permitted to initiate Service Request or SM signalling. |
|  | UDM Update Data | Includes a set of parameters see clause 4.20.1 for parameters possible to deliver) to be delivered from UDM to the UE via NAS signalling as defined in clause 4.20 (NOTE 3).  Optionally includes an indication that the UDM requests an acknowledgement of the reception of this information from the UE and an indication for the UE to re-register. |
|  | NB-IoT UE priority | Numerical value used by the NG-RAN to prioritise between UEs accessing via NB-IoT. |
|  | Enhanced Coverage Restriction | Specifies whether CE mode B is restricted for the UE, or both CE mode A and CE mode B are restricted for the UE, or both CE mode A and CE mode B are not restricted for the UE. |
|  | NB-IoT Enhanced Coverage Restriction | Indicates whether Enhanced Coverage for NB-IoT UEs is restricted or not. |
|  | IAB-Operation allowed | Indicates that the subscriber is allowed for IAB-operation as specified in clause 5.35.2 of TS 23.501 [2]. |
|  | MBSR Operation allowed | Indicates the subscriber is allowed for MBSR operation as specified in clause 5.35A.4 of TS 23.501 [2]. If present, additional location information (i.e. a list of TAIs or Area Codes that can be interpreted by AMF into TAIs ) and/or time information (including one or more time windows, and/or one or more recurring time periods) may also be present to restrict the MBSR operation to be within the location and time provided. |
| MWAB Operation allowed | The information regarding the subscriber allowed for MWAB operation, and the details are specified in clause 5.x.y3 of TS 23.501 [2]. |
|  | Charging Characteristics | It contains the Charging Characteristics as defined in Annex A of TS 32.256 [71].  This information, when provided, shall override any corresponding predefined information at the AMF. |
|  | Extended idle mode DRX cycle length | Indicates a subscribed extended idle mode DRX cycle length value. |
|  | PCF Selection Assistance info | list of combination of DNN and S-NSSAI that indicates that the same PCF needs to be selected for AM Policy Control and SM Policy Control (NOTE 10). |
|  | AerialUESubscriptionInfo | Aerial UE Subscription Information. It contains an Indication on whether Aerial service for the UE is allowed or not. |
|  | 5G Access Stratum-based Time Synchronization Service Data | Includes the Access Stratum Time Synchronization Service Authorization to indicate whether the UE should be provisioned with 5G system internal clock timing information over access stratum.  Optionally includes an Uu time synchronization error budget.  Optionally includes one or more periods of start and stop times defining the times when the UE should be provisioned with 5G system internal clock timing information.  Optionally includes a Time Synchronization Coverage Area comprising a list of TAs where the UE shall be provisioned with 5G system internal clock timing information (NOTE 19).  Optionally includes a clock quality detail level to indicate whether and which clock quality information to provide to the UE. It comprises one of the following values: clock quality metrics or acceptable/not acceptable indication.  Optionally includes the clock quality acceptance criteria for the UE. It may be defined based on one or more of the following attributes: time source, traceability to UTC and to GNSS, synchronization state, clock accuracy, frequency stability. |
|  | Routing Indicator | Routing Indicator assigned to the SUPI. |
|  | ODB for Packet services | Operator Determined Barring for Packet Oriented Services. See TS 23.015 [90] and TS 29.503 [52] for the handling of ODB for Packet service parameter. |
|  | QMC Configuration information | The content of QMC Configuration information (e.g. QoE reference, QoE collection entity address, etc.) is defined in TS 28.405 [92]. |
|  | NCR-Operation allowed | Indicates that the subscriber is allowed for NCR-operation as specified in clause 5.xx of TS 23.501 [2]. |
| Slice Selection Subscription data (data needed for | Subscribed S-NSSAIs | The Network Slices that the UE subscribes to. In roaming case, it indicates the subscribed network slices applicable to the serving PLMN (NOTE 11). |
| Slice Selection as described in clause 4.2.2.2.3 and | Default S-NSSAIs | The Subscribed S-NSSAIs marked as default S-NSSAI. In the roaming case, only those applicable to the Serving PLMN (NOTE 12). |
| in clause 4.11.0a.5) | S-NSSAIs subject to Network Slice-Specific Authentication and Authorization | The Subscribed S-NSSAIs marked as subject to NSSAA. |
|  | Network Slice Simultaneous Registration Group (NSSRG) Information | Optionally, for each S-NSSAI in the Subscribed S-NSSAIs, the one or more value of Network Slice Simultaneous Registration Group(s) (NOTE 11) associated with the S-NSSAI. |
|  | Network Slice validity time information | Optionally, if the Subscribed S-NSSAI is temporarily available network slice, one validity time is associated with this S-NSSAI. |
| SMF Selection | SUPI | Key |
| Subscription data (data needed for SMF | **SMF Selection Subscription data contains one or more S-NSSAI level subscription data:** | |
| Selection as described | S-NSSAI | Indicates the value of the S-NSSAI. |
| in clause 6.3.2 of | Subscribed DNN list | List of the subscribed DNNs for the UE (NOTE 1). |
| TS 23.501 [2]) | Default DNN | The default DNN if the UE does not provide a DNN (NOTE 2). |
|  | DNN(s) subject to aerial services | List of DNNs that are used for aerial services (e.g. UAS operations or C2, etc.) as described in TS 23.256 [80]. (see NOTE 13). |
|  | LBO Roaming Information | Indicates whether LBO roaming is allowed per DNN, or per (S-NSSAI, subscribed DNN). (NOTE 16) |
|  | HR-SBO allowed indication | Indicates whether Session Breakout for HR Session in VPLMN is allowed per DNN, or per (S-NSSAI, subscribed DNN).  (NOTE 17) |
|  | Interworking with EPS indication list | Indicates whether EPS interworking is supported per (S-NSSAI, subscribed DNN). |
|  | Same SMF for Multiple PDU Sessions to the same DNN and S-NSSAI | Indication whether the same SMF for multiple PDU Sessions to the same DNN and S-NSSAI is required. |
|  | Invoke NEF indication | When present, indicates, per S-NSSAI and per DNN, that NEF based infrequent small data transfer shall be used for the PDU Session (see NOTE 8). |
|  | SMF information for static IP address/prefix | When static IP address/prefix is used, this may be used to indicate the associated SMF information per (S-NSSAI, DNN). |
| UE context in SMF | SUPI | Key. |
| data | PDU Session Id(s) | List of PDU Session Id(s) for the UE. |
|  | **For emergency PDU Session Id:** | |
|  | Emergency Information | The SMF+PGW-C FQDN for emergency session used for interworking with EPC. |
|  | **For each non-emergency PDU Session Id:** | |
|  | DNN | DNN for the PDU Session. |
|  | SMF | Allocated SMF for the PDU Session. Includes SMF IP Address and SMF NF Id. |
|  | SMF+PGW-C FQDN | The S5/S8 SMF+PGW-C FQDN used for interworking with EPS (see NOTE 5). |
|  | PCF ID | The PCF ID serving the PDU Session/PDN Connection. |
| SMS Management Subscription data (data needed by | SMS parameters | Indicates SMS parameters subscribed for SMS service such as SMS teleservice, SMS barring list |
| SMSF for SMSF Registration) | Trace Requirements | Trace requirements about a UE (e.g. trace reference, address of the Trace Collection Entity, etc.) is defined in TS 32.421 [39].  This information is only sent to a SMSF in HPLMN. |
|  | Routing Indicator | Routing Indicator assigned to the SUPI. |
| SMS Subscription data | SMS Subscription | Indicates subscription to any SMS delivery service over NAS irrespective of access type. |
| (data needed in AMF) |  |  |
| UE Context in SMSF data | SMSF Information | Indicates SMSF allocated for the UE, including SMSF address and SMSF NF ID. |
|  | Access Type | 3GPP or non-3GPP access through this SMSF |
| Session Management Subscription data (data needed for PDU | GPSI List | List of the GPSI (Generic Public Subscription Identifier) used both inside and outside of the 3GPP system to address a 3GPP subscription. |
| Session Establishment) | Internal Group ID-list | List of the subscribed internal group(s) that the UE belongs to. |
|  | Trace Requirements | Trace requirements about a UE (e.g. trace reference, address of the Trace Collection Entity, etc…) is defined in TS 32.421 [39].  This information is only sent to a SMF in the HPLMN or one of its equivalent PLMN(s). |
|  | Routing Indicator | Routing Indicator assigned to the SUPI. |
|  | **Session Management Subscription data contains one or more S-NSSAI level subscription data:** | |
|  | S-NSSAI | Indicates the value of the S-NSSAI.  For a subscribed S-NSSAI subject to NSAC for the established PDU session number, the applicable NSAC admission mode is included as described in clause 4.2.11.5.2. |
|  | Subscribed DNN list | List of the subscribed DNNs for the S-NSSAI (NOTE 1). |
|  | Slice Usage Policy information | Includes:  - indication the S-NSSAI is on demand; and  - PDU Session inactivity timer value.  The SMF uses this information as described in clause 5.15.15 of TS 23.501 [2].  (NOTE 22). |
|  | ODB for Packet services | Operator Determined Barring for Packet Oriented Services. See TS 23.015 [90] and TS 29.503 [52] for the handling of ODB for Packet service parameter. |
|  | **For each DNN in S-NSSAI level subscription data:** | |
|  | DNN | DNN for the PDU Session. |
|  | Aerial service indication | Indicates whether the DNN is used for aerial services (e.g. UAS operations or C2, etc.) as described in TS 23.256 [80]. |
|  | Framed Route information | Set of Framed Routes. A Framed Route refers to a range of IPv4 addresses / IPv6 Prefixes to associate with a PDU Session established on this (DNN, S-NSSAI).  See NOTE 4. |
|  | IP Index information | Information used for selecting how the UE IP address is to be allocated (see clause 5.8.2.2.1 of TS 23.501 [2]). |
|  | Allowed PDU Session Types | Indicates the allowed PDU Session Types (IPv4, IPv6, IPv4v6, Ethernet and Unstructured) for the DNN, S-NSSAI. See NOTE 6. |
|  | Default PDU Session Type | Indicates the default PDU Session Type for the DNN, S-NSSAI. |
|  | Allowed SSC modes | Indicates the allowed SSC modes for the DNN, S-NSSAI. |
|  | Default SSC mode | Indicate the default SSC mode for the DNN, S-NSSAI. |
|  | Interworking with EPS indication | Indicates whether interworking with EPS is supported for this DNN and S-NSSAI. |
|  | 5GS Subscribed QoS profile | The QoS Flow level QoS parameter values (5QI and ARP) for the DNN, S-NSSAI (see clause 5.7.2.7 of TS 23.501 [2]). |
|  | Charging Characteristics | It contains Charging Characteristics as defined in Annex A clause A.1 of TS 32.255 [45]. This information, when provided, shall override any corresponding predefined information at the SMF. |
|  | Subscribed-Session-AMBR | The maximum aggregated uplink and downlink MBRs to be shared across all Non-GBR QoS Flows in each PDU Session, which are established for the DNN, S-NSSAI. |
|  | Static IP address/prefix | Indicate the static IP address/prefix for the DNN, S-NSSAI. |
|  | User Plane Security Policy | Indicates the security policy for integrity protection and encryption for the user plane. |
|  | PDU Session continuity at inter RAT mobility | Provides for this DDN, S-NSSAI how to handle a PDU Session when UE the moves to or from NB-IoT. Possible values are: maintain the PDU session; disconnect the PDU session with a reactivation request; disconnect PDU session without reactivation request; or to leave it to local VPLMN policy. |
|  | NEF Identity for NIDD | When present, indicates, per S-NSSAI and per DNN, the identity of the NEF to anchor Unstructured PDU Session. When not present for the S-NSSAI and DNN, the PDU session terminates in UPF (see NOTE 8). |
|  | NIDD information | Information such as External Group Identifier, External Identifier, MSISDN, or AF Identifier used for SMF-NEF Connection. |
|  | SMF-Associated Expected UE Behaviour parameters | Parameters on expected characteristics of a PDU Session their corresponding validity times as specified in clause 4.15.6.3. |
|  | SMF-Associated Application-Specific Expected UE Behaviours parameters | Parameters characterise the foreseen behaviour of a UE for a specific application as specified in clause 4.15.6.3f. |
|  | Suggested number of downlink packets | Parameters on expected PDU session characteristics as specified in clauses 4.15.3.2.3b and 4.15.6.3a. |
|  | ATSSS information | Indicates whether MA PDU session establishment is allowed. |
|  | Secondary authentication indication | Indicates that whether the Secondary authentication/authorization (as defined in clause 5.6 of TS 23.501 [2]) is required for PDU Session Establishment or PDN Connection Establishment as specified in clause 4.3.2.3 and clause H.2. (see NOTE 14) |
|  | DN-AAA Server UE IP address allocation indication | Indicates that whether the SMF is required to request the UE IP address from the DN-AAA Server (as defined in clause 5.6 of TS 23.501 [2]) for PDU Session Establishment or or PDN Connection Establishment as specified in clause 4.3.2.3 and clause H.2. |
|  | DN-AAA Server addressing information | If at least one of secondary DN-AAA authentication, DN-AAA authorization or DN-AAA UE IP address allocation is required by subscription data, the subscription data may also contain DN-AAA Server addressing information. |
|  | Edge Configuration Server Address Configuration Information | Consists of one or more ECS Configuration Information as defined in clause 8.3.2.1 of TS 23.558 [83]. The ECS Configuration Information sent by UDM to SMF is associated with the PLMN ID where the UE is roaming on. (see NOTE 20) |
|  | API based secondary authentication indication | Indicates that whether the API based Secondary authentication/authorization (as defined in clause 5.2.3 of TS 23.256 [80]) is required for PDU Session Establishment or PDN Connection Establishment as specified in clause 4.3.2.3 and clause H.2 (see NOTE 14). |
|  | UE authorization for EAS discovery via EASDF | Indicates whether the UE is authorized to use 5GC assisted EAS discovery via EASDF (as defined in TS 23.548 [74]). |
|  | HR-SBO authorization indication | Indicates whether the VPLMN is authorized for Home Routed Session Breakout (HR-SBO) (see NOTE 17 and NOTE 18). |
| Identifier translation | SUPI | Corresponding SUPI for input GPSI. |
|  | (Optional) MSISDN | Corresponding GPSI (MSISDN) for input GPSI (External Identifier). This is optionally provided for legacy SMS infrastructure not supporting MSISDN-less SMS. The presence of an MSISDN should be interpreted as an indication to the NEF that MSISDN shall be used to identify the UE when sending the SMS to the SMS-SC via T4. |
|  | GPSI | Corresponding GPSI for input SUPI and associated application information (e.g. Application Port ID) (NOTE 15). |
| Intersystem continuity Context | (DNN, PGW FQDN) list | For each DNN, indicates the SMF+PGW-C which support interworking with EPC. |
| LCS privacy  (data needed by GMLC) | LCS privacy profile data | Provides information for LCS privacy classes and Location Privacy Indication (LPI) as defined in clause 5.4.2 of TS 23.273 [51] |
| LCS mobile origination  (data needed by AMF) | LCS Mobile Originated Data | When present, indicates to the serving AMF which LCS mobile originated services are subscribed as defined in clause 7.1 of TS 23.273 [51]. |
| User consent (see TS 23.288 [50]) | User consent for UE data collection | Indicates whether the user has given consent for collecting, distributing and analysing UE related data. User consent is provided per purpose (e.g. analytics, model training). |
| UE reachability | UE reachability information | Provides, per PLMN, the list of NF IDs or the list of NF sets or the list of NF types authorized to request notification for UE's reachability (NOTE 7). |
| V2X Subscription data (see TS 23.287 [73]) | NR V2X Services Authorization | Indicates whether the UE is authorized to use the NR sidelink for V2X services as Vehicle UE, Pedestrian UE, or both. |
|  | LTE V2X Services Authorization | Indicates whether the UE is authorized to use the LTE sidelink for V2X services as Vehicle UE, Pedestrian UE, or both. |
|  | NR UE-PC5-AMBR | AMBR of UE's NR sidelink (i.e. PC5) communication for V2X services. |
|  | LTE UE-PC5-AMBR | AMBR of UE's LTE sidelink (i.e. PC5) communication for V2X services. |
| A2X Subscription data (see TS 23.256 [80]) | NR A2X Services Authorization | Indicates whether the UE is authorized to use the NR sidelink for A2X services. |
|  | LTE A2X Services Authorization | Indicates whether the UE is authorized to use the LTE sidelink for A2X services. |
|  | NR UE-PC5-AMBR for A2X | AMBR of UE's NR sidelink (i.e. PC5) communication for A2X services. |
|  | LTE UE-PC5-AMBR for A2X | AMBR of UE's LTE sidelink (i.e. PC5) communication for A2X services. |
| ProSe Subscription data (see TS 23.304 [77]) | ProSe Service Authorization | Indications for whether the UE is authorised to use the 5G ProSe service(s), including:  - use 5G ProSe Direct Discovery;  - use 5G ProSe Direct Communication;  - act as a 5G ProSe Remote UE;  - serve as a 5G ProSe UE-to-Network Relay;  - use multi-path communication via direct Uu path and via 5G ProSe Layer-2 UE-to-Network Relay as a 5G ProSe Layer-2 Remote UE;  - act as a 5G ProSe End UE; and  - serve as a 5G ProSe UE-to-UE Relay. |
|  | ProSe NR UE-PC5-AMBR | AMBR of UE's NR sidelink (i.e. PC5) communication for ProSe services. |
| MBS Subscription data (see TS 23.247 [78]) | MBS Service Authorization | Indicates whether the UE is authorized to use Multicast MBS service. May also indicate the multicast MBS Session which the UE is allowed to join if the UE is authorized to use multicast MBS Service. |
|  | MBS Assistance Information | Include MBS assistance information for a UE that joins a multicast group. |
| Time Synchronization Subscription data (see clause 5.27.1.11 of TS 23.501 [2]) | AF Request Authorization Information | Includes the AF Request Authorization to indicate whether the UE is authorized for an AF-requested 5G access stratum-based time distribution and (g)PTP-based time distribution services (per DNN/S-NSSAI). The indication is provided separately for each service.  Optionally includes a list of TA(s) which specifies the Authorized Time Synchronization Coverage Area in which an AF may request time synchronization services (NOTE 19).  Optionally, one or more periods of authorized start and stop times, which indicates the allowed time period during which an AF may request time synchronization services.  Optionally, authorized Uu time synchronization error budget, which indicates the limit the AF may request.  Optionally includes information to determine whether the AF may request  - to provide clock quality metric information to the UE;  - to provide an acceptable/not acceptable indication to the UE.  Optionally includes one or more sets of the clock quality acceptance criteria for the UE that the AF may request. Clock quality acceptance criteria may be defined using TSS attributes from Table 5.27.1.12-1 of TS 23.501 [2]. |
|  | Subscribed Time Synchronization Service ID(s) | Each containing the DNN/S-NSSAI and a reference to a PTP instance configuration pre-configured at the TSCTSF.  Optionally, for each PTP instance configuration, one or more periods of start and stop times defining active times of time synchronization service for the PTP instance.  Optionally, for each PTP instance configuration, a Time Synchronization Coverage Area defining a list of TAs where the (g)PTP-based time synchronization is available for the UEs in the PTP instance (NOTE 19).  Optionally, for each PTP instance configuration, Uu time synchronization error budget. |
| Ranging/Sidelink Positioning Subscription data (see TS 23.586 [88]) | Ranging/SL Positioning Service Authorization | Indicates whether the UE is authorized to use Ranging/SL Positioning Service. |
| NOTE 1: The Subscribed DNN list can include a wildcard DNN.  NOTE 2: The default DNN shall not be a wildcard DNN.  NOTE 3: The Steering of Roaming information and UDM Update Data are protected using the mechanisms defined in TS 33.501 [15].  NOTE 4: Framed Route information and Framed Route(s) are defined in TS 23.501 [2].  NOTE 5: Depending on the scenario PGW-C FQDN may be for S5/S8, or for S2b (ePDG case).  NOTE 6: The Allowed PDU Session Types configured for a DNN which supports interworking with EPC should contain only the PDU Session Type corresponding to the PDN Type configured in the APN that corresponds to the DNN.  NOTE 7: Providing a list of NF types or a list of NF sets may be more appropriate for some deployments, e.g. in highly dynamic NF lifecycle management deployments.  NOTE 8: For a S-NSSAI and a DNN, the "Invoke NEF Indication" shall be present in the SMF selection subscription data if and only if the "NEF Identity for NIDD" Session Management Subscription Data includes a NEF Identity. When the "NEF Identity for NIDD" Session Management Subscription Data includes a NEF Identity for a S-NSSAI and DNN, the "Control Plane Only Indicator" will always be set for PDU Sessions to this S-NSSAI and DNN (see clause 5.31.4.1 of TS 23.501 [2]).  NOTE 9: When multiple GPSIs are included in the GPSI list, any GPSI in the list can be used in NSSAA procedures.  NOTE 10: The same PCF can be selected to serve the UE and to serve one or multiple PDU sessions, each of them is indicated in the list of S-NSSAI, DNN combinations in the PCF Selection Assistance Info. Providing one combination of DNN and S-NSSAI in the PCF Selection Assistance Info is assumed if interworking with EPS is needed. In case multiple PDU sessions to one DNN, S-NSSAI are established in EPS, it is appropriate to select same PCF by configuration or by using existing method, e.g. same PCF selection in usage monitoring.  NOTE 11: If Network Slice Simultaneous Registration Group information is present and the VPLMN does not support the subscription-based restrictions to simultaneous registration of network slices, the subset of the Subscribed S-NSSAIs defined in clause 5.15.12 of TS 23.501 [2], are included, without providing the NSSRG information.  NOTE 12: The Default S-NSSAIs (if more than one is present) are associated with common NSSRG values if NSSRG information is present. At least one Default S-NSSAI shall be present in a subscription including NSSRG information.  NOTE 13: When UUAA is performed in the AMF (as in clause 5.2.2 of TS 23.256 [80]) and UUAA-MM status is FAILED or PENDING, the AMF shall reject PDU session establishment requests from the UE for a DNN that is subject to aerial services.  NOTE 14: For a DNN in S-NSSAI either a DN-AAA based secondary authentication, or an API based secondary authentication can be configured. When API based authentication of the PDU session is required, Secondary authentication indication shall not be present.  NOTE 15: A GPSI may be associated with Application Port ID, MTC Provider Information and/or AF Identifier.  NOTE 16: For non-roaming UE (e.g. accessing SNPN with CH credentials), LBO roaming information does not apply.  NOTE 17: This information applies only for HR PDU Session.  NOTE 18: This information is only valid for the current serving network. When Session Breakout for HR Session is authorized, usage of corresponding EAS Deployment Information and AF traffic influence in VPLMN is also authorized.  NOTE 19: The subscribed Time Synchronization Coverage Area shall be inside of the Allowed Areas as per UE's service area restriction.  NOTE 20: For roaming UE in a visited PLMN, the corresponding PLMN ID is provided with Edge Configuration Server (ECS) Address Configuration Information.  NOTE 21: The entries in the Credentials Holder controlled prioritized lists of preferred SNPNs and GINs for accessing Localized Services are associated with a time validity information and optionally a location validity information indicating the conditions allowing the UE to access to localized services in the SNPN or/and location assistance information used to aid the UE where to search for the SNPN as specified in clause 5.30.2.3 of TS 23.501 [2].  NOTE 22: Only for an S-NSSAI dedicated to a single AF is associated with Slice Usage Policy information. For roaming UE, Slice Usage Policy information does not apply. | | |

Table 5.2.3.3.1-2: Group Subscription data types

| Subscription data type | Field | Description |
| --- | --- | --- |
| Group Identifier translation | External Group Identifier | Identifies external group of UEs that the UE belongs to as defined in TS 23.682 [23]. |
|  | Internal Group Identifier | Identifies internal group of UEs that the UE belongs to as defined in TS 23.501 [2]. |
|  | SUPI list | Corresponding SUPI list for input External Group Identifier. |
| Group Data  (NOTE 1) | Internal Group Identifier | Internal identifiers of the group of UEs that the Group Data belongs to. |
|  | Group data | In the case of 5G VN related groups the content of this information contains parameters defined in clause 4.15.6.3b.  In the case of DNN and S-NSSAI specific parameters in the Groups, the content of this information contains parameters defined in clause 4.15.6.3e. |
| NOTE 1: Group Data within Group Subscription Data can be managed using the Shared Data feature defined in TS 29.503 [52]. In that case, Shared Data is identified using Shared Data identifier and can contain additional information than the one defined in this table. | | |

At least a mandatory key is required for each Subscription Data Type to identify the corresponding data. Depending on the use case, for some Subscription Data Types it is possible to use one or multiple sub keys to further identify the corresponding data, as defined in Tables 5.2.3.3.1-3 and 5.2.3.3.1-4 below.

Table 5.2.3.3.1-3: UE Subscription data types keys

|  |  |  |
| --- | --- | --- |
| Subscription Data Types | Data Key | Data Sub Key |
| Access and Mobility Subscription data | SUPI | Serving PLMN ID and optionally NID |
| SMF Selection Subscription data | SUPI | Serving PLMN ID and optionally NID |
| UE context in SMF data | SUPI | S-NSSAI |
| SMS Management Subscription data | SUPI | Serving PLMN ID and optionally NID |
| SMS Subscription data | SUPI | Serving PLMN ID and optionally NID |
| UE Context in SMSF data | SUPI | - |
| Session Management Subscription data | SUPI | S-NSSAI |
|  |  | DNN |
|  |  | Serving PLMN ID and optionally NID |
| Identifier translation | GPSI | - |
|  | SUPI | Application Port ID, MTC Provider Information, AF Identifier |
| Slice Selection Subscription data | SUPI | Serving PLMN ID and optionally NID |
| Intersystem continuity Context | SUPI | DNN |
| LCS privacy | SUPI | - |
| LCS mobile origination | SUPI | - |
| User consent | SUPI | Purpose |
| UE reachability | SUPI | - |
| V2X Subscription data | SUPI | - |
| ProSe Subscription data | SUPI | - |
| MBS Subscription data | SUPI | - |
| A2X Subscription data | SUPI | - |
| Ranging/Sidelink Positioning Subscription data | SUPI | - |

Table 5.2.3.3.1-4: Group Subscription data types keys

|  |  |  |
| --- | --- | --- |
| Subscription Data Types | Data Key | Data Sub Key |
| Group Identifier translation | External Group Identifier | - |
|  | Internal Group Identifier | - |
| Group Data | Internal Group Identifier | - |

Wireline access specific subscription data parameters are specified in TS 23.316 [53].

\* \* \* \* End of changes \* \* \* \*