**SA WG2 Meeting #155 S2-2303498**

**Athens, Greece, Feb 20 – 24, 2023 (revision of S2-2302244**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **3871** | **rev** | **1** | **Current version:** |  |  |
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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 |  | Core Network | **X** |

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| ***Title:*** | URSP rule enforcement report to 5GC | | | | | | | | | |
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| ***Source to WG:*** | Vivo. Deutsche Telekom, Samsung, China Telecom | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | eUEPO | | | | |  | ***Date:*** | | | 08 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | |  |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | As the conclusion in TR 23.700-85, it is agreed to UE to report the URSP rule enforcement to 5GC.  During UE registration procedure, the UE should indicate the capability of reporting URSP rule enforcement based on UE configuration to network and the 5GC indicates to the UE to report URSP rule enforcement to network, and if the UE URSP rule includes Connection Capabilities contained in the TD (see TS 23.503, clause 6.6.2.1), when newly-appeared application traffic is matched to the TD during URSP evaluation, the UE reports the Connection Capabilities contained in the TD, which will be included in the PDU Session Establishment or Modification (i.e. when the URSP rule is matched), then to the PCF for the PDU Session and to PCF for the UE.  And after receiving the URSP rule enforcement, the PCF for UE may request the PCF for the PDU Session to generate PCC Rules to apply policies for a PDU Session established with preconfigured URSP Rules. The URSP rule enforcement should be transform to the SDF template or packet filter to generate the PCC rule. | | | | | | | | |
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| ***Summary of change:*** | | During the UE registration procedure, the UE reports the capablity of supporting report the URSP rules enforcement.  During the PDU session establishment/modification procedure, the UE reports the URSP rules enforcement to SMF, and during the SM policy association establishment/modification procedure, the SMF delivers the URSP rules enforcement to PCF for session. And the PCF for session delivers the URSP rule enforcement to PCF for UE.  Not all of the URSP rule delivers to UE should report the URSP rule enforcement. The PCF for UE may indicate to UE to report the certain URSP rule enforcement to network, when the UE enforces this rule.  If the network sides prepares to apply the traffic detection according to the URSP rule enforcement, the PCF for UE sends the URSP rule enforcement to PCF for session. And the PCF for session determines and generate the PCC rule to apply policies for a PDU Session established with preconfigured URSP Rules. The PCF for session may retrieve the information that the corresponding SDF template or application identifier that associated with URSP rule enforcement from UDR.  Includes merging with S2-2302277 and S2-2302342   * Adds missing change to Npcf\_UEPolicyControl\_Create service operation linked with 4.16.11 * Removes change to 5.2.5.4.5 Npcf\_SMPolicyControl\_Update service operation as its inputs/outputs are defined in TS 23.503 * Replace “V-PCF” as consumer of Npcf\_UEPolicyControl with “PCF” in Table 5.2.5.1-1. And indicate PCF for a PDU session is the consumer of Npcf\_UEPolicyControl when UE attaches in EPS in clause 5.2.5.6.1. | | | | | | | | |
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| ***Consequences if not approved:*** | | The network sides doesn’t know whether the UE support to report the URSP rule enforcement.  The network sides can’t deliver the URSP rule enforcement from UE to PCF for UE.  The network sides can’t generate the PCC rule if there is no mapping table between the SDF template or application identifier between URSP rule enforcement (e.g.: traffic descriptor). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.2.2.2.2, 4.3.2.2.1, 4.3.3.2, 4.16.11, 4.16.4, 4.16.5.1, 5.2.5.4.2, 5.2.5.6.2, 4.15.6.7, 5.2.5.7.2, 5.2.5.1, 5.2.5.6.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 23.503 CR 0901 | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* Start of Change 1 \* \* \*

##### 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 mode preference], [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 and the operating system identifier, UE capability of supporting to report URSP rule enforcement to network)] and [UE Radio Capability ID], [Release Request indication], [Paging Restriction Information], PEI, [PLMN with Disaster Condition], [Requested Periodic Update time], [Unavailability Period Duration])).

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 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 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 the PLMN to which the UE is attempting to register, if available;

iv) 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.

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 any other SNPN along with the NID of the SNPN that assigned the 5G-GUTI, if available;

iii) 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 in 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. 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].

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 UE MM Core Network Capability. 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.

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

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.

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].

If the UE and network have indicated support Unavailability Period and an event is triggered in the UE that would make the UE unavailable for a certain period of time, the UE indicates Unavailability Period by including Unavailability Period Duration as described in clause 5.4.1.4 of TS 23.501 [2].

If the UE supports to report the URSP rule enforcement to network, the UE shall report the capability of supporting to report URSP rule enforcement to network in the UE policy container.

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 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, without 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 [29].

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.

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 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.

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.

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.

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.

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 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.

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, if available, the Mapping Of Allowed NSSAI.

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

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

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.

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 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], [Configured NSSAI for the Serving PLMN], [Mapping Of Configured NSSAI], [NSSRG Information], [NSAG Information], [rejected S-NSSAIs], [Pending NSSAI], [Mapping Of Pending NSSAI], [Periodic Registration Update timer], [Active Time], [Strictly Periodic Registration Timer Indication], [LADN Information], [accepted MICO mode], [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 Supported]).

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 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.

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 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. 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 mode in the Registration Request, then AMF responds in the Registration Accept message whether MICO mode should be used. 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 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].

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 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.

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 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, the AMF shall indicate to the UE whether the corresponding feature is supported by providing the Unavailability Period Supported indication.

If the UE has provided Unavailability Period Duration in step 1, the AMF shall store the received Unavailability Period Duration and consider the UE as unreachable until the UE enters CM-CONNECTED state. The AMF may provide Periodic Registration Update timer based on Unavailability Period Duration 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 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].

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 13: 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 in step 1, the AMF shall release the signalling connection immediately after the completion of the Registration procedure.

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 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 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.

\* \* \* Start of Change 2 \* \* \*

##### 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), 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], [Connection Capabilities] 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. If the Mapping of Allowed NSSAI was provided to the UE, the UE shall provide both the S-NSSAI of the VPLMN from the Allowed NSSAI and the corresponding S-NSSAI of the HPLMN from the Mapping Of Allowed NSSAI.

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.

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 is 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 this PDU session establishment is using the values specified by the certain URSP rule, the UE includes the Connection Capabilities in the TD of the matched URSP rule in PDU Session Establishment Request to 5GC as described in clause 6.6.2.X 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 contains an S-NSSAI of the Serving PLMN but it does not contain a DNN, the AMF determines the DNN for the requested PDU Session by selecting the default DNN for this S-NSSAI 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.

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, 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].

3. From AMF to SMF: Either Nsmf\_PDUSession\_CreateSMContext Request (SUPI, selected DNN, UE requested DNN, S-NSSAI(s), 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 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 to the SMF.

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 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 TS 23.501 [2], the AMF includes Satellite backhaul category indication.

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]). 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.

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.

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].

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. 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 URSP rule enforcement including the connection capability shall be included if SMF receives the URSP rule enforcement from UE.

The PCF for session may notify the PCF for UE about the URSP rule enforcement.

Editor’s note: How the PCF for UE subscribes/notified the URSP rule enforcement from PCF serving the session is FFS.

During the SM Policy Association Establishment procedure, if the PCF detects the request relates to SM Policy Association enabling integration with TSN or TSC based on local configuration, the PCF may provide policy control request trigger for 5GS Bridge 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.

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.

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.

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.

PCF may provide updated policies to the SMF according to the URSP rule enforcement that including Connection Capabilities.

Editor’s note: How to the PCF serving the PDU session generates the PCC rule according to Connection Capability is FFS.

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. 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, SMF (e.g. for a certain requested DNN/S-NSSAI) may include an indication to request UPF to provide port numbers.

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 8: 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]), the SMF includes a TL-Container with a get-request to the N4 Session Establishment or Modification request that is sent to the UPF, as described in clause 5.28a.2 of TS 23.501 [2].

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 DS-TT port 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. 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 9: 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 or Modification response, as described in clause 5.28a.2 of TS 23.501 [2]. The SMF/CUC stores 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, 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 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)]))). 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 a 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).

- 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].

- 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 (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. For LBO roaming scenario, the PDU Session Establishment Accept includes the S-NSSAI from the Allowed NSSAI for the VPLMN and also it includes the corresponding S-NSSAI of the HPLMN from the Mapping Of Allowed NSSAI that SMF received in step 3.

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.

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.

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.

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)).

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].

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 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).

NOTE 10: 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]) 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 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 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]).

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.

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 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 information is available. SMF provides the 5GS Bridge information (e.g. 5GS user-plane Node ID, port number of the DS-TT port, 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. If SMF received a Port Management Information Container from either the UE or the UPF, then 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 SMF received a Port Management Information Container from the UPF, then SMF provides the Port Management Information Container to the PCF 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).

\* \* \* Start of Change 3 \* \* \*

#### 4.3.3.2 UE or network requested PDU Session Modification (non-roaming and roaming with local breakout)

The UE or network requested PDU Session Modification procedure (non-roaming and roaming with local breakout scenario) is depicted in figure 4.3.3.2-1.



Figure 4.3.3.2-1: UE or network requested PDU Session Modification (for non-roaming and roaming with local breakout)

1. The procedure may be triggered by following events:

1a. (UE initiated modification) The UE initiates the PDU Session Modification procedure by the transmission of an NAS message (N1 SM container (PDU Session Modification Request (PDU session ID, Packet Filters, Operation, Requested QoS, Segregation, 5GSM Core Network Capability, Number Of Packet Filters, [Connection Capabilities], [Always-on PDU Session Requested])), PDU Session ID, UE Integrity Protection Maximum Data Rate, [Port Management Information Container]) message. Depending on the Access Type, if the UE was in CM-IDLE state, this SM-NAS message is preceded by the Service Request procedure. The NAS message is forwarded by the (R)AN to the AMF with an indication of User location Information. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext (SM Context ID, N1 SM container (PDU Session Modification Request)).

When the UE requests specific QoS handling for selected SDF(s), the PDU Session Modification Request includes Packet Filters describing the SDF(s), the requested Packet Filter Operation (add, modify, delete) on the indicated Packet Filters, the Requested QoS and optionally a Segregation indication. The Segregation indication is included when the UE recommends to the network to bind the applicable SDF(s) on a distinct and dedicated QoS Flow e.g. even if an existing QoS Flow can support the requested QoS. The network should abide by the UE request, but is allowed to proceed instead with binding the selected SDF(s) on an existing QoS Flow.

NOTE 1: Only one QoS Flow is used for traffic segregation. If UE makes subsequent requests for segregation of additional SDF(s), the additional SDF(s) are multiplexed on the existing QoS Flow that is used for segregation.

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

The PS Data Off status, if changed, shall be included in the PCO in the PDU Session Modification Request message.

For a PDU Session which was established in the EPS, when the UE moves from EPS to 5GS for the first time, the UE includes an Always-on PDU Session Requested indication in the PDU Session Modification Request message if it wants to change the PDU Session to an always-on PDU Session.

If UE supports to report URSP rule enforcement to network, and the UE uses the values specified by the certain URSP rule and match the application traffic to this PDU session, the UE includes Connection Capabilities in the TD of the matched URSP rule in PDU Session Modification Request to 5GC as described in clause 6.6.2.X of TS 23.503 [20].

If the UE enforces several URSP rules for multiple applications, and these multiple applications’s traffic are all matched to this PDU session, in order reduce the number of uplinks NAS messages, the UE may include more than one URSP rule enforcement report in one PDU Session Modification Request to 5GC (see clause 6.6.2.X of TS 23.503 [20]).

When PCF is deployed, the SMF shall further report the PS Data Off status to PCF if the PS Data Off event trigger is provisioned, the additional behaviour of SMF and PCF for 3GPP PS Data Off is defined in TS 23.503 [20].

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 UE Integrity Protection Maximum Data Rate indicates the maximum data rate up to which the UE can support UP integrity protection. It is set as defined in TS 23.501 [2].

The Number Of Packet Filters indicates the number of supported packet filters for signalled QoS rules as described in clause 5.17.2.2.2 of TS 23.501 [2].

When it moves from EPS to 5GS for the first time, 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.

When it moves from EPS to 5GS for the first time, 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]).

Port Management Information Container is received from DS-TT and includes DS-TT port related management information as defined in clause 5.28.3 of TS 23.501 [2].

1b. (PCF initiated SM Policy Association Modification) The PCF performs a PCF initiated SM Policy Association Modification procedure as defined in clause 4.16.5.2 to notify SMF about the modification of policies. This may e.g. have been triggered by a policy decision or upon AF requests, e.g. Application Function influence on traffic routing as described in step 5 in clause 4.3.6.2 or AF to provide Port management information Container.

If the QoS Monitoring for URLLC is requested by the AF, the PCF generates the QoS Monitoring policy for the corresponding service data flow and provides the policy in the PCC rules to the SMF in this step.

1c. (SMF requested modification) The UDM updates the subscription data of SMF by Nudm\_SDM\_Notification (SUPI, Session Management Subscription Data). The SMF updates the Session Management Subscription Data and acknowledges the UDM by returning an Ack with (SUPI).

1d. (SMF requested modification) The SMF may decide to modify PDU Session. This procedure also may be triggered based on locally configured policy or triggered from the (R)AN (see clause 4.2.6 and clause 4.9.1). It may also be triggered if the UP connection is activated (as described in Service Request procedure) and the SMF has marked that the status of one or more QoS Flows are deleted in the 5GC but not synchronized with the UE yet.

If interworking with TSN deployed in the transport network is supported and either the UPF supports CN-TL or NG-RAN supports AN-TL (see clause 4.4.8 of TS 23.501 [2]), the procedure may be triggered due to reception of Status group from TN CNC.

The SMF may decide to modify PDU Session to send updated ECS Address Configuration Information to the UE as defined in clause 6.5.2 of TS 23.548 [74].

The SMF may decide to modify PDU Session to send updated DNS server address to the UE as defined in clause 6.2.3.2.3 of TS 23.548 [74].

The SMF may decide to modify PDU Session to send the EAS rediscovery indication to the UE as defined in clause 6.2.3.3 of TS 23.548 [74].

If the SMF receives one of the triggers in step 1b ~ 1d, the SMF starts SMF requested PDU Session Modification procedure.

1e. (AN initiated modification) (R)AN shall indicate to the SMF when the AN resources onto which a QoS Flow is mapped are released irrespective of whether notification control is configured. (R)AN sends the N2 message (PDU Session ID, N2 SM information) to the AMF. The N2 SM information includes the QFI, User location Information and an indication that the QoS Flow is released. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext (SM Context ID, N2 SM information).

(AN initiated notification control) If notification control is configured for a GBR QoS Flow, (R)AN sends a N2 message (PDU Session ID, N2 SM information) to SMF when the (R)AN decides the QoS targets of the QoS Flow cannot be fulfilled or can be fulfilled again, respectively. The N2 SM information includes the QFI and an indication that the QoS targets for that QoS Flow cannot be fulfilled or can be fulfilled again, respectively. When QoS targets cannot be fulfilled, the N2 SM information indicates a reference to the Alternative QoS Profile matching the values of the QoS parameters that the NG-RAN is currently fulfilling as specified in clause 5.7.2.4 of TS 23.501 [2]. If the QoS Flow has a TSCAI including Capability for BAT adaptation and without Burst Arrival Time, the N2 SM information can also include a BAT offset as described in clause 5.27.2.5 of TS 23.501 [2]. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext (SM Context ID, N2 SM information). If the PCF has subscribed to the event, SMF reports this event to the PCF for each PCC Rule for which notification control is set in step 2.

1f. (AMF initiated modification) If the UE supports CE mode B and use of CE mode changes from restricted to unrestricted or vice versa in the Enhanced Coverage Restriction information in the UE context in the AMF and the UE has already established PDU sessions, then the AMF shall trigger a PDU session modification to the SMFs serving the UE's PDU sessions when the AMF determines that NAS-SM timer shall be updated due to the change of Enhanced Coverage Restriction and include the extended NAS-SM indication only if use of CE mode B is now unrestricted in the Enhanced Coverage Restriction information in the UE context in the AMF.

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

1g. (AMF initiated modification) the AMF informs the SMF of updates of the NWDAF ID(s) used for UE related Analytics and corresponding Analytics ID(s). Also, If the PCF request notification of SM Policy Association and there is any PDU Session established to that DNN, S-NSSAI [PCF binding information, notification of SM Policy Association establishment 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].

2. The SMF may need to report some subscribed event to the PCF by performing an SMF initiated SM Policy Association Modification procedure as defined in clause 4.16.5.1. This step may be skipped if PDU Session Modification procedure is triggered by step 1b or 1d. If dynamic PCC is not deployed, the SMF may apply local policy to decide whether to change the QoS profile.

Steps 2a to 7 are not invoked when the PDU Session Modification requires only action at a UPF (e.g. gating).

2a. The SMF may update the UPF with N4 Rules related to new or modified QoS Flow(s).

NOTE 2: This allows the UL packets with the QFI of a new or modified QoS Flow to be transferred.

If the SMF initiated the PDU Session Modification procedure in step 1b due to PCF initiated SM Policy Association Modification that adds one or more PCC Rule(s) with a TSC Assistance Container, and if interworking with TSN deployed in the transport network is supported and the UPF does not support CN-TL, the SMF instructs the UPF to assign a distinct N3 tunnel end point address for the QoS Flow(s) assigned with a TSC Assistance Container.

If the SMF initiated the PDU Session Modification procedure in step 1d due to reception of Status group from TN CNC, the SMF includes a TL-Container with a set-request to the N4 Session Modification request that is sent to the UPF, as described in clause 5.28a.2 of TS 23.501 [2].

If redundant transmission has not been activated to the PDU session and the SMF decides to perform redundant transmission for the QoS Flow, the SMF indicates to the UPF to perform packet duplication and elimination for the QoS Flow.

If redundant transmission has been activated on the PDU Session and the SMF decides to stop redundant transmission, the SMF indicates the UPF to release the CN Tunnel Info which is used as the redundancy tunnel of the PDU Session and also indicates the UPF to stop packet duplication and elimination for the corresponding QoS Flow(s).

NOTE 3: 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 redundant transmission has not been activated to the PDU Session and the SMF decides to perform redundant transmission for the QoS Flow with two I-UPFs between the PSA UPF and the NG-RAN, the SMF sends a N4 Session Establishment Request message to the I-UPFs including UL CN Tunnel Info of the PSA UPF and a request to allocate CN Tunnel Info.

SMF may make use of Redundant Transmission Experience analytics provided by NWDAF, when SMF takes a decision whether to perform redundant transmission, or stop redundant transmission if it had been activated, as described in clause 6.13 of TS 23.288 [50].

2b. The UPF(s) respond to the SMF. If redundant transmission has not been activated to the PDU session and the SMF indicated the UPF to perform packet duplication and elimination for the QoS Flow in step 2a, the UPF allocates an additional CN Tunnel Info. The additional CN Tunnel Info is provided to the SMF.

If redundant transmission has not been activated to the PDU Session and the SMF decides to perform redundant transmission for the QoS Flow with two I-UPFs in step 2a, the UPFs allocate CN Tunnel Info. The CN Tunnel Info of each I-UPF is provided to the SMF.

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

3a. For UE or AN initiated modification, the SMF responds to the AMF through Nsmf\_PDUSession\_UpdateSMContext Response ([N2 SM information (PDU Session ID, QFI(s), QoS Profile(s), [Alternative QoS Profile(s)], Session-AMBR], [CN Tunnel Info(s)]), N1 SM container (PDU Session Modification Command (PDU Session ID, QoS rule(s), QoS rule operation, QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s), Session-AMBR, [Always-on PDU Session Granted], [Port Management Information Container]))). See clause 5.7 of TS 23.501 [2] for the QoS Profile, Alternative QoS Profile and QoS rule and QoS Flow level QoS parameters. Alternative QoS Profile is only valid for AN initiated modification.

If the PDU Session Modification was requested by the UE to modify a PDU Session to an always-on PDU Session, the SMF shall include an Always-on PDU Session Granted indication in the PDU Session Modification Command to indicate whether the PDU Session is to be changed to an always-on PDU Session or not via the Always-on PDU Session Granted indication in the PDU Session Modification Command.

The N2 SM information carries information that the AMF shall provide to the (R)AN. It may include the QoS profiles and the corresponding QFIs to notify the (R)AN that one or more QoS flows were added, or modified. It may include only QFI(s) to notify the (R)AN that one or more QoS flows were removed. The SMF may indicate for each QoS Flow whether redundant transmission shall be performed by a corresponding redundant transmission indicator. If the SMF decides to activate redundant transmission in step 2a, the SMF includes the allocated additional CN Tunnel Info in the N2 SM information. If the SMF decides to perform redundant transmission for new QoS Flow with two I-UPFs in step 2a, the SMF includes the allocated CN Tunnel Info of the two I-UPFs in the N2 SM information. If the PDU Session Modification was triggered by the (R)AN Release in step 1e the N2 SM information carries an acknowledgement of the (R)AN Release. If the PDU Session Modification was requested by the UE for a PDU Session that has no established User Plane resources, the N2 SM information provided to the (R)AN includes information for establishment of User Plane resources.

If redundant transmission has been activated on the PDU Session and the SMF decides to stop redundant transmission in step 2a, the SMF indicates the (R)AN to release the AN Tunnel and stop packet duplication and elimination associated with the redundancy tunnel of the PDU Session.

The N1 SM container carries the PDU Session Modification Command that the AMF shall provide to the UE. It may include the QoS rules, QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s) and corresponding QoS rule operation and QoS Flow level QoS parameters operation to notify the UE that one or more QoS rules were added, removed or modified.

If port number and a Port Management Information Container have been received from PCF in Step 2 and the port number matches the port number assigned for the DS-TT port for this PDU session, then SMF includes the Port Management Information Container in the N1 SM container.

The SMF may need to send transparently through NG-RAN the PDU Session Modification Command to inform the UE about changes in the QoS parameters (i.e. 5QI, GFBR, MFBR) that the NG-RAN is currently fulfilling after the SMF receives QoS Notification Control as defined in clause 5.7.2.4 of TS 23.501 [2]. When the SMF sends on the PDU Session Modification Command transparently through NG-RAN, the N2 SM information is not included as part of the Namf\_Communication\_N1N2MessageTransfer.

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]).

3b. For SMF requested modification, the SMF invokes Namf\_Communication\_N1N2MessageTransfer ([N2 SM information] (PDU Session ID, QFI(s), QoS Profile(s), [Alternative QoS Profile(s)], Session-AMBR, [CN Tunnel Info(s)], QoS Monitoring indication, QoS Monitoring reporting frequency, [TSCAI(s)], TL-Container), N1 SM container (PDU Session Modification Command (PDU Session ID, QoS rule(s), QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s), QoS rule operation and QoS Flow level QoS parameters operation, Session-AMBR))).

If the SMF initiated the PDU Session Modification procedure in step 1b due to PCF initiated SM Policy Association Modification that adds one or more PCC Rule(s) with a TSC Assistance Container and if interworking with TSN deployed in the transport network is supported and the NG-RAN does not support AN-TL, the SMF instructs the NG-RAN to assign a distinct N3 tunnel end point address for the QoS Flow(s) assigned with a TSC Assistance Container.

The SMF may indicate for each QoS Flow whether redundant transmission shall be performed by a corresponding redundant transmission indicator. If the SMF decides to activate redundant transmission in step 2a, the SMF includes the allocated additional CN Tunnel Info in the N2 SM information. If the SMF decides to perform redundant transmission for new QoS Flow with two I-UPFs in step 2a, the SMF includes the allocated CN Tunnel Info of the two I-UPFs in the N2 SM information.

If redundant transmission has been activated on the PDU Session and the SMF decides to stop redundant transmission in step 2a, the SMF indicates the (R)AN to release the AN Tunnel and stop packet duplication and elimination associated with the redundancy tunnel of the PDU Session.

The SMF indicates the request for QoS Monitoring for the QoS Flow according to the information received from the PCF in step 1b, or based on SMF local policy, e.g. when the RAN rejected the creation of a specific QoS Flow for URLLC. In the case of receiving the QoS Monitoring indication, the RAN enables the RAN part of UL/DL packet delay measurement for the QoS Flow and the QoS Monitoring reporting frequency is used by RAN to determine the packet delay measurement frequency of the RAN part. The TSCAI is defined in clause 5.27.2 of TS 23.501 [2].

If the SMF initiated the PDU Session Modification procedure in step 1d due to reception of Status group from TN CNC, the SMF includes a TL-Container with a set-request to the N2 SM information, as described in clause 5.28a.2 of TS 23.501 [2].

If the UE is in CM-IDLE state and an ATC is activated, the AMF updates and stores the UE context based on the Namf\_Communication\_N1N2MessageTransfer and steps 4, 5, 6 and 7 are skipped. When the UE is reachable e.g. when the UE enters CM-CONNECTED state, the AMF forwards the N1 message to synchronize the UE context with the UE.

3c. For SMF requested modification due to updated SMF-Associated parameters from the UDM, the SMF may provide the SMF derived CN assisted RAN parameters tuning to the AMF. The SMF invokes Nsmf\_PDUSession\_SMContextStatusNotify (SMF derived CN assisted RAN parameters tuning) towards the AMF. The AMF stores the SMF derived CN assisted RAN parameters tuning in the associated PDU Session context for this UE.

3d. For SMF requested modification due to updated NWDAF ID, the SMF informs the AMF of updates of the NWDAF ID(s) used for UE related Analytics and corresponding Analytics ID(s).

4. The AMF may send N2 ([N2 SM information received from SMF], NAS message (PDU Session ID, N1 SM container (PDU Session Modification Command))) Message to the (R)AN.

5. 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 modifying the necessary (R)AN resources related to the PDU Session or if only N1 SM container is received in step 4 from AMF, RAN transports only the N1 SM container to the UE.

The (R)AN may consider the updated CN assisted RAN parameters tuning to reconfigure the AS parameters.

As part of this, the N1 SM container is provided to the UE. If the N1 SM container includes a Port Management Information Container then the UE provides the container to DS-TT.

If new DNS server address is provided to the UE in the PCO, the UE can refresh all EAS(s) information (e.g. DNS cache) bound to the PDU Session, based on UE implementation as described in clause 6.2.3.2.3 of TS 23.548 [74].

6. The (R)AN may acknowledge N2 PDU Session Request by sending a N2 PDU Session Ack (N2 SM information (List of accepted/rejected QFI(s), AN Tunnel Info, PDU Session ID, Secondary RAT usage data, TL-Container), User location Information) Message to the AMF. In the case of Dual Connectivity, if one or more QFIs were added to the PDU Session, the Master RAN node may assign one or more of these QFIs to a NG-RAN node which was not involved in the PDU Session earlier. In this case the AN Tunnel Info includes a new N3 tunnel endpoint for QFIs assigned to the new NG-RAN node. Correspondingly, if one or more QFIs were removed from the PDU Session, a (R)AN node may no longer be involved in the PDU Session anymore and the corresponding tunnel endpoint is removed from the AN Tunnel Info. The NG-RAN may reject QFI(s) if it cannot fulfil the User Plane Security Enforcement information for a corresponding QoS Profile, e.g. due to the UE Integrity Protection Maximum Data Rate being exceeded. When receiving the request for QoS Monitoring, the (R)AN may indicate its rejection to perform QoS Monitoring, e.g. due to the (R)AN load condition. 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 the addition or modification of a QoS Flow, the SMF is responsible of updating the QoS rules and QoS Flow level QoS parameters associated to that QoS Flow in the UE accordingly.

If the PLMN has configured secondary RAT usage reporting, the NG-RAN node may provide RAN Usage Data Report. The User Location Information shall include the serving cell's ID and, if Dual Connectivity is activated for the UE, the PSCell ID.

If the redundant transmission has not been activated to the PDU session and the SMF indicates to the RAN that one of the QoS Flow shall perform redundant transmission, the RAN includes an additional AN tunnel info in N2 SM information.

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 set-request from the SM/CUC in step 3b (see clause 4.4.8 of TS 23.501 [2]), the NG-RAN/AN-TL includes a TL-Container with a set-response to the N2 SM information, as described in clause 5.28a.2 of TS 23.501 [2].

7. The AMF forwards the N2 SM information and the User location Information received from the AN to the SMF via Nsmf\_PDUSession\_UpdateSMContext service operation. The SMF replies with a Nsmf\_PDUSession\_UpdateSMContext Response.

If the N2 SM information indicates failure of whole N2 SM request (i.e. no part of the N2 SM request is successful in (R)AN), the SMF assumes that the NAS PDU, if provided in step 3, was not forwarded by NG-RAN to UE, as described in TS 38.413 [10]. In this case, if the PDU Session modification is UE triggered the SMF shall reject the PDU session modification by including a N1 SM container with a PDU Session Modification Reject message (see clause 8.3.3 of TS 24.501 [25]) in the Nsmf\_PDUSession\_UpdateSMContext Response in step 7b. Step 8 is skipped in this case.

Otherwise, the SMF assumes that the NAS PDU was sent to UE successfully. If the (R)AN rejects QFI(s), the SMF is responsible of updating the QoS rules and QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s) in the UE accordingly, i.e. the SMF shall trigger a separate NAS PDU Session Modification procedure after step 11 to align the SM context of this PDU Session in UE.

8. The SMF may update N4 session of the UPF(s) that are involved by the PDU Session Modification by sending N4 Session Modification Request message to the UPF (see NOTE 3).

The SMF may update the UPF with N4 Rules related to new, modified or removed QoS Flow(s), unless it was done already in step 2a.

NOTE 4: This allows the DL packets of the new or modified QoS Flow to be transferred.

If an additional AN Tunnel Info is returned by RAN in step 6, the SMF informs the UPF about this AN Tunnel Info for redundant transmission. In the case of redundant transmission with two I-UPFs, the SMF provides AN Tunnel Info to two I-UPFs. If CN Tunnel Info of two I-UPFs is allocated by the UPFs in step 2b, the SMF also provides the DL CN Tunnel Info of two I-UPFs to the UPF (PSA).

If the QoS Monitoring for URLLC is enabled for the QoS Flow, the SMF provides the N4 rules containing the QoS Monitoring policy generated according to the information received in step 1b to the UPF via the N4 Session Modification Request message.

If port number and a Port Management Information Container have been received from PCF in Step 2 and the port number matches the port number of the NW-TT port for this PDU session, then SMF includes the Port Management Information Container in the N4 Session Modification Request. If the N4 Session Modification Request includes a Port Management Information Container, then UPF also includes a Port Management Information Container in the N4 Session Modification Response.

9. The UE acknowledges the PDU Session Modification Command by sending a NAS message (PDU Session ID, N1 SM container (PDU Session Modification Command Ack, [Port Management Information Container])) message.

10. The (R)AN forwards the NAS message to the AMF.

11. The AMF forwards the N1 SM container (PDU Session Modification Command Ack) and User Location Information received from the AN to the SMF via Nsmf\_PDUSession\_UpdateSMContext service operation. The SMF replies with a Nsmf\_PDUSession\_UpdateSMContext Response.

If the SMF initiated modification is to delete QoS Flows (e.g. triggered by PCF) which do not include QoS Flow associated with the default QoS rule and the SMF does not receive response from the UE, the SMF marks that the status of those QoS Flows is to be synchronized with the UE.

If interworking with TSN deployed in the transport network is supported, for any QoS Flow including a TSC Assistance Container, the SMF/CUC derives the merged stream requirements as described in Annex M of TS 23.501 [2]. If AN-TL and CN-TL are supported, the SMF/CUC uses the get-responses stored during the PDU Session Establishment procedure to derive the merged stream requirements. The SMF/CUC interacts with the CNC deployed in the transport network and provides the merged stream requirements in the Talker and Listener groups to the TN CNC. The TN CNC uses the merged stream requirements as input to select respective path(s) and calculate schedules in TN.

Based on the results, the TN CNC provides a Status group that contains the merged end station communication-configuration back to the SMF/CUC.

12. The SMF may update N4 session of the UPF(s) that are involved by the PDU Session Modification by sending N4 Session Modification Request (N4 Session ID) message to the UPF. For a PDU Session of Ethernet PDU Session Type, the SMF may notify the UPF to add or remove Ethernet Packet Filter Set(s) and forwarding rule(s).

NOTE 5: The UPFs that are impacted in the PDU Session Modification procedure depends on the modified QoS parameters and on the deployment. For example in the case of the session AMBR of a PDU Session with an UL CL changes, only the UL CL is involved. This note also applies to the step 8.

13. If the SMF interacted with the PCF in step 1b or 2, the SMF notifies the PCF whether the PCC decision could be enforced or not by performing an SMF initiated SM Policy Association Modification procedure as defined in clause 4.16.5.1. If the trigger for 5GS Bridge information available is armed and the SMF received a Port Management Information Container from either UE or UPF, then SMF provides the Port Management Information Container and the port number of the related port to the PCF in this step, as described in clause 5.28.3.2 of TS 23.501 [2]. If the trigger for 5GS Bridge information available is armed and the SMF received the User Plane node Management Information Container from UPF, then the SMF provides the User Plane node Management Information Container to the PCF as described in clause 5.28.3.2 of TS 23.501 [2].

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

If step 1b is triggered to perform Application Function influence on traffic routing by step 5 in clause 4.3.6.2, the SMF may reconfigure the User Plane of the PDU Session as described in step 6 in clause 4.3.6.2.

If interworking with TSN deployed in the transport network is supported and if the Status group from TN CNC to SMF/CUC in step 11 includes InterfaceConfiguration, and if the AN-TL/CN-TL are supported, the SMF/CUC initiates a PDU Session Modification procedure as in step 1d.

\* \* \* Start of Change 4 \* \* \*

### 4.16.11 UE Policy Association Establishment

This procedure concerns the following scenarios:

1. UE initial registration with the network.

2. The AMF relocation with PCF change in handover procedure and registration procedure.

3. UE registration with 5GS when the UE moves from EPS to 5GS and there is no existing UE Policy Association between AMF and PCF for this UE.



Figure 4.16.11-1: UE Policy Association Establishment

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved and the role of the H-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF and the H-PCF interacts with the V-PCF:

1. The AMF establishes UE Policy Association with the (V-)PCF when a UE Policy Container is received from the UE. If a UE Policy Container is not received from the UE, the AMF may establish UE Policy Association with the (V-)PCF based on AMF local configuration.

NOTE 1: In roaming scenario, the AMF local configuration can indicate whether UE Policy delivery is needed based on the roaming agreement with home PLMN of the UE.

2. The AMF sends a Npcf\_UEPolicyControl Create Request with the following information: SUPI, may include Access Type and RAT, PEI, ULI, UE time zone, Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]), the Internal-Group-ID-list and UE Policy Container (the list of stored PSIs, operating system identifier, Indication of UE support for ANDSP, indication of UE capability of supporting to reporting URSP rule enforcement to network). In roaming scenario, based on operator policies, the AMF may provide to the V-PCF the PCF ID of the selected H-PCF. The V-PCF contacts the H-PCF. In roaming case, steps 3 and 4 are executed, otherwise step 5 follows.

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

3. The V-PCF forwards the information received from AMF in step 2 to the H-PCF. When a UE Policy Container is received at initial registration, the H-PCF may store the PEI, the OSId, indication of UE capability of supporting to reporting URSP rule enforcement to network or the indication of UE support for ANDSP in the UDR using Nudr\_DM\_Create including DataSet "Policy Data" and Data Subset "UE context policy control data".

4. The H-PCF sends a Npcf\_UEPolicyControl Create Response to the V-PCF. The H-PCF may provide the Policy Control Request Trigger parameters in the Npcf\_UEPolicyControl Create Response.

The (H-)PCF in roaming and the PCF in non-roaming may register to the BSF as the PCF serving this UE, if not already registered at the AM Policy Association establishment. This is performed by using the Nbsf\_Management\_Register operation, providing as inputs the UE SUPI/GPSI and the PCF identity.

5. The (V-) PCF sends a Npcf\_UEPolicyControl Create Response to the AMF. The (V-)PCF relays the Policy Control Request Trigger parameters in the Npcf\_UEPolicyControl Create Response.

The (V-)PCF also subscribes to notification of N1 message delivery of policy information to the UE using Namf\_Communication\_N1N2MessageSubscribe service which is not shown in this figure.

6. The (H-)PCF gets policy subscription related information and the latest list of PSIs from the UDR using Nudr\_DM\_Query service operation (SUPI, Policy Data, UE context policy control data, Policy Set Entry) if either or both are not available and makes a policy decision. The (H-)PCF may get the PEI, the OSId, indication of UE capability of supporting to reporting URSP rule enforcement to network or the indication of UE support for ANDSP in the UDR using Nudr\_DM\_Query including DataSet "Policy Data" and Data Subset "UE context policy control data" if the AMF relocates and the PCF changes. In the roaming scenario, the H-PCF may provide the indication of UE support for ANDSP to the V-PCF, if the indication was not present in the Npcf\_UEPolicyControl Create request from V-PCF and the H-PCF gets this information from the H-UDR. The (H-)PCF may get the 5G VN group data and 5G VN group membership for each Internal-Group-ID received from the AMF using Nudr\_DM\_Query (Internal-Group-Id, Subscription Data, 5G VN Group Configuration). The (H-)PCF may store the 5G VN group data and 5G VN group membership for later use for other SUPIs that belong to the same Internal-Group-ID. The (H-)PCF may request notifications from the UDR on changes in the subscription information by invoking Nudr\_DM\_Subscribe (Policy Data, SUPI, DNN, S-NSSAI, Notification Target Address (+ Notification Correlation Id), Event Reporting Information (continuous reporting), UE context policy control data) service. The (H-)PCF may request notifications from the UDR on changes in the 5G VN group data or 5G VN group membership associated to each of the Internal-Group-Id provided to the PCF by invoking Nudr\_DM\_Subscribe (Subscription Data, 5G VN Group Configuration, Internal Group ID, Notification Target Address (+ Notification Correlation Id), Event Reporting Information (continuous reporting)) service. The (H-)PCF creates the UE policy container including UE policy information as defined in clause 6.6 of TS 23.503 [20] and in the case of roaming H-PCF provides the UE policy container in the Npcf\_UEPolicyControl UpdateNotify Request. In the non-roaming case, the PCF may subscribe to Analytics from NWDAF as defined in clause 6.1.1.3 of TS 23.503 [20].

The PCF may indicate the UE to report URSP rule enforcement to network in the UE policy container, if the UE has the capability to support to report URSP rule enforcement to network (see clause 6.6.2.X of TS 23.503 [20]).

7. The V-PCF sends a response to H-PCF using Npcf\_UEPolicyControl UpdateNotify Response.

NOTE 2: Step 6 (and step 7) can be omitted. Then the (H-)PCF creates the UE policy container including UE polices in step 2 (in the case of non-roaming) or step 3 (in the case of roaming). This means that the potential interactions with UDR as in step 6 will have to be executed in step 2 (non-roaming) or step 3 (roaming).

8. The (V-)PCF triggers UE Configuration Update Procedure in clause 4.2.4.3 to sends the UE policy container including UE policy information to the UE. The (V-)PCF checks the size limit as described in clause 6.1.2.2.2 of TS 23.503 [20].

9. If the V-PCF received notification of the reception of the UE Policy container then the V-PCF forwards the notification response of the UE to the H-PCF using Npcf\_UEPolicyControl\_Update Request.

10. The H-PCF sends a response to the V-PCF.

\* \* \* Start of Change 5 \* \* \*

### 4.16.4 SM Policy Association Establishment



Figure 4.16.4-1: SM Policy Association Establishment

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved. In the local breakout roaming case, the H-PCF is not involved. In the home routed roaming case, the V-PCF is not involved and the H-PCF interacts with the H-SMF.

This procedure is used in UE requests a PDU Session Establishment as explained in clause 4.3.2.2.1, for non-roaming and local breakout roaming. For home-routed roaming, as explained in clause 4.3.2.2.2.

For local breakout roaming, the interaction with HPLMN (e.g. step 3) is not used. In local breakout roaming, the V-PCF interacts with the UDR of the VPLMN.

1. The SMF determines that the PCC authorization is required and requests to establish an SM Policy Association with the PCF by invoking Npcf\_SMPolicyControl\_Create operation, including information about the PDU Session as specified in clause 5.2.5.4.2.

The SMF provides Trace Requirements to the PCF when it has received Trace Requirements and it has selected a different PCF than the one received from the AMF.

If the DNN Selection Mode indicates that the DNN is not explicitly subscribed, the PCF may use the local configuration instead of PDU Session policy control data in UDR.

The QoS constraints from the VPLMN are provided by the H-SMF to the H-PCF in the home routed roaming scenario as defined in clause 4.3.2.2.2.

If the SMF utilizes an NWDAF or in case the SMF has received information from AMF or UPF that are consumer of analytic services, the SMF includes the IDs of each of these NWDAFs serving the UE (for SMF, AMF and UPF), identified by the NWDAF instance Id. The Analytics ID(s) are also included per NWDAF service instance.

The SMF provides the request for notification of SM Policy Association establishment and termination to a DNN, S-NSSAI together with PCF for the UE binding information to the PCF if received from the AMF.

If the SMF receives the URSP rule enforcement report from UE, the SMF includes the URSP rule enforcement to PCF serving the PDU Session when invoking the Npcf\_SMPolicyControl\_Create operation.

When PCF serving the PDU Session receives the URSP rule enforcement including the connection capability from SMF, the PCF serving the PDU Session notifies the PCF for UE about the URSP rule enforcement (see clause 6.6.2.X of TS 23.503 [20]).

2. If the PCF does not have the subscriber's subscription related information, it sends a request to the UDR by invoking Nudr\_DM\_Query (SUPI, DNN, S-NSSAI, Policy Data, PDU Session policy control data, Remaining allowed Usage data) service in order to receive the information related to the PDU Session. The PCF may request notifications from the UDR on changes in the subscription information by invoking Nudr\_DM\_Subscribe (Policy Data, SUPI, DNN, S-NSSAI, Notification Target Address (+ Notification Correlation Id), Event Reporting Information (continuous reporting), PDU Session policy control data, Remaining allowed Usage data) service.

NOTE 1: For local breakout roaming, PDU Session policy control subscription information and Remaining allowed usage subscription information for monitoring control as defined in clause 6.2.1.3 of TS 23.503 [20] are not available in V-UDR and V-PCF uses locally configured information according to the roaming agreement with the HPLMN operator.

3. If the PCF determines that the policy decision depends on the status of the policy counters available at the CHF and such reporting is not established for the subscriber, the PCF initiates an Initial Spending Limit Report Retrieval as defined in clause 4.16.8.2. If policy counter status reporting is already established for the subscriber and the PCF determines that the status of additional policy counters are required, the PCF initiates an Intermediate Spending Limit Report Retrieval as defined in clause 4.16.8.3.

4. The PCF makes the authorization and the policy decision. The PCF may reject Npcf\_SMPolicyControl\_Create request when Validation condition is not satisfied. (see clause 6.1.2.4 of TS 23.503 [20]).

The PCF may invoke Nbsf\_Management\_Register service operation to create the binding information in BSF.

The PCF may report that a SM Policy Association is established as described in clause 4.16.14.2.

In the non-roaming case, the PCF may subscribe to Analytics from NWDAF as defined in clause 6.1.1.3 of TS 23.503 [20].

In the home-routed roaming scenario, the H-PCF ensures that the QoS constraints provided by the VPLMN are taken into account as described in TS 23.503 [20].

5. The PCF answers with a Npcf\_SMPolicyControl\_Create response; in its response the PCF may provide policy information defined in clause 5.2.5.4 (and in TS 23.503 [20]). The SMF enforces the decision. The SMF implicitly subscribes to changes in the policy decisions.

NOTE 2: After this step the PCF can subscribe to SMF events associated with the PDU Session.

If the PCF determines based on a local policy, that the PDU Session is potentially impacted by (g)PTP time synchronization service, the PCF can include a subscription for SMF event for "5GS Bridge information" associated with the PDU Session into the Npcf\_SMPolicyControl\_Create response. In this case, if the SMF has stored the 5GS bridge information and has not reported the event to the PCF, the SMF initiates an SM Policy Association Modification procedure and notifies the PCF for the event of "5GS bridge information Notification".

\* \* \* Start of Change 6 \* \* \*

#### 4.16.5.1 SMF initiated SM Policy Association Modification

The SMF may initiate the SM Policy Association Modification procedure if a Policy Control Request Trigger is met.

NOTE 1: When SMF instance is changed within the same SMF set the callback URI can be updated via this procedure.



Figure 4.16.5.1-1: SMF initiated SM Policy Association Modification

For local breakout roaming, the interaction with HPLMN (e.g. step 2) is not used. In local breakout roaming, the V-PCF interacts with the UDR of the VPLMN.

1. When a Policy Control Request Trigger condition is met the SMF requests to update (Npcf\_SMPolicyControl\_Update) the SM Policy Association and provides information on the conditions that have been met as specified in clause 5.2.5.4.5.

When the PCF serving the PDU Session receives the URSP rule enforcement including the connection capability from SMF, the PCF serving the PDU Session notifies the PCF serving the UE about the URSP rule enforcement (see clause 6.6.2.X of TS 23.503 [20]).

If the SMF is notified by NRF that the stored PCF instance is not reachable, it should query the NRF for PCF instances within the PCF set and select another instance (see clause 6.3.1.0 of TS 23.501 [2]).

The QoS constraints from the VPLMN are provided by the H-SMF to the H-PCF in the home routed roaming scenario as defined in clause 4.3.2.2.2.

2. When an AF has subscribed to an event that is met due to the report from the SMF, the PCF reports the event to the AF by invoking the Npcf\_PolicyAuthorization\_Notify service operation.

If the SMF has reported that new 5GS Bridge information has been detected and no AF session exists for this PDU session yet:

- If integration with TSN applies (see clause 5.28 of TS 23.501 [2]), then the PCF informs a pre-configured TSN AF using the Npcf\_PolicyAuthorization\_Notify (5GS Bridge ID, the port number of the DS-TT port, MAC address of the DS-TT Ethernet port for the PDU Session and UE-DS-TT Residence Time (if available)) service operation for the event of "5GS bridge information Notification" as described in clause 6.1.3.18 of TS 23.503 [20].

- Otherwise, i.e. if the integration with TSN does not apply, the PCF may inform discovered and selected TSCTSF (as described in clause 6.3.24 of TS 23.501 [2]) using the Npcf\_PolicyAuthorization\_Notify (User Plane Node ID, UE-DS-TT Residence Time (if available), the port number of the DS-TT port and MAC address of the DS-TT Ethernet port for Ethernet type PDU Session or IP address for IP type PDU Session) service operation for the event of "5GS bridge information Notification" as described in clause 6.1.3.18 of TS 23.503 [20]. In the case of private IPv4 address being used for IP type PDU Session, the Npcf\_PolicyAuthorization\_Notify also contains DNN and S-NSSAI of the PDU Session.

NOTE 2: For a given DNN and S-NSSAI, it is assumed that the network only needs to deploy one or TSCTSF Set in this Release of the specification.

When the TSN AF or TSCTSF receives the Npcf\_PolicyAuthorization\_Notify message and no AF session exists for this PDU Session, the TSN AF shall use the Npcf\_PolicyAuthorization service described in clause 5.2.5.3 to request creation of a new AF session specific to the received MAC address of the DS-TT Ethernet port of the PDU Session, while the TSCTSF shall use the Npcf\_PolicyAuthorization service to request creation of a new AF session specific to the received MAC address of the DS-TT Ethernet port (if available, for Ethernet type PDU Session) or IP address (for IP type PDU Session) of the PDU Session. In the case of private IPv4 address being used for IP type PDU Session, the TSCTSF shall use the Npcf\_PolicyAuthorization service to request creation of a new AF session specific to the received IP address, DNN and S-NSSAI of the IP type PDU Session. The TSN AF or TSCTSF shall then use the Npcf\_PolicyAuthorization service to subscribe for notifications for 5GS Bridge information Notification event over the newly established AF session. The TSN AF or TSCTSF may provide a Port or User-Plane Management Information Container for the PDU Session and related port number in the Npcf\_PolicyAuthorization creation request.

If the SMF has reported PMIC with port number or UMIC, then the PCF also provides these information elements to the TSN AF or TSCTSF.

When integration with TSN applies (see clause 5.28 of TS 23.501 [2]), the TSN AF calculates the bridge delay for each port pair, using the UE-DS-TT Residence Time of the DS-TT Ethernet port(s) for the 5GS bridge indicated by the 5GS user-plane Node ID.

3. If the PCF determines a change to policy counter status reporting is required, it may alter the subscribed list of policy counters using the Initial, Intermediate or Final Spending Limit Report Retrieval procedures as defined in clause 4.16.8.

4. The PCF makes a policy decision as described in TS 23.503 [20]. The PCF may determine that updated or new policy information needs to be sent to the SMF.

If the SMF reported accumulated usage for the PDU session in step 1 the PCF deducts the value from the remaining allowed usage for the subscriber, DNN and S-NSSAI in the UDR by invoking Nudr\_DM\_Update (SUPI, DNN, S-NSSAI, Policy Data, Remaining allowed Usage data, updated data) service operation.

If the SMF reported accumulated usage for a MK(s) in step 1 the PCF deducts the value from the remaining allowed usage for the MK in the UDR by invoking Nudr\_DM\_Update (SUPI, DNN, S-NSSAI, Policy Data, Remaining allowed Usage data, updated data (including MK(s))) service operation.

When new PCF instance is selected in step 1, the new PCF should invoke Nbsf\_Management\_Update service operation to update the binding information in BSF.

In the non-roaming case, the PCF may subscribe to Analytics from NWDAF as defined in clause 6.1.1.3 of TS 23.503 [20].

In the home-routed roaming scenario, the H-PCF ensures that the QoS constraints provided by the VPLMN are taken into account as described in TS 23.503 [20].

NOTE 3: For local breakout roaming, PDU Session policy control subscription information and Remaining allowed usage subscription information for monitoring control as defined in clause 6.2.1.3 of TS 23.503 [20] are not available in V-UDR and V-PCF uses locally configured information according to the roaming agreement with the HPLMN operator.

5. The PCF answers with a Npcf\_SMPolicyControl\_Update response with updated policy information about the PDU Session determined in step 4.

\* \* \* Start of Change 7 \* \* \*

##### 5.2.5.4.2 Npcf\_SMPolicyControl\_Create service operation

**Service operation name:** Npcf\_SMPolicyControl\_Create.

**Description:** The NF Service Consumer can request the creation of a SM Policy Association and provides relevant parameters about the PDU Session to the PCF.

**Inputs, Required:** SUPI (or PEI in the case of emergency PDU Session without SUPI), PDU Session id, DNN, S-NSSAI and RAT Type.

**Inputs, Optional:** Information provided by the SMF, such as PDU Session Type, Request Type, Access Type, the IPv4 address and/or IPv6 prefix, PEI, GPSI, User Location Information, UE Time Zone, Serving Network identifier (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]), Charging Characteristics information, Session-AMBR, subscribed default QoS information (5QI, 5QI Priority Level, ARP), UE support of reflective QoS (see TS 23.501 [2], clause 5.7.5.1), Number of supported packet filters for signalled QoS rules for the PDU Session (see TS 23.501 [2], clause 5.7.1.4), 3GPP PS Data Off status, Trace Requirements and Internal Group Identifier (see clause 5.9.7 of TS 23.501 [2]), DN Authorization Profile Index, DN authorized Session AMBR, Framed Route information (as defined in Table 5.2.3.3.1-1), MA PDU Request indication, MA PDU Network-Upgrade Allowed indication, ATSSS capabilities of the MA PDU Session, QoS constraints from the VPLMN (see clause 4.3.2.2.2), Satellite Backhaul Category information, list of NWDAF instance Ids (used by AMF, SMF, UPF) and corresponding Analytics ID(s), PVS IP address(es) and/or PVS FQDN(s) and Onboarding Indication in the case of ON-SNPN (see clause 5.30.2.10.4.2 of TS 23.501 [2]), URSP rule enforcement that including Connection Capability .

NOTE: If SMF receives the DN authorized Session AMBR from the DN-AAA at PDU Session establishment, it includes the DN authorized Session AMBR within the Session-AMBR, instead of the subscribed Session-AMBR received from the UDM, in the request.

W-5GAN specific PDU Session information provided by the SMF is specified in TS 23.316 [53].

**Outputs, Required:** SM Policy Association ID defined in TS 29.512 [57]. Success or Failure.

**Outputs, Optional:** Policy information for the PDU Session as defined in TS 23.503 [20] and Policy Control Request Trigger(s) of SM Policy Association as defined in clause 6.1.3.5 of TS 23.503 [20].

See clause 4.16.4 for the detail usage of this service operation.

See clauses 4.22.2.1 and 4.22.3 for detailed usage of this service operation for ATSSS.

\* \* \* \* Start of Next Change (new in rev1) \* \* \* \*

##### 5.2.5.6.2 Npcf\_UEPolicyControl\_Create service operation

**Service operation name:** Npcf\_UEPolicyControl\_Create

**Description:** NF Service Consumer can request the creation of a UE Policy Association by providing relevant parameters about the UE context to the PCF.

**Inputs, Required:** Notification endpoint, SUPI.

**Inputs, Optional:** H-PCF ID (if the NF service producer is V-PCF and AMF is NF service consumer), information provided by the AMF as define in clause 6.2.1.2 of TS 23.503 [20], such as Access Type, Permanent Equipment Identifier, GPSI, User Location Information, UE Time Zone, Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]), RAT type, UE policy information including the list of PSIs, OS id, UE capability of supporting to report URSP rule enforcement to network (see clause 6.6.2.X of TS 23.503 [20]) and Internal Group (see TS 23.501 [2]), Satellite Backhaul Category (see clause 5.43.2 of TS 23.501 [2]).

**Outputs, Required:** Success or Failure, UE Policy Association ID.

**Outputs, Optional:** Policy Control Request Trigger of UE Policy Association. In the case of H-PCF is producer, UE policy information (see clause 5.2.5.6.1).

\* \* \* \* Start of Next Change (new in rev2) \* \* \* \*

#### 5.2.5.1 General

The following table illustrates the PCF Services.

Table 5.2.5.1-1: NF services provided by PCF

|  |  |  |  |
| --- | --- | --- | --- |
| Service Name | Service Operations | Operation  Semantics | Example Consumer (s) |
| Npcf\_AMPolicyControl | Create | Request/Response | AMF |
|  | Update | Request/Response | AMF |
|  | UpdateNotify | Subscribe/Notify | AMF |
|  | Delete | Request/Response | AMF |
| Npcf\_Policy Authorization | Create | Request/Response | AF, NEF, TSCTSF |
| (NOTE) | Update | Request/Response | AF, NEF, TSCTSF |
|  | Delete | Request/Response | AF, NEF, TSCTSF |
|  | Notify | Subscribe/Notify | AF, NEF, NWDAF, PCF, TSCTSF |
|  | Subscribe |  | AF, NEF, NWDAF, PCF, TSCTSF |
|  | Unsubscribe |  | AF, NEF, NWDAF, PCF, TSCTSF |
| Npcf\_SMPolicyControl | Create | Request/Response | SMF |
|  | UpdateNotify | Subscribe/Notify | SMF |
|  | Update | Request/Response | SMF |
|  | Delete | Request/Response | SMF |
| Npcf\_BDTPolicyControl | Create | Request/Response | NEF |
|  | Update | Request/Response | NEF |
|  | Notify |  | NEF |
| Npcf\_UEPolicyControl | Create | Request/Response | AMF, PCF |
|  | Update | Request/Response | AMF, PCF |
|  | UpdateNotify | Subscribe/Notify | AMF, PCF |
|  | Delete | Request/Response | AMF, PCF |
| Npcf\_EventExposure | Subscribe | Subscribe/Notify | NEF, NWDAF |
| Unsubscribe |  |  |
|  | Notify |  |  |
| Npcf\_AMPolicyAuthorization | Create | Request/Response | AF, NEF, TSCTSF |
|  | Update | Request/Response | AF, NEF, TSCTSF |
|  | Delete | Request/Response | AF, NEF, TSCTSF |
|  | Notify | Subscribe/Notify | AF, NEF, 5G DDNMF |
|  | Subscribe |  | AF, NEF, 5G DDNMF |
|  | Unsubscribe |  | AF, NEF, 5G DDNMF |
| Npcf\_PDTQPolicyControl | Create | Request/Response | NEF |
|  | Update | Request/Response | NEF |
|  | Notify |  | NEF |
| NOTE: In the Npcf\_PolicyAuthorization operations, PCF is a consumer when the PCF for the UE and the PCF for the PDU session are different. | | | |

\* \* \* \* Start of Next Change (new in rev2) \* \* \* \*

##### 5.2.5.6.1 General

**Service description:** NF Service Consumer, e.g. AMF, or the PCF serving the PDU Session when a UE attaches in EPS, may create and manage a UE Policy Association in the PCF through which the NF Service Consumer receives Policy Control Request Trigger of UE Policy Association.

The association allows (V-)PCF to provide UE policy information to the UE transparently through the NF Service Consumer using NAS TRANSPORT message to carry:

- UE policy information as defined in clause 6.6 of TS 23.503 [20]. In the case of roaming, the URSP rules are provided by H-PCF and the ANDSP rules may be provided by V-PCF or H-PCF or both.

As part of this service, the PCF may provide the NF Service Consumer, e.g. AMF, with policy information about the UE that may contain:

- Policy Control Request Trigger of UE Policy Association. When such a Policy Control Request Trigger condition is met, the NF Service Consumer, e.g. AMF, shall contact PCF and provide information on the Policy Request Trigger condition that has been met. In the case of roaming, the V-PCF may subscribe to AMF or the H-PCF may subscribe to AMF via V-PCF.

At Npcf\_UEPolicyControl\_Create, the NF Service Consumer, e.g. AMF, requests the creation of a corresponding "UE Policy Association" with the PCF (Npcf\_UEPolicyControl\_Create) and provides relevant parameters about the UE context to the PCF. When the PCF has created the UE Policy Association, the PCF may provide policy information as defined above.

When a Policy Control Request Trigger condition is met, the NF Service Consumer, e.g. AMF, requests the update (Npcf\_UEPolicyControl\_Update) of the UE Policy Association by providing information on the condition(s) that have been met. The PCF may provide updated policy information to the NF Service Consumer.

During the AMF relocation, if the target AMF receives the PCF ID from source AMF and the target AMF decides to contact with the PCF identified by the PCF ID based on the local policies, the target AMF requests the update (Npcf\_UEPolicyControl\_Update) of the UE Policy Association. If a Policy Control Request Trigger condition is met, the information matching the trigger condition may also be provided by the target AMF. The PCF may provide updated policy information to the target AMF.

The PCF may at any time provide updated policy information (Npcf\_UEPolicyControl\_UpdateNotify).

At UE deregistration the NF Service Consumer, e.g. AMF, or the PCF serving the PDU Session when a UE detaches from EPS, requests the deletion of the corresponding UE Policy Association.

\* \* \* End of Change\* \* \*