**3GPP TSG-SA2 Meeting #166-AdHoc-eS2-2500183r01**

**E-meeting, 20 – 24 January 2025 (revision of S2-2412657)**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.502** | **CR** | **5081** | **rev** | **5** | **Current version:** | **19.2.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | Procedures for handling end-to-end encrypted XRM flows | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Google, Futurewei, InterDigital Inc., China Mobile, Huawei, HiSilicon, Ericsson, Nokia | | | | | | | | | |
| ***Source to TSG:*** | S2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | XRM\_Ph2 | | | | |  | ***Date:*** | | | 2024-01-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | SA plenary approved conclusions in 23.700-70 clause 8.2 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Enhance Protocol description information provided by the AF. Add new On-Path N6 Signaling Information to AF provided input and PCC Rules, plus On-Path N6 Connection Information to SMF provided input.  In Annex, add a new feature that supports connect-udp for transfering DL UDP media packet together with media related information using HTTP datagram, forwarded mode datagram, or UDP-Option in outer UDP datagram over On-path N6 connection which is established using connect-udp between the AS proxy and the PSA UPF. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | conclusions in 23.700-70 clause 8.2 are not supported by normative work | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 4.3.3.2, 4.15.6.6, 4.15.6.6a, 5.2.5.3.2, 5.2.6.9.2, 5.2.6.9.5, Annex X (new), 5.2.7.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **x** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | This CR should be implemented after CR xxx | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | r01 adds text from 00295 in steps 2a/2b of § 4.3.3.2 | | | | | | | | |

*FIRST CHANGE*

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] IETF RFC 7296: "Internet Key Exchange Protocol Version 2 (IKEv2)".

[4] Void.

[5] Void.

[6] IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".

[7] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".

[8] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".

[9] 3GPP TS 38.300: "NR and NG-RAN Overall Description; Stage 2".

[10] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[11] Void.

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol Specification".

[13] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[14] Void.

[15] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".

[16] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[17] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[18] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[19] Void.

[20] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System ".

[21] IETF RFC 4191: "Default Router Preferences and More-Specific Routes".

[22] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station in idle mode".

[23] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[24] 3GPP TS 23.203: "Policy and charging control architecture".

[25] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[26] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[27] Void.

[28] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions".

[29] Void.

[30] Void.

[31] Void.

[32] 3GPP TS 29.507: "Access and Mobility Policy Control Service; Stage 3".

[33] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[34] Void.

[35] 3GPP TS 23.251: "Network sharing; Architecture and functional description".

[36] 3GPP TS 29.502: "5G System; Session Management Services; Stage 3".

[37] 3GPP TS 29.510: "5G System; Network function repository services; Stage 3".

[38] 3GPP TS 23.380: "IMS Restoration Procedures".

[39] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[40] IETF RFC 4555: "IKEv2 Mobility and Multihoming Protocol (MOBIKE)".

[41] 3GPP TS 24.502: "Access to the 3GPP 5G Core Network (5GCN) via Non-3GPP Access Networks (N3AN); Stage 3".

[42] 3GPP TS 32.290: "Services, operations and procedures of charging using Service Based Interface (SBI)".

[43] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[44] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[45] 3GPP TS 32.255: "5G system; 5G data connectivity domain charging; Stage 2".

[46] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[47] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[48] IEEE Std 802.11-2016 (Revision of IEEE Std 802.11-2012): "IEEE Standard for Information technology - Telecommunications and information exchange between systems Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[49] IETF RFC 2410: "The NULL Encryption Algorithm and its use with IPsec".

[50] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services; Stage 2".

[51] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[52] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[53] 3GPP TS 23.316: "Wireless and wireline convergence access support for the 5G System (5GS)".

[54] 3GPP TS 23.222: "Functional architecture and information flows to support Common API Framework for 3GPP Northbound APIs; Stage 2".

[55] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[56] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[57] 3GPP TS 29.512: "5G System; Session Management Policy Control Service; Stage 3".

[58] 3GPP TS 29.525: "5G System; UE Policy Control Service; Stage 3".

[59] IETF RFC 6696: "EAP Extensions for the EAP Re-authentication Protocol (ERP)", July 2012.

[60] IETF RFC 5295: "Specification for the Derivation of Root Keys from an Extended Master Session Key (EMSK)", Aug. 2008.

[61] 3GPP TS 23.272: "Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2".

[62] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[63] 3GPP TS 29.561: "5G System; Interworking between 5G Network and external Data Networks; Stage 3".

[64] 3GPP TS 29.413: "Application of the NG Application Protocol (NGAP) to non-3GPP access".

[65] Void.

[66] IEEE Std 802.1Q-2022: "IEEE Standard for Local and Metropolitan Area Networks-Bridges and Bridged Networks".

[67] Void.

[68] 3GPP TS 23.632: "User Data Interworking, Coexistence and Migration".

[69] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane nodes".

[70] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[71] 3GPP TS 32.256: "Charging Management; 5G connection and mobility domain charging; Stage 2".

[72] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[73] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[74] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[75] IEEE Std 802.1AS-2020: "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications".

[76] IEEE Std 1588-2019: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control".

[77] 3GPP TS 23.304: "Proximity based Services (ProSe) in the 5G System (5GS)".

[78] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services".

[79] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[80] 3GPP TS 23.256: "Support of Uncrewed Aerial Systems (UAS) connectivity, identification and tracking; Stage 2".

[81] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); Stage 2".

[82] 3GPP TS 29.519: "5G System; Usage of the Unified Data Repository service for Policy Data, Application Data and Structure Data for Exposure; Stage 3".

[83] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[84] 3GPP TS 23.540: "Technical realization of Service Based Short Message Service; Stage 2".

[85] 3GPP TS 29.598: "Unstructured data storage services".

[86] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[87] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

[88] 3GPP TS 23.586: "Architectural Enhancements to support Ranging based services and Sidelink Positioning".

[89] 3GPP TS 29.214: "Policy and Charging Control over Rx reference point".

[90] 3GPP TS 23.015: "Technical realization of Operator Determined Barring (ODB)".

[91] 3GPP TS 29.505: "5G System; Usage of the Unified Data Repository service for Subscription Data".

[92] 3GPP TS 28.405: "Quality of Experience (QoE) measurement collection; Control and configuration".

[93] 3GPP TS 29.564: "User Plane Function Services; Stage 3".

[94] 3GPP TS 33.533: "Security aspects of ranging based services and sidelink positioning".

[95] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs".

[96] 3GPP TS 23.204: "Support of Short Message Service (SMS) over generic 3GPP Internet Protocol (IP) access; Stage 2".

[xx] IETF RFC 9298: "Proxying UDP in HTTP".

[yy] draft-ietf-masque-quic-proxy: "QUIC-Aware Proxying Using HTTP".

Editor's note: The above document cannot be formally referenced until it is published as an RFC.

[ss] IETF draft-ietf-tsvwg-udp-options: "Transport Options for UDP".

Editor's note: The above reference will be revised to RFC when finalized by IETF.

*NEXT CHANGE (2)*

#### 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, [URSP rule enforcement reports], [Always-on PDU Session Requested], [Requested Non-3GPP Delay Budget], [non-3GPP device connection information])), 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, when the UE associates a newly detected application to an existing PDU Session based on URSP evaluation result and the matched URSP rule included the Indication for reporting URSP rule enforcement, the UE may initiate PDU Session Modification procedure to provide URSP rule enforcement report as described in clause 6.6.2.4 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 may be received from DS-TT and includes DS-TT port related management information as defined in clause 5.28.3 of TS 23.501 [2].

If the UE supports QoS differentiation of traffic for Non-3GPP Device Identifier and when the UE determines that QoS differentiation is required as described in clause 5.52 of TS 23.501 [2], the UE includes the Non-3GPP Device Identifier and user plane address in the non-3GPP device connection information within the PDU Session Modification Request.

Editor's note: Details on how non-3GPP device connection information is included within PDU Session Modification Request are to be defined in stage 3.

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 QoS Monitoring 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.

If Periodicity is provided by the AF, the PCF provides the Periodicity information in the PCC rules. Based on operator's local policies, the PCF sends to the SMF an indication in the PCC Rule to perform N6 Traffic Parameter Measurements for N6 Jitter and, if not received from the AF, also UL and/ or DL Periodicity measurements.

The PCF may provision a PDU Set Control Information and Protocol Description as described in clause 6.1.3.27.4 of TS 23.503 [20], clauses 5.37.5, 5.37.9.2, and 5.37.9.4 of TS 23.501[2], and On-path N6 Signaling Information (as described in clause 5.37.9 in TS 23.501[2] and clause 6.3.1 of TS 23.503 [20]) within PCC Rules based on the information provided by the AF and/or the local operator policies.

The PCF may provision a Data Burst Handing Information and DL Protocol Description as described in clause 6.3.1 of TS 23.503 [20] and clauses 5.37.8.3, 5.37.9.2, and 5.37.9.4 of TS 23.501[2]), and On-pathN6 Signaling Information (as described in clause 5.37.9 in TS 23.501[2] and clause 6.3.1 of TS 23.503 [20]) within PCC Rules based on the information provided by the AF and/or the local operator policies.

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. It may also be triggered to update QoS profile in the NG RAN and PDU Set information marking in the PSA UPF upon completion of mobility procedure as defined in clause 5.37.5.3 of TS 23.501 [2].

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].

1h. (AMF initiated modification) When the AMF determines that the S-NSSAI is to be replaced with an Alternative S-NSSAI (as described in clause 5.15.19 of TS 23.501 [2]), the AMF invokes Nsmf\_PDUSession\_UpdateSMContext Request (SM Context ID, S-NSSAI, Alternative S-NSSAI) to the SMF of the PDU session associated with the S-NSSAI.

(AMF initiated modification) When the AMF determines that the S-NSSAI is subject to area restriction, e.g. when the S-NSSAI is configured with an NS-AoS, or when the S-NSSAI is present in the Partially Allowed NSSAI, the AMF invokes Nsmf\_PDUSession\_UpdateSMContext Request (SM Context ID, S-NSSAI, Slice Area Restriction indication) to the SMF indicating that the PDU Session is subject to area restriction for the S-NSSAI. If the S-NSSAI is replaced with the Alternative S-NSSAI, the AMF checks the area restriction only for the Replaced S-NSSAI for this PDU Session.

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.

The PCF may make policy control decisions based on the awareness of URSP rule enforcement, as described in clause 6.1.1.5 in TS 23.503 [20].

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, the SMF may instruct the UPF to assign or remove 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 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 UL and/or DL Periodicity, the SMF composes the TSCAI with the periodicity information.

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 an indication to perform N6 Traffic Parameter measurements (e.g. the N6 Jitter range associated with the DL Periodicity, and the UL/DL periodicity), the SMF instructs the UPF to perform N6 Traffic Parameter measurement associated with the DL Periodicity for the QoS Flow, as described in clause 5.37.8.2 of TS 23.501 [2].

If N6 Traffic Parameter measurements are requested and DL Periodicity is received in the PCC Rule, the SMF shall include the DL Periodicity as well as the indication of N6 Traffic Parameter measurement in the request to the UPF, see clause 5.8.5.11 of TS 23.501 [2].

If the PCC Rule includes a Protocol Description and PDU Set QoS parameters for DL and the SMF decides to enable PDU Set Identification and marking for PDU Set based Handling by PSA UPF, the SMF should provide the Protocol Description information, On-path N6 Signaling Information (if available), and PDU Set Marking indication to the UPF and request the UPF to mark the PDU Set Information in each PDU belonging to the PDU Sets as described in clause 5.37.5.2, 5.37.9, and 5.8.5.4 of TS 23.501 [2].

If the SMF decides to enable End of Data Burst marking by PSA UPF, the SMF should request the UPF to mark End of Data Burst as described in clause 5.37.8.3 of TS 23.501 [2]. The SMF may instruct the UPF to identify and mark the Data Burst Size as described in clause 5.37.10.1 of TS 23.501 [2]. If the PCC Rule includes a Protocol Description, and/or On-path N6 Signaling Information, the SMF should provide the Protocol Description information and/or On-path N6 Signaling Information to the UPF.

If the PDU Set information marking has been activated in the UPF for a QoS flow, the SMF may request the UPF to stop the marking of the PDU Set information based on the indication from the RAN or PCF, e.g. if the Target RAN does not support the PDU Set based handling as described in clause 5.37.5.3 of TS 23.501 [2].

If the SMF decides using on-path N6 signalling method Media over QUIC (MoQ) and the PSA UPF supports the MoQ relay functionality, then the SMF indicates the UPF to return the MoQ relay address via the N4 session management request procedures as described in clause 5.37.9.2 of TS 23.501 [2].

If the PCF initiated SM Policy Association Modification that adds one or more PCC Rule(s) with PDU Set Control Information, the SMF performs PDU Set based QoS handling, see clause 5.37.5 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].

If the AMF initiated the PDU Session Modification procedure in step 1h due to network slice replacement with the Alternative S-NSSAI and if the SMF determines that the PDU Session is retained, the SMF sends N4 Session Modification request message to the UPF to replace the S-NSSAI with the Alternative S-NSSAI, as described in clause 5.15.19 of TS 23.501 [2].

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].

If requested by SMF in step 2a, the PSA UPF will initiate N4 Session Level reporting for N6 Traffic Parameter Measurement Report as described in clause 4.4.2.2. If N6 Traffic Parameter(s) are available then the response to the SMF in this step may include the N6 Traffic Parameter(s) (e.g. the N6 Jitter range associated with the DL Periodicity, and the UL/DL periodicity) for the QoS Flow (see clause 5.37.8.2 of TS 23.501 [2]). The SMF composes the TSCAI with the received N6 Traffic Parameters.

If the SMF has requested in step 2a the PSA UPF to provide the MoQ relay address, then the UPF returns the MoQ relay address via the N4 Session Establishment/Modification Response as described in clause 5.37.9.2 of TS 23.501 [2].

3a. For UE or AN initiated modification or AMF 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) and associated UL Protocol Description(s) (if available), 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], [Non-3GPP QoS Assistance 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. For Network Slice Replacement if the SMF determines that the PDU Session is to be retained, the S-NSSAI in N2 SM information is set to Alternative S-NSSAI.

- If the SMF has received a Requested Non-3GPP Delay Budget for a QoS flow from the PEGC, the SMF may adjust the dynamic CN PDB signalled to the NG-RAN as defined in clause 5.44.3.4 of TS 23.501 [2].

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 and associated UL Protocol Description(s) (if available), QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s) 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 the PCF provides the PCC rules with Protocol Description for UL in step 2, based on operator policy, the SMF may additionally provide the Protocol Description for UL with the associated QoS rule as described in clause 5.37.5.1 of TS 23.501 [2].

For the AMF initiated the PDU Session Modification procedure in step 1h due to network slice replacement, and if the SMF determines that the PDU Session is to be retained, the SMF includes the Alternative S-NSSAI in the PDU Session Modification Command to the UE and a cause value indicating that the S-NSSAI of the PDU Session is replaced with the Alternative S-NSSAI.

If the AMF initiated the PDU Session Modification procedure in step 1h due to network slice replacement and if the PDU Session is SSC mode 3 and if the SMF determines that the PDU Session is to be re-established on the Alternative S-NSSAI, the SMF includes the Alternative S-NSSAI in the PDU Session Modification Command to the UE and a cause value indicating that a PDU Session re-establishment on the Alternative S-NSSAI is required. The UE re-establishes a new PDU Session on the Alternative S-NSSAI, as described in clause 5.15.19 in TS 23.501 [2]. If the PDU Session is SSC mode 1 or SSC mode 2, the SMF may initiate release of the PDU Session as described in clause 4.3.4.2.

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]).

Based on the S-NSSAI and DNN for PIN, the SMF may provide the UE with per QoS-flow Non-3GPP QoS Assistance Information in the N1 SM container.

If SMF receives the indication indicating that the PDU Session is subject to area restriction for the S-NSSAI, and if SMF has not subscribed before, the SMF subscribes to "UE mobility event notification" event for reporting UE presence in Area of Interest by providing the S-NSSAI as an indicator for the Area Of Interest (see clauses 5.6.11 and 5.3.4.4 of TS 23.501 [2]).

If SMF does not receive the indication indicating that the PDU Session is subject to area restriction for the S-NSSAI, and if the SMF has subscribed the "UE mobility event notification" event in the AMF before, the SMF may unsubscribe "UE mobility event notification" event in the AMF.

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, QoS monitoring parameter), [TSCAI(s)], TL-Container(s), [ECN marking for L4S indicator(s)]), N1 SM container (PDU Session Modification Command (PDU Session ID, QoS rule(s) and associated UL Protocol Description(s) (if available), QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s), QoS rule operation and QoS Flow level QoS parameters operation, Session-AMBR))).

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

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

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

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

- In the case of non-3GPP access, where the 5G-AN corresponds to an N3IWF or TNGF:

- For each QoS Flow, the SMF may request the following to the N3IWF or TNGF:

- ECN marking for L4S at N3IWF or TNGF in the case of ECN marking for L4S in non-3GPP access as described in clause 5.37.3 of TS 23.501 [2].

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, the SMF may instruct the NG-RAN to assign or remove 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. 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. In the case of receiving a congestion information request, RAN initiates reporting of UL and/or DL QoS Flow congestion information to PSA UPF as defined in clause 5.45.3 of TS 23.501 [2]. 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].

The SMF indicates EAS rediscovery indication to the UE, if that initiated the PDU Session Modification procedure in step 1d as defined in clause 6.2.3.3 of TS 23.548 [74].

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.

If the PCF provides the PCC rules with Protocol Description for UL in step 2, based on operator policy, the SMF may provide the Protocol Description(s) for UL with the associated QoS rule(s) as described in clause 5.37.5.1 of TS 23.501 [2].

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].

If EAS rediscovery indication is provided to the UE, the UE can trigger EAS rediscovery procedure as defined in clause 6.2.3.3 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(s), BAT offset, Periodicity, established QoS Flows status (active/not active) (for one of the following: congestion information monitoring, ECN marking for L4S at PSA UPF, ECN marking for L4S at NG-RAN, ECN marking for L4S at N3IWF or TNGF), PDU Set Based Handling Support Indication), 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. 5G-AN includes the PDU Set Based Handling Support Indication in N2 SM information as defined in clause 5.37.5.3 of TS 23.501 [2]

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].

If the NG-RAN has determined a BAT offset and optionally a periodicity as described in clause 5.27.2.5 of TS 23.501 [2], the NG-RAN provides the BAT offset and optionally the periodicity in the N2 SM information.

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 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 as defined in clause 5.45 of TS 23.501 [2].

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.

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

If the N2 SM information includes the PDU Set Based Handling Support Indication and there are PCC Rules with PDU Set QoS parameters for DL, SMF configures PSA UPF to activate PDU set identification and marking for the QoS flow as described in clause 5.37.5.3 of TS 23.501 [2].

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 information provided in 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 processing 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/Router 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/Router 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]. If trigger for Notification on BAT offset is armed and the SMF received BAT offset and/or Periodicity from the RAN, then the SMF provides the BAT offset and/or Periodicity to the PCF as described in clause 5.27.2.5 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.

*NEXT CHANGE (3)*

#### 4.15.6.6 Setting up an AF session with required QoS procedure



Figure 4.15.6.6-1: Setting up an AF session with required QoS procedure

1. The AF sends a request to reserve resources for an AF session using Nnef\_AFsessionWithQoS\_Create request message (UE address, AF Identifier, Flow description information or External Application Identifier, QoS Reference or individual QoS parameters, Alternative Service Requirements (as described in clause 6.1.3.22 of TS 23.503 [20]), DNN, S-NSSAI) to the NEF. Optionally, QoS monitoring requirements, Indication of ECN marking for L4S, Data Burst Size Marking Support Indication, Time to Next Burst Support Indication, PDU Set QoS Parameters (as described in clause 5.7.7 of TS 23.501 [2]) and Protocol Description (as described in clause 5.37 of TS 23.501 [2]), and/or On-path N6 Signaling Information (see clause 5.37.9 of TS 23.501 [2]) can be included in the AF request. For a Multi-modal service, the AF may provide a Multi-modal Service ID together with Multi-modal Service Requirements information for each data flow, as described in clause 6.1.3.27.3 of TS 23.503 [20]. Optionally, a period of time or a traffic volume for the requested QoS can be included in the AF request. The AF may, instead of a QoS Reference, provide one or more of the following individual QoS parameters: Requested 5GS Delay (optional), Requested Priority (optional), Requested Guaranteed Bitrate, Requested Maximum Bitrate, Maximum Burst Size and Requested Packet Error Rate. The AF may also provide an Averaging Window value for deriving such parameters for GBR QoS Flows. Regardless of whether the AF request is formulated using a QoS Reference or individual QoS parameters, the AF may also provide one or more of the following parameters that describe the traffic characteristics: flow direction, Burst Arrival Time at UE (uplink) or UPF (downlink), Periodicity, Time domain, Survival Time, Capability for BAT adaptation or BAT Window, Periodicity Range. The AF may also provide an RT Latency Indication. The optional Alternative Service Requirements provided by the AF shall either contain QoS References or Requested Alternative QoS Parameter Set(s) in a prioritized order as described in clause 6.1.3.22 of TS 23.503 [20]. Optionally, Packet Delay Variation requirements can be included in the AF request as described in clause 6.1.3.26 of TS 23.503 [20]. Optionally, the AF may provide QoS duration and QoS inactivity interval in order to indicate PCF the time period when the QoS should be applied.

NOTE 1: For multi-modal flows related to multiple UEs, multiple UE-specific AF requests are used and the AF provided information to NEF is the same as single UE case (as defined in clause 5.37.2 of TS 23.501 [2]).

2. The NEF authorizes the AF request that contains a single UE address and may apply policies to control the overall amount of QoS authorized for the AF. If the authorisation is not granted, all steps (except step 5) are skipped and the NEF replies to the AF with a Result value indicating that the authorisation failed. The NEF assigns a Transaction Reference ID to the Nnef\_AFsessionWithQoS\_Create request.

The NEF determines whether to invoke the TSCTSF or to directly contact the PCF based on operator configuration. This determination may use the presence of a QoS Reference or individual QoS parameters in the AF request. The determination may also use the AF identifier or the presence of AF provided parameters that describe the traffic characteristics in the AF request.

NOTE 2: The determination can also be based on an SLA between operator and application provider, e.g. using the DNN/S-NSSAI for the AF session according to the SLA.

If the NEF determines not to invoke the TSCTSF, then steps 3, 4, 5, 6, 7, 8 are executed, otherwise, steps 3a, 3b, 4a, 4b, 5, 6a, 7a, 7b, 8 are executed.

3. If the NEF determines to contact the PCF directly without invoking the TSCTSF, the NEF uses the UE address to discover the PCF from the BSF. The NEF forwards received parameters to the PCF in the Npcf\_PolicyAuthorization\_Create request. Any optionally received period of time or traffic volume mapped and forwarded as sponsored data connectivity information (as defined in TS 23.503 [20]).

If the AF is considered to be trusted by the operator, the AF uses the Npcf\_PolicyAuthorization\_Create request message to interact directly with PCF to request reserving resources for an AF session.

3a. If the NEF determines to invoke the TSCTSF, the NEF forwards received parameters in the Ntsctsf\_QoSandTSCAssistance\_Create request message to the TSCTSF. Any optionally received period of time or traffic volume is mapped and forwarded as sponsored data connectivity information (as defined in TS 23.503 [20]).

If the AF is considered to be trusted by the operator, the AF uses the Ntsctsf\_QoSandTSCAssistance\_Create request message to interact directly with TSCTSF to request reserving resources for an AF session.

A TSCTSF address may be locally configured (a single TSCTSF per DNN/S-NSSAI) in the NEF, PCF and trusted AF. Alternatively, the NEF uses the AF Identifier to determine the DNN/S-NSSAI and uses the DNN/S-NSSAI to discover the TSCTSF from the NRF.

3b. The TSCTSF determines whether it has an AF session with a PCF for the given UE address. In this case the TSCTSF sends a Npcf\_PolicyAuthorization\_Update request message to the PCF and forwards the received parameters after executing the adjustment and mapping actions described below.

If the TSCTSF does not have an AF-session for a given UE address, the TSCTSF discovers the PCF and a Npcf\_PolicyAuthorization\_Create request message to the PCF.

If the TSCTSF receives a Requested 5GS Delay, the TSCTSF calculates a Requested PDB by subtracting the UE-DS-TT Residence Time (either provided by the PCF or pre-configured at TSCTSF) from the Requested 5GS Delay and sends the Requested PDB to the PCF instead of the Requested 5GS Delay. If the TSCTSF receives any of the following parameters: flow direction, Burst Arrival Time, Periodicity, Time domain, Survival Time, Capability for BAT adaptation or BAT Window, Periodicity Range from the NEF, the TSCTSF determines the TSC Assistance Container and sends it to the PCF instead of these parameters.

4. For requests received from the NEF in step 3, the PCF determines whether the request is authorized and notifies the NEF if the request is not authorized.

If the request is authorized, the PCF derives the required QoS parameters of the PCC rule based on the information provided by the NEF and determines whether this QoS is allowed (according to the PCF configuration) and notifies the result to the NEF. If the AF is considered to be trusted by the operator, the PCF sends the Npcf\_PolicyAuthorization\_Create response message directly to AF.

If the PCF receives the individual QoS parameters instead of QoS Reference, the PCF determines a 5QI that matches the individual QoS parameters as described in clause 6.1.3.22 of TS 23.503 [20]. It also sets the GBR and MBR for the PCC rule according to the requested values. The PCF may use the Requested Priority from the AF to determine Priority Level as defined in clause 5.7.3.3 of TS 23.501 [2]. Requested individual QoS parameter values supersede default values for the 5QI.

If the PCF receives the RT Latency Indication described in clause 6.1.3.22 of TS 23.503 [20], the PCF executes Uplink-Downlink Transmission Coordination as described in clause 5.37.7 of TS 23.501 [2] and the associated QoS monitoring for the two correlated QoS Flows as described in clause 6.1.3.27.2 of TS 23.503 [20].

If the PCF receives PDU Set QoS parameters described in clause 5.7.7 of TS 23.501 [2], the PDU Set QoS parameters are applied as described in clause 6.1.3.22 of TS 23.503 [20].

If the PCF receives an explicit indication (i.e. Indication of ECN marking for L4S) as described in clause 6.1.3.22 of TS 23.503 [20], PCF decides that the service data flow supports ECN marking for L4S. PCF then indicates to the SMF to enable ECN marking for L4S for that QoS flow.

In addition, if the Alternative Service Requirements are provided, the PCF derives the Alternative QoS parameter set(s) in the same way from the one or more QoS Reference parameters or the Requested Alternative QoS Parameter Set(s) contained in the Alternative Service Requirements keeping the same prioritized order (as defined in clause 6.1.3.22 of TS 23.503 [20]).

NOTE 3: The PCF derived Alternative QoS parameter set(s) for the PCC rule are subsequently used to establish Alternative QoS Profile(s). The Alternative QoS Profile parameters provided to the NG-RAN are specified in clause 5.7.1.2a of TS 23.501 [2].

For multi-modal flows, the PCF derives the required QoS parameters in the PCC rules and generates the QoS monitoring requirements policy for each media flow, based on the information provided by the NEF.

If the PCF determines that the SMF needs updated policy information, the PCF issues a Npcf\_SMPolicyControl\_UpdateNotify request with updated policy information about the PDU Session as described in the PCF initiated SM Policy Association Modification procedure in clause 4.16.5.2.

4a. For requests received from the TSCTSF in step 3b, the PCF determines whether the request is authorized and notifies the TSCTSF if the request is not authorized.

If the request is authorized, the PCF derives the required QoS parameters of the PCC rule in the same way it is described in step 4 based on the information provided by the TSCTSF and determines whether this QoS is allowed (according to the PCF configuration) and notifies the result to the TSCTSF.

If the PCF determines that the SMF needs updated policy information, the PCF issues a Npcf\_SMPolicyControl\_UpdateNotify request with updated policy information about the PDU Session as described in the PCF initiated SM Policy Association Modification procedure in clause 4.16.5.2.

If the PCF receives a subscription for the 5GS Bridge/Router information from the TSCTSF, if the PCF does not have the 5GS Bridge/Router information for the PDU Session, the PCF uses the PCF initiated SM Policy Association Modification procedure as described in clause 4.16.5.2 to subscribe for 5GS Bridge/Router information event from the SMF. Once the PCF has the 5GS Bridge/Router information, the PCF notifies the TSCTSF for the 5GS Bridge/Router information (including the UE-DS-TT Residence Time).

4b. The TSCTSF sends a Ntsctsf\_QoSandTSCAssistance\_Create response message (Transaction Reference ID, Result) to the NEF. Result indicates whether the request is granted or not.

If the AF is considered to be trusted by the operator, the TSCTSF sends the Ntsctsf\_QoSandTSCAssistance\_Create response message directly to AF.

5. The NEF sends a Nnef\_AFsessionWithQoS\_Create response message (Transaction Reference ID, Result) to the AF. Result indicates whether the request is granted or not.

6. The NEF shall send a Npcf\_PolicyAuthorization\_Subscribe message to the PCF to subscribe to notifications of Resource allocation status and may subscribe to other events described in clause 6.1.3.18 of TS 23.503 [20].

6a. The TSCTSF shall send a Npcf\_PolicyAuthorization\_Subscribe message to the PCF to subscribe to notifications of Resource allocation status and may subscribe to other events described in clause 6.1.3.18 of TS 23.503 [20].

The TSCTSF that receives Capability for BAT adaptation or BAT Window in step 3a shall subscribe to notification on BAT offset via sending a Npcf\_PolicyAuthorization\_Subscribe request message to the PCF.

7. When the event condition is met, e.g. that the establishment of the transmission resources corresponding to the QoS update succeeded or failed, the PCF sends Npcf\_PolicyAuthorization\_Notify message to the NEF notifying about the event.

If the AF is considered to be trusted by the operator, the PCF sends the Npcf\_PolicyAuthorization\_Notify message directly to AF.

7a. When the event condition is met, e.g. that the establishment of the transmission resources corresponding to the QoS update succeeded or failed, the PCF sends Npcf\_PolicyAuthorization\_Notify message to the TSCTSF notifying about the event.

7b. The TSCTSF sends Ntsctsf\_QoSandTSCAssistance\_Notify message with the event reported by the PCF to the NEF.

If the AF is considered to be trusted by the operator, the TSCTSF sends the Ntsctsf\_QoSandTSCAssistance\_Notify message directly to AF.

8. The NEF sends Nnef\_AFsessionWithQoS\_Notify message with the event reported by the PCF to the AF.

The AF may send Nnef\_AFsessionWithQoS\_Revoke request to NEF in order to revoke the AF request. The NEF authorizes the revoke request and triggers the Ntsctsf\_QoSandTSCAssistance\_Delete and/or Npcf\_PolicyAuthorization\_Delete service operations for the AF request.

*NEXT CHANGE (4)*

#### 4.15.6.6a AF session with required QoS update procedure



Figure 4.15.6.6a-1: AF session with required QoS update procedure

1. For an established AF session with required QoS, the AF may send a Nnef\_AFsessionWithQoS\_Update request message (AF Identifier, Transaction Reference ID, [Flow description information], [QoS Reference or individual QoS parameters], [Alternative Service Requirements (as described in clause 6.1.3.22 of TS 23.503 [20])]) to NEF for updating the reserved resources. Optionally, Indication of ECN marking for L4S, Data Burst Size Marking Support Indication, Time to Next Burst Support Indication, PDU Set QoS Parameters (as described in clause 5.7.7 of TS 23.501 [2]) and Protocol Description (as described in clause 5.37.5, 5.37.8.3, 5.37.9.2, 5.37.9.4, and other (sub)clauses in clause 5.37 of TS 23.501 [2]), and/or On-pathN6 Signaling Information (see clause 5.37.9 of TS 23.501 [2]) can be included in the AF request. For a Multi-modal service, the AF may provide/update Multi-modal Service Requirements information of the existing data flows as described in clause 6.1.3.27.3 of TS 23.503 [20]. Optionally, a period of time or a traffic volume for the requested QoS can be included in the AF request. The Transaction Reference ID provided in the AF session with required QoS update request message is set to the Transaction Reference ID that was assigned, by the NEF, to the Nnef\_AFsessionWithQoS\_Create request message. The AF may, instead of a QoS Reference, provide one or more of the following individual QoS parameters: Requested 5GS Delay (optional), Requested Priority (optional), Requested Guaranteed Bitrate, Requested Maximum Bitrate, Maximum Burst Size and Requested Packet Error Rate. The AF may also provide an Averaging Window. Regardless whether the AF request is formulated using a QoS Reference or individual QoS parameters, the AF may also provide one or more of the following parameters that describe the traffic characteristics: flow direction, Burst Arrival Time at UE (uplink) or UPF (downlink), Periodicity, Time domain, Survival Time, Capability for BAT adaptation or BAT Window, Periodicity Range. The optional Alternative Service Requirements provided by the AF shall either contain QoS References or Requested Alternative QoS Parameter Set(s) in a prioritized order as specified in clause 6.1.3.22 of TS 23.503 [20]. Optionally, Packet Delay Variation requirements can be included in the AF request as described in clause 6.1.3.26 of TS 23.503 [20].

2. The NEF authorizes the AF request of updating AF session with required QoS and may apply policies to control the overall amount of QoS authorized for the AF. If the authorisation is not granted, all steps (except step 5) are skipped and the NEF replies to the AF with a Result value indicating that the authorisation failed.

3. The NEF shall contact the same NF type (i.e. TSCTSF or PCF) as with the initial Nnef\_AFsessionWithQoS\_Create request during the establishment procedure in clause 4.15.6.6. If the NEF determined not to invoke the TSCTSF, then steps 3, 4, 5, 6, 7 are executed, otherwise, steps 3a, 3b, 4a, 4b, 5, 6a, 6b, 7 are executed. If the Nnef\_AfsessionWithQoS\_Update adds any parameters that would require the NEF to invoke TSCTSF while the NEF determined not to invoke the TSCTSF for the initial Nnef\_AFsessionWithQoS\_Create request, the NEF shall reject the Nnef\_AFsessionWithQoS\_Update request with a cause value indicating the reason of failure.

If the NEF does not invoke the TSCTSF, the NEF interacts with the PCF by triggering a Npcf\_PolicyAuthorization\_Update request and forwards received parameters to the PCF. Any optionally received period of time or traffic volume is mapped and forwarded as sponsored data connectivity information (as defined in TS 23.503 [20]).

If the AF is considered to be trusted by the operator, the AF uses the Npcf\_PolicyAuthorization\_Update request message to interact directly with PCF to update the reserving resources for an AF session.

3a. If the NEF decided to contact the TSCTSF when the session was established, the NEF forwards received parameters in the Ntsctsf\_QoSandTSCAssistance\_Update request message to the TSCTSF. Any optionally received period of time or traffic volume is mapped and forwarded as sponsored data connectivity information (as defined in TS 23.503 [20]).

If the AF is considered to be trusted by the operator, the AF uses the Ntsctsf\_QoSandTSCAssistance\_Update request message to interact directly with TSCTSF to update the reserving resources for an AF session.

3b. The TSCTSF interacts with the PCF by triggering a Npcf\_PolicyAuthorization\_Update request and forwards the received parameters after executing the adjustment and mapping actions described in step 3b of clause 4.15.6.6.

4. The PCF processes the Npcf\_PolicyAuthorization\_Update request according to the actions described in step 4 of clause 4.15.6.6.

4a. The PCF processes the Npcf\_PolicyAuthorization\_Update request according to the actions described in step 4a of clause 4.15.6.6. If the PCF has received a request to unsubscribe for 5GS Bridge/Router information Notification, the PCF uses the PCF initiated SM Policy Association Modification procedure as described in clause 4.16.5.2 to unsubscribe for 5GS Bridge/Router information event from the SMF.

4b. The TSCTSF sends a Ntsctsf\_QoSandTSCAssistance\_Update response message (Transaction Reference ID, Result) to the NEF. Result indicates whether the request is granted or not.

If the AF is considered to be trusted by the operator, the TSCTSF sends the Ntsctsf\_QoSandTSCAssistance\_Update response message directly to AF.

5. The NEF sends a Nnef\_AFsessionWithQoS\_Update response message (Transaction Reference ID, Result) to the AF. Result indicates whether the request is granted or not.

6. The PCF sends Npcf\_PolicyAuthorization\_Notify message to the NEF when the modification of the transmission resources corresponding to the QoS update succeeded or failed, or when an Alternative Service Requirement is being applied.

If the AF is considered to be trusted by the operator, the PCF sends the Npcf\_PolicyAuthorization\_Notify message directly to AF.

6a. The PCF sends Npcf\_PolicyAuthorization\_Notify message to the TSCTSF when the modification of the transmission resources corresponding to the QoS update succeeded or failed, or when an Alternative Service Requirement is being applied.

6b. The TSCTSF sends Ntsctsf\_QoSandTSCAssistance\_Notify message with the event reported by the PCF to the NEF.

If the AF is considered to be trusted by the operator, the TSCTSF sends the Ntsctsf\_QoSandTSCAssistance\_Notify message directly to the AF.

7. The NEF sends Nnef\_AFsessionWithQoS\_Notify message with the event reported by the PCF to the AF.

*NEXT CHANGE (5)*

##### 5.2.5.3.2 Npcf\_PolicyAuthorization\_Create service operation

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

**Description:** Authorize the request and optionally determines and installs SM Policy Control Data according to the information provided by the NF Consumer or provides Port Management Information Container for ports on DS-TT or NW-TT, or User plane node Management Information Container.

**Inputs, Required:** UE (IP or MAC) address, identification of the application session context.

**Inputs, Optional:** GPSI(s) or SUPI(s) if available, Internal Group Identifier, DNN if available, S-NSSAI if available, Media type, Media format, bandwidth requirements, sponsored data connectivity information if applicable, flow description information as described in clause 6.1.3.6 of TS 23.503 [20], AF Application Identifier, AF Communication Service Identifier, AF Record Identifier, Flow status, Priority indicator, emergency indicator, ASP Identifier, resource allocation outcome, AF Application Event Identifier, a list of DNAI(s) and corresponding routing profile ID(s) or N6 traffic routing information, AF Transaction Id, Early and/or late notifications about UP path management events, temporal validity condition, spatial validity condition, Information for EAS IP Replacement in 5GC, Indication for EAS Relocation, AF indication for simultaneous connectivity over source and target PSA at edge relocation, EAS Correlation indication, Common EAS IP address, Traffic Correlation ID, FQDN(s), Indication of considering N6 delay as described in clause 5.6.7 in 23.501 [2], Background Data Transfer Reference ID, priority sharing indicator as described in clause 6.1.3.15 of TS 23.503 [20], pre-emption control information as described in clause 6.1.3.15 of TS 23.503 [20], Port Management Information Container and related port number, User plane node Management Information Container, TSN AF parameters provided by the TSN AF to the PCF as described in clause 6.1.3.23 of TS 23.503 [20], TSCTSF parameters provided by the TSCTSF to the PCF as described in clause 6.1.3.23a and clause 6.1.3.23b of TS 23.503 [20], QoS Monitoring parameter(s) as defined in clause 5.45 of TS 23.501 [2], Reporting frequency, Target of reporting and optional an indication of direct event notification as described in clause 6.1.3.21 of TS 23.503 [20], QoS Reference or individual QoS parameters as described in clause 6.1.3.22 of TS 23.503 [20], RT Latency Indication as described in clause 6.1.3.22 of TS 23.503 [20], Alternative Service Requirements (containing one or more QoS Reference parameters or Requested Alternative QoS Parameter Sets in a prioritized order), TSC Assistance Container, MPS for Data Transport Service indicator as described in clause 6.1.3.11 of TS 23.503 [20], Packet Delay Variation requirements as described in clause 6.1.3.26 of TS 23.503 [20], SFC Identifier(s), Metadata, Header Handling Control information as described in clause 5.6.17 of TS 23.501 [2], Periodicity as described clauses 6.1.3.22 and 6.3.1 of TS 23.503 [20], PDU Set QoS Parameters as described in clause 5.7.7 of TS 23.501 [2], Protocol Description (as described in clause 5.37.5, 5.37.8.3, 5.37.9.2, 5.37.9.4, and other (sub)clauses in clause 5.37 of TS 23.501 [2]) and/or On-path N6 Signaling Information (see clause 5.37.9 of TS 23.501 [2]), Data Burst Handing Information as described in clause 6.3.1of TS 23.503 [20], Indication of ECN marking for L4S as described in clause 6.1.3.22 of TS 23.503 [20], Data Burst Size Marking Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], Time to Next Burst Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], Notification Target Address for PMIC/UMIC UPF event, Correlation ID for PMIC/UMIC UPF event, Multi-Modal Service ID together with Multi-modal Service Requirements information for each data flow as described in clause 6.1.3.27.3 of TS 23.503 [20], QoS duration, QoS inactivity interval as described in clause 6.1.3.22 of TS 23.503 [20].

NOTE 1: When only one DNAI and corresponding routing profile ID(s) and the Indication for EAS Relocation are available, the presented DNAI is the target DNAI as defined in clause 6.3.7 of TS 23.548 [74].

NOTE 2: A dedicated Notification Target Address for PMIC/UMIC UPF event and Correlation ID for PMIC/UMIC UPF event are provided by the event consumer over Npcf\_PolicyAuthorization as the corresponding events are reported by the UPF and not by the PCF. Providing such information indicates that the consumer of the Npcf\_PolicyAuthorization (TSN AF, TSCTSF) supports PMIC/UMIC via Nupf event reporting.

**Outputs, Required:** Success or Failure (reason for failure, e.g. as defined in clauses 6.1.3.16 and clause 6.1.3.10 of TS 23.503 [20]).

**Outputs, Optional:** The service information that can be accepted by the PCF.

*NEXT CHANGE (6)*

##### 5.2.5.3.3 Npcf\_PolicyAuthorization\_Update service operation

**Service operation name:** Npcf\_PolicyAuthorization\_Update

**Description:** Provides updated information to the PCF.

**Inputs, Required:** Identification of the application session context.

**Inputs, Optional:** Media type, Media format, bandwidth requirements, sponsored data connectivity information if applicable, flow description information as described in clause 6.1.3.6 of TS 23.503 [20], AF Application Identifier, AF Communication Service Identifier, AF Record Identifier, Flow status, Priority indicator, resource allocation outcome, AF Application Event Identifier, a list of DNAI(s) and corresponding routing profile ID(s) or N6 traffic routing information, AF Transaction Id, Early and/or late notifications about UP path management events, temporal validity condition, spatial validity condition, Information for EAS IP Replacement in 5GC, Indication for EAS Relocation, AF indication for simultaneous connectivity over source and target PSA at edge relocation, Indication of considering N6 delay as described in clause 5.6.7 of TS 23.501 [2], Background Data Transfer Reference ID, priority sharing indicator as described in clause 6.1.3.15 of TS 23.503 [20], pre-emption control information as described in clause 6.1.3.15 of TS 23.503 [20], Port Management Information Container and related port number, User plane node Management Information Container, TSN AF parameters provided by the TSN AF to the PCF as described in clause 6.1.3.23 of TS 23.503 [20], TSCTSF parameters provided by the TSCTSF to the PCF as described in clause 6.1.3.23a and clause 6.1.3.23b of TS 23.503 [20], QoS Reference or individual QoS parameters as described in clause 6.1.3.22 of TS 23.503 [20], Alternative Service Requirements (containing one or more QoS Reference parameters or Requested Alternative QoS Parameter Sets in a prioritized order), TSC Assistance Container, QoS Monitoring parameter(s) as defined in clause 5.45 of TS 23.501 [2], Reporting frequency, Target of reporting and optional an indication of direct event notification as described in clause 6.1.3.21 of TS 23.503 [20], MPS for Data Transport Service indicator as described in clause 6.1.3.11 of TS 23.503 [20], Packet Delay Variation requirements as described in clause 6.1.3.26 of TS 23.503 [20], SFC Identifier(s), Metadata, Header Handling Control information as described in clause 5.6.17 of TS 23.501 [2], Periodicity as described clauses 6.1.3.22 and 6.3.1 of TS 23.503 [20], PDU Set QoS Parameters as described in clause 5.7.7 of TS 23.501 [2], Protocol Description (as described in clause 5.37.5, 5.37.8.3, 5.37.9.2, 5.37.9.4, and other (sub)clauses in clause 5.37 of TS 23.501 [2]) and/or On-path N6 Signaling Information (see clause 5.37.9 of TS 23.501 [2]), Data Burst Handing Information as described in clause 6.3.1of TS 23.503 [20], Data Burst Size Marking Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], Time to Next Burst Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], Notification Target Address for PMIC/UMIC UPF event, Correlation ID for PMIC/UMIC UPF event, updated information for Multi-modal Service Requirements as described in clause 6.1.3.27.3 of TS 23.503 [20].

NOTE: When only one DNAI and corresponding routing profile ID(s) and the Indication for EAS Relocation are available, the presented DNAI is the target DNAI as defined in clause 6.3.7 of TS 23.548 [74].

**Outputs, Required:** Success or Failure (reason for failure, e.g. as defined in clause 6.1.3.16 of TS 23.503 [20]).

**Outputs, Optional:** The service information that can be accepted by the PCF.

Provides updated application level information and communicates with Npcf\_SMPolicyControl service to determine and install the policy according to the information provided by the NF Consumer. Updates an application context in the PCF.

*NEXT CHANGE (7)*

##### 5.2.6.9.2 Nnef\_AFsessionWithQoS\_Create service operation

**Service operation name:** Nnef\_AFsessionWithQoS Create

**Description:** The consumer requests the network to provide a specific QoS for an AF session for a UE or a list of UEs.

**Inputs, Required:** AF Identifier, UE address (i.e. IP address or MAC address and only applicable for a single UE AF session), a list of UE addresses (as described in clause 4.15.6.13, and only applicable for a Multi-member AF session). Flow description information as described in clause 6.1.3.6 of TS 23.503 [20] or External Application Identifier, QoS Reference or individual QoS parameters as described in clause 6.1.3.22 of TS 23.503 [20].

NOTE 1: In this Release, when a list of UE addresses is provided, the Flow description information is common for all UE addresses in the list. Further details are described in clause 4.15.6.13.2.

**Inputs, Optional:** Time period, traffic volume, Alternative Service Requirements (containing one or more QoS Reference parameters or Requested Alternative QoS Parameter Sets in a prioritized order), QoS Monitoring parameter(s) as defined in clause 5.45 of TS 23.501 [2], Reporting frequency, Target of reporting and optional an indication of direct event notification as described in clause 6.1.3.21 of TS 23.503 [20], DNN if available, S-NSSAI if available.

Only applicable for a single UE AF session: flow direction, Burst Arrival Time at UE (uplink) or UPF (downlink), Periodicity as described in clause 5.27.2 or clause 5.37.8.2 of TS 23.501 [2], Time domain, Survival Time, BAT Window or Capability for BAT adaptation, Packet Delay Variation requirements as described in clause 6.1.3.26 of TS 23.503 [20], Periodicity Range, RT Latency Indication as described in clause 6.1.3.22 of TS 23.503 [20], PDU Set QoS Parameters as described in clause 5.7.7 of TS 23.501 [2], Protocol Description (as described in clause 5.37.5, 5.37.8.3, 5.37.9.2, 5.37.9.4, and other (sub)clauses in clause 5.37 of TS 23.501 [2]) and/or On-path N6 Signaling Information (see clause 5.37.9 of TS 23.501 [2]), Indication of ECN marking for L4S as described in clause 6.1.3.22 of TS 23.503 [20], Data Burst Size Marking Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], Time to Next Burst Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], QoS duration, QoS inactivity interval, Multi-Modal Service ID together with Multi-modal Service Requirements information for each data flow as described in clause 6.1.3.27.3 of TS 23.503 [20].

Only applicable for a Multi-member AF session: Consolidated Data Rate Threshold, a list of UE addresses subject to Consolidated Data Rate monitoring.

NOTE 2: If Consolidated Data Rate Threshold is provided, the QoS Monitoring parameter(s) indicates the Guaranteed Bitrate shall be provided.

NOTE 3: When the AF request is for Consolidated Data Rate monitoring is set for event reporting, the QoS Flow data rate reporting for the list of UEs provided to the AF by the NEF only when the Consolidated Data Rate threshold is exceeded.

NOTE 4: When the Consolidated Data Rate threshold is provided, it applies to the list of UE addresses by default. However, if the list of UE addresses subject for Consolidated Data Rate monitoring is also provided, then such list has to be the subset of the list of UE addresses.

**Outputs, Required:** Transaction Reference ID, result (result as described in clause 4.15.6.13 if a list of UE is targeted).

**Output (optional):** None.

*NEXT CHANGE (8)*

##### 5.2.6.9.5 Nnef\_AFsessionWithQoS\_Update service operation

**Service operation name:** Nnef\_AFsessionWithQoS Update

**Description:** The consumer requests the network to update the parameters for an AF session for a UE or a list of UEs.

**Inputs, Required:** Transaction Reference ID.

**Inputs, Optional:** Flow description information (as described in clause 6.1.3.6 of TS 23.503 [20]) or External Application Identifier, QoS Reference or individual QoS parameters as described in clause 6.1.3.22 of TS 23.503 [20], time period, traffic volume, Alternative Service Requirements (containing one or more QoS Reference parameters or Requested Alternative QoS Parameter Sets in a prioritized order), QoS Monitoring parameter(s) as defined in clause 5.45 of TS 23.501 [2], Reporting frequency, Target of reporting and optional an indication of direct event notification as described in clause 6.1.3.21 of TS 23.503 [20].

Only applicable for a single UE AF session: flow direction, Burst Arrival Time at UE (uplink) or UPF (downlink), Periodicity as described in clause 5.27.2 or clause 5.37.8.2 of TS 23.501 [2], Time domain, Survival Time, Packet Delay Variation requirements as described in clause 6.1.3.26 of TS 23.503 [20], BAT Window or Capability for BAT adaptation, Periodicity Range, PDU Set QoS Parameters as described in clause 5.7.7 of TS 23.501 [2], Protocol Description (as described in clause 5.37.5, 5.37.8.3, 5.37.9.2, 5.37.9.4, and other (sub)clauses in clause 5.37 of TS 23.501 [2]) and/or On-path N6 Signaling Information (see clause 5.37.9 of TS 23.501 [2]), Data Burst Size Marking Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], Time to Next Burst Support Indication as described in clause 6.1.3.27.5 of TS 23.503 [20], updated information for the Multi-modal Service Requirements information as described in clause 6.1.3.27.3 of TS 23.503 [20].

Only applicable for a Multi-member AF session: a list of UE addresses (as described in clause 4.15.6.13), Consolidated Data Rate Threshold, a list of UE addresses subject to Consolidated Data Rate monitoring.

NOTE 1: In this Release, when a list of UE addresses is provided, the Flow description information is common for all UE addresses in the list. Further details are described in clause 4.15.6.13.2.

NOTE 2: If Consolidated Data Rate Threshold is provided, the QoS Monitoring parameter(s) indicates the Guaranteed Bitrate shall be provided.

NOTE 3: When the AF request is for Consolidated Data Rate monitoring is set for event reporting, the QoS Flow data rate reporting for the list of UE addresses is provided to the AF by the NEF only when the Consolidated Data Rate threshold is exceeded.

NOTE 4: When the Consolidated Data Rate threshold is provided, it applies to the list of UE addresses by default. However, if the list of UE addresses subject for Consolidated Data Rate monitoring is also provided, then such list has to be the subset of the list of UE addresses.

NOTE 5: If AF wants to terminate the Consolidated Data Rate monitoring, AF does not include the Consolidated Data Rate threshold in the AF request.

**Outputs, Required:** Success or Failure. Failure Cause in case of Failure, Transaction Reference ID if a list of UE is targeted.

**Output (optional):** None.

*NEXT CHANGE (9)—merged from S2-2411413*

##### 5.2.7.3.2 Nnrf\_NFDiscovery\_Request service operation

**Service operation name:** Nnrf\_NFDiscovery\_Request

**Description:** provides the IP address or FQDN of the expected NF instance(s) and if present in NF profile, the Endpoint Address(es) of NF service instance(s) to the NF service consumer or SCP.

**Inputs, Required:** one or more target NF service Name(s), NF type of the target NF, NF type of the NF service consumer.

If the NF service consumer intends to discover an NF service producer providing all the standardized services, it provides a wildcard NF service name.

**Inputs, Optional:**

- S-NSSAI and the associated NSI ID (if available), DNN, target NF/NF service PLMN ID (or realm in the case of network specific identifier type SUCI/SUPI, see clause 4.17.5a), NRF to be used to select NFs/services within HPLMN or Credentials Holder, Serving PLMN ID (or PLMN ID and NID in the case of SNPN, see clause 4.17.5a), the NF service consumer ID, preferred target NF location, TAI.

NOTE 1: For network slicing the NF service consumer ID is a required input.

- FQDN for the S5/S8 interface of the SMF+PGW-C, to discover the N11/N16 interface of the SMF+PGW-C in the case of EPS to 5GS mobility.

- If the target NF stores Data Set(s) (e.g. UDR, BSF): SUPI, GPSI, IMPI, IMPU, Data Set Identifier(s). (UE) IPv4 address, IP domain or (UE) IPv6 Prefix.

NOTE 2: GPSI is relevant for BSF.

NOTE 3: If the request includes a subscriber identifier the NRF may need to use the association between the supplied subscriber identifier and the appropriate NF Group ID as described in clause 6.3.1 of TS 23.501 [2] to determine the applicable set of NF instances for the response.

NOTE 4: The (UE) IPv4 address or (UE) IPv6 Prefix is provided for BSF discovery: in that case the NRF looks up for a match within one of the Range(s) of (UE) IPv4 addresses or Range(s) of (UE) IPv6 prefixes provided by BSF(s) as part of the invocation of Nnrf\_NFManagement\_NFRegister operation. The NRF is not meant to store individual (UE) IPv4 addresses or (UE) IPv6 prefixes.

- If the target NF is UDM or AUSF, the request may include the UE's Routing Indicator, or the UE's Routing Indicator and Home Network Public Key identifier.

- If the target UDM or NF is AUSF, the request may include the UE's HNI: PLMN ID in the case of PLMN, PLMN ID + NID in the case of SNPN. Optionally, some NFs may additionally include a Home Network Identifier in the form of a realm e.g. in the case of access to an SNPN using credentials owned by CH with AAA Server or in the case of SNPN Onboarding using a DCS with AAA Server.

- If the target NF is NSSAAF, the request may include Home Network Identifier in the form of a realm e.g. in the case of access to an SNPN using credentials owned by CH with AAA Server or in the case of SNPN Onboarding using credentials from a DCS with AAA Server.

- If the target NF is AMF and the consumer NF is MB-SMF for broadcast service, the request includes TAI(s) (see clause 7.3 of TS 23.247 [78]).

- If the target NF is AMF and the consumer NF is other than MB-SMF, the request may include:

- AMF region, AMF Set, GUAMI and Target TAI(s).

- If the target NF is UDR or UDM or AUSF or PCF or BSF, the request may include UDR Group ID or UDM Group ID or AUSF Group ID or PCF Group ID or BSF Group ID respectively.

NOTE 5: It is assumed that the corresponding NF service consumer is either configured with the corresponding Group ID or it received it via earlier Discovery output.

- If the target NF is UDM, the request may include SUPI, GPSI, Internal Group ID and External Group ID.

- If the target NF is UPF, the request may include SMF Area Identity, UE IPv4 Address/IPv6 Prefix, supported ATSSS steering functionality, supported MoQ Relay functionality, the supported UPF event exposure service, the supported Event IDs that can be subscribed, supported operator configurable UPF capabilities, support of NAT information exposure functionality and support of IP or MAC filter-based packet detection functionality. And if UPF can expose NAT information, the UE IPv4 address/IPv6 Prefix seen by the DN (e.g. a Public IP address).

NOTE 6: If UE's IPv4 address or IPv6 Prefix is provided for UPF discovery, then the NRF looks up for a match within one of the Range(s) of IPv4 addresses or IPv6 prefixes provided by UPF in the NF profile at the invocation of Nnrf\_NFManagement\_NFRegister operation. The NRF is not meant to store the UE's individual IPv4 addresses or IPv6 prefixes.

NOTE 7: Discovering UPF at PDU Session Establishment time and creating the N4 association assumes full connectivity between SMF and UPFs.

- If the target NF is CHF, the request may include SUPI or GPSI as specified in TS 32.290 [42].

- If the target NF is PCF or SMF, the request may include the MA PDU Session capability to indicate that a NF instance supporting MA PDU session capability is requested.

- If the target NF is PCF, the request may include the DNN replacement capability to indicate that a NF instance supporting DNN replacement capability is preferred.

- If the target NF is PCF or SMF, the request may include the slice replacement capability to indicate that a NF instance supporting slice replacement capability is preferred.

- If the target NF is PCF, the request may include the 5G ProSe Capability as specified in TS 23.304 [77].

- If the target NF is PCF, the request may include the V2X capability as specified in TS 23.287 [73].

- If the target NF is PCF, the request may include the A2X capability as specified in TS 23.256 [80].

- If the target NF is PCF, the request may include the URSP delivery in EPS capability.

- If the target NF is PCF, the request may include the Ranging/SL Positioning Capability as specified in TS 23.586 [88].

- If the target NF is NWDAF, the request may include:

- Analytics ID(s) (possibly per service).

- TAI(s).

- Analytics aggregation capability and/or Analytics metadata provisioning capability.

- A Real-Time Communication Indication per Analytics ID, NF Set ID and NF Type of the NF data sources.

- Roaming exchange capability if data/analytics exchange between PLMNs is needed.

- The S-NSSAI(s), Area(s) of Interest of the Trained ML Model required and NF consumer information when the target is an NWDAF containing MTLF.

- For HFL, required FL capability type (i.e. FL server, FL client, if available) and Time period of interest when the target is an NWDAF containing MTLF with HFL capability. When the target is an NWDAF containing MTLF with HFL client capability, NF Set ID(s) of data source and NF type(s) where data can be collected as input for local model training may be included.

- Required VFL capability type (i.e. VFL server, VFL client, if available) and optional Time period of interest when the target is an NWDAF containing MTLF with VFL capability. When the VFL capability type indicates VFL client, the NWDAF also includes the VFL interoperability indicator, per Analytics ID and optionally supported Feature IDs.

- If the target NF is NWDAF containing MTLF with ML Model Accuracy checking capability, it includes ML Model Accuracy checking capability for ML model Accuracy Monitoring (see clause 5.2 of TS 23.288 [50]).

- If the target NF is NWDAF containing AnLF with Analytics Accuracy checking capability, it includes Analytics Accuracy checking capability for Analytics Accuracy Monitoring (see clause 5.2 of TS 23.288 [50]).

Details about NWDAF discovery and selection are described in clause 6.3.13 of TS 23.501 [2].

NOTE 8: Analytics metadata provisioning capability is only applicable when NF service consumer is NWDAF.

NOTE 9: NF consumer information such as vendor ID is defined in stage 3.

- If target NF is ADRF, the request may include:

- Data and analytics storage and retrieval capability.

- ML model storage and retrieval capability.

Details about ADRF discovery and selection are described in clause 6.3.20 of TS 23.501 [2].

- If the target NF is HSS, the request may include IMPI and/or IMPU and/or HSS Group ID.

- If the NF service consumer needs to discover NF service producer instance(s) within an NF instance, the request includes the target NF Instance ID and NF Service Set ID of the producer.

- If the NF service consumer needs to discover NF service producer instance(s) in an equivalent NF Service Set within an NF Set, the request includes the identification of the equivalent NF service Set and NF Set ID of producer.

NOTE 10: TS 29.510 [37] specifies the mechanism to identify equivalent NF Service Sets.

- If the NF service consumer needs to discover NF service producer instance(s) in the NF Set, the request includes the target NF Set ID of the producer.

- If the target NF is SMF, the request may include:

- the UE location (TAI); or

- information about the location or serving scope of SMF (operator specific information, e.g. geographical location, data centre) considering UE location; or

- TAI list.

- If the target NF is P-CSCF, the request may include UE location information, UE IP address/IP prefix, Access Type.

- If the target NF is NEF, the request may include Event ID(s) provided by AF and optional AF identification as described in clause 6.2.2.3 of TS 23.288 [50]. The request may also include required AF's VFL capability type (i.e. VFL client, if available), optional Time Period of Interest, per Analytics ID, VFL interoperability indicator, per Analytics ID, optionally supported Feature IDs and Service Area. When the consumer is an AF, the request may include an External Identifier, External Group Identifier, or a domain name. If the target NF is local NEF, the request may include the parameters of list of supported TAI or list of supported DNAI additionally.

- If the target NF is SMF, the request may include the Control Plane CIoT 5GS Optimisation Indication or User Plane CIoT 5GS Optimisation Indication.

- If the target NF is a NSACF, the request may include the S-NSSAI(s) of the PLMN or SNPN where the NSACF is located , the NSAC Service Area Identifier and NSACF service capability. Details about NSACF discovery and selection are described in clause 6.3.22 of TS 23.501 [2].

- If the target NF is SCP, the request may include information about:

- SCP domain(s).

- Remote PLMN reachable through SCP.

- Endpoint addresses or Address Domain(s) (e.g. IP Address or FQDN ranges) accessible via the SCP.

- NF sets of NFs served by the SCP.

- If the target NF is MB-SMF, the request may include UE location (i.e. TAI), MBS Session ID and Area Session ID. Details about MB-SMF discovery and selection are described in TS 23.247 [78].

- If the target NF is 5G DDNMF, the request may include SUPI, IP Address or FQDN of 5G DDNMF.

- If the target NF is DCCF, the request may include TAI(s), NF type of the NF data sources, NF Set ID of the NF data sources, support for relocation of data subscription. Details about DCCF discovery and selection are described in clause 6.3.19 of TS 23.501 [2].

- If the target NF is EASDF, the request may include S-NSSAI, DNN, N6 IP address of the PSA UPF, Supported DNS security protocols, location as per NF profile and DNAI(if exist). Details about EASDF discovery and selection are described in clause 6.3.23 of TS 23.501 [2].

- If the target NF is AMF, the request may include the support of SNPN Onboarding to indicate whether the target NF instance supports SNPN Onboarding or not.

- If the target NF is SMF, the request may include the support of User Plane Remote Provisioning to indicate whether the target NF instance supports User Plane Remote Provisioning or not as described in clause 5.30.2.10.4.3 of TS 23.501 [2].

- If the target NF is NEF, the request may include the support of UAS NF functionality, the capability to support Multi-member AF session with required QoS and the capability to support member UE selection assistance functionality.

- If the target NF is NSSAAF, the request may include SUPI or Internal Group ID.

- If the target NF is DCSF, the request may include IMPU of calling party, SIP URI or Tel URI of called party.

- If the target NF is MF, the request may include the list of required data channel media capabilities or MF location information as specified in TS 23.228 [55].

- If the target NF is IMS AS, the request may include the list of supported IMS DC events.

- If the target NF is MRF or MRFP, it includes the list of required IMS media services (as defined in TS 23.228 [55]).

- If the target NF is in another PLMN or domain, the request may include an indication of "support of the indirect communication with delegated discovery with NF selection at target domain feature" and/or an indication of "support of indirect communication without delegated discovery with NF selection at target domain feature".

**Outputs, Required:**

- One of the following:

- A set of NF instance profiles; or

- an indication that "indirect communication with delegated discovery with NF selection at target domain is requested"; or

- an indication that "indirect communication without delegated discovery with NF selection at target domain is requested" together with a set of NF instance profiles;

- a validity period for the discovery result.

The set of NF instance profiles shall contain per NF Instance: NF type, NF instance ID, FQDN or IP address(es) of the NF instance and if applicable, a list of services instances, where each service instance has a service name, a NF service instance ID and optionally Endpoint Address(es)

Endpoint Address(es) may be a list of IP addresses or an FQDN for the NF service instance.

NOTE 11: SCPs does not have any service instances.

**Outputs, Optional:** Per NF instance, other information in the NF profile listed in clause 6.2.6 of TS 23.501 [2] related to the NF instance, such as:

- NF load information.

- NF capacity information.

- NF priority information.

- If the target NF stores Data Set(s) (e.g. UDR): Range(s) of SUPIs, range(s) of GPSIs, range(s) of external group identifiers, Data Set Identifier(s). If the target NF is BSF or P-CSCF: Range(s) of (UE) IPv4 addresses or Range(s) of (UE) IPv6 prefixes, Range(s) of SUPIs, range(s) of GPSIs.

NOTE 12: Range of SUPI(s) is limited in this release to a SUPI type of IMSI as defined in TS 23.003 [33].

- If the target NF is UDM, UDR, PCF, BSF or AUSF, they can include UDM Group ID, UDR Group ID, PCF Group ID, BSF Group ID, AUSF Group ID respectively.

- If the target NF is HSS, it can include HSS Group ID.

- For UDM and AUSF, Routing Indicator, or Routing Indicator and Home Network Public Key identifier.

- If the target NF is AMF, it includes list of GUAMI(s). In addition, it may include list of GUAMI(s) for which it can serve as backup for failure/maintenance.

- If the target NF is CHF, it includes primary CHF instance and the secondary CHF instance pair(s), if configured in CHF instance profile.

- For the UPF Management: UPF Provisioning Information as defined in clause 4.17.6.

- S-NSSAI(s) and the associated NSI ID(s) (if available).

- Information about the location or serving scope of the target NF (operator specific information, e.g. geographical location, data centre).

- TAI(s).

- PLMN ID.

- If the target is PCF or SMF, it includes the MA PDU Session capability to indicate if the NF instance supports MA PDU session or not.

- If the target is PCF, it includes the DNN replacement capability to indicate if the NF instance supports DNN replacement or not.

- If the target NF is NWDAF, it may include:

- Analytics ID(s) (possibly per service).

- NF Set ID and NF Type of the NF data sources, if available, NWDAF Serving Area information.

- Analytics aggregation capability and/ or Analytics metadata provisioning capability, if such capability is provided by the NWDAF.

- Supported Analytics Delay per Analytics ID.

- If the target NF is NWDAF, it may also include the ML model Filter information parameters S-NSSAI(s) and Area(s) of Interest for the trained ML model(s) per Analytics ID(s) and ML Model Interoperability indicator per Analytics ID(s), if available (see clause 5.2 of TS 23.288 [50]).

- If the target NF is NWDAF with FL capability, it may also include FL capability information per analytics ID containing FL capability type (i.e. FL server and/or FL client, if available) and Time interval supporting FL, if available (see clause 5.2 of TS 23.288 [50]).

- If the target NF is NWDAF with the VFL capability, it may include VFL capability information per Analytics ID containing VFL capability type (i.e. VFL server, VFL client, or both, if available) and optional Time interval supporting VFL, if available. When the VFL capability type indicates VFL client, the NWDAF also includes the VFL interoperability indicator, per Analytics ID and optionally supported Feature IDs (see clause 5.2 of TS 23.288 [50]).

Details about NWDAF specific information are described in clause 6.3.13 of TS 23.501 [2].

NOTE 13: The Supported Analytics Delay is provided for an Analytics ID only when the NRF had received Real-Time Communication Indication for this Analytics ID in the NWDAF discovery request.

- If the target is a trusted AF, it includes one or multiple combination(s) of the S-NSSAI and DNN corresponding to the AF. In addition, it may include supported Application Id(s), Event ID(s) supported by the AF and Internal-Group Identifier.

- NF Set ID.

- NF Service Set ID.

- If the target NF is SMF, it may include the SMF(s) Service Area.

NOTE 14: If neither SMF Service Area nor serving scope of SMF is provided, the AMF assumes that the SMF can serve the whole PLMN.

- If the target NF is P-CSCF, it includes P-CSCF FQDN(s) or IP address(es) and optional Access Type(s) associated with each P-CSCF.

- If the target NF is NEF, it may include Event ID(s) provided by AF and/or it may include AF's VFL capability type (i.e. VFL client, if available) and optional Time Period of Interest, per Analytics ID, VFL interoperability indicator, per Analytics ID, optionally supported Feature IDs, Service Area and/or it includes one or multiple combination(s) of the S-NSSAI and DNN corresponding to the untrusted AF served by the NEF.

- SCP domain the NF belongs to.

NOTE 15: Only one SCP domain is registered in NF profile for an NF.

- If the target is SCP:

- SCP domain(s).

- Remote PLMNs reachable through SCP.

- Endpoint addresses or Address Domain(s) (e.g. IP Address or FQDN ranges) accessible via the SCP.

- NF sets of NFs served by the SCP.

- If the target NF is 5G DDNMF, it may include IP Address or FQDN of 5G DDNMF.

- If the target NF is MB-SMF, it may include the MBS Session ID(s), Area Session ID(s), corresponding MBS service area(s) as described in TS 23.247 [78].

- If the target NF is DCCF, it includes DCCF serving area information, NF type of the NF data sources, NF Set ID of the NF data sources, support for relocation of data subscription. Details about DCCF specific information are described in clause 6.3.19 of TS 23.501 [2].

- If an indication that "indirect communication with delegated discovery with NF selection at target domain is requested" or an "indication that "indirect communication without delegated discovery with NF selection at target domain is requested" is provided, optionally:

- an indication that the reply applies to all NF types; and/or

- the address of an SCP where to send the request.

- If the target NF is UPF with MoQ Relay functionality, it may include IP address(es) of MoQ Relay in the UPF.

See clause 4.17.4 and 4.17.5 for details on the usage of this service operation.

*NEXT CHANGE (all new text)(10) from S2-2411705*

# Annex X (normative): Transmission of media related information for end-to-end encrypted traffic

# X.1 Use of connect-udp

When the traffic is UDP and encrypted end-to-end, the UPF may be configured by the SMF to establish a connection to an HTTP/3 AS proxy using connect-udp according to RFC 9298 [xx], acting as an HTTP/3 client configured to use a UDP proxy.

When an uplink packet is received at the UPF and the packet matches an N4 rule with On-path N6 connection information, if not already established, the UPF sets up a connection using the On-path N6 connection information received from SMF. UPF may use the same or different QUIC connections for different UEs depending on implementation.

The AS may then provide media related information (as defined in clause 5.37.9 of TS 23.501 [2]) together with the UDP media packets within datagrams (as defined in clause 5.37.9.3, and 5.37.9.4 of TS 23.501 [2]).



**Figure X.1.1-1: Use of connect-udp for transmission of media related information**

1. An AF uses Nnef\_AFsessionWithQoS or Npcf\_PolicyAuthorization\_Create service operation that may provide QoS information and On-path N6 Signaling Information indicating support for connect-udp protocol to set up On-path N6 connection and deliver media related information, together with the corresponding AS proxy address. If the AF also includes Protocol Description indicating the use of UDP-Option to deliver media related information, the UDP media packets and media related information carried in UDP-Option are delivered over On-path N6 connection.
2. The PCF issues the corresponding PCC rules with the On-path N6 Signaling Information for the impacted PDU sessions as defined in clause 6.1.3.27 of TS 23.503 [3]. The Protocol Description may be also included as described in clause 5.37.9.4 of 23.501 [2].
3. Based on the received PCC rules and/or on local policies, the SMF configures the PSA UPF with N4 rules including the following information:

- In the uplink direction, PDR rules are used to detect the UDP traffic subject to usage of connect-UDP and linked to FAR rules with the On-path N6 connection information.

- In the downlink direction, PDR rules are used to detect the UDP traffic flows. The Protocol Description in the PDR may optionally indicate the use of UDP-Option. QER rules are used to associate the PDRs with proper QoS related marking (e.g. including PDU set marking as defined in clause 5.37.5 and clause 5.37.9 of TS 23.501 [2]),

1. The SMF configures UE, NG-RAN and UPF with the QoS information derived from the PCC rules as defined in clause 4.3.3.2
2. The UE starts sending end-to-end traffic subject to usage of connect-udp
3. UPF matches this traffic with PDR rules linked to FARs with On-path N6 connection information.
4. If a corresponding QUIC connection with a corresponding AS proxy is not already set up, the UPF establishes it.
5. The UPF sends a HTTP/3 Connect request with connect-udp to the AS proxy using the Connect-UDP address of the AS proxy in the N4 rule, and the target address and port are the destination IP address and port of the received uplink packet. If UPF decides to use the same QUIC connection for different UEs, it opens a different QUIC stream for each UE and sends the CONNECT request to the AS proxy over the corresponding stream. If the traffic is carried over QUIC, UPF may offer the AS proxy to use the Forwarded Mode in draft-ietf-masque-quic-proxy [yy] and negotiate (as defined in TS 33.501) the security to be used for the exchange of media related information. In the case where the same QUIC connection is used for different UEs, different Connection ID to Virtual Connection ID mappings are used for different end-to-end connections in the Forwarded Mode, as described in draft-ietf-masque-quic-proxy [yy]. If the UPF is configured with Protocol Description for using UDP-Option in outer UDP datagram for transferring media related information, UPF offers the AS proxy to use the connect-udp in tunnel mode and negotiate (as defined in TS 33.501) the security to be used for the exchange of media related information carried in the UDP-Option, as described in [ss].
6. The AS proxy responds to the HTTP Connect and agrees on the associated security for the exchange of media related information using DL HTTP datagram, Forwarded Mode datagram if accepting the proposed Forwarded Mode, or UDP-Option in outer UDP datagram if accepting the proposed UDP-Option (as defined in clause 5.37.9.3, and 5.37.9.4 of TS 23.501 [2]).

Editor’s Note: Security aspects of the transmission of media related information will be specified by SA3.

1. The AS proxy inserts media related information together with the DL UDP media packets within HTTP datagrams in tunneled mode (as specified in TS 29.561 [63]) or within Forwarded Mode datagrams resulting from a packet transform when using the forwarded mode, as specified in draft-ietf-masque-quic-proxy [yy] and in TS TS 29.561 [63] for the 3GPP specific packet transform. Alternatively, the AS proxy inserts media related information using UDP-Option, as specified in TS 29.561 [63], in outer UDP datagram together with the DL UDP media packets within inner UDP datagram.
2. The UPF extracts the UDP media packets and media related information from the HTTP datagrams in tunneled mode or obtains them through a packet transform in the Forwarded Mode, as specified in draft-ietf-masque-quic-proxy [yy]. When UDP-options is indicated in the Protocol Description obtains the UDP media packets from the inner UDP datagram and the media related information from the UDP-options in the outer UDP datagram, respectively.
3. The UPF sends the UDP media packets to the NG-RAN, adding the media related information in the GTP-U extension header, as specified clause 5.37 of TS 23.501 [2].

*END OF CHANGES*