**3GPP TSG-WG SA2 Meeting #154-AH-e *S2-2301039r34***

**Elbonia, January 16 – 20, 2023 (revision of S2-230xxxx)**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **4046** | **rev** | **-** | **Current version:** | **18.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network | **X** |

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|  |
| ***Title:***  | Support of PDU Set based handling |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, China Mobile, Lenovo, KDDI, Nokia, Nokia Shanghai Bell,OPPO,, InterDigital Inc. |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | XRM |  | ***Date:*** | 2023-01-09 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | PDU Set based handling and corresponding PDU Set level QoS parameters are concluded in TR 23.700-60 clause 8.4. This paper introduces the support of PDU Set based handling and QoS parameters in 5GS. |
|  |  |
| ***Summary of change:*** | Add support of PDU Set based handling. |
|  |  |
| ***Consequences if not approved:*** | PDU Set based handling is not supported. |
|  |  |
| ***Clauses affected:*** | 2, 5.7.1, 5.7.X(new), 5.8.2.4.2, 5.8.2.11.3, 5.8.2.11.6, 6.2.2, 6.2.3, 6.2.4, 6.2.5.0, 6.2.10, Annex X(new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* \* 1st 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 22.261: "Service requirements for next generation new services and markets; Stage 1".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 23.203: "Policies and Charging control architecture; Stage 2".

[5] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS); Stage 2".

[6] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface: Stage 3".

[7] IETF RFC 7157: "IPv6 Multihoming without Network Address Translation".

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

[9] IETF RFC 2131: "Dynamic Host Configuration Protocol".

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

[11] ITU‑T Recommendation I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[12] ITU‑T Recommendation Q.65: "The unified functional methodology for the characterization of services and network capabilities".

[13] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS): Stage 3".

[14] IETF RFC 3736: "Stateless DHCP Service for IPv6".

[15] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[16] 3GPP TS 22.173: "IMS Multimedia Telephony Service and supplementary services; Stage 1".

[17] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station in idle mode".

[18] 3GPP TS 23.167: "3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects; IP Multimedia Subsystem (IMS) emergency sessions".

[19] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[20] IETF RFC 7542: "The Network Access Identifier".

[21] 3GPP TS 23.002: "Network Architecture".

[22] 3GPP TS 23.335: "User Data Convergence (UDC); Technical realization and information flows; Stage 2".

[23] 3GPP TS 23.221: "Architectural requirements".

[24] 3GPP TS 22.153: "Multimedia priority service".

[25] 3GPP TS 22.011: "Service Accessibility".

[26] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[27] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description".

[28] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol Specification".

[29] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[30] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[31] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity; Stage 2".

[32] 3GPP TS 23.214: "Architecture enhancements for control and user plane separation of EPC nodes; Stage 2".

[33] 3GPP TS 22.101: "3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects; Service aspects; Service principles".

[34] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[35] 3GPP TS 33.126: "Lawful Interception Requirements".

[36] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[37] 3GPP TS 22.280: "Mission Critical Services Common Requirements (MCCoRe); Stage 1".

[38] 3GPP TS 23.379: "Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2".

[39] 3GPP TS 23.281: "Functional architecture and information flows to support Mission Critical Video (MCVideo); Stage 2".

[40] 3GPP TS 23.282: "Functional architecture and information flows to support Mission Critical Data (MCData); Stage 2".

[41] 3GPP TS 32.240: "Charging management; Charging architecture and principles".

[42] 3GPP TS 38.401: "NG-RAN Architecture description".

[43] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[44] IETF RFC 4960: "Stream Control Transmission Protocol".

[45] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".

[46] 3GPP TS 23.041: "Public Warning System".

[47] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[48] 3GPP TS 24.502: "Access to the 5G System (5GS) via non-3GPP access networks; Stage 3".

[49] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[50] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[51] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[52] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[53] Void.

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

[55] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".

[56] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

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

[58] 3GPP TS 29.510: "5G System: Network function repository services; Stage 3".

[59] 3GPP TS 29.502: "5G System: Session Management Services: Stage 3".

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

[61] 3GPP TS 23.380: "IMS Restoration Procedures".

[62] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[63] 3GPP TS 23.292: "IP Multimedia Subsystem (IMS) centralized services; Stage 2".

[64] 3GPP TS 23.222: "Functional architecture and information flows to support Common API Framework for 3GPP Northbound APIs".

[65] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes; Stage 3".

[66] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[67] 3GPP TS 32.290: "5G system; Services, operations and procedures of charging using Service Based Interface (SBI)".

[68] 3GPP TS 32.255: "5G Data connectivity domain charging; Stage 2".

[69] 3GPP TS 38.306: "NR; User Equipment -UE) radio access capabilities".

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[71] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[72] 3GPP TS 23.285: "Architecture enhancements for V2X services".

[73] IETF RFC 2865: "Remote Authentication Dial In User Service (RADIUS)".

[74] IETF RFC 3162: "RADIUS and IPv6".

[75] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)".

[76] 3GPP TS 26.238: "Uplink streaming".

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[78] International Telecommunication Union (ITU), Standardization Bureau (TSB): "Operational Bulletin No. 1156"; http://handle.itu.int/11.1002/pub/810cad63-en (retrieved October 5, 2018).

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[80] 3GPP TS 24.250: "Protocol for Reliable Data Service; Stage 3".

[81] IETF RFC 8684: "TCP Extensions for Multipath Operation with Multiple Addresses".

[82] IETF RFC 8803: "0-RTT TCP Convert Protocol".

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[84] 3GPP TS 23.316: "Wireless and wireline convergence access support for the 5G System (5GS)".

[85] WiFi Alliance Technical Committee, Hotspot 2.0 Technical Task Group: "Hotspot 2.0 (Release 2) Technical Specification".

[86] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[87] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

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[90] BBF TR-124 issue 5: "Functional Requirements for Broadband Residential Gateway Devices".

[91] BBF TR-101 issue 2: "Migration to Ethernet-Based Broadband Aggregation".

[92] BBF TR-178 issue 1: "Multi-service Broadband Network Architecture and Nodal Requirements".

[93] BBF TR-456 issue 2: "AGF Functional Requirements".

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Editor's note: The reference to BBF WT-457 will be revised when finalized by BBF.

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[96] Void.

[97] IEEE Std 802.1AB-2016: "IEEE Standard for Local and metropolitan area networks -- Station and Media Access Control Connectivity Discovery".

[98] IEEE Std 802.1Q-2018: "IEEE Standard for Local and metropolitan area networks--Bridges and Bridged Networks".

[99] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[100] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[101] 3GPP TS 29.274: "Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".

[102] 3GPP TS 23.632: "User Data Interworking, Coexistence and Migration; stage 2".

[103] 3GPP TS 29.563: "5G System (5GS); HSS services for interworking with UDM; Stage 3".

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

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[110] 3GPP TS 24.526: "User Equipment (UE) policies for 5G System (5GS); Stage 3".

[111] 3GPP TS 22.186: "Enhancement of 3GPP support for V2X scenarios; Stage 1".

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[114] 3GPP TS 32.256: "Charging Management; 5G connection and mobility domain charging; Stage 2".

[115] 3GPP TS 33.210: "Network Domain Security (NDS); IP network layer security".

[116] 3GPP TS 38.415: "PDU Session User Plane Protocol".

[117] 3GPP TS 24.535: "Device-side Time-Sensitive Networking (TSN) Translator (DS-TT) to network-side TSN Translator (NW-TT) protocol aspects; Stage 3".

[118] 3GPP TS 32.274: "Charging Management; Short Message Service (SMS) charging".

[119] 3GPP TS 23.008: "Organization of subscriber data".

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[121] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[122] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

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[124] 3GPP TS 33.535: "Authentication and Key Management for Applications based on 3GPP credentials in the 5G System (5GS)".

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[132] 3GPP TS 29.561: "5G System; Interworking between 5G Network and external Data Networks; Stage 3".

[133] 3GPP TS 29.513: "Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[134] 3GPP TS 23.558: "Architecture for enabling Edge Applications (EA)".

[135] 3GPP TS 26.501: "5G Media Streaming (5GMS); General description and architecture".

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[137] GSMA NG.116: "Generic Network Slice Template".

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[139] 3GPP TS 24.539: "5G System (5GS); Network to TSN translator (TT) protocol aspects; Stage 3".

[140] 3GPP TS 33.220: "Generic Authentication Architecture (GAA); Generic bootstrapping architecture".

[141] 3GPP TS 33.223: "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA) Push function".

[142] 3GPP TS 23.540: "Technical realization of Service Based Short Message Service; Stage 2".

[143] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[144] 3GPP TS 29.525: "5G System; UE Policy Control Service; Stage 3".

[145] 3GPP TS 29.505: "5G System; Usage of the Unified Data Repository Services for Subscription Data; Stage 3".

[146] IEEE Std P802.1Qdj-d0.3: "IEEE Draft Standard for Local and metropolitan area networks - Bridges and Bridged Networks - Amendment XX: Configuration Enhancements for Time-Sensitive Networking".

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[X1] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

[X2] IETF RFC 3711: "The Secure Real-time Transport Protocol (SRTP)".

[X3] IETF RFC 6184: "RTP Payload Format for H.264 Video".

[X4] IETF RFC 7798: "RTP Payload Format for High Efficiency Video Coding (HEVC)".

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[X6] IETF RFC 6190: "RTP Payload Format for Scalable Video Coding", May 2011.

[X7] draft-ietf-avtext-framemarking-13: "Frame Marking RTP Header Extension".

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

[X8] ITU-T Recommendation H.264: "Advanced video coding for generic audiovisual services".

[X9] ITU-T Recommendation H.265: "High efficiency video coding".

[X10] ITU-T Recommendation H.266: "Versatile video coding.

[X11] aomedia.org/av1: "AV1 Video Codec".

\* \* \* \* 2nd change \* \* \* \*

## 5.7 QoS model

### 5.7.1 General Overview

#### 5.7.1.1 QoS Flow

The 5G QoS model is based on QoS Flows. The 5G QoS model supports both QoS Flows that require guaranteed flow bit rate (GBR QoS Flows) and QoS Flows that do not require guaranteed flow bit rate (Non-GBR QoS Flows). The 5G QoS model also supports Reflective QoS (see clause 5.7.5).

The QoS Flow is the finest granularity of QoS differentiation in the PDU Session. A QoS Flow ID (QFI) is used to identify a QoS Flow in the 5G System. User Plane traffic with the same QFI within a PDU Session receives the same traffic forwarding treatment (e.g. scheduling, admission threshold). The QFI is carried in an encapsulation header on N3 (and N9) i.e. without any changes to the e2e packet header. QFI shall be used for all PDU Session Types. The QFI shall be unique within a PDU Session. The QFI may be dynamically assigned or may be equal to the 5QI (see clause 5.7.2.1).

Within the 5GS, a QoS Flow is controlled by the SMF and may be preconfigured, or established via the PDU Session Establishment procedure (see clause 4.3.2 of TS 23.502 [3]), or the PDU Session Modification procedure (see clause 4.3.3 of TS 23.502 [3].

Any QoS Flow is characterised by:

- A QoS profile provided by the SMF to the AN via the AMF over the N2 reference point or preconfigured in the AN;

- One or more QoS rule(s) and optionally QoS Flow level QoS parameters (as specified in TS 24.501 [47]) associated with these QoS rule(s) which can be provided by the SMF to the UE via the AMF over the N1 reference point and/or derived by the UE by applying Reflective QoS control; and

- One or more UL and DL PDR(s) provided by the SMF to the UPF.

Within the 5GS, a QoS Flow associated with the default QoS rule is required to be established for a PDU Session and remains established throughout the lifetime of the PDU Session. This QoS Flow should be a Non-GBR QoS Flow (further details are described in clause 5.7.2.7).

A QoS Flow is associated with QoS requirements as specified by QoS parameters and QoS characteristics.

NOTE: The QoS Flow associated with the default QoS rule provides the UE with connectivity throughout the lifetime of the PDU Session. Possible interworking with EPS motivates the recommendation for this QoS Flow to be of type Non-GBR.

A QoS Flow may be enabled with PDU Set based QoS handling as described in clause 5.37.x. For such QoS Flows, PDU Set specific QoS Parameters (see clause 5.7.x) are determined by the SMF and provided to the AN as part of the QoS profile.

###

\* \* \* \* 3rd change \* \* \* \*

### 5.7.x PDU Set QoS Parameters

### 5.7.x.1 General

PDU Set QoS Parameters are used to support PDU Set level handling in the NG-RAN. The following are the PDU Set specific QoS characteristics:

1. PDU Set Delay Budget.

2. PDU Set Error Rate.

3. PDU Set Integrated Handling Indication.Editor’s NOTE: Usage of PSIHI is FFS.

For a QoS Flow supporting PDU Set, the QoS Profile includes the PDU Set QoS Parameters described in this clause in addition to the PDU QoS Characteristics (see clause 5.7.3.1). The PCF determines the PDU Set QoS Parameters based on information provided by AF and/or local configuration. The PDU Set QoS parameters are sent to the SMF as part of PCC rule. The SMF sends them to NG-RAN as part of the QoS Profile.

If the NG-RAN receives PDU Set specific QoS Parameters and supports them, it shall apply PDU Set specific QoS Parameters as described in this clause (see clause 5.37.X).

Editor’s note: [XRM] The applicability and details of PDU Set handling in uplink direction is pending RAN WG’s progress.

#### 5.7.X.2 PDU Set Delay Budget

The PDU Set Delay Budget (PSDB) defines an upper bound for the delay that a PDU Set may experience for the transfer between the UE and the N6 termination point at the UPF, i.e. the duration between the reception time of the first PDU (at the N6 termination point for DL or the UE for UL) and the delivery time of last PDU of a PDU Set. PSDB applies to the DL PDU Set received by the UPF over the N6 interface, and to the UL PDU Set sent by the UE.

NOTE 1: To enable support for PSDB, it is assumed that there is a maximum duration threshold for inter arrival time between the first received PDU and the last received PDUs constituting a the PDU Set as per SLA or pre-configuration.PSDB is an optional parameter that may be provided by the PCF. The provided PSDB can be used by the NG-RAN to support the configuration of scheduling and link layer functions.

When PSDB is not available and/or maximum duration threshold is not met, NG-RAN may use the existing PDB parameter.

Editor's Note: The need for AN PSDB and definition of AN PSDB is FFS.

#### 5.7.X.3 PDU Set Error Rate

The PDU Set Error Rate (PSER) defines an upper bound for the rate of PDU Sets that have been processed by the sender of a link layer protocol (e.g. RLC in RAN of a 3GPP access) but that are not successfully delivered by the corresponding receiver to the upper layer (e.g. PDCP in RAN of a 3GPP access). Thus, the PSER defines an upper bound for a rate of non-congestion related packet losses. The purpose of the PSER is to allow for appropriate link layer protocol configurations (e.g. RLC and HARQ in RAN of a 3GPP access).

NOTE1: In this release, a PDU Set is considered as successfully delivered only when all PDUs of a PDU Set are delivered successfully.

A QoS Flow is associated with only one PDU Set Error Rate. The value of the PDU Set Error Rate is the same in UL and DL.

Editor’s Note: it is FFS how to count PSER when a PDU Set cannot meet PSDB with regard the maximum duration threshold is met or not.

#### 5.7.X.4 PDU Set Integrated Handling Indication

The PDU Set Integrated Handling Indication (PSIHI) indicates that whether all PDUs are needed for the usage of the PDU Set by the application layer in the receiver side.

\* \* \* \* 4th change \* \* \* \*

##### 5.8.2.4.2 Traffic Detection Information

The SMF controls the traffic detection at the UP function by providing detection information for every PDR.

For IPv4 or IPv6 or IPv4v6 PDU Session type, detection information is a combination of:

- CN tunnel info.

- Network instance.

- QFI.

- IP Packet Filter Set as defined in clause 5.7.6.2.

- Application Identifier: The Application Identifier is an index to a set of application detection rules configured in UPF.

For Ethernet PDU Session type, detection information is a combination of:

- CN tunnel info.

- Network instance.

- QFI.

- Ethernet Packet Filter Set as defined in clause 5.7.6.3.

In this Release of the specification for Unstructured PDU Session Type, the UPF does not perform-QoS Flow level traffic detection for QoS enforcement.

Traffic detection information sent by the SMF to the UPF for a PDU Session may be associated with Network instance for detection and routing of traffic over N6. In the case of IP PDU Session Type, Network Instances can e.g. be used by the UPF for traffic detection and routing in the case of different IP domains or overlapping IP addresses. In the case of Ethernet PDU Session Type, different Network Instances can e.g. be configured in the UPF with different ways to handle the association between N6 and the PDU Sessions.

UPF may identify the PDU Sets, derive the PDU Set Information for DL XRM traffics and send them to RAN via DL GTP-U header of each PDU identified as belonging to a PDU Set based on SMF instruction. The PDU Set Information, is described in clause 5.37.X. The identification can be done by UPF implementation or by detecting RTP/SRTP header or payload as described in Annex X.

\* \* \* \* 5th change \* \* \* \*

##### 5.8.2.11.3 Packet Detection Rule

The following table describes the Packet Detection Rule (PDR) containing information required to classify a packet arriving at the UPF. Every PDR is used to detect packets in a certain transmission direction, e.g. UL direction or DL direction.

Table 5.8.2.11.3-1: Attributes within Packet Detection Rule

|  |  |  |
| --- | --- | --- |
| Attribute | Description | Comment |
| N4 Session ID | Identifies the N4 session associated to this PDR. NOTE 5. |  |
| Rule ID | Unique identifier to identify this rule. |  |
| Precedence | Determines the order, in which the detection information of all rules is applied. |  |
| Packet  | Source interface | Contains the values "access side", "core side", "SMF", "N6-LAN", "5G VN internal". | Combination of UE IP address (together with Network instance, if necessary), CN tunnel info, |
| Detection | UE IP address  | One IPv4 address and/or one IPv6 prefix with prefix length (NOTE 3). | packet filter set, application identifier, Ethernet PDU Session |
| Information.NOTE 4. | Network instance (NOTE 1) | Identifies the Network instance associated with the incoming packet. | Information and QFI are used for traffic detection.Source interface identifies the |
|  | CN tunnel info | CN tunnel info on N3, N9 interfaces, i.e. F-TEID. | interface for incoming packets |
|  | Packet Filter Set | Details see clause 5.7.6. | where the PDR applies, e.g. from access side (i.e. up-link), |
|  | Application identifier |  | from core side (i.e. down-link), |
|  | QoS Flow ID | Contains the value of 5QI or non-standardized QFI. | from SMF, from N6-LAN (i.e. the |
|  | Ethernet PDU Session Information | Refers to all the (DL) Ethernet packets matching an Ethernet PDU session, as further described in clause 5.6.10.2 and in TS 29.244 [65]. | DN), or from "5G VN internal" (i.e. local switch). |
|  | Framed Route Information | Refers to Framed Routes defined in clause 5.6.14. | Details like all the combination possibilities on N3, N9 interfaces are left for stage 3 decision. |
| Packet replication and detection carry on information | Packet replication skip information NOTE 7 | Contains UE address indication or N19/N6 indication. If the packet matches the packet replication skip information, i.e. source address of the packet is the UE address or the packet has been received on the interface in the packet replication skip information, the UP function neither creates a copy of the packet nor applies the corresponding processing (i.e. FAR, QER, URR). Otherwise the UPF performs a copy and applies the corresponding processing (i.e. FAR, QER, URR). |  |
| NOTE 6 | Carry on indication | Instructs the UP function to continue the packet detection process, i.e. lookup of the other PDRs. |  |
| Outer header removal | Instructs the UP function to remove one or more outer header(s) (e.g. IP+UDP+GTP, IP + possibly UDP, VLAN tag), from the incoming packet. | Any extension header shall be stored for this packet.  |
| Forwarding Action Rule ID (NOTE 2) | The Forwarding Action Rule ID identifies a forwarding action that has to be applied. |  |
| Multi-Access Rule ID (NOTE 2) | The Multi-Access Rule ID identifies an action to be applied for handling forwarding for a MA PDU Session. |  |
| List of Usage Reporting Rule ID(s) | Every Usage Reporting Rule ID identifies a measurement action that has to be applied. |  |
| List of QoS Enforcement Rule ID(s) | Every QoS Enforcement Rule ID identifies a QoS enforcement action that has to be applied. |  |
| Protocol Description | Protocol Description | Indicates service protocol used by the flow e.g. H.264/RTP, SRTP (NOTE 8). |  |
| NOTE 1: Needed e.g. if: - UPF supports multiple DNN with overlapping IP addresses; - UPF is connected to other UPF or AN node in different IP domains. - UPF "local switch", N6-based forwarding and N19 forwarding is used for different 5G LAN groups.NOTE 2: Either a FAR ID or a MAR ID is included, not both.NOTE 3: The SMF may provide an indication asking the UPF to allocate one IPv4 address and/or IPv6 prefix. When asking to provide an IPv6 Prefix the SMF provides also an IPv6 prefix length.NOTE 4: When in the architecture defined in clause 5.34, a PDR is sent over N16a from SMF to I-SMF, the Packet Detection Information may indicate that CN tunnel info is to be locally determined. This is further defined in clause 5.34.6.NOTE 5: In the architecture defined in clause 5.34, the rules exchanged between I-SMF and SMF are not associated with a N4 Session ID but are associated with a N16a association.NOTE 6: Needed in the case of support for broadcast/multicast traffic forwarding using packet replication with SMF-provided PDRs and FARs as described in clause 5.8.2.13.3.2.NOTE 7: Needed in the case of packet replication with SMF-provided PDRs and FARs as described in clause 5.8.2.13.3.2, to prevent UPF from sending the broadcast/multicast packets back to the source UE or source N19/N6.NOTE 8: May be provided when PDU Set Identification marking applies to the PDR. |

\* \* \* \* 6th change \* \* \* \*

Editor’s Note: Whether the Protocol Description belongs to the existing Flow Description or is standalone IE is FFS

##### 5.8.2.11.6 Forwarding Action Rule

The following table describes the Forwarding Action Rule (FAR) that defines how a packet shall be buffered, dropped or forwarded, including packet encapsulation/decapsulation and forwarding destination.

Table 5.8.2.11.6-1: Attributes within Forwarding Action Rule

|  |  |  |
| --- | --- | --- |
| Attribute | Description | Comment |
| N4 Session ID | Identifies the N4 session associated to this FAR. | NOTE 9. |
| Rule ID | Unique identifier to identify this information. |  |
| Action | Identifies the action to apply to the packet | Indicates whether the packet is to be forwarded, duplicated, dropped or buffered.When action indicates forwarding or duplicating, a number of additional attributes are included in the FAR.For buffering action, a Buffer Action Rule is also included and the action can also indicate that a notification of the first buffered and/or a notification of first discarded packet is requested (see clause 5.8.3.2).For drop action, a notification of the discarded packet may be requested (see clause 5.8.3.2). |
| Network instance(NOTE 2) | Identifies the Network instance associated with the outgoing packet (NOTE 1). | NOTE 8. |
| Destination interface(NOTE 3)(NOTE 7) | Contains the values "access side", "core side", "SMF", "N6-LAN", "5G VN internal". | Identifies the interface for outgoing packets towards the access side (i.e. down-link), the core side (i.e. up-link), the SMF, the N6-LAN (i.e. the DN), or to 5G VN internal (i.e. local switch). |
| Outer header creation(NOTE 3) | Instructs the UP function to add an outer header (e.g. IP+UDP+GTP, VLAN tag), IP + possibly UDP to the outgoing packet. | Contains the CN tunnel info, N6 tunnel info or AN tunnel info of peer entity (e.g. NG-RAN, another UPF, SMF, local access to a DN represented by a DNAI) (NOTE 8).Any extension header stored for this packet shall be added.The time stamps should be added in the GTP-U header if QoS Monitoring is enabled for the traffic corresponding to the PDR(s). |
| Send end marker packet(s)(NOTE 2) | Instructs the UPF to construct end marker packet(s) and send them out as described in clause 5.8.1. | This parameter should be sent together with the "outer header creation" parameter of the new CN tunnel info. |
| Transport level marking(NOTE 3) | Transport level packet marking in the uplink and downlink, e.g. setting the DiffServ Code Point. | NOTE 8. |
| Forwarding policy(NOTE 3) | Reference to a preconfigured traffic steering policy or http redirection (NOTE 4). | Contains one of the following policies identified by a TSP ID:- an N6-LAN steering policy to steer the subscriber's traffic to the appropriate N6 service functions deployed by the operator, or- a local N6 steering policy to enable traffic steering in the local access to the DN according to the routing information provided by an AF as described in clause 5.6.7.or a Redirect Destination and values for the forwarding behaviour (always, after measurement report (for termination action "redirect")). |
| Request for Proxying in UPF | Indicates that the UPF shall perform ARP proxying and / or IPv6 Neighbour Solicitation Proxying as specified in clause 5.6.10.2. | Applies to the Ethernet PDU Session type. |
| Container for header enrichment(NOTE 2) | Contains information to be used by the UPF for header enrichment. | Only relevant for the uplink direction. |
| PDU Set information marking indication | Indicates UPF to mark the PDU Set information in the GTP-U header of the user plane packets.  | Only relevant for the downlink |
| Buffering Action Rule(NOTE 5) | Reference to a Buffering Action Rule ID defining the buffering instructions to be applied by the UPF(NOTE 6) |  |
| NOTE 1: Needed e.g. if: - UPF supports multiple DNN with overlapping IP addresses; - UPF is connected to other UPF or NG-RAN node in different IP domains; - UPF "local switch" and N19 forwarding is used for different 5G LAN groups.NOTE 2: These attributes are required for FAR action set to forwarding.NOTE 3: These attributes are required for FAR action set to forwarding or duplicating.NOTE 4: The TSP ID is preconfigured in the SMF, and included in the FAR according to the description in clauses 5.6.7 and 6.1.3.14 of 23.503 [45] for local N6 steering and 6.1.3.14 of 23.503 [45] for N6-LAN steering. The TSP ID action is enforced before the Outer header creation actions.NOTE 5: This attribute is present for FAR action set to buffering.NOTE 6: The buffering action rule is created by the SMF and associated with the FAR in order to apply a specific buffering behaviour for UL/DL packets requested to be buffered, as described in clause 5.8.3 and clause 5.2.4 of TS 29.244 [65].NOTE 7: The use of "5G VN internal" instructs the UPF to send the packet back for another round of ingress processing using the active PDRs pertaining to another N4 session of the same 5G VN group.NOTE 8: When in architectures defined in clause 5.34, a FAR is sent over N16a from SMF to I-SMF, the FAR sent by the SMF may indicate that the I-SMF is to locally determine the value of this attribute in order to build the N4 FAR rule sent to the actual UPF controlled by the I-SMF. This is further defined in clause 5.34.6.NOTE 9: In the architecture defined in clause 5.34, the rules exchanged between I-SMF and SMF are not associated with a N4 Session ID but are associated with a N16a association. |

\* \* \* \* 6th change \* \* \* \*

6.2.2 SMF

The Session Management function (SMF) includes the following functionality. Some or all of the SMF functionalities may be supported in a single instance of a SMF:

- Session Management e.g. Session Establishment, modify and release, including tunnel maintain between UPF and AN node.

- UE IP address allocation & management (including optional Authorization). The UE IP address may be received from a UPF or from an external data network.

- DHCPv4 (server and client) and DHCPv6 (server and client) functions.

- Functionality to respond to Address Resolution Protocol (ARP) requests and / or IPv6 Neighbour Solicitation requests based on local cache information for the Ethernet PDUs. The SMF responds to the ARP and / or the IPv6 Neighbour Solicitation Request by providing the MAC address corresponding to the IP address sent in the request.

- Selection and control of UP function, including controlling the UPF to proxy ARP or IPv6 Neighbour Discovery, or to forward all ARP/IPv6 Neighbour Solicitation traffic to the SMF, for Ethernet PDU Sessions.

- Configures traffic steering at UPF to route traffic to proper destination.

- 5G VN group management, e.g. maintain the topology of the involved PSA UPFs, establish and release the N19 tunnels between PSA UPFs, configure traffic forwarding at UPF to apply local switching, N6-based forwarding or N19-based forwarding.

- Termination of interfaces towards Policy control functions.

- Lawful intercept (for SM events and interface to LI System).

- Support for charging.

- Control and coordination of charging data collection at UPF.

- Termination of SM parts of NAS messages.

- Downlink Data Notification.

- Initiator of AN specific SM information, sent via AMF over N2 to AN.

- Determine SSC mode of a session.

- Support for Control Plane CIoT 5GS Optimisation.

- Support of header compression.

- Act as I-SMF in deployments where I-SMF can be inserted, removed and relocated.

- Provisioning of external parameters (Expected UE Behaviour parameters or Network Configuration parameters).

- Support P-CSCF discovery for IMS services.

- Act as V-SMF with following roaming functionalities:

- Handle local enforcement to apply QoS SLAs (VPLMN).

- Charging (VPLMN).

- Lawful intercept (in VPLMN for SM events and interface to LI System).

- Support for interaction with external DN for transport of signalling for PDU Session authentication/authorization by external DN.

- Instructs UPF and NG-RAN to perform redundant transmission on N3/N9 interfaces.

NOTE: Not all of the functionalities are required to be supported in an instance of a Network Slice.

In addition to the functionalities of the SMF described above, the SMF may include policy related functionalities as described in clause 6.2.2 of TS 23.503 [45].

In addition to the functionality of the SMF described above, the SMF may include the following functionality to support monitoring in roaming scenarios:

- Normalization of reports according to roaming agreements between VPLMN and HPLMN; and

- Generation of charging information for Monitoring Event Reports that are sent to the HPLMN.

The SMF may also include following functionalities to support Edge Computing enhancements (further defined in TS 23.548 [130]):

- Selection of EASDF and provision of its address to the UE as the DNS Server for the PDU session;

- Usage of EASDF services as defined in TS 23.548 [130];

- For supporting the Application Layer Architecture defined in TS 23.558 [134]: Provision and updates of ECS Address Configuration Information to the UE.

The SMF and SMF+ PGW-C may also include following functionalities to support Network Slice Admission Control:

- Support of NSAC for maximum number of PDU sessions as defined in clauses 5.15.11.2, 5.15.11.3 and 5.15.11.5.

- Support of NSAC for maximum number of UEs as defined in clauses 5.15.11.3 and 5.15.11.5.

- Support of PDU Set based QoS handling as described in clause 5.37.X.

6.2.3 UPF

The User plane function (UPF) includes the following functionality. Some or all of the UPF functionalities may be supported in a single instance of a UPF:

- Anchor point for Intra-/Inter-RAT mobility (when applicable).

- Allocation of UE IP address/prefix (if supported) in response to SMF request.

- External PDU Session point of interconnect to Data Network.

- Packet routing & forwarding (e.g. support of Uplink classifier to route traffic flows to an instance of a data network, support of Branching point to support multi-homed PDU Session, support of traffic forwarding within a 5G VN group (UPF local switching, via N6, via N19)).

- Packet inspection (e.g. Application detection based on service data flow template and the optional PFDs received from the SMF in addition).

- User Plane part of policy rule enforcement, e.g. Gating, Redirection, Traffic steering).

- Lawful intercept (UP collection).

- Traffic usage reporting.

- QoS handling for user plane, e.g. UL/DL rate enforcement, Reflective QoS marking in DL.

- Uplink Traffic verification (SDF to QoS Flow mapping).

- Transport level packet marking in the uplink and downlink.

- Downlink packet buffering and downlink data notification triggering.

- Sending and forwarding of one or more "end marker" to the source NG-RAN node.

- Functionality to respond to Address Resolution Protocol (ARP) requests and / or IPv6 Neighbour Solicitation requests based on local cache information for the Ethernet PDUs. The UPF responds to the ARP and / or the Ipv6 Neighbour Solicitation Request by providing the MAC address corresponding to the IP address sent in the request.

- Packet duplication in downlink direction and elimination in uplink direction in GTP-U layer.

- NW-TT functionality.

- High latency communication, see clause 5.31.8.

- ATSSS Steering functionality to steer the MA PDU Session traffic, refer to clause 5.32.6.

NOTE: Not all of the UPF functionalities are required to be supported in an instance of user plane function of a Network Slice.

- Inter PLMN UP Security (IPUPS) functionality, specified in clause 5.8.2.14.

- event exposure, including exposure of network information, i.e. the QoS monitoring information, as specified in clause 6.4 of TS 23.548 [130] and events as specified in clause 5.2.26.2 of TS 23.502 [3], and exposure of data collected for analytics, as specified in clause 5.2.26.2 of TS 23.502 [3].

- Support PDU Set Handling as defined in clause 5.37.X.

6.2.4 PCF

The Policy Control Function (PCF) includes the following functionality:

- Supports unified policy framework to govern network behaviour.

- Provides policy rules to Control Plane function(s) to enforce them.

- Accesses subscription information relevant for policy decisions in a Unified Data Repository (UDR).

- Support PDU Set Handling as defined in clause 5.37.X.

NOTE: The PCF accesses the UDR located in the same PLMN as the PCF.

The details of the PCF functionality are defined in clause 6.2.1 of TS 23.503 [45].

6.2.5 NEF

6.2.5.0 NEF functionality

The Network Exposure Function (NEF) supports the following independent functionality:

- Exposure of capabilities and events:

 NF capabilities and events may be securely exposed by NEF for e.g. 3rd party, Application Functions, Edge Computing as described in clause 5.13.

 NEF stores/retrieves information as structured data using a standardized interface (Nudr) to the Unified Data Repository (UDR).

- Secure provision of information from external application to 3GPP network:

 It provides a means for the Application Functions to securely provide information to 3GPP network, e.g. Expected UE Behaviour, 5G-VN group information, time synchronization service informationand PDU Set handling service specific information. In that case the NEF may authenticate and authorize and assist in throttling the Application Functions.

- Translation of internal-external information:

 It translates between information exchanged with the AF and information exchanged with the internal network function. For example, it translates between an AF-Service-Identifier and internal 5G Core information such as DNN, S-NSSAI, as described in clause 5.6.7.

 In particular, NEF handles masking of network and user sensitive information to external AF's according to the network policy.

- Redirecting the AF to a more suitable NEF/L-NEF e.g. when serving an AF request for local information exposure and detecting there is a more appropriate NEF instance to serve the AF's request.

- The Network Exposure Function receives information from other network functions (based on exposed capabilities of other network functions). NEF stores the received information as structured data using a standardized interface to a Unified Data Repository (UDR). The stored information can be accessed and "re-exposed" by the NEF to other network functions and Application Functions, and used for other purposes such as analytics.

- A NEF may also support a PFD Function: The PFD Function in the NEF may store and retrieve PFD(s) in the UDR and shall provide PFD(s) to the SMF on the request of SMF (pull mode) or on the request of PFD management from NEF (push mode), as described in TS 23.503 [45].

- A NEF may also support a 5G-VN Group Management Function: The 5G-VN Group Management Function in the NEF may store the 5G-VN group information in the UDR via UDM as described in TS 23.502 [3].

- Exposure of analytics:

 NWDAF analytics may be securely exposed by NEF for external party, as specified in TS 23.288 [86].

- Retrieval of data from external party by NWDAF:

 Data provided by the external party may be collected by NWDAF via NEF for analytics generation purpose. NEF handles and forwards requests and notifications between NWDAF and AF, as specified in TS 23.288 [86].

- Support of Non-IP Data Delivery:

 NEF provides a means for management of NIDD configuration and delivery of MO/MT unstructured data by exposing the NIDD APIs as described in TS 23.502 [3] on the N33/Nnef reference point. See clause 5.31.5.

- Charging data collection and support of charging interfaces.

- Support of UAS NF functionality:

 Details are defined in TS 23.256 [136].

- Support of EAS deployment functionality:

 Details are defined in TS 23.548 [130].

- Support of SBI-based MO SM transmit for MSISDN-less MO SMS:

 Details are defined in TS 23.540 [142].

- Support PDU Set Handling as defined in clause 5.37.X.

A specific NEF instance may support one or more of the functionalities described above and consequently an individual NEF may support a subset of the APIs specified for capability exposure.

NOTE: The NEF can access the UDR located in the same PLMN as the NEF.

The services provided by the NEF are specified in clause 7.2.8.

For external exposure of services related to specific UE(s), the NEF resides in the HPLMN. Depending on operator agreements, the NEF in the HPLMN may have interface(s) with NF(s) in the VPLMN.

When a UE is capable of switching between EPC and 5GC, an SCEF+NEF is used for service exposure. See clause 5.17.5 for a description of the SCEF+NEF.

\* \* \* \* 7th change \* \* \* \*

6.2.10 AF

The Application Function (AF) interacts with the 3GPP Core Network in order to provide services, for example to support the following:

- Application influence on traffic routing (see clause 5.6.7);

- Accessing Network Exposure Function (see clause 5.20);

- Interacting with the Policy framework for policy control (see clause 5.14);

- Time synchronization service (see clause 5.27.1.8);

- IMS interactions with 5GC (see clause 5.16);

- Support PDU Set Handling as defined in clause 5.37.X.

Based on operator deployment, Application Functions considered to be trusted by the operator can be allowed to interact directly with relevant Network Functions.

Application Functions not allowed by the operator to access directly the Network Functions shall use the external exposure framework (see clause 7.3) via the NEF to interact with relevant Network Functions.

The functionality and purpose of Application Functions are only defined in this specification with respect to their interaction with the 3GPP Core Network.

\* \* \* \* 8th change \* \* \* \*

Annex X (informative): PDU Set Identification for different service protocol information

## X.1 Introduction

The Annex X provides informative description on how PDU Set Information may be derived from different service protocol (RTP/SRTP header and payload).

Editor’s Note: The annex should focus on 5GC behaviour instead of RTP protocal itself, and the details are FFS.

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