**3GPP TSG-WG SA2 Meeting #165S2-240xxxx**

**Hyderabad, IN, 14th Oct – 18th Oct, 2024 (revision of S2-240xxxx)**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.501** | **CR** | **XXXX** | **rev** | **X** | **Current version:** | **19.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | MoQ-based PDU Set Information identification for encrypted traffic | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | XRM\_Ph2 | | | | |  | ***Date:*** | | | 2024-08-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | According to the TR conclusion for KI#2, the Media over QUIC should be supported in normative work. This CR implements the conclusion for Media over QUIC based solution. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Enchance Protocol Description with “MoQ Transport” 2. Add description for PDU set information identification based on MoQ relay in UPF. 3. Enchance UPF with MoQ relay functionality for UPF selection. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The conclusion of KI#2 is not implemented. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 3.2, 5.37.5.1, 5.37.5.2, 5.37.5.X(new), 6.2.3, 6.3.3.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* \* First change \* \* \* \*

# 2 References

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[193] IETF RFC 3168: "The Addition of Explicit Congestion Notification (ECN) to IP".

[194] 3GPP TS 33.503: "Security Aspects of Proximity based Services (ProSe) in the 5G System (5GS)".

[X] IETF draft-ietf-moq-transport: "Media over QUIC Transport".

Editor's note: References [X] cannot be formally referenced until published as RFC.

\* \* \* \* Second change \* \* \* \*

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

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MINT Minimization of Service Interruption

ML Machine Learning

MoQ Media Over QUIC

MPQUIC Multi-Path QUIC

MPS Multimedia Priority Service

MPTCP Multi-Path TCP Protocol

MTLF Model Training Logical Function

N3IWF Non-3GPP InterWorking Function

……

\* \* \* \* Third change \* \* \* \*

### 5.37.5 PDU Set based Handling

#### 5.37.5.1 General

A PDU Set is comprised of one or more PDUs carrying an application layer payload such as a video frame or video slice. The PDU Set based QoS handling by the NG-RAN is determined by PDU Set QoS Parameters in the QoS profile of the QoS Flow (specified in clause 5.7.7) and PDU Set Information provided by the PSA UPF via N3/N9 interface as described in clause 5.37.5.2. The PDU Set based Handling can be applied for GBR and non-GBR QoS Flows. The AF should provide PDU Set related assistance information for dynamic PCC control. One or more of the following PDU Set related assistance information may be provided to the NEF/PCF using the AF session with required QoS procedures in clauses 4.15.6.6 and 4.15.6.6a of TS 23.502 [3].

- PDU Set QoS Parameters as described in clause 5.7.7

- Protocol Description: Indicates the transport protocol used by the service data flow (e.g. RTP, SRTP) and information, e.g. the following:

- RTP [185] or SRTP [186];

- RTP or SRTP with RTP Header Extensions, including:

- RTP Header Extensions for PDU Set Marking as defined in TS 26.522 [179];

- Other RTP Header Extensions as defined RFC 8285 [189];

- RTP or SRTP without RTP Header Extensions, but together with RTP Payload Format (e.g. H.264 [187] or H.265 [188]);

- RTP or SRTP with RTP Header Extensions for PDU Set Marking as defined in TS 26.522 [179], and together with RTP Payload Format (e.g. H.264 [187] or H.265 [188]);

- RTP or SRTP with other RTP Header Extensions following RFC 8285 [189], and together with RTP Payload Format (e.g. H.264 [187] or H.265 [188]).

NOTE 1: With the Protocol Description options combining SRTP together with RTP Payload Format the UPF can still obtain some of the PDU Set information from the RTP Header (refer to Annex A of TS 26.522 [179]).

- MoQ Transport [X].

When RTP Header Extensions for PDU Set Marking (as defined in TS 26.522 [179] or other RTP header extensions as defined in RFC 8285 [189] is included, the differentiation between different RTP Header Extension Types should be supported.

When RTP Payload Format is included, the differentiation between different RTP Payload Formats should be supported.

NOTE 2: Multiplexing of different transport protocols and different media traffic for differentiated PDU Set based handling is not supported in the current Release.

The Protocol Description can be UL only, DL only or UL and DL. The Protocol Description for UL and DL traffic may be different.

AF provided PDU Set QoS Parameters and UL and/or DL Protocol Description may be used in determining the PCC Rule by the PCF as defined in clause 6.1.3.27.4 of TS 23.503 [45] and the DL Protocol Description may be used for identifying the PDU Set Information and PDU Set Information marking by the PSA UPF. In case of MoQ Transport [X] is used, AF may also provide MoQ server IP address, which is used by the PSA UPF to establish MoQ connection with MoQ server.

When the SMF receives the PCC rule, the SMF performs binding of the PCC rule to one QoS Flow as described in clause 6.1.3.2.4 of TS 23.503 [45]. At least one of the following shall be included in the PCC rule to enable PDU Set based handling: 1) a PSIHI and/or 2) both PSDB and PSER. Based on the PCC rule, the SMF adds the PDU Set QoS Parameters to the QoS Profile of the QoS Flow as described in clause 6.2.2.4 of TS 23.503 [45]. Alternatively, the SMF may be configured to support PDU Set based Handling without receiving PCC rules from a PCF. SMF may receive MoQ Server IP address from PCC rule and provide the MoQ server IP address to PSA UPF.

For the downlink direction, the PSA UPF identifies PDUs that belong to PDU Sets and marks them accordingly as described in clause 5.37.5.2. If the PSA UPF receives a PDU that does not belong to a PDU Set based on Protocol Description for PDU Set identification, then the PSA UPF still maps it to a PDU Set and determines the PDU Set Information as described in clause 5.37.5.2.

NOTE 3: If the PSA UPF receives a PDU that does not belong to a PDU Set, then it is assumed that the UPF determines the PDU Set Importance value based on pre-configuration.

For the uplink direction, the UE may identify PDU Sets, and how this is done is left up to UE implementation. The SMF may send the UL Protocol Description associated with the QoS rule to UE.

NOTE 4: Using the Protocol Description or not is left to UE implementation. The use of Protocol Description does not impact QoS Flow Mapping in the UE.

In this Release, the PDU Set based handling is supported in 5GS for UE registered in 3GPP access for single access PDU Session with IP PDU Session Type.

\* \* \* \* Fourth change \* \* \* \*

#### 5.37.5.2 PDU Set Information and Identification

To support PDU Set based QoS handling, the PSA UPF identifies PDUs that belong to a PDU Set and determines the below PDU Set Information and sends it to the NG-RAN in the GTP-U header. The PDU Set information is used by the NG-RAN for PDU Set based QoS handling as described above.

The PDU Set Information comprises:

- PDU Set Sequence Number.

- Indication of End PDU of the PDU Set.

- PDU Sequence Number within a PDU Set.

- PDU Set Size in bytes.

- PDU Set Importance, which identifies the relative importance of a PDU Set compared to other PDU Sets within a QoS Flow.

The NG-RAN may use the Priority Level (see clause 5.7.3.3) across QoS Flows and PDU Set Importance within a QoS Flow for PDU Set level packet discarding in presence of congestion.

NOTE 1: In addition to considering the PDU Set Importance within a QoS Flow, NG-RAN could also consider the relative PDU Set Importance across QoS Flows of the same Priority Level when determining which PDU Set needs to be discarded, which is up to implementation and configuration of operator.

NOTE 2: The PDU Set Information can be different for different PDU Sets within a QoS Flow.

If the NG-RAN has provided a PDU Set based handling support Indication indicating that PDU Set handling is supported and a Protocol Description together with 1) a PSIHI and/or 2) PSDB and PSER is included in the PCC rule, the SMF instructs PSA UPF to perform PDU Set marking and may provide the PSA UPF the DL Protocol Description used by the service data flow. The DL Protocol Description may be received in the PCC rule, based on information provided by the AF or by PCF local policies as described in clause 5.37.5.1.

PSA UPF can identify the PDU Set Information using the DL Protocol Description and the received transport protocol headers and payload or using implementation specific means, for encrypted traffic, the PSA UPF identifies PDUs that belong to PDU Sets and marks them accordingly as described in clause 5.37.5.Y. The details of the RTP/SRTP headers, header extensions and/or payloads used to identify PDU Set Information are defined in TS 26.522 [179].

For each DL PDU received on N6 for which PDU Set based QoS handling is indicated from the SMF, the PSA UPF applies the rules for PDU Set identification and provides the available PDU Set Information to the RAN in the GTP-U header.

NOTE 3: The PSA UPF is expected to assign a unique PDU Set Sequence Number in the GTP-U header to each PDU Set of the QoS Flow.

\* \* \* \* Fifth change \* \* \* \*

#### 5.37.5.X Encrypted traffic handling

##### 5.37.5.X.1 Media Over QUIC based encrypted traffic handling

The PSA UPF supporting the MoQ relay functionality may be selected during PDU session establishment procedure with the consideration of the DNN and S-NSSAI.

The application in UE uses MoQ protocol defined in [X] and establishes MoQ connection between UE and MoQ relay in UPF, and the MoQ server IP address may be used by the MoQ relay to establish MoQ connection with MoQ server.

The application in UE may obtain MoQ relay address via application layer way, e.g. EASDF based DNS procedure as described in clause 6.2.3.2.2 of TS 23.548 [48], in case EASDF based DNS procedure is used, UE sends to EASDF the DNS query for FQDN, if the FQDN is specific to MoQ traffic, then SMF instructs EASDF to return the address of MoQ Relay in PSA UPF via DNS response. SMF may get the address of MoQ Relay during PDU Session Establishment procedure, in which case SMF indicates the PSA UPF to provide MoQ relay address in step 10a of clasue 4.3.2.2.1 TS23.502[3] and the PSA UPF returns MoQ relay address in step 10b of clasue 4.3.2.2.1 TS23.502[3] or SMF may get MoQ relay address related to the PSA UPF from NRF as described in clause 5.2.7.3.2 TS23.502[3].NOTE X: The FQDN of the MoQ traffic can be preconfigured in SMF.

##### UPF supports the MoQ relay functionality and for the service data flow using MoQ Transport, UPF identifies the PDU Set information from the MoQ metadata as defined in the MoQ [X]. 5.37.5.X.2 CONNECT UDP based encrypted traffic handling

##### 5.37.5.X.3 UDP option based encrypted traffic handling

\* \* \* \* Sixth change \* \* \* \*

### 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 5.8.2.18, events as specified in clause 5.2.26.2 of TS 23.502 [3], exposure of data collected for analytics, as specified in clause 5.2.26.2 of TS 23.502 [3] and exposure of the TSC management information as specified in clause 5.8.5.14.

- Exposure of the UE information, e.g. UE IP address translation information as specified in clause 5.2.26.3 of TS 23.502 [3] and clause 4.15.10 of TS 23.502 [3] if Network address translation (i.e. NAT) functionality of the UE IP address is deployed within UPF.

- Support PDU Set Handling as defined in clause 5.37.5.

- Support MoQ Relay functionality as defined in MoQ [X].

\* \* \* \* Seventh change \* \* \* \*

#### 6.3.3.3 Selection of an UPF for a particular PDU Session

The following parameter(s) and information may be considered by the SMF for UPF selection and re-selection:

- UPF's dynamic load.

- Analytics (i.e. statistics or predictions) for UPF load, Service Experience analytics and/or DN Performance analytics per UP path (including UPF and/or DNAI and/or AS instance) and UE related analytics (UE mobility, UE communication, and expected UE behavioural parameters) as received from NWDAF (see TS 23.288 [86]), if NWDAF is deployed.

- UPF's relative static capacity among UPFs supporting the same DNN.

- UPF location available at the SMF.

- UE location information.

- Capability of the UPF and the functionality required for the particular UE session: An appropriate UPF can be selected by matching the functionality and features required for an UE.

- Data Network Name (DNN).

- PDU Session Type (i.e. IPv4, IPv6, IPv4v6, Ethernet Type or Unstructured Type) and if applicable, the static IP address/prefix.

- SSC mode selected for the PDU Session.

- UE subscription profile in UDM.

- DNAI as included in the PCC Rules and described in clause 5.6.7.

- Local operator policies.

- S-NSSAI.

- Access technology being used by the UE.

- Information related to user plane topology and user plane terminations, that may be deduced from:

- 5G-AN-provided identities (e.g. CellID, TAI), available UPF(s) and DNAI(s);

- Identifiers (i.e. a FQDN and/or IP address(es)) of N3 terminations provided by a W-AGF or a TNGF or a TWIF;

NOTE 1: A W-AGF or a TNGF may provide Identifiers of its N3 terminations when forwarding over N2 uplink NAS signalling to the 5GC. The AMF may relay this information to the SMF, as part of session management signalling for a new PDU Session.

- Information regarding the user plane interfaces of UPF(s). This information may be acquired by the SMF using N4;

- Information regarding the N3 User Plane termination(s) of the AN serving the UE. This may be deduced from 5G-AN-provided identities (e.g. CellID, TAI);

- Information regarding the N9 User Plane termination(s) of UPF(s) if needed;

- Information regarding the User plane termination(s) corresponding to DNAI(s).

- RSN, support for redundant GTP-U path or support for redundant transport path in the transport layer (as in clause 5.33.2) when redundant UP handling is applicable.

- Information regarding the ATSSS Steering Capability of the UE session (e.g. any combination of ATSSS-LL capability, MPTCP capability, MPQUIC capability) and information on the UPF support of RTT measurements without PMF.

- Support for UPF allocation of IP address/prefix.

- Support of the IPUPS functionality, specified in clause 5.8.2.14.

- Support for High latency communication (see clause 5.31.8).

- Support for functionality associated with high data rate low latency services, eXtended Reality (XR) and interactive media services, specified in clause 5.37 (for example, ECN marking for L4S, specified in clause 5.37.3, PDU Set Marking, specified in clause 5.37.5, UE power saving management, specified in clause 5.37.8).

- User Plane Latency Requirements within AF request (see clause 5.6.7.1 and clause 6.3.6 of TS 23.548 [130]).

- List of supported Event ID(s) for exposure of UPF-related information via service based interface (see clause 7.2.29 and clause 5.2.26.2 of TS 23.502 [3]).

- Support MoQ Relay functionality as defined in MoQ [X].

NOTE 2: How the SMF determines information about the user plane network topology from information listed above, and what information is considered by the SMF, is based on operator configuration.

NOTE 3: In this release the SMF uses no additional parameters for UPF selection for a PDU Session serving TSC or Deterministic Networking. If a PDU Session needs to connect to a specific UPF hosting a specific TSN 5GS bridge or 5GS router, this can be achieved e.g. by using a dedicated DNN/S-NSSAI combination.

If there is an existing PDU Session, and the SMF receives another PDU Session request to the same DNN and S-NSSAI, and if the SMF determines that interworking with EPC is supported for this PDU Session (as specified in clause 4.11.5 of TS 23.502 [3]), the SMF should select the same UPF if it supports all capabilities required for the new PDU Session. Otherwise, if the SMF determines that interworking with EPC is not supported for the new PDU Session or the UPF of the existing PDU Session does not support all capabilities required for the new PDU Session, a different UPF may be selected according to operator policy.

For the same DNN and S-NSSAI if different UPFs are selected at 5GC, when the UE is moved to EPC network, there is no requirement to enforce APN-AMBR. Whether and how to apply APN-AMBR for the PDN Connection associated with this DNN/APN is implementation dependent, e.g. possibly only AMBR enforcement per PDU Session applies.

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