**3GPP TSG-CT WG1 Meeting #88eCP-201284**

**E-Meeting, 29th June – 1st July 2020 (was C1-204087)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **24.501** | **CR** | **2323** | **rev** | **2** | **Current version:** | **16.4.1** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Ethernet header compression for CP CIoT – 5GSM aspects | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated, Samsung, Ericsson | | | | | | | | | |
| ***Source to TSG:*** | Qualcomm Incorporated, Ericsson | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5G\_CIoT | | | | |  | ***Date:*** | | | 2020-06-18 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | TS 23.501 contains requirements for header compression for Ethernet data. The requirements for Ethernet header compression (EHC) are identical to the requirements for IP header compression.  Furthermore, TS 24.501 sc. 5.3.21 contains the following text:  *Optional header compression of IP data and Ethernet data can be applied to PDU sessions with IP PDU session type and Ethernet PDU session type that are configured to support header compression.*  Stage 3 solution for EHC is needed.  The Ethernet header compression protocol was specified for user plane data in the CR#0039 to 3GPP TS 38.323 in R2-2002366. This protocol can be used for control plane as well, with the only change that the length of the CID field is negotiated in the 5GSM signalling (instead of RRC). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | New 5GSM Ethernet header compression configuration IE is defined.  The Header compression configuration IE is re-named to IP header configuration IE. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No Ethernet header compression supported for CP CIoT. Suboptimal bandwidth utilization affecting network capacity and user experience. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2.x (new), 6.3.2.2, 6.4.1.2, 6.4.1.3, 6.4.2.2, 8.3.1.1, 8.3.1.10, 8.3.1.x (new), 8.3.2.1, 8.3.2.17, 8.3.2.x (new), 8.3.7.1, 8.3.7.12, 8.3.7.x (new), 8.3.9.1, 8.3.9.12, 8.3.9.x (new), 9.11.4.24, 9.11.4.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:*** | | R1: added inter-working aspects  R2 (CT#88e):   * added “Ethernet header compression not used” code point for the EHC configuration IE * corrected octet number for CID Length field in table 9.11.4.x.1 * added Ericsson as a co-signing company | | | | | | | | |

\*\*\* change \*\*\*

### 6.2.X Handling of header compression for control plane CIoT optimizations

The UE and the SMF may use:

- IP header compression for PDU sessions of "IPv4", "IPv6" or "IPv4v6" PDU session type; and

- Ethernet header compression for PDU sessions of "Ethernet" PDU session type.

Both the UE and the AMF indicate whether header compression for control plane CIoT 5GS optimization is supported during registration procedures (see subclauses 5.5.1). If both the UE and the network support header compression, the header compression configuration for each PDU session is negotiated during the PDU session establishment procedure and PDU session modification procedure as specified in subclause 6.3.1, 6.4.1 and 6.4.2.

For IP header compression, ROHC protocol specified in IETF RFC 5795 [39B] is used. The IP header compression configuration used for IP header compression is (re-)negotiated between the UE and the SMF using the IP header compression configuration IE as specified in subclauses 6.3.2.2, 6.4.1.2, 6.4.1.3 and 6.4.2.2, respectively.

For Ethernet header compression, Ethernet Header Compression (EHC) protocol specified in 3GPP TS 38.323 [25] is used. The Ethernet header compression configuration used for Ethernet header compression is (re-)negotiatied between the UE and the SMF using the Ethernet header compression configuration IE as specified in subclauses 6.3.2.2, 6.4.1.2, 6.4.1.3 and 6.4.2.2, respectively.

\*\*\* change \*\*\*

#### 6.3.2.2 Network-requested PDU session modification procedure initiation

In order to initiate the network-requested PDU session modification procedure, the SMF shall create a PDU SESSION MODIFICATION COMMAND message.

If the authorized QoS rules of the PDU session is modified or is marked as to be synchronised with the UE, the SMF shall set the authorized QoS rules IE of the PDU SESSION MODIFICATION COMMAND message to the authorized QoS rules of the PDU session. The SMF shall ensure that the number of the packet filters used in the authorized QoS rules of the PDU Session does not exceed the maximum number of packet filters supported by the UE for the PDU session. The SMF may bind service data flows for which the UE has requested traffic segregation to a dedicated QoS flow for the PDU session, if possible. Otherwise the SMF may bind the service data flows to an existing QoS flow. The SMF shall use only one dedicated QoS flow for traffic segregation. If the UE has requested traffic segregation for multiple service data flows with different QoS handling, the SMF shall bind all these service data flows to a single QoS flow. If the SMF allows traffic segregation for service data flows in a QoS rule, then the SMF shall create a new authorized QoS rule for these service data flows and shall delete packet filters corresponding to these service data flows from the other authorized QoS rules.

If the authorized QoS flow descriptions of the PDU session is modified or is marked as to be synchronised with the UE, the SMF shall set the authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message to the authorized QoS flow descriptions of the PDU session.

If SMF creates a new authorized QoS rule for a new QoS flow, then SMF shall include the authorized QoS flow description for that QoS flow in the authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message, if:

a) the newly created authorized QoS rules is for a new GBR QoS flow;

b) the QFI of the new QoS flow is not the same as the 5QI of the QoS flow identified by the QFI; or

c) the new QoS flow can be mapped to an EPS bearer as specified in subclause 4.11.2 of 3GPP TS 23.502 [9].

If the session-AMBR of the PDU session is modified, the SMF shall set the selected Session-AMBR IE of the PDU SESSION MODIFICATION COMMAND message to the session-AMBR of the PDU session.

If interworking with EPS is supported for the PDU session and if the mapped EPS bearer contexts of the PDU session is modified, the SMF shall set the mapped EPS bearer contexts IE of the PDU SESSION MODIFICATION COMMAND message to the mapped EPS bearer contexts of the PDU session. If the association between a QoS flow and the mapped EPS bearer context is changed, the SMF shall set the EPS bearer identity parameter in authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message to the new EPS bearer identity associated with the QoS flow.

If the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and the PDU SESSION MODIFICATION REQUEST message includes a 5GSM capability IE, the SMF shall:

a) if the RQoS bit is set to:

1) "Reflective QoS supported", consider that the UE supports reflective QoS for this PDU session; or

2) "Reflective QoS not supported", consider that the UE does not support reflective QoS for this PDU session; and;

b) if the MH6-PDU bit is set to:

1) "Multi-homed IPv6 PDU session supported", consider that this PDU session is supported to use multiple IPv6 prefixes; or

2) "Multi-homed IPv6 PDU session not supported", consider that this PDU session is not supported to use multiple IPv6 prefixes.

If the SMF considers that reflective QoS is supported for QoS flows belonging to this PDU session, the SMF may include the RQ timer IE set to an RQ timer value in the PDU SESSION MODIFICATION COMMAND message.

If a port management information container needs to be delivered (see 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9]) and the UE has set the TPMIC bit to "Transport of port management information container supported" in the 5GSM capability IE, the SMF shall include a Port management information container IE in the PDU SESSION MODIFICATION COMMAND message.

For a PDN connection established when in S1 mode, upon the first inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, the PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet" and the PDU SESSION MODIFICATION REQUEST message includes a Maximum number of supported packet filters IE, the SMF shall consider this number as the maximum number of packet filters that can be supported by the UE for this PDU session. Otherwise the SMF considers that the UE supports 16 packet filters for this PDU session.

For a PDN connection established when in S1 mode, upon the first inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, the SMF shall consider that the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink are valid for the lifetime of the PDU session.

For a PDN connection established when in S1 mode, upon the first inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and the SMF determines, based on local policies or configurations in the SMF and the Always-on PDU session requested IE in the PDU SESSION MODIFICATION REQUEST message (if available), that either:

a) the requested PDU session needs to be an always-on PDU session, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message and shall set the value to "Always-on PDU session required"; or

b) the requested PDU session shall not be an always-on PDU session and:

i) if the UE included the Always-on PDU session requested IE, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message and shall set the value to "Always-on PDU session not allowed"; or

ii) if the UE did not include the Always-on PDU session requested IE, the SMF shall not include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message.

If a QoS flow for URLLC is created in a PDU session and the SMF has not provided the Always-on PDU session indication IE with the value set to "Always-on PDU session required" in the UE-requested PDU session establishment procedure or a network-requested PDU session modification procedure for the PDU session, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message and shall set the value to "Always-on PDU session required".

If the value of the RQ timer is set to "deactivated" or has a value of zero, the UE considers that RQoS is not applied for this PDU session and remove the derived QoS rule(s) associated with the PDU session, if any.

If the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, the SMF shall set the PTI IE of the PDU SESSION MODIFICATION COMMAND message to the PTI of the PDU SESSION MODIFICATION REQUEST message received as part of the UE-requested PDU session modification procedure.

If the network-requested PDU session modification procedure is not triggered by a UE-requested PDU session modification procedure, the SMF shall set the PTI IE of the PDU SESSION MODIFICATION COMMAND message to "No procedure transaction identity assigned".

If the selected SSC mode of the PDU session is "SSC mode 3" and the SMF requests the relocation of SSC mode 3 PDU session anchor with multiple PDU sessions as specified in 3GPP TS 23.502 [9], the SMF shall include 5GSM cause #39 "reactivation requested" , in the PDU SESSION MODIFICATION COMMAND message, and may include the PDU session address lifetime in a PDU session address lifetime PCO parameter in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message.

The SMF shall send the PDU SESSION MODIFICATION COMMAND message, and the SMF shall start timer T3591 (see example in figure 6.3.2.2.1).

NOTE: If the SMF requests the relocation of SSC mode 3 PDU session anchor with multiple PDU sessions as specified in 3GPP TS 23.502 [9], the reallocation requested indication indicating whether the SMF is to be reallocated or the SMF is to be reused is provided to the AMF.

If the control plane CIoT 5GS optimization is enabled for a PDU session and the IP header compression configuration IE was included in the PDU SESSION ESTABLISHMENT REQUEST message, and the SMF supports control plane CIoT 5GS optimization and IP header compression for control plane CIoT 5GS optimization, the SMF may include the IP header compression configuration IE in the PDU SESSION MODIFICATION COMMAND message to re-negotiate IP header compression configuration associated to the PDU session.

If the control plane CIoT 5GS optimization is enabled for a PDU session and the Ethernet header compression configuration IE was included in the PDU SESSION ESTABLISHMENT REQUEST message, and the SMF supports control plane CIoT 5GS optimization and Ethernet header compression for control plane CIoT 5GS optimization, the SMF may include the Ethernet header compression configuration IE in the PDU SESSION MODIFICATION COMMAND message to re-configure Ethernet header compression configuration associated with the PDU session.



Figure 6.3.2.2.1: Network-requested PDU session modification procedure

\*\*\* change \*\*\*

#### 6.4.1.2 UE-requested PDU session establishment procedure initiation

In order to initiate the UE-requested PDU session establishment procedure, the UE shall create a PDU SESSION ESTABLISHMENT REQUEST message.

NOTE 0: When IMS voice is available over either 3GPP access or non-3GPP access, the "voice centric" UE in 5GMM-REGISTERED state will receive a request from upper layers to establish the PDU session for IMS signalling, if the conditions for performing an initial registration with IMS indicated in 3GPP TS 24.229 [14] subclause U.3.1.2 are satisfied.

If the UE requests to establish a new PDU session, the UE shall allocate a PDU session ID which is not currently being used by another PDU session over either 3GPP access or non-3GPP access. If the N5CW device supports 3GPP access and requests to establish a new PDU session via 3GPP access, the N5CW device shall refrain from allocating "PDU session identity value 15". If the TWIF acting on behalf of the N5CW device requests to establish a new PDU session, the TWIF acting on behalf of the N5CW device shall allocate the "PDU session identity value 15".

The UE shall allocate a PTI value currently not used and shall set the PTI IE of the PDU SESSION ESTABLISHMENT REQUEST message to the allocated PTI value.

If the UE is registered for emergency services over the current access, the UE shall not request establishing a non-emergency PDU session over the current access. If the UE is registered for emergency services over the current access it shall not request establishing an emergency PDU session over the non-current access except if the request is for transferring the emergency PDU session to the non-current access. Before transferring an emergency PDU session from non-3GPP access to 3GPP access, or before transferring a PDN connection for emergency bearer services from untrusted non-3GPP access connected to EPC to 3GPP access, the UE shall check whether emergency services are supported in the NG-RAN cell (either an NR cell or an E-UTRA cell) on which the UE is camping. If:

a) emergency services are not supported in the NG-RAN cell (either an NR cell or an E-UTRA cell) on which the UE is camping;

b) emergency services fallback is supported in the NG-RAN cell (either an NR cell or an E-UTRA cell) on which the UE is camping; and

c) the UE supports emergency services fallback;

the UE may perform emergency services fallback and transfer the emergency PDU session or PDN connection for emergency bearer services after the emergency services fallback is completed.

NOTE 1: Transfer of an existing emergency PDU session or PDN connection for emergency bearer services between 3GPP access and non-3GPP access is needed e.g. if the UE determines that the current access is no longer available.

If the UE requests to establish a new emergency PDU session, the UE shall include the PDU session type IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall set the IE to the IP version capability as specified in subclause 6.2.4.2.

If the UE requests to establish a new non-emergency PDU session with a DN, the UE shall include the PDU session type IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall set the IE to one of the following values: the IP version capability as specified in subclause 6.2.4.2, "Ethernet" or "Unstructured" based on the URSP rules or based on UE local configuration (see 3GPP TS 24.526 [19]).

NOTE 2: When the UE initiates the UE-requested PDU session establishment procedure to transfer an existing non-IP PDN connection in the EPS to the 5GS, the UE can use locally available information associated with the PDN connection to select the PDU session type between "Ethernet" and "Unstructured".

If the UE requests to establish a new non-emergency PDU session with a DN and the UE requests an SSC mode, the UE shall set the SSC mode IE of the PDU SESSION ESTABLISHMENT REQUEST message to the SSC mode. If the UE requests to establish a PDU session of "IPv4", "IPv6" or "IPv4v6" PDU session type, the UE shall either omit the SSC mode IE or set the SSC mode IE to "SSC mode 1", "SSC mode 2", or "SSC mode 3". If the UE requests to establish a PDU session of "Ethernet" or "Unstructured" PDU session type, the UE shall either omit the SSC mode IE or set the SSC mode IE to "SSC mode 1" or "SSC mode 2". If the UE requests transfer of an existing PDN connection in the EPS to the 5GS or the UE requests transfer of an existing PDN connection in an untrusted non-3GPP access connected to the EPC to the 5GS, the UE shall set the SSC mode IE to "SSC mode 1".

If the UE requests to establish a new emergency PDU session, the UE shall set the SSC mode IE of the PDU SESSION ESTABLISHMENT REQUEST message to "SSC mode 1".

If the UE requests to establish a new PDU session with a DN, the UE may include the SM PDU DN request container IE with a DN-specific identity of the UE complying with network access identifier (NAI) format as specified in IETF RFC 7542 [37].

The UE should set the RQoS bit to "Reflective QoS supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message if the UE supports reflective QoS and:

a) the UE requests to establish a new PDU session of "IPv4", "IPv6", "IPv4v6" or "Ethernet" PDU session type;

b) the UE requests to transfer an existing PDN connection in the EPS of "IPv4", "IPv6", "IPv4v6" or "Ethernet" PDN type or of "Non-IP" PDN type mapping to "Ethernet" PDU session type, to the 5GS; or

c) the UE requests to transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC of "IPv4", "IPv6" or "IPv4v6" PDN type to the 5GS.

NOTE 3: The determination to not request the usage of reflective QoS by the UE for a PDU session is implementation dependent.

The UE shall indicate the maximum number of packet filters that can be supported for the PDU session in the Maximum number of supported packet filters IE of the PDU SESSION ESTABLISHMENT REQUEST message if:

a) the UE requests to establish a new PDU session of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDU session type, and the UE can support more than 16 packet filters for this PDU session;

b) the UE requests to transfer an existing PDN connection in the EPS of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDN type or of "Non-IP" PDN type mapping to "Ethernet" PDU session type, to the 5GS and the UE can support more than 16 packet filters for this PDU session; or

c) the UE requests to transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC of "IPv4", "IPv6" or "IPv4v6" PDN type to the 5GS and the UE can support more than 16 packet filters for this PDU session.

The UE shall include the Integrity protection maximum data rate IE in the PDU SESSION ESTABLISHMENT REQUEST message to indicate the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink.

The UE shall set the MH6-PDU bit to "Multi-homed IPv6 PDU session supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message if the UE supports multi-homed IPv6 PDU session and:

a) the UE requests to establish a new PDU session of "IPv6" or "IPv4v6" PDU session type; or.

b) the UE requests to transfer an existing PDN connection of "IPv6" or "IPv4v6" PDN type in the EPS or in an untrusted non-3GPP access connected to the EPC to the 5GS.

The UE shall set the EPT-S1 bit to "Ethernet PDN type in S1 mode supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message if the UE supports Ethernet PDN type in S1 mode and requests "Ethernet" PDU session type.

If the UE requests to establish a new PDU session as an always-on PDU session (e.g. because the PDU session is for TSC), the UE shall include the Always-on PDU session requested IE and set the value of the IE to "Always-on PDU session requested" in the PDU SESSION ESTABLISHMENT REQUEST message.

NOTE 4: Determining whether a PDU session is for TSC is UE implementation dependent.

If the UE has an emergency PDU session, the UE shall not perform the UE-requested PDU session establishment procedure to establish another emergency PDU session. The UE may perform the UE-requested PDU session establishment procedure to transfer an existing emergency PDU session or an existing PDN connection for emergency services.

If:

a) the UE requests to perform handover of an existing PDU session between 3GPP access and non-3GPP access;

b) the UE requests to perform transfer an existing PDN connection in the EPS to the 5GS; or

c) the UE requests to perform transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC to the 5GS;

the UE shall:

a) set the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message and in the UL NAS TRANSPORT message to the stored PDU session ID corresponding to the PDN connection; and

b) set the S-NSSAI in the UL NAS TRANSPORT message to the stored S-NSSAI associated with the PDU session ID only if the S-NSSAI is included in the allowed NSSAI.

If the N5CW device supports 3GPP access and requests to perform handover of an existing PDU session from non-3GPP access to 3GPP access, the N5CW device shall set the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message and in the UL NAS TRANSPORT message to "PDU session identity value 15".

If the UE is registered to a network which supports ATSSS and the UE requests to establish a new PDU session the UE may allow the network to upgrade the requested PDU session to an MA PDU session. In order to allow the network to upgrade the requested PDU session to an MA PDU session, the UE shall set "MA PDU session network upgrade allowed" in the MA PDU session information IE and shall set the request type to "initial request" in the UL NAS TRANSPORT message. If the UE is registered to a network which does not support ATSSS, the UE shall not perform the procedure to allow the network to upgrade the requested PDU session to an MA PDU session.

If the UE is registered to a network which supports ATSSS, the UE may request to establish an MA PDU session. If the UE requests to establish an MA PDU session, the UE shall set the request type to "MA PDU request" in the UL NAS TRANSPORT message. If the UE is registered to a network which does not support ATSSS, the UE shall not request to establish an MA PDU session.

When the UE is registered over both 3GPP access and non-3GPP access in the same PLMN and the UE requests to establish a new MA PDU session, the UE may provide an S-NSSAI in the UL NAS TRANSPORT message only if the S-NSSAI is included in the allowed NSSAIs of both accesses.

If the UE is registered to a network which supports ATSSS and the UE has already an MA PDU session established over one access, the UE may perform the UE-requested PDU session establishment procedure to establish user plane resources over the other access for the MA PDU session as specified in subclause 4.22 of 3GPP TS 23.502 [9] and the S-NSSAI associated with the MA PDU session is included in the allowed NSSAI of the other access. If the UE establishes user plane resources over the other access for the MA PDU session, the UE shall:

a) set the request type to "MA PDU request" in the UL NAS TRANSPORT message;

b) set the PDU session ID to the stored PDU session ID corresponding to the established MA PDU session in the PDU SESSION ESTABLISHMENT REQUEST message and in the UL NAS TRANSPORT message; and

c) set the S-NSSAI in the UL NAS TRANSPORT message to the stored S-NSSAI associated with the PDU session ID.

If the UE requests to establish a new MA PDU session or if the UE requests to establish a new PDU session and the UE allows the network to upgrade the requested PDU session to an MA PDU session:

a) if the UE supports ATSSS Low-Layer functionality with any steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "ATSSS Low-Layer functionality with any steering mode supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message;

b) if the UE supports MPTCP functionality with any steering mode and ATSSS-LL functionality with only active-standby steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "MPTCP functionality with any steering mode and ATSSS-LL functionality with only active-standby steering mode supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message; and

c) if the UE supports MPTCP functionality with any steering mode and ATSSS-LL functionality with any steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "MPTCP functionality with any steering mode and ATSSS-LL functionality with any steering mode supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE is registered to a network which does not support ATSSS and the UE has already an MA PDU session established over one access, the UE shall not attempt to establish user plane resources for the MA PDU session over the network which does not support ATSSS as specified in subclause 4.22 of 3GPP TS 23.502 [9].

If the UE supports 3GPP PS data off, the UE shall include the extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and include the 3GPP PS data off UE status. The UE behaves as described in subclause 6.2.10.

If the UE supports Reliable Data Service, the UE shall include the extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and include the Reliable Data Service request indicator. The UE behaves as described in subclause 6.2.15.

If:

a) the PDU session type value of the PDU session type IE is set to "IPv4", "IPv6" or "IPv4v6";

b) the UE indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

c) the network indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall include the IP header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If:

a) the PDU session type value of the PDU session type IE is set to "Ethernet";

b) the UE indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

c) the network indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall include the Ethernet header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE requests to establish a PDU session of "Ethernet" PDU session type and the UE supports transfer of port management information containers, the UE shall:

a) set the TPMIC bit to "Transfer of port management information containers supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message;

b) include the DS-TT Ethernet port MAC address IE in the PDU SESSION ESTABLISHMENT REQUEST message and set its contents to the MAC address of the DS-TT Ethernet port used for the PDU session;

c) if the UE-DS-TT residence time is available at the UE, include the UE-DS-TT residence time IE and set its contents to the UE-DS-TT residence time; and

d) include the Port management information container IE in the PDU SESSION ESTABLISHMENT REQUEST message.

NOTE 5: Only SSC mode 1 is supported for a PDU session which is for TSC.

The UE shall transport:

a) the PDU SESSION ESTABLISHMENT REQUEST message;

b) the PDU session ID of the PDU session being established, being handed over, being transferred, or been established as an MA PDU session;

c) if the request type is set to:

1) "initial request" or "MA PDU request" and the UE determined to establish a new PDU session or an MA PDU session based on either a URSP rule including one or more S-NSSAIs in the URSP (see subclause 6.2.9) or UE local configuration, according to subclause 4.2.2 of 3GPP TS 24.526 [19]:

i) in case of a non-roaming scenario, an S-NSSAI in the allowed NSSAI which corresponds to one of the S-NSSAI(s) in the matching URSP rule, if any to the S-NSSAI(s) in the UE local configuration or in the default URSP rule, according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19]; or

ii) in case of a roaming scenario:

A) one of the mapped S-NSSAI(s) which corresponds to one of the S-NSSAI(s) in the matching URSP rule, if any, or else to the S-NSSAI(s) in the UE local configuration or in the default URSP rule, according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19]; and

B) the S-NSSAI in the allowed NSSAI associated with the S-NSSAI in A); or

2) "existing PDU session", an S-NSSAI, which is an S-NSSAI associated with the PDU session and (if available in roaming scenarios) a mapped S-NSSAI;

d) the requested DNN, if the request type is set to "initial request" or "existing PDU session", and the UE requests a connectivity to a DNN other than the default DNN;

e) the request type which is set to:

1) "initial request", if the UE is not registered for emergency services and the UE requests to establish a new non-emergency PDU session;

2) "existing PDU session", if the UE is not registered for emergency services and the UE requests:

i) handover of an existing non-emergency PDU session between 3GPP access and non-3GPP access;

ii) transfer of an existing PDN connection for non-emergency bearer services in the EPS to the 5GS; or

iii) transfer of an existing PDN connection for non-emergency bearer services in an untrusted non-3GPP access connected to the EPC to the 5GS;

3) "initial emergency request", if the UE requests to establish a new emergency PDU session;

4) "existing emergency PDU session", if the UE requests:

i) handover of an existing emergency PDU session between 3GPP access and non-3GPP access;

ii) transfer of an existing PDN connection for emergency bearer services in the EPS to the 5GS; or

iii) transfer of an existing PDN connection for emergency bearer services in an untrusted non-3GPP access connected to the EPC to the 5GS; or

5) "MA PDU request", if the UE requests to establish an MA PDU session; and

f) the old PDU session ID which is the PDU session ID of the existing PDU session, if the UE initiates the UE-requested PDU session establishment procedure upon receiving the PDU SESSION MODIFICATION COMMAND messages with the 5GSM cause IE set to #39 "reactivation requested";

using the NAS transport procedure as specified in subclause 5.4.5, and the UE shall start timer T3580 (see example in figure 6.4.1.2.1).

For bullet c), if the matching URSP rule does not have an associated S-NSSAI, or if the UE does not have any matching URSP rule and there is no S-NSSAI in the UE local configuration or in the default URSP rule, the UE shall not provide any S-NSSAI in a PDU session establishment procedure.

If the request type is set to "initial emergency request" or "existing emergency PDU session", neither DNN nor S-NSSAI is transported by the UE using the NAS transport procedure as specified in subclause 5.4.5.



Figure 6.4.1.2.1: UE-requested PDU session establishment procedure

Upon receipt of a PDU SESSION ESTABLISHMENT REQUEST message, a PDU session ID, optionally an S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI, optionally a DNN determined by the AMF, optionally a DNN selected by the network (if different from the DNN determined by the AMF), the request type, and optionally an old PDU session ID, the SMF checks whether connectivity with the requested DN can be established. If the requested DNN is not included, the SMF shall use the default DNN.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session" and the PDU session authentication and authorization by the external DN is required due to local policy, the SMF shall check whether the PDU SESSION ESTABLISHMENT REQUEST message includes the SM PDU DN request container IE.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session", the SM PDU DN request container IE is included in the PDU SESSION ESTABLISHMENT REQUEST message, the PDU session authentication and authorization by the external DN is required due to local policy and user's subscription data, and:

a) the information for the PDU session authentication and authorization by the external DN in the SM PDU DN request container IE is compliant with the local policy and user's subscription data, the SMF shall proceed with the EAP Authentication procedure specified in 3GPP TS 33.501 [24] and refrain from accepting or rejecting the PDU SESSION ESTABLISHMENT REQUEST message until the EAP Authentication procedure finalizes; or

b) the information for the PDU session authentication and authorization by the external DN in the SM PDU DN request container IE is not compliant with the local policy and user's subscription data, the SMF shall consider it as an abnormal case and proceed as specified in subclause 6.4.1.7.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session", the SM PDU DN request container IE is not included in the PDU SESSION ESTABLISHMENT REQUEST message and the PDU session authentication and authorization by the external DN is required due to local policy and user's subscription data, the SMF shall proceed with the EAP Authentication procedure specified in 3GPP TS 33.501 [24] and refrain from accepting or rejecting the PDU SESSION ESTABLISHMENT REQUEST message until the EAP Authentication procedure finalizes.

If the SMF receives the old PDU session ID from the AMF and a PDU session exists for the old PDU session ID, the SMF shall consider that the request for the relocation of SSC mode 3 PDU session anchor with multiple PDU sessions as specified in 3GPP TS 23.502 [9] is accepted by the UE.

If the UE has set the TPMIC bit to "Transfer of port management information containers supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message and has included a DS-TT Ethernet port MAC address IE and Port management information container IE in the PDU SESSION ESTABLISHMENT REQUEST message, the SMF shall operate as specified in 3GPP TS 23.502 [9] subclause 4.3.2.2.1.

#### 6.4.1.3 UE-requested PDU session establishment procedure accepted by the network

If the connectivity with the requested DN is accepted by the network, the SMF shall create a PDU SESSION ESTABLISHMENT ACCEPT message.

If the UE requests establishing an emergency PDU session, the network shall not check for service area restrictions or subscription restrictions when processing the PDU SESSION ESTABLISHMENT REQUEST message.

The SMF shall set the authorized QoS rules IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the authorized QoS rules of the PDU session and may include the authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message set to the authorized QoS flow descriptions of the PDU session. The SMF shall ensure that the number of the packet filters used in the authorized QoS rules of the PDU Session does not exceed the maximum number of packet filters supported by the UE for the PDU session. If the received request type is "initial emergency request", the SMF shall set the authorized QoS flow descriptions IE according to the initial QoS parameters used for establishing emergency services configured in the SMF emergency configuration data.

SMF shall set the authorized QoS flow descriptions IE to the authorized QoS flow descriptions of the PDU session, if:

a) the authorized QoS rules IE contains at least one GBR QoS flow;

b) the QFI is not the same as the 5QI of the QoS flow identified by the QFI; or

c) the QoS flow can be mapped to an EPS bearer as specified in subclause 4.11.2 of 3GPP TS 23.502 [9].

If interworking with EPS is supported for the PDU session, the SMF shall set in the PDU SESSION ESTABLISHMENT ACCEPT message:

a) the Mapped EPS bearer contexts IE to the EPS bearer contexts mapped from one or more QoS flows of the PDU session; and

b) the EPS bearer identity parameter in the authorized QoS flow descriptions IE to the EPS bearer identity corresponding to the QoS flow, for each QoS flow which can be transferred to EPS.

If the "Create new EPS bearer" operation code in the mapped EPS bearer contexts IE was received, and there is no corresponding authorized QoS flow descriptions IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall send a PDU SESSION MODIFICATION REQUEST message including a mapped EPS bearer contexts IE to delete the mapped EPS bearer context.

Furthermore, the SMF shall store the association between the QoS flow and the mapped EPS bearer context, for each QoS flow which can be transferred to EPS.

The SMF shall set the selected SSC mode IE of the PDU SESSION ESTABLISHMENT ACCEPT message to:

a) the received SSC mode in the SSC mode IE included in the PDU SESSION ESTABLISHMENT REQUEST message based on one or more of the PDU session type, the subscription and the SMF configuration;

b) either the default SSC mode for the data network listed in the subscription or the SSC mode associated with the SMF configuration, if the SSC mode IE is not included in the PDU SESSION ESTABLISHMENT REQUEST message.

If the PDU session is an emergency PDU session, the SMF shall set the Selected SSC mode IE of the PDU SESSION ESTABLISHMENT ACCEPT message to "SSC mode 1". If the PDU session is a non-emergency PDU session of "Ethernet" or "Unstructured" PDU session type, the SMF shall set the Selected SSC mode IE to "SSC mode 1" or "SSC mode 2". If the PDU session is a non-emergency PDU session of "IPv4", "IPv6" or "IPv4v6" PDU session type, the SMF shall set the selected SSC mode IE to "SSC mode 1", "SSC mode 2", or "SSC mode 3".

If the PDU session is a non-emergency PDU session, the SMF shall set the S-NSSAI IE of the PDU SESSION ESTABLISHMENT ACCEPT message to:

a) the S-NSSAI of the PDU session; and

b) the mapped S-NSSAI (if available in roaming scenarios).

The SMF shall set the selected PDU session type IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the PDU session type of the PDU session.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv4v6", the SMF shall select "IPv4", "IPv6" or "IPv4v6" as the selected PDU session type IE of the PDU session. If the subscription, the SMF configuration, or both, are limited to IPv4 only or IPv6 only for the DNN selected by the network, the SMF shall include the 5GSM cause value #50 "PDU session type IPv4 only allowed", or #51 "PDU session type IPv6 only allowed", respectively, in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT ACCEPT message.

If the selected PDU session type is "IPv4", the SMF shall include the PDU address IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the PDU address IE to an IPv4 address is allocated to the UE in the PDU session.

If the selected PDU session type is "IPv6", the SMF shall include the PDU address IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the PDU address IE to an interface identifier for the IPv6 link local address allocated to the UE in the PDU session.

If the selected PDU session type is "IPv4v6", the SMF shall include the PDU address IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the PDU address IE to an IPv4 address and an interface identifier for the IPv6 link local address, allocated to the UE in the PDU session.

If the PDU session is a non-emergency PDU session, the SMF shall set the DNN IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the DNN determined by the AMF of the PDU session.

The SMF shall set the Session-AMBR IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the Session-AMBR of the PDU session.

If the selected PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet" and if the PDU SESSION ESTABLISHMENT REQUEST message includes a 5GSM capability IE with the RQoS bit set to "Reflective QoS supported", the SMF shall consider that reflective QoS is supported for QoS flows belonging to this PDU session and may include the RQ timer IE set to an RQ timer value in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the selected PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet" and if the PDU SESSION ESTABLISHMENT REQUEST message includes a Maximum number of supported packet filters IE, the SMF shall consider this number as the maximum number of packet filters that can be supported by the UE for this PDU session. Otherwise the SMF considers that the UE supports 16 packet filters for this PDU session.

The SMF shall consider that the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink are valid for the lifetime of the PDU session.

If the value of the RQ timer is set to "deactivated" or has a value of zero, the UE considers that RQoS is not applied for this PDU session.

NOTE 1: If the 5G core network determines that reflective QoS is to be used for a QoS flow, the SMF sends reflective QoS indication (RQI) to UPF to activate reflective QoS. If the QoS flow is established over 3GPP access, the SMF also includes reflective QoS Attribute (RQA) in QoS profile of the QoS flow during QoS flow establishment.

If the selected PDU session type is "IPv6" or "IPv4v6" and if the PDU SESSION ESTABLISHMENT REQUEST message includes a 5GSM capability IE with the MH6-PDU bit set to "Multi-homed IPv6 PDU session supported", the SMF shall consider that this PDU session is supported to use multiple IPv6 prefixes.

If the selected PDU session type is "Ethernet", the PDU SESSION ESTABLISHMENT REQUEST message includes a 5GSM capability IE with the EPT-S1 bit set to "Ethernet PDN type in S1 mode supported" and the network supports Ethernet PDN type in S1 mode, the SMF shall set the EPT-S1 bit of the 5GSM network feature support IE of the PDU SESSION ESTABLISHMENT ACCEPT message to "Ethernet PDN type in S1 mode supported".

If the DN authentication of the UE was performed and completed successfully, the SMF shall set the EAP message IE of the PDU SESSION ESTABLISHMENT ACCEPT message to an EAP-success message as specified in IETF RFC 3748 [34], provided by the DN.

Based on local policies or configurations in the SMF and the Always-on PDU session requested IE in the PDU SESSION ESTABLISHMENT REQUEST message (if available), if the SMF determines that either:

a) the requested PDU session needs to be established as an always-on PDU session (e.g. because the PDU session is for TSC, for URLLC, or for both), the SMF shall include the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the value to "Always-on PDU session required"; or

b) the requested PDU session shall not be established as an always-on PDU session and:

i) if the UE included the Always-on PDU session requested IE, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the value to "Always-on PDU session not allowed"; or

ii) if the UE did not include the Always-on PDU session requested IE, the SMF shall not include the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the PDU session is an MA PDU session, the SMF shall include the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message. The SMF shall set the content of the ATSSS container IE as specified in 3GPP TS 24.193 [13B].

If the PDU session is a single access PDU session containing the MA PDU session information IE with the value set to "MA PDU session network upgrade is allowed" and:

a) if the SMF decides to establish a single access PDU session, the SMF shall not include the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message; or

b) if the SMF decides to establish an MA PDU session, the SMF shall include the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message, which indicates to the UE that the requested single access PDU session was established as an MA PDU Session.

If the network decides that the PDU session is only for control plane CIoT 5GS optimization, the SMF shall include the control plane only indication in the PDU SESSION ESTABLISHMENT ACCEPT message.

If:

a) the UE provided the IP header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message; and

b) the SMF supports IP header compression for control plane CIoT 5GS optimization;

the SMF shall include the IP header compression configuration IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If:

a) the UE provided the Ethernet header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message; and

b) the SMF supports Ethernet header compression for control plane CIoT 5GS optimization;

the SMF shall include the Ethernet header compression configuration IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

The SMF shall send the PDU SESSION ESTABLISHMENT ACCEPT message.

Upon receipt of a PDU SESSION ESTABLISHMENT ACCEPT message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE shall stop timer T3580, shall release the allocated PTI value and shall consider that the PDU session was established.

The UE shall store the authorized QoS rules, and the session-AMBR received in the PDU SESSION ESTABLISHMENT ACCEPT message for the PDU session. The UE shall also store the authorized QoS flow descriptions if it is included in the authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message for the PDU session.

If the number of the authorized QoS rules, the number of the packet filters, or the number of the authorized QoS flow descriptions associated with the PDU session have reached the maximum number supported by the UE upon receipt of a PDU SESSION ESTABLISHMENT ACCEPT message, then the UE may initiate the PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #26 "insufficient resources".

For a PDU session that is being established with the request type set to "initial request", "initial emergency request" or "MA PDU request", or a PDU session that is being transferred from EPS to 5GS and established with the request type set to "existing PDU session" or "existing emergency PDU session" or a PDU session that is being handed over between non-3GPP access and 3GPP access and established with the request type set to "existing PDU session" or "existing emergency PDU session ", the UE shall verify the authorized QoS rules and the authorized QoS flow descriptions provided in the PDU SESSION ESTABLISHMENT ACCEPT message for different types of errors as follows:

a) Semantic errors in QoS operations:

1) When the rule operation is "Create new QoS rule", and the DQR bit is set to "the QoS rule is the default QoS rule" when there's already a default QoS rule.

2) When the rule operation is "Create new QoS rule", and there is no rule with the DQR bit set to "the QoS rule is the default QoS rule".

3) When the rule operation is "Create new QoS rule" and two or more QoS rules associated with this PDU session would have identical precedence values.

4) When the rule operation is an operation other than "Create new QoS rule", and the request type is "initial request" or "initial emergency request".

5) When the rule operation is "Create new QoS rule" and two or more QoS rules associated with this PDU session would have identical QoS rule identifier values.

6) When the flow description operation is an operation other than "Create new QoS flow description", and the request type is "initial request" or "initial emergency request".

In case 4, if the rule operation is for a non-default QoS rule, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS rule with 5GSM cause #83 "semantic error in the QoS operation".

In case 6, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS flow description with 5GSM cause #83 "semantic error in the QoS operation".

Otherwise for all the cases above, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #83 "semantic error in the QoS operation".

b) Syntactical errors in QoS operations:

1) When the rule operation is "Create new QoS rule" and the packet filter list in the QoS rule is empty.

2) When there are other types of syntactical errors in the coding of the QoS rules IE, such as a mismatch between the number of packet filters subfield, and the number of packet filters in the packet filter list.

3) When, the

A) rule operation is "Create new QoS rule", the UE determines that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1), and there is no QoS flow description with a QFI corresponding to the QFI of the resulting QoS rule.

B) request type is "existing PDU session" or "existing emergency PDU session", the flow description operation is "Delete existing QoS flow description", and the UE determines that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) with a QFI corresponding to the QFI of the QoS flow description that is deleted (i.e. there is no associated QoS flow description with the same QFI).

4) When the flow description operation is "Create new QoS flow description", and the UE determines that there is a QoS flow description of a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) which lacks at least one of the mandatory parameters (i.e., GFBR uplink, GFBR downlink, MFBR uplink and MFBR downlink).

In case 1, case 2 or case 3, if the QoS rule is not the default QoS rule, the UE shall send a PDU SESSION MODIFICATION REQUEST message including a requested QoS rule IE to delete the QoS rule with 5GSM cause #84 "syntactical error in the QoS operation". Otherwise, if the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #84 "syntactical error in the QoS operation".

In case 4, if the default QoS rule is associated with the QoS flow description which lacks at least one of the mandatory parameters, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #84 "syntactical error in the QoS operation". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS flow description which lacks at least one of the mandatory parameters and the associated QoS rule(s), if any, with 5GSM cause #84 "syntactical error in the QoS operation".

c) Semantic errors in packet filters:

1) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

If the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #44 "semantic error in packet filter(s)". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS rule with 5GSM cause #44 "semantic error in packet filter(s)".

d) Syntactical errors in packet filters:

1) When the rule operation is "Create new QoS rule" and two or more packet filters in the resultant QoS rule would have identical packet filter identifiers.

2) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

If the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #45 "syntactical errors in packet filter(s)". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS rule with 5GSM cause #45 "syntactical errors in packet filter(s)".

If the Always-on PDU session indication IE is included in the PDU SESSION ESTABLISHMENT ACCEPT message and:

a) the value of the IE is set to "Always-on PDU session required", the UE shall consider the established PDU session as an always-on PDU session; or

b) the value of the IE is set to "Always-on PDU session not allowed", the UE shall not consider the established PDU session as an always-on PDU session.

The UE shall not consider the established PDU session as an always-on PDU session if the UE does not receive the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

The UE shall store the mapped EPS bearer contexts, if received in the PDU SESSION ESTABLISHMENT ACCEPT message. Furthermore, the UE shall also store the association between the QoS flow and the mapped EPS bearer context, for each QoS flow which can be transferred to EPS, based on the received EPS bearer identity parameter in authorized QoS flow descriptions IE and the mapped EPS bearer contexts. The UE shall check each mapped EPS bearer context for different types of errors as follows:

NOTE 2: An error detected in a mapped EPS bearer context does not cause the UE to discard the Authorized QoS rules IE and Authorized QoS flow descriptions IE included in the PDU SESSION ESTABLISHMENT ACCEPT, if any.

a) Semantic error in the mapped EPS bearer operation:

1) When the operation code is an operation code other than "Create new EPS bearer" and the PDU session is being established with the request type set to "initial request" or "initial emergency request".

2) When the operation code is "Create new EPS bearer" and there is already an existing mapped EPS bearer context with the same EPS bearer identity associated with any PDU session.

3) When the operation code is "Create new EPS bearer" or "Modify existing EPS bearer" and the resulting mapped EPS bearer context has invalid or missing mandatory parameters (e.g., mapped EPS QoS parameters or traffic flow template for a dedicated EPS bearer context).

In case 2, if the existing mapped EPS bearer context is associated with the PDU session that is being established, the UE shall not diagnose an error, further process the create request and, if it was process successfully, delete the old EPS bearer context.

Otherwise, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

b) if the mapped EPS bearer context includes a traffic flow template, the UE shall check the traffic flow template for different types of TFT IE errors as follows:

1) Semantic errors in TFT operations:

i) When the TFT operation is an operation other than "Create a new TFT"

The UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #41 "semantic error in the TFT operation".

2) Syntactical errors in TFT operations:

i) When the TFT operation = "Create a new TFT" and the packet filter list in the TFT IE is empty.

ii) When there are other types of syntactical errors in the coding of the TFT IE, such as a mismatch between the number of packet filters subfield, and the number of packet filters in the packet filter list.

The UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message with to delete the mapped EPS bearer context 5GSM cause #42 "syntactical error in the TFT operation".

3) Semantic errors in packet filters:

i) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

ii) When the resulting TFT does not contain any packet filter which applicable for the uplink direction.

The UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #44 "semantic errors in packet filter(s)".

4) Syntactical errors in packet filters:

i) When the TFT operation = "Create a new TFT" and two or more packet filters in the resultant TFT would have identical packet filter identifiers.

ii) When the TFT operation = "Create a new TFT" and two or more packet filters in all TFTs associated with this PDN connection would have identical packet filter precedence values.

iii) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

In case ii, if the old packet filters do not belong to the default EPS bearer context, the UE shall not diagnose an error and shall delete the old packet filters which have identical filter precedence values.

In case ii, if one or more old packet filters belong to the default EPS bearer context, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical errors in packet filter(s)".

In cases i and iii the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical error in packet filter(s)".

If the UE detects different errors in the mapped EPS bearer contexts, QoS rules or QoS flow descriptions, the UE may send a single PDU SESSION MODIFICATION REQUEST message to delete the erroneous mapped EPS bearer contexts, QoS rules or QoS flow descriptions. In that case, the UE shall include a single 5GSM cause in the PDU SESSION MODIFICATION REQUEST message.

NOTE 4: The 5GSM cause to use cannot be different from: #41 "semantic error in the TFT operation", #42 "syntactical error in the TFT operation", #44 "semantic error in packet filter(s)", #45 "syntactical errors in packet filter(s)", #83 "semantic error in the QoS operation", #84 "syntactical error in the QoS operation", and #85 "Invalid mapped EPS bearer identity". The selection of a 5GSM cause is up to the UE implementation.

The UE shall only use the Control plane CIoT 5GS optimization for this PDU session if the Control plane only indication is included in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the UE requests the PDU session type "IPv4v6" and:

a) the UE receives the selected PDU session type set to "IPv4" and does not receive the 5GSM cause value #50 "PDU session type IPv4 only allowed"; or

b) the UE receives the selected PDU session type set to "IPv6" and does not receive the 5GSM cause value #51 "PDU session type IPv6 only allowed";

the UE may subsequently request another PDU session for the other IP version using the UE-requested PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) with a single address PDN type (IPv4 or IPv6) other than the one already activated.

If the UE requests the PDU session type "IPv4v6", receives the selected PDU session type set to "IPv4" and the 5GSM cause value #50 "PDU session type IPv4 only allowed", the UE shall not subsequently request another PDU session for "IPv6" using the UE-requested PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) and the PDU session type "IPv6" until:

- the UE is registered to a new PLMN which is not in the list of equivalent PLMNs;

- the PDU session type which is used to access the DNN (or no DNN, if no DNN was indicated by the UE) and the S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) is changed;

- the UE is switched off, or

- the USIM is removed.

If the UE requests the PDU session type "IPv4v6", receives the selected PDU session type set to "IPv6" and the 5GSM cause value #51 "PDU session type IPv6 only allowed", the UE shall not subsequently request another PDU session for "IPv4" using the UE-requested PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) and the PDU session type "IPv4" until:

- the UE is registered to a new PLMN which is not in the list of equivalent PLMNs;

- the PDU session type which is used to access the DNN (or no DNN, if no DNN was indicated by the UE) and the S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) is changed;

- the UE is switched off, or

- the USIM is removed.

If the selected PDU session type of the PDU session is "Unstructured" or "Ethernet", the UE supports inter-system change from N1 mode to S1 mode, the UE does not support establishment of a PDN connection for the PDN type set to "non-IP" in S1 mode, and the parameters list field of one or more authorized QoS flow descriptions received in the authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions. Additionally the UE shall also initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

If the selected PDU session type of the PDU session is "Ethernet", the UE supports inter-system change from N1 mode to S1 mode, the UE does not support establishment of a PDN connection for the PDN type set to "non-IP" in S1 mode, the UE, the network or both of them do not support Ethernet PDN type in S1 mode, and the parameters list field of one or more authorized QoS flow descriptions received in the authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions. Additionally, the UE shall also initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

If the UE receives an IPv4 Link MTU parameter, an Ethernet Frame Payload MTU parameter, or an Unstructured Link MTU parameter in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall pass to the upper layer the received IPv4 link MTU size, the received Ethernet frame payload MTU size, or the unstructured link MTU size.

NOTE 3: The IPv4 link MTU size corresponds to the maximum length of user data packet that can be sent via N3 interface for a PDU session of the "IPv4" PDU session types.

NOTE 4: The Ethernet frame payload MTU size corresponds to the maximum length of a payload of an Ethernet frame that can be sent via N3 interface for a PDU session of the "Ethernet" PDU session type.

NOTE 5: The unstructured link MTU size correspond to the maximum length of user data packet that can be sent via N3 interface for a PDU session of the "Unstructured" PDU session types.

If the 5G-RG receives an ACS information parameter in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, the 5G-RG shall pass the ACS URL in the received ACS information parameter to the upper layer.

If the UE has indicated support for CIoT 5GS optimizations and receives a small data rate control parameters container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store the small data rate control parameters value and use the stored small data rate control parameters value as the maximum allowed limit of uplink user data for the PDU session in accordance with 3GPP TS 23.501 [8].

If the UE has indicated support for CIoT 5GS optimizations and receives an additional small data rate control parameters for exception data container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store the additional small data rate control parameters for exception data value and use the stored additional small data rate control parameters for exception data value as the maximum allowed limit of uplink exception data for the PDU session in accordance with 3GPP TS 23.501 [8].

If the UE has indicated support for CIoT 5GS optimizations and receives an initial small data rate control parameters container or an initial additional small data rate control parameters for exception data container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall use these parameters for the newly established PDU Session. When the validity period of the initial parameters expire, the parameters received in a small data rate control parameters container or an additional small data rate control parameters for exception data container shall be used.

If the UE receives a Serving PLMN rate control IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store the Serving PLMN rate control IE value and use the stored serving PLMN rate control value as the maximum allowed limit of uplink control plane user data for the corresponding PDU session in accordance with 3GPP TS 23.501 [8].

If the network accepts the use of Reliable Data Service to transfer data for the PDU session, the network shall include the extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and include the Reliable Data Service accepted indicator. The UE behaves as described in subclause 6.2.15.

\*\*\* change \*\*\*

#### 6.4.2.2 UE-requested PDU session modification procedure initiation

In order to initiate the UE-requested PDU session modification procedure, the UE shall create a PDU SESSION MODIFICATION REQUEST message.

The UE shall allocate a PTI value currently not used and shall set the PTI IE of the PDU SESSION MODIFICATION REQUEST message to the allocated PTI value.

The UE shall not perform the UE-requested PDU session modification procedure for an emergency PDU session except for the error cases described in subclause 6.4.1.3 and subclause 6.3.2.3.

The UE shall not perform the UE-requested PDU session modification procedure for a PDU session for LADN when the UE is located outside the LADN service area except for indicating a change of 3GPP PS data off UE status.

If the UE requests a specific QoS handling, the UE shall include the requested QoS rules IE indicating requested QoS rules or the requested QoS flow descriptions IE indicating requested QoS flow descriptions or both for the specific QoS handling. The QoS rules IE includes the packet filters which describe the service data flows requested by the UE. The specific QoS parameters requested by the UE is specified in the QoS flow descriptions IE. If the UE requests the network to bind specific service data flows to a dedicated QoS flow, the UE shall create a new QoS rule by setting the rule operation code to "Create new QoS rule" and shall set the segregation bit to "Segregation requested" for the corresponding QoS rule in the QoS rules IE. The UE shall set the QRI values to "no QoS rule identifier assigned" in the requested QoS rules IE, if the QoS rules are newly created; otherwise, the UE shall set the QRI values to those of the existing QoS rules for which the specific QoS handling applies. The UE shall set the QFI values to "no QoS flow identifier assigned" in the requested QoS flow descriptions IE, if the QoS flow descriptions are newly created; otherwise, the UE shall set the QFI values to the QFIs of the existing QoS flow descriptions for which the specific QoS handling applies. The UE shall not request to create more than one QoS flow in a UE-requested PDU session modification procedure. If the SMF receives a PDU SESSION MODIFICATION REQUEST message with a Requested QoS rules IE containing more than one QoS rule with the rule operation code set to "Create new QoS rule", the SMF shall assign the same QFI to all the QoS rules which are created.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is operating in single-registration mode in the network supporting N26 interface, the PDU session is of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDU session type, and:

a) the UE is performing the PDU session modification procedure to indicate the support of reflective QoS, the UE shall set the RQoS bit to "Reflective QoS supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message; or

b) the UE is performing the PDU session modification procedure to indicate that reflective QoS is not supported, the UE shall set the RQoS bit to "Reflective QoS not supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.

If the UE is performing the PDU session modification procedure to revoke the previously indicated support of reflective QoS, the UE shall set the RQoS bit to "Reflective QoS not supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message. The UE shall not indicate support for reflective QoS for this PDU Session for the remaining lifetime of the PDU Session.

NOTE: The determination to revoke the usage of reflective QoS by the UE for a PDU session is implementation dependent.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is operating in single-registration mode in the network supporting N26 interface, the PDU session is of "IPv6" or "IPv4v6" PDU session type, and:

a) the UE is performing the PDU session modification procedure to indicate the support of Multi-homed IPv6 PDU session, the UE shall set the MH6-PDU bit to "Multi-homed IPv6 PDU session supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message; or

b) the UE is performing the PDU session modification procedure to indicate that Multi-homed IPv6 PDU session is not supported, the UE shall set the MH6-PDU bit to "Multi-homed IPv6 PDU session not supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is operating in single-registration mode in the network supporting N26 interface, the PDU session is of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDU session type, and the UE supports more than 16 packet filters for this PDU session, the UE shall indicate the maximum number of packet filters supported for the PDU session in the Maximum number of supported packet filters IE of the PDU SESSION MODIFICATION REQUEST message.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is operating in single-registration mode in the network supporting N26 interface, the UE shall include the Integrity protection maximum data rate IE in the PDU SESSION MODIFICATION REQUEST message.

If the UE is performing the PDU session modification procedure

a) to request the deletion of a non-default QoS rule due to errors in QoS operations or packet filters;

b) to request the deletion of a QoS flow description due to errors in QoS operations; or

c) to request the deletion of a mapped EPS bearer context due to errors in mapped EPS bearer operation, TFT operation or packet filters,

the UE shall include the 5GSM cause IE in the PDU SESSION MODIFICATION REQUEST message as described in subclauses 6.3.2.3, 6.3.2.4 and 6.4.1.3.

When the UE-requested PDU session modification procedure is used to indicate a change of 3GPP PS data off UE status for a PDU session, the UE shall include the extended protocol configuration options IE in the PDU SESSION MODIFICATION REQUEST message and setting the 3GPP PS data off UE status.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is operating in single-registration mode in the network supporting N26 interface and the UE requests the PDU session to be an always-on PDU session in the 5GS, the UE shall include the Always-on PDU session requested IE and set the value of the IE to "Always-on PDU session requested" in the PDU SESSION MODIFICATION REQUEST message.

If a port management information container needs to be delivered (see 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9]), the UE shall include a Port management information container IE in the PDU SESSION MODIFICATION REQUEST message.To request re-negotiation of IP header compression configuration, the UE shall include the IP header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message if the network indicated "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature support IE.

To request re-negotiation of Ethernet header compression configuration, the UE shall include the Ethernet header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message if the network indicated "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature support IE.

After an inter-system change from S1 mode to N1 mode, if:

a) the UE is operating in single-registration mode in a network that supports N26 interface;

b) the PDU session type value of the PDU session type IE is set to "Ethernet";

c) the UE indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

d) the network indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall initiate the PDU session modification procedure to negotiate the Ethernet header compression configuration and include the Ethernet header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message.

The UE shall transport:

a) the PDU SESSION MODIFICATION REQUEST message;

b) the PDU session ID; and

c) if the UE-requested PDU session modification:

1) is not initiated to indicate a change of 3GPP PS data off UE status associated to a PDU session, then the request type set to "modification request"; and

2) is initiated to indicate a change of 3GPP PS data off UE status associated to a PDU session, then without transporting the request type;

using the NAS transport procedure as specified in subclause 5.4.5, and the UE shall start timer T3581 (see example in figure 6.4.2.2.1).

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is registered in a network supporting the ATSSS,

a) the UE may request to modify a PDU session to an MA PDU session; or

b) the may UE allow the network to upgrade the PDU session to an MA PDU session. In order for the UE to allow the network to upgrade the PDU session to an MA PDU session, the UE shall set "MA PDU session network upgrade allowed" in the MA PDU session information IE and set the request type to "modification request" in the UL NAS TRANSPORT message.

In case UE executes case a) or b):

1) if the UE supports ATSSS Low-Layer functionality with any steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "ATSSS Low-Layer functionality with any steering mode supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message;

2) if the UE supports MPTCP functionality with any steering mode and ATSSS-LL functionality with only Active-Standby steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "MPTCP functionality with any steering mode and ATSSS-LL functionality with only Active-Standby steering mode supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message; and

3) if the UE supports MPTCP functionality with any steering mode and ATSSS-LL functionality with any steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "MPTCP functionality with any steering mode and ATSSS-LL functionality with any steering mode supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.



Figure 6.4.2.2.1: UE-requested PDU session modification procedure

\*\*\* change \*\*\*

#### 8.3.1.1 Message definition

The PDU SESSION ESTABLISHMENT REQUEST message is sent by the UE to the SMF to initiate establishment of a PDU session. See table 8.3.1.1.1.

Message type: PDU SESSION ESTABLISHMENT REQUEST

Significance: dual

Direction: UE to network

Table 8.3.1.1.1: PDU SESSION ESTABLISHMENT REQUEST message content

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IEI | Information Element | Type/Reference | | Presence | | Format | | Length | |
|  | Extended protocol discriminator | Extended protocol discriminator  9.2 | | M | | V | | 1 | |
|  | PDU session ID | PDU session identity  9.4 | | M | | V | | 1 | |
|  | PTI | Procedure transaction identity  9.6 | | M | | V | | 1 | |
|  | PDU SESSION ESTABLISHMENT REQUEST message identity | Message type  9.7 | | M | | V | | 1 | |
|  | Integrity protection maximum data rate | Integrity protection maximum data rate  9.11.4.7 | | M | | V | | 2 | |
| 9- | PDU session type | PDU session type  9.11.4.11 | | O | | TV | | 1 | |
| A- | SSC mode | SSC mode  9.11.4.16 | | O | | TV | | 1 | |
| 28 | 5GSM capability | 5GSM capability  9.11.4.1 | | O | | TLV | | 3-15 | |
| 55 | Maximum number of supported packet filters | Maximum number of supported packet filters  9.11.4.9 | | O | | TV | | 3 | |
| B- | Always-on PDU session requested | Always-on PDU session requested  9.11.4.4 | | O | | TV | | 1 | |
| 39 | SM PDU DN request container | SM PDU DN request container  9.11.4.15 | | O | | TLV | | 3-255 | |
| 7B | Extended protocol configuration options | Extended protocol configuration options  9.11.4.6 | | O | | TLV-E | | 4-65538 | |
| 66 | IP header compression configuration | | IP header compression configuration  9.11.4.24 | | O | | TLV | | 5-257 | |
| 6E | DS-TT Ethernet port MAC address | | DS-TT Ethernet port MAC address  9.11.4.25 | | O | | TLV | | 8 | |
| 6F | UE-DS-TT residence time | | UE-DS-TT residence time  9.11.4.26 | | O | | TLV | | 10 | |
| 7C | Port management information container | | Port management information container  9.11.4.27 | | O | | TLV-E | | 4-65538 | |
| TBD | Ethernet header compression configuration | | Ethernet header compression configuration  9.11.4.x | | O | | TLV | | 3 | |

\*\*\* change \*\*\*

#### 8.3.1.10 IP header compression configuration

The UE shall include the IP header compression configuration IE if:

- the PDU session type value of the PDU session type IE is set to "IPv4", "IPv6" or "IPv4v6";

- the UE indicates "Control Plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

- the network indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message.

\*\*\* change \*\*\*

#### 8.3.1.x Ethernet header compression configuration

The UE shall include the Ethernet header compression configuration IE if:

- the PDU session type value of the PDU session type IE is set to "Ethernet";

- the UE indicated "Control Plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

- the network indicated "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message.

\*\*\* change \*\*\*

#### 8.3.2.1 Message definition

The PDU SESSION ESTABLISHMENT ACCEPT message is sent by the SMF to the UE in response to PDU SESSION ESTABLISHMENT REQUEST message and indicates successful establishment of a PDU session. See table 8.3.2.1.1.

Message type: PDU SESSION ESTABLISHMENT ACCEPT

Significance: dual

Direction: network to UE

Table 8.3.2.1.1: PDU SESSION ESTABLISHMENT ACCEPT message content

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IEI | Information Element | Type/Reference | | Presence | | Format | | Length | |
|  | Extended protocol discriminator | Extended protocol discriminator  9.2 | | M | | V | | 1 | |
|  | PDU session ID | PDU session identity  9.4 | | M | | V | | 1 | |
|  | PTI | Procedure transaction identity  9.6 | | M | | V | | 1 | |
|  | PDU SESSION ESTABLISHMENT ACCEPT message identity | Message type  9.7 | | M | | V | | 1 | |
|  | Selected PDU session type | PDU session type  9.11.4.11 | | M | | V | | 1/2 | |
|  | Selected SSC mode | SSC mode  9.11.4.16 | | M | | V | | 1/2 | |
|  | Authorized QoS rules | QoS rules  9.11.4.13 | | M | | LV-E | | 6-65538 | |
|  | Session AMBR | Session-AMBR  9.11.4.14 | | M | | LV | | 7 | |
| 59 | 5GSM cause | 5GSM cause  9.11.4.2 | | O | | TV | | 2 | |
| 29 | PDU address | PDU address  9.11.4.10 | | O | | TLV | | 7, 11 or 15 | |
| 56 | RQ timer value | GPRS timer  9.11.2.3 | | O | | TV | | 2 | |
| 22 | S-NSSAI | S-NSSAI  9.11.2.8 | | O | | TLV | | 3-10 | |
| 8- | Always-on PDU session indication | Always-on PDU session indication  9.11.4.3 | | O | | TV | | 1 | |
| 75 | Mapped EPS bearer contexts | Mapped EPS bearer contexts  9.11.4.8 | | O | | TLV-E | | 7-65538 | |
| 78 | EAP message | EAP message  9.11.2.2 | | O | | TLV-E | | 7-1503 | |
| 79 | Authorized QoS flow descriptions | QoS flow descriptions  9.11.4.12 | | O | | TLV-E | | 6-65538 | |
| 7B | Extended protocol configuration options | Extended protocol configuration options  9.11.4.6 | | O | | TLV-E | | 4-65538 | |
| 25 | DNN | DNN  9.11.2.1B | | O | | TLV | | 3-102 | |
| 17 | 5GSM network feature support | 5GSM network feature support  9.11.4.18 | | O | | TLV | | 3-15 | |
| 18 | Serving PLMN rate control | Serving PLMN rate control  9.11.4.20 | | O | | TLV | | 4 | |
| 77 | ATSSS container | ATSSS container  9.11.4.22 | | O | | TLV-E | | 3-65538 | |
| C- | Control plane only indication | Control plane only indication  9.11.4.23 | | O | | TV | | 1 | |
| 66 | IP header compression configuration | | IP header compression configuration  9.11.4.24 | | O | | TLV | | 5-257 |
| TBD | Ethernet header compression configuration | | Ethernet header compression configuration  9.11.4.x | | O | | TLV | | 3 |

\*\*\* change \*\*\*

#### 8.3.2.17 IP header compression configuration

The SMF may include the IP header compression configuration IE if:

- the network accepts an IP PDU session type; and

- control plane CIoT 5GS optimization is selected.

\*\*\* change \*\*\*

#### 8.3.2.x Ethernet header compression configuration

The SMF may include the Ethernet header compression configuration IE if:

- the network accepts an Ethernet PDU session type; and

- control plane CIoT 5GS optimization is selected.

\*\*\* change \*\*\*

#### 8.3.7.1 Message definition

The PDU SESSION MODIFICATION REQUEST message is sent by the UE to the SMF to request a modification of a PDU session. See table 8.3.7.1.1.

Message type: PDU SESSION MODIFICATION REQUEST

Significance: dual

Direction: UE to network

Table 8.3.7.1.1: PDU SESSION MODIFICATION REQUEST message content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| IEI | Information Element | Type/Reference | Presence | Format | Length |
|  | Extended protocol discriminator | Extended protocol discriminator  9.2 | M | V | 1 |
|  | PDU session ID | PDU session identity  9.4 | M | V | 1 |
|  | PTI | Procedure transaction identity  9.6 | M | V | 1 |
|  | PDU SESSION MODIFICATION REQUEST message identity | Message type  9.7 | M | V | 1 |
| 28 | 5GSM capability | 5GSM capability  9.11.4.1 | O | TLV | 3-15 |
| 59 | 5GSM cause | 5GSM cause  9.11.4.2 | O | TV | 2 |
| 55 | Maximum number of supported packet filters | Maximum number of supported packet filters  9.11.4.9 | O | TV | 3 |
| B- | Always-on PDU session requested | Always-on PDU session requested  9.11.4.4 | O | TV | 1 |
| 13 | Integrity protection maximum data rate | Integrity protection maximum data rate  9.11.4.7 | O | TV | 3 |
| 7A | Requested QoS rules | QoS rules  9.11.4.13 | O | TLV-E | 7-65538 |
| 79 | Requested QoS flow descriptions | QoS flow descriptions  9.11.4.12 | O | TLV-E | 6-65538 |
| 75 | Mapped EPS bearer contexts | Mapped EPS bearer contexts  9.11.4.8 | O | TLV-E | 7-65538 |
| 7B | Extended protocol configuration options | Extended protocol configuration options  9.11.4.6 | O | TLV-E | 4-65538 |
| 7C | Port management information container | Port management information container  9.11.4.27 | O | TLV-E | 3-65538 |
| 66 | IP header compression configuration | Header compression configuration  9.11.4.24 | O | TLV | 5-257 |
| TBD | Ethernet header compression configuration | Ethernet header compression configuration  9.11.4.x | O | TLV | 3 |

NOTE: It is possible for UEs compliant with earlier versions of this specification to send the Mapped EPS bearer contexts IE with IEI of value "7F" for this message.

\*\*\* change \*\*\*

#### 8.3.7.12 IP header compression configuration

This IE is included in the message if the UE wishes to re-negotiate IP header compression configuration associated to a PDU session and both the UE and the network supports Control plane CIoT 5GS optimization and IP header compression.

\*\*\* change \*\*\*

#### 8.3.7.x Ethernet header compression configuration

This IE is included in the message:

a) if the UE wishes to re-negotiate Ethernet header compression configuration associated to a PDU session and both the UE and the network support Control plane CIoT 5GS optimization and Ethernet header compression; or

b) to negotiate Ethernet header compression configuration associated to a PDU session after an inter-system change from S1 mode to N1 mode.

\*\*\* change \*\*\*

#### 8.3.9.1 Message definition

The PDU SESSION MODIFICATION COMMAND message is sent by the SMF to the UE to indicate a modification of a PDU session. See table 8.3.9.1.1

Message type: PDU SESSION MODIFICATION COMMAND

Significance: dual

Direction: network to UE

Table 8.3.9.1.1: PDU SESSION MODIFICATION COMMAND message content

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IEI | Information Element | Type/Reference | | Presence | | Format | | Length | |
|  | Extended protocol discriminator | Extended protocol discriminator  9.2 | | M | | V | | 1 | |
|  | PDU session ID | PDU session identity  9.4 | | M | | V | | 1 | |
|  | PTI | Procedure transaction identity  9.6 | | M | | V | | 1 | |
|  | PDU SESSION MODIFICATION COMMAND message identity | Message type  9.7 | | M | | V | | 1 | |
| 59 | 5GSM cause | 5GSM cause  9.11.4.2 | | O | | TV | | 2 | |
| 2A | Session AMBR | Session-AMBR  9.11.4.14 | | O | | TLV | | 8 | |
| 56 | RQ timer value | GPRS timer  9.11.2.3 | | O | | TV | | 2 | |
| 8- | Always-on PDU session indication | Always-on PDU session indication  9.11.4.3 | | O | | TV | | 1 | |
| 7A | Authorized QoS rules | QoS rules  9.11.4.13 | | O | | TLV-E | | 7-65538 | |
| 75 | Mapped EPS bearer contexts | Mapped EPS bearer contexts  9.11.4.8 | | O | | TLV-E | | 7-65538 | |
| 79 | Authorized QoS flow descriptions | QoS flow descriptions  9.11.4.12 | | O | | TLV-E | | 6-65538 | |
| 7B | Extended protocol configuration options | Extended protocol configuration options  9.11.4.6 | | O | | TLV-E | | 4-65538 | |
| 77 | ATSSS container | ATSSS container  9.11.4.22 | | O | | TLV-E | | 3-65538 | |
| 66 | IP header compression configuration | IP header compression configuration  9.11.4.24 | | O | | TLV | | 5-257 | |
| 7C | Port management information container | | Port management information container  9.11.4.27 | | O | | TLV-E | | 3-65538 |
| 1E | Serving PLMN rate control | | Serving PLMN rate control  9.11.4.20 | | O | | TLV | | 4 |
| TBD | Ethernet header compression configuration | | Ethernet heaer compression configuration  9.11.4.x | | O | | TLV | | 3 |

\*\*\* change \*\*\*

#### 8.3.9.12 IP header compression configuration

This IE is included in the message if the network wishes to re-negotiate IP header compression configuration associated to a PDU session and both the UE and the network support Control plane CIoT 5GS optimization and IP header compression.

\*\*\* change \*\*\*

#### 8.3.9.x Ethernet header compression configuration

This IE is included in the message if the network wishes to re-negotiate Ethernet header compression configuration associated to a PDU session and both the UE and the network support Control plane CIoT 5GS optimization and Ethernet header compression.

\*\*\* change \*\*\*

#### 9.11.4.24 IP header compression configuration

The purpose of the IP header compression configuration information element is to negotiate ROHC channel setup parameters specified in IETF RFC 5795 [39B] and, optionally, provide additional IP header compression context setup parameters.

The IP header compression configuration information element is coded as shown in figure 9.11.4.24.1 and table 9.11.4.24.1.

The IP header compression configuration is a type 4 information element with a minimum length of 5 octets and a maximum length of 257 octets.

The optional Additional IP header compression parameters container field conveys the additional IP header compression context setup parameters as specified in 3GPP TS 23.501 [8] in a generic container. This field corresponds to the profile-specific information in the header of the ROHC IR packet type in IETF RFC 5795 [39B].

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 8 | 7 | 6 | 5 | 4 | | 3 | 2 | 1 |  |
| IP header compression configuration IEI | | | | | | | | | octet 1 |
| Length of IP header compression configuration contents | | | | | | | | | octet 2 |
| Spare | P0x0104 | P0x0103 | P0x0102 | | P0x0006 | P0x0004 | P0x0003 | P0x0002 | octet 3 |
| MAX\_CID | | | | | | | | | octet 4 |
| octet 5 |
| Additional IP header compression context setup parameters type | | | | | | | | | octet 6\* |
| Additional IP header compression context setup parameters container | | | | | | | | | octet 7\* |
|  |
| octet n\* |

Figure 9.11.4.24.1: IP header compression configuration information element

Table 9.11.4.24.1: IP header compression configuration information element

|  |
| --- |
| ROHC Profiles (octet 3)  The ROHC Profiles shall indicate which of the ROHC profiles is supported. When a particular bit is set to 1, this indicates that the corresponding profile is supported. The No Compression profile 0x0000 (see IETF RFC 5795 [39B]) shall always be supported. When all the bits are set to 0, this indicates that only the No Compression profile 0x0000 is supported.  Profile 0x0002 support indicator (see IETF RFC 3095 [33A] and IETF RFC 4815 [38A]) (octet 3 bit 1)  0 RoHC profile 0x0002 (UDP/IP) is not supported  1 RoHC profile 0x0002 (UDP/IP) is supported  Profile 0x0003 support indicator (see IETF RFC 3095 [33A] and IETF RFC 4815 [38A]) (octet 3 bit 2)  0 RoHC profile 0x0003 (ESP/IP) is not supported  1 RoHC profile 0x0003 (ESP/IP) is supported  Profile 0x0004 support indicator (see IETF RFC 3843 [34A] and IETF RFC 4815 [38A]) (octet 3 bit 3)  0 RoHC profile 0x0004 (IP) is not supported  1 RoHC profile 0x0004 (IP) is supported  Profile 0x0006 support indicator (see IETF RFC 6846 [40B]) (octet 3 bit 4)  0 RoHC profile 0x0006 (TCP/IP) is not supported  1 RoHC profile 0x0006 (TCP/IP) is supported  Profile 0x0102 support indicator (see IETF RFC 5225 [39A]) (octet 3 bit 5)  0 RoHC profile 0x0102 (UDP/IP) is not supported  1 RoHC profile 0x0102 (UDP/IP) is supported  Profile 0x0103 support indicator (see IETF RFC 5225 [39A]) (octet 3 bit 6)  0 RoHC profile 0x0103 (ESP/IP) is not supported  1 RoHC profile 0x0103 (ESP/IP) is supported  Profile 0x0104 support indicator (see IETF RFC 5225 [39A]) (octet 3 bit 7)  0 RoHC profile 0x0104 (IP) is not supported  1 RoHC profile 0x0104 (IP) is supported  Bits 8 is spare and shall be set to 0.  MAX\_CID (octet 4 and octet 5)  This is the MAX\_CID value as specified in 3GPP TS 36.323 [25]. It is encoded in binary coding with a value in the range from 1 to 16383.  Additional IP header compression context parameters type (octet 6).  The Additional IP header compression context parameters type octet indicates the profile associated with the profile-specific information in the Additional IP header compression context parameters container.  Bits  **8 7 6 5 4 3 2 1** Type    0 0 0 0 0 0 0 0 0x0000 (No Compression)  0 0 0 0 0 0 0 1 0x0002 (UDP/IP)  0 0 0 0 0 0 1 0 0x0003 (ESP/IP)  0 0 0 0 0 0 1 1 0x0004 (IP)  0 0 0 0 0 1 0 0 0x0006 (TCP/IP)  0 0 0 0 0 1 0 1 0x0102 (UDP/IP)  0 0 0 0 0 1 1 0 0x0103 (ESP/IP)  0 0 0 0 0 1 1 1 0x0104 (IP)  0 0 0 0 1 0 0 0 Other  0 0 0 0 1 0 0 1  to  1 1 1 1 1 1 1 1 Spare  Additional IP header compression context parameters container (octets 7 to n).  Additional IP header compression context parameters container carries the profile-specific information (see IETF RFC 5795 [39B]). The maximum size is 251 octets.  NOTE: If the Additional IP header compression context setup parameters container is included, then the Additional IP header compression context parameters type shall be included in the octet 6. |

\*\*\* change \*\*\*

#### 9.11.4.x Ethernet header compression configuration

The purpose of the Ethernet header compression configuration information element is to negotiate the use of EHC and the length of the CID field in the EHC packet (see 3GPP TS 38.323 [25]).

The Ethernet header compression configuration information element is coded as shown in figure 9.11.4.x.1 and table 9.11.4.x.1.

The Ethernet header compression configuration is a type 4 information element with the length of 3 octets.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 8 | 7 | | 6 | 5 | 4 | | | 3 | 2 | 1 |  |
| Ethernet header compression configuration IEI | | | | | | | | | | | octet 1 |
| Length of Ethernet header compression configuration contents | | | | | | | | | | | octet 2 |
| 0  Spare | | 0  Spare | 0  Spare | 0  Spare | | 0  Spare | 0  Spare | | CID Length | | octet 3 |

Figure 9.11.4.x.1: Ethernet header compression configuration information element

Table 9.11.4.x.1: Ethernet header compression configuration information element

|  |  |  |
| --- | --- | --- |
| Length of CID field value (CID Length) (octet 3 bits 1 and 2) | | |
|  | | |
| Bit | | |
| 2 | **1** |  |
| 0 | 0 | Ethernet header compression not used |
| 0 | 1 | 7 bits |
| 1 | 0 | 15 bits |
|  | | |
| All other values shall be interpreted as "7 bits".  Bits 3 to 8 of octet 3 are spare and shall be coded as zero. | | |

\*\*\* last change \*\*\*