**3GPP TSG-CT WG4 Meeting #111-eC4-224xxx**

**E-Meeting, 18th – 26th August 2022** *Revision of C4-224163*

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

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|  | | | | | | | | | | |
| ***Title:*** | No URR support over N4mb | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | , Huawei | | | | | | | | | |
| ***Source to TSG:*** | CT4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5MBS | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | TS 29.244 contains an editor's note and "FFS" statements on whether URR is supported over N4mb.  In LS [S2-2203652](https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_151E_Electronic_2022-05/Docs/S2-2203652.zip)/S5-222812, SA5 confirmed that 5MBS charging is not in Rel-17 scope.  Accordingly, CR 23.247 #0117 clarified that the collection and reporting of MBS specific charging information are not specified in this release and removed traffic usage reporting related requirement. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | URRs are not supported over N4mb. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Incomplete specification | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 7.4.4.3, 7.5.2.1, 7.5.2.2, 7.5.2.4, 7.5.4.1, 7.5.4.2, 7.5.4.4, 7.5.4.8, 7.5.5.1, 7.5.5.2, 7.5.7.1, 7.5.7.2, 7.5.8.1, 7.5.8.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Rev. 1: Huawei is added as co-source (merge of CRs) | | | | | | | | |

\* \* \* First Change \* \* \* \*

#### 7.4.4.3 PFCP Association Update Request

Table 7.4.4.3-1: Information Elements in a PFCP Association Update Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Information  elements | P | Condition / Comment | **Appl.** | | | | | **IE Type** |
| **Sxa** | **Sxb** | **Sxc** | **N4** | **N4mb** |
| Node ID | M | This IE shall contain the unique identifier of the sending Node. | X | X | X | X | X | Node ID |
| UP Function Features | O | If present, this IE shall indicate the supported Features when the sending node is the UP function. | X | X | X | X | X | UP Function Features |
| CP Function Features | O | If present, this IE shall indicate the supported Features when the sending node is the CP function. | X | X | X | X | X | CP Function Features |
| PFCP Association Release Request | C | This IE shall be present if the UP function requests the CP function to release the PFCP association. | X | X | X | X | X | PFCP Association Release Request |
| Graceful Release Period | C | This IE shall be present if the UP function requests a graceful release of the PFCP association. | X | X | X | X | X | Graceful Release Period |
| PFCPAUReq-Flags | O | This IE shall be included if at least one of the flags is set to "1".  - PARPS (PFCP Association Release Preparation Start): if both the CP function and UP function support the EPFAR feature, the CP or UP function may set this flag to "1" to indicate that the PFCP association is to be released and all non-zero usage reports for those PFCP Sessions affected by the release of the PFCP association shall be reported. | X | X | X | X | - | PFCPAUReq-Flags |
| Alternative SMF IP Address | O | This IE may be present if the (MB-)SMF advertises the support of the SSET and/or MPAS feature in the CP Function Features IE (see clause 8.2.58).  When present, this IE shall contain an IPv4 and/or IPv6 address of an alternative (MB-)SMF or an alternative PFCP entity in the same (MB-)SMF when SSET feature is used, or an alternative PFCP entity in the same (MB-)SMF when MPAS feature is used.  Several IEs with the same IE type may be present to represent multiple alternative (MB-)SMF IP addresses. | - | - | - | X | X | Alternative SMF IP Address |
| SMF Set ID | O | This IE may be present if the CP function sends this message and (MB-)SMF advertises the support of the MPAS feature in the CP Function Features IE (see clause 5.22.3), and there is a change in FQDN representing the (MB-)SMF set to which the (MB-)SMF belongs. | - | - | - | X | X | SMF Set ID |
| Clock Drift Control Information | C | This IE shall be present if the Clock Drift Control Information needs to be modified (see clause 5.26.4).  Several IEs with the same IE type may be present to represent TSN domains.  When present, the UPF shall replace any Clock Drift control information received earlier with the new received information.  A Clock Drift Control Information with a null length indicates that clock drift reporting shall be stopped.  See Table 7.4.4.1.2-1. | - | - | - | X | - | Clock Drift Control Information |
| UE IP address Pool Information | O | This IE may be present when the UP function sends this message, if UE IP Address Pools are configured in the UP function.  Several IE with the same IE type may be present to represent multiple UE IP address Pool Information.  The IE shall be encoded as in Table 7.4.4.1-3. | - | X | - | X | - | UE IP address Pool Information |
| GTP-U Path QoS Control Information | C | This IE shall be present if the GTP-U Path QoS Control Information needs to be modified (see clause 5.24.5).  Several IEs with the same IE type may be present to represent multiple GTP-U paths to monitor.  When present, the UPF shall replace any GTP-U path control information received earlier with the new received information.  A GTP-U Path QoS Control Information with a null length indicates that QoS monitoring of GTP-U paths shall be stopped.  See Table 7.4.4.1.3-1. | - | - | - | X | - | GTP-U Path QoS Control Information |
| UE IP Address Usage Information | O | The UP function may include this IE if both UP and CP functions support the UE IP Address Usage Reporting feature.  See Table 7.4.4.3.1-1  Several IEs with the same type may be present to represent UE IP Address Usage Information for different UE IP Address Pools and/or Network Instances.  See clause 5.21.3. | - | X | - | X | - | UE IP Address Usage Information |

\* \* \* Next Change \* \* \* \*

### 7.5.2 PFCP Session Establishment Request

#### 7.5.2.1 General

The PFCP Session Establishment Request shall be sent over the Sxa, Sxb, Sxc, N4 and N4mb interface by the CP function to establish a new PFCP session context in the UP function.

Table 7.5.2.1-1: Information Elements in a PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Information elements | | P | | Condition / Comment | | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Node ID | | M | | This IE shall contain the unique identifier of the sending Node. | | X | X | X | X | X | Node ID |
| CP F-SEID | | M | | This IE shall contain the unique identifier allocated by the CP function identifying the session. | | X | X | X | X | X | F-SEID |
| Create PDR | | M | | This IE shall be present for at least one PDR to be associated to the PFCP session.  Several IEs with the same IE type may be present to represent multiple PDRs.  See Table 7.5.2.2-1. | | X | X | X | X | X | Create PDR |
| Create FAR | | M | | This IE shall be present for at least one FAR to be associated to the PFCP session.  Several IEs with the same IE type may be present to represent multiple FARs.  See Table 7.5.2.3-1. | | X | X | X | X | X | Create FAR |
| Create URR | | C | | This IE shall be present if a measurement action shall be applied to packets matching one or more PDR(s) of this PFCP session.  Several IEs within the same IE type may be present to represent multiple URRs.  See Table 7.5.2.4-1. | | X | X | X | X | - | Create URR |
| Create QER | | C | | This IE shall be present if a QoS enforcement or QoS marking action shall be applied to packets matching one or more PDR(s) of this PFCP session.  Several IEs within the same IE type may be present to represent multiple QERs.  See Table 7.5.2.5-1. | | - | X | X | X | X | Create QER |
| Create BAR | | O | | When present, this IE shall contain the buffering instructions to be applied by the UP function to any FAR of this PFCP session set with the Apply Action requesting the packets to be buffered and with a BAR ID IE referring to this BAR. See table 7.5.2.6-1. | | X | - | - | X | - | Create BAR |
| Create Traffic Endpoint | | C | | This IE may be present if the UP function has indicated support of PDI optimization.  Several IEs within the same IE type may be present to represent multiple Traffic Endpoints.  See Table 7.5.2.7-1. | | X | X | X | X | X | Create Traffic Endpoint |
| PDN Type | | C | | This IE shall be present if the PFCP session is setup for an individual PDN connection or PDU session (see clause 5.2.1).  When present, this IE shall indicate whether this is an IP or non-IP PDN connection/PDU session or, for 5GC, an Ethernet PDU session. See NOTE 3. | | X | X | - | X | - | PDN Type |
| SGW-C FQ-CSID | | C | | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | | X | X | - | - | - | FQ-CSID |
| MME FQ-CSID | | C | | This IE shall be included when received on the S11 interface or on S5/S8 interface according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | | X | X | - | - | - | FQ-CSID |
| PGW-C/SMF FQ-CSID | | C | | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24] and clause 4.6 of 3GPP TS 23.527 [40]. | | X | X | - | X | - | FQ-CSID |
| ePDG FQ-CSID | | C | | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | | - | X | - | - | - | FQ-CSID |
| TWAN FQ-CSID | | C | | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | | - | X | - | - | - | FQ-CSID |
| User Plane Inactivity Timer | | O | | This IE may be present to request the UP function to send a User Plane Inactivity Report when no user plane packets are received for this PFCP session for a duration exceeding the User Plane Inactivity Timer.  When present, it shall contain the duration of the inactivity period after which a User Plane Inactivity Report shall be generated. | | - | X | X | X | X | User Plane Inactivity Timer |
| User ID | | O | | This IE may be present, based on operator policy. It shall only be sent if the UP function is in a trusted environment.  See NOTE 1. | | X | X | X | X | - | User ID |
| Trace Information | | O | | When present, this IE shall contain the trace instructions to be applied by the UP function for this PFCP session. | X | X | X | X | - | Trace Information | |
| APN/DNN | | O | | This IE may be present, if related functionalities in the UP function require the APN/DNN information. See NOTE 2. | X | X | - | X | X | APN/DNN | |
| Create MAR | | C | | This IE shall be present for a N4 session established for a MA PDU session.  Several IEs with the same IE type may be present to represent multiple MARs.  See Table 7.5.2.8-1. | - | - | - | X | - | Create MAR | |
| PFCPSEReq-Flags | | C | | This IE shall be included if at least one of the flags is set to "1".  - RESTI (Restoration Indication): this bit shall be set to "1" if the CP function re-establishes an existing PFCP session and the allocation of GTP-U F-TEID and/or UE IP address is performed by the UP function. (NOTE 4)  - SUMPC (Stop Usage Measurement to Pause Charging): the CP function, e.g. PGW-C or (H-)SMF, shall set this flag if the usage measurement for the URRs which are applicable for charging (i.e. with the "ASPOC" flag set to "1") shall be stopped in the UP function. | X | X | - | X | - | PFCPSEReq-Flags | |
| Create Bridge Info for TSC | | C | | This IE shall be present for a PFCP session established for TSC to request the UPF to provide Bridge information for TSC. | - | - | - | X | - | Create Bridge Info for TSC | |
| Create SRR | | O | | This IE may be present to request the UPF to detect and report events not related to specific PDRs.  Several IEs within the same IE type may be present to represent multiple SRRs.  See Table 7.5.2.9-1. | - | - | - | X | - | Create SRR | |
| Provide ATSSS Control Information | | C | | This IE shall be present for N4 session establishment for a MA PDU session.  When present, this IE shall contain the required ATSSS functionalities for this MA PDU session.  See Table 7.5.2.10-1. | - | - | - | X | - | Provide ATSSS Control Information | |
| Recovery Time Stamp | | O | | This IE may be included to contain the time stamp when the CP function was started. (See clause 19A of 3GPP TS 23.007 [24].) | X | X | X | X | - | Recovery Time Stamp | |
| S-NSSAI | | O | | This IE may be present, if related functionalities in the UP function require the S-NSSAI information. (NOTE 2, NOTE 5)  When present, it shall indicate the S-NSSAI of the PDU session or MBS session. | - | - | - | X | X | S-NSSAI | |
| Provide RDS configuration information | | O | | When present, this IE shall contain the RDS configuration information to be applied by the UP function for this PFCP session. | - | X | - | X | - | Provide RDS configuration information | |
| RAT Type | | O | | This IE may be present to provide the UP Function the current RAT Type for the PDN connection/PDU session to which this PFCP Session is corresponding for statistics purpose if the PFCP session is not established for a MA PDU session. | X | X | - | X | - | RAT Type | |
| L2TP Tunnel Information | | C | | This IE shall be present if L2TP tunnel information is received from an AAA server, e.g. Radius/Diameter server or if it is configured in the CP function.  Several IE with the same IE type may be present to provide L2TP Tunnel Information for alternative LNS. | - | X | - | X | - | L2TP Tunnel Information | |
| L2TP Session Information | | C | | This IE shall be present to include the information to establish a L2TP session, if an L2TP session needs to be established for this PFCP session. | - | X | - | X | - | L2TP Session Information | |
| Group Id | | O | | This IE may be included by the CP function to indicate the group identifier to which the PFCP session pertains (see clause 5.22). | - | X | - | X | - | Group Id | |
| MBS Session N4mb Control Information | | M | | This IE shall identify the MBS session, or the MBS session and Area Session ID for a location dependent MBS service, and it may contain further control information for the MB-UPF. | - | - | - | - | X | MBS Session N4mb Control Information | |
| MBS Session N4 Control Information | | C | | This IE shall be included if the correspond PDU session shall be associated with an MBS session, or with an MBS session and Area Session ID for a location dependent MBS service.  Several IEs with the same IE type may be present to provide N4 control information for several MBS sessions, e.g., when the UE requests to join several MBS sessions. | - | - | - | X | - | MBS Session N4 Control Information | |
| DSCP to PPI Control Information | | O | | This IE may be present if the UPF is required to insert the Paging Policy Indicator (PPI) in the GTP-U PDU Session Container extension header of outgoing GTP-U packets (encapsulating payload packets) based on the DSCP in the TOS/Traffic Class field in the IP header of payload packet and if the UPF supports the EPPPI feature as specified in clause 5.36.2.  Several IEs with the same IE type may be present to provide different DSCP to PPI Control Information for different set of QFI(s). | - | - | - | X | - | DSCP to PPI Control Information | |
| NOTE 1: This can be used for troubleshooting problems in the UP function affecting a subscriber.  NOTE 2: The CP function may provide additional information (e.g. APN/DNN, S-NSSAI) to the UP function, e.g. used by the forwarding rules pre-defined in UP function (some forwarding rules are APN specific), used by the UP function for performance measurement, used by the UP function for resource management, or used by the UPF to include a proper User plane node/Bridge ID in the response message during a PFCP session establishment for a PDU session for TSC.  NOTE 3: The SGW-C may set PDN type as Non-IP for an Ethernet PDN to allow interworking with a legacy SGW-U.  NOTE 4: The UP function shall accept the CP function allocated GTP-U F-TEID and/or UE IP address in the PFCP Session Establishment Request message with the RESTI flag set to "1", if the requested GTP-U F-TEID and/or UE IP address are available. If the GTP-U F-TEID or UE IP address provided by the CP function is not available at the UP function, the UP function shall reject the PFCP Session Establishment Request with the cause "PFCP session restoration failure due to requested resource not available" (see clause 8.2.1).  NOTE 5: A UPF shall support allocating resources using the Network Instance IE and the UPF may additionally support allocating resources using the Network Instance IE and S-NSSAI IE (see clause 5.35). | | | | | | | | | | | |

Table 7.5.2.1-2: L2TP Tunnel Information IE in the PFCP Session Establishment Request message

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | L2TP Tunnel Information IE Type = 276 (decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| LNS Address | M | This IE shall be present to include the Tunnel Server Endpoint, i.e. LNS IP address. | - | X | - | X | - | LNS Address |
| Tunnel Password | O | This IE may be present to include the password to be used to authenticate to a remote server. | - | X | - | X | - | Tunnel Password |
| Tunnel Preference | C | This IE shall be present if multiple L2TP Tunnel Information IEs are included in the message.  If present this IE indicates the order in which the L2TP Tunnel Information IEs shall be used when trying to establish the L2TP session. | - | X | - | X | - | Tunnel Preference |

Table 7.5.2.1-3: L2TP Session Information IE in the PFCP Session Establishment Request message

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | L2TP Session Information IE Type = 277 (decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Calling Number | O | This IE may be present, e.g. to include an MSISDN of the UE. | - | X | - | X | - | Calling Number |
| Called Number | O | This IE may be present, e.g. to include an APN/DNN. | - | X | - | X | - | Called Number |
| Maximum Receive Unit | O | This IE may be present to include Maximum Receive Unit for LCP/PPP which may be set to the value of the MTU received from the UE or may be configured in the CP function. | - | X | - | X | - | Maximum Receive Unit |
| L2TP Session Indications | C | This IE shall be present if the CP function requests the UP function to get a UE IP Address, and/or DNS server information, and/or NBNS server information from the LNS. | - | X | - | X | - | L2TP session Indications |
| L2TP User Authentication | O | This IE may be present to include the authentication information to be used during L2TP session establishment. | - | X | - | X | - | L2TP User Authentication |
| NOTE: The Tunnel Password and L2TP User Authentication IE are transferred with plain text, a Network Domain Security/IP based security mechanism may be deployed between the CP function and the UP function if required by the local policies. | | | | | | | | |

Table 7.5.2.1-4: MBS Session N4mb Control Information IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | MBS Session N4mb Control Information IE Type = 300 (decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| MBS Session Identifier | M |  | - | - | - | - | X | MBS Session Identifier |
| Area Session ID | C | This IE shall be present for a location dependent MBS service. When present, it shall contain the Area Session ID, which together with the MBS Session Identifier, uniquely identify the service area part of the content data of the MBS service. | - | - | - | - | X | Area Session ID |
| MBSN4mbReq-Flags | C | This IE shall be included if at least one of the flags is set to "1".  - PLLSSM (Provide Lower Layer SSM): the MB-SMF shall set this flag to "1" to request the MB-UPF to allocate a LL SSM (i.e. multicast destination address and related source IP address) and a GTP-U Common Tunnel EndPoint Identifier (C-TEID), if multicast transport is used over N3mb and/or N19mb.  - JMBSSM (Join MBS Session SSM): the MB-SMF shall set this flag to "1" to request the MB-UPF to join the multicast tree towards the Source Specific Multicast (SSM) address information provided by AF/AS or MBSTF for the MBS Session, if multicast transport is used over N6mb or Nmb9. .  - MBS RESTI (MBS Restoration Indication): this bit shall be set to "1" if the MB-SMF re-establishes an existing PFCP session. (NOTE) | - | - | - | - | X | MBSN4mbReq-Flags |
| Multicast Transport Information for N3mb and/or N19mb | C | This IE shall be present during the restoration of a PFCP session of an MBS session after an MB-UPF restart, as defined in clause 8.2.2 of 3GPP TS 23.527 [40].  When present, it shall include the low layer source specific multicast address information (i.e. multicast destination address and related source IP address) and the GTP-U Common Tunnel EndPoint Identifier (C-TEID) that the MB-SMF requests the MB-UPF to allocate for multicast transport over N3mb and/or N19mb, if possible.  (NOTE) | - | - | - | - | X | Multicast Transport Information |
| NOTE: The MB-UPF shall accept the MB-SMF allocated N3mb/N19mb and/or the N6mb/Nmb9 address in the PFCP Session Establishment Request message with the MBS RESTI flag set to "1", if the requested addresses are available. If one requested address is not available at the MB-UPF, the MB-UPF shall reject the PFCP Session Establishment Request with the cause "PFCP session restoration failure due to requested resource not available" (see clause 8.2.1). | | | | | | | | |

Table 7.5.2.1-5: MBS Session N4 Control Information IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | MBS Session N4 Control Information IE Type = 310 (decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| MBS Session Identifier | M |  | - | - | - | X | - | MBS Session Identifier |
| Area Session ID | C | This IE shall be present for a location dependent MBS service. When present, it shall contain the Area Session ID, which together with the MBS Session Identifier, uniquely identify the service area part of the content data of the MBS service. | - | - | - | X | - | Area Session ID |
| Multicast Transport Information | C | This IE shall be present to include a low layer source specific multicast address information (i.e. multicast destination address and related source IP address) and a GTP-U Common Tunnel EndPoint Identifier (C-TEID) which was allocated by the MB-UPF, if IP multicast transport is used over N19mb. | - | - | - | X | - | Multicast Transport Information |

Table 7.5.2.1-6: DSCP to PPI Control Information IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | DSCP to PPI Control Information IE Type = 316 (decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| DSCP to PPI Mapping Information | M | This IE shall be present to instruct the UPF to insert the corresponding PPI for the downlink GTP-U packet, where the DSCP of its payload packet is matching one of DSCP codes in the DSCP to PPI Mapping Information.  Several IEs with the same IE type may be present to provide different DSCP to PPI mapping information. | - | - | - | X | - | DSCP to PPI Mapping Information |
| QFI | O | This IE may be present to request the UPF to only insert PPI for those packets pertain to the requested QoS flow(s).  Several IEs with the same IE type may be present to provide a list of QFIs.  (NOTE 1) | - | - | - | X | - | QFI |
| NOTE 1: The absence of QFI(s) indicates that insertion of the corresponding PPI shall be applied for all DL packets (matching the DSCP(s) of the DSCP to PPI Mapping Information IE) pertaining to all QoS flows of the PFCP session. | | | | | | | | |

\* \* \* Next Change \* \* \* \*

#### 7.5.2.2 Create PDR IE within PFCP Session Establishment Request

The Create PDR grouped IE shall be encoded as shown in Figure 7.5.2.2-1.

Table 7.5.2.2-1: Create PDR IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | Create PDR IE Type = 1(decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| PDR ID | M | This IE shall uniquely identify the PDR among all the PDRs configured for that PFCP session. | X | X | X | X | X | PDR ID |
| Precedence | M | This IE shall indicate the PDR's precedence to be applied by the UP function among all PDRs of the PFCP session, when looking for a PDR matching an incoming packet. | - | X | X | X | X | Precedence |
| PDI | M | This IE shall contain the PDI against which incoming packets will be matched.  See Table 7.5.2.2-2. | X | X | X | X | X | PDI |
| Outer Header Removal | C | This IE shall be present if the UP function is required to remove one or more outer header(s) from the packets matching this PDR. | X | X | - | X | X | Outer Header Removal |
| FAR ID | C | This IE shall be present if the Activate Predefined Rules IE is not included or if it is included but it does not result in activating a predefined FAR, and if the MAR ID is not included. This IE may be present if the CP function activated a predefined rule name with a predefined FAR but the CP function wishes to overwrite the predefined FAR by another FAR. (NOTE 2)  When present this IE shall contain the FAR ID to be associated to the PDR. | X | X | X | X | X | FAR ID |
| URR ID | C | This IE shall be present if a measurement action shall be applied to packets matching this PDR.  When present, this IE shall contain the URR IDs to be associated to the PDR.  Several IEs within the same IE type may be present to represent a list of URRs to be associated to the PDR. | X | X | X | X | - | URR ID |
| QER ID | C | This IE shall be present if a QoS enforcement or QoS marking action shall be applied to packets matching this PDR.  When present, this IE shall contain the QER IDs to be associated to the PDR. Several IEs within the same IE type may be present to represent a list of QERs to be associated to the PDR. | - | X | X | X | X | QER ID |
| Activate Predefined Rules | C | This IE shall be present if Predefined Rule(s) shall be activated for this PDR. When present this IE shall contain one Predefined Rules name.  Several IEs with the same IE type may be present to represent multiple "Activate Predefined Rules" names. | - | X | X | X | - | Activate Predefined Rules |
| Activation Time | O | This IE may be present if the PDR activation shall be deferred. (NOTE 1) | - | X | X | X | - | Activation Time |
| Deactivation Time | O | This IE may be present if the PDR deactivation shall be deferred. (NOTE 1) | - | X | X | X | - | Deactivation Time |
| MAR ID | C | This IE shall be present if the PDR is provisioned to match the downlink traffic of non-GBR QoS flows towards the UE for a PFCP session established for a MA PDU session. | - | - | - | X | - | MAR ID |
| Packet Replication and Detection Carry-On Information | C | This IE shall be present if the PDR is provisioned to match a broadcast packet. When present, it contains the information to instruct the UPF to replicate the packet and to carry-on the look-up of other PDRs of other PFCP sessions matching the packet (see clause 5.2.1). | - | - | - | X | - | Packet Replication and Detection Carry-On Information |
| IP Multicast Addressing Info | O | This IE may be present in an UL PDR controlling UL IGMP/MLD traffic (see 5.25).  When present, it shall contain a (range of) IP multicast address(es), and optionally source specific address(es), identifying a set of IP multicast flows. See Table 7.5.2.2-4.  Several IEs with the same IE type may be present to represent multiple IP multicast flows. | - | - | - | X | - | IP Multicast Addressing Info |
| UE IP address Pool Identity | O | This IE may be present if UE IP Addresses Pools are configured in the UPF.  When present, this IE shall contain the identity of a UE IP address Pool configured in the UPF.  Two IEs with the same IE type shall be present to represent UE IPv4 Address Pool Identity and UE IPv6 Address Pool Identity if different pool identities are used for UE IPv4 address and UE IPv6 address and both an UE IPv4 and an UE IPv6 address are requested to be assigned for the PFCP session. In this case, the UE IPv4 Address Pool Identity shall be encoded before the UE IPv6 Address Pool Identity. | - | X | - | X | - | UE IP address Pool Identity |
| MPTCP Applicable Indication | C | This IE shall be present if the PDR is used to detect UL user plane traffic for which MPTCP is applicable. | - | - | - | X | - | MPTCP Applicable Indication |
| Transport Delay Reporting | C | This IE shall be present to request the UPF to add the delay of the GTP-U path with the preceding uplink GTP-U entity to the "N3/N9 Delay Result received in the GTP-U PDU Session Container extension header (see 3GPP TS 38.415 [34]) of the uplink packet, when monitoring the QoS of a PDU session based on GTP-U path monitoring (see clause 5.24.5.3). See Table 7.5.2.2-6. | - | - | - | X | - | Transport Delay Reporting |
| RAT Type | O | This IE may be present to provide the UP Function the current RAT Type for the UL PDR for statistics purpose if the PFCP session is established for a MA PDU session. | - | - | - | X | - | RAT Type |
| NOTE 1: When the Activation Time and Deactivation Time are not present, the PDR shall be activated immediately at receiving the message.  NOTE 2: If a predefined FAR is or has been activated using a predefined rule name, it is UP function implementation specific whether this predefined FAR can be overwritten by a FAR ID pointing to another predefined FAR (i.e. with the most significant bit set to 1). If not, the UP function shall reject such a request if received from the CP function. | | | | | | | | |

Table 7.5.2.2-2: PDI IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 | |  | | PDI IE Type = 2 (decimal) | | | | | | | | |
| Octets 3 and 4 | |  | | Length = n | | | | | | | | |
| Information elements | | P | | Condition / Comment | | Appl. | | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb | |
| Source Interface | | M | | This IE shall identify the source interface of the incoming packet. | | X | X | X | X | X | | Source Interface |
| Local F-TEID | | O | | This IE shall not be present if Traffic Endpoint ID is present.  If present, this IE shall identify the local F-TEID to match for an incoming packet.  The CP function shall set the CHOOSE (CH) bit to 1 if the CP function requests the UP function to assign a local F-TEID to the PDR. | | X | X | - | X | - | | F-TEID |
| Local Ingress Tunnel | | C | | This IE shall not be present if Traffic Endpoint ID is present.  If present, this IE shall identify the IP address and the UDP port for a UDP/IP tunnel.  The CP function shall set the CHOOSE (CH) bit to 1 if the CP function requests the UP function to assign a local ingress tunnel to the PDR. | | - | - | - | - | X | | Local Ingress Tunnel |
| Network Instance | | O | | This IE shall not be present if Traffic Endpoint ID is present. It shall be present if the CP function requests the UP function to allocate a UE IP address/prefix and the Traffic Endpoint ID is not present.  If present, this IE shall identify the Network instance to match for the incoming packet. See NOTE 1, NOTE2. | | X | X | X | X | X | | Network Instance |
| Redundant Transmission Detection Parameters | | O | | If present, this IE shall contain the information used for the reception of redundant uplink packets on N3/N9 interfaces. | | - | - | - | X | - | | Redundant Transmission Detection Parameters |
| UE IP address | | O | | This IE shall not be present if Traffic Endpoint ID is present.  If present, this IE shall identify the UE IP address as the source or destination IP address to match for the incoming packet. (NOTE 5).  The CP function shall set the CHOOSE IPV4 (CHV4) and/or the CHOOSE IPV6 (CHV6) bits to 1 if the UP function supports the allocation of UE IP address/ prefix and the CP function requests the UP function to assign a UE IP address/prefix to the PDR.  This IE may also present to identify the IP address of the CP function as the destination IP address to match for the incoming packet, e.g. Radius, Diameter or DHCP signalling packet. (NOTE 8).  In the 5GC, several IEs with the same IE type may be present to represent multiple UE IP addresses, if the UPF indicated support of the IP6PL feature (see clause 5.21). | | - | X | X | X | - | | UE IP address |
| Traffic Endpoint ID | | C | | This IE may be present if the UP function has indicated the support of PDI optimization.  If present, this IE shall uniquely identify the Traffic Endpoint for that PFCP session.  Several IEs with the same IE type may be present to provision several Traffic Endpoints with different Traffic Endpoint IDs, from which the UPF may receive packets pertaining to the same service data flow, which is subject for the same FAR, QER and URR, if the UPF has indicated it supports MTE feature as specified in clause 8.2.25. See NOTE 6. | | X | X | X | X | X | | Traffic Endpoint ID |
| SDF Filter | | O | | If present, this IE shall identify the SDF filter to match for the incoming packet. Several IEs with the same IE type may be present to provision a list of SDF Filters. The full set of applicable SDF filters, if any, shall be provided during the creation or the modification of the PDI.  See NOTE 3. | | - | X | X | X | X | | SDF Filter |
| Application ID | | O | | If present, this IE shall identify the Application ID to match for the incoming packet. | | - | X | X | X | X | | Application ID |
| Ethernet PDU Session Information | | O | | This IE may be present to identify all the (DL) Ethernet packets matching an Ethernet PDU session (see clause 5.13.1). | | - | - | - | X | - | | Ethernet PDU Session Information |
| Ethernet Packet Filter | | O | | If present, this IE shall identify the Ethernet PDU to match for the incoming packet.  Several IEs with the same IE type may be present to represent a list of Ethernet Packet Filters.  The full set of applicable Ethernet Packet filters, if any, shall be provided during the creation or the modification of the PDI. | | - | - | - | X | - | | Ethernet Packet Filter |
| QFI | | O | | This IE shall not be present if Traffic Endpoint ID is present and the QFI(s) are included in the Traffic Endpoint.  If present, this IE shall identify the QoS Flow Identifier to match for the incoming packet.  Several IEs with the same IE type may be present to provision a list of QFIs. When present, the full set of applicable QFIs shall be provided during the creation or the modification of the PDI. | | - | - | - | X | - | | QFI |
| Framed-Route | | O | | This IE may be present for a PDR if the UPF indicated support of Framed Routing (see clauses 8.2.25 and 5.16). If present, this IE shall describe a framed route.  Several IEs with the same IE type may be present to provision a list of framed routes. (NOTE 5) | - | X | - | X | | - | Framed-Route | |
| Framed-Routing | | O | | This IE may be present for a DL PDR if the UPF indicated support of Framed Routing (see clauses 8.2.25 and 5.16). If present, this IE shall describe the routing method for the UP function for the IP route related to Framed-Routes or Framed-IPv6-Routes. (NOTE 7) | - | X | - | X | | - | Framed-Routing | |
| Framed-IPv6-Route | | O | | This IE may be present for a PDR if the UPF indicated support of Framed Routing (see clauses 8.2.25 and 5.16). If present, this IE shall describe a framed IPv6 route.  Several IEs with the same IE type may be present to provision a list of framed IPv6 routes. (NOTE 5) | - | X | - | X | | - | Framed-IPv6-Route | |
| Source Interface Type | | O | | This IE may be present to indicate the 3GPP interface type of the source interface, if required by functionalities in the UP Function, e.g. for performance measurements. | X | X | - | X | | X | 3GPP Interface Type | |
| IP Multicast Addressing Info | | O | | This IE may be present in a DL PDR controlling DL IP multicast traffic (see clause 5.25).  When present, it shall contain a (range of) IP multicast address(es), and optionally source specific address(es), identifying a set of IP multicast flows. See Table 7.5.2.2-4.  This IE shall be present over N4mb, if multicast transport is used over N6mb or Nmb9 and if Traffic Endpoint ID is not present.  Several IEs with the same IE type may be present to represent multiple IP multicast flows. | - | - | - | X | | X | IP Multicast Addressing Info | |
| DNS Query Filter | | O | | This IE may be present for an UL PDR if the UPF indicated support of DNS traffic steering based on FQDN in the DNS Query message.  If present, this IE shall identify the DNS Query filter to match for the incoming DNS Query packets. Several IEs with the same IE type may be present to provision a list of DNS Query Filters. The full set of applicable DNS Query filters, if any, shall be provided during the creation or the modification of the PDI. | - | - | - | X | | - | DNS Query Filter | |
| MBS Session Identifier | | C | | This IE shall be present when the PDR is created to receive MBS session data. (NOTE 9) | - | - | - | X | | - | MBS Session Identifier | |
| Area Session ID | | C | | This IE shall be present for a location dependent MBS service. When present, it shall contain the Area Session ID, which together with the MBS Session Identifier, uniquely identify the service area part of the content data of the MBS service. (NOTE 9) | - | - | - | X | | - | Area Session ID | |
| NOTE 1: The Network Instance parameter is needed e.g. in the following cases:  - PGW/TDF UP function supports multiple PDNs with overlapping IP addresses;  - SGW UP function is connected to PGWs in different IP domains (S5/S8);  - PGW UP function is connected to SGWs in different IP domains (S5/S8);  - SGW UP function is connected to eNodeBs in different IP domains;  - UPF is connected to 5G-ANs in different IP domains;  - Separation of multiple 5G VN groups communication in the UPF;  - Indirect data forwarding.  NOTE 2: When a Local F-TEID is provisioned in the PDI, the Network Instance shall relate to the IP address of the F-TEID. Otherwise, the Network Instance shall relate to the UE IP address if provisioned or the destination IP address in the SDF filter if provisioned  NOTE 3: SDF Filter IE(s) shall not be present if Ethernet Packet Filter IE(s) is present.  NOTE 4: When several SDF filter IEs are provisioned, the UP function shall consider that the packets are matched if matching any SDF filter. The same principle shall apply for Ethernet Packet Filters and QFIs.  NOTE 5: If both the UE IP Address and the Framed-Route (or Framed-IPv6-Route) are present, the packets which are considered being matching the PDR shall match at least one of them.  NOTE 6: Maximum two Traffic Endpoint ID containing different Local TEIDs per PDI may be provisioned over the N4 interface for a PFCP session which is established for a PDU session subject for 5G to EPS mobility with N26 supported. Several Traffic Endpoint ID containing different UE IP Addresses may be provisioned over the N4 interface for a PFCP session if the UPF also indicated support of the IP6PL feature (see clause 5.21.1).  NOTE 7: In this release of specification, the UP function shall announce the IP route(s) for Framed-Route(s) or Framed-IPv6-Route(s) to the PDN regardless of the value of the Framed-Routing.  NOTE 8: The IP address of the CP function is needed e.g. perform Router Advertisements and match the destination IP address of the incoming packet if the Radius, Diameter or DHCP signaling packets between the SMF and the external DN is forwarded by the UPF.  NOTE 9: The Inclusion of the MBS Session Identifier, or MBS Session Identifier and Area Session ID for a location dependent MBS session, enables the UPF to allocate the same N19mb tunnel for the same MBS Session, or for the same MBS session and Area Session ID for a location dependent MBS session, when receiving multiple PFCP Session Establishment or Modification Request messages for different PFCP sessions being associated with the same MBS session, or with the same MBS session and Area Session ID for a location dependent MBS session, and also helps the UPF to identify the PFCP sessions associated with a MBS Session, or with the same MBS session and Area Session ID for a location dependent MBS session. | | | | | | | | | | | | |

Table 7.5.2.2-3: Ethernet Packet Filter IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Ethernet Packet Filter IE Type = 132 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Ethernet Filter ID | C | This shall be present if Bidirectional Ethernet filter is required. This IE shall uniquely identify an Ethernet Filter among all the Ethernet Filters provisioned for a given PFCP session. | | - | - | - | X | - | Ethernet Filter ID |
| Ethernet Filter Properties | C | This IE shall be present when provisioning a bidirectional Ethernet Filter the first time (see clause 5.13.4). | | - | - | - | X | - | Ethernet Filter Properties |
| MAC address | O | If present, this IE shall identify the MAC address.  This IE may be present up to 16 times. | | - | - | - | X | - | MAC address |
| Ethertype | O | If present, this IE shall identify the Ethertype. | | - | - | - | X | - | Ethertype |
| C-TAG | O | If present, this IE shall identify the Customer-VLAN tag. | | - | - | - | X | - | C-TAG |
| S-TAG | O | If present, this IE shall identify the Service-VLAN tag. | | - | - | - | X | - | S-TAG |
| SDF Filter | O | If packet filtering is required, for Ethernet frames with Ethertype indicating IPv4 or IPv6 payload, this IE shall describe the IP Packet Filter Set.  Several IEs with the same IE type may be present to represent a list of SDF filters. | | - | - | - | X | - | SDF Filter |

Table 7.5.2.2-4: IP Multicast Addressing Info IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | IP Multicast Addressing Info IE Type = 188 (decimal) | | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| IP Multicast Address | M | This IE shall contain the IP multicast address(es) of the DL multicast flow(s) or indicate "any" IP multicast address.  For N4mb, the IP Multicast Address shall be set to the value of IP Multicast Address in the SSM for the MBS Session. | - | - | - | X | X | IP Multicast Address |
| Source IP Address | O | When present, this IE shall contain the source specific IP address of the DL multicast flow.  Several IEs with the same IE type may be present to represent multiple source specific addresses.  If this IE is not present, this indicates "any" source IP address. | - | - | - | X |  | Source IP Address |
| M | This IE shall be set to the value of the IP Source Address in the SSM for the MBS Session. | - | - | - | - | X |

Table 7.5.2.2-5: Redundant Transmission Detection Parameters IE in PDI

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Redundant Transmission Detection Parameters IE Type = 255 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Local F-TEID for Redundant Transmission | M | This IE shall identify the local F-TEID to match for an incoming packet for redundant transmission.  The CP function shall set the CHOOSE (CH) bit to 1 if it requests the UP function to assign a local F-TEID to the PDR. | | - | - | - | X | - | F-TEID |
| Network Instance for Redundant Transmission | C | This IE shall be included if the Local F-TEID for Redundant Transmission uses a different network Instance than the Network Instance used for the Local F-TEID for the primary GTP-U tunnel. | | - | - | - | X | - | Network Instance |

Table 7.5.2.2-6: Transport Delay Reporting IE in Create PDR IE

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Transport Delay Reporting IE Type = 271 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Preceding UL GTP-U Peer | M | This IE shall identify the preceding UL GTP-U peer. | | - | - | - | X | - | Remote GTP-U Peer |
| DSCP | O | If present, this IE shall contain the DSCP to use to measure the GTP-U path delay with the preceding UL GTP-U peer. | | - | - | - | X | - | Transport Level Marking |

#### 

\* \* \* Next Change \* \* \* \*

#### 7.5.2.4 Create URR IE within PFCP Session Establishment Request

The Create URR grouped IE shall be encoded as shown in Figure 7.5.2.4-1.

Table 7.5.2.4-1: Create URR IE within PFCP Session Establishment Request

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 | |  | |  | | Create URR IE Type = 6 (decimal) | | | | | | | | | | | | |
| Octets 3 and 4 | |  | |  | | Length = n | | | | | | | | | | | | |
| Information elements | | P | | Condition / Comment | | |  | | Appl. | | | | | | | | IE Type | |
| Sxa | | Sxb | | Sxc | | N4 | | N4mb | |
| URR ID | | M | | This IE shall uniquely identify the URR among all the URRs configured for this PFCP session. | | | X | | X | | X | | X | | - | | URR ID | |
| Measurement Method | | M | | This IE shall indicate the method for measuring the network resources usage, i.e. whether the data volume, duration (i.e. time), combined volume/duration, or event shall be measured. | | | X | | X | | X | | X | | - | | Measurement Method | |
| Reporting Triggers | | M | | This IE shall indicate the trigger(s) for reporting network resources usage to the CP function, e.g. periodic reporting or reporting upon reaching a threshold, or envelope closure, or when an SMF instructs an UPF to report the reception of the End Marker packet from the old I-UPF during a Service Request procedure (see clauses 4.2.3.2 and 4.23.4.3 in 3GPP TS 23.502 [29]). | | | X | | X | | X | | X | | - | | Reporting Triggers | |
| Measurement Period | | C | | This IE shall be present if periodic reporting is required. When present, it shall indicate the period for generating and reporting usage reports. | | | X | | X | | X | | X | | - | | Measurement Period | |
| Volume Threshold | | C | | This IE shall be present if volume-based measurement is used and reporting is required upon reaching a volume threshold. When present, it shall indicate the traffic volume value after which the UP function shall report network resources usage to the CP function for this URR. | | | X | | X | | X | | X | | - | | Volume Threshold | |
| Volume Quota | | C | | This IE shall be present if volume-based measurement is used and the CP function needs to provision a Volume Quota in the UP function (see clause 5.2.2.2)  When present, it shall indicate the Volume Quota value. | | | - | | X | | X | | X | | - | | Volume Quota | |
| Event Threshold | | C | | This IE shall be present if event-based measurement is used and reporting is required upon reaching an event threshold. When present, it shall indicate the number of events after which the UP function shall report to the CP function for this URR. | | | - | | X | | X | | X | | - | | Event Threshold | |
| Event Quota | | C | | This IE shall be present if event-based measurement is used and the CP function needs to provision an Event Quota in the UP function (see clause 5.2.2.2)  When present, it shall indicate the Event Quota value. | | | - | | X | | X | | X | | - | | Event Quota | |
| Time Threshold | | C | | This IE shall be present if time-based measurement is used and reporting is required upon reaching a time threshold. When present, it shall indicate the time usage after which the UP function shall report network resources usage to the CP function for this URR. | | | X | | X | | X | | X | | - | | Time Threshold | |
| Time Quota | | C | | This IE shall be present if time-based measurement is used and the CP function needs to provision a Time Quota in the UP function (see clause 5.2.2.2)  When present, it shall indicate the Time Quota value | | | - | | X | | X | | X | | - | | Time Quota | |
| Quota Holding Time | | C | | This IE shall be present, for a time, volume or event-based measurement, if reporting is required and packets are no longer permitted to pass on when no packets are received during a given inactivity period.  When present, it shall contain the duration of the inactivity period. | | | - | | X | | X | | X | | - | | Quota Holding Time | |
| Dropped DL Traffic Threshold | | C | | This IE shall be present if reporting is required when the DL traffic being dropped exceeds a threshold.  When present, it shall contain the threshold of the DL traffic being dropped. | | | X | | - | | - | | X | | - | | Dropped DL Traffic Threshold | |
| Quota Validity Time | | C | | This IE shall be present if reporting is required when the Quota Validity time for a given Quota is over. | | | - | | X | | - | | X | | - | | Quota Validity Time | |
| Monitoring Time | | O | | When present, this IE shall contain the time at which the UP function shall re-apply the volume or time threshold. | | | X | | X | | X | | X | | - | | Monitoring Time | |
| Subsequent Volume Threshold | | O | | This IE may be present if the Monitoring Time IE is present and volume-based measurement is used.  When present, it shall indicate the traffic volume value after which the UP function shall report network resources usage to the CP function for this URR for the period after the Monitoring Time. | | | X | | X | | X | | X | | - | | Subsequent Volume Threshold | |
| Subsequent Time Threshold | | O | | This IE may be present if the Monitoring Time IE is present and time-based measurement is used.  When present, it shall indicate the time usage after which the UP function shall report network resources usage to the CP function for this URR for the period after the Monitoring Time. | | | X | | X | | X | | X | | - | | Subsequent Time Threshold | |
| Subsequent Volume Quota | | O | | This IE may be present if Monitoring Time IE is present and volume-based measurement is used (see clause 5.2.2.2).  When present, it shall indicate the Volume Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Volume Quota | |
| Subsequent Time Quota | | O | | This IE may be present if Monitoring Time IE is present and time-based measurement is used (see clause 5.2.2.2)  When present, it shall indicate the Time Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Time Quota | |
| Subsequent Event Threshold | | O | | This IE may be present if the Monitoring Time IE is present and event-based measurement is used.  When present, it shall indicate the number of events after which the UP function shall report to the CP function for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Event Threshold | |
| Subsequent Event Quota | | O | | This IE may be present if Monitoring Time IE is present and event-based measurement is used (see clause 5.2.2.2).  When present, it shall indicate the Event Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Event Quota | |
| Inactivity Detection Time | | C | | This IE shall be present if time-based measurement is used and the time measurement need to be suspended when no packets are received during a given inactivity period. When present, it shall contain the duration of the inactivity period. | | | - | | X | | X | | X | | - | | Inactivity Detection Time | |
| Linked URR ID | | C | | This IE shall be present if linked usage reporting is required. When present, this IE shall contain the linked URR ID which is related with this URR (see clause 5.2.2.4).  Several IEs with the same IE type may be present to represent multiple linked URRs which are related with this URR. | | | - | | X | | X | | X | | - | | Linked URR ID | |
| Measurement Information | | C | | This IE shall be included if any of the following flag is set to "1".  Applicable flags are:  - Measurement Before QoS Enforcement Flag: this flag shall be set to "1" if the traffic usage before any QoS Enforcement is requested to be measured.  - Inactive Measurement Flag: this flag shall be set to "1" if the measurement shall be paused (inactive). The measurement shall be performed (active) if the bit is set to "0" or if the Measurement Information IE is not present in the Create URR IE.  - Reduced Application Detection Information Flag: this flag may be set to "1", if the Reporting Triggers request to report the start or stop of application, to request the UP function to only report the Application ID in the Application Detection Information, e.g. for envelope reporting.  - Immediate Start Time Metering Flag: this flag may be set to "1" if time-based measurement is used and the UP function is requested to start the time metering immediately at receiving the flag. .  - Measurement of Number of Packets Flag: this flag may be set to "1" when the Volume-based measurement applies, to request the UP function to report the number of packets in UL/DL/Total in addition to the measurement in octet.  - Send Start Pause of Charging Flag: this flag may be set to "1" by the CP function if the UP Function is requested to send a Start Pause of Charging indication to the upstream GTP-U entity(s) when the Dropped DL Traffic Threshold is reached.  - Applicable for Start of Pause of Charging Flag: this flag may be set to "1" if the URR is applicable for Start of Pause of Charging, so that the UP function shall stop the usage measurement for the URR when receiving Start Pause of Charging indication from the peer downstream GTP-U entity.  - Control of Inactive Measurement Flag: the flag shall be set to "1" if the CP function requests the UP function to stop or resume the usage measurement for the URR with the "ASPOC" flag set to "1" according to the value of Inactive Measurement Flag. | | | -  -  -  -  X  X  -  - | | X  X  X  X  X  -  X  X | | X  -  -  X  X  -  -  - | | X  X  X  X  X  X  X  X | | -  -  -  -  -  -  -  - | | Measurement Information | |
| Time Quota Mechanism | | C | | This IE shall be present if time-based measurement based on CTP or DTP is used. | | | - | | X | | - | | - | | - | | Time Quota Mechanism | |
| Aggregated URRs | | C | | This IE shall be included if the URR is used to support a Credit Pool.  Several IEs with the same IE type may be present to provide multiple aggregated URRs. | | | - | | X | | - | | - | | - | | Aggregated URRs | |
| FAR ID for Quota Action | | C | | This IE may be present if the Volume Quota IE and/or the Time Quota IE and/or Event Quota IE is provisioned in the URR and the UP Function indicated support of the Quota Action feature.  When present, it shall contain the identifier of the substitute FAR the UP function shall apply, for the traffic associated to this URR, when exhausting any of these quotas. See NOTE 1, NOTE 3. | | | - | | X | | X | | X | | - | | FAR ID | |
| Ethernet Inactivity Timer | | C | | This IE shall be present if Ethernet traffic reporting is used and the SMF requests the UP function to also report inactive UE MAC addresses.  When present, it shall contain the duration of the Ethernet inactivity period. | | | - | | - | | - | | X | | - | |  | |
| Additional Monitoring Time | | O | | When present, this IE shall contain the time at which the UP function shall re-apply the volume or time or event threshold/quota provisioned in the IE.  Several IEs with the same IE type may be present to provide multiple Monitoring Times. | | | X | | X | | X | | X | | - | | Additional Monitoring Time | |
| Number of Reports | | O | | This IE may be present if the UP function supports the NORP feature. When present, it shall indicate the number of usage reports to be generated by the URR. See also clauses 5.2.2.2.1 and 5.2.2.3.1. See NOTE 2. | | | X | | X | | X | | X | | - | | Number of Reports | |
| Exempted Application ID for Quota Action | | O | | This IE may be present if the Volume Quota IE and/or the Time Quota IE and/or Event Quota IE is provisioned in the URR and the UP Function has indicated support of the QUASF feature as specified in clause 8.2.25.  When present, it shall contain an Application ID matching packets that shall be exempted from applying the FAR ID for Quota Action when the quota has been exhausted.  Several IEs with the same IE type may be present to provide multiple Application IDs.  See NOTE 4. | | | - | | X | | X | | X | | - | | Application ID | |
| Exempted SDF Filter for Quota Action | | O | | This IE may be present if the Volume Quota IE and/or the Time Quota IE and/or Event Quota IE is provisioned in the URR and the UP Function has indicated support of the QUASF feature as specified in clause 8.2.25.  When present, it shall contain an SDF Filter matching packets that shall be exempted from applying the FAR ID for Quota Action when the quota has been exhausted.  Several IEs with the same IE type may be present to provide multiple SDF Filters.  See NOTE 4. | | | - | | X | | X | | X | | - | | SDF Filter | |
| User Plane Inactivity Timer | | C | | This IE shall be present, for a time, volume or event-based measurement, if reporting is required when no packets are received for any PDR(s) associated with the URR during a given inactivity period. See clause 5.11.3.  When present, it shall contain the duration of the inactivity period. | | | - | | - | | - | | X | | - | | User Plane Inactivity Timer | |
| NOTE 1: The substitute FAR used when exhausting a Volume Quota or Time Quota may be set to drop the packets or redirect the traffic towards a redirect destination as specified in clause 5.4.7.  NOTE 2: This IE may be provisioned and set to "1" e.g. for a URR with the Dropped DL Traffic Threshold used for the Pause of Charging feature, if the UP function supports the NORP feature.  NOTE 3: If the FAR as indicated in the FAR ID for Quota Action is removed after being provisioned, the UP function shall behave as if the FAR ID for Quota Action is not provisioned and shall apply the default behaviour per local configuration when the quota is exhausted.  NOTE 4: The Exempted Application ID for Quota Action IE or Exempted Filter ID for Quota Action IE may be provisioned as the Restricted-Filter-Rule AVP or Filter ID AVP which is included in Final-Unit-Indication AVP from the online charging system when the Final-Unit-Action AVP is set to "REDIRECT" or "RESTRICT\_ACCESS". See also 3GPP TS 32.299 [18]. | | | | | | | | | | | | | | | | | | |

Table 7.5.2.4-2: Aggregated URRs

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Aggregated URRs = 118 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Aggregated URR ID | M | This IE shall be present for the aggregated URR ID of the URR sharing the credit pool. | | - | X | - | - | - | Aggregated URR ID |
| Multiplier | M | This IE shall be included to measure the abstract service units the traffic of the corresponding aggregated URR consumes from the credit pool. | | - | X | - | - | - | Multiplier |

Table 7.5.2.4-3: Additional Monitoring Time

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Additional Monitoring Time = 147 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Monitoring Time | M | This IE shall be present and contain the time at which the UP function shall re-apply the volume or time threshold/quota. | | X | X | X | X | - | Monitoring Time |
| Subsequent Volume Threshold | O | This IE may be present if the Monitoring Time IE is present and volume-based measurement is used.  When present, it shall indicate the traffic volume value after which the UP function shall report network resources usage to the CP function for this URR for the period after the Monitoring Time. | | X | X | X | X | - | Subsequent Volume Threshold |
| Subsequent Time Threshold | O | This IE may be present if the Monitoring Time IE is present and time-based measurement is used.  When present, it shall indicate the time usage after which the UP function shall report network resources usage to the CP function for this URR for the period after the Monitoring Time. | | X | X | X | X | - | Subsequent Time Threshold |
| Subsequent Volume Quota | O | This IE may be present if Monitoring Time IE is present and volume-based measurement is used (see clause 5.2.2.2).  When present, it shall indicate the Volume Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | - | X | X | X | - | Subsequent Volume Quota |
| Subsequent Time Quota | O | This IE may be present if Monitoring Time IE is present and time-based measurement is used (see clause 5.2.2.2)  When present, it shall indicate the Time Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | - | X | X | X | - | Subsequent Time Quota |
| Subsequent Event Threshold | O | This IE may be present if the Monitoring Time IE is present and event-based measurement is used.  When present, it shall indicate the number of events after which the UP function shall report to the CP function for this URR for the period after the Monitoring Time. | | - | X | X | X | - | Event Threshold |
| Subsequent Event Quota | O | This IE may be present if Monitoring Time IE is present and event-based measurement is used (see clause 5.2.2.2).  When present, it shall indicate the Event Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | - | X | X | X | - | Event Quota |

\* \* \* Next Change \* \* \* \*

### 7.5.4 PFCP Session Modification Request

#### 7.5.4.1 General

The PFCP Session Modification Request is used over the Sxa, Sxb, Sxc, N4 and N4mb interface by the CP function to request the UP function to modify the PFCP session.

Table 7.5.4.1-1: Information Elements in a PFCP Session Modification Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| CP F-SEID | C | This IE shall be present if the CP function decides to change its F-SEID for the PFCP session. The UP function shall use the new CP F-SEID for subsequent PFCP Session related messages for this PFCP Session. See Note 2. | X | X | X | X | X | F-SEID |
| Remove PDR | C | When present, this IE shall contain the PDR Rule which is requested to be removed. See Table 7.5.4-6-1.  Several IEs within the same IE type may be present to represent a list of PDRs to remove. | X | X | X | X | X | Remove PDR |
| Remove FAR | C | When present, this IE shall contain the FAR Rule which is requested to be removed. See Table 7.5.4-7-1.  Several IEs within the same IE type may be present to represent a list of FARs to remove. | X | X | X | X | X | Remove FAR |
| Remove URR | C | When present, this shall contain the URR Rule which is requested to be removed. See Table 7.5.4-8-1.  Several IEs within the same IE type may be present to represent a list of URRs to remove. | X | X | X | X | - | Remove URR |
| Remove QER | C | When present, this IE shall contain the QER Rule which is requested to be removed. See Table 7.5.4-9-1.  Several IEs within the same IE type may be present to represent a list of QERs to remove. | - | X | X | X | X | Remove QER |
| Remove BAR | C | When present, this IE shall contain the BAR Rule which is requested to be removed. See Table 7.5.4.12-1. | X | - | - | X | - | Remove BAR |
| Remove Traffic Endpoint | C | When present, this IE shall contain the Traffic Endpoint ID identifying the traffic endpoint to be removed, if the UP function has indicated support of PDI optimization.  All the PDRs that refer to the removed Traffic Endpoint shall be deleted.  See Table 7.5.4.14-1.  Several IEs within the same IE type may be present to represent a list of Traffic Endpoints to remove. | X | X | X | X | X | Remove Traffic Endpoint |
| Create PDR | C | This IE shall be present if the CP function requests the UP function to create a new PDR.  See Table 7.5.2.2-1.  Several IEs within the same IE type may be present to represent a list of PDRs to create. | X | X | X | X | X | Create PDR |
| Create FAR | C | This IE shall be present if the CP function requests the UP function to create a new FAR. See Table 7.5.2.3-1.  Several IEs within the same IE type may be present to represent a list of FARs to create. | X | X | X | X | X | Create FAR |
| Create URR | C | This IE shall be present if the CP function requests the UP function to create a new URR. See Table 7.5.2.4-1.  Several IEs within the same IE type may be present to represent a list of URRs to create. | X | X | X | X | - | Create URR |
| Create QER | C | This IE shall be present if the CP function requests the UP function to create a new QER. See Table 7.5.2.5-1.  Several IEs within the same IE type may be present to represent a list of QERs to create. | - | X | X | X | X | Create QER |
| Create BAR | C | This IE shall be present if the CP function requests the UP function to create a new BAR.  See Table 7.5.2.6-1. | X | - | - | X | - | Create BAR |
| Create Traffic Endpoint | C | When present this IE shall contain the information associated with the Traffic Endpoint to be created, if the UP function has indicated support of PDI optimization. See Table 7.5.2.7-1.  Several IEs within the same IE type may be present to represent a list of Traffic Endpoints to create. | X | X | X | X | X | Create Traffic Endpoint |
| Update PDR | C | This IE shall be present if a PDR previously created for the PFCP session need to be modified.  See Table 7.5.4.2-1.  Several IEs within the same IE type may be present to represent a list of PDRs to update. | X | X | X | X | X | Update PDR |
| Update FAR | C | This IE shall be present if a FAR previously created for the PFCP session need to be modified. See Table 7.5.4.3-1. Several IEs within the same IE type may be present to represent a list of FARs to update. | X | X | X | X | X | Update FAR |
| Update URR | C | This IE shall be present if URR(s) previously created for the PFCP session need to be modified.  Several IEs within the same IE type may be present to represent a list of modified URRs. Previously URRs that are not modified shall not be included.  See Table 7.5.4.4-1. | X | X | X | X | - | Update URR |
| Update QER | C | This IE shall be present if QER(s) previously created for the PFCP session need to be modified.  Several IEs within the same IE type may be present to represent a list of modified QERs.  Previously created QERs that are not modified shall not be included.  See Table 7.5.4.5-1. | - | X | X | X | X | Update QER |
| Update BAR | C | This IE shall be present if a BAR previously created for the PFCP session needs to be modified.  A previously created BAR that is not modified shall not be included.  See Table 7.5.4.11-1. | X | - | - | X | - | Update BAR |
| Update Traffic Endpoint | C | When present this IE shall contain the information associated with the traffic endpoint to be updated, if the UP function has indicated support of PDI optimization.  All the PDRs that refer to the Traffic Endpoint shall use the updated Traffic Endpoint information.  See Table 7.5.4.13-1.  Several IEs within the same IE type may be present to represent a list of Traffic Endpoints to update. | X | X | X | X | X | Update Traffic Endpoint |
| PFCPSMReq-Flags | C | This IE shall be included if at least one of the flags is set to "1".  - DROBU (Drop Buffered Packets): the CP function shall set this flag if the UP function is requested to drop the packets currently buffered for this PFCP session (see NOTE 1).  - QAURR (Query All URRs): the CP function shall set this flag if the CP function requests immediate usage report(s) for all the URRs previously provisioned for this PFCP session (see NOTE 3).  - SUMPC (Stop Usage Measurement to Pause Charging): the CP function, e.g. PGW-C or (H-)SMF, shall set this flag if the usage measurement for the URRs which are applicable for charging (i.e. with the "ASPOC" flag set to "1") shall be stopped in the UP function.  - RUMUC (Resume Usage Measurement to Un-pause Charging): the CP function, e.g. PGW-C or (H-)SMF, shall set this flag if the usage measurement for the URRs which are applicable for charging (i.e. with the "ASPOC" flag set to "1") shall be resumed in the UP function. | X  X  -  - | -  X  X  X | -  X  -  - | X  X  X  X | -  -  -  - | PFCPSMReq-Flags |
| Query URR | C | This IE shall be present if the CP function requests immediate usage report(s) to the UP function.  Several IEs within the same IE type may be present to represent a list of URRs for which an immediate report is requested.  See Table 7.5.4.10-1.  See NOTE 3. | X | X | X | X | - | Query URR |
| PGW-C/SMF FQ-CSID | C | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24] and clause 4.6 of 3GPP TS 23.527 [40]. | X | X | - | X | - | FQ-CSID |
| SGW-C FQ-CSID | C | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | X | X | - | - | - | FQ-CSID |
| MME FQ-CSID | C | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | X | X | - | - | - | FQ-CSID |
| ePDG FQ-CSID | C | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | - | X | - | - | - | FQ-CSID |
| TWAN FQ-CSID | C | This IE shall be included according to the requirements in clause 23 of 3GPP TS 23.007 [24]. | - | X | - | - | - | FQ-CSID |
| User Plane Inactivity Timer | C | This IE shall be present if it needs to be changed. | - | X | X | X | X | User Plane Inactivity Timer |
| Query URR Reference | O | This IE may be present if the Query URR IE is present or the QAURR flag is set to "1". When present, it shall contain a reference identifying the query request, which the UP function shall return in any usage report sent in response to the query. | X | X | X | X | - | Query URR Reference |
| Trace Information | O | When present, this IE shall contain the trace instructions to be applied by the UP function for this PFCP session.  A Trace Information with a null length indicates that the trace session shall be deactivated. | X | X | X | X | - | Trace Information |
| Remove MAR | C | When present, this IE shall contain the MAR Rule which is requested to be removed. See Table 7.5.4.15-1.  Several IEs within the same IE type may be present to represent a list of MARs to remove. | - | - | - | X | - | Remove MAR |
| Update MAR | C | This IE shall be present if an MAR previously created for the PFCP session needs to be modified.  See Table 7.5.4.16-1.  Several IEs within the same IE type may be present to represent a list of MARs to update. | - | - | - | X | - | Update MAR |
| Create MAR | C | This IE shall be present if the CP function requests the UP function to create a new MAR for a new PDR. See Table 7.5.2.8-1.  Several IEs within the same IE type may be present to represent a list of MARs to create. | - | - | - | X | - | Create MAR |
| Node ID | C | This IE shall be present if a new SMF in an SMF Set, with one PFCP association per SMF and UPF (see clause 5.22.3), takes over the control of the PFCP session.  When present, it shall contain the unique identifier of the new SMF. | - | - | - | X | X | Node ID |
| TSC Management Information | C | This IE shall be present if the SMF needs to send TSC Management information to the UPF.  Several IEs within the same IE type may be present to transfer PMICs for different NW-TT ports. | - | - | - | X | - | TSC Management Information |
| Remove SRR | C | When present, this shall indicate the SRR Rule which is requested to be removed. See Table 7.5.4-19-1.  Several IEs within the same IE type may be present to represent a list of SRRs to remove. | - | - | - | X | - | Remove SRR |
| Create SRR | C | This IE shall be present if the CP function requests the UP function to create a new SRR. See Table 7.5.2.9-1.  Several IEs within the same IE type may be present to represent a list of SRRs to create. | - | - | - | X | - | Create SRR |
| Update SRR | C | This IE shall be present if SRR(s) previously created for the PFCP session need to be modified.  Several IEs within the same IE type may be present to represent a list of modified SRRs. Previously SRRs that are not modified shall not be included. See Table 7.5.4.20-1. | - | - | - | X | - | Update SRR |
| Provide ATSSS Control Information | C | This IE shall be present for PFCP session modification for an MA PDU session, if the ATSSS Control Information changes.  When present, this IE shall contain the required ATSSS functionalities for this MA PDU session.  The UPF shall replace any value received previously by the new information received in this IE. See Note 4.  See Table 7.5.2.10-1. | - | - | - | X | - | Provide ATSSS Control Information |
| Ethernet Context Information | C | This IE shall be present to update the list of MAC addresses associated to the PDU session during an Ethernet PDU session anchor relocation. | - | - | - | X | - | Ethernet Context Information |
| Access Availability Information | O | This IE may be present for an MA PDU session to signal that an access type has become transiently unavailable or has become available again (see clause 5.20.5).  Two IEs with the same IE type may be present to report changes of access availability for both 3GPP and non-3GPP accesses. | - | - | - | X | - | Access Availability Information |
| Query Packet Rate Status | C | This IE shall be present if the CP function requests immediate packet rate status report(s) to the UP function.  Several IEs within the same IE type may be present to represent a list of QERs for which an immediate packet rate status report is requested.  See Table 7.5.4.22-1. | - | X | - | X | - | Query Packet Rate Status |
| S-NSSAI | O | This IE may be present to indicate the S-NSSAI of the PDU session or MBS session, if the S-NSSAI of the PDU Session or MBS session has been provided previously to the UP function and the S-NSSAI has changed. (NOTE 5) | - | - | - | X | X | S-NSSAI |
| RAT Type |  | This IE shall be present if there is a RAT change and the CP function wants to inform the UP Function about the new RAT Type if the PFCP session is not established for a MA PDU session. | X | X | - | X | - | RAT Type |
| Group Id | C | This IE shall be included by the CP function to indicate the new group identifier to which the PFCP session pertains, if it has been changed (see clause 5.22.4).  When present, the UP function shall replace any earlier value associated to the PFCP session with the new value. | - | X | - | X | - | Group Id |
| MBS Session N4 Control Information | C | This IE shall be included if:  - the correspond PDU session is being associated with an MBS session, or with an MBS session and Area Session ID for a location dependent MBS service; or  - the PDU session is already associated with an MBS session, or with an MBS session and Area Session ID for a location dependent MBS service, and the N19mb multicast transport information has changed. In this case, the Multicast Transport Information IE shall contain the new multicast transport information to use to receive MBS session data from the MB-UPF.  Several IEs with the same IE type may be present to provide N4 control information for several MBS sessions, e.g. when the UE requests to join several MBS sessions.  See Table 7.5.2.1-5 for encoding. | - | - | - | X | - | MBS Session N4 Control Information |
| DSCP to PPI Control Information | C | This IE shall be present if the DSCP to PPI Control Information needs to be changed. The UPF shall replace any value received previously by the new information received in this IE.  See Table 7.5.2.1-6 for encoding. | - | - | - | X | - | DSCP to PPI Control Information |
| NOTE 1: The CP function may request the UP function to drop the packets currently buffered for the PFCP session when using extended buffering of downlink data packets, buffering is performed in the UP function and the DL Data Buffer Expiration Time is handled by the CP function. In this case, when the DL Data Buffer Expiration Time expires, the CP function shall send a PFCP Session Modification Request including the DROBU flag (to drop the downlink data packets currently buffered in the UP function) and updating the Apply Action within the FARs of this PFCP session to request the UP function to start buffering the downlink data packets with notifying the arrival of subsequent downlink data packets. See clause 5.9.3 of 3GPP TS 23.214 [2].  NOTE 2: When changing the CP F-SEID of an established PFCP Session, the CP function shall be able to handle any incoming PFCP Session related messages sent by the UP function with the previous CP F-SEID for a duration at least longer than twice the PFCP retransmission timer (N1xT1).  NOTE 3: The QAURR (Query All URRs) flag in the PFCPSMReq-Flags IE and the Query URR IE are exclusive from each other in a PFCP Session Modification Request.  NOTE 4: If the ATSSS resources have already been allocated to the PFCP session previously, e.g. during the PFCP session establishment, the UPF shall not allocate new values for such resources (e.g. UE Link-Specific IP Address).  NOTE 5: S-NSSAI for the PDU session may be updated after PDU session establishment, i.e. during EPS to 5GS handover procedure, the initial AMF may use configured S-NSSAI for interworking to create the PDU session in 5GS. For home routed PDU session, if the S-NSSAI in serving PLMN (mapped from S-NSSAI in HPLMN) is different from the configured S-NSSAI for interworking and V-SMF reselection is not needed, the AMF will update V-SMF with S-NSSAI in serving PLMN for the PDU session, as specified in clause 4.11.1.3.3 of 3GPP TS 23.502 [29]. The S-NSSAI may also be updated by SMF+PGW-C during EPS to 5GS handover in non-roaming or roaming-with-LBO case. The S-NSSAI may be used by the UP function for performance measurement. | | | | | | | | |

\* \* \* Next Change \* \* \* \*

#### 7.5.4.2 Update PDR IE within PFCP Session Modification Request

The Update PDR grouped IE shall be encoded as shown in Figure 7.5.4.2-1.

Table 7.5.4.2-1: Update PDR IE within PFCP Session Modification Request

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Update PDR IE Type = 9 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| PDR ID | M | This IE shall uniquely identify the PDR among all the PDRs configured for that PFCP session. | | X | X | X | X | X | PDR ID |
| Outer Header Removal | C | This IE shall be present if it needs to be changed. | | X | X | - | X | X | Outer Header Removal |
| Precedence | C | This IE shall be present if there is a change in the PDR's precedence to be applied by the UP function among all PDRs of the PFCP session, when looking for a PDR matching an incoming packet. | | - | X | X | X | X | Precedence |
| PDI | C | This IE shall be present if there is a change within the PDI against which incoming packets will be matched. When present, this IE shall replace the PDI previously stored in the UP function for this PDR. See Table 7.5.2.2-2. | | X | X | X | X | X | PDI |
| FAR ID | C | This IE shall be present if it needs to be changed | | X | X | X | X | X | FAR ID |
| URR ID | C | This IE shall be present if a measurement action shall be applied or no longer applied to packets matching this PDR.  When present, this IE shall contain the list of all the URR IDs to be associated to the PDR. | | X | X | X | X | - | URR ID |
| QER ID | C | This IE shall be present if a QoS enforcement action shall be applied or no longer applied to packets matching this PDR.  When present, this IE shall contain the list of all the QER IDs to be associated to the PDR. | | - | X | X | X | X | QER ID |
| Activate Predefined Rules | C | This IE shall be present if new Predefined Rule(s) needs to be activated for the PDR. When present this IE shall contain one Predefined Rules name.  Several IEs with the same IE type may be present to represent multiple "Activate Predefined Rules" names. | | - | X | X | X | - | Activate Predefined Rules |
| Deactivate Predefined Rules | C | This IE shall be present if Predefined Rule(s) needs to be deactivated for the PDR. When present this IE shall contain one Predefined Rules name.  Several IEs with the same IE type may be present to represent multiple "Activate Predefined Rules" names. | | - | X | X | X | - | Deactivate Predefined Rules |
| Activation Time | O | This IE may be present if the PDR activation time shall be changed. (NOTE 2) | | - | X | X | X | - | Activation Time |
| Deactivation Time | O | This IE may be present if the PDR deactivation time shall be changed. (NOTE 2) | | - | X | X | X | - | Deactivation Time |
| IP Multicast Addressing Info | O | This IE may be present in an UL PDR controlling UL IGMP/MLD traffic (see clause 5.25), if it needs to be changed  When present, it shall contain a (range of) IP multicast address(es), and optionally source specific address(es), identifying a set of IP multicast flows. See Table 7.5.2.2-4.  Several IEs with the same IE type may be present to represent multiple IP multicast flows.  When present, the UPF shall replace any IP multicast address(es) previously stored for this PDR by the IP multicast address(es) received in this IE. | | - | - | - | X | - | IP Multicast Addressing Info |
| Transport Delay Reporting | C | This IE shall be present if Transport Delay Reporting needs to be changed (e.g. transport delay reporting needs to be activated or deactivated). See Table 7.5.2.2-6. | | - | - | - | X | - | Transport Delay Reporting |
| RAT Type | O | This IE may be present if there is a RAT change for the UL PDR if the PFCP session is established for a MA PDU session. | | - | - | - | X | - | RAT Type |
| NOTE1: The IEs which do not need to be modified shall not be included in the Update PDR IE. The UP function shall continue to behave according to the values previously received for IEs not present in the Update PDR IE.  NOTE2: When the Activation Time and Deactivation Time are not present, the PDR shall keep its current activation status, either active or inactive. | | | | | | | | | |

\* \* \* Next Change \* \* \* \*

#### 7.5.4.4 Update URR IE within PFCP Session Modification Request

The Update URR grouped IE shall be encoded as shown in Figure 7.5.4.4-1.

Table 7.5.4.4-1: Update URR IE within PFCP Session Modification Request

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 | |  | |  | | Update URR IE Type = 13 (decimal) | | | | | | | | | | | | | |
| Octets 3 and 4 | |  | |  | | Length = n | | | | | | | | | | | | | |
| Information elements | | P | | Condition / Comment | | |  | | Appl. | | | | | | | | IE Type | | |
| Sxa | | Sxb | | Sxc | | N4 | | N4mb | |
| URR ID | | M | | This IE shall uniquely identify the URR among all the URRs configured for that PFCP session | | | X | | X | | X | | X | | - | | URR ID | | |
| Measurement Method | | C | | This IE shall be present if the measurement method needs to be modified.  When present, this IE shall indicate the method for measuring the network resources usage, i.e. whether the data volume, duration (i.e. time), combined volume/duration, or event shall be measured. | | | X | | X | | X | | X | | - | | Measurement Method | | |
| Reporting Triggers | | C | | This IE shall be present if the reporting triggers needs to be modified.  When present, this IE shall indicate the trigger(s) for reporting network resources usage to the CP function, e.g. periodic reporting or reporting upon reaching a threshold, or envelope closure, or when an SMF instructs an UPF to report the reception of the End Marker packet from the old I-UPF during a Service Request procedure (see clauses 4.2.3.2 and 4.23.4.3 in 3GPP TS 23.502 [29]). | | | X | | X | | X | | X | | - | | Reporting Triggers | | |
| Measurement Period | | C | | This IE shall be present if the Measurement Period needs to be modified.  When present, it shall indicate the period for generating and reporting usage reports. | | | X | | X | | X | | X | | - | | Measurement Period | | |
| Volume Threshold | | C | | This IE shall be present if the Volume Threshold needs to be modified. When present, it shall indicate the traffic volume value after which the UP function shall report network resources usage to the CP function for this URR. | | | X | | X | | X | | X | | - | | Volume Threshold | | |
| Volume Quota | | C | | This IE shall be present if the Volume Quota needs to be modified.  When present, it shall indicate the Volume Quota value. | | | - | | X | | X | | X | | - | | Volume Quota | | |
| Time Threshold | | C | | This IE shall be present if the Time Threshold needs to be modified. When present, it shall indicate the time usage after which the UP function shall report network resources usage to the CP function for this URR. | | | X | | X | | X | | X | | - | | Time Threshold | | |
| Time Quota | | C | | This IE shall be present if the Time Quota needs to be modified.  When present, it shall indicate the Time Quota value. | | | - | | X | | X | | X | | - | | Time Quota | | |
| Event Threshold | | C | | This IE shall be present if Event Threshold needs to be modified.  When present, it shall indicate the number of events after which the UP function shall report to the CP function for this URR. | | | - | | X | | X | | X | | - | | Event Threshold | |
| Event Quota | | C | | This IE shall be present if Event Quota needs to be modified.  When present, it shall indicate the Event Quota value. | | | - | | X | | X | | X | | - | | Event Quota | |
| Quota Holding Time | | C | | This IE shall be present if the Quota Holding Time needs to be modified.  When present, it shall contain the duration of the Quota Holding Time. | | | - | | X | | X | | X | | - | | Quota Holding Time | | |
| Dropped DL Traffic Threshold | | C | | This IE shall be present if the Dropped DL Threshold needs to be modified.  When present, it shall contain the threshold of the DL traffic being dropped. | | | X | | - | | - | | X | | - | | Dropped DL Traffic Threshold | | |
| Quota Validity Time | | C | | This IE shall be present if Quota Validity time was not sent earlier or quota validity time value needs to be modified. | | | - | | X | | - | | X | | - | | Quota Validity Time | | |
| Monitoring Time | | C | | This IE shall be present if the Monitoring Time needs to be modified. When present, this IE shall contain the time at which the UP function shall re-apply the volume or time threshold. | | | X | | X | | X | | X | | - | | Monitoring Time | | |
| Subsequent Volume Threshold | | C | | This IE shall be present if the Subsequent Volume Threshold needs to be modified and volume-based measurement is used.  When present, it shall indicate the traffic volume value after which the UP function shall report network resources usage to the CP function for this URR for the period after the Monitoring Time. | | | X | | X | | X | | X | | - | | Subsequent Volume Threshold | | |
| Subsequent Time Threshold | | C | | This IE shall be present if the Subsequent Time Threshold needs to be modified. When present, it shall indicate the time usage value after which the UP function shall report network resources usage to the CP function for this URR for the period after the Monitoring Time. | | | X | | X | | X | | X | | - | | Subsequent Time Threshold | | |
| Subsequent Volume Quota | | C | | This IE shall be present if the Subsequent Volume Quota needs to be modified.  When present, it shall indicate the Volume Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Volume Quota | | |
| Subsequent Time Quota | | C | | This IE shall be present if the Subsequent Time Quota needs to be modified.  When present, it shall indicate the Time Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Time Quota | | |
| Subsequent Event Threshold | | O | | This IE shall be present if the Subsequent Event Threshold needs to be modified.  When present, it shall indicate the number of events after which the UP function shall report to the CP function for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Event Threshold | |
| Subsequent Event Quota | | O | | This IE shall be present if the Subsequent Event Quota needs to be modified.  When present, it shall indicate the Event Quota value which the UP function shall use for this URR for the period after the Monitoring Time. | | | - | | X | | X | | X | | - | | Subsequent Event Quota | |
| Inactivity Detection Time | | C | | This IE shall be present if the Inactivity Detection Time needs to be modified.  When present, it shall indicate the duration of the inactivity period after which time measurement needs to be suspended when no packets are received during this inactivity period. | | | - | | X | | X | | X | | - | | Inactivity Detection Time | | |
| Linked URR ID | | C | | This IE shall be present if linked usage reporting is required. When present, this IE shall contain the linked URR ID which is related with this URR (see clause 5.2.2.4).  Several IEs with the same IE type may be present to represent multiple linked URRs which are related with this URR. | | | - | | X | | X | | X | | - | | Linked URR ID | | |
| Measurement Information | | C | | his IE shall be included if any of the following flag is set to "1" or if the change of flag(s) from "1" to "0" results in the IE becoming set to all zeros.  Applicable flags are:  - Inactive Measurement Flag: this flag shall be set to "1" if the measurement shall be paused (inactive). The measurement shall be performed (active) if the bit is set to "0" or if the Measurement Information IE is not present in the Update URR IE.  - Reduced Application Detection Information Flag: this flag may be set to "1", if the Reporting Triggers request to report the start or stop of application, to request the UP function to only report the Application ID in the Application Detection Information, e.g. for envelope reporting.  - Immediate Start Time Metering Flag: this flag may be set to "1" if time-based measurement is used and the UP function is requested to start the time metering immediately at receiving the flag.  - Send Start Pause of Charging Flag: this flag may be set to "1" by the CP function if the UP Function is requested to send a Start Pause of Charging indication to the upstream GTP-U entity(s) when the Dropped DL Traffic Threshold is reached.  - Applicable for Start of Pause of Charging Flag: this flag may be set to "1" if the URR is applicable for Start of Pause of Charging, so that the UP function shall stop the usage measurement for the URR when receiving Start Pause of Charging indication from the peer downstream GTP-U entity.  - Control of Inactive Measurement Flag: the flag shall be set to "1" if the CP function requests the UP function to stop or resume the usage measurement for the URR with the "ASPOC" flag set to "1" according to the value of Inactive Measurement Flag. | | | -  -  -  X  - | | X  X  X  -  X | | -  -  X  -  - | | X  X  X  X  X | | -  -  -  -  - | | Measurement Information | | |
| Time Quota Mechanism | | C | | This IE shall be present if time-based measurement based on CTP or DTP needs to be modified. | | | - | | X | | - | | - | | - | | Time Quota Mechanism | | |
| Aggregated URRs | | C | | This IE shall be included if the Aggregated URRs IE needs to be modified. See Table 7.5.2.4-2.  Several IEs with the same IE type may be present to provision multiple aggregated URRs.  When present, this IE shall provide the complete list of the aggregated URRs. | | | - | | X | | - | | - | | - | | Aggregated URRs | | |
| FAR ID for Quota Action | | C | | This IE shall be present if the FAR ID for Quota Action IE needs to be modified. This IE may be present if the Volume Quota IE or the Time Quota IE or Event Quota IE is newly provisioned in the URR and the UP Function indicated support of the Quota Action.  When present, it shall contain the identifier of the substitute FAR the UP function shall apply, for the traffic associated to this URR, when exhausting any of these quotas. See NOTE 1, NOTE 2. | | | - | | X | | X | | X | | - | | FAR ID | | |
| Ethernet Inactivity Timer | | C | | This IE shall be present if the Ethernet Inactivity Timer needs to be modified. When present, it shall contain the duration of the Ethernet inactivity period. | | | - | | - | | - | | X | | - | | Ethernet Inactivity Timer | | |
| Additional Monitoring Time | | O | | This IE shall be present if the additional Monitoring Time needs to be modified. When present, this IE shall contain the time at which the UP function shall re-apply the volume or time or event threshold/quota. See Table 7.5.2.4-3.  The CP function shall provide the full set of Additional Monitoring Times IE(s). The UP function shall replace any Additional Monitoring Times IE(s) provisioned earlier by the new set of received IE(s). | | | X | | X | | X | | X | | - | | Additional Monitoring Time | | |
| Number of Reports | | O | | This IE may be present if the Number of Reports need to be changed. When present, it shall indicate the number of usage reports to be generated by the URR. See also clauses 5.2.2.2.1 and 5.2.2.3.1. | | | X | | X | | X | | X | | - | | Number of Reports | | |
| Exempted Application ID for Quota Action | | C | | This IE shall be present if Application ID for Quota Action needs to be changed.  When present, it shall contain an Application ID matching packets that shall be exempted from applying the FAR ID for Quota Action when the quota has been exhausted.  Several IEs with the same IE type may be present to provide multiple Application IDs.  The CP function shall always provide a complete list of Application IDs.  See NOTE 3. | | | - | | X | | X | | X | | - | | Application ID | | |
| Exempted SDF Filter for Quota Action | | C | | This IE shall be present if the SDF Filter for Quota Action needs to be changed.  When present, it shall contain a SDF Filter matching packets that shall be exempted from applying the FAR ID for Quota Action when the quota has been exhausted.  Several IEs with the same IE type may be present to provide multiple SDF Filters.  The CP function shall always provide a complete list of SDF Filters.  See NOTE 3. | | | - | | X | | X | | X | | - | | SDF Filter | | |
| User Plane Inactivity Timer | | C | | This IE shall be present if the User Plane Inactivity Timer needs to be modified.  When present, it shall contain the duration of the User Plane Inactivity Timer. | | | - | | - | | - | | X | | - | | User Plane Inactivity Timer | | |
| NOTE 1: The substitute FAR used when exhausting a Volume Quota or Time Quota may be set to drop the packets or redirect the traffic towards a redirect destination as specified in clause 5.4.7.  NOTE 2: If the FAR as indicated in the FAR ID for Quota Action is removed after being provisioned, the UP function shall behave as if the FAR ID for Quota Action is not provisioned and shall apply the default behaviour per local configuration when the quota is exhausted.  NOTE 3: The Exempted Application ID for Quota Action IE or Exempted Filter ID for Quota Action IE may be provisioned as the Restricted-Filter-Rule AVP or Filter ID AVP which is included in Final-Unit-Indication AVP from the online charging system when the Final-Unit-Action AVP is set to "REDIRECT" or "RESTRICT\_ACCESS". See also 3GPP TS 32.299 [18]. | | | | | | | | | | | | | | | | | | | |

\* \* \* Next Change \* \* \* \*

#### 7.5.4.8 Remove URR IE within PFCP Session Modification Request

The Remove URR grouped IE shall be encoded as shown in Figure 7.5.4.7-1.

Table 7.5.4.8-1: Remove URR IE within PFCP Session Modification Request

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Remove URR IE Type = 17 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| URR ID | M | This IE shall identify the URR to be deleted. | | X | X | X | X | - | URR ID |

\* \* \* Next Change \* \* \* \*

### 7.5.5 PFCP Session Modification Response

#### 7.5.5.1 General

The PFCP Session Modification Response shall be sent over the Sxa, Sxb, Sxc and N4 interface by the UP function to the CP function as a reply to the PFCP Session Modification Request.

Table 7.5.5.1-1: Information Elements in a PFCP Session Modification Response

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Cause | M | This IE shall indicate the acceptance, partial acceptance or rejection of the corresponding request message. | X | X | X | X | X | Cause |
| Offending IE | C | This IE shall be included if the rejection is due to a conditional or mandatory IE missing or faulty. | X | X | X | X | X | Offending IE |
| Created PDR | C | This IE shall be present if the cause is set to "success", new PDR(s) were requested to be created and the UP function was requested to allocate the local F-TEID or a UE IP address/prefix for the PDR(s).  When present, this IE shall contain the PDR information associated to the PFCP session.  See Table 7.5.3.2-1.  Several IEs within the same IE type may be present to represent a list of created PDRs. | X | X | - | X | X | Created PDR |
| Load Control Information | O | The UP function may include this IE if it supports the load control feature and the feature is activated in the network.  See Table 7.5.3.3-1. | X | X | X | X | X | Load Control Information |
| Overload Control Information | O | During an overload condition, the UP function may include this IE if it supports the overload control feature and the feature is activated in the network. | X | X | X | X | X | Overload Control Information |
| Usage Report | C | This IE shall be present if:  - the Query URR IE was present or the QAURR flag was set to "1" in the PFCP Session Modification Request,  - traffic usage measurements for that URR are available at the UP function, and  - the UP function decides to return some or all of the requested usage reports in the PFCP Session Modification Response.  This IE shall be also present if:  - a URR or the last PDR associated to a URR has been removed,  - non-null traffic usage measurements for that URR are available in the UP function, and  - the UP function decides to return some or all of the related usage reports in the PFCP Session Modification Response (see clause 5.2.2.3.1).  Several IEs within the same IE type may be present to represent a list of Usage Reports. | X | X | X | X | - | Usage Report |
| Failed Rule ID | C | This IE shall be included if the Cause IE indicates a rejection due to a rule creation or modification failure. | X | X | X | X | X | Failed Rule ID |
| Additional Usage Reports Information | C | This IE shall be included if the Query URR IE was present or the QAURR flag was set to "1" in the PFCP Session Modification Request, and usage reports need to be sent in additional PFCP Session Report Request messages (see clause 5.2.2.3.1).  When present, this IE shall either indicate that additional usage reports will follow, or indicate the total number of usage reports that need to be sent in PFCP Session Report Request messages. | X | X | X | X | - | Additional Usage Reports Information |
| Created/Updated Traffic Endpoint | C | This IE shall be present if the cause is set to "success", Traffic Endpoint(s) were requested to be created or updated, and the UP function was requested to allocate the local F-TEID or a UE IP address/prefix for the Traffic Endpoint(s).  If the UP function allocates additional UE IP address/prefix (upon receiving a Create Traffic Endpoint or Update Traffic Endpoint in the corresponding PFCP Session Modification Request message from the CP function), this IE shall be present and shall contain the complete list of UE IP address / prefix assigned by the UP function for this PFCP session.  In the 5GC, several IEs with the same IE type may be present to represent multiple UE IP addresses, if the UPF indicated support of the IP6PL feature (see clause 5.21).  (NOTE 1)  When present, this IE shall contain the Traffic Endpoint information associated to the PFCP session.  See Table 7.5.3.5-1.  Several IEs within the same IE type may be present to represent a list of created/updated Traffic Endpoints. | X | X | - | X | X | Created Traffic Endpoint |
| TSC Management Information | C | This IE shall be present if the UPF needs to send TSC Management information to the SMF.  Several IEs within the same IE type may be present to transfer PMICs for different NW-TT ports. | - | - | - | X | - | TSC Management Information |
| ATSSS Control Parameters | C | This IE shall be present if ATSSS functionality is required in the request message, and the UPF allocates the resources and parameters corresponding to the required ATSSS functionality.  See Table 7.5.3.7-1. | - | - | - | X | - | ATSSS Control Parameters |
| Updated PDR | C | This IE shall be present if a Update PDR is present in the corresponding PFCP Session Modification Request and UP function is requested to allocate a new F-TEID, e.g. to support the redundant transmission on N3/N9 interfaces, or move the application traffic from a default bearer to a new dedicated bearer, or the UP function is requested to assign additional UE IP Address or Prefix, e.g. a shorter than /64 prefix delegation. See Table 7.5.5.5-1.  Several IEs within the same IE type may be present to represent a list of updated PDRs. | - | X | - | X | - | Updated PDR |
| Packet Rate Status Report | C | This IE shall be present if the CP function has requested to report an immediate packet rate status in the PFCP Session Modification Request and the UP function supports the CIOT feature (see clause 8.2.25).  Several IEs within the same IE type may be present to represent a list of Packet Rate Status Reports. | - | X | - | X | - | Packet Rate Status Report |
| Partial Failure Information | C | This IE shall be present if the Cause IE indicates partial acceptance of the request to provide failure information related to a failed rule.  Several IEs within the same IE type may be present to report failures to apply multiple rules.  See Table 7.5.3.1-2. | - | X | X | X | X | Partial Failure Information |
| MBS Session N4 Information | C | This IE shall be included if any IE in this grouped IE needs to be included as specified in clause 5.34.1.  Several IE with the same IE type may be present to contain N4 Information for several MBS Sessions.  See Table 7.5.3.1-5 for encoding. | - | - | - | X | - | MBS Session N4 Information |
| NOTE 1: The UP function supporting the PDI optimization feature and the IP6PL feature (see clause 8.2.25) shall support providing the complete list of UE IP Address IEs in the Created/Updated Endpoint IE. | | | | | | | | |

\* \* \* Next Change \* \* \* \*

#### 7.5.5.2 Usage Report IE within PFCP Session Modification Response

The Usage Report grouped IE shall be encoded as shown in Table 7.5.5.2-1.

Table 7.5.5.2-1: Usage Report IE within PFCP Session Modification Response

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Usage Report IE Type = 78 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| URR ID | M | This IE shall identify the URR for which usage is reported. | | X | X | X | X | - | URR ID |
| UR-SEQN | M | This IE shall uniquely identify the Usage Report for the URR (see clause 5.2.2.3). | | X | X | X | X | - | UR-SEQN |
| Usage Report Trigger | M | This IE shall identify the trigger for this report. | | X | X | X | X | - | Usage Report Trigger |
| Start Time | C | This IE shall be present, except if the Usage Report Trigger indicates 'Start of Traffic', 'Stop of Traffic' or 'MAC Addresses Reporting'.  When present, this IE shall provide the timestamp when the collection of the information in this report was started. | | X | X | X | X | - | Start Time |
| End Time | C | This IE shall be present, except if the Usage Report Trigger indicates 'Start of Traffic', 'Stop of Traffic' or 'MAC Addresses Reporting'.  When present, this IE shall provide the timestamp when the collection of the information in this report was generated. | | X | X | X | X | - | End Time |
| Volume Measurement | C | This IE shall be present if a volume measurement needs to be reported. | | X | X | X | X | - | Volume Measurement |
| Duration Measurement | C | This IE shall be present if a duration measurement needs to be reported. | | X | X | X | X | - | Duration Measurement |
| Time of First Packet | C | This IE shall be present if available for this URR. | | - | X | X | X | - | Time of First Packet |
| Time of Last Packet | C | This IE shall be present if available for this URR. | | - | X | X | X | - | Time of Last Packet |
| Usage Information | C | This IE shall be present if the UP function reports Usage Reports before and after a Monitoring Time or before and after QoS enforcement. When present, it shall indicate whether the usage is reported for the period before or after that time, or before or after QoS enforcement. | | X | X | X | X | - | Usage Information |
| Query URR Reference | C | This IE shall be present if this usage report is sent as a result of a query URR received in a PFCP Session Modification Request and the Query URR Reference IE was present in the PFCP Session Modification Request.  When present, it shall be set to the Query URR Reference value received in the PFCP Session Modification Request. | | X | X | X | X | - | Query URR Reference |
| Ethernet Traffic Information | C | This IE shall be present if Ethernet Traffic Information needs to be reported. | | - | - | - | X | - | Ethernet Traffic Information |

\* \* \* Next Change \* \* \* \*

### 7.5.7 PFCP Session Deletion Response

#### 7.5.7.1 General

The PFCP Session Deletion Response shall be sent over the Sxa, Sxb, Sxc and N4 interface by the UP function to the CP function as a reply to the PFCP Session Deletion Request.

Table 7.5.7.1-1: Information Elements in a PFCP Session Deletion Response

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Cause | M | This IE shall indicate the acceptance or the rejection of the corresponding request message. | X | X | X | X | X | Cause |
| Offending IE | C | This IE shall be included if the rejection is due to a conditional or mandatory IE missing or faulty. | X | X | X | X | X | Offending IE |
| Load Control Information | O | The UP function may include this IE if it supports the load control feature and the feature is activated in the network.  See Table 7.5.3.3-1. | X | X | X | X | X | Load Control Information |
| Overload Control Information | O | During an overload condition, the UP function may include this IE if it supports the overload control feature and the feature is activated in the network.  See Table 7.5.3.4-1. | X | X | X | X | X | Overload Control Information |
| Usage Report | C | This IE shall be present if a URR had been provisioned in the UP function for the PFCP session being deleted and traffic usage measurements for that URR are available at the UP function.  Several IEs within the same IE type may be present to represent a list of Usage Reports. | X | X | X | X | - | Usage Report |
| Additional Usage Reports Information | C | This IE shall be included if the usage reports need to be sent in additional PFCP Session Report Request messages (see clause 5.2.2.3.1).  When present, this IE shall either indicate that additional usage reports will follow, or indicate the total number of usage reports that need to be sent in PFCP Session Report Request messages. | X | X | X | X | - | Additional Usage Reports Information |
| Packet Rate Status Report | C | This IE shall be present if the CP function has requested in a QER to report the packet rate status when the PFCP session is released and the UP function supports CIOT feature. (See clause 8.2.25) | - | X | - | X | - | Packet Rate Status Report |
| Session Report | C | This IE shall be present if a SRR for QoS monitoring had been provisioned in the UP function for the PFCP session being deleted and QoS monitoring measurements for that SRR are available at the UP function. See Table 7.5.8. 6-1.  Several IEs within the same IE type may be present to represent a list of Session Reports. | - | - | - | X | - | Session Report |
| MBS Session N4 Information | C | This IE shall be included if any IE in this grouped IE needs to be included as specified in clause 5.34.1.  Several IE with the same IE type may be present to contain N4 Information for several MBS Sessions.  See Table 7.5.3.1-5 for encoding. | - | - | - | X | - | MBS Session N4 Information |
| PFCPSDRsp-Flags | C | This IE shall be included if at least one of the flags is set to "1".  - PURU (Pending Usage Reports Unacknowledged): the UP function shall set this flag if the UP function has pending PFCP Session Report Request messages which have not been acknowledged yet when it sends the PFCP Session Deletion Response message. | X | X | X | X | - | PFCPSDRsp-Flags |

Table 7.5.7.1-2: Packet Rate Status Report IE within PFCP Session Deletion Response message

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Packet Rate Status Report IE Type = 252 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| QER ID | M | This IE shall uniquely identify a QER in a PFCP session. | | - | X | - | X | - | QER ID |
| Packet Rate Status | M | This IE shall indicate the remaining validity time and the remaining number of UL/DL packets that still can be sent. | | - | X | - | X | - | Packet Rate Status |

\* \* \* Next Change \* \* \* \*

#### 7.5.7.2 Usage Report IE within PFCP Session Deletion Response

The Usage Report grouped IE shall be encoded as shown in Table 7.5.7.2-1.

Table 7.5.7.2-1: Usage Report IE within PFCP Session Deletion Response

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Usage Report IE Type = 79 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| URR ID | M | This IE shall identify the URR for which usage is reported. | | X | X | X | X | - | URR ID |
| UR-SEQN | M | This IE shall uniquely identify the Usage Report for the URR (see clause 5.2.2.3). | | X | X | X | X | - | UR-SEQN |
| Usage Report Trigger | M | This IE shall identify the trigger for this report. | | X | X | X | X | - | Usage Report Trigger |
| Start Time | C | This IE shall be present, except if the Usage Report Trigger indicates 'Start of Traffic', 'Stop of Traffic' or 'MAC Addresses Reporting'.  When present, this IE shall provide the timestamp when the collection of the information in this report was started. | | X | X | X | X | - | Start Time |
| End Time | C | This IE shall be present, except if the Usage Report Trigger indicates 'Start of Traffic', 'Stop of Traffic' or 'MAC Addresses Reporting'.  When present, this IE shall provide the timestamp when the collection of the information in this report was generated. | | X | X | X | X | - | End Time |
| Volume Measurement | C | This IE shall be present if a volume needs to be reported. | | X | X | X | X | - | Volume Measurement |
| Duration Measurement | C | This IE shall be present if a duration measurement needs to be reported. | | X | X | X | X | - | Duration Measurement |
| Time of First Packet | C | This IE shall be present if available for this URR. | | - | X | X | X | - | Time of First Packet |
| Time of Last Packet | C | This IE shall be present if available for this URR. | | - | X | X | X | - | Time of Last Packet |
| Usage Information | C | This IE shall be present if the UP function reports Usage Reports before and after a Monitoring Time, or before and after QoS enforcement. When present, it shall indicate whether the usage is reported for the period before or after that time, or before or after QoS enforcement. | | X | X | X | X | - | Usage Information |
| Ethernet Traffic Information | C | This IE shall be present if Ethernet Traffic Information needs to be reported. See Table 7.5.8.3-3. | | - | - | - | X | - | Ethernet Traffic Information |

\* \* \* Next Change \* \* \* \*

### 7.5.8 PFCP Session Report Request

#### 7.5.8.1 General

The PFCP Session Report Request shall be sent over the Sxa, Sxb, Sxc, N4 and N4mb interface by the UP function to report information related to a PFCP session to the CP function.

Table 7.5.8-1: Information Elements in a PFCP Session Report Request

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Information elements | P | Condition / Comment | Appl. | | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Report Type | M | This IE shall indicate the type of the report. | X | X | X | X | X | Report Type |
| Downlink Data Report | C | This IE shall be present if the Report Type indicates a Downlink Data Report. | X | - | - | X | X | Downlink Data Report |
| Usage Report | C | This IE shall be present if the Report Type indicates a Usage Report.  Several IEs within the same IE type may be present to represent a list of Usage Reports. | X | X | X | X | - | Usage Report |
| Error Indication Report | C | This IE shall be present if the Report Type indicates an Error Indication Report. | X | X | - | X | X | Error Indication Report |
| Load Control Information | O | The UP function may include this IE if it supports the load control feature and the feature is activated in the network.  See Table 7.5.3.3-1. | X | X | X | X | X | Load Control Information |
| Overload Control Information | O | During an overload condition, the UP function may include this IE if it supports the overload control feature and the feature is activated in the network.  See Table 7.5.3.4-1. | X | X | X | X | X | Overload Control Information |
| Additional Usage Reports Information | C | This IE shall be included in one of the additional PFCP Session Report Request messages, if the PFCP Session Modification Response or the PFCP Session Deletion Response indicated that more usage reports would follow (i.e. if the AURI flag was set to "1") (see clause 5.2.2.3.1).  When present, this IE shall indicate the total number of usage reports that need to be sent in all the additional PFCP Session Report Request messages.  This IE may also be included in every additional PFCP Session Report Request message but the last one, with the AURI flag set to 1, to indicate that more usage reports will follow in additional PFCP Session Report Request message. | X | X | X | X | - | Additional Usage Reports Information |
| PFCPSRReq-Flags | C | This IE shall be included if at least one of the flags is set to "1".  - PSDBU (PFCP Session Deleted By the UP function): if both the CP function and UP function support the EPFAR feature, the UP function may set this flag if the UP function needs to delete the PFCP session, e.g. to report all remaining non-zero usage reports for all URRs in the PFCP Session and the PFCP session is being deleted locally in the UP function.  - the UP function shall also set this flag when sending the last PFCP Session Report Request message after having received a PFCP Session Deletion Request (see clause 5.2.2.3.1). | X | X | X | X | - | PFCPSRReq-Flags |
| Old CP F-SEID | C | This IE shall be present if the UPF sends the PFCP Session Report Request to a different SMF in an SMF Set. See clauses 5.22.2 and 5.22.3.  When present, it shall indicate the CP F-SEID assigned by the previous SMF to the PFCP session. | - | - | - | X | X | F-SEID |
| Packet Rate Status Report | C | This IE shall be present if the EPFAR is used (see clause 5.18), UP function initiates a PFCP Session release and the CP function has requested in a QER to report the packet rate status when the PFCP session is released.  See Table 7.5.7.1-1. | - | X | - | X | - | Packet Rate Status Report |
| TSC Management Information | C | This IE shall be present if the Report Type indicates TSC Management Information Report.  Several IEs within the same IE type may be present to transfer PMICs for different NW-TT ports. | - | - | - | X | - | TSC Management Information |
| Session Report | C | This IE shall be present if the Report Type indicates a Session Report. See Table 7.5.8.6-1.  Several IEs within the same IE type may be present to represent a list of Session Reports. | - | - | - | X | - | Session Report |
| Cause | O | This IE may be present to provide additional reason for sending the PFCP Session Report Request message, e.g. for a UP function initiated PFCP session deletion due to the corresponding L2TP session being terminated. | - | X | - | X | - | Cause |

\* \* \* Next Change \* \* \* \*

#### 7.5.8.3 Usage Report IE within PFCP Session Report Request

The Usage Report grouped IE shall be encoded as shown in Table 7.5.8.3-1.

Table 7.5.8.3-1: Usage Report IE within PFCP Session Report Request

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Usage Report IE Type = 80 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| URR ID | M | This IE shall identify the URR for which usage is reported. | | X | X | X | X | - | URR ID |
| UR-SEQN | M | This IE shall uniquely identify the Usage Report for the URR (see clause 5.2.2.3). | | X | X | X | X | - | UR-SEQN |
| Usage Report Trigger | M | This IE shall identify the trigger for this report. | | X | X | X | X | - | Usage Report Trigger |
| Start Time | C | This IE shall be present, except if the Usage Report Trigger indicates 'Start of Traffic', 'Stop of Traffic' or 'MAC Addresses Reporting'.  When present, this IE shall provide the timestamp when the collection of the information in this report was started. | | X | X | X | X | - | Start Time |
| End Time | C | This IE shall be present, except if the Usage Report Trigger indicates 'Start of Traffic', 'Stop of Traffic' or ' MAC Addresses Reporting'.  When present, this IE shall provide the timestamp when the collection of the information in this report was generated. | | X | X | X | X | - | End Time |
| Volume Measurement | C | This IE shall be present if a volume measurement needs to be reported. (NOTE 2) | | X | X | X | X | - | Volume Measurement |
| Duration Measurement | C | This IE shall be present if a duration measurement needs to be reported. (NOTE 2) | | X | X | X | X | - | Duration Measurement |
| Application Detection Information | C | This IE shall be present if application detection information needs to be reported. | | - | X | X | X | - | Application Detection Information |
| UE IP address | C | This IE shall be present if the start or stop of an application has been detected and no UE IP address was provisioned in the PDI. See NOTE 1. | | - | - | X | X | - | UE IP address |
| Network Instance | C | This IE shall be present if the start or stop of an application has been detected, no UE IP address was provisioned in the PDI and multiple PDNs with overlapping IP addresses are used in the UP function. See NOTE 1. | | - | - | X | X | - | Network Instance |
| Time of First Packet | C | This IE shall be present if available for this URR. | | - | X | X | X | - | Time of First Packet |
| Time of Last Packet | C | This IE shall be present if available for this URR. | | - | X | X | X | - | Time of Last Packet |
| Usage Information | C | This IE shall be present if the UP function reports Usage Reports before and after a Monitoring Time, or before and after QoS enforcement. When present, it shall indicate whether the usage is reported for the period before or after that time, or before or after QoS enforcement. | | X | X | X | X | - | Usage Information |
| Query URR Reference | C | This IE shall be present if this usage report is sent as a result of a query URR received in a PFCP Session Modification Request and the Query URR Reference IE was present in the PFCP Session Modification Request.  When present, it shall be set to the Query URR Reference value received in the PFCP Session Modification Request. | | X | X | X | X | - | Query URR Reference |
| Event Time Stamp | C | This IE shall be present, if the report is related to an event.  When present, it shall be set to the time when the event occurs.  Several IEs with the same IE type may be present to report multiple occurrences for an event for this URR ID. | | - | X | X | X | - | Time Stamp |
| Ethernet Traffic Information | C | This IE shall be present if Ethernet Traffic Information needs to be reported. See Table 7.5.8.3-3. | | - | - | - | X | - | Ethernet Traffic Information |
| Join IP Muticast Information | C | This IE shall be present if the UPF needs to report that it has added the PDU session to the DL replication tree of a new IP multicast flow.  Several IEs with the same IE type may be present to report multiple IP multicast flows added to the PDU session. | | - | - | - | X | - | Join IP Multicast Information |
| Leave IP Muticast Information | C | This IE shall be present if the UPF needs to report that it has removed the PDU session from the DL replication tree of an IP multicast flow.  Several IEs with the same IE type may be present to report multiple IP multicast flows removed from the PDU session. | | - | - | - | X | - | Leave IP Multicast Information |
| Predefined Rules Name | O | This IE may be present to identify a predefined rule if the usage report is generated for a predefined URR which was activated via a Activate Predefined Rules IE in a Create PDR IE or an Update PDR IE.  Several IEs with the same IE type may be present to represent multiple Predefined Rules with which the URR is associated. | | - | X | - | X | - | Predefined Rules Name |
| NOTE 1: This is the case for unsolicited application reporting by the TDF. The Network instance is required when the UE IP address cannot be used to determine the corresponding PDN connection.  NOTE 2: The UP function may send a Usage Report with the Volume/Duration Measurement set to zero. | | | | | | | | | |

Table 7.5.8.3-2: Application Detection Information IE within Usage Report IE

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Application Detection Information IE Type = 68 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| Application ID | M | This IE shall identify the Application ID for which a start or stop of traffic is reported. | | - | X | X | X | - | Application ID |
| Application Instance ID | C | When present, this IE shall identify the Application Instance Identifier for which a start or stop of traffic is reported. It shall be present, when reporting the start of an application, if the Reduced Application Detection Information flag was not set in the Measurement Information and if the flow information for the detected application is deducible. It shall be present, when reporting the stop of an application, if the Reduced Application Detection Information flag was not set in the Measurement Information and if it was provided when reporting the start of the application. | | - | X | X | X | - | Application Instance ID |
| Flow Information | C | When present, this IE shall contain the flow information for the detected application. It shall be present, when reporting the start of an application, if the Reduced Application Detection Information flag was not set in the Measurement Information and if the flow information for the detected application is deducible. | | - | X | X | X | - | Flow Information |
| PDR ID | O | When present, it shall contain the PDR ID which the application traffic matches. | | - | X | X | X | - | PDR ID |

Table 7.5.8.3-3: Ethernet Traffic Information IE within Usage Report IE

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Ethernet Traffic Information IE Type = 143 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| MAC Addresses Detected | C | This IE shall be present if one or more new MAC addresses have been detected.  When present, it shall identify the MAC (Ethernet) addresses newly detected as source address of frames sent UL by the UE.  Several IEs with the same IE type may be present to to provision multiple lists of MAC addresses (e.g. with different V-LAN tags). | | - | - | - | X | - | MAC Addresses Detected |
| MAC Addresses Removed | C | This IE shall be present if one or more new MAC addresses have been removed.  When present, it shall identify the MAC (Ethernet) addresses that have been inactive for a duration exceeding the Ethernet inactivity Timer.  Several IEs with the same IE type may be present to to provision multiple lists of MAC addresses (e.g. with different V-LAN tags). | | - | - | - | X | - | MAC Addresses Removed |

Table 7.5.8.3-4: Join IP Multicast Information IE within Usage Report IE

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Join IP Multicast Information IE Type = 189 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| IP Multicast Address | M | This IE shall contain the IP multicast address of the DL multicast flow added to the PDU session. | | - | - | - | X | - | IP Multicast Address |
| Source IP Address | C | This IE shall contain the source specific IP address of the DL multicast flow added to the PDU session, if available.  Several IEs with the same IE type may be present to represent multiple source specific addresses. | | - | - | - | X | - | Source IP Address |

Table 7.5.8.3-5: Leave IP Multicast Information IE within Usage Report IE

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  |  | Leave IP Multicast Information IE Type = 190 (decimal) | | | | | | |
| Octets 3 and 4 |  |  | Length = n | | | | | | |
| Information elements | P | Condition / Comment | |  | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 | N4mb |
| IP Multicast Address | M | This IE shall contain the IP multicast address of the DL multicast flow removed from the PDU session. | | - | - | - | X | - | IP Multicast Address |
| Source IP Address | C | This IE shall contain the source specific IP address of the DL multicast flow removed from the PDU session, if available.  Several IEs with the same IE type may be present to represent multiple source specific addresses. | | - | - | - | X | - | Source IP Address |

\* \* \* End of Changes \* \* \* \*