**3GPP TSG-CT4 Meeting #99-e C4-204xxx**

**E-meeting, 18th Aug 2020 - 28th Aug 2020** *Revision of 4074, 4417, incorporating 4272*

|  |
| --- |
| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **29.244** | **CR** | **0471** | **rev** | **2** | **Current version:** | **16.4.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
|  |

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

|  |
| --- |
|  |
| ***Title:***  | Report the Status of the UE IP Address Allocation Capacity |
|  |  |
| ***Source to WG:*** | Huawei, Ericsson |
| ***Source to TSG:*** | CT4 |
|  |  |
| ***Work item code:*** | CUPS-CT, TEI16 |  | ***Date:*** | 2020-08-06 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | When UPF allocates IP addresses to UEs and an SMF sends a PFCP Session Establishment Request message to a UPF, the UPF may not have IP address available anymore. Therefore, the UPF will need to reject the request, which will trigger the SMF to select another UPF, which delays successful session establishment. In order to avoid such extra latency, UPFs may periodically inform SMFs on the remaining UE IP address allocation capacity. |
|  |  |
| ***Summary of change:*** | New UE IP Address Availability IE of type Metric is added to the existing UE IP address Pool Information IE, which was marked as optional in PFCP Association Setup Request/Response and also in PFCP Association Update Request. The presence of this IE is changed to conditional and the condition is specified. The UE IP address Pool Information IE is added also to PFCP Association Update Request. New cause value "UE IP address is not available" is added to Table 8.2.1-1: Cause values. |
|  |  |
| ***Consequences if not approved:*** | PFCP session establishment failures and extra latency to establish PFCP Sessions when the pool of available addresses becomes exhausted. |
|  |  |
| ***Clauses affected:*** | 5.8.2, 5.21.3, 7.4.4.3, 7.4.4.3.x (new), 7.4.4.4, 8.1.2, 8.2.1, 8.2.58, 8.2.x (new). |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | At the previous CT4 meeting #98-e, which took place before stage 3 work froze for 3GPP Rel-16, CT4 reached agreement to specify this feature for Rel-16. |
|  |  |
| ***This CR's revision history:*** | Rev1: Proposal to use Heartbeat is replaced by a proposal to use PFCP association procedure. Therefore, the CR was basically rewritten, including the cover sheet.Rev2: * CR 29.244 0483 Rel-16 Report of UE IP address Allocation Status (C4-204272) is incorporated into this CR.
* The title of the CR changed and the cover sheet was revised.
* xxx
 |

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

### 5.8.2 Behaviour with an Established PFCP Association

When a PFCP Association is established with a UP function, the CP function:

- shall provision node related parameters (i.e. parameters that apply to all PFCP sessions) in the UP function, if any, e.g. PFDs;

- shall provision the UP function with the list of features (affecting the UP function behaviour) the CP function supports, if any, e.g. support of load and/or overload control;

- shall check the responsiveness of the UP function using the Heartbeat procedure as specified in clause 6.2.2;

- may establish PFCP sessions on that UP function;

- shall refrain from attempting to establish new PFCP sessions on the UP function, if the UP function has indicated it will shut down gracefully.

When a PFCP Association is established with a CP function, the UP function:

- shall update the CP function with the list of features it supports;

- shall update the CP function with its load and/or overload control information, if load and/or overload control is supported by the CP and UP functions;

- shall accept PFCP Session related messages from that CP function (unless prevented by other reasons, e.g. overload);

- shall check the responsiveness of the CP function using the Heartbeat procedure as specified in clause 6.2.2;

- shall indicate to the CP function if it will shut down within a graceful period and, when possible, if it fails and becomes out of service;

- may update the CP function with the UE IP address Allocation Information, if Reporting the Status of the UE IP Address Allocation Capacity feature is supported by the CP function (see clause 5.21.3.x).

\* \* \* 2nd Change \* \* \* \*

### 5.21.3 UE IP address/prefix allocation in the UP function

When performing UE IP address/prefix allocation in the UP function, the CP function shall request the UP function to allocate the UE IP address/prefix by:

- setting the CHOOSE flags (CHOOSE IPV4 and/or CHOOSE IPV6) in the UE IP Address IE of the PDR IE (see Table 7.5.2.2-1) or of the Traffic Endpoint (see Table 7.5.2.7-1); the IPv6 prefix length shall be indicated in the UE IP Address if an IPv6 prefix other than default /64 and other than for IPv6 prefix delegation (see clause 5.14) is to be assigned and the UPF indicated support of the IP6PL feature (see clause 8.2.25); and

- including the Network Instance IE to indicate the IP address pool from which the UE IP address/prefix is to be assigned.

- optionally including the UE IP address Pool Identity from which the UE IP address shall be allocated by the UP function.

The CP function may request the UP function to allocate the same UE IP address/prefix to several PDRs to be created within one single PFCP Session Establishment Request or PFCP Session Modification Request by:

- setting the CHOOSE flags (CHOOSE IPV4 and/or CHOOSE IPV6) in the UE IP Address IE of each PDR to be created with a new UE IP address/prefix;

or, if the UP function indicated support of the PDI optimization (see clause 8.2.25), by:

- including the UE IP Address IE only in the Create Traffic Endpoint IE and by setting the CHOOSE flags (CHOOSE IPV4 and/or CHOOSE IPV6) in the UE IP Address IE of this IE; and

- including the Traffic Endpoint ID in all the PDRs to be created with the same UE IP address.

If the PDR(s) is created successfully, the UP function shall return the UE IP address/prefix it has assigned to the PDR(s) or to the Traffic Endpoint(s) in the PFCP Session Establishment Response or PFCP Session Modification Response.

Upon receiving a request to delete a PFCP session, to remove a Traffic Endpoint, or to remove the last PDR associated with the UE IP address/prefix, the UP function shall release the UE IP address/prefix that was assigned to the PFCP session, to the Traffic Endpoint, or to the PDR.

#### 5.21.3.x Reporting the Status of the UE IP Address Allocation Capacity

If the CP funtion supports the Reporting the Status of the UE IP Address Allocation Capacity feature (see clause 8.2.58), the UP function that also supports the feature shall send the UE IP address Allocation Information IE to the CP function with the PFCP Association Update Request/Response message, when the ratio of occupied (i.e. already assigned) IP addresses to the configured IP addresses for certain UE IP Address Pool(s) and/or Network Instance(s) in the UP function exceeds a configurable threshold. In this case, the UP function shall also inform the CP function for how long this information shall be treated as valid. If the ratio drops below another configurable threshold or the validity expires, the UP function shall send PFCP Association Update Request/Response message with UE IP address Allocation Information IE, which shall contain the updated ratio and also validity time. The validity time shall be measured in units of seconds.

NOTE: It is recommended to set the upper threshold to a reasobably high value, e.g to 80%. The selection would depend on the number of all available IP addresses and also on the selected validity time interval. It is also recommended to set the lower threshold to a reasobably lower value, e.g to 50%, so that no extra signaling will be necessary until the ratio drops from 80% to 50%.

\* \* \* 3rd 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 | IE Type |
| Node ID | M | This IE shall contain the unique identifier of the sending Node. | Node ID |
| UP Function Features | O | If present, this IE shall indicate the supported Features when the sending node is the UP function. | UP Function Features |
| CP Function Features | O | If present, this IE shall indicate the supported Features when the sending node is the CP function. | 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. | 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. | 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. | PFCPAUReq-Flags |
| Alternative SMF IP Address | O | This IE may be present if the 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 SMF or an alternative PFCP entity in the same SMF when SSET feature is used, or an alternative PFCP entity in the same SMF when MPAS feature is used.Several IEs with the same IE type may be present to represent multiple alternative SMF IP addresses. | Alternative SMF IP Address |
| 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. | 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.  | 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. | GTP-U Path QoS Control Information |
| UE IP Address Allocation Information | O | The UP function may include if both UP and CP functions support Reporting the Status of the UE IP Address Allocation Capacity feature.See Table 7.4.4.3.x-1Several IEs with the same type may be present to represent UE IP Address Allocation Information for different UE IP Address Pools and/or Network Instances. See clause 5.21.3 | UE IP Address Allocation Information |

\* \* \* 4th Change \* \* \* \*

#### 7.4.4.3.x UE IP Address Allocation Information IE within PFCP Association Update Request

The UE IP Address Allocation Information grouped IE shall be encoded as shown in Figure 7.4.4.3.x-1.

Table 7.5.3.x-1: UE IP Address Allocation Information IE within PFCP Session Establishment Response

|  |  |  |
| --- | --- | --- |
| Octet 1 and 2 |  | UE IP Address Allocation Information IE Type = xxx (decimal) |
| Octets 3 and 4 |  | Length = n |
| **Information elements** | **P** | **Condition / Comment** | **Appl.** | **IE Type** |
| **Sxa** | **Sxb** | **Sxc** | **N4** |
| UE IP Address Allocation Sequence Number | M | This IE shall be used by the receiver of the UE IP Address Allocation Information IE to properly collate out-of-order Allocation Information, e.g. due to PFCP retransmissions. This parameter shall also be used by the receiver to determine whether the newly received UE IP address allocation information has changed compared to UE IP address allocation information previously received from the same node earlier. | - | X | - | X | Sequence Number |
| UE IP Address Allocation Metric | M | This IE shall represent the current ratio of occupied UE IP addresses in the UP function for the Network Instance indicated in the Network Instance IE and also for the UE IP address Pool indicated by the UE IP Address Pool Id IE when this IE is present. The value is expressed as a percentage within the range of 0 to100, where 0 means no or 0% usage and 100 means maximum or 100% usage reached (i.e. it is not desirable to receive further PFCP Session Establishment Requests). | - | X | - | X | Metric |
| Validity Timer | M | This IE shall represent the period of time during which the UE IP Address Allocation Information shall be considered as valid. | - | X | - | X | Timer |
| Number of UE IP Addresses  | M | This IE shall indicate the total number of UE IP addresses configured for the Network Instance or also for the IP address Pool, when this IE is present. (NOTE) | - | X | - | X | Number of UE IP Addresses |
| Network Instance | M | This IE shall identify the associated Network instance. | - | X | - | X | Network Instance |
| UE IP Address Pool Id | 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 the associated UE IP address Pool. | - | X | - | X | UE IP address Pool Identity |
| NOTE: When reporting the number of IPv6 UE Addresses for a specific Network Instance and/or IP address pool, the number of default /64 prefixes is reported by default, unless configured otherwise. |

\* \* \* 5th Change \* \* \* \*

#### 7.4.4.4 PFCP Association Update Response

Table 7.4.4.4-1: Information Elements in a PFCP Association Update Response

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | P | Condition / Comment | IE-Type |
| Node ID | M | This IE shall contain the unique identifier of the sending Node. | Node ID |
| Cause | M | This IE shall indicate the acceptance or the rejection of the corresponding request message. | Cause |
| UP Function Features | O | If present, this IE shall indicate the supported Features when the sending node is the UP function. | UP Function Features |
| CP Function Features | O | If present, this IE shall indicate the supported Features when the sending node is the CP function. | CP Function Features |
| UE IP Address Allocation Information | O | The UP function may include if both UP and CP functions support Reporting the Status of the UE IP Address Allocation Capacity feature.See Table 7.4.4.3.x-1Several IEs with the same type may be present to represent UE IP Address Allocation Information for different UE IP Address Pools and/or Network Instances. See clause 5.21.3 | UE IP Address Allocation Information |

\* \* \* 6th Change \* \* \* \*

### 8.1.2 Information Element Types

A PFCP message may contain several IEs. In order to have forward compatible type definitions for the PFCP IEs, all of them shall be TLV (Type, Length, Value) coded. PFCP IE type values are specified in the Table 8.1.2-1.

The 3rd column of this table specifies if the IE is either Extendable or has a variable length or a fixed length and a reference to the clause where the IE is specified:

- Fixed Length: the IE has a fixed set of fields, and a fixed number of octets;

- Variable Length: the IE has a fixed set of fields, and has a variable number of octets.
For example, the last octets may be numbered similar to "5 to (n+4)". In this example, if the value of the length field, n, is 0, then the last field is not present;

- Extendable: the IE has a variable number of fields, and has a variable number of octets.
The last fields are typically specified with the statement: "These octet(s) is/are present only if explicitly specified". The legacy receiving entity shall ignore the unknown octets.

The 4th column of this table indicates the number of fixed Octets the IE contained when the IE was first defined in the specification, which shall be an integer value reflecting the minimum length of fixed octets defined for the IE.

An IE of any of the above types may have a null length as specified in clause 5.6.3. This shall not be considered as an error by the receiving PFCP entity.

In order to improve the efficiency of troubleshooting, it is recommended that the IEs should be arranged in the signalling messages as well as in the grouped IEs, according to the order the IEs are listed in the message definition table or grouped IE definition table in clause 7. However the receiving entity shall be prepared to handle the messages with IEs in any order.

Within IEs, certain fields may be described as spare. These bits shall be transmitted with the value set to "0". To allow for future features, the receiver shall not evaluate these bits.

Table 8.1.2-1: Information Element Types

| IE Type value(Decimal) | Information elements | Comment / Reference | Number of Fixed Octets |
| --- | --- | --- | --- |
| 0 | Reserved |  |  |
| 1 | Create PDR | Extendable / Table 7.5.2.2-1 | Not Applicable |
| 2 | PDI | Extendable / Table 7.5.2.2-2 | Not Applicable |
| 3 | Create FAR | Extendable / Table 7.5.2.3-1 | Not Applicable |
| 4 | Forwarding Parameters | Extendable / Table 7.5.2.3-2 | Not Applicable |
| 5 | Duplicating Parameters | Extendable / Table 7.5.2.3-3 | Not Applicable |
| 6 | Create URR | Extendable / Table 7.5.2.4-1 | Not Applicable |
| 7 | Create QER | Extendable / Table 7.5.2.5-1 | Not Applicable |
| 8 | Created PDR | Extendable / Table 7.5.3.2-1 | Not Applicable |
| 9 | Update PDR | Extendable / Table 7.5.4.2-1 | Not Applicable |
| 10 | Update FAR | Extendable / Table 7.5.4.3-1 | Not Applicable |
| 11 | Update Forwarding Parameters | Extendable / Table 7.5.4.3-2 | Not Applicable |
| 12 | Update BAR (PFCP Session Report Response) | Extendable / Table 7.5.9.2-1  | Not Applicable |
| 13 | Update URR | Extendable / Table 7.5.4.4 | Not Applicable |
| 14 | Update QER | Extendable / Table 7.5.4.5 | Not Applicable |
| 15 | Remove PDR | Extendable / Table 7.5.4.6 | Not Applicable |
| 16 | Remove FAR | Extendable / Table 7.5.4.7 | Not Applicable |
| 17 | Remove URR | Extendable / Table 7.5.4.8 | Not Applicable |
| 18 | Remove QER | Extendable / Table 7.5.4.9 | Not Applicable |
| 19 | Cause | Fixed / Clause 8.2.1 | 1 |
| 20 | Source Interface | Extendable / Clause 8.2.2 | 1 |
| 21 | F-TEID | Extendable / Clause 8.2.3 | 1 |
| 22 | Network Instance | Variable Length / Clause 8.2.4 | Not Applicable |
| 23 | SDF Filter | Extendable / Clause 8.2.5 | 2 |
| 24 | Application ID | Variable Length / Clause 8.2.6 | Not Applicable |
| 25 | Gate Status | Extendable / Clause 8.2.7 | 1 |
| 26 | MBR | Extendable / Clause 8.2.8 | 10 |
| 27 | GBR | Extendable / Clause 8.2.9 | 10 |
| 28 | QER Correlation ID | Extendable / Clause 8.2.10 | 4 |
| 29 | Precedence | Extendable / Clause 8.2.11 | 4 |
| 30 | Transport Level Marking | Extendable / Clause 8.2.12 | 2 |
| 31 | Volume Threshold | Extendable /Clause 8.2.13 | 1 |
| 32 | Time Threshold | Extendable /Clause 8.2.14 | 4 |
| 33 | Monitoring Time | Extendable /Clause 8.2.15 | 4 |
| 34 | Subsequent Volume Threshold | Extendable /Clause 8.2.16 | 1 |
| 35 | Subsequent Time Threshold | Extendable /Clause 8.2.17 | 4 |
| 36 | Inactivity Detection Time | Extendable /Clause 8.2.18 | 4 |
| 37 | Reporting Triggers | Extendable /Clause 8.2.19 | 2 |
| 38 | Redirect Information | Extendable /Clause 8.2.20 | 3 |
| 39 | Report Type | Extendable / Clause 8.2.21 | 1 |
| 40 | Offending IE | Fixed / Clause 8.2.22 | 2 |
| 41 | Forwarding Policy | Extendable / Clause 8.2.23 | 1 |
| 42 | Destination Interface | Extendable / Clause 8.2.24 | 1 |
| 43 | UP Function Features | Extendable / Clause 8.2.25 | 1 |
| 44 | Apply Action | Extendable / Clause 8.2.26 | 1 |
| 45 | Downlink Data Service Information | Extendable / Clause 8.2.27 | 1 |
| 46 | Downlink Data Notification Delay | Extendable / Clause 8.2.28 | 1 |
| 47 | DL Buffering Duration | Extendable / Clause 8.2.29 | 1 |
| 48 | DL Buffering Suggested Packet Count | Variable / Clause 8.2.30 | Not Applicable |
| 49 | PFCPSMReq-Flags | Extendable / Clause 8.2.31 | 1 |
| 50 | PFCPSRRsp-Flags | Extendable / Clause 8.2.32 | 1 |
| 51 | Load Control Information | Extendable / Table 7.5.3.3-1 | Not Applicable |
| 52 | Sequence Number | Fixed Length / Clause 8.2.33 | 4 |
| 53 | Metric | Fixed Length / Clause 8.2.34 | 1 |
| 54 | Overload Control Information | Extendable / Table 7.5.3.4-1 | Not Applicable |
| 55 | Timer | Extendable / Clause 8.2 35 | 1 |
| 56 | PDR ID | Extendable / Clause 8.2 36 | 2 |
| 57 | F-SEID | Extendable / Clause 8.2 37 | 9 |
| 58 | Application ID's PFDs | Extendable / Table 7.4.3.1-2 | Not Applicable |
| 59 | PFD context | Extendable / Table 7.4.3.1-3 | Not Applicable |
| 60 | Node ID | Extendable / Clause 8.2.38 | 1 |
| 61 | PFD contents | Extendable / Clause 8.2.39 | 2 |
| 62 | Measurement Method | Extendable / Clause 8.2.40 | 1 |
| 63 | Usage Report Trigger | Extendable / Clause 8.2.41 | 2 |
| 64 | Measurement Period | Extendable / Clause 8.2.42 | 4 |
| 65 | FQ-CSID | Extendable / Clause 8.2.43 | 1 |
| 66 | Volume Measurement | Extendable / Clause 8.2.44 | 1 |
| 67 | Duration Measurement | Extendable / Clause 8.2.45 | 4 |
| 68 | Application Detection Information | Extendable / Table 7.5.8.3-2 | Not Applicable |
| 69 | Time of First Packet | Extendable / Clause 8.2.46 | 4 |
| 70 | Time of Last Packet | Extendable / Clause 8.2.47 | 4 |
| 71 | Quota Holding Time | Extendable / Clause 8.2.48 | 4 |
| 72 | Dropped DL Traffic Threshold | Extendable / Clause 8.2.49 | 1 |
| 73 | Volume Quota | Extendable / Clause 8.2.50 | 1 |
| 74 | Time Quota | Extendable / Clause 8.2.51 | 4 |
| 75 | Start Time | Extendable / Clause 8.2.52 | 4 |
| 76 | End Time | Extendable / Clause 8.2.53 | 4 |
| 77 | Query URR | Extendable / Table 7.5.4.10-1 | Not Applicable |
| 78 | Usage Report (Session Modification Response) | Extendable / Table 7.5.5.2-1 | Not Applicable |
| 79 | Usage Report (Session Deletion Response) | Extendable / Table 7.5.7.2-1 | Not Applicable |
| 80 | Usage Report (Session Report Request) | Extendable / Table 7.5.8.3-1 | Not Applicable |
| 81 | URR ID | Extendable / Clause 8.2.54 | 4 |
| 82 | Linked URR ID | Extendable / Clause 8.2.55 | 4 |
| 83 | Downlink Data Report | Extendable / Table 7.5.8.2-1 | Not Applicable |
| 84 | Outer Header Creation | Extendable / Clause 8.2.56 | 2 |
| 85 | Create BAR | Extendable / Table 7.5.2.6-1 | Not Applicable |
| 86 | Update BAR (Session Modification Request) | Extendable / Table 7.5.4.11-1 | Not Applicable |
| 87 | Remove BAR | Extendable / Table 7.5.4.12-1 | Not Applicable |
| 88 | BAR ID | Extendable / Clause 8.2.57 | 1 |
| 89 | CP Function Features | Extendable / Clause 8.2.58 | 1 |
| 90 | Usage Information | Extendable / Clause 8.2.59 | 1 |
| 91 | Application Instance ID | Variable Length / Clause 8.2.60 | Not Applicable |
| 92 | Flow Information | Extendable / Clause 8.2.61 | 3 |
| 93 | UE IP Address | Extendable / Clause 8.2.62 | 1 |
| 94 | Packet Rate | Extendable / Clause 8.2.63 | 1 |
| 95 | Outer Header Removal | Extendable / Clause 8.2.64 | 1 |
| 96 | Recovery Time Stamp | Extendable / Clause 8.2.65 | 4 |
| 97 | DL Flow Level Marking | Extendable / Clause 8.2.66 | 1 |
| 98 | Header Enrichment | Extendable / Clause 8.2.67 | 1 |
| 99 | Error Indication Report | Extendable / Table 7.5.8.4-1 | Not Applicable |
| 100 | Measurement Information | Extendable / Clause 8.2.68 | 1 |
| 101 | Node Report Type | Extendable / Clause 8.2.69 | 1 |
| 102 | User Plane Path Failure Report | Extendable / Table 7.4.5.1.2-1 | Not Applicable |
| 103 | Remote GTP-U Peer | Extendable / Clause 8.2.70 | 1 |
| 104 | UR-SEQN | Fixed Length / Clause 8.2.71 | 4 |
| 105 | Update Duplicating Parameters | Extendable / Table 7.5.4.3-3 | Not Applicable |
| 106 | Activate Predefined Rules  | Variable Length / Clause 8.2.72 | Not Applicable |
| 107 | Deactivate Predefined Rules  | Variable Length / Clause 8.2.73 | Not Applicable |
| 108 | FAR ID | Extendable / Clause 8.2.74 | 4 |
| 109 | QER ID | Extendable / Clause 8.2.75 | 4 |
| 110 | OCI Flags | Extendable / Clause 8.2.76 | 1 |
| 111 | PFCP Association Release Request | Extendable / Clause 8.2.77 | 1 |
| 112 | Graceful Release Period | Extendable / Clause 8.2.78 | 1 |
| 113 | PDN Type | Extendable / Clause 8.2.79 | 1 |
| 114 | Failed Rule ID | Extendable / Clause 8.2.80 | 1 |
| 115 | Time Quota Mechanism | Extendable / Clause 8.2.81 | 1 |
| 116 | Reserved |  |  |
| 117 | User Plane Inactivity Timer | Extendable /Clause 8.2.83 | 4 |
| 118 | Aggregated URRs | Extendable / Table 7.5.2.4-2 | Not Applicable |
| 119 | Multiplier | Fixed / Clause 8.2.84 | 12 |
| 120 | Aggregated URR ID | Fixed / Clause 8.2.85 | 4 |
| 121 | Subsequent Volume Quota | Extendable / Clause 8.2.86 | 1 |
| 122 | Subsequent Time Quota | Extendable / Clause 8.2.87 | 4 |
| 123 | RQI | Extendable / Clause 8.2.88 | 1 |
| 124 | QFI | Extendable / Clause 8.2.89 | 1 |
| 125 | Query URR Reference | Extendable / Clause 8.2.90 | 4 |
| 126 | Additional Usage Reports Information | Extendable / Clause 8.2.91 | 2 |
| 127 | Create Traffic Endpoint | Extendable / Table 7.5.2.7 | Not Applicable |
| 128 | Created Traffic Endpoint | Extendable / Table 7.5.3.5 | Not Applicable |
| 129 | Update Traffic Endpoint | Extendable / Table 7.5.4.13 | Not Applicable |
| 130 | Remove Traffic Endpoint | Extendable / Table 7.5.4.14 | Not Applicable |
| 131 | Traffic Endpoint ID | Extendable / Clause 8.2.92 | 1 |
| 132 | Ethernet Packet Filter | Extendable / Table 7.5.2.2-3 | Not Applicable |
| 133 | MAC address | Extendable / Clause 8.2.93 | 1 |
| 134 | C-TAG | Extendable / Clause 8.2.94 | 3 |
| 135 | S-TAG | Extendable / Clause 8.2.95 | 3 |
| 136 | Ethertype | Extendable / Clause 8.2.96 | 2 |
| 137 | Proxying | Extendable / Clause 8.2.97 | 1 |
| 138 | Ethernet Filter ID | Extendable / Clause 8.2.98 | 4 |
| 139 | Ethernet Filter Properties | Extendable / Clause 8.2.99 | 1 |
| 140 | Suggested Buffering Packets Count | Extendable / Clause 8.2.100 | 1 |
| 141 | User ID | Extendable / Clause 8.2.101 | 1 |
| 142 | Ethernet PDU Session Information | Extendable / Clause 8.2.102 | 1 |
| 143 | Ethernet Traffic Information | Extendable / Table 7.5.8.3-3 | Not Applicable |
| 144 | MAC Addresses Detected | Extendable / Clause 8.2.103 | 7 |
| 145 | MAC Addresses Removed | Extendable / Clause 8.2.104 | 7 |
| 146 | Ethernet Inactivity Timer | Extendable / Clause 8.2.105 | 4 |
| 147 | Additional Monitoring Time | Extendable / Table 7.5.2.4-3 | Not Applicable |
| 148 | Event Quota | Extendable / Clause 8.2.112 | 4 |
| 149 | Event Threshold | Extendable / Clause 8.2.113 | 4 |
| 150 | Subsequent Event Quota | Extendable / Clause 8.2.106 | 4 |
| 151 | Subsequent Event Threshold | Extendable / Clause 8.2.107 | 4 |
| 152 | Trace Information | Extendable / Clause 8.2.108 | 7 |
| 153 | Framed-Route | Variable Length / Clause 8.2.109 | Not Applicable |
| 154 | Framed-Routing | Fixed Length / Clause 8.2.110 | 4 |
| 155 | Framed-IPv6-Route | Variable Length / Clause 8.2.111 | Not Applicable |
| 156 | Event Time Stamp  | Extendable / Clause 8.2.114 | 4 |
| 157 | Averaging Window | Extendable /Clause 8.2.115 | 4 |
| 158 | Paging Policy Indicator | Extendable / Clause 8.2.116 | 1 |
| 159 | APN/DNN | Variable Length / Clause 8.2.117 | Not Applicable |
| 160 | 3GPP Interface Type | Extendable / Clause 8.2.118 | 1 |
| 161 | PFCPSRReq-Flags | Extendable / Clause 8.2.119 | 1 |
| 162 | PFCPAUReq-Flags | Extendable / Clause 8.2.120 | 1 |
| 163 | Activation Time | Extendable / Clause 8.2.121 | 4 |
| 164 | Deactivation Time | Extendable / Clause 8.2.122 | 4 |
| 165 | Create MAR | Extendable / Table 7.5.2.8-1 | Not Applicable |
| 166 | 3GPP Access Forwarding Action Information | Extendable / Table 7.5.2.8-2 | Not Applicable |
| 167 | Non-3GPP Access Forwarding Action Information | Extendable / Table 7.5.2.8-3 | Not Applicable |
| 168 | Remove MAR | Extendable / Table 7.5.4.15-1 | Not Applicable |
| 169 | Update MAR | Extendable / Table 7.5.4.16-1 | Not Applicable |
| 170 | MAR ID | Extendable / Clause 8.2.123 | 2 |
| 171 | Steering Functionality | Extendable / Clause 8.2.124 | 1 |
| 172 | Steering Mode | Extendable / Clause 8.2.125 | 1 |
| 173 | Weight | Fixed / Clause 8.2.126 | 1 |
| 174 | Priority | Extendable / Clause 8.2.127 | 1 |
| 175 | Update 3GPP Access Forwarding Action Information | Extendable / Table 7.5.4.16-2 | Not Applicable |
| 176 | Update Non 3GPP Access Forwarding Action Information | Extendable / Table 7.5.4.16-3 | Not Applicable |
| 177 | UE IP address Pool Identity | Extendable / Clause 8.2.128 | 2 |
| 178 | Alternative SMF IP Address | Extendable / Clause 8.2.129 | 1 |
| 179 | Packet Replication and Detection Carry-On Information | Extendable / Clause 8.2.130 | 1 |
| 180 | SMF Set ID | Extendable / Clause 8.2.131 | Not applicable |
| 181 | Quota Validity Time | Extendable / Clause 8.2.132 | 4 |
| 182 | Number of Reports | Fixed / Clause 8.2.133 | 2 |
| 183 | PFCP Session Retention Information (within PFCP Association Setup Request) | Extendable / Table 7.4.4.1-2 | 1 |
| 184 | PFCPASRsp-Flags | Extendable / Clause 8.2.134 | 1 |
| 185 | CP PFCP Entity IP Address | Extendable / Clause 8.2.135 | 1 |
| 186 | PFCPSEReq-Flags | Extendable / Clause 8.2.136 | 1 |
| 187 | User Plane Path Recovery Report | Extendable / Table 7.4.5.1.3-1 | Not Applicable |
| 188 | IP Multicast Addressing Info within PFCP Session Establishment Request | Extendable / Clause 7.5.2.2-4 | Not Applicable |
| 189 | Join IP Multicast Information IE within Usage Report | Extendable / Table 7.5.8.3-4 | Not Applicable |
| 190 | Leave IP Multicast Information IE within Usage Report | Extendable / Table 7.5.8.3-5 | Not Applicable |
| 191 | IP Multicast Address | Extendable / Clause 8.2.137 | 1 |
| 192 | Source IP Address | Extendable / Clause 8.2.138 | 1 |
| 193 | Packet Rate Status | Extendable / Clause 8.2.139 | 1 |
| 194 | Create Bridge Info for TSC | Extendable / Clause 8.2.140 | 1 |
| 195 | Created Bridge Info for TSC | Extendable / Table 7.5.3.6-1 | Not Applicable |
| 196 | DS-TT Port Number | Fixed Length / Clause 8.2.141 | 4 |
| 197 | NW-TT Port Number | Fixed Length / Clause 8.2.142 | 4 |
| 198 | TSN Bridge ID | Extendable / Clause 8.2.143 | 1 |
| 199 | Port Management Information for TSC IE within PFCP Session Modification Request | Extendable / Table 7.5.4.18-1 | Not Applicable |
| 200 | Port Management Information for TSC IE within PFCP Session Modification Response | Extendable / Table 7.5.5.3-1 | Not Applicable |
| 201 | Port Management Information for TSC IE within PFCP Session Report Request | Extendable / Table 7.5.8.5-1 | Not Applicable |
| 202 | Port Management Information Container | Variable Length / Clause 8.2.144 | Not Applicable |
| 203 | Clock Drift Control Information | Extendable / Table 7.4.4.1.2-1 | Not Applicable |
| 204 | Requested Clock Drift Information | Extendable / Clause 8.2.145 | 1 |
| 205 | Clock Drift Report | Extendable / Table 7.4.5.1.4-1 | Not Applicable |
| 206 | TSN Time Domain Number | Extendable / Clause 8.2.146 | 1 |
| 207 | Time Offset Threshold | Extendable / Clause 8.2.147 | 8 |
| 208 | Cumulative rateRatio Threshold | Extendable / Clause 8.2.148 | 4 |
| 209 | Time Offset Measurement | Extendable / Clause 8.2.149 | 8 |
| 210 | Cumulative rateRatio Measurement | Extendable / Clause 8.2.150 | 4 |
| 211 | Remove SRR  | Extendable/ Table 7.5.4.19-1 | Not applicable |
| 212 | Create SRR  | Extendable/ Table 7.5.2.9-1 | Not applicable |
| 213 | Update SRR | Extendable/ Table 7.5.4.21-1 | Not applicable |
| 214 | Session Report | Extendable / Table 7.5.8.7-1 | Not Applicable |
| 215 | SRR ID | Extendable / Clause 8.2.151 | 1 |
| 216 | Access Availability Control Information | Extendable / Table 7.5.2.9-2 | Not applicable |
| 217 | Requested Access Availability Information | Extendable / Clause 8.2.152 | 1 |
| 218 | Access Availability Report | Extendable / Table 7.5.8.6-2 | Not applicable |
| 219 | Access Availability Information | Extendable / Clause 8.2.153 | 1 |
| 220 | Provide ATSSS Control Information | Extendable / Table 7.5.2.10-1 | Not Applicable |
| 221 | ATSSS Control Parameters | Extendable / Table 7.5.3.7-1 | Not Applicable |
| 222 | MPTCP Control Information | Extendable / Clause 8.2.154 | 1 |
| 223 | ATSSS-LL Control Information | Extendable / Clause 8.2.155 | 1 |
| 224 | PMF Control Information | Extendable / Clause 8.2.156 | 1 |
| 225 | MPTCP Parameters | Extendable / Table 7.5.3.7-2 | Not Applicable |
| 226 | ATSSS-LL Parameters | Extendable / Table 7.5.3.7-3 | Not Applicable |
| 227 | PMF Parameters | Extendable / Table 7.5.3.7-4 | Not Applicable |
| 228 | MPTCP Address Information | Extendable / Clause 8.2.157 | 4 |
| 229 | UE Link-Specific IP Address | Extendable / Clause 8.2.158 | 1 |
| 230 | PMF Address Information | Extendable / Clause 8.2.159 | 1 |
| 231 | ATSSS-LL Information | Extendable / Clause 8.2.160 | 1 |
| 232 | Data Network Access Identifier | Variable Length / Clause 8.2.161 | Not applicable |
| 233 | UE IP address Pool Information | Extendable / Table 7.4.4.1-3 | Not Applicable |
| 234 | Average Packet Delay | Extendable / Clause 8.2.162 | 4 |
| 235 | Minimum Packet Delay | Extendable / Clause 8.2.163 | 4 |
| 236 | Maximum Packet Delay | Extendable / Clause 8.2.164 | 4 |
| 237 | QoS Report Trigger | Extendable / Clause 8.2.165 | 1 |
| 238 | GTP-U Path QoS Control Information | Extendable / Table 7.4.4.1.3-1 | Not Applicable |
| 239 | GTP-U Path QoS Report (PFCP Node Report Request) | Extendable / Table 7.4.5.1.5-1 | Not Applicable |
| 240 | QoS Information in GTP-U Path QoS Report | Extendable / Table 7.4.5.1.6-1 | Not Applicable |
| 241 | GTP-U Path Interface Type | Extendable / Clause 8.2.166 | 1 |
| 242 | QoS Monitoring per QoS flow Control Information | Extendable / Table 7.5.2.9-3 | Not applicable |
| 243 | Requested QoS Monitoring | Extendable / Clause 8.2.167 | 1 |
| 244 | Reporting Frequency | Extendable / Clause 8.2.168 | 1 |
| 245 | Packet Delay Thresholds | Extendable / Clause 8.2.169 | 1 |
| 246 | Minimum Wait Time | Extendable / Clause 8.2.170 | 4 |
| 247 | QoS Monitoring Report | Extendable / Table 7.5.8.6-3 | Not applicable |
| 248 | QoS Monitoring Measurement | Extendable / Clause 8.2.171 | 1 |
| 249 | MT-EDT Control Information | Extendable / Clause 8.2.172 | 1 |
| 250 | DL Data Packets Size | Extendable / Clause 8.2.173 | 2 |
| 251 | QER Control Indications | Extendable / Clause 8.2.174 | 1 |
| 252 | Packet Rate Status Report | Extendable / Table 7.5.7.1-2 | Not applicable |
| 253 | NF Instance ID | Fixed / Clause 8.2.175 | 16 |
| 254 | Ethernet Context Information | Extendable / Table 7.5.4.21-1 | Not Applicable |
| 255 | Redundant Transmission Parameters | Extendable / Table 7.5.2.2-5, Table 7.5.2.3-4 | Not Applicable |
| 256 | Updated PDR | Extendable / Table 7.5.9.3-1 | Not Applicable |
| xxx | UE IP Address Allocation Information | Extendable / Table 7.4.4.3.x-1 | Not Applicable |
| yyy | Number of UE IP Addresses | Fixed Length / Clause 8.2.x | 4 |
| zzz to 32767 | Spare. For future use. |  |  |
| 32768 to 65535 | Reserved for vendor specific IEs |  |  |

\* \* \* 7th Change \* \* \* \*

### 8.2.1 Cause

Cause IE is coded as depicted in Figure 8.2.1-1.

|  |  |  |  |
| --- | --- | --- | --- |
| . |  | Bits |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 to 2 | Type = 19 (decimal) |  |
|  | 3 to 4 | Length = n |  |
|  | 5 | Cause value |  |

Figure 8.2.1-1: Cause

The Cause value shall be included in a response message. In a response message, the Cause value indicates the acceptance or the rejection of the corresponding request message. The Cause value indicates the explicit reason for the rejection.

Table 8.2.1-1: Cause values

|  |  |  |  |
| --- | --- | --- | --- |
| Message Type | Cause value(decimal) | Meaning | Description |
|  | 0 | Reserved.  | Shall not be sent and if received the Cause shall be treated as an invalid IE |
| Acceptance in a response | 1 | Request accepted (success) | "Request accepted (success)" is returned when the PFCP entity has accepted a request. |
| 2 | More Usage Report to send | This cause shall be returned by the UP function in the PFCP Session Deletion Response message when it has more usage reports to send. (See clause 5.2.2.3.1) |
| 3-63 | Spare.  | This value range shall be used by Cause values in an acceptance response message. See NOTE 1. |
| Rejection in a response | 64 | Request rejected (reason not specified) | This cause shall be returned to report an unspecified rejection cause |
| 65 | Session context not found | This cause shall be returned, if the F-SEID included in a PFCP Session Modification/Deletion Request message is unknown. |
| 66 | Mandatory IE missing | This cause shall be returned when the PFCP entity detects that a mandatory IE is missing in a request message |
| 67 | Conditional IE missing | This cause shall be returned when the PFCP entity detects that a Conditional IE is missing in a request message. |
| 68 | Invalid length | This cause shall be returned when the PFCP entity detects that an IE with an invalid length in a request message |
| 69 | Mandatory IE incorrect | This cause shall be returned when the PFCP entity detects that a Mandatory IE is incorrect in a request message, e.g. the Mandatory IE is malformated or it carries an invalid or unexpected value. |
| 70 | Invalid Forwarding Policy | This cause shall be used by the UP function in the PFCP Session Establishment Response or PFCP Session Modification Response message if the CP function attempted to provision a FAR with a Forwarding Policy Identifier for which no Forwarding Policy is locally configured in the UP function. |
| 71 | Invalid F-TEID allocation option | This cause shall be used by the UP function in the PFCP Session Establishment Response or PFCP Session Modification Response message if the CP function attempted to provision a PDR with a F-TEID allocation option which is incompatible with the F-TEID allocation option used for already created PDRs (by the same or a different CP function). |
| 72 | No established PFCP Association  | This cause shall be used by the CP function or the UP function if they receive a PFCP message other than the PFCP Association Setup Request and the Heartbeat Request message from a peer with which there is no established PFCP Association. |
| 73 | Rule creation/modification Failure  | This cause shall be used by the UP function if a received Rule failed to be stored and be applied in the UP function. |
| 74 | PFCP entity in congestion | This cause shall be returned when a PFCP entity has detected node level congestion and performs overload control, which does not allow the request to be processed. |
| 75 | No resources available | This cause shall be returned to indicate a temporary unavailability of resources to process the received request. |
| 76 | Service not supported | This cause shall be returned when a PFCP entity receives a message requesting a feature or service that is not supported.  |
| 77 | System failure | This cause shall be returned to indicate a system error condition.  |
| 78 | Redirection Requested | This cause may be returned to indicate a request to the UPF to redirect its PFCP request to a different SMF.  |
| xx | All dynamic addresses are occupied | This cause may be returned if the UE IP address is to be assigned by UP function but, when all UE IP addresses configured for a given Network Instance in the UP function are occupied or when all UE IP addresses in the UE IP address Pool indicated by the CP function are occupied. |
| xx to 255 | Spare for future use in a response message. See NOTE 2. | This value range shall be used by Cause values in a rejection response message. See NOTE 2. |
| NOTE 1: This value is or may be used in future version of the specification. If the receiver cannot comprehend the value, it shall be interpreted as an unspecified acceptance cause. Unspecified/unrecognized acceptance cause shall be treated in the same ways as the cause value 1 " Request accepted (success)".NOTE 2: This value is or may be used in a future version of the specification. If the receiver cannot comprehend the value, it shall be interpreted as an unspecified rejection cause. Unspecified/unrecognized rejection cause shall be treated in the same ways as the cause value 64 "Request rejected (reason not specified)". |

\* \* \* 8th Change \* \* \* \*

### 8.2.58 CP Function Features

The CP Function Features IE indicates the features supported by the CP function. Only features having an impact on the (system-wide) UP function behaviour are signalled in this IE. It is coded as depicted in Figure 8.2.58-1.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Bits |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 to 2 | Type = 89 (decimal) |  |
|  | 3 to 4 | Length = n |  |
|  | 5  | Supported-Features |  |
|  | 6 to 7 | Additional Supported-Features 1 |  |
|  | 8 to (n+4) | These octet(s) is/are present only if explicitly specified |  |

Figure 8.2.58-1: CP Function Features

The CP Function Features IE takes the form of a bitmask where each bit set indicates that the corresponding feature is supported. Spare bits shall be ignored by the receiver. The same bitmask is defined for all PFCP interfaces.

The following table specifies the features defined on PFCP interfaces and the interfaces on which they apply.

Table 8.2.58-1: CP Function Features

|  |  |  |  |
| --- | --- | --- | --- |
| Feature Octet / Bit | Feature | Interface | Description |
| 5/1 | LOAD | Sxa, Sxb, Sxc, N4 | Load Control is supported by the CP function. |
| 5/2 | OVRL | Sxa, Sxb, Sxc, N4 | Overload Control is supported by the CP function. |
| 5/3 | EPFAR | Sxa, Sxb, Sxc, N4 | The CP function supports the Enhanced PFCP Association Release feature (see clause 5.18). |
| 5/4 | SSET | N4 | SMF support of PFCP sessions successively controlled by different SMFs of a same SMF Set (see clause 5.22). |
| 5/5 | BUNDL | Sxa, Sxb, Sxc, N4 | PFCP messages bunding (see clause 6.5) is supported by the CP function. |
| 5/6 | MPAS | N4 | SMF support for multiple PFCP associations from an SMF set to a single UPF (see clause 5.22.3). |
| 5/7 | ARDR | Sxb, N4 | CP function supports Additional Usage Reports in the PFCP Session Deletion Response (see clause 5.2.2.3.1). |
| 5/8 | RSUIAAC | Sxb, N4 | CP function supports Reporting the Status of the UE IP Address Allocation Capacity featue, i.e. receiving and handling of UE IP Address Allocation Information IE (see clause 5.21.3.x).  |
| Feature Octet / Bit: The octet and bit number within the Supported-Features IE, e.g. "5 / 1".Feature: A short name that can be used to refer to the octet / bit and to the feature.Interface: A list of applicable interfaces to the feature.Description: A clear textual description of the feature. |

\* \* \* 9th Change \* \* \* \*

### 8.2.x Number of UE IP Addresses

Number of UE IP Addresses IE shall be coded as depicted in Figure 8.2.x-1. It contains an Unsigned32 binary integer value.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Bits |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 to 2 | Type = xxx (decimal) |  |
|  | 3 to 4 | Length = n |  |
|  | 5 | Spare | Spare | Spare | Spare | Spare | Spare | IPv6 | IPv4 |  |
|  | a to (a+3) | Number of UE IPv4 Addresses |  |
|  | b to (b+3) | Number of UE IPv6 Addresses |  |
|  | k to (n+4) | These octet(s) is/are present only if explicitly specified |  |

Figure 8.2.x-1: Number of UE IP Addresses

The following flags are coded within Octet 5:

- Bit 1 – IPv4: If this bit is set to "1", e Number of UE IPv4 Addresses field shall be present. Otherwise the Number of UE IPv4 Addresses field shall not be present.

- Bit 2 – IPv6: If this bit is set to "1", e Number of UE IPv6 Addresses field shall be present. Otherwise the Number of UE IPv6 Addresses field shall not be present.

Octets "a to (a+3)" and/or "b to (b+3)" shall be present if Bis 1 and/or Bit 2 in octet 5 is present. Otgerwise, these octets shall not be present.

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