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

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

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **29.244** | **CR** | **0471** | **rev** | **1** | **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)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **x** |

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|  | | | | | | | | | | |
| ***Title:*** | UE IP Address Allocation Control | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, Ericsson, Nokia? | | | | | | | | | |
| ***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 can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | 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 should 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:*** | | Extra latency in PFCP Session Establishment. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 5.8.2, 6.2.x (new), 7.4.4.1.1, 7.4.4.2, 7.4.4.3, 7.4.4.4, 8.2.1. | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 \* \* \* \*

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ADC Application Detection and Control

ATSSS Access Traffic Steering, Switching, Splitting

ATSSS-LL ATSSS Low Layer

BAR Buffering Action Rule

BP Branching Point

BMIC Bridge Management Information Container

CP Control Plane

DDoS Distributed Denial of Service

DEI Drop Eligible Indicator

DNAI Data Network Access Identifier

DSCP Differentiated Services Code Point

DS-TT Device-Side TSN Translator

eMPS enhanced Multimedia Priority Service

FAR Forwarding Action Rule

F-SEID Fully Qualified SEID

F-TEID Fully Qualified TEID

IP Internet Protocol

IPUPS Inter-PLMN User Plane Security

IPv4 Internet Protocol version 4

IPv6 Internet Protocol version 6

I-SMF Intermediate SMF

LMISF LI Mirror IMS State Function

MA Multi-Access

MAR Multi-Access Rule

MPTCP Multi-Path TCP Protocol

MT-EDT Mobile Terminated Early Data TransmissionNR New Radio

NPN Non-Public Network

NW-TT Network-side TSN Translator

PCC Policy and Charging Control

PCP Priority Code Point

PCEF Policy and Charging Enforcement Function

PCRF Policy and Charging Rule Function

PDI Packet Detection Information

PDR Packet Detection Rule

PFCP Packet Forwarding Control Protocol

PFD Packet Flow Description

PGW PDN Gateway

PGW-C PDN Gateway Control plane function

PGW-U PDN Gateway User plane function

PMF Performance Measurement Function

PMIC Port Management Information Container

PSA PDU Session Anchor

PTP Precision Time Protocol

QER QoS Enforcement Rule

RDS Reliable Data Service

S8HR S8 Home Routed

SDF Service Data Flow

SEID Session Endpoint Identifier

SGW Serving Gateway

SGW-C Serving Gateway Control plane function

SGW-U Serving Gateway User plane function

SMF Session Management Function

SNPN Stand-alone Non-Public Network

SRR Session Reporting Rule

SX3LIF Split X3 LI Interworking Function

TDF Traffic Detection Function

TDF-C Traffic Detection Function Control plane function

TDF-U Traffic Detection Function User plane function

ToS Type of Service

TSC Time Sensitive Communication

TSSF Traffic Steering Support Function

UDP User Datagram Protocol

UL CL Uplink Classifier

UP User Plane

UPAC UE IP Address Allocation Control

UPF User Plane Function

URR Usage Reporting Rule

VID VLAN Identifier

\* \* \* 2nd 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;

- shall update the CP function with the UE IP address availability information, if UE IP Address Allocation Control (UPAC) feature is supported by the UP function (see clause 6.2.x).

\* \* \* 3rd Change \* \* \* \*

### 6.2.x UE IP Address Allocation Control Procedure

#### 6.2.x.1 General

UE IP Address Allocation Control is a node level procedure.

UE IP Address Allocation Control (UPAC) is an optional feature, which applies when the UE IP address/prefix allocation in the UP function is utilized (see clause 5.21.3). UPAC is defined over the Sxa, Sxb, Sxc and N4 reference points.

UPAC feature enables a UP function to send to CP function information on the amount of the UE IP addresses, which are still available for allocation from the UE IP address pools managed by this UP function.

#### 6.2.x.2 UE IP Address Allocation Control Procedure

During a PFCP association setup, the UP function, which supports UPAC feature shall send one or more UE IP address Pool Information IEs (see clauses 6.2.6.2.2 and 6.2.6.2.3). In this case, the UE IP address Pool Information IE shall contain UE IP Address Availability IE, which is an integer, representing a remaining UE IP Address pool capacity, i.e. a percentage of the currently available IP addresses over the overall number of IP addresses in this UE IP address pool.

After a successful PFCP association setup, the UP function that supports UPAC feature shall periodically update the CP function with the remaining UE IP address pool capacity by sending UE IP Address Availability IE. If no UE IP addresses are left available, the UP function, which supports UPAC feature shall inform the CP function about this with an appropriate rejection cause (see clause 8.2.1). The CP function that supports the UPAC feature shall use this information in an implementation dependent way to augment the UP function selection procedure before initiating the next PFCP Session Establishment procedure.

NOTE: There is no need for the UPAC feature negotiation between UP and CP functions.

Therefore, UP function that supports UPAC feature shall periodically send UE IP Address Availability IE to the CP function with the PFCP Association Update Request, if the procedure is initiated by UP function and with the regular PFCP Association Update Response, if the procedure is initiated by CP function.

In a UP function, the calculation of the node-wide UE IP address availability value is implementation dependent. The frequency with which a UP function sends extra PFCP Association Update Request messages is also implementation dependent, but this shall not unnecessarily increase the signalling load. It is recommended that a UP function should not send extra PFCP Association Update Request, unless the IP address availability value has changed more than 10%.

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

### 7.4.4 PFCP Association messages

#### 7.4.4.1 PFCP Association Setup Request

##### 7.4.4.1.1 General

Table 7.4.4.1-1: Information Elements in a PFCP Association Setup Request

|  |  |  |  |
| --- | --- | --- | --- |
| Information elements | P | Condition / Comment | IE Type |
| Node ID | M | This IE shall contain the unique identifier of the sending Node. | Node ID |
| Recovery Time Stamp | M | This IE shall contain the time stamp when the CP or UP function was started, see clause 19A of 3GPP TS 23.007 [24]. (NOTE) | Recovery Time Stamp |
| UP Function Features | C | This IE shall be present if the UP function sends this message and the UP function supports at least one UP feature defined in this IE.  When present, this IE shall indicate the features the UP function supports. | UP Function Features |
| CP Function Features | C | This IE shall be present if the CP function sends this message and the CP function supports at least one CP feature defined in this IE.  When present, this IE shall indicate the features the CP function supports. | CP Function Features |
| 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 |
| SMF Set ID | C | This IE shall be present if the SMF advertises the support of the MPAS feature in the CP Function Features IE (see clause 5.22.3).  When present, this IE shall contain an FQDN representing the SMF set to which the SMF belongs. | SMF Set ID |
| PFCP Session Retention Information | O | This IE may be present to request the UP function to keep all or part of the existing PFCP sessions upon receipt of a PFCP association setup request with a Node ID for which a PFCP association was already established. See clause 6.2.6.2.1. | PFCP Session Retention Information |
| UE IP address Pool Information | C | This IE shall be present when the UP function sends this message, if UE IP Address Pools are configured in the UP function and the UP function supports UE IP Address Allocation Control (UPAC).  Several IE with the same IE type may be present to represent multiple UE IP address Pool Information. | UE IP address Pool Information |
| GTP-U Path QoS Control Information | C | This IE may be present, if the CP function sends this message, to request the UPF to monitor the QoS on GTP-U paths (see clause 5.24.5).  Several IEs with the same IE type may be present to represent multiple GTP-U paths (with different parameters) to monitor. | GTP-U Path QoS Control Information |
| Clock Drift Control Information | O | This IE may be present, if the CP function sends this message, to request the UPF to report clock drift between the TSN time and 5GS time for TSN working domains (see clause 5.26.4).  Several IEs with the same IE type may be present for multiple TSN Time domains (with different parameters). | Clock Drift Control Information |
| UPF Instance ID | O | This IE may be present if the UP function is a 5G UPF and if available, and if the message is sent by the UPF. | NF Instance ID |
| PFCPASReq-Flags | O | This IE shall be included if at least one of the flags is set to "1":  - UUPSI (UPF configured for IPUPS): when the message is sent by a UPF, the UP function shall set this flag to "1" if the UPF is configured to be used for IPUPS. See clause 5.27. | PFCPASReq-Flags |
| NOTE: A PFCP function shall ignore the Recovery Timestamp received in the PFCP Association Setup Request message. | | | |

Table 7.4.4.1-2: PFCP Session Retention Information IE within PFCP Association Setup Request

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | PFCP Session Retention Information IE Type = 183 (decimal) | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 |
| CP PFCP Entity IP Address | O | This IE may be present to indicate the IP address of a CP PFCP entity for which the UP function shall retain the existing PFCP sessions, upon receipt of a PFCP association setup request with a Node ID for which a PFCP association was already established. See clause 6.2.6.2.1  Several IEs with the same IE type may be present to represent multiple CP PFCP entities for which PFCP sessions shall be retained.  If no CP PFCP Entity IP Address IE is present in the PFCP Session Retention Information IE, all existing PFCP sessions shall be kept upon receipt of a PFCP association setup request with a Node ID for which a PFCP association was already established. | X | X | X | X | CP PFCP Entity IP Address |

Table 7.4.4.1-3: UE IP address Pool Information IE within PFCP Association Setup Request

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | UE IP address Pool Information IE Type = 233 (decimal) | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 |
| UE IP address Pool Identity | M | When present, this IE shall contain an UE IP address Pool Identity.  Several IEs with the same IE type may be present to represent multiple UE IP address Pool Identities. | - | X | - | X | UE IP address Pool Identity |
| Network Instance | O | The IE may be present to indicate for which DNN/APN the UE IP Address Pool Identifies are configured. | - | X | - | X | Network Instance |
| S-NSSAI | O | The IE may be present to indicate for which S-NSSAI the UE IP Address Pool Identities are configured.  Several IEs with the same IE type may be present to represent multiple S-NSSAIs. | - | - | - | X | S-NSSAI |
| IP version | O | The IE may be present to indicate for which IP version the UE IP Address Pool Identities are configured. | - | - | - | X | IP version |
| UE IP Address Availability | C | The IE shall be present if UP function supports UE IP Address Allocation Control (UPAC).  When present, this IE shall contain an integer, representing a percentage of available IP addresses over the overall number of IP addresses in this IP address pool. |  |  |  |  | Metric |

##### 7.4.4.1.2 Clock Drift Control Information IE within PFCP Association Setup Request

The Clock Drift Control Information grouped IE shall be encoded as shown in Table 7.4.4.1.2-1.

Table 7.4.4.1.2-1: Clock Drift Control Information within PFCP Association Setup Request

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | Clock Drift Control Information IE Type = 203 (decimal) | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 |
| Requested Clock Drift Information | M | This IE shall indicate the requested clock drift information. | - | - | - | X | Requested Clock Drift Information |
| TSN Time Domain Number | C | When present, this IE shall identifiy the TSN time domain(s) for which clock drift information is requested.  More than one IE with this type may be included to represent multiple TSN Time Domain Numbers.  The absence of this IE shall indicate that the request targets all the TSN time domains the UPF is connected to. | - | - | - | X | TSN Time Domain Number |
| Time Offset Threshold | C | This IE shall be present if Time Offset Reporting is requested.  When present, it shall indicate the threshold to report the time offset, i.e. the offset shall be reported only when it exceeds the threshold compared to the previous report. | - | - | - | X | Time Offset Threshold |
| Cumulative rateRatio Threshold | C | This IE shall be present if Cumulative RateRatio Reporting is requested.  When present, it shall indicate the threshold to report the cumulative rateRatio, i.e. the cumative rateRatio shall be reported only when it exceeds the threshold compared to the previous report. | - | - | - | X | Cumulative rateRatio Threshold |

##### 7.4.4.1.3 GTP-U Path QoS Control Information IE within PFCP Association Setup Request

The GTP-U Path QoS Control Information grouped IE shall be encoded as shown in Table 7.4.4.1.3-1.

Table 7.4.4.1.3-1: GTP-U Path QoS Control Information within PFCP Association Setup Request

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octet 1 and 2 |  | GTP-U Path QoS Control Information IE Type = 239 (decimal) | | | | | |
| Octets 3 and 4 |  | Length = n | | | | | |
| Information elements | P | Condition / Comment | Appl. | | | | IE Type |
| Sxa | Sxb | Sxc | N4 |
| Remote GTP-U Peer | C | When present, this IE shall include the IP address of the remote GTP-U peer for which QoS information is to be reported, and the network instance used towards the remote GTP-U peer if available.  Several IEs with the same IE type may be present to represent multiple remote GTP-U peers.  (NOTE) | - | - | - | X | Remote GTP-U Peer |
| GTP-U Path Interface Type | C | When present, this IE shall include the Interface Type of the GTP-U paths for which QoS information is to be reported.  (NOTE) | - | - | - | X | GTP-U Path Interface Type |
| QoS Report Trigger | M | This IE shall indicate the trigger for reporting QoS information to the SMF. | - | - | - | X | QoS Report Trigger |
| DSCP | C | This IE shall be present, if available. When present, it shall contain the value of the DSCP in the TOS/Traffic Class field to measure the packet delay.  Several IEs with the same IE type may be present to represent multiple DSCP values to use for QoS monitoring. | - | - | - | X | Transport Level Marking |
| Measurement Period | C | This IE shall be present if the QoS Report Trigger indicates periodic reporting. When present, it shall contain the time period for the QoS reports towards the SMF. | - | - | - | X | Measurement Period |
| Average Packet Delay Threshold | C | This IE may be present if the QoS Report Trigger indicates reporting based on thresholds. | - | - | - | X | Average Packet Delay |
| Minimum Packet Delay Threshold | C | This IE may be present if the QoS Report Trigger indicates reporting based on thresholds. | - | - | - | X | Minimum Packet Delay |
| Maximum Packet Delay Threshold | C | This IE may be present if the QoS Report Trigger indicates reporting based on thresholds. | - | - | - | X | Maximum Packet Delay |
| Minimum Waiting Time | C | This IE may be present if the QoS Report Trigger indicates reporting based on thresholds. When present, it shall contain the minimum waiting time between two consecutive reports for the same type of measurement and the same remote GTP-U peer. | - | - | - | X | Timer |
| NOTE: At least one Remote GTP-U Peer IE or GTP-U Path Interface Type IE shall be present. | | | | | | | |

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

#### 7.4.4.2 PFCP Association Setup Response

Table 7.4.4.2-1: Information Elements in a PFCP Association Setup 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 |
| Recovery Time Stamp | M | This IE shall contain the time stamp when the CP or UP function was started, see clause 19A of 3GPP TS 23.007 [24]. (NOTE) | Recovery Time Stamp |
| UP Function Features | C | This IE shall be present if the UP function sends this message and the UP function supports at least one UP feature defined in this IE.  When present, this IE shall indicate the features the UP function supports. | UP Function Features |
| CP Function Features | C | This IE shall be present if the CP function sends this message and the CP function supports at least one CP feature defined in this IE.  When present, this IE indicates the features the CP function supports. | CP Function Features |
| 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 |
| PFCPASRsp-Flags | O | This IE shall be included if at least one of the flags is set to "1":  - PSREI (PFCP Session Retained Indication): the UP function shall set this flag to "1" if the PFCP Session Retention Information IE was received in the Request, an existing PFCP association was already established for the same Node ID and the requested PFCP sessions have been retained. See clause 6.2.6.2.2.  - UUPSI (UPF configured for IPUPS): the UP function shall set this flag to "1" if the UPF is configured to be used for IPUPS. See clause 5.27. | PFCPASRsp-Flags |
| Clock Drift Control Information | C | his IE may be present, if the CP function sends this message, to request the UPF to report clock drift between the TSN time and 5GS time for TSN working domains (see clause 5.26.4).  Several IEs with the same IE type may be present to represent multiple TSN time domains (with different parameters).  See Table 7.4.4.1.2-1. | Clock Drift Control Information |
| UE IP address Pool Information | O | This IE shall be present when the UP function sends this message, if UE IP Address Pools are configured in the UP function and the UP function supports UE IP Address Allocation Control (UPAC).  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 may be present, if the CP function sends this message, to request the UPF to monitor the QoS on GTP-U paths (see clause 5.24.5).  Several IEs with the same IE type may be present to represent multiple GTP-U paths to monitor.  See Table 7.4.4.1.3-1. | GTP-U Path QoS Control Information |
| UPF Instance ID | O | This IE may be present if the UP function is a 5G UPF and if available, and if the message is sent by the UPF. | NF Instance ID |
| NOTE: A PFCP function shall ignore the Recovery Timestamp received in PFCP Association Setup Response message. | | | |

\* \* \* 6th 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 and the UP function supports UE IP Address Allocation Control (UPAC).  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 |

\* \* \* 7th 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 Pool Information | C | This IE shall be present when the UP function sends this message, if UE IP Address Pools are configured in the UP function and the UP function supports UE IP Address Allocation Control (UPAC).  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 |

\* \* \* 8th 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. |
| x | UE IP address is not available | UP function, which supports UE IP Address Allocation Control (UPAC) feature shall return this cause value if no UE IP Address is available. |
| x 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)". | | | |

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