**3GPP TSG-CT WG4 Meeting #99eC4-204xxx**

**E-Meeting, 18th – 28th August 2020 *Revision of C4-204152***

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **29.244** | **CR** | **0474** | **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:***  | Small data rate control and Serving PLMN rate control |
|  |  |
| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | CT4 |
|  |  |
| ***Work item code:*** | 5G\_CIoT |  | ***Date:*** | 2020-08-03 |
|  |  |  |  |  |
| ***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:*** | Serving PLMN Rate Control is used to allow the Serving PLMN to restrict the signalling load caused by the NAS Data PDUs, the I-SMF will send the Serving PLMN Rate Control parameters to the PSA SMF.Small Data Rate Control is used to allow the HPLMN to restrict the user plane data and NAS Data PDUs.If both the PLMN rate control and small data rate control are enforced, e.g. PSA SMF receives the Serving PLMN Rate Control parameters from I-SMF, and the Small Data Rate Control is also allowed, how to send the packet rate to the UPF is not clear. Currently, only one Packet Rate IE either for PLMN rate control or for small data rate control is allowed in QER.In NAS specification, the UE can receive the Serving PLMN Rate Control parameters from I-SMF in PDU SESSION ESTABLISHMENT ACCEPT, and receive the Small Data Rate Control parameters from PSA SMF in ePCO.In addition, the time unit used for Serving PLMN Rate Control and Small Data Rate Control are different, which is 6mins for Serving PLMN Rate Control, and minute/hour/day/week for Small Data Rate Control, it shall be clarified. |
|  |  |
| ***Summary of change:*** | Provide separate QERs for Serving PLMN Rate Control and Small Data Rate Control/APN rate control;If both Serving PLMN Rate Control and Small Data Rate Control/APN rate control applied, another alternative is only sending the parameters related to Small Data Rate Control/APN rate control to the UPF;Update the description of QER correlation ID for APN rate control;Update the definition of packet rate to indicate the differences between Serving PLMN Rate Control and Small Data Rate Control/APN rate control. |
|  |  |
| ***Consequences if not approved:*** | Serving PLMN Rate Control and Small Data Rate Control/APN rate control will fail. |
|  |  |
| ***Clauses affected:*** | 5.4.15.2, 5.4.15.3, 7.5.2.5, 8.2.63 |
|  |  |
|  | **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:*** | Rev1:Serving PLMN Rate Control is per PDU session;Description in clause 8.2.63 is changed to an informative NOTE;Add alternative solution to only enforce the Small Data Rate Control/APN rate control if both Serving PLMN Rate Control and Small Data Rate Control/APN rate control applied. |

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

#### 5.4.15.2 Packet rate enforcement over Sxb and N4 interfaces

The CP function may instruct the UP function to perform packet rate enforcement, during the establishment or the modification of a PFCP session, over the Sxb and N4 reference points.

The CP function shall control packet rate enforcement in the UP function by:

1) creating the necessary PDR(s) to represent the uplink or downlink traffic to be enforced, if not already existing;

2) creating QER(s) containing the Packet Rate IE with one or more of the following enforcement rules and information:

- Maximum Uplink/Downlink Packet Rates (i.e. Number of Uplink/Downlink Packets Allowed and Time units that determine the time periods for limiting the packet rates);

- Additional Maximum Uplink/Downlink Packet Rates (i.e. Number of Additional Uplink/Downlink Packets Allowed and Time units that determine the time periods for limiting the packet rates), if additional packets are allowed to be sent beyond the maximum Uplink/Downlink Packet Rates;

The QER may also contain the Packet Rate Status IE to indicate remaining numbers of allowed packets until a given time.

The QER may also contain the QER Control Indications IE with the Rate Control Status Reporting (RCSR) flag, indicating the UP function shall report to the CP function the status of the packet rate usage when the PFCP session is released.

3) associating the QER(s) to the UL and/or DL PDRs of the traffic for which packet rate enforcement is required.

When so instructed, the UP function shall proceed as follows:

1) the UP function shall count UL/DL packets within the time period (e.g. per minute, per day, etc.) and if the 'maximum allowed rate' is reached, the UP function shall discard or delay further packets.

2) If 'Additional Maximum Uplink/Downlink Packet Rates' are provided, the UPF shall consider 'maximum allowed rate' is equal to the 'number of packets per time unit' plus the 'number of additional allowed exception report packets per time unit'. Otherwise, the UPF shall consider 'maximum allowed rate' is equal to the 'number of packets per time unit'.

3) If the CP function has requested to report the rate control status, the UP function shall send to the CP function the Packet Rate Status IE, when the PFCP session is released. Otherwise, the UP function shall not send the Packet Rate Status IE to the CP function during the release of the PFCP session.

4) If the CP function provided Packet Rate Status information, then the UP function shall first enforce the rules in the Packet Rate Status IE until either the packet rate limits are reached, or the validity time expires. Only after this shall the UP function enforce the rules in the Packet Rate IE.

#### 5.4.15.3 PGW and SMF behaviour

A PGW, SMF or SMF/PGW shall apply APN rate control, Small Data Rate Control and Serving PLMN rate control by instructing the UP function to perform packet rate enforcement as described in clause 5.4.15.2 with the following additions:

- Serving PLMN rate control:

- the Maximum Downlink Packet Rate shall be set to the DL rate permitted by the Serving PLMN rate control parameters;

- the CP function shall indicate to the UP function to not report the status of the packet rate usage.

NOTE 1: Serving PLMN rate control applies only to control plane PDU sessions and PDN connections. Uplink rate for Serving PLMN rate control is enforced by the MME or SMF, so it does not require support from the UP function.

- Small Data Rate Control:

- the CP function shall indicate to the UP function to report the status of the packet rate usage;

- the QER shall be associated to all the DL/UL PDRs of the PDU session;

- APN rate control:

- the CP function shall indicate to the UP function to report the status of the packet rate usage;

- the QER shall be associated to all the DL/UL PDRs of all the PDN connections of the UE to the same APN, using the QER Correlation ID (see clause 5.2.1).

If both Serving PLMN rate control and Small Data Rate Control are applied in 5GS, or both Serving PLMN rate control and APN rate control are applied in EPS, the SMF/PGW-C shall control packet rate enforcement in the UP function by provisioning:

* QER for Small Data Rate Control/APN rate control, and by associating DL/UL PDRs to the QER; or
* alternatively, different QERs for Serving PLMN rate control and for Small Data Rate Control/APN rate control, and by associating DL PDRs to both of the QER(s).

APN rate control and Small Data Rate Control are distinct functionalities that apply in EPS and 5GS respectively. For PDU sessions supporting interworking with EPC, the SMF/PGW-C shall start APN rate control (if required for the UE's PDN connections to the APN) and stop Small Data Rate Control (if this was performed for the PDU session) upon 5GS to EPS mobility, and vice-versa upon EPS to 5GS mobility, e.g. by:

- updating the information of the QER associated to the UL/DL PDRs with the packet rates and packet rate status (if available) applicable for APN rate control or Small Data Rate Control respectively, if the same QER is associated to UL/DL PDRs when the UE is in EPC and in 5GC; in this case, the SMF/PGW-C shall also request the UPF/PGW-U to report immediately the packet rate status at the time of the mobility between 5GS and EPS by including the Query Packet Rate Status IE in the PFCP Session Modification Request; or

NOTE 2: Requesting the UPF/PGW-U to report immediately the packet rate status enables to retrieve the current rate status applicable to the source system before the UPF/PGW-U overwrites the QER parameters with the packet rates and packet rate status (if available) applicable to the target system.

- provisioning different QERs for APN rate control and for Small Data Rate Control, and by associating UL/DL PDRs to the appropriate QER, when the UE is in EPC or in 5GC. In this case, when releasing the PFCP session, the UP function shall include the packet rate status for every QER for which this information has been requested in the corresponding QER Control Indications IE.

Besides, if the SMF/PGW-C set up additional PDRs in the UP function for S5/S8 tunnels for a PDU session supporting interworking with EPS, these PDRs shall not be associated to the QER used to perform Small Data Rate Control.

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

#### 7.5.2.5 Create QER IE within PFCP Session Establishment Request

The Create QER grouped IE shall be encoded as shown in Figure 7.5.2.5-1.

Table 7.5.2.5-1: Create QER IE within PFCP Session Establishment Request

|  |  |  |
| --- | --- | --- |
| Octet 1 and 2 |  | Create QER IE Type = 7 (decimal) |
| Octets 3 and 4 |  | Length = n |
| Information elements | P | Condition / Comment | Appl. | IE Type |
| Sxa | Sxb | Sxc | N4 |
| QER ID | M | This IE shall uniquely identify the QER among all the QER configured for that PFCP session | - | X | X | X | QER ID |
| QER Correlation ID | C | This IE shall be present if the UP function is required to correlate the QERs of several PFCP sessions, for APN-AMBR enforcement/APN rate control of multiple UE's PDN connections to the same APN. | - | X | - | X | QER Correlation ID |
| Gate Status | M | This IE shall indicate whether the packets are allowed to be forwarded (the gate is open) or shall be discarded (the gate is closed) in the uplink and/or downlink directions. | - | X | X | X | Gate Status |
| Maximum Bitrate | C | This IE shall be present if an MBR enforcement action shall be applied to packets matching this PDR. When present, this IE shall indicate the uplink and/or downlink maximum bit rate to be enforced for packets matching the PDR.For EPC, this IE may be set to the value of:- the APN-AMBR, for a QER that is referenced by all the PDRs of the non-GBR bearers of a PDN connection;- the TDF session MBR, for a QER that is referenced by all the PDRs of a TDF session;- the bearer MBR, for a QER that is referenced by all the PDRs of a bearer;- the SDF MBR, for a QER that is referenced by all the PDRs of a SDF.For 5GC, this IE may be set to the value of:- the Session-AMBR, for a QER that is referenced by all the PDRs of the non-GBR QoS flows of a PDU session;- the QoS Flow MBR, for a QER that is referenced by all the PDRs of a QoS Flow;- the SDF MBR, for a QER that is referenced by all the PDRs of a SDF. | - | X | X | X | MBR |
| Guaranteed Bitrate | C | This IE shall be present if a GBR has been authorized to packets matching this PDR. When present, this IE shall indicate the authorized uplink and/or downlink guaranteed bit rate.This IE may be set to the value of:- the aggregate GBR, for a QER that is referenced by all the PDRs of a GBR bearer;- the QoS Flow GBR, for a QER that is referenced by all the PDRs of a QoS Flow (for 5GC);- the SDF GBR, for a QER that is referenced by all the PDRs of a SDF. | - | X | X | X | GBR |
| Packet Rate | C | This IE shall be present if a Packet Rate enforcement action (in terms of number of packets per time interval) shall be applied to packets matching this PDR.When present, this IE shall indicate the uplink and/or downlink maximum packet rate to be enforced for packets matching the PDR.This IE may be set to the value of:- downlink packet rate for Serving PLMN Rate Control, for a QER that is referenced by all PDRs of the UE belonging to the PDN connection, or belonging to the PDU session (5GC) using CIoT EPS Optimizations as described in 3GPP TS 23.401 [2] and 3GPP TS 23.501 [28], respectively;- uplink and/or downlink packet rate for APN Rate Control, for a QER that is referenced by all the PDRs of the UE belonging to all PDN connections to the same APN, or for Small Data Rate Control (5GC) for a QER related to the PDU session using CIoT EPS Optimizations as described in 3GPP TS 23.401 [2] and 3GPP TS 23.501 [28], respectively. | - | X | - | - | Packet Rate |
| Packet Rate Status | C | This IE may be present during the UE requested PDU session establishment, or UE requested PDN connection establishment.When present, the UP function shall first enforce these rules. Only after that shall the UP function enforce the rules in the Packet Rate IE. | - | X | - | X | Packet Rate Status |
| DL Flow Level Marking | C | This IE shall be set if the UP function is required to mark the packets for QoS purposes:- by the TDF-C, for DL flow level marking for application indication (see clause 5.4.5);- by the PGW-C, for setting the GTP-U Service Class Indicator extension header for service indication towards GERAN (see clause 5.4.12). | - | X | X | - | DL Flow Level Marking |
| QoS flow identifier | C | This IE shall be present if the QoS flow identifier shall be inserted by the UPF. | - | - | - | X | QFI |
| Reflective QoS | C | This IE shall be present if the UP function is required to insert a Reflective QoS Indicator to request reflective QoS for uplink traffic. | - | - | - | X | RQI |
| Paging Policy Indicator | C | This IE shall be present if the UPF is required to set the Paging Policy Indicator (PPI) in outgoing packets (see clause 5.4.3.2 of 3GPP TS 23.501 [28]).When present, it shall be set to the PPI value to set.  | - | - | - | X | Paging Policy Indicator |
| Averaging Window | O | This IE may be present if the UP function is required to use a different Averaging window than the default one. (NOTE) | - | - | - | X | Averaging Window |
| QER Control Indications | C | This IE shall be included if the CP function needs to provide the QoS enforcement control information:- RCSR (Rate Control Status Reporting): the CP function shall set this bit "1" to request the UP function to report the rate control status when the PFCP session is released.  | - | X | - | X | QER Control Indications |
| NOTE: As 5QI is not signalled over N4, one default averaging window shall be pre-configured in the UPF. |

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

### 8.2.63 Packet Rate

The Packet Rate IE contains the packet rate thresholds to be enforced by the UP function. It shall be encoded as shown in Figure 8.2.63-1.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Bits |  |
|  | Octets | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  | 1 to 2 | Type = 94 (decimal) |  |
|  | 3 to 4 | Length = n |  |
|  | 5 | Spare | APRC | DLPR | ULPR |  |
|  | m | Spare | Uplink Time Unit |  |
|  | (m+1) to (m+2) | Maximum Uplink Packet Rate  |  |
|  | p | Spare | Downlink Time Unit |  |
|  | (p+1) to (p+2) | Maximum Downlink Packet Rate |  |
|  | q | Spare | Additional Uplink Time Unit |  |
|  | (q+1) to (q+2) | Additional Maximum Uplink Packet Rate  |  |
|  | r | Spare | Additional Downlink Time Unit |  |
|  | (r+1) to (r+2) | Additional Maximum Downlink Packet Rate  |  |
|  | s to (n+4) | These octet(s) is/are present only if explicitly specified |  |

Figure 8.2.63-1: Packet Rate

The following flags are coded within Octet 5:

- Bit 1 – ULPR (Uplink Packet Rate): If this bit is set to "1", then octets m to (m+2) shall be present, otherwise these octets shall not be present.

- Bit 2 – DLPR (Downlink Packet Rate): If this bit is set to "1", then octets p to (p+2) shall be present, otherwise these octets shall not be present.

- Bit 3 – APRC (Additional Packet Rate Control): If this bit is set to "1", then the presence of octets q to (r+2) is determined as follows:

- If bit 1 (ULPR) is set to "1", then octets q to (q+2), the Additional Maximum Uplink Packet Rate shall be present. Otherwise, octets q to (q+2) shall not be present;

- If bit 2 (DLPR) is set to "1", then octets r to (r+2), the Additional Maximum Downlink Packet Rate shall be present. Otherwise, octets r to (r+2) shall not be present.

- Bits 4 to 8: Spare, for future use and set to "0".

At least one bit in Octet 5 shall be set to "1". Several bits may be set to "1".

When present, octets m to (m+2) indicate the maximum number of uplink packets allowed to be sent within the uplink time unit.

When present, octets p to (p+2) indicate the maximum number of downlink packets allowed to be sent within the downlink time unit.

When present, octets q to (q+2) indicate the additional maximum number of uplink packets allowed to be sent within the additional uplink time unit.

When present, octets r to (r+2) indicate the additional maximum number of downlink packets allowed to be sent within the additional downlink time unit.

The Additional Uplink/Downlink Time Unit shall be encoded as the Uplink/Downlink Time Unit, see Table 8.2.63.1.

Table 8.2.63.1: Uplink/Downlink Time Unit

|  |
| --- |
| Uplink/Downlink Time unitBits 1 to 3 define the time unit as follows:Bits**3 2 1**0 0 0 minute0 0 1 6 minutes0 1 0 hour0 1 1 day1 0 0 weekOther values shall be interpreted as 000 in this version of the protocol. |

The Maximum Uplink/Downlink Packet Rate shall be encoded as an Unsigned16 binary integer value. They shall indicate the maximum number of uplink/downlink packets allowed to be sent in the indicated uplink/downlink time unit respectively.

The Additional Maximum Uplink/Downlink Packet Rate shall be encoded as an Unsigned16 binary integer value. They shall indicate the additional maximum number of uplink/downlink packets allowed to be sent in the indicated Additional uplink/downlink time unit respectively.

NOTE: The Serving PLMN rate control is only applicable to downlink packets with the value of Maximum Downlink Packet Rate set to equal to or higher than 10 and with the Downlink Time Unit set to 6 minutes. The Small Data Rate Control/APN rate control is applicable to both uplink/downlink packets with the Time Unit set to minute/hour/day/week.

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