**3GPP TSG SA WG5 Meeting #156 *S5-244548***

Maastricht, The Netherlands 19 - 23 August 2024

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **32.255** | **CR** | **0531** | **rev** | **3?** | **Current version:** | **18.4.0** |  |
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| *For* [***HELP***](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:*** | Rel-18 CR 32.255 Correction on FBC and QBC in 5G data connectivity charging | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, Ericsson LM | | | | | | | | | |
| ***Source to TSG:*** | S5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | TEI18 | | | | |  | ***Date:*** | | | 2024-08-23 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | In roaming scenario, the reqirement to support FBC / QBC charging for V-SMF and H-SMF depends on the specific roaming scenario, which should be clearly specified. | | | | | | | | |
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| ***Summary of change:*** | | 1. Clarify the requirements for H-SMF and V-SMF in HR and LBO roaming scenario, clause 5.1.2.  2. Clarify the principle for QBC charging, clause 5.1.9.1, 5.2.1.6 and 5.2.3.3.1.  4. Minor corrections in clause 5.2.3.2.3, 5.2.3.3.2, 5.2.3.3.3, 5.2.3.3.4. | | | | | | | | |
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| ***Consequences if not approved:*** | | The requirement for SMF to support roaming charging scenario is not clear. | | | | | | | | |
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| ***Clauses affected:*** | | 5.1.2, 5.1.9.1, 5.2.1.6, 5.2.3.2.3, 5.2.3.3.1, 5.2.3.3.2, 5.2.3.3.3, 5.2.3.3.4. | | | | | | | | |
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|  | | **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:*** | | Revision of S5-243999 | | | | | | | | |

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| **First change** |

### 5.1.2 Requirements

The following are high-level charging requirements specific to the packet domain, derived from the requirements in TS 22.115 [101], TS 22.261 [102], TS 23.501 [200], TS 23.502 [201], TS 23.503 [202] and TS 23.247 [204].

- The SMF shall support converged online and offline charging.

- The SMF may support offline only charging.

- The SMF shall support PDU session charging using service based interface.

- The SMF shall support network slice instance charging.

- The SMF shall collect charging information per PDU session for UEs served under 3GPP access and non-3GPP access (untrusted non-3GPP access, trusted non-3GPP access and wireline).

- Every PDU session shall be assigned a unique identity number for billing purposes per PLMN. (i.e. the Charging Id).

- Data volumes on both the uplink and downlink directions shall be counted separately. The data volumes shall reflect the data as delivered to and forwarded from the user.

- The charging mechanisms shall provide the date and time information when the PDU session starts.

- The SMF shall be capable of handling the Charging Characteristics. Charging Characteristics can be specific to a subscription or subscribed DNN.

- The SMF may be capable of identifying data volumes, elapsed time or events for individual service data flows (flow based charging). One PCC rule identifies one service data flow.

- SMF shall allow reporting of the service or the detected application usage per rating group or per combination of the rating group and service id. This reporting level can be activated per PCC rule.

- The quota management shall be per rating group per PDU session.

- If there are multiple UPFs for one PDU session, the quota management may be one for all UPFs or separate per UPF and the usage and charging information reporting per UPF.

- The SMF shall support charging for PDU Session types of IP, Ethernet and Unstructured.

- In roaming charging scenario, the SMF may collect charging information per QoS Flow.

- For interworking between 5GS and EPC, the dedicated PGW-C + SMF shall collect charging information using the same mechanisms as the SMF.

- The SMF shall support PDU session charging when the PDU session is served by both I-SMF and SMF.

- The SMF shall support charging for MA PDU Connectivity Service over 3GPP access and non-3GPP access.

- The SMF in VPLMN and in HPLMN shall support charging for MA PDU Connectivity Service in roaming Home Routed scenario with UE registered to the same VPLMN for 3GPP access and non-3GPP access.

- The SMF in HPLMN shall support charging for MA PDU Connectivity Service in roaming Home Routed scenario with UE registered in different PLMNs.

- The SMF shall support the charging of redundant transmission for high reliability communication.

- The SMF shall support the charging of 5G LAN VN group communication.

- The SMF shall support the charging of 5GS CIoT.

- The SMF may support the charging of time sensitive communication traffic.

- The SMF may support the IMS data channel volume-based charging.

- The SMF may support PDU session charging of 5G multicast services.

- The SMF may support the charging of 5GS satellite backhaul.

- The SMF may support the converged charging for NPN. -

- The SMF may support the charging of 5GS satellite access.

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| **Next change** |

#### 5.1.9.1 General

In home routed scenario, based on roaming agreements between the V-PLMN and the H-PLMN, for each UE roaming in VPLMN:

- The SMF in VPLMN (V-SMF) shall be able to collect charging information per QoS Flow within a PDU session when UE is determined as an in-bound roamer, for CDR generation in VPLMN.

- The SMF in HPLMN (H-SMF) may be able to collect charging information per QoS Flow within a PDU session when UE is determined as an out-bound roamer, for CDR generation in HPLMN.

In home routed scenario, this charging information collection mechanism is achieved under Roaming QoS flow Based Charging (QBC) performed by each PLMN, based on a set of charging parameters exchanged between the V-SMF and the H-SMF on a per PDU session basis.

In home routed scenario, the main parameters exchanged at PDU session establishment are:

- The Charging Identifier assigned by the V-SMF and transferred to the H-SMF in the HPLMN.

- Optionally, for QBC, the "Roaming Charging Profile" negotiated between the VPLMN and the HPLMN.

In home routed scenario, the parameters exchanged during the PDU session handover from EPS to 5GS:

- The home provided Charging Identifier which includes the Charging Identifier assigned by the H-SMF to the original PDU session over EPS and transferred by the H-SMF to the V-SMF. This home provided Charging Identifier shall be used by the V-SMF to replace the existing Charging Identifier previously generated by V-SMF.

- Optionally, for QBC, the "Roaming Charging Profile" negotiated between the VPLMN and the HPLMN on 5GS side.

In roaming home routed PDU session, upon V-SMF change:

- intra-PLMN V-SMF change: Charging Identifier, "Roaming Charging Profile" and optionally CHF address are transferred from the old V-SMF to the new V-SMF.

NOTE: How the new V-SMF selects the V-CHF is operator specific.

- inter-PLMN V-SMF change: Charging Identifier is transferred from the old V-SMF to the new V-SMF.

- The "Roaming Charging Profile" is optionally exchanged between the new V-SMF and the H-SMF as for a PDU session establishment.

In roaming home routed PDU session, when a UE moves from HPLMN with I-SMF insertion to a VPLMN:

- The home provided Charging Identifier assigned by the H-SMF to the original PDU session and transferred by the H-SMF to the V-SMF. This home provided Charging Identifier shall be used by the V-SMF to replace the existing Charging Identifier previously generated by V-SMF.

- Optionally, for QBC, the "Roaming Charging Profile" negotiated between the VPLMN and the HPLMN.

In local breakout scenario, based on roaming agreements between the V-PLMN and the H-PLMN, for each UE roaming in VPLMN:

- The SMF in VPLMN (V-SMF) shall be able to collect charging information within a PDU session when UE is determined as a roamer:

- per QoS flow for CDR generation by V-CHF in VPLMN and CDR generation by H-CHF in HPLMN;

- per service data flow for converged charging, based on PCC rules from V-PCF which uses locally configured policies according to the roaming agreement with the HPLMN operator, when applicable:

- with or without quota management to H-CHF in HPLMN;

- without quota management to V-CHF in VPLMN.

- The SMF in VPLMN (V-SMF) shall be able to determine applicable combinations based on operator policy.

In local breakout scenario, the main parameters exchanged at PDU session establishment are:

- The Charging Identifier assigned by the V-SMF and reported to the V-CHF and H-CHF.

- Optionally, for QBC, the "Roaming Charging Profile" is used for the set of triggers, associated category, and trigger thresholds and negotiated between the VPLMN and the HPLMN

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| **Next change** |

#### 5.2.1.6 QoS flow Based Charging (QBC)

QoS flow Based Charging allows the SMF to collect charging information related to data volumes per PDU session, categorized per QoS Flow for roaming charging scenarios. QBC doesn't support quota management.

The user can be identified by SUPI.

For a given PDU session, QBC shall be performed by the SMF within the same charging session used for Flow Based Charging. For the case where QBC is performed from SMF in VPLMN, Flow Based Charging is not applicable and there is no possibility to have quota management for the PDU Session. For the case where QBC is performed from SMF in HPLMN, FBC can be performed or not performed at the same time according to operator's policy.

The SMF categorizes the volume within PDU session by QoS Flow identified by QoS Flow Identifier (QFI).

The amount of data counted for the QoS Flow shall be the user plane payload at the UPF.

Table 5.2.1.6.1 summarizes the set of default trigger conditions and their category which shall be supported by the SMF in QBC. For "immediate report" category, the table also provides the corresponding Charging Data Request [Initial, Update, Termination] message sent from SMF towards the CHF.

Table 5.2.1.6.1: Default Chargeable events in SMF for QBC

| Chargeable event | Trigger level | Default category | CHF allowed to change category | CHF allowed to enable and disable | Message when "immediate reporting" category |
| --- | --- | --- | --- | --- | --- |
| Start of PDU session | PDU session | Immediate | Not Applicable | Not Applicable | Charging Data Request [Initial] |
| Start of a QoS Flow | QoS Flow | Deferred | Not Applicable | Not Applicable | Charging Data Request [Update] |
| **Change of Charging conditions** | | | | |
| QoS change | QoS Flow | Deferred | Yes | Yes |
| GFBR guaranteed status change | QoS Flow | Deferred | Yes | Yes |
| User Location change | PDU session | Deferred | Yes | Yes |
| Serving Node change | PDU session | Deferred | Yes | Yes |
| Change of 3GPP PS Data off Status | PDU session | Deferred | Yes | Yes |
| Tariff time change | PDU session | Deferred | No | No |
| UE time zone change | PDU session | Immediate | Yes | Yes |
| PLMN change | PDU session | Immediate | Yes | Yes |
| RAT type change | PDU session | Immediate | Yes | Yes |
| Session-AMBR change | PDU session | Immediate | Yes | Yes |
| Addition of UPF | PDU session | Immediate | Yes | Yes |
| Removal of UPF | PDU session | Immediate | Yes | Yes |
| Handover cancel | PDU session | Immediate | Yes | Yes |
| Handover start | PDU session | Immediate | Yes | Yes |
| Handover complete | PDU session | Immediate | Yes | Yes |
| Redundant transmission change | QoS Flow | Immediate | Yes | Yes |
| Satellite backhaul category change | PDU session | Deferred | Yes | Yes |
| Satellite Backhaul QoS change | QoS Flow | Deferred | Yes | Yes |
| GEO satellite ID change | PDU session | Deferred | Yes | Yes |
| S-NSSAI replacement | PDU session | Immediate | Yes | Yes |
| **Limit per PDU session** | | | | |
| Expiry of data time limit per PDU session | PDU session | Immediate | No | Yes |
| Expiry of data volume limit per PDU session | PDU session | Immediate | No | Yes |
| Expiry of data event limit per PDU session | PDU session | Immediate | No | Yes |
| Expiry of limit of number of charging condition changes | PDU session | Immediate | No | Yes |
| **Limit per QoS Flow** | | | | |
| Expiry of data time limit per QoS Flow | QoS Flow | Deferred | Yes | Yes |
| Expiry of data volume limit per QoS Flow | QoS Flow | Deferred | Yes | Yes |
| **Others** | | | | |
| End of QoS Flow | QoS Flow | Deferred | Yes | Yes |
| Management intervention | PDU session | Immediate | No | No | Charging Data Request [Update]  Charging Data Request [Termination] |
| V-SMF change | PDU session | Immediate | Not Applicable | Not Applicable | Charging Data Request [Initial]  Charging Data Request [Termination] |
| End of PDU session | PDU session | Immediate | No | No | Charging Data Request [Termination] |
| Abort request is received from the CHF | PDU session | Immediate | No | No |
| NOTE 1: If GFBR guaranteed status change is enabled, SMF needs to ensure the request for the notification from the access network (i.e. 3GPP RAN) when the GFBR can no longer (or can again) be guaranteed for a QoS Flow during the lifetime of the QoS Flow.  NOTE 2: The columns CHF allowed to change category, and CHF allowed enable and disable are only applicable for the PDU session establishment, for other cases they are not applicable. | | | | | |

The default "Limit" trigger conditions, are trigger thresholds configured in the Charging Characteristics applied to the PDU session for QBC. It shall be possible for the CHF to override these default triggers when providing Charging Data Response [Initial], either to disable the triggers, or to enable triggers new thresholds value.

The "Limit" trigger conditions applied to the QoS Flow level of QBC is common for all QFIs, and applies the limit for each QFI in the PDU session.

For QBC the following details of chargeable events and corresponding actions in the SMF are defined in Table 5.2.1.6.2:

Table 5.2.1.6.2: Chargeable events and their related actions in SMF for QBC

| Chargeable event | | Conditions | | SMF action |
| --- | --- | --- | --- | --- |
| Start of PDU session | |  | | Charging Data Request [Initial]. |
| Start of a QoS Flow | | Start of the QoS Flow associated with the default QoS rule | | Charging Data Request [Update]. |
|  | Start of a QoS Flow | | Start new counts with time stamps. | |
| V-SMF change | | If the session is moved to the V-SMF | | Charging Data Request [Initial]. |
| If the session is moved from the V-SMF | | Charging Data Request [Termination]  Close the counts with time stamps |
| End of a QoS Flow | |  | | Close the counts with time stamps for the QoS flows |
| End of PDU session | |  | | Charging Data Request [Termination]  Close the counts with time stamps |
| Change of charging condition in the SMF | | If the corresponding trigger is enabled | | Close the counts and start new counts with time stamps for all active QoS flows. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update] |
| Handover start | | If the corresponding trigger is enabled | | Close the counts with time stamps and start new counts with time stamps. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update]. |
| Handover cancel | | If the corresponding trigger is enabled | | Close the counts with time stamps and start new counts with time stamps for active QoS flows. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update]. |
| Handover complete | | If the corresponding trigger is enabled | | Close the counts and start new counts with time stamps for active QoS flows. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update] |
| Redundant transmission change | | If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update].  Close the counts and start new counts with time stamps. |
| Addition of UPF | If the corresponding trigger is enabled | | Start new counts with time stamps for the added UPF. | |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update]. | |
| Removal of UPF | If the corresponding trigger is enabled | | Close the counts with time stamps for the removed UPF | |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | | Charging Data Request [Update]. | |
| Expiry of time limit per QoS Flow | | If the corresponding trigger is enabled | | Close the counts with time stamps. |
| If the category is set to "immediate reporting" | | Charging Data Request [Update] |
| If the QoS Flow is still active | | Start new counts with time stamps |
| Expiry of data volume limit per QoS Flow | | If the corresponding trigger is enabled | | Close the counts with time stamps |
| If the category is set to "immediate reporting" | | Charging Data Request [Update] |
| If the QoS Flow is still active | | Start new counts with time stamps |
| Expiry of time limit per PDU session | | If the corresponding trigger is enabled | | Close the counts with time stamps for all QoS flows. |
| If the category is set to "immediate reporting" | | Charging Data Request [Update] |
| If the PDU session is still active | | Start new counts with time stamps for all active QoS flows |
| Expiry of data volume limit per PDU session | | If the corresponding trigger is enabled | | Close the counts with time stamps for all QoS flows. |
| If the category is set to "immediate reporting" | | Charging Data Request [Update] |
| If the PDU session is still active | | Start new counts with time stamps for all active QoS flows |
| Expiry of a limit of number of charging condition changes per PDU session | | If the corresponding trigger is enabled | | Close the counts with time stamps for all QoS flows. |
| If the category is set to "immediate reporting" | | Charging Data Request [Update] |
| If the PDU session is still active | | Start new counts with time stamps for all active QoS flows |
| Management intervention | | If the management intervention causes an update e.g., a reauthorization request. | | Charging Data Request [Update]  Close the counts with time stamps for all QoS Flows |
| If the PDU session is still active | | Start new counts with time stamps |
| If the management intervention causes a termination e.g., an abort charging request. | | Charging Data Request [Termination]  Close the counts with time stamps |
| Abort |  | | Charging Data Request [Termination]  Close the counts with time stamps | |

The CDR generation mechanism processed by the CHF upon receiving Charging Data Request [Initial, Update, Termination] issued by the SMF for these chargeable events in QBC, is specified in clause 5.2.3.

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| **Next change** |

##### 5.2.3.2.3 Triggers for CHF CDR partial record closure

When the CHF receives Charging Data Request [Update], with the change conditions identified in Table 5.2.3.2.3.1, the charging information shall be added in the PDU session charging CHF CDR, before the CDR is closed and a subsequent CHF CDR shall be opened with an incremented Sequence Number, as the default supported mechanism.

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Table 5.2.3.2.3.1: Triggers for CHF CDR partial record closure

|  |
| --- |
| Trigger Conditions |
| Change of Charging conditions |
| UE time zone change |
| PLMN change |
| RAT type change |
| Session-AMBR change |
| Removal of UPF |
| Insertion\_of\_ISMF |
| Change\_of\_ISMF |
| Removal\_of\_ISMF |
| Handover complete |
| Management intervention |
| Addition of access |
| Removal of access |
| S-NSSAI replacement |
| Limit per PDU session |
| Expiry of data time limit per PDU session |
| Expiry of data volume limit per PDU session |
| Expiry of data event limit per PDU session |
| Expiry of limit of number of charging condition changes |

In case the "Individual Partial record" mechanism is enabled, the Table 5.2.3.2.3.1 is not applicable, as specified in clause 5.2.3.2.2.

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| **Next change** |

##### 5.2.3.3.1 General

A Roaming QBC CHF CDR is used to collect charging information related to Roaming QBC in V-SMF, and Optional, the PDU session charging CHF CDR is used to collect charging information related to Roaming QBC in H-SMF. QoS flow containers per PDU session can be added in the CHF CDRs by the CHF, upon receiving a Charging Data Request.

The charging information received from the CHF consists of a set of containers, which are added as "List Multiple QFI container" parameter of the CHF CDRs. Each container identifies the configured counts (volume separated for uplink and downlink, elapsed time) per QoS Flow, associated with the changed charging conditions.

A Roaming QBC CHF CDR shall be opened when the CHF receives Charging Data Request [Initial] indicating "in-bound roamer".

##### 5.2.3.3.2 Triggers for CHF CDR charging information addition for roaming QBC

When the CHF receives Charging Data Request [Update], with the change conditions identified in Table 5.2.3.3.2.1 the charging information shall be added in the CHF CDR, and the CDR shall remain open, as the default supported mechanism.

Table 5.2.3.3.2.1: Triggers for CHF CDR charging information addition for roaming QBC

|  |
| --- |
| Trigger Conditions |
| Change of Charging conditions |
| QoS change |
| User Location change |
| Serving Node change |
| Change of 3GPP PS Data off Status |
| Limit per QoS Flow |
| Expiry of data time limit per QoS Flow |
| Expiry of data volume limit per QoS Flow |
| Others |
| End of QoS Flow |

In case the "Individual partial record" mechanism is enabled, the Table 5.2.3.3.2.1 is not applicable, as specified in clause 5.2.3.2.2.

##### 5.2.3.3.3 Triggers for CHF CDR partial record closure for roaming QBC

When the CHF receives Charging Data Request [Update] with the change conditions identified in Table 5.2.3.3.3.1, the charging information shall be added in the CHF CDR, before the CDR is closed and a subsequent CHF CDR shall be opened with an incremented Sequence Number, as the default supported mechanism.

Table 5.2.3.3.3.1: Triggers for CHF CDR partial record closure for roaming QBC

|  |
| --- |
| Trigger Conditions |
| Change of Charging conditions |
| UE time zone change |
| PLMN change |
| RAT type change |
| Session-AMBR change |
| Removal of UPF |
| Management intervention |
| Limit per PDU session |
| Expiry of data time limit per PDU session |
| Expiry of data volume limit per PDU session |
| Expiry of data event limit per PDU session |
| Expiry of limit of number of charging condition changes |

In case the "Individual partial record" mechanism is enabled, the Table 5.2.3.3.3.1 is not relevant: instead, the charging information shall be added in the CHF CDR, before the CDR is closed and a subsequent CHF CDR shall be opened with an incremented Sequence Number for each Charging Data Request [Update] received by the CHF.

##### 5.2.3.3.4 Triggers for roaming QBC CHF CDR closure

When the CHF receives Charging Data Request [Termination], the charging information shall be added in the roaming QBC CHF CDR and the CDR shall be closed.

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| **End of change** |