**3GPP TSG-SA5 Meeting #129e *S5-201225***

**e-meeting, 24 February – 4 March 2020**

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| *CR-Form-v11.4* |
| **CHANGE REQUEST** |
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|  | **32.255** | **CR** | **0182** | **rev** | **-** | **Current version:** | **16.3.0** |  |
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| *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:***  | Add the branching point or UL CL controlled by I-SMF |
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| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | S5 |
|  |  |
| ***Work item code:*** | ETSUN |  | ***Date:*** | 2020-02-27 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***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)* |
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| ***Reason for change:*** | The general description for support of deployments topologies with specific SMF service areas and the operation for the scenarios branching point or UL CL controlled by I-SMF should be added.  |
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| ***Summary of change:*** | Add the description of branching point or UL CL controlled by I-SMF. |
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| ***Consequences if not approved:*** | The branching point or UL CL controlled by I-SMF is not supported.  |
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| ***Clauses affected:*** | 5.1.x (New), 5.2.1.4, 5.2.1.5, 5.2.1.x(new) |
|  | n |
|  | **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 ...  |
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| ***Other comments:*** | Implement the new clause after 5.1.12.Implement the new clause 5.2.1.x after 5.2.1.5. |

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| **First change** |

### 5.1.X Support of deployments topologies with specific SMF Service Areas

Depending on scenario, a PDU Session in non-roaming case is either served by a single SMF or served by an SMF and an I-SMF, specified in the clause 5.34 of TS 23.501 [200].When a PDU Session is served by both an SMF and an I-SMF, the SMF is the NF Consumer that has the interfaces towards CHF for I-SMF for the case of an I-SMF insertion, relocation or removal.

For the following case with the I-SMF involved, the SMF shall collect the charging information and report to CHF:

- PDU session establishment, modification and release;

- PDU Session message flows for N2 based handover procedure, with I-SMF insertion/change/removal;

- PDU Session message flows for Xn based handover procedure, with I-SMF insertion/change/removal;

- PDU Session message flows for Service Request, with I-SMF insertion/change/removal

- branching point or UL CL controlled by I-SMF.

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| **Next change** |

#### 5.2.1.4 Flow Based Charging (FBC)

For FBC charging, the SMF categorizes the service data flows within PDU session data traffic by rating group and / or combination of the rating group and service id. The level of the reporting and charging method is defined per PCC rule. Details of this functionality are specified in TS 23.503 [202] and TS 32.240 [1].

NOTE: The SMF can only include one QoS Information occurrence per combination of rating group/service id. This implies if an operator wishes to be able to separate usage according to 5QI and ARP for the same charging method, they will need to ensure that service data flows having different 5QI and ARP do not have the same:

- rating group in cases where rating reporting is used;

- rating group/service id where rating group/service id reporting is used.

When a service data flow is governed by a PCC Rule indicated with "Online" charging method, quota management is required before service delivery for controlling this service data flow to be able to start or continue. There is also a special case of "Online" where the SMF may allow traffic to start before quota management.

When a service data flow is governed by a PCC Rule indicated with "Offline" charging method, quota management is not required for this service data flow. Usage reporting is required for this service data flow without affecting the delivery.

According to TS 23.503 [202], FBC shall support different charging models per PCC rule. These charging models may be based on volume and/or time and on number of events matching a specific service data flow template in PCC rule. When a chargeable event occurs for which quota needs to be requested by the SMF to the CHF, the type of requested quota may depend on measurement method configured for the PCC rule.

In general, the charging of a service data flow shall be linked to the PDU session under which the service data flow has been activated.

The amount of data counted shall be the user plane payload at the UPF separated between UL and DL.

For PDU session specific charging, time metering shall start when PDU session is activated.

Table 5.2.1.4.1 summarizes the set of default trigger conditions and their category which shall be supported by the SMF. For "immediate report" category, the table also provides the corresponding Charging Data Request [Initial, Update, Termination] message sent from SMF towards the CHF.

Table 5.2.1.4.1: Default Trigger conditions in SMF

| Trigger Conditions | Trigger level | Converged Charging default category | Offline only charging 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 | Immediate | Not Applicable | Not Applicable | Charging Data Request [Initial] |
| Start of the Service data flow and no charging session exists. | RG | Immediate | Immediate | No | No |
|  |  | Charging Data Request [Update] |
| **Change of Charging conditions** |
| QoS change | PDU session/ RG | Deferred | Deferred | Yes | Yes |
| GFBR guaranteed status change | RG | Deferred | Deferred | Yes | Yes |
| User Location change | PDU session/ RG | Deferred | Deferred | Yes | Yes |
| Serving Node change | PDU session/ RG | Deferred | Deferred | Yes | Yes |
| Change of UE presence in Presence Reporting Area(s) | PDU session/ RG | Deferred | Deferred | Yes | Yes |
| Change of 3GPP PS Data off Status | PDU session/ RG | Deferred | Deferred | Yes | Yes |
| Tariff time change | PDU session/ RG | Deferred | Deferred | No | No |
| UE time zone change | PDU session/ RG | Immediate | Deferred | Yes | Yes |
| PLMN change | PDU session/ RG | Immediate | Deferred | Yes | Yes |
| RAT type change | PDU session/ RG | Immediate | Deferred | Yes | Yes |
| Session-AMBR change | PDU session | Immediate | Deferred | Yes | Yes |
| Addition of UPF | PDU Session/RG | Immediate | Deferred | Yes | Yes |
| Removal of UPF  | PDU session/RG | Immediate | Deferred | Yes | Yes |
| Insertion of I-SMF | PDU Session | Deferred | Deferred | Yes | Yes |
| Re-allocation of I-SMF | PDU Session | Deferred | Deferred | Yes | Yes |
| Removal of I-SMF | PDU Session | Deferred | Deferred | Yes | Yes |
| Handover cancel | PDU session | Immediate | Deferred | Yes | Yes |
| Handover start | PDU session | Immediate | Deferred | Yes | Yes |
| Handover complete | PDU session | Immediate | Deferred | Yes | Yes |
|  |  |
| **Limit per PDU session** |
| Expiry of data time limit per PDU session | PDU session | Immediate | Immediate | No | Yes |
| Expiry of data volume limit per PDU session | PDU session | Immediate | Immediate | No | Yes |
| Expiry of data event limit per PDU session | PDU session | Immediate | Immediate | No | Yes |
| Expiry of limit of number of charging condition changes | PDU session | Immediate | Immediate | No | Yes |
|  |  |
| **Limit per Rating group** |
| Expiry of data time limit per rating group | RG | Deferred | Deferred | Yes | Yes |
| Expiry of data volume limit per rating group | RG | Deferred | Deferred | Yes | Yes |
| Expiry of data event limit per rating group | RG | Deferred | Deferred | Yes | Yes |
|  |  |
| **Quota management** |
| Time threshold reached | RG | Immediate | Not applicable | No | Yes |
| Volume threshold reached | RG | Immediate | Not applicable | No | Yes |
| Unit threshold reached | RG | Immediate | Not applicable | No | Yes |
| Time quota exhausted | RG | Immediate | Not applicable | No | Yes |
| Volume quota exhausted | RG | Immediate | Not applicable | No | Yes |
| Unit quota exhausted | RG | Immediate | Not applicable | No | Yes |
| Expiry of quota validity time | RG | Immediate | Not applicable | No | Yes |
| Expiry of quota holding time | RG | Immediate | Not applicable | No | Yes |
| Re-authorization request by CHF | RG | Immediate | Not applicable | No | No |
| Start of service data flow, in case no valid quota for this rating group  | RG | Immediate | Not applicable | No | No |
|  |  |
| **Others** |
| Termination of service data flow - last service data flow under a given Rating Group. | RG | Immediate | Immediate | No | No |
| Management intervention | PDU session | Immediate | Immediate | No | No |
| Expiry of Unit Count Inactivity Timer | PDU session | Immediate | Not applicable | No | Yes | Charging Data Request [Termination] |
| End of PDU session | PDU session | Immediate | Immediate | No | No |
| CHF response with session termination  | PDU session | Immediate | Not applicable | No | No |
| Abort request is received from the CHF | PDU session | Immediate | Immediate | No | No |

The default "Limit" trigger conditions, are trigger thresholds configured in the Charging Characteristics applied to the PDU session. 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.

When the traffic is counted in more than one UPF, the CHF overrides these default triggers of volume limit for the all UPFs.

For converged charging, the following details of chargeable events and corresponding actions in the SMF are defined in Table 5.2.1.4.2:

Table 5.2.1.4.2: Chargeable events and their related actions in SMF

| Chargeable event | Conditions | SMF action |
| --- | --- | --- |
| Start of PDU session |  | Charging Data Request [Initial] with a possible request quota for later use |
| Start of service data flow | If quota management is required, and valid quota for this rating group does not exist | Charging Data Request [Update] with a request quota with a possible amount of quota. |
| If service identifier level reporting is required by the PCC rule | Start new counts with time stamps for the combination of the rating group and service id |
| If rating group level reporting is required by the PCC rule | Start new counts with time stamps for the rating group |
| If sponsored connectivity level reporting is required by the PCC rule | Start new counts with time stamps for the combination of the rating group, sponsor identity and application service provider identity |
| If charging resource, i.e. charging session, for the PDU session does not exist | Charging Data Request [Initial] with a possible request quota |
| Termination of service data flow | If service identifier level reporting is required by the PCC rule and this is the last service data flow for this combination of the rating group and service id | Close the counts with time stamps |
| If rating group level reporting is required by the PCC rule and this is the last service data flow utilizing that specific rating group | Close the counts with time stamps |
| If sponsored connectivity level reporting is required by the PCC rule and this was the last active service data flow for this combination of rating group, sponsor identity and application service provider identity | Close the counts with time stamps |
| Expiry of the Unit Count Inactivity Timer for the PDU session |  | Charging Data Request [Termination], indicating that charging session is terminated, and the PDU session is still activeMay include the configured Unit Count Inactivity Timer value  |
| End of PDU session in the SMF |  | Charging Data Request [Termination]Close the counts with time stamps |
| Quota specific chargeable events (e.g. threshold reached, QHT expires, quota exhaustion, validity time reached, forced re-authorization, expiry of quota holding time) |  | Charging Data Request [Update] with a possible request quotaClose the counts and start new counts with time stamps |
| Change of charging condition in the SMF (e.g. QoS change, Session-AMBR change, user location change, Radio access type change, PLMN change, Serving Node change, UE Time Zone change, change of UE presence in Presence Reporting Area(s), change of 3GPP PS Data Off status, handover cancel, GFBR guaranteed status change) | If the corresponding trigger is enabled | Close the counts and start new counts with time stamps for all active service data 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 | Start new counts with time stamps for all active service data flows. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | Charging Data Request [Update] with a possible request quota. |
| Handover complete | If the corresponding trigger is enabled | Close the counts with time stamps for all active service data flows. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" | Charging Data Request [Update] |
| Addition of UPF | If the corresponding trigger is enabled and the category is set to "immediate reporting" | Charging Data Request [Update] with a request quota with a possible amount of quota. |
| Tariff time change |  | Close the counts and start new counts with time stamps |
| CHF response with session termination (e.g. Not Applicable), abort request |  | Charging Data Request [Termination]Close the counts with time stamps |
| Removal of a UPF | If quota management is being performed and quota is granted per each UPF | Charging Data Request [Update]Close the counts with time stamps for the removed UPF |
| If quota management is being performed and quota is shared between UPFs | Close the counts with time stamps for the removed UPF |
| If there is no quota management performed | Close the counts with time stamps for the removed UPF |
| Insertion of I-SMF | If the corresponding trigger is enabled | Close the counts with time stamps for all active service data flows in SMF, open new accounts for all active service data flows with I-SMF information. |
| If the corresponding trigger is enabled and the category is set to "immediate reporting" with quota management is being performed and quota is granted per each UPF | Charging Data Request [Update]. Close the counts with time stamps for all active service data flows usage report in SMF, open new accounts for all active service data flows with I-SMF information.  |
| If the corresponding trigger is enabled and the category is set to "immediate reporting", with quota management is being performed and quota is shared between UPFs | Charging Data Request [Update]. Close the counts with time stamps for all active service data flows usage report in SMF, open new accounts for all active service data flows with I-SMF information.  |
| If the corresponding trigger is enabled and the category is set to "immediate reporting", without quota management | Charging Data Request [Update]. Close the counts with time stamps for all active service data flows usage report in SMF, open new accounts for all active service data flows with I-SMF information. |
| Removal of I-SMF | If quota management being performed and quota is granted per each UPF | Charging Data Request [Update].Close the counts with time stamps for the removed I-SMF |
| If quota management being performed and quota is shared between UPFs | Charging Data Request [Update]. Close the counts with time stamps for the removed I-SMF |
| If there is no quota management performed | Charging Data Request [Update]. Close the counts with time stamps for the removed I-SMF |
| Change of I-SMF | If quota management being performed and quota is granted per each UPF | Charging Data Request [Update].Close the counts with time stamps for the removed I-SMF, open active traffic flows’ counts for the new I-SMF |
| If quota management being performed and quota is shared between UPFs | Charging Data Request [Update].Close the counts with time stamps for the removed I-SMF, open active traffic flows’ counts for the new I-SMF |
| If there is no quota management performed | Charging Data Request [Update]. Close the counts with time stamps for the removed I-SMF, open active traffic flows’ counts for the new I-SMF  |
| Expiry of time limit per rating group |  | Close the counts with time stamps |
| If the category is set to "immediate reporting" | Charging Data Request [Update] |
| If any matching service data flow is still active | Start new counts with time stamps |
| Expiry of data volume limit per rating group |  | Close the counts with time stamps |
| If the category is set to "immediate reporting" | Charging Data Request [Update] |
| If any matching service data flow is still active | Open a new service data container |
| Expiry of data event limit per rating group |  | Close the counts with time stamps |
| If the category is set to "immediate reporting" | Charging Data Request [Update] |
| If any matching service data flow is still active | Open a new service data container |
| Expiry of data event limit per PDU session |  | Charging Data Request [Update]Close the counts with time stamps |
| If the PDU session is still active | Start new counts with time stamps |
| Expiry of time limit per PDU session |  | Charging Data Request [Update]Close the counts with time stamps |
| If the PDU session is still active | Start new counts with time stamps |
| Expiry of data volume limit per PDU session |  | Charging Data Request [Update]Close the counts with time stamps |
| If the PDU session is still active | Start new counts with time stamps |
| Expiry of a limit of number of charging condition changes per PDU session |  | Charging Data Request [Update]Close the counts with time stamps |
| If the PDU session is still active | Start new counts with time stamps |
| Management intervention |  | Charging Data Request [Update]Close the counts with time stamps |
| If the PDU session is still active | Start new counts with time stamps |

When event based charging applies, the first occurrence of an event matching a service data flow template in PCC rule shall be considered as the start of a service.

How the termination of service data flows is detected, is specified in TS 23.503 [202]. Termination of the service data flow itself does not trigger Charging Data Request [Update].

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

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| **Next change** |

#### 5.2.1.5 SSC Mode and Triggers

In case of SSC Mode1, the chargeable events are Change of charging condition in the SMF.

In case of SSC Mode2 and SSC Mode3 PDU session Anchor with multiple PDU session, the chargeable events are Start of PDU session and End of PDU session.

There are two cases related to quota management when the granted quota is volume for multiple UPFs and per Operator's policy, the traffic is counted in more than one UPF:

- Quota shared by UPFs means that SMF manages the shared quota consumption per RG for multiple UPFs and reports the total quota consumed to CHF;

- Quota granted for each UPF means that the CHF manages the quota granted for each UPF and SMF manages and reports the quota consumption per UPF.

For configurations involving multiple UPFs and Operator's policy is to count the traffic in a single UPF (e.g. BP), the quota is granted to the SMF for this single UPF per RG for the whole traffic.

The following scenarios describe configurations in which the traffic is counted in more than one UPF:

In case of SSC mode 3 PDU Session Anchor with IPv6 Multi-homed PDU Session,

- The addition of UPF2 and BP (Change the part of traffic from UPF1 to UPF2):

- if quota granted for each UPF, SMF triggers the chargeable event of Start of SDF for UPF2 to request the quota;

- if quota shared by UPFs, SMF requests UPF1 report usage of quota, caches the usage from UPF1 and re-allocates the remaining quota to UPF2 and UPF1(if needed). When the granted quota from CHF is used up, the SMF reports total usage of quota to CHF.

- The removal of UPF1and BP:

- In case the quota management and quota granted for each UPF, UPF1 reports final counts to SMF, SMF triggers the chargeable event of Remove the UPF to report final counts from UPF1;

- In case the quota management and quota shared by UPFs, UPF1 report final counts to SMF, SMF caches the final count from UPF1. SMF sends counts from UPF1 and UPF2 to the CHF together in next Charging Data Request.

- In case without the quota management or offline only charging, UPF1 report final count to SMF, SMF caches the final count from UPF1 and sends counts from UPF1 and UPF2 to the CHF together in next a Charging Data Request. In case of Addition of additional PDU Session Anchor and Branching Point or UL CL:

- The addition of UPF2 and BP (Change the part of traffic from UPF1 to UPF2):

- if quota granted for each UPF, SMF triggers the chargeable event of Start of SDF for UPF2 to request the quota for Rating group;

- if quota shared by UPFs, SMF indicates UPF1 report usage of quota, caches the usage from UPF1 and re-allocates the remain quota to UPF2 and UPF1(if needed). When the granted quota from CHF is used up, the SMF reports total usage of quota to CHF.

In case of Removal of additional PDU Session Anchor and Branching Point or UL CL:

- The removal of UPF1 and BP (Change traffic from UPF1 to UPF2):

- In case the quota management and quota granted for each UPF, UPF1 report final counts to SMF, SMF triggers chargeable event of Remove the UPF to report final counts from UPF1;

- In case the quota management and quota shared by UPFs, UPF1 report final counts to SMF, SMF caches the final count from UPF1 and re-allocates the remain quota to UPF2. SMF sends counts from UPF1 and UPF2 to the CHF together in next a Charging Data Request.

- In case without the quota management or offline only charging, UPF1 report final count to SMF, SMF caches the final count from UPF1 and sends counts from UPF1 and UPF2 to the CHF together in next a Charging Data Request.In case of Change of additional PDU Session Anchor for IPv6 multi-homing or UL CL and Simultaneous change of Branching Point or UL CL and additional PSA for a PDU Session.

- The additional of UPF2 (Change the part of traffic from UPF1 to UPF2):

- if quota granted for each UPF, SMF triggers the chargeable event of Start of SDF for UPF2 to request the quota for Rating group;

- if quota shared by UPFs, SMF indicates UPF1 report usage of quota, caches the usage from UPF1 and re-allocates the remain quota to UPF2 and UPF1(if needed). When the granted quota from CHF is used up, the SMF reports total usage of quota to CHF.

- The removal of UPF1:

- In case the quota management and quota granted for each UPF, UPF1 report final counts to SMF, SMF triggers chargeable event of Remove the UPF to report final counts from UPF1.

- In case the quota management and quota shared by UPFs, UPF1 report final counts to SMF, SMF caches the final count from UPF1 and re-allocates the remain quota to UPF2. SMF sends counts from UPF1 and UPF2 to the CHF together in next Charging Data Request.

- In case without the quota management or offline only charging, UPF1 report final count to SMF, SMF caches the final count from UPF1 and sends counts from UPF1 and UPF2 to the CHF together in next a Charging Data Request.

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| **Next change** |

#### 5.2.1.x Branching point or UL CL controlled by I-SMF

The interaction between I-SMF and SMF for the support of traffic offload by UPF controlled by the I-SMF is specified in the clause 5.34.6 TS 23.501[200].

There are two cases related to quota management when the granted quota is volume for multiple UPFs and per Operator's policy for the scenarios, i.e.Addition, Removal and Change of PDU Session Anchor (PSA2), Branching Point or UL CL controlled by I-SMF, the traffic is counted in more than one UPF:

- Quota shared by UPFs (PSA)

- Quota granted for each UPF (PSA)

In the scenario UL CL/BP controlled by I-SMF, the I-SMF forwards traffic usage information of UPF (PSA2) to the SMF as specified clause 5.34.4 and clause 5.34.5 in TS 23.501 [200].

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| **End of change** |