**3GPP TSG SA WG5 Meeting #158 S5-246769**

**Orlando, USA, 18– 22 November, 2024**

**Source: CATT**

**Title:** **Update store and forward satellite operation charging solutions to resolve ENs**

**Document for: Approval**

**Agenda Item: 7.5.1**

# 1 Decision

***The group is asked to discuss and agree on the proposal.***

# 2 References

[1] 3GPP TR 28.846: " Study on charging aspects of satellite access Phase 3 ".

# 3 Rationale

This pCR proposes to resolve ENs.

# 4 Detailed proposal

The following changes are proposed to be incorporated into the new TR.

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| **1st Modified Section** |

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.261: "Service requirements for the 5G system; Stage 1".

[3] 3GPP TR 23.700-29: "Study on integration of satellite components in the 5G architecture; Phase 3".

[4] 3GPP TR 22.844: "Study on charging aspects of satellite in the 5G System"

[5] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[6] 3GPP TR 22.822: "Study on using Satellite Access in 5G ".

[7] 3GPP TS 32.251: " Packet Switched (PS) domain charging".

[8] 3GPP TS 32.255: "Telecommunication management; Charging management; 5G data connectivity domain charging; Stage 2".

[9] 3GPP TS 23.502: " Procedures for the 5G System (5GS)".

[x] 3GPP TS 32.253: " Control Plane (CP) data transfer domain charging ".

[y] 3GPP TS 32.299: " Diameter charging applications".

[z] 3GPP TS 32.298: " Charging Data Record (CDR) parameter description".

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| **2nd Modified Section** |

#### 6.1.4.2 Solution #1.2: MME Charging Trigger Function (CTF) based solution for S&F operation charging with Control Plane CIoT

This solution which relying on EPC offline Charging System for store and forward satellite operation charging, addresses the Key Issue#1.1 and Key Issue#1.2.

As specified in the clause 5.3.4B of TS 23.401 [5], when the UE accesses the network with Control Plane CIoT EPS Optimisation, the data is stored in the MME-onboard. The UE registers in S&F mode to access S&F-based services from E-UTRAN satellite access running in S&F mode. The attach and service request procedure for S&F-based services may use one or more satellites, depending on the deployment and implementation options. On-board MME determines a list of satellites (i.e. S&F Monitoring list) from the same (UE selected) PLMN with which UE can attempt to use to finish the attach and service request procedure.

For the MME split architecture, the CTF may be deployed on the ground. The MME-ground together with the set of MME-onboard instances deployed in the set of satellites behaves jointly as a single MME entity and the UE context is synchronized between them. Each MME-onboard instance is associated with a different Satellite ID identifier. The high level of the MME split architecture is shown below:



Figure 6.1.4.2-1: MME split charging architecture

The MME-ground reports charging information to OFCS about satellite access running in S&F mode with the following trigger events:

- Attach Complete via the MME onboard for the CIoT CP Optimizations;

- Service Request via the MME onboard for the CIoT CP Optimizations.

For the whole EPC on-board architecture, the CTF may be deployed on the satellite. SA2 has pointed out that this architecture does not support roaming. The high level of the whole EPC on-board architecture is shown below:



Figure 6.1.4.2-2: Whole EPC on-board charging architecture

 The MME on-board reports charging information to OFCS about satellite access running in S&F mode with the following trigger events:

- Attach Complete via the MME onboard for the CIoT CP Optimizations;

- Service Request via the MME onboard for the CIoT CP Optimizations.

When the MME obtains the attach request or service request including S&F support indication from the UE and determines to support the S&F-based services, the MME (CTF) sends the Charging Data Request to OFCS for S&F operation charging, which has the following enhancement charging information:

- RAT type extends to include "WB-E-UTRAN(LEO)", "WB-E-UTRAN(MEO)", " WB-E-UTRAN(GEO)", " WB-E-UTRAN(OTHERSAT)", "NB-IoT(LEO)", "NB-IoT(MEO)", "NB-IoT(GEO)", "NB-IoT(OTHERSAT)", "LTE-M(LEO)", "LTE-M(MEO)", "LTE-M(GEO)" and "LTE-M(OTHERSAT)"

- Satellite Access Indicator

- Satellite information

- Store and Forward indicator

- S&F Monitoring list (i.e.Satellite IDs)

- Store duration

- Store data volume

The Figure 6.1.4.x-1 describes the high level charging procedure for MME (CTF) charging for S&F operation charging of MME split architecture.



Figure 6.1.4.2-1: Attach procedure message flow for S&F operation charging with Control Plane CIoT

1. If the PLMN broadcast that it is in S&F mode, the UE sends the attach request including S&F support indication.
2. If the UE indicates that it supports S&F satellite operation, the on-board MME shall consider whether to accept the request.

3-16. Attach procedure as described in clause 5.3.2.1 of TS 23.401 [5].

17. After successful attach, the MME may provide the estimated UL delivery time, a S&F wait timer and S&F monitoring list to UE in the Attach Accept message as described in clause 5.3.2.1 of TS 23.401 [5].

17ch-a. The MME sends Charging Data Request [Event] including Satellite Access Indicator, Store and Forward indicator and S&F Monitoring list to OFCS for the UE's successful attach for the S&F-based services.

17ch-b. The CDF creates the CDR.

17ch-c. The CDF acknowledges by sending Charging Data Response [Event] to the MME.

The high level charging procedure for whole EPC on-board architecture is similar to above. The only difference is that all the NFs are on the satellite.

The MME-CDR shall be produced for S&F operation charging with Control Plane CIoT via the MME on-board and would be:

Table 6.1.4.2 MME-CDR

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| --- | --- | --- |
| Field | Category | Description |
| Satellite Access Indicator | OC | This field holds the use of 4G Satellite Access. |
| Satellite information | OC | This field holds all the satellite information that support to finish the Store and Forward Satellite operation. |
| Store and Forward indicator | OC | This field holds the use of Store and Forward Satelllite operation. |
| S&F Monitoring list (1..max)  | OC | This field holds the satellite IDs that used for the Store and Forward Satelllite operation. |
| Store duration | OC | This field holds the storage duration of data on the satellite. |
| Store data volume | OC | This field stores the amount of data stored on the satellite. |

For IP data, this solution and MME-CDR would be specified in the TS 32.251[7].

For non-IP data, this solution and MME-CDR would be specified in the TS 32.253[x].

The corresponding AVPs for S&F operation would be specified in the TS 32.299[y].

The MME-CDR ASN.1 would be specified in the TS 32.298[z].

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| **3rd Modified Section** |

#### 6.1.4.2 Solution #1.2: MME Charging Trigger Function (CTF) based solution for S&F operation charging with Control Plane CIoT

This solution which relying on EPC offline Charging System for store and forward satellite operation charging, addresses the Key Issue#1.1 and Key Issue#1.2.

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For the whole EPC on-board architecture, the CTF may be deployed on the satellite. SA2 has pointed out that this architecture does not support roaming. The high level of the whole EPC on-board architecture is shown below:



Figure 6.1.4.2-2: Whole EPC on-board charging architecture

 The MME on-board reports charging information to OFCS about satellite access running in S&F mode with the following trigger events:

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- Satellite Access Indicator

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- Store and Forward indicator

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The Figure 6.1.4.x-1 describes the high level charging procedure for MME (CTF) charging for S&F operation charging of MME split architecture.



Figure 6.1.4.2-1: Attach procedure message flow for S&F operation charging with Control Plane CIoT

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| S&F Monitoring list (1..max)  | OC | This field holds the satellite IDs that used for the Store and Forward Satelllite operation. |
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The corresponding AVPs for S&F operation would be specified in the TS 32.299[y].

The MME-CDR ASN.1 would be specified in the TS 32.298[z].

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| **End of Modified Sections** |