**3GPP TSG-SA WG6 Meeting #60 S6-241419**

**Changsha, China 15th – 19th April 2024 (revision of S6-241122)**

**Source: China Mobile**

**Title: New Sol for KI#5: Enhancement for on board EES(s) and service provisioning**

**Spec: 3GPP TR 23.700-01**

**Agenda item: 8.6**

**Document for: Approval**

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**1. Introduction**

This contribution propose to address the following open issues in KI#5,

- How the EES(s) are placed on board the Satellite.

- Whether and how the service provisioning is impacted.​

**2. Reason for Change**

When EES is onboard, the relative position between the UE and the onboard EES is constantly changing, so the key issue of service provisioning is to ensure that the EES provided by the ECS is available to the UE.

So, the EES registration and service provisioning need to be enhanced. It is proposed to add the Satellite assistant information in the EES profile to indicating the EES(s) are placed on board, so that, the ECS could do the service provisioning based on those Satellite assistant information.

As for the Satellite assistant information, it is proposed to consider the ephemeris data. This data provides the precise position and velocity of the satellite at a specific time, which is crucial for determining the satellite's availability. The specific information included in ephemeris data varies depending on the type of satellite being tracked, typical elements found in ephemeris data may include:

* Orbital Elements: This includes parameters that define the shape, size, and orientation of the satellite's orbit. Key orbital elements may include the semi-major axis, eccentricity, inclination, right ascension of the ascending node, argument of perigee, and mean anomaly.
* Position: The precise three-dimensional coordinates (latitude, longitude, and altitude) of the satellite at a specific time. This information is crucial for tracking the satellite's location in space.
* Velocity: The velocity vector of the satellite, which includes the speed and direction of the satellite's movement. Velocity information is essential for predicting the satellite's trajectory.
* Acceleration: Information about the acceleration of the satellite, which affects its movement and orbit. Acceleration data helps in understanding changes in the satellite's velocity and trajectory.
* Clock Correction Parameters: Details about any clock corrections or adjustments needed to synchronize the satellite's clock with ground control centers and user equipment. This ensures accurate timing for communication and tracking.
* Health Status: Data indicating the operational status of the satellite, including battery levels, system health, and any anomalies or issues affecting its performance.
* Predicted Trajectory: Future trajectory predictions based on the current position, velocity, and acceleration of the satellite. Predicted trajectory data helps in planning and tracking the satellite's path.
* Signal Quality Metrics: Information about signal strength, signal-to-noise ratio, and other quality metrics related to satellite communication. This data helps in assessing the quality of the satellite signal for communication purposes.

Signal Quality Metrics and orbital elements are some static information which could be used to predict the satellite's position and calculate available information. With those information, the ECS could always selects the EES(s) which is available to the UE.

**3. Conclusions**

<Conclusion part (optional)>

**4. Proposal**

It is proposed to agree the following changes to 3GPP TR 23.700-01.

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

## 7.2 Solutions for Application Enablers

### 7.2.X Solution #X: Enhancement for on board EES(s) and service provisioning

#### 7.2.X.1 Solution description

This solution proposes to address the following open issues in KI#5,

- How the EES(s) are placed on board the Satellite.

- Whether and how the service provisioning is impacted.​

It is proposed to add the Satellite assistant information in the EES profile to indicating the EES(s) are placed on board the satellite, so that, the ECS could do the service provisioning based on those Satellite assistant information.

##### 7.2.X.1.1 General

When EES is deployed in the satellite, it is proposed to add the Satellite assistant information in the EES Profile to indicating the EES is deployed on-board. The Satellite assistant information could be the satellite ephemeris information(e.g., time slot and spatial location). So that the ECS could obtain the EES’s Satellite assistant information during the EES registration.

Table 7.2.x.1.1-1: EES Profile

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| EESID | M | The identifier of the EES |
| EES Endpoint | M | Endpoint information (e.g. URI, FQDN, IP address) used to communicate with the EES. This information is provided to the EEC to connect to the EES. |
| EDN information | O | EDN information where the EES resides. |
| > DNN | M | Data network name to identify the EDN. |
| > DNAI(s) | O | DNAI(s) associated with the EDN. |
| EASIDs | M | List of EASIDs registered or expected to be registered with the EES. |
| >Allowed MNO information | O | Information of the allowed operator as described in EAS profile clause 8.2.4, Only subscribers from these operators can consume the EES services. |
| List of EAS bundle information | O | List of EAS bundles per EASID to which the EAS belongs and related bundling requirements. |
| > Bundle ID  (NOTE 2) | O | A bundle ID as described in clause 7.2.10. |
| > List of EASIDs  (NOTE 2) | O | List of EASIDs associated with the EAS bundle. |
| > Bundle type | M | Type of the EAS bundle as described in clause 7.2.10 |
| > EAS bundle requirements | O | Requirements associated with the EAS bundle as described in clause 8.2.10. |
| Instantiable EAS information | O | The EAS instantiation status per EASID (e.g. instantiated, instantiable but not be instantiated yet). |
| > Instantiation criteria (NOTE 1) | O | The criteria upon which EAS can be instantiated (e.g. based on specific date and time). |
| EEC registration configuration | M | Indicates whether the EEC is required to register on the EES to use edge services or not. |
| ECSP ID | O | The identifier of the ECSP that provides the EES. |
| EES Topological Service Area | O | The EES serves UEs that are connected to the Core Network from one of the cells included in this service area. EECs in UEs that are located outside this area shall not be served. See possible formats in Table 8.2.7-1. |
| EES Geographical Service Area | O | The area being served by the EES in Geographical values (as specified in clause 7.3.3.3) |
| List of EES DNAI(s) | O | DNAI(s) associated with the EES. This IE is used as Potential Locations of Applications in clause 5.6.7 of 3GPP TS 23.501 [2].  It is a subset of the DNAI(s) associated with the EDN, where the EES resides. |
| EES Service continuity support | O | Indicates if the EES supports service continuity or not. This IE indicates which ACR scenarios are supported by the EES, also indicates the EES ability (e.g. EAS bundle information) of handling bundled EAS ACR. |
| **Satellite assistant information** | **O** | **Assistant information indicating the EES is on-board, and could be used to calculate the satellite's position and movement. It could be the statistic satellite ephemeris information (e.g.,signal quality metrics and orbital elements)** |
| NOTE 1: "Instantiation criteria" IE shall be present only when the value of "Instantiable EAS information" IE is "instantiable but not be instantiated yet".  NOTE 2: At least one of the IEs shall be present if EAS bundle information is provided. | | |

After that, when UE requests the service provisioning, the following changes may apply.

Pre-condition:

1. The ECS support the available information calculation.



Figure 7.x.2.1.1-1: service provisioning

- In step2, the ECS calculates the on-board EES available information based on the Satellite assistant information, and determines the EES based on the EES available information to that the EES is accessible to the UE. The on-board EES available information indicates when and how the EES is available for the requesting EEC. It could be a sequence of time durations for each grid point where each time duration includes an indication of coverage availability or unavailability as discussed in Annex Q of TS 23.501.

- In step3, if the on-board EES meet the requirement so that the on-board EES is selected by the ECS, the ECS should send the on-board EES available information to the EEC. The EEC can select one or more such EES(s) to perform EAS discovery based on EES available information.

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

<Proposed change in revision marks>

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

<Proposed change in revision marks>