**3GPP TSG-SA WG6 Meeting #62-Ad Hoc-e S6a240329**

**10th – 18th July 2024 (revision of S6a240175)**

**Source: Convida Wireless LLC**

**Title: Solution 8 update**

**Spec: 3GPP TR 23.700-21 V 1.0.0**

**Agenda item: 8.4**

**Document for: Approval**

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**1. Introduction**

Spatial map management services and spatial anchor management services are currently defined to address spatial maps and spatial anchors as two distict “layers” of information. Without changing this framework, this contribution looks at stage 1 requirements, use cases and definitions and proposes simple methods to provide exposure of Spatial Anchor-Augmented Spatial Maps (SAASM).

**2. Reason for Change**

The following (in *italics*) are excerpts from TS 22.156 on Metaverse stage 1 clause 5.2:

*“ Localized mobile metaverse services can be associated with specific places (3D locations in the physical world). The association between these places and service information is termed a spatial anchor. Spatial anchors can associate diverse information with spatial location, beyond access control and access information of mobile metaverse services.”*

…and…

*“The spatial map is created using processed sensor data. The 5G system supports a spatial mapping service to customers that, for example, want to offer mobile metaverse services associated with spatial anchors on their premises. Creation of a spatial map for a location makes localization there possible, as well as assignment of spatial anchors in that location.”*

**Observation 1: The main service use cases on loclized metaverse service refer to joint exposure of spatial anchors and spatial maps.**

*“[R-5.2.1-003] Subject to operator policy, regulatory requirements and user consent, the 5G system shall provide a means for a UE to provide sensor data (e.g., from UE sensors, cameras, etc.) to the network in order to derive localization information, e.g., to produce or modify a spatial map or discover or find spatial anchors. The 5G system shall enable an authorized third party to obtain all the spatial anchors in a given three dimensional area.*

*NOTE 3: How an authorized third party identifies which three-dimensional area to request spatial anchors in is not in scope of the 3GPP standard. Spatial localization and mapping information could be used to identify areas of interest.”*

…and…

*“[R-8.2.1-001] The 5G system shall be able to collect charging information for the actions related to spatial anchors, where a third party creates, deletes, or modifies a spatial anchor or associated service information.*

*NOTE: It is assumed that exposure of network anchors and associated service information can be a service provided by a network operator to third parties.”*

**Observation 2: Several SA1 requirements specifically call for (or assume) spatial anchor exposure within the context of a spatial map**

*“Spatial anchors can associate diverse information with spatial location, beyond access control and access information of mobile metaverse services. Type of service information can also allow a user to discover appropriate spatial anchors, e.g., when the user seeks restaurants.”*

*“ The 5G system supports a spatial mapping service to customers that, for example, want to offer mobile metaverse services associated with spatial anchors on their premises. Creation of a spatial map for a location makes localization there possible, as well as assignment of spatial anchors in that location.”*

**Observation 3: Spatial anchors are defined as associations of service information with spatial localization information. Therefore, the context in which a spatial anchor is defined is essential to the service.**

**3. Proposal**

**Propoal: Describe SL procedures and APIs for exposure of Spatial Anchor Augmented Spatial Maps (SAASM), in addition to those for management of spatial anchors (i.e. solutions 1-4) and to those for spatial maps management (i.e. solution 8).**

This contribution proposes such procedures and APIs as enhancements to solution #8, but a separate solution can also be included. It is proposed to agree the following changes to 3GPP TR 23.700-21

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

7.8 Solution #8: Support for spatial map management

7.8.1 Solution description

This solution maps to KI#4. This solution enhances SEAL LM service to provide spatial map management service.

7.8.2 Architecture Impacts

This clause provides the architecture impacts of the solution. The solution provides enhancements to the SEAL LM functionalities for managing (i.e. produce, update, get, subscribe) spatial maps. To manage spatial maps between VAL server/SEAL LM client and SEAL LM server, reference points LM-S and LM-UU are used in this solution.

Editor's Note: Whether to use a new application enablement server such as a Mobile Metaverse Enabler Server (MMES) or a new SEAL server for this solution is FFS.

7.8.3 Procedures

7.8.3.1 Producing spatial map

Figure 7.8.3.1-1 depicts the procedure for producing a spatial map. For the request from the spatial map requestor (VAL server or SEAL LM client), the service is provided by SEAL LM server.

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**Figure 7.8.3.1-1: Producing spatial map**

1) The VAL server (or SEAL LM client) sends a request message to the SEAL LM server to produce the spatial map. The request includes requestor ID, three-dimensional area of interest, information to be included in the spatial map such as access control rules defining which entities are permitted to discover and access the spatial map.

NOTE 1: In the normative phase, description of the area of interest for the spatial map includes at least three-dimensional coordinate systems and spatial anchors. Other information in the request message to be included in the spatial map, will be further defined in the normative work phase.

The SEAL LM server authorizes VAL server (or SEAL LM client), and validates the request.

2) The SEAL LM server produces a requested spatial map using the processed sensor data required to estimate the number of objects, type of the object, position, direction and speed of the object, etc.

3) The SEAL LM server sends response message to the requestor with produced spatial map ID and information which includes three-dimensional space defined by the spatial map, stationary or moving objects with attributes of them.

NOTE 2: The spatial map information in the response message will be further defined in the normative work phase. As an example, a list of spatial anchors which belong to the spatial map could be included.

7.8.3.2 Update spatial map

Figure 7.8.3.2-1 dipicsts the procedure to update the spatial map. For the request from the spatial map consumer (VAL server or SEAL LM client), modifying or deleting the spatial map is provided by SEAL LM server.

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**Figure 7.8.3.2-1: Update spatial map**

1. The VAL server (or SEAL LM client) sends a request message to the SEAL LM server to update a spatial map. The request includes requestor ID, spatial map ID, indicator to modify or delete, information on what to modify such as updated access control rules and updated spatial map coverage area, etc. The SEAL LM server authorizes VAL server (or SEAL LM client) and validates the request.

NOTE 1: In the normative phase, description of the spatial map to be updated includes three-dimensional coordinate systems and spatial anchors.

2) The SEAL LM server delete or modifies the spatial map as requested.

3) Then it sends response message to the requestor with result of the request and modified spatial map information with the spatial map ID.

7.8.3.3 Get spatial map

Figure 7.8.3.3-1 dipicts the procedure for the authorized spatial map consumer (VAL server or SEAL LM client) to get the spatial map. The service is provided by SEAL LM server.

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**Figure 7.8.3.3-1: Get spatial map**

1) The VAL server (or SEAL LM client) sends a request message to the SEAL LM server to get the spatial map. The request includes requestor ID, spatial map ID to get the information on it, three-dimensional area of interest or localization information to discover spatial maps in the area, optionally discovery filters, i.e. a set of characteristics to search the matching spatial maps when multiple spatial maps are allowed in the area of interest.

NOTE 1: In the normative phase, description of the area of interest for the spatial map includes three-dimensional coordinate systems and spatial anchors.

2) The SEAL LM server authorizes VAL server (or SEAL LM client), and validates the request. If spatial anchor information is included in the request, the SEAL LM server determines whether the information can be resolved/ disambiguated for the request. Then the server collects the requested spatial map information. The SEAL LM server sends the get spatial map response message to the authorized third party consumer with spatial map ID and spatial map information when matching spatial map is found, otherwise it sends failure indication with reason.

7.8.3.4 Subscribe/unsubscribe spatial map

Figure 7.8.3.4-1 dipicts the procedure for the authorized spatial map consumer (VAL server or SEAL LM client) to subscribe the spatial map. The service is provided by SEAL LM server.

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**Figure 7.8.3.4-1: Subscribe/unsubscribe spatial map**

1. The VAL server (or SEAL LM client) sends a request message to the SEAL LM server to subscribe/unsubscribe spatial map(s). The request includes requestor ID, spatial map ID(s) or or other information to identify the applicable spatial map(s), a list of events to subscribe/unsubscribe, which trigger the notification, with triggering criteria, minimum time between consecutive notifications, etc. For the unsubscribe spatial map request, the subscription ID is included in the message.

NOTE 1: In the normative phase, the localization information in the request is provided in three-dimensional coordinate systems and spatial anchors.

2) The SEAL LM server authorizes VAL server (or SEAL LM client), and validates the request. Then server add/delete the requestor into/from the subscriber list and event list of the spatial map, and sends response message with the result. For the subscribe spatial map request, the subscription ID is included in the message as well.

NOTE 1: For the VAL server (or SEAL LM client) which unsubscribed all the events of the spatial map, the SEAL LM server removes the VAL server (or SEAL LM client) completely from the subscriber list of the spatial map. In this case, step 3) will not be initiated.

3) When an event is detected, the SEAL LM server notifies the VAL servers (or SEAL LM clients) which subscribed the corresponding event. Spatial map notification message includes the information on the detected triggering event, e.g. added or removed objects, position or direction changes of the objects in the spatial map etc.

NOTE 2: Further triggering events and triggering criteria etc. will be defined in the normative work phase.

#### 7.8.3.5 Management of spatial anchor augmented spatial map

Figure 7.8.3.5-1 depicts an abstracted procedure for management of spatial anchor-augmented spatial maps (SAASM) The requestor (VAL server or SEAL LM client), the service is provided by SEAL LM server.

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**Figure 7.8.3.5-1: Manage Spatial anchor-augmented spatial map**

1. The VAL server (or SEAL LM client) sends a request message to the SEAL LM server to manage a SAASM. The request includes requestor ID, localization information for the area of interest, and a management operation. The area of interest is defined by or includes spatial anchors.

NOTE 1: The normative phase will determine whether the requested management operations are to be implemented as individual create/retreieve/update/ delete/ subscribe requests.

1. The SEAL LM server authorizes VAL server (or SEAL LM client) and validates the request.
2. The SEAL LM server performs the requested operation using the necessary processed sensor data and spatial anchor information. This may reault in creation, modification or deletion of spatial mapping data and/or spatial anchor information.

NOTE 2: How the SEAL LM server manages jointly spatial anchor and spatial map information , i.e. SAASM, is up to implementation.

1. The SEAL LM server sends response message to the requestor with information about the outcome of the operation.

7.8.4 Corresponding APIs

Editor's Note: This clause provides the corresponding APIs for supporting the solution.

7.8.5 Solution evaluation

This solution addresses KI#4 by providing the spatial map management service procedures based on the SEAL-LM architecture and functional model. The solution enhances the existing SEAL LM server by adding new functionalities to manage spatial maps. Therefore interactions between location management functionalities and spatial map management functionalities can be made in the same server.The SEAL server and SEAL client are impacted.

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