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TECHNICAL SPECIFICATION

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Modal verbs terminology

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

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1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the protocol aspects and APIs for the metaverse application over the 3GPP network for SAn-UU, SM-UU, and DA-UU reference points. The APIs are specified as RESTful APIs except for custom operations wherever required.

The present document is applicable to the user equipment (UE) supporting the digital asset as described in 3GPP TS 23.438 [3], spatial mapping and spatial anchor client functionalities as described in 3GPP TS 23.437 [2], to the application server supporting the digital asset as described in 3GPP TS 23.438 [3], spatial mapping and spatial anchor server functionalities as described in 3GPP TS 23.437 [2] and to the application server supporting the vertical application server (VAL server) functionality as defined in specific vertical application service (VAL service) specification.

NOTE: The specification of the VAL server for a specific VAL service is out of scope of the present document.

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 23.437: "Service Enabler Architecture Layer for Verticals (SEAL); Spatial map and Spatial anchors; Stage 2".

[3] 3GPP TS 23.438: "Service Enabler Architecture Layer for Verticals (SEAL); Digital assets Stage 2".

[4] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

[5] 3GPP TS 24.545: "Location Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[6] 3GPP TS 29.437: "Service Enabler Architecture Layer for Verticals (SEAL); Metaverse Enablement Services; Stage 3".

[7] 3GPP TS 29.549: "Service Enabler Architecture Layer for Verticals (SEAL); Application Programming Interface (API) specification; Stage 3".

[8] 3GPP TS 29.122: "T8 reference point for Northbound APIs".

[9] 3GPP TS 29.558: "Enabling Edge Applications; Application Programming Interface (API) specification; Stage 3".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

DA	Digital Asset
SAn-C	Spatial Anchor Client
SAn-S	Spatial Anchor Server
SEAL	Service Enabler Architecture Layer for verticals
SM-C	Spatial Map Client
SM-S	Spatial Map Server
VAL	Vertical Application Layer

4 Overview

Spatial anchor, spatial mapping and digital assets are the SEAL services that provides the spatial anchor, spatial mapping and digital asset related capabilities to one or more vertical applications. The present document enables the:

a) SEAL spatial anchor client (SAn client) to interact with the SEAL spatial anchor server (SAn server) over the SAn-UU interface as defined in 3GPP TS 23.437 [2] for below services;

   1) spatial anchor management and usage reporting as specified in clause 5.2.1; and

   2) spatial anchor discovery as specified in clause 5.2.2;

b) SEAL spatial map client (SM client) to interact with the SEAL spatial map server (SM server) over the SM-UU interface as defined in 3GPP TS 23.437 [2] for below services;

   1) spatial map management and spatial map localization as specified in clause 5.3.1;

   2) spatial map discovery as specified in clause 5.3.2; and

   3) spatial map data soruce management as specified in clause 5.3.3;

c) SEAL digital asset client (DA client) to interact with the SEAL digital asset server (DA server) over the DA-UU interface as defined in 3GPP TS 23.438 [3] for below services;

   1) digital asset discovery as specified in clause 5.4.1;

   2) digital asset profile management as specified in clause 5.4.2; and

   3) digital asset media management as specified in clause 5.4.3.

5 Digital Asset, Spatial Anchor and Spatial Map Services

5.1 Introduction

Table 5.1-x summarizes the corresponding APIs defined for this specification.

Table 5.1-x: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	API Name	Annex
<service name>	<ref clause>	<short description as included in the OpenAPI file>	<file name>	<apiName in the URI>	<ref Annex >

NOTE: When 3GPP TS 29.122 [8] is referenced for the common protocol and interface aspects for API definition in the clauses under clause 5, the service producer (i.e. <NF or Entity, e.g. UAE Server>) takes the role of the SCEF and the service consumer (e.g. <examples of service consumers>) takes the role of the SCS/AS.

5.2 Spatial Anchor Services

5.2.1 SS_SAnManagement Service

5.2.1.1 Service Description

The SS_SAnManagement API, as defined in 3GPP TS 23.437 [2], allows the SAn client via SSAn-Uu interface to create, update the spatial anchor at a given SAn server.

5.2.1.2 Service Operations

5.2.1.2.1 Introduction

The service operation defined for SS_SAnManagement API is shown in the table 5.2.1.2.1-1.

Table 5.2.1.2.1-1: Operations of the SS_SAnManagement API

Service operation name	Description	Initiated by
SS_SAnManagement_Create	This service operation is used by the SAn client to create the spatial anchor on SAn server.	SAn client, VAL Server
SS_SAnManagement_Update	This service operation is used by the SAn client to update the spatial anchor on SAn server.	SAn client
SS_SAnManagement_Delete	This service operation is used by the SAn client to delete the spatial anchor resource on SAn server.	SAn client
SS_SAnManagement_Subscribe	This service operation is used by the SAn client to subscribe for the spatial anchor related notifications on SAn server.	SAn client
SS_SAnManagement_UpdateSubscription	This service operation is used by the SAn client to update a subscription for the spatial anchor related notifications on SAn server.	SAn client
SS_SAnManagement_Unsubscribe	This service operation is used by the SAn client to unsubscribe for the spatial anchor related notifications on SAn server.	SAn client
SS_SAnManagement_Retrieve	This service operation is used by SAn client to retrieve to spatial anchor information from the SAn server.	SAn client
SS_SAnManagement_Notify	This service operation is used by the spatial anchor server to notify the spatial anchor(s) related notifications to the spatial anchor client.	SAn server
SS_SAnUsage_Report	This service operation is used by SAn client to report the spatial anchor usage to the SAn server.	SAn client

5.2.1.2.2 SS_SAnManagement_Create

5.2.1.2.2.1 General

This service operation is used by SAn client to create the spatial anchor at a given SAn server.

5.2.1.2.2.2 SAn client creating spatial anchor on SAn server

Upon receiving the request from the VAL client for the creation of spatial anchor(s), the SAn client shall send an HTTP POST request to the SAn server on the resource URI identifying the "Spatial Anchors Lists" collection resource as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.2. The body of the HTTP POST request shall include the "SpatialAnchorsList" data structure as specified in 3GPP TS 29.437 [6] in clause 6.1.1.6.2.2.

Upon reception of the HTTP POST message from the SAn client, the SAn server shall:

a) process the spatial anchor create request;

b) verifiy and check if the SAn client is authorized to create the spatial anchor; and

c) if the requestor is authorized, shall perform the creation of the spatial anchor(s). If the create operation:

1) is successful, then the SAn server shall further generate a globally unique spatial anchor identifier for each of the newly created spatial anchor. The SAn server shall send the POST response with HTTP "201 Created" status code and the POST response body including the "SpatialAnchorsList" data structure, which includes the spatial anchor identifier(s) of newly created spatial anchor(s); and

NOTE: Associating the spatial anchor identifier with the VAL service information and requestor identifier is up to implementation.

2) fails, then the SAn server shall send the POST response set with the appropriate HTTP status code indicating the "failure" and the data structure as specified in 3GPP TS 29.437 [6] in clause 6.1.1.7.

5.2.1.2.3 SS_SAnManagement_Update

5.2.1.2.3.1 General

This service operation is used by SAn client to update the spatial anchor resource at a given SAn server.

5.2.1.2.3.2 SAn client updating spatial anchor on SAn server

Upon receiving the request from the VAL client to update the spatial anchor resource, the SAn client shall send:

a) an HTTP PATCH request (for partial update) to the SAn server on the resource URI identifying the "Individual Spatial Anchors List" resource with the "SpatialAnchorsListPatch" data structure in the request message as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.3.3.4; or

b) an HTTP PUT request (for full replacement) to the SAn server on the resource URI identifying the "Individual Spatial Anchors List" resource with the "SpatialAnchorsList" data structure in request message as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.3.3.2.

Upon reception of the HTTP PATCH or PUT request from the SAn client, the SAn server shall:

a) validate if the SAn client is authorized to update the spatial anchor; if the SAn client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SAn client is authorized, then SAn server shall check for the spatial anchor resources. If the matching spatial anchor resource is:

1) found, the SAn server shall:

i) update the "valServInfo", "anchors" attribute(s) of the matching spatial anchor resource with the received spatial anchor information for the case of HTTP PATCH request;

ii) replace the matching spatial anchor resource with the received spatial anchor information for the case of HTTP PUT request; and

iii) the SAn server shall send the HTTP "204 No Content" response to the SAn client; or

2) not found, return the HTTP "404 Not Found" response to the SAn client.

5.2.1.2.4 SS_SAnManagement_Delete

5.2.1.2.4.1 General

This service operation is used by SAn client to delete the spatial anchor resource at a given SAn server.

5.2.1.2.4.2 SAn client deleting spatial anchor on SAn server

Upon receiving the request from the VAL client to delete the spatial anchor resource, the SAn client shall send an HTTP DELETE request to the SAn server on the resource URI identifying the "Individual Spatial Anchors List" resource as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.3.3.

Upon reception of the HTTP DELETE request from the SAn client, the SAn server shall:

a) validate if the SAn client is authorized to delete the spatial anchor; if the SAn client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SAn client is authorized, then SAn server shall check for the spatial anchor resources. If the matching spatial anchor resource is:

   1) not found, return "404 Not Found" response to the SAn client; or

   2) found, delete the identified spatial anchor resource and shall send the HTTP "204 No Content" response to the SAn client.

5.2.1.2.5 SS_SAnManagement_Subscribe

5.2.1.2.5.1 General

This service operation is used by SAn client to subscribe with the SAn server to receive notifications related to spatial anchors.

5.2.1.2.5.2 SAn client subscribe for spatial anchor related notifications on SAn server

Upon receiving the request from the VAL client to subscribe for the spatial anchors related notifications, the SAn client shall send an HTTP POST message to the SAn server on the resource URI identifying the "Spatial Anchors Subscriptions" resource as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.4. The body of the HTTP POST request shall include the "SpatialAnchorsSub" data structure as specified in 3GPP TS 29.437 [6] in clause 6.1.1.6.2.11.

Upon reception of the HTTP POST request from the SAn client, the SAn server shall:

a) validate if the SAn client is authorized to subscribe for the spatial anchors related notifications; if the SAn client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SAn client is authorized, then the SAn server shall create the subscription. If the creation of the subscription by the SAn server:

   1) is successful, then the SAn server shall further generate a globally unique spatial anchor subscription identifier for the newly created subscription. The SAn server shall send the POST response with HTTP "201 Created" status code and the POST response body including the "SpatialAnchorsSub" data structure as described in 3GPP TS 29.437 [6] in clause 6.1.1.6.2.11, which includes the subscription identifier(s) of newly created subscription; or

   2) fails, then the SAn server shall send the POST response set with the appropriate HTTP status code indicating the "failure" and the data structure as specified in 3GPP TS 29.437 [6] in clause 6.1.1.7.

5.2.1.2.6 SS_SAnManagement_UpdateSubscription

5.2.1.2.6.1 General

This service operation is used by SAn client to update a subscription with the SAn server to receive notifications related to spatial anchors.

5.2.1.2.6.2 SAn client update subscription for spatial anchor related notifications on SAn server

Upon receiving the request from the VAL client to update the subscription for the spatial anchors related notifications, the SAn client shall send an HTTP PATCH request (for partial update) or HTTP PUT request (for full replacement) to the SAn server on the resource URI identifying the "Individual Spatial Anchors Subscriptions" resource with the data structure "SpatialAnchorsSubPatch" in the request as specified in 3GPP TS 29 437 [6] in clause 6.1.1.3.5.3.4 with the data structure for an HTTP PATCH request and the "Individual Spatial Anchors Subscriptions" resource with the data structure "SpatialAnchorsSub" in the request as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.5.3.2 for an HTTP PUT request.

Upon reception of the HTTP PATCH or PUT request from the SAn client, the SAn server shall:

a) validate if the SAn client is authorized to update the subscription resource for spatial anchor related notifications; if the SAn client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SAn client is authorized, then SAn server shall check for the subscription resource. If the matching subscription resource is:

   1) found, the SAn server shall:

      i) update the matching subscription resource in accordance with the spatial anchor subscription update information received within the HTTP PATCH or PUT request; and

      ii) send the HTTP "204 No Content" response to the SAn client; or

   2) not found, return the HTTP "404 Not Found" response to the SAn client.

5.2.1.2.7 SS_SAnManagement_Unsubscribe

5.2.1.2.7.1 General

This service operation is used by SAn client to unsubscribe with the SAn server to receive notifications related to spatial anchors.

5.2.1.2.7.2 SAn client unsubscribe for spatial anchor related notifications on SAn server

Upon receiving the request from the VAL client to unsubscribe for the spatial anchors related notifications the SAn client shall send an HTTP DELETE request to the SAn server on the resource URI identifying the "Individual Spatial Anchors Subscriptions" resource as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.4.

Upon reception of the HTTP DELETE request from the SAn client, the SAn server shall:

a) validate if the SAn client is authorized to unsubscribe for the spatial anchor related notifications; if the SAn client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SAn client is authorized, then SAn server shall check for the subscription resource. If the matching subscription is:

   1) not found, return "404 Not Found" response to the SAn client; or

   2) found, unsubscribe the identified spatial anchor subscription and shall send the HTTP "204 No Content" response to the SAn client.

5.2.1.2.8 SS_SAnManagement_Notify

5.2.1.2.8.1 General

This service operation is used by the spatial anchor server to notify the spatial anchor(s) related notifications to the spatial anchor client.

5.2.1.2.8.2 SAn server notifying the spatial anchor notification to SAn client

The SAn server shall send an HTTP POST request to the SAn client with the request URI set to the "{notifUri}" URI as specified in 3GPP TS 29.437 [6] in clause 6.1.1.5.2.2. The body of the HTTP POST request shall include the "SpatialAnchorsNotif" data structure as specified in 3GPP TS 29.437 [6] clause 6.1.1.5.2.3.1.

Upon reception of the HTTP POST request from the SAn server, the SAn client shall:

a) validate if there is an active spatial anchor subscription with SAn server; in case of none the HTTP "406 Not Acceptable" response is sent;

b) process the "SpatialAnchorsNotif" data structure as specified in 3GPP TS 29.437 [6] clause 6.1.1.6.2.13 shared in the POST request body and send the HTTP "204 No Content" response to the SAn server; and

c) notify the data spatial anchor notification to the VAL client.

5.2.1.2.9 SS_SAnManagement_Retrieve

5.2.1.2.9.1 General

This service operation is used by SAn client to retrieve to spatial anchor information from the SAn server.

5.2.1.2.9.2 SAn client retrieving the spatial anchor information from SAn server

Upon receiving the request from the VAL client to retrieve the spatial anchor information, the SAn client shall send an HTTP GET request to the SAn server on the resource URI identifying the "Individual Spatial Anchor" resource as specified in 3GPP TS 29.437 [6] in clause 6.1.1.3.3.3.1.

Upon reception of the HTTP GET request from the SAn client, the SAn server shall validate if the SAn client is authorized to retrieve the spatial anchor information. If the SAn client is:

a) unauthorized, the HTTP "403 Forbidden" response is sent; or

b) authorized, then SAn server shall check for the spatial anchor resource. If the matching spatial anchor resource is:

   1) not found, return "404 Not Found" response to the SAn client; or

   2) found, return HTTP "200 OK" response to the SAn client, with the identified spatial anchor resource set to the response body as specified in 3GPP TS 29.437 [6] clause 6.1.1.3.3.3.1.

5.2.1.2.10 SS_SAnUsage_Report

5.2.1.2.10.1 General

This service operation is used by SAn client to report the spatial anchor usage to the SAn server.

5.2.1.2.10.2 SAn client reporting the spatial anchor usage information to SAn server

Upon receiving the request from the VAL client to share the spatial anchor usage information, the SAn client shall send an HTTP POST request to the SAn server on the custom resource URI as specified in 3GPP TS 29 437 [6] clause "6.1.3.4.1", with the data structure "SpatialAnchorUsageReportReq" in the request body as specified in 3GPP TS 29 437 [6] in clause 6.1.3.6.2.10.

Upon reception of the HTTP POST request from the SAn client, the SAn server shall validate if the SAn client is authorized to share the spatial anchor usage information. If the SAn client is:

a) unauthorized, the HTTP "403 Forbidden" response is sent; or

b) authorized, then SAn server shall:

   1) check for the spatial anchors matching the spatial anchor identities provided in the "SpatialAnchorUsageReportReq" and update their usage information; and