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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:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

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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

Editor's Note: This clause will provide description of digital asset, spatial anchor, and spatial map server- SEAL services from stage 3 perspective.

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 [2] 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 6.1.1.3.3.3.3.

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

   2) send the HTTP "204 No Content" response to the SAn client.

NOTE: It is left to the SAn server implementation to trigger the SAn usage notification immediately or defer for an interval.

5.2.2 SS_SAnDiscovery Service

5.2.2.1 Service Description

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

5.2.2.2 Service Operations

5.2.2.2.1 Introduction

The service operation defined for SS_SAnDiscovery API is shown in the table 5.2.2.2.1-1.

Table 5.2.2.2.1-1: Operations of the SS_SAnDiscovery API

Service operation name	Description	Initiated by
SS_SAnDiscovery_Request	This service operation is used by the SAn client to discover the spatial anchors on SAn server.	SAn client

5.2.2.2.2 SS_SAnDiscovery_Request

5.2.2.2.2.1 General

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

5.2.2.2.2.2 SAn client discovering spatial anchors on SAn server

Upon receiving the request from the VAL client to discover the spatial anchors, the SAn client shall send an HTTP POST request (custom operation) to the SAn server on the resource URI identifying the spatial anchors collection resource as specified in 3GPP TS 29 437 [6] clause 6.1.2.3.2.2 and the request query parameters (e.g., anchor identity, service identity, area of interest) as specified in 3GPP TS 29 437 [6] clause 6.1.2.3.2.3.1.

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

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

b) if the SAn client is authorized, identify the spatial anchors:

   1) that are authorized to be accessed by the SAn client; and

   2) matching the given request query parameters(e.g., anchor identity, service identity, area of interest). If the area of interest is not provided by the SAn client, the SAn server may decide to fetch current location of the SAn client from NEF as described in 3GPP TS 29.522 [4] or by invoking the SEAL Location Management service as described in 3GPP TS 24.545 [5]; and

NOTE: How the SAn server identifies the spatial anchor(s) based on the provided discovery filters and the VAL UE location of the SAn client is implementation specific.

c) if the matching spatial anchor resources are:

   1) found, send the HTTP "200 OK" response with the spatial anchor list in response body as specified in 3GPP TS 29.437 [6] in the clause 6.1.2.6.2.2 to the SAn client; or

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

Upon receiving an HTTP "200 OK" response, the SAn client shall parse the spatial anchor list received in response body and notify the VAL client.

5.3 Spatial Map Services

5.3.1 SS_SmManagement Service

5.3.1.1 Service Description

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

5.3.1.2 Service Operations

5.3.1.2.1 Introduction

The service operation defined for SS_SmManagement API is shown in the table 5.3.1.2.1-1.

Table 5.3.1.2.1-1: Operations of the SS_SmManagement API

Service operation name	Description	Initiated by
SS_SmManagement_Create	This service operation is used by the SM client to create the spatial map on SM server.	SM client, VAL Server
SS_SmManagement_Update	This service operation is used by the SM client to update the spatial map on SM server.	SM client
SS_SmManagement_Delete	This service operation is used by the SM client to delete the spatial map on SM server.	SM client
SS_SmManagement_Subscribe	This service operation is used by SM client to subscribe with the SM server to receive notifications related to spatial maps.	SM client
SS_SmManagement_UpdateSubscription	This service operation is used by SM client to update a subscription with the SM server to receive notifications related to spatial maps.	SM client
SS_SmManagement_Unsubscribe	This service operation is used by SM client to unsubscribe with the SM server to receive notifications related to spatial maps.	SM client
SS_SmManagement_Get	This service operation is used by SM client to retrieve to spatial map information from the SM server.	SM client
SS_SmManagement_Notify	This service operation is used by the spatial map server to notify the spatial map(s) related notifications to the spatial map client.	SM server
SS_SmLocalization_Request	This service operation is used by SM client to retrieve the localized information from the SM server.	SM client

5.3.1.2.2 SS_SmManagement_Create

5.3.1.2.2.1 General

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

5.3.1.2.2.2 SM client creating spatial map on SM server using SS_SmManagement_Create operation

Upon receiving the request from the VAL client for the creation of spatial map, the SM client shall send an HTTP POST request to the SM server on the resource URI identifying the "Spatial Maps" collection resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.2.2. The body of the HTTP POST message shall include the "SpatialMapCreateReq" data structure as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.2.3.1.

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

a) process the spatial map create request;

b) the SM server verifies and checks if the SM client is authorized to create the spatial map; and

c) if the requestor is authorized, the SM server shall perform the creation of the spatial map. If the create operation:

   1) is successful, then the SM server shall further generate a globally unique spatial map identifier for the newly created spatial map and the layer identifier for the corresponding layers of the map. The SM server shall send the POST response with HTTP "201 Created" status code and the POST response body including the "SpatialMap" data structure as specified in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.5, which includes the spatial map information of newly created spatial map;

NOTE: Associating the spatial map identifier and its associated layer identifiers with the VAL service information and the requestor identifier is up to implementation.

   2) is in progress, then the SM server shall further generate a globally unique spatial map identifier for the newly created spatial map and shall send the map identifier in the POST response with HTTP "202 Accepted" status code and the POST response body including the "SpatialMapTempResp" data structure as specified in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.21. When the request is processed the SM server shall send a notification to the SM client as specified in 3GPP TS 29.437 [6] in clause 5.3.1.2.7.2; and

3) fails, then the SM 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 6.2.1.7.

5.3.1.2.3 SS_SmManagement_Update

5.3.1.2.3.1 General

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

5.3.1.2.3.2 SM client updating spatial map on SM server

Upon receiving the request from the VAL client to update the spatial map resource, the SM client shall:

a) send an HTTP PATCH request (for partial update) to the SM server on the resource URI identifying the "Individual Spatial Map" resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.3.2 with the "SpatialMapPatch" data structure in the request message as specified in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.11; or

b) HTTP PUT request (for full replacement) to the SM server on the resource URI identifying the "Individual Spatial Map" resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.3.2 with the "SpatialMap" data structure in the request message as specified in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.5.

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

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

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

   1) found, the SM server shall:

      i) update the attributes of the matching spatial map resource with the received "SpatialMapPatch" information in the request body for the case of HTTP PATCH request;

      ii) replace the matching spatial map resource with the received "SpatialMap" information in the request body for the case of HTTP PUT request; and

      iii) if the update operation:

         A) is successful, then the SM server shall send the HTTP "204 No Content" response to the SM client; and

         B) is in progress, then the SM server shall send the HTTP "202 Accepted" response to the SM client. When the request is processed the SM server shall send a notification to the SM client as described in 3GPP TS 29.437 [6] in clause 5.3.1.2.7; and

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

5.3.1.2.4 SS_SmManagement_Delete

5.3.1.2.4.1 General

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

5.3.1.2.4.2 SM client deleting spatial map on SM server

Upon receiving the request from the VAL client to delete the spatial map resource, the SM client shall send an HTTP DELETE request to the SM server on the resource URI identifying the "Individual Spatial Map" resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.3.2.

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

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

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

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

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

5.3.1.2.5 SS_SmManagement_Retrieve

5.3.1.2.5.1 General

This service operation is used by SM client to retrieve to spatial map information from the SM server.

5.3.1.2.5.2 SM client retrieving the spatial map information from SM server

Upon receiving the request from the VAL client to retrieve the spatial map information, the SM client shall send an HTTP GET request to the SM server on the resource URI identifying the "Individual Spatial Map" resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.2.3.2.

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

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

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

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

   2) found, return HTTP "200 OK" response to the SM client, with the identified spatial map resource set to the response body as specified in 3GPP TS 29.437 [6] clause 6.2.1.3.2.3.2.

5.3.1.2.6 SS_SmManagement_Subscribe

5.3.1.2.6.1 General

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

5.3.1.2.6.2 SM client subscribe for spatial map related notifications on SM server

Upon receiving the request from the VAL client to subscribe for the spatial maps related notifications, the SM client shall send an HTTP POST message to the SM server on the resource URI identifying the "Spatial Maps Subscriptions" resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.4. The body of the HTTP POST request shall include the "SpatialMapsSub" data structure as specified in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.13.

Upon reception of the HTTP POST request from the SM client, the SM server shall validate if the SM client is authorized to subscribe for the spatial maps related subscription. If the SM client is:

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

b) authorized, then the SM server shall create the subscription. If the creation of the subscription by the SM server:

   1) is successful, then the SM server shall further generate a unique spatial map subscription identifier for the newly created subscription. The SM server shall send the POST response with HTTP "201 Created" status code and the POST response body including the "SpatialMapsSub" data structure as described in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.13, which also includes the HTTP location header with the URI of the of newly created subscription resource; or

2) fails, then the SM 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 6.2.1.7.

5.3.1.2.7 SS_SmManagement_UpdateSubscription

5.3.1.2.7.1 General

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

5.3.1.2.7.2 SM client update subscription for spatial map related notifications on SM server

Upon receiving the request from the VAL client to update the subscription for the spatial maps related notifications, the SM client shall send an HTTP PATCH request (for partial update) or HTTP PUT request (for full replacement) to the SM server on the resource URI identifying the "Individual Spatial Maps Subscriptions" resource with the data structure "SpatialMapsSubPatch" in the request as specified in 3GPP TS 29 437 [6] in clause 6.2.1.6.2.17 with the data structure for an HTTP PATCH request and the "Individual Spatial Maps Subscriptions" resource with the data structure "SpatialMapsSub" in the request as specified in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.13 for an HTTP PUT request.

Upon reception of the HTTP PATCH or PUT request from the SM client, the SM server shall validate if the SM client is authorized to update the subscription resource for spatial map related notifications. If the SM client is:

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

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

   1) found, the SM server shall:

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

      ii) send the HTTP "200 OK" response with the response body including the "SpatialMapsSub" data structure as described in 3GPP TS 29.437 [6] in clause 6.2.1.6.2.13 to the SM client; or

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

5.3.1.2.8 SS_SmManagement_Unsubscribe

5.3.1.2.8.1 General

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

5.3.1.2.8.2 SM client unsubscribe for spatial map related notifications on SM server

Upon receiving the request from the VAL client to unsubscribe for the spatial maps related notifications, the SM client shall send an HTTP DELETE request to the SM server on the resource URI identifying the "Individual Spatial Maps Subscriptions" resource as specified in 3GPP TS 29.437 [6] in clause 6.2.1.3.4.

Upon reception of the HTTP DELETE request from the SM client, the SM server shall validate if the SM client is authorized to unsubscribe for the spatial map related notifications; if the SM client is:

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

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

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

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

5.3.1.2.9 SS_SmManagement_Notify

5.3.1.2.9.1 General

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

5.3.1.2.9.2 SM server notifying the spatial map notification to SM client

The SM server shall send an HTTP POST request to the SM client with the request URI set to the "{notifUri}" URI as specified in the clause 6.2.1.5.2.2. The body of the HTTP POST request shall include the "SpatialMapsNotif" data structure as specified in the clause 6.2.1.5.2.3.1.

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

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

b) process the "SpatialMapsNotif" data structure as specified in clause 6.2.1.6.2.18 shared in the POST request body and send the HTTP "204 No Content" response to the SM server; and

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

5.3.1.2.10 SS_SmLocalization_Request

5.3.1.2.10.1 General

This service operation is used by SM client to retrieve the localized information of users or UEs from the SM server.

5.3.1.2.10.2 SM client to retrieve the localized information from SM server

Upon receiving the request from the VAL client to retrieve the localized information of list of users or UEs, the SM client shall send an HTTP POST request to the SM server on the resource URI identifying the spatial maps resource as specified in 3GPP TS 29.437 [6] in clause 6.2.3.3, with the request query parameters as specified in 3GPP TS 29 437 [6] in clause 6.2.3.3.2.3.1.

Upon reception of the HTTP POST request from the SM client, the SM server shall validate if the SM client is authorized to retrieve the localized information. If the SM client is:

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

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

   1) found, the SM server shall:

      i) check for the area of interest or target identities attributes in the request are:

         A) provided, then identify those localized users or UE(s) in the requested spatial map matching the area of interest or target identities or both; or

         B) not provided; then identify the localized users or UE(s) in the requested spatial map according to the area associated with spatial map identifier; and

      ii) send the HTTP "200 OK" response with the response body including the identified localized users or UE(s) encoded as per "SpatialMapLocalizeResp" data structure as described in 3GPP TS 29.437 [6] in clause 6.2.3.6.2.2 to the SM client; or

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

5.3.2 SS_SmDiscovery Service

5.3.2.1 Service Description

The SS_SmDiscovery API, as defined in 3GPP TS 23.437 [2], allows the SM client via SM-Uu interface to discover the spatial map at a given SM server.

5.3.2.2 Service Operations

5.3.2.2.1 Introduction

The service operation defined for SS_SmDiscovery API is shown in the table 5.3.2.2.1-1.

Table 5.3.2.2.1-1: Operations of the SS_SmDiscovery API

Service operation name	Description	Initiated by
SS_SmDiscovery_Request	This service operation is used by the SM client to discover the spatial map on SM server.	SM client

5.3.2.2.2 SS_SmDiscovery_Request

5.3.2.2.2.1 General

This service operation is used by SM client to discover the spatial maps at a given SM server.

5.3.2.2.2.2 SM client discovering spatial map on SM server

Upon receiving the request from the VAL client to discover the spatial maps, the SM client shall send an HTTP POST (custom operation) request to the SM server on the resource URI identifying the spatial map resource as specified in 3GPP TS 29.437 [6] in clause 6.2.2.3.2.2 and the request query parameters as specified in 3GPP TS 29.437 [6] in clause 6.2.2.3.2.3.1.

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

a) validate if the SM client is authorized to perform the spatial map discovery; if the SM client is unauthorized, the HTTP "403 Forbidden" response is sent;

b) if the SM client is authorized, identify the spatial maps that are authorized to be accessed by the SM client and matching the given application service identity and spatial map filters (e.g., area of interest, location information); and

NOTE: How the SM server identifies the spatial map(s) based on the provided map discovery filters and the VAL UE location of the SM client is implementation specific.

c) if the matching spatial map resources are:

   1) found, send the HTTP "200 OK" response with the "SpatialMapDiscResp" in response body as specified in the clause 6.2.2.6.2.3 to the SM client; or

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

Upon receiving an HTTP "200 OK" response, the SM client shall parse the spatial map ID list received in response body and notify the VAL client.

5.3.3 SS_SmDataSourceRegistration Service

5.3.3.1 Service Description

The SS_SmDataSourceRegistration API, as defined in 3GPP TS 23.437 [2], allows the SM client via SM-Uu interface to register, deregister at a given SM server.

5.3.3.2 Service Operations

5.3.3.2.1 Introduction

The service operation defined for SS_SmDataSourceRegistration API is shown in the table 5.3.3.2.1-1.

Table 5.3.3.2.1-1: Operations of the SS_SmDataSourceRegistration API

Service operation name	Description	Initiated by
SS_SmDataSourceRegistration_Request	This service operation is used by the SM client to register as the data source on SM server.	SM client

5.3.3.2.2 SS_SmDataSourceRegistration_Request

5.3.3.2.2.1 General

This service operation is used by SM client to register as the data source at a given SM server.

5.3.3.2.2.2 SM client registering as data source on SM server

The SM client shall send an HTTP POST request to the SM server on the resource URI identifying the "datasources-reg-lists " collection resource as specified in clause 6.2.1.3.2.2. The body of the HTTP POST request shall include the "DataSourceRegReq" data structure as specified in clause 6.2.1.3.2.3.1.

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

a) validate if the SM client is authorized to perform the data source registration; if the SM client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SM client is authorized, shall perform the data source registration. If the registration request operation:

   1) is successful, shall further generate a unique data source registration identifier for the newly registered data source and send the HTTP "201 Created" response with the response body including the "DataSourceRegReq" data structure as specified in the clause 6.2.1.6.2.2; or

   2) fails, shall send the POST response set with the appropriate HTTP status code indicating the "failure" and the data structure as described in the clause 6.2.1.7.

5.3.3.2.3 SS_SmDataSourceRegistration_Update

5.3.3.2.3.1 General

This service operation is used by SM client to update the data source registration at a given SM server.

5.3.3.2.3.2 SM client updating the data source registration on SM server

The SM client shall send an HTTP PATCH request (for partial update) or HTTP PUT request (for full replacement) to the SM server on the resource URI identifying the "Individual data source registration" resource as specified in clause 6.2.1.4.2. The body of the HTTP PUT shall include the "DataSourceRegReq" data structure as specified in clause 6.2.1.6.2.2 or the HTTP PATCH request shall include the "DataSourcePatchRegReq" data structure as specified in clause 6.2.1.6.2.3.

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

a) validate if the SM client is authorized to perform the data source registration update; if the SM client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SM client is authorized, shall check for the data source registration resource. If the matching data source registration resource is:

   1) found, the SM server shall:

i) update the SM data source profile attribute(s) of the matching data source registration resource with the received SM data source profile attribute(s) information for the case of HTTP PATCH request;

ii) replace the SM data source profile of the matching data source registration resource with the received SM data source profile information for the case of HTTP PUT request; and

iii) the SM server shall send the HTTP "200 OK" response with the response body including the "DataSourceRegReq" data structure as specified in the clause 6.2.1.6.2.2; or

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

5.3.3.2.4 SS_SmDataSourceRegistration_Deregister

5.3.3.2.4.1 General

This service operation is used by SM client to deregister its existing data source registration at a given SM server.

5.3.3.2.4.2 SM client deregistering the data source registration on SM server

The SM client shall send an HTTP DELETE request to the SM server on the resource URI identifying the "Individual data source registration" collection resource as specified in clause 6.2.1.4.2.

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

a) validate if the SM client is authorized to perform the data source deregistration; if the SM client is unauthorized, the HTTP "403 Forbidden" response is sent; or

b) if the SM client is authorized, shall check for the registration resource. If the matching registration is:

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

2) found, deregister the identified spatial map data source registration and return the HTTP "204 No Content" response to the SM client.

5.3.3.2.5 SS_SmDataSourceDiscovery_Notify

5.3.3.2.5.1 General

This service operation is used by SM server to share data source notification to SM client.

5.3.3.2.5.2 SM server sharing the data source notification to SM client

The SM server shall send an HTTP POST request to the SM client with the request URI set to the "{notificationDestination}" URI as specified in the clause 6.2.1.5.2.2. The body of the HTTP POST request shall include the "DataSourceNotification" data structure as specified in the clause 6.2.1.5.2.3.1.

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

a) validate if there is an active data source registration with SM server; in case of none the HTTP "406 Not Acceptable" response is sent;

b) process the "DataSourceNotification" data structure as specified in clause 6.2.1.6.2.x shared in the POST request body and send the HTTP "204 No Content" response to the SM server; and

c) notify the data source notification to the VAL client.

5.4 Digital Asset Services

5.4.1 SS_DADiscovery Service

5.4.1.1 Service Description

The SS_DADiscovery API, as defined in 3GPP TS 23.438 [3], allows the DA client via DA-Uu interface to discover the digital asset at a given DA server.

5.4.1.2 Service Operations

5.4.1.2.1 Introduction

The service operation defined for SS_DADiscovery API is shown in the table 5.4.1.2.1-1.

Table 5.4.1.2.1-1: Operations of the SS_DADiscovery API

Service operation name	Description	Initiated by
SS_DADiscovery_Request	This service operation is used by the DA client to discover the digital asset(s) at the DA server.	DA client

5.4.1.2.2 SS_DADiscovery_Request

5.4.1.2.2.1 General

This service operation is used by DA client to discover the digital asset(s) at a given DA server.

5.4.1.2.2.2 DA client discovering digital assets on DA server

Upon receiving the request from the VAL client to discover the digital asset(s), the DA client shall send an HTTP POST request (custom operation) to the DA server.

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

a) validate if the DA client is authorized to perform the digital asset discovery; if the DA client is unauthorized, the HTTP "403 Forbidden" response is sent;

b) if the DA client is authorized, identify the digital asset(s):

   1) that are authorized to be accessed by the DA client; and

   2) matching the given discovery filters like Digital asset identifier, Digital asset name, Digital asset description, location, VAL client type, Digital asset type, Digital asset owner, Allowed user, Digital asset profile, etc. as described in the clause "TBD"; and

NOTE: How the DA server identifies the digital asset(s) based on the provided discovery filters is implementation specific.

c) if the matching digital asset(s) resources are:

   1) found, send the HTTP "200 OK" response with the digital asset list in response body as described in the clause "TBD" to the DA client; or

   2) not found, return HTTP "200 OK" response with an indication that no digital asset is found in the response body in the clause "TBD" to the DA client.

Upon receiving an HTTP "200 OK" response, the DA client shall parse the digital asset list received in response body and notify the VAL client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.2 SS_DAProfileManagement Service

5.4.2.1 Service Description

The SS_DAProfileManagement API, as defined in 3GPP TS 23.438 [3], allows the DA client via DA-Uu interface to create, update, or delete a digital asset(s) at the DA server.

5.4.2.2 Service Operations

5.4.2.2.1 Introduction

The service operation defined for SS_DAProfileManagement API is shown in the table 5.4.2.2.1-1.

Table 5.4.2.2.1-1: Operations of the SS_DAProfileManagement API

Service operation name	Description	Initiated by
SS_DAProfileManagement_Create	This service operation is used by the DA client to create the digital asset at a DA server.	DA client
SS_DAProfileManagement_Update	This service operation is used by the DA client to update the digital asset at a DA server.	DA client
SS_DAProfileManagement_Delete	This service operation is used by the DA client to delete the digital asset at a DA server.	DA client

5.4.2.2.2 SS_DAProfileManagement_Create

5.4.2.2.2.1 General

This service operation is used by DA client to create the digital asset on a given DA server.

5.4.2.2.2.2 DA client creating DA profile on DA server

Upon receiving the request from the VAL client for the creation of digital asset, the DA client shall send an HTTP POST request to the DA server on the resource URI identifying the "Digital Asset Lists" resource collection as specified in clause "TBD". The body of the HTTP POST request shall include the data structure as specified in clause "TBD".

Upon reception of the HTTP POST request for creation of DA profile from the DA client, the DA server shall perform the creation of the digital asset profile, if the requestor is authorized. If the create operation:

1) is successful, then the DA server shall further generate a globally unique digital asset identifier for the newly created digital asset. The DA server shall send the POST response with HTTP "200 OK" status code and the POST response body including the data structure as described in the clause "TBD", which includes the digital asset identifier of newly created digital asset; or

2) failed, then the POST response is sent to the DA client with the appropriate HTTP status code indicating the "failure" and the data structure as described in the clause "TBD".

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.2.2.3 SS_DAProfileManagement_Update

5.4.2.2.3.1 General

This service operation is used by DA client to update the digital asset on a given DA server.

5.4.2.2.3.2 DA client updating digital asset on DA server

Upon receiving the request from the VAL client to update the digital asset resource, the DA client shall send an HTTP PATCH request (for partial update) or HTTP PUT request (for full replacement) to the DA server on the resource URI identifying the digital asset resource with the digital asset information in request message as specified in clause "TBD".

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

a) validate if the DA client is authorized to update the digital asset. If the DA client is unauthorized, the HTTP "403 Forbidden" response is sent to the DA client; or

b) if the DA client is authorized, check for the digital asset resource and if the matching digital asset resource is:

   1) found then update the matching digital asset resource according to the received data for the case of HTTP PATCH request;

   2) found then replace the matching digital asset resource with the received digital asset information for the case of HTTP PUT request; or

   3) if the DA client is authorized and the matching digital asset resource is not found, then HTTP "404 Not Found" response is sent to the DA client; and

c) if the update operation was successful, then HTTP "204 No Content" response is sent to the DA client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.2.2.4 SS_DAProfileManagement_Delete

5.4.2.2.4.1 General

This service operation is used by DA client to delete the digital asset at a given DA server.

5.4.2.2.4.2 DA client deleting digital asset at DA server

Upon receiving the request from the VAL client to delete the digital asset resource, the DA client shall send an HTTP DELETE request to the DA server on the resource URI identifying the digital asset resource as specified in clause "TBD".

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

a) validate if the DA client is authorized to delete the digital asset and if the DA client is unauthorized, the HTTP "403 Forbidden" response is sent to the DA client; or

b) if the DA client is authorized, then DA server shall check for the digital asset resources. If the digital asset resource is:

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

   2) found, delete the identified digital asset resource and shall send the HTTP "204 No Content" response to the DA client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.2.2.5 SS_DAProfileManagement_Retrieve

5.4.2.2.5.1 General

This service operation is used by DA client to retrieve the digital asset from a given DA server.

5.4.2.2.5.2 DA client retrieving digital asset on DA server

Upon receiving the request from the VAL client for the retrieval of the digital asset, the DA client shall send an HTTP POST request to the DA server on the resource URI identifying the "Digital Asset Lists" resource collection as specified in clause "TBD". The body of the HTTP POST request shall include the data structure as specified in clause "TBD".

Upon reception of the HTTP POST request from the DA client, the DA server shall validate if the DA client is authorized to retrieve the digital asset. If the DA client is:

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

b) authorized, check for the digital asset profile and if the matching digital asset profile is:

1) found, then send the POST response with HTTP "200 OK" status code and the POST response body including the retrieved digital asset profile to the DA client; or

2) not found, then POST response with HTTP "204 No Content" status code is sent to the DA client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.3 SS_DAMediaManagement Service

5.4.3.1 Service Description

The SS_DAMediaManagement API, as defined in 3GPP TS 23.438 [3], allows the DA client via DA-Uu interface to manage the media information related to digital asset profile.

5.4.3.2 Service Operations

5.4.3.2.1 Introduction

The service operation defined for SS_DAMediaManagement API is shown in the table 5.4.3.2.1-1.

Table 5.4.3.2.1-1: Operations of the SS_DAMediaManagement API

Service operation name	Description	Initiated by
SS_DAMediaManagement_Upload	This service operation is used by the DA client to upload digital asset media information of a spatial map profile to the DA server.	DA client
SS_DAMediaManagement_Download	This service operation is used by the DA client to download digital asset media information of a spatial map profile from the DA server.	DA client
SS_DAMediaManagement_Update	This service operation is used by the DA client to update digital asset media information of a spatial map profile at the DA server.	DA client
SS_DAMediaManagement_Delete	This service operation is used by the DA client to delete digital asset media information of a spatial map profile at the DA server.	DA client

5.4.3.2.2 SS_DAMediaManagement_Upload

5.4.3.2.2.1 General

This service operation is used by DA client to upload digital asset media request to the DA server.

5.4.3.2.2.2 DA client uploading digital asset media request at DA server using SS_DAMediaManagement_Upload operation

Upon receiving the request from the VAL client for the uploading of digital asset media information, the DA client shall send an HTTP POST request to the DA server on the resource URI identifying the "Digital Asset Media Lists" collection resource as specified in clause "TBD". The body of the HTTP POST request shall include the data structure as specified in clause "TBD".

Upon reception of the HTTP POST request for upload, the DA server shall store the digital asset media information and generate a globally unique digital asset media identifier for the newly uploaded digital asset media information, if the DA client is authorized. If the digital asset media upload operation:

1) is successful, the DA server shall send the POST response with HTTP "200 OK" status code and the POST response body including the data structure as described in the clause "TBD", which includes the digital asset media information identifier of newly uploaded digital asset media information; or

2) failed, then the POST response is sent to the DA client with the appropriate HTTP status code indicating the "failure" and the data structure as described in the clause "TBD".

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.3.2.3 DA client downloading digital asset media request at DA server using SS_DAMediaManagement_Download operation

Upon receiving the request from the VAL client for the downloading of digital asset media information, the DA client shall send an HTTP POST request to the DA server on the resource URI identifying the "Individual Digital Asset Media" resource as specified in clause "TBD". The body of the HTTP POST request shall include the data structure as specified in clause "TBD".

Upon reception of the HTTP POST request, the DA server shall perform the downloading of the stored digital asset media information of the spatial map profile as per the sent digital asset media identifier, if the DA client is authorized. If the digital asset media download operation:

Upon reception of the HTTP POST request from the DA client, the DA server shall validate if the DA client is authorized to download the digital asset media information. If the DA client is:

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

b) authorized, check for the digital asset media information resource and if the matching digital asset media information resource has:

   1) found, then return HTTP "200 OK" response to the DA client, with identified digital asset media information set to the response body as specified in clause "TBD"; or

   2) not found, then HTTP "404 Not Found" response is sent to the DA client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.3.2.4 SS_DAMediaManagement_Update

5.4.3.2.4.1 General

This service operation is used by DA client to update digital asset media information at the DA server.

5.4.3.2.4.2 DA client Update digital asset media request at DA server using SS_DAMediaManagement_Update operation

Upon receiving the request from the VAL client to update the digital asset media information resource, the DA client shall send an HTTP PATCH request (for partial update) or HTTP PUT request (for full replacement) to the DA server on the resource URI identifying the "Digital Asset Media List" resource as specified in clause "TBD".

Upon reception of the HTTP PATCH or PUT request from the DA client, the DA server shall validate if the DA client is authorized to update the digital asset media information and:

a) if the DA client is unauthorized, HTTP "403 Forbidden" response is sent to the DA client;

b) if the DA client is authorized, check for the digital asset media information resource and if the matching digital asset media information resource is:

   1) found then update the matching digital asset media information resource according to the received data for the case of HTTP PATCH request;

   2) found then replace the matching digital asset media information resource with the received digital asset information for the case of HTTP PUT request; or

   3) if the matching digital asset media information resource is not found, then HTTP "404 Not Found" response is sent to the DA client; and

c) if the update operation was successful, then HTTP "204 No Content" response is sent to the DA client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

5.4.3.2.5 SS_DAMediaManagement_Delete

5.4.3.2.5.1 General

This service operation is used by DA client to delete digital asset media information at the DA server.

5.4.3.2.5.2 DA client Delete digital asset media request at DA server using SS_DAMediaManagement_Delete operation

Upon receiving the request from the VAL client to delete the digital asset media information resource, the DA client shall send an HTTP DELETE request to the DA server on the resource URI identifying the "Digital Asset Media List" resource collection as specified in clause "TBD".

Upon reception of the HTTP DELETE request from the DA client, the DA server shall validate if the DA client is authorized to delete the digital asset media information and:

a) if the DA client is unauthorized, the HTTP "403 Forbidden" response is sent to the DA client; or

b) if the DA client is authorized, then DA server shall check for the digital asset media information resources. If the digital asset resource is:

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

   2) found, delete the identified digital asset resource and shall send the HTTP "204 No Content" response to the DA client.

Editor's Note: The reference to clauses under "TBD" to be resolved with correct reference number.

6 API Definitions

6.1 Spatial Anchor Server APIs

Editor's Note: This clause will describe the spatial anchor API definitions based on 3GPP TS 23.437 [2].

6.2 Spatial Map Server APIs

6.2.1 SS_SmDataSourceRegistration Service API

6.2.1.1 Introduction

The SS_SmDataSourceRegistration service shall use the SS_SmDataSourceRegistration API.

The API URI of the SS_SmDataSourceRegistration API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 6.5 of 3GPP TS 29.549 [7], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificSuffixes>

with the following components:

- The {apiRoot} shall be set as described in clause 6.5 of 3GPP TS 29.549 [7].
- The <apiName> shall be "<sm_smds>".
- The <apiVersion> shall be "v1".

- The <apiSpecificSuffixes> shall be set as described in clause 6.2.1.3.

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 SM server takes the role of the SCEF and the service consumer takes the role of the SCS/AS.

6.2.1.2 Usage of HTTP and common API related aspects

The provisions of clause 6.3 of 3GPP TS 29.549 [7] shall apply for the SS_SmDataSourceRegistration API.

6.2.1.3 Resources

6.2.1.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.2.1.3.1-1 depicts the resource URIs structure for the SS_SmDataSourceRegistration API.

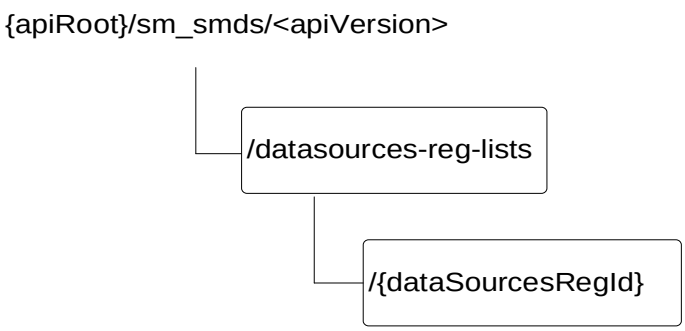

Figure 6.2.1.3.1-1: Resource URI structure of the SS_SmDataSourceRegistration API

Table 6.2.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.2.1.3.1-1: Resources and methods overview

Resource purpose /name	Resource URI (relative path after API URI)	HTTP method or custom operation	Description (service operation)
Spatial Map Data Source Registration Info Lists	/datasources-reg-lists	POST	Register new Data Source.
Individual Spatial Map Data Source Registration Info	/datasources-reg-lists/{dataSourceRegId}	PUT	Replace the existing "Individual Data Source registration".
		PATCH	Partial update the existing "Individual Data Source registration".
		DELETE	Deregister the existing "Individual Data Source registration".

6.2.1.3.2 Resource: Spatial Map Data Source Registration Lists

6.2.1.3.2.1 Description

This resource represents the collection of Spatial Map Data Source Registration List managed by the SM Server.

6.2.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/<sm_smds>/<apiVersion>/datasources-reg-lists**

This resource shall support the resource URI variables defined in table 6.2.1.3.2.2-1.

Table 6. 2.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.2.1

6.2.1.3.2.3 Resource Standard Methods

6.2.1.3.2.3.1 POST

The HTTP POST method allows a service consumer to request the Spatial Map Data Source registration at the SM Server.

This method shall support the URI query parameters specified in table 6.2.1.3.2.3.1-1.

Table 6.2.1.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.2.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.2.3.2.3.1-3.

Table 6.2.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
DataSourceRegReq	M	1	Represents the parameters of the Spatial Map Data Source requested for registration on Spatial Map server.

Table 6.2.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
DataSourceRegReq	M	1	201 Created	Successful case: The Data Source is successfully registered. An HTTP “Location” header contains the URI of the registered resource shall also be included.
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in table 5.2.1.6-1 of 3GPP TS 29.122 [8] also apply.				

Table 6.2.1.3.2.3.1-4: Headers supported by the 201 response code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Represents the URI of the newly registered data source resource, according to the structure: {apiRoot}/<sm_smds>/<apiVersion>/datasources-reg-lists/{dataSourceRegId}

6.2.1.3.2.4 Resource Custom Operations

There are no resource custom operations defined for this resource in this release of the specification.

6.2.1.4 Resource: Individual Spatial Map Data Source registration

6.2.1.4.1 Description

This resource represents a Spatial Map Data Source registration managed by the SM Server.

6.2.1.4.2 Resource Definition

Resource URI: **{apiRoot}/SM_SMm/<apiVersion>/datasources-reg-lists/{dataSourceRegId}**

This resource shall support the resource URI variables defined in table 6.2.1.4.2-1.

Table 6.2.1.4.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1.1.
dataSourceRegId	string	Represents the identifier of the "Individual Spatial Map Data Source registration" resource.

6.2.1.4.3 Resource Standard Methods

6.2.1.4.3.1 PUT

The HTTP PUT method allows a service consumer to request the replacement of an existing "Individual Spatial Map Data Source registration" resource at the SM Server.

This method shall support the URI query parameters specified in the table 6.2.1.4.3.1-1.

Table 6.2.1.4.3.1-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.1.4.3.1-2 and the response data structures and response codes specified in table 6.2.1.4.3.1-3.

Table 6.2.1.4.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
DataSourceRegReq	M	1	Represents the updated representation of the "Individual Spatial Map Data Source registration" resource.

Table 6.2.1.4.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
DataSourceRegReq	M	1	200 OK	Successful case. The "Individual Spatial Map Data Source registration" resource is successfully updated and a representation of the updated resource shall be returned in the response body.
n/a			204 No Content	Successful case. The "Individual Spatial Map Data Source registration" resource is successfully updated and no content is returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative SM Server. Redirection handling is described in clause 5.2.10 of TS 29.122 [8].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative SM Server. Redirection handling is described in clause 5.2.10 of TS 29.122 [8].
NOTE: The mandatory HTTP error status codes for the HTTP PUT method listed in Table 5.2.6-1 of 3GPP TS 29.122 [8] shall also apply.				

Table 6.2.1.4.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Represents an alternative URI of the resource located in an alternative SM Server.

Table 6.2.1.4.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Represents an alternative URI of the resource located in an alternative SM Server.

6.2.1.4.3.2 PATCH

The HTTP PATCH method allows a service consumer to request the modification of an existing "Individual Spatial Map Data Source registration" resource at the SM Server.

This method shall support the URI query parameters specified in the table 6.2.1.4.3.2-1.

Table 6.2.1.4.3.2-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.1.4.3.2-2 and the response data structures and response codes specified in table 6.2.1.4.3.2-3.

Table 6.2.1.4.3.2-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
DataSourcePatchRegReq	M	1	Represents the parameters to request the modification of the "Individual Spatial Map Data Source registration" resource.

Table 6.2.1.4.3.2-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
DataSourceRegReq	M	1	200 OK	Successful case. The "Individual Spatial Map Data Source registration" resource is successfully modified and a representation of the updated resource shall be returned in the response body.
n/a			204 No Content	Successful case. The "Individual Spatial Map Data Source registration" resource is successfully modified and no content is returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative SM Server. Redirection handling is described in clause 5.2.10 of TS 29.122 [8].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative SM Server. Redirection handling is described in clause 5.2.10 of TS 29.122 [8].
NOTE: The mandatory HTTP error status codes for the HTTP PATCH method listed in Table 5.2.6-1 of 3GPP TS 29.122 [8] shall also apply.				

Table 6.2.1.4.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative SM Server.

Table 6.2.1.4.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative SM Server.

6.2.1.4.3.3 DELETE

The HTTP DELETE method allows a service consumer to request the deletion of an existing "Individual Spatial Map Data Source registration" resource at the SM Server.

This method shall support the URI query parameters specified in the table 6.2.1.4.3.3-1.

Table 6.2.1.4.3.3-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.1.4.3.3-2 and the response data structures and response codes specified in table 6.2.1.4.3.3-3.

Table 6.2.1.4.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.1.4.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The "Individual Spatial Map Data Source registration" resource is successfully deleted.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative SM Server. Redirection handling is described in clause 5.2.10 of TS 29.122 [8].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative SM Server. Redirection handling is described in clause 5.2.10 of TS 29.122 [8].
NOTE: The mandatory HTTP error status codes for the HTTP DELETE method listed in Table 5.2.6-1 of 3GPP TS 29.122 [8] shall also apply.				

Table 6.2.1.4.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative SEAL SM server.

Table 6.2.1.4.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative SEAL SM server.

6.2.1.4.3.3 Resource Custom Operations

There are no resource custom operations defined for this resource in this release of the specification.

6.2.1.5 Notifications

None.

6.2.1.5.1 General

Notifications shall comply to clause 5.2.1.5 of 3GPP TS 29.122 [2].

Table 6.2.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Spatial Maps Data Source Notification	{notificationDestination}	POST	Enables the SM Server to notify the service consumer registered for Spatial Maps Data Source related event(s).
NOTE: The notificationDestination callback URI is provided by the SM client during the data source registration.			

6.2.1.5.2 Spatial Maps Data Source Notification

6.2.1.5.2.1 Description

The Spatial Maps Data Source Notification is used by the SM Server to notify the service consumer registered for Spatial Maps Data Source related event(s).

6.2.1.5.2.2 Target URI

The Callback URI **"{notificationDestination}"** shall be used with the callback URI variables defined in table 6.2.1.5.2.2-1.

Table 6.2.1.5.2.2-1: Callback URI variables

Name	Definition
notificationDestination	Represents the callback URI encoded as a string formatted as a URI.

6.2.1.5.2.3 Standard Methods

6.2.1.5.2.3.1 POST

This method shall support the request data structures specified in table 6.2.1.5.2.3.1-1 and the response data structures and response codes specified in table 6.2.1.5.2.3.1-2.

Table 6.2.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
DataSourceNotification	M	1	Contains the Spatial Maps Data Source Notification.

Table 6.2.1.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The Spatial Maps Data Source Notification is successfully received and acknowledged.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI representing the end point of an alternative service consumer where the notification should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [2].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI representing the end point of an alternative service consumer where the notification should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [2].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.1.6-1 of 3GPP TS 29.122 [2] shall also apply.				

Table 6.2.1.5.2.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative service consumer towards which the notification should be redirected.

Table 6.2.1.5.2.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative service consumer towards which the notification should be redirected.

6.2.1.6 Data Model

6.2.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.2.1.6.1-1 specifies the data types defined for the SS_SmDataSourceRegistration API.

Table 6.2.1.6.1-1: SS_SmDataSourceRegistration API specific Data Types

Data type	Clause defined	Description	Applicability
DataSourceProfile	6.2.1.6.2.4		
DataSourcePatchRegReq	6.2.1.6.2.3		
DataSourceRegReq	6.2.1.6.2.2		
SpatialMapInfoDetails	6.2.1.6.2.5		

Table 6.2.1.6.1-2 specifies data types re-used by the SS_SmDataSourceRegistration API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the SS_SmDataSourceRegistration API.

Table 6.2.1.6.1-2: SS_SmDataSourceRegistration API re-used Data Types

Data type	Reference	Comments	Applicability
DurationSec	3GPP TS 29.122 [8]	Represents unsigned integer identifying a period of time in units of seconds.	
EndPoint	3GPP TS 29.558 [9]	Represents the end point information.	
PositionInfo	3GPP TS 29.437 [2]	Represents the position information of the spatial map.	
ServiceArea	3GPP TS 29.558 [9]	Represents the service area information.	

6.2.1.6.2 Structured data types

6.2.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.2.1.6.2.2 Type: DataSourceRegReq

Table 6.2.1.6.2.2-1: Definition of type DataSourceRegReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	string	M	1	Represents the identity of the requestor, either a VAL User or a VAL UE.	
expTime	DateTime	O	0..1	Represents the expiration time for the data source registration.	
ueId	Gpsi	O	0..1	Represents the identifier of the UE.	
valClientID	string	O	0..1	Represents the identifier of the VAL client.	
notificationDestination	Uri	M	1	Represents URI of the SM Data Source client, where the notifications should be delivered for the Data source registration information.	
dsProfile	DataSourceProfile	M	1	Represents the profile information of the SM data source.	

6.2.1.6.2.3 Type: DataSourcePatchRegReq

Table 6.2.1.6.2.3-1: Definition of type DataSourcePatchRegReq

Attribute name	Data type	P	Cardinality	Description	Applicability
expTime	DateTime	O	0..1	Represents the proposed expiration time for the data source registration.	
dsProfile	DataSourceProfile	O	0..1	Represents the profile information of the SM data source.	

6.2.1.6.2.4 Type: DataSourceProfile

Table 6.2.1.6.2.4-1: Definition of type DataSourceProfile

Attribute name	Data type	P	Cardinality	Description	Applicability
dsId	string	M	1	Represents the identifier of the SM data source.	
smInformation	SpatialMapInfoDetails	M	1	Represents the identifier of the spatial map information.	

6.2.1.6.2.5 Type: SpatialMapInfoDetails

Table 6.2.1.6.2.5-1: Definition of type SpatialMapInfoDetails

Attribute name	Data type	P	Cardinality	Description	Applicability
smDataIdentifier	string	M	1	Represents the identifier of the spatial map information.	
smDataType	string	M	1	Represents the type of the spatial map information provided by the VAL.	
smFormat	string	O	0..1	Represents the spatial map format.	
smDataArea	ServiceArea	M	1	Represents the spatial coverage area	
smPosition	PositionInfo	O	0..1	Represents the 3D position of the spatial map in space (e.g. x, y and z coordinates)	
availabilityInfo	TimeWindow	O	0..1	Represents the time period availability information of the SM data source	
dsUpdateIntervalInfo	DurationSec	O	0..1	Represents the rate at which the data source information is generated.	

6.2.1.6.2.6 Type: DataSourceNotification

Table 6.2.1.6.2.6-1: Definition of type DataSourceNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	string	M	1	Represents the identity of the requestor, either a VAL User or a VAL UE.	
dataSourceRegId	string	M	1	Represents the identifier of the SM data source registration resource.	
dsNotificationInfo	DataSourceNotificationInfo	M	1	Represents the detailed data source notification.	

6.2.1.6.2.7 Type: DataSourceNotificationInfo

Table 6.2.1.6.2.7-1: Definition of type DataSourceNotificationInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
smDataIdentifier	string	M	1	Represents the identifier of the spatial map information.	
smDataType	string	O	0..1	Represents the type of the spatial map information provided by the VAL.	
smFormat	string	O	0..1	Represents the spatial map format.	
smDurationInfo	TimeWindow	O	0..1	Represents the time duration information for which the notification is provided.	
smFrequencyInfo	DurationSec	O	0..1	Represents the frequency at which the notification is provided.	
smEndPt	EndPoint	M	1	Contains the endpoint information for which the notification is shared.	

6.2.1.6.3 Simple data types and enumerations

6.2.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.2.1.6.4 Data types describing alternative data types or combinations of data types

There are no data types describing alternative data types or combinations of data types defined for this API in this release of the specification.

6.2.1.6.5 Binary data

There are no binary data defined for this API in this release of the specification.

6.2.1.7 Error Handling

6.2.1.7.1 General

For the SS_SmDataSourceRegistration API, HTTP error responses shall be supported as specified in clause 5.2.1.6 of 3GPP TS 29.122 [8]. Protocol errors and application errors specified in clause 5.2.1.6 of 3GPP TS 29.122 [8] shall be supported for the HTTP status codes specified in table 5.2.1.6-1 of 3GPP TS 29.122 [8].

In addition, the requirements in the following clauses are applicable for the SS_SmDataSourceRegistration API.

6.2.1.7.2 Protocol Errors

No specific procedures for the SS_SmDataSourceRegistration API are specified.

6.2.1.7.3 Application Errors

The application errors defined for the SS_SmDataSourceRegistration API are listed in Table 6.2.1.7.3-1.

Table 6.2.1.7.3-1: Application errors

Application Error	HTTP status code	Description

6.2.1.8 Feature negotiation

The optional features in table 6.2.1.8-1 are defined for the SS_SmDataSourceRegistration API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.1.7 of 3GPP TS 29.122 [8].

Table 6.2.1.8-1: Supported Features

Feature number	Feature Name	Description
n/a		

6.3 Digital Asset Server APIs

6.3.1 SS_DADiscovery Service API

6.3.1.1 Introduction

The SS_DADiscovery service shall use the SS_DADiscovery API.

The API specific provisions defined in subclause 7.13.2 of 3GPP TS 29.549 [7] shall apply for the SS_ DADiscovery API.

7 Using Common API Framework

Editor's Note: This clause will describe the CAPIF usage for spatial anchor and map services.

Annex A (normative): Spatial Anchor Server OpenAPI specification

A.1 General

A.2 SS_SAnManagement API

Editor's Note: This clause will define the Open API for spatial anchor based on 3GPP TS 23.437 [2].

Annex B (normative): Spatial Map Server OpenAPI specification

B.1 General

B.2 SS_SmManagement API

Editor's Note: This clause will define the Open API for spatial map based on 3GPP TS 23.437 [2].

B.3 SS_SmDataSourceRegistration API

```
openapi: 3.0.0
info:
  title: SM Server Data Source Registration and Notification Service
  version: 1.0.1
  description: >
    API for Data Source Registration and Notification Service.

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    TTC).

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externalDocs:
  description: >
    3GPP TS 24.550 V19.0.0; Digital asset, Spatial mapping and Spatial anchors
    server - Service Enabler Architecture Layer for Verticals (SEAL); Stage 3.
  url: https://www.3gpp.org/ftp/Specs/archive/24_series/24.550/

security:
  - {}
  - oAuth2ClientCredentials: []

servers:
  - url: '{apiRoot}/sm_smds/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 6.5 of 3GPP TS 29.549.

paths:

  /datasources-reg-lists:
    post:
      description: Register a new Data Source Registration.
      operationId: DataSourceRegistration
      tags:
        - Data Source Registration List (Collection)
      requestBody:
          required: true
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/DataSourceRegReq'
      responses:
        '201':
          description: >
            Created. The Data Source Registration List is successfully created and a representation
of the created Individual Data Source Registration List resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/DataSourceRegReq'
          headers:
            Location:
              description: Contains the URI of the newly created resource.
              required: true
              schema:
```

```
              type: string
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

      callbacks:
        DataSourceNotification:
          '{$request.body#/notificationDestination}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/DataSourceNotification'
              responses:
                '204':
                  description: >
                    No Content. The Spatial Anchors Notification is successfully
                    received and acknowledged.
                '307':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/415'
                '429':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/429'
                '500':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/500'
                '503':
                  $ref: 'TS29122_CommonData.yaml#/components/responses/503'
                default:
                  $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  /datasources-reg-lists/{dataSourceRegId}:
    parameters:
      - name: dataSourceRegId
        in: path
        description: Represents the identifier of the Individual Data Source Registration List
resource.
        required: true
        schema:
          type: string

    put:
      summary: Update an existing Individual Data Source Registration List.
```

```
      operationId: UpdateIndDataSourceRegistrationList
      tags:
        - Individual Data Source Registration List (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/DataSourceRegReq'
      responses:
        '200':
          description: >
            OK. The Individual Data Source Registration List resource is successfully updated and
            a representation of the updated resource shall be returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/DataSourceRegReq'
        '204':
          description: >
            No Content. The Individual Data Source Registration List resource is successfully
            updated and no content is returned in the response body.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

    patch:
      summary: Modify an existing Individual Data Source Registration List.
      operationId: ModifyIndDataSourceRegistrationList
      tags:
        - Individual Data Source Registration List (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/DataSourcePatchRegReq'
      responses:
        '200':
          description: >
            OK. The Individual Data Source Registration List resource is successfully modified and
            a representation of the updated resource shall be returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/DataSourceRegReq'
        '204':
          description: >
            No Content. The Individual Data Source Registration List resource is successfully
modified
            and no content is returned in the response body.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
```

```
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

    delete:
      summary: Delete an existing Individual Data Source Registration List.
      operationId: DeleteIndDataSourceRegistrationList
      tags:
        - Individual Data Source Registration List
      responses:
        '204':
          description: >
            No Content. The 'Individual Data Source Registration List' resource is successfully
            deleted.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

    DataSourceRegReq:
        description: >
          Represents the Data Source Registration Request List.
        type: object
        properties:
          requestorId:
            type: string
            description: Represents the identity of the requestor, either a VAL User or a VAL UE.
          expTime:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
          ueId:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
```

```
      valClientID:
        type: string
        description: Represents the identifier of the VAL client.
      notificationDestination:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
      dsProfile:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    required:
      - requestorId
      - notificationDestination
      - dsProfile

DataSourcePatchRegReq:
  description: >
    Represents the Data Source Patch Registration Request List.
  type: object
  properties:
    expTime:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
    dsProfile:
      $ref: '#/components/schemas/DataSourceProfile'

DataSourceProfile:
  description: Represents the profile information of the SM data source.
  type: object
  properties:
    dsId:
      type: string
      description: Represents the identifier of the SM data source.
    smInformation:
      $ref: '#/components/schemas/SpatialMapInfoDetails'
  required:
    - dsId
    - smInformation

SpatialMapInfoDetails:
  description: Represents the Spatial Map Information.
  type: object
  properties:
    smDataIdentifier:
      type: string
      description: Represents the identifier of the spatial map information.
    smDataType:
      type: string
      description: Represents the type of the spatial map information provided by the VAL.
    smRawDataFormat:
      type: boolean
      description: >
        Indicates data format. When present, it shall be set as follows:
        true: indicates the raw data format.
        false: indicates processed data format.
        Default value when omitted is "false".
    smDataArea:
      $ref: 'TS29558_Eecs_EESRegistration.yaml#/components/schemas/ServiceArea'
    smPosition:
      $ref: 'TS29437_SS_SAnManagement.yaml#/components/schemas/PositionInfo'
    availabilityInfo:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    dsUpdateIntervalInfo:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/DurationSec'
  required:
    - smDataIdentifier
    - smDataType
    - smDataArea

DataSourceNotification:
  description: >
    Represents the Data Source Notification.
  type: object
  properties:
    requestorId:
      type: string
      description: >
        Represents the identity of the requestor, either a VAL User or a VAL UE.
    dataSourceRegId:
      type: string
      description: >
        Represents the identifier of the SM data source registration resource.
```

```
      dsNotificationInfo:
          $ref: '#/components/schemas/DataSourceNotificationInfo'
    required:
      - requestorId
      - dataSourceRegId
      - dsNotificationInfo

  DataSourceNotificationInfo:
    description: >
      Represents the detailed Data Source Notification information.
    type: object
    properties:
      smDataIdentifier:
        type: string
      smDataType:
        type: string
      smFormat:
        anyOf:
        - type: string
          enum:
            - RAW_MAP
            - PROCESSED_MAP
        - type: string
          description: >
            This string provides forward-compatibility with future
            extensions to the enumeration but is not used to encode
            content defined in the present version of this API.
        description: >
            Possible values are:
            - RAW_MAP: Represents the raw spatial map.
            - PROCESSED_MAP: Represents the processed spatial map.
      smDurationInfo:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      smFrequencyInfo:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/DurationSec'
      smEndPt:
        $ref: 'TS29558_Eees_EASRegistration.yaml#/components/schemas/EndPoint'
    required:
      - smDataIdentifier
      - smEndPt
```

Annex C (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2024-12	CT#106					Based on latest v0.1.0 of 24.437 as agreed in CT1#152, with TS number change approval from CT#106.	0.1.0
2025-02	CT1#153					Incorporates agreed pCRs C1-250988, C1-250989, C1-251061, C1-251062, C1-251063, C1-251064	0.2.0
2025-04	CT1#154					Incorporates agreed pCRs C1-252390, C1-252391, C1-252392, C1-252393, C1-252394, C1-252395, C1-252396	0.3.0
2025-05	CT1#155					Incorporates agreed pCRs C1-253989, C1-253992, C1-253993, C1-253994, C1-253995, C1-253996, C1-253997, C1-253998, C1-253999, C1-254028, C1-254029	0.4.0
2025-06	CT#108	CP-251215				TS presented in CT#108	1.0.0
2025-09	CT1#156					Incorporates agreed pCRs C1-255508, C1-255509, C1-255510, C1-255511, C1-255512, C1-255513, C1-255537, C1-255539, C1-255572, C1-255577	1.1.0
2025-10	CT1#157					Incorporates agreed pCRs C1-256028, C1-256030, C1-256031, C1-256231, C1-256803, C1-256804, C1-256805, C1-256806, C1-256807, C1-256808, C1-256809, C1-256810	1.2.0
2025-11	CT1#158					Incorporates agreed pCRs C1-257275, C1-257276, C1-257795	1.3.0
2025-12	CT#110	CP-253070				TS presentation to TSG CT for approval	2.0.0
2025-12	CT#110	CP-253070				Approved by TSG CT.	19.0.0

History

Version	Date	Status
V19.0.0	February 2026	Publication