

ETSI TS 124 545 V16.1.0 (2020-08)



**5G;
Location Management -
Service Enabler Architecture Layer for Verticals (SEAL);
Protocol specification
(3GPP TS 24.545 version 16.1.0 Release 16)**



ReferenceDTS/TSGC-0124545vg10

Keywords5G

ETSI

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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:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

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

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

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

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

- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

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

- can** indicates that something is possible
- cannot** indicates that something is impossible

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

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

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

In addition:

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

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

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

1 Scope

The present document specifies the protocol aspects for the location management capability of SEAL to support vertical applications (e.g. V2X) over the 3GPP system.

The present document is applicable to the user equipment (UE) supporting the location management client functionality as described in 3GPP TS 23.434 [4], to the application server supporting the location management server functionality as described in 3GPP TS 23.434 [4] and to the application server supporting the vertical application server (VAL server) functionality as defined in the specific vertical application service (VAL service) specifications.

NOTE: The specification of the VAL server for a specific VAL service is out of scope of 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 23.003: "Numbering, addressing and identification".
- [3] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [4] 3GPP TS 23.434: "Service Enabler Architecture Layer for Verticals (SEAL); Functional architecture and information flows".
- [5] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".
- [6] 3GPP TS 24.547: "Identity management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".
- [7] IETF RFC 2616: "Hypertext Transfer Protocol -- HTTP/1.1".
- [8] IETF RFC 3261 (June 2002): "SIP: Session Initiation Protocol". [9] IETF RFC 4825: "The Extensible Markup Language (XML) Configuration Access Protocol (XCAP)".
- [10] IETF RFC 6050 (November 2010): "A Session Initiation Protocol (SIP) Extension for the Identification of Services"
- [11] IETF RFC 6665 (July 2012): "SIP-Specific Event Notification".
- [12] OMA OMA-TS-XDM_Group-V1_1_1-20170124-A: "Group XDM Specification".
- [13] IETF RFC 6750: "The OAuth 2.0 Authorization Framework: Bearer Token Usage".
- [14] IETF RFC 3428 (December 2002): "Session Initiation Protocol (SIP) Extension for Instant Messaging".

3 Definitions of terms 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].

SEAL location management client: An entity that provides the client side functionalities corresponding to the SEAL location management service.

SEAL location management server: An entity that provides the server side functionalities corresponding to the SEAL location management service.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.434 [4] apply:

SEAL client
SEAL server
SEAL service
VAL server
VAL service
VAL user
Vertical
Vertical application

3.2 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].

SCEF	Service Capability Exposure Function
SEAL	Service Enabler Architecture Layer for verticals
SLM-C	SEAL Location Management Client
SLM-S	SEAL Location Management Server
VAL	Vertical Application Layer

4 General description

Location management is a SEAL service that provides the location management related capabilities to one or more vertical applications. The present document enables a SEAL location management client (SLM-C) and a VAL server that communicate with a SEAL location management server (SLM-S).

5 Functional entities

5.1 SEAL location management client (SLM-C)

The SLM-C functional entity acts as the application client for location management related transactions. To be compliant with the procedures in the present document the SLM-C:

- shall support the role of XCAP client as specified in IETF RFC 4825 [9];
- shall support the role of XDMC as specified in OMA OMA-TS-XDM_Core-V2_1 [12]; and
- shall support the location management procedures in clause 6.2.

5.2 SEAL location management server (SLM-S)

The SLM-S is a functional entity used to provide location management supported within the vertical application layer. To be compliant with the procedures in the present document the SLM-S:

- a) shall support the role of XCAP server as specified in IETF RFC 4825 [9];
- b) shall support the role of XDMS as specified in OMA OMA-TS-XDM_Core-V2_1 [12]; and
- c) shall support the location management procedures in clause 6.2.

6 Location management procedures

6.1 General

6.2 On-network procedures

6.2.1 General

6.2.1.1 Authenticated identity in HTTP request

Upon receiving an HTTP request, the SLM-S shall authenticate the identity of the sender of the HTTP request is authorized as specified in 3GPP TS 24.547 [6], and if authentication is successful, the SLM-S shall use the identity of the sender of the HTTP request as an authenticated identity.

6.2.2 Event-triggered location reporting procedure

6.2.2.1 General

The SLM-C sends a location reporting configuration request when it needs to fetch location reporting configuration from the SLM-S.

The SLM-C sends a location report when at least one of the trigger criteria is fulfilled. To send the location report the SLM-C can use an appropriate HTTP request message.

If a location reporting trigger is met, the SLM-C checks if the minimum-report-interval timer is running. If the timer is running, the SLM-C waits until the timer expires. When the minimum-report-interval timer expires, the SLM-C:

- a) shall send a location information report as specified in clause 6.2.2.2, if any of the reporting triggers are still met.

Editor's note: It is FFS how the minimum-report-interval timer value is available in the UE.

6.2.2.2 Client procedure

6.2.2.2.1 Fetching location reporting configuration

In order to fetch location reporting configuration, the SLM-C shall send an HTTP GET request message according to procedures specified in IETF RFC 2616 [7] "Fetch a Document". In the HTTP GET request message, the SLM-C:

- a) shall set the Request-URI to the URI identifying the XML document to be fetched. In the Request-URI;
 - 1) the "aud" is set to specific VAL service identity; and
 - 2) the document selector is set to a document URI pointing to the location reporting configuration document; and

- b) shall include an Authorization header field with the "Bearer" authentication scheme set to an access token of the "bearer" token type as specified in IETF RFC 6750 [13].

Upon receiving an HTTP 200 (OK) response from the SLM-S containing:

- a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- b) an application/vnd.3gpp.seal-location-info+xml MIME body with a <configuration> element included in the <location-info> root element;

the SLM-C:

- a) shall store the content of the <configuration> elements;
- b) shall set the location reporting triggers accordingly; and
- c) shall start the minimum-report-interval timer.

6.2.2.2.2 Location reporting

In order to report the location information, the SLM-C shall send a HTTP POST request message according to procedures specified in IETF RFC 2616 [7]. In the HTTP POST request message, the SLM-C:

- a) shall set the Request-URI to the URI included in the received HTTP response message for location report configuration;
- b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include a <identity> element with a <VAL-user-id> child element set to the identity of the VAL user for location report; and
 - 2) shall include a <report> element and, if the report was triggered by a location request, include the <report-id> attribute set to the value of the <request-id> attribute in the received request. The <report> element:
 - i) shall include a <trigger-id> child element set to the value of each <trigger-id> value of the triggers that have been met; and
 - ii) shall include the location reporting elements corresponding to the triggers that have been met;
- d) shall set the minimum-report-interval timer to the minimum-report-interval time and start this timer; and
- e) shall reset all the trigger criteria for location reporting.

6.2.2.3 Server procedure

6.2.2.3.1 Fetching location reporting configuration

Upon receiving of an HTTP GET request where the Request-URI of the HTTP GET request identifies a location reporting configuration document as specified in the specific vertical application, the SLM-S:

- a) shall determine the identity of the sender of the received HTTP GET request as specified in clause 6.2.1.1, and:
 - 1) if the identity of the sender of the received HTTP GET request is not authorized to fetch requested configuration document, shall respond with a HTTP 403 (Forbidden) response to the HTTP GET request and skip rest of the steps;
- b) shall support handling an HTTP GET request from a SLM-C according to procedures specified in IETF RFC 4825 [9] "GET Handling".
- c) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [7]. In the HTTP 200 (OK) response message, the SLM-S:

- 1) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- 2) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - i) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the VAL user requesting for location reporting configuration;
 - ii) shall include a <configuration> element which shall include at least one of the followings:
 - A) the location reporting elements which are requested;
 - B) a <triggering-criteria> child element which provides the triggers for the SLM-C to request a location report as described in clause 7; and
 - C) a <minimum-interval-length>child element specifying the minimum time between consecutive reports. The value is given in seconds;
- 3) shall include the <trigger-id> attribute where defined for the sub-elements defining the trigger criterion; and
- d) shall send the HTTP 200 (OK) response towards the SLM-C.

6.2.2.3.2 Location reporting

Upon reception of an HTTP POST request message containing:

- a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- b) an application/vnd.3gpp.seal-location-info+xml MIME body with a <report> element included in the <location-info> root element;

where the Request-URI of the HTTP POST request identifies an element of a XML document as specified in application usage of the specific vertical application, the SLM-S:

- a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1; and
 - 1) if the identity of the sender of the received HTTP POST request is not authorized to obtain location information of another VAL user, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and
 - 2) shall support handling an HTTP POST request from a SLM-C according to procedures specified in IETF RFC 4825 [9] where the Request-URI of the HTTP POST request identifies an element of XML document as specified in application usage of the specific vertical application. The SLM-S:
 - i) shall store the received location information of the reporting SLM-C; and
 - ii) shall use the location information as needed.

NOTE: The <report> element contains the event triggering identity in the location information report from the VAL client, and can contain location information.

6.2.3 On-demand location reporting procedure

6.2.3.1 Client procedure

Upon receiving an HTTP POST request containing:

- a) an Accept header field set to "application/vnd.3gpp.seal-location-info+xml";
- b) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) an application/vnd.3gpp.seal-location-info+xml MIME body with a <request> element included in the <location-info> root element;

the SLM-C:

- a) may send a location report as specified in clause 6.2.2.2.2.

6.2.3.2 Server procedure

If the SLM-S needs to request the SLM-C to report its location, the SLM-S shall generate an HTTP POST request according to procedures specified in IETF RFC 2616 [7]. The SLM-S:

- a) shall include a Request-URI set to the URI corresponding to the identity of the SLM-C;
- b) shall include an Accept header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- d) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include a <requested-identity> element with a <VAL-user-id> child element set to the identity of the VAL user whose location is requested;
 - 2) shall include a <request> element; and
- e) shall send the HTTP POST request as specified in IETF RFC 2616 [7].

6.2.4 Client-triggered or VAL server-triggered location reporting procedure

6.2.4.1 Client procedure

Upon receiving a request from a VAL user to obtain the location information of another VAL user, the SLM-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [7]. In the HTTP POST request, the SLM-C:

- a) shall set the Request-URI to the URI included in the received HTTP response message for location report configuration;
- b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- c) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include a <identity> element with a <VAL-user-id> child element set to the identity of the VAL user which requests the location report;
 - 2) shall include a <requested-identity> element with a <VAL-user-id> child element set to the identity of the VAL user for which a location report is requested. The VAL user should belong to the same VAL service as the identity of the VAL user which requests the location report; and
 - 3) a <report-request> element which shall include at least one of the followings:
 - i) a <immediate-report-indicator> child element to indicate that an immediate location report is required;
 - ii) the location reporting elements which are requested;
 - iii) a <triggering-criteria> child element which indicate a specified location trigger criteria to send the location report; and
 - iv) a <minimum-interval-length>child element specifying the minimum time between consecutive reports. The value is given in seconds.;

6.2.4.2 Server procedure

Upon reception of an HTTP POST request where the Request-URI of the HTTP POST request identifies an element of a XML document as specified in application usage of the specific vertical application, the SLM-S:

- a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1 and;

- 1) if the identity of the sender of the received HTTP POST request is not authorized to obtain location information of another VAL user, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and
- 2) shall support handling an HTTP POST request from a SLM-C according to procedures specified in IETF RFC 4825 [9] where the Request-URI of the HTTP POST request identifies an element of XML document as specified in application usage of the specific vertical application. Depending on the information specified by the HTTP POST request, the SLM-S initiates either an event-triggered location reporting procedure as specified in clause 6.2.2.2 or an on-demand location reporting procedure as specified in clause 6.2.2.3 for providing the SLM-C with the location of the requested VAL user.

6.2.5 Location reporting event-triggered configuration cancel procedure

6.2.5.1 Client procedure

Upon receiving an HTTP POST request containing:

- a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- b) an application/vnd.3gpp.seal-location-info+xml MIME body with a <configuration> element included in the <location-info> root element, which has none of child elements;

the SLM-C:

- a) shall delete the content of the <configuration> elements;
- b) shall stop the location reporting; and
- c) shall generate an HTTP 200 (OK) response to the received HTTP POST request message according to IETF RFC 2616 [7].

6.2.5.2 Server procedure

The SLM-S may cancel the location reporting event triggers configuration in the SLM-C by generating an HTTP POST request message according to procedures specified in IETF RFC 2616 [7]. The SLM-S:

- a) shall include a Request-URI set to the URI corresponding to the identity of the SLM-C;
- b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the VAL user for location reporting event triggers configuration cancellation;
 - 2) shall include a <configuration> element which shall not include any child element; and
- d) shall send the HTTP POST request as specified in IETF RFC 2616 [7].

6.2.6 Location information subscription procedure

The VAL service will use the same identity which has been authenticated by VAL service with SIP core using SIP based REGISTER message. If VAL service do not support SIP protocol, then HTTP based method needs to be used.

6.2.6.1 VAL server procedure

6.2.6.1.1 SIP based procedure

6.2.6.1.1.1 Create subscription

In order to subscribe location information of one or more VAL users or VAL UEs, if VAL server supports SIP, the VAL server shall generate an initial SIP MESSAGE request according to 3GPP TS 24.229 [5] and IETF RFC 3428 [14]. In the SIP MESSAGE request, the VAL server:

- a) shall set the Request-URI to the public service identity identifying the originating SLM-S serving the VAL server;
- b) shall include the ICSI value "urn:urn-7:3gpp-service.ims.icsi.seal" (coded as specified in 3GPP TS 24.229 [5]), in a P-Preferred-Service header field according to IETF RFC 6050 [10];
- c) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element;
 - 1) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the VAL server which requests the location information subscription;
 - 2) shall include a <subscription> element which shall include:
 - i) an <identities-list> element with one or more <VAL-user-id> child elements set to the identities of the VAL users whose location information is requested;
 - ii) an <time-interval-length> element specifying the time between consecutive reports. The value is given in seconds; and
 - iii) an <expiry-time> element specifying the time when the VAL server wants to receive the current status and later notification; and
- d) shall send the SIP MESSAGE request towards the SLM-S according to 3GPP TS 24.229 [5].

Upon receiving a SIP MESSAGE with an application/vnd.3gpp.seal-location-info+xml MIME body, the VAL server:

- a) shall store the Subscription expiry value set in <expiry-time> element; and
- b) may start subscription refresh timer and set expiry time for the subscription refresh timer to the 2/3 of Subscription expiry value.

NOTE: It is upto implementation to refresh subscribe upon expiry of subscription refresh timer.

6.2.6.1.1.2 Deleting subscription

In order to delete the subscription as identified by the subscription identifier, the VAL server:

- a) shall generate a SIP MESSAGE request according to 3GPP TS 24.229 [5] and IETF RFC 3428 [14];
- b) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element, the VAL server:
 - 1) a <subscription-identifier> element set to the subscription identifier value which uniquely identified the subscription; and
 - 2) set an <expiry-time> element to zero;
- c) shall send the SIP MESSAGE request towards the SLM-S according to 3GPP TS 24.229 [5].

Upon receiving a SIP MESSAGE with an application/vnd.3gpp.seal-location-info+xml MIME body containing <subscription-identifier> element along with <expiry-time> element set to zero, the VAL server:

- a) shall delete the subscription related data.

6.2.6.1.2 HTTP based procedure

If VAL server does not support SIP, the VAL server shall send an HTTP POST request to the SLM-S according to procedures specified in IETF RFC 2616 [7]. In the HTTP POST request message, the VAL server:

- a) shall include a Request-URI set to the URI corresponding to the identity of the SLM-S;
- b) shall include an Accept header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- d) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the VAL server which requests the location information subscription; and
 - 2) shall include a <subscription> element which shall include:
 - i) an <identities-list> element with one or more <VAL-user-id> child elements set to the identities of the VAL users whose location information is requested; and
 - ii) an <interval-length> element specifying the time between consecutive reports. The value is given in seconds.

6.2.6.2 Server procedure

6.2.6.2.1 SIP based procedure

6.2.6.2.1.1 Create subscription

Upon receiving a SIP MESSAGE request such that:

- a) Request-URI of the SIP MESSAGE request contains the public service identity identifying the SLM-S of the served VAL server;
- b) the ICSI value "urn:urn-7:3gpp-service.ims.icsi.seal" (coded as specified in 3GPP TS 24.229 [5]), in a P-Asserted-Service header field according to IETF RFC 6050 [10]; and
- c) the SIP MESSAGE request contains an application/vnd.3gpp.seal-location-info+xml MIME body with an <subscription> element included in the <location-info> root element;

the SLM-S:

- a) shall identify the served VAL user ID in the <identity> element of the application/vnd.3gpp.seal-location-info+xml MIME body of the SIP MESSAGE request;
- b) if the Request-URI of the SIP MESSAGE request contains the public service identity identifying the SLM-S serving the VAL server, shall identify the originating VAL user ID from public user identity in the P-Asserted-Identity header field of the SIP MESSAGE request;
- c) if the originating VAL user ID is different than the served VAL user ID, shall send a 403 (Forbidden) response and shall not continue with the rest of the steps; and
- d) shall generate a 200 (OK) response to the SIP MESSAGE request according to 3GPP TS 24.229 [5] and send it towards VAL server.
- e) shall store all users information contained in <VAL-user-id> element of <identities-list> element;
- f) shall store the expiry time for the subscription to the <expiry-time> value; if the expiry time value as present in <expiry-time> element is not acceptable to the SLM-S, the SLM-S may change the expiry time value to a lower value;
- g) shall store the time interval value to the <time-interval-length> element;

- h) shall generate and assign a unique integer as subscription identifier to the subscription request received from VAL server;
- i) shall generate a SIP MESSAGE request according to 3GPP TS 24.229 [5] and IETF RFC 3428 [14].
- j) In the SIP MESSAGE, the SLM-S shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element;
 - 1) shall include a <subscription> element which shall include:
 - i) a <subscription-identifier> element set to the unique subscription identifier which is assigned to the subscription request;
 - ii) an <expiry-time> element set to the accepted expiry time value; and
 - iii) if the VAL users whose location information is requested as present in <identities-list> element is not fully acceptable to the SLM-S, the SLM-S may change the VAL users to a subset and shall include an <identities-list> with one or more <VAL-user-id> child elements set to the identities of the new VAL users;
- k) shall send the SIP MESSAGE request towards the VAL server according to 3GPP TS 24.229 [5]; and
- l) shall start the timer TLM-1 (subscription expiry) and set the expiry time of the timer to the expiry time for the subscription.
- m) shall start the timer TLM-2 (notification interval) timer and set the internal time of the timer to the <time-interval-length> element value.

6.2.6.2.1.2 Delete subscription

Upon receiving a SIP MESSAGE with an application/vnd.3gpp.seal-location-info+xml MIME body containing <subscription-identifier> element along with <expiry-time> element set to zero, the SLM-S:

- a) shall generate a SIP 200 (OK) response and send it towards VAL server;
- b) shall delete all information related to subscription;
- c) shall generate a SIP MESSAGE request according to 3GPP TS 24.229 [5] and IETF RFC 3428 [14].
- d) In the SIP MESSAGE, the SLM-S shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element;
 - 1) shall include a <subscription> element which shall include:
 - i) a <Subscription Identifier> element set to the unique subscription identifier which is assigned to the subscription request;
- d) shall send the SIP MESSAGE request towards the VAL server according to 3GPP TS 24.229 [5];
- e) shall stop TLM-1 (subscription expiry) timer if it is running; and
- f) shall stop TLM-2 (notification interval) timer if it is running.

6.2.6.2.1.3 Expiry of TLM-1 (subscription expiry)

On expiry of TLM-1 (subscription expiry) timer, the SLM-S shall consider the subscription terminated and shall inform VAL server about subscription terminated. In order to notify the VAL server about the termination of the subscription, the SLM-S:

- a) shall generate a SIP MESSAGE request according to 3GPP TS 24.229 [5] and IETF RFC 6086 [r6086];
- b) shall include in the SIP MESSAGE request, an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element, the VAL server:
 - 1) a <subscription-identifier> element set to the subscription identifier value which uniquely identified the subscription; and

- 2) set an <expiry-time> element to zero;
- c) shall send the SIP MESSAGE request towards the VAL server according to 3GPP TS 24.229 [5].

6.2.6.2.1.4 Expiry of TLM-2 (notification interval) timer

On expiry of TLM-2 (notification interval) timer, the SLM-S shall check if any notification is pending to send or not. The SLM-S should follow procedure described in clause 6.2.7.2 to send notification if any pending notifications are present.

6.2.6.2.2 HTTP based procedure

Upon receiving an HTTP POST request containing:

- a) an Accept header field set to "application/vnd.3gpp.seal-location-info+xml";
- b) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) an application/vnd.3gpp.seal-location-info+xml MIME body with a <subscription> element included in the <location-info> root element;

the SLM-S:

- a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1; and
 - 1) if the identity of the sender of the received HTTP POST request is not authorized to subscribe location information of another VAL user or VAL UE, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and
 - 2) shall support handling an HTTP POST request from a SLM-C according to procedures specified in IETF RFC 4825 [9] "POST Handling";
- b) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [7].

6.2.7 Event-triggered location information notification procedure

NOTE: The SLM-C will use the same identity which has been authenticated by VAL service with SIP core using SIP based REGISTER message. If VAL service do not support SIP protocol, then HTTP based method needs to be used.

6.2.7.1 Client procedure

Upon receiving a SIP NOTIFY request containing an application/vnd.3gpp.seal-location-info+xml MIME body with a <notification> element included in the <location-info> root element, or an HTTP POST request message containing:

- a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- b) an application/vnd.3gpp.seal-location-info+xml MIME body with a <notification> element included in the <location-info> root element;

the SLM-C:

- a) shall store the received location information; and
- b) may share the information to a group or to another VAL user or VAL UE.

6.2.7.2 Server procedure

In order to notify the subscriber about the location information report, the SLM-S:

- a) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body containing:
 - 1) an <identity> element with a <VAL-user-id> child element set to the identity of the VAL user which subscribed to location of another VAL user or VAL UE; and

- 2) a <notification> element which shall include:
 - i) an <identities-list> element with one or more <VAL-user-id> child elements set to the identities of the VAL users whose location information needs to be notified;
 - ii) a <trigger-id> element set to the value of each <trigger-id> value of the triggers that have been met; and
 - iii) a <reports> element containing one or more <loc-info-report> elements. The <loc-info-report> shall include:
 - A) a <VAL-user-id> element set to the identity of the VAL user whose location information needs to be notified; and
 - B) the latest location information corresponding to the VAL user; and
- b) if SLM-C supports SIP, shall send a SIP NOTIFY request according to 3GPP TS 24.229 [5] and IETF RFC 6665 [11] with the constructed application/vnd.3gpp.seal-location-info+xml MIME body;
- c) if SLM-C does not support SIP, shall send an HTTP POST request message to the SLM-C according to procedures specified in IETF RFC 2616 [7] with the constructed application/vnd.3gpp.seal-location-info+xml MIME body and an Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml".

6.2.8 On-demand usage of location information procedure

6.2.8.1 VAL server procedure

If the VAL server needs to request UE location information, the VAL server shall send an HTTP POST request to the SLM-S according to procedures specified in IETF RFC 2616 [7]. In the HTTP POST request message, the VAL server:

- a) shall include a Request-URI set to the URI corresponding to the identity of the SLM-S;
- b) shall include an Accept header field set to "application/vnd.3gpp.seal-location-info+xml";
- c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
- d) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the VAL server which requests the location information; and
 - 2) shall include an <identities-list> element with one or more <VAL-user-id> child elements set to the identities of the VAL users whose location information is requested;

Upon receiving an HTTP 200 (OK) response from the SLM-S containing:

- a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- b) an application/vnd.3gpp.seal-location-info+xml MIME body with a <reports> element included in the <location-info> root element;

the VAL server:

- a) shall store the received location information; and
- b) may share the information to a group or to another VAL user or VAL UE.

6.2.8.2 Server procedure

Upon receiving an HTTP POST request containing:

- a) an Accept header field set to "application/vnd.3gpp.seal-location-info+xml";
- b) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";

- c) an application/vnd.3gpp.seal-location-info+xml MIME body with an < identities-list > element included in the <location-info> root element;

the SLM-S:

- a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1; and
 - 1) if the identity of the sender of the received HTTP POST request is not authorized to obtain location information of another VAL user, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and
- b) shall support handling an HTTP POST request from a SLM-C according to procedures specified in IETF RFC 4825 [9] "POST Handling";
- c) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [7]. In the HTTP 200 (OK) response message, the SLM-S:
 - 1) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";
 - 2) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - i) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the VAL user for location reporting configuration;
 - ii) an <identities-list> element with one or more <VAL-user-id> child elements set to the identities of the VAL users whose location information is requested;
 - iii) a <reports> element containing one or more <loc-info-report> elements. The <loc-info-report> contains a <VAL-user-id> element set to the identity of the VAL user in the requested-identity-list and the latest location information corresponding to the VAL user; and
- d) shall send an HTTP 200 (OK) response towards the VAL server.

6.2.9 Query list of users based on location

6.2.9.1 Client procedure

The procedure defined in this clause can be used by SEAL server to query list of users based on given geolocation area.

In order to query the list of users based on given geolocation area, the client shall send an HTTP POST request message according to procedures specified in IETF RFC 2616 [7]. In the HTTP POST request message, the SLM-C:

- a) shall set the Request-URI to the URI corresponding to the identity of the SEAL server;
- b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- c) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include an <identity> element with a <VAL-user-id> child element set to the identity of the SEAL server querying list of users; and
 - 2) shall include an <location-based-query> element with a <polygon-area> child element or an <ellipsoid-arc-area> child element.

6.2.9.2 Server procedure

Upon reception of an HTTP POST request containing:

- a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml"; and
- b) an application/vnd.3gpp.seal-location-info+xml MIME body with a < location-based-query> element included in the <location-info> root element;

the SLM-S:

- a) shall authorize the identity of the sender of the received HTTP POST request; and
 - 1) if the identity of the sender of the received HTTP POST request is not authorized to obtain list of users based on given geolocation area, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps;
- b) shall generate the list of users who are currently available in requested geographical area; and
- c) shall send an HTTP 200 (OK) response message to SLM-C. In the HTTP 200 (OK) response message, the SLM-S:
 - 1) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body containing:
 - i) an <identity> element with a <VAL-user-id> child element set to the identity of the SEAL server querying list of users; and
 - ii) a <location-based-response> element which shall include:
 - A) an <identities-list> element with one or more <VAL-user-id> child elements set to the identities of the VAL users to be queried;

6.3 Off-network procedures

The off-network procedures are out of scope of the present document in this release of the specification.

7 Coding

7.1 General

This clause specifies the coding to enable an SLM-C and an SLM-S to communicate.

7.2 Application unique ID

The AUID shall be set to the VAL service ID as specified in specific VAL service specification.

7.3 Structure

The location management document shall conform to the XML schema described in clause 7.4.

The <location-info> element shall be the root element of the SEALLocationManagement document.

The <location-info> element shall include at least one of the following:

- a) an <identity> element;
- b) a <subscription> element;
- c) a <notification> element;
- d) a <report> element;
- e) a <configuration> element;
- f) a <request> element;
- g) a <requested-identity> element;
- h) a <report-request> element;

- i) a <location-based-query> element; or
- j) a <location-based-query> element.

The <identity> element shall include one of the following:

- a) a <VAL-user-id> element may include a <VAL-client-id> element; or
- b) a <VAL-group-id> element.

The <subscription> element shall include:

- a) an <identities-list> element which shall include:
 - 1) one or more <VAL-user-id> elements; and
- b) a <time-interval-length> element;
- c) a <subscription-identifier> element;
- d) an <expiry-time> element;

The <notification> element shall include:

- a) an <identities-list> element which shall include:
 - 1) one or more <VAL-user-id> elements;
- b) a <trigger-id> element; and
- c) a <reports> element containing one or more <loc-info-report> elements. The <loc-info-report> element shall include:
 - 1) a <VAL-user-id> element;
 - 2) a <latest-location> element, which shall include at least one of the following sub-elements:
 - i) a <latest-serving-NCGI> element;
 - ii) a <neighbouring-NCGI> element;
 - iii) an <mbms-service-area-id> element;
 - iv) an <mbsfn-area> element; or
 - v) a <latest-coordinate> element;

The <report> element shall contain a <report-id> attribute. The <report> shall include:

- a) a <trigger-id> element; and
- b) a <current-location> element which shall include at least one of the following:
 - 1) a <current-serving-NCGI> element;
 - 2) a <neighbouring-NCGI> element;
 - 3) a <mbms-service-area-id> element; or
 - 4) a <current-coordinate> element.

The <configuration> element includes:

- a) a <location-information> element including:
 - 1) a <current-serving-NCGI> element;
 - 2) a <neighbouring-NCGI> element;

- 3) an <mbms-service-area-id> element;
 - 4) an <mbsfn-area-id> element; or
 - 5) a <current-geographical-coordinate> element;
- b) a <triggering-criteria> element shall include at least one of the following sub-elements:
- 1) a <cell-change> element shall include one of the following sub-elements:
 - i) an <any-cell-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-cell> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-cell> element include a <trigger-id> element;
 - 2) a <tracking-area-change> element shall include one of the following sub-elements:
 - i) an <any-tracking-area-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-tracking-area> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-trackin-area> element shall include a <trigger-id> element;
 - 3) a <plmn-change> element shall include one of the following sub-elements:
 - i) an <any-plmn-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-plmn>element shall include a <trigger-id> element; and
 - iii) an <exit-specific-plmn> element shall include a <trigger-id> element;
 - 4) an <mbms-sa-change> element shall include one of the following sub-elements:
 - i) an <any-mbms-sa-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-mbms-sa> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-mbms-sa> element shall include a <trigger-id> element;
 - 5) an <mbsfn-area-change> element shall include one of the following sub-elements:
 - i) an <any-mbsfn-area-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-mbsfn-area> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-mbsfn-area> element shall include a <trigger-id> element;
 - 6) a <periodic-report> element shall include a <trigger-id> element;
 - 7) a <travelled-distance> element shall include a <trigger-id> element;
 - 8) a <vertical-application-event> element shall include one of the following sub-elements:
 - i) an <initial-log-on> element shall include a <trigger-id> element;
 - ii) a <location-configuration-received> element shall include a <trigger-id> element; and
 - iii) an <any-other-event>, an optional element specifying that any other application signalling event than initial-log-on and location-configuration-received triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - 9) a <geographical-area-change> element shall include one of the following sub-elements:
 - i) an <any-area-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-area> element shall include the following sub-element:
 - A) a <geographical-area> element shall include the following two sub-elements:

- I) a <polygon-area> element shall include a <trigger-id> element; and
- II) an <ellipsoid-arc-area> element shall include a <trigger-id> element;
- iii) an <exit-specific-area-type> element shall include a <trigger-id> element;
- c) a <minimum-interval-length> element;

The <request> shall contain a <request-id> attribute.

The <requested-identity> element shall include one of the following sub-elements:

- a) a <VAL-user-id> element may include a <VAL-client-id> element; or
- b) a <VAL-group-id> element.

The <report-request> element shall include at least one of the following sub-elements:

- a) an <immediate-report-indicator > element; and
- b) a <current-location> element which shall include at least one of the following sub-elements:
 - 1) a <current-serving-NCGI> element;
 - 2) a <neighbouring-NCGI> element;
 - 3) an <mbms-service-area-id> element; or
 - 4) a <current-coordinate> element;
- c) a <triggering-criteria> element shall include at least one of the following sub-elements:
 - 1) a <cell-change> element shall include one of the following sub-elements:
 - i) an <any-cell-change> element shall include a <trigger-id> element;
 - ii) a <enter-specific-cell> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-cell> element include a <trigger-id> element;
 - 2) a <tracking-area-change> element shall include one of the following sub-elements:
 - i) an <any-tracking-area-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-tracking-area> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-trackin-area> element shall include a <trigger-id> element;
 - 3) a <plmn-change> element shall include one of the following sub-elements:
 - i) an <any-plmn-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-plmn>element shall include a <trigger-id> element; and
 - iii) an <exit-specific-plmn> element shall include a <trigger-id> element;
 - 4) an <mbms-sa-change> element shall include one of the following sub-elements:
 - i) an <any-mbms-sa-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-mbms-sa> element shall include a <trigger-id> element; and
 - iii) an <exit-specific-mbms-sa> element shall include a <trigger-id> element;
 - 5) an <mbsfn-area-change> element shall include one of the following sub-elements:
 - i) an <any-mbsfn-areaChange> element shall include a <trigger-id> element;
 - ii) an <enter-specific-mbsfn-area> element shall include a <trigger-id> element; and

- iii) an <exit-specific-mbsfn-area> element shall include a <trigger-id> element;
- 6) a <periodic-report> element shall include a <trigger-id> element;
- 7) a <travelled-distance> element shall include a <trigger-id> element;
- 8) a <vertical-application-event> element shall include one of the following sub-elements:
 - i) an <initial-log-on> element shall include a <trigger-id> element;
 - ii) a <location-configuration-received> element shall include a <trigger-id> element; and
 - iii) an <any-other-event>, an optional element specifying that any other application signalling event than initial-log-on and location-configuration-received triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 9) a <geographical-area-change> element shall include one of the following sub-elements:
 - i) an <any-area-change> element shall include a <trigger-id> element;
 - ii) an <enter-specific-area> element shall include the following sub-element:
 - A) a <geographical-area> element shall include the following two sub-elements:
 - I) a <polygon-area> element shall include a <trigger-id> element; and
 - II) an <ellipsoid-arc-area> element shall include a <trigger-id> element;
 - iii) an <exit-specific-area-type> element shall include a <trigger-id> element.

The <location-based-query> element shall include at least one of the following:

- a) a <polygon-area> element; or
- b) an <ellipsoid-arc-area> element.

The <location-based-response> element may include:

- a) an <identities-list> element which shall include:
 - 1) one or more <VAL-user-id> elements;

7.4 XML schema

7.4.1 General

This clause defines the XML schema for location information.

7.4.2 XML schema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:ns:sealLocationInfo:1.0"
xmlns:sealloc="urn:3gpp:ns:sealLocationInfo:1.0"
elementFormDefault="qualified"
attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmenc#">
  <xs:element name="location-info" id="loc">
    <xs:annotation>
      <xs:documentation>Root element, contains all information related to location configuration,
location request and location reporting for the SEAL service</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:choice>
        <xs:element name="Configuration" type="sealloc:tConfigurationType"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:choice>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

```

    <xs:anyAttribute namespace="##any" processContents="lax" />
  </xs:complexType>
</xs:element>
<xs:complexType name="tConfigurationType">
  <xs:sequence>
    <xs:element name="LocationInformation" type="sealloc:tRequestedLocationType" minOccurs="0" />
    <xs:element name="TriggeringCriteria" type="sealloc:TriggeringCriteriaType" />
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
  </xs:sequence>
  <xs:attribute name="ConfigScope">
    <xs:simpleType>
      <xs:restriction base="xs:string">
        <xs:enumeration value="Full" />
        <xs:enumeration value="Update" />
      </xs:restriction>
    </xs:simpleType>
  </xs:attribute>
  <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tRequestedLocationType">
  <xs:sequence>
    <xs:element name="ServingEcgi" type="sealloc:tEmptyType" minOccurs="0" />
    <xs:element name="NeighbouringEcgi" type="sealloc:tEmptyType" minOccurs="0"
maxOccurs="unbounded" />
    <xs:element name="MbmsSaId" type="sealloc:tEmptyType" minOccurs="0" />
    <xs:element name="MbsfnArea" type="sealloc:tEmptyType" minOccurs="0" />
    <xs:element name="GeographicalCoordinate" type="sealloc:tEmptyType" minOccurs="0" />
    <xs:element name="minimumIntervalLength" type="xs:positiveInteger" />
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="TriggeringCriteriaType">
  <xs:sequence>
    <xs:element name="CellChange" type="sealloc:tCellChange" minOccurs="0" />
    <xs:element name="TrackingAreaChange" type="sealloc:tTrackingAreaChangeType" minOccurs="0" />
    <xs:element name="PlmnChange" type="sealloc:tPlmnChangeType" minOccurs="0" />
    <xs:element name="MbmsSaChange" type="sealloc:tMbmsSaChangeType" minOccurs="0" />
    <xs:element name="MbsfnAreaChange" type="sealloc:tMbsfnAreaChangeType" minOccurs="0" />
    <xs:element name="PeriodicReport" type="sealloc:tIntegerAttributeType" minOccurs="0" />
    <xs:element name="TravelledDistance" type="sealloc:tIntegerAttributeType" minOccurs="0" />
    <xs:element name="SealSignallingEvent" type="sealloc:tSignallingEventType" minOccurs="0" />
    <xs:element name="GeographicalAreaChange" type="sealloc:tGeographicalAreaChange" />
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tEmptyType" />
<xs:complexType name="tCellChange">
  <xs:sequence>
    <xs:element name="AnyCellChange" type="sealloc:tEmptyTypeAttribute" minOccurs="0" />
    <xs:element name="EnterSpecificCell" type="sealloc:tSpecificCellType" minOccurs="0"
maxOccurs="unbounded" />
    <xs:element name="ExitSpecificCell" type="sealloc:tSpecificCellType" minOccurs="0"
maxOccurs="unbounded" />
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:simpleType name="tEcgi">
  <xs:restriction base="xs:string">
    <xs:pattern value="\d{3}\d{3}[0-1]{28}" />
  </xs:restriction>
</xs:simpleType>
<xs:complexType name="tSpecificCellType">
  <xs:simpleContent>
    <xs:extension base="sealloc:tEcgi">
      <xs:attribute name="TriggerId" type="xs:string" use="required" />
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tEmptyTypeAttribute">
  <xs:complexContent>
    <xs:extension base="sealloc:tEmptyType">
      <xs:attribute name="TriggerId" type="xs:string" use="required" />
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

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</xs:complexContent>
</xs:complexType>
<xs:complexType name="tTrackingAreaChangeType">
  <xs:sequence>
    <xs:element name="AnyTrackingAreaChange" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="EnterSpecificTrackingArea" type="sealloc:tTrackingAreaIdentity"
minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="ExitSpecificTrackingArea" type="sealloc:tTrackingAreaIdentity"
minOccurs="0" maxOccurs="unbounded"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:simpleType name="tTrackingAreaIdentityFormat">
  <xs:restriction base="xs:string">
    <xs:pattern value="\d{3}\d{3}[0-1]{16}"/>
  </xs:restriction>
</xs:simpleType>
<xs:complexType name="tTrackingAreaIdentity">
  <xs:simpleContent>
    <xs:extension base="sealloc:tTrackingAreaIdentityFormat">
      <xs:attribute name="TriggerId" type="xs:string" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tPlmnChangeType">
  <xs:sequence>
    <xs:element name="AnyPlmnChange" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="EnterSpecificPlmn" type="sealloc:tPlmnIdentity" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="ExitSpecificPlmn" type="sealloc:tPlmnIdentity" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:simpleType name="tPlmnIdentityFormat">
  <xs:restriction base="xs:string">
    <xs:pattern value="\d{3}\d{3}"/>
  </xs:restriction>
</xs:simpleType>
<xs:complexType name="tPlmnIdentity">
  <xs:simpleContent>
    <xs:extension base="sealloc:tPlmnIdentityFormat">
      <xs:attribute name="TriggerId" type="xs:string" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tMbmsSaChangeType">
  <xs:sequence>
    <xs:element name="AnyMbmsSaChange" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="EnterSpecificMbmsSa" type="sealloc:tMbmsSaIdentity" minOccurs="0"/>
    <xs:element name="ExitSpecificMbmsSa" type="sealloc:tMbmsSaIdentity" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:simpleType name="tMbmsSaIdentityFormat">
  <xs:restriction base="xs:integer">
    <xs:minInclusive value="0"/>
    <xs:maxInclusive value="65535"/>
  </xs:restriction>
</xs:simpleType>
<xs:complexType name="tMbmsSaIdentity">
  <xs:simpleContent>
    <xs:extension base="sealloc:tMbmsSaIdentityFormat">
      <xs:attribute name="TriggerId" type="xs:string" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tMbsfnAreaChangeType">
  <xs:sequence>
    <xs:element name="EnterSpecificMbsfnArea" type="sealloc:tMbsfnAreaIdentity" minOccurs="0"/>
    <xs:element name="ExitSpecificMbsfnArea" type="sealloc:tMbsfnAreaIdentity" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>

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        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:simpleType name="tMbsfnAreaIdentityFormat">
<xs:restriction base="xs:integer">
    <xs:minInclusive value="0"/>
    <xs:maxInclusive value="255"/>
</xs:restriction>
</xs:simpleType>
<xs:complexType name="tMbsfnAreaIdentity">
<xs:simpleContent>
    <xs:extension base="sealloc:tMbsfnAreaIdentityFormat">
        <xs:attribute name="TriggerId" type="xs:string" use="required"/>
    </xs:extension>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tIntegerAttributeType">
<xs:simpleContent>
    <xs:extension base="xs:integer">
        <xs:attribute name="TriggerId" type="xs:string" use="required"/>
    </xs:extension>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tTravelledDistanceType">
<xs:sequence>
    <xs:element name="TravelledDistance" type="xs:positiveInteger"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
</xs:sequence>
<xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:complexType name="tSignallingEventType">
<xs:sequence>
    <xs:element name="InitialLogOn" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="GroupCallNonEmergency" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="PrivateCallNonEmergency" type="sealloc:tEmptyTypeAttribute"
minOccurs="0"/>
    <xs:element name="LocationConfigurationReceived" type="sealloc:tEmptyTypeAttribute"
minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
</xs:sequence>
<xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:complexType name="tEmergencyEventType">
<xs:sequence>
    <xs:element name="GroupCallEmergency" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="GroupCallImminentPeril" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="PrivateCallEmergency" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="InitiateEmergencyAlert" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
</xs:sequence>
<xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:complexType name="tRequestedLocationType">
<xs:sequence>
    <xs:element name="ServingEcgi" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="NeighbouringEcgi" type="sealloc:tEmptyType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="MbsfnAreaId" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="MbsfnArea" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="GeographicalCoordinate" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="minimumIntervalLength" type="xs:positiveInteger"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
</xs:sequence>
<xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:complexType name="tCurrentLocationType">
<xs:sequence>
    <xs:element name="CurrentServingEcgi" type="sealloc:tLocationType" minOccurs="0"/>
    <xs:element name="NeighbouringEcgi" type="sealloc:tLocationType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="MbsfnAreaId" type="sealloc:tLocationType" minOccurs="0"/>
    <xs:element name="MbsfnArea" type="sealloc:tLocationType" minOccurs="0"/>
    <xs:element name="CurrentCoordinate" type="sealloc:tPointCoordinate" minOccurs="0"/>

```

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        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:sequence>
</xs:complexType>
<xs:complexType name="tLocationType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="Normal" />
        <xs:enumeration value="Encrypted" />
    </xs:restriction>
</xs:complexType>
<xs:complexType name="tLocationType">
    <xs:choice minOccurs="1" maxOccurs="1">
        <xs:element name="Ecgi" type="sealloc:tEcgi" minOccurs="0" />
        <xs:element name="SaId" type="sealloc:tMbsmSaIdentity" minOccurs="0" />
        <xs:element name="MbsfnAreaId" type="sealloc:tMbsfnAreaIdentity" minOccurs="0" />
        <xs:any namespace="##other" processContents="lax" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:choice>
    <xs:attribute name="type" type="sealloc:protectionType" />
    <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tGeographicalAreaChange">
    <xs:sequence>
        <xs:element name="AnyAreaChange" type="sealloc:tEmptyTypeAttribute" minOccurs="0" />
        <xs:element name="EnterSpecificAreaType" type="sealloc:tSpecificAreaType" minOccurs="0" />
        <xs:element name="ExitSpecificAreaType" type="sealloc:tSpecificAreaType" minOccurs="0" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tSpecificAreaType">
    <xs:sequence>
        <xs:element name="GeographicalArea" type="sealloc:tGeographicalAreaDef" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:sequence>
    <xs:attribute name="TriggerId" type="xs:string" use="required" />
    <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tPointCoordinate">
    <xs:sequence>
        <xs:element name="longitude" type="sealloc:tCoordinateType" />
        <xs:element name="latitude" type="sealloc:tCoordinateType" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tCoordinateType">
    <xs:choice minOccurs="1" maxOccurs="1">
        <xs:element name="threebytes" type="sealloc:tThreeByteType" minOccurs="0" />
        <xs:any namespace="##other" processContents="lax" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:choice>
    <xs:attribute name="type" type="sealloc:protectionType" />
    <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:simpleType name="tThreeByteType">
    <xs:restriction base="xs:integer">
        <xs:minInclusive value="0" />
        <xs:maxInclusive value="16777215" />
    </xs:restriction>
</xs:simpleType>
<xs:complexType name="tGeographicalAreaDef">
    <xs:sequence>
        <xs:element name="PolygonArea" type="sealloc:tPolygonAreaType" minOccurs="0" />
        <xs:element name="EllipsoidArcArea" type="sealloc:tEllipsoidArcType" minOccurs="0" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax" />
</xs:complexType>
<xs:complexType name="tPolygonAreaType">
    <xs:sequence>
        <xs:element name="Corner" type="sealloc:tPointCoordinate" minOccurs="3" maxOccurs="15" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
    </xs:sequence>

```

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    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
<xs:complexType name="tEllipsoidArcType">
  <xs:sequence>
    <xs:element name="Center" type="sealloc:tPointCoordinate"/>
    <xs:element name="Radius" type="xs:nonNegativeInteger"/>
    <xs:element name="OffsetAngle" type="xs:unsignedByte"/>
    <xs:element name="IncludedAngle" type="xs:unsignedByte"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>
</xs:schema>

```

7.5 Data semantics

The <location-info> element is the root element of the XML document. The <location-info> element contains the <identity>, <subscription>, <request>, <configuration> and <report> sub-elements.

<identity> is a mandatory element used to include the identity of a VAL user, a VAL client or a VAL group. The <identity> element contains one of following sub-elements:

- a) <VAL-user-id>, an element contains the identity of the VAL user. This element contains an optional <VAL-client-id> attribute that contains the identity of the VAL client; or
- b) <VAL-group-id>, an element contains the group identity of a set of VAL users or VAL clients according to the VAL service.

<subscription> contains the following sub-elements:

- a) <identities-list>, an element contains one or more <VAL-user-id> elements. Each <VAL-user-id> element contains the identity of the VAL user whose location information is requested.
- b) <time-interval-length>, an element specifying the interval time the SLM-S needs to wait before sending location reports. The value is given in seconds.
- c) <subscription-identifier>, an element specifying the value to uniquely identify the subscription.
- d) <expiry-time>, an element specifying expiry time for subscription in seconds.

<notification> contains the following sub-elements:

- a) <identities-list>, an element contains one or more <VAL-user-id> elements. Each <VAL-user-id> element contains the identity of the VAL user whose location information needs to be notified.
- b) <trigger-id>, an element which can occur multiple times that contains the value of the <trigger-id> attribute associated with a trigger that has fired; and
- c) <reports>, an element contains one or more <loc-info-report> elements. Each <loc-info-report> element contains the following sub-elements:
 - 1) <VAL-user-id>, an element contains the identity of a VAL user in the identities list;
 - 2) <latest-location >, an element contains at least one of the following sub-elements:
 - i) <latest-serving-NCGI>, an optional element containing the NR cell global identity (NCGI) of the serving cell coded as specified in clause 19.6A in 3GPP TS 23.003 [2];
 - ii) <neighbouring-NCGI>, an optional element that can occur multiple times. It contains the NCGI of any neighbouring cell the SLM-C can detect;
 - iii) <mbms-service-area-id>, an optional element containing the MBMS service area id the SLM-C is using coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI);
 - iv) <mbsfn-area> element, an optional element specifying that the MBSFN area Id needs to be reported; and

- v) <latest-coordinate>, an optional element containing the longitude and latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3];

<report> is a mandatory element used to include the location report. It contains a <report-id> attribute. The <report-id> attribute is used to return the value in the <request-id> attribute in the <request> element. The <report> element contains the following sub-elements:

- a) <trigger-id>, a mandatory element which can occur multiple times that contain the value of the <trigger-id> attribute associated with a trigger that has fired; and
- b) <current-location>, a mandatory element that contains the location information. The <current-location> element contains the following sub-elements:
 - 1) <current-serving-NCGI>, an optional element containing the NR cell global identity (NCGI) of the serving cell coded as specified in clause 19.6A in 3GPP TS 23.003 [2];
 - 2) <neighbouring-NCGI>, an optional element that can occur multiple times. It contains the NCGI of any neighbouring cell the SLM-C can detect;
 - 3) <mbms-service-area-id>, an optional element containing the MBMS service area id the SLM-C is using coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI); and
 - 4) <current-coordinate>, an optional element containing the longitude and latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3].

<request> is an element with a <request-id> attribute. The <request> element is used to request a location report. The value of the <request-id> attribute is returned in the corresponding <report-id> attribute in order to correlate the request and the report.

<requested-identity> is a mandatory element used to include the identity of a VAL user, a VAL client or a VAL group for which a location report is requested. The <requested-identity> element contains one of following sub-elements:

- a) <VAL-user-id>, an element contains the identity of the VAL user. This element contains an optional <VAL-client-id> attribute that contains the identity of the VAL client; or
- b) <VAL-group-id>, an element contains the group identity of a set of VAL users or VAL clients according to the VAL service.

<configuration> is an element with a <configuration-scope> attribute that can have the value "Full" or "Update" . The value "Full" means that the <configuration> element contains the full location configuration which replaces any previous location configuration. The value "Update" means that the location configuration is an addition to any previous location configuration. To remove configuration elements a "Full" configuration is needed. The <configuration> element contains the following sub-elements:

- a) <location-information>, an optional element that specifies the location information. The <location-information> has the sub-elements:
 - 1) <serving-NCGI>, an optional element containing the NR cell global identity (NCGI) of the serving cell coded as specified in clause 19.6A in 3GPP TS 23.003 [2];
 - 2) <neighbouring-NCGI>, an optional element that can occur multiple times. It contains the NCGI of any neighbouring cell the SLM-C can detect;
 - 3) <mbms-service-area-id>, an optional element containing the MBMS service area id that the SLM-C is using. The MBMS service area id is coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI);
 - 4) <mbsfn-area-id>, an optional element specifying that the MBSFN area id that needs to be reported;
 - 5) <current-geographical-coordinate>, an optional element containing the longitude and latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3]; and
- b) <triggering-criteria>, an optional element specifying the triggers for the SLM-C to request a location report of a VAL user, a VAL client or a VAL group. The <triggering-criteria> element contains at least one of the following sub-elements:

- 1) <cell-change>, an optional element specifying what cell changes trigger the request for a location report. This element consists of the following sub-elements:
 - i) <any-cell-change>, an optional element. The presence of this element specifies that any cell change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-cell>, an optional element specifying an NCGI which when entered triggers a request for a location report coded as specified in clause 19.6A in 3GPP TS 23.003 [2]. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-cell>, an optional element specifying an NCGI which when exited triggers a request for a location report coded as specified in clause 19.6A in 3GPP TS 23.003 [2]. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 2) <tracking-area-change>, an optional element specifying what tracking area changes trigger a request for a location report. This element consists of the following sub-elements:
 - i) <any-tracking-area-change>, an optional element. The presence of this element specifies that any tracking area change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-tracking-area>, an optional element specifying a tracking area identity coded as specified in clause 19.4.2.3 in 3GPP TS 23.003 [2] which when entered triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-tracking-area>, an optional element specifying a tracking area identity coded as specified in clause 19.4.2.3 in 3GPP TS 23.003 [2] which when exited triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 3) <plmn-change>, an optional element specifying what PLMN changes trigger a request for a location report. This element consists of the following sub-elements:
 - i) <any-plmn-change>, an optional element. The presence of this element specifies that any PLMN change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-plmn>, an optional element specifying a PLMN id (MCC+MNC) coded as specified in 3GPP TS 23.003 [2] which when entered triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-plmn>, an optional element specifying a PLMN id (MCC+MNC) coded as specified in 3GPP TS 23.003 [2] which when exited triggers a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 4) <mbms-sa-change>, an optional element specifying what MBMS changes trigger location reporting. This element consists of the following sub-elements:
 - i) <any-mbms-sa-change>, an optional element. The presence of this element specifies that any MBMS SA change is a trigger for a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-mbms-sa>, an optional element specifying an MBMS service area id which when entered triggers a request for a location report. The MBMS service area id is coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI). This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-mbms-sa>, an optional element specifying an MBMS service area id which when exited triggers a request a location report. The MBMS service area id is coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI). This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 5) <mbsfn-area-change>, an optional element specifying what MBSFN changes trigger a request for a location report. This element consists of the following sub-elements:

- i) <any-mbsfn-area-change>, an optional element. The presence of this element specifies that any MBSFN area change is a trigger for a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-mbsfn-area>, an optional element specifying an MBSFN area which when entered triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-mbsfn-area>, an optional element specifying an MBSFN area which when exited triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 6) <periodic-report>, an optional element specifying that periodic request for a location report shall be sent. The value in seconds specifies the reporting interval. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 7) <travelled-distance>, an optional element specifying that the travelled distance shall trigger a request for a location report. The value in metres specified the travelled distance. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 8) <vertical-application-event>, an optional element specifying what application signalling events triggers a request for a location report. The <vertical-application-event> element has the following sub-elements:
- i) <initial-log-on>, an optional element specifying that an initial log on triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <location-configuration-received>, an optional element specifying that a received location configuration triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <any-other-event>, an optional element specifying that any other application signalling event than initial-log-on and location-configuration-received triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 9) <geographical-area-change>, an optional element specifying what geographical area changes trigger a request for a location reporting. This element consists of the following sub-elements:
- i) <any-area-change>, an optional element. The presence of this element specifies that any geographical area change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-area>, an optional element specifying a geographical area which when entered triggers a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string. The <enter-specific-area> element has the following sub-elements:
 - A) <geographical-area>, an optional element containing a <trigger-id> attribute and the following two subelements:
 - I) <polygon-area>, an optional element specifying the area as a polygon specified in clause 5.2 in 3GPP TS 23.032 [2]; and
 - II) <ellipsoid-arc-area>, an optional element specifying the area as an ellipsoid arc specified in clause 5.7 in 3GPP TS 23.032 [2]; and
 - iii) <exit-specific-area-type>, an optional element specifying a geographical area which when exited triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string.
 - c) <minimum-interval-length>, a mandatory element specifying the minimum time the SLM-C needs to wait between sending location reports. The value is given in seconds;

<report-request> is a mandatory element used to include the requested location report. The <report-request> element contains at least one of the following sub-elements:

- a) <immediate-report-indication>, a mandatory element which can occur multiple times that contain the value of the <trigger-id> attribute associated with a trigger that has fired; and

- b) <current-location>, a mandatory element that contains the location information. The <current-location> element contains the following sub-elements:
- 1) <current-serving-NCGI>, an optional element containing the NR cell global identity (NCGI) of the serving cell coded as specified in clause 19.6A in 3GPP TS 23.003 [2];
 - 2) <neighbouring-NCGI>, an optional element that can occur multiple times. It contains the NCGI of any neighbouring cell the SLM-C can detect;
 - 3) <mbms-service-area-id>, an optional element containing the MBMS service area id that the SLM-C is using. The MBMS service area id is coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI); and
 - 4) <current-coordinate>, an optional element containing the longitude and latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3].
- c) <triggering-criteria>, a mandatory element specifying the triggers for the SLM-C to request a location report of a VAL user, a VAL client or a VAL group. The <triggering-criteria> element contains at least one of the following sub-elements:
- 1) <cell-change>, an optional element specifying what cell changes trigger the request for a location report. This element consists of the following sub-elements:
 - i) <any-cell-change>, an optional element. The presence of this element specifies that any cell change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-cell>, an optional element specifying an NCGI which when entered triggers a request for a location report coded as specified in clause 19.6A in 3GPP TS 23.003 [2]. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-cell>, an optional element specifying an NCGI which when exited triggers a request for a location report coded as specified in clause 19.6A in 3GPP TS 23.003 [2]. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - 2) <tracking-area-change>, an optional element specifying what tracking area changes trigger a request for a location report. This element consists of the following sub-elements:
 - i) <any-tracking-area-change>, an optional element. The presence of this element specifies that any tracking area change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-tracking-area>, an optional element specifying a tracking area identity coded as specified in clause 19.4.2.3 in 3GPP TS 23.003 [2] which when entered triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-tracking-area>, an optional element specifying a tracking area identity coded as specified in clause 19.4.2.3 in 3GPP TS 23.003 [2] which when exited triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - 3) <plmn-change>, an optional element specifying what PLMN changes trigger a request for a location report. This element consists of the following sub-elements:
 - i) <any-plmn-change>, an optional element. The presence of this element specifies that any PLMN change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-plmn>, an optional element specifying a PLMN id (MCC+MNC) coded as specified in 3GPP TS 23.003 [2] which when entered triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-plmn>, an optional element specifying a PLMN id (MCC+MNC) coded as specified in 3GPP TS 23.003 [2] which when exited triggers a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - 4) <mbms-sa-change>, an optional element specifying what MBMS changes trigger location reporting. This element consists of the following sub-elements:

- i) <any-mbms-sa-change>, an optional element. The presence of this element specifies that any MBMS SA change is a trigger for a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-mbms-sa>, an optional element specifying an MBMS service area id which when entered triggers a request for a location report. The MBMS service area id is coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI). This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-mbms-sa>, an optional element specifying an MBMS service area id which when exited triggers a request a location report. The MBMS service area id is coded as specified in clause 15.3 in 3GPP TS 23.003 [2] for service area identifier (SAI). This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 5) <mbsfn-area-change>, an optional element specifying what MBSFN changes trigger a request for a location report. This element consists of the following sub-elements:
- i) <any-mbsfn-area-change>, an optional element. The presence of this element specifies that any MBSFN area change is a trigger for a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-mbsfn-area>, an optional element specifying an MBSFN area which when entered triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <exit-specific-mbsfn-area>, an optional element specifying an MBSFN area which when exited triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 6) <periodic-report>, an optional element specifying that periodic request for a location report shall be sent. The value in seconds specifies the reporting interval. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 7) <travelled-distance>, an optional element specifying that the travelled distance shall trigger a request for a location report. The value in metres specified the travelled distance. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 8) <vertical-application-event>, an optional element specifying what application signalling events triggers a request for a location report. The <vertical-application-event> element has the following sub-elements:
- i) <initial-log-on>, an optional element specifying that an initial log on triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <location-configuration-received>, an optional element specifying that a received location configuration triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and
 - iii) <any-other- event>, an optional element specifying that any other application signalling event than initial-log-on and location-configuration-received triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
- 9) <geographical-area-change>, an optional element specifying what geographical are changes trigger a request for a location reporting. This element consists of the following sub-elements:
- i) <any-area-change>, an optional element. The presence of this element specifies that any geographical area change is a trigger. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;
 - ii) <enter-specific-area>, an optional element specifying a geographical area which when entered triggers a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string. The <enter-specific-area> element has the following sub-elements:
 - A) <geographical-area>, an optional element containing a <trigger-id> attribute and the following two subelements:

- D) <polygon-area>, an optional element specifying the area as a polygon specified in clause 5.2 in 3GPP TS 23.032 [3]; and
- II) <ellipsoid-arc-area>, an optional element specifying the area as an ellipsoid arc specified in clause 5.7 in 3GPP TS 23.032 [3]; and
- iii) <exit-specific-area-type>, an optional element specifying a geographical area which when exited triggers a request for a location report. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string.

<location-based-query> contains at least one of the following sub-elements:

- a) <polygon-area>, an optional element specifying the area as a polygon specified in subclause 5.2 in 3GPP TS 23.032 [3]; and
- b) <ellipsoid-arc-area>, an optional element specifying the area as an Ellipsoid Arc specified in subclause 5.7 in 3GPP TS 23.032 [3].

<location-based-response> contains the following sub-elements:

- a) <identities-list>, an optional element contains one or more <VAL-user-id> elements. Each <VAL-user-id> element contains the identity of the VAL user to be queried.

The recipient of the XML ignores any unknown element and any unknown attribute.

7.6 MIME type

The MIME type for the LocationInfo document shall be "application/vnd.3gpp.seal-location-info+xml".

7.7 IANA registration template

Your Name:

<MCC name>

Your Email Address:

<MCC email address>

Media Type Name:

Application

Subtype name:

vnd.3gpp.seal-location-info+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP, so the security considerations from IETF RFC 3261 apply.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.545 "Location Management - Service Enabler Architecture Layer for Verticals (SEAL)" version 16.0.0, available via <http://www.3gpp.org/specs/numbering.htm>.

Applications which use this media type:

Applications supporting the SEAL location management as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

1. Deprecated alias names for this type: none
2. Magic number(s): none
3. File extension(s): none
4. Macintosh File Type Code(s): none
5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>
- Email: <MCC email address>
- Author/Change controller:
 - i) Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG
 - ii) Change controller: <MCC name>/<MCC email address>

Annex A (normative): Timers

A.1 General

This subclause provides a brief description of the timers used in this specification.

A.2 On network timers

The table A.2-1 provides a description of the timers used in this specification, specifies the timer values, describes the reason for starting of the timer, normal stop and the action on expiry.

Table A.2-1: On network timers

Timer	Timer value	Cause of start	Normal stop	On expiry
TLM-1 (subscription expiry)	The timer value is negotiated between SLM-C and SLM-S while creating or modifying subscription.	The SLM-S starts the timer upon sending response to create subscription request message towards SLM-C;	On sending response to delete subscription request message towards SLM-C;	Consider that the subscription associated with the timer is terminated and shall delete all data related to the subscription.
TLM-2 (notification interval)	The timer value is set by user in create subscription request message in <time-interval-length>element.	The SLM-S starts timer each time after sending location information notification.	On sending response to delete subscription request message towards SLM-C;	If any location information data is pending to be notified then the SLM-S sends the notification.

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2019-10	CT1#120	C1-196855				Draft skeleton provided by the rapporteur.	0.0.0
2019-10	CT1#120					Implementing the following p-CRs agreed by CT1: C1-196355, C1-196612, C1-196856, C1-196857	0.1.0
2019-11	CT1#121					Implementing the following p-CRs agreed by CT1: C1-198605, C1-198606, C1-198607, C1-198609, C1-198818, C1-198820 Corrections done by the rapporteur.	0.2.0
2020-03	CT1#122-e					Implementing the following p-CRs agreed by CT1: C1-200526, C1-200555, C1-200558, C1-200560, C1-200808, C1-200901, C1-200902, C1-201018, C1-201019 Corrections done by the rapporteur.	0.3.0
2020-03	CT-87e	CP-200169				Presentation to TSG CT for information and approval	1.0.0
2020-03	CT-87e					Version 16.0.0 created after approval	16.0.0
2020-06	CT-88e	CP-201129	0001		B	IANA registration template of SEAL location management	16.1.0
2020-06	CT-88e	CP-201129	0002		F	Removal of editor's note on MIME types	16.1.0
2020-06	CT-88e	CP-201129	0003		B	Resolution of editor's note on application unique ID	16.1.0
2020-06	CT-88e	CP-201129	0004		B	Structure and data semantics for query list of users based on location procedure	16.1.0
2020-06	CT-88e	CP-201129	0005	3	B	XML scheme for location reporting configuration procedure for SEAL location management	16.1.0
2020-06	CT-88e	CP-201129	0013		F	Correction of references	16.1.0
2020-06	CT-88e	CP-201129	0014		F	Resolution of the editor's note on access token	16.1.0
2020-06	CT-88e	CP-201129	0016	1	B	SIP based subscription procedures	16.1.0
2020-06	CT-88e	CP-201129	0017	1	F	Adding required XML elements for subscription	16.1.0
2020-06	CT-88e	CP-201129	0018	1	B	Timers used in location management	16.1.0

History

Document history		
V16.1.0	August 2020	Publication