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Protocol specification
(3GPP TS 24.545 version 17.12.0 Release 17)**



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Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	7
1 Scope	9
2 References	9
3 Definitions of terms and abbreviations.....	10
3.1 Terms.....	10
3.2 Abbreviations	11
4 General description.....	11
5 Functional entities	11
5.1 SEAL location management client (SLM-C)	11
5.2 SEAL location management server (SLM-S).....	12
5.2 SEAL location management server (SLM-S).....	12
6 Location management procedures.....	12
6.1 General	12
6.2 On-network procedures	12
6.2.1 General.....	12
6.2.1.1 Authenticated identity in HTTP request.....	12
6.2.1.2 Boot up procedure	13
6.2.1.3 Authenticated identity in CoAP request	13
6.2.2 Event-triggered location reporting procedure	13
6.2.2.1 General	13
6.2.2.2 SLM client HTTP procedure.....	13
6.2.2.2.1 Fetching location reporting configuration	13
6.2.2.2.2 Location reporting	14
6.2.2.3 SLM server HTTP procedure	14
6.2.2.3.1 Fetching location reporting configuration	14
6.2.2.3.2 Location reporting	15
6.2.2.4 SLM client CoAP procedure	15
6.2.2.4.1 Fetching location reporting configuration	15
6.2.2.4.2 Location reporting	16
6.2.2.5 SLM server CoAP procedure	16
6.2.2.5.1 Fetching location reporting configuration	16
6.2.2.5.2 Location reporting	17
6.2.3 On-demand location reporting procedure	17
6.2.3.1 SLM client HTTP procedure.....	17
6.2.3.2 SLM server HTTP procedure	17
6.2.3.3 SLM client CoAP procedure	18
6.2.3.4 SLM server CoAP procedure	18
6.2.4 Client-triggered or VAL server-triggered location reporting procedure.....	18
6.2.4.1 SLM client HTTP procedure.....	18
6.2.4.2 SLM server HTTP procedure.....	19
6.2.4.3 SLM client CoAP procedure.....	19
6.2.4.4 SLM server CoAP procedure	21
6.2.5 Location reporting triggers configuration cancel procedure	22
6.2.5.1 SLM client HTTP procedure.....	22
6.2.5.2 SLM server HTTP procedure.....	22
6.2.5.3 VAL Server procedure	22
6.2.5.4 SLM client CoAP procedure	23
6.2.5.5 SLM server CoAP procedure	23
6.2.6 Location information subscription procedure	23

6.2.6.1	VAL server procedure.....	23
6.2.6.1.1	SIP based procedure	23
6.2.6.1.2	HTTP based procedure	24
6.2.6.2	Server procedure	25
6.2.6.2.1	SIP based procedure	25
6.2.6.2.2	HTTP based procedure.....	27
6.2.7	Event-triggered location information notification procedure.....	28
6.2.7.1	SLM client HTTP or SIP procedure.....	28
6.2.7.2	SLM server HTTP or SIP procedure.....	29
6.2.7.3	SLM client CoAP procedure	29
6.2.7.4	SLM server CoAP procedure	29
6.2.8	On-demand usage of location information procedure.....	30
6.2.8.1	VAL server procedure.....	30
6.2.8.2	Server procedure	30
6.2.9	Query list of users based on location	31
6.2.9.1	SLM client HTTP procedure.....	31
6.2.9.2	SLM server HTTP procedure.....	31
6.2.9.3	SLM client CoAP procedure	32
6.2.9.4	SLM server CoAP procedure	32
6.2.10	Location area monitoring information procedure	32
6.3	Off-network procedures	33
6.3.1	General.....	33
6.3.1.1	SEAL Off-network Location Management message transport	33
6.3.1.2	Basic Message Control.....	33
6.3.1.2.1	General	33
6.3.1.2.2	State: Start	33
6.3.1.2.3	State: Waiting for Ack/Resp.....	33
6.3.1.2.4	State: Stop.....	34
6.3.1.3	Sending acknowledgement.....	34
6.3.2	Event-triggered location reporting procedure	34
6.3.2.1	Location reporting trigger configuration.....	34
6.3.2.1.1	Client originating procedure	34
6.3.2.1.2	Client terminating procedure	35
6.3.2.2	Location reporting.....	35
6.3.2.2.1	Client originating procedure	35
6.3.2.2.2	Client terminating procedure	36
6.3.2.3	Location reporting trigger cancel	36
6.3.2.3.1	Client originating procedure	36
6.3.2.3.2	Client terminating procedure	37
6.3.3	On-demand location reporting	37
6.3.3.1	Client originating procedure.....	37
6.3.3.2	Client terminating procedure.....	37
7	Coding	38
7.1	General	38
7.2	Application unique ID	38
7.3	Structure	38
7.4	XML schema	42
7.4.1	General.....	42
7.4.2	XML schema	42
7.5	Data semantics.....	49
7.6	MIME type	56
7.7	IANA registration template	56
8	SEAL Off-network Location Management protocol message formats	58
8.1	Functional definitions and contents.....	58
8.1.1	General.....	58
8.1.2	Off-network location management message.....	58
8.1.2.1	Message definition	58
8.2	General message format and information elements coding.....	58
8.2.1	General.....	58
8.2.2	Message type	59

8.2.3	VAL user ID	59
8.2.4	Message Data.....	60
8.2.5	Cause	60
8.2.6	Message ID	61
8.2.7	Reply-to message ID.....	61
Annex A (normative): Timers.....		63
A.1	General	63
A.2	On network timers	63
A.3	Off-network timers	63
Annex B (normative): CoAP resource representation and encoding.....		64
B.1	General	64
B.2	Data types applicable to multiple resource representations.....	64
B.2.1	Referenced structured data types.....	64
B.2.2	Referenced simple data types	64
B.2.3	Common structured data types	65
B.2.3.1	Type: BaseTrigger	65
B.2.3.2	Type: LocationReportConfiguration.....	65
B.2.3.3	Type: TriggeringCriteriaType.....	65
B.2.3.4	Type: CellChange	66
B.2.3.5	Type: SpecificCells.....	66
B.2.3.6	Type: TrackingAreaChange.....	66
B.2.3.7	Type: SpecificTrackingAreas	66
B.2.3.8	Type: PlmnChange	66
B.2.3.9	Type: SpecificPlmns	67
B.2.3.10	Type: MbmsSaChange.....	67
B.2.3.11	Type: SpecificMbmsSas	67
B.2.3.12	Type: MbsfnAreaChange.....	67
B.2.3.13	Type: SpecificMbsfnAreas	67
B.2.3.14	Type: PeriodicReport.....	68
B.2.3.15	Type: TravelledDistance.....	68
B.2.3.16	Type: VerticalAppEvent	68
B.2.3.17	Type: GeographicalAreaChange.....	68
B.2.3.18	Type: SpecificGeoAreas	68
B.2.3.19	Type: LocationReport	69
B.2.3.20	Type: LocationInfo	69
B.2.4	Common simple data types	69
B.2.5	Common enumerations.....	69
B.2.5.1	Enumeration: Accuracy	69
B.3	Resource representation and APIs for location reporting provided by SLM-S.....	70
B.3.1	SU_LocationReporting API provided by SLM-S.....	70
B.3.1.1	API URI	70
B.3.1.2	Resources.....	70
B.3.1.2.1	Overview.....	70
B.3.1.2.2	Resource: Trigger Configurations.....	71
B.3.1.2.2.1	Description	71
B.3.1.2.2.2	Resource Definition.....	71
B.3.1.2.2.3	Resource Standard Methods	71
B.3.1.2.3	Resource: Location Reports	72
B.3.1.2.3.1	Description	72
B.3.1.2.3.2	Resource Definition.....	72
B.3.1.2.3.3	Resource Standard Methods	72
B.3.1.2.4	Resource: Locations	72
B.3.1.2.4.1	Description	72
B.3.1.2.4.2	Resource Definition.....	73
B.3.1.2.4.3	Resource Standard Methods	73
B.3.1.2.5	Resource: Location Area Information.....	74

B.3.1.2.5.1	Description	74
B.3.1.2.5.2	Resource Definition.....	74
B.3.1.2.5.3	Resource Standard Methods	74
B.3.1.3	Data Model	75
B.3.1.3.1	General	75
B.3.1.3.2	Structured data types	76
B.3.1.3.2.1	Type: LocationAreaQuery.....	76
B.3.1.3.2.2	Type: LocationAreaInfo	76
B.3.1.3.2.3	Type: UeInfo	76
B.3.1.3.3	Simple data types and enumerations	76
B.3.1.4	Error Handling.....	77
B.3.1.5	CDDL Specification	77
B.3.1.5.1	Introduction.....	77
B.3.1.5.2	CDDL document	77
B.3.1.6	Media Types	81
B.3.1.7	Void	81
B.3.1.8	Void	81
B.3.1.9	Void	81
B.3.1.10	Void	81
B.4	Resource representation and APIs for location reporting provided by SLM-C	81
B.4.1	SU_LocationReporting API provided by SLM-C	81
B.4.1.1	API URI	81
B.4.1.2	Resources.....	82
B.4.1.2.1	Overview	82
B.4.1.2.2	Resource: Trigger Configuration	82
B.4.1.2.2.1	Description	82
B.4.1.2.2.2	Resource Definition.....	83
B.4.1.2.2.3	Resource Standard Methods	83
B.4.1.2.3	Resource: Location.....	84
B.4.1.2.3.1	Description	84
B.4.1.2.3.2	Resource Definition.....	84
B.4.1.2.3.3	Resource Standard Methods	84
B.4.1.3	Data Model	84
B.4.1.3.1	General	84
B.4.1.4	Error Handling.....	86
B.4.1.5	CDDL Specification	86
B.4.1.5.1	Introduction.....	86
B.4.1.5.2	CDDL document	86
B.4.1.6	Media Types	90
B.5	Media types	90
B.5.1	General.....	90
B.5.2	Media type structure and definition	90
B.5.3	Media type registration template for application/vnd.3gpp.seal-location-info+cbor	91
Annex C (Informative): IANA UDP port registration form.....		93
Annex C (normative): Counters.....		95
C.1	General	95
C.2	Off-network counters	95
Annex D (informative): Change history		96
History		99

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

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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] Void.
- [8] IETF RFC 3261: "SIP: Session Initiation Protocol".
- [9] IETF RFC 4825: "The Extensible Markup Language (XML) Configuration Access Protocol (XCAP)".
- [10] IETF RFC 6050: "A Session Initiation Protocol (SIP) Extension for the Identification of Services".
- [11] IETF RFC 6665: "SIP-Specific Event Notification".
- [12] Void
- [13] IETF RFC 6750: "The OAuth 2.0 Authorization Framework: Bearer Token Usage".
- [13A] IETF RFC 6838: "Media Type Specifications and Registration Procedures".
- [14] IETF RFC 3428: "Session Initiation Protocol (SIP) Extension for Instant Messaging".
- [15] 3GPP TS 24.379: "Mission Critical Push To Talk (MCPTT) call control Protocol specification".
- [16] IETF RFC 7231 : "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content".

- [17] 3GPP TS 29.122: "T8 reference point for northbound Application Programming Interfaces (APIs)".
- [18] 3GPP TS 29.549: "Service Enabler Architecture Layer for Verticals (SEAL); Application Programming Interface (API) specification".
- [19] IETF RFC 7159: "The JavaScript Object Notation (JSON) Data Interchange Format".
- [20] IETF RFC 7230: "Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing".
- [21] IETF RFC 7252: "The Constrained Application Protocol (CoAP)".
- [22] IETF RFC 7959: "Block-Wise Transfers in the Constrained Application Protocol (CoAP)".
- [23] IETF RFC 7641: "Observing Resources in the Constrained Application Protocol (CoAP)".
- [24] IETF RFC 8132: "PATCH and FETCH Methods for the Constrained Application Protocol (CoAP)".
- [25] IETF RFC 8323: "CoAP (Constrained Application Protocol) over TCP, TLS, and WebSockets".
- [26] IETF RFC 8949: "Concise Binary Object Representation (CBOR)".
- [27] IETF RFC 9177: "Constrained Application Protocol (CoAP) Block-Wise Transfer Options Supporting Robust Transmission".
- [28] IETF RFC 8610: "Concise Data Definition Language (CDDL): A Notational Convention to Express Concise Binary Object Representation (CBOR) and JSON Data Structures".
- [29] 3GPP TS 24.546: "Configuration management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".
- [30] OMA OMA-TS-XDM_Core-V2_1-20120403-A: "XML Document Management (XDM) Specification".
- [31] IETF RFC 4122: "A Universally Unique Identifier (UUID) URN Namespace".
- [32] IETF RFC 6086: "Session Initiation Protocol (SIP) INFO Method and Package Framework".

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 HTTP procedures in the present document the SLM-C:

- a) shall support the role of XCAP client as specified in IETF RFC 4825 [9]; b) shall support the role of XDMC as specified in OMA OMA-TS-XDM_Core-V2_1 [30];
- c) shall support the location management procedures in clause 6.2;
- d) shall support the off-network location management procedure in clause 6.3; and
- e) shall support HTTP client and HTTP server functionalities as specified in IETF RFC 7230 [20].

To be compliant with the CoAP procedures in the present document the SLM-C:

- a) shall support the role of CoAP client as specified in IETF RFC 7252 [21];
- b) shall support FETCH method of CoAP as specified in IETF RFC 8132 [24];
- c) shall support the capability to observe resources as specified in IETF RFC 7641 [23];
- d) shall support the block-wise transfer as specified in IETF RFC 7959 [22];
- e) may support the robust block transfer as specified in IETF RFC 9177 [27];
- f) should support CoAP over TCP and Websocket as specified in IETF RFC 8323 [25];
- g) shall support CBOR encoding as specified in IETF RFC 8949 [26]; and
- h) shall support the procedures in clause 6.2.

NOTE 1: The security mechanism to be supported for the CoAP procedures is described in 3GPP TS 24.547 [6].

NOTE 2: Support for TCP for the CoAP procedures is required if the client connects over the network which blocks or impedes the use of UDP, e.g. when NATs are present in the communication path.

NOTE 3: The CoAP protocol supports mechanism for reliable message exchange over UDP. Use of TCP can also be beneficial if reliable transport is required for other reasons, e.g. better observability of resources. Usage of CoAP over TCP is an implementation choice.

NOTE 4: Support for the robust block transfer mechanism for the CoAP procedures is beneficial in environments where packet loss is highly asymmetrical and where performance optimization of block transfers is required.

5.2 SEAL location management server (SLM-S)

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 HTTP 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 [30];
- c) shall support the location management procedures in clause 6.2; and
- d) shall support HTTP client and HTTP server functionalities as specified in IETF RFC 7230 [20].

To be compliant with the CoAP procedures in the present document the SLM-C:

- a) shall support the role of CoAP server as specified in IETF RFC 7252 [21];
- b) shall support FETCH method of CoAP as specified in IETF RFC 8132 [24];
- c) shall support the capability to observe resources as specified in IETF RFC 7641 [23];
- d) shall support the block-wise transfer as specified in IETF RFC 7959 [22];
- e) shall support the robust block transfer as specified in IETF RFC 9177 [27];
- f) shall support CoAP over TCP and Websocket as specified in IETF RFC 8323 [25];
- g) shall support CBOR encoding as specified in IETF RFC 8949 [26]; and
- h) shall support the procedures in clause 6.2.

NOTE: The security mechanism to be supported for the CoAP procedures is described in 3GPP TS 24.547 [6].

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.

6.2.1.2 Boot up procedure

Upon device boot up, the SLM-C in the UE shall send HTTP POST message to SLM-S containing the call back URI (where the SLM-S can send request message to SLM-C) in a JavaScript Object Notation (JSON) structure as specified in IETF RFC 7159 [19].

6.2.1.3 Authenticated identity in CoAP request

Upon receiving an CoAP request, the SLM-S shall authenticate the identity of the sender of the CoAP request 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 CoAP 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 or CoAP 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 for HTTP and in 6.2.2.4 for CoAP if any of the reporting triggers are still met.

6.2.2.2 SLM client HTTP 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 7231 [16]. 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 an HTTP POST request message according to procedures specified in IETF RFC 7231 [16]. 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 an <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;
 - ii) shall include the location reporting elements corresponding to the triggers that have been met; and
 - iii) may include a <timestamp> child element set to the timestamp of the VAL user location report; and
- 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 SLM server HTTP 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 7231 [16]. 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 an 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 and timestamp.

6.2.2.4 SLM client CoAP procedure

6.2.2.4.1 Fetching location reporting configuration

In order to fetch trigger configuration, the SLM-C shall send a CoAP GET request message to the SLM-S according to procedures specified in IETF RFC 7252 [21]. In the CoAP GET request, the SLM-C:

- a) shall set the CoAP URI identifying the trigger configuration to be fetched according to the resource definition in Annex B.3.1.2.2;
 - 1) the "apiRoot" is set to the SLM-S URI;
 - 2) the "valServiceId" is set to specific VAL service; and
 - 3) the "val-tgt-ue" query option is set to either the VAL user identity or VAL UE identity for which the trigger configuration is applicable;
- b) shall include an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration"; and
- c) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].

Upon receiving a CoAP 2.05 (Content) response from the SLM-S containing:

- a) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration"; and
- b) including a "LocationReportConfiguration" object,

the SLM-C:

- a) shall store the content of the "LocationReportConfiguration" object;
- b) shall set the location reporting triggers accordingly;
- c) shall start the minimum report interval timer; and
- d) shall consider the "timestampInd" attribute in order to know whether timestamp of location reports is required.

6.2.2.4.2 Location reporting

In order to report the location information, the SLM-C shall send a CoAP PUT request message according to procedures specified in IETF RFC 7252 [21]. In the CoAP PUT request message, the SLM-C:

- a) shall set the CoAP URI identifying the location report to be sent according to the resource definition in Annex B.3.1.2.3;
 - 1) the "apiRoot" is set to the SLM-S URI; and
 - 2) the "valTgtUe" is set to either the VAL user identity or VAL UE identity for which the location is reported; and
- b) shall include a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report";
- c) shall include a "LocationReport" object:
 - 1) shall include a "triggerIds" attribute set to the value of each trigger ID value of the triggers that have been met; and
 - 2) shall include a "locInfo" object corresponding to the triggers that have been met;
- d) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].
- e) shall set the minimum-report-interval timer to the minimum-report-interval time and start this timer; and
- f) shall reset all the trigger criteria for location reporting.

6.2.2.5 SLM server CoAP procedure

6.2.2.5.1 Fetching location reporting configuration

Upon receiving of a CoAP GET request where the CoAP URI of the CoAP GET request identifies a trigger configuration as specified in Annex B.3.1.2.2.3.1, the SLM-S:

- a) shall determine the identity of the sender of the received CoAP GET request as specified in clause 6.2.1.2, and:
 - 1) if the identity of the sender of the received CoAP GET request is not authorized to fetch requested trigger configuration, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP GET request and skip rest of the steps;
- b) shall generate a CoAP 2.05 (Content) response according to IETF RFC 7252 [21]. In the CoAP 2.05 (Content) response message, the SLM-S:
 - 1) shall include a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration"; and
 - 2) shall include a "LocationReportConfiguration" object:
 - i) shall include a "locationType" attribute which is requested; and
 - ii) shall include at least one of the followings:
 - A) a "triggeringCriteria" object which provides the triggers for the SLM-C to request a location report;

- B) a "minimum-interval-length" attribute specifying the minimum time between consecutive reports. The value is given in seconds;
 - C) an "immediateReportInd" attribute which indicates that an immediate location report is required and if the "immediateReportInd" attribute indicates the immediate location report is required:
 - I) an "endpointId" attribute containing the endpoint information of the requesting VAL server to which the location report notification has to be sent; and
 - D) a "timestampInd" attribute which indicates that timestamp of the location report is required; and
- c) shall send the CoAP 2.05 (Content) response towards the SLM-C.

6.2.2.5.2 Location reporting

Upon reception of a CoAP PUT request message where the CoAP URI of the CoAP PUT request identifies a location report as specified in Annex B.3.1.2.3.3.1, and containing:

- a) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
- b) a "LocationReport" object;

the SLM-S:

- a) shall determine the identity of the sender of the received CoAP PUT request as specified in clause 6.2.1.2; and
- 1) if the identity of the sender of the received CoAP PUT request is not authorized to report location information, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP PUT request and shall skip rest of the steps; and
- 2) shall support handling a CoAP PUT request from a SLM-C:
 - i) shall store the received location information of the reporting SLM-C; and
 - ii) shall use the location information as needed.

NOTE: The "LocationReport" object contains the event triggering identity in the location information report from the VAL client, and can contain location information and timestamp.

6.2.3 On-demand location reporting procedure

6.2.3.1 SLM client HTTP 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 SLM server HTTP 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 7231 [16]. 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 7231 [16].

NOTE: Push notification service can be used to send HTTP POST request to the client. Details about the push notification service is out of scope this specification.

6.2.3.3 SLM client CoAP procedure

Upon receiving an CoAP GET request where the CoAP URI of the CoAP GET request identifies the location resource as specified in Annex B.4.1.2.2.3.1, and containing:

- a) an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report",

the SLM-C shall generate a CoAP 2.05 (Content) response according to IETF RFC 7252 [21]. In the CoAP 2.05 (Content) response message, the SLM-C:

- a) shall include a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report";
- b) shall include a "LocationReport" object:
 - 1) shall include a "locInfo" object containing the location information; and
- c) shall send the CoAP 2.05 (Content) response towards the SLM-S.

6.2.3.4 SLM server CoAP procedure

If the SLM-S needs to request the SLM-C to report its location, the SLM-S shall generate a CoAP GET request according to procedures specified in IETF RFC 7252 [21]. The SLM-S:

- a) shall set the CoAP URI identifying the location to be retrieved according to the resource definition in Annex B.4.1.2.2.3.1;
 - 1) the "apiRoot" is set to the SLM-C URI;
- b) shall include an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
- c) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].

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

6.2.4.1 SLM client HTTP procedure

Upon receiving a request from a VAL user to obtain the location information of another VAL user or to update the location reporting trigger, the SLM-C shall send an HTTP POST request according to procedures specified in IETF RFC 7231 [16]. 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 an <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) an <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 triggering criteria to send the location report;
 - iv) a <minimum-interval-length> child element specifying the minimum time between consecutive reports. The value is given in seconds;
 - v) if an <immediate-report-indicator> element is set to required, an <endpoint-info> child element set to the information of the endpoint of the requesting VAL server to which the location report notification has to be sent; and
 - vi) a <timestamp-indicator> child element to indicate that timestamp of the location report is required.

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 an XML document as specified in application usage of the specific vertical application, the SLM-C shall follow the procedure as specified in clause 6.2.2.3.2.

6.2.4.2 SLM server HTTP procedure

Upon reception of an HTTP POST request where the Request-URI of the HTTP POST request identifies an element of an 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; and
- b) For on-demand location report request, upon receiving the location information of the SLM-C, the SLM-S sends location report to the requesting SLM-C or VAL server as specified in clause 6.2.2.2.

6.2.4.3 SLM client CoAP procedure

Upon receiving a request from a VAL user to obtain the location information of another VAL user, the SLM-C shall:

- a) if trigger configuration is provided, send a CoAP FETCH request according to procedures specified in IETF RFC 8132 [24] to SLM-S to observe the location information of another VAL user; and
- b) otherwise, send a CoAP GET request according to procedure specified in IETF RFC 7252 [21] to SLM-S to retrieve the location information of another VAL user.

In the CoAP FETCH request, the SLM-C shall:

- a) set the CoAP URI identifying the location information to be observed according to the resource definition in Annex B.3.1.2.4.3.1;
 - 1) the "apiRoot" is set to the SLM-S URI;
- b) include an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report";
- c) set an Observe option to 0 (Register);
- d) set a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration";
- e) include a "LocationReportConfiguration" object:
 - 1) shall include a "valTgtUes" object set to the identity of the observed VAL users;
 - 2) shall include a "locationType" attribute which is requested; and
 - 3) shall include at least one of the following:
 - i) a "triggeringCriteria" object which provides the triggers for the SLM-C to request a location report as described in Annex B.3;
 - ii) a "minimumIntervalLength" attribute specifying the minimum time between consecutive reports. The value is given in seconds;
 - iii) an "immediateReportInd" attribute which indicates that an immediate location report is required and if the "immediateReportInd" attribute indicates the immediate location report is required:
 - A) an "endpointId" attribute containing the endpoint information of the requesting VAL server to which the location report notification has to be sent; and
 - iv) a "timestampInd" attribute which indicates that timestamp of the location report is required; and
- f) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].

In the CoAP GET request, the SLM-C shall:

- a) set the CoAP URI identifying the location information to be fetched according to the resource definition in Annex B.3.1.2.4.3.2;
 - 1) the "apiRoot" is set to the SLM-S URI; and
 - 2) the "val-tgt-ue" query option is set to either the VAL user identity or VAL UE identity for which the location is requested;
- b) include an Accept option set to "application/vnd.3gpp.seal-location-info+cbor"; and
- c) send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].

Upon receiving a CoAP 2.05 (Content) response from the SLM-S containing:

- a) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
- b) including one or more "LocationReport" objects,

the SLM-C:

- a) shall store the content of the received "LocationReport" object(s).

6.2.4.4 SLM server CoAP procedure

Upon reception of a CoAP FETCH request message where the CoAP URI of the CoAP FETCH request identifies a location resource as specified in B.3.1.2.4.3.1, and containing:

- a) an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report";
- b) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration";
- c) an Observe option; and
- d) a "LocationReportConfiguration" object;

the SLM-S:

- a) shall determine the identity of the sender of the received CoAP FETCH request as specified in clause 6.2.1.2; and
 - 1) if the identity of the sender of the received CoAP FETCH request is not authorized to obtain location information of another VAL user, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP FETCH request and shall skip rest of the steps; and
 - 2) shall generate a series of CoAP 2.05 (Content) response according to IETF RFC 8132 [24]. In the CoAP 2.05 (Content) response message, the SLM-S:
 - i) shall include a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
 - ii) shall include one or more "LocationReport" objects corresponding to the triggers that have been met; and
- b) shall send the CoAP 2.05 (Content) response towards the SLM-C.

Upon reception of a CoAP GET request message where the CoAP URI of the CoAP GET request identifies a location resource as specified in B.3.1.2.4.3.2, and containing:

- a) an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
- b) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration".

the SLM-S:

- a) shall determine the identity of the sender of the received CoAP GET request as specified in clause 6.2.1.2; and
 - 1) if the identity of the sender of the received CoAP GET request is not authorized to obtain location information of another VAL user, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP GET request and shall skip rest of the steps;
- b) shall generate a CoAP 2.05 (Content) response according to IETF RFC 7252 [21]. In the CoAP 2.05 (Content) response message, the SLM-S:
 - 1) shall include a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
 - 2) shall include a "LocationReport" object corresponding to the triggers that have been met; and
- c) shall send the CoAP 2.05 (Content) response towards the SLM-C.

6.2.5 Location reporting triggers configuration cancel procedure

6.2.5.1 SLM client HTTP 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 7231 [16] and shall send it towards SLM-S.

6.2.5.2 SLM server HTTP 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-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 7231 [16].

Upon receiving response from the SLM-C, the SLM-S shall generate an HTTP 200 (OK) response to the received HTTP POST request message according to IETF RFC 7231 [16] and shall send it towards VAL server.

6.2.5.3 VAL Server procedure

The VAL Server (or authorized VAL user) may cancel the location reporting triggers configuration for the SLM-C by generating an HTTP POST request message according to procedures specified in IETF RFC 7231 [16]. The VAL server:

- a) shall include a Request-URI set to the URI corresponding to the identity of the SLM-S;
- 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 <VAL-user-id> 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 7231 [16].

6.2.5.4 SLM client CoAP procedure

Upon receiving an CoAP DELETE request where the CoAP URI of the CoAP DELETE request identifies a location reporting configuration resource as specified in B.4.1.2.2.3.3, the SLM-C:

- a) shall delete the content of the trigger configuration object;
- b) shall stop the location reporting; and
- c) shall generate a CoAP 2.02 (Deleted) response to the received CoAP DELETE request message according to IETF RFC 7252 [21] and shall send it towards SLM-S.

6.2.5.5 SLM server CoAP procedure

Upon receiving an HTTP POST request containing from VAL server:

- 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-S shall send a CoAP DELETE request message to the SLM-C. In the CoAP DELETE request, the SLM-S:

- a) shall set the CoAP URI identifying the trigger configuration to be deleted according to the resource definition in Annex B.4.1.2.2.3.3;
 - 1) the "apiRoot" is set to the SLM-C URI; and
 - 2) "valServiceId" is set to the specific VAL service identity; and
- b) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].

Upon receiving a response from the SLM-C, the SLM-S shall generate an HTTP 200 (OK) response to the received HTTP POST request message according to IETF RFC 7231 [16] and shall send it towards VAL server.

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 does 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) a <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

6.2.6.1.2.1 Create subscription

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 7231 [16]. 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 as described in clause 6.2.6.1.1.1; and

- e) shall send the HTTP POST request towards the SLM-S as specified in IETF RFC 7231 [16].

Upon receiving an HTTP POST request 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 up to implementation to refresh subscribe upon expiry of subscription refresh timer.

6.2.6.1.2.2 Delete subscription

In order to delete the subscription as identified by the subscription identifier, the VAL server shall generate an HTTP POST request according to procedures specified in IETF RFC 7231 [16]. In the HTTP POST request message, the VAL server:

- a) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include a <subscription-identifier> element set to the subscription identifier value which uniquely identified the subscription; and
 - 2) shall include an <expiry-time> element set to zero;
- b) shall send the HTTP POST request towards the SLM-S as specified in IETF RFC 7231 [16].

Upon receiving an HTTP POST 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.

6.2.6.2 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 user's 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 [32];
- 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;
 - 2) shall support handling an HTTP POST request from a SLM-C according to procedures specified in IETF RFC 4825 [9] "POST Handling";
 - 3) may initiate location reporting configuration with the location management client of the UE for immediate reporting as specified in clause 6.2.3.2; and
 - 4) may subscribe for the location of the UE as specified in clause 4.4.2.2.2 of 3GPP TS 29.122 [17];
- b) 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;
- c) shall store the time interval value to the <time-interval-length> element. If the time interval value as present in <time-interval-length> element is not acceptable to the SLM-S, the SLM-S may change the time interval value to a lower value;
- d) shall generate and assign a unique integer as subscription identifier to the subscription request received from VAL server;
- e) shall store the user's information contained in the <VAL-user-id> elements of <identities-list> element. 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 store the identities of the new VAL users;
- f) shall generate an HTTP 200 (OK) response according to IETF RFC 7231 [16]. In the HTTP 200 (OK) message, the SLM-S:
 - 1) shall include an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element;

- 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;
- g) shall send the HTTP 200 (OK) message towards the VAL server according to IETF RFC 7231 [16];
- h) shall start the timer TLM-1 (subscription expiry) and set the expiry time of the timer to the expiry time for the subscription; and
- i) shall start the timer TLM-2 (notification interval) timer and set the internal time of the timer to the <time-interval-length> element value.

Upon receiving an HTTP POST request 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 delete all information related to subscription;
- b) shall generate an HTTP 200 (OK) message according to IETF RFC 7231 [16]. In the HTTP 200 (OK) 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 HTTP 200 (OK) message towards the VAL server according to IETF RFC 7231 [16];
- 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.

6.2.7 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 SLM client HTTP or SIP 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;
- b) shall generate either a SIP 200 (OK) response to the received SIP MESSAGE request according to 3GPP TS 24.229 [5] or an HTTP 200 (OK) response to the received HTTP POST request message according to IETF RFC 9110 [16] and shall send it towards the SLM-S; and
- c) may share the information to a group or to another VAL user or VAL UE.

6.2.7.2 SLM server HTTP or SIP 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>:
 - A) shall include a <VAL-user-id> element set to the identity of the VAL user whose location information needs to be notified;
 - B) shall include the latest location information corresponding to the VAL user; and
 - C) may include a <timestamp> child element set to the timestamp of the VAL user location report; 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 7231 [16] with the constructed application/vnd.3gpp.seal-location-info+xml MIME body and a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml".

6.2.7.3 SLM client CoAP procedure

Upon receiving a CoAP 2.05 (Content) response to a CoAP FETCH request message used to observe a location resource as specified in Annex B.3.1.2.4.3.1, and containing:

- a) a Content-Type option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and
- b) one or more "LocationReport" object,

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.

6.2.7.4 SLM server CoAP procedure

In order to notify the subscriber about the location information report, the SLM-S shall send a CoAP 2.05 (Content) response to SLM-C in response to a CoAP FETCH request message used to observe a location resource as specified in Annex B.3.1.2.4.3.1. In the CoAP 2.05 (Content) response, the SLM-S:

- a) shall include one or more "LocationReport" objects, each "LocationReport" object containing:
 - 1) "valTgtUe" attribute set to the identity of the VAL user whose location information is notified;
 - 2) "triggerIds" attribute set to the value of each "triggerId" value of the triggers that have been met;
 - 3) "locInfo" attribute set to the location information; and
 - 4) a "timestamp" attribute which indicates the timestamp of the location report(s).

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 7231 [16]. 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 7231 [16]. 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 may include timestamp; 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 SLM client HTTP 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 7231 [16]. 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 SLM server HTTP 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;

6.2.9.3 SLM client CoAP procedure

In order to query the list of users based on given geolocation area, the SLM-C shall send an CoAP FETCH request message to SLM-S according to procedures specified in IETF RFC 8132 [24]. In the CoAP FETCH request message, the SLM-C:

- a) shall set the CoAP URI identifying the UE information to be fetched according to the resource definition in Annex B.3.1.2.5.3.1;
 - 1) the "apiRoot" is set to the SLM-S URI;
- b) shall include an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-info";
- c) shall include a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-query";
- d) shall include a "LocationAreaQuery" object including the geolocation area; and
- e) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [6].

6.2.9.4 SLM server CoAP procedure

Upon reception of an CoAP FETCH request where the CoAP URI of the CoAP GET request identifies a location area information resource as specified in Annex B.3.1.2.5.3.1, and containing:

- a) an Accept option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-info";
- b) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-query"; and
- c) a "LocationAreaQuery" object,

the SLM-S:

- a) shall authorize the identity of the sender of the received CoAP FETCH request; and
 - 1) if the identity of the sender of the received CoAP FETCH request is not authorized to obtain list of users based on given geolocation area, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP FETCH 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 CoAP 2.05 (Content) response message to SLM-C. In the CoAP 2.05 (Content) response message, the SLM-S:
 - 1) shall generate an "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-info" MIME body with a "UeInfos" object containing a "ueList" object with one or more "UeInfo" objects set to the identities of the VAL users and their corresponding locations.

6.2.10 Location area monitoring information procedure

In order to subscribe for monitoring location area, the SLM-C sends subscription request as specified in clause 5.2.6 and clause 6 of 3GPP TS 29.549 [18].

6.3 Off-network procedures

6.3.1 General

6.3.1.1 SEAL Off-network Location Management message transport

In order to send the request, response or acknowledgement, the SEAL location management client:

- 1) shall send the message as a UDP message to the local IP address of the VAL user, to UDP port 65400, with an IP time-to-live set to 255; and
- 2) shall treat UDP messages received on the port 65400 as received messages.

The SEAL Off-network Location Management message is the entire payload of the UDP message.

6.3.1.2 Basic Message Control

6.3.1.2.1 General

The figure 6.3.1.2.1-1 gives an overview of the main states and transitions on the UE for sending a SEAL Off-network Location Management message.

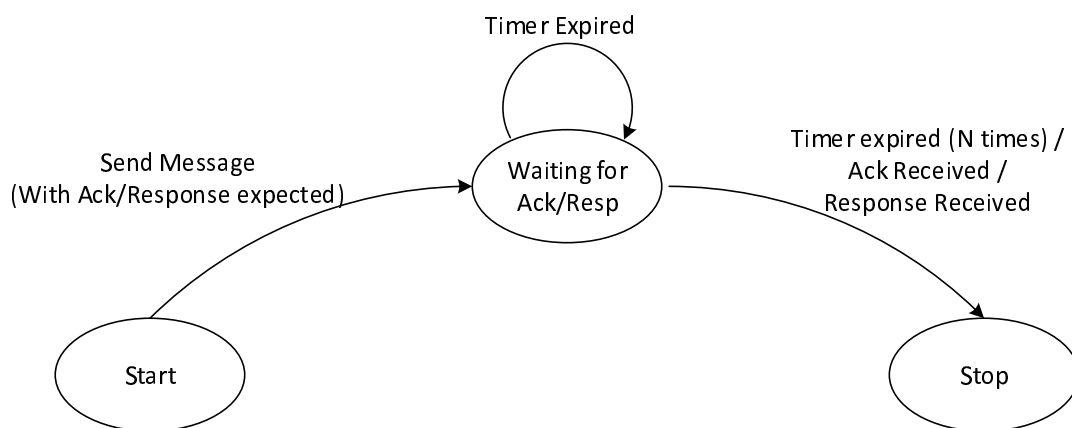


Figure 6.3.1.2.1-1: Basic state machine to send SEAL Off-network Location Management message

6.3.1.2.2 State: Start

This state exists for the SLM-C, when the SLM-C decides the SEAL Off-network Location Management message.

6.3.1.2.2.1 Send Message (With Ack/Response expected)

When SLM-C sends a SEAL Off-network Location Management message for which response or acknowledgement from the target UE is expected, the SLM-C:

- a) shall set counter C101 to the value 1;
- b) shall start the timer T101 (waiting for ack/resp);
- c) shall send the message to the target UE; and
- d) shall enter the state "Waiting for Ack/Resp".

6.3.1.2.3 State: Waiting for Ack/Resp

This state exists for the SLM-C, when the SLM-C has already sent the SEAL Off-network Location Management message, and waiting to receive which response or acknowledgement.

6.3.1.2.3.1 Timer T101 Expired

Upon expiry of the timer T101 where current value of the counter C101 is less than N, the SLM-C:

- a) shall increment the value of the counter C101 by 1;
- b) shall restart the timer T101 (waiting for ack/resp);
- c) shall send the message to the target UE; and
- d) shall remain in the state "Waiting for Ack/Resp".

6.3.1.2.3.2 Timer T101 Expired (N times)

Upon expiry of the timer T101 where current value of the counter C101 is greater than or equal to N, the SLM-C:

- a) shall consider the message sending as failure;
- b) shall stop the timer T101 (waiting for ack/resp);
- c) shall inform the VAL user about the failure of the message; and
- d) shall enter the state "Stop".

6.3.1.2.3.2 Acknowledgement Received or Response Received

Upon receiving response of the message or acknowledgement of the message, the SLM-C:

- a) shall stop the timer T101 (waiting for ack/resp);
- b) shall enter the state "Stop"; and
- c) shall inform the VAL user about the success of the message.

6.3.1.2.4 State: Stop

This state exists for the SLM-C, when the procedure to send the SEAL Off-network Location Management message is completed, and no further response or acknowledgement is expected.

6.3.1.3 Sending acknowledgement

The SLM-C:

- a) shall generate the Off-network location management message according to clause 8.1.2 by setting:
 - i) the Message type IE to "LOCATION MANAGEMENT ACK";
 - ii) the Originating VAL user ID IE to its own VAL user ID;
 - iii) the Terminating VAL user ID IE to the VAL user ID of the target VAL user;
 - iv) the Message ID IE to the value of the Message ID of the received message; and
- b) shall send the message as specified in clause 6.3.1.2.

6.3.2 Event-triggered location reporting procedure

6.3.2.1 Location reporting trigger configuration

6.3.2.1.1 Client originating procedure

Upon receiving a request from a VAL user to configure the location information trigger to another VAL user, the SLM-C:

- a) shall generate the Off-network location management message according to clause 8.1.2. In the Off-network location management message:
 - i) shall set the Message type IE to "LOCATION REPORTING TRIGGER CONFIGURATION REQUEST";
 - ii) shall set the Originating VAL user ID IE to its own VAL user ID;
 - iii) shall set the Terminating VAL user ID IE to the VAL user ID of the target VAL user;
 - iv) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element including a <configuration> element with at least one of the followings:
 - 1) the location reporting elements which are requested;
 - 2) a <triggering-criteria> child element which indicate a specified location triggering criteria to send the location report; or
 - 3) a <minimum-interval-length>child element specifying the minimum time between consecutive reports. The value is given in seconds; and
 - v) shall set the Location Management Data IE to the application/vnd.3gpp.seal-location-info+xml MIME body; and
 - vi) shall set the Message ID IE to the unique identity of this message; and
- b) shall send the message as specified in clause 6.3.1.2.

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION REPORTING TRIGGER CONFIGURATION RESPONSE", the SLM-C shall send the acknowledgement message as specified in clause 6.3.1.3.

6.3.2.1.2 Client terminating procedure

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION REPORTING TRIGGER CONFIGURATION REQUEST", the SLM-C:

- a) shall store the content of the <configuration> elements;
- b) shall set the location reporting triggers accordingly;
- c) shall start the minimum-report-interval timer;
- d) shall generate the Off-network location management message according to clause 8.1.2 by setting:
 - i) the Message type IE to "LOCATION REPORTING TRIGGER CONFIGURATION RESPONSE";
 - ii) the Originating VAL user ID IE to its own VAL user ID; and
 - iii) the Terminating VAL user ID IE to the VAL user ID of the originating VAL user;
 - iv) the Message ID IE to the unique identity of this message; and
 - v) the Reply-to message ID IE to the value of the Message ID of the received message; and
- e) shall send the message as specified in clause 6.3.1.2.

6.3.2.2 Location reporting

6.3.2.2.1 Client originating procedure

In order to report the location information, the SLM-C:

- a) shall generate the Off-network location management message according to clause 8.1.2. In the Off-network location management message:
 - i) shall set the Message type IE to "LOCATION REPORT";

- ii) shall set the Originating VAL user ID IE to its own VAL user ID;
 - iii) shall set the Terminating VAL user ID IE to the VAL user ID of the target VAL user;
 - iv) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) shall include a <report> element and, in the <report> element:
 - A) shall include a <trigger-id> child element set to the value of each <trigger-id> value of the triggers that have been met;
 - B) shall include the location reporting elements corresponding to the triggers that have been met; and
 - C) may include a <timestamp> child element set to the timestamp of the location report; and
 - 2) 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; and
 - v) shall set the Location Management Data IE to the application/vnd.3gpp.seal-location-info+xml MIME body; and
 - vi) shall set the Message ID IE to the unique identity of this message;
- b) shall send the message as specified in clause 6.3.1.2;
 - c) shall set the minimum-report-interval timer to the minimum-report-interval time and start this timer; and
 - d) shall reset all the trigger criteria for location reporting.

6.3.2.2.2 Client terminating procedure

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION REPORT", the SLM-C:

- a) shall acknowledge by the acknowledgement message as specified in clause 6.3.1.3.
- b) shall store the received location information of the reporting SLM-C; and
- c) shall use the location information as needed.

6.3.2.3 Location reporting trigger cancel

6.3.2.3.1 Client originating procedure

Upon receiving a request from a VAL user to cancel the location information trigger to another VAL user, the SLM-C:

- a) shall generate the Off-network location management message according to clause 8.1.2. In the Off-network location management message:
 - i) shall set the Message type IE to "LOCATION REPORTING TRIGGER CANCEL REQUEST";
 - ii) shall set the Originating VAL user ID IE to its own VAL user ID;
 - iii) shall set the Terminating VAL user ID IE to the VAL user ID of the target VAL user;
 - iv) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element including a <configuration> element which shall not include any child element;
 - v) shall set the Location Management Data IE to the application/vnd.3gpp.seal-location-info+xml MIME body; and
 - vi) shall set the Message ID IE to the unique identity of this message; and
- b) shall send the message as specified in clause 6.3.1.2.

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION REPORTING TRIGGER CANCEL RESPONSE", the SLM-C shall acknowledge the acknowledgement message as specified in clause 6.3.1.3.

6.3.2.3.2 Client terminating procedure

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION REPORTING TRIGGER CANCEL REQUEST", the SLM-C:

- a) shall delete the content of the <configuration> elements;
- b) shall stop the location reporting;
- d) shall generate the Off-network location management message according to clause 8.1.2 by setting:
 - i) the Message type IE to "LOCATION REPORTING TRIGGER CANCEL RESPONSE";
 - ii) the Originating VAL user ID IE to its own VAL user ID;
 - iii) the Terminating VAL user ID IE to the VAL user ID of the originating VAL user;
 - iv) the Message ID IE to the unique identity of this message; and
 - v) the Reply-to message ID IE to the value of the Message ID of the received message; and
- e) shall send the message as specified in clause 6.3.1.2.

6.3.3 On-demand location reporting

6.3.3.1 Client originating procedure

Upon receiving a request from a VAL user to request the location information from another VAL user, the SLM-C:

- a) shall generate the Off-network location management message according to clause 8.1.2. In the Off-network location management message:
 - i) shall set the Message type IE to "LOCATION REQUEST (ON-DEMAND)";
 - ii) shall set the Originating VAL user ID IE to its own VAL user ID;
 - iii) shall set the Terminating VAL user ID IE to the VAL user ID of the target VAL user;
 - iv) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element shall include a <report-request> element which shall include at least one of the followings:
 - 1) an <immediate-report-indicator> child element to indicate that an immediate location report is required;
 - 2) the location reporting elements which are requested; andmay include a <timestamp-indicator> child element to indicate that timestamp of the location report is required; and
 - v) shall set the Location Management Data IE to the application/vnd.3gpp.seal-location-info+xml MIME body;
 - vi) shall set the Message ID IE to the unique identity of this message; and
- b) shall send the message as specified in clause 6.3.1.2.

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION RESPONSE (ON-DEMAND)", the SLM-C shall send the acknowledgement message as specified in clause 6.3.1.3.

6.3.3.2 Client terminating procedure

Upon reception of Off-network location management message containing a Message type IE set to "LOCATION REQUEST (ON-DEMAND)", the SLM-C:

- a) shall generate the Off-network location management message according to clause 8.1.2. In the Off-network location management message:
 - i) shall set the Message type IE to "LOCATION RESPONSE (ON-DEMAND)";
 - ii) shall set the Originating VAL user ID IE to its own VAL user ID;
 - iii) shall set the Terminating VAL user ID IE to the VAL user ID of the originating VAL user;
 - iv) shall generate an application/vnd.3gpp.seal-location-info+xml MIME body and in the <location-info> root element:
 - 1) 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:
 - A) shall include a <trigger-id> child element set to the value of each <trigger-id> value of the triggers that have been met; and
 - B) shall include the location reporting elements corresponding to the triggers that have been met; and
 - v) shall set the Location Management Data IE to the application/vnd.3gpp.seal-location-info+xml MIME body;
 - vi) shall set the Message ID IE to the unique identity of this message; and
 - vii) shall set the Reply-to message ID IE to the value of the Message ID of the received message; and
- b) shall send the message as specified in clause 6.3.1.2.

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- response> 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:
 - 1) a <VAL-user-id> element;
 - 2) a <latest-location> element, which shall include at least one of the following sub-elements:
 - i) shall include a <latest-serving-NCGI> element;
 - ii) shall include a <neighbouring-NCGI> element;
 - iii) an <mbms-service-area-id> element;
 - iv) an <mbsfn-area> element; or
 - v) a <latest-coordinate> element; and
 - 3) may include a <timestamp> element.

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

- a) shall include a <trigger-id> element; and
- b) shall include 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; and
- c) may include a <timestamp> 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-tracking-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 includes the following sub-elements:

a) an <immediate-report-indicator> element;

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;
 - d) a <minimum-interval-length> element;
 - e) an <endpoint-info> element; and
 - f) a <timestamp> element.

At least one of the bullet a) to d) above shall be present in the <report-request> 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/xmldsig#">

<xs:import namespace="http://www.w3.org/XML/1998/namespace"
  schemaLocation="http://www.w3.org/2001/xml.xsd"/>

  <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 maxOccurs="unbounded">
        <xs:element name="identity" type="sealloc:tIdentityType"/>
        <xs:element name="configuration" type="sealloc:tConfigurationType"/>
        <xs:element name="report" type="sealloc:tReportType"/>
        <xs:element name="location-based-query" type="sealloc:tLocationBasedQueryType"/>
        <xs:element name="location-based-response" type="sealloc:tLocationBasedResponseType"/>
        <xs:element name="notification" type="sealloc:tNotificationType"/>
        <xs:element name="request" type="sealloc:tRequestType"/>
        <xs:element name="requested-identity" type="sealloc:tRequestedIDType"/>
        <xs:element name="subscription" type="sealloc:tSubscriptionType"/>
        <xs:element name="report-request" type="sealloc:tReportRequestType"/>
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:choice>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>
  </xs:element>

  <xs:complexType name="tIdentityType">
    <xs:choice>
      <xs:element name="VAL-user-id" type="sealloc:contentType" minOccurs="0"/>
      <xs:element name="VAL-group-id" type="xs:string" minOccurs="0"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:choice>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="tConfigurationType">
    <xs:sequence>
      <xs:element name="location-information" type="sealloc:tRequestedLocationType" minOccurs="0"/>
      <xs:element name="triggering-criteria" type="sealloc:TriggeringCriteriaType" minOccurs="0"/>
      <xs:element name="minimum-interval-length" type="xs:positiveInteger" minOccurs="0"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="config-scope">
      <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="tReportType">
    <xs:sequence>
      <xs:element name="trigger-id" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="current-location" type="sealloc:tCurrentLocationType"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="report-id" type="xs:string" use="optional"/>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="tLocationBasedQueryType">
    <xs:sequence>
      <xs:element name="polygon-area" type="sealloc:tPolygonAreaType" minOccurs="0"/>
      <xs:element name="ellipsoid-arc-area" type="sealloc:tEllipsoidArcType" minOccurs="0"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>

```

```

    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="tLocationBasedResponseType">
    <xs:sequence>
      <xs:element name="identities-list" type="sealloc:tIDsListType"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!-- The following elements are added for extensibility and to be placed in the anyExt element
  above -->
  <xs:element name="timestamp" type="xs:dateTime"/>
  <xs:annotation>
    <xs:documentation>timestamp can only be present once in a single report</xs:documentation>
  </xs:annotation>

  <xs:complexType name="tNotificationType">
    <xs:sequence>
      <xs:element name="identities-list" type="sealloc:tIDsListType"/>
      <xs:element name="reports" type="sealloc:tReportsType"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="trigger-id" type="xs:string" use="required"/>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="tRequestType">
    <xs:complexContent>
      <xs:extension base="sealloc:tEmptyType">
        <xs:attribute name="request-id" type="xs:string" use="required"/>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>

  <xs:complexType name="tRequestedIDType">
    <xs:choice>
      <xs:element name="VAL-user-id" type="sealloc:contentType" minOccurs="0"/>
      <xs:element name="VAL-group-id" type="xs:string" minOccurs="0"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:choice>
  </xs:complexType>

  <xs:complexType name="tSubscriptionType">
    <xs:sequence>
      <xs:element name="identities-list" type="sealloc:tIDsListType"/>
      <xs:element name="time-interval-length" type="xs:positiveInteger"/>
      <xs:element name="subscription-identifier" type="xs:string" minOccurs="0" maxOccurs="1"/>
      <xs:element name="expiry-time" type="xs:nonPositiveInteger"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="tReportRequestType">
    <xs:sequence>
      <xs:element name="immediate-report-indicator" type="xs:boolean"/>
      <xs:element name="current-location" type="sealloc:tCurrentLocationType"/>
      <xs:element name="triggering-criteria" type="sealloc:TriggeringCriteriaType"/>
      <xs:element name="minimum-interval-length" type="xs:positiveInteger" minOccurs="0"
maxOccurs="1"/>
      <xs:element name="endpoint-info" type="sealloc:contentType" minOccurs="0" maxOccurs="1"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="trigger-id" type="xs:string" use="required"/>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!-- The following elements are added for extensibility and to be placed in the anyExt element
  above -->
  <xs:element name="timestamp-indicator" type="xs:boolean"/>

```

```

<xs:complexType name="tRequestedLocationType">
  <xs:sequence>
    <xs:element name="current-serving-NCGI" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="neighbouring-NCGI" type="sealloc:tEmptyType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="mbms-service-area-id" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="mbsfn-area-id" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="current-geographical-coordinate" type="sealloc:tEmptyType" minOccurs="0"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <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="cell-change" type="sealloc:tCellChange" minOccurs="0"/>
    <xs:element name="tracking-area-change" type="sealloc:tTrackingAreaChangeType" minOccurs="0"/>
    <xs:element name="plmn-change" type="sealloc:tPlmnChangeType" minOccurs="0"/>
    <xs:element name="mbms-sa-change" type="sealloc:tMbmsSaChangeType" minOccurs="0"/>
    <xs:element name="mbsfn-area-change" type="sealloc:tMbsfnAreaChangeType" minOccurs="0"/>
    <xs:element name="periodic-report" type="sealloc:tIntegerAttributeType" minOccurs="0"/>
    <xs:element name="travelled-distance" type="sealloc:tIntegerAttributeType" minOccurs="0"/>
    <xs:element name="vertical-application-event" type="sealloc:tVerticalAppEventType"
minOccurs="0"/>
    <xs:element name="GeographicalAreaChange" type="sealloc:tGeographicalAreaChange"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <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="any-cell-change" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="enter-specific-cell" type="sealloc:tSpecificCellType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="exit-specific-cell" type="sealloc:tSpecificCellType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:simpleType name="tNcgi">
  <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:tNcgi">
      <xs:attribute name="trigger-id" 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="trigger-id" type="xs:string" use="required"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="tTrackingAreaChangeType">
  <xs:sequence>
    <xs:element name="any-tracking-area-change" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="enter-specific-tracking-area" type="sealloc:tTrackingAreaIdentity"
minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="exit-specific-tracking-area" type="sealloc:tTrackingAreaIdentity"
minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>

```

```

    </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="trigger-id" type="xs:string" use="required" />
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>

  <xs:complexType name="tPlmnChangeType">
    <xs:sequence>
      <xs:element name="any-plmn-change" type="sealloc:tEmptyTypeAttribute" minOccurs="0" />
      <xs:element name="enter-specific-plmn" type="sealloc:tPlmnIdentity" minOccurs="0"
maxOccurs="unbounded" />
      <xs:element name="exit-specific-plmn" type="sealloc:tPlmnIdentity" minOccurs="0"
maxOccurs="unbounded" />
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0" />
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
    </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="trigger-id" type="xs:string" use="required" />
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>

  <xs:complexType name="tMbmsSaChangeType">
    <xs:sequence>
      <xs:element name="any-mbsfn-area-change" type="sealloc:tEmptyTypeAttribute" minOccurs="0" />
      <xs:element name="enter-specific-mbsfn-area" type="sealloc:tMbmsSaIdentity" minOccurs="0"
maxOccurs="unbounded" />
      <xs:element name="exit-specific-mbsfn-area" type="sealloc:tMbmsSaIdentity" 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="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="trigger-id" type="xs:string" use="required" />
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>

  <xs:complexType name="tMbsfnAreaChangeType">
    <xs:sequence>
      <xs:element name="any-mbsfn-area-change" type="sealloc:tMbsfnAreaIdentity" minOccurs="0" />
      <xs:element name="enter-specific-mbsfn-area" type="sealloc:tMbsfnAreaIdentity" minOccurs="0"
maxOccurs="unbounded" />

```

```

    <xs:element name="exit-specific-mbsfn-area" type="sealloc:tMbsfnAreaIdentity" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </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="trigger-id" 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="trigger-id" type="xs:string" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>

<xs:complexType name="tVerticalAppEventType">
  <xs:sequence>
    <xs:element name="initial-log-on" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="location-configuration-received" type="sealloc:tEmptyTypeAttribute"
minOccurs="0"/>
    <xs:element name="any-other-event" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="tCurrentLocationType">
  <xs:sequence>
    <xs:element name="current-serving-NCGI" type="sealloc:tLocationType" minOccurs="0"/>
    <xs:element name="neighbouring-NCGI" type="sealloc:tLocationType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="mbms-service-area-id" type="sealloc:tLocationType" minOccurs="0"/>
    <xs:element name="mbsfn-area-id" type="sealloc:tLocationType" minOccurs="0"/>
    <xs:element name="current-geographical-coordinate" type="sealloc:tPointCoordinate"
minOccurs="0"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<!-- The following element is added for extensibility and to be placed in the above anyExt element
-->
<xs:element name="altitude" type="sealloc:tCoordinateType"/>

<xs:simpleType name="protectionType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="Normal"/>
    <xs:enumeration value="Encrypted"/>
  </xs:restriction>
</xs:simpleType>

<xs:complexType name="tLocationType">
  <xs:choice minOccurs="1" maxOccurs="1">
    <xs:element name="Ncgi" type="sealloc:tNcgi" minOccurs="0"/>
    <xs:element name="SaId" type="sealloc:tMbmsSaIdentity" minOccurs="0"/>
    <xs:element name="MbsfnAreaId" type="sealloc:tMbsfnAreaIdentity" minOccurs="0"/>
    <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax"/>
  </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="any-area-change" type="sealloc:tEmptyTypeAttribute" minOccurs="0"/>
      <xs:element name="enter-specific-area" type="sealloc:tSpecificAreaType" minOccurs="0"/>
      <xs:element name="exit-specific-area" type="sealloc:tSpecificAreaType" minOccurs="0"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="tSpecificAreaType">
    <xs:sequence>
      <xs:element name="geographical-area" type="sealloc:tGeographicalAreaDef"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="trigger-id" 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:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </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:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax"/>
    </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="polygon-area" type="sealloc:tPolygonAreaType" minOccurs="0"/>
      <xs:element name="ellipsoid-arc-area" type="sealloc:tEllipsoidArcType" minOccurs="0"/>
      <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </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:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </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:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>

```

```

        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="tReportsType">
      <xs:sequence>
        <xs:element name="loc-info-report" type="sealloc:tlocInfoReportType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="tlocInfoReportType">
      <xs:sequence>
        <xs:element name="VAL-user-id" type="sealloc:contentType" minOccurs="0"/>
        <xs:element name="latest-location" type="sealloc:tLatestLocationType"/>
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="tLatestLocationType">
      <xs:sequence>
        <xs:element name="latest-serving-NCGI" type="sealloc:tLocationType" minOccurs="0"/>
        <xs:element name="neighbouring-NCGI" type="sealloc:tLocationType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="mbms-service-area-id" type="sealloc:tLocationType" minOccurs="0"/>
        <xs:element name="mbsfn-area" type="sealloc:tLocationType" minOccurs="0"/>
        <xs:element name="latest-coordinate" type="sealloc:tPointCoordinate" minOccurs="0"/>
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="contentType">
      <xs:choice>
        <xs:element name="sealURI" type="xs:anyURI"/>
        <xs:element name="sealString" type="xs:string"/>
        <xs:element name="sealBoolean" type="xs:boolean"/>
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax"/>
      </xs:choice>
      <xs:attribute name="type" type="sealloc:protectionType"/>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="tIDsListType">
      <xs:choice maxOccurs="unbounded">
        <xs:element name="VAL-user-id" type="sealloc:contentType" minOccurs="0"/>
        <xs:element name="anyExt" type="sealloc:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:choice>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="anyExtType">
      <xs:sequence>
        <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </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, latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3] and altitude coded as specified in clause 6.3 in 3GPP TS 23.032 [3]; and
 - 3) <timestamp>, an optional element set to the timestamp in date and time of the location report with an offset from the UTC time.

<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, latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3] and altitude coded as as specified in clause 6.3 in 3GPP TS 23.032 [3]; and
- c) <timestamp>, an option element set to the timestamp in date and time of the location report with an offset from the UTC time.

<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, latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3] and altitude coded as specified in clause 6.3 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 alocation 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 allocation 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 the following sub-elements:

- a) <immediate-report-indicator>, presence of the element indicates that an immediate location report is required;
- b) <current-location>, an optional 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, latitude coded as specified in clause 6.1 in 3GPP TS 23.032 [3] and altitude coded as as specified in clause 6.3 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 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;
- 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 [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;
- d) `<minimum-interval-length>`, an optional element that defaults to 0 if absent otherwise indicates the interval time between consecutive reports. The value is given in seconds.
- e) `<endpoint-info>`, an optional element specifying information of the endpoint of the requesting VAL server to which the location report notification has to be sent. It is provided if Immediate Report Indicator is set to required; and

- f) <timestamp-indicator>, an optional element which presence indicates that timestamp of the location report is required.

At least one of bullet a) to e) shall be present.

<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 clause 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 clause 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>

8 SEAL Off-network Location Management protocol message formats

8.1 Functional definitions and contents

8.1.1 General

The following clauses describe the SEAL Off-network Location Management message functional definition and contents. The standard format of a MONP message and the encoding rules for each type of information element as documented in Annex I of 3GPP TS 24.379 [15] is used to describe Off-network location management message and information elements.

8.1.2 Off-network location management message

8.1.2.1 Message definition

This message is used between SEAL location management clients (of UE-1 and UE-2) to send request, response or acknowledgement. The Message Type IE identifies the request, response, or acknowledgement. For contents of the message see Table 8.1.2.1-1.

Message type: Off-network location management message

Direction: UE to other UE

Table 8.1.2.1-1: Off-network location reporting trigger configuration message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	Message Type	Message Type 8.2.2	M	V	1
	Originating VAL user ID	VAL user ID 8.2.3	M	LV-E	3-65537
	Terminating VAL user ID	VAL User ID 8.2.3	M	LV-E	3-65537
	Message ID	Message ID 8.2.6	M	V	16
30	Reply-to message ID	Reply-to message ID 8.2.7	O	TV	17
78	Location Management Data	Message Data 8.2.4	O	TLV-E	4-65538
20	Cause	Cause 8.2.5	O	TLV	3-129

8.2 General message format and information elements coding

8.2.1 General

The least significant bit of a field is represented by the lowest numbered bit of the highest numbered octet of the field. When the field extends over more than one octet, the order of bit values progressively decreases as the octet number increases.

Figure 8.2.1-1 shows an example of a field where the most significant bit of the field is marked MSB and the least significant bit of the field is marked LSB.

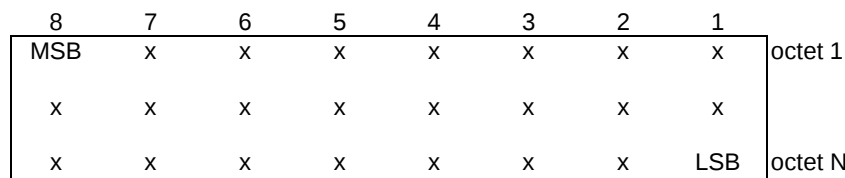


Figure 8.2.1-1: Example of bit ordering of a field

Within the protocols defined in the present document, the message consists of the following parts:

- a) message type information element; and
- b) other information elements, as required.

The organization of a message is illustrated in the example shown in Figure 8.2.1-2.

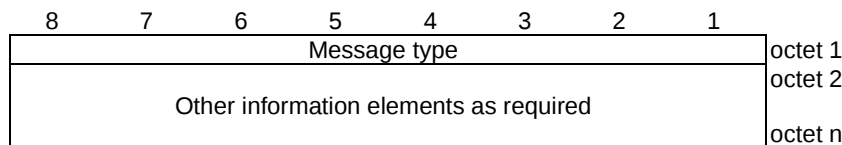


Figure 8.2.1-2: General message organization example

Unless specified otherwise in the message descriptions of clause 8.1, a particular information element shall not be present more than once in a given message.

The sending entity shall set value of a spare bit to zero. The receiving entity shall ignore value of a spare bit.

The sending entity shall not set a value of an information element to a reserved value. The receiving entity shall discard message containing an information element set to a reserved value.

8.2.2 Message type

The purpose of the Message type information element is to identify the type of the message.

The value part of the Message type information element is coded as shown in Table 8.2.2-1.

The Message type information element is a type 3 information element with a length of 1 octet.

Table 8.2.2-1: Message types

Bits								
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	LOCATION REPORTING TRIGGER CONFIGURATION REQUEST
0	0	0	0	0	0	1	0	LOCATION REPORTING TRIGGER CONFIGURATION RESPONSE
0	0	0	0	0	0	1	1	LOCATION MANAGEMENT ACK
0	0	0	0	0	1	0	0	LOCATION REPORT
0	0	0	0	0	1	0	1	LOCATION REPORTING TRIGGER CANCEL REQUEST
0	0	0	0	0	1	1	0	LOCATION REPORTING TRIGGER CANCEL RESPONSE
0	0	0	0	0	1	1	1	LOCATION REQUEST (ON-DEMAND)
0	0	0	0	1	0	0	0	LOCATION RESPONSE (ON-DEMAND)
All other values are reserved.								

8.2.3 VAL user ID

The VAL user ID information element is used to indicate a VAL user ID.

The VAL user ID information element is coded as shown in Figure 8.2.3-1 and Table 8.2.3-1.

The VAL user ID information element is a type 6 information element.

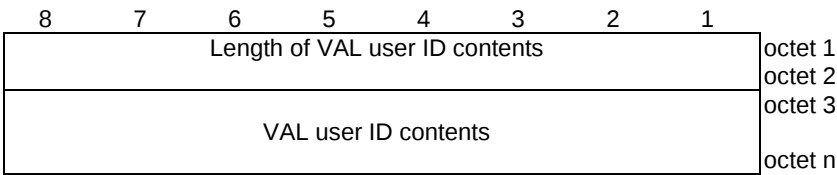


Figure 8.2.3-1: VAL user ID information element

Table 8.2.3-1: VAL user ID information element

VAL user ID is contained in octet 3 to octet n; Max value of 65535 octets.
--

8.2.4 Message Data

The Message data information element is used to send message specific data based on Message Type IE;

The Message data information element is coded as shown in Figure 8.2.4-1 and Table 8.2.4-1.

The Message data information element is a type 6 information element.

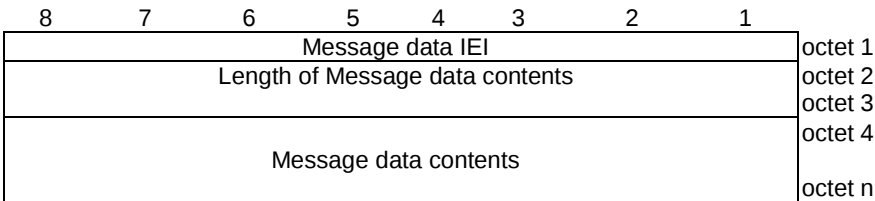


Figure 8.2.4-1: Message data information element

Table 8.2.4-1: Message data information element

Message data is contained in octet 4 to octet n; Max value of 65535 octets.

The Message data information element contains the seal-location-info+xml defined in clause 7.4.

8.2.5 Cause

The Cause information element is used to provide short cause of the failure;

The Cause information element is a type 3 information element with a length of 2 octets.

The Cause information element is coded as shown in Figure 8.2.5-1 and Table 8.2.5-1.

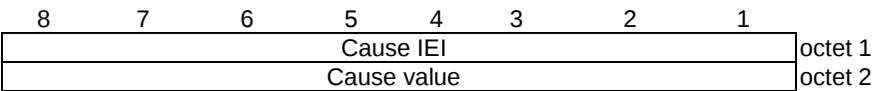


Figure 8.2.5-1: Cause information element

Table 8.2.5-1: Cause information element

Cause value (octet 2)								
Bits								
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	Required service not allowed
0	0	0	0	0	0	1	0	Lack of resources
0	1	1	0	1	1	1	1	Protocol error, unspecified
Any other value received by the UE shall be treated as 0110 1111, "protocol error, unspecified".								

8.2.6 Message ID

The Message ID information element uniquely identifies a message.

The Message ID information element is coded as shown in Figure 8.2.6-1 and Table 8.2.6-1.

The Message ID information element is a type 3 information element with a length of 16 octets.

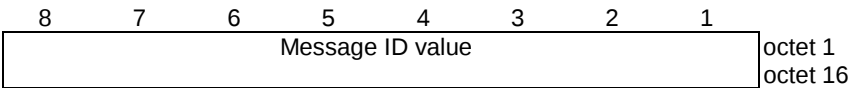


Figure 8.2.6-1: Message ID value

Table 8.2.6-1: Message ID value

Message ID value (octet 1 to 16)															
The Message ID contains a number uniquely identifying a message. The value is a universally unique identifier as specified in IETF RFC 4122 [31].															

8.2.7 Reply-to message ID

The Reply-to message ID information element is used to associate a message within a conversation that is a reply to an existing message in a conversation.

The Reply-to message ID information element is coded as shown in Figure 8.2.7-1 and Table 8.2.7-1.

The Reply-to message ID information element is a type 3 information element with a length of 17 octets.

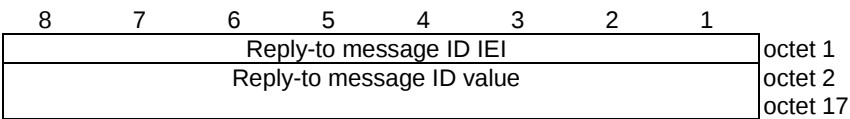


Figure 8.2.7-1: Reply-to message ID value

Table 8.2.7-1: Reply-to message ID value

Reply-to message ID value (octet 2 to 17) The Reply-to message ID contains a number uniquely identifying a message. The value is a universally unique identifier as specified in IETF RFC 4122 [31].

Annex A (normative):
Timers

A.1 General

This clause 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.

A.3 Off-network timers

The table A.3-1 provides a description of the off-network 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.3-1: Off-network timers

Timer	Timer value	Cause of start	Normal stop	On expiry
T101 (waiting for ack/resp)	Default value: 150 milliseconds Maximum value: 10 seconds	The SLM-C sends a SEAL off-network location management message for which response or acknowledgement from the target UE is expected.	Reception of an expected response or acknowledgement to a SEAL off-network location management message.	Send again the SEAL off-network location management message.

Annex B (normative): CoAP resource representation and encoding

B.1 General

The information in this annex provides a normative description of CoAP resource representation and encoding.

The general rules for resource URI structure, cache usage, error handling, and common data types are described in Annex C.1 of 3GPP TS 24.546 [29].

B.2 Data types applicable to multiple resource representations

This clause defines structured data types, simple data types, and enumerations that are applicable to several APIs defined for CoAP resource representations in the present specification.

B.2.1 Referenced structured data types

Table B.2.1-1 lists structured data types referenced by multiple CoAP resource representations and defined in other specifications.

Table B.2.1-1: Referenced Structured Data Types

Data type	Reference	Description
ValTargetUe	3GPP TS 24.546 [29]	Information identifying a VAL user ID or VAL UE ID.
GeographicalCoordinates	3GPP TS 24.546 [29]	Defines geographical coordinates.
GeographicArea	3GPP TS 24.546 [29]	Defines a geographical area.

B.2.2 Referenced simple data types

Table B.2.2-1 lists simple datatypes referenced by multiple CoAP resource representations and defined in other specifications.

Table B.2.2-1: Referenced Simple Data Types

Type name	Reference	Description
UInteger	3GPP TS 24.546 [29]	Unsigned integer, i.e. only value 0 and values above 0 are permissible.
CellId	3GPP TS 24.546 [29]	String representing a unique identifier of a cell.
TaId	3GPP TS 24.546 [29]	String representing a unique identifier of a tracking area.
PlmnId	3GPP TS 24.546 [29]	String representing a unique identifier of a PLMN.
MbmsSaid	3GPP TS 24.546 [29]	String representing a unique identifier of a MBMS serving area.
MbsfnAreaId	3GPP TS 24.546 [29]	String representing a unique identifier of a MSFN area.
boolean	3GPP TS 24.546 [29]	Boolean is a type which has 2 values "false" and "true" with the values.

B.2.3 Common structured data types

B.2.3.1 Type: BaseTrigger

Table B.2.3.1-1: Definition of type CellChange

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	

B.2.3.2 Type: LocationReportConfiguration

Table B.2.3.2-1: Definition of type LocationReportConfiguration

Attribute name	Data type	P	Cardinality	Description	Applicability
valTgtUes	array(ValTargetUe)	M	1..N	VAL users to whom the configuration information is applied	
locationType	Accuracy	M	1	The type of location information is requested.	
triggeringCriteria	TriggeringCriteriaType	O	0..1	The triggering criteria associated with this configuration.	
minimumIntervalLength	UInteger	O	0..1	The minimum time between consecutive reports.	
immediateReportInd	boolean	O	0..1	Indicates whether an immediate location report is required.	
endpointId	EndpointId	O	0..1	Identity of the endpoint of the selected VAL server to which the location report notification has to be sent. NOTE	
timestampInd	boolean	O	0..1	Indicates whether timestamp of the location report is required.	
NOTE: The "endpointId" attribute shall be present only if the "immediateReportInd" attribute set to value "true" (immediate location report is required) is present.					

B.2.3.3 Type: TriggeringCriteriaType

Table B.2.3.3-1: Definition of type TriggeringCriteriaType

Attribute name	Data type	P	Cardinality	Description	Applicability
cellChange	CellChange	O	0..1	The triggers for cell change.	
trackingAreaChange	TrackingAreaChange	O	0..1	The triggers for tracking area change.	
plmnChange	PlmnChange	O	0..1	The triggers for PLMN change.	
mbmsSaChange	MbmsSaChange	O	0..1	The triggers for MBMS serving area change.	
mbsfnAreaChange	MbsfnAreaChange	O	0..1	The triggers for MBSFN area change.	
periodicReport	PeriodicReport	O	0..1	The triggers for periodic reporting.	
travelledDistance	TravelledDistance	O	0..1	The triggers for the distance that is travelled.	
verticalAppEvent	VerticalAppEvent	O	0..1	The triggers for events generated by vertical application.	
geographicalAreaChange	GeographicalAreaChange	O	0..1	The triggers for geographical area change.	

B.2.3.4 Type: CellChange

Table B.2.3.4-1: Definition of type CellChange

Attribute name	Data type	P	Cardinality	Description	Applicability
anyCellChange	BaseTrigger	O	0..1	The trigger of any cell change.	
enterSpecificCells	SpecificCells	O	0..1	The trigger of entering one or more cells.	
exitSpecificCells	SpecificCells	O	0..1	The trigger of existing one or more cells.	

B.2.3.5 Type: SpecificCells

Table B.2.3.5-1: Definition of type SpecificCells

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
cells	array(CellId)	M	1	The specific cell list.	

B.2.3.6 Type: TrackingAreaChange

Table B.2.3.6-1: Definition of type TrackingAreaChange

Attribute name	Data type	P	Cardinality	Description	Applicability
anyTrackingAreaChange	BaseTrigger	O	0..1	The trigger of any tracking area change.	
enterSpecificTrackingAreas	SpecificTrackingAreas	O	0..1	The trigger of entering one or more tracking areas.	
exitSpecificTrackingAreas	SpecificTrackingAreas	O	0..1	The trigger of existing one or more tracking areas.	

B.2.3.7 Type: SpecificTrackingAreas

Table B.2.3.7-1: Definition of type SpecificTrackingAreas

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
trackingAreas	array(TacId)	M	1	The specific tracking area list.	

B.2.3.8 Type: PlmnChange

Table B.2.3.8-1: Definition of type PlmnChange

Attribute name	Data type	P	Cardinality	Description	Applicability
AnyPlmnChange	BaseTrigger	O	0..1	The trigger of any PLMN change.	
EnterSpecificPLMNs	SpecificPLMNs	O	0..1	The trigger of entering one or more PLMNs.	
ExitSpecificPLMNs	SpecificPLMNs	O	0..1	The trigger of existing one or more PLMNs.	

B.2.3.9 Type: SpecificPlmns

Table B.2.3.9-1: Definition of type SpecificPlmns

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
plmns	array(PlmnId)	M	1	The specific PLMN list.	

B.2.3.10 Type: MbmsSaChange

Table B.3.1.10-1: Definition of type MbmsSaChange

Attribute name	Data type	P	Cardinality	Description	Applicability
anyPlmnChange	BaseTrigger	O	0..1	The trigger of any MBMS serving area change.	
enterSpecificPlmns	SpecificMbmsSas	O	0..1	The trigger of entering one or more MBMS serving areas.	
exitSpecificPlmns	SpecificMbmsSas	O	0..1	The trigger of existing one or more MBMS serving areas.	

B.2.3.11 Type: SpecificMbmsSas

Table B.2.3.11-1: Definition of type SpecificMbmsSas

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
mbmsSas	array(MbmsSald)	M	1	The specific MBMS serving area list.	

B.2.3.12 Type: MbsfnAreaChange

Table B.2.3.12-1: Definition of type MbsfnAreaChange

Attribute name	Data type	P	Cardinality	Description	Applicability
anyPlmnChange	BaseTrigger	O	0..1	The trigger of any MBSFN area change.	
enterSpecificMbsfnAreas	SpecificMbsfnAreas	O	0..1	The trigger of entering one or more MBSFN areas.	
exitSpecificPlmn	SpecificMbsfnAreas	O	0..1	The trigger of existing one or more MBSFN areas.	

B.2.3.13 Type: SpecificMbsfnAreas

Table B.2.3.13-1: Definition of type SpecificMbsfnAreas

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
mbsfnAreas	array(MbsfnAreaId)	M	1	The specific MBSFN area list.	

B.2.3.14 Type: PeriodicReport

Table B.2.3.14-1: Definition of type PeriodicReport

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
interval	UInteger	M	1	The time interval for location reporting.	

B.2.3.15 Type: TravelledDistance

Table B.2.3.15-1: Definition of type TravelledDistance

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
distance	UInteger	M	1	The distance interval for location reporting.	

B.2.3.16 Type: VerticalAppEvent

Table B.2.3.16-1: Definition of type VerticalAppEvent

Attribute name	Data type	P	Cardinality	Description	Applicability
initialLogOn	BaseTrigger	O	0..1	The event of initial log-on.	
locConfigReceived	BaseTrigger	O	0..1	The event of location configuration being received.	
anyOtherEvent	BaseTrigger	O	0..1	Any other event.	

B.2.3.17 Type: GeographicalAreaChange

Table B.2.3.17-1: Definition of type GeographicalAreaChange

Attribute name	Data type	P	Cardinality	Description	Applicability
AnyGeoAreaChange	BaseTrigger	O	0..1	The trigger of any geographical area change.	
EnterSpecificGeoAreas	SpecificGeoAreas	O	0..1	The trigger of entering one or more geographical areas.	
ExitSpecificGeoAreas	SpecificGeoAreas	O	0..1	The trigger of existing one or more geographical areas.	

B.2.3.18 Type: SpecificGeoAreas

Table B.2.3.18-1: Definition of type SpecificGeoAreas

Attribute name	Data type	P	Cardinality	Description	Applicability
triggerId	TriggerId	M	1	The unique identity of the trigger criterion.	
geoAreas	array(GeographicArea)	M	1	The specific geographical area list.	

B.2.3.19 Type: LocationReport

Table B.2.3.20-1: Definition of type LocationReport

Attribute name	Data type	P	Cardinality	Description	Applicability
valTgtUe	ValTargetUe	M	1	VAL user who reports the location information.	
triggerIds	array(TriggerId)	M	1..N	The triggers that have been met for this location report.	
locInfo	LocationInfo	M	1	The location information in this report.	
timestamp	TimeOfDay	O	0..1	Information of the timestamp of location measurement results.	

B.2.3.20 Type: LocationInfo

Table B.2.3.21-1: Definition of type LocationInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
cellId	CellId	O	0..1	Current cell.	
neighbouringCellIds	array(CellId)	O	0..N	The neighbouring cells of current cell.	
mbmsSaid	MbmsSaid	O	0..1	Current MBMS serving area.	
mbsfnAreaId	MbsfnAreaId	O	0..1	Current MBSFN area.	
currentCoordinates	GeographicalCoordinates	O	0..1	Current geographical coordinate.	

B.2.4 Common simple data types

Table B.2.4-1: Simple data types applicable to multiple CoAP resource representations

Type name	Description
TriggerId	String representing a unique identifier of a trigger criterion.
EndpointId	String representing a unique identifier of the endpoint of the selected VAL server.

B.2.5 Common enumerations

B.2.5.1 Enumeration: Accuracy

Table B.2.5.1-1: Accuracy

Enumeration value	Description	Applicability
CURRENT_SERVING_NCGI	Current cell.	
NEIGHBOURING_NCGI	The neighbouring cells of current cell.	
MBMS_SA	Current MBMS serving area.	
MBSFN_AREA	Current MBSFN area.	
CURRENT_GEOGRAPHICAL_COORDINATE	Current geographical coordinate.	

B.3 Resource representation and APIs for location reporting provided by SLM-S

B.3.1 SU_LocationReporting API provided by SLM-S

B.3.1.1 API URI

The CoAP URIs used in CoAP requests from SLM-S towards the SLM-C shall have the Resource URI structure as defined in Annex C.1.1 of 3GPP TS 24.546 [29] with the following clarifications:

- the <apiName> shall be "su-lr";
- the <apiVersion> shall be "v1"; and
- the <apiSpecificSuffixes> shall be set as described in clause B.3.1.2.

B.3.1.2 Resources

B.3.1.2.1 Overview

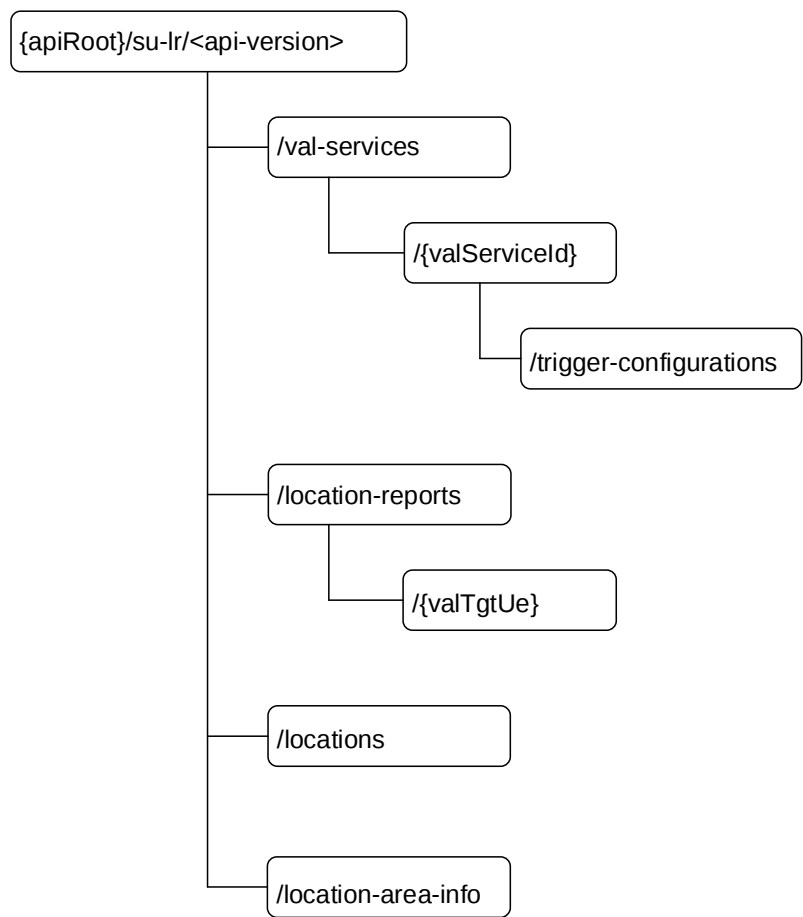


Figure B.3.1.2.1-1: Resource URI structure of the SU_LocationReporting API provided by SLM-S

Table B.3.1.2.1-1 provides an overview of the resources and applicable CoAP methods.

Table B.3.1.2.1-1: Resources and methods overview

Resource name	Resource URI	CoAP method	Description
Trigger Configurations	/val-services/{valServiceId}/trigger-configurations	GET	Retrieve trigger configuration of the SLM-C for a given VAL service, according to query criteria.
Location Report	/location-reports/{valTgtUe}	PUT	Report location information of the SLM-C.
Locations	/locations	FETCH	Observe the location information of another SLM-C.
		GET	Retrieve location information of another SLM-C.
Location Area Information	/location-area-info	FETCH	Query the information, e.g., user information based on the specific location area.

B.3.1.2.2 Resource: Trigger Configurations

B.3.1.2.2.1 Description

The Trigger Configurations resource allows a SLM-C to retrieve the trigger configuration for its own from SLM-S.

B.3.1.2.2.2 Resource Definition

Resource URI: {apiRoot}/su-lr/<apiVersion>/val-services/{valServiceId}/trigger-configurations

This resource shall support the resource URI variables defined in the table B.3.1.2.2.2-1.

Table B.3.1.2.2.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [29].
apiVersion	string	See clause B.3.1.1.
valServiceId	string	Identifier of a VAL service.

B.3.1.2.2.3 Resource Standard Methods

B.3.1.2.2.3.1 GET

This operation retrieves the trigger configuration.

This method shall support URI query options specified in table B.3.1.2.2.3.1-1, the response data structures and response codes specified in table B.3.1.2.2.3.1-1.

Table B.2.1.2.3.3.1-1: URI query options supported by the GET Request on this resource

Name	Data type	P	Cardinality	Description
val-tgt-ue	string	M	1	The identifier of VAL UE owns the trigger configuration.
NOTE: Other request options also apply in accordance with normal CoAP procedures.				

Table B.3.1.2.2.3.1-2: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationReportConfiguration	M	1	2.05 Content	The trigger configuration information.
NOTE: The mandatory CoAP error status codes for the GET Request listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.3.1.2.3 Resource: Location Reports

B.3.1.2.3.1 Description

The Location Reports resource allows a SLM-C to report its own location information to SLM-S.

B.3.1.2.3.2 Resource Definition

Resource URI: {apiRoot}/su-lr/<apiVersion>/location-reports/{valTgtUe}

This resource shall support the resource URI variables defined in the table B.3.1.2.3.2-1.

Table B.3.1.2.3.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [29].
apiVersion	string	See clause B.3.1.1.
valTgtUe	string	The identifier of VAL UE owns the location information.

B.3.1.2.3.3 Resource Standard Methods

B.3.1.2.3.3.1 PUT

This operation sends a location report.

This method shall support the request data structures specified in table B.3.1.2.3.3.1-1, the response data structures and response codes specified in table B.3.1.2.3.3.1-2.

Table B.3.1.2.3.3.1-1: Data structures supported by the PUT Request payload on this resource

Data type	P	Cardinality	Description
LocationReport	M	1	The location report to be sent.

Table B.3.1.2.3.3.1-2: Data structures supported by the PUT Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationReport	O	0..1	2.04 Changed	The location report was created successfully.
NOTE: The mandatory CoAP error status codes for the PUT method listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.3.1.2.4 Resource: Locations

B.3.1.2.4.1 Description

The Locations resource allows a SLM-C to retrieve the location information of another SLM-C. This resource is observable.

B.3.1.2.4.2 Resource Definition

Resource URI: {apiRoot}/su-lr/<apiVersion>/locations

This resource shall support the resource URI variables defined in the table B.3.1.2.4.2-1.

Table B.3.1.2.4.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [29].
apiVersion	string	See clause B.3.1.1.

B.3.1.2.4.3 Resource Standard Methods

B.3.1.2.4.3.1 FETCH

This operation the location information of other SLM-Cs.

This method shall support:

- the request options specified in table B.3.1.2.4.3.1-1;
- the request data structures specified in table B.3.1.2.4.3.1-2;
- the response data structures and response codes specified in table B.3.1.2.4.3.1-3; and
- the response options specified in table B.3.1.2.4.3.1-4.

Table B.3.1.2.4.3.1-1: Options supported by the FETCH Request on this resource

Name	Data type	P	Cardinality	Description
Observe	UInteger	O	0..1	When set to 0 (Register) it extends the GET request to subscribe to the changes of this resource. When set to 1 (Deregister) it cancels the subscription.

NOTE: Other request options also apply in accordance with normal CoAP procedures.

Table B.3.1.2.3.3.1-2: Data structures supported by the FETCH Request payload on this resource

Data type	P	Cardinality	Description
LocationReportConfiguration	O	0..1	The trigger configuration information.

Table B.3.1.2.4.3.1-3: Data structures supported by the FETCH Response payload on this resource

Data type	P	Cardinality	Response codes	Description
array(LocationReport)	O	0..N	2.05 Content	The location information based on the request from the SLM-C.

NOTE: The mandatory CoAP error status codes for the FETCH Request listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.

Table B.3.1.2.4.3.1-4: Options supported by the 2.05 Response Code on this resource

Name	Data type	P	Cardinality	Description
Observe	UInteger	O	0..1	Sequence number of the notification.

NOTE: Other response options also apply in accordance with normal CoAP procedures.

B.3.1.2.4.3.2 GET

This operation retrieves the location information of another SLM-C.

This method shall support:

- the URI query options specified in table B.3.1.2.4.3.2-1; and
- the response data structures and response codes specified in table B.3.1.2.4.3.2-2.

Table B.3.1.2.4.3.2-1: URI query options supported by the GET Request on this resource

Name	Data type	P	Cardinality	Description
val-tgt-ue	string	M	1	The VAL UE owns the location information.

Table B.3.1.2.4.3.2-2: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationReport	O	0..1	2.05 Content	The location information based on the request from the SLM-C.
NOTE: The mandatory CoAP error status codes for the GET Request listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.3.1.2.5 Resource: Location Area Information

B.3.1.2.5.1 Description

The UE Information resource allows a SLM-C to query a list of users based on a specified location from SLM-S.

B.3.1.2.5.2 Resource Definition

Resource URI: {apiRoot}/su-lr/<apiVersion>/location-area-info

This resource shall support the resource URI variables defined in the table B.3.1.2.5.2-1.

Table B.3.1.2.5.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [29].
apiVersion	string	See clause B.3.1.1.

B.3.1.2.5.3 Resource Standard Methods

B.3.1.2.5.3.1 FETCH

This operation queries the relevant information based on a specific location.

This method shall support:

- the request data structures specified in table B.3.1.2.5.3.1-1; and
- the response data structures and response codes specified in table B.3.1.2.5.3.1-2.

Table B.3.1.2.5.3.1-1: Data structures supported by the FETCH Request payload on this resource

Data type	P	Cardinality	Description
LocationAreaQuery	M	1	The specific location area for query.

Table B.3.1.2.5.3.1-2: Data structures supported by the FETCH Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationAreaInfo	O	0..1	2.05 Content	The query result was returned successfully.
NOTE: The mandatory CoAP error status codes for the FETCH method listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.3.1.3 Data Model

B.3.1.3.1 General

Table B.3.1.3.1-1 specifies the data types defined specifically for the SU_LocationReporting API service provided by SLM-S.

Table B.3.1.3.1-1: SU_LocationReporting API provided by SLM-S specific Data Types

Data type	Section defined	Description	Applicability
ValTargetUe	B.2.1	Information identifying a VAL user ID or VAL UE ID.	
GeographicArea	B.2.1	Defines a geographical area.	
BaseTrigger	B.2.3.1	The unique identity of the trigger criterion.	
LocationReportConfiguration	B.2.3.2	The configuration for location reporting.	
TriggeringCriteriaType	B.2.3.3	The triggering criteria of location reporting.	
CellChange	B.2.3.4	The triggers of cell change.	
SpecificCells	B.2.3.5	The specific cell list.	
TrackingAreaChange	B.2.3.6	The triggers of tracking area change.	
SpecificTrackingAreas	B.2.3.7	The specific tracking area list.	
PlmnChange	B.2.3.8	The triggers of PLMN change.	
SpecificPlmns	B.2.3.9	The specific PLMN list.	
MbmsSaChange	B.2.3.10	The triggers of MBMS serving area change.	
SpecificMbmsSas	B.2.3.11	The specific MBMS serving area list.	
MbsfnAreaChange	B.2.3.12	The triggers of MBSFN area change.	
SpecificMbsfnAreas	B.2.3.13	The specific MBSFN area list.	
PeriodicReport	B.2.3.14	The trigger of periodical reporting.	
TravelledDistance	B.2.3.15	The trigger of travelled distance.	
VerticalAppEvent	B.2.3.16	The triggers of specific vertical application events.	
GeographicalAreaChange	B.2.3.17	The triggers of geographical area change.	
SpecificGeoAreas	B.2.3.18	The specific list of geographical areas.	
LocationReport	B.2.3.19	The location report information.	
LocationInfo	B.2.3.20	The location information.	
LocationAreaQuery	B.3.1.3.2.1	The specific location area.	
LocationAreaInfo	B.3.1.3.2.2	The location-based query result.	
UeInfo	B.3.1.3.2.3	The UE information.	

Table B.3.1.3.1-2 specifies the simple data types defined specifically for the SU_LocationReporting API service provided by SLM-S.

Table B.3.1.3.1-2: SU_LocationReporting API provided by SLM-S specific Simple Data Types

Data type	Section defined	Description
UInteger	B.2.1	Information identifying a VAL user ID or VAL UE ID.
TriggerId	B.2.4	String representing a unique identifier of a trigger criterion.
CellId	B.2.4	String representing a unique identifier of a cell.
TaId	B.2.4	String representing a unique identifier of a tracking area.
PlmnId	B.2.4	String representing a unique identifier of a PLMN.
MbmsSaid	B.2.4	String representing a unique identifier of a MBMS serving area.
MbsfnAreaId	B.2.4	String representing a unique identifier of a MSFN area.

Table B.3.1.3.1-3 specifies the enumerations defined specifically for the SU_LocationReporting API service provided by SLM-S.

Table B.3.1.3.1-3: SU_LocationReporting API provided by SLM-S specific Enumeration

Data type	Section defined	Description
Accuracy	B.2.5	The accuracy of location information.

B.3.1.3.2 Structured data types

B.3.1.3.2.1 Type: LocationAreaQuery

Table B.3.1.3.2.1-1: Definition of type LocationAreaQuery

Attribute name	Data type	P	Cardinality	Description	Applicability
geoArea	GeographicArea	M	1	The specific location area.	

B.3.1.3.2.2 Type: LocationAreaInfo

Table B.3.1.3.2.2-1: Definition of type LocationAreaInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ueList	array(UeInfo)	M	1	The list of users inside the specific location area.	
valReqUe	ValTargetUe	O	0..1	VAL user information.	

B.3.1.3.2.3 Type: UeInfo

Table B.3.1.3.2.3-1: Definition of type UeInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ueId	ValTargetUe	M	1	VAL user information.	
ueLoc	LocationInfo	M	1	Location information of the VAL user.	

B.3.1.3.3 Simple data types and enumerations

None.

B.3.1.4 Error Handling

General error responses are defined in Annex C.1.3 of 3GPP TS 24.546 [29].

B.3.1.5 CDDL Specification

B.3.1.5.1 Introduction

The data model described in clause B.3.1.3 shall be binary encoded in the CBOR format as described in IETF RFC 8949 [26].

Clause B.3.1.5.2 uses the Concise Data Definition Language described in IETF RFC 8610 [28] and provides corresponding representation of the SU_LocationReporting API provided by SLM-S data model.

B.3.1.5.2 CDDL document

```

;;; LocationAreaQuery
LocationAreaQuery = {
  geoArea: GeographicArea
}

;;; LocationAreaInfo
LocationAreaInfo = {
  ? valReqUe: ValTargetUe
  ? ueList: [* UeInfo]
}

;;; UeInfo
UeInfo = {
  ? ueId: ValTargetUe
  ? ueLoc: LocationInfo
}

;;; LocationReportConfiguration
;;;+ Represents Location reporting configuration information.
LocationReportConfiguration = {
  valTgtUes: [* ValTargetUe]
  locationType: Accuracy
  ? triggeringCriteria: [* TriggeringCriteriaType]
  ? minimumIntervalLength: Uinteger
  ? immediateReportInd: boolean
  ? endpointId: EndpointId
  ? timestampInd: boolean
}

;;; Accuracy
Accuracy = "CURRENT_SERVING_NCGI" / "NEIGHBOURING_NCGI" / "MBMS_SA" / "MBSFN_AREA" /
"CURRENT_GEOGRAPHICAL_COORDINATE"

;;; TriggeringCriteriaType
TriggeringCriteriaType = {
  ? cellChange: CellChange
  ? trackingAreaChange: TrackingAreaChange
  ? plmnChange: PlmnChange
  ? mbmsSaChange: MbmsSaChange
  ? mbsfnAreaChange: MbsfnAreaChange
  ? periodicReport: PeriodicReport
  ? travelledDistance: TravelledDistance
  ? verticalAppEvent: VerticalAppEvent
  ? geographicalAreaChange: GeographicalAreaChange
}

;;; CellChange
CellChange = {
  ? anyCellChange: BaseTrigger
  ? enterSpecificCells: SpecificCells
  ? exitSpecificCells: SpecificCells
}

;;; SpecificCells
SpecificCells = {

```

```
    triggerId: TriggerId
    cells: [* CellId]
}

;;; TrackingAreaChange
TrackingAreaChange = {
    ? anyTrackingAreaChange: BaseTrigger
    ? enterSpecificTrackingAreas: SpecificTrackingAreas
    ? exitSpecificTrackingAreas: SpecificTrackingAreas
}

;;; SpecificTrackingAreas
SpecificTrackingAreas = {
    triggerId: TriggerId
    trackingAreas: [* TaId]
}

;;; PlmnChange
PlmnChange = {
    ? AnyPlmnChange: BaseTrigger
    ? EnterSpecificPlmns: SpecificPlmns
    ? ExitSpecificPlmns: SpecificPlmns
}

;;; SpecificPlmns
SpecificPlmns = {
    triggerId: TriggerId
    plmns: [* PlmnId]
}

;;; MbmsSaChange
MbmsSaChange = {
    ? anyPlmnChange: BaseTrigger
    ? enterSpecificPlmns: SpecificMbmsSas
    ? exitSpecificPlmns: SpecificMbmsSas
}

;;; SpecificMbmsSas
SpecificMbmsSas = {
    triggerId: TriggerId
    mbmsSas: [* MbmsSaId]
}

;;; MbsfnAreaChange
MbsfnAreaChange = {
    ? anyPlmnChange: BaseTrigger
    ? enterSpecificMbsfnAreas: SpecificMbsfnAreas
    ? exitSpecificPlmn: SpecificMbsfnAreas
}

;;; SpecificMbsfnAreas
SpecificMbsfnAreas = {
    triggerId: TriggerId
    mbsfnAreas: [* MbsfnAreaId]
}

;;; PeriodicReport
PeriodicReport = {
    triggerId: TriggerId
    interval: Uinteger
}

;;; TravelledDistance
TravelledDistance = {
    triggerId: TriggerId
    distance: Uinteger
}

;;; VerticalAppEvent
VerticalAppEvent = {
    ? initialLogOn: BaseTrigger
    ? locConfigReceived: BaseTrigger
    ? anyOtherEvent: BaseTrigger
}

;;; GeographicalAreaChange
GeographicalAreaChange = {
    ? AnyGeoAreaChange: BaseTrigger
```

```

? EnterSpecificGeoAreas: SpecificGeoAreas
? ExitSpecificGeoAreas: SpecificGeoAreas
}

;;; SpecificGeoAreas
SpecificGeoAreas = {
  triggerId: TriggerId
  geoAreas: [* GeographicArea]
}

;;; EndpointId
;;+ Unique identifier of an endpoint of the selected VAL server.
EndpointId = text

;;; LocationReport
LocationReport = {
  valTgtUe: ValTargetUe
  triggerIds: [* TriggerId]
  locInfo: LocationInfo
? timestamp: TimeOfDay
}

;;; LocationInfo
LocationInfo = {
  ? cellId: CellId
  ? neighbouringCellIds: [* CellId]
  ? mbmsSaId: MbmsSaId
  ? mbsfnAreaId: MbsfnAreaId
  ? currentCoordinate: GeographicalCoordinates
}

;;; BaseTrigger
BaseTrigger = {
  triggerId: TriggerId
}

;;; TriggerId
;;+ Unique identifier of a trigger.
TriggerId = text

;;; ValTargetUe
;;+ Represents information identifying a VAL user ID or a VAL UE ID.
valUserId = {
  valUserId: text ; Unique identifier of a VAL user.
}

valUeId = {
  valUeId: text ; Unique identifier of a VAL UE.
}

ValTargetUe = valUserId / valUeId

;;; UInteger
;;+ Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.
UInteger = int .ge 0

;;; GeographicArea
;;+ Geographic area specified by different shape.
GeographicArea = Point / PointUncertaintyCircle / PointUncertaintyEllipse / Polygon / PointAltitude
/ PointAltitudeUncertainty / EllipsoidArc

;;; GADShape
;;+ Common base type for GAD shapes.
GADShape = {
  shape: SupportedGADShapes
}

;;; Point
;;+ Ellipsoid Point.
Point = {
  ~GADShape
  point: GeographicalCoordinates
}

;;; PointUncertaintyCircle
;;+ Ellipsoid point with uncertainty circle.
PointUncertaintyCircle = {
  ~GADShape

```

```
    point: GeographicalCoordinates
    uncertainty: Uncertainty
  }

  ;;; PointUncertaintyEllipse
  ;;;+ Ellipsoid point with uncertainty ellipse.
  PointUncertaintyEllipse = {
    ~GADShape
    point: GeographicalCoordinates
    uncertaintyEllipse: UncertaintyEllipse
    confidence: Confidence
  }

  ;;; Polygon
  ;;;+ Polygon.
  Polygon = {
    ~GADShape
    pointList: PointList
  }

  ;;; PointAltitude
  ;;;+ Ellipsoid point with altitude.
  PointAltitude = {
    ~GADShape
    point: GeographicalCoordinates
    altitude: Altitude
  }

  ;;; PointAltitudeUncertainty
  ;;;+ Ellipsoid point with altitude and uncertainty ellipsoid.
  PointAltitudeUncertainty = {
    ~GADShape
    point: GeographicalCoordinates
    altitude: Altitude
    uncertaintyEllipse: UncertaintyEllipse
    uncertaintyAltitude: Uncertainty
    confidence: Confidence
  }

  ;;; EllipsoidArc
  ;;;+ Ellipsoid Arc.
  EllipsoidArc = {
    ~GADShape
    point: GeographicalCoordinates
    innerRadius: InnerRadius
    uncertaintyRadius: Uncertainty
    offsetAngle: Angle
    includedAngle: Angle
    confidence: Confidence
  }

  ;;; GeographicalCoordinates
  ;;;+ Geographical coordinates.
  GeographicalCoordinates = {
    lon: -180.0..180.0
    lat: -90.0..90.0
  }

  ;;; UncertaintyEllipse
  ;;;+ Ellipse with uncertainty.
  UncertaintyEllipse = {
    semiMajor: Uncertainty
    semiMinor: Uncertainty
    orientationMajor: Orientation
  }

  ;;; PointList
  ;;;+ List of points.
  PointList = [3*15 GeographicalCoordinates]

  ;;; Altitude
  ;;;+ Indicates value of altitude.
  Altitude = -32767.0..32767.0

  ;;; Angle
  ;;;+ Indicates value of angle.
  Angle = 0..360
```

```
;;; Uncertainty
;;;+ Indicates value of uncertainty.
Uncertainty = float32 .ge 0

;;; Orientation
;;;+ Indicates value of orientation angle.
Orientation = 0..180

;;; Confidence
;;;+ Indicates value of confidence.
Confidence = 0..100

;;; InnerRadius
;;;+ Indicates value of the inner radius.
InnerRadius = (0..327675) .and int32

;;; SupportedGADShapes
;;;+ Indicates supported GAD shapes.
SupportedGADShapes = "POINT" / "POINT_UNCERTAINTY_CIRCLE" / "POINT_UNCERTAINTY_ELLIPSE" / "POLYGON"
/ "POINT_ALTITUDE" / "POINT_ALTITUDE_UNCERTAINTY" / "ELLIPSOID_ARC" /
"LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE" / "LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID" / text

;;; CellId
;;;+ Unique identifier of a cell.
CellId = text

;;; TaId
;;;+ Unique identifier of a tracking area.
TaId = text

;;; PlmnId
;;;+ Unique identifier of a PLMN.
PlmnId = text

;;; MbmsSaId
;;;+ Unique identifier of a MBMS serving area.
MbmsSaId = text

;;; MbsfnAreaId
;;;+ Unique identifier of a MBSFN area.
MbsfnAreaId = text
```

B.3.1.6 Media Types

See clause B.5.

B.3.1.7 Void

B.3.1.8 Void

B.3.1.9 Void

B.3.1.10 Void

B.4 Resource representation and APIs for location reporting provided by SLM-C

B.4.1 SU_LocationReporting API provided by SLM-C

B.4.1.1 API URI

The CoAP URIs used in CoAP requests from SLM-S towards the SLM-C shall have the Resource URI structure as defined in Annex C.1.1 of 3GPP TS 24.546 [29] with the following clarifications:

- the <apiName> shall be "su-lr-c";
- the <apiVersion> shall be "v1"; and
- the <apiSpecificSuffixes> shall be set as described in clause B.4.1.2.

B.4.1.2 Resources

B.4.1.2.1 Overview

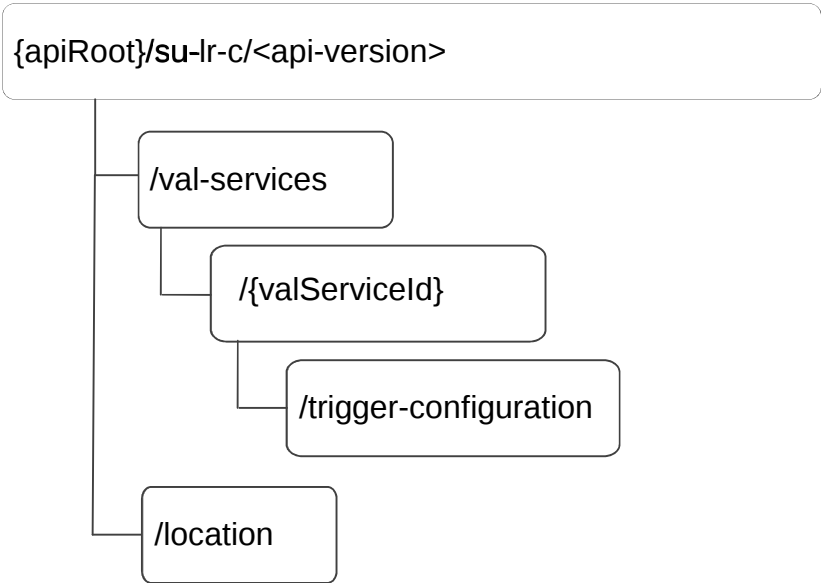


Figure B.4.1.2.1-1: Resource URI structure of the SU_LocationReporting API provided by SLM-C

Table B.4.1.2.1-1 provides an overview of the resources and applicable CoAP methods.

Table B.4.1.2.1-1: Resources and methods overview

Resource name	Resource URI	CoAP method	Description
Trigger Configuration	/val-services/{valServiceId}/trigger-configuration	GET	Retrieve trigger configuration of the SLM-C for a given VAL service, according to query criteria.
		PUT	Update trigger configuration of the SLM-C for a given VAL service, according to query criteria.
		DELETE	Delete trigger configuration of the SLM-C for a given VAL service, according to query criteria.
Location	/location	GET	Retrieve location information of the SLM-C.

B.4.1.2.2 Resource: Trigger Configuration

B.4.1.2.2.1 Description

The Trigger Configuration resource allows a SLM-S to manage the trigger configuration of a SLM-C.

B.4.1.2.2.2 Resource Definition

Resource URI: {apiRoot}/su-lr-c/<apiVersion>/val-services/{valServiceId}/trigger-configuration

This resource shall support the resource URI variables defined in the table B.4.1.2.2.2-1.

Table B.4.1.2.2.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [29].
apiVersion	string	See clause B.3.1.1.
valServiceId	string	Identifier of a VAL service.

B.4.1.2.2.3 Resource Standard Methods

B.4.1.2.2.3.1 GET

This operation retrieves the trigger configuration.

This method shall support the response data structures and response codes specified in table B.4.1.2.2.3.1-1.

Table B.4.1.2.2.3.1-1: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationReportConfiguration	M	0..1	2.05 Content	The trigger configuration information.
NOTE: The mandatory CoAP error status codes for the GET Request listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.4.1.2.2.3.2 PUT

This operation updates the trigger configuration.

This method shall support the request data structures specified in table B.4.1.2.2.3.2-1 and the response data structures and response codes specified in table B.4.1.2.2.3.2-2.

Table B.4.1.2.2.3.2-1: Data structures supported by the PUT Request payload on this resource

Data type	P	Cardinality	Description
LocationReportConfiguration	M	1	Updated details of the trigger configuration.

Table B.4.1.2.2.3.2-2: Data structures supported by the PUT Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationReportConfiguration	O	1	2.04 Changed	The trigger configuration updated successfully and the updated trigger configuration may be returned in the response.
NOTE: The mandatory CoAP error status codes for the PUT method listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.4.1.2.2.3.3 DELETE

This operation deletes the trigger configuration.

This method shall support the response data structures and response codes specified in table B.4.1.2.2.3.3-1.

Table B.4.1.2.2.3.3-1: Data structures supported by the DELETE Response payload on this resource

Data type	P	Cardinality	Response codes	Description
n/a			2.02 Deleted	The trigger configuration is deleted.
NOTE: The mandatory CoAP error status codes for the DELETE method listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.4.1.2.3 Resource: Location

B.4.1.2.3.1 Description

The Location resource allows a SLM-S to retrieve the location information of a SLM-C.

B.4.1.2.3.2 Resource Definition

Resource URI: **{apiRoot}/su-lr-c/<apiVersion>/location**

This resource shall support the resource URI variables defined in the table B.4.1.2.3.2-1.

Table B.4.1.2.3.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [29].
apiVersion	string	See clause B.4.1.1.

B.4.1.2.3.3 Resource Standard Methods

B.4.1.2.3.3.1 GET

This operation retrieves the location information.

This method shall support the response data structures and response codes specified in table B.4.1.2.3.3-1.

Table B.4.1.2.3.3-1: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
LocationReport	M	0..1	2.05 Content	The location information of the SLM-C.
NOTE: The mandatory CoAP error status codes for the GET Request listed in table C.1.3-1 of 3GPP TS 24.546 [29] shall also apply.				

B.4.1.3 Data Model

B.4.1.3.1 General

Table B.4.1.3.1-1 specifies the data types defined specifically for the SU_LocationReporting API service provided by SLM-C.

Table B.4.1.3.1-1: SU_LocationReporting API provided by SLM-C specific Data Types

Data type	Section defined	Description	Applicability
ValTargetUe	B.2.1	Information identifying a VAL user ID or VAL UE ID.	
GeographicArea	B.2.1	Defines a geographical area.	
BaseTrigger	B.2.3.1	The unique identity of the trigger criterion.	
LocationReportConfiguration	B.2.3.2	The configuration for location reporting.	
TriggeringCriteriaType	B.2.3.3	The triggering criteria of location reporting.	
CellChange	B.2.3.4	The triggers of cell change.	
SpecificCells	B.2.3.5	The specific cell list.	
TrackingAreaChange	B.2.3.6	The triggers of tracking area change.	
SpecificTrackingAreas	B.2.3.7	The specific tracking are list.	
PlmnChange	B.2.3.8	The triggers of PLMN change.	
SpecificPlmns	B.2.3.9	The specific PLMN list.	
MbmsSaChange	B.2.3.10	The triggers of MBMS serving area change.	
SpecificMbmsSas	B.2.3.11	The specific MBMS serving area list.	
MbsfnAreaChange	B.2.3.12	The triggers of MBSFN area change.	
SpecificMbsfnAreas	B.2.3.13	The specific MBSFN are list.	
PeriodicReport	B.2.3.14	The trigger of periodical reporting.	
TravelledDistance	B.2.3.15	The trigger of travelled distance.	
VerticalAppEvent	B.2.3.16	The triggers of specific vertical application events.	
GeographicalAreaChange	B.2.3.17	The triggers of geographical area change.	
SpecificGeoAreas	B.2.3.18	The specific list of geographical areas.	
LocationReport	B.2.3.19	The location report information.	
LocationInfo	B.2.3.20	The location information.	

Table B.4.1.3.1-2 specifies the simple data types defined specifically for the SU_LocationReporting API service provided by SLM-C.

Table B.4.1.3.1-2: SU_LocationReporting API provided by SLM-C specific Simple Data Types

Data type	Section defined	Description
UInteger	B.2.1	Information identifying a VAL user ID or VAL UE ID.
TriggerId	B.2.4	String representing a unique identifier of a trigger criterion.
CellId	B.2.4	String representing a unique identifier of a cell.
TaId	B.2.4	String representing a unique identifier of a tracking area.
PlmnId	B.2.4	String representing a unique identifier of a PLMN.
MbmsSaid	B.2.4	String representing a unique identifier of a MBMS serving area.
MbsfnAreaId	B.2.4	String representing a unique identifier of a MSFN area.

Table B.4.1.3.1-3 specifies the enumerations defined specifically for the SU_LocationReporting API service provided by SLM-C.

Table B.4.1.3.1-3: SU_LocationReporting API provided by SLM-C specific Enumeration

Data type	Section defined	Description
Accuracy	B.2.5	The accuracy of location information.

B.4.1.4 Error Handling

General error responses are defined in clause C.1.3 of 3GPP TS 24.546 [23].

B.4.1.5 CDDL Specification

B.4.1.5.1 Introduction

The data model described in clause B.4.1.3 shall be binary encoded in the CBOR format as described in IETF RFC 8949 [26].

Clause B.4.1.5.2 uses the Concise Data Definition Language described in IETF RFC 8610 [28] and provides corresponding representation of the SU_LocationReporting API provided by SLM-C data model.

B.4.1.5.2 CDDL document

```

;;; LocationReportConfiguration
;;;+ Represents Location reporting configuration information.
LocationReportConfiguration = {
  valTgtUes: [* ValTargetUe]
  locationType: Accuracy
  ? triggeringCriteria: [* TriggeringCriteriaType]
  ? minimumIntervalLength: UInteger
  ? timestampInd: boolean
  ? immediateReportInd: boolean
  ? endpointId: EndpointId
}

;;; Accuracy
Accuracy = "CURRENT_SERVING_NCGI" / "NEIGHBOURING_NCGI" / "MBMS_SA" / "MBSFN_AREA" /
"CURRENT_GEOGRAPHICAL_COORDINATE"

;;; TriggeringCriteriaType
TriggeringCriteriaType = {
  ? cellChange: CellChange
  ? trackingAreaChange: TrackingAreaChange
  ? plmnChange: PlmnChange
  ? mbmsSaChange: MbmsSaChange
  ? mbsfnAreaChange: MbsfnAreaChange
  ? periodicReport: PeriodicReport
  ? travelledDistance: TravelledDistance
  ? verticalAppEvent: VerticalAppEvent
  ? geographicalAreaChange: GeographicalAreaChange
}

;;; CellChange
CellChange = {
  ? anyCellChange: BaseTrigger
  ? enterSpecificCells: SpecificCells
  ? exitSpecificCells: SpecificCells
}

;;; SpecificCells
SpecificCells = {
  triggerId: TriggerId
  cells: [* CellId]
}

;;; TrackingAreaChange
TrackingAreaChange = {
  ? anyTrackingAreaChange: BaseTrigger
  ? enterSpecificTrackingAreas: SpecificTrackingAreas
  ? exitSpecificTrackingAreas: SpecificTrackingAreas
}

;;; SpecificTrackingAreas
SpecificTrackingAreas = {
  triggerId: TriggerId
  trackingAreas: [* TaId]
}

;;; PlmnChange

```

```
PlmnChange = {
  ? AnyPlmnChange: BaseTrigger
  ? EnterSpecificPlmns: SpecificPlmns
  ? ExitSpecificPlmns: SpecificPlmns
}

;;; SpecificPlmns
SpecificPlmns = {
  triggerId: TriggerId
  plmns: [* PlmnId]
}

;;; MbmsSaChange
MbmsSaChange = {
  ? anyPlmnChange: BaseTrigger
  ? enterSpecificPlmns: SpecificMbmsSas
  ? exitSpecificPlmns: SpecificMbmsSas
}

;;; SpecificMbmsSas
SpecificMbmsSas = {
  triggerId: TriggerId
  mbmsSas: [* MbmsSaId]
}

;;; MbsfnAreaChange
MbsfnAreaChange = {
  ? anyPlmnChange: BaseTrigger
  ? enterSpecificMbsfnAreas: SpecificMbsfnAreas
  ? exitSpecificPlmn: SpecificMbsfnAreas
}

;;; SpecificMbsfnAreas
SpecificMbsfnAreas = {
  triggerId: TriggerId
  mbsfnAreas: [* MbsfnAreaId]
}

;;; PeriodicReport
PeriodicReport = {
  triggerId: TriggerId
  interval: Uinteger
}

;;; TravelledDistance
TravelledDistance = {
  triggerId: TriggerId
  distance: Uinteger
}

;;; VerticalAppEvent
VerticalAppEvent = {
  ? initialLogOn: BaseTrigger
  ? locConfigReceived: BaseTrigger
  ? anyOtherEvent: BaseTrigger
}

;;; GeographicalAreaChange
GeographicalAreaChange = {
  ? AnyGeoAreaChange: BaseTrigger
  ? EnterSpecificGeoAreas: SpecificGeoAreas
  ? ExitSpecificGeoAreas: SpecificGeoAreas
}

;;; SpecificGeoAreas
SpecificGeoAreas = {
  triggerId: TriggerId
  geoAreas: [* GeographicArea]
}

;;; LocationReport
LocationReport = {
  valTgtUe: ValTargetUe
  triggerIds: [* TriggerId]
  locInfo: LocationInfo
  ? timestamp: TimeOfDay
}
```

```

;;; LocationInfo
LocationInfo = {
  ? cellId: CellId
  ? neighbouringCellIds: [* CellId]
  ? mbmsSaId: MbmsSaId
  ? mbsfnAreaId: MbsfnAreaId
  ? currentCoordinate: GeographicalCoordinates
}

;;; BaseTrigger
BaseTrigger = {
  triggerId: TriggerId
}

;;; TriggerId
;;+ Unique identifier of a trigger.
TriggerId = text

;;; ValTargetUe
;;+ Represents information identifying a VAL user ID or a VAL UE ID.
valUserId = {
  valUserId: text ; Unique identifier of a VAL user.
}

valUeId = {
  valUeId: text ; Unique identifier of a VAL UE.
}

ValTargetUe = valUserId / valUeId

;;; Uinteger
;;+ Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.
UInteger = int .ge 0

;;; GeographicArea
;;+ Geographic area specified by different shape.
GeographicArea = Point / PointUncertaintyCircle / PointUncertaintyEllipse / Polygon / PointAltitude
/ PointAltitudeUncertainty / EllipsoidArc

;;; GADShape
;;+ Common base type for GAD shapes.
GADShape = {
  shape: SupportedGADShapes
}

;;; Point
;;+ Ellipsoid Point.
Point = {
  ~GADShape
  point: GeographicalCoordinates
}

;;; PointUncertaintyCircle
;;+ Ellipsoid point with uncertainty circle.
PointUncertaintyCircle = {
  ~GADShape
  point: GeographicalCoordinates
  uncertainty: Uncertainty
}

;;; PointUncertaintyEllipse
;;+ Ellipsoid point with uncertainty ellipse.
PointUncertaintyEllipse = {
  ~GADShape
  point: GeographicalCoordinates
  uncertaintyEllipse: UncertaintyEllipse
  confidence: Confidence
}

;;; Polygon
;;+ Polygon.
objecv5 = {
  pointList: PointList
}

Polygon = {
  ~GADShape
  pointList: PointList
}

```

```
}

;;; PointAltitude
;;;+ Ellipsoid point with altitude.
PointAltitude = {
  ~GADShape
  point: GeographicalCoordinates
  altitude: Altitude
}

;;; PointAltitudeUncertainty
;;;+ Ellipsoid point with altitude and uncertainty ellipsoid.
PointAltitudeUncertainty = {
  ~GADShape
  point: GeographicalCoordinates
  altitude: Altitude
  uncertaintyEllipse: UncertaintyEllipse
  uncertaintyAltitude: Uncertainty
  confidence: Confidence
}

;;; EllipsoidArc
;;;+ Ellipsoid Arc.
EllipsoidArc = {
  ~GADShape
  point: GeographicalCoordinates
  innerRadius: InnerRadius
  uncertaintyRadius: Uncertainty
  offsetAngle: Angle
  includedAngle: Angle
  confidence: Confidence
}

;;; GeographicalCoordinates
;;;+ Geographical coordinates.
GeographicalCoordinates = {
  lon: -180.0..180.0
  lat: -90.0..90.0
}

;;; UncertaintyEllipse
;;;+ Ellipse with uncertainty.
UncertaintyEllipse = {
  semiMajor: Uncertainty
  semiMinor: Uncertainty
  orientationMajor: Orientation
}

;;; PointList
;;;+ List of points.
PointList = [3*15 GeographicalCoordinates]

;;; Altitude
;;;+ Indicates value of altitude.
Altitude = -32767.0..32767.0

;;; Angle
;;;+ Indicates value of angle.
Angle = 0..360

;;; Uncertainty
;;;+ Indicates value of uncertainty.
Uncertainty = float32 .ge 0

;;; Orientation
;;;+ Indicates value of orientation angle.
Orientation = 0..180

;;; Confidence
;;;+ Indicates value of confidence.
Confidence = 0..100

;;; InnerRadius
;;;+ Indicates value of the inner radius.
InnerRadius = (0..327675)

;;; SupportedGADShapes
;;;+ Indicates supported GAD shapes.
```

```
SupportedGADShapes = "POINT" / "POINT_UNCERTAINTY_CIRCLE" / "POINT_UNCERTAINTY_ELLIPSE" / "POLYGON"  
/ "POINT_ALTITUDE" / "POINT_ALTITUDE_UNCERTAINTY" / "ELLIPSOID_ARC" /  
"LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE" / "LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID" / text  
  
;;; CellId  
;;+ Unique identifier of a cell.  
CellId = text  
  
;;; TaId  
;;+ Unique identifier of a tracking area.  
TaId = text  
  
;;; PlmnId  
;;+ Unique identifier of a PLMN.  
PlmnId = text  
  
;;; MbmsSaId  
;;+ Unique identifier of a MBMS serving area.  
MbmsSaId = text  
  
;;; MbsfnAreaId  
;;+ Unique identifier of a MBSFN area.  
MbsfnAreaId = text
```

B.4.1.6 Media Types

See clause B.3.1.6.

B.5 Media types

B.5.1 General

This clause defines media types and its model that are applicable to APIs defined for CoAP resource representations in the present specification.

NOTE: Media types (formerly known as a multipurpose internet mail extensions (MIME) types) indicate the nature and format of a document, file, or assortment of bytes and are defined in IETF RFC 6838 [13A].

B.5.2 Media type structure and definition

The media type for the APIs defined for CoAP resource representations shall be "application/vnd.3gpp.seal-location-info+cbor". This media type may be appended with a media type parameter to identify a particular data type, e.g., "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration", "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-query", "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-area-info".

Editor's note (WI:eSEAL CR:0122): The MIME type needs to be registered towards IANA.

Table B.5.2.1 lists the single media type for the APIs defined for CoAP resource representations with a required parameter to identify the defined data types.

Table B.5.2.1: Media type and parameter

Media type and parameter	Section used	Description
vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration	6.2.2.4.2, 6.2.2.5.2, 6.2.4.3, 6.2.4.4	The media type and parameter for a trigger configuration or location report configuration.
vnd.3gpp.seal-location-info+cbor;modeltype=location-report	6.2.2.4.1, 6.2.2.5.1, 6.2.3.3, 6.2.3.4, 6.2.4.3, 6.2.4.4, 6.2.7.3	The media type and parameter for location information or location report.
vnd.3gpp.seal-location-info+cbor;modeltype=location-area-query	6.2.9.3, 6.2.9.4	The media type and parameter for a location area query.
vnd.3gpp.seal-location-info+cbor;modeltype=location-area-info	6.2.9.3, 6.2.9.4	The media type and parameter for a location area information.

B.5.3 Media type registration template for application/vnd.3gpp.seal-location-info+cbor

Type name: application

Subtype name: vnd.3gpp.seal-location-info+cbor

Required parameters: none

Optional parameters: modeltype.

The "modeltype" parameter identifies a specific data type, e.g. "vnd.3gpp.seal-location-info+cbor;modeltype=location-report-configuration" where "location-report-configuration" indicates the "LocationReportConfiguration" data type in 3GPP TS 24.545 clause B.2.3.2.

Encoding considerations: Must be encoded as using IETF RFC 8949 [20]. See data types defined in 3GPP TS 24.545 clause B.2, B.3, and B.4 for details. Clause B.5 provides the media type structure and definition.

Security considerations: See Section 10 of IETF RFC 8949 [20] and Section 11 of IETF RFC 7252 [14].

Interoperability considerations: Applications must ignore any key-value pairs that they do not understand. This allows backwards-compatible extensions to this specification.

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

Applications that use this media type: Applications supporting the SEAL location management procedures as described in the published specification.

Fragment identifier considerations: Fragment identification is the same as specified for "application/cbor" media type in IETF RFC 8949 [20]. Note that currently that RFC does not define fragmentation identification syntax for "application/cbor".

Additional information:

Deprecated alias names for this type: N/A

Magic number(s): N/A

File extension(s): none

Macintosh file type code(s): none

Person & email address to contact for further information: <MCC name>, <MCC email address>

Intended usage: COMMON

Restrictions on usage: None

Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

Change controller: <MCC name>/<MCC email address>

Annex C (Informative): IANA UDP port registration form

This annex contains information to be provided to IANA for SEAL Off-network Location Management Protocol (SLMP) UDP port registration. The following information is to be used to register SLMP user port number and service name in the "IANA Service Name and Transport Protocol Port Number Registry" and specifically "Service Name and Transport Protocol Port Number Registry". This registration form can be found at: <https://www.iana.org/form/ports-services>.

Assignee Name	<MCC name>
Assignee E-mail	<MCC email address>
Contact Person	<MCC name>
Contact E-mail	<MCC email address>
Resources required	Port number and service name
Transport Protocols	UDP
Service Code	
Service Name	SLMP
Desired Port Number	
Description	Service Enabler Architecture Layer for Verticals (SEAL) Off-network Location Management Protocol (SLMP) is a 3GPP control protocol used by a SEAL Location Management Client (SLM-C) hosted on a User Equipment (UE). SLMP facilitates the SEAL location management service functionality between SLM-C hosted on UEs communicating using IP using a single physical network segment, separated from Internet and any other IP network. The network segment is wireless network segment and UEs are mobile devices.
Reference	3GPP TS 24.545
Defined TXT keys	N/A
If broadcast/multicast is used, how and what for?	SLMP does not used broadcast/multicast.
If UDP is requested, please explain how traffic is limited, and whether the protocol reacts to congestion.	The number of SLMP messages that need to be sent between SEAL Location Management clients (SLM-C) depends upon the number of members of the SEAL group. SLMP employs a message control mechanism which includes a back-off mechanism to defer transmission of another SLMP message once a SLMP message is received. SLMP implements a timer-based mechanism once a SLMP message is sent waiting for SLMP message response. SLMP controls the number of messages transmitted within a certain, configurable amount of time, thus averting congestion. At maximum a few SLMP messages per second are expected in communication between SLMP clients. SLMP does not support any reaction to congestion.
If UDP is requested, please indicate whether the service is solely for the discovery of hosts supporting this protocol.	SLMP is not used solely for discovery of hosts supporting this protocol.
Please explain how your protocol supports versioning.	SLMP does not support versioning.
If your request is for more than one transport, please explain in	N/A

detail how the protocol differs over each transport.	
Please describe how your protocol supports security. Note that presently there is no IETF consensus on when it is appropriate to use a second port for an insecure version of a protocol.	SLMP does not support security. SLMP relies on the security mechanisms of the lower layers.
Please explain why a unique port assignment is necessary as opposed to a port in range (49152-65535) or existing port.	As a general principle, 3GPP protocols use assigned User Ports, e.g. GTP-C uses UDP port number 2123, GTP-U uses UDP port number 2152, S1AP uses SCTP port number 36412, X2AP uses SCTP port number 36422, WLCP uses 36411. A dynamic port number (i.e. 49152 to 65535) cannot be used for the SLMP because of the nature of communication on a single physical network segment, separated from Internet and any other IP network. The requirement of SLMP to continuously listen for incoming messages needs an always active listener port. There is no local server that is administering the use of ephemeral ports in the SLMP architecture, so there would be no way for one SLMP client to know that a port is already being used by another SLMP client.
Please explain the state of development of your protocol.	Protocol standard definition. No implementation exists yet.
If SCTP is requested, is there an existing TCP and/or UDP service name or port number assignment? If yes, provide the existing service name and port number.	N/A
What specific SCTP capability is used by the application such that a user who has the choice of both TCP (and/or UDP) and SCTP ports for this application would choose SCTP? See RFC 4960 section 7.1.	N/A
Please provide any other information that would be helpful in understanding how this protocol differs from existing assigned services	This protocol is between the UEs communicating using IP over a single physical network segment, separated from Internet and any other IP network. SEAL location management service functionality offered by the SLM clients (SLM-C) hosted by the UEs is to support vertical applications (e.g. V2X) over the 3GPP system. The need of listening for incoming messages requires an active listener port. This differs from existing protocols in 3GPP where UDP ports have been requested, as those protocols have been either between the UE and network or between network elements.

Annex C (normative): Counters

C.1 General

This clause provides a brief description of the counters used in this specification.

C.2 Off-network counters

The table C.2-1 lists the counters used by off-network procedures, their default upper limits and the action to take upon reaching the upper limit. The counters start at 1.

Table C.2-1: Off-network counters

Counter	Upper Limit	Associated timer	Upon reaching the upper limit
C101 (waiting for ack/resp)	Default value: 5 Maximum value: implementation dependent	T101	Stop timer T101.

Annex D (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
2020-09	CT-89e	CP-202163	0019		F	Miscellaneous editorial corrections	16.2.0
2020-09	CT-89e	CP-202163	0020	1	F	Updates to HTTP based location information subscription procedure	16.2.0
2020-09	CT-89e	CP-202163	0021	1	F	Updates to XML schema of configuration for SEAL location management	16.2.0
2020-09	CT-89e	CP-202163	0022	1	F	XML schema for location information report	16.2.0
2020-09	CT-89e	CP-202163	0023		F	XML schema for location based query	16.2.0
2020-09	CT-89e	CP-202163	0024	1	F	XML schema for location information notification	16.2.0
2020-09	CT-89e	CP-202163	0025		F	XML schema for location information request	16.2.0
2020-09	CT-89e	CP-202163	0026	1	F	XML schema for location information subscription	16.2.0
2020-09	CT-89e	CP-202163	0027		F	XML schema for location reporting trigger	16.2.0
2020-12	CT-90e	CP-203210	0028	3	F	Add the XML schema of identity	16.3.0
2020-12	CT-90e	CP-203210	0029	1	F	Update to the client-triggered or VAL server-triggered location reporting procedure	16.3.0
2020-12	CT-90e	CP-203210	0031	1	F	Correct location trigger configuration	16.3.0
2021-03	CT-91e	CP-210111	0033	1	F	Resolution of editor's note under clause 6.2	16.4.0
2021-09	CT-93e	CP-212138	0034	1	B	Off network Location Management - Basic Message Control and Message Format	17.0.0
2021-09	CT-93e	CP-212138	0035	1	B	Off network Location Management - Event-triggered location reporting procedure	17.0.0
2021-09	CT-93e	CP-212138	0036	1	B	Off network Location Management - On-demand location reporting	17.0.0
2021-12	CT-94e	CP-213052	0037	1	C	Message Id and Reply-to Message Id for SEAL offnetwork location management protocol	17.1.0
2021-12	CT-94e	CP-213031	0039	-	B	Reference update for HTTP/1.1 protocol	17.1.0
2022-03	CT-95e	CP-220245	0040	1	C	Updates to Location information subscription procedure	17.2.0
2022-03	CT-95e	CP-220245	0041	-	B	Location area monitoring information procedure	17.2.0
2022-06	CT-96	CP-221198	0052	-	A	Fix to send HTTP POST message to SLM-C	17.3.0
2022-06	CT-96	CP-221217	0042	-	B	Addition of Functional entities for CoAP	17.3.0
2022-06	CT-96	CP-221217	0043	-	B	Addition of Authenticated identity for CoAP	17.3.0
2022-06	CT-96	CP-221217	0044	-	B	Addition of CoAP for Event-triggered location reporting procedure	17.3.0
2022-06	CT-96	CP-221217	0045	-	B	Addition of CoAP for On-demand location reporting procedure	17.3.0
2022-06	CT-96	CP-221217	0047	-	B	Addition of CoAP for Location reporting triggers configuration cancel procedure	17.3.0
2022-06	CT-96	CP-221217	0048	-	B	Addition of CoAP for Event-triggered location information notification procedure	17.3.0
2022-06	CT-96	CP-221217	0049	-	B	Addition of CoAP for Query list of users based on location	17.3.0
2022-06	CT-96	CP-221217	0050	-	B	Addition of CoAP resource representation and encoding annex	17.3.0
2022-06	CT-96	CP-221217	0046	1	B	Addition of CoAP for Client-triggered or VAL server-triggered location reporting procedure	17.3.0
2022-09	CT-97e	CP-222150	0053	1	F	Addition of altitude in location co-ordinates	17.4.0
2022-12	CT-98e	CP-223123	0054	1	F	IANA Registration form for UDP Port number	17.5.0
2022-12	CT-98e	CP-223123	0055	1	F	Resolution of editor's note in B.3.1.6	17.5.0
2023-03	CT-99	CP-230233	0060	1	F	Reference update: RFC 9177 and OMA-TS-XDM_Core-V2_1	17.6.0
2023-03	CT-99	CP-230248	0059	1	A	Corrections to the XML schema	17.6.0
2023-03	CT-99	CP-230309	0065	-	A	Correction to undefined references	17.6.0

2023-03	CT-99	CP-230233	0061	2	F	Alignment with CDDL specification, and miscellaneous corrections	17.6.0
2023-03	CT-99					Editorial Correction	17.6.1
2023-06	CT-100	CP-231242	0072	-	F	Resolution of the editor's note on UDP port number for the SEAL off-network location management protocol (SLMP)	17.7.0
2023-06	CT-100	CP-231242	0074	1	F	Resolution of the editor's note under clause 6.3.1.2.2.1	17.7.0
2023-09	CT-101	CP-232212	0081	1	F	Correction of the Cause information element	17.8.0
2023-09	CT-101	CP-232212	0085	2	F	Updates to the Off-network location reporting trigger configuration message	17.8.0
2024-03	CT-103	CP-240107	0095	1	F	Correction to the Off-network location reporting trigger configuration message	17.9.0
2024-03	CT-103	CP-240107	0097	1	F	Correction to the Event-triggered location information notification procedure	17.9.0
2024-12	CT-106	CP-243188	0113	1	F	Correction on the LocationReportConfiguration	17.10.0
2025-03	CT#107	CP-250163	0117	2	A	SEAL LM - XML schema corrections R17	17.11.0
2025-03	CT#107	CP-250151	0122	1	F	Update of MIME types for CBOR payload	17.11.0
2025-06	CT#108	CP-251193	0130	3	A	Correction to the XML schema on element names	17.12.0
2025-06	CT#108	CP-251147	0148	1	F	Correction to the event-triggered location reporting procedure and the client-triggered or VAL server-triggered location reporting procedure for CoAP	17.12.0
2025-06	CT#108	CP-251147	0151	1	F	Correction to off-network location management protocol	17.12.0
2025-06	CT#108	CP-251147	0161	1	F	Correction to include timestamp for location report information for CoAP	17.12.0
2025-06	CT#108	CP-251147	0154	2	F	Correction to include timestamp for location report information for HTTP	17.12.0

History

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