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Contents

Foreword

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

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

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

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

NOTE 1: The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

NOTE 2: 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

NOTE 3: 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

NOTE 4: The constructions "can" and "cannot" shall not to be used as 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

NOTE 5: The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the protocols for application layer support for V2X services as specified in 3GPP TS 23.286 [4] for:

a) V2X application communication among UEs (over the V5-AE interface); and

b) V2X application communication between the UE and the V2X application server (over the V1-AE interface).

The present specification defines the associated procedures for V2X application communication between the UE and the V2X application server and among UEs.

The present specification defines the usage and interactions of the VAE layer with SEAL services.

The present specification also defines the message format, message contents, error handling and system parameters applied by the protocols for the VAE layer.

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 23.286: "Application layer support for V2X services; Functional architecture and information flows".

[5] 3GPP TS 23.434: "Service Enabler Architecture Layer for Verticals (SEAL); Functional architecture and information flows".

[6] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".

[7] 3GPP TS 24.385: "V2X services Management Object (MO)".

[8] 3GPP TS 24.386: "User Equipment (UE) to V2X control function; protocol aspects; Stage 3".

[9] 3GPP TS 24.544: "Group Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[10] 3GPP TS 24.545: "Location Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[11] 3GPP TS 24.546: "Configuration Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[12] 3GPP TS 24.547: "Identity Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[13] 3GPP TS 24.548: "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[14] 3GPP TS 26.348: "Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point".

[15] 3GPP TS 29.468: "Group Communication System Enablers for LTE (GCSE_LTE); MB2 Reference Point; Stage 3".

[16] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRAN); Overall description; Stage 2".

[17] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[18] ETSI TS 102 965: "Intelligent Transport Systems (ITS); Application Object Identifier (ITS-AID); Registration".

[19] IETF RFC 2616: "Hypertext Transfer Protocol -- HTTP/1.1".

[20] ISO TS 17419: "Intelligent Transport Systems - Cooperative systems - Classification and management of ITS applications in a global context".

[21] 3GPP TS 23.285: "Architecture enhancements for V2X services".

[22] 3GPP TS 29.486: "V2X Application Enabler (VAE) Services; Stage 3".

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].

V2X application enabler client: An entity that provides the client side functionalities corresponding to the V2X application enabler layer.

V2X application enabler server: An entity that provides the server side functionalities corresponding to the V2X application enabler layer.

V2X service identifier: An identifier of a V2X service, e.g. PSID or ITS-AIDs of the V2X application.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.286 [4] apply:

V2X group
V2X dynamic group
V2X service

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.434 [5] apply:

SEAL service

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].

AS Application Server
SEAL Service Enabler Architecture Layer for Verticals
USD User Service Description

V2X	Vehicle-to-Everything
VAE	V2X Application Enabler
VAE-C	V2X Application Enabler Client
VAE-S	V2X Application Enabler Server

4 General description

The UE can contain a VAE client (VAE-C). The VAE-C communicates with the VAE server (VAE-S) over the V1-AE interface (see 3GPP TS 23.286 [4]). Furthermore, the VAE-C of a UE can communicate with the VAE-C of another UE over the V5-AE interface (see 3GPP TS 23.286 [4]). Both the VAE-C and the VAE-S can act as an HTTP client or an HTTP server (see IETF RFC 2616 [19]). The HTTP protocol interactions are described in detail in clause 6 and 7.

The VAE layer supports UEs in the LTE-Uu communication range assigning a ProSe Layer-2 Group ID for application layer V2X dynamic group formation (on-network dynamic group creation procedure as defined in clause 6.10).

Additionally, the VAE layer supports UEs in assigning a ProSe Layer-2 Group ID for application layer V2X dynamic group formation (off-network dynamic group creation procedure as defined in clause 6.10).

By means of using the V1-AE interface:

a) V2X UE registration and de-registration towards the VAE-S can be provided as defined by clause 6.2 and 6.3;

b) application level location tracking can be provided as defined by clause 6.4;

c) V2X message delivery can be provided as defined by clause 6.5;

d) V2X service discovery information can be provided as defined by clause 6.6;

e) V2X service continuity can be provided as defined by clause 6.7;

f) dynamic local service information for V2X service continuity can be obtained as defined by clause 6.8;

g) network monitoring by the V2X UE can be provided as defined by clause 6.9;

h) V2X USD provisioning can be provided as defined by clause 7.2; and

i) PC5 parameters provisioning can be provided as defined by clause 7.3.

5 SEAL services

The VAE layer utilizes SEAL services to support V2X services. The SEAL services are specified in 3GPP TS 24.544 [9], 3GPP TS 24.545 [10], 3GPP TS 24.546 [11], 3GPP TS 24.547 [12] and 3GPP TS 24.548 [13]. Interactions between the VAE layer and the SEAL services are described in detail in clause 6.

6 VAE procedures

6.1 General

6.2 V2X UE registration procedure

6.2.1 Client procedure

Upon receiving a request from a V2X application to register for receiving V2X messages from the V2X AS, the VAE-C shall generate an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI included in the received HTTP response message for V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml";

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <registration-info> element in the <VAE-info> root element:

   1) shall include a <V2X-UE-id> element set to the identity of the UE which requests the registration; and

   2) shall include one or more with a <V2X-service-id> element(s), each element set to the V2X service ID which the V2X UE is interested in receiving; and

d) shall send the HTTP POST request towards the VAE-S according to IETF RFC 2616 [19].

6.2.2 Server procedure

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <registration-info> element in the <VAE-info> root element

the VAE-S:

a) shall store the received registration information;

b) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [19]. In the HTTP 200 (OK) response message, the VAE-S:

   1) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml";

   2) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <VAE-info> root element:

      i) shall include a <registration-info> element with a <result> child element set to the value "success" or "failure" indicating success or failure of the registration; and

      ii) if success and if the V2X service IDs as present in the <registration-info> element of the received HTTP POST request is not fully acceptable to the VAE-S, the VAE-S may change the V2X service IDs to a subset and shall include one or more <V2X-service-id> child elements set to the identities of the new V2X service IDs; and

c) shall send the HTTP 200 (OK) response towards the VAE-C.

6.3 V2X UE de-registration procedure

6.3.1 Client procedure

Upon receiving a request from a V2X application to de-register for receiving certain V2X service-IDs from the V2X AS, the VAE-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI included in the received HTTP response message for V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml";

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <de-registration-info> element in the <VAE-info> root element:

   1) shall include a <V2X-UE-id> element set to the identity of a UE which requests the de-registration; and

2) shall include one or more a <V2X-service-id> child element(s), each element set to the V2X service ID that the UE is no longer interested in receiving; and

d) shall send the HTTP POST request towards the VAE-S according to IETF RFC 2616 [19].

6.3.2 Server procedure

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <de-registration-info> element in the <VAE-info> element in the <VAE-info> element,

the VAE-S:

a) shall remove the received V2X service IDs from registration information corresponding to the V2X UE;

b) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [19]. In the HTTP 200 (OK) response message, the VAE-S:

1) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

2) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <VAE-info> root element:

i) shall include a <de-registration-info> element with a <result> child element set to the value "success" or "failure" indicating success or failure of the de-registration; and

c) shall send the HTTP 200 (OK) response towards the VAE-C.

6.4 Application level location tracking procedure

6.4.1 Client procedure

Upon entering a new geographical area if the V2X UE has been provisioned with geographical identifier groups (see clause 7) and the V2X UE has subscribed to a certain geographical area identifier group in order to receive V2X messages from the V2X AS for this area, the VAE-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI included in the received HTTP response message for V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <location-tracking-info> element in the <VAE-info> root element:

1) shall include a <identity> element with a <V2X-UE-id> child element set to the identity of the UE which requests the registration;

2) shall include a <geographical-identifier> element with a <geo-id> child element set to the identity of the geographical area to be subscribed, i.e. the new geographical area where the UE entered; and

3) shall include an <operation> element set to "subscribe".

Upon a successful subscription to a geographical area, the VAE-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI included in the received HTTP response message for the V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <location-tracking-info> element in the <VAE-info> root element:

1) shall include a <identity> element with a <V2X-UE-id> child element set to the identity of the UE which requests the registration;

2) shall include a <geographical-identifier> element with a <geo-id> child element set to the identity of the geographical area to be unsubscribed, i.e. the old geographical area where the UE exited; and

3) shall include an <operation> element set to "unsubscribe".

6.4.2 Server procedure

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <VAE-info> root element with a <location-tracking-info> element with an <identity> element and an <operation> element set to "subscribe",

the VAE-S:

a) shall store the received geographical area information and associate this area with the UE identity provided in the <identity> element;

b) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [19]. In the HTTP 200 (OK) response message, the VAE-S:

1) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

2) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <location-tracking-info> element in the <VAE-info> root element:

i) shall include a <result> child element set to the value "success" or "failure" indicating success or failure of the subscription; and

ii) shall include an <operation> element set to "subscribe"; and

c) shall send the HTTP 200 (OK) response towards the VAE-C.

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.VAE-registration-+xml MIME body with a <VAE-info> root element with a <location-tracking-info> element with an <identity> element and an <operation> element set to "unsubscribe",

the VAE-S:

a) shall remove the received geographical area information associated with the UE identity provided in the <identity> element;

b) shall generate an HTTP 200 (OK) response according to IETF RFC 2616 [19]. In the HTTP 200 (OK) response message, the VAE-S:

1) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

2) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <location-tracking-info> element in the <VAE-info> root element:

i) shall include a <result> child element set to the value "success" or "failure" indicating success or failure of the subscription; and

ii) shall include an <operation> element set to "subscribe"; and

c) shall send the HTTP 200 (OK) response towards the VAE-C.

6.5 V2X message delivery procedure

6.5.1 Client procedure

6.5.1.1 Reception of a V2X message

Upon receiving an HTTP POST request containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with either a <identity> element or a <group> element, a <payload>element and a <service> element included in the <message-info> element in the <VAE-info> root element;

the VAE-C:

a) shall provide the received information to the V2X application identified by the service indicated in the V2X message, if the identity or group of theV2X message matches the identity of the V2X UE or the group of the VAE client; and

b) shall send a V2X message reception report as specified in clause 6.5.1.3 if the <message-reception-ind> element and <message-reception-uri> element are included in the received V2X message.

6.5.1.2 Reception of a V2X message reception report

Upon receiving an HTTP POST request containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <result> element included in the <message-info> root element;

the VAE-C:

a) evaluates the content of the <result> element.

6.5.1.3 Sending of a V2X message reception report

In order to send a V2X message reception report, the VAE-C shall generate an HTTP 200(OK) response message according to procedures specified in IETF RFC 2616 [19]. In the HTTP 200(OK) message, the VAE-C:

a) shall set the Request-URI to the URI included in the <message-reception-uri> element in the received HTTP POST request message for the V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <reception-report> element included in the <VAE-info> root element. In the <reception-report> element, the VAE-C:

   1) shall include a <result> element set to a value "success" or "fail" indicating success or failure of the V2X message reception.

6.5.1.4 Sending of a V2X message

In order to send a V2X message, the VAE-C shall send an HTTP POST request message according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request message, the VAE-C:

a) shall set the Request-URI to the URI included in the received HTTP response message for V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <message-info> element in the <VAE-info> root element:

1) shall include a <identity> element with a <V2X-UE-id> child element set to the identity of the UE which requests the sending of the V2X message;

2) shall include a <service> element with a <V2X-service-id> child element set to the identity of the V2X service which is interested in sending the V2X message;

3) may include a <geographical-identifier> element with one or more <geo-id> child elements each set to the identity of the geographical area containing the location of the V2X UE;

4) may include a <message-reception-ind> element to indicate to the VAE server that a reception report is required; and

5) if a <message-reception-ind> element is included, shall include a <message-reception-uri> element set to the URI for a response to the VAE-C.

6.5.2 Server procedure

6.5.2.1 Reception of a V2X message

Upon receiving an HTTP POST request containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with either a <identity> element or a <group> element, a <payload> element and a <service> element included in the <message-info> element in the <VAE-info> root element;

the VAE-S:

a) shall provide the received information to the V2X application server identified by the service indicated in the V2X message; and

b) shall send a V2X message reception report as specified in clause 6.5.2.3 if the <message-reception-ind> element and <message-reception-uri> element are included in the received V2X message.

6.5.2.2 Reception of a V2X message reception report

Upon receiving an HTTP POST request containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <result> element included in the <message-info> element in the <VAE-info> root element;

the VAE-S:

a) evaluates the content of the <result> element.

6.5.2.3 Sending of a V2X message reception report

In order to send a V2X message reception report, the VAE-S shall send a HTTP POST request message according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request message, the VAE-S:

a) shall set the Request-URI to the URI included in the <message-reception-uri> element in the received HTTP POST request message for reception of a V2X message (see clause 6.5.2.1);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and a <result> element of the <message-info> element set to a value "success" or "fail".

6.5.2.4 Sending of a V2X message to target geographical areas

In order to send a V2X message received from a V2X application server to target geographical areas, the VAE-S shall send a HTTP POST request message according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request message, the VAE-S:

a) shall set the Request-URI to the URI included in the received HTTP response message for V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <message-info> element in the <VAE-info> root element:

   1) shall include a <identity> element with a <V2X-UE-id> child element set to the identity of the UE to receive the V2X message, determined by association from the target geographical area indicated by the V2X application server;

   2) shall include a <service> element with a <V2X-service-id> child element set to the identity of the V2X service which is interested in sending the V2X message;

   3) may include a <geographical-identifier> element with a <geo-id> child element set to the identity of the geographical area containing the location of the V2X UE;

   4) may include a <message-reception-ind> element to indicate to the VAE server that a reception report is required; and

   5) if a <message-reception-ind> element is included, shall include a <message-reception-uri> element set to the URI for a response to the VAE-S.

6.5.2.5 Sending of a V2X message to a V2X group

In order to send a V2X message received from a V2X application server, the VAE-S shall send a HTTP POST request message according to procedures specified in IETF RFC 2616 [19] to each VAE-C which has subscribed to the V2X message delivery service. In the HTTP POST request message, the VAE-S:

a) shall set the Request-URI to the URI of each VAE-C subscribed for V2X message delivery service;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <message-info> root element:

   1) shall include a <V2X-group-id> child element set to the V2X group identity of the VAE-C to receive the V2X message, determined by registration with the identity of the V2X group indicated by the V2X application server;

   2) shall include a <service> element with a <V2X-service-id> child element set to the identity of the V2X service which is interested in sending the V2X message;

   3) may include a <geographical-identifier> element with a <geo-id> child element set to the identity of the geographical area applicable for the V2X message;

   4) may include a <message-reception-ind> element to indicate to the VAE-C that a reception report is required; and

   5) if a <message-reception-ind> element is included, shall include a <message-reception-uri> element set to the URI for a response to the VAE-C.

6.6 V2X service discovery procedure

6.6.1 Client procedure

In order to discover V2X service information from a VAE-S (e.g. available VAE services identified by V2X service identities), the VAE-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI received in the VAE client UE configuration document via the SCM-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <service-discovery-info> element in the <VAE-info> root element:

   1) shall include a <identity> element with a <V2X-UE-id> child element set to the identity of the UE which requests the service discovery.

6.6.2 Server procedure

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <service-discovery-info> element in the <VAE-info> root element, the VAE-S:

   1) shall reply with a HTTP response with a <result> element of the <service-discovery-info> element set to a value "success" or "fail", and may include a <service-discovery-data> element which provides the V2X UE service discovery data.

6.7 V2X service continuity procedure

6.7.1 Client procedure

In order to obtaining dynamic local V2X service information from a VAE-S, the VAE-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI included in the received HTTP response message for V2X service discovery procedure (see clause 6.6);

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body and in the <local-service-info> element in the <VAE-info> root element:

   1) shall include an <identity> element with a <V2X-UE-id> child element set to the identity of the UE which requests the local service information; and

   2) shall include a <geographical-identifier> element with a <geo-id> child element set to the identity of the geographical area for which the local service information is requested.

6.7.2 Server procedure

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with an <identity> element and a <geographical-identifier> element in the <local-service-info> element in the <VAE-info> root element;

the VAE-S:

a) shall determine the local service information (e.g. V2X server USD(s), V2X USD) corresponding to the geographical location information received in <geographical-identifier>; and

b) shall reply with an HTTP response with a <result> element of the <local-service-info> element set to a value "success" or "fail", and if the result is "success", the VAE-S shall include a <local-service-info-content> element which provides the local service information to the VAE-C.

6.8 Dynamic group management procedure

6.8.1 On-network dynamic group creation procedure

6.8.1.1 Server procedure

Upon receiving a Configure Dynamic Group request from a V2X application specific server (see 3GPP TS 29.486 [22]) the VAE-S shall assign a ProSe Layer-2 Group ID to the received dynamic group information from the available ProSe Layer-2 Group ID pool. Then the VAE-S shall generate an HTTP PUT request message according to procedures specified in IETF RFC 2616 [19]. In the HTTP PUT request message, the VAE-S:

a) shall include a Request-URI set to the URI corresponding to the identity of the VAE-C of the group leader;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info +xml";

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <layer2-group-id-mapping> element in the <VAE-info> root element which shall include:

   1) a <dynamic-group-info> element which shall include:

      i) a <dynamic-group-id> element set to the identity of the dynamic group;

      ii) a <group-definition> element set to information about the V2X group; and

      iii) a <group-leader-id> element set to the identity of the group leader; and

   2) a <prose-layer2-group-id> element corresponding to the dynamic group information; and

d) shall send the HTTP PUT request message towards the VAE-C according to IETF RFC 2616 [19].

6.8.1.2 Client procedure

Upon receiving an HTTP PUT request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info +xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <layer2-group-id-mapping> element in the <VAE-info> root element;

the VAE-C shall store the content of the <layer2-group-id-mapping> element and may further announce the dynamic group information including the corresponding ProSe Layer-2 Group ID to the other VAE clients within the PC5 communication proximity on a PC5 channel dedicated for V5-AE communications, enabling more V2X UEs to join the dynamic group.

6.8.2 On-network dynamic group notification procedure

6.8.2.1 Client procedure

Once the on-network dynamic group is created as defined in clause 6.10.1, if the group changes (i.e. UE joins or leaves the group), the VAE-C shall generate an HTTP POST request message according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall include a Request-URI set to the URI corresponding to the identity of the VAE-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info +xml";

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with an <id-list-notification> element in the <VAE-info> root element which shall include:

   1) a <dynamic-group-id> element set to the identity of the dynamic group; and

   2) one or more <group-member-id> element(s), each of which contains an <identity> child element set to the identity of the joined or left V2X UE and a <group-scope> child element that has the value "joined" or "left"; and

d) shall send the HTTP POST request message towards the VAE-S according to IETF RFC 2616 [19].

6.8.2.2 Server procedure

Upon receiving an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info +xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with an <id-list-notification> element in the <VAE-info> root element;

the VAE-S shall send Notify Dynamic Group request (see 3GPP TS 29.486 [22]) towards the V2X application specific server according to IETF RFC 2616 [19].

6.9 Network monitoring by the V2X UE procedure

6.9.1 V2X UE subscription for network monitoring information

6.9.1.1 Client procedure

In order to subscribe for the network monitoring information from the VAE-S, the VAE-C shall send an HTTP POST request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-C:

a) shall set the Request-URI to the URI corresponding to the identity of the VAE-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with a <subscription-info> element in the <VAE-info> root element:

   1) shall include an <identity> element with a <V2X-UE-id> child element set to the identity of the UE which requests the registration;

   2) shall include a <subscription-events> element with one or more <event> child element set to the network monitoring events (e.g. uplink degradation, congestion, overload, coverage) to be subscribed; and

   3) shall include a <triggering-criteria> element set to the criteria to indicate when the VAE-S sends the monitoring reports to the VAE-C.

6.9.1.2 Server procedure

Upon reception of an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

b) an application/vnd.3gpp.vae-info+xml MIME body with a <subscription-info> element in the <VAE-info> root element;

the VAE-S:

a) shall store the received subscription information if the VAE-C is authorized and allowed to access the network monitoring information;

b) shall include a <V2X-UE-id> child element within the <identity> element of the <subscription-info> element, and set it to the identity of the UE which requests to subscribe for the network monitoring information from the VAE-S; and

c) shall reply with a HTTP response with a <result> element of the <subscription-info> element set to a value "success" or "fail".

6.9.2 Notifications for network monitoring information

6.9.2.1 Server procedure

Based on the UE subscription for network monitoring information, the VAE-S shall generate an HTTP POST request message according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-S:

a) shall include a Request-URI set to the URI corresponding to the identity of the VAE-C;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info +xml";

c) shall include an application/vnd.3gpp.vae-info+xml MIME body with a < notification-info> element in the <VAE-info> root element which shall include:

1) a <V2X-UE-id> element set to the identity of the subscribed V2X UE;

2) a <network-monitoring-info> element, which:

i) shall include one or more <trigger-id> elements set to the identity of the triggering criteria that resulted in the VAE-S sending the monitoring report to the VAE-C;

ii) may include an <uplink-quality-level> element set to the uplink quality level;

iii) may include a <congestion-level> element set to the congestion level;

iv) may include a <overload-level> element set to the overload level;

v) may include a <geographical-area> element which shall include at least one of the followings:

A) <cell-area>, an 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] for which the monitoring applies; and

B) <tracking-area>, an element specifying a tracking area identity coded as specified in clause 19.4.2.3 in 3GPP TS 23.003 [2] for which the monitoring applies;

vi) may include a <time-validity> element set to the period for which the monitoring applies; and

vii)may include an <MBMS-level> element, which may include:

A) an <MBMS-coverage-level> element set to the coverage level for MBMS; and

B) an <MBMS-bearer-level-event> element set to the MBMS bearer level events; and

d) shall send the HTTP POST request message towards the VAE-C according to IETF RFC 2616 [19].

7 Provisioning of parameters by the VAE server

7.1 General

The VAE-S can provision network related information to a VAE-C over the V1-AE interface:

a) V2X USD provisioning in order to provision V2X USDs for receiving MBMS based V2X traffic; and

b) PC5 parameters provisioning in order to provide PC5 parameters configuration data.

7.2 V2X USD provisioning

7.2.1 General

The V2X USD information is provided to the VAE-C to allow the V2X service to send V2X messages using MBMS.

7.2.2 Client procedure

Upon receiving an HTTP POST request message containing:

a) an Accept header field set to "application/vnd.3gpp.vae-info+xml";

b) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) an application/vnd.3gpp.vae-usd-announcement-info+xml MIME body with an <announcement> element;

the VAE-C:

a) shall store the received V2X USD information; and

b) if the SEAL layer (see 3GPP TS 24.548 [13]) indicates that the V2X USD information was sent by unicast, the VAE-C shall send an acknowledgement of the V2X USD information to the VAE-S.

7.2.3 Server procedure

For each VAE-C that the VAE-S is sending a V2X USD announcement to, the VAE-S shall generate an HTTP POST request message request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-S:

a) shall set the Request-URI to the URI corresponding to the identity of the V2X UE;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml";

c) shall include in a MIME body with Content-Type header field set to "application/vnd.3gpp.vae-info+xml", the <announcement> element associated with the MBMS bearer used to send V2X messages. The <announcement> element:

   1) shall include a <TMGI> element set to a TMGI value;

   2) shall include one or more MBMS service area IDs in <mbms-service-area-id> elements in the <mbms-service-areas> element;

   3) if multiple carriers are supported, shall include the frequency to be used in the <frequency> element;

   4) shall include a <V2X-mbms-sdp> element set to the SDP configuration information applicable to MBMS bearer to use for sending V2X messages; and

d) shall send the HTTP POST request towards the VAE-C according to IETF RFC 2616 [19].

7.3 PC5 parameters provisioning

7.3.1 General

The PC5 parameters ares provided to the VAE-C to allow the V2X service to send V2X messages using V2X communication over PC5.

7.3.2 Client procedure

Upon receiving an HTTP POST request message containing:

a) an Accept header field set to "application/vnd.3gpp.vae-info+xml";

b) a Content-Type header field set to "application/vnd.3gpp.vae-info+xml"; and

c) an application/vnd.3gpp.vae-usd-announcement-info+xml MIME body with an <PC5-parameters-request> element;

the VAE-C:

a) shall store the received PC5 parameters; and

b) shall send a <PC5-parameters-response> element as an acknowledgement of the PC5 parameters to the VAE-S.

7.3.3 Server procedure

For each VAE-C that the VAE-S is sending PC5 parameters to, the VAE-S shall generate an HTTP POST request message request according to procedures specified in IETF RFC 2616 [19]. In the HTTP POST request, the VAE-S:

a) shall set the Request-URI to the URI corresponding to the identity of the V2X UE;

b) shall include a Content-Type header field set to "application/vnd.3gpp.vae-info+xml";

c) shall include in a MIME body with Content-Type header field set to "application/vnd.3gpp.vae -info+xml", the <PC5-parameters-request> element associated with the configuration parameters for V2X communication over PC5 used to send V2X messages. The <PC5-parameters-request> element:

   1) shall include a <expiration-time> element set to the validity of the configuration parameters for V2X communication over PC5;

   2) shall include one or more PLMNs in <plmn-id> elements in the <plmn-list> element which indicate the PLMNs in which the UE is authorized to use V2X communication over PC5 when the UE is served by E-UTRAN for V2X communication;

   3) may include an <authorized-when-not-served-by-E-UTRAN> which indicates that the UE is authorized to use V2X communication over PC5 when the UE is not served by E-UTRAN;

   4) shall include one or more <radio-parameters> elements in the <radio-parameters-list> element which shall include one of the following elements:

      i) a <radio-parameters-contents > element set to the radio parameters for V2X communication over PC5 applicable when the UE is not served by E-UTRAN;

      ii) a <geographical-area> element set to the geographical location where the radio parameters are applicable; and

      iii) a <operator-managed> element which indicates that the radio parameters are "operator managed";

   5) shall include one or more <V2X-service-id> elements and one or more <layer-2-id> in the <V2X-service-ids-list> element which indicate the V2X services authorized for V2X communication over PC5; and

d) shall send the HTTP POST request towards the VAE-C according to IETF RFC 2616 [19].

8 Coding

8.1 General

This clause specifies the coding to enable a VAE-C and a VAE-S to communicate.

8.2 Application unique ID

The AUID shall be set to the VAE service ID as specified in specified in ETSI TS 102 965 [18] or ISO TS 17419 [20].

8.3 Structure

The VAE document shall conform to the XML schema described in clause 8.4.

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

The <VAE-info> element shall include at least one of the followings:

a) an <identity> element;

b) a <registration-info> element;

c) a <de-registration-info> element;

d) a <location-tracking-info> element;

e) a <message-info> element;

f) a <service-discovery-info> element;

g) a <local-service-info> element;

h) an <announcement> element;

i) a <PC5-parameters-request> element;

j) a <V2X-app-requirement-notification> element;

k) a <layer2-group-id-mapping> element;

l) an <id-list-notification> element;

m) a <configure-dynamic-group-notification> element;

n) a <subscription-request> element;

o) a <subscription-response> element; or

p) a <network-monitoring-info-notification> element.

The <identity> element shall include a <V2X-UE-id> child element.

The <service-discovery-info> element shall include:

a) an <identity> element; or

b) a <result> element and may include a <service-discovery-data> element.

The <service-discovery-data> element shall include a <V2X-service-mapping-list> element.

The <V2X-service-mapping-list> element shall include one or more <V2X-service-map> elements. Each <V2X-service-map> element shall include following elements:

a) one or more <V2X-service-id> element(s); and

b) a <V2X-AS-address> element.

The <registration-info> element shall include at least one of the followings:

a) a <V2X-UE-id> element and one or more <V2X-service-ID> element(s); or

b) a <result> element.

The <service> element shall include a <V2X-service-id> or a <V2X-MSG-type> child element.

The <de-registration-info> element shall include the followings:

a) a <V2X-UE-id> element; and

b) one or more <V2X-service-id> element(s).

The <location-tracking-info> element shall include either:

a) the following elements:

- an <identity> element shall include a <V2X-UE-id> element;
- a <geographical-identifier> element shall include a <geo-id> element; and
- an <operation> element; or

b) the following elements:

- a <result> element; and
- an <operation> element.

The <geographical-identifier> element shall include one or more <geo-id> elements.

The <message-info> element shall include at least one of the followings:

a) an <identity> element shall include a <V2X-UE-id> element;

b) a <group> element shall include a <V2X-group-id>;

c) a <payload> element;

d) a <service> element shall include a <V2X-service-id>;

e) a <geographical-identifier> element shall include a <geo-id> element;

f) a <message-reception-ind> element;

g) <message-reception-uri>; or

h) a <result> element.

The <group> element shall include a <V2X-group-id> child element.

The <local-service-info> element shall include one of the following:

a) an <identity> element and a <geographical-identifier> element; or

b) a <result> element and optionally a <local-service-info-content> element.

The <announcement> element shall include the followings:

a) a <TMGI> element;

b) a <mbms-service-areas> element;

c) a <frequency> element; and

d) a <V2X-mbms-sdp> element.

The <PC5-parameters-request> element shall include the followings:

a) a <expiration-time> element;

b) a <plmn-list> element which shall include one or more <plmn-id> elements;

c) an <authorized-when-not-served-by-E-UTRAN> element;

d) a <radio-parameters-list> element which shall include the following elements:

1) a <radio-parameters-content> element;

2) a <geographical-area> element which shall include:

i) a <polygon-area> element; or

ii) an <ellipsoid-arc-area> element; and

3) a <operator-managed> element;

e) a <V2X-service-ids-list > element which shall include the following elements:

1) a <V2X-service-id> element; or

2) a <layer-2-id> element.

The <layer2-group-id-mapping> element shall include the followings:

a) a <dynamic-group-info> element which shall include the following elements:

1) a <dynamic-group-id> element;

2) a <group-definition> element; and

3) a <group-leader-id> element; and

b) a <prose-layer2-group-id> element.

The <id-list-notification> element shall include the followings:

a) a <dynamic-group-id> element;

b) one or more <group-member-id> element(s), each of which shall include the followings:

1) an <identity> element shall include a <V2X-UE-id> element; and

2) a <group-scope> element.

The <configure-dynamic-group-notification> element shall include the followings:

a) a <dynamic-group-id> element; and

b) one or more <group-member-id> element(s), each of which shall include the followings:

1) an <identity> element shall include a <V2X-UE-id> element; and

2) a <group-scope> element.

The <subscription-info> element shall include either:

a) the following elements:

1) an <identity> element;

2) a <subscription-events> element which shall include one or more <event> elements; and

3) a <triggering-criteria> element; or

b) the following elements:

1) an <identity> element; and

2) a <result> element.

The <triggering-criteria> element shall include at least one of the following 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; or

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; or

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; or

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; or

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; or

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; or

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; or

II) an <ellipsoid-arc-area> element shall include a <trigger-id> element;

iii) an <exit-specific-area-type> element shall include a <trigger-id> element;

The <notification-info> element shall include the followings:

a) a <V2X-ue-id> element; and

b) a <network-monitoring-info> element, which shall include one or more <trigger-id> elements and may include:

1) an <uplink-quality-level> element;

2) a <congestion-level> element;

3) a <overload-level> element;

4) a <geographical-area> element which shall include at least one of the followings:

i) a <cell-area> element; or

ii) a <tracking-area> element;

5) a <time-validity> element; or

6) an <MBMS-level> element which may include:

i) an <MBMS-coverage-level> element; or

ii) an <MBMS-bearer-level-event> element.

8.4 XML schema

Editor's note: This clause will describe the XML schema for VAE layer.

8.4.1 General

This clause defines the XML schema for application/vnd.3gpp.vae-info+xml.

8.4.2 XML schema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs=http://www.w3.org/2001/XMLSchema
targetNamespace="urn:3gpp:ns:vaeInfo:1.0"
xmlns:vaeinfo="urn:3gpp:ns:vaeInfo:1.0"
elementFormDefault="qualified"
attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <!-- root XML element -->
  <xs:element name="vae-info" type="vaeinfo:vaeinfo-Type" id="info"/>
  <xs:complexType name="vaeinfo-Type">
    <xs:sequence>
      <xs:element name="registration-info" type="vaeinfo:tRegistrationType" minOccurs="0"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>
  <xs:complexType name="tRegistrationType">
    <xs:sequence>
      <xs:element name="v2x-ue-id" type="vaeinfo:contentType" minOccurs="0" maxOccurs="1"/>
      <xs:element name="v2x-service-id" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="result" type="xs:string" minOccurs="0" maxOccurs="1"/>
      <xs:any namespace="##other" processContents="lax"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>
  <xs:complexType name="contentType">
    <xs:choice>
      <xs:element name="vaeURI" type="xs:anyURI"/>
      <xs:element name="vaeString" type="xs:string"/>
      <xs:element name="vaeBoolean" type="xs:boolean"/>
      <xs:any namespace="##other" processContents="lax"/>
    </xs:choice>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>
</xs:schema>
```

8.5 Data semantics

The <VAE-info> element is the root element of the XML document. The <VAE-info> element contains the <identity>, <registration-info>, <de-registration-info>, <location-tracking.info>, <message-info>, <service-discovery-info>, <local-service-info>, <announcement>, <PC5-parameters-request>, <V2X-app-requirement-notification>, <layer2-group-id-mapping>, <id-list-notification>, <configure-dynamic-group-notification>, <subscription-request>, <subscription-response> and <network-monitoring-info-notification> sub-elements.

<identity> is a mandatory element used to include the identity of a VAL client. The <identity> element contains a <V2X-UE-id> attribute that contains the identity of the VAL client.

<registration-info> element contains the following elements:

a) <V2X-UE-id>, an element contains the identity of the V2X UE; and

b) one or more <V2X-service-id> elements. Each <V2X-service-id> element contains the V2X service ID which the V2X UE is interested in receiving (e.g. PSID or ITS AID of ETSI ITS DENM, ETSI ITS CAM); or

c) <result>, an element which indicates a value either "success" or "fail".

<de-registration-info> element contains the following elements:

a) <V2X-UE-id>, an element contains the identity of the V2X UE; and

b) one or more <V2X-service-id> elements. Each <V2X-service-id> element contains the V2X service ID which the V2X UE is no longer interested in receiving (e.g. PSID or ITS AID of ETSI ITS DENM, ETSI ITS CAM).

<service-discovery-info> is a mandatory element used to include the V2X service discovery response information. The <service-discovery-info> element contains either:

a) an <identity> sub-element; or

b) a <result> sub-element and an optional <service-discovery-data> sub-element.

The <service-discovery-data> is an optional element shall include a <V2X-service-mapping-list> element which shall include one or more <V2X-service-map> elements.

The <V2X-service-map> element shall include following attributes:

1) one or more <V2X-service-id> attributes that each contains a V2X service identifier as specified in ETSI TS 102 965 [18] and ISO TS 17419 [20]; and

2) a <V2X-AS-address> attribute that contains a V2X application server address as specified in 3GPP TS 23.285 [21].

<geographical-identifier>, an optional element specifying one or more geographical area identifiers. This element consists of one or more <geo-id> elements. The <geo-id> element contains a geographical area identity representing a geographical area.

<operation> is a mandatory element which indicates a value either "subscribe" or "unsubscribe".

<group> is an optional element used to include the identity of a VAL group. The <group> element contains a <V2X-group-id> attribute that contains the group identity of a set of VAL clients according to the VAL service.

<payload> is an optional element used to include the payload of the V2X message as specified in ETSI TS 102 965 [18].

<message-reception-ind> is an optional element used to indicate that a reception report is required to be sent.

<message-reception-uri> is an optional element to indicate the destination URI of a requested reception report, and includes a URI as specified in IETF RFC 2616 [19].

<local-service-info-content> is an optional element: V2X server USD information, V2X application server address information and V2X USD information.

<TMGI> is a mandatory element encoded as specified in 3GPP TS 24.008 [6] excluding the Temporary mobile group identity IEI and the length of Temporary mobile group identity IE contents.

<mbms-service-areas> is a mandatory element which contains one or more <mbms-service-area-id> elements. Each <mbms-service-area-id> contains a MBMS SAI, encoded as specified in 3GPP TS 23.003 [2].

<frequency> is an optional element encoded as specified in 3GPP TS 29.468 [15].

<V2X-mbms-sdp> is mandatory element which contains SDP configuration information encoded as specified in 3GPP TS 24.386 [8] clause 7.2.2.

<expiration-timer> is a mandatory element encoded as specified in 3GPP TS 24.385 [7] clause 5.5.2.

<plmn-id> is a mandatory element encoded as specified in 3GPP TS 23.003 [2].

<authorized-when-not-served-by-E-UTRAN> is a mandatory element encoded as specified in 3GPP TS 24.385 [7] clause 5.5.8.

<radio-parameters-content> is a mandatory element encoded as specified in3GPP TS 36.331 [17] clause 9 for the SL-V2X-Preconfiguration.

<geographical-area> is a mandatory element specifying a geographical area and has the following sub-elements:

a) <polygon-area>, an optional element specifying the area as a polygon specified in clause 5.2 of 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 of 3GPP TS 23.032 [3].

<operator-managed> is a mandatory element encoded as specified in 3GPP TS 24.385 [7] clause 5.5.19.

<layer-2-id> is a mandatory element encoded as the DestinationLayer2ID specified in 3GPP TS 36.300 [16].

<V2X-app-requirement-notification> element contains a string set to either "success" or "failure" used to indicate success or failure of the network resource adaptation corresponding to the V2X application requirement.

<layer2-group-id-mapping> element contains the following elements:

a) <dynamic-group-info> element; and

b) <prose-layer2-group-id>, an element contains the identity of the ProSe Layer-2 Group.

<dynamic-group-info> element contains the following elements:

a) <dynamic-group-id>, an element contains the identity of the dynamic group;

b) <group-definition>, an element containing dynamic group definition information; and

c) <group-leader-id>, an element contains the identity of the group leader.

<id-list-notification> element contains the following sub-elements:

a) <dynamic-group-id>, an element set to the identity of the dynamic group; and

b) one or more <group-member-id> element(s), each <group-member-id> element contains the following sub-elements:

1) <identity> element shall include a <V2X-UE-id> element, an element set to the identity of the joined or left V2X UE; and

2) <group-scope>, an element that has the value "joined" or "left". The value "joined" means that the V2X UE joined the group. The value "left" means that the V2X UE left the group.

<configure-dynamic-group-notification> element contains the following sub-elements:

a) <dynamic-group-id>, an element set to the identity of the dynamic group; and

b) one or more <group-member-id> element(s), each <group-member-id> element contains the following sub-elements:

1) <identity> element shall include a <V2X-UE-id> element, an element set to the identity of the joined or left V2X UE; and

2) <group-scope>, an element that has the value "joined" or "left". The value "joined" means that the V2X UE joined the group. The value "left" means that the V2X UE left the group.

<subscription-request> is an optional element which contains the <identity>, <subscription-events> and <triggering-criteria> sub-elements.

<subscription-events> is a mandatory element which contains one or more <events> sub-elements.

<event> element contains a string set to either "uplink degradation" or "congestion" or "overload" or "coverage".

<triggering-criteria>, a mandatory element which contains at least one of the following sub-elements:

a) <cell-change>, an optional element specifying what cell changes trigger the VAE-S to send monitoring reports to the VAE-C. This element consists of the following sub-elements:

1) <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;

2) <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

3) <exit-specific-cell>, an optional element specifying an NCGI which when exited triggers the VAE-S to send monitoring reports to the VAE-C 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;

b) <tracking-area-change>, an optional element specifying what tracking area changes trigger the VAE-S to send monitoring reports to the VAE-C. This element consists of the following sub-elements:

1) <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;

2) <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 the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and

3) <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 the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

c) <plmn-change>, an optional element specifying what PLMN changes trigger the VAE-S to send monitoring reports to the VAE-C. This element consists of the following sub-elements:

1) <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;

2) <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 the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and

3) <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 the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

d) <mbms-sa-change>, an optional element specifying what MBMS changes trigger the VAE-S to send monitoring reports to the VAE-C. This element consists of the following sub-elements:

1) <any-mbms-sa-change>, an optional element. The presence of this element specifies that any MBMS SA change is a trigger for the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

2) <enter-specific-mbms-sa>, an optional element specifying an MBMS service area id which when entered triggers the VAE-S to send monitoring reports to the VAE-C. 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

3) <exit-specific-mbms-sa>, an optional element specifying an MBMS service area id which when exited triggers the VAE-S to send monitoring reports to the VAE-C. 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;

e) <mbsfn-area-change>, an optional element specifying what MBSFN changes trigger a request for the VAE-S to send monitoring reports to the VAE-C. This element consists of the following sub-elements:

1) <any-mbsfn-area-change>, an optional element. The presence of this element specifies that any MBSFN area change is a trigger for the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

2) <enter-specific-mbsfn-area>, an optional element specifying an MBSFN area which when entered triggers the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and

3) <exit-specific-mbsfn-area>, an optional element specifying an MBSFN area which when exited triggers the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

f) <periodic-report>, an optional element specifying that periodic request for the VAE-S to send monitoring reports to the VAE-C 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;

g) <travelled-distance>, an optional element specifying that the travelled distance shall trigger a request for the VAE-S to send monitoring reports to the VAE-C. The value in metres specified the travelled distance. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

h) <vertical-application-event>, an optional element specifying what application signalling events triggers the VAE-S to send monitoring reports to the VAE-C. The <vertical-application-event> element has the following sub-elements:

1) <initial-log-on>, an optional element specifying that an initial log on triggers the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

2) <location-configuration-received>, an optional element specifying that a received location configuration triggers the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string; and

3) <any-other- event>, an optional element specifying that any other application signalling event than initial-log-on and location-configuration-received triggers the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string;

i) <geographical-area-change>, an optional element specifying what geographical are changes trigger the VAE-S to send monitoring reports to the VAE-C. This element consists of the following sub-elements:

1) <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;

2) <enter-specific-area>, an optional element specifying a geographical area which when entered triggers the VAE-S to send monitoring reports to the VAE-C. 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:

i) <geographical-area>, an optional element containing a <trigger-id> attribute and the following two 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]; and

3) <exit-specific-area-type>, an optional element specifying a geographical area which when exited triggers the VAE-S to send monitoring reports to the VAE-C. This element contains a mandatory <trigger-id> attribute that shall be set to a unique string.

<subscription-response> is an optional element which contains the <identity> and <result> sub-elements.

The <notification-info> element contains the following sub-elements:

a) <VAL-UE-id>, an element contains the identity of the V2X UE who subscribes the network monitoring information;

b) <network-monitoring-info>, an element contains one or more <trigger-id> attributes that identifies the triggering criteria that resulted in the VAE-S sending the monitoring report to the VAE-C. In addition, the <network-monitoring-info> contains the following sub-elements:

1) <uplink-quality-level>, an optional element contains an integer used to indicate the uplink quality level;

2) <congestion-level>, an optional element contains an integer used to indicate the congestion level;

3) <overload-level>, an optional element contains an integer used to indicate the overload level;

4) <geographical-area>, an optional element contains the following elements:

i) <cell-area>, 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] for which the monitoring applies;

ii) <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] for which the monitoring applies;

5) <time-validity>, an optional element specifies the period for which the monitoring applies; and

6) <MBMS-level>, an optional element contains the following elements:

i) <MBMS-coverage-level>, an optional element contains an integer used to indicate the MBMS coverage level; or

ii) <MBMS-bearer-level-event>, an optional element contains an integer used to indicate the MBMS bearer level events.

8.6 MIME types

The MIME type for the VAE document shall be "application/vnd.3gpp.vae-info+xml MIME body".

8.7 IANA registration template

Editor's note: The registration should be made after approval of the specification.

<MCC name>

Your Email Address:

<MCC email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.vae-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 or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 2616 apply while exchanging information in HTTP.

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 24.486 "Vehicle-to-Everything (V2X) Application Enabler (VAE) layer; Protocol aspects; Stage 3" version 16.0.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the Vehicle-to-Everything (V2X) Application Enabler (VAE) layer 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>

9 VAE related configuration

9.1 General

This clause specifies VAE specific configurations to be used along with common configurations defined in 3GPP TS 24.546 [11].

9.2 VAE client UE configuration coding

9.2.1 General

This clause specified the extension of the SEAL UE configuration document as defined in 3GPP TS 24.546 [11]. The procedure to retrieve configuration document is also specified in 3GPP TS 24.546 [11].

9.2.2 Application unique ID

The AUID shall be set to the VAE service ID as specified in specified in ETSI TS 102 965 [18] or ISO TS 17419 [20].

9.2.3 Structure

The VAE client UE configuration document structure is described in clause 7.2 of 3GPP TS 24.546 [11] with the VAE specific clarifications specified in this clause.

The <on-network> element of the <seal-UE-configuration> element specified in clause 7.2 of 3GPP TS 24.546 [11]:

a) shall include a <VAE-server-ip> element;

b) shall include a <VAE-server-transport-port> element;

c) may include an <announcement> element as specified in clause 8; and

d) may include a <geo-id> element as specified in clause 8.

9.2.4 XML schema

9.2.4.1 General

The V2X UE configuration document is composed according the XML schema described in the clause 7.2 of 3GPP TS 24.546 [11], and extended with extensions from the XML schema defined in clause 9.2.4.2.

9.2.4.2 XML schema for V2X specific extensions

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
  xmlns="urn:3gpp:ns:seal:V2XUEConfig:1.0"
  targetNamespace="urn:3gpp:ns:seal:V2XUEConfig:1.0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:v2xuec="urn:3gpp:ns:seal:v2xUEConfig:1.0"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified">

  <!--V2X specific "on-network" child elements -->
  <xs:element name="VAE-server-ip" type="xs:string"/>
  <xs:element name="VAE-server-transport-port" type="xs:unsignedInt"/>

</xs:schema>
```

9.2.5 Data semantics

The <VAL-UE-id> element in <seal-UE-configuration> element is V2X UE ID.

The <VAL-Service-id> element in <seal-UE-configuration> element is V2X service ID.

The <VAE-server-ip> element in <on-network> element of <seal-UE-configuration> element is IP address information of the initial VAE server serving the VAE client.

The <VAE-server-transport-port> element in <on-network> element of <seal-UE-configuration> element is port information of the initial VAE server serving the VAE client.

The <announcement> element contains V2X server USD as specified in clause 8.

The <geo-id> element contains GEO ID identity information as specified in clause 8.

9.2.6 MIME types

The MIME type for the VAE client UE configuration document shall use the MIME type as specified in the clause 7.2.6 of 3GPP TS 24.546 [11].

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2019-08	CT1#119	C1-194367				Draft skeleton provided by the rapporteur.	0.0.0
2019-09	CT1#119					Implementing the following p-CR agreed by CT1: C1-194368	0.1.0
2019-09	CT1 e-mail review					Correction done by the rapporteur to the title of clause 3	0.1.1
2019-10	CT1#120					Implementing the following p-CRs agreed by CT1: C1-196373, C1-196376, C1-196618, C1-196859	0.2.0
2019-11	CT1#121					Implementing the following p-CRs agreed by CT1: C1-198550, C1-198624 Corrections done by the rapporteur.	0.3.0
2020-03	CT1#122-e					Implementing the following p-CRs agreed by CT1: C1-200530, C1-200532, C1-200533, C1-200622, C1-200623, C1-200624, C1-200903, C1-200905, C1-200906, C1-200944 Corrections done by the rapporteur.	0.4.0
2020-03	CT-87e	CP-200165				Presentation to TSG CT for information	1.0.0
2020-04	CT1#123-e					Implementing the following p-CRs agreed by CT1: C1-202212, C1-202458, C1-202546, C1-202728, C1-202729, C1-202762, C1-202763, C1-202764, C1-202765, C1-202766, C1-202788, C1-202789, C1-202790, C1-202791 Corrections done by the rapporteur.	1.1.0
2020-06	CT1#124-e					Implementing the following p-CRs agreed by CT1: C1-203448, C1-203452, C1-203568, C1-203570, C1-203573, C1-203574, C1-203575, C1-203623, C1-203953, C1-203954, C1-204072, C1-204073, C1-204074, C1-204076, C1-204102, C1-204105, C1-204106 Corrections done by the rapporteur.	1.2.0
2020-06	CT-88e					Presentation to TSG CT for approval	2.0.0
2020-06	CT-88e					Version 16.0.0 created after approval	16.0.0
2020-09	CT-89e	CP-202169	0001		F	Addition of used abbreviations	16.1.0
2020-09	CT-89e	CP-202169	0002		F	Correction of root element term use	16.1.0
2020-09	CT-89e	CP-202169	0004	1	F	Application level location tracking procedure correction	16.1.0
2020-09	CT-89e	CP-202169	0005	1	F	V2X message delivery procedure corrections	16.1.0
2020-09	CT-89e	CP-202169	0006	1	F	V2X service discovery procedure corrections	16.1.0
2020-09	CT-89e	CP-202169	0007	1	F	Geo-id correction	16.1.0
2020-09	CT-89e	CP-202169	0008	1	F	V2X service continuity procedure corrections	16.1.0
2020-09	CT-89e	CP-202169	0009	1	F	Network monitoring procedure corrections	16.1.0
2020-09	CT-89e	CP-202169	0010	1	F	V2X application resource management procedure	16.1.0
2020-09	CT-89e	CP-202169	0011	1	F	File distribution procedure	16.1.0
2020-09	CT-89e	CP-202169	0012	2	F	Dynamic group management procedure	16.1.0
2020-09	CT-89e	CP-202169	0013		F	Reference update for V2X service ID	16.1.0
2020-09	CT-89e	CP-202169	0014	1	F	Correction to client procedure of V2X UE registration procedure	16.1.0
2020-09	CT-89e	CP-202169	0015	1	F	Update to server procedure of V2X UE registration procedure	16.1.0
2020-09	CT-89e	CP-202169	0016		F	XML schema for UE registration procedure	16.1.0
2020-09	CT-89e	CP-202169	0017		F	Correction to client procedure of V2X UE de-registration procedure	16.1.0
2020-09	CT-89e	CP-202169	0018	1	F	Update to server procedure of V2X UE de-registration procedure	16.1.0
2020-09	CT-89e	CP-202169	0019		F	Update to server procedure of application level location tracking procedure	16.1.0
2020-09	CT-89e	CP-202169	0020	1	F	Corrections to request URI and clause reference	16.1.0
2020-09	CT-89e	CP-202169	0023		F	Correction to V2X message reception report	16.1.0

History

Document history		
V16.0.0	July 2020	Publication
V16.1.0	October 2020	Publication