**3GPP TSG-SA WG6 Meeting #39-bis-e S6-201853**

**e-meeting, 12th – 20th October 2020 (revision of S6-xxxxxx)**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.286** | **CR** | **0022** | **rev** | **-** | **Current version:** | **16.4.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | V2X application layer architecture enhancement | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, Hisilicon | | | | | | | | | |
| ***Source to TSG:*** | S6 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | eV2XAPP | | | | |  | ***Date:*** | | | 2020-09-28 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | Enhancement to V2X application layer architecture considering 5GS | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Modifications to functional model and deployment models. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | V2X application layer architecture considering 5GS will not be enabled. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 1, 3.2, 6.2, 6.3.5, 6.5.1, 6.5.x (new), 6.5.y (new), 7.1, 7.2.1, 7.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **N** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* First Change \* \* \* \*

# 1 Scope

The present document specifies the functional architecture, procedures and information flows for V2X application enabler layer. This specification includes the capabilities of the application layer support for V2X services that are necessary to ensure efficient use and deployment of V2X services over 3GPP systems. The VAE capabilities applies to EPS and 5GS.

\* \* \* Next Change \* \* \* \*

## 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].

5GS 5G System

AS Application Server

AID Application Object Identifier

E-UTRAN Evolved Universal Terrestrial Radio Access Network

EPS Evolved Packet System

ETSI European Telecommunications Standards Institute

LTE Long-Term Evolution

MBMS Multimedia Broadcast Multicast Service

PSID Provider Service Identifier

SAE Society of Automotive Engineers

SCEF Service Capability Exposure Function

SCS Services Capability Server

UE User Equipment

USD User Service Description

V2I Vehicle-to-Infrastructure

V2N Vehicle-to-Network

V2P Vehicle-to-Pedestrian

V2V Vehicle-to-Vehicle

V2X Vehicle-to-Everything

VAE V2X Application Enabler

\* \* \* Next Change \* \* \* \*

## 6.2 Functional model description

Figure 6.2-1 illustrates the simplified architectural model for the V2X application layer. It utilizes the architectural reference model specified in clause 4.2 in 3GPP TS 23.285 [5] and clause 4.2 in 3GPP TS 23.287 [x] which have impact on the application layer support aspects.



Figure 6.2-1: Simplified architectural model for the V2X application layer

The V2X UE1 communicates with V2X application server over V1 reference point. The V2X UE1 and V2X UE2 communicate over V5 reference point. V2X UE1 can also act as a UE-to-network relay, to enable V2X UE2 to access the V2X application server over V1 reference point.

The reference point V1 supports the V2X application related interactions between V2X UE and V2X AS and is specified in 3GPP TS 23.285 [5] and 3GPP TS 23.287 [x]. This reference point is supported for both unicast and multicast delivery modes. The reference point V5 supports the interactions between the V2X UEs and is specified in 3GPP TS 23.285 [5] and 3GPP TS 23.287 [x].

Figure 6.2-2 illustrates the detailed V2X application layer functional model. It enhances the simplified architectural model for the V2X application layer by specifying the functional entities at the V2X application layer.



Figure 6.2-2: V2X application layer functional model

The V2X application layer functional entities for the V2X UE and the V2X application server are grouped into the V2X application specific layer and the VAE layer. The VAE layer offers the VAE capabilities to the V2X application specific layer. The V2X application layer functional model utilizes the SEAL services as specified in 3GPP TS 23.434 [6].

The VAE server is located in the VAE layer. The SEAL services utilized by VAE layer are location management, group management, configuration management, identity management, key management and network resource management. The V2X application specific layer consists of the V2X application specific functionalities.

NOTE 1: The functionalities of the V2X application specific layer are out of scope of the present document.

The V2X application server consists of the VAE server, the SEAL servers and the V2X application specific server. The VAE server provides the V2X application layer support functions to the V2X application specific server over Vs reference point. The SEAL server(s) provide the SEAL services to the V2X application specific server over SEAL‑S reference point.

The V2X UEs consist of the VAE client, the SEAL clients and the V2X application specific client. The VAE client provides the V2X application layer support functions to the V2X application specific client over Vc reference point. The SEAL client(s) provide the SEAL services to the V2X application specific client over SEAL‑C reference point.

NOTE 2: In some deployments, the client and server entities of SEAL can be part of VAE client and VAE server respectively.

The VAE client acts as a VAL client for its interaction with the SEAL clients as specified in 3GPP TS 23.434 [6]. The VAE server acts as a VAL server for its interaction with the SEAL servers as specified in 3GPP TS 23.434 [6].

In the VAE layer, the VAE client communicates with the VAE server over V1-AE reference point. In the V2X application specific layer, the V2X application specific client communicates with V2X application specific server over V1-APP reference point.

NOTE 3: The V1-APP reference point is out of scope of the present document.

In the VAE layer, the VAE client of V2X UE2 communicates with VAE client of V2X UE1 over V5-AE reference point. In the V2X application specific layer, the V2X application specific client of V2X UE2 communicates with VAE client of V2X UE1 over V5-APP reference point.

NOTE 4: The V5-APP reference point is out of scope of the present document.

The following SEAL services for V2X applications are supported:

- Location management as specified in 3GPP TS 23.434 [6];

- Group management as specified in 3GPP TS 23.434 [6];

- Configuration management as specified in 3GPP TS 23.434 [6];

- Identity management as specified in 3GPP TS 23.434 [6];

- Key management as specified in 3GPP TS 23.434 [6]; and

- Network resource management as specified in 3GPP TS 23.434 [6].

The VAE client interacts with SEAL clients over the SEAL-C reference point specified for each SEAL service. The VAE server interacts with SEAL servers over the SEAL-S reference point specified for each SEAL service. The interaction between the SEAL clients is supported by SEAL-PC5 reference point specified for each SEAL service. The interaction between a SEAL client and the corresponding SEAL server is supported by SEAL-UU reference point specified for each SEAL service.

NOTE 5: The SEAL-C, SEAL-S, SEAL-PC5, SEAL-UU reference points for each SEAL service is specified in 3GPP TS 23.434 [6].

To support distributed VAE server deployments, the VAE server interacts with another VAE server over VAE-E reference point.

V2X UE1 can also act as a UE-to-network relay,

- to enable VAE client on V2X UE2 to access VAE server over V1-AE reference point; and

- to enable V2X application specific client on V2X UE2 to access V2X application specific server over V1-APP reference point.

A V1-AE message can be sent over unicast, transparent multicast via xMB, transparent multicast via MB2. The non-transparent multicast via xMB (as specified in 3GPP TS 26.348 [11]) is triggered by a V1-AE message. Multicast distribution can be supported by both transparent and non-transparent multicast modes.

The VAE server interacts with the 3GPP network system over V2, MB2, xMB, Rx, T8, N5 and N33 reference points. The EPS and 5GS are considered as the 3GPP network system.

\* \* \* Next Change \* \* \* \*

### 6.3.5 VAE server

The VAE server acts as a GCS AS as described in 3GPP TS 23.468 [7] or acts as a content provider as described in 3GPP TS 26.346 [10].

The VAE server provides the server side V2X application layer support functions as below:

- communicating with the underlying 3GPP network systems (EPS, 5GS) for unicast and multicast network resource management;

- receiving monitoring reports/events from the underlying 3GPP network systems (EPS, 5GS) regarding network situation corresponding to RAN and core network;

- supporting registration of V2X UEs;

- tracking the application level geographic location of the V2X UEs;

- supporting V2X message distribution for the V2X applications;

- supporting provisioning of 3GPP system configuration information (e.g. V2X USD, PC5 parameters);

- perform the role of content provider for multicast file transfer using xMB APIs;

- providing network monitoring reports to the V2X UEs;

- communicating V2X service requirements to the underlying 3GPP network systems (EPS, 5GS);

- maintaining the mapping between the V2X user ID and the V2X UE ID;

- providing V2X service discovery;

- supporting V2X service continuity; and

- supporting V2X application resource adaptation.

\* \* \* Next Change \* \* \* \*

### 6.5.1 General

The reference points between the V2X application layer and the 3GPP network systems (EPS, 5GS) are described in the following clauses.

\* \* \* Next Change \* \* \* \*

### 6.5.x N5

The reference point N5 supports the interactions between the V2X AS and the PCF and is specified in 3GPP TS 23.501 [y]. The functions of N5 interface are supported by VAE server.

### 6.5.y N33

The reference point N33 supports the interactions between the V2X AS and the NEF and is specified in 3GPP TS 23.501 [y]. The functions of N33 interface are supported by VAE server and the functions related to location management of N33 are supported by the location management server.

\* \* \* Next Change \* \* \* \*

## 7.1 General

This clause describes deployments of the functional model specified in clause 6. The reference points utilized from underlying 3GPP network as specified in clause 6.5 is represented as 3GPP interfaces in the deployment models.

NOTE: The representation of SEAL functionalities in the vertical deployment is specified in 3GPP TS 23.434 [6].

\* \* \* Next Change \* \* \* \*

### 7.2.1 Centralized deployments

A centralized deployment is where a single VAE server offers the VAE capabilities to one or more V2X application specific server. The VAE server and the V2X application specific server may be co-located in a single physical entity. The VAE server may be deployed either in the PLMN operator domain or deployed in the V2X service provider domain. The VAE server connects with the 3GPP network systems (EPS, 5GS) in one or more PLMN operator domain. When VAE server and V2X application specific server are co-located in a single physical entity, the Vs reference point between the VAE server and the V2X application enabler server may not be used.

Figure 7.2.1-1 illustrates a deployment of the VAE server and the V2X application specific server in a single physical entity and deployed in V2X service provider domain. The VAE server may be deployed in a separate physical entity from the V2X application specific server in the V2X service provider domain. In such deployments, the Vs reference point is used for the communication between the VAE server and the V2X application specific server.



Figure 7.2.1-1: VAE server co-located with V2X application specific server in a single physical entity

Figure 7.2.1-2 illustrates a deployment of the VAE server in the PLMN operator domain and the V2X application specific server in the V2X service provider domain. The Vs reference point is used for the communication between V2X application specific server and the VAE server. The VAE server may support multiple V2X application specific servers.



Figure 7.2.1-2: VAE server deployed in the PLMN operator domain

Figure 7.2.1‑3 illustrates a deployment of the VAE server which connects to the 3GPP network systems (EPS, 5GS) in multiple PLMN operator domain. The VAE server may be co-located with the V2X application specific server in a single physical entity or deployed in different physical entities.



Figure 7.2.1-3: Deployment of VAE server with connections to 3GPP network systems in multiple PLMN operator domains

Figure 7.2.1‑4 illustrates a deployment of the VAE server which provides VAE capabilities to multiple V2X application specific servers over Vs reference point and connects to the 3GPP network systems (EPS, 5GS) in multiple PLMN operator domain.



Figure 7.2.1-4: Deployment of VAE server with connections to multiple V2X application specific servers

### 7.2.2 Distributed deployment

The distributed deployment is where multiple VAE servers are deployed either in the V2X service provider domain or in the PLMN operator domain. The distributed deployment of the VAE servers provide geographical coverage or support multiple PLMN operator domains in a geographical location. The VAE servers interconnect via VAE-E and the Vs reference point is used for interaction between V2X application specific server and the VAE server.

Figure 7.2.2-1 illustrates the deployment of VAE servers in multiple PLMN operator domain and provides VAE capabilities to the V2X application specific server deployed in the V2X service provider domain. The V2X application specific server connects via Vs to the VAE servers.



Figure 7.2.2-1: Distributed deployment of VAE servers in multiple PLMN operator domain without interconnection between VAE servers

Figure 7.2.2-2 illustrates the deployment of multiple VAE servers deployed in multiple PLMN operator domains. The V2X application specific server connects via Vs to the VAE server. The interconnection between VAE servers is via VAE-E and supports the V2X applications for the V2X UEs connected to the VAE servers in multiple PLMN operator domains.



Figure 7.2.2-2: Distributed deployment of VAE servers in multiple PLMN operator domain with interconnection between VAE servers

Figure 7.2.2-3 illustrates the deployment of multiple VAE servers in PLMN operator domain based on geographical coverage. The V2X application specific server connects via Vs to the VAE server 1. The VAE servers interconnect via VAE-E and support the V2X communications to the V2X UEs connected to the VAE servers.



Figure 7.2.2-3: Distributed deployment of VAE servers in PLMN operator domain

Figure 7.2.2-4 illustrates the deployment of multiple VAE servers in the V2X service provider domain where VAE server 1 and VAE server 2 connect with 3GPP network system of PLMN operator domain 1 and PLMN operator domain 2 respectively. The PLMN operator domains provide coverage to different geographical areas. The V2X application specific server connects via Vs to the VAE server 1. The VAE servers interconnect via VAE-E and support the V2X applications for the V2X UEs connected via both the PLMN operator domains.



Figure 7.2.2-4: Distributed deployment of VAE servers in V2X service provider domain