5GAA TR A-170188

Technical Report

5G Automotive Association; Working Group System Architecture and Solution Development; 5GAA V2X Terms and Definitions

Internal 5GAA use only

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Contents

Foreword

This Technical Report has been produced by 5GAA.

The contents of the present document are subject to continuing work within the Working Groups (WG) and may change following formal WG approval. Should the WG modify the contents of the present document, it will be re-released by the WG with an identifying change of the consistent numbering that all WG meeting documents and files should follow (according to 5GAA Rules of Procedure):

x-nnzzzz

(1) This numbering system has six logical elements:

(a) x: a single letter corresponding to the working group:

where x =

T (Use cases and Technical Requirements)

B (Business Models and Go-To-Market Strategies)

A (System Architecture and Solution Development)

S (Standards and Spectrum)

P (Evaluation, Testbed and Pilots)

(b) nn: two digits to indicate the year. i.e. 16,17,18, etc

(c) zzzz: unique number of the document

(2) No provision is made for the use of revision numbers. Documents which are a revision of a previous version should indicate the document number of that previous version

(3) The file name of documents shall be the document number. For example, document S-160357 will be contained in file S-160357.doc

1 Scope

The present document is a collection of terms and their definitions to be used within 5GAA. The motivations for this collection are:

- To get common terms and definitions that are relevant for both the automotive industry and the telecom industry.
- To ensure that editors use terminology that is consistent across 5GAA documents.
- To provide a reader with convenient reference for technical terms that are used across multiple 5GAA documents.

This document should be enhanced with new terms and their definitions as the work progresses within 5GAA.

All terms in **bold** are defined in this document.

2 References

[1] 3GPP TR 21.905 “Vocabulary for 3GPP Specifications”

[2] 3GPP TS 23.285 “Architecture enhancements for V2X services”

[3] 3GPP TS 38.300 “NR; Overall description; Stage-2”

[4] ETSI TR 102 638 “Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions”

3 Terms and Definitions

3.1 V2V (Vehicle-to-vehicle)

V2V is communication where both endpoints are vehicles. The vehicles are in close proximity. Endpoint means application layer endpoint. **V2V** is direct communication between vehicles. The vehicles use short range communication, e.g. **LTE PC5** or IEEE 802.11p. This definition corresponds in ETSI ITS to V2V in [4].

Figure 1: V2V

3.2 V2N2V (Vehicle-to-network-to-vehicle)

V2N2V is indirect communication between vehicles via cellular network and **ICT infrastructure**. The vehicles use cellular communication.

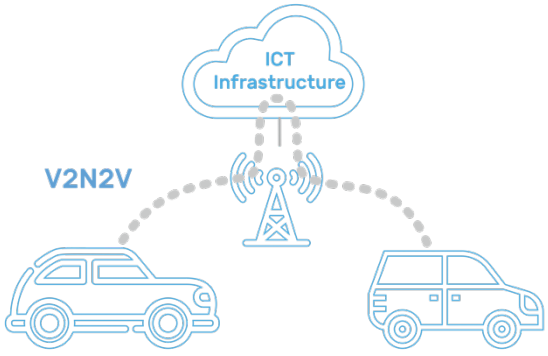

Figure 2: V2N2V

3.3 V2I (Vehicle-to-infrastructure)

V2I is communication where one endpoint is a vehicle and the other endpoint is a **roadside infrastructure**. Messages may be transmitted in both directions between the endpoints. **V2I** is direct communication between a vehicle and a **roadside infrastructure** with an **RSU**. The vehicle and the **RSU** use short range communication. This definition corresponds in ETSI ITS to V2I in [4].

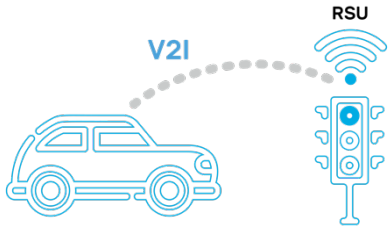

Figure 3: V2I

3.4 V2N2I (Vehicle-to-network-to-infrastructure)

V2N2I is indirect communication between a vehicle and a **roadside infrastructure** via cellular network and **ICT infrastructure**. The vehicle uses cellular communication.

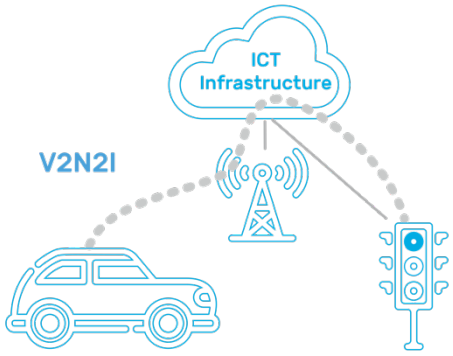

Figure 4: V2N2I

3.5 V2P (Vehicle-to-pedestrian)

V2P is communication where one endpoint is a vehicle and the other endpoint is a pedestrian or any other Vulnerable Road User (VRU). The vehicle and the pedestrian are in close proximity. Messages may be transmitted in both directions between the endpoints. **V2P** is direct communication between a vehicle and a pedestrian. The vehicle and the pedestrian use short range communication.

Figure 5: V2P

3.6 V2N2P (Vehicle-to-network-to-pedestrian)

V2N2P is indirect communication between a vehicle and a pedestrian via cellular network and **ICT infrastructure**. The vehicle and the pedestrian use cellular communication.

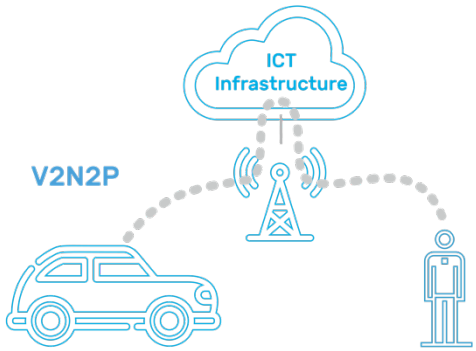

Figure 6: V2N2P

3.7 V2N (Vehicle-to-network)

V2N is communication where one endpoint is a vehicle and the other endpoint is located in **ICT infrastructure**. Messages may be transmitted in both directions between the endpoints. The vehicle uses cellular communication.

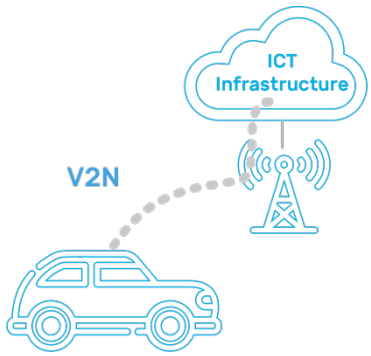

Figure 7: V2N

3.8 Roadside Infrastructure

Roadside infrastructure is road traffic management equipment installed along the roadside, to convey traffic or traveller information to passing drivers. Traffic lights and variable road signs are examples of **roadside infrastructure**.

3.9 RSU (Road Side Unit)

RSU is a communication unit, often connected to **roadside infrastructure**[1]. **RSU** supports **V2I** or **V2N2I** communication. The **RSU** may communicate with vehicles using short range communication (e.g. **LTE PC5** or 802.11p) or cellular communication (e.g. **LTE Uu** or **NR Uu**).

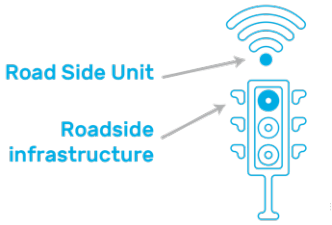

Figure 8: Roadside infrastructure and Road Side Unit

3.10 ICT (Information and Communications Technology) Infrastructure

ICT infrastructure is infrastructure with communication, computation and storage capabilities. **ICT Infrastructure** may be deployed anywhere from distributed installations along the roads to centralized installations in data centres. One example of such deployment is **MEC**.

3.11 MEC (Multi-access Edge Computing)

MEC is a network architecture concept that enables cloud computing capabilities at the edge of the cellular network.

3.12 C-V2X (Cellular-V2X or Cellular Vehicle-to-Everything)

C-V2X is defined as existing 3GPP standards and their future improvements. **C-V2X** includes both cellular (e.g. **LTE Uu**) and short range communication (e.g. **LTE PC5**)

3.13 eNB (LTE) and gNB (NR)

eNB is an LTE base station, defined in 3GPP TR 21.905 [1]. **eNB** uses **LTE Uu** interface for cellular communication to devices.

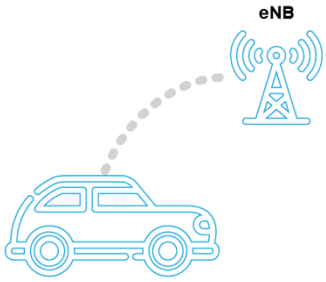

Figure 9: eNB

[1] United States Department of Transportation (USDOT) Federal Highway Administration: "DSRC Roadside Unit (RSU) Specifications Document"

gNB is an NR base station, defined in 3GPP TS 38.300 [3]. **gNB** use **NR Uu** interface for cellular communication to devices.

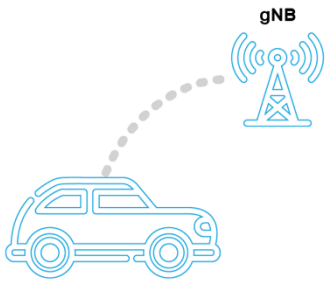

Figure 10: gNB

3.14 UE (User Equipment)

UE is an LTE and/or NR device, defined in 3GPP TR 21.905 [1]. **UE** use **LTE Uu** and/or **NR Uu** interface for cellular communication to a base station and **LTE PC5** for short range communication directly with other UEs.

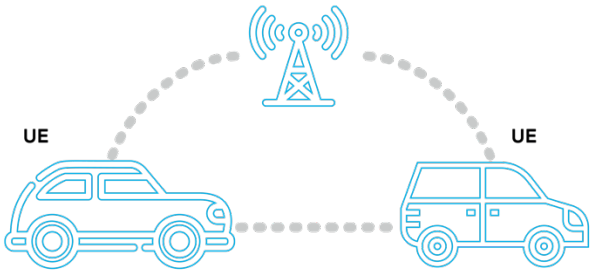

Figure 11: UE

3.15 LTE Uu and NR Uu

LTE Uu is an interface for cellular communication between device and base station, defined in 3GPP TR 21.905 [1]. **LTE Uu** supports uplink unicast communication from device to base station as well as downlink unicast or multicast communication from base station to device.

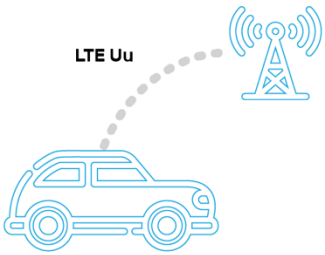

Figure 12: LTE Uu

NR Uu is an interface for cellular communication between device and base station, defined in 3GPP TS 38.300 [3]. **NR Uu** supports uplink unicast communication from device to base station as well as downlink unicast or multicast communication from base station to device.

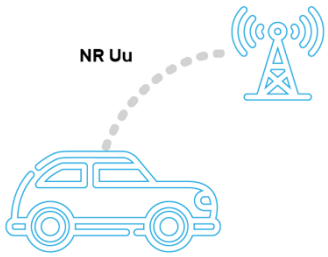

Figure 13: NR Uu

3.16 LTE PC5

LTE PC5 is an interface for short range communication directly between devices[2], defined in 3GPP TS 23.285 [2]. Two modes of **LTE PC5** are specified: in-coverage mode and out-of-coverage mode.

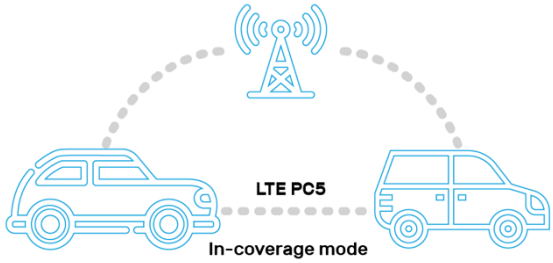

Figure 14: LTE PC5 In-coverage mode

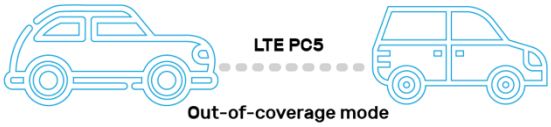

Figure 15: LTE PC5 Out-of-coverage mode

3.17 LTE PC5 Scenarios

LTE PC5 Scenarios are scenarios for control of **LTE PC5** communication. Following **LTE PC5 Scenarios** are defined:

- **eNB-controlled LTE PC5**
- **Standalone LTE PC5**

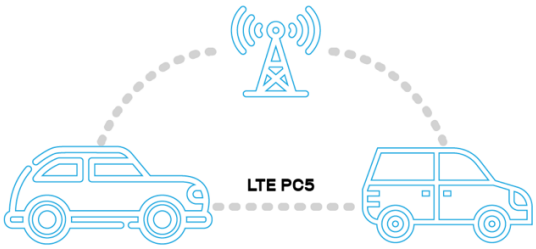

Figure 16: eNB-controlled LTE PC5 Scenario

[2] LTE PC5 Rel. 14 supports only broadcast communication at radio layer.

Figure 17: Standalone LTE PC5 Scenario

One **LTE PC5 Scenario** will probably be selected per region. However, vehicles moving between regions using different **LTE PC5 Scenarios** has to be taken into account.

3.18 eNB-controlled LTE PC5

eNB-controlled LTE PC5 scenario is characterized by following:

- MNO provide LTE V2X service
- MNO authorize vehicles to use **LTE PC5**
- **eNB** performs the fast scheduling of **LTE PC5** radio resources in the vehicles (3GPP PC5 mode 3)
- **eNB** performs configuration for **LTE PC5** parameters (3GPP PC5 mode 3 and 4)
  - E.g., resource configuration for mode 4 can also be provided by the cellular network, for in-coverage or out-of-coverage

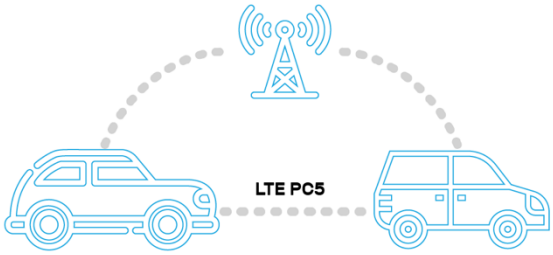

Figure 18: eNB-controlled LTE PC5

3.19 Standalone LTE PC5

Standalone LTE PC5 scenario is characterized by following:

- The **LTE PC5** V2X service operation does not rely on provisioning of parameters or authorization from a MNO
- Vehicles perform autonomous resource selection of **LTE PC5** radio resources (3GPP PC5 mode 4)
- **LTE PC5** parameters e.g. maximum output power and resource pools, are provided by e.g. legislation, specification, pre-installed firmware, or potentially a configuration server
- This scenario is similar to a corresponding scenario using IEEE 802.11p technology

Figure 19: Standalone LTE PC5

Annex A: Change history

Date	Meeting	TDoc	Subject/Comment
2017-07	3rd WG2	A-170188	Initial version