Note by the secretariat

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Draft definitions for the purpose of the Task Force on Vehicular Communications (TF on VC)

This document provides definitions of vehicular communications and V2X for use by WP.29. The definitions are for understanding, not for technical standards.

I. Vehicular communications – context

A. Different ways of looking at vehicle communications

Vehicular communications refer to the exchange of information and data between vehicles as well as between vehicles and their surroundings. It involves the use of various wired or wireless communication technologies to enable communication and data sharing between vehicles, as well as between vehicles and roadside units, traffic management systems, and other infrastructure components.

In general, vehicular communication includes Vehicle-to-Vehicle (V2V) communication, Vehicle-to-Motorcycle (V2M) communication, Vehicle-to-Infrastructure (V2I) communication, Vehicle-to-Grid (V2G) communication, Vehicle-to-Network (V2N) communication, Vehicle-to-Pedestrian (V2P) communication and Vehicle-to-Cyclist (V2C) communication. Together, these can be loosely called Vehicle-to-Everything (V2X) but better to call them vehicular communications.

B. Goals of vehicular communications

The primary goal of vehicular communications is to improve road safety, transport efficiency, and the overall transport experience. By facilitating real-time communication among vehicles and infrastructure, vehicular communications enable the exchange of information such as vehicle speed, position, acceleration, braking, signalling, road conditions, and traffic flow. This information can be used to support various purposes, including:

(a) *Safety and traffic related information sharing:* It allows the vehicle to issue warnings to the driver based on information transmitted by other vehicles or on clouds and information sharing services.

(b) *Traffic management:* By collecting data from vehicles and infrastructure, vehicular communications can assist in optimizing traffic flow, reducing congestion, and improving overall transport efficiency.

(c) *Collision avoidance:* Vehicular communications can help vehicles detect and avoid potential collisions by sharing information about their positions, velocities, and intentions.

(d) *Protecting vulnerable road users:* Messages from devices in the possession of pedestrians, cyclists, and motorcyclists can alert vehicles to their presence.

(e) *Automated driving support:* There are various ways in which the deployment of automated driving systems may be accelerated and/or their safety improved through V2I and V2V communications. E.g. Roadside infrastructure may be able to provide information to assist automated driving systems at complex junctions; and merging is a difficult activity for automated driving systems and might need V2V to reliably do merge successfully 100% of the time.

(f) *Emergency services:* It enables faster response times for emergency services by providing real-time information about accidents, road hazards, and other incidents.

(g) *Cooperative driving:* Vehicular communications can support cooperative driving applications where vehicles collaborate to enhance safety and efficiency, such as platooning, and automated driving systems for example by supporting intersection crossing.

(h) *Charging support:* Information from the grid can be used to control timing of charging and information can be provided to chargers about payment. Communication may also facility two-way energy flows e.g. to allow electric vehicle batteries to be used to provide power to the grid or an owner's home.

(i) *Traffic signal interface:* Message can be sent by emergency vehicles and possibly transit vehicles to the traffic signal controller to change the signal to green and the traffic signal controller can send its signal phase and timing (SPAT) to vehicles so that they can adjust their speed to reduce energy use.

(j) *Infotainment and convenience:* It allows for the delivery of multimedia content, internet access, and personalized services to enhance the in-vehicle experience.

(k) *Other purposes*. It is recognized that WP.29 has already developed regulatory requirements regarding emergency services (eCall / Accident Emergency Call Systems), OBD ports, Software Updates, which therefore might fall out of the initial focus of the TF on VC.

[The secretariat proposes that the task force on VC prioritise it's activities (a) – (k). A proposal for such prioritization is as follows:

The TF on VC would initially explore (a), (c), and (e) which primarily involve vehicles. After completion of this initial effort, the TF might next explore (d) and (i) with the involvement of a broader membership that represents the non-vehicle entities that are on the other side of these V2X communications.]

II. Proposed definitions (initial drafts) for use by the TF on VC

V2X is information exchange between vehicle and communication devices and something, including other vehicles. V2X includes messages sent from vehicles and messages sent to vehicles (which could be called X2V but is usually not).

In the WP.29 context, each V2X message must precisely identify the message sender, the location of the message sender, and the time that the message was sent. Note: Some V2X messages, such as roadside SPATs, traffic events, and traffic signs, do not include the sender's identity and location. Even the messages sent by the vehicle are Data anonymization, which cannot be regarded as "precisely identify the message sender".

In the WP.29 context, the V2X message must be sent via a dedicated over-the-air communications channel [, ~~not via cellular. Thus, emergency calls, software updates over-the-air, telematics etc. are not V2X since they use cellular. Thus, physical communications between a vehicle and a charging port are not V2X since they are not over the air~~].

Within V2X, there can be:

(a) V2V which goes between communications devices in vehicles located near-by to each other.

(b) V2I which goes between communications devices in vehicles and communications devices in infrastructure elements such as a traffic signal controller, parking facilities, road signs, and toll booths.

(c) V2P which goes between communications devices in vehicles and communications devices in the possession of a person that is not using some type of vehicle.

(d) V2C which goes between communications devices in vehicles and communications devices in the possession of a person that is using a bicycle and/or communications devices embedded in bicycles. Note: V2C may be merged together with V2P if P is understood as Vulnerable Traffic Participants.

(e) V2M communication which goes between communication devices in vehicles and communication devices in possession of a person using a motorcycle and/or communication devices embedded in a motorcycle (vehicles of Category L). Note: it could be merged with V2V.

In addition, there are communications that are not necessarily V2X that might be important to WP.29

(a) Vehicle-to-Grid (V2G) which supports and manages bi-directional flow of electricity between electric vehicles (EVs) and the power grid to allow EV charging as well as EV discharging aimed to support the grid during peak demand periods or to support grid stability. This is often done by a physical connection.

(b) Vehicle-to-Network (V2N) involves the connection between vehicles and wider networks, such as cellular networks or cloud-based platforms. It allows vehicles an additional way to access services and information from the cloud, enabling features like real-time traffic data and safety information (e.g. wet or icy roads), if not already part of V2I.