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# Road vehicles — Vehicle domain service —

## Part 1:
## General information and use case definitions

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# Contents

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1299e6b18e2f/iso-dis-23239-1

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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22.

The project developing this document is agreed to allocated under both ISO TC 22 and ITU-T SG16 as JVDS (Joint project on Vehicle Domain Service). JVDS is established between ISO TC 22/SC 31/WG 8 – vehicle domain service – and ITU-T SG16/Q27 – vehicle gateway – as category A liaison. This document is issued by each ISO and ITU-T as technically aligned twin texts.

ISO 23239 consists of the following parts, under the general title *Road vehicles — Vehicle domain service*:

— *Part 1: General information and use case definitions*

— *Part 2: Application layer and sequence requirements*

— *Part 3: Internet and transport layer requirements*

— *Part 4: Network interface layer requirements*

# Introduction

The deployment of connected vehicle is expected. Many developments and discussions about various techniques came to be performed by many uses. If the details of the technique that is necessary by prescribing definite usages become clear, the implementation of necessary technique enables to give drivers much more utility value.

It is necessary for all drivers of the cars to collect much traffic information and recognize the correct traffic information and relevant driving situation, in order to judge right driving movement.

It never changes that an automatic driving function needs the right decision of driving operation in substitution for the user driving. Many independent type automatic driving cars and the intelligent driving support function can provide the information collected with a various types of sensor lidar and radar, but there exists a limit in the performance of them, and always constant blind spot. By the reason of these, it may not get to the sufficient situation recognition only by independent sensor functions.

If a vehicle communicates with neighbouring vehicles or other traffic participants and exchange necessary information, it will be helpful to change such kind of recognition about traffic situation above beyond the limit of sensor performance or with cancellation of the blind spots. Moreover, vehicles change from indicating one-sidedly with blinkers normally equipped to talk freely each other by communication, it will be able for them not only to talk but negotiate planning driving maneuverers with neighbouring relevant vehicles to adjust their turns and timings.

Such kind of information sharing function available in vehicle, provided on the communication network between vehicles and neighbouring traffic participants, will be realized only by vehicle implemented functions without investing a large amount of communication infrastructure on the road side. Vehicles on the road will enable to choose more correct and appropriate driving operation, and it is expected many effects such as decreasing traffic accidents, cancellation of traffic jam and improvement of transportation efficiency.

In many cases, a lot of vehicles on the road communicate mutually and instantly, establish safe connection or adjust the driving plan at the same time. So there exist many problems and challenges to be resolved in communication specifications, such as collecting sufficient information, generating trustable integrated information with mutual validation, transmitting necessary information to the valuable receivers and talking with multiple vehicle on a secure session. Therefore, it is so important to clarify carefully selected use cases including these traffic situations, they will figure out to us necessary requirements about specification and technology for the vehicle application more than V2X communication.

The main aspect of this document development is focusing on a point of the whole vehicle implementation. It will be performed by collecting typical use cases, deriving requirements for specification of implementation with referring to necessary existing documents. All of documents will be developed within unique standard series in order to remove contradiction, inconsistency and redundancy within the documents. Results of these works will confirm compatibility and interoperability, adding economy and efficiency of the implementation with global harmonization. Furthermore, it will show the figure of the road for the implementation of a vehicle from existing documents to support smooth starting and accelerating the introduction of the communication technology of present or next generation into the future vehicle market.

# Road vehicles — Vehicle domain service —

## Part 1:
## General information and use case definitions

## 1  Scope

These series documents define the specification of application implemented within a vehicle, to provide integrated information service used in the vehicle, generated from various information, acquired by the communication, concerned with the domain around the vehicle such as traffic condition and so on.

The application defined in this document enables to acquire useful information by directly or indirectly communicating with neighbouring vehicles and other traffic participants without any supports by the road sided infrastructures.

The specification of application includes the definition of OSI layers of required communication, selection of physical, data link, transport and network layers, definitions of data and message formats and typical control sequences.

This document, as the first document of these series of documents, provides general information that defines general policies for required or recommended specification with statements for additional information, definitions of representative and other relevant use cases necessary to define specifications of application. Other detailed specifications are provided in the following documents of this series documents.

Note        The remote processes by the connected tools to the vehicle, such as repair and maintenance, prognostics, monitoring, configuration and reprogramming of vehicle are out of the scope of this document.

## 2  Normative references

The following documents, in whole or in part, are normatively referred in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 7498-1:1994, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

IEEE 1588:2008, *Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems*

INTERNET ENGINEERING TASK FORCE(IETF), RFC 5905: Network Time Protocol Version 4: Protocol and Algorithms Specification. Available at https://tools.ietf.org/html/rfc5905

## 3   Terms and definitions

### 3.1   Basis of vehicle domain

**3.1.1**
**vehicle domain**
**VD**
network area, or group of secure and trusted connection established on the dedicated network service provided by master vehicle, by the registration of domain actor to participate in

Note 1 to entry: Vehicle domain is only related to network connection between master vehicle and domain actor. Physical or geometrical conditions are not included.

**3.1.2**
**vehicle domain dynamic map**
**VDDM**
dynamic map in vehicle domain generated by a master vehicle

Note 1 to entry: VDDM consists of static high definition features, dynamic actors and other characteristics.

**3.1.3**
**vehicle domain service**
**VDS**
group of functions provided by master vehicle to domain actor in vehicle domain

Note 1 to entry: It includes vehicle domain dynamic map and et al.

**3.1.4**
**vehicle domain service account**
**VDSA**
unique identifier of domain actor certified and issued by vehicle domain service operator

**3.1.5**
**vehicle domain service master time**
**VDS master time**
basic time steps for synchronization between MV and DA generated by master vehicle

Note 1 to entry: It generates both past and future time steps.

**3.1.6**
**vehicle domain service system**
**VDSS**
physical structure that consists of master vehicle (server), neighbouring vehicles (client), other traffic participants (clients), and wireless network between the server and its clients that provides vehicle domain service

Note 1 to entry: Element in VDSS is named as primary actor. That outside VDS is secondary actor.

### 3.2   Primary actor

Primary actor is either a master vehicle or one of its clients in vehicle domain.

**3.2.1**
**master vehicle**
**MV**
server of vehicle domain

Note 1 to entry: This means the vehicle in which the server function implemented.

**3.2.2**
**domain actor**
**DA**
client of a master vehicle in a vehicle domain

Note 1 to entry: They are traffic participants, such as vehicles, bikes and walkers around the master vehicle in general.

**3.2.3**
**domain vehicle**
**DV**
vehicle client of a master vehicle in a vehicle domain

**3.2.4**
**domain participant**
**DP**
client of a master vehicle except for vehicle in a vehicle domain

EXAMPLE     walker, bike and other traffic participants with network function.

**3.2.5**
**domain sensor**
**DS**
client of a master vehicle with sensing function in a vehicle domain

Note 1 to entry: It is the network entity and typically vehicle with network and sensing function is often both of domain vehicle and domain sensor at the same time.

Note 2 to entry: General definition of domain sensor never exclude domain actor except vehicle.

## 3.3   Secondary actor

Secondary actor is a logical function communicates with master vehicle.

**3.3.1**
**smart city traffic manager**
**SCTM**
central management server of traffic information in a smart city

**3.3.2**
**smart traffic**
optimized traffic controlled by SCTM in a smart city

**3.3.3**
**smart traffic architecture model proposal**
**STAMP**
model proposal of the multi-layer-like control structure of smart traffic

**3.3.4**
**traffic operator**
**TO**
lower functional server of SCTM manages traffic control information

**3.3.5**
**traffic monitor**
**TM**
lower functional server of SCTM monitors traffic status

**3.3.6**
**vehicle domain service operator**
**VDSO**
service operator who will issue VDSA

## 4   Symbols and abbreviated terms

For the purpose of this document, the following abbreviations apply:

BUC        business use case

DSRC       dedicated short range communication

IP         internet protocol

LDM        local dynamic map

NTP        network time protocol

STAMP      smart traffic architecture model proposal

SUC        system use case

TCP        transmission control protocol

TLS        transport layer security

UTC        universal time

## 5   Conventions

### 5.1   Documents overview on OSI based services.

Figure 1 shows the organization and coverage of the different ISO 23239 documents on the OSI layered architecture.

As indicated by the bold framed shapes this part of ISO 23239 defines general information and use case definitions. This is the most basic document for other detailed and separated specific documents according to the OSI layered architecture.

**Key**

☐ Applicable requirements described in this part of ISO 23239

☐ OSI Layers and applicable requirements defined in other parts of ISO 23239
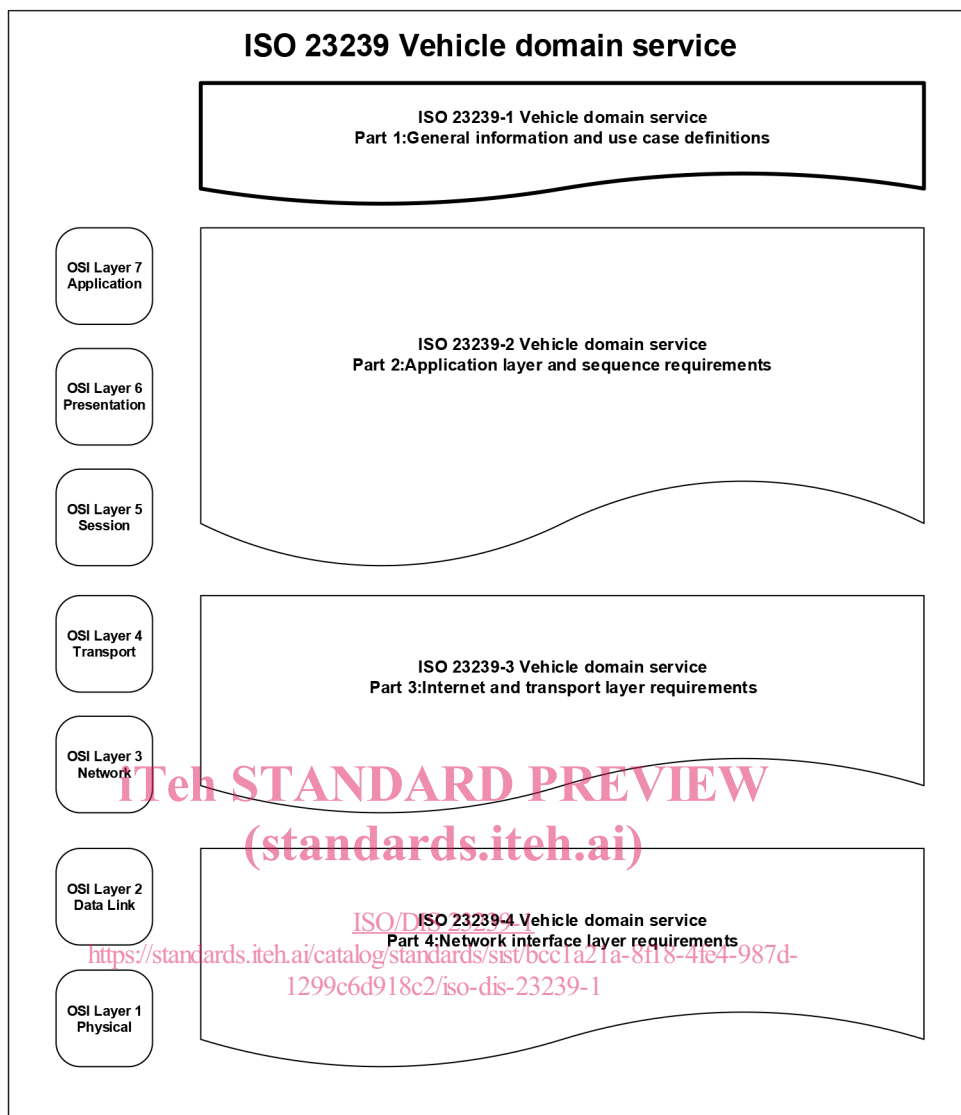
**Figure 1 — Documents overview of vehicle domain service**

Note        Actually, upper layers are not fit good to TCP/IP communication, so titles of documents are defined based on TCP/IP layer model.

## 5.2   General policy structure

This document provides general policies for specifications as one of general information. The list of general policies consists of required or recommended one. Additional statement are attached to them in order to provide better understandings about them. All of provisions included in general policy definitions and attached explanation align to ISO Directive Part 2. All policies are expressed in unified format.

This document uses a policy structure i.e. a unique number identifies each individual policy included in this document. It will improve the readability with easier policy tracking. The following modified recommended format will be applied:

| 'VDS''Y' - 'xxx' — policy name |
|---|
| policy text |

Where:

— 'VDS' represents the ISO 23239 set of standards,

— 'Y' represents the document part of the ISO 23239 document set

— 'xxx' represents the individual policy number,

— 'policy name' represents the name of policy and

— 'policy text' defines the provisions of the policy.

EXAMPLE:

| VDS1 - 000 — The form of general policy |
|---|
| This sentence shall give the example form of general policy defined in this document. |

## 6   General information for vehicle domain service

### 6.1   General

Vehicle domain is the area which consists of road vehicles in which the applications are implemented. The applications provide integrated information services used in the vehicle. The provided information is generated from various source information, acquired by the communication, concerned with the area around the vehicle such as traffic condition and so on. The source information is acquired directly or indirectly by the communication with neighbouring vehicles and other traffic participants (bikes, bicycles, walkers, et al.) without any supports by the road sided infrastructure.

This clause gives the basic definitions of vehicle domain services.

### 6.2   6.2 Vehicle domain service

The master vehicle generates vehicle domain network. Surrounding participants, such as vehicles, bikes and walkers join in that network as domain actors. Various types of sensors equipped with participants also could join it as additional actors. The master vehicle may provide vehicle domain services to the actors participated in its domain service network.

**VDS1 - 001 — Vehicle domain service**

| If vehicle is the master vehicle of vehicle domain, it shall provide vehicle domain services to domain actors. |
|---|

Figure 2 shows basic vehicle domain service. Master vehicle communicates with domain actors, such as domain vehicles, sensors and participants. Master vehicle provides vehicle domain services and domain actors response to them.
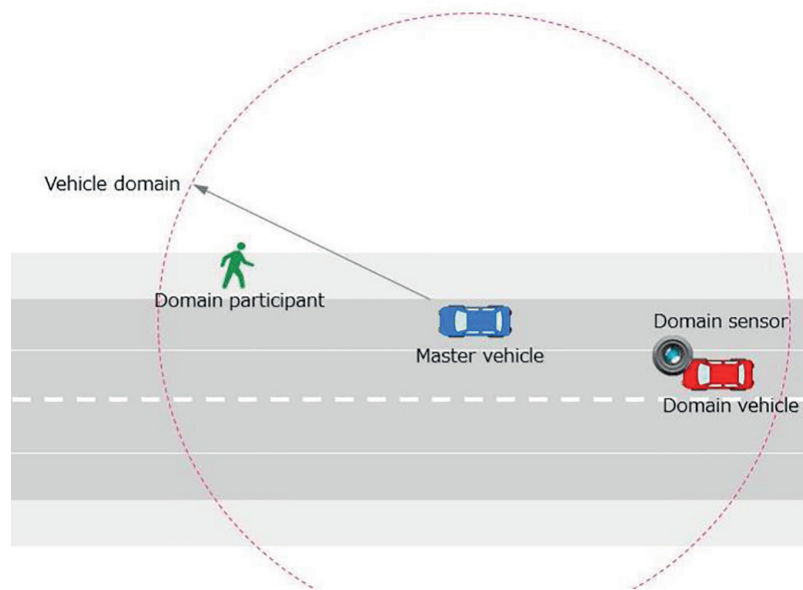
**Figure 2 — Basic vehicle domain service**

Note 1     Minimum structure of vehicle domain service consists of one master vehicle and one domain actor.

Note 2     The field in which vehicle domain is located includes everywhere vehicle goes such as traffic road, public parking area and private garage.

Vehicle domain is the area which consists of road vehicles in which the applications are implemented. The applications provide integrated information services used in the vehicle. The provided information is generated from various source information, acquired by the communication, concerned with the area around the vehicle such as traffic condition and so on. The source information is acquired directly or indirectly by the communication with neighbouring vehicles and other traffic participants (bikes, bicycles, walkers, et al.) without any supports by the road sided infrastructure.

VDS implementation depends on OEM decision. Activation of implemented VDS function depends on user's or owner's decision, local regulation or other rules before driving.

## 6.3   Vehicle domain dynamic map service

Most typical service of VDS is vehicle domain dynamic map service. The VDDM is the beginning, original and most important one of VDS. It is applied to the vehicle driving with no restriction of location, on the road, street, freeway, public parking area and private road.

The master vehicle collects relevant information from all of domain actors. The domain sensors reports acquired information about silent traffic participants and conditions instead of them. The master vehicle generates dynamic map information within the vehicle domain. The master vehicle provides VDDM based services to domain actors.

### VDS1 - 002 — Vehicle domain dynamic map service

The master vehicle shall provide vehicle domain dynamic map services to domain actors.

Figure 3 shows typical vehicle domain dynamic map service. Master vehicle communicates with domain actors, such as domain vehicles, sensors and participants. Master vehicle provides vehicle domain dynamic map services and domain actors response to them.