TECHNICAL REPORT

ISO/TR 13185-1

First edition
2012-05-15

Intelligent transport systems — Vehicle interface for provisioning and support of ITS services —

Part 1:
General information and use case definition

Systèmes intelligents de transport — Interface véhicule pour la fourniture et le support de services ITS —

Partie 1: Informations générales et définition des cas d'utilisation

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ISO/TR 13185-1:2012
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 13185-1 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

ISO 13185 consists of the following parts, under the general title *Intelligent transport systems — Vehicle interface for provisioning and support of ITS services*:

— Part 1: *General information and use case definition* [Technical Report]

— Part 2: *Protocol requirements and specification for vehicle ITS station gateway (V-ITS-SG) interface*[1)]

— Part 3: *Configuration process requirements and specification for vehicle ITS station gateway (V-ITS-SG)*[2)]

The following document is under development:

— Part 4: *Protocol conformance test cases for vehicle ITS station gateway (V-ITS-SG) interface*

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1) To be published.

2) To be published.

Introduction

This part of ISO 13185 specifies the requirements for a common software interface to a vehicle gateway to easily exchange vehicle information data among nomadic and/or mobile device, vehicle gateway and the vehicle's ECUs.

Applications supporting ITS service provision and multimedia use via nomadic and mobile device need a common access method to vehicle data through an in-vehicle interface as well as the harmonization of existing standards to support a single vehicle data access solution.

This document defines a vehicle data transfer protocol between vehicle gateway also called V-ITS-SG and the nomadic and/or mobile device (ND).

This part of ISO 13185 may be used by vehicle manufacturers for future vehicle design to support the design of ITS/Telematics and as a retrofit equipment for aftersales vehicles.

Applications supporting ITS service provision and multimedia use via ND may be implemented using vehicle information, driver advisory, warning systems and entertainment systems. The following standards are subject to analysis in regard to their applicability to supporting ITS service provision and multimedia use via nomadic and mobile device.

— ISO 15031 defines emissions-related diagnostic data supported by vehicles in all countries requiring OBD compliance.

— ISO 27145 WWH-OBD defines diagnostic data (emissions-related systems, future safety related systems, etc.) to be supported by vehicles in all countries implementing the GTR (Global Technical Regulation) into their local legislation.

— ISO 22900-2 defines the Modular Vehicle Communication Interface (MVCI) D-PDU API to separate the protocol data unit (PDU) from the vehicle specific protocols.

— ISO 22901 defines the Open Diagnostic data eXchange (ODX) format which is a standard for describing diagnostic related ECU data. This International Standard is becoming the vehicle manufacturer's choice to document vehicle system diagnostic data and protocol information.

— ISO 22902 is a multimedia and telematics standard based on the AMI-C specification and reference documents for automotive industry. The important logical element of the architecture is a vehicle interface.

— ISO 22837 defines the reference architecture for probe vehicle systems and a basic data framework for probe data.

— ISO/TS 29284 defines the standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the ITS field.

— SAE J2534 defines a standardized system for programming of ECUs in a vehicle.

— SAE J2735 defines the support of interoperability among DSRC applications through the use of standardized message sets, data frames and data elements.

This part of ISO 13185 supports ITS applications which are based on ND in vehicles to operate on a common software interface to a V-ITS-SG integrated within the CALM architecture and easily exchange vehicle information data among ND, V-ITS-SG and ECUs.

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Intelligent transport systems — Vehicle interface for provisioning and support of ITS services —

Part 1:
General information and use case definition

1   Scope

This part of ISO 13185 specifies the communications architecture and generic protocol to provide and maintain ITS services to travellers (including drivers, passengers and pedestrians), using nomadic and portable devices for:

— The mobile device as a mobile router,

— Augmentation of the capabilities of a nomadic device using information from in-vehicle systems,

— Nomadic device acting as a key to personalise the vehicle configuration,

— Using capabilities of a nomadic or mobile device to augment functionality within the vehicle,

— The use of portable nomadic devices within commercial vehicles and public transport,

— Optimising the use of the capabilities in nomadic and mobile devices in the provision of ITS services,

— Harmonization of existing standards to support a single solution access method,

— Applications supporting ITS service provision and multimedia use a common access method to retrieve vehicle data through a vehicle communication interface.

2   Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 10731:1994, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*

ISO 15031 (all parts), *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics*

ISO/IEC 15118-1[3]), *Road vehicles — Vehicle to grid communication interface — Part 1: General information and use-case definition*

ISO 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

ISO 22837, *Vehicle probe data for wide area communications*

ISO 22900-2, *Road vehicles — Modular vehicle communication interface (MVCI) — Part 2: Diagnostic protocol data unit application programming interface (D-PDU API)*

ISO 22901 (all parts), *Road vehicles — Open diagnostic data exchange (ODX)*

ISO 22902-5, *Road vehicles — Automotive multimedia interface — Part 5: Common message set*

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3)   To be published.

ISO 22902-6, *Road vehicles — Automotive multimedia interface — Part 6: Vehicle interface requirements*

ISO/TS 29284, *Intelligent transport systems — Event-based probe vehicle data*[4)]

ISO 27145 (all parts), *Road vehicles — Implementation of WWH-OBD communication requirements*

ETSI EN 302 665, *Intelligent Transport System (ITS) — Communications Architecture*

SAE J2735, *Dedicated Short Range Communications (DSRC) — Message Set Dictionary*

SAE J2534, *Recommended Practice for Pass-Thru Vehicle Programming*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15031-2 and the following apply.

Bluetooth
BT
communication protocol for exchanging data over short distances

Communications Access for Land Mobiles
CALM
specification of a common architecture, network protocols and communications interface definitions to enable continuous or quasi-continuous communications between vehicles and the infrastructure, or between vehicles, using wireless telecommunications media that are available in any particular location, and have the ability to migrate to a different available media where required

eco lamp
lamp that is implemented on the dashboard or nomadic device to guide the driver to drive the vehicle in the most economical way

EXAMPLE   A green lamp/symbol will indicate high fuel efficiency driving or travelling at a constant speed while a red lamp/symbol will indicate low fuel efficiency, i.e. strong acceleration, sudden braking.

event log file
data record with multiple event data stored with time stamp

nomadic device
ND
device that provides communications connectivity via equipment such as cellular telephones, mobile wireless broadband (WIMAX, HC-SDMA, etc.), WiFi, etc. and includes short range links, such as Bluetooth, Zigbee, etc. to connect nomadic devices to the motor vehicle communications system network

Vehicle-Intelligent Transport Systems-Station Gateway
V-ITS-SG
interface device in the vehicle that acts as the vehicle's mobile gateway between the vehicle's ECU(s) and the external nomadic device

V-ITS-SG long term memory
storage of all data in internal memory which are required to be available after key On/Off cycles

V-ITS-SG short term memory
storage of all data in internal memory which shall only be available during this key On/Off cycle

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4)   To be published.

Vehicle State Of Capabilities Log File
VSOCLogFile
data record with multiple data snapshots including a pre-selected data set providing a vehicle capabilities status of the vehicle's electronic system(s)

3.2   Abbreviated terms

BT	Bluetooth
CALM	Communications Access for Land Mobiles
DLL	Dynamic Link Library
DSRC	Dedicated Short Range Communications
DTC	Diagnostic Trouble Code
ECU	Electronic Control Unit
GUI	Graphical User Interface
ITS-S	Intelligent Transport System-Station
LL	Logical Link
N2V	Nomadic and mobile devices to Vehicle
ND	nomadic device
OBE	On-Board Equipment
PDU	protocol data unit
RMI	Repair and Maintenance Information
RSE	Road Side Equipment
V2N	Vehicle to Nomadic and mobile devices
VIN	Vehicle Identification Number
V-ITS-SG	Vehicle-Intelligent Transport System-Station Gateway
VSOC	Vehicle State Of Capabilities

4   Conventions

This part of ISO 13185 is based on the conventions discussed in the OSI Service Conventions (ISO/IEC 10731:1994) as they apply to communication services. The vehicle data transfer protocol is applicable to OSI layers 4, 5, 6 and 7.

5   General information

5.1   Document overview and structure

The ISO 13185 series provides an implementer with all documents and references required to support the implementation of the requirements related to standardized access to automotive Repair and Maintenance Information (RMI) in accordance with the requirements set forth in the EC mandate M/421.

— Part 1: This Technical Report provides an overview of the document set and structure along with the use case definitions and a common set of resources (definitions, references) for use by all subsequent parts.

— Part 2: This part of ISO 13185 specifies all technical requirements related to the protocol to be used between the V-ITS-SG and the ND to retrieve data from the vehicle's electronic systems connected to the V-ITS-SG. The requirements will reflect the deriving needs from the use cases as specified in Part 1.

— Part 3: This part of ISO 13185 specifies the requirements related to the configuration of the V-ITS-SG. The configuration data derive from an ISO 22901-1 ODX data source converted to a V-ITS-SG specific format which is V-ITS-SG system supplier specific.

— Part 4: This part of ISO 13185 specifies conformance test cases for self-certification purposes of a provider of the ND and V-ITS-SG system. The conformance test cases will follow the use-case definition of Part 1 as well as the requirements stated in Part 2. The purpose of this part of ISO 13185 is to provide information to the ND and V-ITS-SG system provider to build and test the ND and V-ITS-SG system against the conformance test cases. This final step in the development process of the ND and V-ITS-SG system is an enabler for all providers to ensure that their ND and/or V-ITS-SG system meets a high degree of functional requirements expected by the end user.

Vehicle interface for provisioning and support of ITS services

Part 1 General information and use case definition	Part 2 Protocol requirements and specification for vehicle ITS station gateway (V-ITS-SG) interface	Part 3 Configuration process requirements and specification for vehicle ITS station gateway (V-ITS-SG) interface	Part 4 Protocol conformance test cases for vehicle ITS station gateway (V-ITS-SG) interface

Figure 1 — Document structure

5.2 Purpose of this Technical Report

The main purpose of this Technical Report is to:

a) Identify the requirements of bidirectional vehicle data transfer,

b) Identify the usability of the existing International Standards for nomadic and mobile devices and existing vehicle communication network access standards,

c) Identify additional work required to develop the common software interface to a vehicle gateway integrated within the CALM architecture by the amendment of the existing interface to D-PDU API in the provision and support of ITS services via nomadic and mobile devices.

5.3 ITS communication architecture components

The ITS communication architecture is a communication system designed for ITS and made of four physically separated subsystem components:

— the vehicle subsystem component: Vehicle ITS Station (Vehicle ITS-S),

— the nomadic and mobile subsystem component: Personal ITS Station (Personal ITS-S),

— the roadside subsystem component: Roadside ITS Station (Roadside ITS-S),

— the central subsystem component: Central ITS Station (Central ITS-S).

Figure 2 illustrates the connection between the Personal and Vehicle ITS Station. The V-ITS-S consists of:

— the V-ITS-S Router supporting the CALM architecture, and

— the V-ITS-S Host and Gateway to the in-vehicle networks.

ITS standardized message and data formats

vehicle specific message and data formats

Personal ITS Station

Facilities

ITS-S
1. Internet Apps
2. ISO 13185-2 Protocol

Presentation
(ITS standardized)

Management & Security

Session

Networking & Transport (CALM)

| 3G CI | … CI | BT CI | USB CI |

Vehicle ITS Station Router

Management & Security

Networking & Transport (CALM)

| M5 CI | … | USB CI | BT CI | LAN CI |

Vehicle ITS Station Host & Gateway (V-ITS-S)

Facilities

Application
(support of ISO 13185-2)

Application
(vehicle manufacturer specific)

Presentation
(ITS standardized)

Presentation
(vehicle specific PDU)

Management & Security

Session

Session

Networking & Transport (CALM)

TP & NW … TP & NW

LAN CI

IVN CI … IVN CI

Sensors and Controls

In-vehicle application … In-vehicle application

IVN CI … IVN CI

Vehicle Manufacturer in-vehicle networks

Use Case: Personal ITS Station applications

OSI 7: GW IVN-CI ISO 13185-2 Appl. Layer Protocol
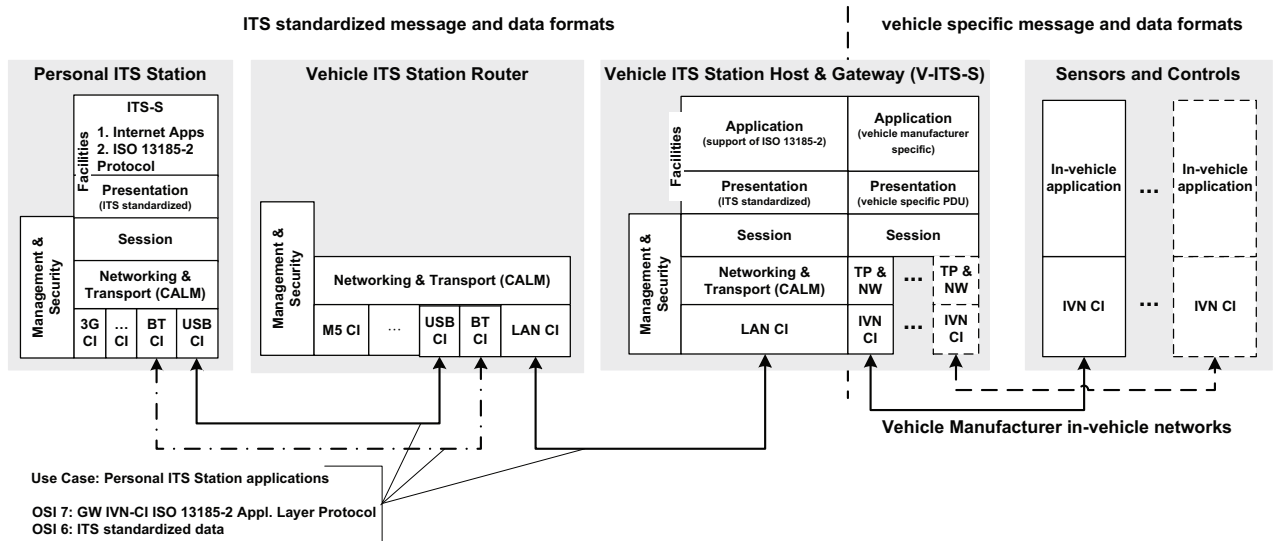OSI 6: ITS standardized data

Figure 2 — Vehicle ITS Station Gateway implementation based on CALM architecture

Each of the four components described in 5.3 and in Figure 3 contains the ITS subsystem components and usually a vehicle gateway connecting the ITS Station to a legacy system. The vehicle requires a vehicle gateway connected to the Vehicle Station and to the vehicle manufacturer's proprietary vehicle network. These components are inter-linked by a communication network. The communication between the vehicle subsystem component and the mobile subsystem component are performed over a short range wireless or wired communication media.

Figure 3 illustrates the communication system designed for ITS.

Figure 3 — ITS communication architecture
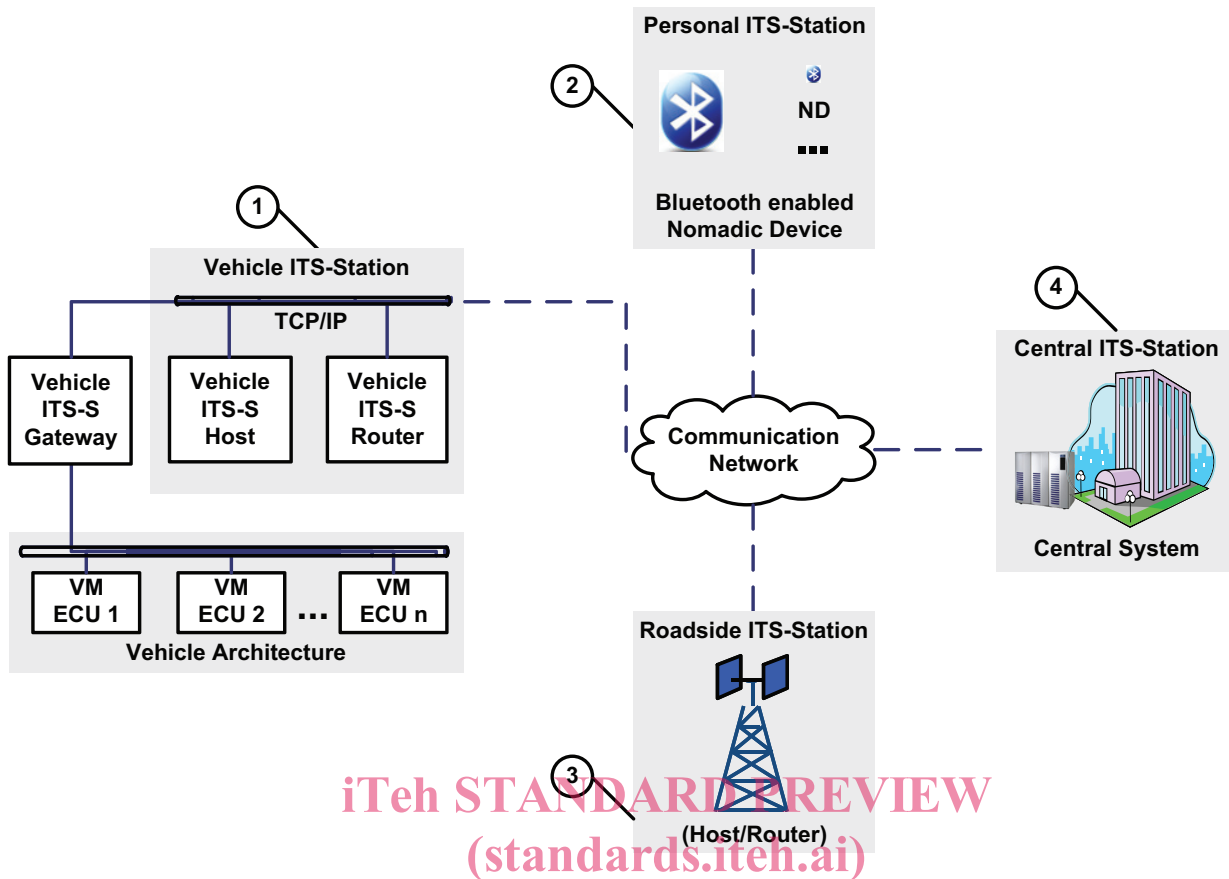
Key

1 Vehicle ITS Station: Vehicle subsystem component connected to vehicle domain architecture designed by vehicle manufacturer via the V-ITS-SG
2 Personal ITS Station: Nomadic and mobile subsystem component
3 Roadside ITS Station: Roadside subsystem component
4 Central ITS Station: Central subsystem component

NOTE   The V-ITS-SG is not a part of the Vehicle ITS Station.

The scope of this Technical Report is V2N (or N2V). V2N is the abbreviation used to cover all types of communication between vehicle and nomadic and mobile devices.

There are many existing International Standards for the communication between Vehicle ITS Station and Personal ITS Station for bidirectional vehicle data transfer.

There is a need to identify the usability of the existing International Standards for nomadic devices and existing vehicle communication network access standards.

6   Vehicle interface standardization

6.1   Overview of relevant standards

Various standards exist which are applicable to either the vehicle network or ITS infrastructure. The following is a summary of applicable standards:

—   ISO 15031 (all parts) defines emissions-related diagnostic data supported by vehicles in all countries requiring legislative OBD compliance. This International Standard defines a diagnostic connector and facilities which should be provided by an external test tool. ISO 15031 (all parts) also specifies the diagnostic

messages and DTCs (Diagnostic Trouble Codes) which are reported by the vehicle to the external test tool. It specifies additional details of the diagnostic message format and communication for the ISO 9141-2, ISO 14230-4 and SAE J1850 protocols. ISO 15031-5 supersedes those protocol standards.

— ISO 27145 (all parts) defines diagnostic data (emission-related systems, future safety related systems) to be supported by vehicles in all countries implementing the GTR (Global Technical Regulation) into their local legislation. The ISO 27145 series includes the definitions for a common data dictionary, provides data definitions for emissions-related legislated diagnostics (reference to SAE J1930-DA, SAE J1979-DA, SAE J2012-DA) and common message dictionary, provides the message implementation details from ISO 14229-1 and ISO 14229-2, Unified Diagnostic Services (UDS) to support the required legislated WWH-OBD. It also defines the details necessary to implement the communication between the vehicle's WWH-OBD systems and external test equipment including the definition/reference of physical layers, data link layers, network layer, transport layer and session layer.

— ISO 22837 defines the reference architecture for probe vehicle systems and a basic data framework for probe data. The basic data framework provides an initial set of probe data elements which are commonly used in typical probe data enabled application domains, such as traffic, weather, and safety. The basic data framework provides example probe messages, which define how probe data elements are combined to convey information to a probe processing centre.

— ISO 22900-2 defines the Modular Vehicle Communication Interface (MVCI) D-PDU API to separate the protocol data unit (PDU) from the vehicle specific protocols. This part of ISO 22900 is becoming the diagnostic tool supplier's choice to separate diagnostic data conversion and application test logic from the vehicle communication.

— ISO 22901 (all parts) defines the Open Diagnostic data eXchange (ODX) format, which is a standard for describing diagnostic related ECU data. This series of International Standards is becoming the vehicle manufacturer's choice to document vehicle system diagnostic data and protocol information.

— ISO 22902-5 and ISO 22902-6 define a multimedia and telematics standard based on the AMI-C specification and reference documents for the automotive industry. The important logical element of the architecture is a vehicle interface. The vehicle interface is defined as a component that provides access to vehicle services from an AMI-compliant network. It may act as a gateway to the in-vehicle manufacturer defined network or it may implement some or all of the vehicle services directly.

— ISO/TS 29284 defines the probe data format that is sent from vehicles depending on particular events. The proposed Technical Specification defines events for, e.g. fog, snowfall, and accidents.

— SAE J2534 defines a standardized system for programming that includes a standard personal computer (PC), standard interface to a software device driver, and an interface that connects between the PC and a programmable ECU in a vehicle.

— SAE J2735 defines the interoperability among DSRC applications through the use of standardized message sets, data frames and data elements. This International Standard provides the messages sets, data frames and data elements to produce interoperable DSRC applications between Road Side Equipment (RSE) and On-Board Equipment (OBE).
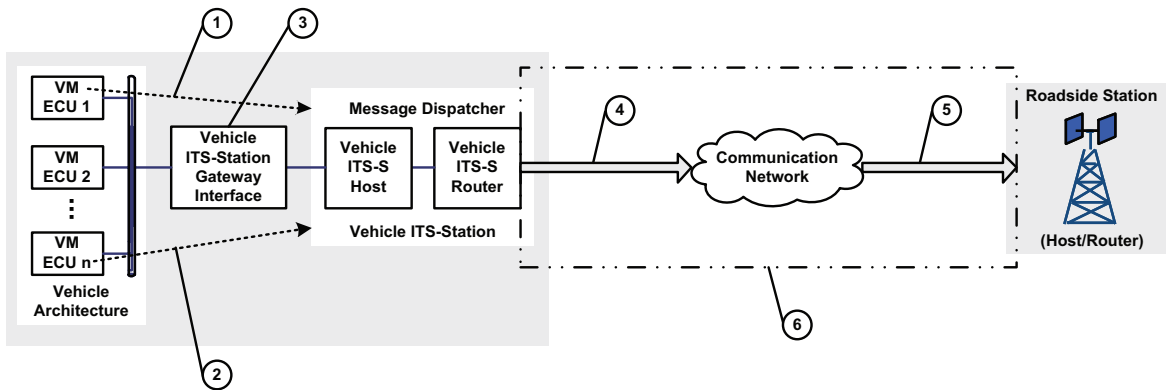
6.2 Standardized vehicle interface

6.2.1 Vehicle interface for ITS applications

Each International Standard (ISO 22837, ISO/TS 29284 and SAE J2735) defines messages sets, data frames and data elements to produce interoperable ITS applications between Vehicle Station and Roadside Station.

Figure 4 illustrates that these International Standards do not include the access method to '1' and '2' from the vehicle manufacturer's in-vehicle network (vehicle domain architecture).

IMPORTANT — The vehicle interface does not include a standardized access method to data elements from the in-vehicle network.

Key

1   Access method to data elements Vehicle Speed, Vehicle Acceleration from ECU 1

2   Access method to data element Brake Status from ECU n

3   Vehicle interface with non-standardized access methods to data elements of vehicle network

4   Standardized message including data elements Vehicle Speed, Vehicle Acceleration, Brake Status

5   Standardized message including data elements Vehicle Speed, Vehicle Acceleration, Brake Status

6   Short length packet message

Figure 4 — ISO 22837, ISO/TS 29284 and SAE J2735 based vehicle interface for ITS applications
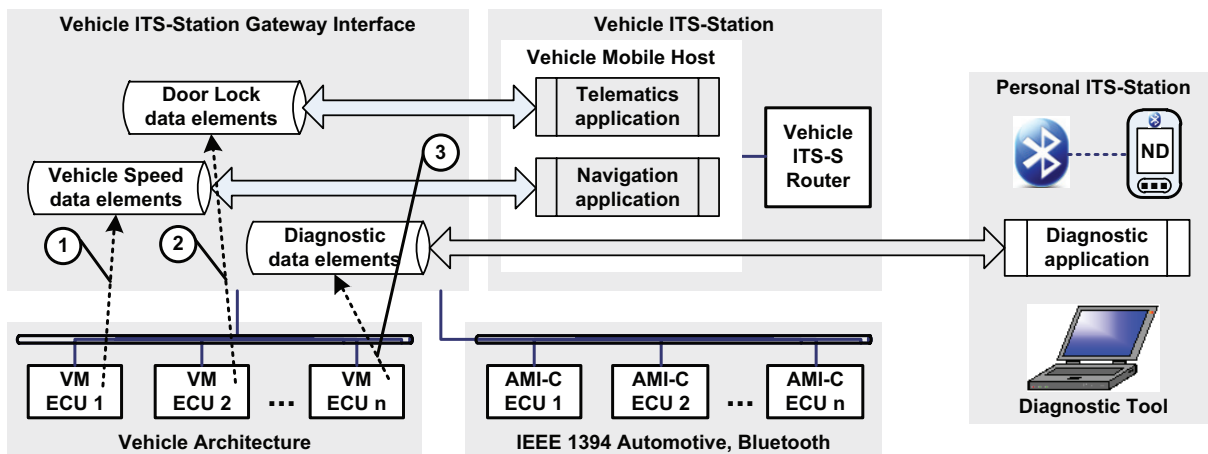
6.2.2   Vehicle interface for multimedia and telematics

The ISO 22902 series provides network protocol requirements for vehicle interface access and a Common Message Set (CMS). The network protocol requirements are focused on supporting access to vehicle services.

This series of International Standards does not include an access method to '1', '2' and '3' from the vehicle manufacturer's in-vehicle network (vehicle domain architecture).

Figure 5 depicts the vehicle interface for multimedia and telematics.

Key

1   Vehicle Speed data elements from ECU 1

2   Door Lock data elements from ECU 2

3   Diagnostic data elements from ECU n

Figure 5 — Vehicle interface for multimedia and telematics

IMPORTANT — The vehicle interface does not include a standardized access method to data elements from the in-vehicle network.
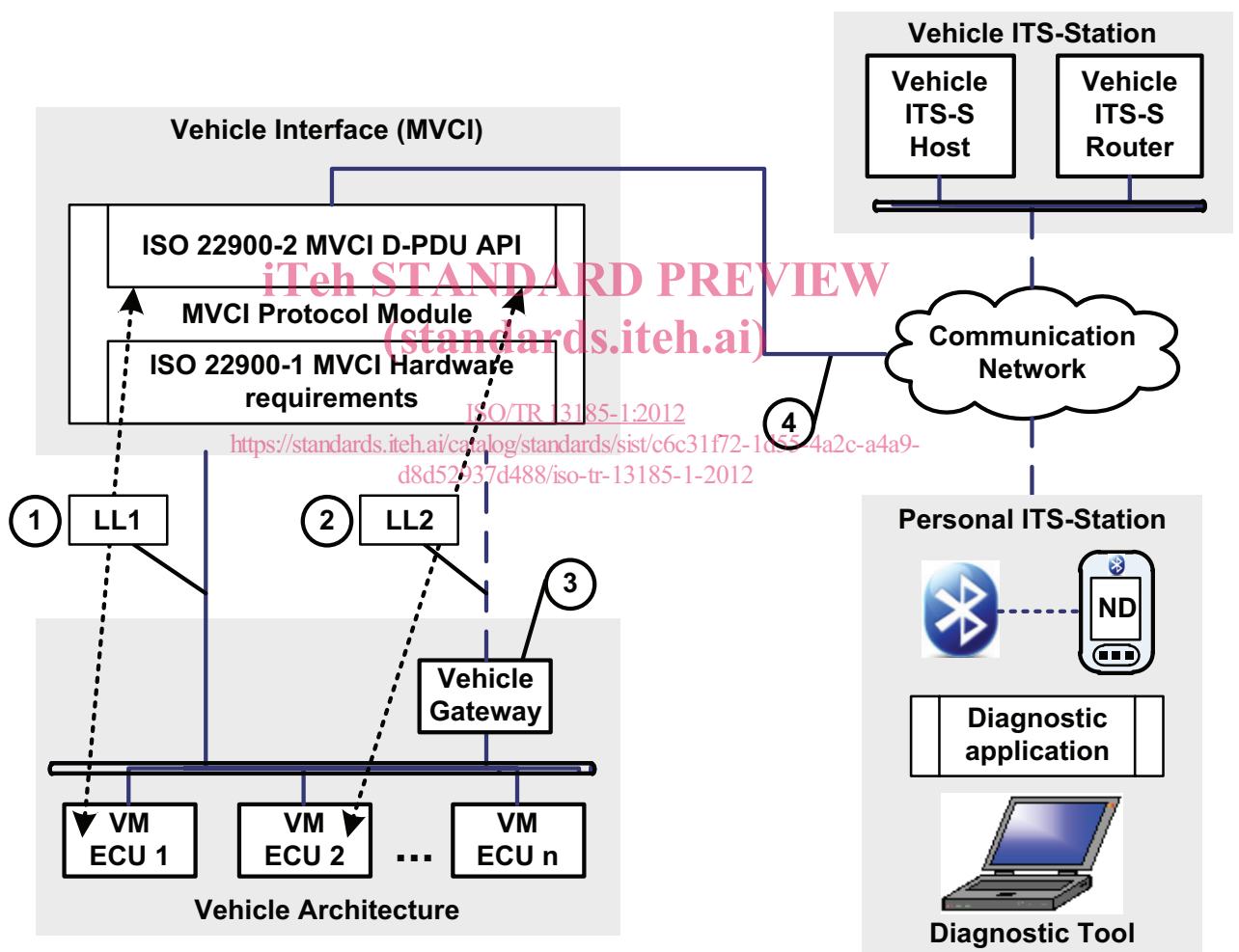
6.2.3 Vehicle interface for diagnostics

ISO 15031 (all parts), ISO 27145 (all parts), and ISO 22901(all parts) do not include any definition of a vehicle interface to support a standardized access method to the vehicle manufacturer's in-vehicle network.

ISO 22900-2 and SAE J2534 define a standardized access method to the vehicle manufacturer's in-vehicle network.

SAE J2534 requires a Windows™ 32 bit DLL while ISO 22900-2 is independent.

Figure 6 illustrates ISO 22900-2 Modular VCI – D_PDU API used as the vehicle interface supporting standardized access methods (PDU) to vehicle manufacturer's in-vehicle network through Logical Link 1 (LL1) between ECU 1 and the Modular VCI D-PDU API or Logical Link 2 (LL 2) between ECU 2 through the Vehicle Gateway (optional) and the Modular VCI D-PDU API.

Key

1   LL1 between MVCI D-PDU API and ECU 1
2   LL2 between MVCI D-PDU API and ECU 2 (only if Vehicle Gateway installed)
3   Optional Vehicle Gateway
4   TCP/IP on, e.g. IEEE 802.3 Ethernet

Figure 6 — Vehicle interface for diagnostics

IMPORTANT — The vehicle interface includes a standardized access method to data elements from the in-vehicle network.