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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Vehicular gateways and intelligent transportation systems
(ITS) – Architecture for vehicular gateways

Architecture and functional entities of vehicle gateway platforms

Recommendation ITU-T H.550



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Recommendation ITU-T H.550

Architecture and functional entities of vehicle gateway platforms

Summary

Recommendation ITU-T H.550 describes the architecture, functional architecture framework and functional entities of vehicle gateway platforms (VGPs). Some signalling flows of VGP are also described in Appendix I.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.550	2017-12-14	16	11.1002/1000/13434

Keywords

Architecture, functional architecture framework, functional entities, signalling flow, vehicle gateway platforms, VGP.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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Recommendation ITU-T H.550

Architecture and functional entities of vehicle gateway platforms

1 Scope

This Recommendation specifies the architecture, functional architecture framework and functional entities for vehicle gateway platforms (VGPs). Some signalling flows of VGP are also described in Appendix I.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T F.749.1] Recommendation ITU-T F.749.1 (2015), *Functional requirements for vehicle gateways*.
- [ITU-T F.749.2] Recommendation ITU-T F.749.2 (2017), *Service requirements for vehicle gateway platforms*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 driver-vehicle interface (DVI) [ITU-T F.749.2]: The integrated user interface for the vehicle. It includes visual displays, loudspeakers, microphones, manual input controls, etc.

3.1.2 functional entity [b-ITU-T Y.2012]: An entity that comprises an indivisible set of specific functions. Functional entities are logical concepts, while groupings of functional entities are used to describe practical, physical implementations.

3.1.3 intelligent transport systems (ITS) [b-ITU-R handbook]: ITS can be defined as systems utilizing the combination of computers, communications, positioning and automation technologies to improve the safety, management and efficiency of terrestrial transport systems.

3.1.4 nomadic devices [ITU-T F.749.1]: Nomadic devices include all types of information and communication as well as entertainment devices that can be brought into the vehicle by the driver and/or passengers to be used while driving. Examples include mobile phones, portable computers, tablets, mobile navigation devices, portable media players and multi-functional smart phones.

3.1.5 remote user interface (UI) [ITU-T F.749.2]: An approach to realize the interaction between applications in nomadic devices and the driver-vehicle interface (DVI). The UI of applications in nomadic devices can be displayed in the vehicle's touch screen and drivers are able to control the applications through DVIs (touch screen, buttons etc.). A remote UI can help drivers avoid distraction from applications and thus reduce the probability of accidents.

3.1.6 telematics [b-ISO 15638-16]: Telematics is the use of wireless media to obtain and transmit (data) from a distant source.

3.1.7 vehicle gateway (VG) [ITU-T F.749.1]: A VG is a device in a vehicle that enables communications between a device in the vehicle and another device which may be physically located either inside the vehicle or outside the vehicle (e.g., roadside station, cloud-based server, etc.). A VG provides standardized interfaces and protocols, communications across heterogeneous networks, optimized network selection based on application needs and network QoS, arbitration and integration of network communications, security and switching network connections to maintain service continuity.

3.1.8 vehicle gateway platform (VGP) [ITU-T F.749.1]: A VGP is the collection of ICT hardware and software in a vehicle operating as an open platform to provide an integrated runtime environment for delivering the communications services of a VG. A VGP may also provide higher layer communications services such as interaction with the driver through the driver-vehicle access services and so on. Subsystems dedicated solely to vehicle operation are not considered part of the VGP. Supported applications/services include ITS and infotainment.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
CAN	Controller Area Network
CI	Communication Interface
DLL	Data Link Layer
DVA	Driver Vehicle Access
EAP	Extensible Authentication Protocol
ECU	Electronic Control Unit
ETC	Electronic Toll Collection
GPS	Global Positioning System
GRE	Generic Routing Encapsulation
HUD	Head Up Display
ICT	Information and Communications Technology
IP	Internet Protocol
ITS	Intelligent Transport System
L2TP	Layer 2 Tunnelling Protocol
MAC	Medium Access Control
MAN	Metropolitan Area Network
MIB	Management Information Base
NAT	Network Address Translation
OSI	Open System Interconnection
POI	Point Of Interest
PPTP	Point to Point Tunnelling Protocol

PSAP	Public Service Answering Point
QoS	Quality of Service
RSU	Roadside Unit
SAM	Situational Awareness Management
SIM	Subscriber Identification Module
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TLS	Transport Layer Security Protocol
TSP	Telematics Service Provider
UDP	User Datagram Protocol
UI	User Interface
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
VG	Vehicle Gateway
VGP	Vehicle Gateway Platform
VPN	Virtual Private Network
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network
WWAN	Wireless Wide Area Network

5 Conventions

In this Recommendation:

- The keywords "shall" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.
- The keywords "should" indicate an optional requirement which is permissible. This term is not intended to imply that the vendor's implementation must provide the option, and the feature can be optionally enabled by the vendor. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Introduction

Figure 1 shows VGP positioning in the intelligent transport system (ITS) reference model: there are six major scenarios, i.e., vehicle to vehicle, vehicle to infrastructure, vehicle to cloud-based server, vehicle to nomadic device, vehicle to pedestrian/bicycle and interaction with in-vehicle network scenarios.

- The vehicle to vehicle (V2V) scenario mainly describes the safety and auto-driving scenarios in which vehicles communicate with each other.
- The vehicle to infrastructure (V2I) scenario mainly describes the safety, electronic toll collection (ETC) and traffic information exchange scenarios in which vehicles communicate with roadside infrastructures.
- The vehicle to cloud-based server scenario mainly describes the emergency call and telematics scenarios in which vehicles communicate with cloud-based services.

- The vehicle to nomadic device scenario mainly describes the telecommunication and remote user interface (UI) scenarios in which vehicles connect to nomadic devices.
- The vehicle to pedestrian/bicycle scenario mainly describes the safety warning scenarios in which vehicles communicate with the devices carried by pedestrian/bicycles.
- Interaction with the in-vehicle network scenario mainly describes the vehicle diagnostics, remote data collection and vehicle remote control scenarios in which a VGP communicates with the proprietary in-vehicle network.

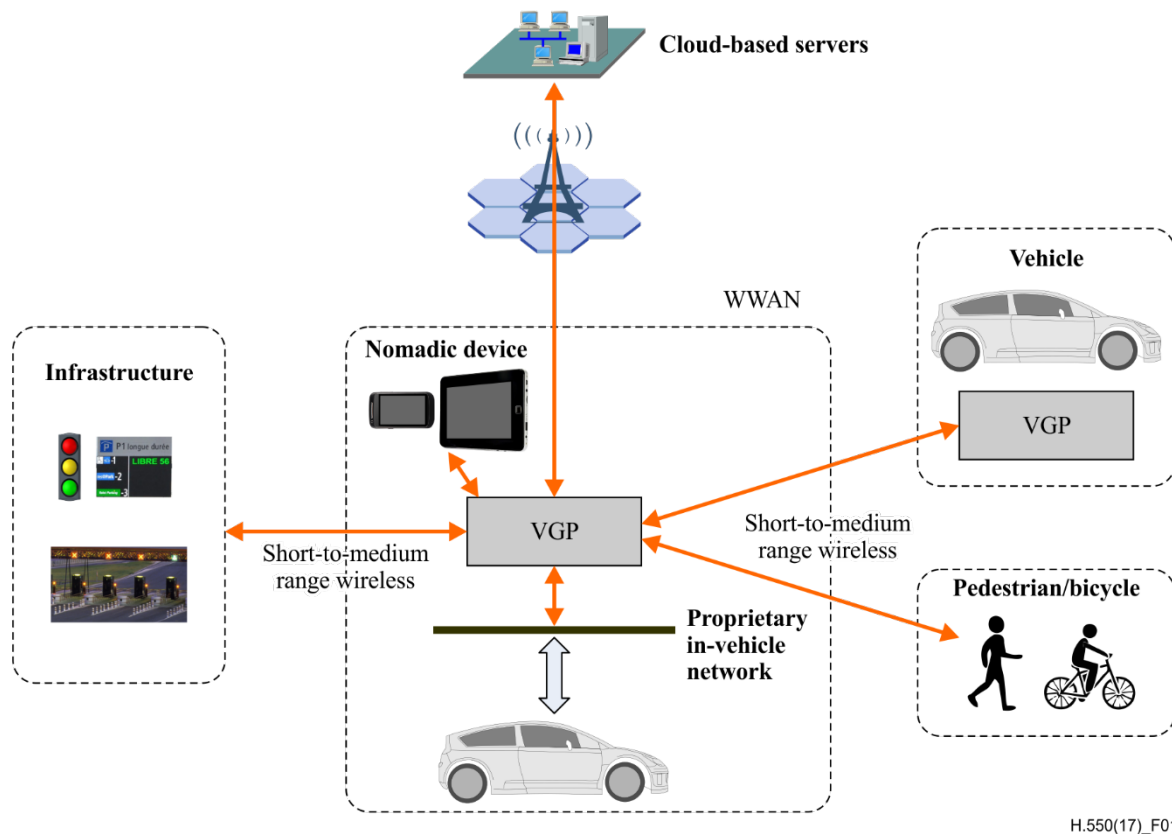


Figure 1 – Location of VGP in the ITS reference model

7 Architecture of VGP

Figure 2 presents the high-layer architecture of VGPs. The functionalities in the various subsystems of a VGP include:

- vehicle gateway
- services
- service functionalities
- management.

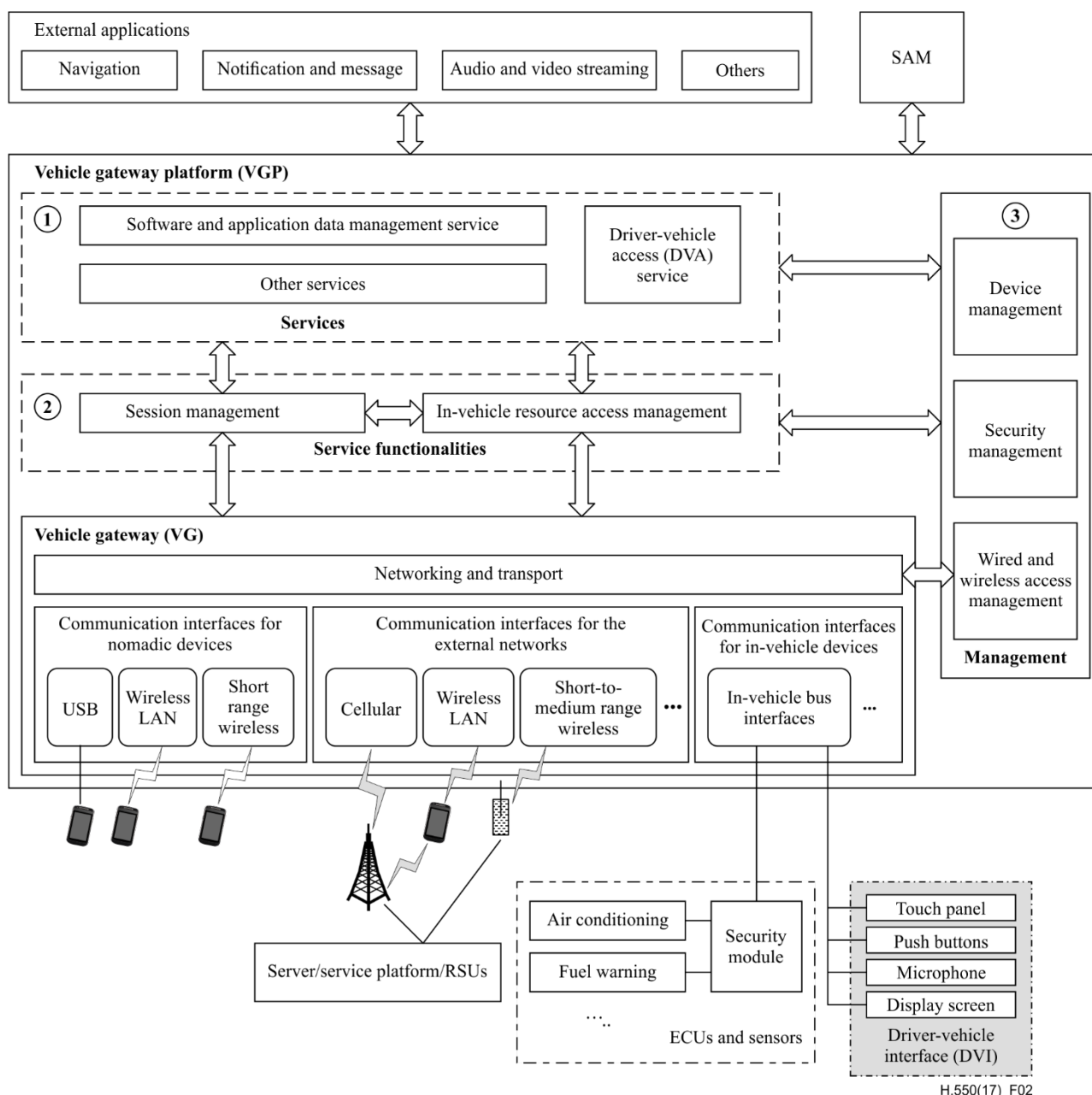


Figure 2 – High-level architecture of a VGP

The VGP services include software and an application data management service, driver-vehicle access service, and other services (see block (1) in Figure 2). Service functionalities include session management and in-vehicle resource access management (see block (2) in Figure 2). Management includes device management; security management and wired and wireless access management (see block (3) in Figure 2). Services support external applications such as navigation and infotainment to accomplish the session establishment, data format conversion and specific processing. A general description of the services and management of a VGP are presented below.

- **Vehicle gateway:** The VG functionality covers OSI layers 1 to 4. It includes transport functions, networking functions and network access functions.
- **Services:** Services support basic service capabilities for applications running and data / message processing. It includes the driver-vehicle access (DVA) service, software and application data management service, and other services.
- **Service functionalities:** Service functionalities support service management functions such as session management and in-vehicle resource access management.