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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

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

Architecture of vehicular multimedia systems

Recommendation ITU-T H.551

ITU-T

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Recommendation ITU-T H.551

Architecture of vehicular multimedia systems

Summary

Recommendation ITU-T H.551 defines the configuration for vehicle multimedia systems (VMSs), the reference model of VMS architecture, and the reference solution for VMS multimedia applications. VMS security issues and personally identifiable information protection and privacy issues are also described.

History

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Recommendation ITU-T H.551

Architecture of vehicular multimedia systems

1 Scope

This Recommendation defines the features and configurations of vehicle multimedia systems (VMSs) and the reference model of VMS architecture. The reference model of vehicular multimedia service platform, the reference protocol stack for convergence transmission, and the reference receiver model of in-vehicle devices for VMS multimedia applications are also defined. VMS security issues and personally identifiable information protection and privacy issues are described as well.

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.749.3] Recommendation ITU-T F.749.3 (2020), *Use cases and requirements for vehicular multimedia networks*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 vehicular multimedia networks (VMN) [ITU-T F.749.3]: The VMN consist of the vehicular multimedia service platform (VMSP), broadcast and communication networks, and the vehicle multimedia system (VMS) in the vehicle.

3.1.2 vehicular multimedia service platform (VMSP) [ITU-T F.749.3]: The VMSP is a platform in the cloud that enables the multimedia service for end-user(s) in the vehicle.

3.1.3 vehicle multimedia system (VMS) [ITU-T F.749.3]: The VMS consists of vehicle multimedia system inputs (VM I/P), vehicle multimedia unit (VMU) and vehicle multimedia system outputs (VM O/P).

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 VMS core function: A function that deals with the physical, functional and logical data of VMS.

3.2.2 VMS associated function: A function that only receives and displays functional and logical data from other systems or sub-systems.

3.2.3 VMS shared function: A function that is used by other systems or sub-systems to share the physical, functional and logical data and control information.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ADAS	Advanced Driver Assistance System
AM	Amplitude Modulation
ANC	Active Noise Cancellation
APP	Application
AR	Augmented Reality
AVM	Around View Monitoring
bCall	Breakdown Call
BGS	Background Scan
CA	Conditional Access
CDN	Content Distribution Network
CDR	Convergent Digital Radio
DAB	Digital Audio Broadcasting
DASH	Dynamic Adaptive Streaming over HTTP
DMS	Driver Monitoring System
DNT	Do Not Track
DRM	Digital Rights Management
DTTB	Digital Terrestrial Television Broadcasting
eCall	Emergency Call
ECM	Entitlement Control Message
ECU	Electronic Control Unit
EMM	Entitlement Management Message
FM	Frequency Modulation
GDPR	General Data Protection Regulation
HEO	High Earth Orbit
HLS	HTTP Live Streaming
HMI	Human Machine Interface
HTTP	Hypertext Transfer Protocol
HVAC	Heating, Ventilation and Air Conditioning
IAM	Identity and Access Management
IBOC	In-Band On-Channel
iCall	Information Call
IP	Internet Protocol
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEO	Low Earth Orbit

MR	Mixed Reality
NAT	Network Address Translation
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OLED	Organic Light Emitting Diode
OS	Operating System
OTA	Over The Air
PD	Phase Diversity
PII	Personally Identifiable Information
PUF	Physical Unclonable Function
RDS	Radio Data System
RF	Radio Frequency
RVC	Rear View Camera
TCP	Transfer Control Protocol
TMC	Traffic Message Channel
UDP	User Datagram Protocol
V2I	Vehicle-to-Infrastructure
V2P	Vehicle-to-Person
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-Everything
VM	Vehicular Multimedia
VM I/P	Vehicle Multimedia System Inputs
VM O/P	Vehicle Multimedia System Outputs
VMN	Vehicular Multimedia Network
VMSP	Vehicular Multimedia Service Platform
VMS	Vehicle Multimedia System
VMU	Vehicle Multimedia Unit
VR	Virtual Reality

5 Conventions

In this Recommendation:

- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.
- The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

- The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this Recommendation can still be claimed even if this requirement is present.

6 Background

In this Recommendation, the features and configurations of vehicle multimedia systems (VMSs) and the reference model of VMS architecture are defined in compliance with the requirements in [ITU-T F.749.3]. The reference model of vehicular multimedia service platform (VMSP), the reference protocol stack for convergence transmission, and the reference receiver model of in-vehicle devices for VMS multimedia applications are also defined. VMS security issues, personally identifiable information (PII) protection and privacy issues are defined as well.

The Recommendation is organized as follows:

Clause 7 defines the features and configurations of VMS. Clause 8 defines the reference model of VMS architecture. Clause 9 defines the reference model of VMSP, the reference protocol stack for convergence transmission of multimedia contents over heterogeneous networks, and the reference receiver model of in-vehicle devices. Clause 10 addresses VMS security issues. Clause 11 addresses PII protection and privacy issues.

7 VMS features and configurations

7.1 VMS features

VMS features are determined based on the following principles:

- User experience, entertainment and information features and applications for the driver and the passenger.
- Market, regional and country specific requirements.
- Legal and mandatory requirements.

However, VMS features do not describe the overall network architecture of vehicles or the integration of multiple domains in vehicles.

7.2 VMS configurations

VMS configurations are based on the following principles:

- VMS configurations define standalone requirements for entertainment and information display to driver and passenger.
- VMS configurations are recommended to be defined at the level of features and functions.
- VMS configurations are recommended to include hardware components within the VMS.
- Multiple VMS configurations are possible.
- VMS configurations are recommended to be highly variable. Both OEM-built and after-market plug-in VMS products are recommended to be considered.

However, VMS configurations do not describe the overall network architecture of vehicles or the integration of multiple domains in the vehicle.

7.2.1 Deciding factors

VMS configurations are determined based on the following deciding factors:

- Usage requirements.
- Features, functional requirements.
- Interface requirements.

- Cost requirements.
- Benchmarked requirements.

7.3 List of VMS features

The reference VMS features are summarized in Table 1.

Table 1 – Reference VMS features

Features	Sub-features	Configurable
Human machine interface (HMI)	Display technology	Light emitting diode (LED)/liquid crystal display (LCD)/organic light emitting diode (OLED), etc.
	Number of displays	Multiple (front, central, rear, etc.)
	Control	Traditional controls: Button / knobs / touch controls, etc.
		Intelligent controls: Voice control, face recognition, voice biometric, gesture, personalization, eye movement control, tactile-flexible feedback touch, etc.
	Multi-screen interaction	Push information to different screens
		Video file synchronous or asynchronous display
		Dual navigation display
		Free matching of the display interface
	System language	User interface: Different language requirements as mandated by regulations
	Display for camera	Rear view camera (RVC) / Around view monitoring (AVM)
Broadcast	Terrestrial	Analogue: Amplitude modulation (AM) broadcasting, frequency modulation (FM) broadcasting, FM broadcasting with dual tuner and phase diversity (PD), FM broadcasting with background scan (BGS), Radio data system (RDS), etc.
		Digital: Digital audio broadcasting (DAB), digital terrestrial television broadcasting (DTTB), in-band on-channel (IBOC) technologies, convergent digital radio (CDR), etc.
	Satellite	Satellite audio/video services (e.g., satellite audio/video streaming service)
External Network Connectivity	Cellular networks	3G/4G/5G
	Satellites bi-directional	Low earth orbit (LEO) satellite bi-directional communication networks
		High earth orbit (HEO) satellite bi-directional communication networks
	Vehicle-to-everything (V2X)	Vehicle-to-vehicle (V2V), Vehicle-to-infrastructure (V2I), Vehicle-to-person (V2P)
	Wireless local area networks	IEEE 802.11 hotspots
		Hands-free calls and music playing using personal area networks