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“Vehicular Multimedia Use Cases and Requirements”

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interdigital™

FG-VM: Vehicular Multimedia



Vehicular multimedia system

- 4th screen after *TV, PC & Mobile Phone*
- 3rd infotainment space after *home, office*

Aim of FG-VM: delivering multimedia to vehicles

- Integration of Terrestrial and Satellite networks
- Integration of Broadcasting and Internet services
- Reduce costs using converged networking
- Provide wide area coverage with good QoE



Source: <https://www.hlmediacomms.com>

Challenges

- Integration and compatibility with mobile communication: 3, 4, 5G and beyond
- Harmonization of Transport regulations
- Variety of Privacy and security related regulations
- Upcoming codecs and transport protocols

Focus Group on Vehicular Multimedia FG-VM



WG1 - Vehicular Multimedia use cases and Requirements

- **Chair:** Gaëlle Martin-Cocher (InterDigital, Canada)
- **Vice-chair:** Kaname Tokita (Honda, Japan)
- **Vice-chair:** Lu Yu (Changan Automobile Co, LTD, China)
- **Vice-chair:** Guo Yansong (Great Wall Motor Co, LTD, China)
- Deliverables:
 - [[Flipbook](#)] Use cases and requirements for the vehicular multimedia networks"
 - **Recommendation ITU-T F.749.3 (ex F.VM-URVMN) (July 2020)**
 - Vehicle Domain dynamic map Service (VDS) related work spun of in a joint ITU-T SG16 and ISO TC22 WG

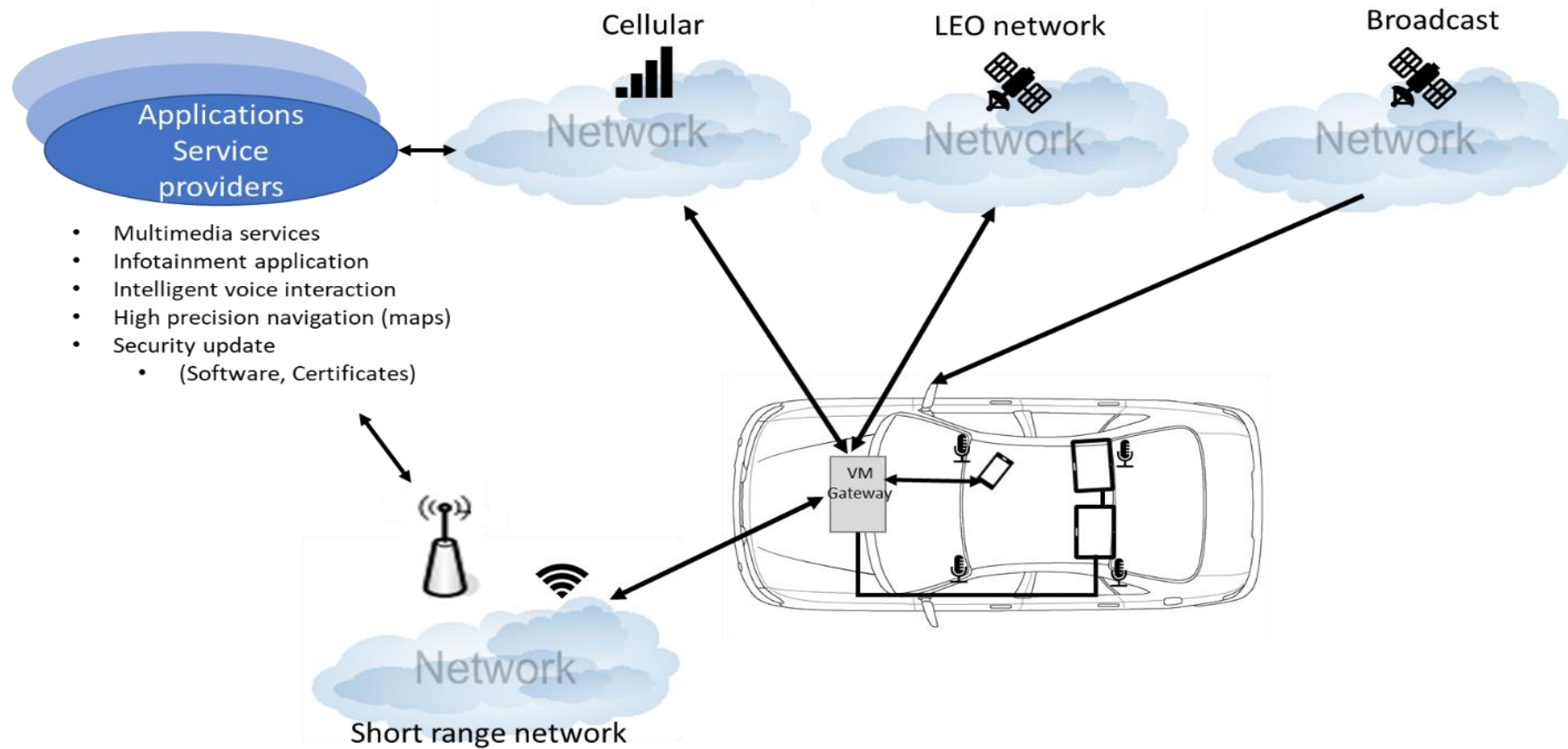
WG2 - Vehicular Multimedia Architecture

- **Chair:** Yajun Kou (Global Fusion Media Technology and Development Co. Ltd, China)
- **Vice-chair:** Dimitri Konstantas (University of Geneva, Switzerland)
- **Vice-chair:** Jie Li (China Telecom, China)

WG3 - Implementation aspects of Vehicular Multimedia

- **Leadership:** to-be-appointed

Overview



FG-VM: Multi Networks Connectivity



Scenarios:

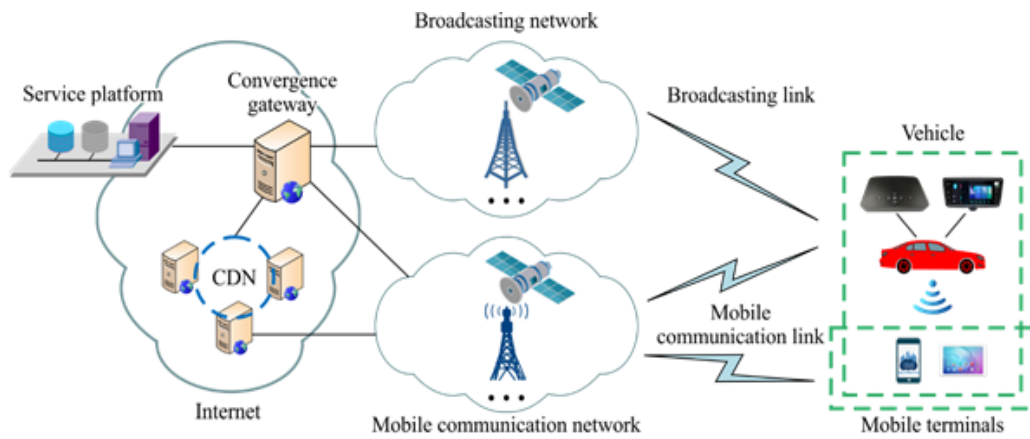
- cost of mobile Internet may impede wide deployment of VM systems
- wireless coverage may be an issue
 - Signal strength can be poor or non-existent
 - Congestion



FG-VM Connectivity Requirements

- Connect simultaneously and provide seamless handoffs between communication networks:
 - 3G/4G/5G cellular networks.
 - Low Earth Orbit bi-directional communication networks
 - Satellites with both broadcast and bi-directional communications.
 - Short range networks
 - Terrestrial broadcast networks
- Inclusive of bi-directional and broadcast communication networks
- Transmission and reception functions shall be agnostic to the underlying physical layer transmission standards and transparent to the upper layer applications
- Shall require none or minimum modifications to the existing broadcasting and mobile communication infrastructures and shall be compatible with major media streaming and broadcasting protocols

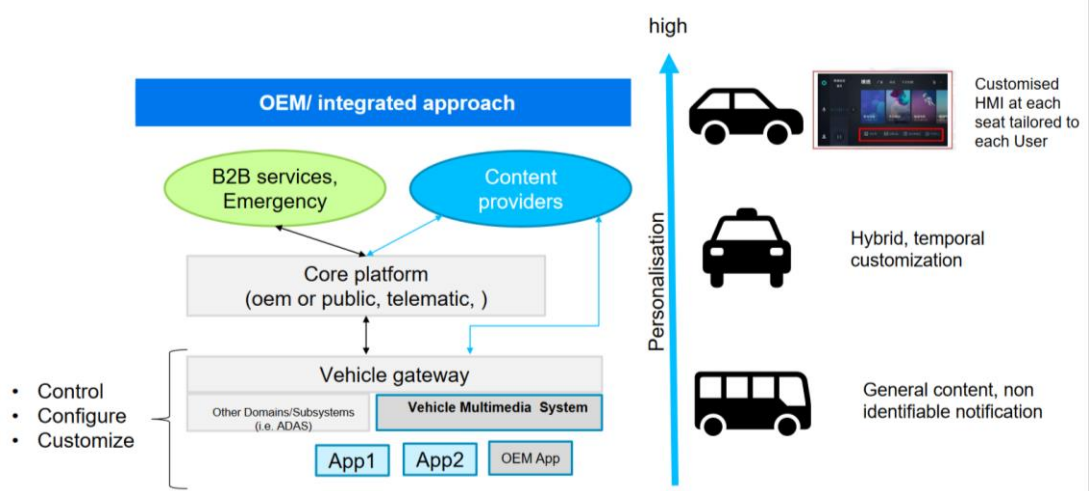
FG-VM Content delivery



FG-VM Content Delivery Requirements

- Deliver different channels, to different users/screens
- Content sharing within the vehicle (e.g. from phone)
- Conditional Access and DRM
- Parental control
- User controlled, upload and download of user viewing history.
- Content subscription link to user, to the vehicle, to device
- Content right and privilege management system

FG-VM Personalisation and Integration



FG-VM Personalization and Integration Requirements

- Customization of HMI based on User ID
- Portability of personalized HMI
- Seamless integration of apps in the multimedia system
- Preloaded content link to the vehicle
- ID & Account management
- Driver/Passenger differentiated customization
- Voice command
- Speech recognition, speech to text
- Gaze command
- Sensor command in and outside the vehicle
- Various projection/screen types

FG-VM Use-cases vs Autonomous Driving Levels



SAE J3016 Definition of Driving Levels

Use Case	SAE LEVEL 0		SAE LEVEL 1		SAE LEVEL 2		SAE LEVEL 3		SAE LEVEL 4		SAE LEVEL 5	
	D	P	D	P	D	P	D	P	D	P	D	P
Listen to audio services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Use video, TV and gaming services		✓		✓		✓		✓	✓	✓	✓	✓
Use mobile devices		✓		✓		✓	(✓)	✓	✓	✓	✓	✓
Use mobile devices through VMS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phone conferencing (handsfree)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Video conferencing		✓		✓		✓		✓	✓	✓	✓	✓
Reading in vehicle (books, mails, news, etc.)		✓		✓		✓		✓	✓	✓	✓	✓
Getting read content (text-to-speech)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Working in vehicle (office applications)		✓		✓		✓		✓	✓	✓	✓	✓

✓ = Allowed

(✓) = Partly Allowed (in autonomous driving mode)

Matching of Generic multimedia use cases with SAE Driving Levels

Privacy regulations and FG-VM



Photo Source: USDOT

https://www.its.dot.gov/factsheets/pdf/Privacy_factsheet.pdf

US department of Transport:

- Vehicle shall not be tracked
- PII shall not be collected and shared.



Photo Source: European Commission

https://ec.europa.eu/commission/priorities/justice-and-fundamental-rights/data-protection/2018-reform-eu-data-protection-rules_en

EU GDPR:

- Protection of PII
- Obligations on service provider
- Right to be forgotten



SenseTime surveillance software, Beijing
Photo source: thomas peter/Reuters

China:

- Vehicle are equipped with RFID chips
- Vehicle tracking is required

FG-VM Privacy Requirements

- Design should allow for different privacy regulations
- Opt-in/opt-out
- Secure log-in/log out via phone, screens
- network-layer identifiers shall not be used as PII
- Protect private conversation when voice recognition is used(particularly cloud base)

FG-VM Security Requirements

- End-to-end data protection
- Protect any permanent hardware identifiers and only allow access for authentication purposes
- Isolation from other vehicular control systems

Various configurations



- **FG-VM allows for multiple configurations**
 - After market (M0)
 - Integrated, with different levels of services (M1 to M5)
- **Media display and media format capabilities:**
 - Text.
 - Image.
 - Audio: Normal audio and high-fidelity audio.
 - Video: Normal video, 4K/8K video, AR and VR.
 - Holographic projection and image.
- **HMI control capabilities**
 - Button
 - Touch screen
 - Intelligent control (speech control/gesture control/eye movement control)
- **Networks connectivity capabilities:**
 - 3G/4G/5G cellular networks.
 - Satellites bi-directional communication networks,
 - Satellites / terrestrial broadcast networks.
 - Short range networks and/or local area wireless networks.
 - V2V and V2I networks.
 - Brought-in, built-in and hybrid connectivity.

Entertainment Functions	Social use Functions	Office use Functions	Game play Functions
1. Music playback: Local music/CD-AUX-SD-USB	1. Pre-installed customized social software for the car and in-car social support is in the following formats: text, pictures, voices, small video social and Live social, interactive games social	1. Support for on-board video conferencing (supports real-time screens, does not support file picture sharing), voice memos, voice memos, text and voice memos, and memos shared to mail/social software, Support for tablet recording memo	1. Co-driver or main driver parking can support small games based on gesture recognition, such as cutting fruit;
2. Radio: FM-AM/Online Internet radio	2. Communication social: Support for short-range connections phones (headphone-free, multiple-way calls, unheard-of content between different passengers) and headphone conduction calls (single support)	2. Calendar event phone, two-way synchronization (car cannot only see, but also can be edited)	2. Racing games based on the steering wheel when parking
3. Video playback: Local video	3. Support complex team travel: positioning, navigation screen sharing, support mobile bus route planning sharing, route 3D visualization	3. The rear windshield supports the inspection and editing of mail;	3. Mini games (question and answer games based on voice interaction)
4. Support mobile connectivity solutions		4. Support for handwriting/review/forwarding messages when parking	4. Parking support: on-board version of online competitive games;
5. Voice interaction: Smart voice interaction to Get Through the Internet Service Ecology		5. Front row supports on-board custom office software operations based on holographic projection/gesture recognition/eye control (in conjunction with hardware)	5. Games that support holographic projection and holographic interaction
6. Simple multi-screen interaction: Display entertainment function information on the instrument screen/HUD/air conditioning control screen, which can be easily interacted by protocol			
7. Multimedia entertainment information system platform and rich content resources with the fusion of satellite broadcasting networks multi-satellite and terrestrial cellular networks			
8. AR enhanced display can be applied on any screen, including HUD and Centre Screen			
9. Customized holographic projection, users can display the contents of the screen in multiple areas of the car, not only to support display, but also to support interaction, similar to virtual assistant			
10. Driver video recording, Driver Monitoring System, Around view Monitoring Cameras			
11. Gesture Recognition capability			
12. Voice Biometric identity			

M5 configuration

Thank you.
Join us to progress the work of FG-VM!

