An OSGi based HMI for networked vehicles

Telefónica I+D
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Networked Vehicle
Networked Vehicle

• Tomorrow, the vehicles will be networked
  • Using Always Best Connected communications
    • An on-board communications gateway chooses the best available option for the given service requirements and user preferences
  • Examples of networked applications:
    • Fast communications exchange among vehicles to warn about incidents or dangerous situations → using vehicular ad-hoc networks (VANET)
    • High-quality services like VoIP → using either VANETs or cellular networks (GPRS or UMTS)
Networked Vehicle: vision of Telefónica I+D

- Vehicle + Infrastructure = Intelligent Environment
  - Joint consideration of vehicle and its context

**Services**
- New value-added services
  - for the vehicular user
  - for door-to-door mobility
- Requirements and spec’s

**Communications**
- Hybrid node (OSI layer 3)
- Infrastructure integration
- Gateway on board
- VANETs
- Security in cellular and IMS

**Demonstration**
- V2I
- V2V
- service platform
- in-vehicle integration
Some services

1. Security (anti-theft) and park location service
2. Driver Information service
3. Remote vehicle diagnostics, advice and help service
4. Fleet Management service
5. Productivity service (mail and Internet access)
6. ADAS service
7. Safety service (collision avoidance)
8. Safety service (early warning)
9. Passenger and Infotainment service (video streaming)
10. Enhanced e-Call service
Moving to the new scenario
Change drivers (towards Networked vehicles)

- Business
  - Opportunity of offering new added value services
- Technology
  - It’s feasible to provide technical solutions
- User experience
  - Improve the user experience for already available services
- Safety
  - Not only the user is concerned about his security, public authorities invests enormous effort trying to decrease the number of accidents
- Efficient use of resources
  - Improve traffic flow
Change actors

- The current available infrastructure isn’t enough
  - Massive new infrastructure deployment
- Services should run on a high number of vehicles
  - Standardization to reach critical mass
- The number of implied technologies is overwhelming
  - No one single actor dispose of these technologies
Change actors

It must be a shared effort!

Public authorities have a key role
Public Programs

• European Commission eSafety Program
  • About 95% of accidents depend on **driver errors**
  • Main objective: cut the number of fatal traffic accidents by another half by 2010
  • Progress of reducing serious road accidents reached through:
    • **passive safety** (safety cells, airbag, seat belt usage, etc.)
    • **active safety** (ABS Anti-Lock Brake, ESC - Electronic Stability Control)
    • control and enforcement
    • driver awareness and training
  • **Networked systems** are on the rise but necessary parallel investments in infrastructure lack behind in many countries

• Other example: U.S. Department of Transportation
  • ITS (Intelligent Transportation Systems) Joint Program
Human Machine Interface for networked vehicles
HMI for networked vehicles

- A **safe HMI** is a key factor to reach the scenario
  - both users and public authorities demand it
  - maximizing the safety benefits of new ADAS (Advance Drive Assistance Systems)
  - drivers have the control
    - have into account user preferences
High level requirements

• Must not distract the driver (adaptive behavior)
  • selecting which information is presented to the driver

• Several channels for driver-vehicle interaction
  • voice and little displays when driving

• Increase situational awareness
  • provide useful information to the driver about the situation of the vehicle and the roads

• Avoid annoyance HMI behavior
  • the potential safety impact depends on systems actually used by drivers

• Nomadic devices
Why OSGi

• Complex environment
  • Modularity and SOA style programming

• Dynamic
  • dynamic deployment of modules and discovery of services

• Maintenance
  • Remote management

• Reduction of costs
  • Standard (and open)
  • Portability
  • Reutilization

• Some problems
  • High priority messages have (almost) RealTime requirements
Flow of HMI messages

- HMI Service
- Application Instance
- HMIEvent Handler

Messages Buffer and Dispatcher

Interaction Contexts and HMI Resources

Interaction Manager

Voice Manager
- TTS
- ASR

Audio/Micro Manager

GUI Manager 1

Haptic Manager

GUI Manager N
Scheduler and priority manager

Context Information: CAN Bus, ADAS generated events, UPnP, Zigbee
Priority Manager
HMI Messages characterization

Messages
  - Importance
  - Nature
  - Time Constraint
  - Access Frequency
  - Workload
  - Possible Interfaces

Risk
  - Relevance

Duration
  - Deadline

Voice and GUI 1
  - Voice and GUI 2
  - Voice
  - GUI 1
  - GUI 2

Preference order
Priority Manager
Priority evaluation

• The priority Manager takes into account
  • All the parameters associated to the message
  • All the context information
  • Available resources:
    • Existing interfaces
    • Applications using interfaces
  • Current driver workload
    • Driver capacity to manage different tasks concurrently

• The resolution may be to accept the message with its preferred interface, select other interface of the list or deny the message
  • In case of accepting the message, it may interrupt other sources
OSGi VEG Standardization

• ¿What HMI functionalities must be standardized?
  • HMI Service and HMIEventHandler
  • Applications and HMI Messages characterization
  • Priority
  • Nomadic devices

• Other areas of standardization
  • Communications interface for the “Always Best Connected” node: CALM based
Telefónica I+D
Networked vehicles group
About Networked Vehicles Group

- Created in 2007 from in-house experience in vehicular networking
- Strong focus on vehicular services and communications
  - Advanced services for the vehicular environment
  - Vehicle to vehicle (V2V) and to infrastructure (V2I) communications
  - Proof of concept, demonstrations and field operational tests (FOT)
- Participation in 10+ R&D projects, highlighting:
  - Ongoing: FP6-GOODROUTE, FP6-SAFESPOT, EUREKA-CaringCars, Spanish CENIT-MARTA, Spanish PSE-m:Vía (leader)
  - Due: FP6-MYCAREVENT, FP6-COM2REACT, Telefónica eCar
- Participation in a number of related fora and technology platforms:
Demonstrator for Intelligent Vehicular Environments (DRIVE)

- Fully developed by Telefónica I+D
- One logical architecture
- Several implementation scenarios for the in-vehicle system
  - Embedded (car manufacturer)
    - Open API for third-party providers
  - Aftermarket
- Nomadic
DRIVE Demonstrator
DRIVE Demonstrator

Communications (gateway in vehicle)

Framework for developing and executing services + Local services

Interface with user and vehicle (HMI)

Wireless sensors, devices and terminals in the vehicle

Vehicle sensors and actuators

External Comm’s

Roadside elements

Other vehicles

Cellular network

Services In network

CAN bus
Steering wheel
Display
Service Platform

BASIC SERVICES

- Scheduler
- HMI Manager
- Logging
- Location
- Navigation
- Navigation
- CALM Comms.
- Telephone
- AA Security
- Vehicle API
- CAN Bus
- Alarms
- WS engine
- UPnP
- Remote Management

OSGi Framework R4

Java Virtual Machine

Drivers
- WIFI, 3G, WiMAX,…

Linux OS

- GPS
- CAN
- NFC
- Graphics
- Audio
- Bluetooth

TTS

ASR
Conclusions
Conclusions

- New scenario
  - Networked Vehicles
- Human Machine Interface is a key factor for the success of this vision
- OSGi technology provides an excellent base to build this system
Questions?
Thank you!
Documentation

- European Commission eSafety Recommendations
- OSGi VEG
  - Documentation of different OSGi VEG workshops
  - Requirements: RFP “HMI API High Level Requirements“, LogicaCMG
- “Advanced Driver Assistance Systems Information Management and Presentation”
  - Alexandre Dugarry, PhD Thesis
- Ami-C
- AIDE project
  - Adaptive Integrated Driver-vehicle InterfacE
- W3C Multimodal Interaction Activity
- Commercial vehicle HMI systems
  - Example: Microsoft Sync
- Spoken dialogue systems
  - OLYMPUS, DIPPER, SPHINX, PHOENIX, HELIOS, RAVENCLAW, ROSSETA, KALLIOPE