ISO TC 204 Automotive Use Cases and Derived Requirements

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Overview

• Purpose of this presentation
• Background on ISO Intelligent Transportation Systems (ITS) work
• ITS Architecture
• Scope of ISO/TR 13185 vehicle provisioning spec
  – Interface between Vehicle Mobile Gateway (VMG) and Nomadic Device (ND)
• ISO/TR 13185 use cases
• Requirements derived from these use cases
Purpose of this Presentation

• At the TR-50.1 meeting in Denver, the group agreed to obtain Smart Device use cases from different application domains and study their communication patterns in order to derive SDC requirements

• This presentation gives an overview of some Automotive use cases provided by ISO TC 204 and proposes some derived requirements
Document Background

  – Other parts of this series include:
    • Part 2: Vehicle Mobile Gateway (VMG) protocol requirements
    • Part 3: Vehicle Mobile Gateway (VMG) configuration requirements
    • Part 4: Vehicle Mobile Gateway (VMG) protocol compliance test cases

• Developed by ISO Technical Committee (TC) 204 (Intelligent Transportation Systems), Working Group 17
  – TC 204 charter: “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 intelligent transport systems (ITS) field.”
  – WG 17: Nomadic Devices in ITS Systems
ISO/TR 13185 defines “an XML based vehicle data transfer protocol between...a Vehicle Mobile Gateway (VMG) and the nomadic and/or mobile device”

- This protocol enables remote control and monitoring of vehicle systems and equipment, e.g. displaying engine warning/alarm conditions, changing seat positions
Definitions

• Vehicle Mobile Gateway (VMG)
  – In-vehicle interface device that acts as the mobile gateway between the vehicle’s Electronic Control Units (ECUs) and the external Nomadic Device

• Nomadic Device
  – Connects to the on-board unit in the vehicle to request and display information
  – Examples include PDAs, mobile phones, smart phones
ITS Communication Architecture

1. Vehicle Station
   - Vehicle Mobile Gateway
   - Vehicle Mobile Host
   - Vehicle Mobile Router

2. Personal Station
   - Bluetooth enabled Nomadic Device

3. Roadside Station
   - (Host/Router)

4. Central Station
   - Central System
Role of Vehicle Mobile Gateway (VMG)

**Key**
1. Vehicle Station: Vehicle Mobile Host and Vehicle Mobile Router
2. Personal Station
3. Roadside Station
4. Central Station
5. Vehicle Domain Architecture with optional VM Gateway
6. Automotive Multimedia Interface Domain Architecture
7. Firewall implemented in Vehicle Mobile Gateway
8. Vehicle Protocol converter to standardized XML based vehicle data transfer protocol
Benefits of Standard VMG-ND Interface

• Enables open access to vehicle information for current and future ITS services
• Supports commercial vehicle management through a single interface
• Enables addition of new services and use of new nomadic devices
• Allows drivers to be aware of their vehicle’s fuel-efficiency performance and CO$_2$ emissions
Use Case Categories

1. Requesting VMG and vehicle identification related information
2. Requesting vehicle and ECU data values
3. Requesting and clearing diagnostic trouble codes and related data
4. Unsolicited VMG messages
5. Controlling/adjusting vehicle equipment
6. Writing short- and long-term data to VMG
7. VMG Firewall Protection
8. VMG special features
9. Vehicle diagnostics
10. VMG maintenance
1. Requesting VMG and vehicle identification related information

- Browse available VMGs (version, vehicle type/model, etc) from ND
- Browse supported ECUs from ND
- Browse list of data items that can be obtained from each ECU
2. Requesting vehicle and ECU data values

- Request current value of an ECU data item, with ECU and data item IDs displayed
- Request “raw” ECU data item value only
- Request data ID text and data type information
- Request data type information only
- Request all available text and data type information
3. Requesting /clearing Diagnostic Trouble Codes (DTCs) and related data

- Request current active DTCs and status information for each ECU
- Request additional DTC data
- Clear DTC(s)
4. Unsolicited VMG messages

- **SendOnEvent** – emergency situation
  - When VMG triggered by accident event, emergency message sent to ND, which may also initiate an eCall

- **SendOnEvent** – critical driving situation
  - When critical driving situation (e.g. ABS or traction control engaged) occurs, warning message sent to ND

- **SendOnEvent** – safety situation
  - When e.g. anti-theft system activated, message with GPS position information sent to ITS service system

- **SendOnChange** – warning situation
  - Warning text sent from VMG to ND when the value of an ECU data item falls outside a min/max threshold range
5. Controlling/adjusting vehicle equipment

• Learn customer profile settings
  – Capture and store a customer’s preferred settings (seat control, sunroof & mirror positions, radio station pre-sets, etc)

• Control convenience system
  – Remotely control heat and air conditioning settings
6. Writing short- and long-term data to VMG

• Write data to VMG
  – Data written may include vehicle type/model, license plate and vehicle ID numbers

• Write vehicle profile to VMG
  – Enter data from vehicle manufacturer such as average fuel consumption

• Enable and disable functional system data IDs
  – User selects via ND the functional system data IDs to be sent by the VMG

• Write data ID thresholds to VMG
  – Define min/max threshold values for each data item (VMG SendOnEvent occurs when data item value outside range)
7. VMG Firewall Protection

• Secure access to VMG
  – Require user to enter login name and password to access restricted VMG functions

• Request VMG firewall status
  – Read status of firewall services and functions

• Configuration of VMG firewall
  – Control access to VMG memory areas, features and functions by applications and personnel
8. VMG special features

• General data exchange
  – Covers all data transfer between the VMG and ND by applications

• VMG activation mode
  – Allows VMG to capture events in a log file when ND is not connected

• Upload log file from VMG to ND
  – Enables ND to upload the latest event log file
9. Vehicle diagnostics

- Perform Functional Group On-Board Diagnostics (FG-OBD)
  - Enables user to initiate diagnostic tests for a vehicle functional group (emissions system, safety system etc)

- Perform Enhanced OBD (Enh-OBD)
  - Similar to FG-OBD

- Upload Vehicle State of Health (VSOH) log file from VMG
  - VSOH log file contains active DTCs, sent both to ND and to ITS back office to allow remote telemaintenance and diagnostics
10. VMG maintenance

- Update core software of VMG
  - Enables download and installation of new VMG software

- Perform a key on/off reset in VMG
  - Simulates driver key on/off sequence, power-cycles VMG

- Perform VMG hardware reset

- Upload VMG configuration file to ND
  - Enables ND to save current VMG configuration

- Download VMG configuration file to VMG
  - Restores a previously saved VMG configuration
  - May need to do this when VMG hardware or software is replaced
Discussion on Derived Requirements

• As with many SDC use cases, a gateway is involved in the 13185 use cases
  – But no WAN connectivity: the ND communicates over short-range wireless, and the VMG provides connectivity with the internal car network

• Many of the use cases could be realized with the URL naming scheme proposed by Peter in document TR501-20100527-004, e.g.
  – Listing all ECUs attached to the VMG and their data values
  – Controlling seat, sunroof, mirror settings

• Many of the use cases are basic device management
  – Reading and clearing diagnostic trouble codes
  – Event triggers (emergency, critical driving, safety situations)
  – Software and configuration file download and update
  – Firewall configuration
  – Log file generation and uploading

• Sending alarms when a data value falls outside a threshold range is a function that applies in other SDC vertical applications, e.g. health care