Legislated OBD in AUTOSAR and Vector Tools
Agenda

- Why be Concerned about Legislated OBD?
  
  AUTOSAR Diagnostic Solution
  
  Legislated OBD Support in Vector Tools
  
  Summary
Why be Concerned about Legislated OBD?

Demand is increasing

North America

- Passenger cars
  - SAE J1979 / SAE J2012

- Trucks, Off-Highway, Marine
  - SAE J1939-3
  - SAE J1979 / SAE J2012

Europe

- Passenger cars
  - ISO 15031

- Trucks since Euro VI
  - SAE J1939-3
  - ISO 27145

- Off-Highway/Marine
  - SAE J1939-3

China

- Passenger cars
  - ISO 15031
  - China6 (LD)

- Trucks
  - SAE J1939
  - ISO 27145
  - China6 (HD)

- Off-Highway/Marine
  - SAE J1939-3

Rest of world

- Passenger cars
  - SAE J1979 / SAE J2012
  - ISO 15031

- Trucks, Off-Highway, Marine
  - SAE J1939-3
  - SAE J1979 / SAE J2012
  - ISO 15031

- Off-Highway/Marine
  - SAE J1939-3

- Legislation continues to require more systems
- More vehicle types will require OBD in future
- After 2000, many countries introduced OBD, mostly based on CARB OBD-II or EOBD
- Increasing number of standards
Why be Concerned about Legislated OBD?

More OBD Domains

**OBD-Relevance**
- Initially engine controllers and ECUs close to engine
- Later more powertrain ECUs (Brake, AC, ..)

**OBD-Relevance**
- More ECUs
- New ECU domains
  - E.g. ADAS

With electrification and hybrid vehicles

More ECUs are OBD-relevant

---

ECM  TCM  AC
Camera  Radar  Steering
Wiper

ECM  TCM  AC
Camera  Radar  Steering

Wiper

FUTURE

---
Agenda

Why be Concerned about Legislated OBD?

- **AUTOSAR Diagnostic Solution**
  - Legislated OBD Support in Vector Tools
  - Summary
AUTOSAR Diagnostic Solution

Layered Architecture

MICROSAR is the Vector implementation of the AUTOSAR Standard.

Modules Implemented by MICRO SAR

1 Includes Adr, Eth, Fis, EthSw, Eth, Lin and Wdd
2 Functionality represented in FINSTm and SIBM
3 Different variants available
AUTOSAR Diagnostic Solution

Main Diagnostic Modules

- **Diagnostic Communication Manager**
  - Receive and Send diagnostic messages
  - UDS
  - OBD-II / WWH-OBD
  - Application layer timing
  - Diagnostic service dispatching
  - Diagnostic service processing
  - UDS session & security handling

- **Diagnostic Event Manager**
  - Monitor result processing
  - Event mapping to DTC(s)
  - DTC Status Managing
  - FreezeFrame capturing and storage
  - Extended Data capturing and storage
  - Reporting to Dcm

**Note:** A SAE J1939 DCM is also available
Diagnostic Event Manager – Optional Legislated OBD Functionality

- Support for US (J1979) and EU (ISO 15031/ISO 27145) requirements
- In Use Monitor Performance Ratio (IUMPR) calculation
- Mode $06 Diagnostic Test Result (DTR) management
- J1979 Mode data management
- DTC handling (healing & aging) according to legislated requirements
- Handling of Permanent DTCs
- Legislated Freeze Frame storage and reporting
- Auto generation of responses for all requested data managed by DCM/DEM (e.g. DTC readiness, IUMPR, freeze frame data...
AUTOSAR Diagnostic Solution

Functional Overview

- **SWC**
  - RTE
    - Function Inhibition state
  - Monitor SWC
    - Cycle Start...
  - Monitor SWC
    - Fault Reporting
  - SWC
    - Read
    - Write
    - Start Routine

- **Dcm**
  - Request FreezeFrame, DTC, ...
  - Provide FreezeFrame, DTC, ...

- **Fim**
  - IMUPR Locking
  - Report Event State

- **Diagnostics**

- **Memory Services**
  - NvM
    - Store/Retrieve FreezeFrames DTCs ...

- **Network Services**
  - PduR
    - CAN
    - ETH
    - ...
Simplified Dem Functions

**Monitor** (in Application)
- Report: Passed or Failed

**Debouncing**
e.g. 10 consecutive failed

**Increment IUMPR Numerator**
Max once per cycle

**Set Readiness**
Bit 6 "TestNotCompletedThis OperationCycle 1 -> 0"

**On qualified Failed**
- Status Bit Update (Pending/Confirmed)
- Start FreezeFrame Capturing
- Permanent DTC Entry?
- Aging / Healing

**Cycle**

**IUMPR**

**DEM Diagnostic Event Manager**
- Decouples monitors from DTC processing
- Diagnostic protocol Independent
- Legislation independent

**Conditions Met**
AUTOSAR Diagnostic Solution

IUMPR Managing in the Dem

Application provides
- Monitor result
- Denominator Increment Conditions

⇒ Everything else is done by the Dem

- Ratio stored per DTC, allows reporting per
  - smallest of group (OBD-II)
  - individual DTC
AUTOSAR Diagnostic Solution

AUTOSAR Approach

What about the AUTOSAR slogan

"Configuration instead of implementation"?

- Configure as much as possible
- Same behavior for same configuration
- Review reduced on configuration
  - Instead of code review
- Field proven in many projects
  - In many projects
  - For many OEMs
- Concentrate on what is important
- Let AUTOSAR do the nasty parts
Different regions have different OBD requirements and legislations
  - e.g. Confirmed DTCs
    - US: 2 Trips
    - EU: 3 Trips

Superset with variant selection on ECU startup
Basically all OBD projects require calibration
- Fine-Tuning DTC parameters, e.g. Debouncing or Readiness Group assignment

**Post-Build Loadable is the AUTOSAR Solution for Calibration of BSW Components**

AUTOSAR has a solution for all needs
- The solution can also be different than it used to be
- And you may need to adapt your development process
- But all the challenges are solved
AUTOSAR Diagnostic Solution

Further Advantages

For **OEM**
- **Common solution** for all ECU projects
- OBD requires **adjustment** and **consulting** only **once**
- **Minimized risks** for certification

For **Tier1**
- **Common solution** for different ECU projects and different OEMs
- Reuse of existing SW architectures
- Reduces required alignment with OEM
Why be Concerned about Legislated OBD?
AUTOSAR Diagnostic Solution

- **Legislated OBD Support in Vector Tools**

Summary
Legislated OBD Support in Vector Tools

At a Glance

- **CANdelaStudio**
  - Author Diagnostic Specification
  - Create CDD, ODX or OEM specific
  - OBD II: Mode & Data Defn

- **ODXStudio**
  - Edit ODX Data

- **vFlash**
  - Update ECU SW

- **CANalyzer/CANoe/CANape**
  - Test Functions and Diagnostics
  - OBD II: Mode & Data Display

- **CANoe.DiVa**
  - Auto Validate ECU Diagnostics
  - OBD II: Mode & Data Validation

- **Indigo**
  - Vehicle and System Diagnostics
  - OBD II: Mode & Data Display

- **AUTOSAR DCM/DEM**
  - Generate ECU SW Diagnostics

- **Other: J2534 PassThru & D-PDU API Drivers for HW interfaces**

**Training & Engineering Services** for perfect fit
Agenda

Why be Concerned about Legislated OBD?
AUTOSAR Diagnostic Solution
Legislated OBD Support in Vector Tools

Summary
Vector Supports OBD Systems

Summary

Separate OBD protocol & fault handling from the application

Low costs to realize legislated OBD

One ECU variant for all markets

Short time to market

Stable application

Let AUTOSAR do the nasty things for you!
For more information about Vector and our products please visit

www.vector.com

Author:
Craig, Jeff
Vector North America