Survey on ODX (open diagnostics data exchange)

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Abstract—Demands on the diagnostic applications to support modern vehicles have been increased. This is because the complexity of modern vehicles has grown. Today to diagnose modern vehicles have a difficult task. They need to keep up with rapid changes, variant management and complex systems. This makes it challenging to test them and develop in an efficient way.

These problems can be mitigated or solved with a simulator which the diagnostic application can be run against.

There are two common vehicle description formats: ODX and ASAP2. ODX contains many components that offer great flexibility such as its parameter, service structures and memory.

Keywords— **ODX=Open Diagnostic Data Exchange, ASAM=Association for Standardization of Automation and Measuring systems), XML =Extensible Markup Language, MCD =Measurement, Calibration, and Diagnostics, CAN= Controller Area Network) ,ECU =Electronic Control Unit , ISO =International Organization for Standardization.**

INTRODUCTION

Today's cars contain a large number of onboard computers which are there both to provide services for the driver and to perform fine-grained engine mechanisms.

It has become harder to develop diagnostic applications and service tools to support these systems, as the complexity of vehicle electronics has increased. Many diagnostic services of a vehicle use standardized communication interfaces which is required by law but many difficulties remain. The tool providers must offer more features than diagnostic read-outs .This is because the service technicians can perform their work with as few tools as possible. Complicated task for the service tool developer to support vehicle variation which involves various communication interfaces, software and hardware.

Many diagnostic tools include a simulation mode. It is used to test the application itself without the need to access real hardware. Uses for the simulation mode are for educational purpose, easier testing during development of the tool and demonstrational use.

Development of electronic networking
based on the example of
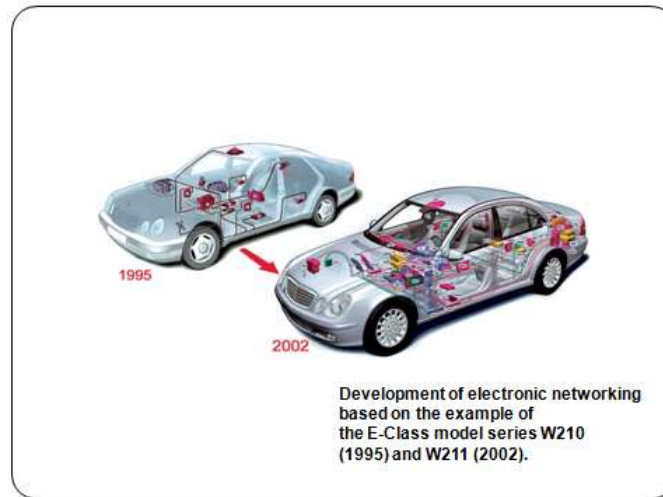the E-Class model series W210
(1995) and W211 (2002).

FIGURE 1: Development of electronic networking based on the example of the E-Class model series W210 (1995) and W211 (2002)

During the second half of the 1980s there is fast growth of electronic functions in vehicles. Firstly it led to many limited solutions that prevented comprehensive concepts from taking hold in the area of electrical architectures. A consolidation phase began at the beginning of the 1990s that was marked by development of electrical/electronic structures and associated networking topology from a inclusive perspective. This shows that its networking and electrical/electronic content could claim an undisputed position in the vehicle. The recognition that with the help of electronics many functions could only be implemented sensibly also prevailed. So the electronics' image transformed from being a necessary evil to being a key to new, innovative and interesting functions.

PROBLEM DESCRIPTION AND PURPOSE

- How are diagnostic applications being used?

- What are the needs of diagnostic applications.?

- Testing the diagnostic application.

- Better diagnostic application that can lead to better stability and performance for the end user.

- Easier testing against different vehicle versions and to add new hardware to simulate.

- Easier debugging during development and test of diagnostic application.

ODX(OPEN DIAGNOSTIC DATA EXCHANGE)

1.Diagnostic

Vehicle diagnostics describes the alignment of symptoms and fault detected to electronic components and sensor in vehicles. It covers methods and applications for fault analysis while repairing, quality control and statistics thru the vehicle life cycle. Additionally it informs and warns the driver about mal functions and possibly deactivation of vehicle components or functions. Generally vehicle diagnostics is divide in two parts:
➢ On Board (diagnostic functionality within the vehicle)
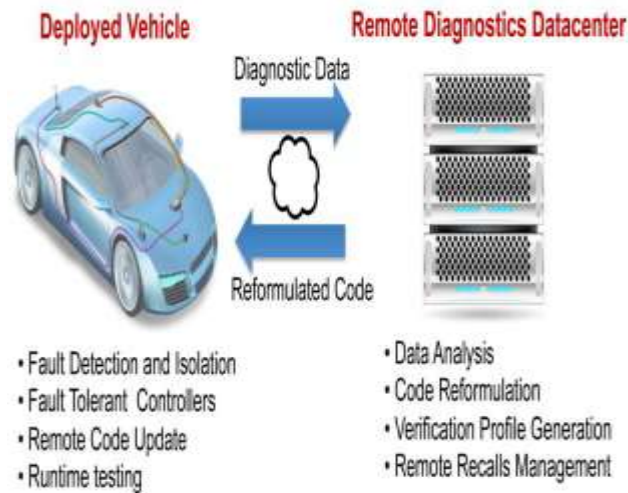➢ Off Board (diagnostic information and equipment outside the vehicle)

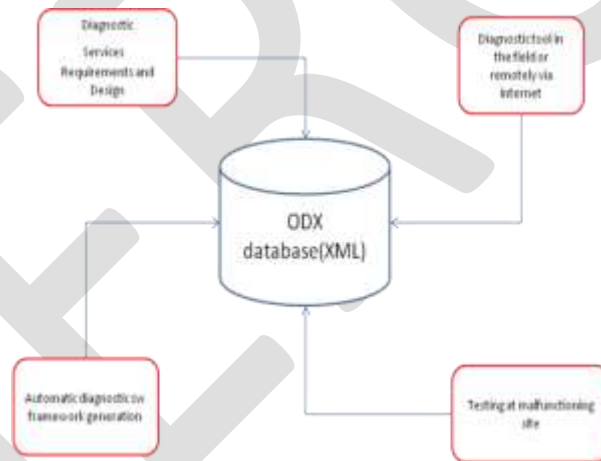FIGURE 2: Remote Diagnostics of automotive control systems[1]

FIGURE 3: *ODX context*

The goal behind ODX is to provide a single source of diagnostic information for the different parties involved in the car diagnostics. These parties include the software development team that designs and implements the diagnostics software, manufacturing staff and service personnel.

ODX defines the diagnostics services of a car type in an XML file. A diagnostic or testing tool from any vendor can read this XML file to configure itself to be able to perform diagnostic tests embedded into the car control system. Furthermore, the XML file can be fed as an input to a code generation tool to produce the framework for the diagnostic software of the electronic control units, thus speeding up the diagnostic software production process.

2.How ODX works

FIGURE 4: Basic structure of a diagnostic system[2]

In a sense, diagnostics in the vehicle industry means the communication between a test equipment (diagnostic tester – client) and the control units (ECU – server) using a diagnostic communication protocol. The link between the on-board and off-board is given by a diagnostic data base (e.g. ODX) describing all relevant information like parameters, request and responses and as well as conversion of data in physical values.

METHADOLOGY

ASAM

ASAM full form is Association for Standardisation of Automation and Measuring Systems. It was founded in December 1998 as an initiative of German Car manufacturers. This association provides standards for interfaces, data models, and syntax specifications for a variety of applications for example testing, evaluation and simulation. For the development of ASAM standards ,ASAM provides an professional project management platform which is efficient. ASAM head office is located near Munich, Germany. ASAM members are from the Automotive OEM, Tier One and tool supplier communities, as well as universities.

ISO

ISO (International Organization for Standardization) is the world's largest developer and publisher of International Standards. ISO is a network of the national standards institutes of 163 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system.

ODX

ASAM MCD-2 D (market name: ODX) defines a unique, open XML exchange format for diagnostics data. The ODX standard, which is also named MCD-2D, is an extensible Markup Language (XML) based format to describe diagnostic data, functionality, and communication interfaces of ECUs inside a vehicle. The ODX standard is currently jointly being developed by ASAM and ISO. The ODX specification contains a model to describe all diagnostic data and information about a vehicle and its physical ECUs. Some examples of what this data can contain are the following: diagnostic trouble codes, data parameters, identification data, variant coding

data, and communication parameters. The ODX model itself is described in Unified Modeling Language (UML) and the data exchange format uses XML.

ADVANTAGES

- ODX can describe the layout of diagnostic request and response messages as well as decoding and encoding information for conversion of message parameters from hexadecimal to physical representation

- ODX can capture information about the topology of the on-board ECU network and the pin-out of the vehicle fitted diagnosis connectors

- ODX provides description elements for ECU reprogramming, session handling and flash data .
- The seamless exchange of data between different partners and tools in the process chain is a major progress supported by ODX.

- Diagnostics utilities like service testers or development tools can be parameterized by ODX data.

CONCLUSION

Vehicle communication and diagnostics is a vast area of complex standards. It is not possible to cover this whole area in the time scope of this project. Some parts and ideas have deliberately been left out while some interesting ideas that have occurred have been dropped to keep realistic limitations of this project. ODX data modeling principles is impressive and provides flexible structures that is said to not depend on underlying communication standards. One interesting area would be to compare ODX to Autosar and see how these standards solve common communication/diagnostic idioms such as parameters and memory structures.

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