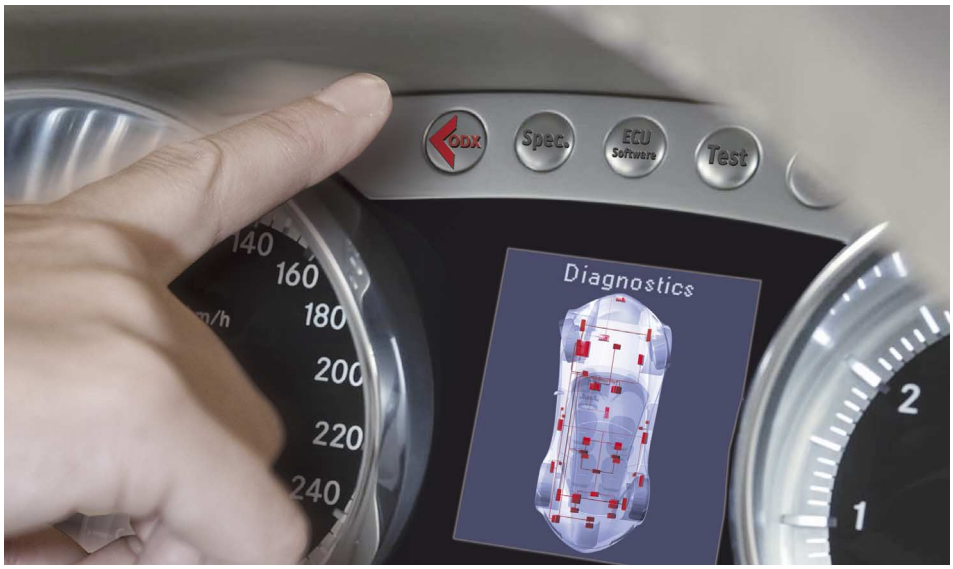
ODX in Practice

Experiences, challenges and potential



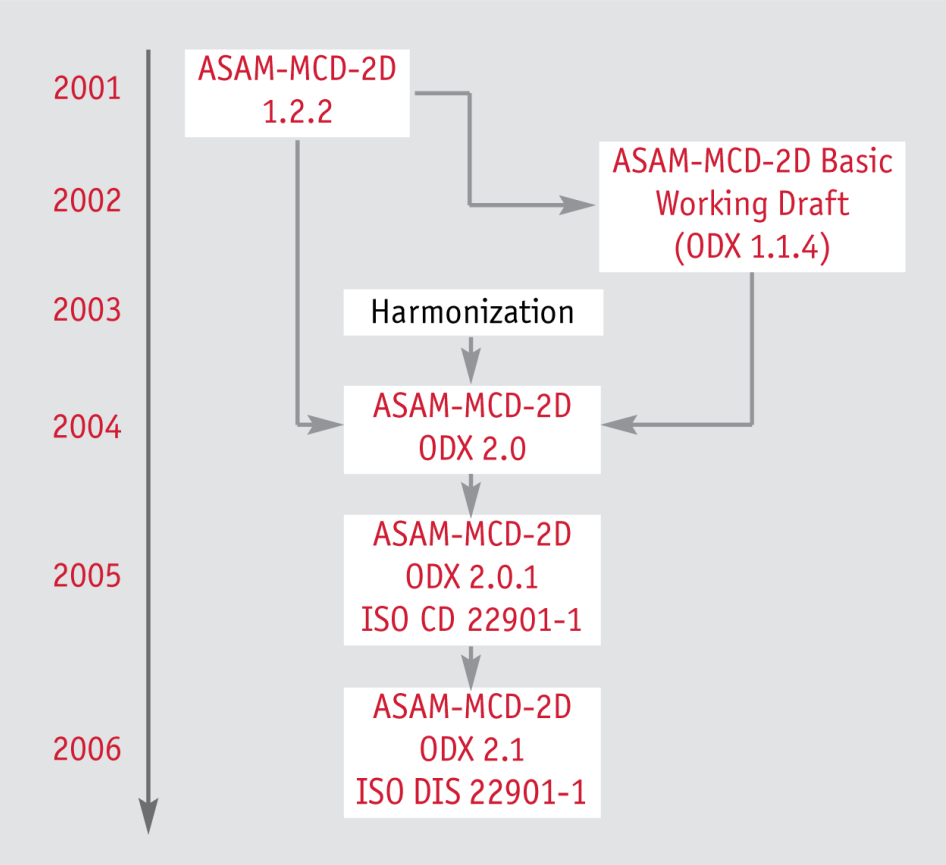
The diagnostic exchange format ODX has been implemented successfully in a number of pilot projects. For the first time now it has also been used productively in a multi-OEM, vehicle project. Experience to date has been promising. Practice has shown that the standard offers sufficient latitude for individual variation, but due to its complexity it places enormous requirements on the tools used.

The development of test systems for ECU diagnostics requires precise knowledge of the protocol, the layout, the format and the contents of the diagnostic messages. In the past automotive OEMs developed proprietary solutions. Even slight differences in requirements resulted in specific diagnostic test systems with their proprietary data formats. Diagnostic tests could only be performed with testers developed specifically for them. Frequently a uniform description format would not even be used uniformly

throughout a company. The introduction of ODX will change all of this.

ODX – Standard format for diagnostic data exchange

In 2002 the ODX working group of ASAM (Association for Standardization of Automation and Measuring Systems) began to formulate a standard for describing diagnostic data to enable simple exchange of diagnostic data, even across tool boundaries. The first version of the ODX (Open Diagnostic Data Exchange) diagnostic standard was published in 2004 and since then has undergone continuous advanced development (Figure 1). The ODX data exchange format is primarily used to parameterize test systems. ODX data contain all information needed to diagnose ECUs and vehicles. This facilitates the creation of data-driven diagnostic applications, since all information on the ECU to be diagnosed is provided in the form of ODX data.



[Figure 1: Development of the ODX data format in ASAM and in ISO.]

ODX, in its latest Release 2.1, consists of seven sub-models. They describe services (executable requests with their responses), jobs (sequences of services), communication parameters, vehicle topologies, functional views, flash data and ECU configurations. The sub-models may be combined to implement the specific diagnostic use cases occurring in practice.

Another ASAM/ISO standard (MCD-3D) defines the programming interface of a diagnostic runtime system. Provision of data to the software libraries that implement this standard is based on ODX.

Experience from projects

The ODX standard provides a modular system for diagnostic description. It supports many application cases, offers various methods for avoiding redundancy, and lets users take their specific requirements into account in describing the data.

In the first cross-OEM project of its kind in the world, two German automotive manufacturers have exchanged and implemented diagnostic data based on the ASAM ODX standard. The first OEM created the diagnostic data description for a vehicle's ECUs based on a diagnostic template. The second OEM took all data contents and uses them to parameterize its test systems, especially those in the service area. Consequently, diagnostic tools are available to vehicle service garages that are optimally tuned to the vehicle. This successful implementation of cross-OEM data exchange underscores the standard's capabilities in practice.

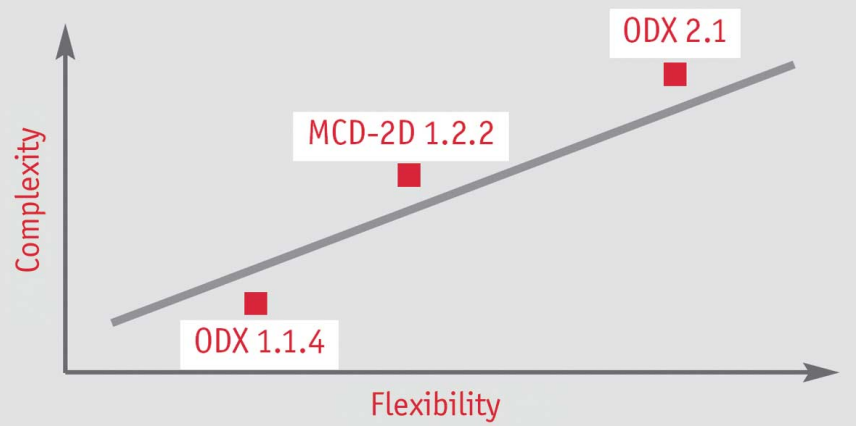
Experience from other projects in which OEMs and suppliers exchange data have shown that the different description philosophies require additional coordination and guidelines. In most cases, simple reliance on the ODX specification does not fulfill the individual requirements of the vehicle producer. Each OEM has its own diagnostic philosophy, utilizes different diagnostic capabilities or prefers certain modes of description. The ODX standard offers broad latitude here. Specific individual variations must therefore be regulated in additional authoring guidelines. Conformance to configuration guidelines is in part assured by customized checker tools. An offshoot of

this development is OEM-specific ODX dialects, all conforming to the ODX specification.

Example: In ODX there are multiple possible ways of storing the description of a single diagnostic service and the interpretation of its transported data in the tester. While all possible descriptions of the service may be ODX compliant and also lead to same behavior in runtime systems, only some will be consistent with the OEM-specific diagnostic testing strategy.

Challenges in introducing ODX

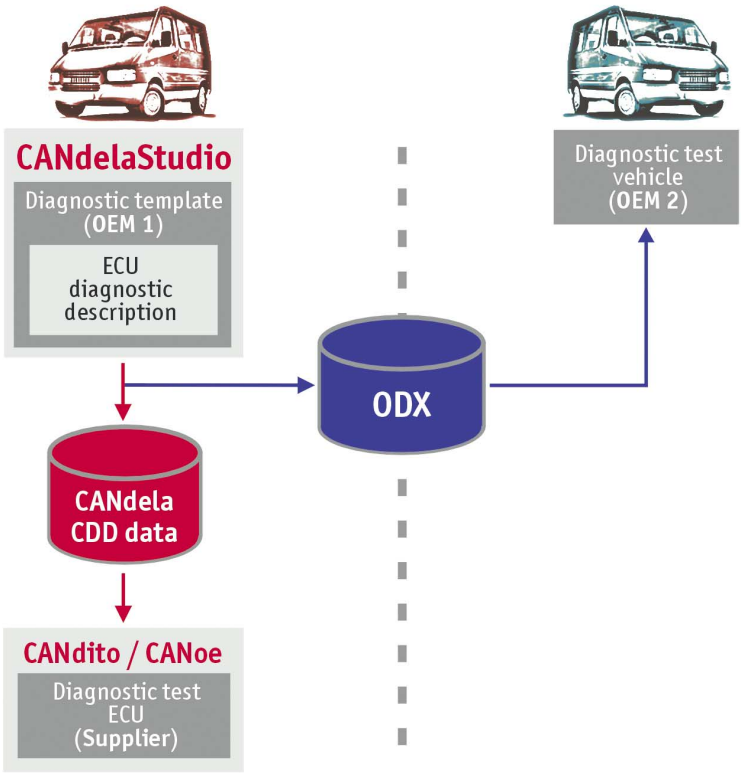
Until now, the process of creating ODX data has been restricted to just a limited circle of experts, due to its complexity (Figure 2). The current specification encompasses almost 400 pages. Users of the ODX data would rather concentrate on their actual task, namely the development of diagnostic applications, without having to deal with the specification or the data format and its dialects. With suitable tool support this is possible. In the ideal case, the user would only be confronted with a diagnostically-driven view of the data. Similar to application software in the office area, special knowledge of the underlying data format is then no longer necessary. This makes it possible to also create standard conformant ODX diagnostic data and process them without expert knowledge.



[Figure 2: Comparison of different diagnostic description formats.]

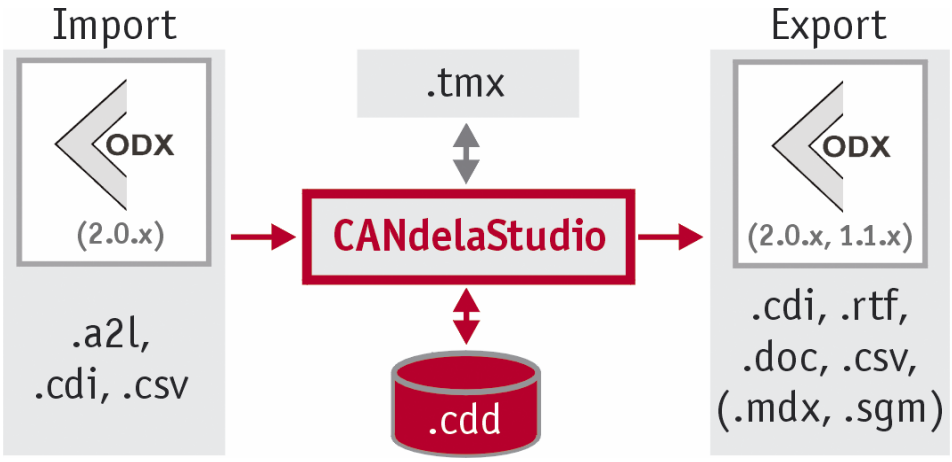
Efficient support of the diagnostic development process

In the cross-OEM project mentioned above, CANdelaStudio from Vector was used to create the ODX data (Figure 3).



[Figure 3: Cross-OEM exchange of diagnostic data in the first ODX project worldwide.]

The CANdela tool chain not only supports data creation, but covers the entire diagnostic development process from specification to code generation and software validation to ECU testing. The centerpiece here is the authoring tool CANdelaStudio, which supports data import and export from and to the ODX format. CANdelaStudio decouples a wide variety of data formats and is therefore also ideal for performing migrations of legacy data to the ODX format (Figure 4).



[Figure 4: Exchange of diagnostic data and migration of data inventories in a wide variety of formats using CANdelaStudio.]

Every diagnostic description is based on a diagnostic template. Depending on the context, this template ensures that only allowable and meaningful data may be input. Diagnostic templates are OEM-specific and permit automatic tool adaptation to OEM-specific requirements. This approach guarantees that the ODX data generated by CANdelaStudio agree with the OEM-specific interpretation of a specific diagnostic protocol.

Summary

There is no way around ODX. The market is calling for a standardized exchange format for diagnostic data. However, it has become apparent that the coining of different OEM-specific dialects and the availability of different ODX versions will make uniform data exchange difficult. Vector is aware of these issues and is developing tools that offer user-oriented support of ODX. As experience in various projects has shown, future broad acceptance of the standard is conditional on the availability of high-performance tools.

ODX is continuing to develop. So far the ODX standardization committee has presented expansions on an annual basis, and in the future it will build upon experience from practice too. In 2007 plans call for releasing ODX as an ISO standard as well. Vector is working on the ASAM committee and is actively engaged in developing the specification within ISO. That is one of the reasons that Vector can offer well-adapted ODX-related tools. Its know-how acquired in customer projects continuously flows into advanced product development and guarantees user-oriented solutions in ECU development.

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Figures:

Figure 1: Development of the ODX data format in ASAM and in ISO

Figure 2: Comparison of different diagnostic description formats

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Authors:

Christoph Rätz manages the Automotive Diagnostics product line at the company Vector Informatik GmbH.
Tel. +49-711/80670-275, Fax +49-711/80670-111,
E-mail: christoph.raetz@vector-informatik.de.

Dr. Klaus Beiter leads a development team at the company Vector Informatik GmbH. He is a member of the ASAM/ISO ODX working group.
Tel. +49-711/80670-261, Fax +49-711/80670-111,
E-mail: klaus.beiter@vector-informatik.de

Vector Informatik GmbH
Ingersheimer Str. 24
D-70499 Stuttgart Germany
www.vector-informatik.de

Editorial contact person: Holger Heit
Tel. +49-711/80670-567, Fax +49-711/80670-555,
E-mail: holger.heit@vector-informatik.de