ODX Simplifies Diagnostic Process Chain

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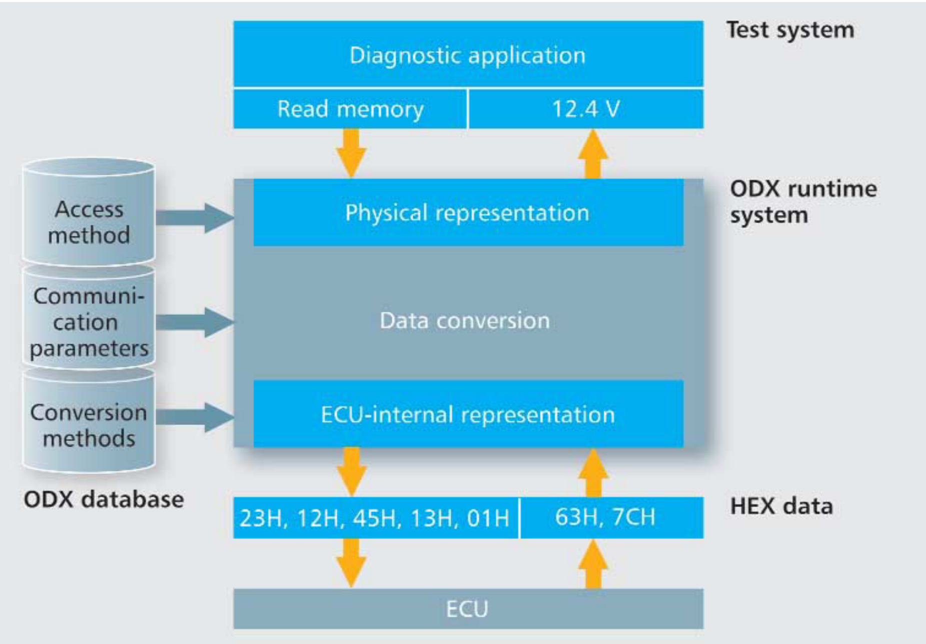
Ever since the ODX standard (Open Diagnostic data eXchange) was adopted in May 2004, it has been seen by many OEMs and ECU suppliers as the ultimate data exchange format for the diagnostic process chain. First ECU projects were initiated as early as 2004 and are currently in their final stages. Soon, all projects will be based on this new standard.

Savings in time and cost

ODX considerably reduces coordination, as vehicle projects can be processed in a tool landscape based on one standard data exchange format. Diagnostic information has to be created and described only once for Engineering, Test, Manufacturing and Service. That creates savings in time and cost. Depending on the complexity of the ECU, several person-months of engineering can be saved both by the OEM and by the ECU supplier.

Communication in ODX Format

ODX contains all the information necessary for diagnostic communication with one or more ECUs. This includes in particular the diagnostic services through which it is possible to access ECU information as well as the communication parameters that, for example, allow the control and automatic monitoring of communication timing. Diagnostic services typically describe requests made by the test system of the ECU and in turn their response to this request as well as their parameterisation. All descriptions are realised on a symbolic level. This means that the Specifications contain a diagnostic service with a readable name (e.g. Read memory), the result of which is also a physical value (12.4 V). The conversion of the request "Read memory" into hex values (23H,12H, 45H, 13H, 01H), the conversion of the response (63H, 7CH) into symbolic representation (12.4 V) and the transfer method are all described in the ODX database and executed in the runtime system.

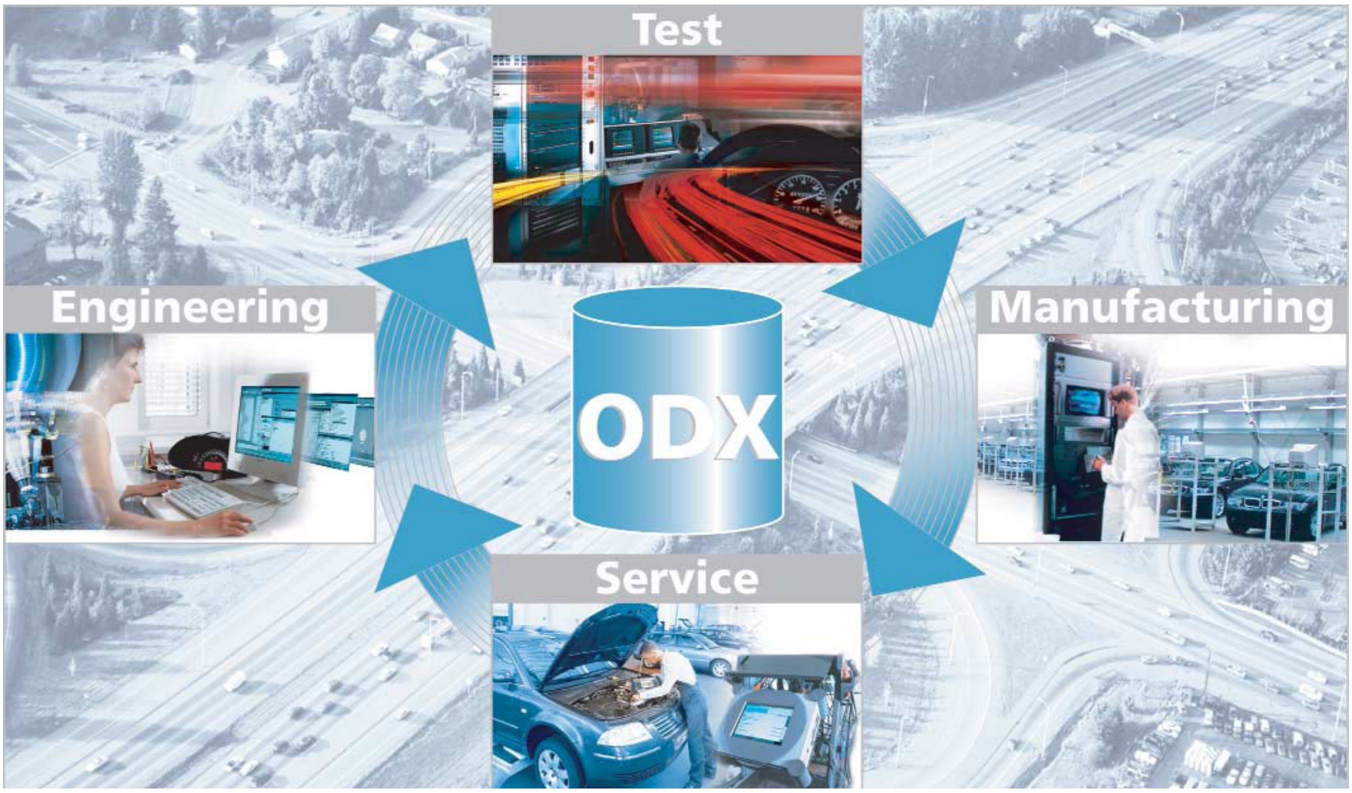


Schematic of a typical ODX request.

Practical Experience

Definitions of the diagnostic services or even entire ECU descriptions are virtually redundancy-free in ODX format. This is achieved in part by using an intelligent inheritance mechanism. For example, predefined diagnostic services are automatically used for variants of an ECU due to inheritance. Only those services that are being implemented for the first time in this variant have to be described explicitly.

ODX – or to give it its full name ASAM MCD-2D v2.0 (ODX)



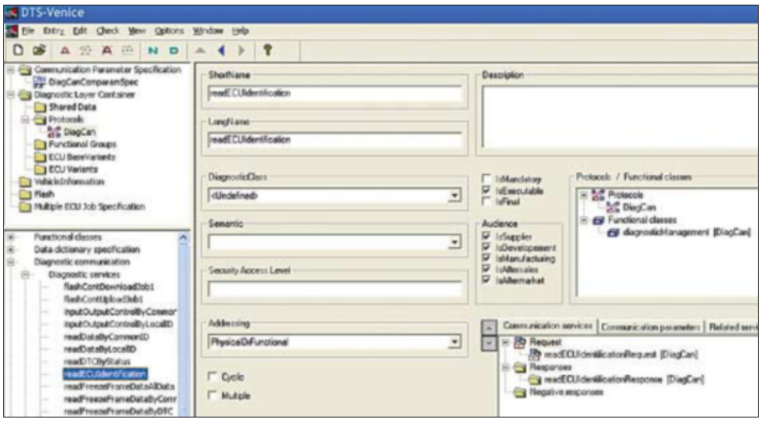
ODX allows a seamless, integrated process chain of vehicle diagnostics from Engineering right through to Service.

– is based on its time-tested predecessor ASAM MCD-2D v1.2. Version 2.0 (ODX) incorporates experience that has been gained in practice since its predecessor was first introduced. In addition to improvements in operation in some areas, the new version features two major extensions:

Customer-service issues: When data is exchanged with service organisations, more detailed information on a vehicle must be able to be exchanged in addition to the communication data. This information must be able to be made available in a non-manufacturer-specific format in future as the legislator is planning on allowing independent workshops to access manufacturer-specific diagnostic information.

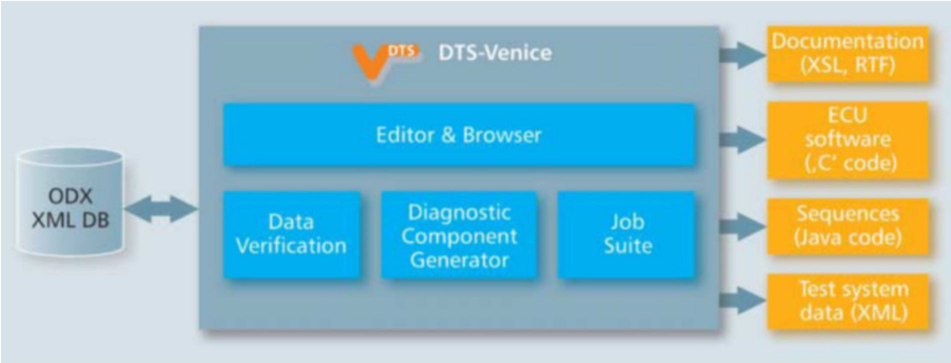
Extended Specifications: Although ASAM MCD-2D v1.2 took demands for creating Specifications into account, this was restricted to the information necessary for communicating with the ECU. However, further information is necessary for diagnostic Specifications which can, in part, be standardised, but which, in part, are manufacturer-specific. The set conditions under which a fault can be logged in the fault memory are an example of standardisation. This information is of no significance to the runtime system, i.e. for reading out error information, but must be known for the diagnostic application to be implemented in the ECU and must be verified accordingly with the test system. Specifications for structuring task descriptions of a diagnostic service, for example a table format with a specific context, are often manufacturer-specific.

The ODX data content is processed with DTS-Venice.

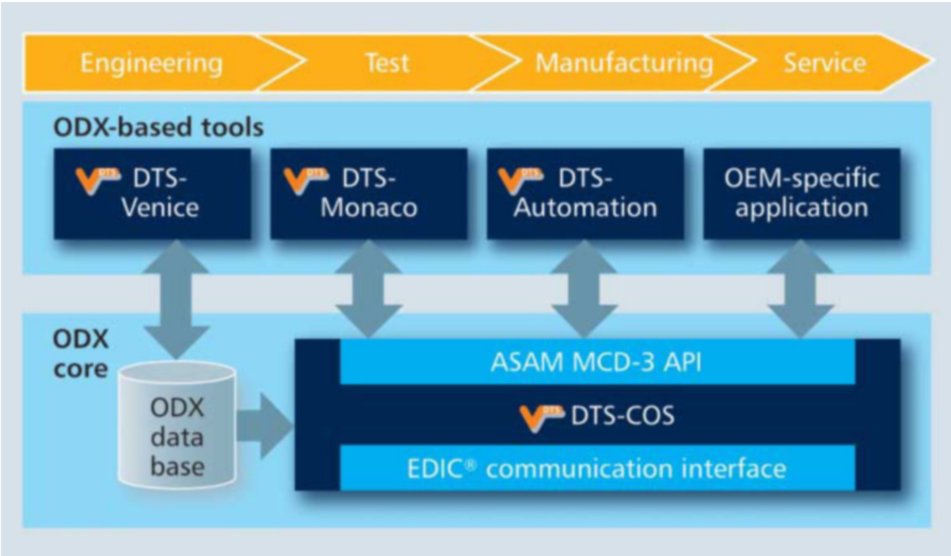


Optimised Process Chain

But how does the typical ODX data exchange work? First of all, the vehicle manufacturer defines the diagnostic protocol. In a lot of cases, it will be a standardised protocol (e.g. UDS). This protocol can contain OEM-specific adaptations (e.g. corporate-wide address specification for ECUs).



Documentation, electronic control unit software, test system data and JAVA test sequences can be generated using Softing's DTS-Venice



With ODX tools, Softing supports the entire vehicle diagnostic process from Engineering right through to Service.

The diagnostic ability of an ECU is considerably improved

The corporate-wide Specifications are used as a reference for the ECU-specific Specifications. This is where the ECU-specific adaptations are made. For an engine ECU, this could be a diagnostic service for reading out engine speed. The Specifications are then given to the ECU supplier. As ODX is an XML-based data format, the ECU supplier can use the data immediately without any adaptations. In addition, the XML data can be converted into different printable formats. The ECU supplier adds information from his area of expertise to the ODX Specifications during Engineering. These are usually conversion methods and conversion tables that, for example, depend on sensors, AD converters and special ECU implementations. The resulting ODX database is used as the input format for test systems of the ECU suppliers as early as the Engineering phase. Once the test tasks have been completed, the supplier provides a complete, electronic ECU description in XML. This description is also used for the approval of the ECU by the OEM test system. Due to electronic transfer, the ODX data is now just as approval-relevant as the ECU itself, as it will be incorporated without being modified into the OEM's testing, manufacturing and service processes.

ODX Content

Logically, this means that the diagnostic ability of an ECU is considerably improved by using one standard database over the entire process chain (single-source principle).

The ODX data content can be divided into five main groups:

- Diagnostics (DiagLayerStructure)
- Flash data (Flash)
- Vehicle topology (VehicleInfo)
- Communication parameters (Comparam)
- Multiple-ECU test sequences (MultipleECUJobs)

The diagnostics part has remained very much the same as in the predecessor. It contains diagnostic protocol descriptions as well as ECU descriptions. These include diagnostic services and more complex diagnostic sequences. In addition to the inheritance in ASAM MCD-2D v1.2, ODX offers a data container (ECU Shared Data) by means of which specific diagnostic information has to be described only once for multiple ECUs. This information can then easily be reused. A typical example is an error code table that has the same structure for multiple ECUs.

In addition to the actual data that can be loaded into an ECU, the flash data part contains a structured definition of the physical and logical memory architecture. Both the memory addresses of the individual flash areas and the distribution of the code and data segments to these modules are described. There is also a definition of which logical parts have to be loaded together into the ECU to ensure continuous process support for ECU programming.

All ECUs have already been described in the diagnostics part. The aim of vehicle topology is to create vehicle variants (e.g. petrol or diesel engine, with or without air-conditioning, etc.) from the total description of all ECUs. The individual ECUs do not have to be described again each time. The creation of vehicle variants is made easier by ODX thanks to the inheritance mechanisms and the ECU Shared Data. In addition to the vehicle variants, the communication path to the individual ECUs is described via the PINs of the diagnostic connector and is thus available in its entirety to the test system. This results in a reduction in the time and effort involved in configuring a test system. All that is required to run an ECU test is to select the vehicle variant and the ECU to be tested.

The communication parameter part enables a structured description of the parameters to be used in communication. A distinction is made between parameters standardised in ASAM and OEM-specific parameters. This not only allows ODX data to be used regardless of the tool concerned, but also gives the OEM the opportunity to define parameters in more detail within his own specific diagnostic process.

In addition to the two mechanisms supported to date (functional addressing and diagnostic sequences for individual ECUs), multiple-ECU sequences can be defined with ODX. Due to the increasing networking of ECUs, checking the resulting system or its subsystems is becoming more and more complex. These systems can only be checked with multiple-ECU diagnostic sequences. This is of particular significance for all active and passive safety systems in the vehicle.

Supporting the ODX Process Chain

Softing has used its long-term experience in the standardisation of ASAM MCD-2D v1.2 and v2.0 (ODX) to offer intelligent product solutions for using ODX in automotive electronics. One of these solutions is DTS-Venice. The engineering tool consists of the Database Editor and Browser, which completely support the ODX format. Further modules are Data Verification, the Diagnostic Component Generator and the Job Suite. Using DTS-Venice, the documentation, the diagnostic parts of the ECU software, the test system data and the JAVA test sequences can be generated in parallel from the Specifications. The JAVA jobs created (e.g. flash sequence, actuator test, etc.) can not only be programmed but also tested step by step with the integrated debugger. Even data created in AUTOSAR can be integrated into C code by the Diagnostic Component Generator.

Once the ECU software has been created, the ECUs have to be tested. For this purpose, Softing has developed an ODX core consisting of the ODX database and DTS-COS (DTS-Communication Server). The test system data generated is used by the DTS-COS as a runtime database. For test systems based on this (e.g. DTS-Monaco), DTS-COS supports the programming interface ASAM MCD-3D v2.0. DTS-Monaco is adapted to ODX for this purpose. Other DTS tools, such as DTS-Automation in Manufacturing and OEM-specific applications, can be used on the ODX core without any adaptations.

In conclusion, this means that all tools required for the ODX process chain can be provided. With the aid of these tools, the entire vehicle diagnostic process is supported from Engineering right through to Service.

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