INTERNATIONAL STANDARD

ISO 22901-1

First edition
2008-11-15

Road vehicles — Open diagnostic data exchange (ODX) —

Part 1:
Data model specification

Véhicules routiers — Échange de données de diagnostic ouvert (ODX) —

Partie 1: Spécification de modèle de données

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

Reference number
ISO 22901-1:2008(E)

© ISO 2008

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

COPYRIGHT PROTECTED DOCUMENT

© ISO 2008

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2c3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

© ISO 2008 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22901-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 22901 consists of the following parts, under the general title *Road vehicles — Open diagnostic data exchange (ODX)*:

— *Part 1: Data model specification*

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

The following parts are under preparation:

— *Part 2: Emissions-related diagnostic data*

© ISO 2008 – All rights reserved

Introduction

The purpose of this part of ISO 22901 is to define the data format for transferring Electronic Control Unit (ECU) diagnostic and programming data between the system supplier, vehicle manufacturer and service dealerships and diagnostic tools of different vendors.

In today's automotive industry, an informal description is generally used to document the diagnostic data stream information of vehicle ECUs. Any user wishing to use the ECU diagnostic data stream documentation to set up development tools or service diagnostic test equipment needs a manual transformation of this documentation into a format readable by these tools. This effort will no longer be required if the diagnostic data stream information is provided in Open Diagnostic Data Exchange (ODX) format and if those tools support the ODX format.

This part of ISO 22901 includes the data model definition of ECU diagnostic and programming data and the related vehicle interface description in Unified Modelling Language (UML). This part of ISO 22901 also includes an implementation by Extensible Mark-up Language (XML) schema in Annex C.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

 © ISO 2008 – All rights reserved

Road vehicles — Open diagnostic data exchange (ODX) —

Part 1: Data model specification

1 Scope

This part of ISO 22901 specifies the concept of using a new industry standard diagnostic format to make diagnostic data stream information available to diagnostic tool application manufacturers, in order to simplify the support of the aftermarket automotive service industry. The Open Diagnostic Data Exchange (ODX) modelled diagnostic data are compatible with the software requirements of the Modular Vehicle Communication Interface (MVCI), as specified in ISO 22900-2 and ISO 22900-3. The ODX modelled diagnostic data will enable an MVCI device to communicate with the vehicle Electronic Control Unit(s) (ECU) and interpret the diagnostic data contained in the messages exchanged between the external test equipment and the ECU(s). For ODX compliant external test equipment, no software programming is necessary to convert diagnostic data into technician readable information to be displayed by the tester.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The ODX specification contains the data model to describe all diagnostic data of a vehicle and physical ECU, e.g. diagnostic trouble codes, data parameters, identification data, input/output parameters, ECU configuration (variant coding) data and communication parameters. ODX is described in Unified Modelling Language (UML) diagrams and the data exchange format uses Extensible Mark-up Language (XML).

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c05f4e2202a/iso-22901-1-2008

The ODX modelled diagnostic data describe:

— protocol specification for diagnostic communication of ECUs;

— communication parameters for different protocols and data link layers and for ECU software;

— ECU programming data (Flash);

— related vehicle interface description (connectors and pinout);

— functional description of diagnostic capabilities of a network of ECUs;

— ECU configuration data (variant coding).

Figure 1 shows the usage of ODX in the ECU life cycle.

The purpose of this part of ISO 22901 is to ensure that diagnostic data from any vehicle manufacturer is independent of the testing hardware and protocol software supplied by any test equipment manufacturer.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

© ISO 2008 – All rights reserved

ISO 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ISO/IEC 8859-2, *Information technology — 8-bit single-byte coded graphic character sets — Part 2: Latin alphabet No. 2*

ISO/IEC 10646, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*

ISO 22900-2, *Road vehicles — Modular vehicle communication interface (MVCI) — Part 2: Diagnostic protocol data unit application programming interface (D-PDU API)*

ISO 22900-3, *Road vehicles — Modular vehicle communication interface (MVCI) — Part 3: Diagnostic server application programming interface (D-Server API)*

IEEE 754, *Binary floating-point arithmetic*

XML Schema — 2, *XML Schema Part 2: Datatypes, 2nd Edition, W3C Recommendation, 2004-10-28*

ASAM MCD 2, *Harmonized Data Objects Version 1.0*

3 Abbreviated terms

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/f62e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

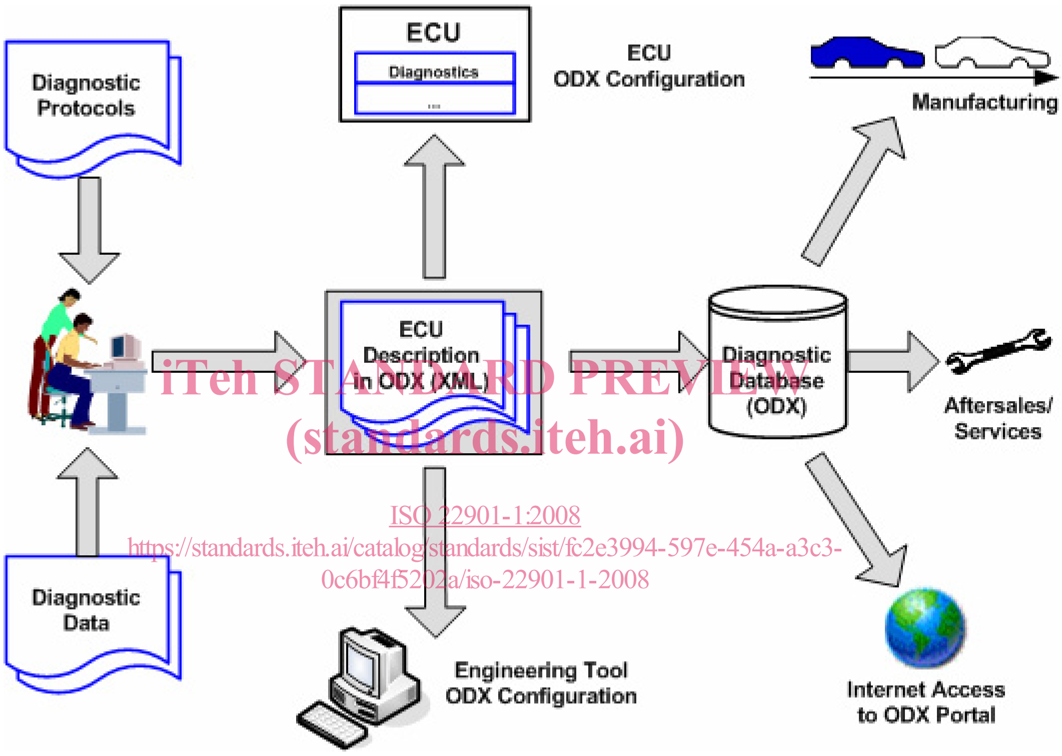
API	Application Programming Interface
ASAM	Association for Standardisation of Automation and Measuring Systems
ASCII	American Standard for Character Information Interchange
DOP	Data Object Property
ECU	Electronic Control Unit
GMT	Greenwich Mean Time
MCD	Measurement, Calibration and Diagnosis
ODX	Open Diagnostic Data Exchange
OEM	Original Equipment Manufacturer
PDU	Protocol Data Unit
PDX	Packaged ODX
UML	Unified Modelling Language
UTC	Coordinated Universal Time
VMM	Vehicle Message Matrix
W3C	World Wide Web Consortium
XML	Extensible Mark-up Language

© ISO 2008 – All rights reserved

4 ODX use cases

4.1 General

Figure 1 — Usage of ODX data in the ECU life cycle shows the usage of ODX in the ECU life cycle. Engineering, manufacturing, and service specify communication protocol and data to be implemented in the ECU. This information will be documented in a structured format utilizing the XML standard and by an appropriate ODX authoring tool. There is potential to generate ECU software from the ODX file. Furthermore, the same ODX file is used to setup the diagnostic engineering tools to verify proper communication with the ECU and to perform functional verification and compliance testing. Once all quality goals are met, the ODX file may be released to a diagnostic database. Diagnostic information is now available to manufacturing, service, OEM franchised dealers, and aftermarket service outlets via Intranet and Internet.



iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

Figure 1 — Usage of ODX data in the ECU life cycle

4.2 Use case 1: ODX process chain

Figure 2 shows an example of how ODX data is used in a process chain consisting of three phases, as described below.

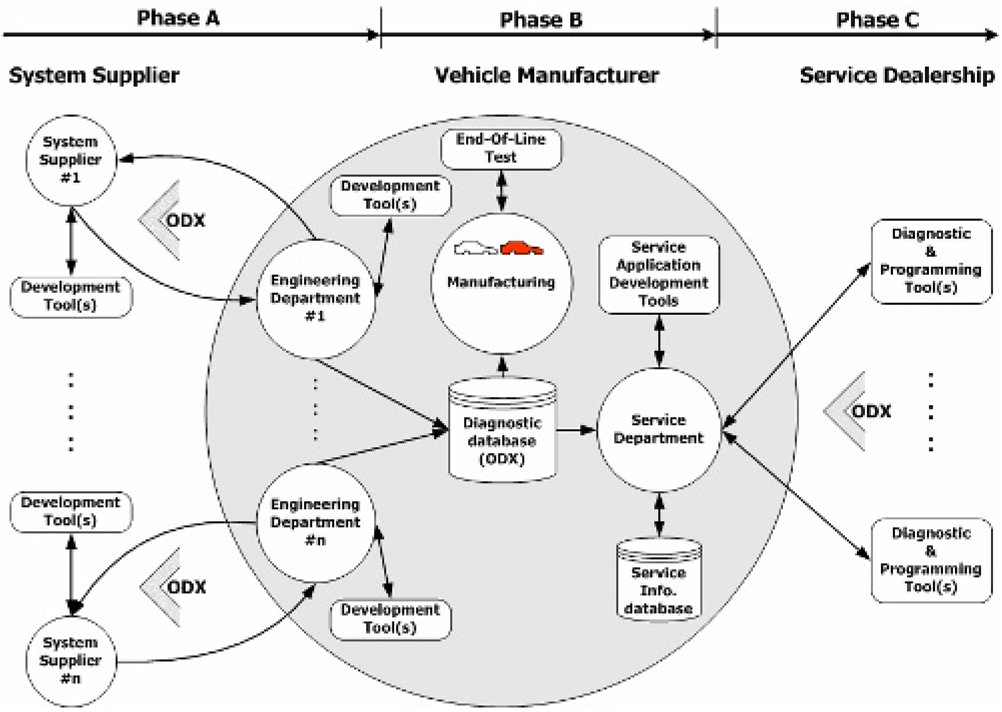
a) Phase A of the development process between vehicle manufacturer and system supplier comprises the exchange of ODX data to support the development of the diagnostic implementation in the ECU and the development tools.

b) In phase B of the development process at the vehicle manufacturer, the engineering departments release the ODX data into a diagnostic database. The manufacturing and service departments use the ODX data as the basis to setup the End-Of-Line test equipment and service application development tools and generate service documentation.

c) Phase C of the development process supports the service dealership diagnostic and programming tools. The service department develops service tool application software based on the ODX data model. The diagnostic and programming software is now available to all service dealerships.

© ISO 2008 – All rights reserved

The ODX data is the base for all exchange of diagnostic and programming data.



iTeh STANDARD PREVIEW

Figure 2 — Example of ODX process chain

(standards.iteh.ai)

4.3 Use case 2: Cross vehicle platform ECU diagnostic development

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bfaf5202a/iso-22901-1-2008

A vehicle manufacturer implements electronic systems into multiple new vehicle platforms. There is little variation in the electronic system across the different vehicle platforms. Utilizing the same ECU in many different vehicle platforms reduces redundant development effort. The majority of design, normal operation, and diagnostic data of an electronic system can be reused in various vehicles.

Large automotive manufacturer tend to have multiple engineering development centres. Diagnostic data exchange can be based on the ODX data format to reduce the amount of proofreading of diagnostic data at different development sites. Establishing an ODX compliant tool chain will avoid re-authoring diagnostic data into various specific formats at different engineering sites.

 © ISO 2008 – All rights reserved

Figure 3 shows an example of cross vehicle platform ECU diagnostic development between two engineering sites.

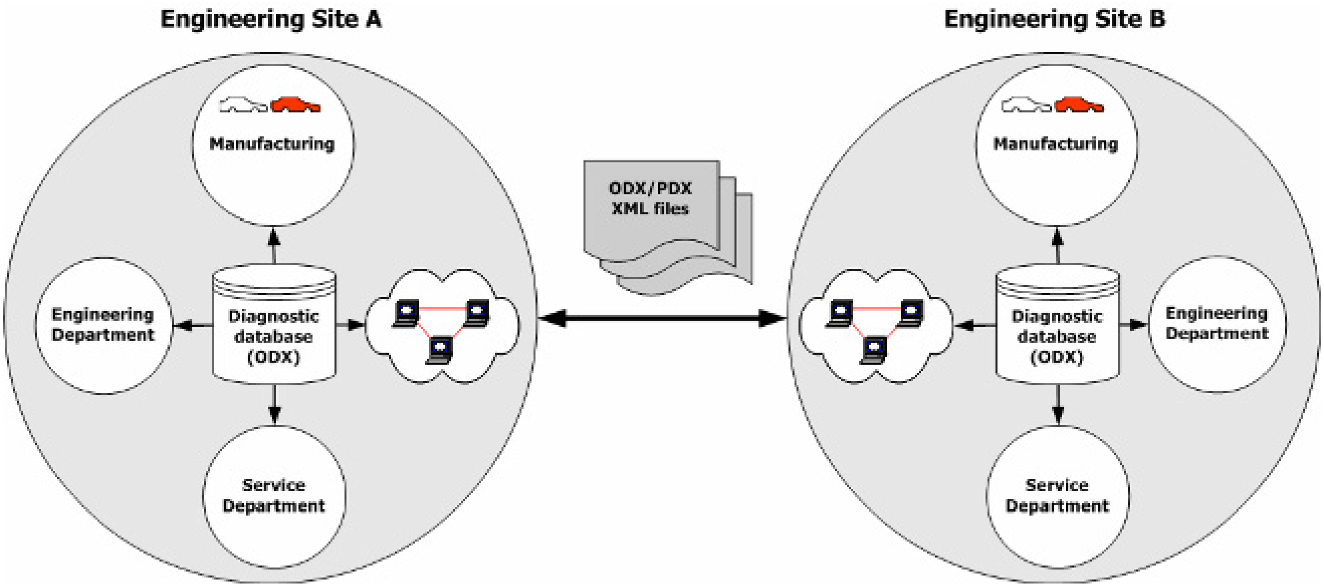


Figure 3 — Example of cross vehicle platform ECU diagnostic development

iTeh STANDARD PREVIEW
(standards.iteh.ai)

4.4 Use case 3: Franchise and aftermarket service dealership diagnostic tool support

Figure 4 shows one of many scenarios a vehicle manufacturer may implement to support the service dealership, franchise and aftermarket. ODX files may be converted into an ODX runtime format for download to the dealership diagnostic system.

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

IMPORTANT — The ODX runtime data format may be different between many diagnostic and programming applications and tools. In such cases, an ODX runtime converter may be used to support the data conversion to dealership specific test equipment.

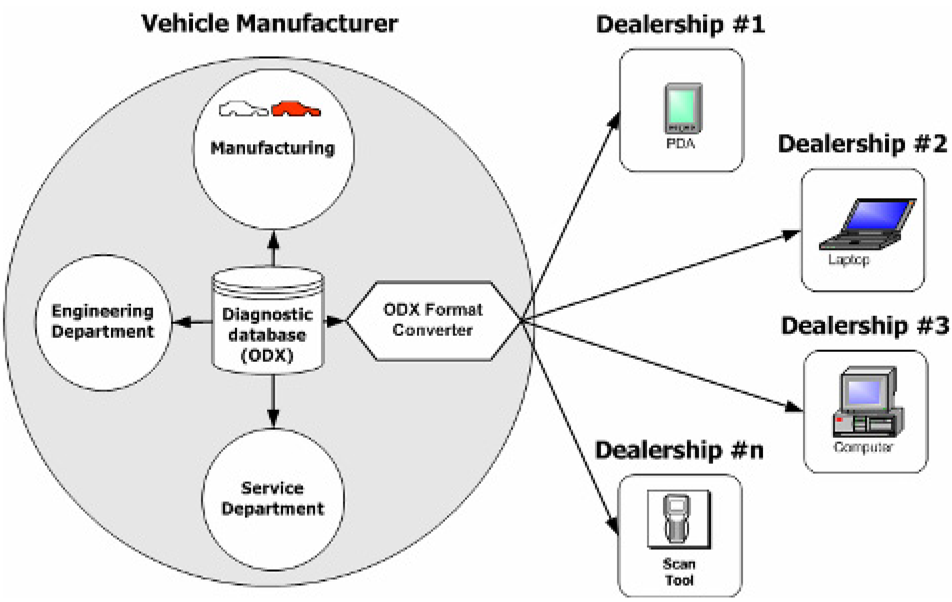
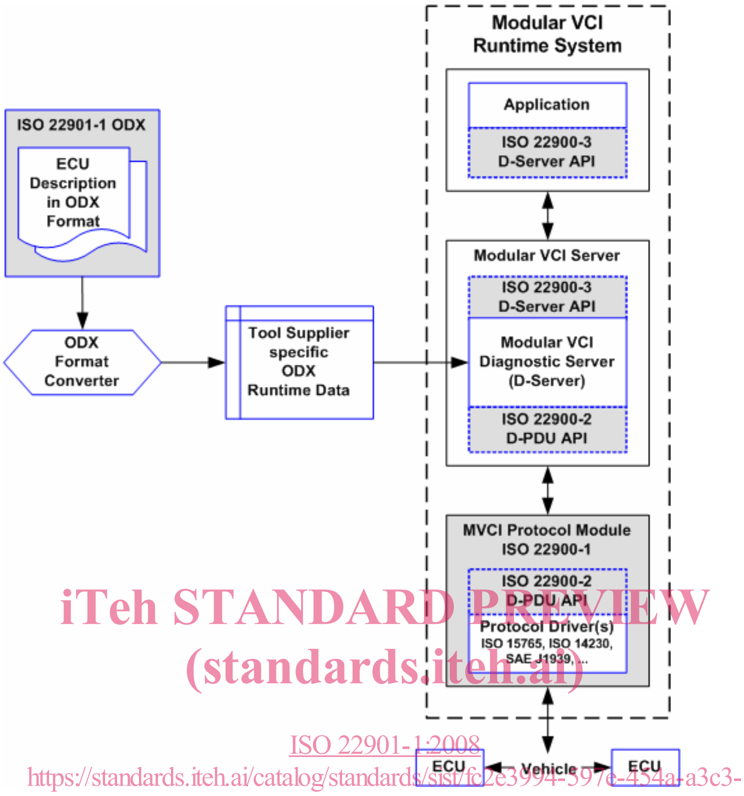


Figure 4 — Example of automotive dealership diagnostic tool support

4.5 Architecture of a Modular VCI compliant D-server

Figure 5 shows the interfaces of a D-server and the position of ODX in a diagnostic system. The D-server may use its own internal specific runtime data format. This data can be imported from the ODX using a specific format converter.



iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

Figure 5 — Architecture of a Modular VCI compliant D-server

4.6 ODX benefit examples

4.6.1 ECU system supplier

The following benefits are applicable to the ECU system supplier:

— automatic configuration of ECU diagnostic data stream & protocol;

— documentation is generated from XML data format (ECU diagnostic content = documentation);

— automatic configuration of development tester to verify ECU diagnostic behaviour;

— XML data format provides machine readable information to import into supplier diagnostic data base;

— generation of source code to configure diagnostic kernel software components.

4.6.2 Vehicle manufacturer engineering

The following benefits are applicable to the vehicle manufacturer engineering:

— reduction of diagnostic data stream authoring effort;

— various development testers can be supported with “single source” data;

— one single file format for import and export into/from diagnostic database.

 © ISO 2008 – All rights reserved

4.6.3 Vehicle manufacturer production

The following benefits are applicable to the vehicle manufacturer production:

— reduced effort for diagnostic data verification, because verification needs to be performed only once;

— reuse of verified diagnostic data;

— fewer errors because of fewer manual process steps;

— end-of-line tester uses the same diagnostic data as engineering diagnostic tester.

4.6.4 Vehicle manufacturer service department and dealerships

The following benefits are applicable to the vehicle manufacturer service department and dealerships:

— more convenient reuse of verified diagnostic data;

— less cost to distribute diagnostic data;

— "pull" (via Intranet/Internet) diagnostic data (e.g. from a portal into a D-server) versus "push" (e.g. send CD ROMs);

— one single file format for various diagnostic service systems.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

4.6.5 Test equipment manufacturer

The following benefits are applicable to the test equipment manufacturer:

ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/82e59991-597e-4948-a3e3-0c6bf4f5202a/iso-22901-1-2008

— less effort needed to implement high quality scan tool software by using a generic data driven approach;

— focus on "rich diagnostic application(s)" versus bits & bytes;

— more convenient reuse of vehicle manufacturer verified diagnostic data.

4.6.6 Franchise and aftermarket dealerships

The following benefits are applicable to the franchise and aftermarket dealerships:

— more convenient reuse of vehicle manufacturer verified diagnostic data;

— tester configuration by data download instead of by software modification;

— download on demand versus buying tester software update upfront.

4.6.7 Legal authorities

The following benefits are applicable to the legal authorities:

— standardized description format for enhanced diagnostic data documentation (e.g. DTCs, PIDs);

— enables road-side scan tools and I&M (inspection and maintenance) tools to be vehicle manufacturer independent;

— fulfils requirement of making enhanced diagnostic data available to independent aftermarket.

© ISO 2008 – All rights reserved

5 Specification release version information

5.1 Specification release version location

The release version of the ODX standard can be obtained from every ODX file instance. It is contained in the MODEL-VERSION element.

```
<ODX xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation=" odx.xsd" MODEL-VERSION="2.2.0">
```

5.2 Specification release version

The specification release version of this part of ISO 22901 is: 2.2.0.

6 Introduction to and use of Unified Modelling Language (UML)

6.1 General aspects

Unified Modelling Language (UML) is used to define the ODX data model formally and unambiguously. It enhances readability by graphical data model diagrams.

A short introduction to UML is given in this clause. Only those aspects of UML are described that are used in the ODX data model. Specifically, from the large set of available UML diagrams, class diagrams are only applied for data modelling.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

6.2 Class diagrams

6.2.1 Class

The central modelling element in UML is a class. A class represents a set of similar objects. Generally speaking, a class can be instantiated many times. Every instance of a class is called an object. A class has attributes (defining the properties of these objects) and methods (defining the actions an object can perform). For ODX, methods are irrelevant and are not used.

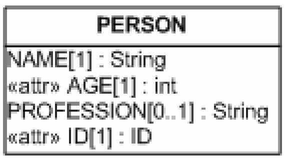


Figure 6 — UML representation of class

Figure 6 shows the representation of a class and its attributes in UML notation. A class is symbolized by a rectangle having up to three fields. The top field contains the name of the class, e.g. PERSON. The second field contains the attributes of the class, e.g. NAME, AGE, PROFESSION, and ID. Methods are defined in an optional third field. The attribute field is not always displayed in the ODX data model diagrams. Since the method-field is unused in the ODX data model, it is never displayed.

Attributes consist of the attribute name, e.g. NAME, followed by the attribute's cardinality, e.g. [1] or [0...1] and the attribute type, e.g. String. Furthermore, a default value for the attribute may be specified. Such a default value follows the type descriptor of the attribute and is separated from it by the symbol "=".

© ISO 2008 – All rights reserved

UML attributes specified with the <<attr>> stereotype in front of their name are implemented as XML attributes of XML elements. UML attributes without this stereotype are implement as XML sub-elements of XML elements.

Throughout the ODX data model, class names and attribute names are written in capital letters.

6.2.2 Inheritance relationships

Classes can inherit attributes from other classes. In Figure 7, a new class SCHOOLKID is derived from the class PERSON. This means that implicitly the class SCHOOLKID has all the same attributes as PERSON plus those that are defined specifically for the new class SCHOOLKID, e.g. GRADE. PERSON is called the parent or super class; SCHOOLKID is called the child or subclass of the inheritance relationship. Because the subclass adds more detail to the super class and is thus more specific, inheritance relationships are often called “specializations”.

Inheritance relationships can be used to build inheritance trees of arbitrary depth. A class in such a tree inherits all attributes from those classes in the transitive closure of all ancestors (parents, grandparents, etc.) in the inheritance tree.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 22901-1:2008
https://standards.iteh.ai/catalog/standards/sist/fc2e3994-597e-454a-a3c3-0c6bf4f5202a/iso-22901-1-2008

Figure 7 — UML representation of inheritance relationship

6.2.3 Aggregation and composition relationships

Besides the inheritance relationship, a pair of classes may also have an aggregation or a composition relationship. Aggregation or composition relationships are used if an object of one class is contained in an object of another class. They are drawn as a line with a diamond at the end of the containing class. A composition relationship’s diamond is filled; an aggregation’s diamond is not.

The difference between these two kinds of relationships is as follows:

a) the contained element in a composition relationship is a part of the containing element;

b) if the containing element is deleted, the contained element no longer exists.

Therefore, composition means an object may only be contained in one other object. An aggregation relationship is one of shared objects. This means that multiple objects may aggregate the same object. Consequently, an aggregated object still exists, even if the aggregating object is deleted[1]).

1) In the special case where the data model is implemented in XML (see below), aggregation and composition relationships are both mapped onto a sub element relationship between the two model elements. However, the UML semantics guide prohibits multiple classes from having a composition relationship to the same class. Therefore, aggregation relationships are used instead, even though the implementation in XML does not differ.

© ISO 2008 – All rights reserved