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ASAM ODS
VERSION 5.0
ISO-PAS

CHAPTER 1
INTRODUCTION

Association for **S**tandardization of
Automation and **M**easuring Systems

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Note: ASAM ODS has invoked a Formal Technical Review (FTR) process which intends to continuously improve the quality and timeliness of its specifications. Whenever an error is identified or a question arises from this specification, a corresponding note should be sent to ASAM (odsftr@asam.net) to make sure this issue will be addressed within the next review cycle.

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Contents

Scope

This document is a brief description of ASAM ODS Version 5.0.

Intended Audience

This document is intended for people interested in ASAM ODS Version 5.0. It shall be used as a brief overview of the features of ASAM ODS Version 5.0.

This document is part of a series of documents referring to ASAM ODS Version 5.0 and must not be used as a stand-alone document. The documents referenced below build the technical reference of ASAM ODS Version 5.0 as a whole. They may be requested from the ASAM e.V. at www.asam.net.

ASAM ODS Specification

The following chapters build the technical reference for ASAM ODS Version 5.0:

- ASAM ODS Version 5.0, Chapter 1, Introduction
- ASAM ODS Version 5.0, Chapter 2, Architecture
- ASAM ODS Version 5.0, Chapter 3, Physical Storage (1.1)
- ASAM ODS Version 5.0, Chapter 4, Base Model (28)
- ASAM ODS Version 5.0, Chapter 5, ATF/CLA (1.4.1)
- ASAM ODS Version 5.0, Chapter 6, ATF/XML (1.0)
- ASAM ODS Version 5.0, Chapter 7: N/A ('Security' moved to Chapter 2)
- ASAM ODS Version 5.0, Chapter 8, MIME Types and External References (1.0)
- ASAM ODS Version 5.0, Chapter 9, RPC-API (3.2.1)
- ASAM ODS Version 5.0, Chapter 10, OO-API (5.0)
- ASAM ODS Version 5.0, Chapter 11, NVH Model (1.3)
- ASAM ODS Version 5.0, Chapter 12, Calibration Model (1.0)

Normative References

- ISO 10303-11: STEP EXPRESS
- Object Management Group (OMG): www.omg.org
- Common Object Request Broker Architecture (CORBA): www.corba.org
- IEEE 754: IEEE Standard for Binary Floating-Point Arithmetic, 1985
- ISO 8601: Date Formats
- Extensible Markup Language (XML): www.w3.org/xml

1 INTRODUCTION TO ASAM ODS

The rapid progress in hard- and software leads to storage of data in many different data base systems as well as under different hardware and/or server generations – not only within the automotive industry, but also within the supplying industry.

During development and production of vehicles, a huge mass of data is produced. Today, data are stored within the automotive industry in a standardised format specified by the ASAM ODS workgroup. ASAM stands for „Association for Standardisation of Automation and Measuring Systems“, and ODS stands for „Open Data Services“.

The ASAM ODS standard has the fundamental quality of storing data with an architecture-independent method. This leads to great advantages when exchanging data between different sources and possible prospective customers.

This document shall provide an overview of the goals of ASAM ODS as well as the technical approaches made to achieve these goals.

It is intended for readers with some technical background that want to get an impression on what ASAM ODS really standardizes and how the standards work. Readers may get an impression on what it means to implement these standards and what real benefit they may draw from using the standards.

Furthermore this document may be a starting point for implementers, before they dive into the detail standards documentation itself.

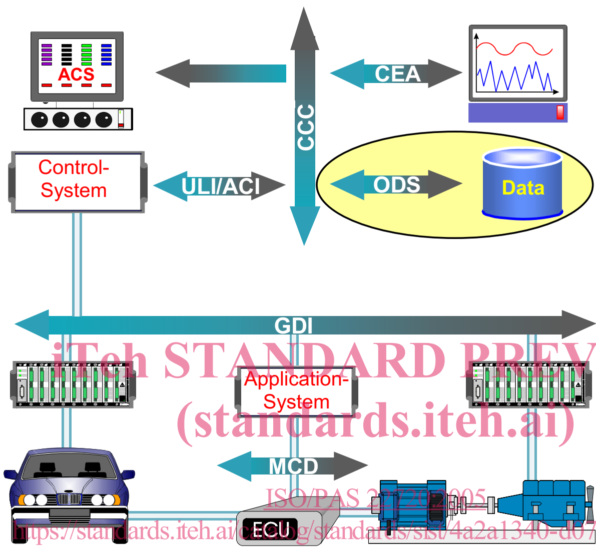
This chapter must **NOT** be seen as a specification; it is an introduction with some details to provide an overview to the interested reader.

1.1 GOALS AND BENEFITS OF ASAM ODS

1.1.1 POSITIONING OF ASAM ODS WITHIN ASAM

The overall ASAM standards structure is shown in the figure, illustrating components which typically can be found in an automotive testing environment, and how these components use ASAM interfaces to communicate and interact with each other.

ASAM ODS is that part of the ASAM standards which focuses on persistent storage and retrieval of data.



➢ *ASAM standards in an example testing environment* ≺

ASAM ODS describes service interfaces. They can be used by any component of the testing environment to store its data and/or retrieve data required for proper operation.

Components using these interfaces are typically

- data acquisition systems, collecting data from a vehicle, an engine, etc.
- test control systems, used for running test procedures
- optimization tools, looking for an optimum set of calibration parameters
- analysis and reporting tools, presenting data to engineers and decision makers
- evaluation tools, supporting research and development tasks

Data stored and retrieved are typically

- test procedure configurations of a test control system,
- descriptive data of the test equipment and of the unit under test
- data measured during a test of an engine on a test bench, a vehicle in the wind tunnel, etc.
- data produced during a simulation run

- data resulting from test evaluation tools
- calibration data for engine or vehicle parts

The regular way to access ASAM ODS interfaces is, as the figure shows, through ASAM CCC (this is true for ASAM GDI/ACI and ASAM CEA as well).

ASAM CCC has proposed a server access based on the OMG-specified CORBA standard which requires object oriented system design.

CORBA does not specify what kind of services an interface provides; this is up to the specific service provider (in this case: ASAM ODS). Instead, CORBA specifies how an interface can be identified, found and connected to by any component that intends to use it. Thereby CORBA cares for a transparent network transfer, if required.

CORBA is an open standard and is wide-spread in all kinds of large-scale industrial and business processes. ASAM ODS specified an object oriented (OO-)API which can be implemented with the CORBA approach; however the defined interfaces are not restricted to CORBA and it may happen in the future that servers based on new technologies come up providing the same interfaces.

Because the first ASAM ODS interface specification used RPC as communication method and came up before ASAM CCC started its work, a lot of implementations still base on the RPC-API. For compatibility reasons the RPC-API will still be supported by ASAM ODS in the future, though the object oriented OO-API will be the main focus.

Since the access to a persistent data store typically requires network transfer, ASAM ODS is not generally optimized for realtime performance. However, ASAM ODS does not prevent realtime operation; time-related behavior depends on the design/implementation decision of a specific ODS-server as well as on the Object Request Broker (the ORB) used.

ASAM ODS specifies interfaces; the way data is finally stored persistently is not exclusively defined. While using some kind of object oriented or relational data base (with a common database model) might be reasonable, that decision is up to the ODS-server implementation.

Although ASAM ODS is the data storage/retrieval oriented part within the ASAM set of standards, it does not claim exclusive rights to specify file or database formats. Other ASAM standards may do so as well, if necessary. E.g. it may be required to store configuration or measurement data of a control system locally during operation. Or it may be required to use other internationally accepted data formats to exchange data with regulatory institutions (as e.g. is required for ASAM MCD aspects).

1.1.2 DRAWBACKS OF CURRENT SYSTEMS

Current systems in test, evaluation, and simulation environments within the automotive industry have in most cases their own proprietary formats to store data. These formats usually are very different from each other regarding the description of the configuration (unit under test, test sequence, test equipment, etc.) as well as the way results are stored (database, binary files, etc.).

View of the users:

Installations have grown during the past decades. Providers of the early days were replaced by others, each new one bringing in a new storage philosophy and another incompatible format. Accessing data from such a diversity of systems results in the need for a large variety of interface adaptors and converters - most of them individually developed or extended for each new project. The increasing complexity of the underlying systems causes expensive, specialized, isolated, and thus increasingly uneconomical solutions.

This is contradictory to the general desire within the automotive industry to develop and use easily manageable applications, which provide valuable information to other departments and systems within the company and to suppliers.

Additionally, even if alternative providers offer technically advanced systems, they often cannot be taken into account because of the amount of follow-up work required to link the already existing systems to them.

View of the providers:

Since each customer has built up a specific variety of systems, and interaction with these systems is usually strongly required with each new product being introduced, much of the development work of a new product is spent to become compatible. And not only the amount of work spent but also the knowledge required (and mostly gained through experience) is a critical issue. Thus the capability to connect into an existing environment often depends on the availability of specific people.

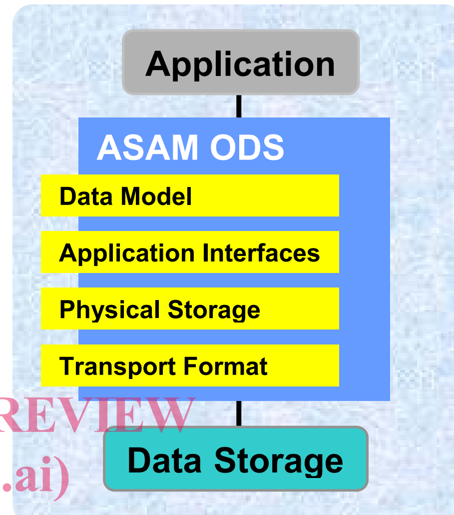
Moreover different customers require a different interaction scenario. Product releases become customer specific, version control becomes a major job.

New companies trying to contribute new ideas and solutions hardly have a chance to place any product; either they invest a lot into the connectivity issues or they will always play a minor role. This inhibits innovation in the automotive industry and finally jeopardizes competitiveness.

1.1.3 BENEFITS OF ASAM ODS

The main objectives for a standardization of data access interfaces are to reduce costs and risks within projects, and to provide a reliable basis for implementations in the area of data storage and data usage. Using standardized interfaces and common structures minimizes the efforts for the system integration within the heterogeneous environments discussed above and makes it much easier to exchange data.

To overcome the mentioned problems ASAM ODS provides:



- A common data model (base model) for the unambiguous and complete storage of data. This base model can be viewed as a rough data classification, thereby adding semantics to the data, which finally allows different systems to interpret same data in the same way. The data model covers the needs of a multitude of application areas and is adaptable to individual requirements of a specific system or even project by building a so called 'application model' from the base model.
- Interfaces (Application Programmer's Interfaces, APIs) to access data of ASAM-compatible systems and tools in a standardized way. Interfaces (APIs) to create and access a self-explanatory description (meta-information) of the actual application model. This allows systems to operate on very different ASAM ODS data.
- A database model for the (wide-spread) relational databases. This specifies physical storage of the data,. It also allows to exchange database files between systems with the same DBMS. Finally (in case an appropriate ODS server application is not available) it provides easy access through SQL commands even on different platforms, and between different DBMSs.
- A standardized, easy to use, text-based exchange format (ASAM Transport Format, ATF) in order to exchange ASAM ODS data (including its meta-information) between different systems and different platforms. The ASAM ODS Version 5.0 now supports both, the classic ATF (ATF/CLA) as well as the XML based ATF/XML.
- A set of application models that reflect typical scenarios for the use of ASAM ODS and that easily allow a mapping between data originating from different companies.

Another benefit of such a standardization is its impact on product quality. The standards specified will allow to measure products' implementations. Certification procedures are defined, another way to check the interoperability of products is to do crosstests, which were already undergone with very good results. Both approaches shall lead to product conformity with the standards.

Finally ASAM ODS provides the opportunity to integrate data of the whole lifecycle of automotive products. Though the kind of relevant information in the areas research, development, production, and after-sales are very different from each other, ODS allows to store them (each with their specific application models) and retrieve them, thereby keeping the meaning of the data items. And the ODS interfaces allow tools to combine information from each of those areas, analyze dependencies, generate overall reports etc..

1.2 TECHNICAL APPROACH

ASAM ODS standardizes data access regarding five important aspects:

- The data model
- The interfaces
- The physical storage
- The transport formats
- Application Models

1.2.1 THE DATA MODEL

The first and most important aspect of ASAM ODS is its **data model**.

Typically there are different levels to exchange a data item.

- Two systems or software packages might not be able to exchange this data item at all. This is the case if e.g. system A expects the data item to be represented as a 4-byte floating point number while system B expects it to be represented by a 2-byte integer value.
  The drawback is obvious: no automatic data exchange can be set up without changing either of the systems (that is: its software).
- Two systems or software packages may be able to exchange this data item as a number because the data representation of the item is the same on both systems. This capability often is the result of some standardization effort, specifying universal data formats. An example is the wide-spread CSV (comma separated values) format, where data items are represented by an ASCII string, and consecutive data items are separated from each other by a comma. System A may produce such a CSV file and system B may be able to read it and know about the numbers contained in it.
  The drawback is still obvious: without additional knowledge about the meaning of the data item its value is quite useless.
- Similarly two systems or software packages may be able to exchange this data item as a number with a name e.g. because a common database is used. In this case system A stores the value of the data item in some place in a table, using a row and/or column name; this is typically done through some database interfaces. System B may now use the same database interfaces, identify the data item by its name and/or location in the table and thus get back its value.
  The drawback is not very obvious; it seems that the data item is fully described by (i) its value and (ii) its name. However, its value is only useful if the retrieving system B knows about the meaning of the data item's name. This requires additional conventions on naming of data items. And questions like "What unit belongs to the value?", "Is this the most recent of a set of available values for the data item?" etc. still remain open.
- Some data exchange solutions overcome this drawback by specifying everything. Examples can be found looking at some serial interface protocol specifications or at some quite fixed database models. Though this provides a maximum of information provision, such solutions proved to be very inflexible and are tailored to the needs of one specific task.

ASAM ODS headed for an optimum compromise.

On the one hand the specifications shall be applicable to a variety of application areas. Data gathered from small vehicle parts shall be accessible in the same way as those of complete vehicles. Data taken in overseas shall be available together with on-site data (regardless of the language, unit schemes, etc.). Data from research projects as well as from production processes or even after-sales information shall be exchangeable. All systems involved in any of those steps shall be able to store and retrieve data based on the ASAM ODS data model. And, since large amounts of data already are existing all over the companies, ASAM ODS should provide some means to integrate them into the new approach.

On the other hand the information stored shall still be valuable and contain enough meaning to allow some automatic retrieval and data analysis. There should be a relation between a data value (the number) and a corresponding unit in order to know about the real physical value. There should be a relation between the data item and the vehicle or part where it was taken, and with what equipment it has been taken, and who has taken it, and so on.

This finally led to the current data model of ASAM ODS. It distinguishes between a so called ‘base model’ and an ‘application model’.

The base model is a set of defined base elements and a set of base relations between them.

Each base element represents a type of information. E.g. ‘AoUnit’ is the base element that represents information on a physical unit (like Newton, Kelvin,...), ‘AoMeasurementQuantity’ is the base element that represents information on a measured physical quantity (like force, temperature,...), and so on.

Each base relation represents a link with a specific meaning between two such base elements. E.g. AoMeasurementQuantity and AoUnit are linked together and the relation tells which of all possible units is the current unit of that quantity.

The base model is unique for all kinds of applications that use ASAM ODS.

The application model is application specific. A test system for wind tube tests may have a different application model than a system running engine endurance tests.

The application model specifies which elements are really in use by the application. For example, an engine test shall measure a temperature, a pressure, and a force and will use the SI units Kelvin, Pascal, and Newton. These six instances are quantities going to be measured (thus belong to the base element AoMeasurementQuantity) or units (thus belong to the base element AoUnit). Each of them is an individual application element (derived from the corresponding base element), and there is a relation between each such quantity used and an appropriate unit.

Though each application may have its own application model, all application elements in that model know of which base element type they are. And any software accessing such an application element knows more about it than just name and value: it knows the type of information this element carries, it knows in which unit its values currently are expressed and so on.

The data model is explained in more detail in section 1.5.

