

ASAM Regional Meeting - Korea

Introduction of ASAM ODS and Its Application & Usecases

S. Yoo

Y. Choi



9/12 – 9/13, 2023
at Jeju



TENERGY(**T**echnology + **E**nergy)는 CO2와 배출가스 저감 등 환경 개선 및 자동차 산업 분야에서 최고의 기술을 지향하는 엔진개발전문 엔지니어링 회사입니다. 이런 특화된 기술을 최신의 IT기술과 융합하여 환경과 미래를 위해 기여하는 기업이 되고자 노력하고 있습니다.

수원 HQ / R&D Center



동탄 R&D Center



2024년 판교사옥 이전 예정(건축 중)



임직원
130명+



R&D 인원
85%+



연매출
400억원+



R&D Center
2



2008년 설립
15년

ASAM Introduction

ASAM – At a Glance

Foundation	1998 as an initiative of the major German car manufacturers: 
Vision	To create an engineering, simulation, testing and automation environment where devices and software applications can be freely interconnected and data can be seamlessly exchanged.
Purpose	- Platform to develop, enhance and to promote standards for the automotive industry - Legal representative of currently 30 standards
Legal Form	- Registered Association under German law - Non-profit
Member Base	- More than 300 members - More than 25 OEMs

ASAM Introduction

Some Highlights

ASAM Actively Drives Standardization – Inside and Outside

- **Services for ASAM members** worldwide
ASAM Website, International Conference 2019, trade show participation, ...
- **Standards related Activities**
Standards developed internationally, both locally and in internationally staffed project groups
new standard domain “Simulation”, ...
- **A Recognized Partner in the Standardization Community**
Liaison Agreement with ISO, MoU with SAE, AUTOSAR Attendee, ...
- **Next Steps towards Internationalization**
Entered Chinese market,
- **Non-automotive Industries:**
ASAM Standards are used e.g. in the aviation industry, etc.



ASAM Introduction

ASAM Standardization Domains

Data exchange and tool interoperability in automotive development and test.

Simulation

Description of road networks for driving and traffic simulation. Specification of driving maneuvers and test scenarios.

Data Management & Analysis

Standards for storing, retrieving and analyzing mass data captured during simulation, testing, production and the operation of vehicles.

Test Automation

Standards for working with test systems:

- APIs for programmatic access to sensor and actuator devices, measurement and calibration systems, HIL systems, and DoE systems
- Formats for test descriptions



Measurement & Calibration

Standards for working with ECU variables and parameters:

- Read-write access to data in the ECU memory
- Meta-description of the data
- Storing data in files
- Describing calibration process

Diagnostics

Standards for describing and testing the diagnostic subsystems of ECUs.

ECU Networks

Standards for describing and testing ECU networks.

Software Development

Standards supporting the ECU software development process:

- Formal description and documentation of ECU software
- Description of change requests
- Blocksets for model-based software engineering

ASAM Introduction

ASAM Standardization Domains

Data exchange and tool interoperability in automotive development and test.

Simulation

OpenCRG OpenDRIVE OpenSCENARIO

Measurement & Calibration

MCD-1 POD MCD-1 CCP / XCP MCD-2 MC
MCD-2 CERP MDF CDF CPX

Data Management & Analysis

CEA ODS

Diagnostics

MCD-2 D MCD-3 D

Test Automation

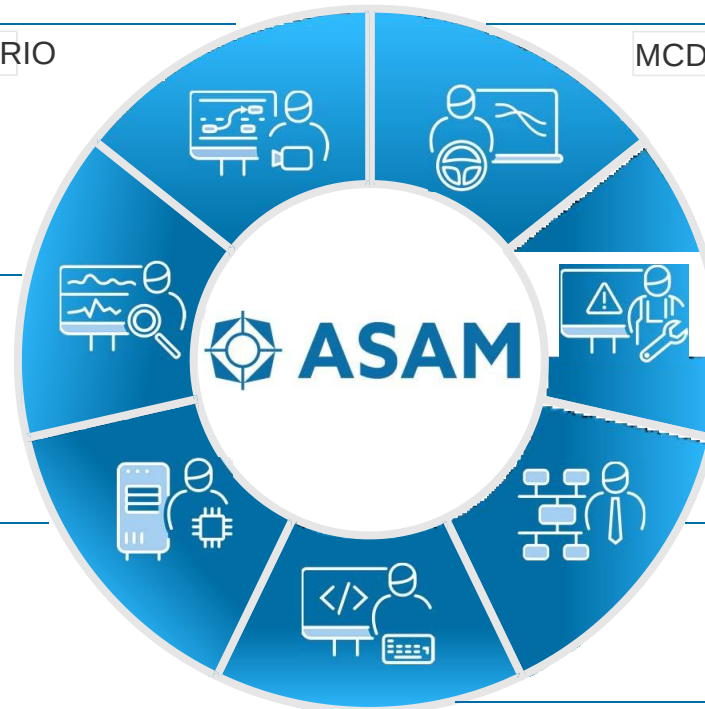
ACI
ASAP 3 ATX GDI iLinkRT
MCD-3 MC OTX Extensions
XIL

ECU Networks

MCD-2 NET

Software Development

CC FSX ISSUE LXF MBFS MDX



ASAM Introduction

Testing in an Enterprise - Applications

Stationary Test Stands



Engine | Emissions | NVH | ...

Fleet Testing



Durability | ADAS | Fleet Data

Life-Cycle / Maintenance Evaluation



NVH data detect / evaluate life cycle

Maintenance Prediction



Track Conditions /Forecast for renovation

ASAM Introduction

Testing in an Enterprise - Domains

Challenges in IT & Engineering



Organization / IT

Different Test Stands /
Vehicles and Sensors

Different File Formats

Different Channel
Naming

Engineering

Different Tools by
specialized Vendors

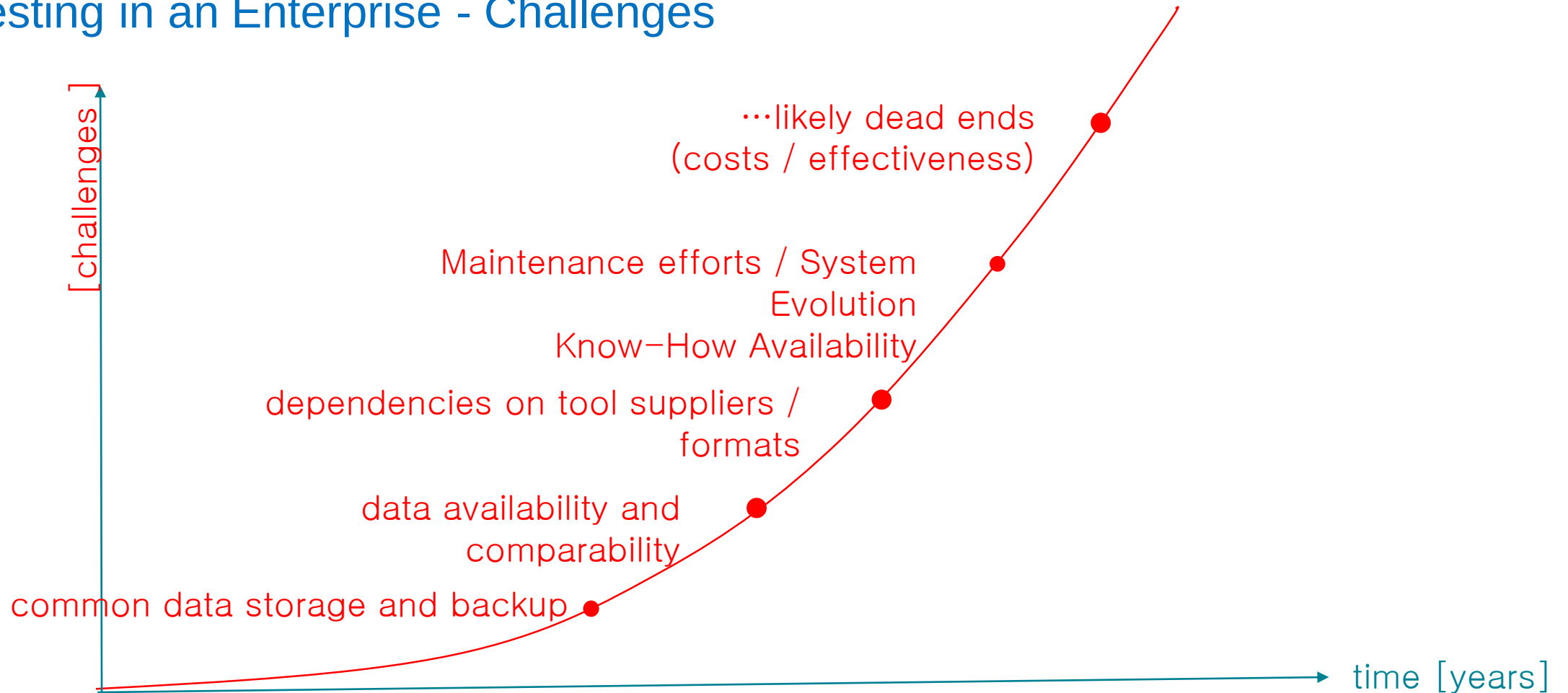
Different Specific
Features & Work-Flows

Required
Analyses / Algorithms

Test Data Management with ASAM ODS makes you the owner of your data.

- . Independency and Protection of Investment
- . Shared know-how and costs in a none-competitive infrastructure

Testing in an Enterprise - Challenges

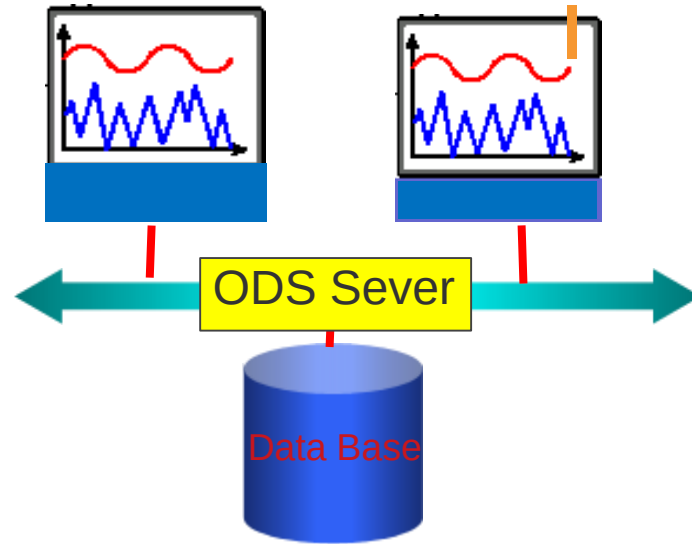


There are many unforeseen pitfalls ahead and many decisions and compromises to make right.

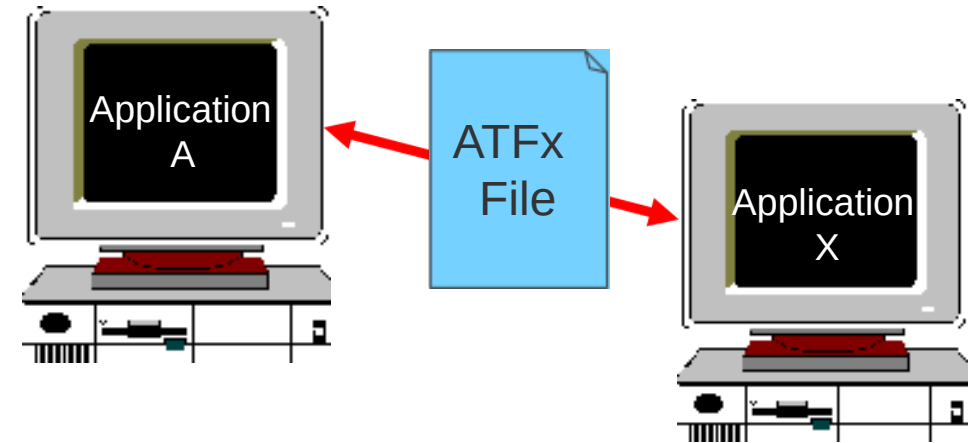
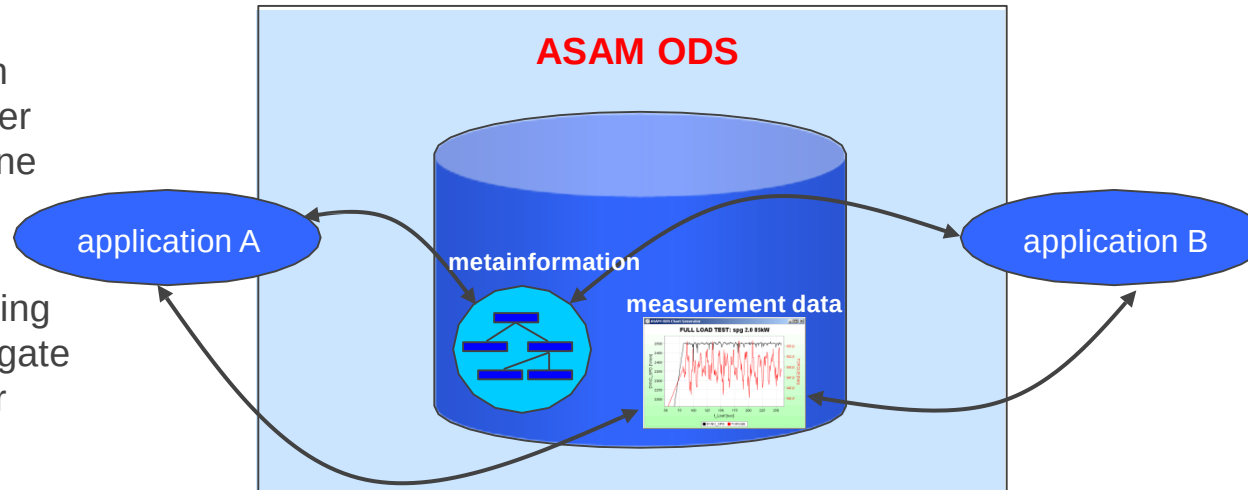
ASAM ODS (Open Data Services)

ASAM ODS Overview & Main Features

ASAM ODS defines
· application
Programming
Interfaces (API) for a
server.



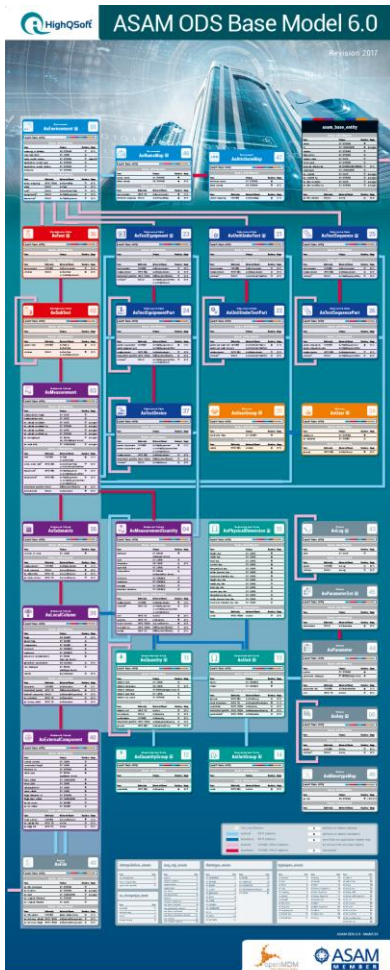
ASAM ODS defines
· a basic data model which
can be mapped to customer
specific applications (engine
test, brake test, engine
calibration, ... etc)
· a meta data model enabling
a client application to navigate
through domain specific or
application specific data
structures



ASAM ODS defines
· a file format for the
exchange of test result
data

ASAM ODS (Open Data Service)

ASAM ODS Overview - Structure



The ASAM ODS standard

- ...defines a common basis for **data generation, storage and analysis**
- ...is a world-wide standard **for more than 25 years**
- ...is supported & utilized **by most automotive OEMs world-wide**

The ASAM ODS takes care of:

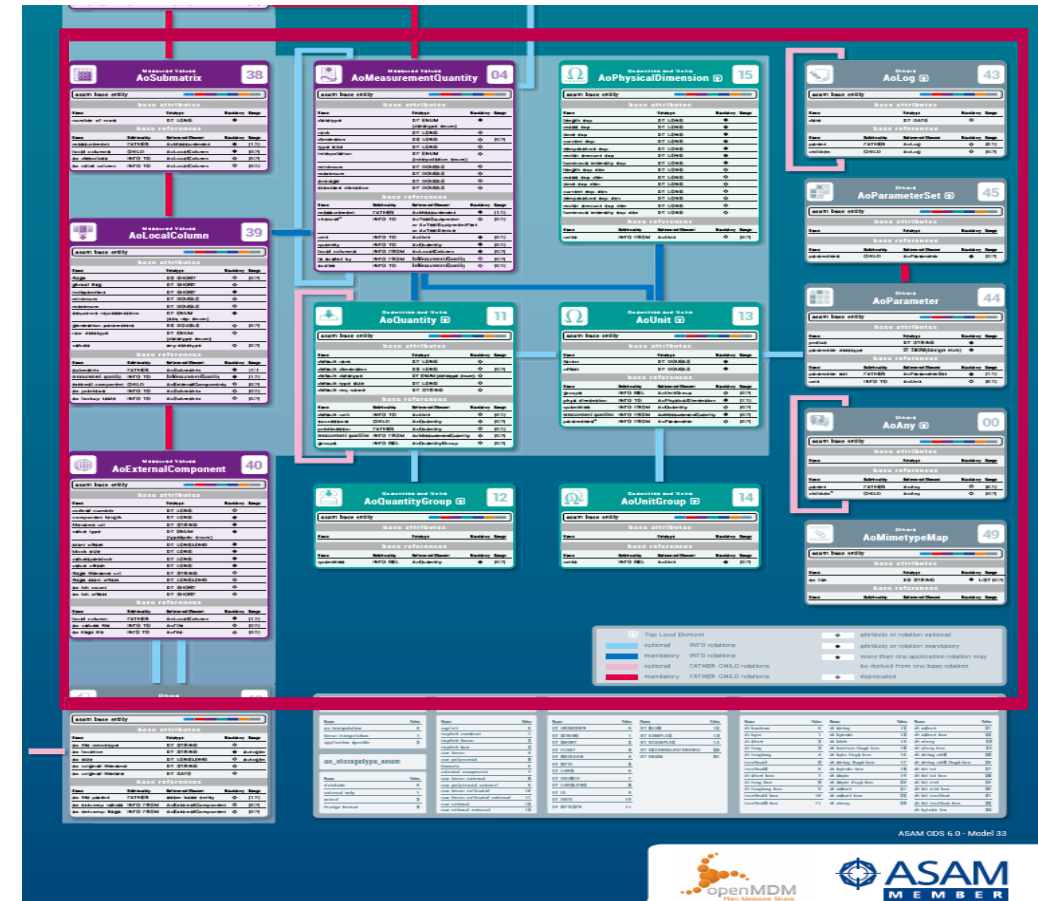
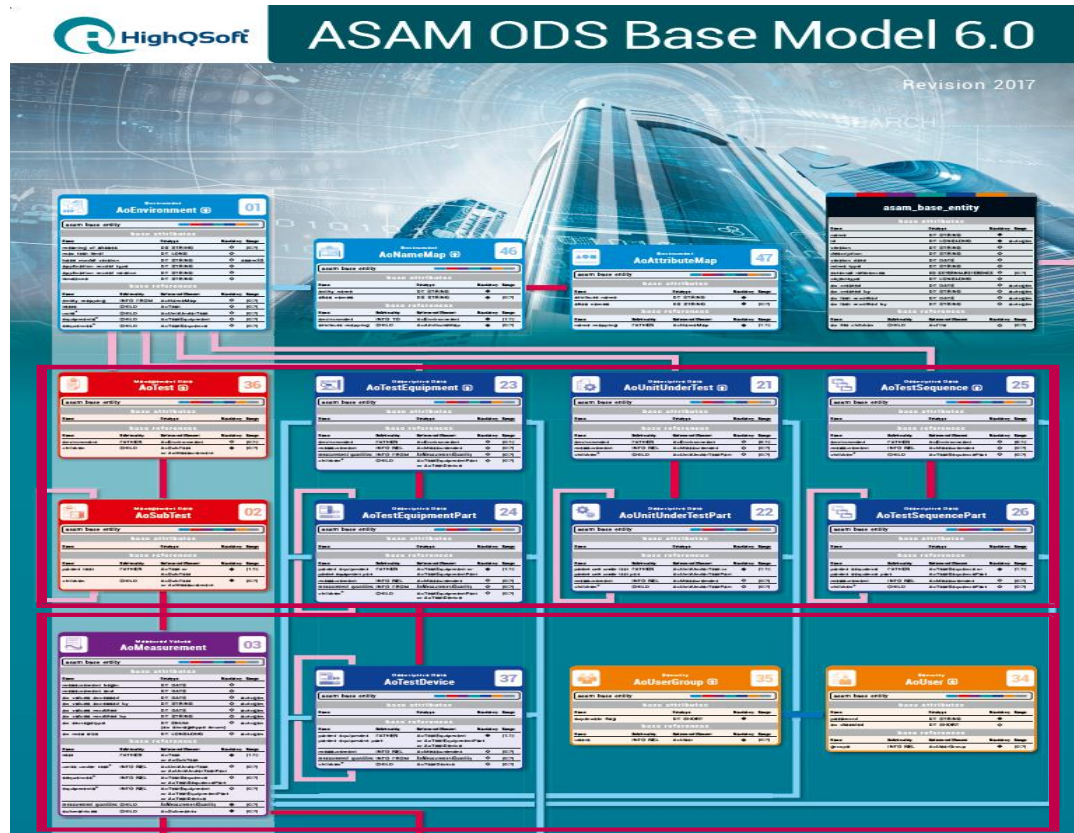
- . Physical Data Storage (ASAM ODS Base Model)
- . Standardized Access Layer (ODS API)
- . Data Exchange Format (ATFx File Format)

Content of ASAM ODS

- . Meta Data: Project, Test Object, Test Environment and Test Sequences
- . Mass Data: Time Series, Event-based, BUS, ...
- . Domains: Powertrain, Safety, NVH, Wind tunnel, ...

ASAM ODS (Open Data Service)

ASAM ODS Overview - Structure



Light Blue: Environ. Data
Dark Blue: Meta Data
Orange: Security
Grey: Others

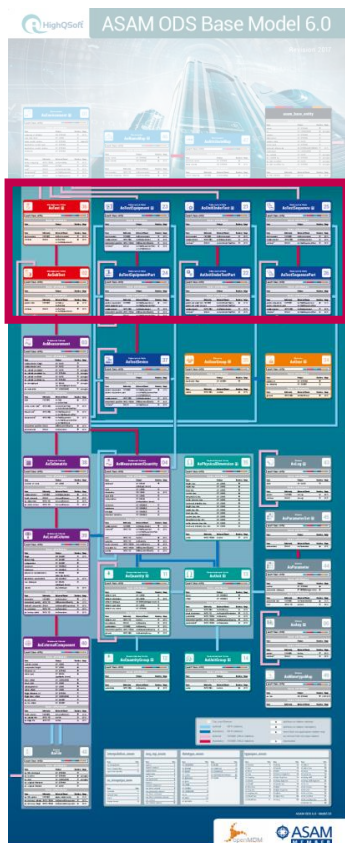
Red: Management Data
Purple: Mass Data
Green: Quantities+Units

Dark Blue: Mandatory
Red: Mandatory
Orange+Green: Optional

RDBMS: 관계형 DB

ASAM ODS (Open Data Service)

ASAM ODS: Descriptive Data / Meta-Data



Project	Test Object / UUT	Test Environment	Test Sequence / Test Steps
Measurement (units quantities physical dimensions)			

The meta information described in ASAM ODS is information about:

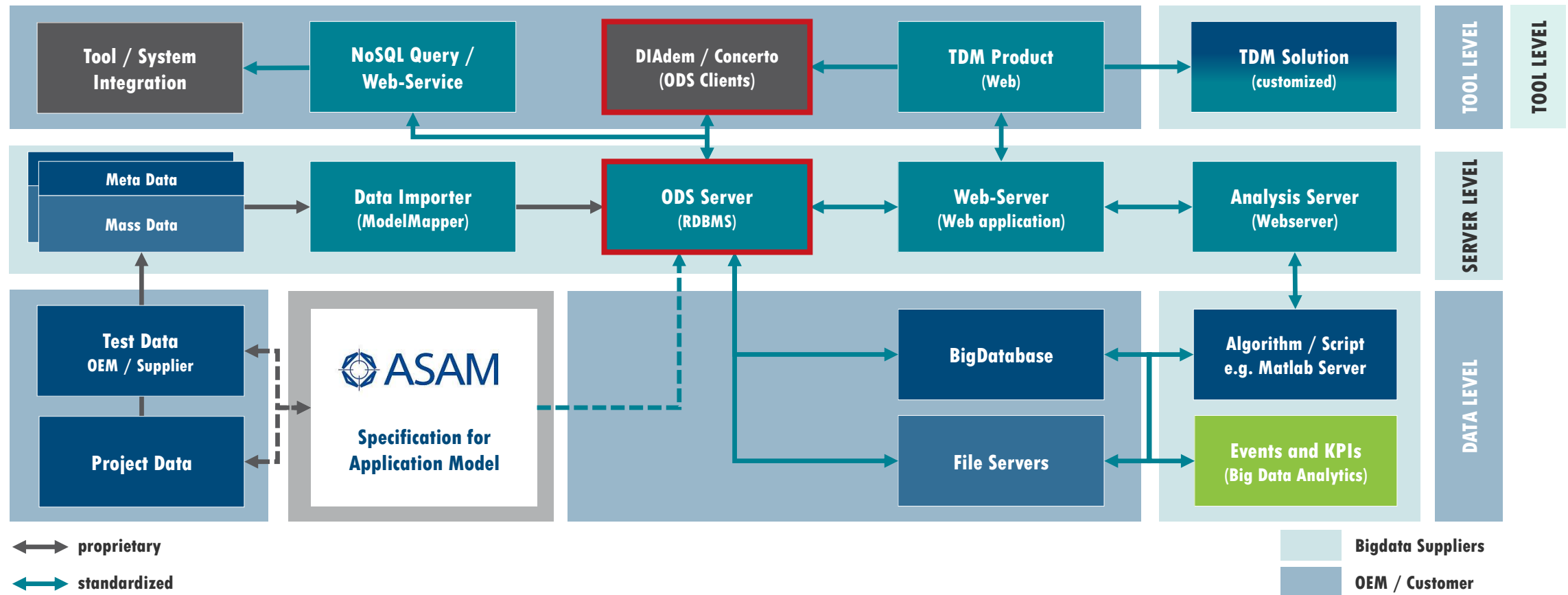
- . the project such as “customer, project-ID, location, time zone, ...” [obligatory]
- . UUT (engine, type, parts, ...)
- . the test stand, vehicle, or generally devices and sensors
- . the procedure of testing (durability tests or trip files for vehicles)

Meta information is stored in the database and is a network of information used to retrieve measures data (even after years after recording).

Important: Descriptive data is often retrieved from external systems (Laboratory MGMT)

ASAM ODS (Open Data Service)

Bigdata Structure



ASAM ODS (Open Data Services)

Database Structures

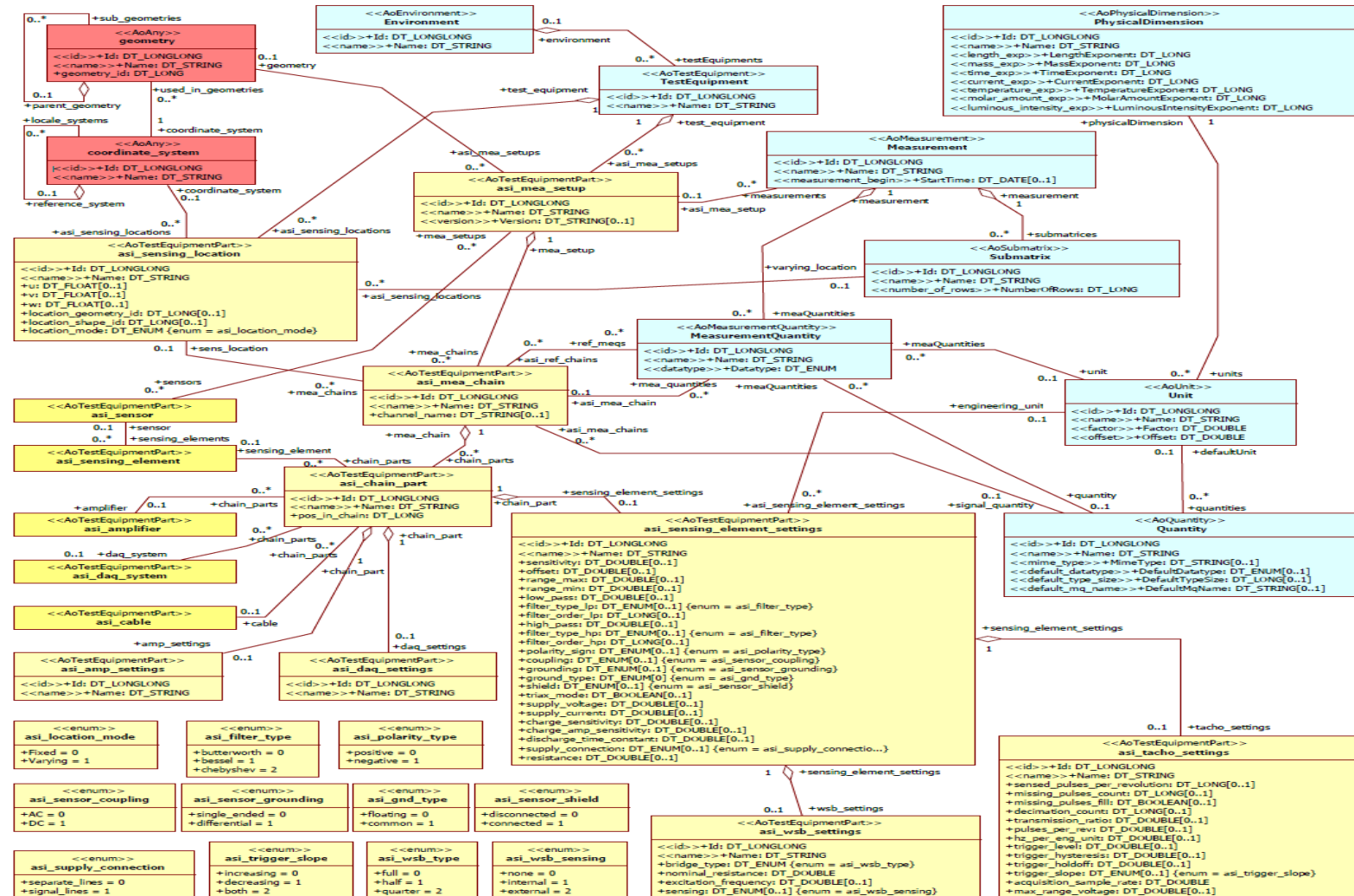


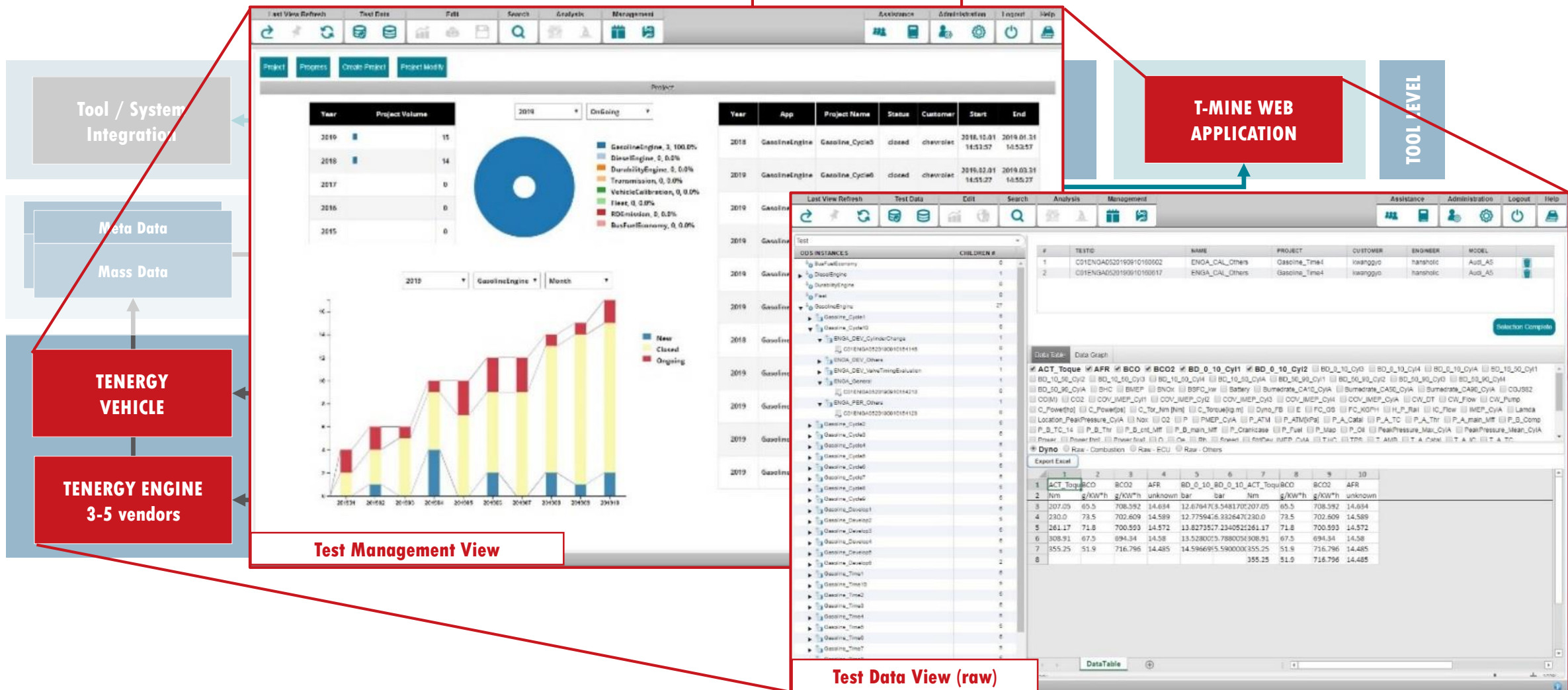
Figure 6 - Application model for the instrumentation settings

ASAM ODS (Open Data Services)



Tenergy Usecase

Uniplot

DIAdem

ASAM ODS (Open Data Services 6.2.0)



Base Standard Specification

Contents	
Chapter 1	Introduction
Chapter 2	Relation to Other Standards
Chapter 3	Architecture
Chapter 4	Base Model (36)
Chapter 5	OO-API (5.3.1)
Chapter 6	RPC-API (3.2.1)
Chapter 7	ATF/XML (1.3.1)
Chapter 8	ATF/CLA (1.4.1)
Chapter 9	Physical Storage (1.4.0)
Chapter 10	MIME Types and External References (1.2.3)
Chapter 11	HTTP-API (1.2.0)
Chapter 12	Terms and Definitions
Chapter 13	Symbols and Abbreviations

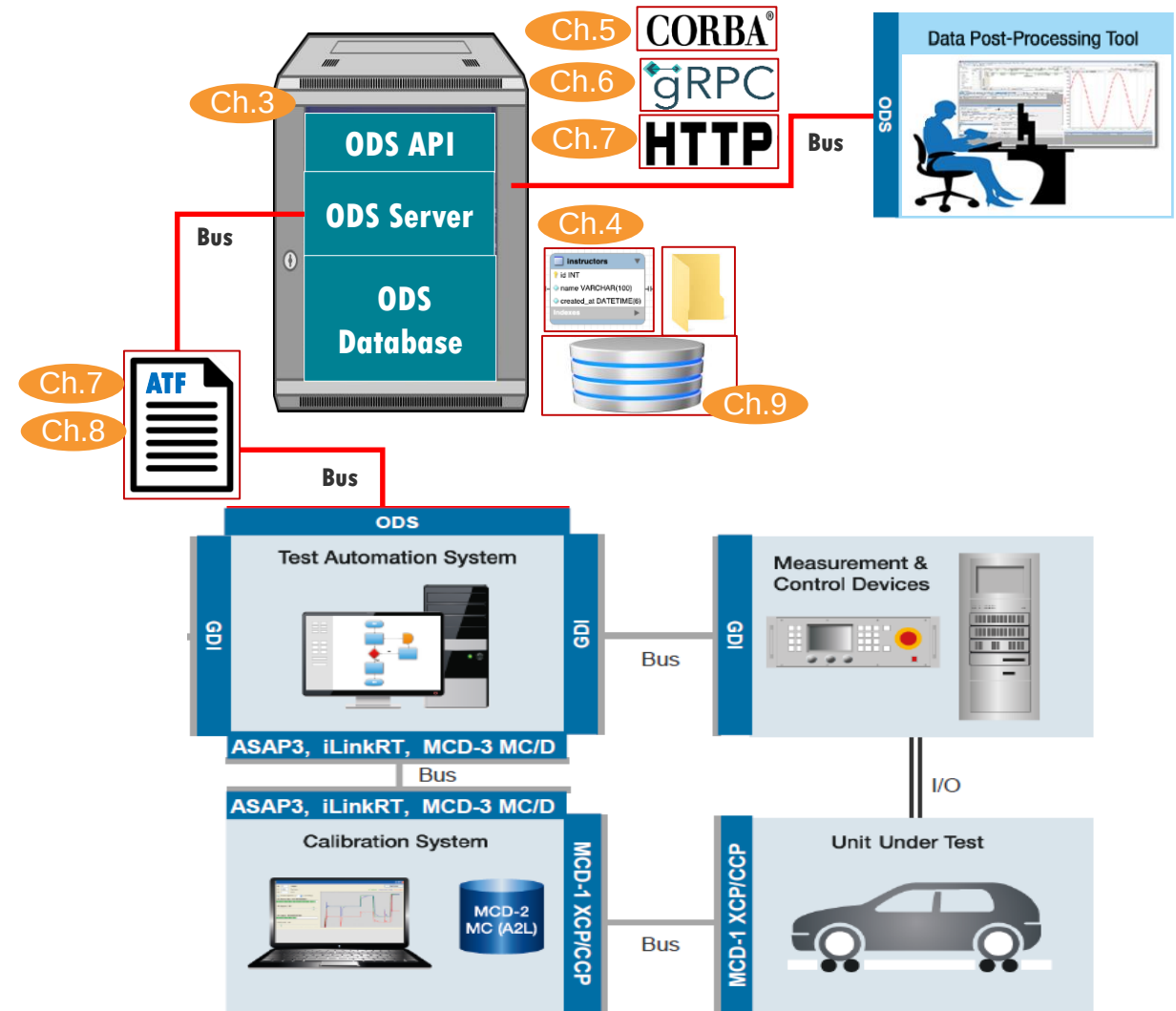
Association Standard Specification

Contents	
Big Data Connector	Ver. 1.1.1 / 2022-12
Bus Data Model	Ver. 1.0.2 / 2022-12
Calibration Model	Ver. 1.1.2 / 2022-12
Geometry Model	Ver. 1.1.0 / 2022-12
NVH Model	Ver. 1.5.3 / 2022-12
Workflow Model	Ver. 1.0.1 / 2022-12

ASAM ODS (Open Data Services 6.2.0)

Base Standard Specification

Contents	
Chapter 1	Introduction
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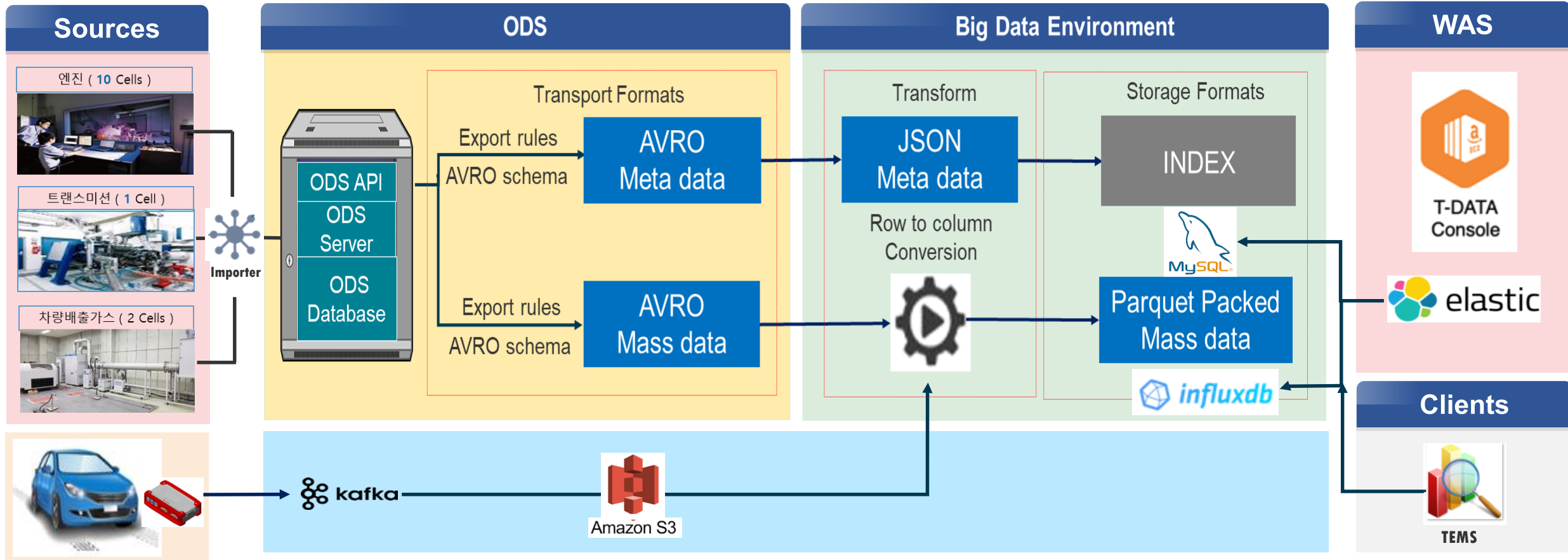
ASAM ODS (Open Data Services 6.2.0)

Association Standard Specification

Standard Specification		Description
Big Data Connector	Ver. 1.1.1	• Serialization Upgrade required: “CORBA dependency” • “Big Data” require alternative data sources and data access methods for data analysis.
Bus Data Model	Ver. 1.0.2	• describes the storage of the raw measurement data as provided by bus loggers from vehicle networks. Currently supported bus protocols are CAN, LIN, FlexRay, MOST and Ethernet.
Calibration Model	Ver. 1.1.2	• is intended as a schema to structure calibration data obtained from the calibration process of test stand components like sensors, amplifiers, etc..
Geometry Model	Ver. 1.0.2	• is intended for documenting the test object geometry and for providing a standardized way of linking measured data with elements on the test object geometry.
Instrumentation	Ver. 1.1.0	• can be used for preparation of upcoming measurement tasks as well as for documenting the configuration that was used to create measurement data in the ASAM ODS storage.
NVH Model	Ver. 1.5.3	• a lot of simulation results and measurement data exist. Since there exist quite a lot of software solutions for problem solving in the NVH field, being able to share data between all these solutions is of high importance to the users of such software.
Workflow Model	Ver. 1.0.1	• is intended for use in cases where information on workflow within processes shall be specified and stored together with any related measurement data and results.

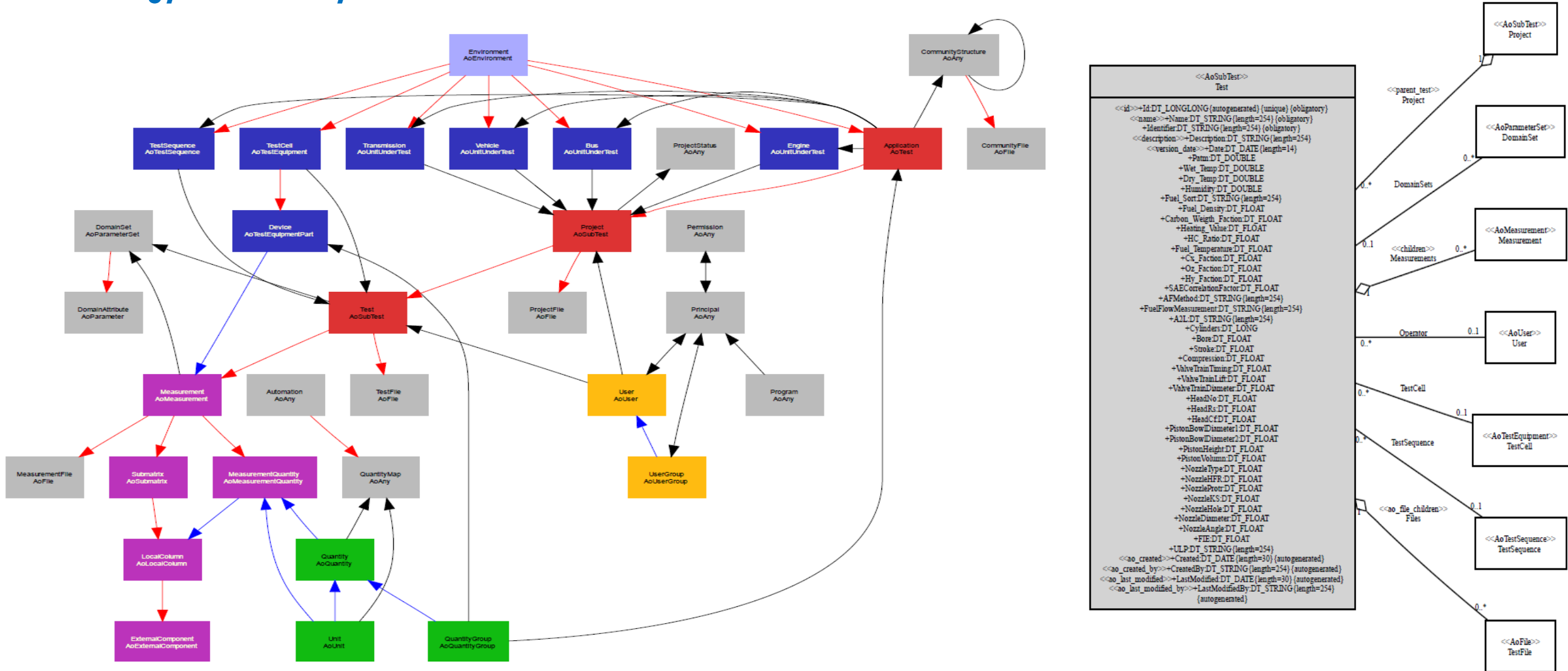
ASAM ODS Application

Tenergy Data Lake System : Architecture



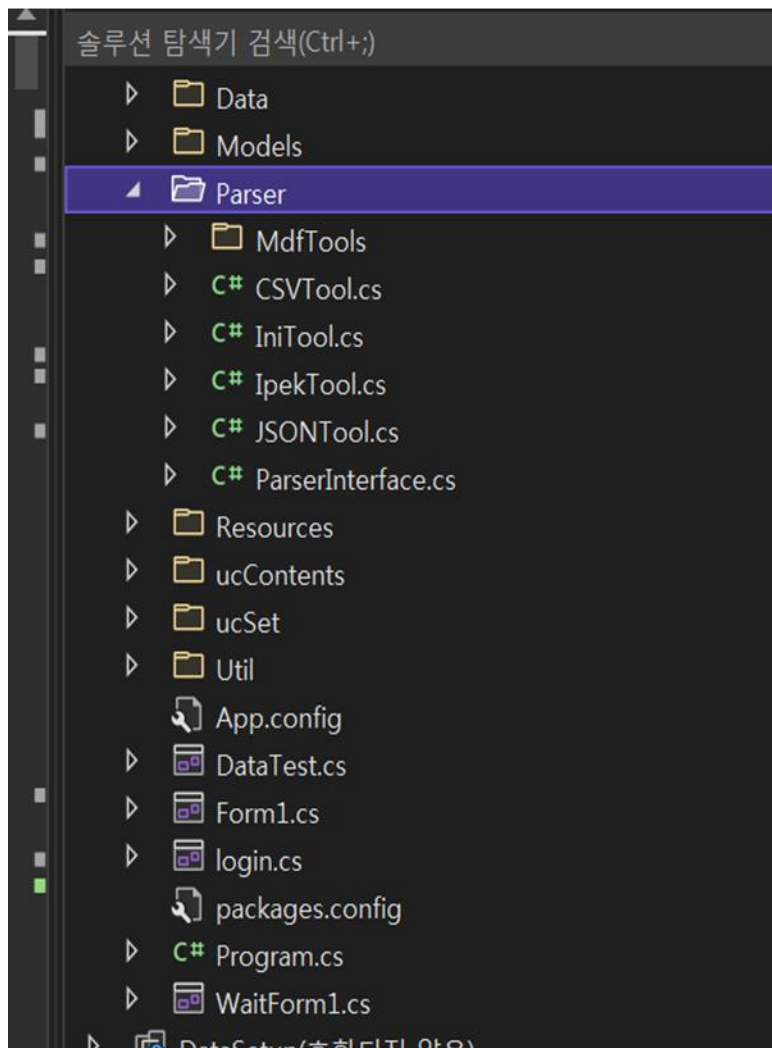
ASAM ODS Application

Tenergy Data Lake System : Data Model



ASAM ODS Application

Tenergy Data Lake System : Data Importer



1

EMS 데이터 - MDF 포맷

```
5 namespace DataAnalyTool.Parser.MdfTools
6
7 {
8     class ChannelData
9     {
10         public enum DataType
11         {
12             UnsignedInteger,
13             SignedInteger,
14             Float,
15             Double,
16             UIntString
17         }
18
19         private DateTime date;
20         private string name;
21         private string unit;
22         private DataType datatype;
23         private string groupname;
24         private bool isSelected = false;
25         private string replaceName;
26         private List<double> value = new List<double>();
27         private List<string> valueStr = new List<string>();
28         private bool isChangedRules = false;
29         private List<DiagRuleInfo> diagRules = new List<DiagRuleInfo>();
30     }
31 }
```

2

IPEK 데이터 - Binary 포맷

```
5 namespace DataAnalyTool.Parser
6 {
7     class IpekTool : ParserInterface
8     {
9         public const string ENCODINGTYPE_JS_C_5601_1987 = "js_c_5601-1987";
10        public const string ENCODINGTYPE_WINDOWS_1250 = "windows-1250";
11        public const string ENCODINGTYPE_ISO_8859_1 = "iso-8859-1";
12        public const string ENCODINGTYPE_EUC_KR = "euc-kr";
13
14        public const string BEGINGLOBALHEADER = "#BEGINGLOBALHEADER";
15        public const string ENDGLOBALHEADER = "#ENDGLOBALHEADER";
16        public const string BEGINCHANNELHEADER = "#BEGINCHANNELHEADER";
17        public const string ENDCHANNELHEADER = "#ENDCHANNELHEADER";
18        public const string HEADER_KEY_NUM = "106";
19        public const string HEADER_VALUE_NUM = "102";
20
21        public const string HEADER_KEY_STARTDATE = "Start date";
22        public const string HEADER_KEY_STARTTIME = "Start time";
23        public const string HEADER_KEY_STOPDATE = "Stop date";
24        public const string HEADER_KEY_STOPTIME = "Stop time";
25        public const string HEADER_KEY_SAMPLINGRATE = "SamplingRate";
26        public const string HEADER_KEY_STORAGERATE = "StorageRate";
27
28        public const string CHANNEL_KEY_NAME = "200";
29        public const string CHANNEL_KEY_DESCRIPTION = "201";
30        public const string CHANNEL_KEY_UNIT = "202";
31        public const string CHANNEL_KEY_FORMAT = "213";
32        public const string CHANNEL_KEY_SIZE = "214";
33        public const string CHANNEL_KEY_NUMBER = "220";
34        public const string CHANNEL_KEY_INDEX = "221";
35        public const string CHANNEL_KEY_NOCHANNEL = "222";
36    }
37 }
```

3

측정 데이터 - CVS 포맷

```
5 class CSVTool : ParserInterface
6 {
7     public const string ENCODINGTYPE_JS_C_5601_1987 = "js_c_5601-1987";
8     public const string ENCODINGTYPE_WINDOWS_1250 = "windows-1250";
9     public const string ENCODINGTYPE_ISO_8859_1 = "iso-8859-1";
10    public const string ENCODINGTYPE_EUC_KR = "euc-kr";
11
12    public CSVTool()
13    {
14    }
15
16    public void GetMatrix(string path, int sort_type, List<ChannelData> selectedChannels, List<ChannelData> matrix)
17    {
18        int i = 0;
19        long startTime = 0, endTime = 0;
20        List<string> stringList = new List<string>();
21        if (path != null && path.Length > 0)
22        {
23            var ReadDataAllText = File.ReadAllText(path, Encoding.GetEncoding(ENCODINGTYPE_EUC_KR));
24            if (ReadDataAllText != null && ReadDataAllText.Length > 0)
25            {
26                foreach (string item in ReadDataAllText)
27                {
28                    var strings = item.Split(',');
29                    stringList.Add(strings);
30                }
31            }
32        }
33    }
34 }
```

3

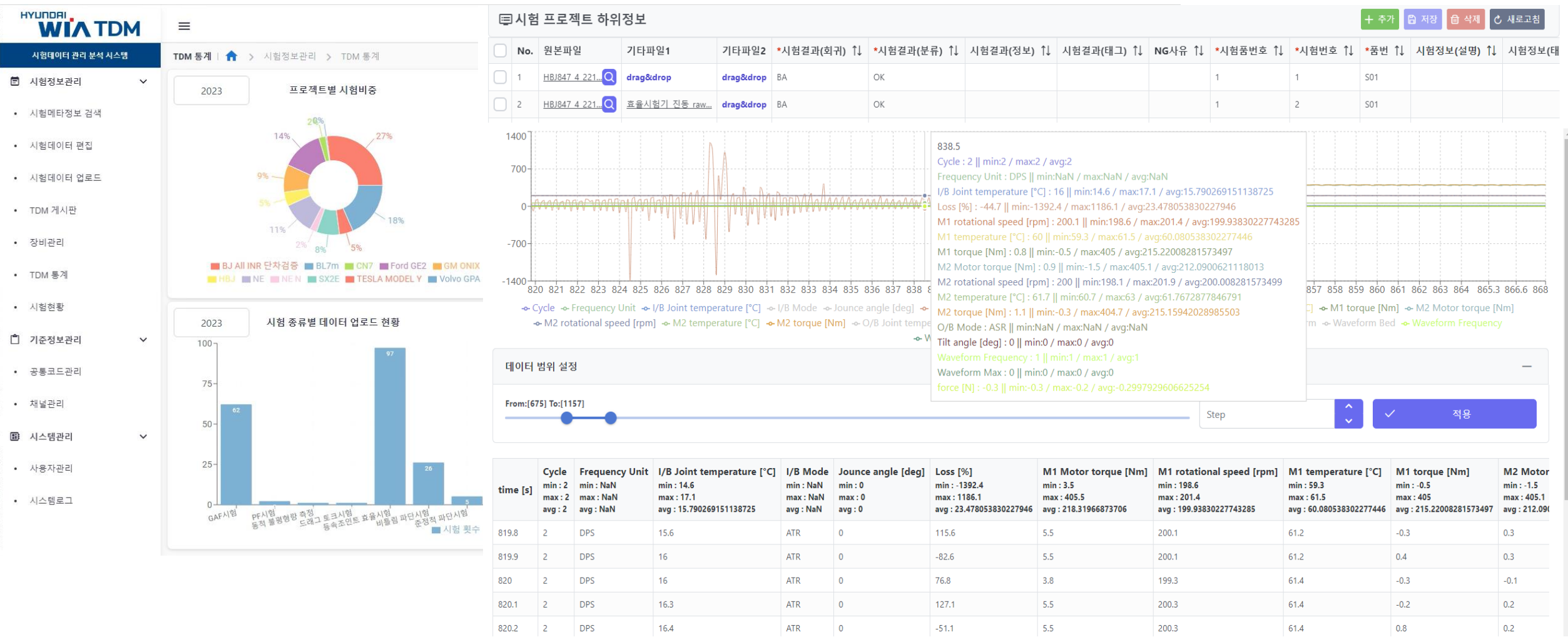
통신 데이터 - JSON 포맷

```
5 namespace DataAnalyTool.Parser
6 {
7     class JSONTool : ParserInterface
8     {
9         private int GetColumnCount(List<ChannelData> selectedChannels)
10        {
11            int columnCount = 0;
12            foreach (ChannelData channelData in selectedChannels)
13            {
14                int columnCount = channelData.Length;
15                if (columnCount > columnCount)
16                {
17                    columnCount = columnCount;
18                }
19            }
20            return columnCount;
21        }
22
23        public void GetMatrixChannelName(string path, List<ChannelData> selectedChannels, ref long startTime, ref long endTime)
24        {
25            string ReadDataAllText = File.ReadAllText(path, Encoding.GetEncoding(ENCODINGTYPE_EUC_KR));
26            if (ReadDataAllText != null && ReadDataAllText.Length > 0)
27            {
28                foreach (string item in ReadDataAllText)
29                {
30                    var strings = item.Split(',');
31                    stringList.Add(strings);
32                }
33            }
34        }
35
36        public void GetMatrixChannelName(string path, int sort_type, List<ChannelData> selectedChannels, List<ChannelData> matrix)
37        {
38        }
39    }
40 }
```

ASAM ODS Application



Lab Application – Chassis Parts Performance



ASAM ODS Application

Road Application – Fleet Management

The screenshot displays the ASAM ODS Application interface. On the left, a sidebar shows a project tree under '운행지원팀' (Operation Support Team) with a sub-project '자동차 안전 연구원 수소버스 project 1세부 과제' (Vehicle Safety Researcher Hydrogen Bus Project 1 Sub-task). The selected project is 'Hydrogen-bus-test01', which includes several measurement files like 'Hydrogen-bus-measurement_3701', 'Hydrogen-bus-measurement_3738', 'Hydrogen-bus-measurement01', 'Hydrogen-bus-measurement01_3707', and 'Hydrogen-bus-measurement01_TEST'. Below this, there are links for '냉각공조개발팀' (Cooling/Climate Development Team) and '냉각시험팀' (Cooling Test Team).

The main area shows the '측정대상체 정보' (Measurement Target Information) for 'UUT(측정체)' (UUT (Measurement Body)). The information includes:

- 아이디 (ID): UUTYP0113
- 이름 (Name): FCEV
- 유형코드 (Type Code): 측정유형1[UUTYP01]
- 모델년식 (Model Year): 2021
- 개발단계 (Development Stage): 개발단계
- 일련번호 (Serial Number): ddxoooyyg0020
- 관리번호 (Management Number): MCBUS_3701
- 엔진 (Engine): HMS01EG01[카파1]
- 트랜스미션 (Transmission): HMS01TM01[1]
- 에어컨디션 (Air Conditioner): HMS01AC01[1]

Below the information, there are icons representing different components: 'Hydrogen Bus', 'Fuel Cell', 'Motor', 'Inverter', 'Battery', and 'DC/DC Converter'. A diagram of a hydrogen bus is shown with these components labeled. A file 'uut.jpg' (408.65KB) is displayed. On the right, there are buttons for '측정대상체-엔진 정보' (Measurement Target-Engine Information), '측정대상체-에어컨' (Measurement Target-Air Conditioner), and '측정대상체-트랜스' (Measurement Target-Transmission).



서울시 시내버스 홍보영상 <2020 YouTube>

The screenshot displays the 'TENERGY TDATA CONSOLE' interface. The top navigation bar includes 'SERVICE ADMIN' and 'SYSTEM ADMIN' tabs. A search bar is present with the text '통합검색' (Integrated Search) and '언어: Korean' (Language: Korean). The main area shows the '측정 데이터 기간 선택' (Measurement Data Period Selection) for the date '2021-11-27'. A graph displays the '측정 데이터' (Measurement Data) for 'ABS_BrakePressure_Rig'. The graph shows a line plot of brake pressure over time, with a peak around 09:10. A table on the right lists the '측정 데이터' (Measurement Data) with columns 'index' and 'sys time'.

index	sys time
1	09:00:00
2	09:00:01
3	09:00:02
4	09:00:03

ASAM ODS Application



Road Application – Driving Durability Performance Analysis System



평가 현황 데이터 검토 통합 분석 보고서 시험 검색 자동 분석 환경설정

박경석(ParkKS) / 전동화시험센터 로그아웃



성능 평가 현황
신규 평가 생성
데이터 가져오기

2023-03-13

2023-09-13

평가
검색

평가 명

(2023P006)_EURO7 엔진 실차평가

선택

Team

평가 아이디

평가 명

시작일

관리자

설명

차종

모델상세

엔진

변속기

구동전동기

구동축전...

자동...

2023P006

EURO7 엔진 ...

2023-08-...

CCC

CCC

Elec...

e_PE_48V

ELEC_CI...

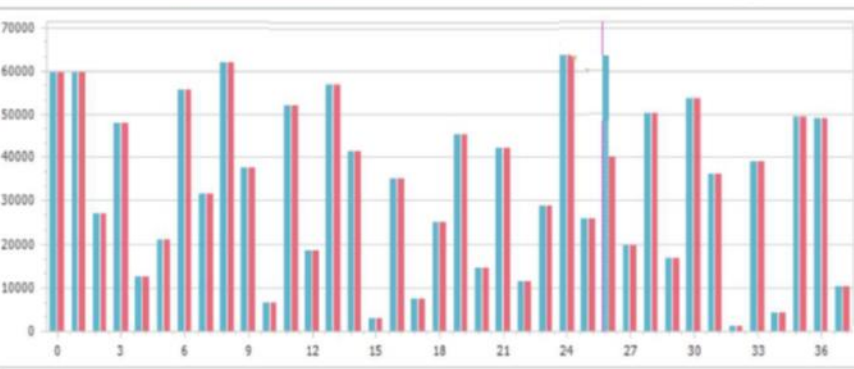
Electro B

Graph

그래프 타입

Refresh

그래프 저장



주행 실적 (%)



주행 루트

37,413,294

127,0017

지도보기

Enter text to search...

Find

선택	시험 ID	차량 ID	차량 명	주행루트 ID	주행루트 거리	주행루트 분석	시작일	목표 주행거리	총 주행거리	주행률(%)	일평균주행...	시험데이터	주행 실적	주행 분석	정기 점검	시.	주간
☐		2023P006	ElectroBus		ELEC_CITY	CCC	2023-08-24				e_PE_48V	EURO7 엔진 실차평가	EURO7 엔진 실차평가		Electro Bus		Electro...



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yongho.choi@tenergy.co.kr

