

# ASAM e.V.

## ASAM MDF, ASAM ODS, and ASAM OpenX

Dr. Ralf Nörenberg

ASAM Board Member  
HighQSoft GmbH

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Novi, Michigan



Association for Standardization of  
Automation and Measuring Systems

# ASAM standards portfolio

Combining standards

## Simulation

OpenCRG   OpenDRIVE   **OpenLABEL**  
**OpenSCENARIO**   OSI

## Data Management & Analysis

CEA   **ODS**

## Test Automation

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



## Measurement & Calibration

ARTI   CDF   CMP   CPX   HMS  
MCD-1 CCP / XCP   MCD-1 POD  
MCD-2 MC   MCD-2 CERP   **MDF**

## Diagnostics

MCD-2 D   MCD-3 D   SOVD

## ECU Networks

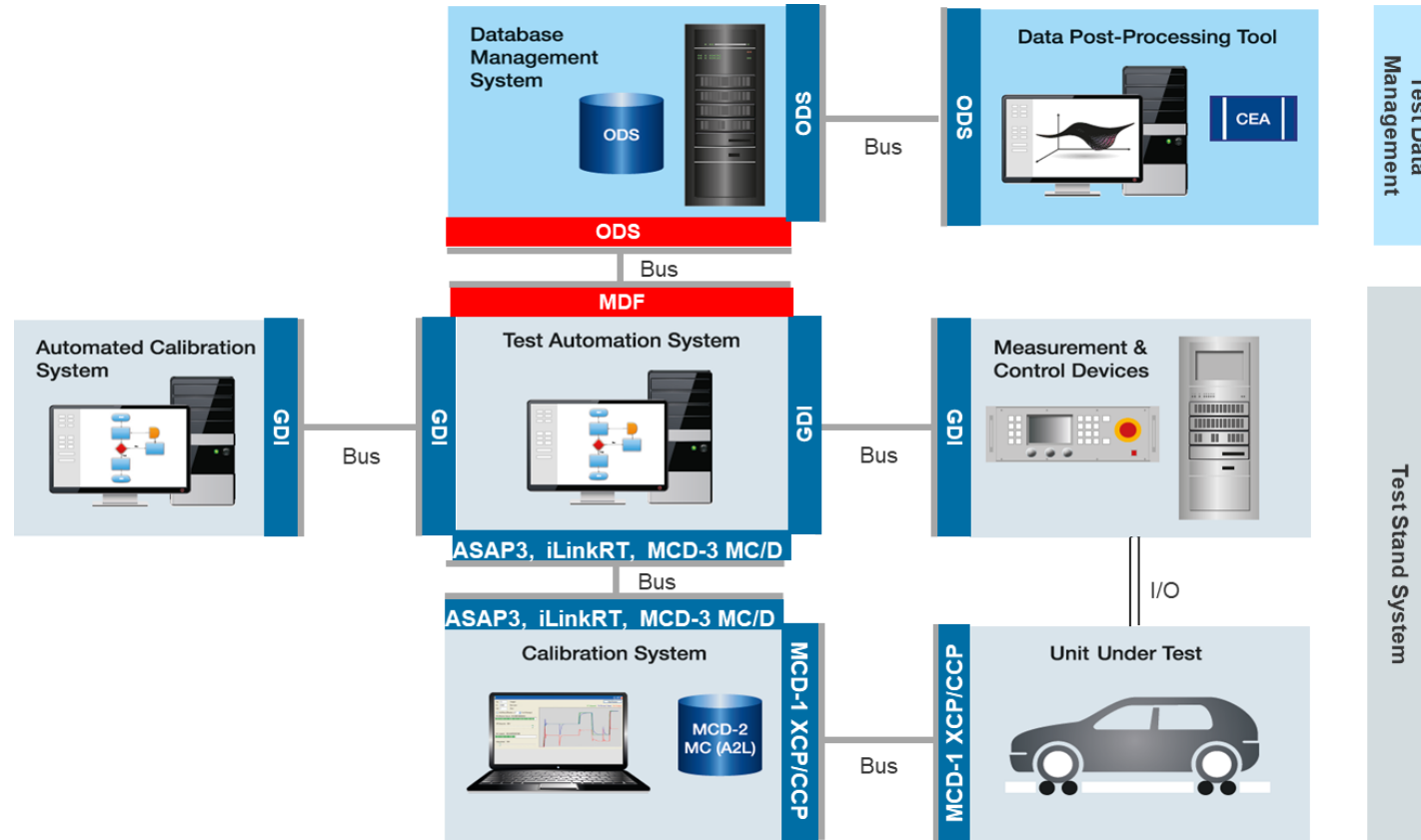
MCD-2 NET

## Software Development

CC   FSX   ISSUE   LXF   MBFS   MDX   SCDL

# ASAM standards supporting processes in test systems

Application in a test system



**ASAM MDF** is a standard for storing newly captured, measured data into a file (container)

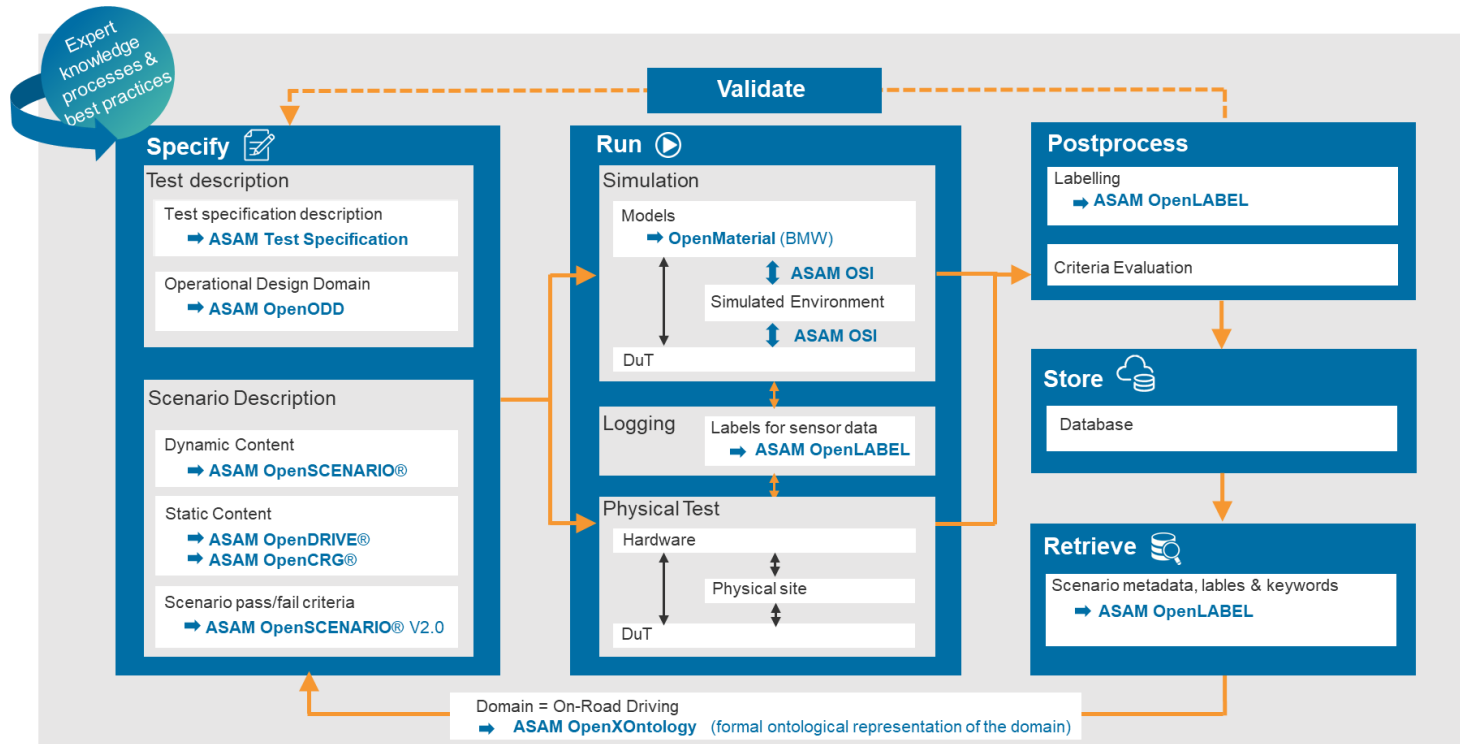
... and a primary input format for ...

**ASAM ODS**, a standard for measured data storage. It supports standardizing measured data from all domains, formats and types.

# Scenario-based testing with ASAM OpenX®

ASAM OpenX are a series of standards and initiatives in the simulation domain, capturing “ADAS”-data for scenario-based testing.

For the validation loop, new types of raw data are captured, and new types of analysis artefacts are produced such as:



- object lists and labels
- scenarios

For analysis, a combined look into data of all domains is required.

What is the **outlook** on enabling this?

# ASAM MDF Project

## Current status

Currently, the project group

- integrates **Lidar / Radar / Video** data can be stored within the MDF file together with Measurement Data
- Rosbag-files (point clouds) can be stored or referenced from the MDF file.

In future,

- A potential outlook is the **integration of scenarios** via „Range-Events“ and corresponding meta information (which are linked to MDF-events)
- Integration of „**object lists**“ of dynamic lengths is a task for 2023 (for example: list of recognized vehicles)

# ASAM ODS Project

Current status

Currently, the project group

- Works with the ASAM MDF group to integrate **Lidar / Radar / Video** data into ASAM MDF and support it with ASAM ODS
- defines a server interface for direct access to MDF files
  - Information can directly be accessed within the files (reducing table size in ASAM ODS)
  - A **hybrid storage** in ASAM ODS and ASAM MDF is possible (allows hot & cold storage)

The ASAM ODS file-interface can be used to generally read data streams (**integration of alternative data sources & technologies**).

# ASAM Test Specification Study Group

Current status

Results of the study group “**ASAM Test Specification**” indicate the following challenges (among others):

- **Consolidation** of RAW data artefacts in an eco-system (storage/access)
- **Interoperability** of captured data with new artefacts (scenarios/libraries/labels/...)

	TEST ENVIRONMENT								
	MODEL- IN-THE-LOOP	SOFTWARE REPROCESSING	CLOSED-LOOP SIL	HARDWARE REPROCESSING DATA REPLAY	CLOSED-LOOP HIL	VEHICLE- IN-THE-LOOP (VIL)	DRIVER- IN-THE-LOOP (DIL)	PROVING GROUND	OPEN ROAD TESTING FIELD MONITORING
TEST METHOD									
REQUIREMENTS- BASED TEST (FUNCTIONAL TEST) <small>Software architectural design/Specified functionality</small>	More details <b>5.2.2</b> Requirements-based testing MIL	Test of ADAS/AD software via open loop e.g. detection quality	More details <b>5.2.1</b> Use cases Requirements-based test SIL		More details <b>5.2.1</b> Requirements-based testing on closed-loop HIL	More details <b>5.2.7</b> Requirements-based testing vehicle-in-the-loop		Testing in a controlled proving ground environment e.g. testing of the complete ADAS function in real-world conditions	Testing of the ADAS/AD functions under real-life use cases in the field e.g. shadowing
INTERFACE TEST <small>Software unit implementation/ Hardware-software interface specification</small>			Software integration tests e.g. test of interfaces for communication between ...	More details <b>5.2.6</b> Hardware reprocessing Data replay	Higher-level integration tests e.g. testing of bus communication between ECUs	Testing of complete ADAS/AD effect chain on system level e.g. interaction			
FAULT INJECTION <small>Testing of safety mechanism/ Robustness</small>	More details <b>5.2.3</b> Fault injection on MIL	Evaluation of robustness e.g. robustness against pixel faults	Verification of safety mechanisms e.g. out of range e.g. testing robustness of software calibration	Verification of safety mechanisms including hardware e.g. testing robustness	Testing of safety mechanisms with integrated system e.g. electrical failure simulation like short to ground e.g. testing of robustness against vehicle tolerances		Validation of overall system behavior e.g. testing of controllability	Validation of overall system performance e.g. testing of safety	
RESOURCE USAGE PERFORMANCE TEST <small>Sufficiency of resources/ Hardware architectural design</small>					Testing of the vehicle network performance e.g. sleep and wake				
SCENARIO-BASED TEST <small>Validation of real-life use cases SOTIF validation</small>	Validation of control components e.g. testing of ADAS/AD effect chain in modeling environment		More details <b>5.2.8</b> Scenario-based testing SIL Closed loop		Validation of electronics integration e.g. testing the overall system behavior in challenging scenarios	Validation on system level e.g. complete system reaction to the most challenging scenarios	Validate interaction of driver with safety- relevant vehicle function (HMI, ADAS, active chassis systems), confirm controllability classifications from hazard analysis and risk assessment	More details <b>5.2.5</b> Scenario-based testing on proving grounds	More details <b>5.2.4</b> Scenario-based open road testing

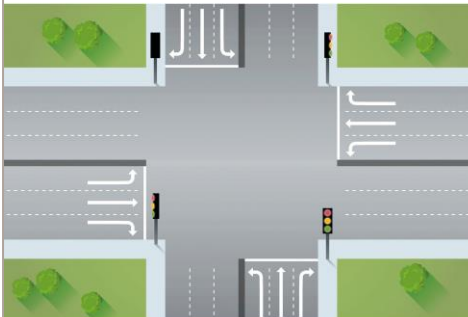


# Topics will be further discussed....

In Sub-groups of the “Test Specification Study Group”


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**ASAM OpenDRIVE®**



Static Road Network Description

**ASAM OpenCRG®**



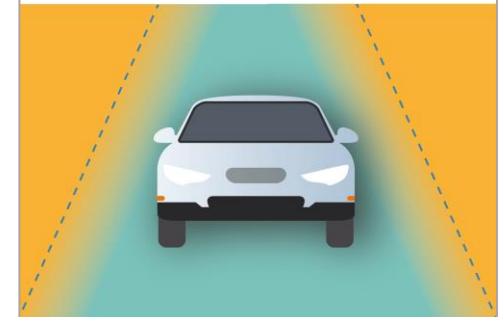
Static Road

**ASAM OpenSCENARIO®**



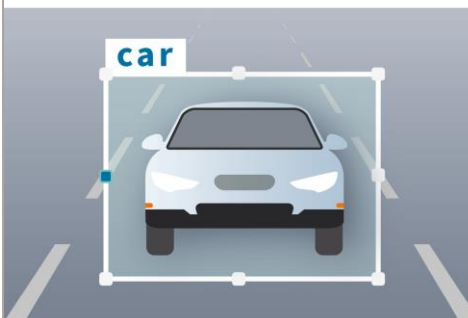
Scenario Description

**ASAM OpenODD®**



Defining the Operational Design Domain for Automated Vehicles

**ASAM OpenLABEL®**



Standardized Labeling for objects and Scenarios

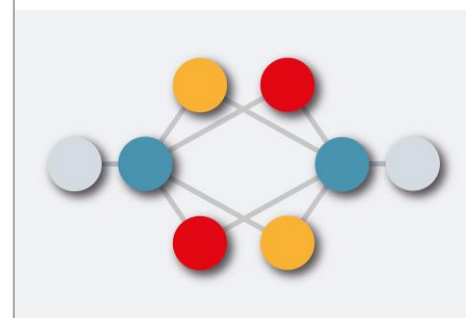
**ASAM Test Specification Workshop**  
Nov 17, 2022 | 9:00 am - 16:00 CET  
at ASAM e.V. in Hoehenkirchen, Germany

**ASAM OpenXOntology®**



Interface for Simulation

**ASAM OpenXOntology®**



Core Domain Model for the ASAM Simulation Domain

**Test Specification Study Group**

Analysis and harmonization of automotive testing techniques and standards



Dr. Ralf Nörenberg  
ASAM Board Member / CEO of HighQSoft GmbH

Phone: +49 176 10474402

Email: [ralf.noerenberg@asam.net](mailto:ralf.noerenberg@asam.net) / [ralf.noerenberg@highqsoft.de](mailto:ralf.noerenberg@highqsoft.de)