

Data-Driven Development

Standardized Test Data Management for ADAS/AD

Dr. Hans-Jörg Kremer - ASAM ODS Proposal Workshop
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Background

Abstract ADAS/AD Domain Model

Preview of an ODS Application Model

Recommendation





Background

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Test Strategy Blueprint for the validation of ADAS/AD

- Overview of the wide range of Test Strategies, Test Methods and Use Cases
- Key question: How must standards work together to enable better support for complex testing workflows
- Emphasizing the importance of a standardized approach to Test Data Management



**EVOLVING LANDSCAPES OF
COLLABORATIVE TESTING FOR ADAS & AD**
ASAM Test Specification Study Group Report 2022

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Background

Reasons for standardized Test Data Management

- Validation of ADAS/AD requires sophisticated tool chains, which integrate tools from different tool vendors
- In all phases of validation process different tools require and/or create huge amounts of descriptive, recorded, calculated and/or measured data
- Type approval and homologation must be able to trace and understand the variety of data, in order to rely on the derived validation results

Conclusion

Self-contained, proprietary or tool-focused solutions for Test Data Management reach their limits in the long term

Using a standard for Test Data Management facilitates the interoperability of different tools

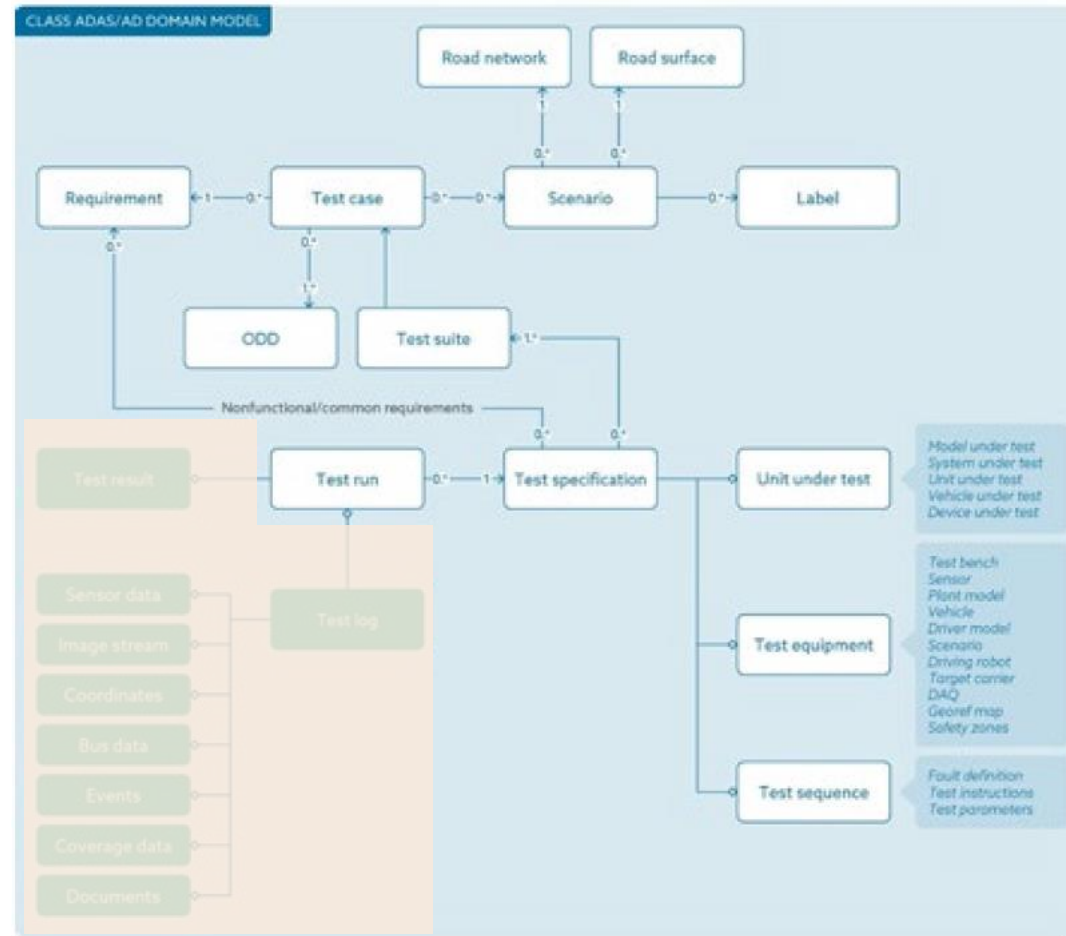
Test Data Management based on a standard is a crucial pillar for smooth collaboration between suppliers, manufacturers, technical services and other stakeholders

Abstract ADAS/AD Domain Model

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Information, necessary to prepare, re-conduct or interpret a validation (= test run)

- **Test Case**, that reference to information artefacts, describing
 - Requirements
 - Operation Design Domain (ODD)
 - Scenarios (described by label, road networks and surface information)
- **Test Suite (Campaign)**, which is a group of test cases, for a defined test specification
- **Test Specification**, includes all elements which describe the execution of a concrete test run

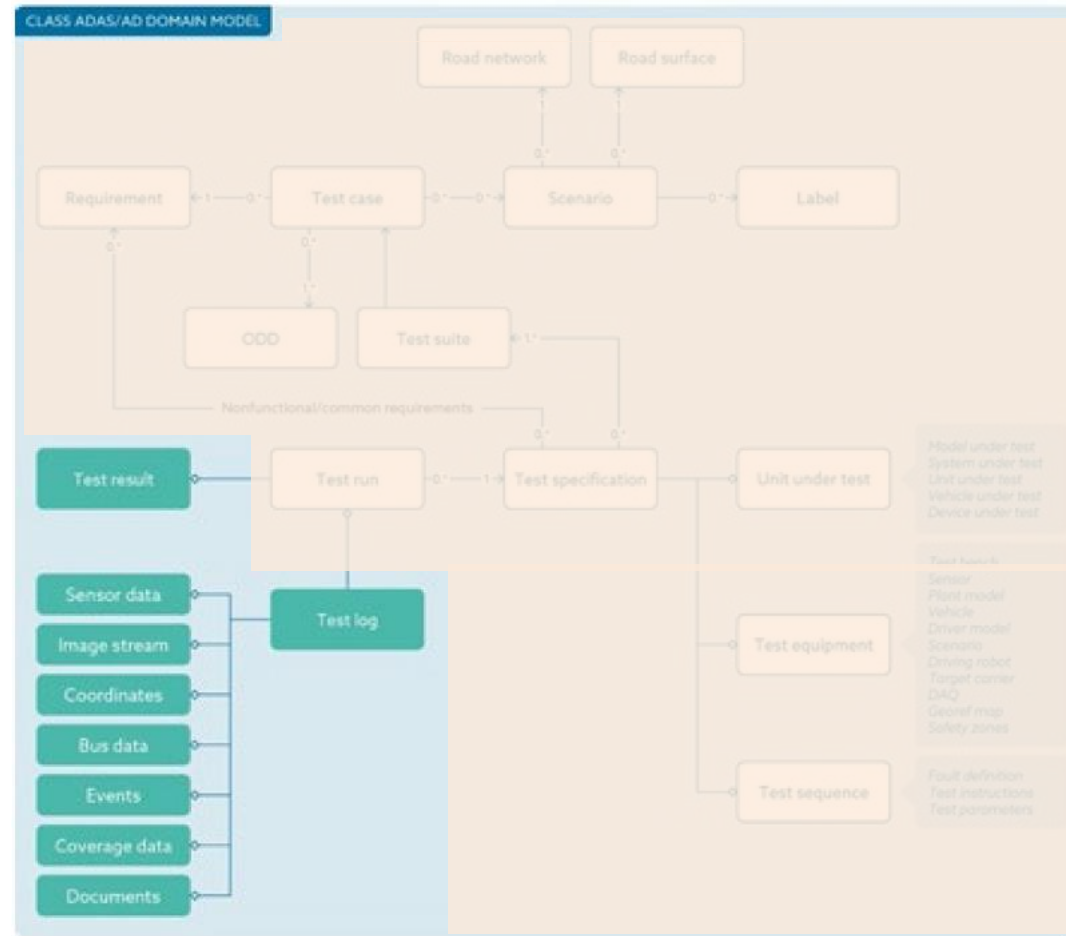


- **Unit under Test**, contains information about “what” has been tested, e.g. model, function, device, system, vehicle, etc.
- **Test equipment**, contains information about “with what” has been tested, e.g. with a specific test bench, sensor, Scenario, driving robot, vehicle, etc.
- **Test Sequence**, that contains information about “how” has been tested resp. “which steps” has been conducted, e.g. with alternating test parameters, fault injections or test instructions
- **Test run**, representing the execution of a specified test on a specific version of the test object

Abstract ADAS/AD Domain Model

Information, which is created during a test run

- **Test Log**, summarizing different outputs of a test run
- **Sensor data**, relating to “classical” physical dimensions (e.g. pressure, acceleration, voltage, etc.), which can be measured or calculated
- **Image streams**, which include image-driven sensor data, like lidar, radar, video, etc.
- **Coordinates**, representing the movement of one or several test objects through a relative (e.g. proving ground) or global (e.g. GPS) coordinate system
- **Bus data**, representing recorded bus signals, which were sent during a test run



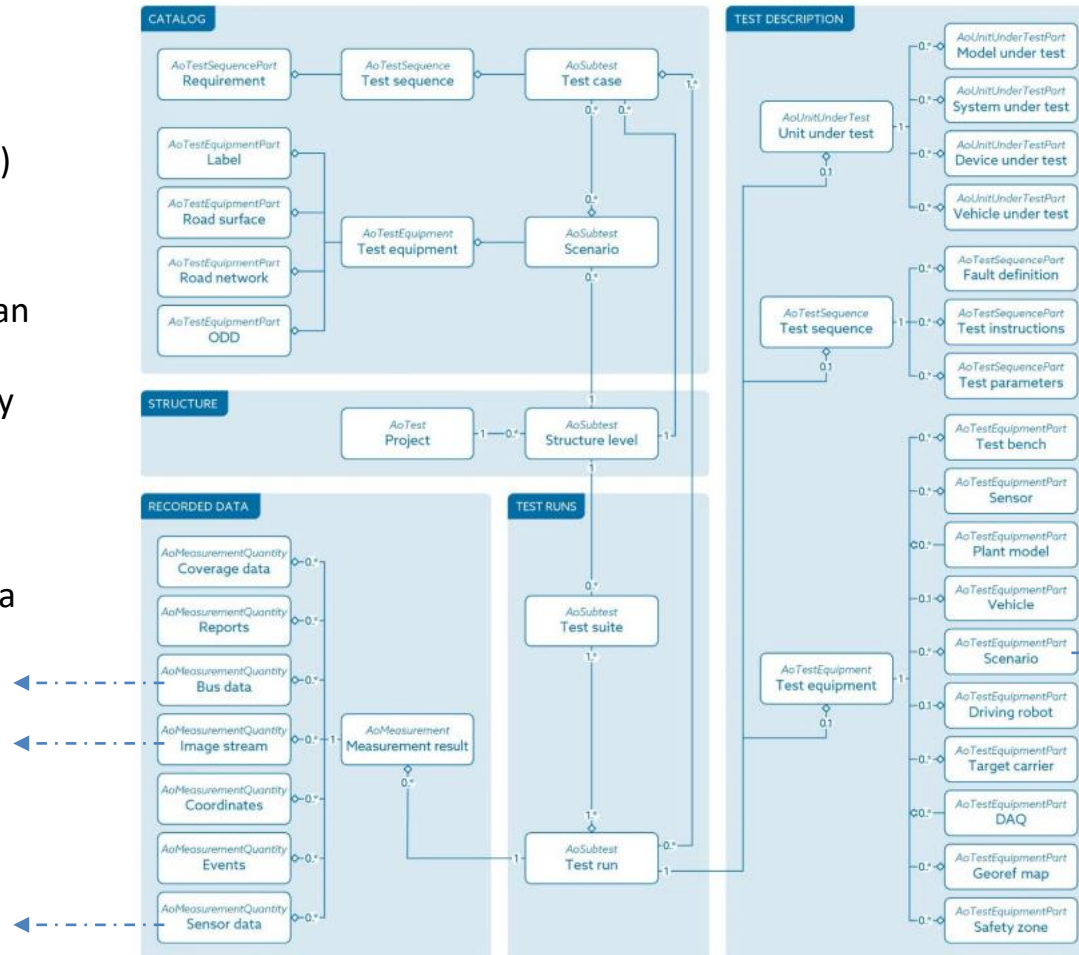
- **Events**, which can be
 - a singular moment in time, at which some perceptible change occurs at a certain place
 - a event, that causes an operation of function
- **Coverage data**, representing the degree to which some specific test items have been determined or have been exercised by a test run
- **Documents**, e.g. final reports in different formats like Word, Excel, Power Point, pictures, etc.
- **Test results**, indicating whether or not a specific test case, or test run has passed or failed

Preview of an ODS Application Model

Impression of a possible ODS Application Model

Covering different data areas

- **Structure:** This area provides data elements based on “AoTest” and “AoSubtest” to create a (hierarchical) structure for navigation
- **Catalog:** In the catalog area (predefined) scenarios / test cases can be stored. This is optional as such information is often stored externally as well.
- **Test Run:** This area structures and saves all executed simulations and tests. With relations to recorded data and test description it provides all information about simulations and tests necessary for interpretation, evaluation or repetition.



- **Recorded Data:** All recorded or calculated data are saved and relate to a measurement.
Don't forget: Specific file formats (e.g. sensor data, image streams, bus data, etc.) are referenced if needed
- **Test Description:** This area contains all entities, necessary to describe a concrete simulation or test run with all related metadata
This can also include additional information, e.g. the used openScenario file, a specific test specification file, simulation model files, etc.

Recommendation

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Extension of the ASAM ODS standard by way of an ODS Associate Standard, which describes an ADAS/AD Application Model

The ASAM ODS Maintenance Group should address this topic and include it in the upcoming project proposal

Relations to other ADAS/AD-relevant standards also need to be investigated in this context (e.g. ATX, OTX, OpenScenario, OpenLABEL, OpenXOntology, Test Specification, etc.)

ASAM ODS Maintenance Group must be supported by experts from the respective working groups



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