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Association for Standardization of Automation and Measuring Systems

Agenda

- Roadmap
- Definition of Scope
- Collection of Use-Cases
- Derivation of Requirements
- Call for Candidates
- Candidate Selection Results
- MVP Creation
- Proposal for Further Development (tbd)





Roadmap

- Due to the open focus of the project, the scope definition, the formulation of corresponding requirements and the identification and selection of suitable candidates for further standardization was slightly delayed.
- Since the MVP planned in the project is now created in collaboration with multiple standardization groups, the project needs to be further extended.

Project Start	Choose Candidate	Create MVP	Project Review	Project End	Concept Release
May '23	Jul '23	Aug '23	Dez '23	Mar '24	Apr '24
	Jan '24	Feb '24	May '24	Jun '24	Jul '24



Definition of Scope

- Based on ISO 29119 processes, areas of application of related standards and developments as well as blind spots in standardization were identified.
- The resulting map enabled the definition of the scope of (a) potentially new ASAM standard(s) for test specification.



Based on: https://www.imbus.de/fileadmin/Repositories/Imbus/Downloads/Softwaretest_Services/Poster-ISO29119_EN.pdf

ASAM

Collection of Use-Cases

19 individual use-cases for automotive testing were identified from the results of the ASAM Test Specification Study Group and discussions within the concept project.

ID	Short Name	Test Spec Report Reference	Description
UC #1	REQ-based Test MIL	5.2.2	Requirements-based generic model-in-the- loop (MIL) testing process as applicable in model-based development processes. Intended to find flaws inside a (potentially still incomplete) functional model.
UC #2	Scenario-based Test MIL	-	Scenario-based generic model-in-the-loop (MIL) testing as applicable in model-based development processes. Intention is the validation of control components e.g. testing the ADAS/AD effect chain for different scenarios in the modelling environment.
UC #3	REQ-based Test SIL Replay (Open-Loop)	-	Open-loop test of SW functionality (e.g. object detection and tracking) by replaying recorded real world data (e.g. camera image data).



Tools involved: environment access (bus, diagnostic, fault infection), device under test access, test automation, requirement tool, scenario editor



Identification of Requirements

- 140 requirements on test specification were derived from the identified use-cases.
- The requirements were generalized, grouped and documented in a requirements document.
- This document served as basis for the "Call for Candidates" (see next slide).

Requirement Groups

- 1. General
- 2. Interoperability
- 3. Consistency
- 4. Abstraction
- 5. Traceability
- 6. Intuitiveness
- 7. Execution and Automation
- 8. Preconditions, Parametrization and Configuration
- 9. Timing and Synchronization
- 10. Modeling and Virtualization
- 11. Hardware and Software
- 12. External Artifacts
- 13. Scenarios
- 14. Reporting
- 15. Use-Case Specifics
- 16. ODD



Call for Candidates

- On September 18th, 2023, a public "Call for Candidates" was issued, inviting all interested parties to submit proposals for candidates to serve as basis for further standardization. The requirements document, a validation sheet and submission guidelines were distributed to all potential submitters.
- In a dedicated meeting series taking place in fall 2023, 8 submitters presented their candidate to the project group.
- Within the candidate selection, candidates were elected by secret ballot. Election of individual candidates per specific area of application was possible.

	Area of Application
1	Test Model Specification
2	Test Case Specification
3	Test Procedure Specification
4	Test Case Implementation
5	Test Bench Configuration
6	Test Data Management
7	Test Bench Access



Candidate Selection Results

Test Model Specification	???
Test Case Specification	ASAM
	OTX
Test Procedure Specification	ASAM
	OTX
Test Case Implementation	ASAM
	OTX
Test Bench Configuration	ASAM XIL
Test Data Management	ASAM
	ODS
Test Bench Access	ASAM XIL
Consistency with ASAM ecosystem /	ASAM
Interoperability with other ASAM standards	OTX





MVP Creation

Scenario

- 2 entities: Ego vehicle (EV) equipped with active ACC (SUT) and other vehicle (OV)
- Initial positions: Both entities are in same lane of straight road (length: 2000m), OV is 200m ahead of EV
- Initial velocities: EV: 120 km/h, OV: 80 km/h
- Scenario duration: 20 s



Test criteria

- Longitudinal distance D is measured between EV and OV reference points
- Success criteria: D = minDist(Ev.pos, OV.pos) > 60 m throughout test run





MVP Creation – Interaction of the Standards depicted in the 4-Layer Reference Architecture

Test Specification Topics

	Abstraction Levels	Test Management View	Test Infrastructure View	Test Object (SuT) View	Test Scenario View	Test Procedure/Case View
	Level 1: Requirements	 Requirements on "how to test", given by: standards, regulations stakeholders, 3rd parties, the organisaztions test policy other testing objectives 	Description of the tooling, equipment, infrastructure needed or wanted to perform the tests	Description of the intended function and/or behavior of the SuT (vehicle, subsystem, component, external IT system, etc.	Description of a traffic scenario (intended as environment where the SuT shall perform its mission)	Description of the instructions that are performed or events that occur during the test (scenario), including the respective expected results.
Test Artifacts Implementa	Level 2: Specification	Toolbox/blueprints of test approaches and test methods in use or available (within the organization). Test campaign planning	 Refined and formalized Requirements: Detailed setups and configurations ASAM OpenTest 	 Refined and formalized Requirements: SuT boundaries Points of Control & Observation (PoC, PoO). Predicates/constraints to decide on passed/failed Test Coverage Items 	 Refined and formalized (by defined ontologies) Scenario: ODD Elements (OpenODD) to be contained Manouvers to be supported and other road network requirements (OpenScenario DSL) Safety characteristics Predicates/constraints to decide on passed/failed Test Coverage Items (e.g. ODD Coverage,) 	 Refined and formalized Requirements: Test data variables, Test data partitioning (equivalence classes,) expected results or predicates/constraints to decide on passed/failed => Abstract Test Cases written in Keywords & Pseudo code notation =>Grouping Test Cases to test procedures
tion	Level 3: Implementation	Testing frameworks in use or available (within the organization).	Set of infrastructure elements configured to run a specific test or test campaign	Functional modelor Implementation	 Formal Scenario definition (logical scenario) (OpenScenario XML, vendor specific, etc.) Proving ground 	 Parametrized test procedures/keyword sequences executable within specified test Arsannur OTX Test data tables
	Level 4: Execution	Library of testware artifacts that are available for reuse.	s.o. ASAM XIL	Test stand equipped with Functional model or Implementation 	Concrete Scenario	 Concrete Test Cases as test procedures/keyword sequences instantiated with a set of data values (from the test data table) Aster Cases creates exactly bind test result set test data row

Proposal for Further Development

Findings:

- Comprehensive analysis of use-cases, requirements and existing developments in the context of test specification
- Practical implementation of test specifications using ASAM standards OpenTestSpecification/OTX/XIL/ODS
- Cross-standard collaboration

Next steps:

- Initial implementation of an ASAM OpenTestSpecification umbrella standard
- Establishment of a cross-standard controlling board to synchronize ASAM OpenTestSpecification/OTX/XIL/ODS development
- Coordinated planning of project launches in 2025





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