ASAM TestSpecification

From efficient testing to successful validation with ASAM standards

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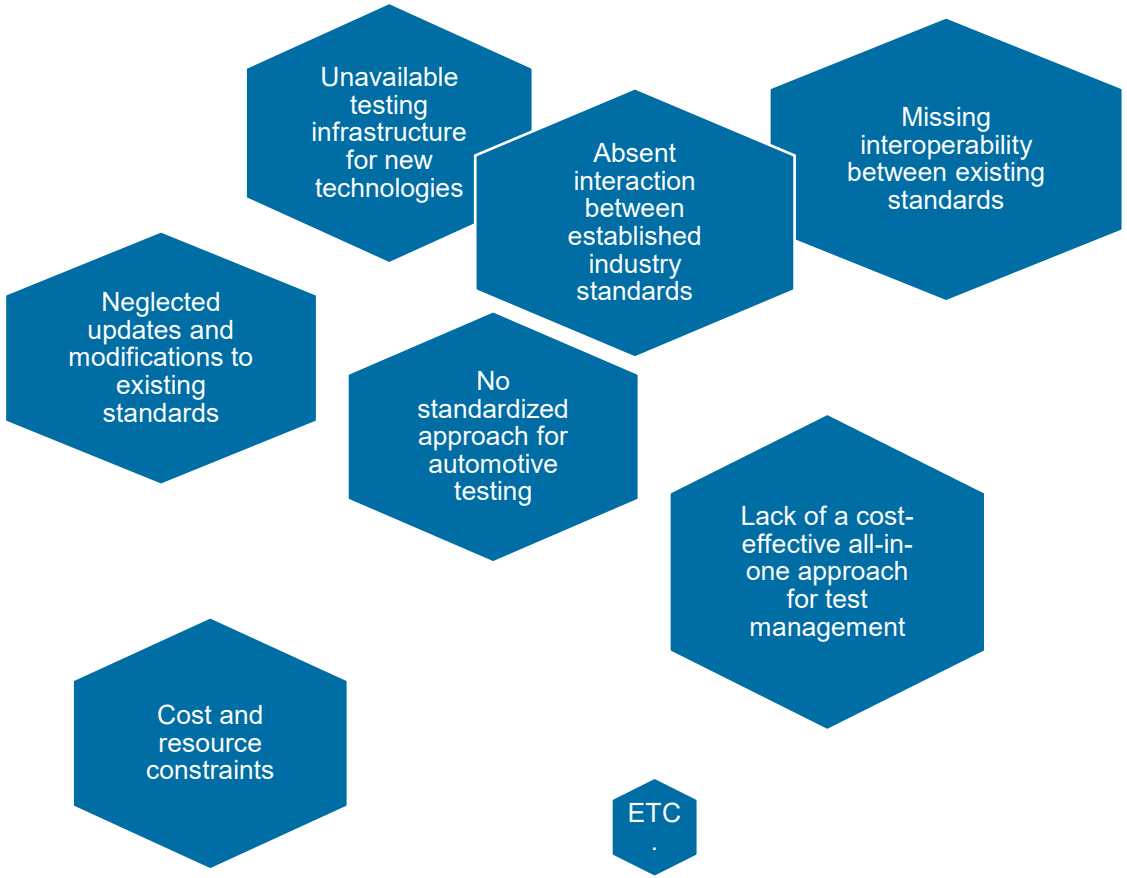
ASAM Association for Standardization of Automation and Measuring Systems

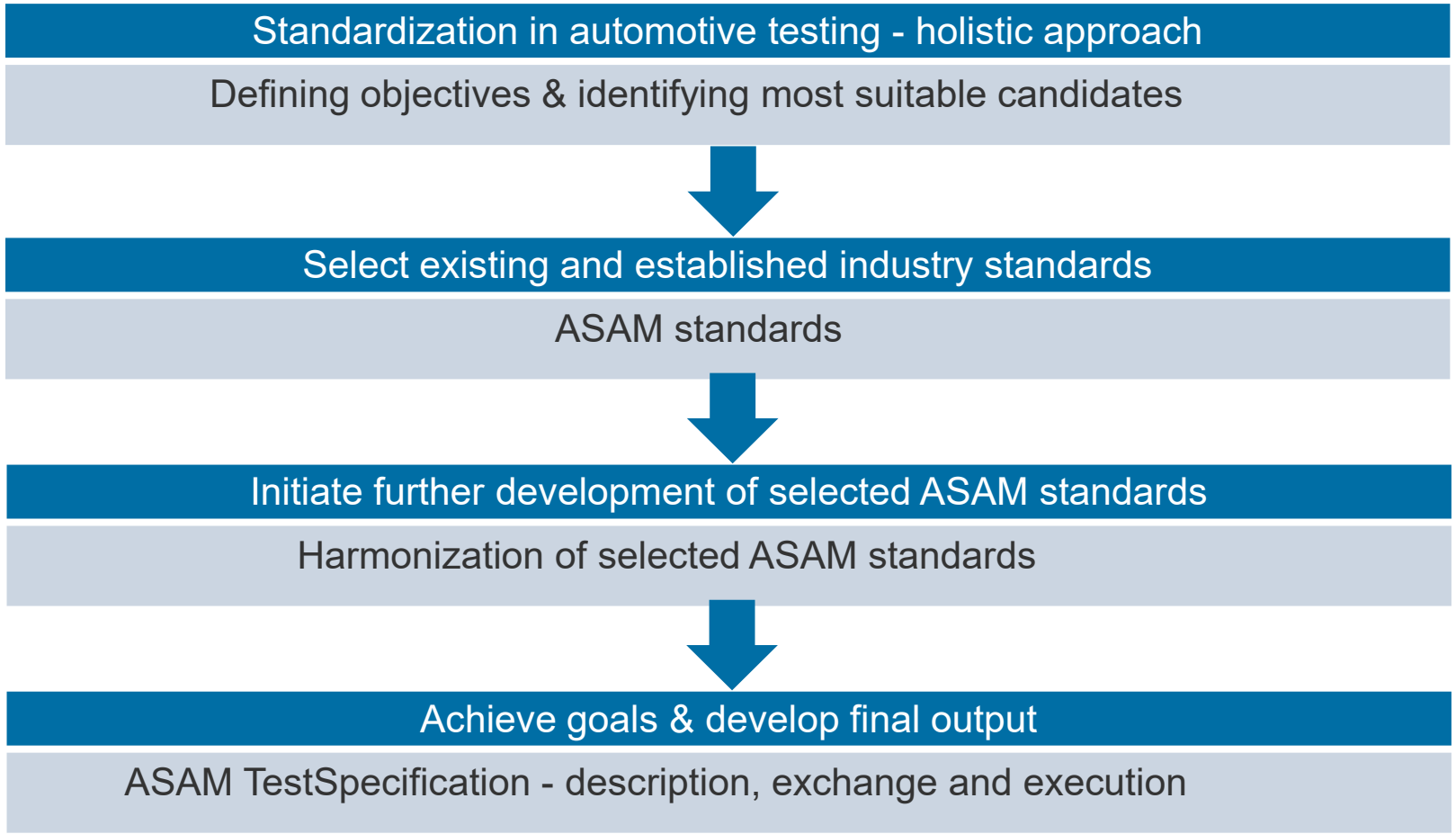
Challenges

Key advantages



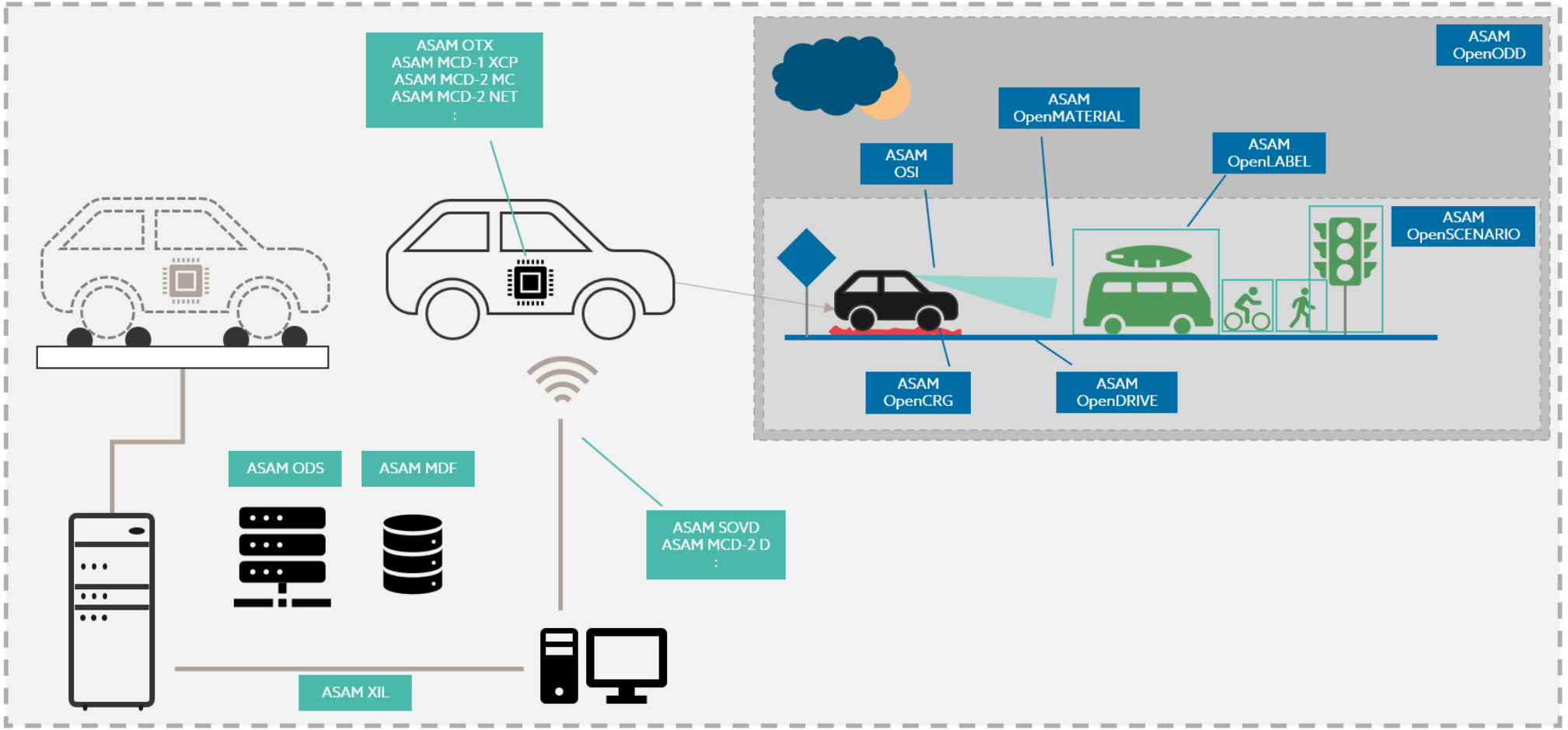
Process

How to advance Interoperability of proven standards in automotive testing?



ASAM Standards (excerpt)

Key advantages



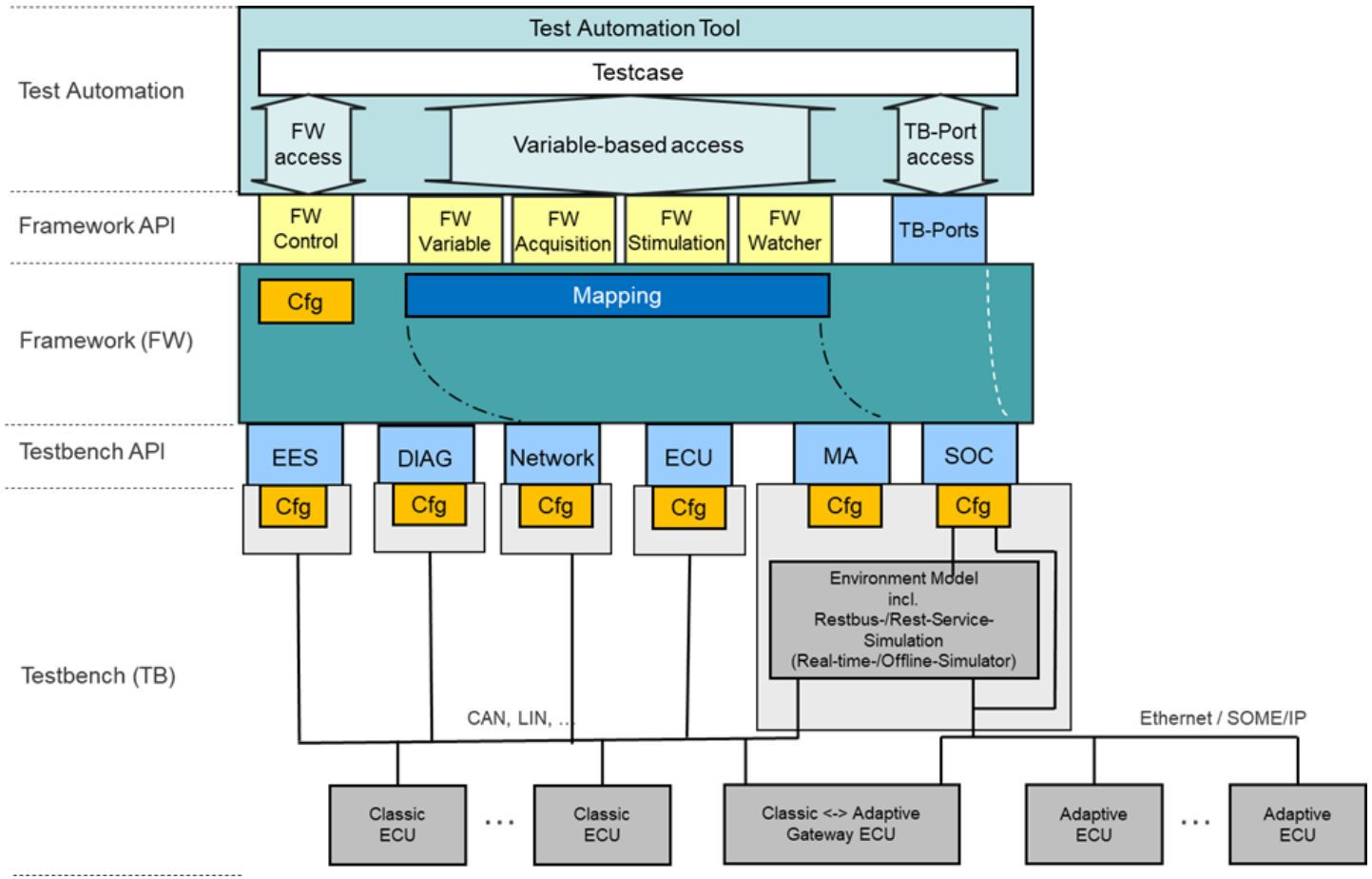
ASAM XIL (Generic Simulator Interface)

Key advantages

ASAM XIL

Key benefits of ASAM XIL:

- Connects test automation tools and test benches
- Supports different test processes
- Enables the reuse of test cases across diverse test systems



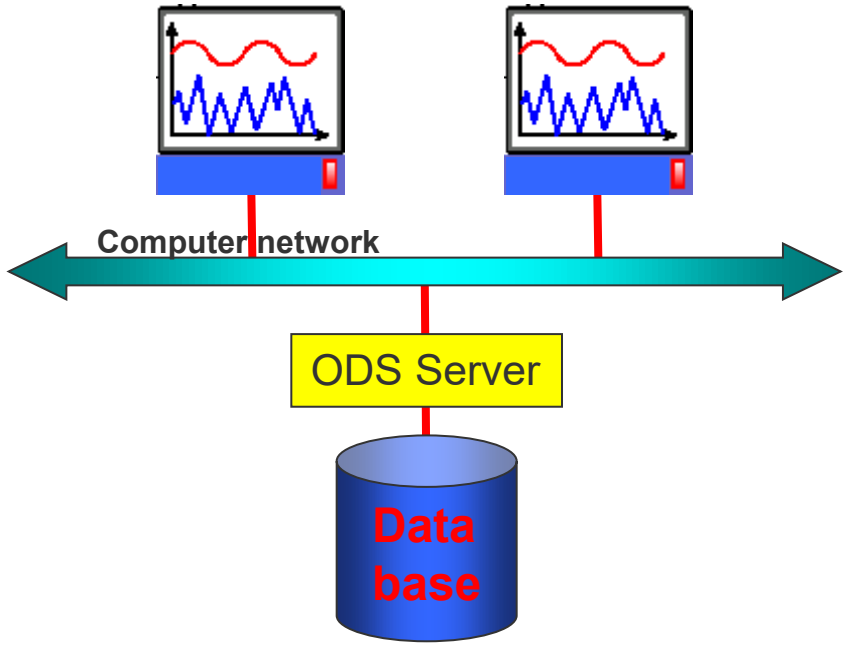
ASAM

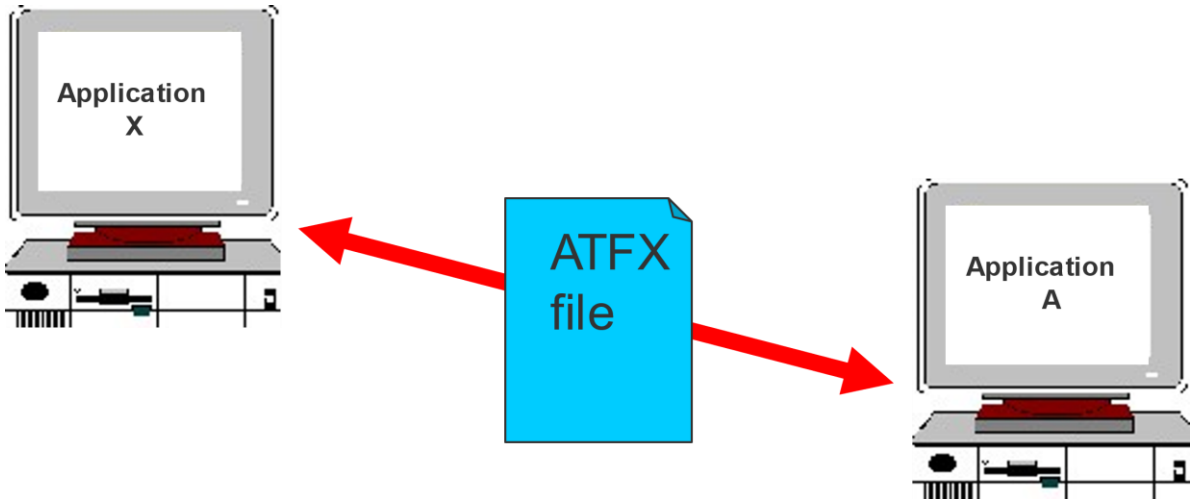
ASAM ODS (Open Data Services)

Key advantages

Key benefits of ASAM ODS

- Archives test data persistently
- API for ASAM ODS server access
- Exchanges test result data
- Defines data models for dedicated applications





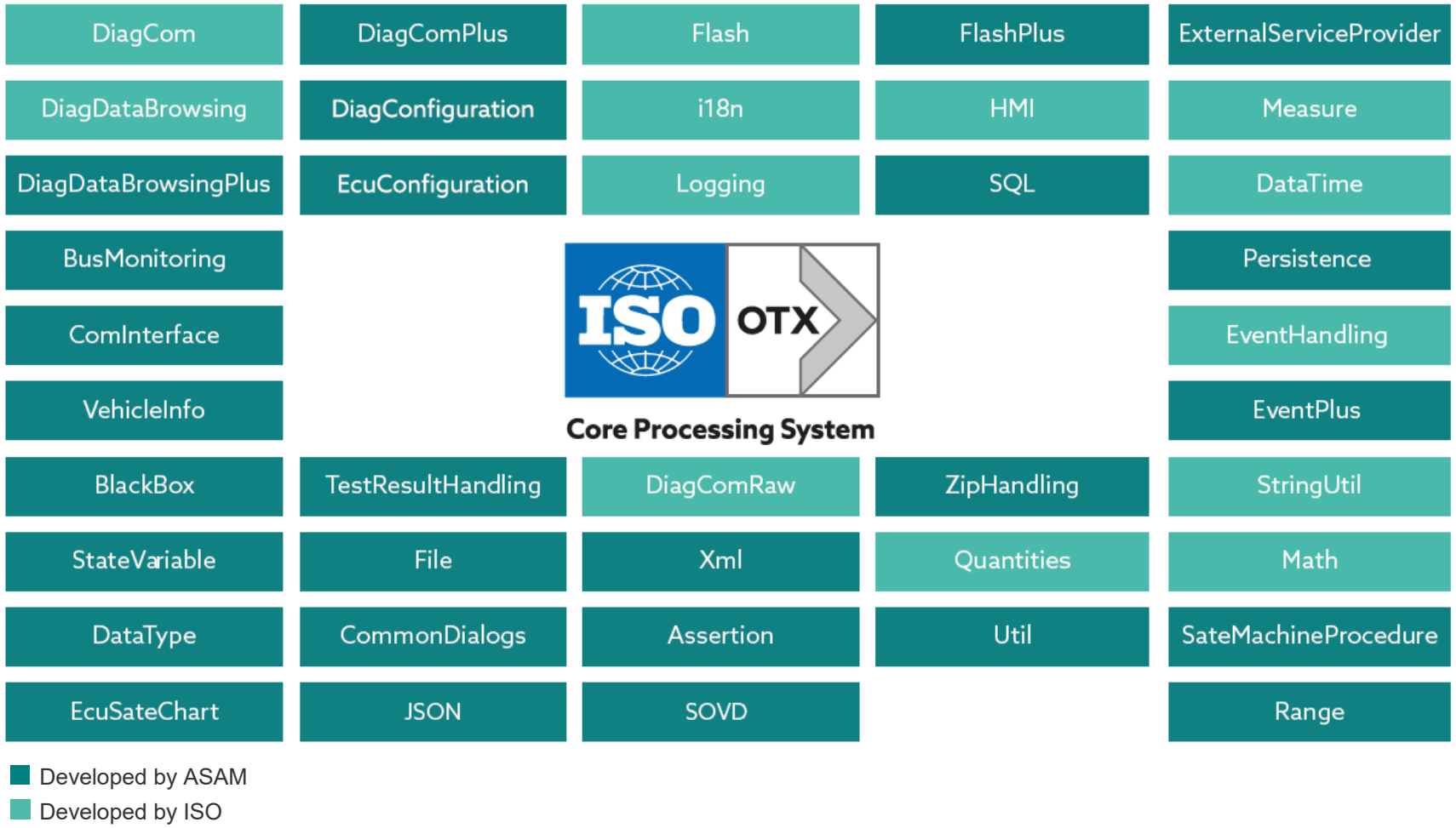
ASAM OTX Extensions (Open Test Sequence eXchange format)

DSL for process reliable description of exchangeable and executable test logic

ASAM
OTX Extensions

Key benefits of ASAM OTX

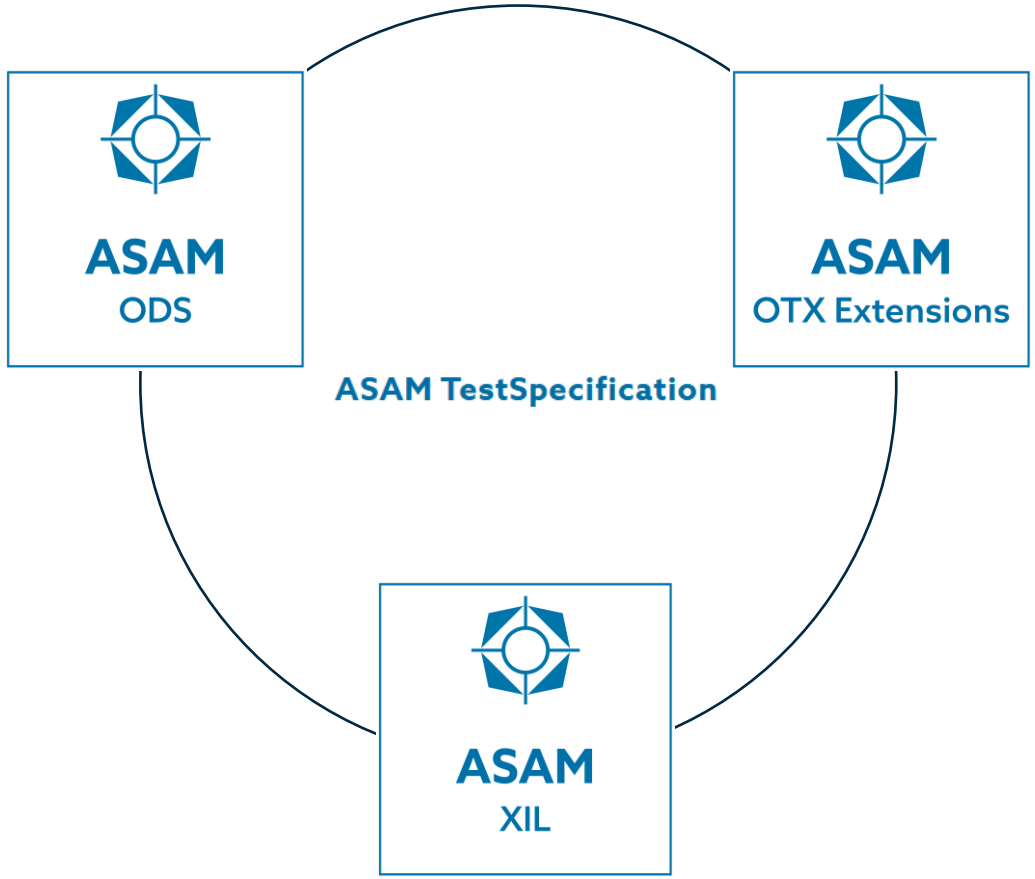
- Specifies executable test sequences
- Describes test sequences
- Improves reusability of test artifacts and facilitates validation



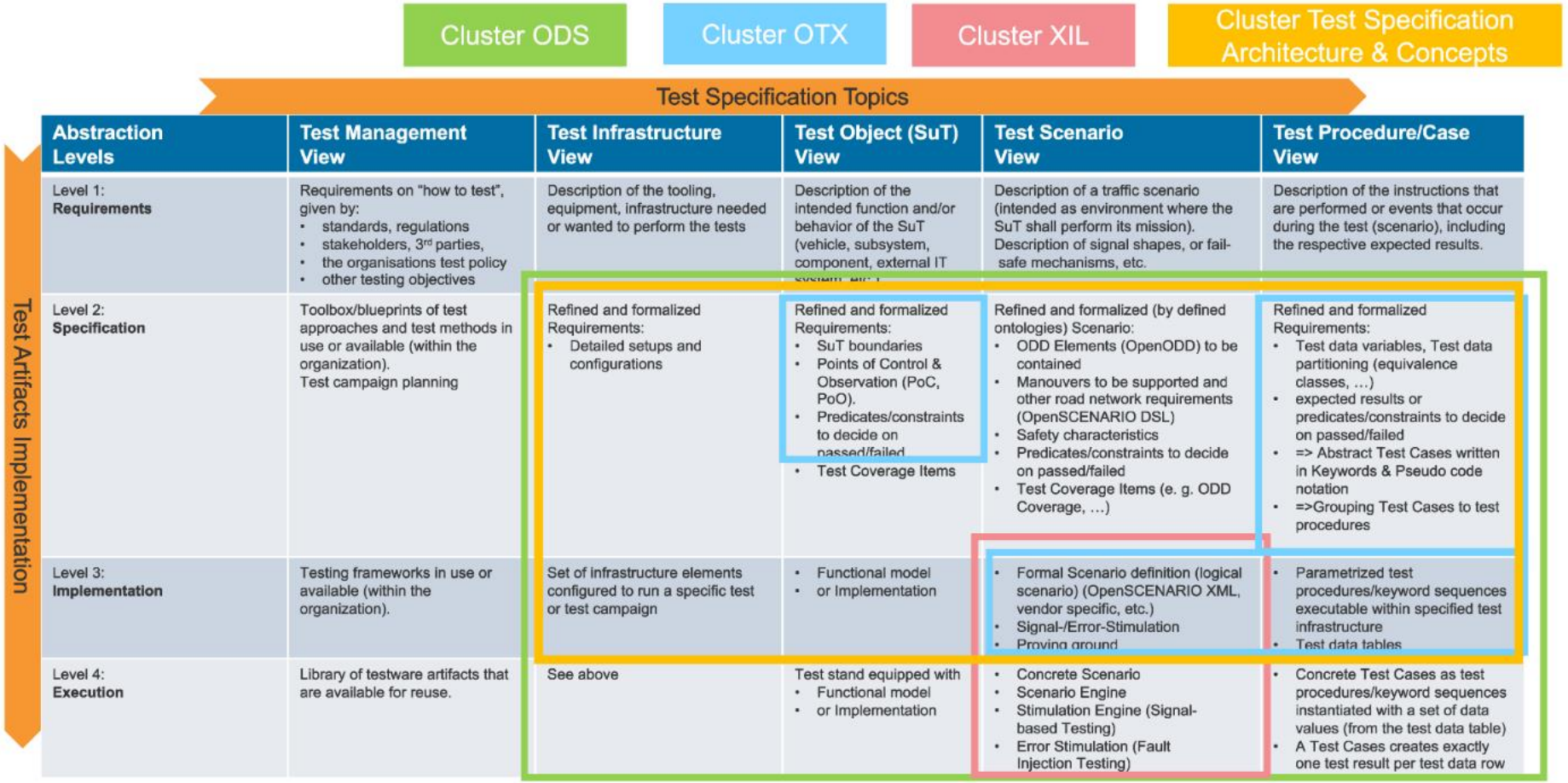
ASAM TestSpecification project

Key advantages

- Harmonizing ASAM standards for a unified testing process
- Ensuring compatibility across automotive testing tools & test execution
- Streamlining testing processes
- Improving reusability of test artifacts
- Facilitating validation & collaboration among stakeholders



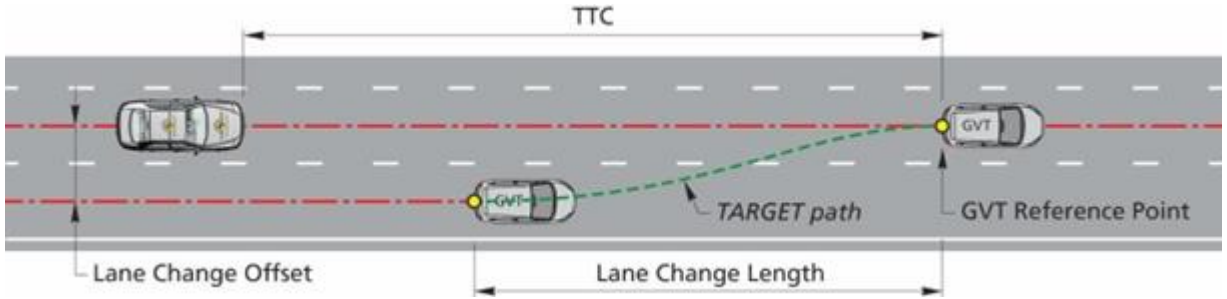
4-layer model



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 organisations 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	Description of a traffic scenario (intended as environment where the SuT shall perform its mission). Description of signal shapes, or fail-safe mechanisms, etc.	Description of the instructions that are performed or events that occur during the test (scenario), including the respective expected results.
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	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
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 model • or Implementation	• Formal Scenario definition (logical scenario) (OpenSCENARIO XML, vendor specific, etc.) • Signal-/Error-Stimulation • Proving ground	• Parametrized test procedures/keyword sequences executable within specified test infrastructure • Test data tables
Level 4: **Execution**	Library of testware artifacts that are available for reuse.	See above	Test stand equipped with • Functional model • or Implementation	• Concrete Scenario • Scenario Engine • Stimulation Engine (Signal-based Testing) • Error Stimulation (Fault Injection Testing)	• Concrete Test Cases as test procedures/keyword sequences instantiated with a set of data values (from the test data table) • A Test Cases creates exactly one test result per test data row

Example NCAP ACC cut-in scenario / Level 1 requirements

Key advantages



Test Specification Topics

Abstraction Levels	Test Management View	Test Infrastructure View	Test Object (SuT) View	Test Scenario View	Test Procedure/Case View
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Level 1 requirements test scenario

Key advantages

	ACC CUT-IN Start Distance	Operational Domain	VUT Speed	GVT Speed	GVT Lateral Acceleration	GVT Change Length	GV Radius of turning segments
#1	58m	dry	50km/h	10km/h	0.5m/ss	14.5m	15m
#2	58m	wet	50km/h	10km/h	0.5m/ss	14.5m	15m
#3	75m	dry	120km/h	70km/h	1.5m/ss	60m	250m
#4	75m	wet	120km/h	70km/h	1.5m/ss	60m	250m

Example NCAP ACC cut-in scenario / Level 2 test specification

Key advantages

Test Specification Topics

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Example NCAP ACC cut-in scenario / Level 3 implementation

Key advantages

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 signal shapes, or fail-safe mechanisms, etc.	Description of the instructions that are performed or events that occur during the test (scenario), including the respective expected results.
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Summary

- Software-defined vehicles and autonomous driving functions are continuously and drastically increasing the complexity of testing.

- Collaborative efforts focus primarily on the efficient development and execution of test cases. The project ASAM TestSpecification aims to ensure that each test case can be described easily and executed effortlessly. In addition, we consider the storage of recorded data and metadata. The test case is gradually refined from a rough outline to a detailed version.

- The ASAM TestSpecification project harmonizes multiple ASAM standards. It addresses gap in established industry standards enabling more efficient and seamless interaction throughout the testing process.

Thank you for your attention

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