

Concept Project ASAM OpenTestSpecification

ASAM Regional Meeting in North America

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Hexagon



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Santa Clara, CA, USA



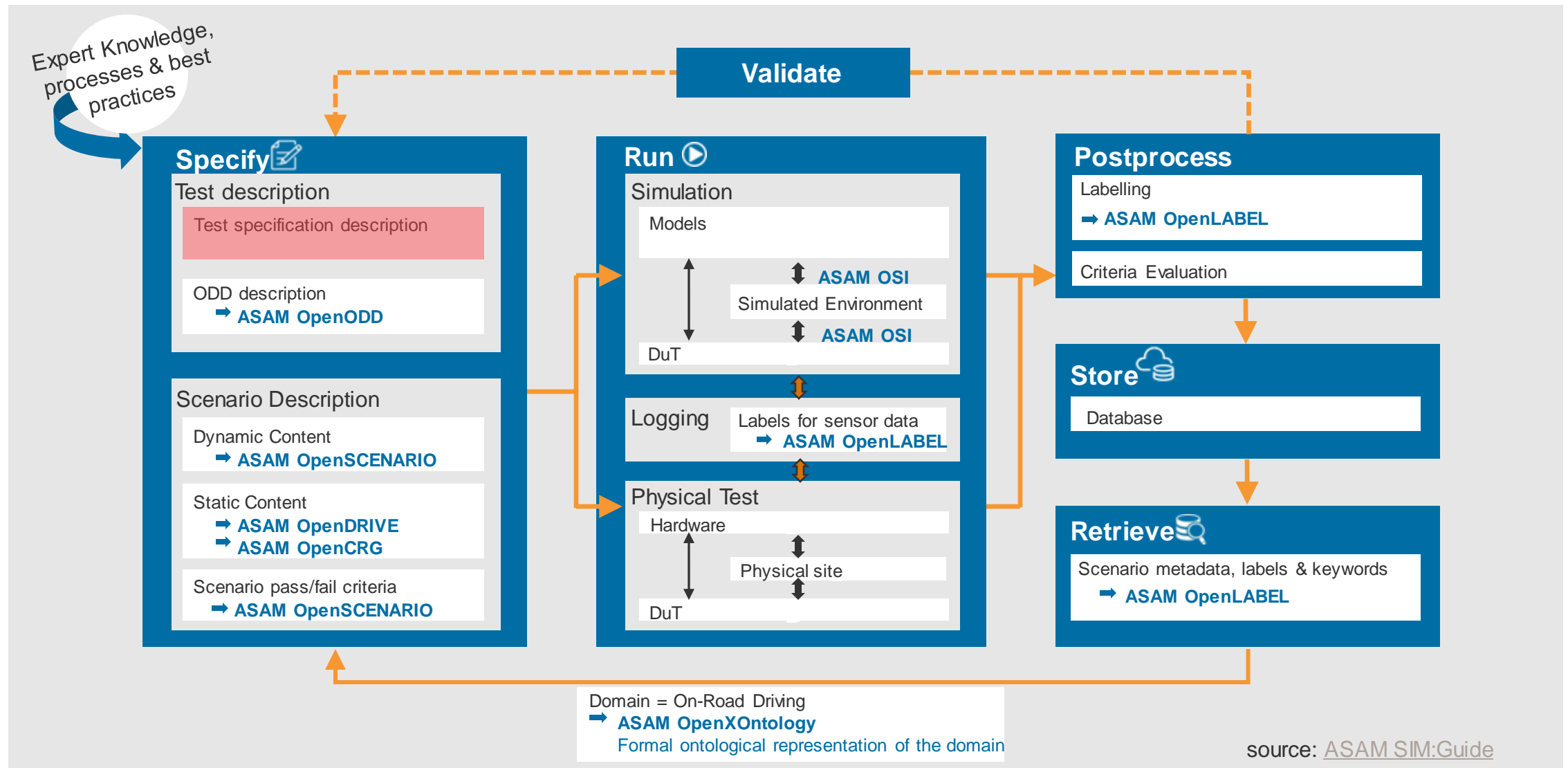
Association for Standardization of
Automation and Measuring Systems

Agenda

1	How did the activity start?
2	ASAM Test Specification Study Group
3	Concept Project ASAM Open Test Specification
4	Next Step: Call for Candidates
5	Q&A

How did the activity start?

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ASAM Test Specification Study Group

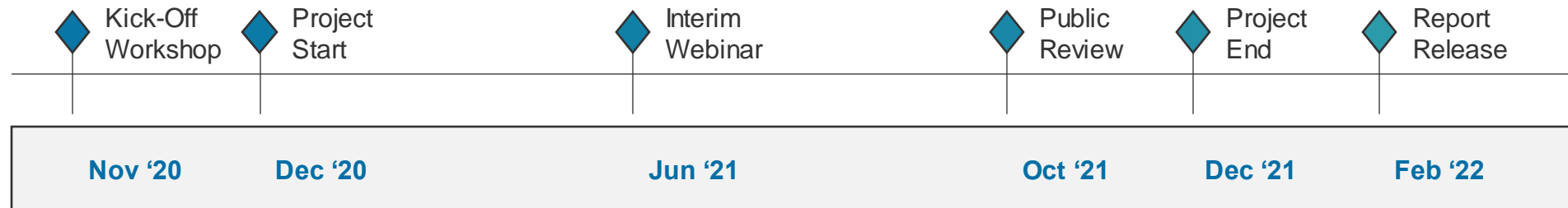
ASAM Test Specification Study Group

Project summary

- **Major goal**

- ✓ To understand and document the comprehensive overview of testing landscape for ADAS/AD domain
- ✓ To identify the potentially needed additions to existing standards, connection between standards, or need for completely new standards
- ✓ To develop a valid technical basis for follow-up activities and projects

- **Schedule**



- **Deliverable**

- ✓ ASAM Test Specification Study Group Report 2022: <https://report.asam.net/>
- ✓ Test Strategy Blueprint

ASAM Test Specification Study Group

Test strategy Blueprint

		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	TEST METHOD									
	REQUIREMENTS-BASED TEST (FUNCTIONAL TEST) <i>Software architectural design/Specified functionality</i>	More details 5.2.2 Requirements-based testing MIL +	Test of ADAS/AD software via open loop e.g. detection quality	Testing of ADAS/AD software stack in closed loop For example the trajectory planning algorithms		Testing of complete effect chains of ADAS/AD function in closed loop e.g. Integration testing of software and hardware	More details 5.2.7 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 <i>Software unit implementation/ Hardware-software interface specification</i>			Software integration tests e.g. test of interfaces for communication between ...	More details 5.2.6 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 <i>Testing of safety mechanisms/ Robustness</i>	More details 5.2.3 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	Verification of overall system performance e.g. testing of safety	
	RESOURCE USAGE PERFORMANCE TEST <i>Sufficiency of resources/ Hardware architectural design</i>					Testing of the vehicle network performance e.g. sleep and wake				
	SCENARIO-BASED TEST <i>Validation of real-life use cases/SOTIF validation</i>	Validation of control components e.g. testing of ADAS/AD effect chain in modeling environment		More details 5.2.8 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	Testing of system reaction in controlled environment e.g. testing of system reaction to the most relevant scenarios	Validating the complete system in real-life use cases e.g. endurance testing in the field

Use cases

- The blueprint encompasses various test environments and test methods
- **A holistic best practice** that can be tailored according to the specific requirements of manufacturing and other projects, but one that meets regulatory, legal, and technical requirements.
- **Possible basis** to achieve the intended goals of testing and homologation for ADAS/AD domain

Concept Project ASAM OpenTestSpecification

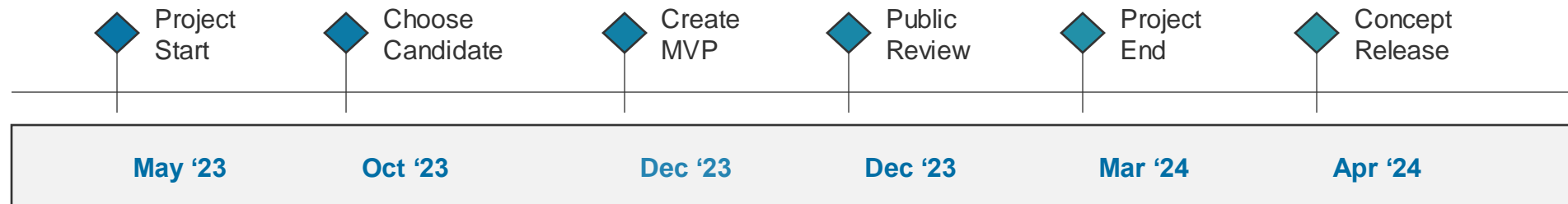
Concept Project ASAM OpenTestSpecification

Project summary

- **Major goal;**

- ✓ To ensure that different test methods and test environments along the test strategy blueprint are applicable and used
- ✓ To develop technical basis including clear requirements, for how a suite of standards could support various testing workflows

- **Schedule**



- **Deliverables**

- ✓ Requirements document
- ✓ The blueprint update of the Test Specification Study Group

Concept Project ASAM OpenTestSpecification

Project overview

Standardization proposal (Requirements report)

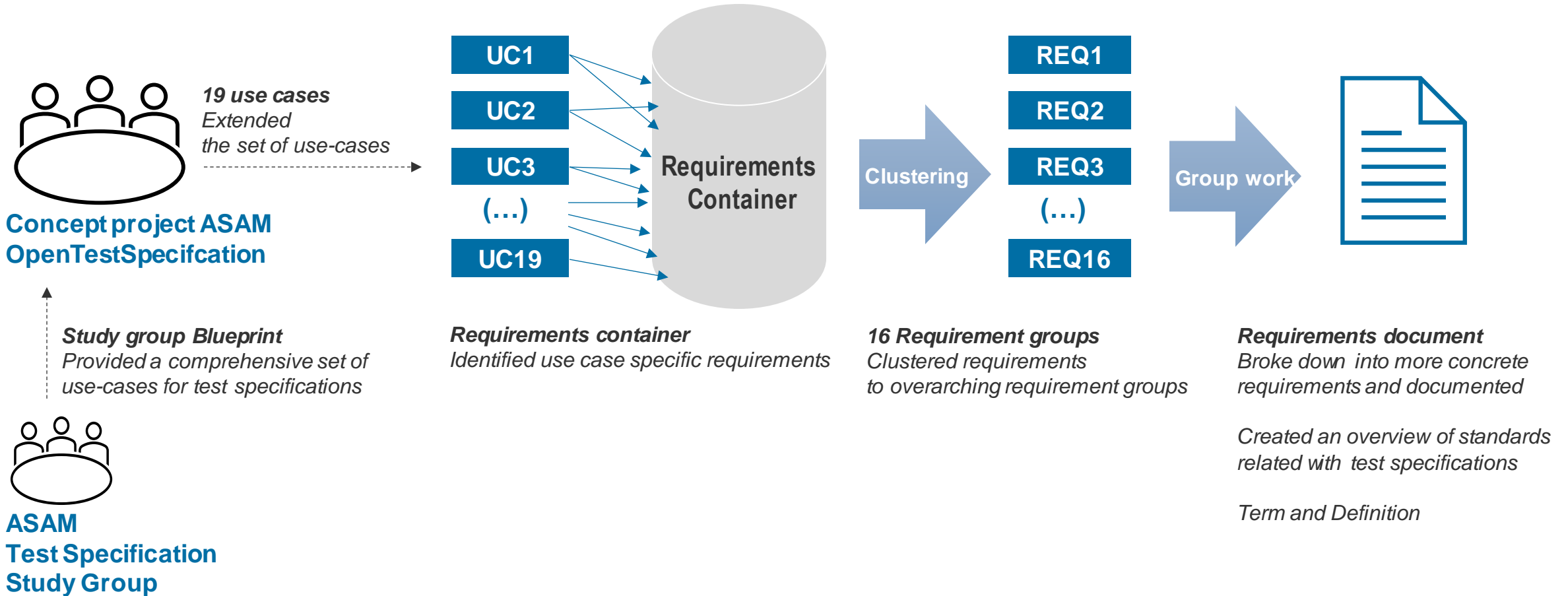


Blueprint update



Concept Project ASAM OpenTestSpecification

Requirements on a standardized test specification



Concept Project ASAM OpenTestSpecification

Test specification related standards

- **Generic test and quality standard**
 - ✓ ISO/IEC/IEEE 29119, Software and systems engineering — Software testing
 - ✓ ISO/IEC 2501x, Systems and software engineering
 - ✓ ...
- **Automotive-domain specific safety standards**
 - ✓ ISO 21448:2022, Road vehicles — Safety of the intended functionality (SOTIF)
 - ✓ ISO 26262-x:2018, Road vehicles — Functional safety
 - ✓
- **Automotive-domain specific standards**
 - ✓ ASAM OpenX
 - ✓ ModelicaFMI
 - ✓ ISO/TR 21959-1:2020, Road vehicles — Human performance and state in the context of automated driving — Part 1: Common underlying concepts
 - ✓ ...
- **ODD-related standards**
 - ✓ BSI PAS 1883 (Operational Design Domain (ODD) taxonomy for an automated driving system (ADS) - Specification)
 - ✓ ASAM OpenODD (Data format for ODD description exchange)
 - ✓ NHTSA 13882 (A Framework for Automated Driving System Testable Cases and Scenarios)
 - ✓

Concept Project ASAM OpenTestSpecification

19 Use cases

ID	Name	ID	Short Name
UC #1	REQ-based Test MIL	UC #11	Interface Test HIL Closed-Loop
UC #2	Scenario-based Test MIL	UC #12	Fault Injection Test HIL Closed-Loop
UC #3	REQ-based Test SIL Replay (Open-Loop)	UC #13	Scenario-based Test HIL Closed-Loop
UC #4	Scenario-based Test SIL Replay (Open-Loop)	UC #14	Scenario-based Test VIL
UC #5	REQ-based Test SIL Closed-Loop	UC #15	REQ-based Test DIL
UC #6	Interface Test SIL Closed-Loop	UC #16	Interface Test DIL
UC #7	Fault Injection Test SIL Closed-Loop	UC #17	Fault Injection Test DIL
UC #8	Scenario-based Test SIL Closed-Loop	UC #18	Scenario-based Test Proving Ground
UC #9	Resource usage Perf. Test HW Replay	UC #19	Scenario-based Test Open Road
UC #10	REQ-based Test HIL Closed-Loop		

Concept Project ASAM OpenTestSpecification

16 overarching requirements groups

ID	Name	ID	Short Name
REQ #1	Referencing of external artifacts	REQ #9	Use-case specific
REQ #2	Test specification	REQ #10	General
REQ #3	Reporting	REQ #11	Hardware/Software
REQ #4	Consistency	REQ #12	Timing and Synchronization
REQ #5	Traceability	REQ #13	Preconditions, Parameterization and Configuration
REQ #6	Intuitiveness	REQ #14	Scenarios
REQ #7	Abstraction	REQ #15	Modeling/Virtualization
REQ #8	Interoperability	REQ #16	ODD-related requirement

4.16.3 Relevance in Use-Cases

This requirement is relevant for use-case UC1-UC19 (all).

NOTE All requirements define the relevant use cases.

Next Steps: Call for Candidates

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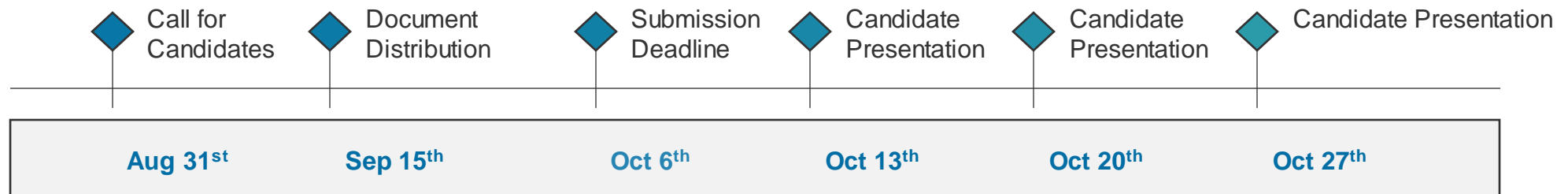
Call for candidates

- The project group is finalizing the requirements documents, which will serve as foundation for the evaluation of existing test specifications (“candidates”) and their potential to serve as basis for standardization
- On **September 15th**, within a “Call for Candidates”, application documents will be distributed by ASAM e.V.:
 - Abstract (Brief description of the candidate)
 - ASAM OpentestSpecification Requirements Document (Detailed description of the requirements)
 - ASAM OpentestSpecification Requirements Evaluation Sheet (Requirement assessment sheet)
- Applications from interested parties who would like to present a candidate will be accepted until October 6"
- After successful submission, applicants will be invited for individual, 30-minute candidate presentations
- After completion of all presentations, the project group will select none, one or more (complementary) candidates for further standardization. Therefore, applications should be considered even if not all requirements are met.
- The selected candidate(s) will serve as basis for implementation of an exemplary test specification demonstrating scenario-based SiL simulation and its validation in a generic tool chain to further evaluate its/their potential

Concept Project ASAM OpenTestSpecification

Call for candidates

- August 31st: Webinar, presentation of “Call for Candidates”
- September 15th: Distribution of application documents by ASAM e.V.
- October 6th: Deadline for submission of completed documents by interested parties
- From October 13th: 30-minute presentations in weekly project meeting (Fridays, 12-14)



Q&A

In case of further questions please contact the ASAM Office Responsible below via Email.

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