

ASAM – Open Standards

Proposal Workshop ASAM Quality Checker

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20th November 2023

Höhenkirchen



Where do we stand today in our projects?

>400
participants



>200
unique companies



9 Standardisation
projects



9 Releases
in 2022



2 Concept
projects

1 Ongoing
ideation



1 Study
group



3 Proposals being
prepared

6 Office
employees
supporting
projects

Ongoing standardisation efforts...

SOVD
Communication with SDVs

ODS
Test data management

OpenSCENARIO
Description of dynamic content

XIL
Communication between test automation tools and test benches

OTX
Definition of test procedures

OpenDRIVE
Description of logical road networks

OSI
Interface for the environmental perception of AD functions

OpenTestSpecification
Hollistic test specification

OpenODD
Specification of ODDs

MDF
Storage of measurement data

OpenLabel
Data structure for labels & tags

OpenSCENARIO

OpenSCENARIO Differentiation Statement

ASAM OpenSCENARIO®

OpenSCENARIO 1.x

- XML schema for describing **scenarios** with synchronized maneuvers of vehicles, pedestrians, and other traffic participants
- Supports specifying precise trajectories with capability to parameterize and vary their properties
- Structured format that can be validated, edited, imported, and exported by simulation tools and content editors
- Tuned to support trigger-action scenario descriptions
- Optimized for simple machine parsing and processing
- **Primary** use case: predictable highly precise scenarios that may be used with external test specification for V&V

OpenSCENARIO 2.x

- Domain specific programming language for describing **test scenarios** of synchronized maneuvers of vehicles, pedestrians, other traffic participants and ADS function control
- Supports specifying scenario intent at a higher level of abstraction along with KPIs, checks, & coverage metrics
- Built-in abstract road descriptions
- Designed to enable exploration of scenario/functionality space to identify potential unknowns
- Optimized for composability to maximize scenario reuse
- Designed as V&V programming language
- Enables higher level of automated test generation at scale
- **Primary** Use case: Large scale V&V

The differentiation between the two standards is by their primary use cases. A primary use case describes the main use case for which the standard is intended and a key consideration behind many design decisions. The primary use case is not exclusive, the standards may be (and are) used for a wide variety of additional use cases, with overlap, but these are not specified here.

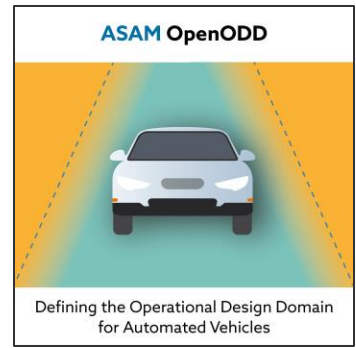
Roadmap

- The two versions, 1.x. and 2.x, shall be developed as two separate standards, with no formal migration nor convergence required by ASAM.
- Continued alignment of the two standards is encouraged but is subject to project participant interests and is not required by ASAM. This will be driven by the market/members and is not part of the formal roadmap of ASAM OpenSCENARIO.

OpenODD

What is an ODD in the context of OpenODD?

A machine and human readable format for representing a defined Operational Design Domain that is measurable and verifiable



A list of attributes and values, based on a taxonomy or ontology

weather

temperature: **single**(-20..40) [°C]

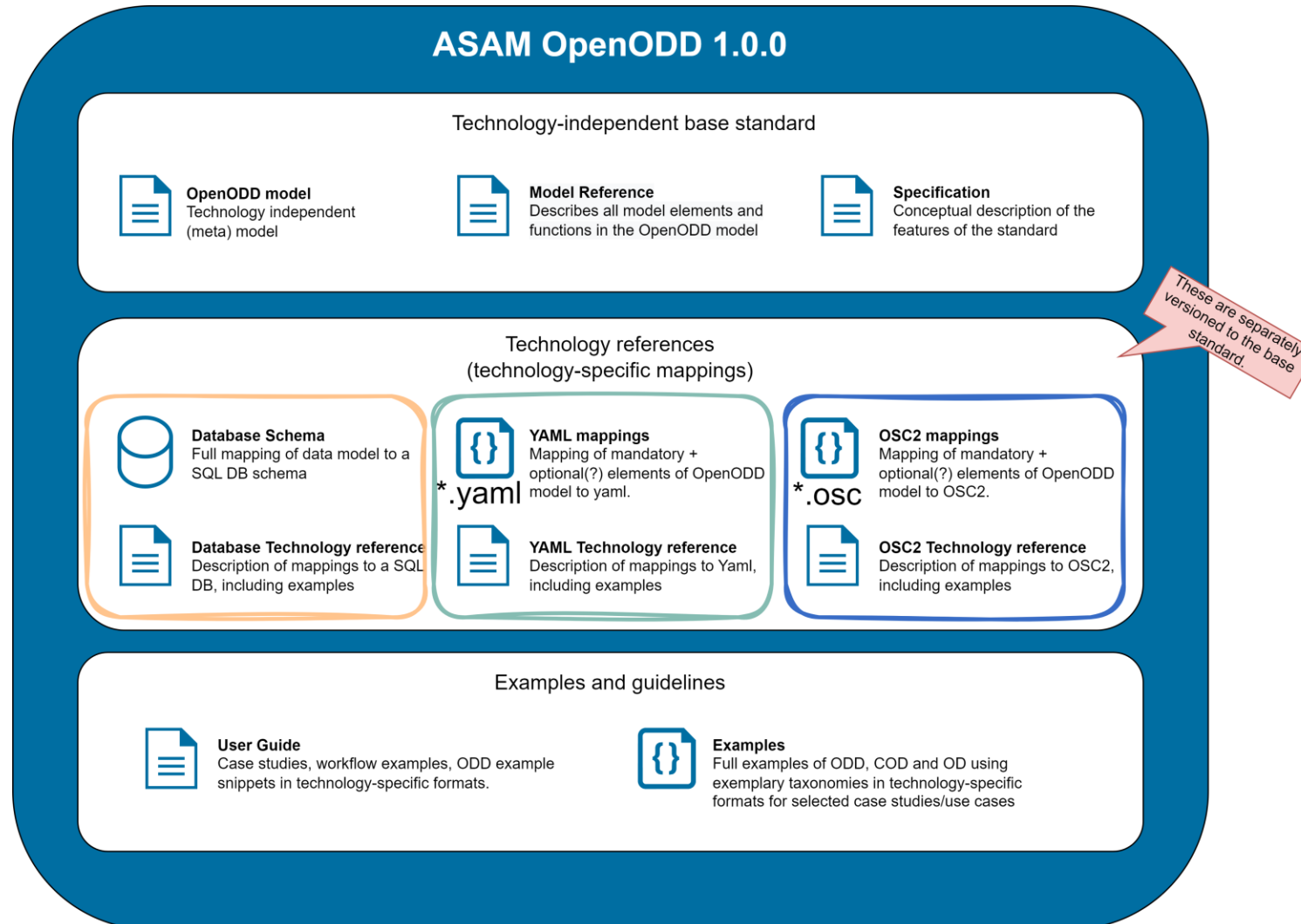
rain

light:(droplet_size: **single**,
density: **single**) ((0..1),
(0..1k)) ([mm³], [1/m³])



Boundary definition

ASAM OpenODD deliverables

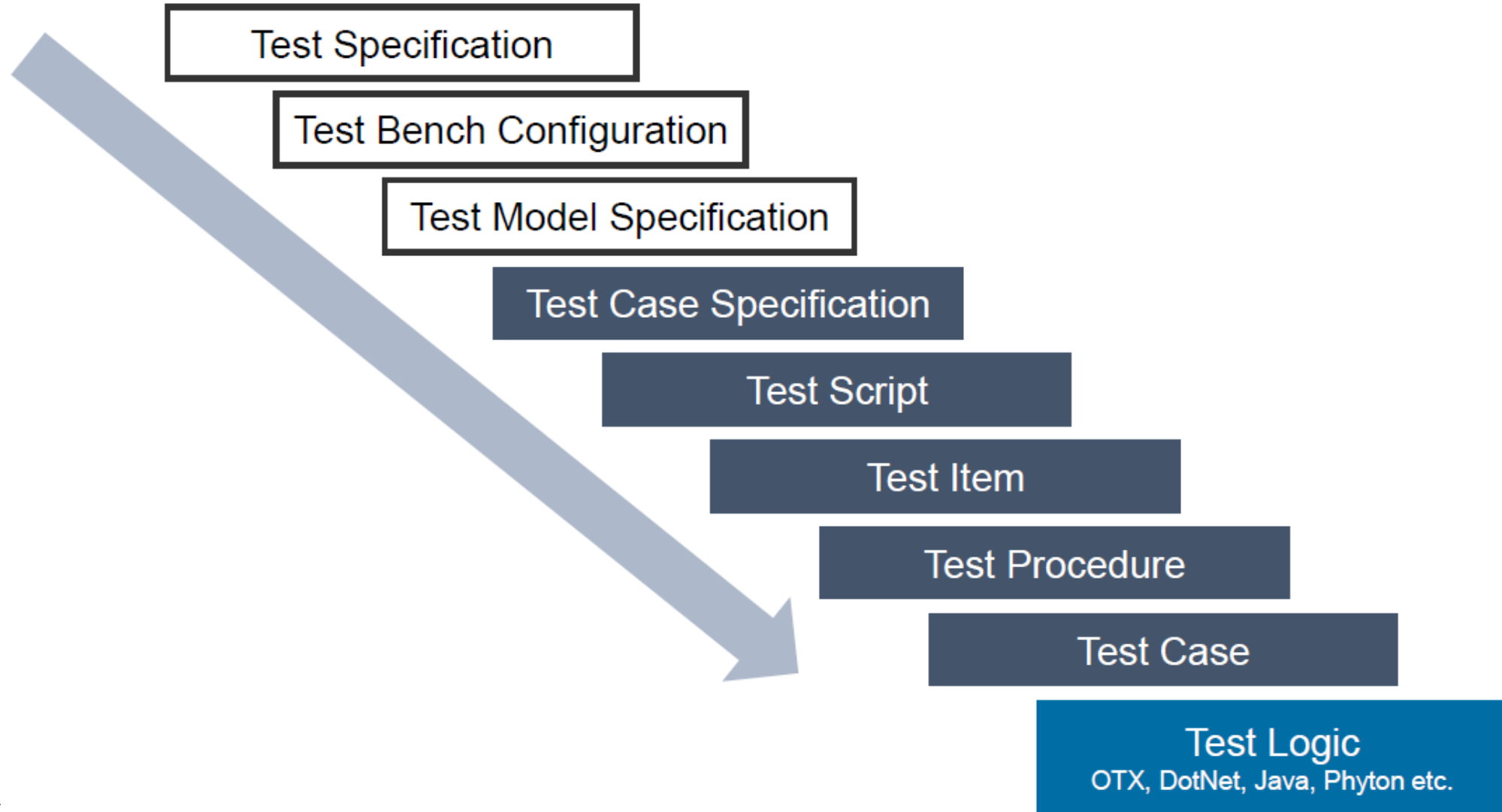


OpenTestSpecification

Concept Project ASAM OpenTestSpecification

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

Concept Project ASAM OpenTestSpecification



Offroad Challenges

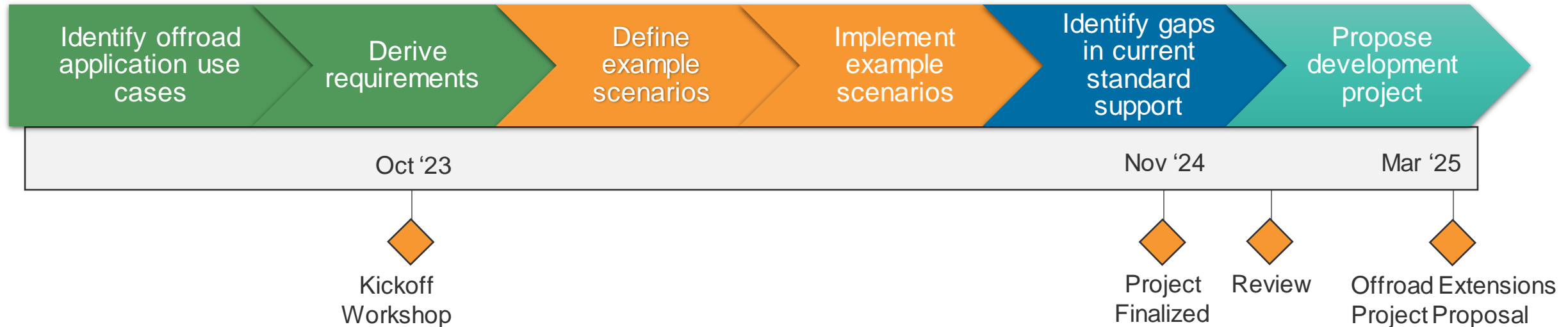
- Complex 3D terrain
- Sensor modeling and surface materials (including link between appearance and physical characteristics)
- Object representation
 - Vegetation and other natural obstacles
 - Meshes, materials, physics
- Representation of the subsurface
 - Soil strength, density, temperature, water content
 - Effects on mobility
- Vehicle-terrain interaction and material dynamics
 - Mud and water spray
 - Mud and snow deformation
 - Accumulation of material on vehicles
- Weather conditions
- Occlusion of sensors
 - Mud, snow, dirt in the air and on camera lens



Concept Project ASAM OpenX in Offroad Applications

GOAL

- Evaluate the need for extensions to existing standards or development of new standards to support modeling and simulation of (a) vehicle mobility in off -road conditions and (b) earth moving for digging, loading, and hauling

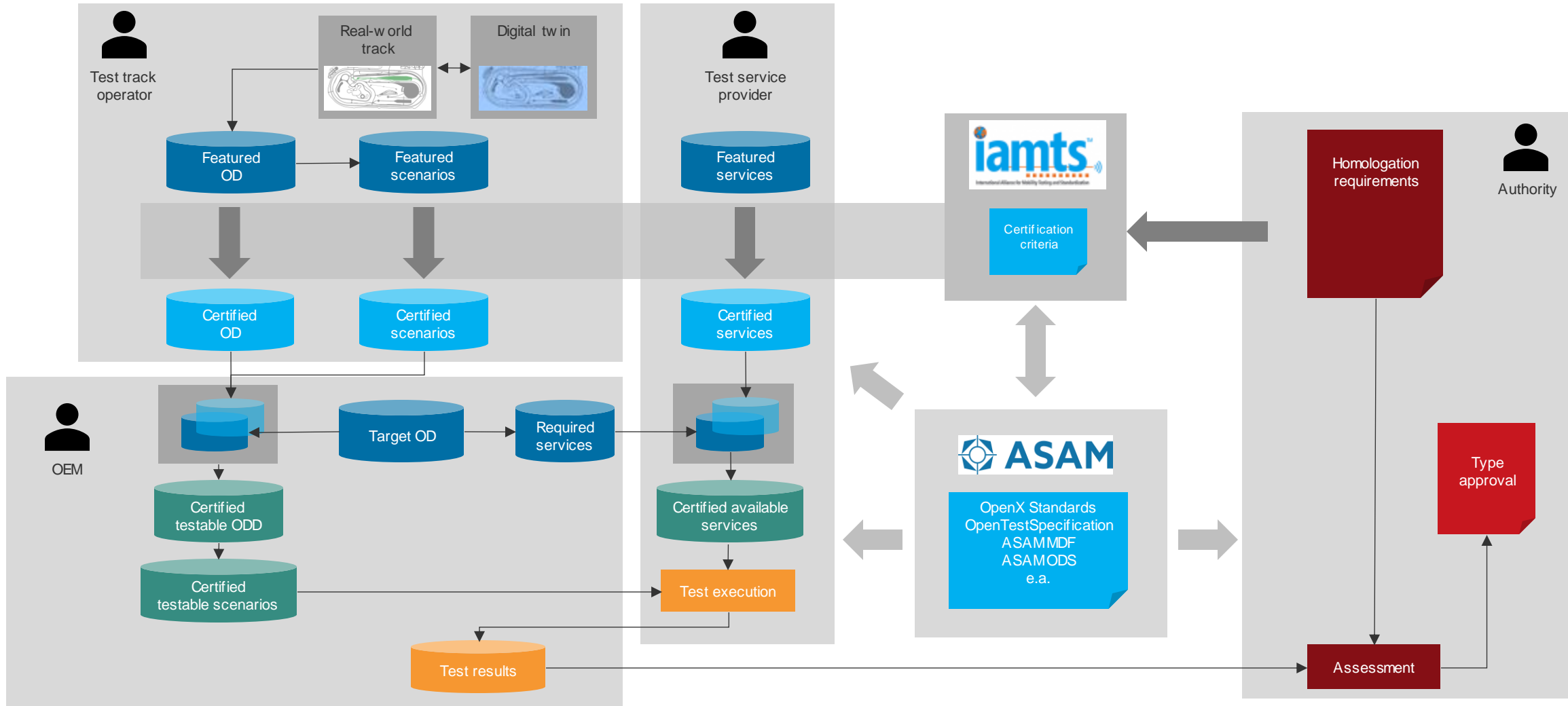


Upcoming topics

Describing and Certifying Proving Grounds with the help of ASAM standards

Collaboration along the workflow

How it works – on OD(D) level

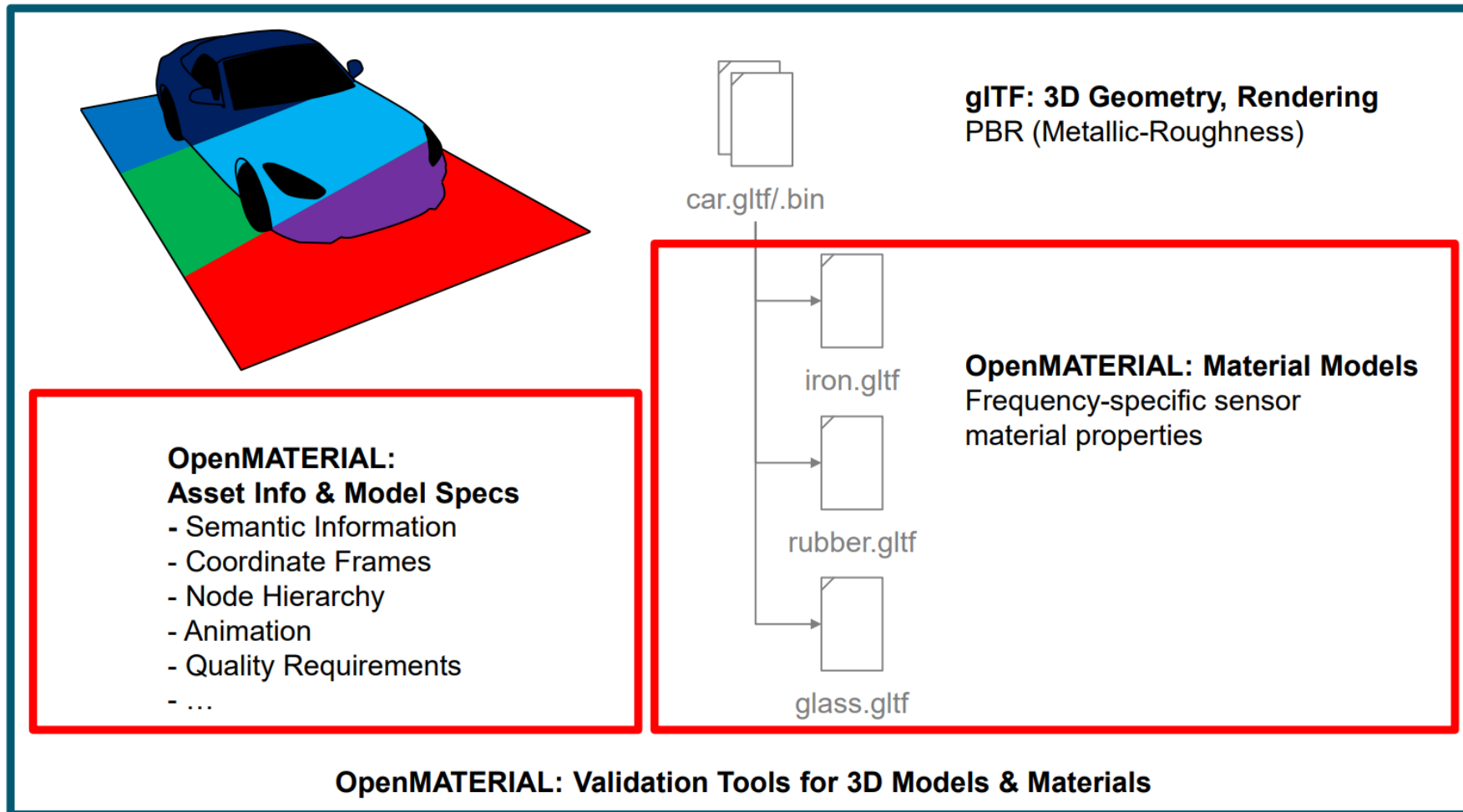


OpenMaterial

OpenMaterial

Status

Standardized data structure for materials and 3D assets



Define a format for material properties

Extend OSI Sensor View to support material properties

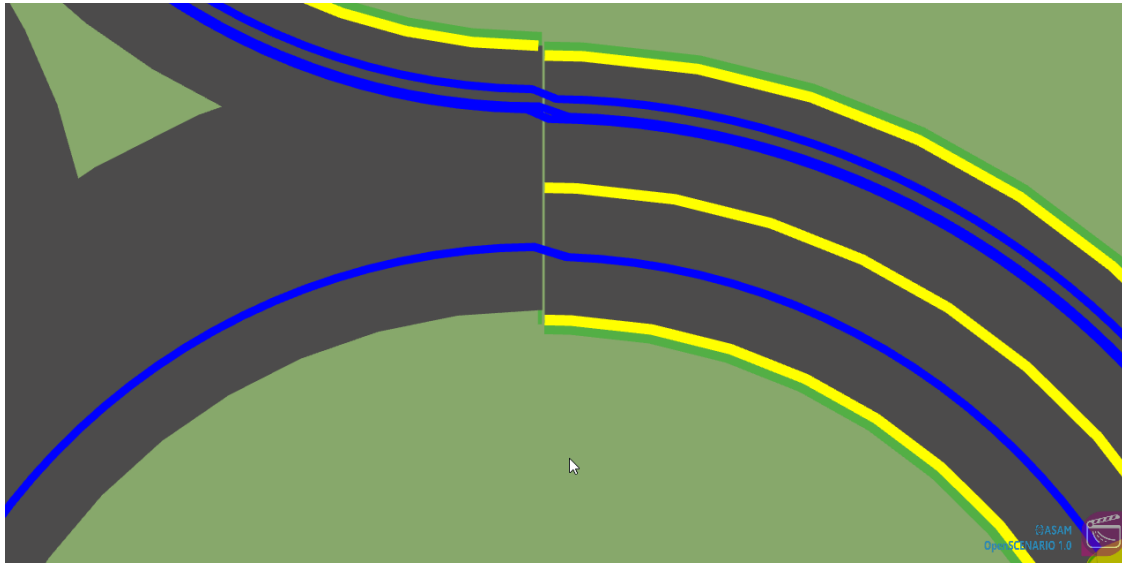
Define a format for data associated with assets

Define a data structure for 3D models

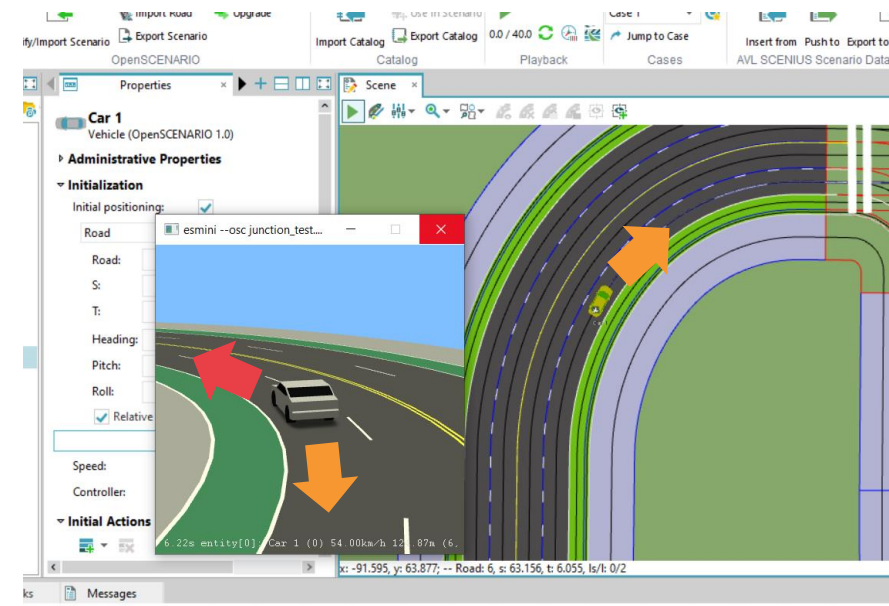
Quality Checker

Ambiguity examples

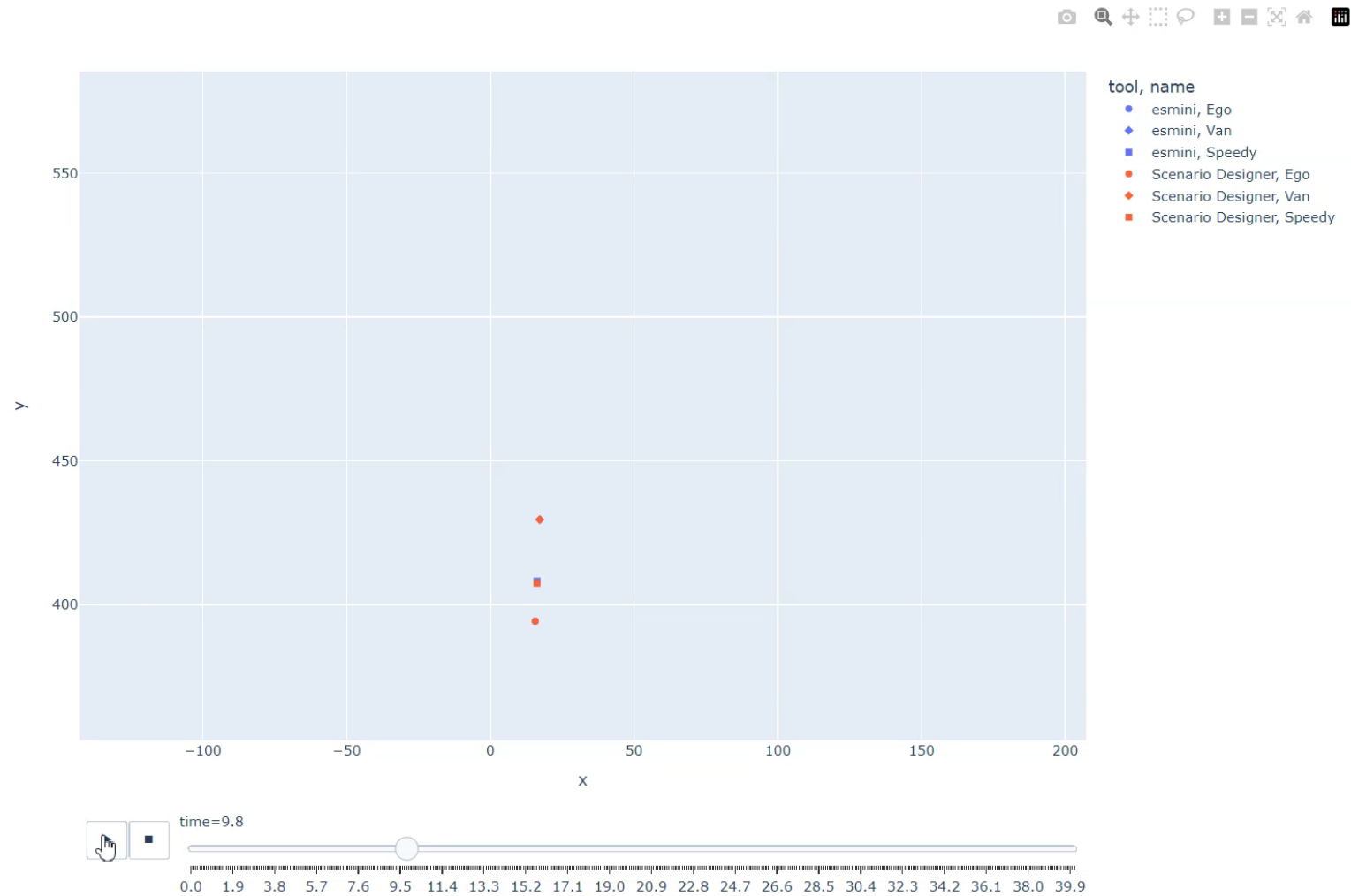
Geometric discontinuity



Default value misinterpretation – driving direction rules



OpenSCENARIO



Video credit: Simon Terres, AVL, presented at ASAM Technical Seminar 2023

Another example: Traffic participants

What's wrong?

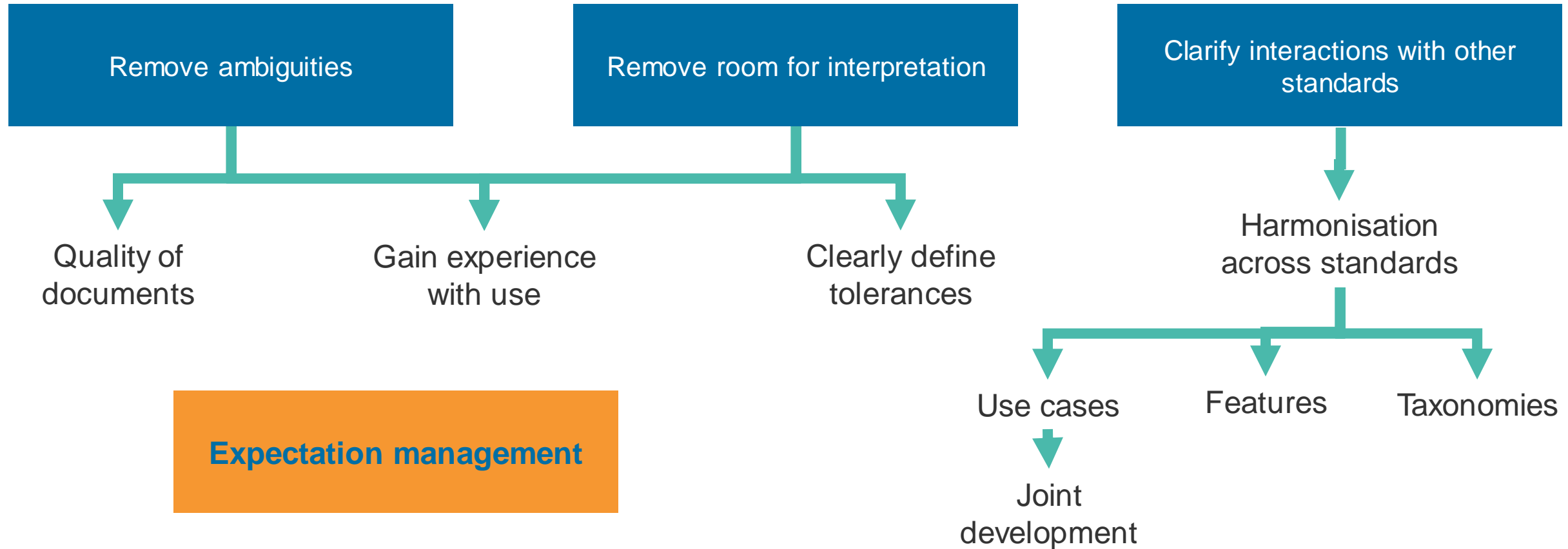


A **pedestrian** in OSC 1.x and a **vehicle** in OSI.

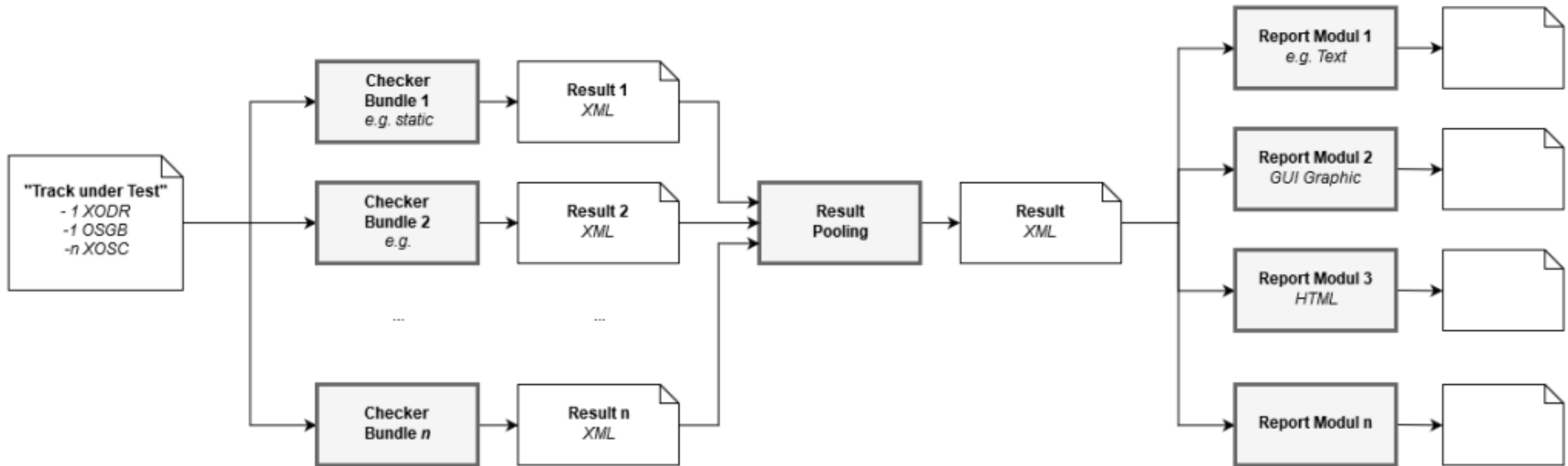


Truck or **car with trailer** in OSC 1.x?
Luxury_Sedan with Trailer in OSI?

Mitigating the differences



ASAM Checker & Validation Tooling



Upcoming topics

SCDL

*Formal notation for
ISO26262 safety
concepts*



OpenMaterial

*Description of material
properties & 3D model
data structures*



ASAM Quality Checker

*Checking & validation
framework for ASAM
standards*



Offroad

*Application of OpenX in
other domains*

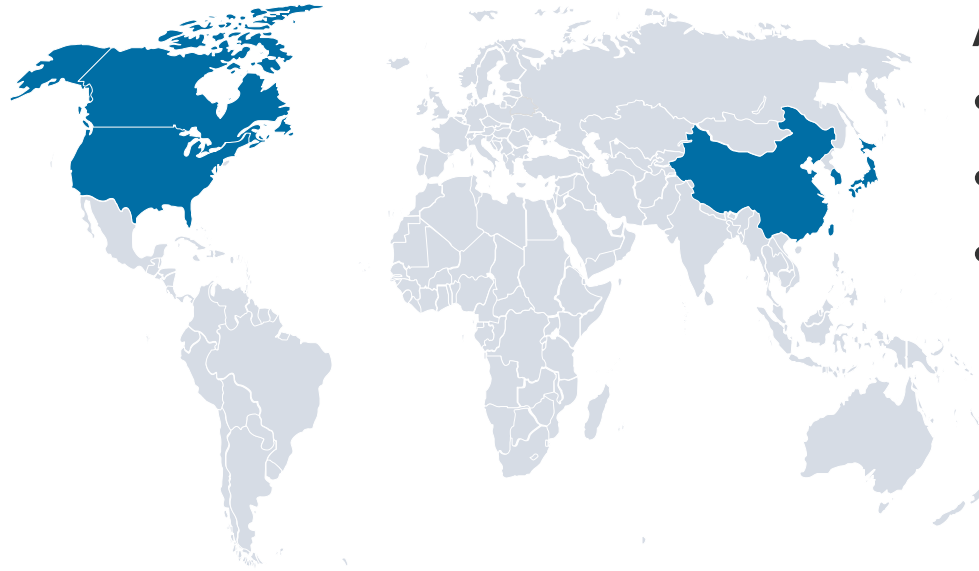


What else?

New topics



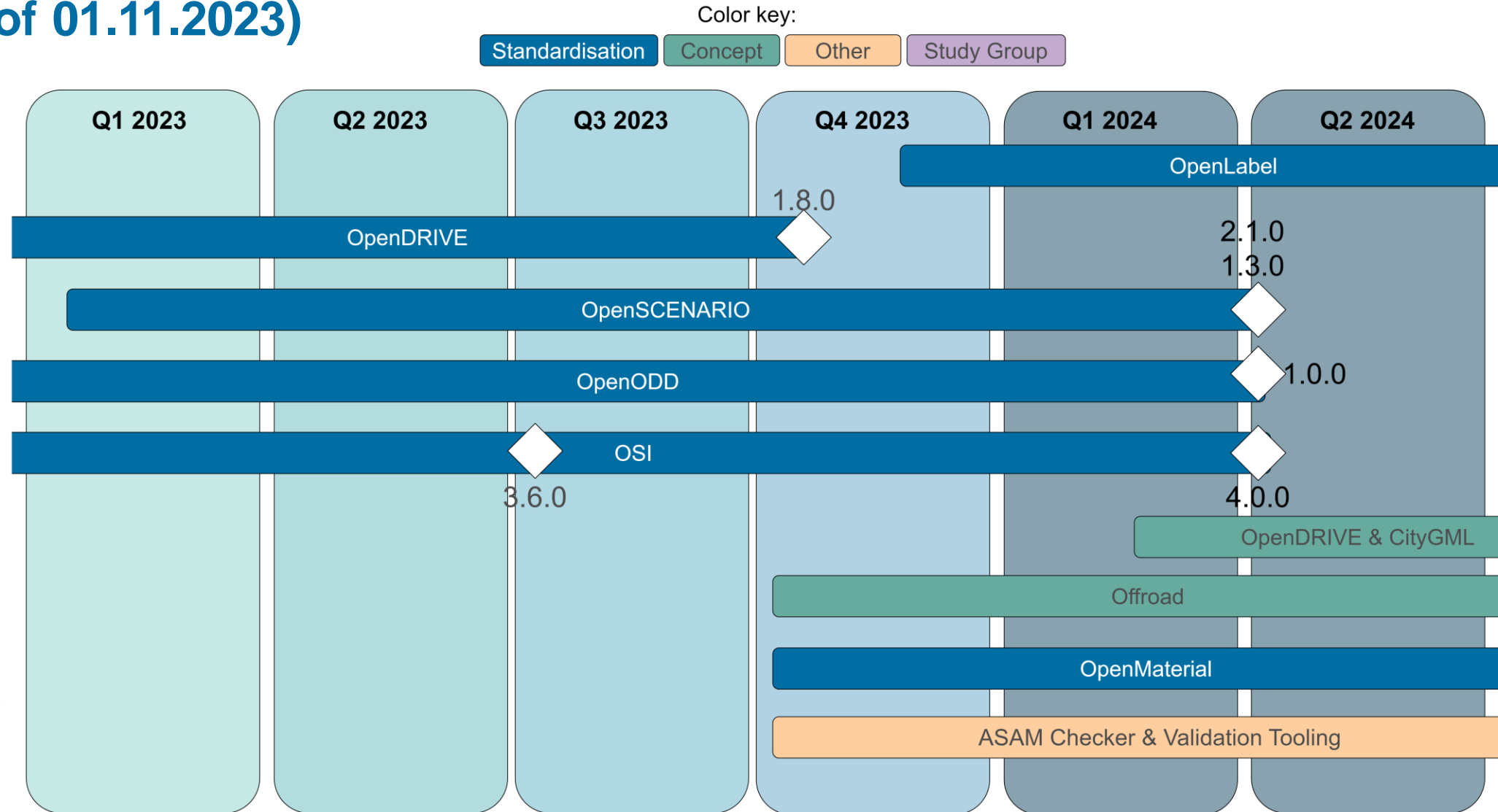
More targeted regional efforts



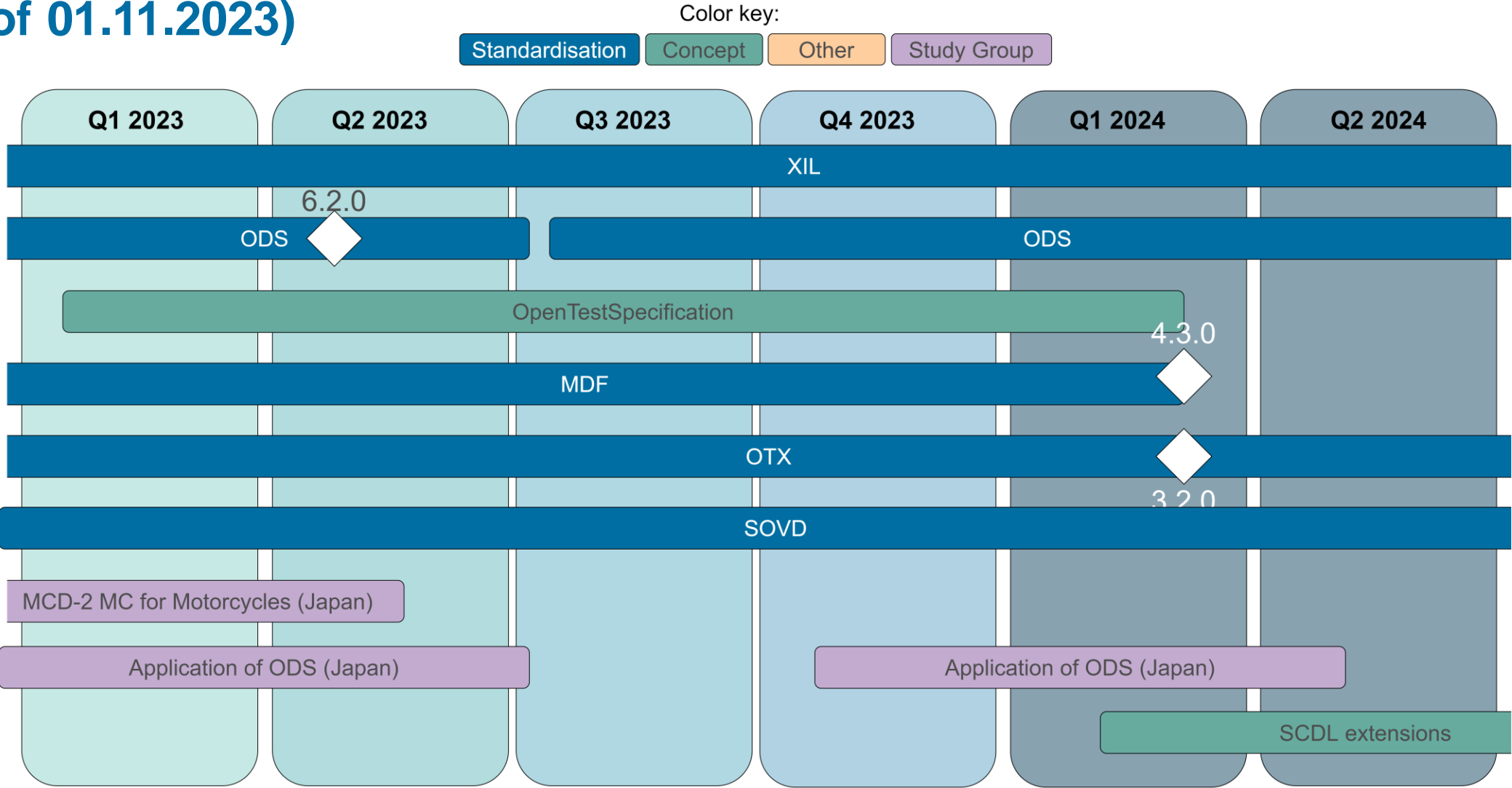
And more...

- Growing the team
- Harmonisation
- Supporting research projects

Project roadmap 2023 (simulation) (as of 01.11.2023)



Project roadmap 2023 (all other domains) (as of 01.11.2023)



Thank you for your attention!

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Getting involved in ASAM

Putting ASAM into perspective

- Understand the goals & strengths of each organisation



Our main driver: leverage each organization's strengths and expertise!

Why become a member?



Access to
all ASAM
standards

Global community
of experts



Participate
in projects



„Early access“
to new features

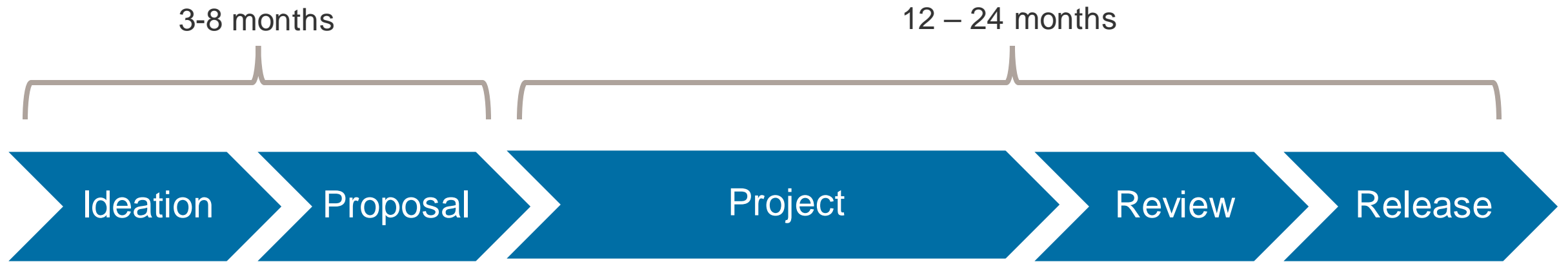


Fast, lean processes
& toolchains



Ensure ASAM standards
cater to your use cases
& requirements

How does a project work?



All projects are **member-driven**

Average commitment / yr **25-30 person days**

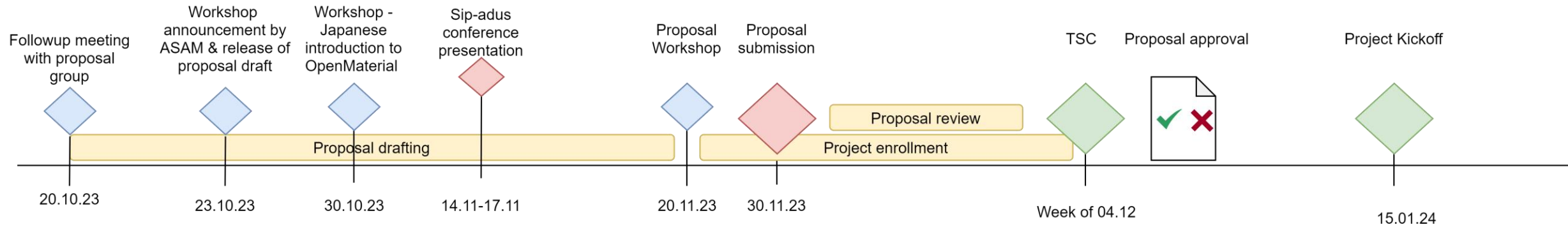
Work involves: Expert **discussion**, content **authoring**, **review**

Other topics

OpenMaterial

Status

Standardized data structure for materials and 3D assets



ASAM Checker & Validation Tooling

- Scope of the activity
 1. Checker framework (standard independent)
 2. Checker libraries for OpenSCENARIO XML/DSL, OpenDRIVE, OpenCRG
- Followups may address additional libraries or standards
- Project participants to define requirements towards a framework and an initial set of checks for OSC & ODR
- Software development to be performed by a service provider (framework & check implementation)

