

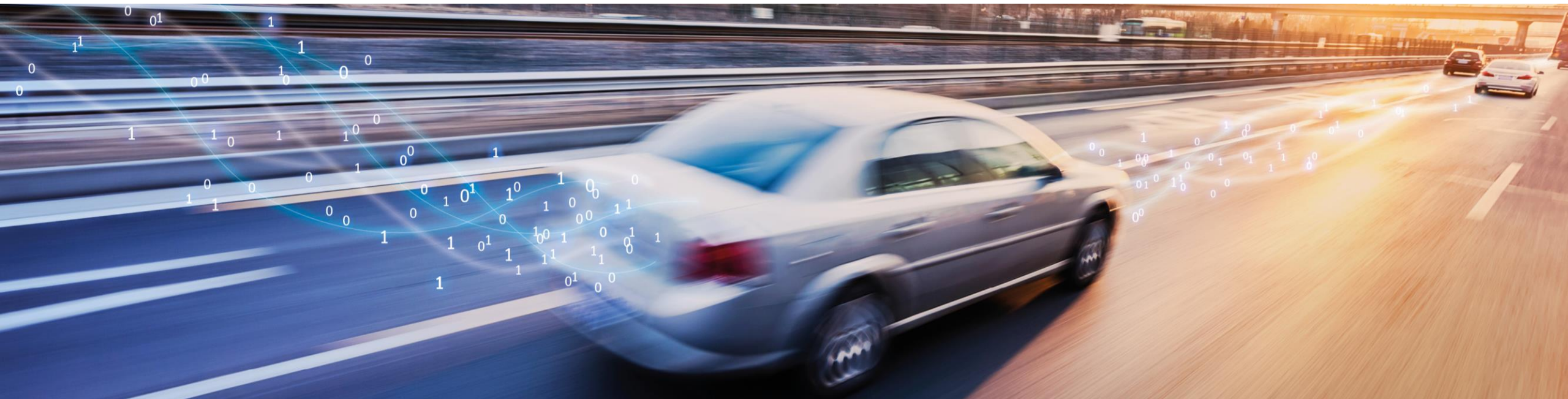
# ASAM OpenX

## An Overview

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ASAM e.V.

August 18, 2020

OpenADx SC Meeting



# About ASAM

Who we are and what we do

# ASAM - Introduction

- Not for profit standardization within the Automotive Industry
- Focus on implementation level standards – (rather than the process level standards of e.g. ISO/SAE)
- ASAM standards are recommendations, they do not have an impact on regulatory framework
- Open, non-competitive standard development groups
- Membership driven standardization projects

<https://www.asam.net/home/about-asam/compliance.html>

# ASAM Membership

More Than 290 Member Organizations Develop and Apply ASAM Standards

## OEMs



## Tier-1 Suppliers



## Tool Vendors / Service Providers



## Universities / Research Institutes



Status March 16, 2020

# ASAM Standards Portfolio

Currently seven Domains (Status March 2020)

## Simulation

OpenDRIVE    OpenSCENARIO

...

## Data Management & Analysis

CEA    ODS

## Test Automation

ACI    ASAP 3    ATX    GDI    iLinkRT

MCD-3 MC    XIL    OTX Extensions



## Measurement & Calibration

MCD-1 POD    MCD-1 CCP / XCP

MCD-2 MC    MCD-2 CERP    MDF

ARTI    CDF    CPX

## Diagnostics

MCD-2 D    MCD-3 D

## ECU Networks

MCD-2 NET

## Software Development

CC    FSX    ISSUE    LXF    MBFS    MDX

<https://www.asam.net/standards/>

## Goal of the simulation domain

Enable and support the automotive industry in furthering the state of the autonomous driving, especially with respect to (virtual) validation and/or verification.

# Why ASAM & OpenX?

- High market coverage
  - OpenX standards are already in use by a large number of tool vendors, research groups & OEMs across the globe
- Development speed → Essential for the extremely rapidly developing world of AV and ADAS
  - Fast integration of new members into development process
  - Flat hierarchy
  - Public approval & review process
- Direct support by ASAM representatives
  - Technical direction
  - Logistics
  - Coordination amongst project members
  - Modern development & collaboration infrastructure (tools, approaches, etc.)

# About the Standards (those released so far)





# ASAM OpenX: Overview

The OpenX Domain so far:

## OpenSCENARIO

- Dynamic scene description

## OpenDRIVE

- Static road network

## OpenCRG

- Detailed Road surface description

## Open Simulation Interface

- Generic interface between sensor models & ground truth

## OpenLABEL

- Object and scenario labelling format

## OpenODD

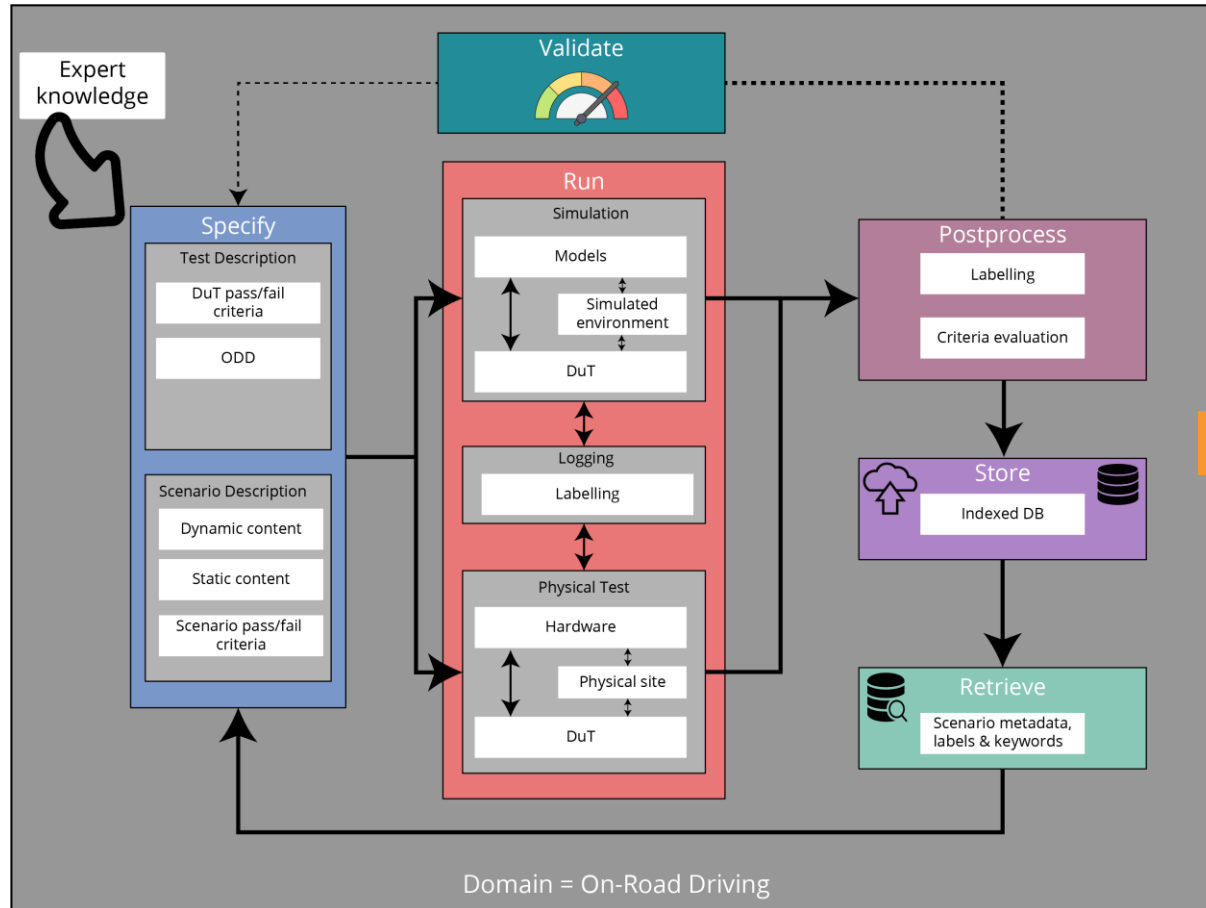
- ODD description format

## OpenXOntology

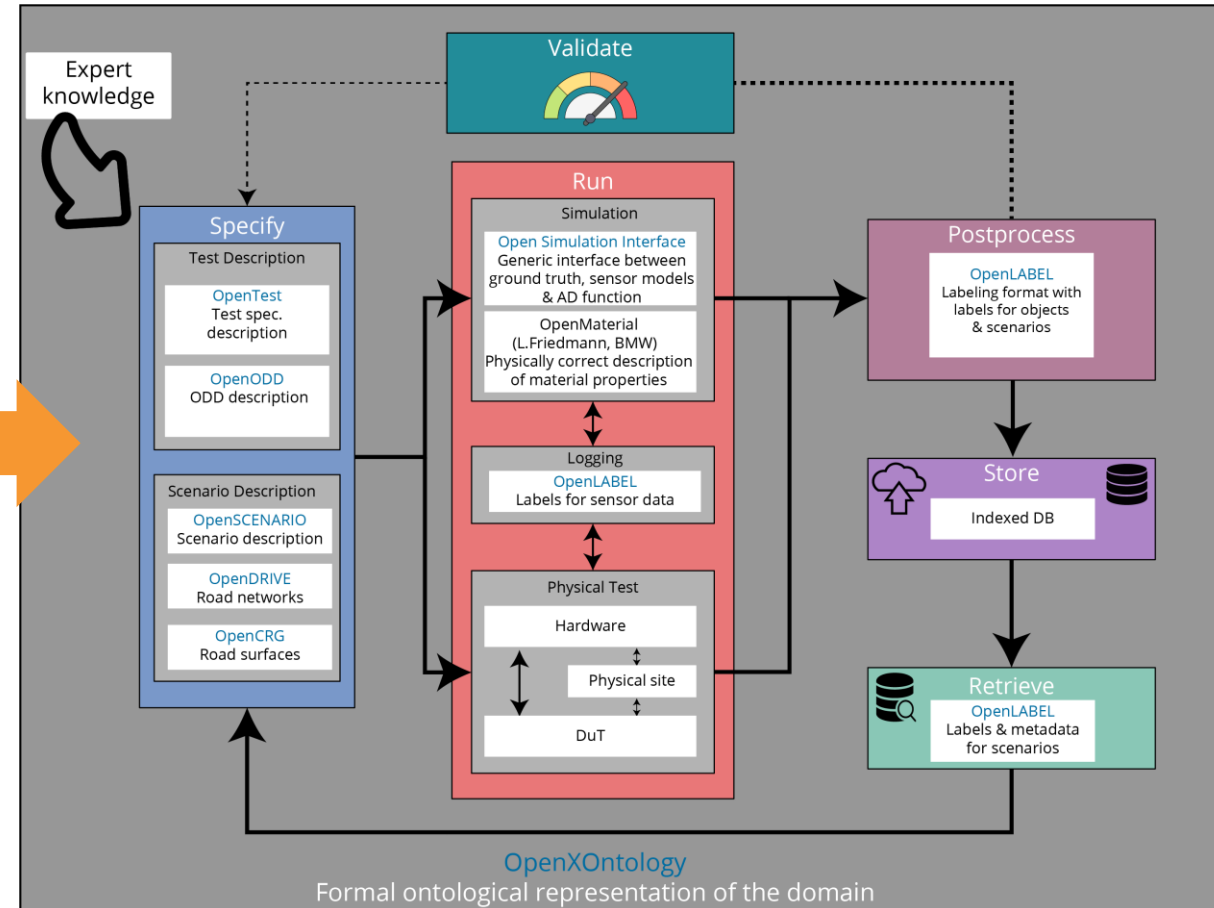
- Extendable domain ontology for OpenX

# ASAM OpenX Standards for Automated Driving: An Example

An example of a scenario-based testing (SBT) workflow

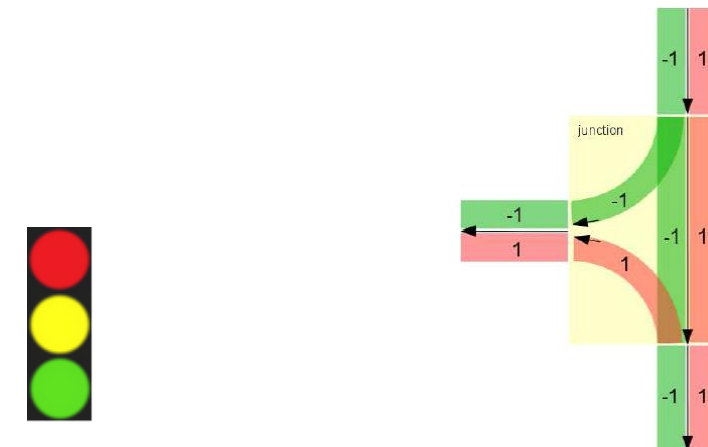
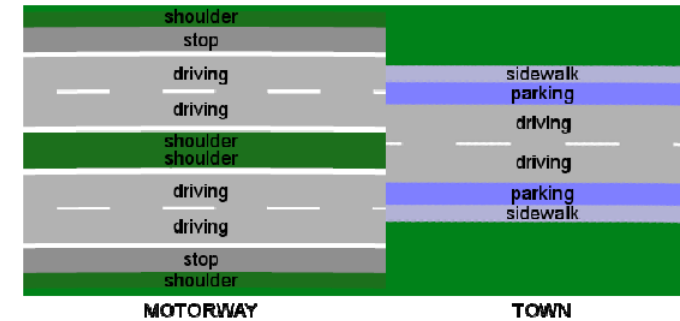
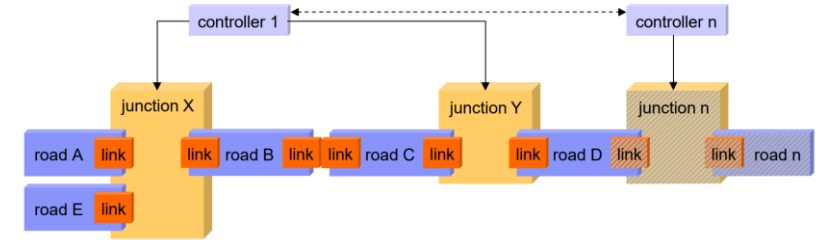


OpenX activities in an SBT workflow



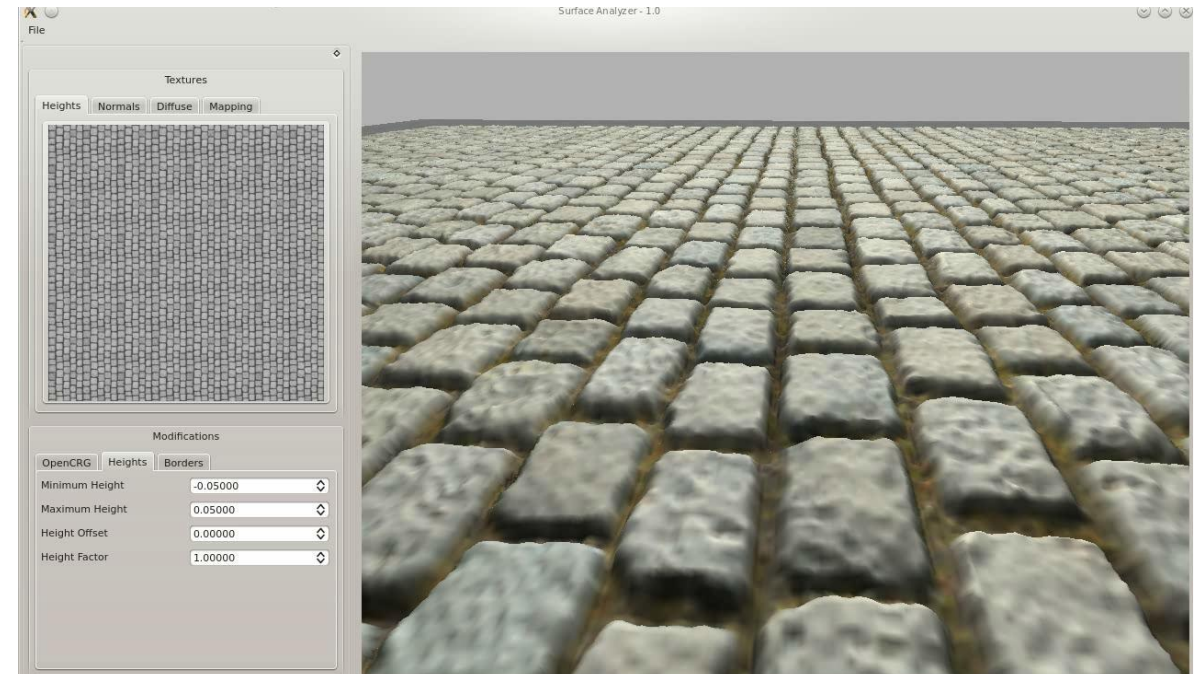
# OpenDRIVE

- OpenDRIVE: Open Dynamic Road Information for Vehicle Environment
- File format for the **description of road networks**.
- Used for simulators in the area of
  - Drive simulation
  - Traffic simulation
  - Sensor simulation
- Based upon XML and a hierarchical data model.
- Basic elements:
  - Roads
  - Junctions
  - Controller
- Not covered: entities acting on or interacting with the road network.



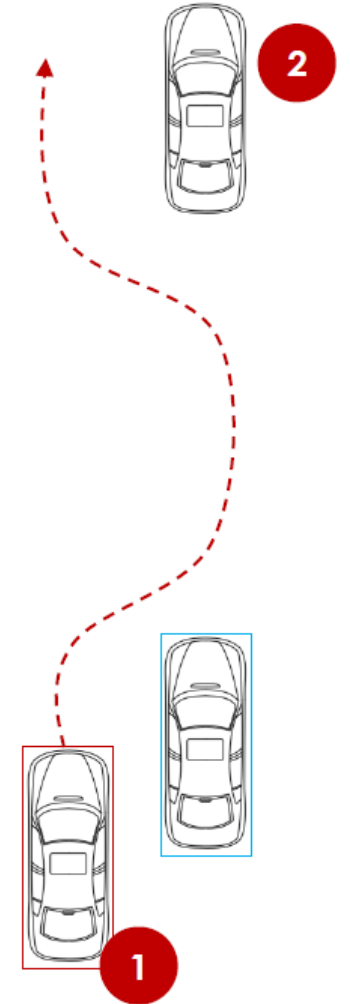
# OpenCRG

- OpenCRG: Open Curved Regular Grid
- File format and source-code for the **detailed description of road surfaces**.
- The file format of OpenCRG is integrated in OpenDRIVE.
- Used for the description of patches of road surfaces in a very detailed manner, so that it can be used for:
  - Tire simulation
  - Vibration simulation
  - Driving simulation, etc.
- Source-code included:
  - C API for data read/write and evaluation
  - MATLAB API for data read/write, evaluation, generation, modification and visualization
  - Library of sample data



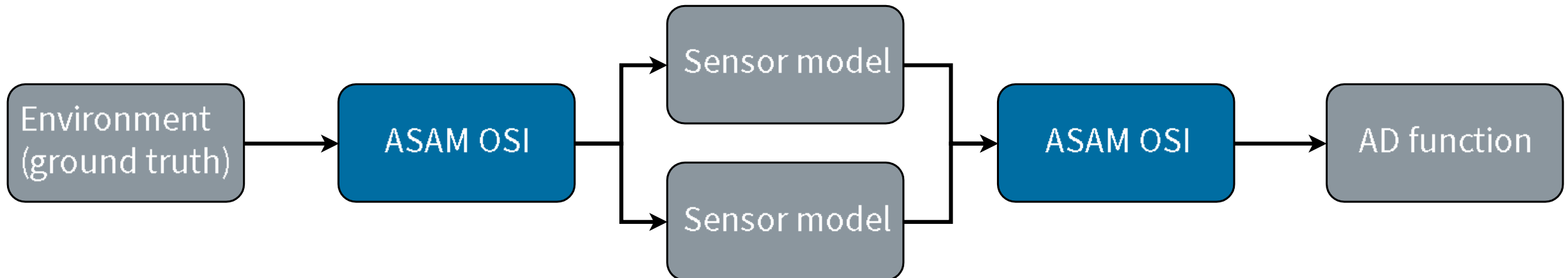
# OpenSCENARIO

- File format for the **description of dynamic content in driving simulation applications**.
- Currently: focus on drive maneuver description.
- Used for driving simulators.
- Description elements:
  - **Maneuver**  
(complex maneuver descriptions that involve multiple cars)
  - **Trajectory**  
(polyline, clothoid, nurbs)
  - **Vehicle**  
(geometry, type, axes, performance)
  - **Driver**  
(appearance)
  - **Environment**  
(weather, time of day, road condition)
- Based upon XML.



# OSI

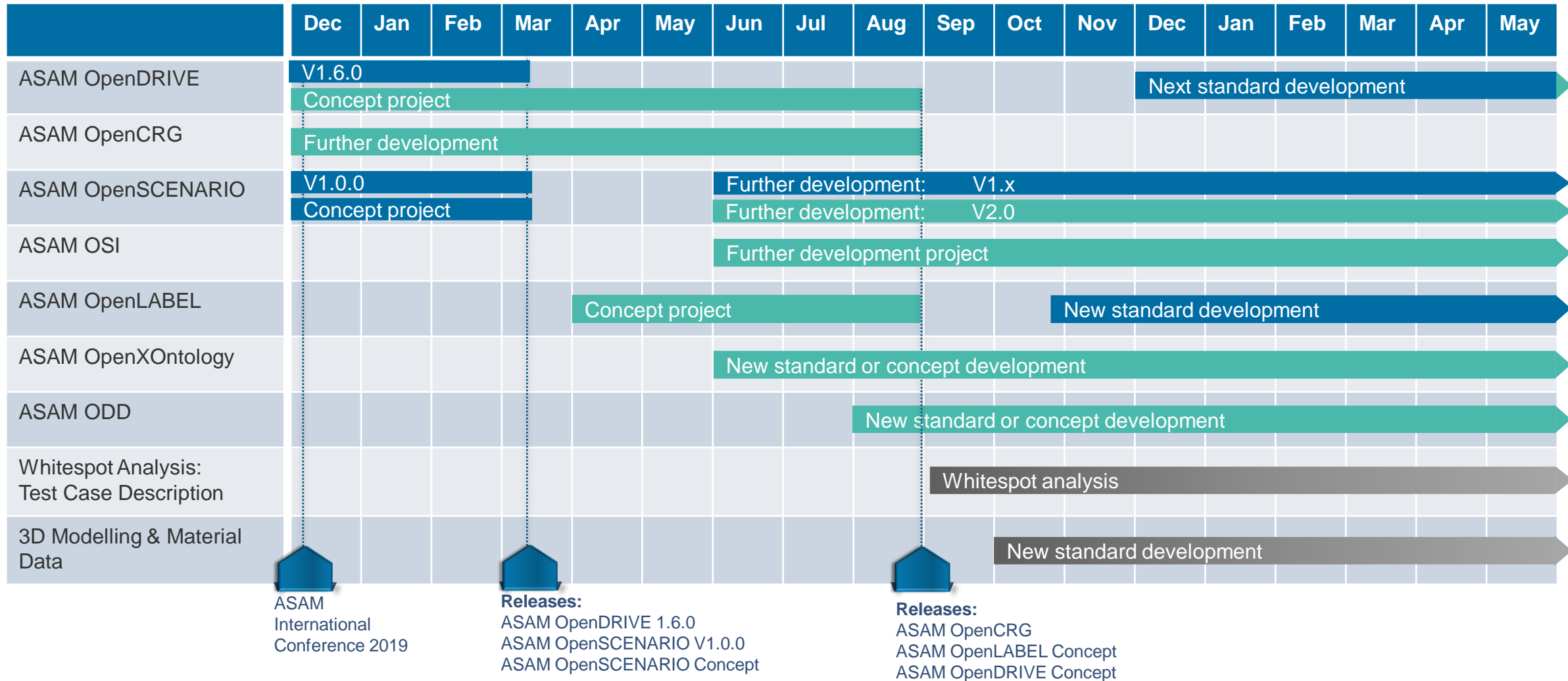
- OSI: Open Simulation Interface
- A generic interface for the **environment perception of automated driving functions in virtual scenarios**.
- Contains an object-based environment description using message formats for two types of data:
  - **GroundTruth**: gives an exact view on the simulated objects in a global coordinate system.
  - **SensorData**: describes the objects in the reference frame of a sensor for environmental perception.



# Current Projects & Activities

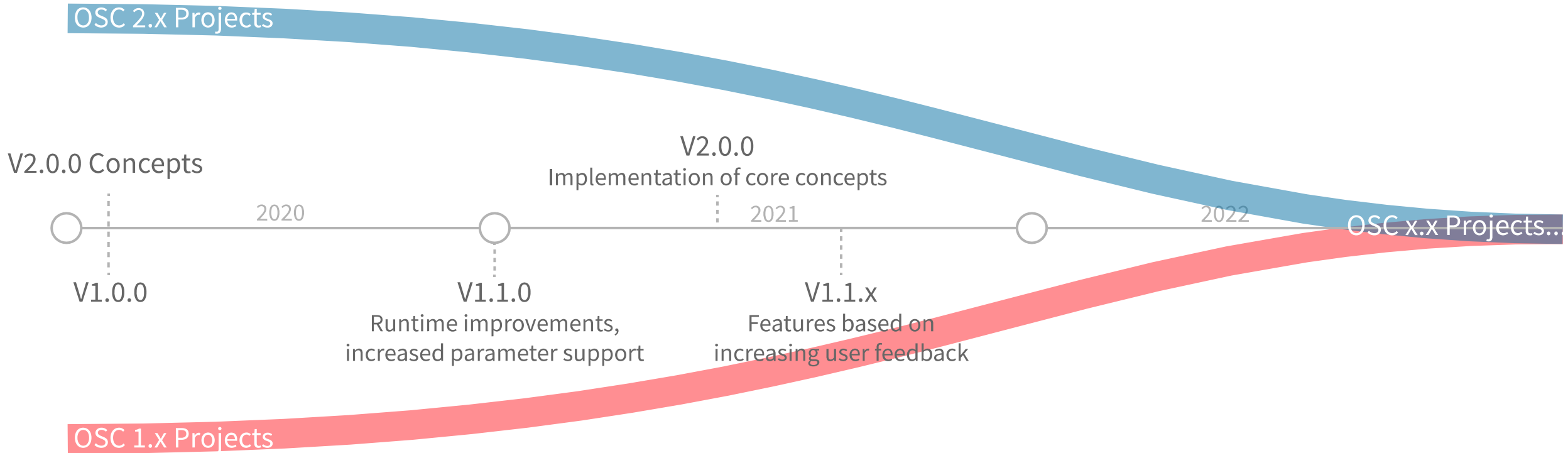


# Timeline 2020 / 2021



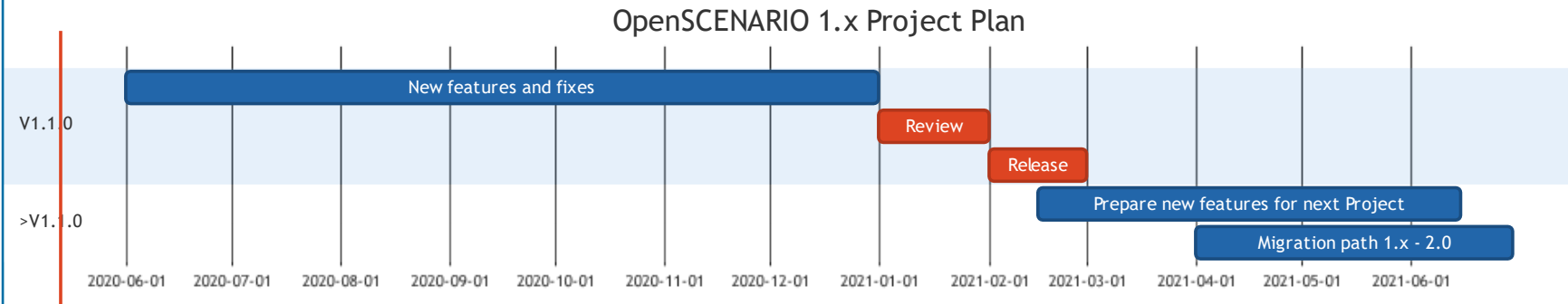


# ASAM OpenSCENARIO



# ASAM OpenSCENARIO 1.x

- [Proposal Link](#)
- 28 participating companies
- >700 days committed
- 49.000 EUR budget
- June 2020 - June 2021 (1 year)



## Harmonization & Maintenance

- Alignment with other OpenX standards
- Fixes and clarifications to V1.0.0

## Parameters & Conditions

- more parameters and conditions for more complex scenarios
- Parameter ranges & distributions

## Actions & Controllers

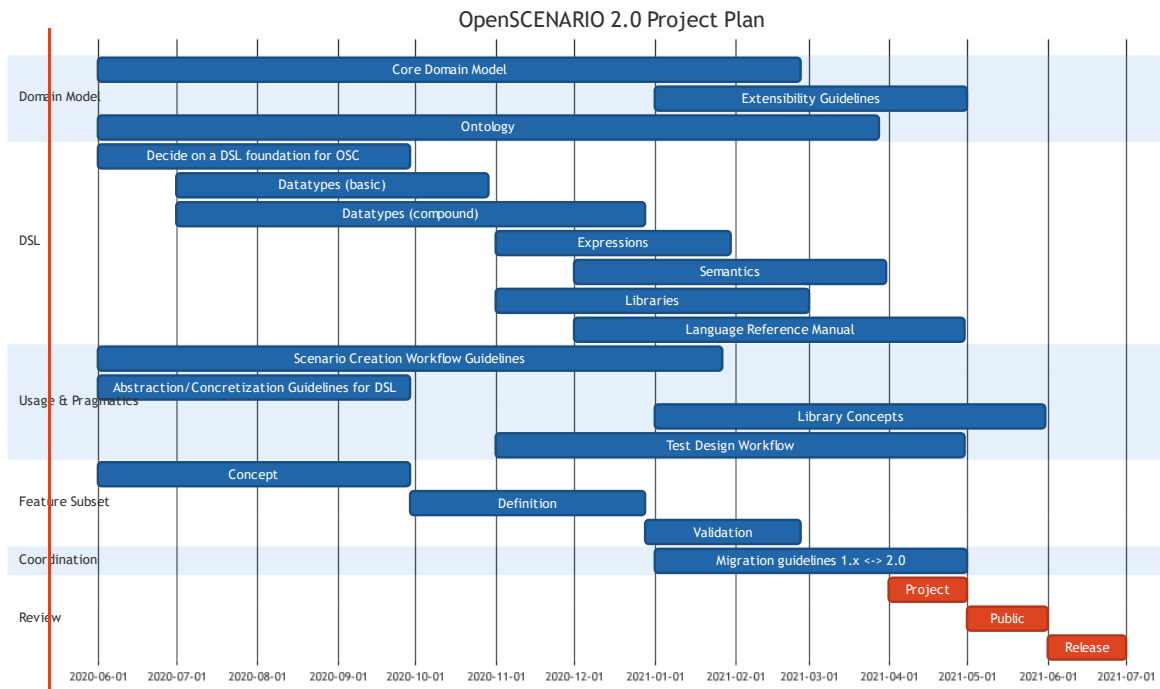
- More actions (e.g. parking, traffic)
- Increase flexibility of action definition & remove strong dependency on runtime positioning

## Runtime & System Boundaries

- Clarify runtime interaction between actions, entities and controllers
- Define clear system boundaries between OSC & tooling

# ASAM OpenSCENARIO 2.0

- [Proposal Link](#)
- 55 participating companies
- >1300 days committed
- 105.000 EUR budget
- June 2020 - July 2021 (1 year)



## Language Concepts

- Define a domain specific language to be used for OpenSCENARIO
  - Semantics, syntax & structure
  - Extendibility
  - Migration with 1.x
  - Library concepts
  - Measurement and success criteria (KPIs, observers, etc.)

## Usage & Pragmatics

- Analyse the different scenario creation & testing workflows described by the use cases in the proposal
- Provide guidelines and documentation on the use of OpenSCENARIO in these workflows

## Domain Model

- Define the underlying domain model for OpenSCENARIO
- Guidelines on extending the domain model
- Interface with the OpenXOntology project to investigate feasibility of representing this via an ontology

## Feature Subsets

- Investigate the feasibility of and define the division of OpenSCENARIO into multiple feature subsets for compatibility
  - E.g. a subset that defines all the features of 1.x or for a specific use case

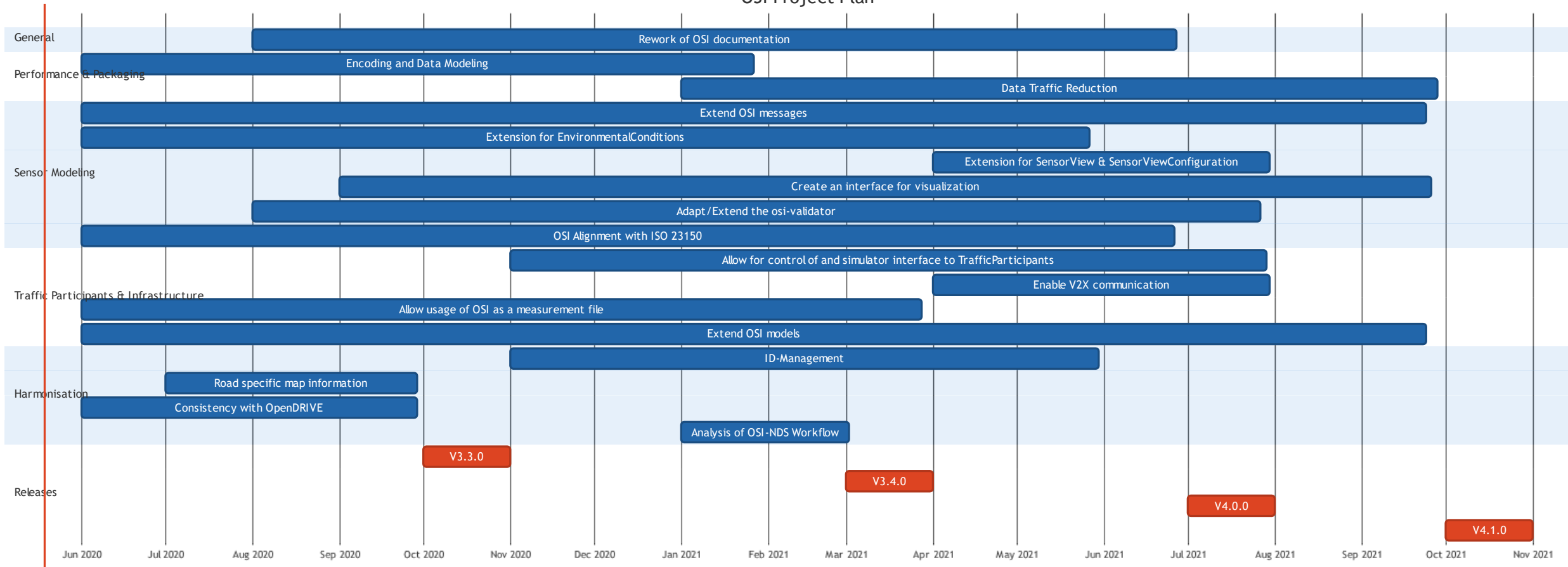
# ASAM OSI

- Open source development (contributions from non-members & individuals allowed)
- [Proposal Link](#)
- 23 participating companies
- >600 days committed
- June 2020 - Nov 2021 (1.5 years)

Sensor modelling	Extend OSI with support for higher fidelity models, this includes: <ul style="list-style-type: none"><li>• Stochastic sensor models</li><li>• Physics based sensor models</li></ul>
Traffic participants & infrastructure	Add support for bi-directional exchange between any traffic participant and a simulator framework
Performance & packaging	Increase OSI performance for high data rates and real-time applications <ul style="list-style-type: none"><li>• Improvements to the encoding layer (e.g. support for Flatbuffer)</li><li>• Guidelines on using OSI for performance critical applications</li><li>• Allow for more control on the data being transmitted (e.g. delta encoding)</li></ul>
Harmonization with OpenX	Ensure alignment and closer integration with the other OpenX standards & activities

# ASAM OSI

## OSI Project Plan



# ASAM OpenLabel

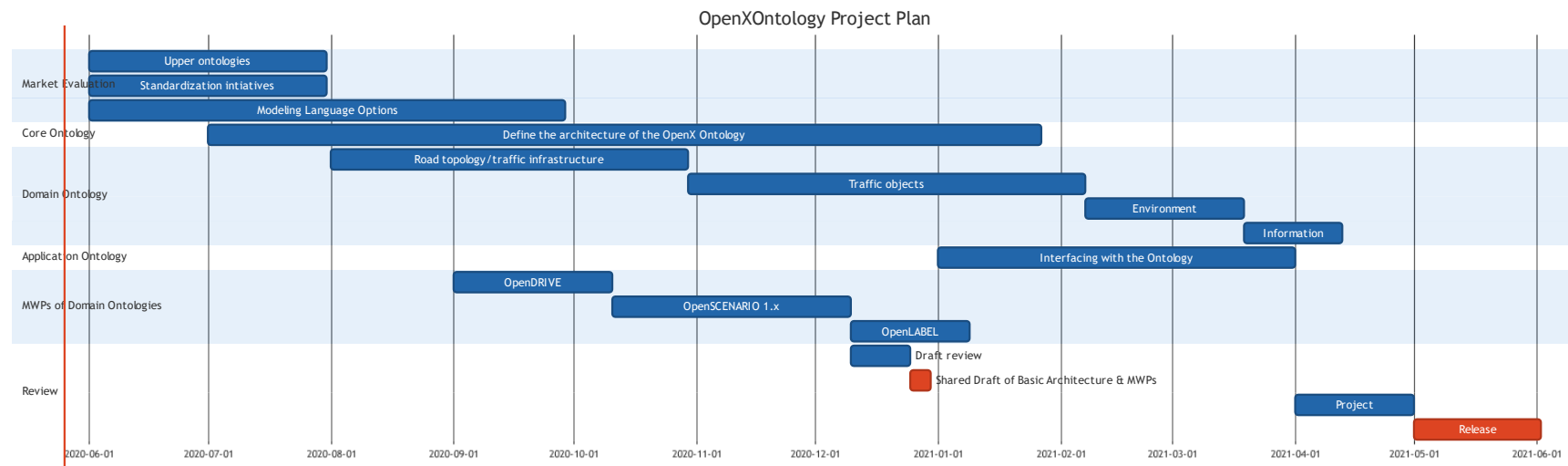
## Life of the recorded data



- April 2020 – October 2020
- > 40 companies participating
- Focus on the HOW to label  
→ Provide labeling formats that can be linked to e.g. an ontology for the WHAT
- Allow for labels of objects of interest & scenarios
- 2 deliverables:
  - Concept paper for OpenLABEL
  - List of requirements for the ASAM OpenXOntology project

# ASAM OpenXOntology

- Goal: Link OpenX standards through a common domain model, represented by an ontology  
→ increased inter-compatibility
- June 2020 - June 2021 (1 year)
- 20 participating companies
- >350 committed days
- 59.500 EUR budget
- [Proposal link](#)



# ASAM OpenODD

- Concept Project starting mid August
- Ideation Workshop end of April 2020
- High interest 100 Participants
- Standardised format for definition of Operational Design Domains (ODDs)
- [Proposal link](#)

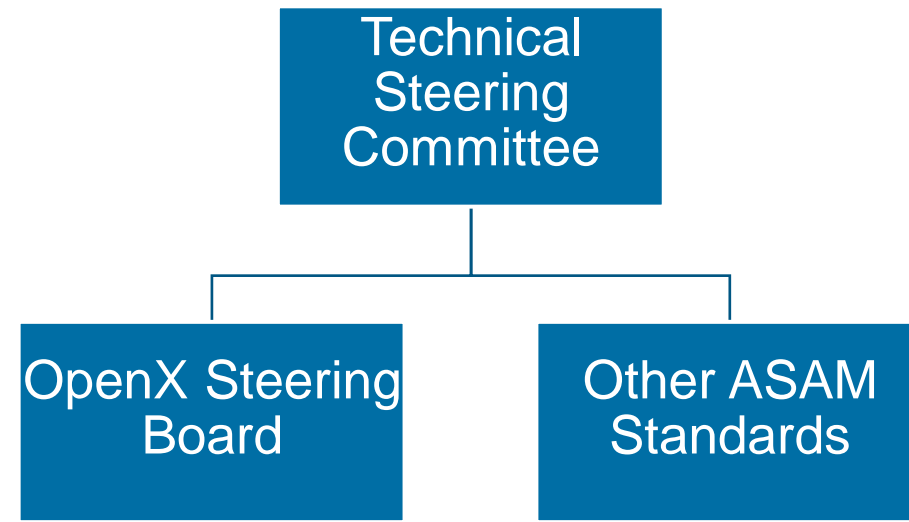


# ASAM Coordination Group: Simulation



# Coordination Group: Simulation

- Develop and maintain a roadmap of the ASAM simulation domain
- Strategic analysis of the automotive domain
  - Identify potential for further standardization within the simulation domain and initiate activities, e.g. whitespace analysis
  - Ensure no overlap of standards
  - Ensure alignment with external activities
- Pre-approval (subject to final approval by TSC) for domain relevant topics to accelerate the ASAM decision making process
- Review and refine relevant processes
  - e.g. release process, collaborative software development, accompanying implementation projects, development process, versioning, licensing, open-source strategies, etc.



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