Standardization for Highly Automated Driving

August 19, 2019
Detroit, MI

The Ohio State University

ASAM Association for Standardization of Automation and Measuring Systems

Standardization for Highly Automated Driving

Workshop Agenda

1	**Welcome** Prof. Dr. Marcus Rieker, David Emerling
2	**Virtual Vehicle Validation – Current Standardization Activities at ASAM** Dr. Klaus Estenfeld
3	**Cooperative Development of Advanced Driver Assistance Systems (ADAS) and Connected and Automated Vehicles (CAV) – A European Approach** Prof. Dr. Frank Köster
4	**Lunch**
5	**Discussion on Simulation Topics - Current Needs and Requirements** All
6	**Summary**

Welcome

Prof. Dr. Marcus Rieker - ASAM e.V.

David Emerling - Ohio State University

ASAM

Standards for the Automotive Industry

Dr. Klaus Estenfeld
Managing Director, ASAM e.V.

August 19, 2019
Detroit, MI

ASAM
Association for Standardization of Automation and Measuring Systems

ASAM - Introduction

Compliance Statement

For more than 20 years, ASAM e.V. (Association for Standardization of Automation and Measuring Systems) is actively promoting standardization within the Automotive Industry. Together with its more than 260 members worldwide, the association develops standards that define interfaces and data models for tools used for the development and testing of electronic control units (ECUs) and for the validation of the whole vehicle.

ASAM standards are recommendations, they do not have an impact on regulatory framework.

From the beginning, ASAM has requested and encouraged an open exchange among all stakeholders: manufacturers, suppliers, tool vendors and research institutes. Following this ASAM policy, technical experts from ASAM member companies worldwide commonly develop new standards in project groups. The developed standards are accessible for all interested companies and serve as basis for the development of tools and ECUs within the respective companies worldwide. Tools and products developed based on ASAM standards allow easy integration into existing value chains and seamless data exchange.

ASAM project groups do not define products or take any business decisions preventing competition.

Prof. Dr. Marcus Rieker
Chairman of the Board of Directors

Dr. Klaus Estenfeld
Managing Director

https://www.asam.net/about-asam/compliance/

ASAM
The Organization

ASAM – At a Glance

Foundation	• 1998 as an initiative of the major German car manufacturers: 
Vision	• To create an engineering, simulation, testing and automation environment where devices and software applications can be freely interconnected and data can be seamlessly exchanged.
Purpose	• Platform to develop, enhance and to promote standards for the automotive industry • Legal representative of currently around 30 standards
Legal Form	• Registered Association under German law • Non-profit
Member Base	• More than 260 members worldwide • More than 25 OEMs

Organizational Structure

Strategy

The Board of Directors is responsible for the strategic concept of ASAM e.V.

Technology

The TSC is responsible for the technical steering of ASAM e.V.

The standardisation work is organized in project groups.

Board of Directors

Voluntary Representatives from International Tier-1s, Tool Vendors and Research Institutes

- Prof. Dr. Frank Köster
  DLR
- Dr. Ralf Nörenberg
  HighQSoft GmbH
- Prof. Dr. Marcus Rieker
  HORIBA Europe GmbH
- Armin Rupalla
  RA Consulting GmbH
- Richard Vreeland
  Cummins Inc.





ASAM

Technical Steering Committee (TSC)

A Highly Experienced International Team of Experts from Automotive Industry

- AVL LIST GmbH
  Dr. Gerald Sammer
- BMW AG
  Michael Schwarzbach
- Continental AG
  Helmut Wellnhofer
- dSPACE GmbH
  Dr. Hans-Joachim Rabe
- emotive GmbH
  Dr. Jörg Supke
- ETAS GmbH
  Killian Schnellbacher
- National Instruments Corp.
  Stefan Romainczyk (Speaker)
- Softing GmbH
  Markus Steffelbauer
- Siemens Industry Software GmbH
  Oliver Philipp
- Vector Informatik GmbH
  Dr. Christoph Dallmayr

ASAM Membership

More Than 260 Member Organizations Develop and Apply ASAM Standards

OEMs

Tier-1 Suppliers

Tool Vendors / Service Providers

Universities / Research Institutes

Status August 15, 2019

ASAM

Some Highlights (Last Twelve Months)

ASAM actively drives its evolution – inside and outside

- Services for ASAM members worldwide (members in 26 countries)
  New ASAM Website well received, International Conference 2019, …
- New Standards Related Activities
  New domain “Simulation” established, high interest worldwide, six ASAM OpenX projects identified, first successful local Concept Project outside Europe, standard development started, …
- Next Steps towards Internationalization
  Re-vitalization of North American Activities, entry in China, requests from Korea, first ASAM members in Croatia, Slovenia, Romania, Israel, ….
- A Recognized Partner in the Standardization Community
  Liaison Agreements with ISO, MoU with SAE, AUTOSAR Attendee Agreement, …
- ASAM Standards used in Non-Automotive Industries (e.g. in aviation)

Standardization at ASAM

Portfolio, Process, Support

ASAM Standards Portfolio

A New Domain “Simulation” was Established in 2018

Data Management & Analysis

CEA | ODS

Measurement & Calibration

CDF | CPX | MCD-1 CCP / XCP | MCD-1 POD | MCD-2 MC | MDF | MCD-2 CERP

Test Automation

ACI | ASAP 3 | ATX | GDI | MCD-3 D | MCD-3 MC | XIL

Diagnostics

MCD-2 D | MCD-3 D | OTX Extensions

Software Development

CC | FSX | ISSUE | LXF | MBFS | MDX

ECU Networks

MCD-2 NET

Simulation

OpenX standards

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

Standards Development

Process

- ASAM members can propose a new standardization activity at any time.
- Standards are developed and maintained via projects.
- Experts from member organizations participate in standard development projects.
- Projects have a defined start and end.
- Project groups (working groups) are given a lot of leeway to organize their own work.
- Errors are corrected via a continuous issue resolution process.

Project Support

- Projects may have a budget, funded by ASAM.
- Projects may be supported by a service provider.
- Administrative and infrastructure support through the ASAM office.

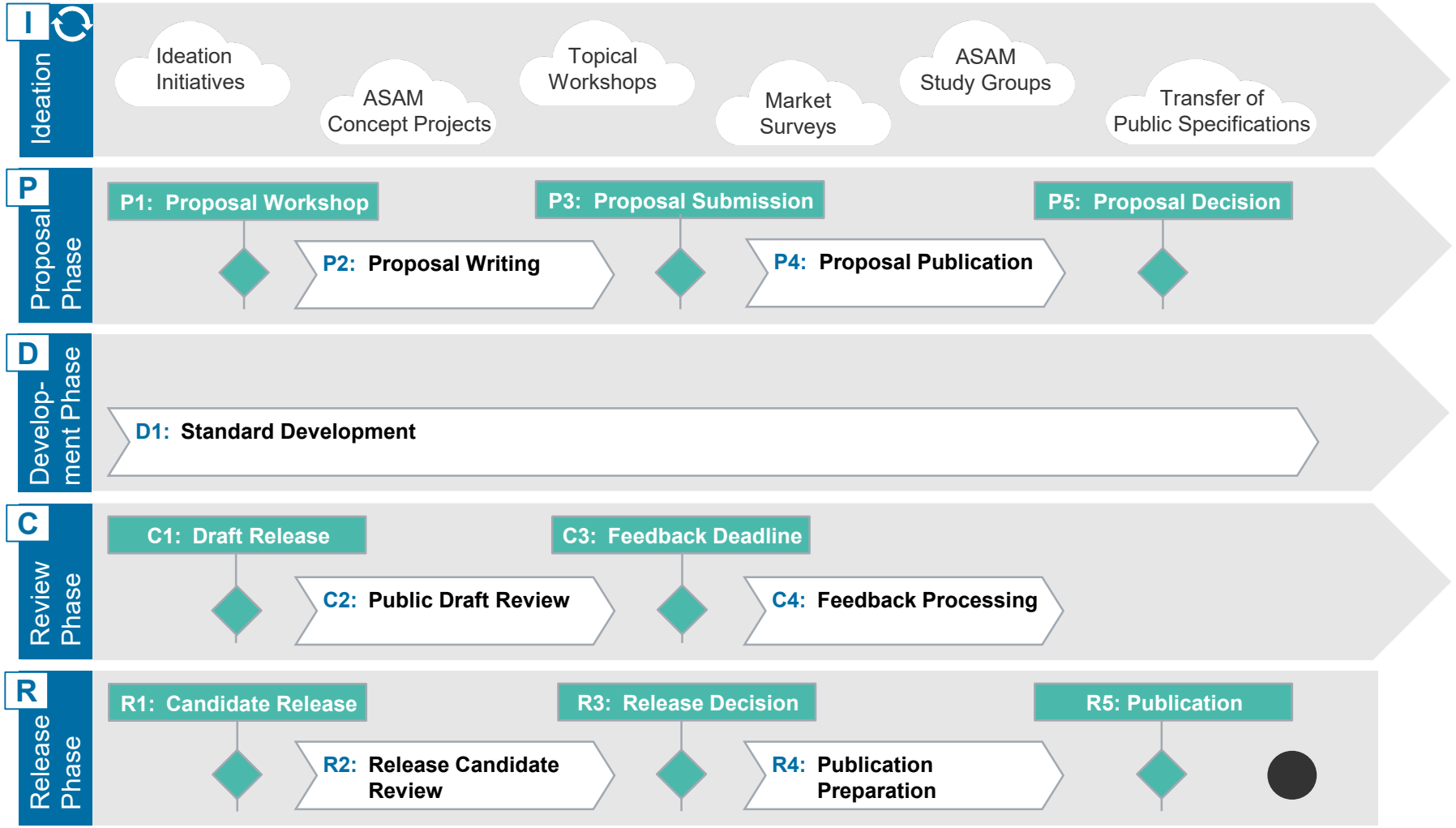
Project Types

- Standard Development Projects:
- New Standard Development
- Major Version Development
- Minor Version Development
- Revision Version Development

- Other Projects:
- Implementation Project
- Concept Project
- Study Project

ASAM Development Process for Standards

From First Ideas to New Standards



ASAM Offers a Complete Environment for Standardization

Professionalism & Culture

- Proven processes for standards development and long-term maintenance.
- Time-to-Market: Low process overhead, fast project turn-around times.
- Legitimacy: Decisions are made by elected industry representatives.
- Neutrality: The ASAM Office guarantees unbiased support for every company (big or small).
- Non-Profit Paradigm: Our goal is to provide best-in-class technologies in automotive electronic engineering.

Project Budget

- Membership fees are invested in technical projects (ROI can be higher than 100%, if a member uses ASAM a lot).
- ASAM pays for project service providers, e.g. standard writing, code development, prototyping, benchmarking, etc.
- Relieve experts from routine work. Let them focus on requirements, concept development and reviews.

Tools

- IT Infrastructure: Bugzilla, SVN, Adobe Shared Review, Microsoft Teams.
- Communication Infrastructure: WebEx, Video conferencing (as required, e.g. for inter-continental projects).

Network

- Large, worldwide network of experts in the automotive electronic engineering, throughout all tiers.
- Collaboration with ISO, SAE, AUTOSAR, other SDOs*) and government agencies.

*) Standard Development Organizations

Worldwide Marketing & Distribution

ASAM Home Page

- Specifically geared towards standard promotion and distribution.
- Technical Wiki for standards.
- Download of standards for members. Sales for non-members.
- Project and events information.

Regional Membership Activities

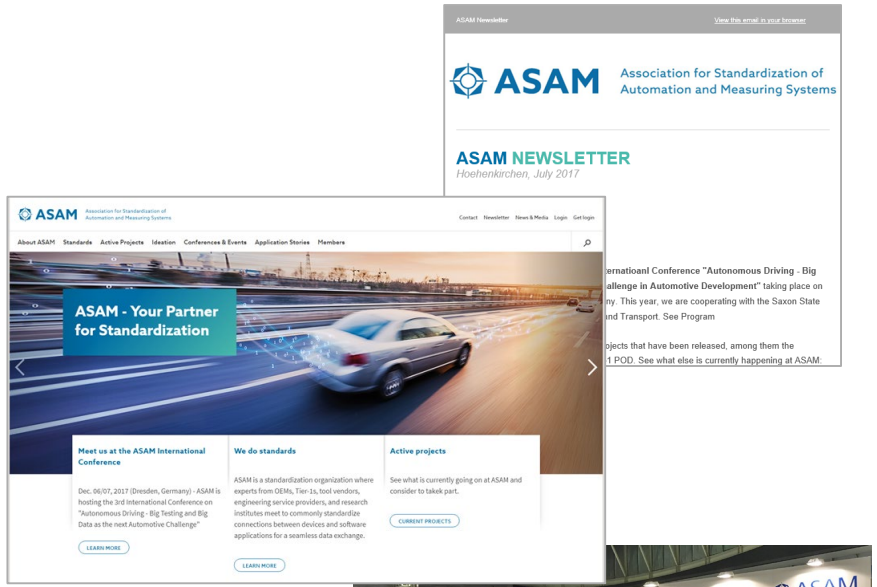
- Regular meetings in EU, USA and JP.

Public Relations

- ASAM Newsletter.
- Presentations at international conferences
- Trade show participation in emerging markets (JSAE, …).

Training & Support

- Technical support for all standards (support@asam.net).
- Overview training on ASAM standard portfolio.
- Update training on new releases (upon request).



ASAM International Conference 2019

December 10+11, 2019

Autonomous Driving – Standardized Virtual Development as a Key to Future Mobility

- Location: **Dresden, Congress Center**
- Concept: Two-day conference incl. exhibition
- Organization: In cooperation with Saxon State Ministry of Economic Affairs

- Presentations selected
- Agenda finished
- Invitation published

https://www.asam.net/conferences-events/detail/asam-international-conference-2019/

A New ASAM Domain for Highly Automated Driving

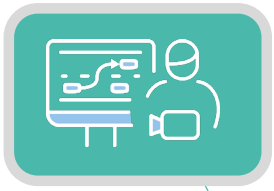
ASAM OpenX Standards for Driving and Traffic Simulation

Transfer of OpenDRIVE® to ASAM

Contract Signed last September at DSC 2018, Juan les Pins

Open
Dynamic
Road
Information for
Vehicle
Environment

New Domain at ASAM: Simulation



Simulation

- Standards for simulation model data exchange.
- High demand for standards for new type of simulation: Driving and Traffic Simulation.
- Public specs driven by tool vendors have emerged in recent years.
- **Specs have been transferred to ASAM to:**
  - **Be hosted by a neutral professional organization**
  - **Become official standards for the industry**
  - **Guarantee long-term and professional further development**
- Current projects transferred to ASAM:
  - OpenDRIVE
  - OpenCRG
  - OpenSCENARIO
  - Open Simulaton Interface (OSI) (in transfer)

First Steps – ASAM OpenX Kick-Off and Proposal Workshops

High Interest from all over the World

OpenDRIVE/OpenCRG

• 28.09.2018	**OpenX Standards Training for Japanese Organizations**	Tokyo
• 09.+10.10.2018	**Kick-Off Workshop ASAM OpenDRIVE (incl. ASAM OpenCRG)**	Höhenkirchen
• 15.+16.01.2019	**Proposal Workshop ASAM OpenDRIVE (incl. ASAM OpenCRG)**	Höhenkirchen

OpenSCENARIO

• 17.09.2018	**Use Case and Requirements Workshop**	Höhenkirchen
• 13.11.2018	**Kick-Off Workshop ASAM OpenSCENARIO**	Kaiserslautern
• 17.+18.01.2019	**Proposal Workshop ASAM OpenSCENARIO**	Höhenkirchen

Projects Defined for ASAM OpenDRIVE and ASAM OpenSCENARIO

Standard Development Projects

- **Standard Transfer Project:** Write missing chapters, clarifications on semantics and syntax, formal data model.
- **Standard Further Development:** New feature concepts, implementation of new concepts into the standard.

Concept Projects

- **Concept Development:** New feature concepts.

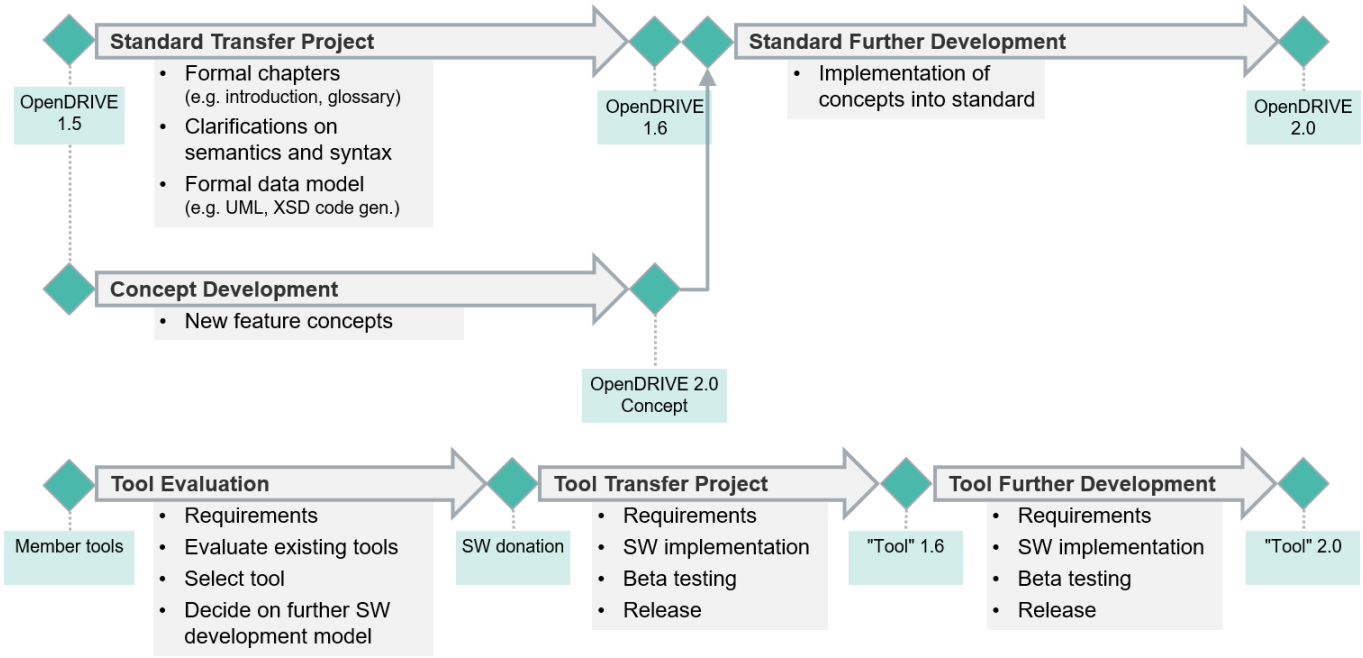
Implementation Project

- **Tool Evaluation:** Determine evaluation criteria, evaluate & choose.
- **Tool Transfer:** Requirements, SW implementation, beta testing, release.
- **Tool Further Development:** ditto.

Parallel Concept Development

Parallel standard and concept development have worked out best in similar situations

- Faster time-to-marked.
- Less coordination efford between groups.
- But: Double work effort per month for participating companies due to parallel project groups.



Positioning of OpenX Standards

OpenDRIVE

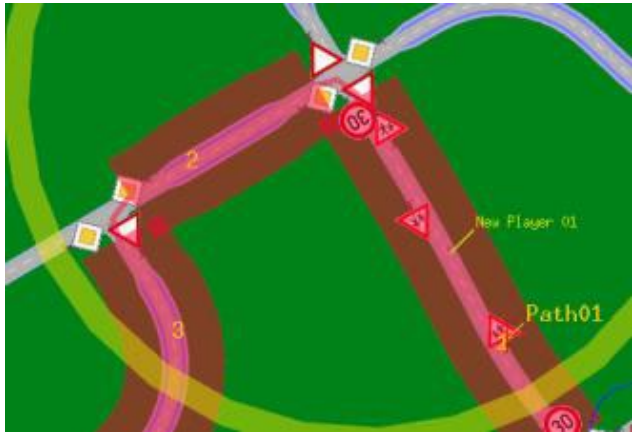
- Road Network

OpenCRG

- Road Surface

OpenSCENARIO

- Driving Maneuvers



Static Content

Dynamic Content

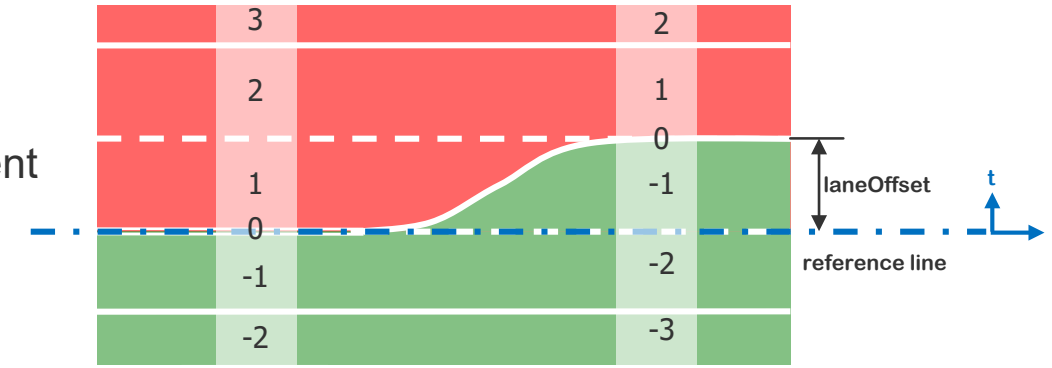
- **Motivation**
- Exchange of data between creation tools (e.g. road network editors) and simulators.
- Use of the data in simulators from different vendors.
- Use with other public standards.

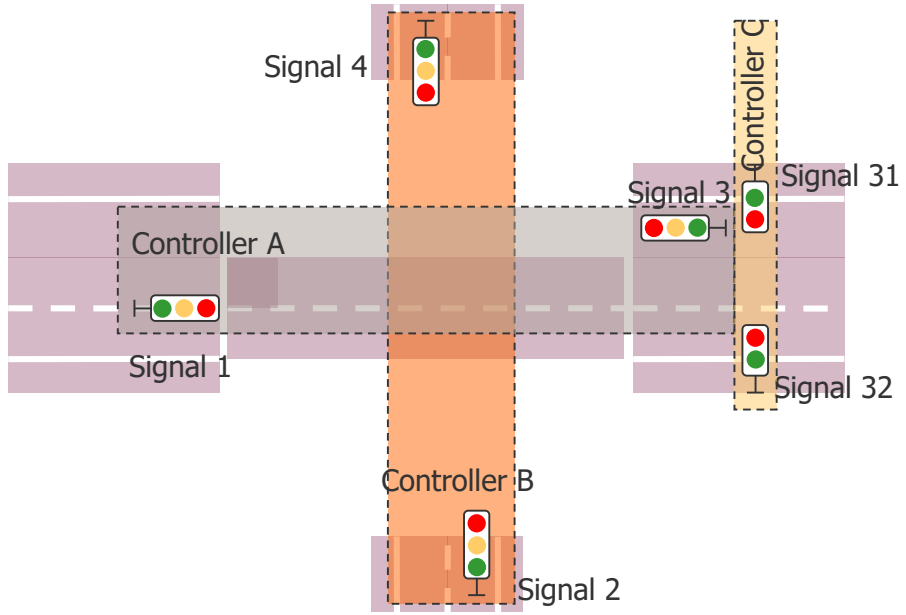
OpenDRIVE

ASAM

OpenDRIVE

- OpenDRIVE: Open Dynamic Road Information for Vehicle Environment
- File format for the **description of road networks**.
- Initiative started in 2005 by Daimler and VIRES.
- Used for simulators in the area of
  - Driving 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.

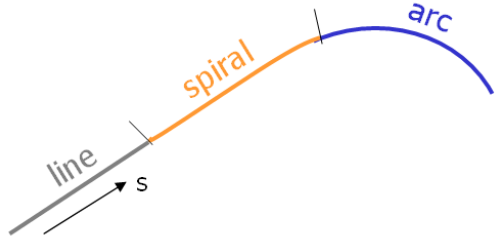




Principal Design Pattern for Roads

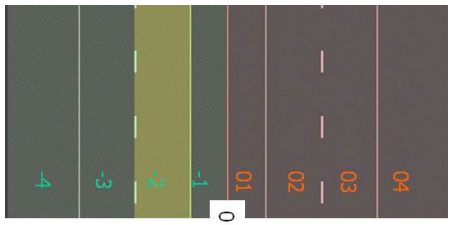
1: Create Reference Line

- Primitives
:
- Line
- Arc
- Spiral
- Poly3



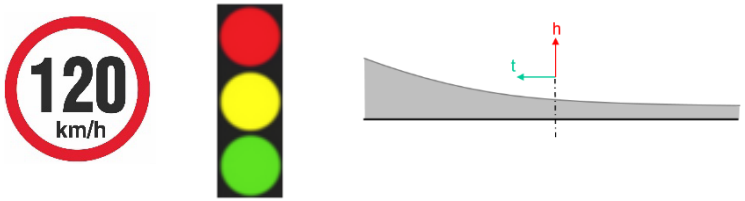
2: Add Lanes Along the Reference Line

Elements:
- Width
- Link
- Material
- Roadmarks



3: Add Features

Elements:
- Sign
- Signal
- Object
- Elevation



Further Development of ASAM OpenDRIVE

Input of the first workshops with industry-experts

Features

- Junction Model
- Road Geometry Models
- Arbitrary Spaces Model
- International Signs Model
- Environment Representation
- Roundabouts
- Parametrization & Variation
- Georeferencing

Other Topics

- Reference Visualization and Checker Tool
- Reference Examples
- Best Practices Guide

Requirements

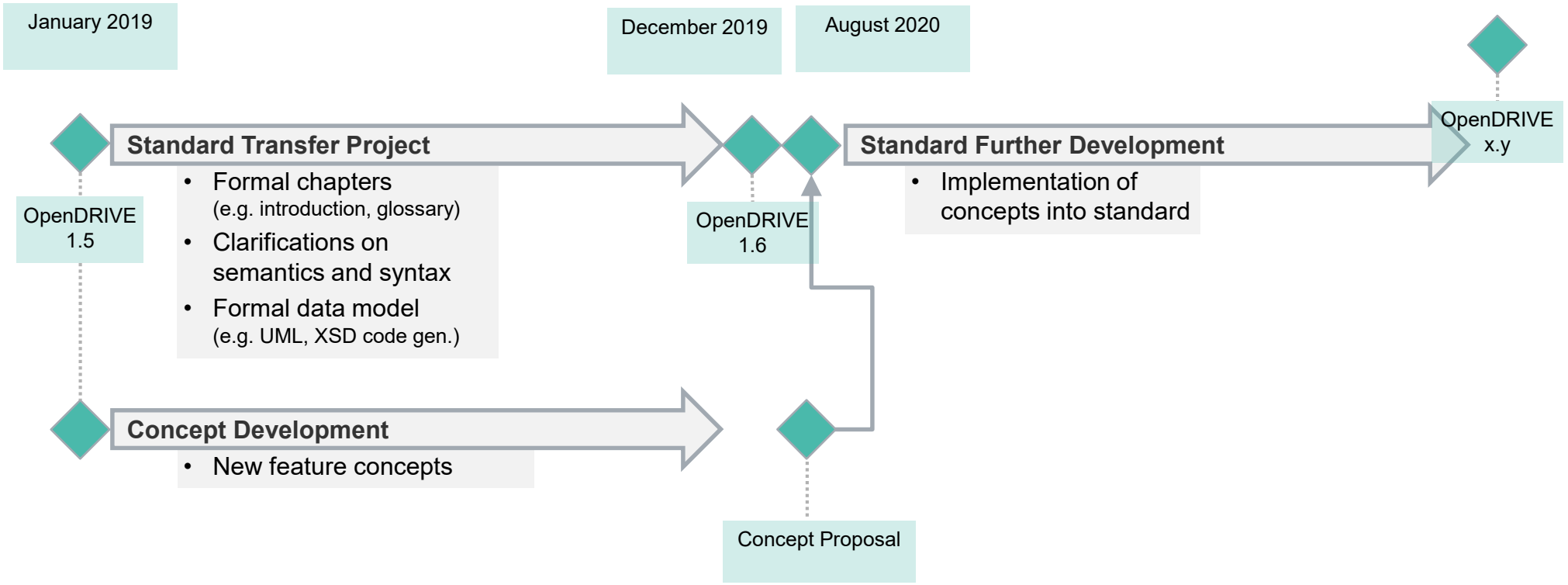
- Add more model parameters
- Remove or reduce redundant information
- Harmonize OpenDRIVE with other standards
- Remove or reduce different ways to model

ASAM OpenDRIVE Concept: Project Structure

Working Groups

	OpenDrive Concept Project Working Groups				
Name	**Junction Model**	**Environment Representation**	**Road Geometry Models**	**International Signs Model**	**Area Model**
Description	Revise the junction model approach to simplify description of complex junctions.	Provide an approach for describing the environment around a road network (e.g. areas between lanes).	Extend the road model to describe roads with further model elements (e.g. DLM, polylines, Bezier curves).	Description of traffic signs, traffic lights, etc.. Provision of parameters to translate between all major jurisdictions.	Investigate the feasibility of an area-based modelling approach as an alternative to the current OpenDRIVE implementation of line segments.
Participants (companies)	– 3D Mapping Solutions – Daimler AG – dSPACE GmbH – IPG Automotive GmbH – fka GmbH – BMW AG – Siemens – TESIS GmbH – Continental AG – **VIRES**	– Daimler AG – Mitsubishi Precision Co. – BMW AG – Rheinmetall Electronics – 3D Mapping Solutions – **virtualcitySYSTEMS**	– fka – RA Consulting – VIRES – TESIS GmbH – 3D Mapping Solutions – Continental AG – **IPG Automotive GmbH**	– ASAM e.V. – 3D Mapping Solutions – **Details of Japanese participation have to be confirmed**	– virtualcitySYSTEMS – Daimler AG – dSPACE – fka – VIRES – Rheinmetall Electronics – BMW AG – Mitsubishi Precision Co. – 3D Mapping Solutions – Continental AG – **Volkswagen AG**

Roadmap ASAM OpenDRIVE



*) tentative

ASAM

ASAM OpenDRIVE Concept: Status

Concept Projects

Current Activities & Discussions in Working Groups

v1.7 – feature improvements, Quality-of-Life

- Modelling of road sections – Current implementation can lead to gaps in the representation of road segments. The discussion is currently focused on alternative representations for road segments, e.g. not as lines but as splines
- Technical documentation – service provider selected to begin at in January 2020

v2.0 – long term changes to meet evolving demand of the AV industry, new features

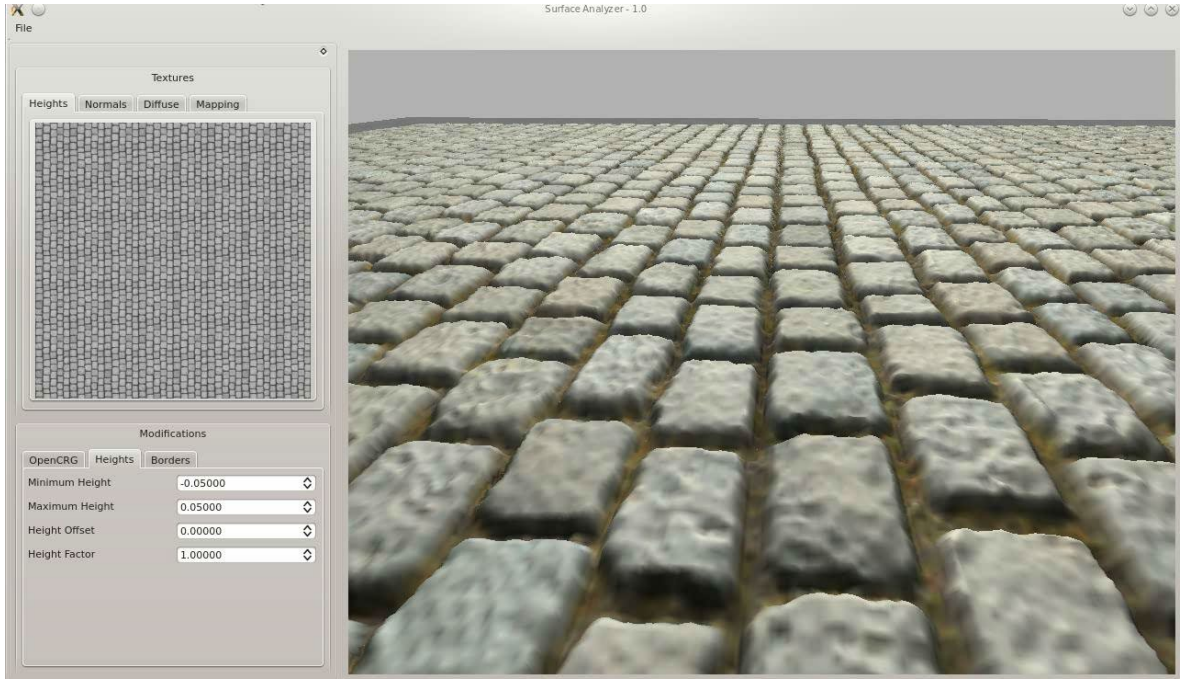
- Area concept model – Initial investigation into its feasibility and applicability to the OpenDRIVE standard
- Levels of detail – Performance consideration – Allow for the selection of various levels of details of objects, selected as required
- Layer approach – Current OpenDRIVE is based on a single layer of information – this would divide the standard into multiple layers of information – e.g. a logical road layer, static road objects, environment objects, etc.
- Junctions – Current implementation is not user-friendly for creating complex junctions – alternative possibilities are being investigated

OpenCRG

ASAM

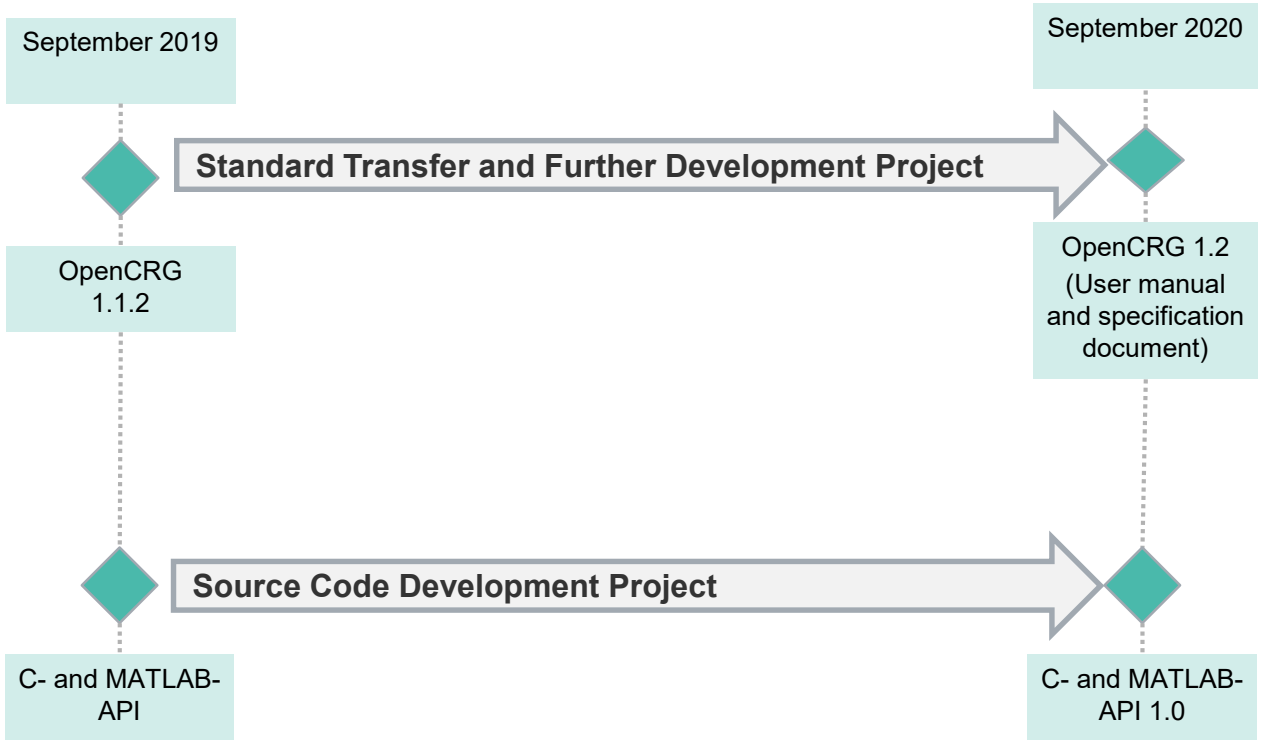
OpenCRG

- OpenCRG: Open Curved Regular Grid
- File format and source-code for the **detailed description of road surfaces**.
- OpenCRG initiative was started in 2008 by Daimler together with AUDI, BMW, Porsche, and Volkswagen.
- 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



ASAM OpenCRG Roadmap

Project Kick-Off on August 28, 2019 @ ASAM, Höhenkirchen



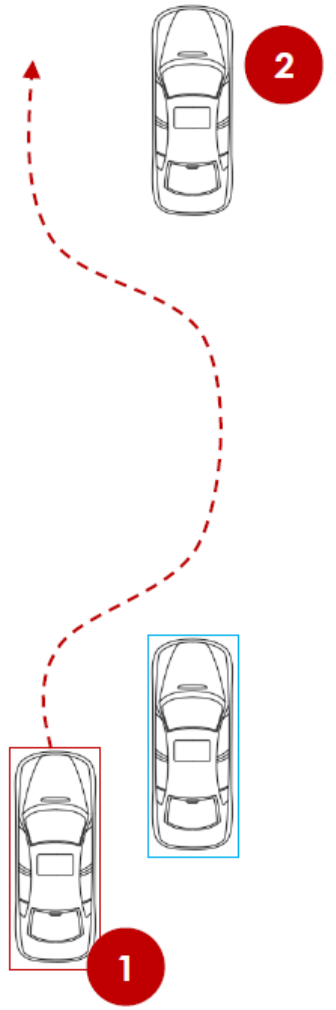
*) tentative, as meetings are on-going

OpenSCENARIO

ASAM

OpenSCENARIO

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



Principal Design Pattern for Maneuvers

Storyboard

1: Story

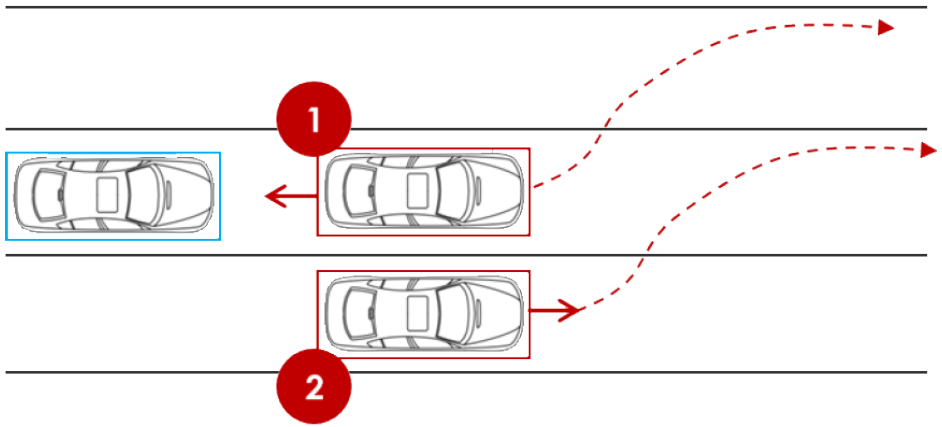
2: Act

3: Sequence

4: Maneuver

5: Event

6: Action




```
storyboard
 story: owner = Ego
   act 1: condition = TTC to player 1 in front right lane < 3s
     sequence 1.1: actor = player 1
       maneuver 1.1.1: name = complex lane change
         event 1.1.1.1: condition = upon start of act
           action 1.1.1.1.1: slow down by 5kph
           action 1.1.1.1.2: perform lane change to left within 4s
     sequence 1.2: actor = player 2
       maneuver 1.2.1: name = complex lane change
         event 1.2.1.1: condition = 1s after start of act
           action 1.2.1.1.1: increase speed by 5kph
           action 1.2.1.1.2: perform lane change to left within 4s
```

Further Development of ASAM OpenSCENARIO

Input of first workshops with industry-experts

Features

- Maneuver Model
- Driver Model
- Traffic Model
- Weather Model
- Environmental Event Model
- Vehicle Dynamics
- Parameter Stochastics
- High-Level Maneuver Descriptions
- Replay of Recorded Scenarios
- Automatic Parameter Calculation

Other Topics

- Checker Tool
- Parser
- Data Access API
- Test Specifications
- Tool Qualification
- Traffic Simulation Driver Reference Models and Implementations

Requirements

- Avoid multiple ways of defining the same maneuver
- Define elements as 'mandatory' only when absolutely needed
- Maintain independence of standards and open linking between standards
- Define three levels of control for ego vehicles
- Allow tool-vendor specific extensions
- Allow definition of feature subsets
- Define simulation results reproducibility
- Maneuver descriptions shall be suitable for open-loop and closed-loop simulation.
- Define parameter boundaries
- Synchronize maneuvers
- Allow the definition of success criteria for maneuvers
- The description format shall be suitable for manual scenario creation in text editors

ASAM OpenSCENARIO Concept

Working Groups

OpenScenario Concept Project Working Groups

Name	Architecture	Glossary & Notations	Parameters & constraint handling	Measurements, grading & success	Scenario creation methods	Driver, traffic & vehicle models	Maneuver Description
Description	Define a global architecture based on requirements of other WGs	Define the vocabulary needed to address each OSC requirement/feature.	Methods for describing parameter distributions and variations	Methodology for determining the performance of a scenario simulation, i.e. pass/fail?	Identify requirements based on different approaches to scenario creation	Define a data interface to the external models, e.g.: Traffic, Driver, Dynamics, Road, Topology	Define an approach for expressing the dynamic behaviour of a scenario
Participants (companies)	• **PMSF IT Consulting** • ZF • Foretellix • Aliaro • Rheinmetall Electronics • Vector Informatik • AKKA • IASYS • GOD • Univ. of Warwick • HLRS	• **HORIBA MIRA** • CP Catapult • ZF • APTIV • M&K • Audi • Volvo • IRT Systemx • Univ. of Warwick	• **AVL** • MicroNova • RA Consulting • EMOTIVE • MSC Software • IKA Aachen	• **Nvidia** • RA Consulting • PMSF IT Consulting • Univ. of Kempten • BTC systems • Catapult • CATARC • ZF • Siemens	• **Volvo** • CATS • AKKA • Vires • Jaguar / Landrover • IASYS • GOD • Bosch • Continental • Toyota • Audi • Symphony • RAC • Univ.of Warwick • Mitsubishi	• **Daimler AG** • RA Consulting • FZI • BMW • Vector • SAIC Motor • IPG • Volvo • ZF • Rheinmetall Electronics • TU Dresden • ANSYS • Symphony • Univ. of Warwick • dSPACE • Nvidia	• **Univ. of Warwick** • Opel Vauxhall • BTC ES • FZI • Nvidia • IPG • ZF • APTIV • M&K • Continental • Vector • IRT SystemsX • TÜV SÜD • HLRS • Jaguar/Land Rover

ASAM

ASAM OpenScenario Concept

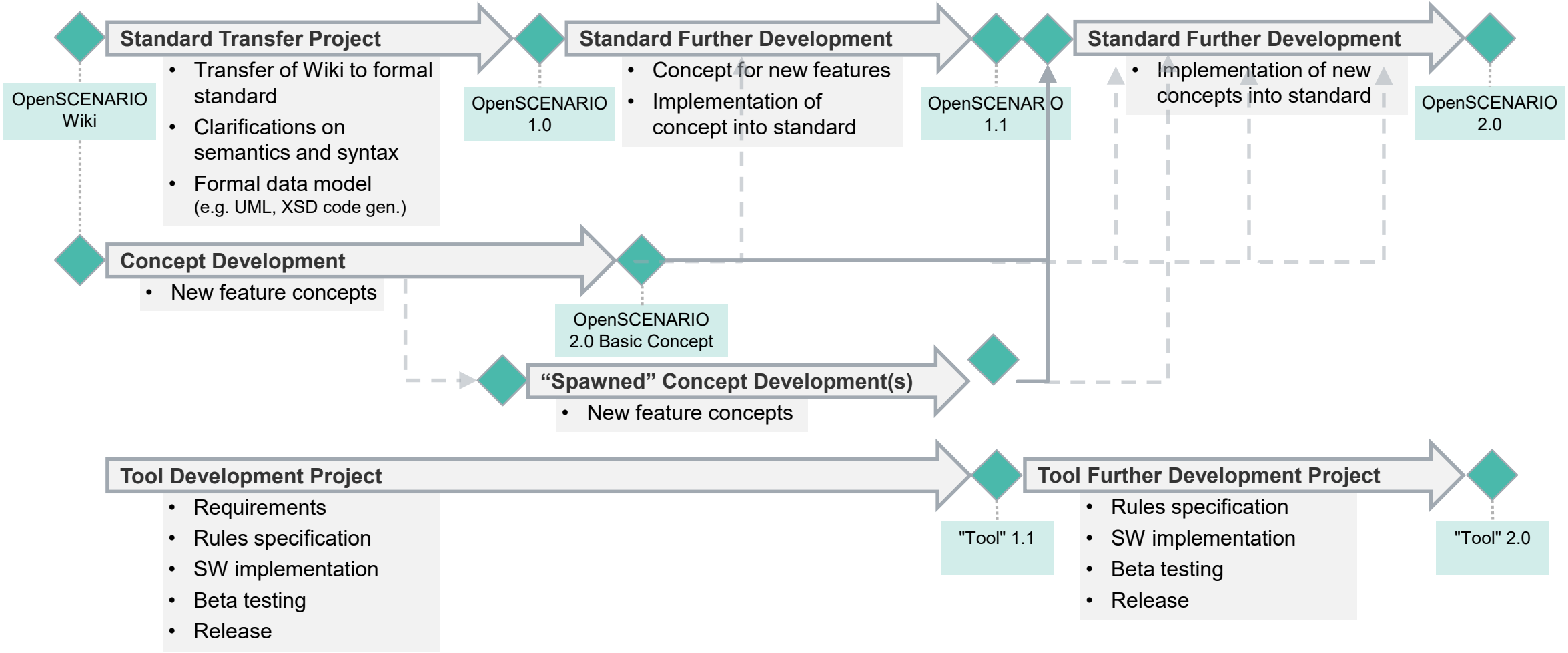
Concept Projects

Current Activities & Discussions in Working Groups

v2.0 - should serve as the format and mechanism to supply dynamic content and functional behavior to multiple testing and execution platforms

- **Primary focus: Review of currently available tools, languages & approaches. What can be used as a base for the various WGs?**
- Glossary - Clarification of basic naming conventions – What is a scenario, an actor, an event?
- Parametrization - What is a parameter and how is it exposed?
- Measurements - How to capture the expected accuracy/quality of measurements in a scenario to determine pass/fail criteria?
- Models – Defining the requirements of the interface to the road, driver and dynamics models

ASAM OpenSCENARIO Roadmap – Parallel Concept Development

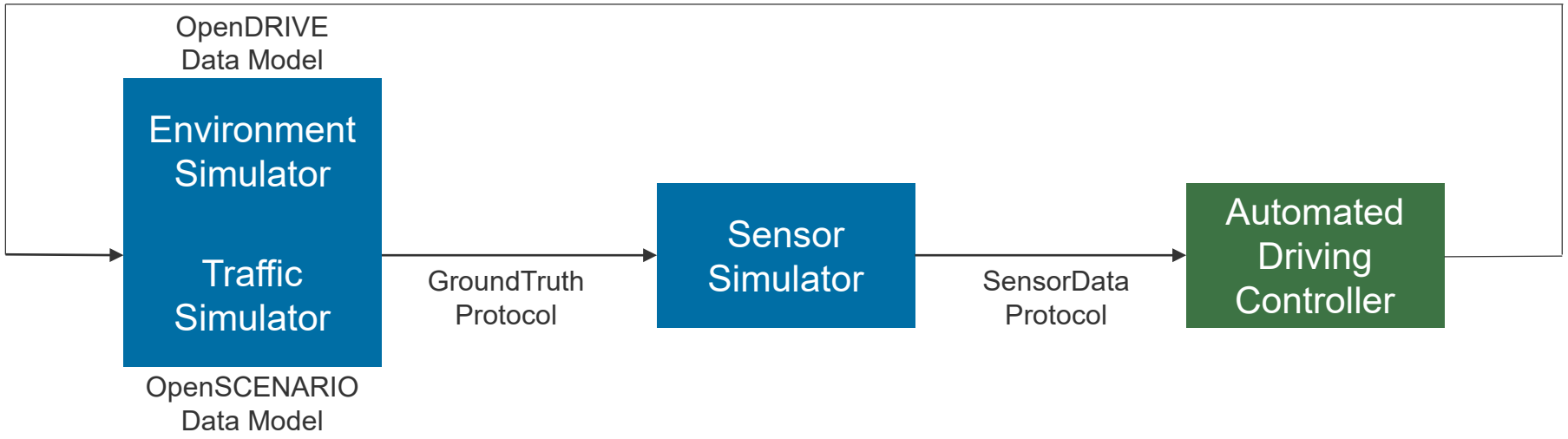


Open Simulation Interface - OSI

ASAM

OSI

- **OSI: Open Simulation Interface**
- A generic interface for the **environmental perception of automated driving functions in virtual scenarios**.
- Initiated by BMW and Technical University Munich (TUM).
- Contains an object-based environment description using message formats based on Google Protocol Buffers 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.



- In preparation: code of a run-time environment based on the Open Simulation Interface, including the conversions between GroundTruth and SensorData messages.

Open Simulation Interface (OSI)

Interfaces Description

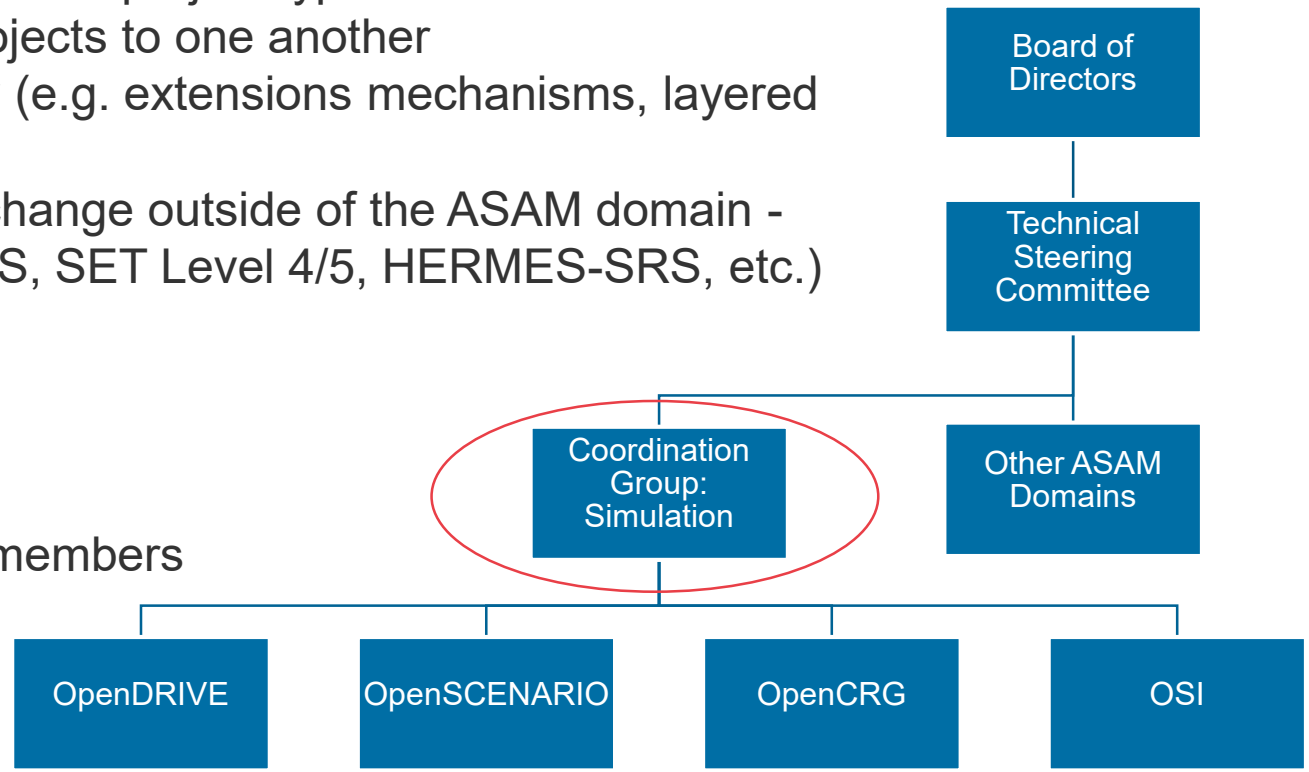
osi::GroundTruth	
Vehicle	*Dynamic objects (wheeled and usually motorized)*
Object	*Static obstacles and slow-moving road users (pedestrians)*
TrafficSign	*Traffic signs*
TrafficLight	*Traffic lights*
Road	*Road, lane, and lane marking description*
Environment	*General environmental conditions*

osi::SensorData	
SensorDataGroundTruth	*Link to original ground truth data (for reference and validation)*
MountingPosition	*Sensor position relative to the ego vehicle reference frame, simplifies transformation*
SensorDataObject	*Description of objects in the environment as seen by the sensor, incl. uncertainties*
ModelInternal	*Additional data for internal use by the sensor model only*

Coordination Group: Simulation

Organization, Purpose

- Consists of domain experts, project leads & external consultants
- Clarification of project requirements
- Identify and assist in implementation of new projects & project types
- Ensures alignment of individual ASAM OpenX projects to one another
- Homogenize approaches to standard extensibility (e.g. extensions mechanisms, layered standard approaches)
- Provides an interface for synchronization and exchange outside of the ASAM domain - collaborations with other projects, e.g. ISO, IAMTS, SET Level 4/5, HERMES-SRS, etc.)



Current Status

- Successful initial Kick-off: Aug. 09
- Presentation of TSC approved proposal to initial members
  - Discussion of group role & participants
  - First operational meeting → Sept. 18

Liaison in ISO TC22 SC33 WG9

Test scenario of autonomous driving vehicle

International Organization for Standardization

Agreement between the partners to go for **Category C Liaison in ISO TC22 SC33 WG9**

Reasons for Liaison with ISO

- Use synergies between the current ASAM OpenX (ASAM OpenDRIVE/OpenCRG/OpenSCENARIO) standardization activities (represented by the ASAM Coordination Group: Simulation) and ISO WG9 WP 4.2 and 4.3 activities (represented by the respective leads)

	WG 9	
	Highway Scenario	General road Scenario
1. ***General Information for Automated Driving Vehicle Test Scenarios	Mr. Sun	
2. **Engineering Framework for Automated Driving Vehicle Test Scenarios	Mr. Taniguchi, Mr. Mazzega	
3.*Structure for Automated Driving Vehicle Test Scenarios (Complexity)		
4. Scenario Generation and Formation		
4.1. ** Scenario Data Sources Extraction Format	Mr. Mazzega, Mr. Taniguchi	Mr. Zhao
4.2. *** Scenario Parameters, Formats and Architectures	Mr. van Driesten, Mr. de Gelder	Mr. van Driesten, Mr. de Gelder
4.3. *Scenario Database Requirements	Mr. van Driesten, Mr. de Gelder	Mr. van Driesten, Mr. de Gelder

- Goal: **complementary, not competitive** work!
- Provide a common Glossary for Scenario descriptions (as staring point) for ASAM and ISO

ASAM

Category C Liaison in ISO TC22/SC33 WG9

Test scenario of autonomous driving vehicle

International Organization for Standardization

Next Steps

- Short to mid term
  - Define (and agree upon) the workflow between the parties
  - Prepare and sign a Liaison C between ASAM and ISO
  - Formation of ASAM Coordination Group: Simulation
  - Set up a regular exchange between the relevant working groups in ASAM and ISO

- Mid to long term
  - Evaluate further options (e.g. Open Simulation Interface (OSI) and ISO 23150 activities) after the official transfer of OSI to ASAM is concluded
  - ….

ASAM

ASAM OpenX Standards

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ASAM OpenDRIVE

Der Exekutivdirektor / The Executive Director

Christian Archambeau

www.euipo.europa.eu

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No 017949793

ASAM OpenCRG

Der Exekutivdirektor / The Executive Director

Christian Archambeau

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No 017949794

ASAM OpenSCENARIO

Der Exekutivdirektor / The Executive Director

Christian Archambeau

ASAM

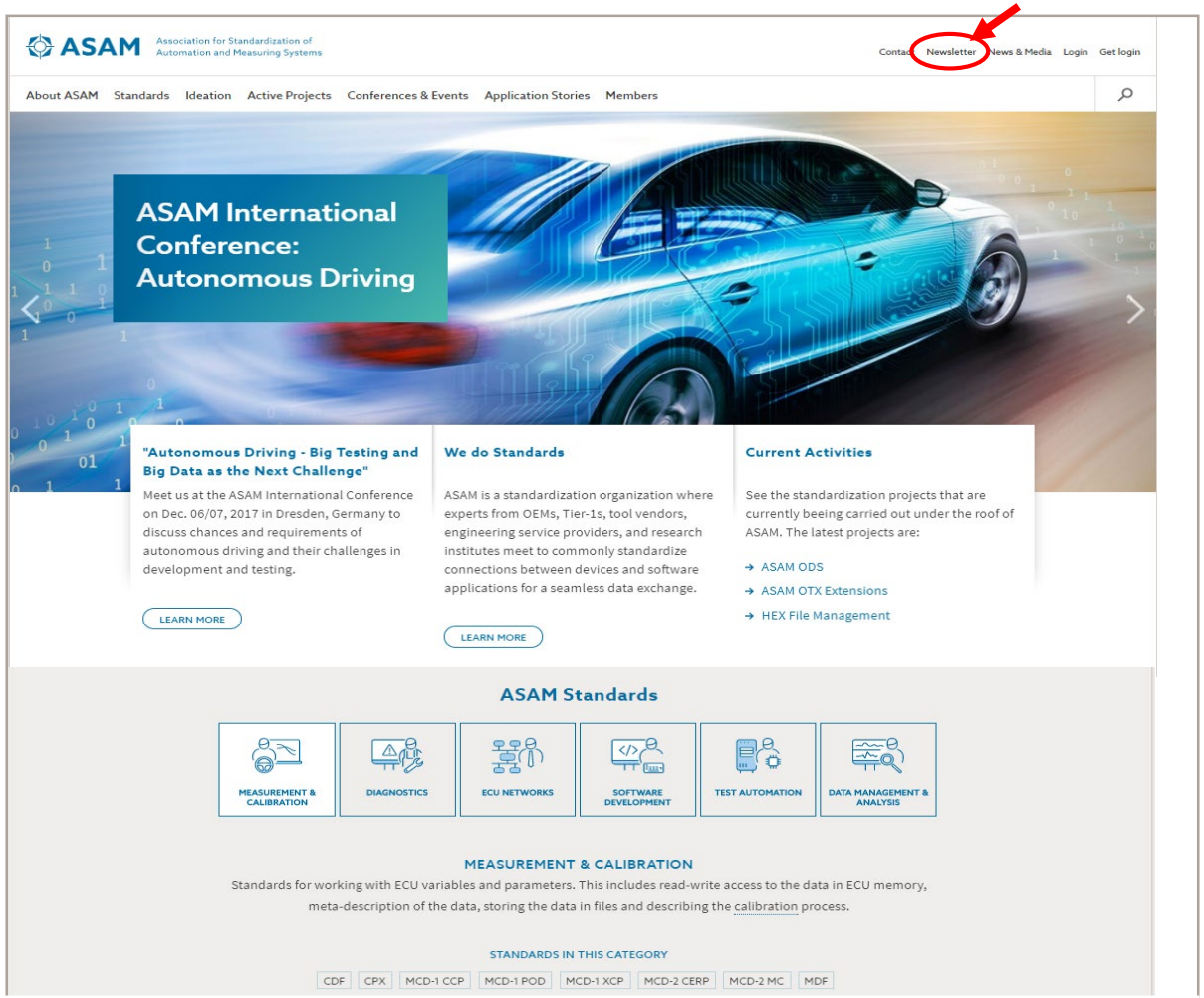
Services for ASAM Members

Website, conferences, …

ASAM Website www.asam.net

Comprehensive Information about ASAM – Accessible for Everybody

Please, register here for further information on OpenX standards



ASAM Office

We are “At Your Disposal” – At Any Time

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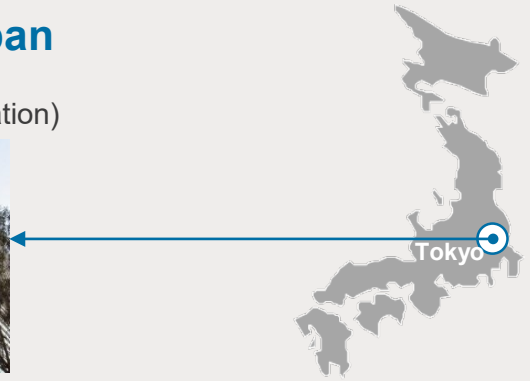

ASAM

Thank you!

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For more information
on ASAM visit

www.asam.net

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