# **ASAM OpenX**

# Past, Present and Future Activities in the Simulation Domain

October 24, 2019 Novi, MI





Association for Standardization of Automation and Measuring Systems

## Agenda



## Agenda

Novi, MI - October 24, 2018, 9:30 - 12:00

#### Welcome and Introduction

#### Session 1: Status of ASAM OpenX Activities

- ASAM OpenX Activities General Overview
- ASAM OpenSCENARIO Concept Project

#### **Session 2: Activities in North America**

- SAE On-Road Automated Driving (ORAD) Committee Simulation Task Force
- GeoScenario: A Lightweight, WISIWIG Scenario-Based Test Definition Language for Automated Driving

#### **Session 3: Future Activities, Ideation**

- "Labeling and Storage for Scenarios and Vehicle Data"
- Data Management approach for scenario-based validation of autonomous driving functions
- Conclusions, Next Steps

(Dr. Klaus Estenfeld, ASAM Managing Director)

(Dr. Klaus Estenfeld, ASAM) (Gil Amid, Foretellix Inc.)

(Andrew Smart, Andrew Smart Consulting, LLC)

(Dr. Michal Antkiewicz, University of Waterloo)

(Ben Engel, Nicco Dillmann, ASAM)

(Dr. Hans-Jörg Kremer, Peak Solution GmbH) (All)



## **ASAM OpenX Activities**

Dr. Klaus Estenfeld, Managing Director ASAM



#### **ASAM - Introduction**

**Compliance Statement** 

For almost 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 270 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/home/about-asam/compliance.html



## **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 finished, first standard development outside Europe, ...

Next Steps towards Internationalization

Local entry in China (C-ASAM), Re-vitalization of North American Activities, Requests from Korea, First ASAM members in Canada, Croatia, Israel, Slovenia, Romania, ....

- 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. ASAM XIL in aviation)

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## **ASAM Membership**

More Than 270 Member Organizations Develop and Apply ASAM Standards

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Status October 10, 2019



## **ASAM Standards Portfolio**

A New Domain to Come in 2018





#### **ASAM Development Process for Standards**

From First Ideas to New Standards





## **ASAM International Conference 2019**

December 10+11, 2019

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

- Location: Dresden, Congress Center
- Concept: 2 days conference incl. exhibition
- Organization: In cooperation with Saxon State Ministry of Economic Affairs

# See you!



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:
  - Become official standards for the industry
  - Be hosted by a neutral professional organization
  - Guarantee long-term and professional further development
- Current projects transferred to ASAM:
  - OpenDRIVE
  - OpenCRG
  - OpenSCENARIO
  - Open Simulation Interface (OSI)



## First Steps – ASAM OpenX Kick-Off and Proposal Workshops

High Interest from all over the World

#### **OpenDRIVE/OpenCRG**

•	28.09.2018	<b>OpenX Standards Training for Japanese Organizations</b>	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
С	penSCENARIO		
•	17.09.2018	Use Case and Requirements Workshop	Höhenkirchen
•	17.09.2018 13.11.2018	Use Case and Requirements Workshop Kick-Off Workshop ASAM OpenSCENARIO	Höhenkirchen Kaiserslautern



## 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 (postponed)

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



# OpenDRIVE





### Roadmap ASAM OpenDRIVE





## **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 based on the existing modelling approach.	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)	<ul> <li>3D Mapping Solutions</li> <li>Daimler AG</li> <li>dSPACE GmbH</li> <li>IPG Automotive GmbH</li> <li>fka GmbH</li> <li>BMW AG</li> <li>Siemens</li> <li>TESIS GmbH</li> <li>Continental AG</li> <li>VIRES</li> </ul>	<ul> <li>Daimler AG</li> <li>Mitsubishi Precision Co.</li> <li>BMW AG</li> <li>Rheinmetall Electronics</li> <li>3D Mapping Solutions</li> <li>virtualcitySYSTEMS</li> </ul>	<ul> <li>fka</li> <li>RA Consulting</li> <li>VIRES</li> <li>TESIS GmbH</li> <li>3D Mapping Solutions</li> <li>Continental AG</li> <li>IPG Automotive GmbH</li> </ul>	<ul> <li>ASAM e.V.</li> <li>3D Mapping Solutions</li> <li>Details of Japanese participation have to be confirmed</li> </ul>	<ul> <li>virtualcitySYSTEMS</li> <li>Daimler AG</li> <li>dSPACE</li> <li>fka</li> <li>VIRES</li> <li>Rheinmetall Electronics</li> <li>BMW AG</li> <li>Mitsubishi Precision Co.</li> <li>3D Mapping Solutions</li> <li>Continental AG</li> <li>Volkswagen AG</li> </ul>						



# OpenCRG





#### ASAM OpenCRG Roadmap

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



\*) tentative, as meetings are on-going



# OpenSCENARIO





### ASAM OpenSCENARIO Roadmap





## **Open Simulation Interface - OSI**





#### 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

05	si::GroundTruth	osi::SensorData				
Vehicle	<i>Dynamic objects (wheeled and usually motorized)</i>		SensorDataGround Truth	Link to original ground truth data (for reference and validation)		
Object	Static obstacles and slow-moving road users (pedestrians)		MountingPosition	Sensor position relative to the ego vehicle reference frame, simplifies transformation		
TrafficSign	Traffic signs	2	SensorDataObject	Description of objects in the environment as seen by the sensor, incl. uncertainties		
TrafficLight	Traffic lights		ModelInternal	Additional data for internal use by the sensor model only		
Road	Road, lane, and lane marking description					
Environment	General environmental conditions					



## **Coordination Group: Simulation**

#### **Organization and 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.)





Board of Directors

Technical

Steering Committee

## Liaison in ISO TC22 SC33 WG9

Test scenario of autonomous driving vehicle



#### 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. Sc	***General Information for Automated Driving Vehicle Test enarios	Mr. Sun					
2. Sci	**Engineering Framework for Automated Driving Vehicle Test enarios	Mr. Taniguchi, Mr. Mazzega					
3.' (C	*Structure for Automated Driving Vehicle Test Scenarios omplexity)						
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



## Category C Liaison in ISO TC22/SC33 WG9

Test scenario of autonomous driving vehicle



#### Next Steps

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

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## **ASAM OpenX Standards**

Trademarks are registered in Europe, USA, Japan, China, and India





### ASAM Website www.asam.net

#### Comprehensive Information about ASAM – Accessible for Everybody



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

Please, register here for further information on OpenX standards and all other ASAM activities



# Thank you!

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www.asam.net

