ASAM Regional Meeting North America 2019

October 24, 2019 Novi, MI





Association for Standardization of Automation and Measuring Systems

Agenda



Agenda

Novi, MI - October 24, 2018 – 1:00 p.m. – 5:00 p.m.

Welcome and Introduction

Session 1: Latest ASAM News

- ASAM – Update

2:00 p.m. – 2:30 p.m. Break

Session 2: Standardization Highlights

Recently Started Standardization ActivitiesThe Road to ASAM ODS 6.1

3:30 p.m. – 4:00 p.m. Break

Session 3: North America Focus

- Opportunities in Real-Time 3D Autonomous Driving Simulations
- Awarding of Honorary Membership
- ASAM in the US Next Steps

(Prof. Dr. Marcus Rieker, ASAM Chairman)

(Dr. Klaus Estenfeld, ASAM MD – 50 mins.)

(Armin Rupalla, ASAM BoD – 30 mins.) (Dr. Ralf Noerenberg, ASAM BoD – 30 mins.)

(Ed Martin, Unity Technologies – 30 mins.) (Prof. Dr. Marcus Rieker, ASAM – 10 mins.) (Prof. Dr. Marcus Rieker, all – 20+ mins.)



ASAM – Latest News

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



Organizational Development



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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Board of Directors

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

- Prof. Dr. Frank Köster DLR
- Dr. Ralf Nörenberg ٠ HighQSoft GmbH
- Prof. Dr. Marcus Rieker, Chairman HORIBA Europe GmbH
- Armin Rupalla RA Consulting GmbH
- **Richard Vreeland** • Cummins Inc.









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



emotive

- 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 270 Member Organizations Develop and Apply ASAM Standards

OEMs												Tier-1 Su	ppliers								
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Universities / Research Institutes																					
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Status October 10, 2019



North American ASAM Members

Currently 25 Members – More to Come

• OEMs



• Tier-1 Suppliers



Tool Vendors / Service Providers



Status October 10, 2019



Internationalization

North American Region Accelerating

First steps to revitalize the ASAM community in the US have been taken

 ASAM Regional Meeting: A successful yearly event that provided opportunity to network and stay informed
 ASAM Board of Directors: Richard Vreeland (re-elected member of the board) is representing interests of US membership within ASAM

ASAM cooperation agreement with SAE

- Target: Coordinated and consolidated development of standards; Avoiding redundancies of standards
- Taking advantage of geographical strengths of SAE and ASAM to push standards globally
- SAE On-Road Automated Driving (ORAD), common focus on Scenario Glossary
- SAE speech at the ASAM International Conference 2019 in Dresden

New US members – technology/market leaders in ADAS and AV development

Active Participation by US members in ASAM OpenX work groups



Internationalization

Revitalize the US Activities - Task Force USA

Business Development by Increasing Technical Competence Locally

Target: Cooperation with selected US based Universities with a clear focus on

- Automotive domains such as ADAS and AV, testing and engineering
- Network of national and international partners
- Customer related / funding projects
- Lectures on ASAM standards for students before they become young professionals

Discussions on ASAM and ASAM OpenX standards with

- Ohio State University (Center of Automotive Research Prof. Dr. Giorgio Rizzoni)
- Carnegie Mellon University together with ANSYS (Edge Case Research Center)
- University of Windsor, Ontario (Prof. Dr. Peter Frise)
- University of Waterloo, Ontario (Prof. Dr. Krzystof Czarnecki)

Workshop "Standardization for Highly Automated Driving" (together with OSU - Detroit, August 19, 2019) Target: Start discussion with industry managers and experts on ASAM OpenX activities

Second workshop on ASAM OpenX activities this morning



Standardization Activities



ASAM Standards Portfolio

A New Domain to Come in 2018





Release and Project Roadmap for 2018

2018											
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Release	S										
• ASAM ODS 6.0.1 • ASAM MCD-2 MC 1.7.1 Concept Project		.7.1	• HEX File Manageme	Project					• ASAM • ASAM Check	I ATX 1.0.1 I MCD-2 M ker 1.7.1	С
• Big Data for ODS	recnnolog	les	• ASAM XIL : EES-Port	t 2.0.1							

Project Starts

• ASAM ODS 6.1.0

 HEX-File Management System (HMS) 1.0.0



Release and Project Roadmap for 2019

A First OpenX Standards under Development

2019											
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Release	s										

• ASAM ASAP-3 3.0.0

• ASAM iLinkRT 2.0.0

Project Starts	 OpenDRIVE Transfer OpenDRIVE Concept 		 ASA 	M SOVD	
	 OpenSCENARIO Transfer 	 ASAM Ope 	nCRG		 ASAM OTX Extension/ Core Rework
 OpenS¹ 	CENARIO Concept				
 AS. (AF 	AM Runtime Interface				

• ASAM MDF 4.2.0



Release and Project Roadmap for 2020

First ASAM OpenX Standards Released, New Development Methods, Possibly a New Domain



Project Starts

- ASAM OSI
- ASAM SCDL

• ASAM XIL 3.0.0, tbd.



More Details About New Projects in 2020

Piloting a New Standard Development Process, Most Probably a Further New Domain for ASAM

• ASAM OSI (Open Simulation Interface)

- Purpose: Definition of a sensor data model ('ground truth') and recognized objects model for driving simulators.
- Project of BMW and the Technical University of Munich.
- Shall be transferred to ASAM and become new standard in 2020.
- Will include a new method for standard development via collaborative software development.

• SCDL (Safety Concept Description Language)

- Public specification for the description of the safety architecture of safety-critical systems.
- Is one building block to meet ISO 26262 certification.
- Created by a Japanese work group consisting of 4 OEMs and 23 other companies.
- Transfer to ASAM.



Services for ASAM Members

Website, conferences, ...



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/



ASAM Office

We are "At Your Disposal" - At Any Time

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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 Simulaton Interface (OSI)



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
С	penSCENARIO		
•	17 09 2018	Use Case and Requirements Workshop	Höhenkirchen
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•	13.11.2018	Kick-Off Workshop ASAM OpenSCENARIO	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, tbd.

- **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.



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Positioning of OpenX Standards



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





OpenDRIVE

- OpenDRIVE: <u>Open Dynamic Road Information for Vehicle Environment</u>
- 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





- 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 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)	 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





OpenCRG





OpenCRG

- OpenCRG: <u>Open C</u>urved <u>R</u>egular <u>G</u>rid
- 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





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





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 – Original Structure

			OpenScen				
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 behavior of a scenario.
^{>} articipants (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 	 Univ. of Warwick Opel Vauxhall BTC ES FZI Nvidia IPG ZF APTIV M&K Continental Vector IRT SystemsX TÜV SÜD HLRS Jaguar/Land Rover

Nvidia





- Key concepts identified and agreed upon by Concept work group
- Project restructured in order to accelerate progress toward meeting schedule.
- New structure launched early October (details in next slides)
- Expecting to meet schedule +/- a month.



Key Decisions of the Concept Work Group

Around 40 Participants in the Face2Face Meeting (Sept. 19+20)

- Project approved a DSL direction
- Project approved key concepts recommended by the maneuvers work group for the DSL content (Composability of scenarios, constraints, scenario modifiers for abstract scenarios)
- Concepts for parameters, measurements and grading were ratified
- Project decided to use M-SDL as an example language, whenever syntax and examples are required
- Project created a revised outline for the concept document
- Approved restructure to 3 main work groups, with smaller teams/tasks forces to deliver different sections of the concept document.



New Project Structure

- 3 main clusters, each coordinating smaller task forces
- Each task force is responsible for a section of the concept document





Overview Documentation

Prepare the general chapters in

the Concept

ASAM OpenSCENARIO Roadmap – Parallel Concept Development





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		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)

		Wd	G 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
 - •



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!

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

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www.asam.net

