ASAM Ideation Activities in 2019

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Association for Standardization of Automation and Measuring Systems

ASAM Ideation in 2019

Overview

- 1. Real Time Measurement and Calibration for Automation Systems ASAM MC-3 iLink Real Time Protocol (ASAM
- 2. Update on ASAM Telematics Reference Architecture
 - MCD Components
 - Extended OTX Integration
- 3. Service Oriented Vehicle Diagnostics
 - New Demands
 - New Architecture
 - Covered Use-Cases
 - Differentiation to other Standards
 - Vision of in-car HMI for engineers
- 4. SCENARIO Labeling and Storage



Real Time Measurement and Calibration for Automation Systems (iLinkRT)

- Motivation, Status und Preview -



Motivation

- Use-case: transfer of measurement values from a MC system to a client (e.g. automation system) with high data rates and calibration which is fast and independent of measurement
- One major result of the former ASAM project "Conceptual Study on MC-3 Automation Access" was that there is a high demand for a standard that allows fast data transfers between test automation and test execution systems.
- Current requirements to improve the standards in the ASAM MCD-3 MC area are:
 - better support for current ECU software data objects
 - markedly higher performance, esp. with remote connections
 - multiple client support
 - better usability and lean standard



ASAM iLinkRT

Market evaluation

- current standard of ASAM for this field is ASAM MCD-3 MC API but:
 - ASAM MCD-3 MC is an object-oriented API using COM/DCOM
 - main problem of ASAM MCD-3 MC is its high complexity
 - ASAM MCD-3 MC is not accepted in the field of test benches
- the old standard ASAP3 protocol is still dominant in the area of conventional test benches:
 - ASAP3 has issues with high performance measurements (polling mechanism)
 - measurement is blocked by calibration commands
 - missing MultiClient support
- In the conventional test bench area the non standardized protocol iLinkRT is used for high speed measurement and calibration
- the ASAM XIL API standard is widely established in the field of simulation based test benches







Further development

- The iLinkRT specification was transferred to ASAM as a public standard.
- ASAM iLinkRT protocol shall be extended with an interface for configuration. Existing ASAP3 commands are transferred to iLinkRT for the purpose of configuration.
- iLinkRT protocol shall support multiple clients on protocol level.
- The new standard will be combined with ASAM ASAP3.
- The ASAM MCD-3 MC standard will exist in parallel.
- In another future project, ASAM iLinkRT may be included in ASAM XIL.



ASAM iLink

Further development

- The current iLinkRT V2.0 (Released in 02/2019) of ASAM iLinkRT reflects the already existing implementations on the market.
- iLinkRT V3.0 (in development, expected release 12/2020):
 - The protocol commands shall be reworked for a better description and meaningful usage of all contained parameters.
 - Unused parameters shall be removed.
 - Parameters shall be aligned to the full command set.
 - The handling of measurements and characteristics shall be adapted so that they are treated in an identical way.
 - Parameters shall be aligned to the object type (e.g. a curve have no y-axis).
- iLinkRT V3.0 will not be backward-compatible to version 2.0.

Participating Companies

AVL LIST GMBH BMW AG Continental AG Daimler AG dSPACE GmbH ETAS GmbH FEV Software and Testing Solutions GmbH HORIBA IAV GmbH **KPIT Technologies GmbH** Kristl, Seibt & Co GmbH M&K Mess- und Kommunikationstechnik GmbH **RA Consulting GmbH** Vector Informatik GmbH We4Data GmbH Opel Automobile GmbH



ASAM iLink

iLinkRT V2.0 - released 02/2019

- based on the non-standardized marked solution (V1.0)
- supports transfer of measurement values and online calibration
- event-driven mechanism is used to transfer measurement values (similar to DAQ in XCP). No polling.
- no configuration of the MC system is part of the standard. The MC system must be configured either using ASAP3 or using a proprietary interface.
- simple and cooperative multi-client is supported
- requires Ethernet transport (UDP-IP)
- still strong relations to XCP



ASAM iLink

iLinkRT V3.0 - in development, expected release 12/2020

- Status: project started in 03/2019, release planned in 12/2020
 - review all parts of the iLinkRT V2.0 protocol and refactor if needed
 - no compatibility to previous standard V2.0 is intended
- main goal is to develop a standalone standard (independent of ASAP3) covering all communication of client and MC system
 - add configuration part to the standard on project level and for measurement and calibration
- remove remaining XCP references and clean up commands (e.g. many commands have XCP parameters which are irrelevant for iLinkRT communication)
- respect requirements of concept project
 - rate specific configuration of measurement lists
 - recording must be supported
 - high-performance measurement
- challenges:
 - keep lean protocol and good usability
 - keep cooperative multi-client support



ASAM Telematics Reference Architecture - Need for Ideation -



ASAM Development Process for Standards

From First Ideas to New Standards





ASAM ADAS R&D activities

ASAM associated research partner in SmartLoad

Selection/reduction of ADAS data recording (6) (only critical status/situation/scenario):

- Safe driving through pedestrian areas or through school areas.
- Safe stops when encountering pedestrian crossing
- Evasive maneuvering when encountering slow traffic or pedestrians on the driving lane
- Safe driving through roads with multi-modal traffic lanes for bikes, cars, truck, bus and electric tram.
- Handling of complex intersections with operational and defect traffic lights.
- Safe driving in adverse weather situations like heavy rain, storm or snow.





XCP/ROS & XCP/DDS Interoperability

Match two industrial standards





ASAM Telematics Reference architecture

Interoperability and compatibility - based on standardization





OpenX Standards

Acceptance and electronic Periodical Technical Inspection (ePTI)

Evaluation procedure for a test run (test instruction: "Turn left at the next traffic light crossing!")

Individual maneuvers/scenarios:

- Approach the crossing
- Stop at stop line
- Observing the traffic light signal
- Left Turn
- Acceleration to appropriate speed



Variance:

- Traffic situation: Free travel, little traffic, lots of traffic, rush hour
- Weather: rain, ice, snow, sunshine
- · Environment: pedestrians, cyclists, animals
- Road network layout: How many entrances does the intersection have, roundabout, traffic lights, ...
- · Concrete driving manoeuvre: turn left/right, drive through the crossroads
- left or right-hand traffic

Measured value acquisition in the vehicle:

- Speedt
- urn signal
- Deceleration and acceleration (e.g. brake pressure as criticality measure)
- steering angle
- Driving intervention (e.g. steward, remote control, AD emergency function)
- Speed profile and driving cycle lateral acceleration and yaw rate
- High-precision vehicle positions (EGO vehicle with GPS and environment detection)
- Object distances (sensor data)

Measured value acquisition by infrastructure:

- Localisation of all road users in the period under consideration (e.g. by high-precision surveying and cadastral information)
- Lane occupancy and traffic flow (relative speeds and vehicle interaction) in the period under consideration (e.g. camera/video)
- Track fidelity and object distances (e.g. camera/video)

Derivation of test criteria and evaluation:

- Lane guidance quality and embedding in traffic flow
- driving characteristics in traffic (correct and inconspicuous, incorrect and incorrect)
- Traffic safety (with or without triggering critical situations)



Service Oriented Vehicle Diagnostics - Motivation, Status und Preview -



ASAM SOVD

Service Oriented Vehicle Diagnostics (- just started -)





ASAM SOVD

Service Oriented Vehicle Diagnostics (- just started -)





ASAM SOVD

Use Case Examples

Engineer Use-Cases before SOP (better control)

- Reading of vehicle configuration and Reading out of vehicle status
- Vehicle data logging with an external device
- Testing of isolated HPCs or partly integrated vehicle electronics (bench mode)
- Implement test and commissioning applications for manufacturing and servicing of the vehicles based before vehicle exists (Interactive capability discovery, Execution of diagnostic command sequences)
- Testing of isolated HPCs or partly integrated vehicle electronics (bench mode)
- Reading and Writing of bulk data container of varying data formats to HPC

Use-Cases for the whole Life-Cycle including Field Operation (additional security aspects)

- Authentification against vehicle and Autorization of access (Confidentiality, Authenticity, Integrity of services)
- Variant Coding and activation of functions (Data writing, access to actuators and routines)
- Access to sensor data, DTC, environment data or variables (single shot: After Sales, OBD, ePTI,.. Or on event)
- Software Update / Upgrade of vehicle or component
- Reading and Writing of bulk data container of varying data formats to HPC
- Analysis of vehicle state



Telematics Interest Group North America (Ideation project until 2018)

Service Oriented Vehicle Diagnostics (- localization North America -)





High Performance Computing

HMI for Engineers (- any and many device -





SCENARIO Labeling and Storage - Motivation and next Steps -



Life of the recorded data



AD vehicles produce data while driving (real/simulated), capturing scenarios every second.





Data **pre-processing** and labeling. Detecting captured scenarios. Analyse vehicle behavior according to defined KPI's



Search processed data for detected scenarios, using keywords



Store the captured data in large data centers and make the data sets available for post processing activities



Post-processing of the stored data, detecting new scenarios, labeling scenarios variants, creating data sets for ML/DL/AI



Find Scenarios by keyword



]	left turn
] [noon
] [Tram













IDEA: Standardize the storage of processed scenario data...



- Millions if not billions of miles of driving data are being collected yearly by companies around the world
- In future, we will be generating this volume in much shorter periods of time virtually
- This data is necessary for further validation and testing of AD systems
- OpenSCENARIO will provide a high level description of such data or situations but will not include the results
- These datasets often contain different fields as well as proprietary encoded data
- How do we encourage the sharing and exchange of these massive datasets to allow for ease of validation?

 \rightarrow We propose to standardize a subset of these attributes to ensure an easily extendable base for dataset exchange

Next Steps:

- Interest check via discussions with OpenX members...
- Set up an initial workshop towards the end of 2019



Example: Camera and Lidar Object detection and Classification

Camera: Object detection and classification



Lidar: Object detection





Example: Semantic Segmentations





IDEA: Standardize the data labeling

- Exchangeable Datasets can enhance the learning process of algorithms in the industry and can accelerate the definitions of new relevant scenarios for validation and homologation purposes.
- Make Data sets searchable
- Standardized labeled vehicle data can improve the analysis capabilities of independent parties for recorded data
- Make Labeled Datasets exchangeable:
 - Public Datasets are becoming more common
 - <u>https://waymo.com/open/</u>
 - <u>https://bdd-data.berkeley.edu/</u>
 - http://apolloscape.auto/
 - <u>https://blog.cambridgespark.com/50-free-machine-learning-datasets-self-driving-cars-d37be5a96b28</u>
- Data produced by simulations can be labeled and matched to real vehicle data and vice versa
- Labels should be synchronized with OpenDRIVE and OpenSCENARIO Elements







Static road network description	dynamic scenario description
ASAM OpenDRIVE®	ASAM OpenSCENARIO®



Possible Targets and Next Steps

Possible Targets:

- Option 1: Label Description Language
- Option 2: Standardize Meta Data files for the data labeling = Format description
- Option 3: ???

Possible next steps:

- · Find interested Parties to contribute
- Ideation Project
- Concept Project
-







Timeline

CG:Sim @ASAM





Interested Parties





Thank you for your attention!

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