Overcoming Testing and Validation Challenges for Automated Driving



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Introduction

Automated Driving **Development Challenges**



One-Stop Solution for **Testing and Validation**







EB software offering for Automotive





Scalable software for in-vehicle infrastructure AUTOSAR Classic & Adaptive, Virtualization, Android & Linux



Trends in Automated Driving

Tackle the challenges and pave the way towards future mobility.





EB's Solutions for Automated Driving



EB robinos

Building blocks for automated driving systems (hardware- and sensor- agnostic)

- Comprehensive environment model
- Accurate vehicle positioning
- Code-generation based tooling to **monitor system parameters**
- Electronic horizon



EB Assist

Test and validation for automated driving

• Proven-in-use hardware and software products





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One-Stop Solution for Testing and Validation







Increasing Functional Complexity





Verification and Validation Requires Vast Test Coverage

Complexity



Unusual situations



Hazards



Difficult conditions



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Automated Driving Development Challenges

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One-Stop Solution for Testing and Validation







240 Million Kilometers without Accidents

5% done with real driving equals 12 million test kilometers



- An average of 200 test cars with each recording 275 km/day
- For one year (220 working days)
- Producing 10 TB per day per car
- The whole fleet generating 2 petabytes of data per day

95% done in simulation equals 228 million virtual test kilometers



- 114,000 scenarios with 1 km length each
- 2,000 variants per scenario at an average of 60 km/h
 -> 158,000 days of simulation on one high performance computer
- 10,000 high performance computers running software and simulation takes 15.8 days

At the same time, development and update cycles must get shorter. Virtualization enables parallel replay and simulation for accelerated testing.





In Order to Manage Upcoming Tasks We Need...

Reliable measurement technology

Suitable test environments

Well-matched, fully integrated solutions





Introduction



One-Stop Solution for Testing and Validation

Automated Driving **Development Challenges**









One-Stop Solution for Testing and Validation





Test Drive Recording

Smart solutions for efficient test drive recording and handling of large amounts of data are essential.

- Efficient logging software
- Hardware which supports all common bus types and high bandwidths
- Various possibilities for direct annotation, triggering, and recording feedback





Scenario Generation

Efficient solutions for generation and simulation of test drives are crucial.

- Efficient creation of new scenarios
- Efficient simulation of scenarios
- Physically correct modeling of:
 - Ego car behavior
 - Behavior of other objects
 - Sensor simulation





Data Enhancement

Enabling a high level of automation to handle the rising amounts of required test drive data at reasonable expenses.

- Data ingestion into cloud has to be supported, e.g. with disc logistics and upload facilities
- Basic meta data has to be generated automatically for newly uploaded recordings
- Services (AI-based) for meta data generation like driving context
- Efficient label tool supporting (semi-) automatic labeling of recordings
- Adaptable and customizable to customer and use-case specific needs





Test Case Management

Allowing efficient generation and administration of test cases and test sets

- Define preconditions
 - Software version
 - Algorithm state
- List of input data
 - Recordings
- Simulation scenarios including variations
- Expected results
 - Ground truth
 - KPIs
- Automatic generation of test cases
- History and coverage of test cases





Test Execution and Test Post-Processing

Executing abstracted test cases to cover any kind of test scenarios in a transparent, efficient way

- Supporting infinite scalability by using cloud-based solution
- Improving efficiency of existing hardware by providing smart load balancing
- Decreasing down time by automatically detecting and handling execution errors
- Enabling efficient post processing of tests and test runs
- Automatic creation of meaningful test reports
- Administration and archiving of test results
- Comparison between test results





The EB Assist Product Line at a Glance

Hardware products



EB Assist CAR Box

- High-performant and reliable automotive-grade PC systems for testing and validation
- Data-logging, replaying, and simulation of real and virtual driving scenes



EB Assist bus tools

- Modular I/O slot cards, I/O interface modules, and simulation tools
- Built for highly precise data-logging, replaying, and simulation

Software products



EB Assist Busmirror

- Tool for testing ECU software during implementation stage, both on hardware and on PC
- Supports all established bus systems, including Ethernet/BroadR-Reach, FlexRay, CAN, and LIN
- Tool for the development, testing, validation, and visualization of ADAS and AD systems

EB Assist ADTF

 Wide range of toolboxes available to extend its functionality



Test Lab by EB

 Comprehensive driving scene database and management



EB Assist Covers all Automated Driving Development Phases





Introduction

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Automated Driving **Development Challenges**











Further Enhancement with Partners

Simulation experts



Test tracks



Data plugin specialists



Computer center providers



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Test and Validation Tools for Automated Driving

EB Assist

- Data-logging, replaying, and simulation of driving scenes
- **Test and visualization** for continuous development
- Leverage development with products based on industry standards
- Test and validation to prove mass production
- Fast and flexible tool customization through comprehensive in-house hardware/firmware development







Summary

Comprehensive testing and validation solution to bring automated cars to serial production.

- Flexible platform covers data from real driving scenes and from simulation
- Automated labeling and data enhancement
- Management, execution, and postprocessing of parallel tests
- Leverages cloud-computing platform for maximum flexibility and scalability
- Open interfaces to create a comprehensive solution with partners, answering the needs of car makers and suppliers







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