European Initiative to Enable Validation for Highly Automated Safe and Secure Systems

http://www.enable-s3.eu/

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Automated systems are everywhere

Just about every major automaker is developing automated vehicle technology. Experts predict first highly automated production vehicles by 2020 with fully automated cars expected by 2025.

Singapore orders driverless trains

Drone ships would be safer, cheaper and less polluting for the $375 billion shipping industry.

Airbus has developed an electrically-driven autonomous taxiing system for the A320.

“A grower could have three or four autonomous systems and plant around the clock,” says Susanne Kinzebaw Veatch, vice president of Kinze Manufacturing.

Robotic assisted surgeries, Medical intervention


5. Cars of Change, Green Car Journals 2015-01-11
Growing complexity as a major challenge

• **New and high number of sensors**
• **Sensor fusion** to overcome weaknesses of individual sensors
• Necessity to **coexist** with conventional (human being guided) systems
• IoT support opens threat of **security breaches**
• Automated systems have to work in **uncountable possible scenarios**

[Source: Bill Gross via Twitter]
How do we ensure that it really works?

- **Uncountable potential scenarios** need to be tested
- Realistic tests in **pure simulation environments** are often not possible
- Real life test can be **too dangerous for humans**
- No or **not enough unit under tests** available for real life testing
- **Safety and security** are tied together
- Many of the **necessary test situations do occur** just by accident in real world - **reproducibility**?
- **Certification** of automated vehicles is **unclear**
Modular validation framework to be developed within ENABLE-S3

Validation Methodology

- Analysis of REAL WORLD data
- Result of Safety & Security analysis
- As input from other related projects

Scenario variations
- Representative routes
- Weather conditions
- Vehicle types
- Human being types
- Traffic
- Scenario parameters
- ... other parameters

Scenario extraction

Validation scenarios

Full scenario coverage with all variations \( x \times 10^{12} \) tests

Intelligent Accelerated Validation \( y \times 10^3 \) tests

Validation Platform

- Virtual world models
- Runtime validation

- MiL/SiL
- Proving ground/Public road
- HiL
- ViL

Reusable validation procedures
Main objective of the project

• ENABLE-S3 is industry-driven and aspires to substitute today’s cost-intensive validation and verification efforts by virtual and semi-virtual testing and verification, coverage-oriented test selection methods and standardization to pave the way for efficient development of highly automated and autonomous systems.

- Scenario-based V&V in virtual, semi-virtual and real testing environments
- Environment and sensor models and sensor stimuli for (MiL, SiL, HiL, XiL)
- Extraction of test scenarios (vehicle road data, …)
- Reduce the number of required tests for highly varying environmental conditions
- Integrated safety and security analysis approaches
- Runtime verification approaches
- Simulation-based approaches for homologation, certification and type approval
- Draft-standards for test scenario descriptions
- Integrating into reproducible and composable test cases and cross-domain V&V platforms for ACPS
IOS based research activities

• Where in this process is interoperability and data exchange between development tools needed
  • Gap Analysis: What does the existing IOS provide, what is missing?
  • Identify Engineering Concerns as a basis for new IOS parts
  • Identify/Draft Content of these new IOS parts

• Two Engineering Concerns
  • Scenario definitions, variations and abstractions
    • Based on existing specifications like OpenScenario and Traffic Sequence Charts

  • Heterogenous Co-Simulation
    • Based on existing specifications/standards like FMI (functional model interface), ROS (robot operating system), VTD (Vires Virtual Test Drive), Model.Connect (AVL) and similar

• Resulting specifications will be made available in the IOS database.
Thank you!

Contact: andrea.leitner@avl.com