PROJECT of the PEGASUS FAMILY

VERIFICATION VALIDATION METHODS

Final Event 21 / 22 November 2023

Day1 – Stream2:
V&V Test Design, Test Planning and Execution
V&V Concept & Requirements of the Argumentation

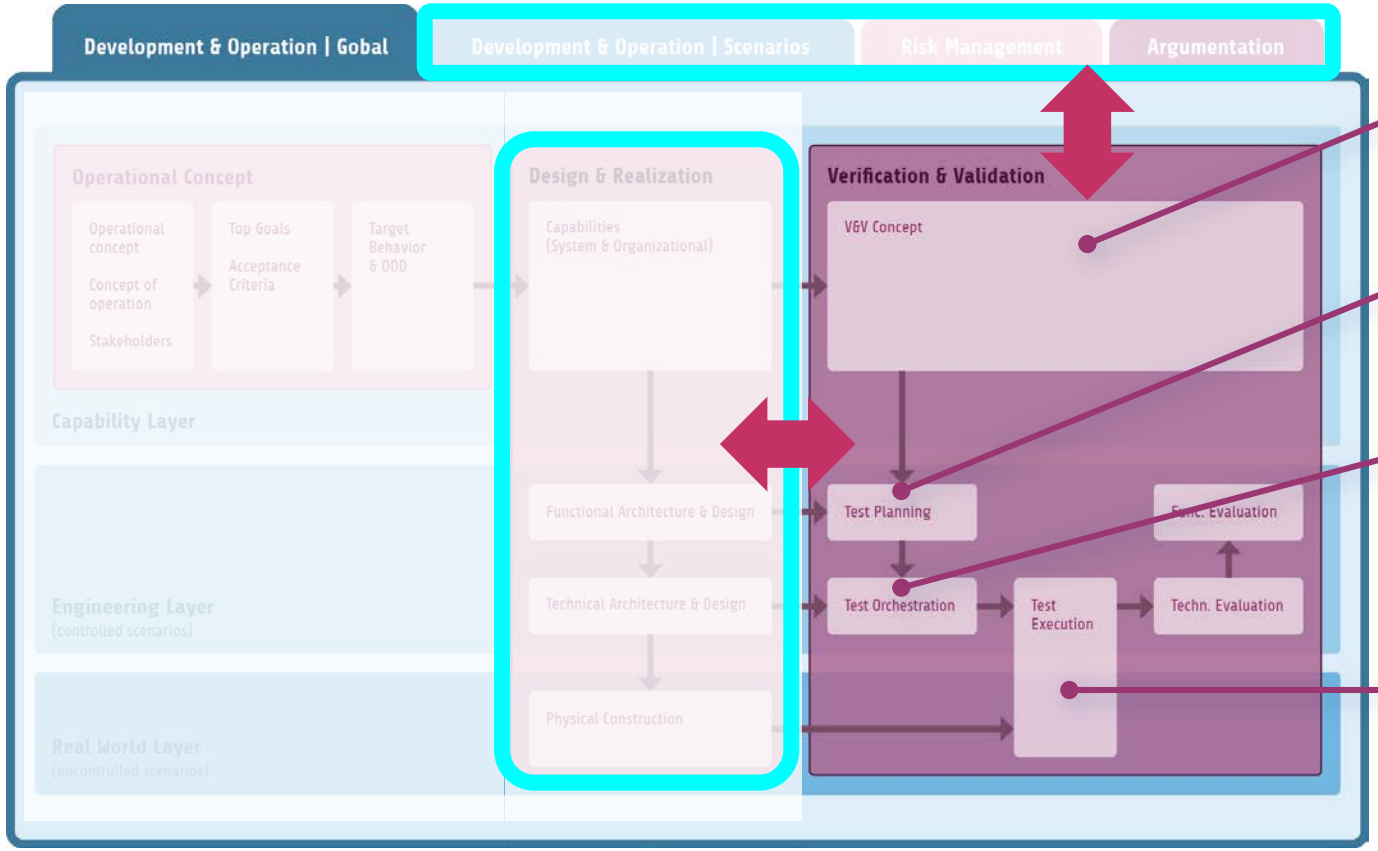
Roland Galbas, Robert Bosch GmbH

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

Day1 – Stream2: V&V Test Design, Test Planning and Execution



- V&V Concept & Requirements of the Argumentation
- Design & Test Planning
- Test orchestration – The way to seamless testing
- Seamless Testing in Practice – Example realizations
- Scenario based Testing
- Demonstrator: Scenario Database

- Process flow of V&V and the Interaction to Design-Domain and to the other Perspectives.

V&V Concept

Scope: Systematize the acquisition of evidences for the argumentation of the safety case according to the main approach.

Capability Layer

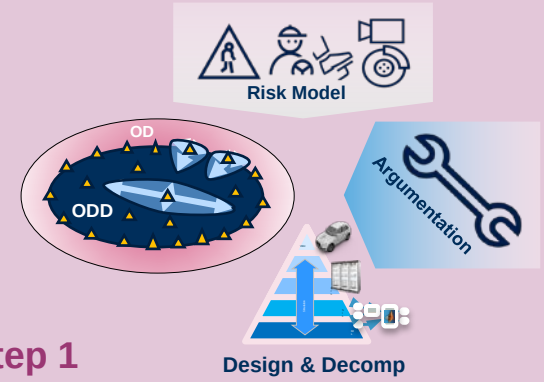
Top Goals

Target Behavior ODD

Capa-bilities

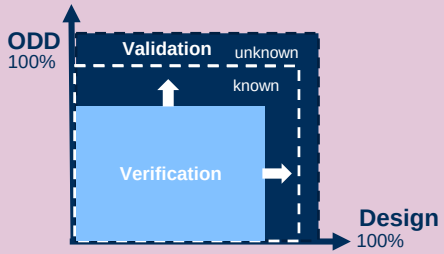
Verification & Validation

V&V Concept



Step 1

- Select the risk-sensitive areas of behavior by decomposition of ODD and design along risk model.
- Build extrapolation models for safe behavior and define risk and performance thresholds along risk model.



Step 2

- Verification until performance thresholds are proven (otherwise iterate development)
- Validation to prove that risk is below risk thresholds (otherwise iterate development)

Scenario Operation
In scenario meta model incl. probabilistic. **Out** decomp. aspects

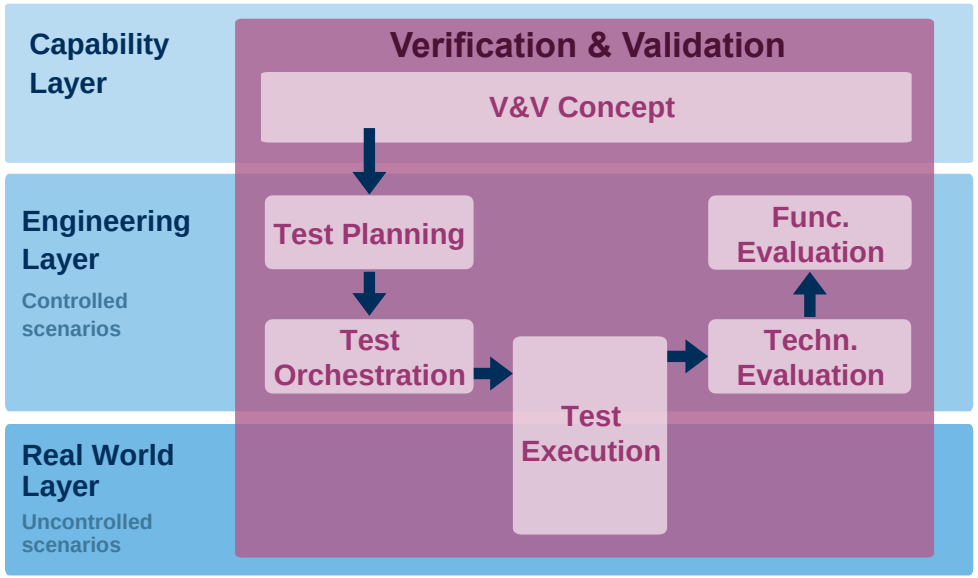
Design
In capabilities, decomp. of design
Out capabilities for V&V

Risk Management
In risk model **Out** assessed risk reduction of measures

Argumentation
In argumentation rules
Out argum. concepts & evidences

Tasks and Elements of V&V Domain

- **Scope of V&V Domain** Create evidences for the argumentation of the safety case.



- **V&V Concept** – systemization of evidence acquisition. **Conception**
- **Test Planning** – functional test space & functional test spec.
- **Test Orchestration** – technical test spec. & distribution.
- **Tech. Evaluation** – assessment technical.
- **Func. Evaluation** – assessment functional. **Step 1**
- **Test Execution** – conduction of tests. **Step 2**

- **Enabler for handling of complexity and feasibility**
  - Clearly defined interaction to other perspective (scenarios, risk, argumentation).
  - Separation of functional and technical V&V.
  - Separation of verification ►[controlled scenarios] and validation ►[uncontrolled scenarios].

V&V Domain and Concept - Summary

VERIFICATION
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Scope

- Of the V&V Domain is to create the acquisition of evidences for the argumentation of the safety case and the Scope of V&V Concept is it's systematization.

Approach

- Test cases for V&V are generated from the decomposition of the system and the ODD along risk model by selection of risk-sensitive areas of the behavior - following the main approach.
- The sum of the test cases from V&V at all system levels provides the evidence to argue that the system actual behavior represents the target behavior in the defined ODD and thus meets the TOP Goal "safety by absence of unreasonable risk".

Main Enabler

- Clearly defined interaction to other perspective (scenarios, risk, argumentation).

VERIFICATION
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Thank you!

Roland Galbas, Robert Bosch GmbH
roland.galbas@de.bosch.com

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VDA LEITINITIATIVE

A project developed by the VDA Leitinitiative
autonomous and connected driving

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