PROJECT of the PEGASUS FAMILY

VERIFICATION VALIDATION METHODS

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The VVM view on the ODD Metamodel in the safety case

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on the basis of a decision by the German Bundestag

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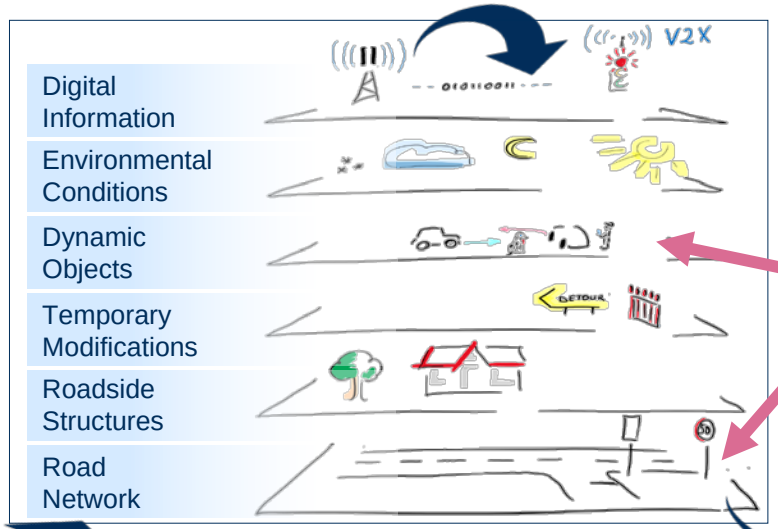
ODD Metamodel

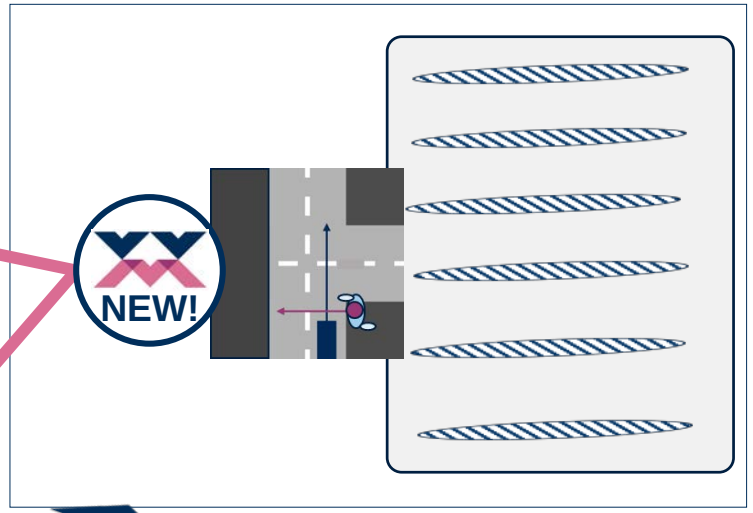
Structure is needed to understand the world and to decompose its complex challenges

Real World Scenario

6 Layer -Model



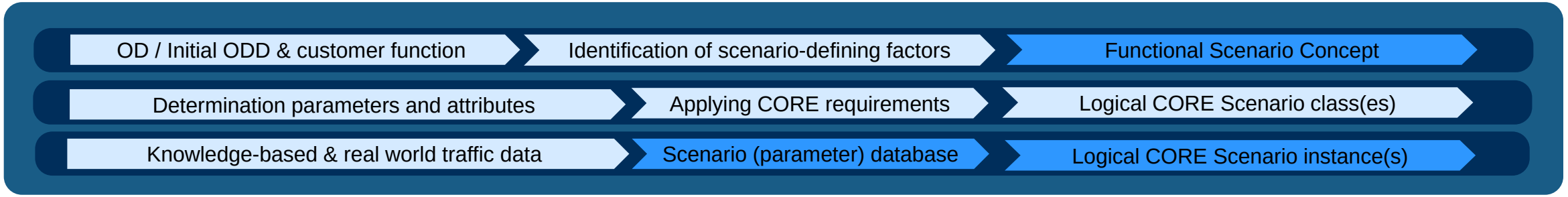
Logical Scenario (w. parameter space)



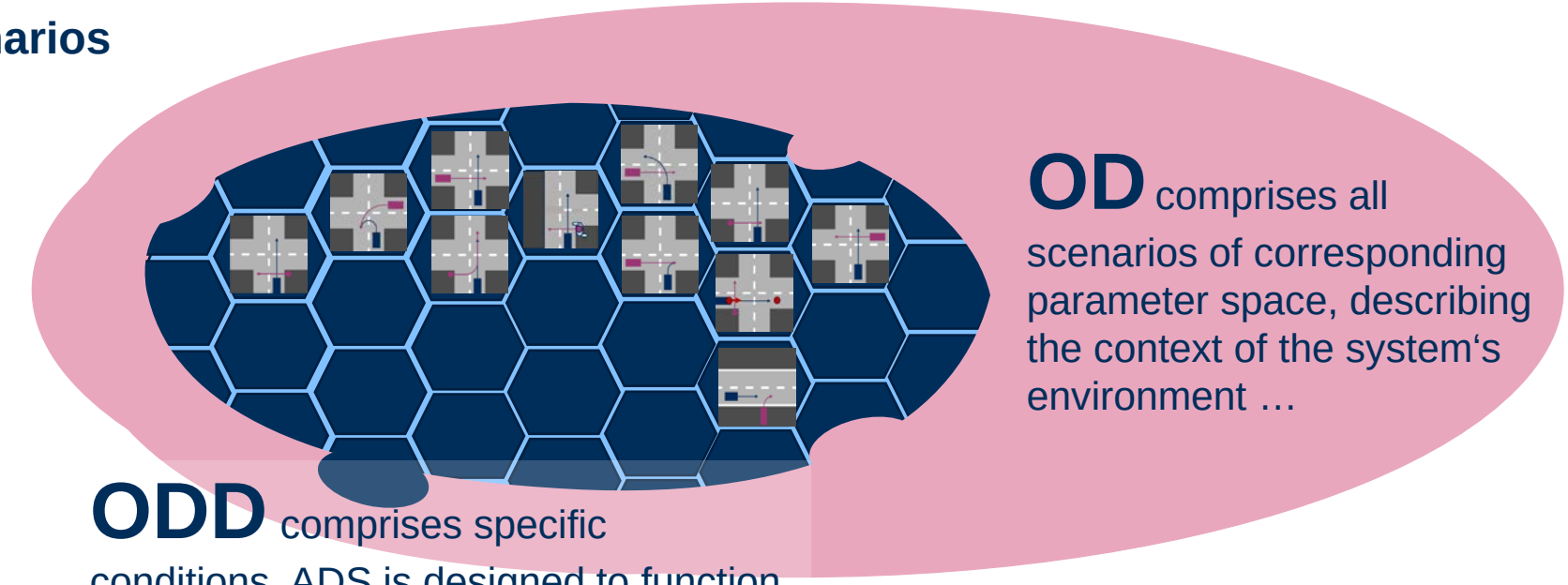
- Continuation of work from **PEGASUS** project
- Further development of the concept for scenarios forming the ODD in **VVMethods**

- Introduces basic entity categories
- **Declaring** relevant describing Parameter

Defining an ODD Metamodel – a sufficient complete coverage



The **set of logical CORE scenarios** is defined as a set of logical scenario that have certain properties:
minimum set of logical scenarios, that covers / represent the ODD,
free of overlap with the underlying BASE scenarios, …



OD comprises all scenarios of corresponding parameter space, describing the context of the system‘s environment …

ODD comprises specific conditions, ADS is designed to function

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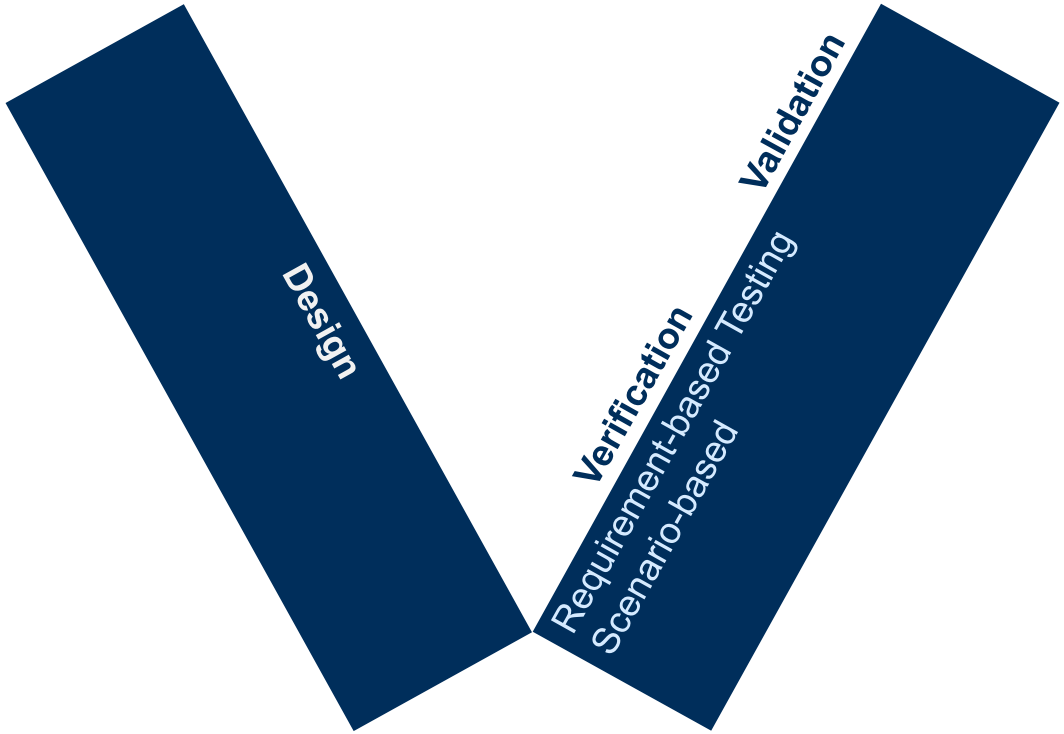
One Model fits for all – holistic usage of the ODD metamodel

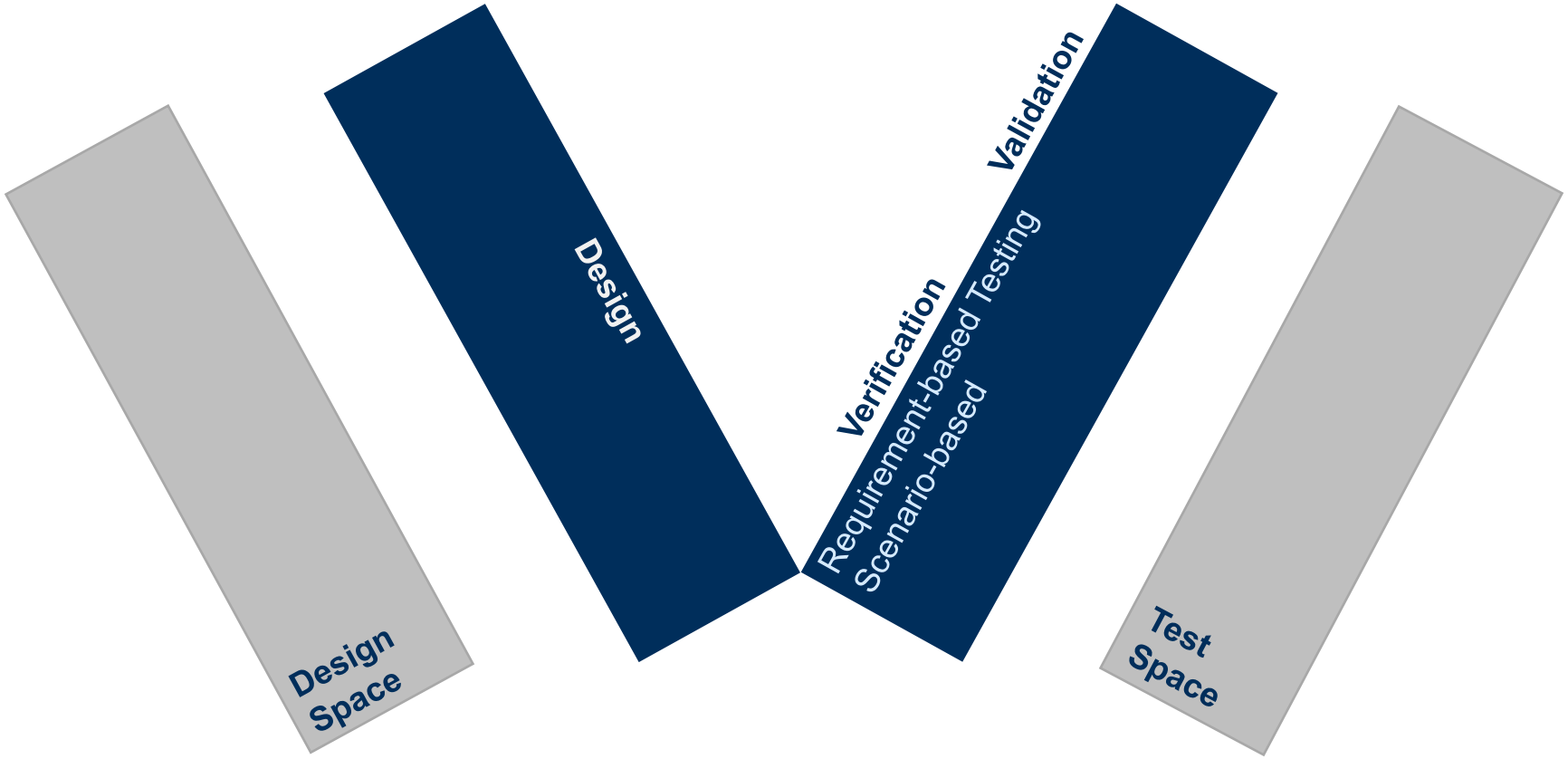
The ODD Metamodel

Starting with the **V-Model** …



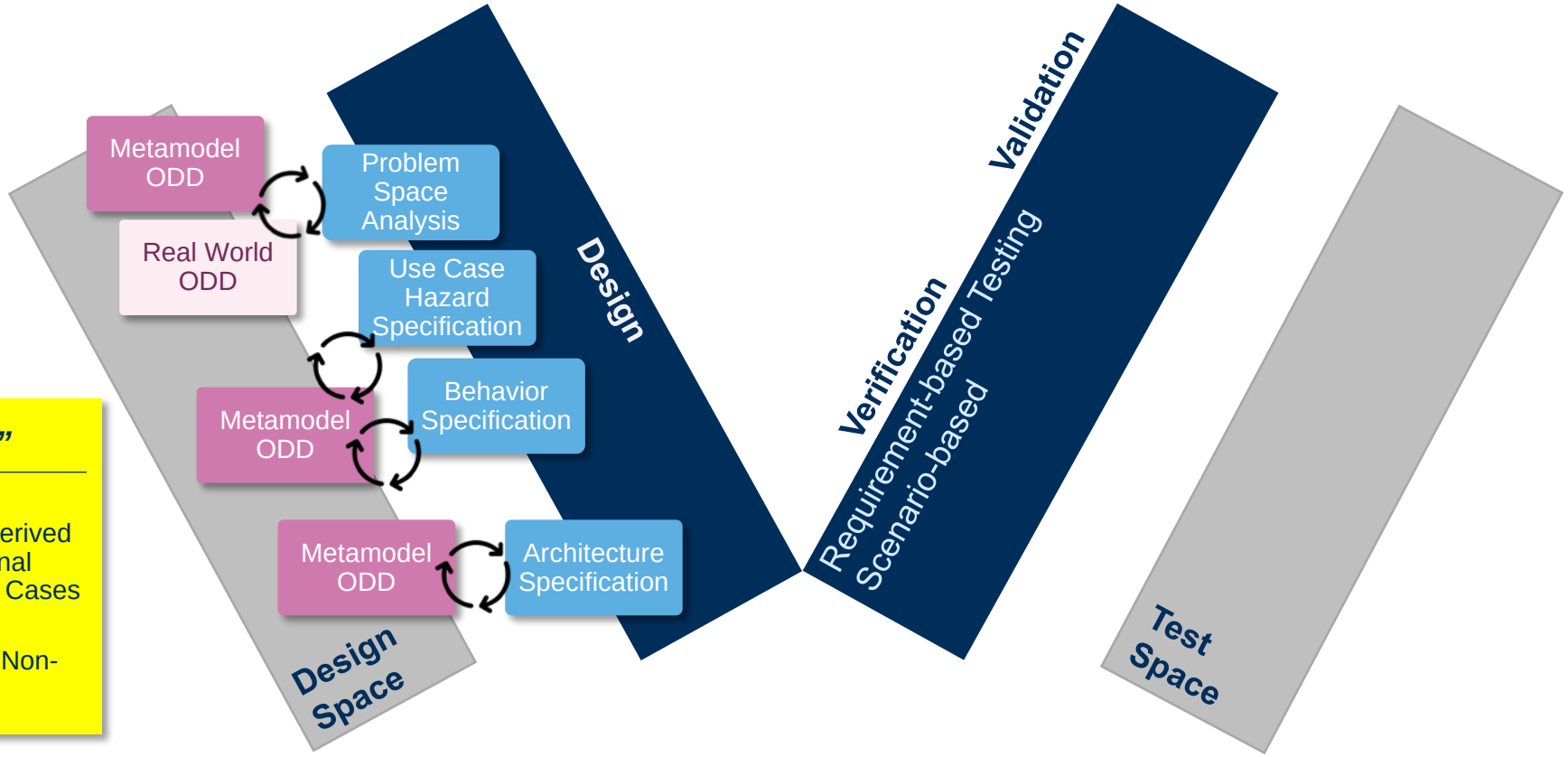
The ODD Metamodel

... supplemented by a **Design** and **Test Space** …



The ODD Metamodel

… using the ODD Metamodel for **Designing** an AD-System …

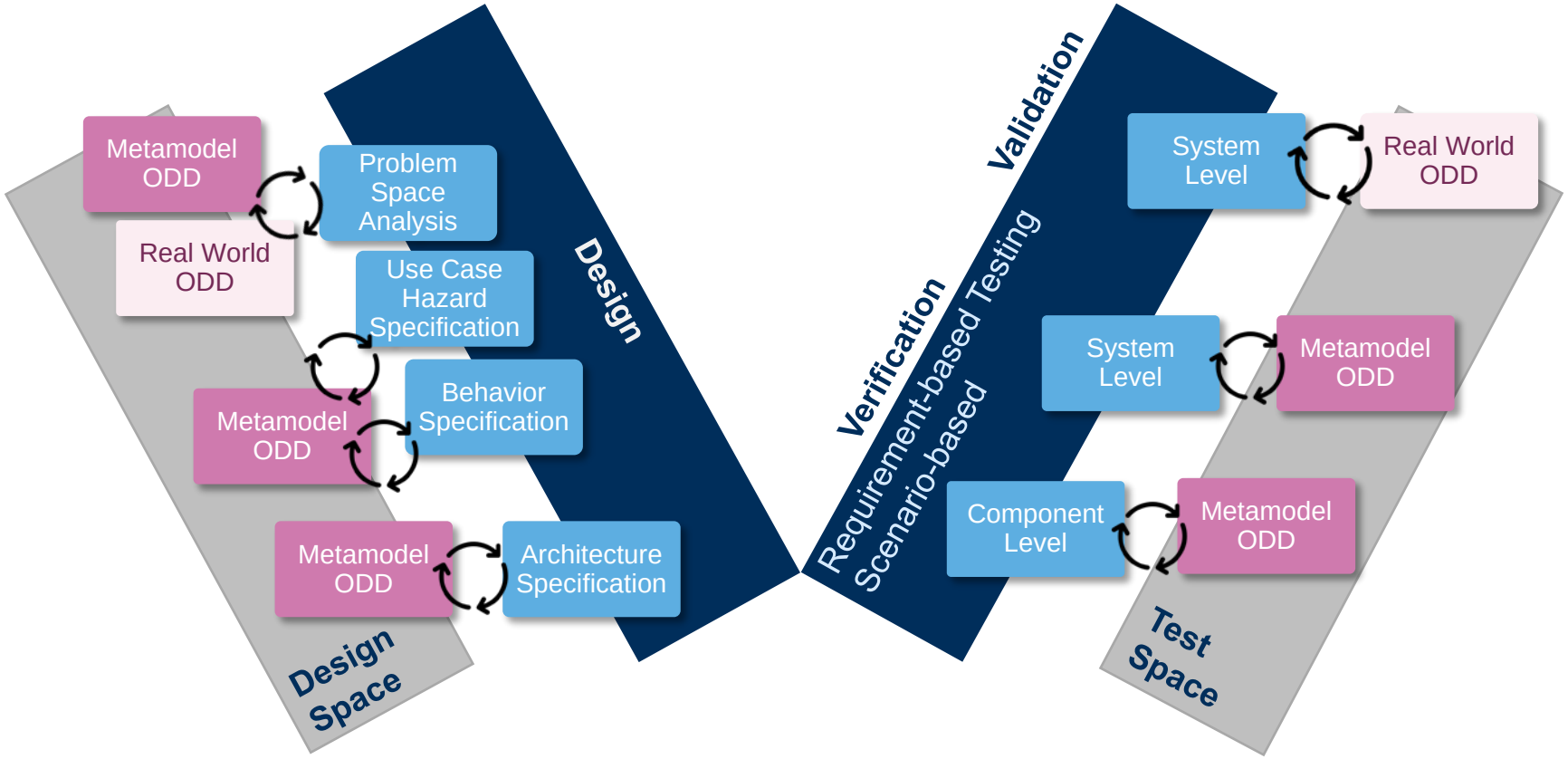


"Use Cases"

- Core Scenarios with „desired behavior" (derived from CF) and functional ranges serve as Use Cases
- Core Scenarios with boundaries serve as Non-Use Cases

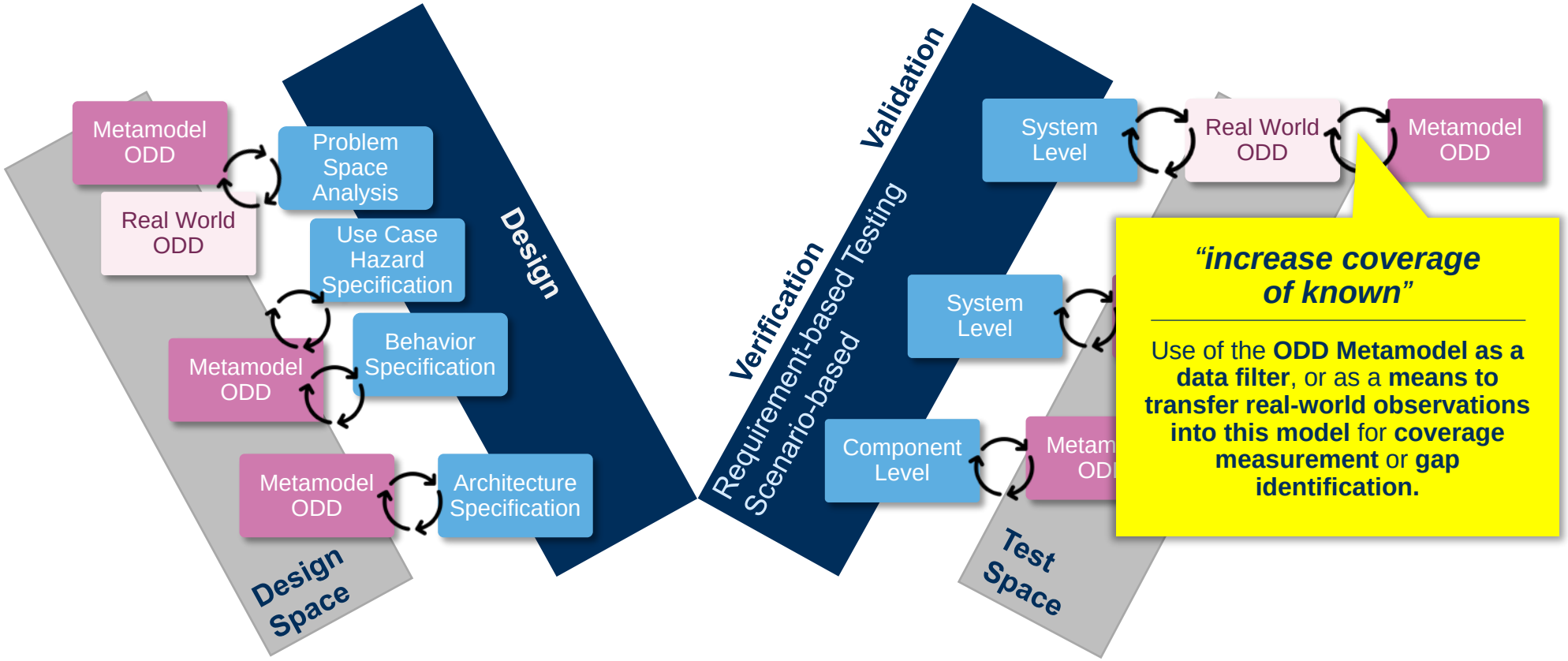
The ODD Metamodel

… using the ODD Metamodel for **Verifying and Validating** an AD-System …



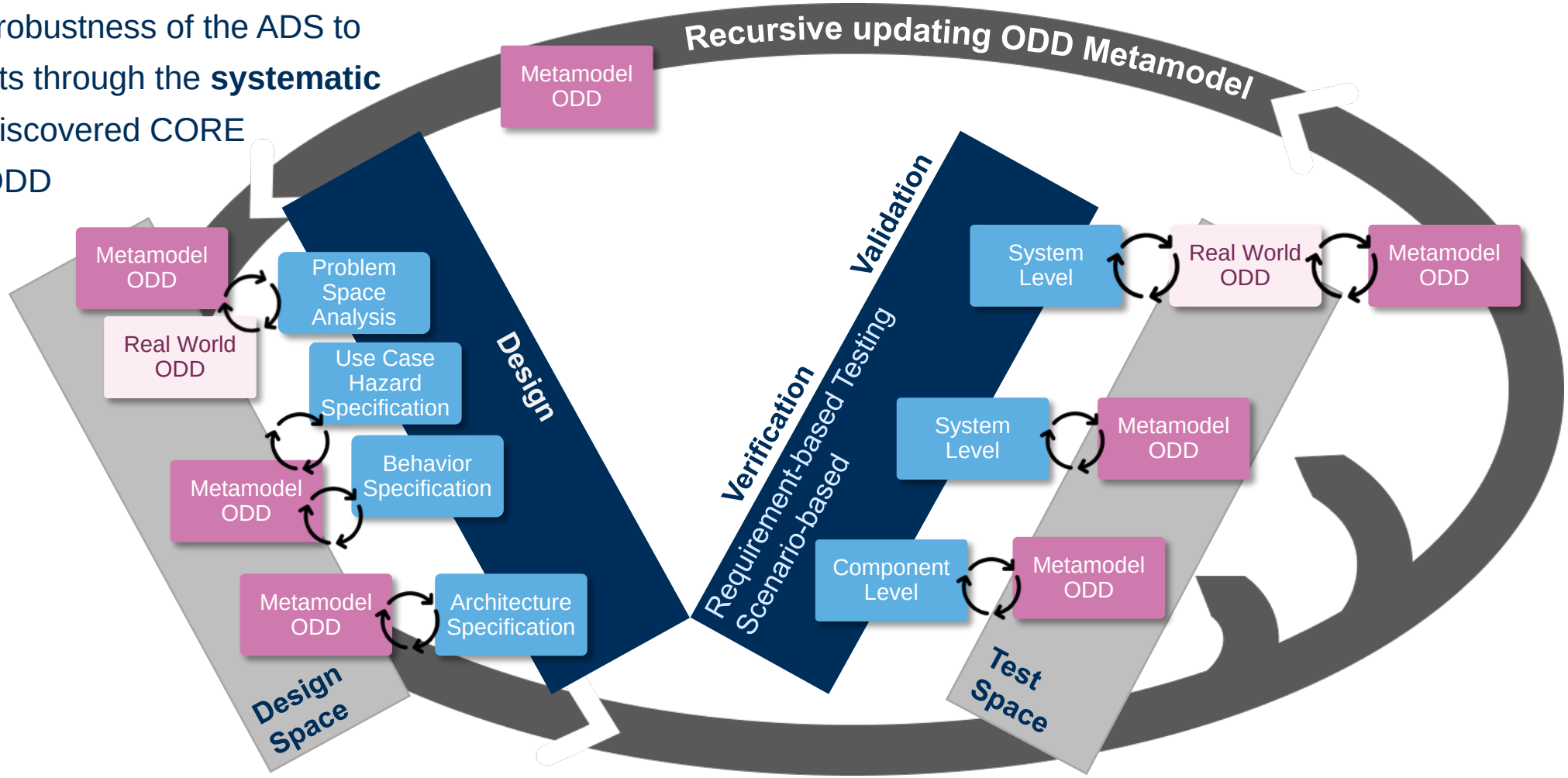
The ODD Metamodel

… validate the Completeness of the ODD Metamodel by **identifying** undiscovered **CORE Scenario Classes** or relevant **Domain Characteristics**...

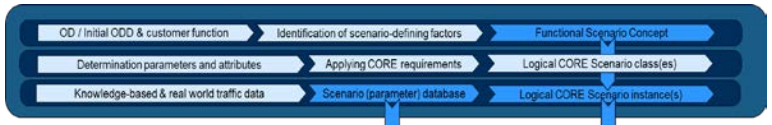


The ODD Metamodel

… increase the robustness of the ADS to hazardous events through the **systematic integration** of discovered CORE scenarios and ODD characteristics into the ODD Metamodel...



The ODD Metamodel



Initial Solution

… this is performed until a statistically relevant Driving Distance is achieved, with the possibility of uncovering unspecified Situations.

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View on ODD Metamodel against der background of Argumentation

VVM: “The ODD Metamodel is the building block of the safety Case.”

With the CORE scenarios, the **ODD Metamodel provides** (a sufficiently complete set of) classes of scenarios in which the **AD-system is designed to operate**.

- The ODD Metamodel is validated in the real world to ensure that the **ODD Metamodel is a valid representation of the real-world target ODD** with respect to the set of CORE scenarios and their declared parameters.
- **Systematic Problem Space Analysis** is performed on the ODD Metamodel. This **provides the basis for a deep, fundamental understanding of the environment and the inherent hazards** in which the AD system to be developed will operate.
- **A systematic hazard and risk analysis** identifies both the events within the core scenarios in which a **failure of the ego-vehicle function may occur**, as well as systemically **inherently hazardous conditions within the interaction between the ADS and its environment** that must be avoided.
- **Scenario-based testing** as well as **statistical analysis of endurance runs** are based on the **same scenario model** that was **used during Problem Space Analysis** and specifying **target** (safety) **behavior** of the ADS.

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Thank you!

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PROJECT of the PEGASUS FAMILY

VDA LEITINITIATIVE

A project developed by the VDA Leitinitiative
autonomous and connected driving

Supported by:

Federal Ministry
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