

VERIFICATION
VALIDATION
METHODS

Final Event 21 / 22 November 2023

Operational Concept: ODD Description Creation, Ontology, Omega Format

Kai Storms, TU Darmstadt

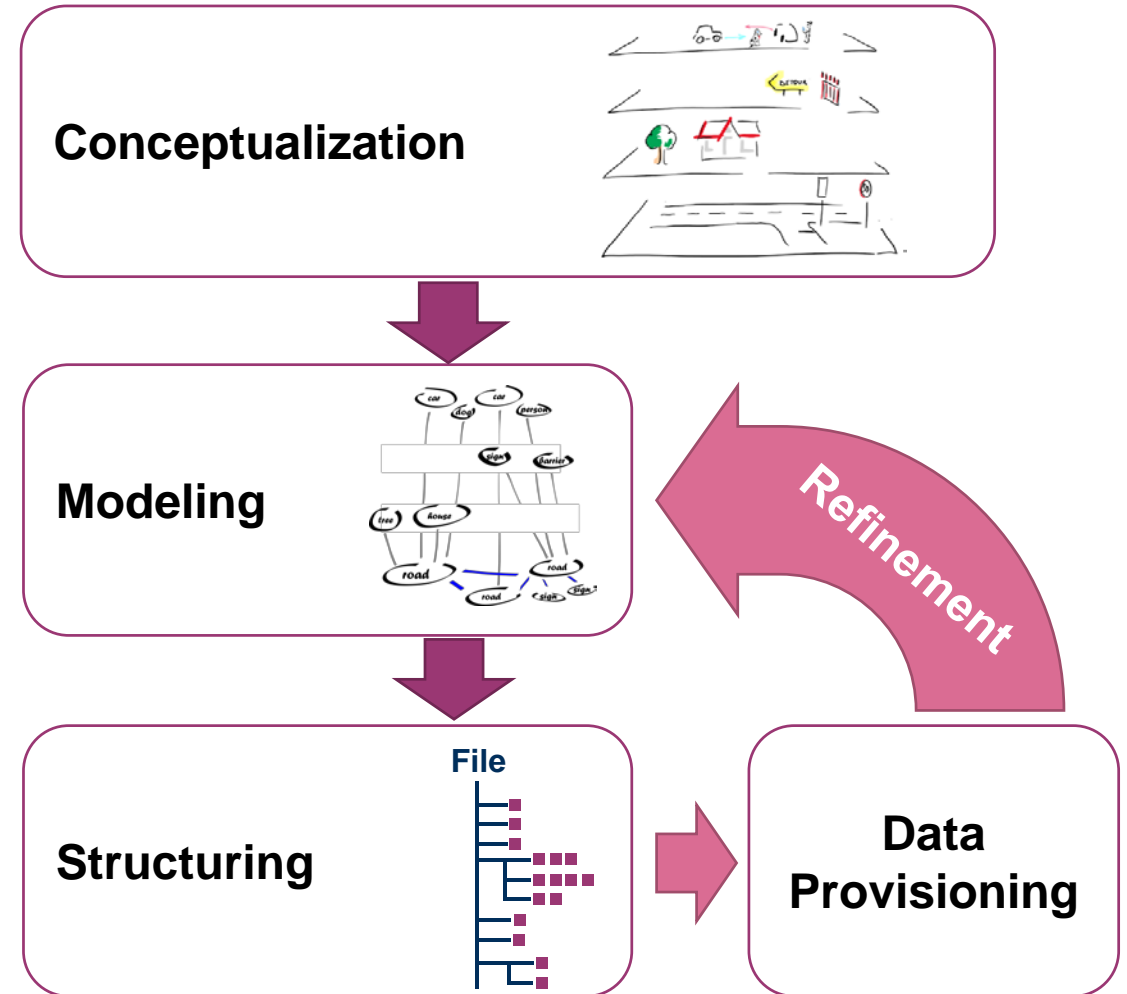
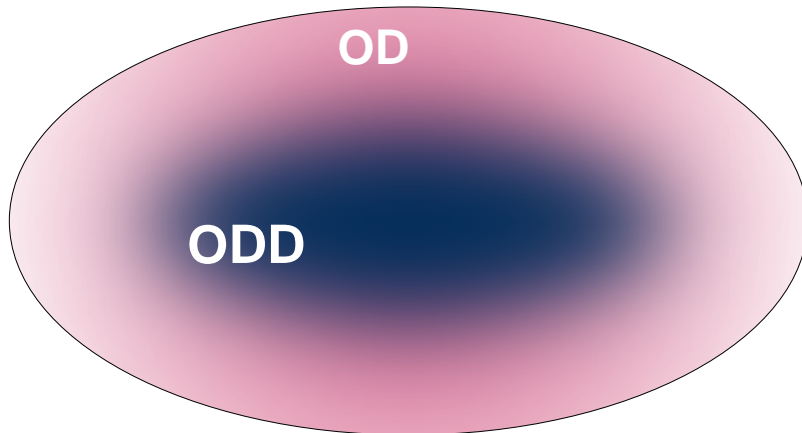
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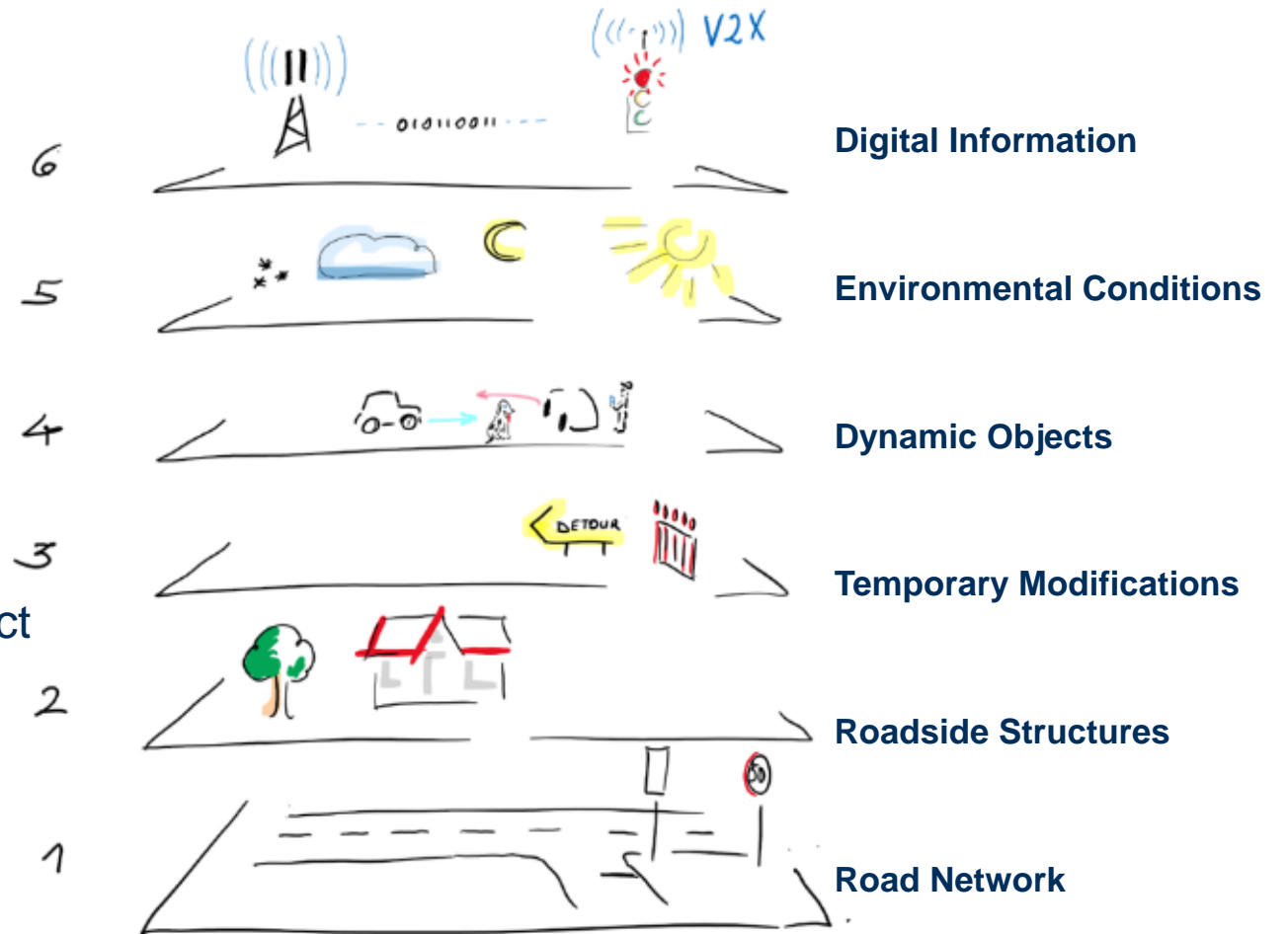
Structuring the OD

- ▶ To accurately test the targeted ODD
 - ▶ Which tools are necessary to describe the ODD?
 - ▶ How to enable targeted tests?
 - ▶ How to account for open context?



Conceptualization

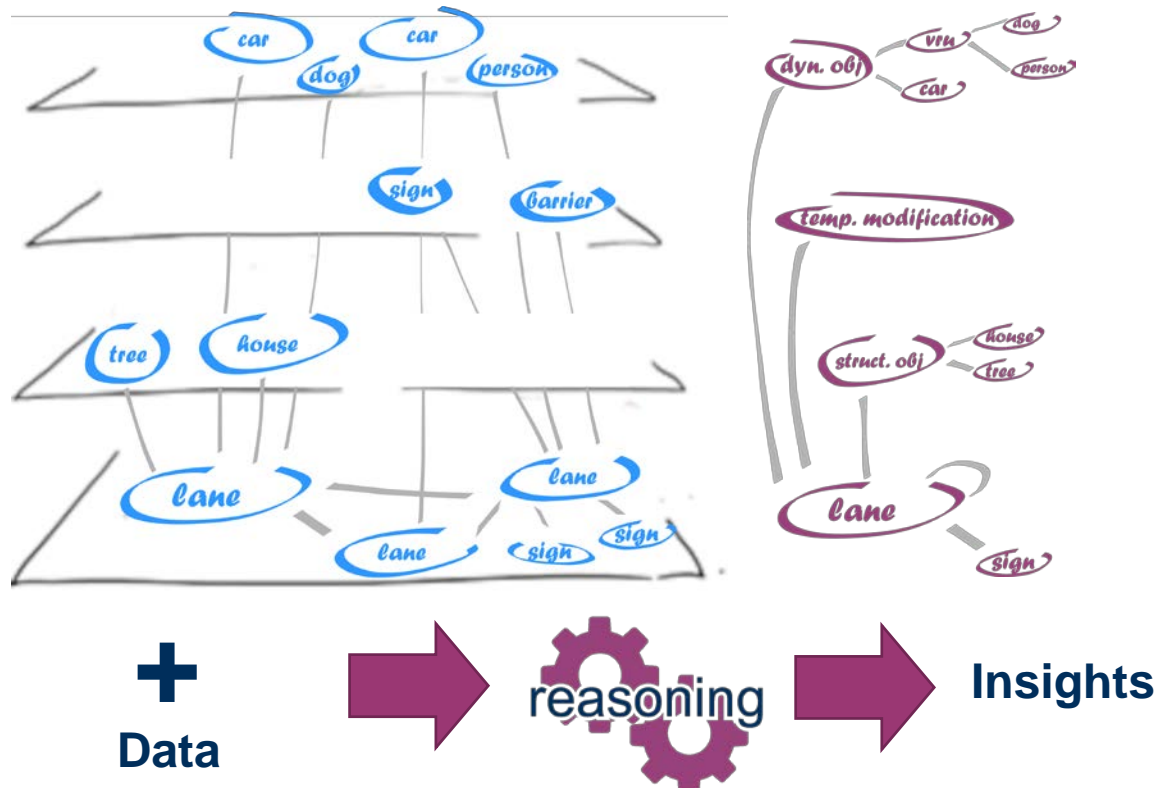
- ▶ Common “abstraction of reality” for the OD
- ▶ Introduces basic entity categories
- ▶ Starting point for all further description



- ▶ 6-Layer Model

- ▶ Continuation of work from Pegasus project
- ▶ Basis for ontology & data format

M. Scholtes *et al.*, "6-Layer Model for a Structured Description and Categorization of Urban Traffic and Environment," in *IEEE Access*, vol. 9, pp. 59131-59147, 2021, doi: 10.1109/ACCESS.2021.3072739



- ▶ Suitable tool to formalize and describe the OD
- ▶ Establishes relations between entities
 - ▶ Both **abstract** for classes
 - ▶ And **concrete** for individuals
- ▶ Enables **reasoning** to gain **insights**



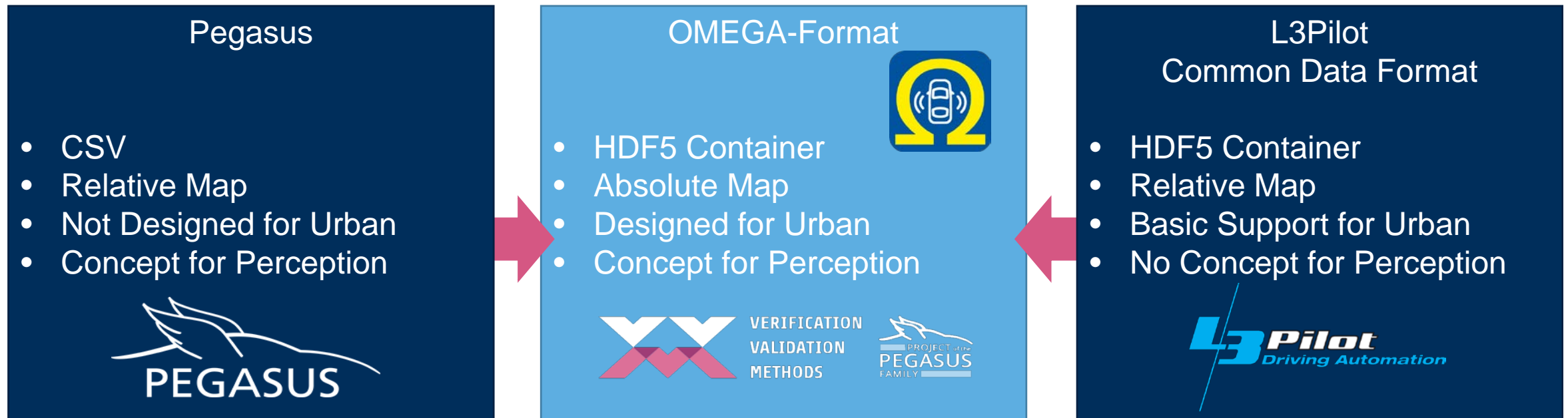
- ▶ Automotive Urban Traffic Ontology (A.U.T.O.)
- ▶ Insights into **criticality phenomena**
 - ▶ „What is the relation between an individual and criticality?“

L. Westhofen, C. Neurohr, M. Butz, M. Scholtes and M. Schuldes, "Using Ontologies for the Formalization and Recognition of Criticality for Automated Driving," in *IEEE Open Journal of Intelligent Transportation Systems*, vol. 3, pp. 519-538, 2022, doi: 10.1109/OJITS.2022.3187247



OMEGA Format - Evolving Data Formats

- ▶ Data Format realizing 6-Layer Model and A.U.T.Ontology
- ▶ Unifying Map and Object-list based Trajectory Data in a hierarchical Format
- ▶ Omega Format - A Comprehensive Open-Source Measurement Data Format



- Enabling automated algorithms for scenario extraction & abstraction
- Exchanged with working group of UN ECE 157

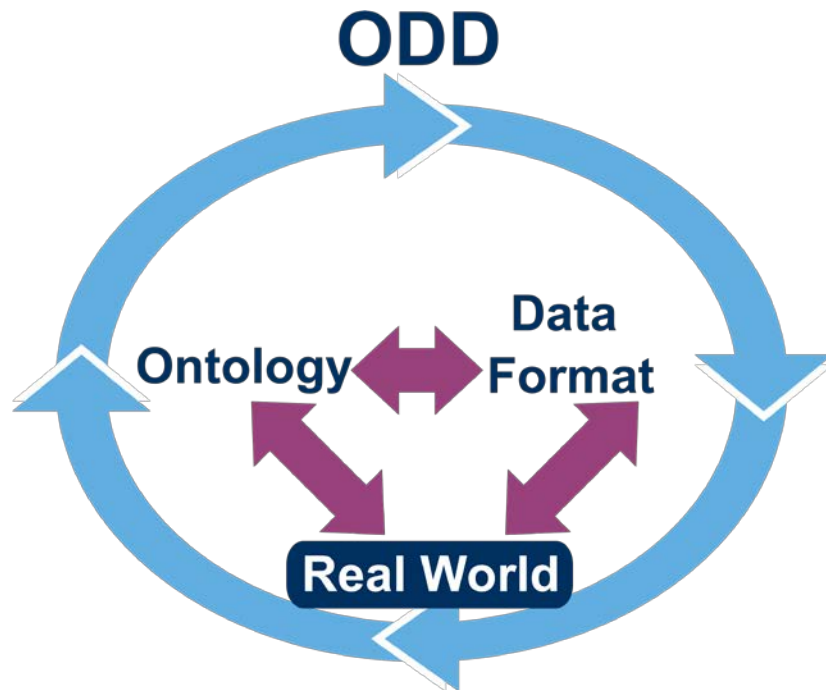
#7.2

Poster

Refinement – Ensuring consistency of ODD description

► Problem:

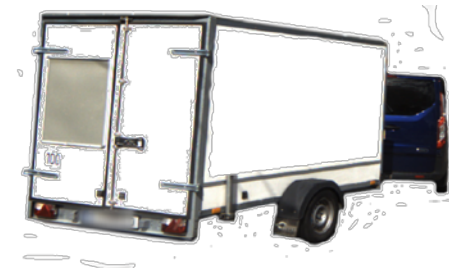
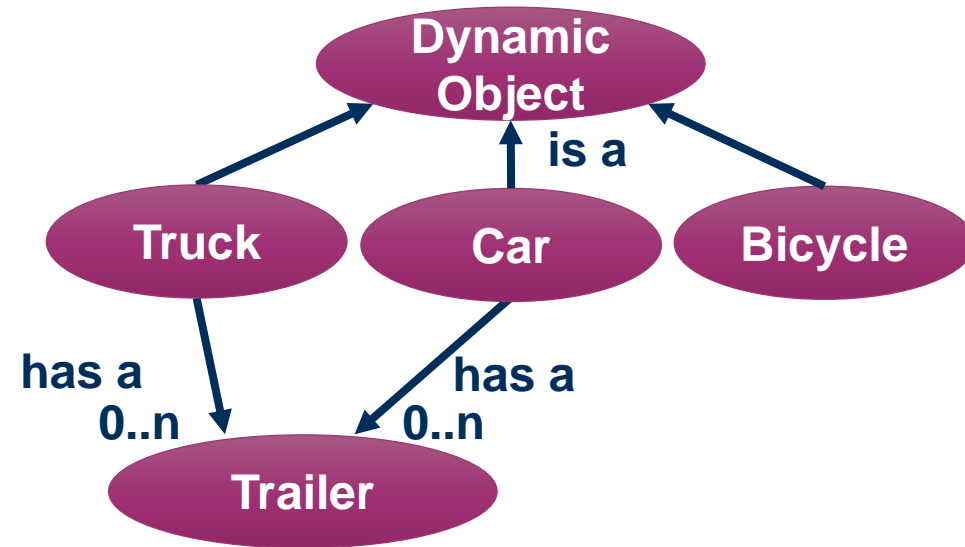
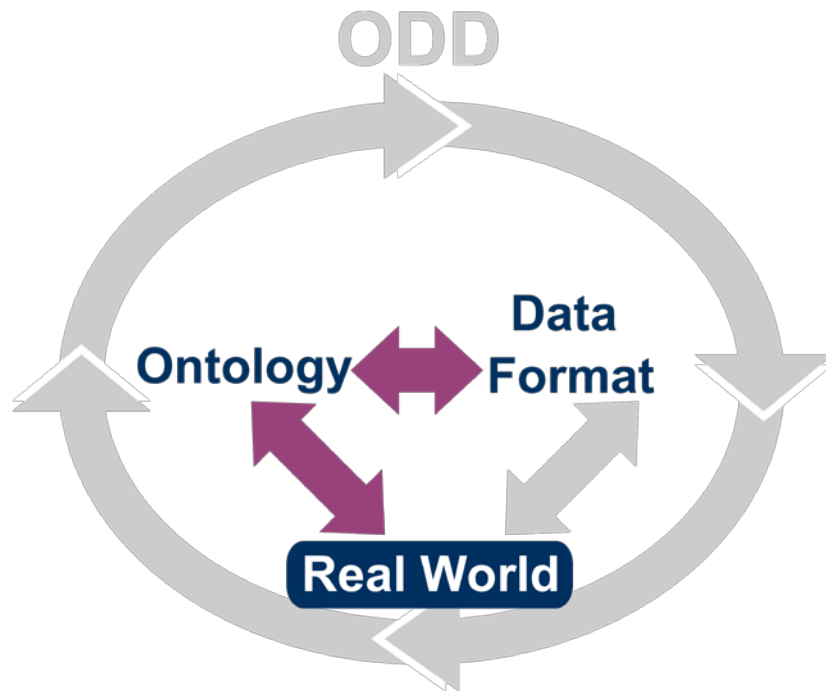
- Does the ontology **cover** the ODD?
- Does the ontology **precisely** represent the ODD?
- Do the formats enable **usable** description?



Refinement – Ensuring consistency of ODD description

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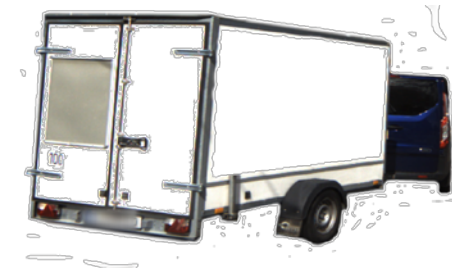
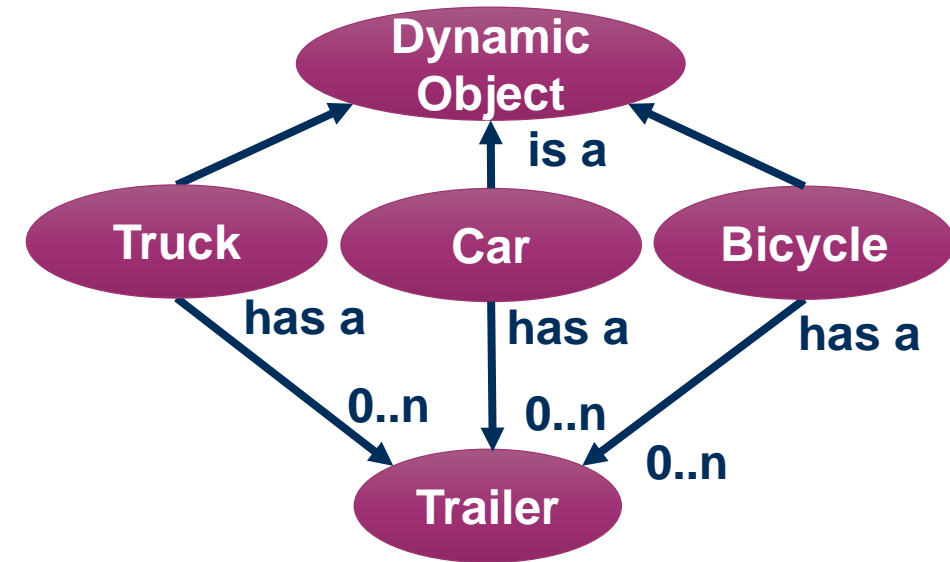
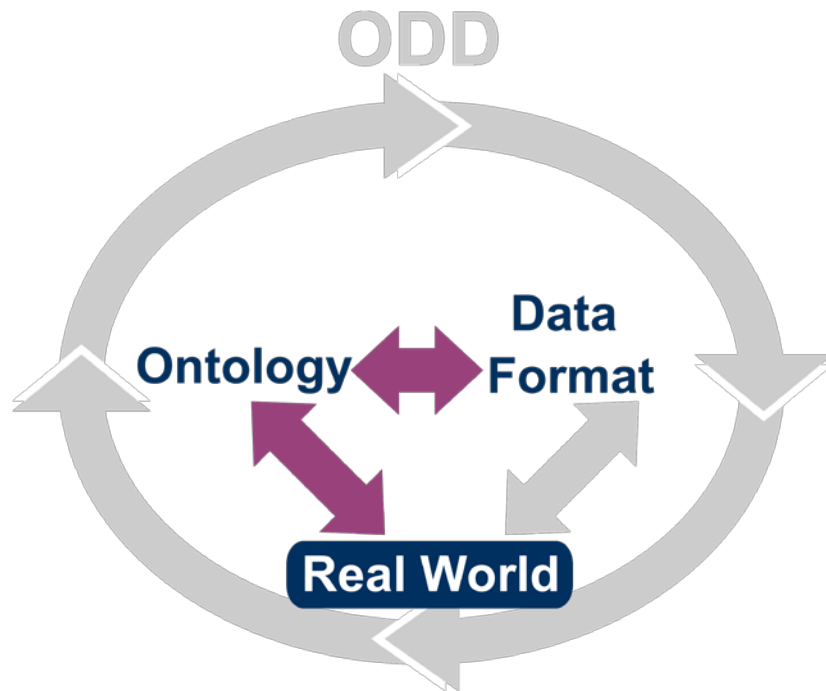
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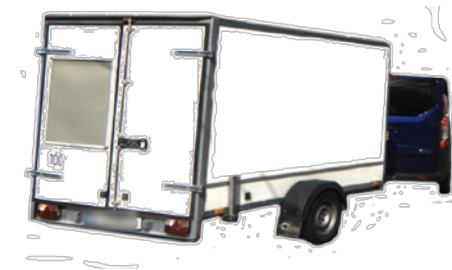
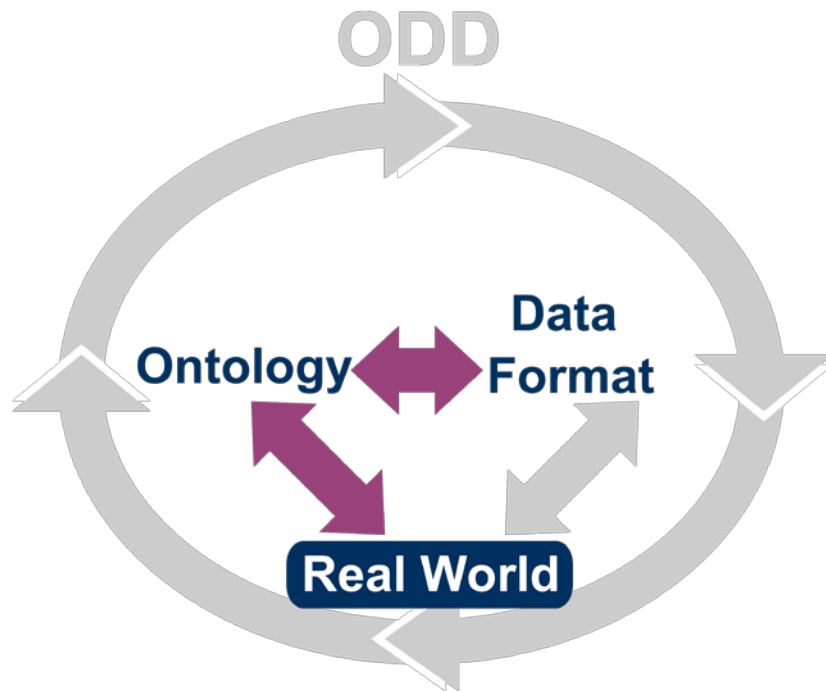
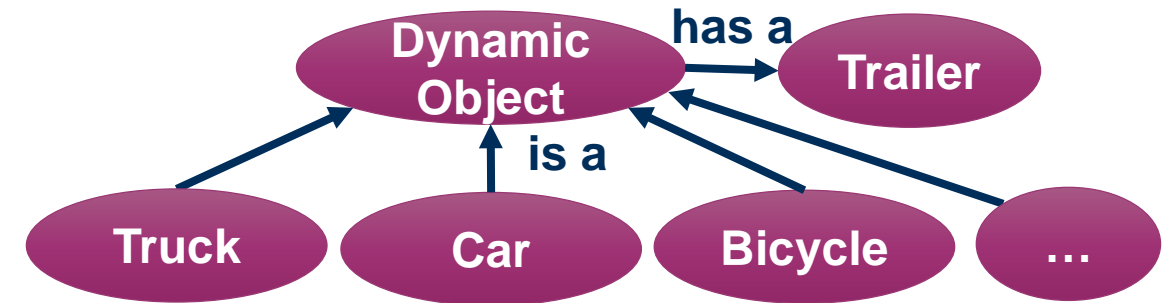
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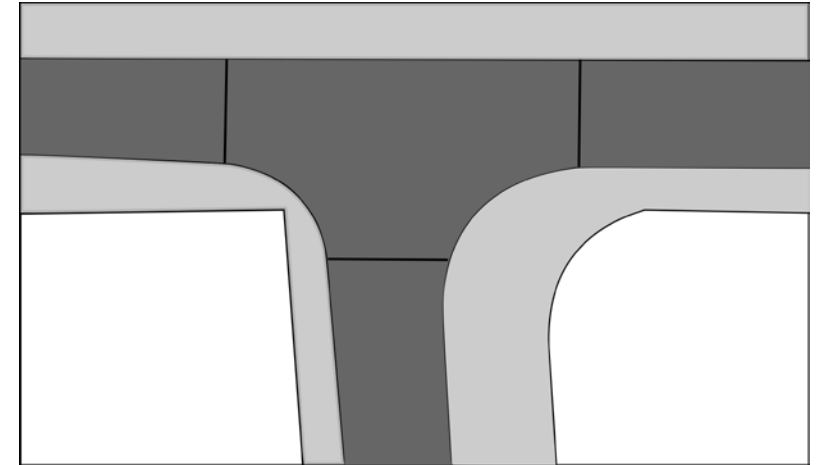
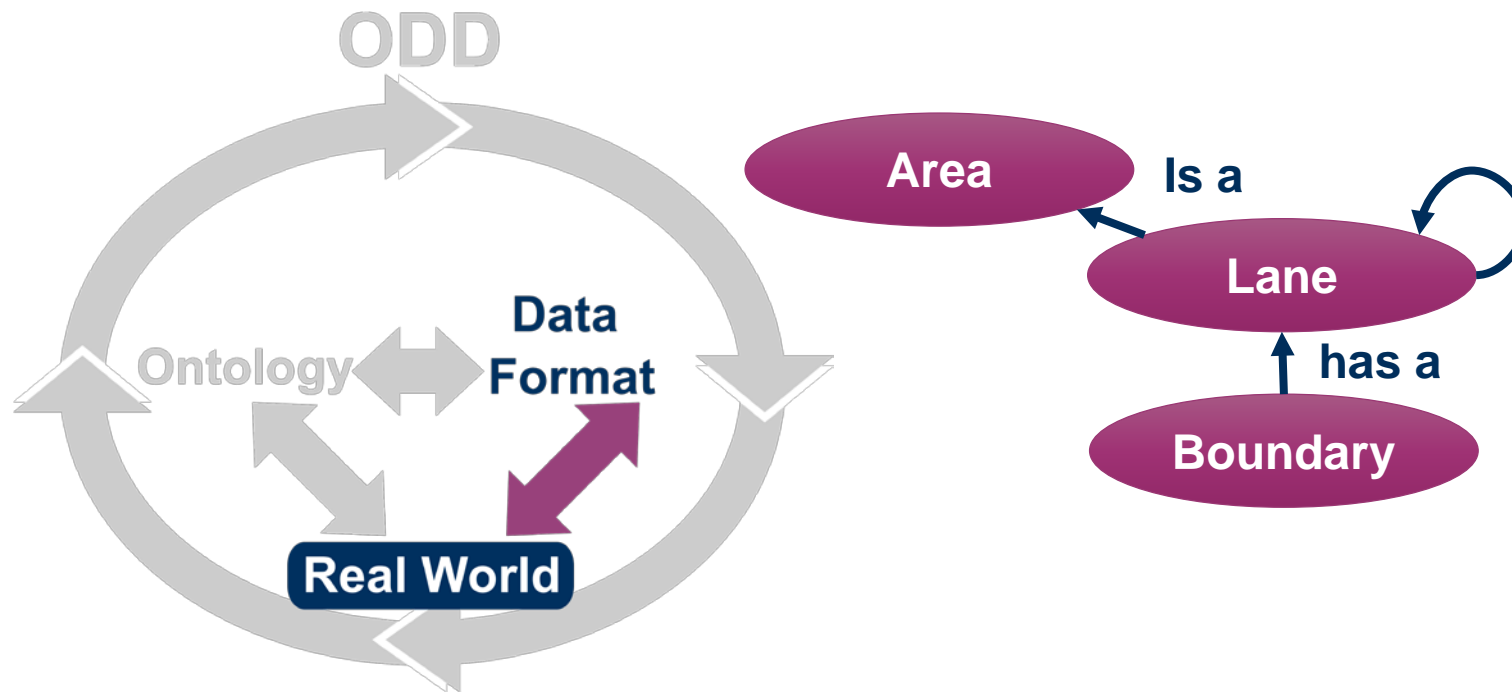
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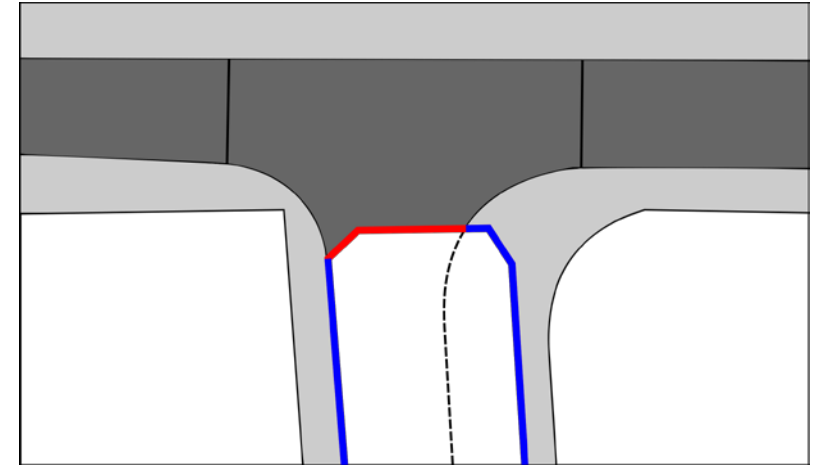
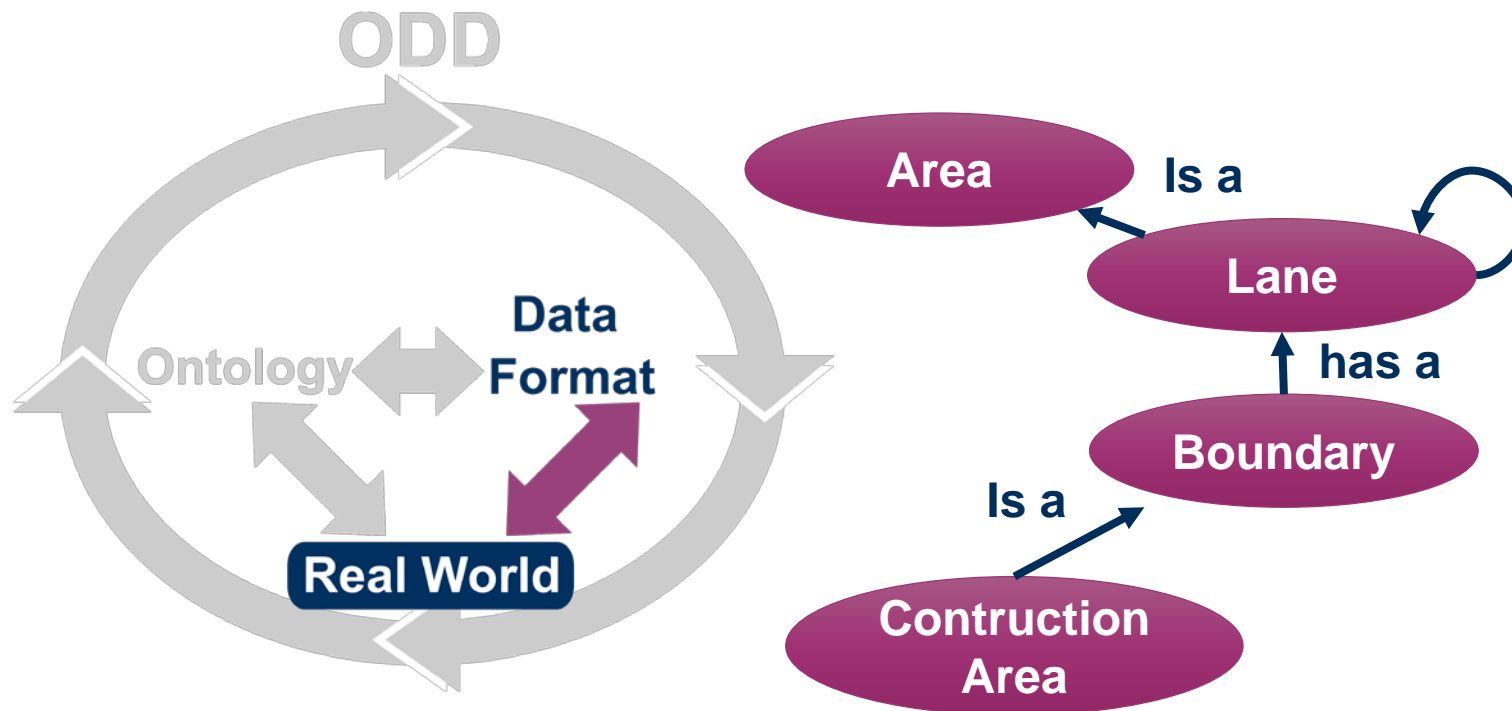
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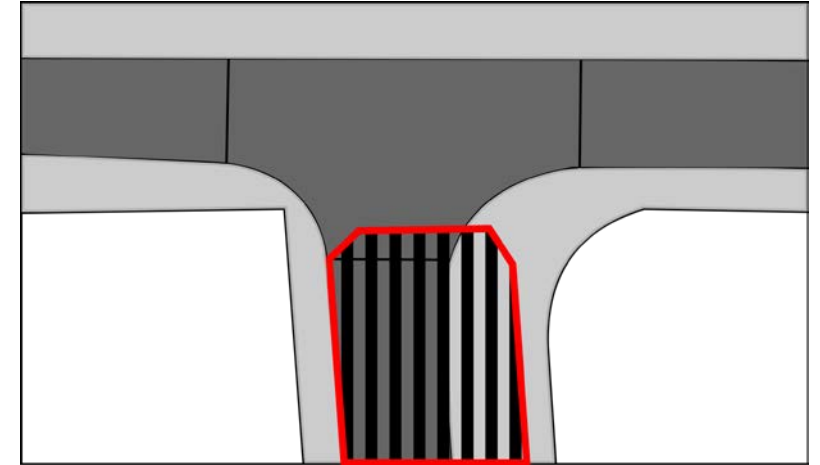
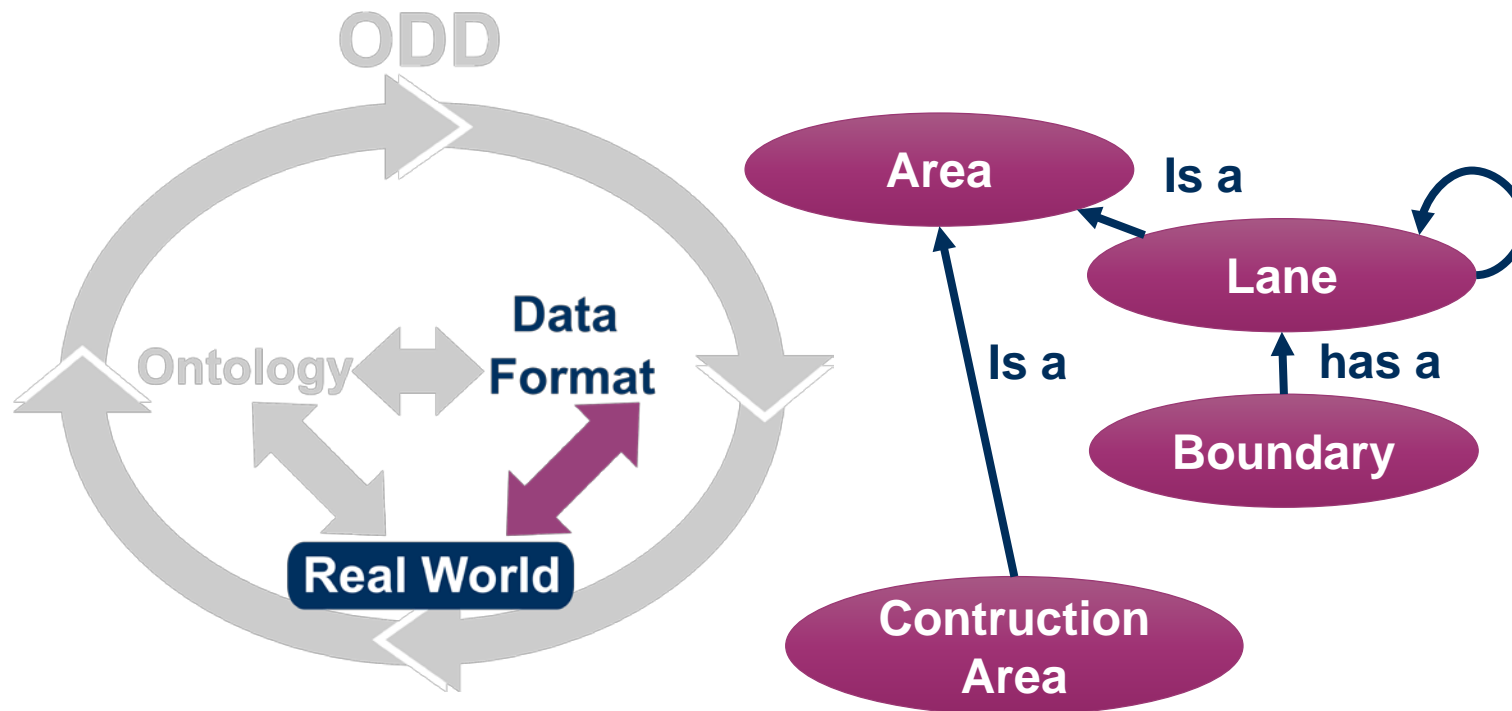
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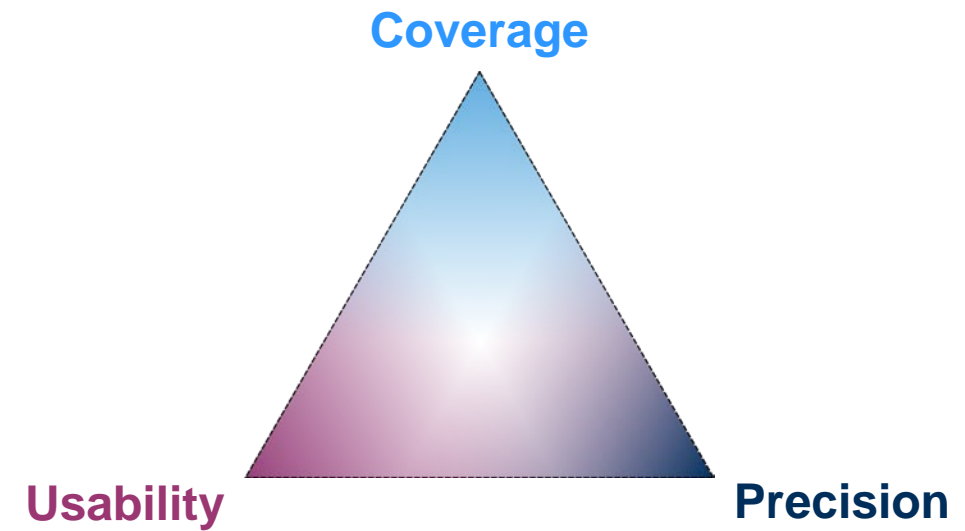
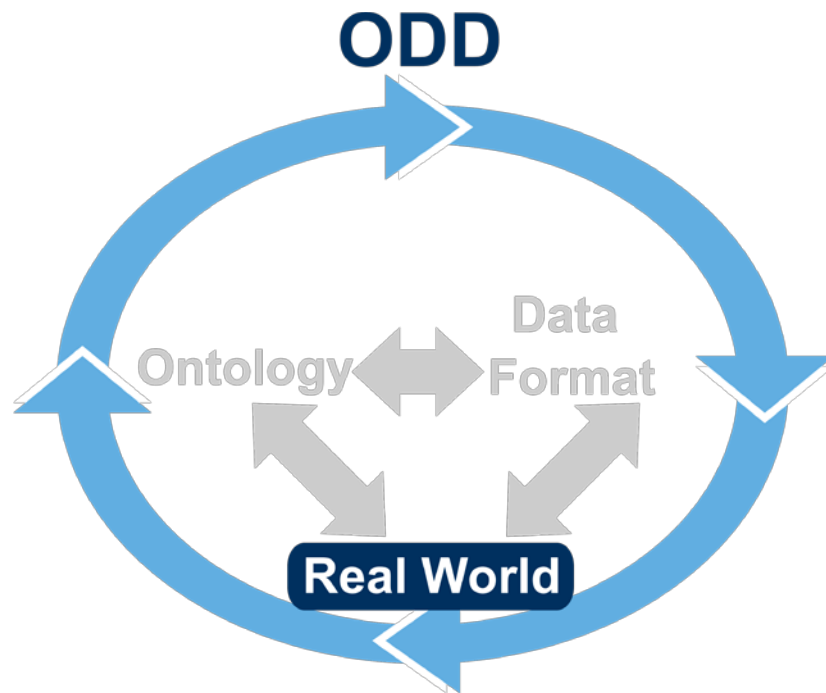


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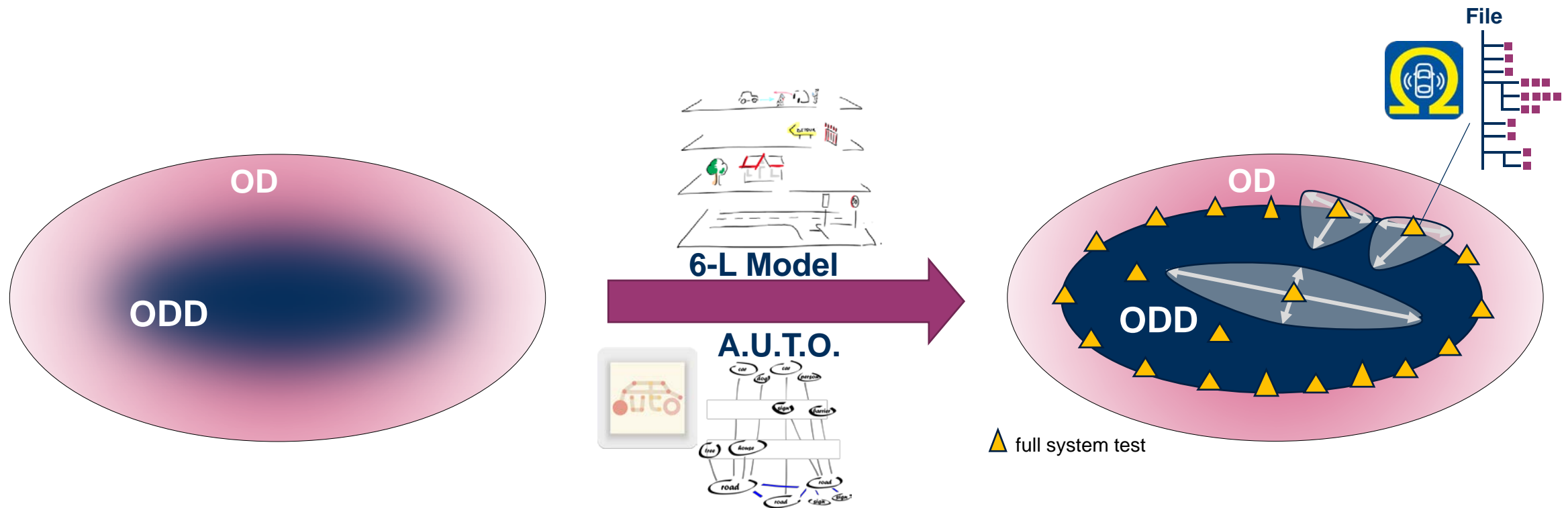
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➔ **Tradeoff**



Enabling a clear picture of the OD

- ▶ **Conceptualization & Modeling** for a clear picture of the OD & ODD
- ▶ **Structuring** of scenario formats enabling targeted Tests
- ▶ **Refinement** to continuously account for open context



Thank you!

Kai Storms

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A project developed by the VDA Leitinitiative
autonomous and connected driving

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