

ASAM OpenODD Concept Project Overview

V1.0.0 Standardisation Proposal Kickoff workshop

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Online



ASAM OpenODD Motivation

Some Challenges for CAVs

11 Billion miles¹

To demonstrate with 95% confidence that AVs are 20% better than human drivers

1 N. Kalra and S. M. Paddock, "Driving to safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability?," *Transp. Res. Part A Policy Pract.*, vol. 94, no. December, pp. 182–193, 20163

Some Challenges for CAVs

11 Billion miles¹

To demonstrate with 95% confidence that AVs are 20% better than human drivers

100,000 lives²

Saved (in the next 30 years) if AVs which are 10% better than human drivers are introduced

1 N. Kalra and S. M. Paddock, "Driving to safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability?," *Transp. Res. Part A Policy Pract.*, vol. 94, no. December, pp. 182–193, 20163

2 N. Kalra and D. G. Groves, *The Enemy of Good*. 2017

Why is ODD important?

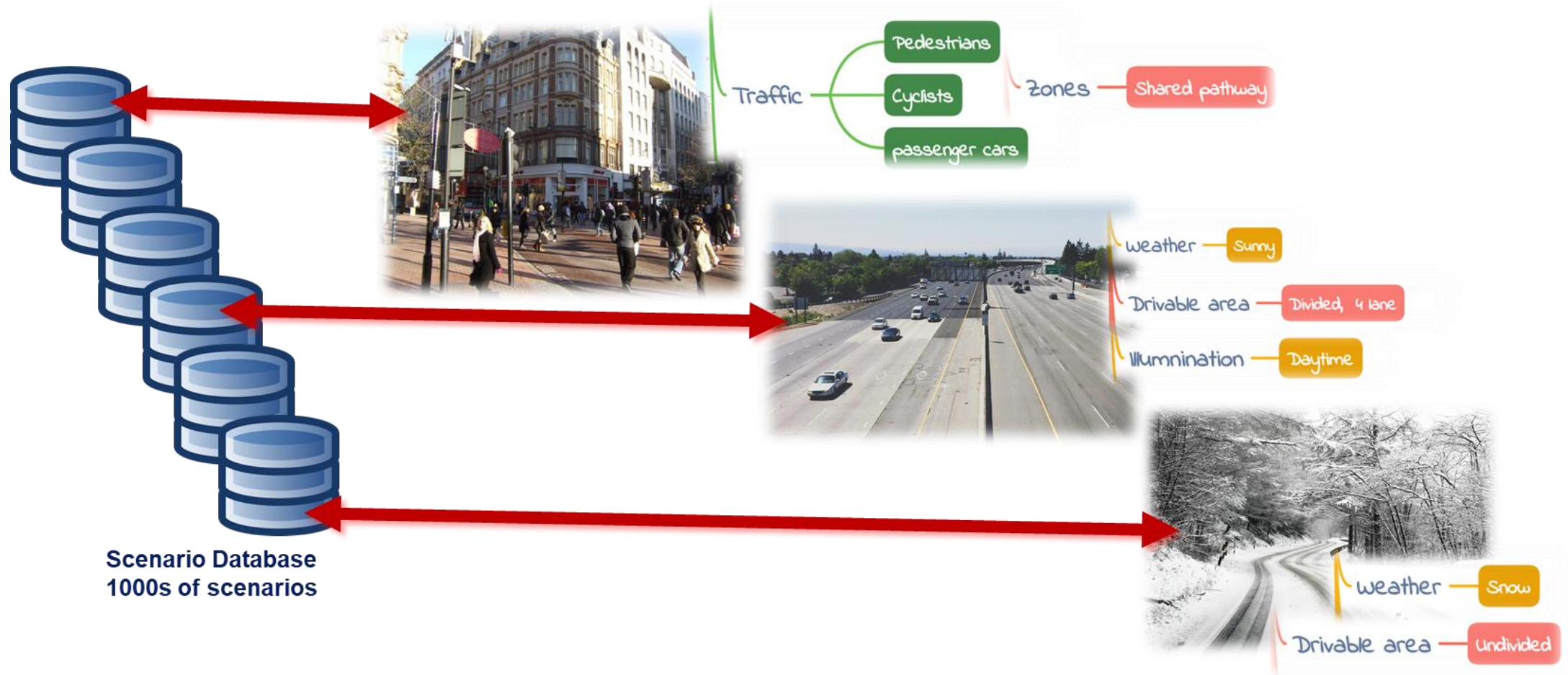
- Number of miles driven?
- Types of scenarios experienced?



Why is ODD important?



Scenario mapping to ODD



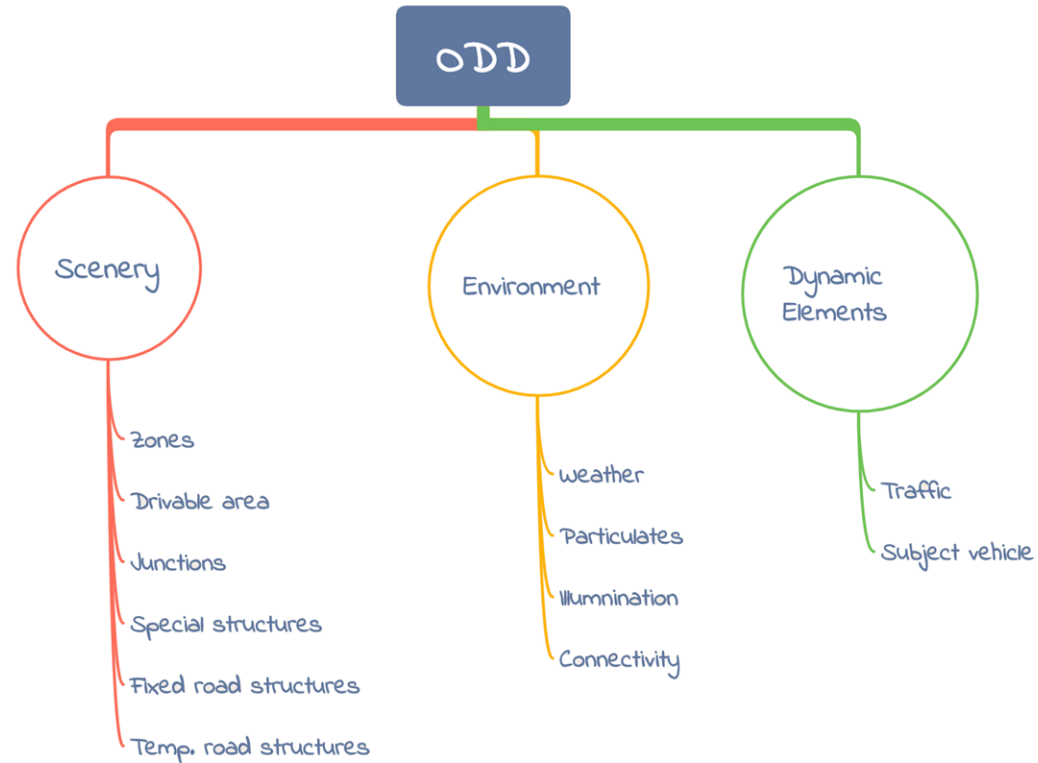
ODD considerations

What is an ODD?

*“**Operating conditions** under which a given driving automation system or feature thereof is specifically designed to function, including, but not limited to, **environmental**, **geographical**, and **time-of-day restrictions**, and/or the requisite **presence or absence** of certain traffic or roadway characteristics.”*

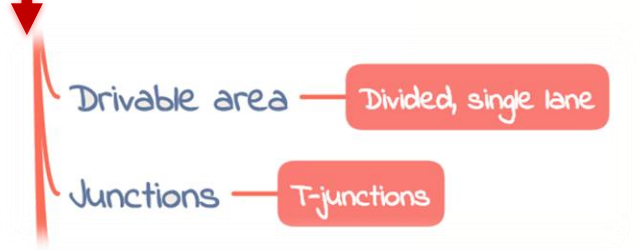
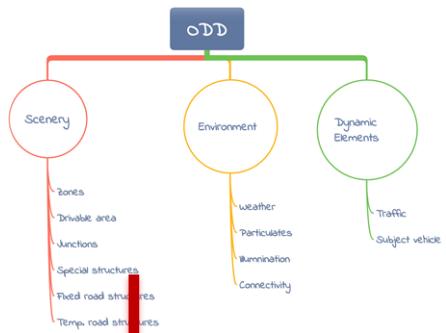
- SAE J3016 (2021)

What is an ODD?

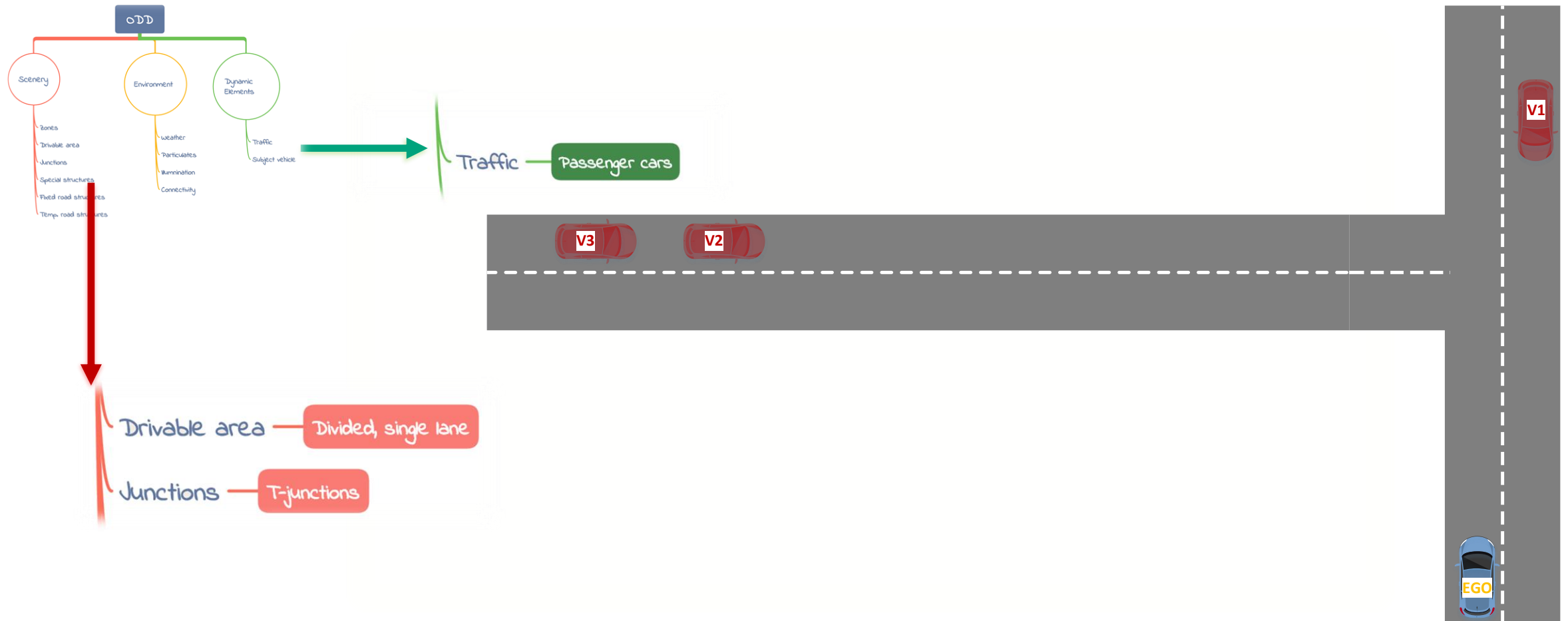


ODD Taxonomy as per BSI PAS 1883

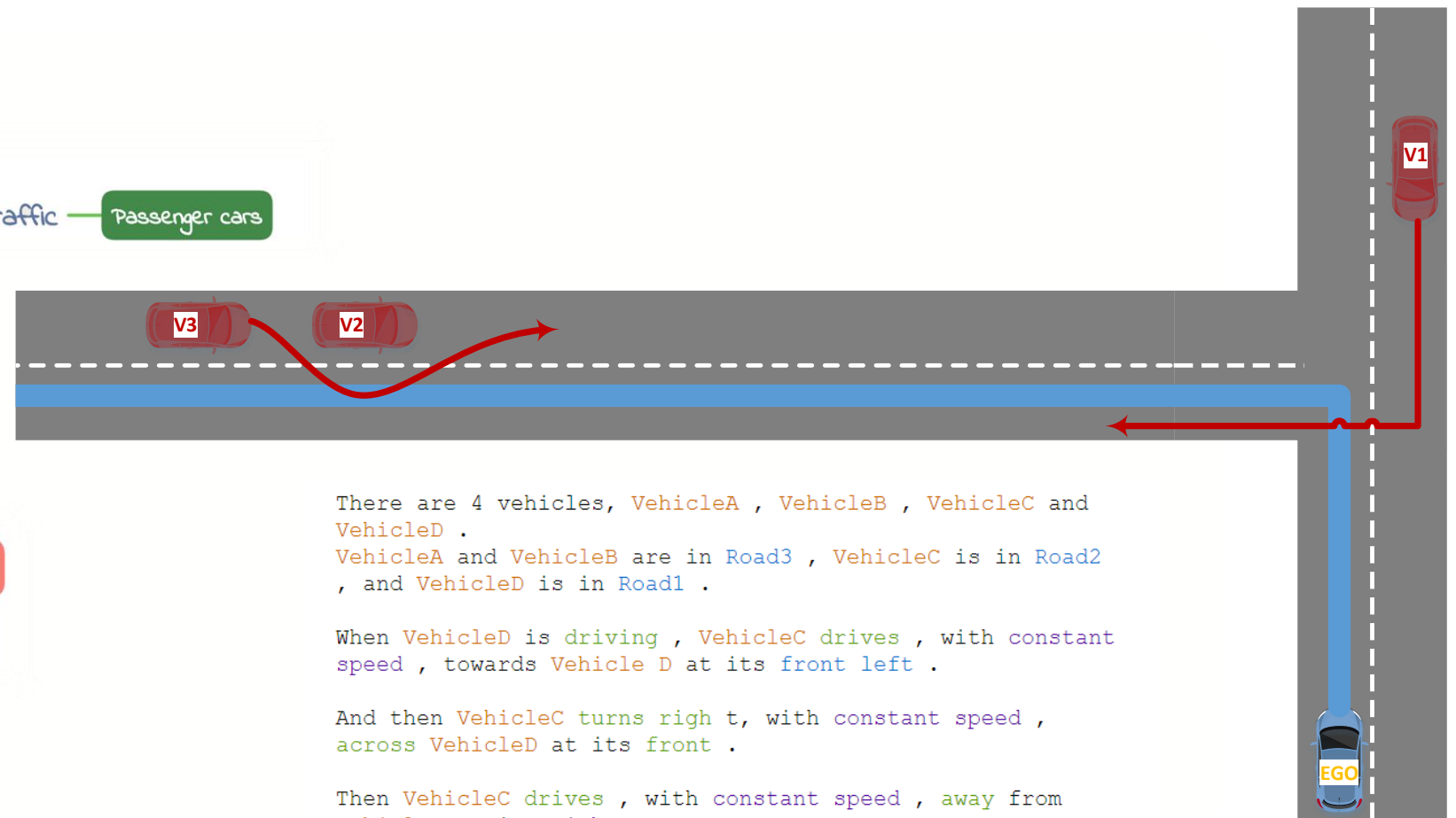
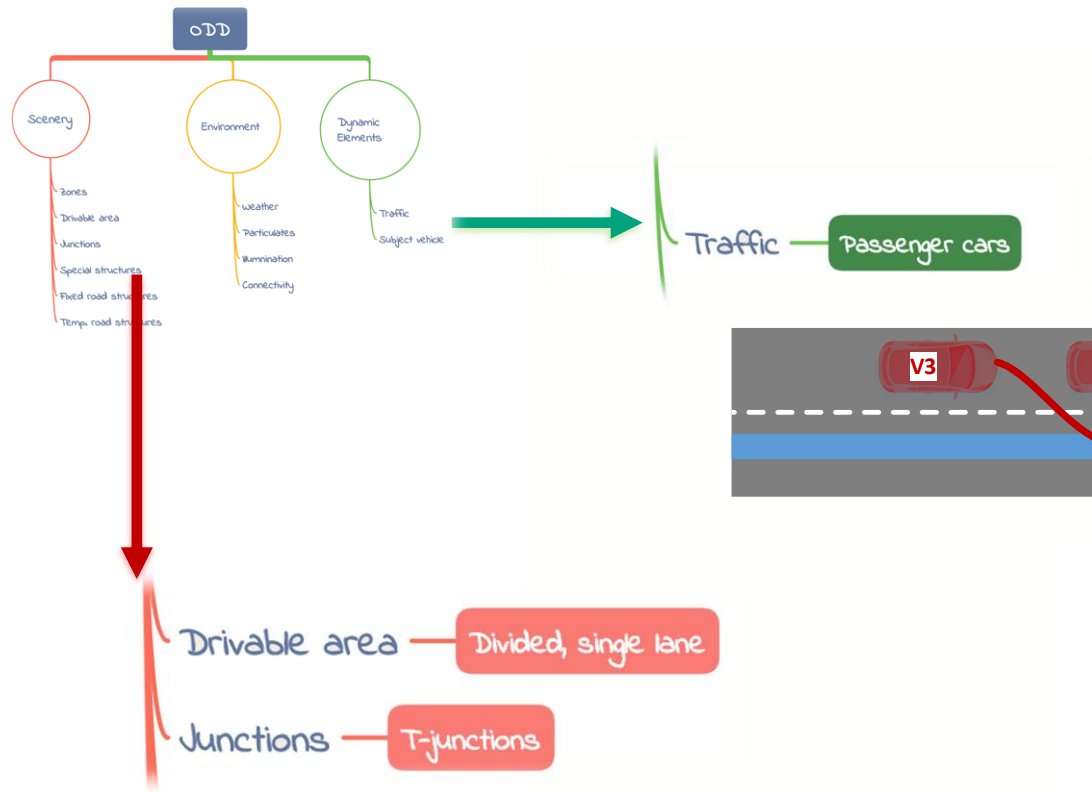
ODD and Scenario



ODD and Scenario



ODD and Scenario



ODD attributes awareness - Rainfall

- What does rainfall rate mean?
- How do we measure rainfall rate?
- Can the CAV measure it via on-board sensing only?
- How do we address local variability issues?



For more on Curious case of ODD: <https://bit.ly/CuriousCaseODD>

Other standardization activities

- Need for common understanding
- Need for collaboration
- Crowded landscape

Major activities

- BSI (UK): PAS 1883: ODD Taxonomy
- SAE: ORAD (J3259), AVSC: ODD Lexicon
- ISO: ISO 34503: ODD Taxonomy and definition format
- ASAM: OpenX family of standards



ASAM OpenODD Concept Project

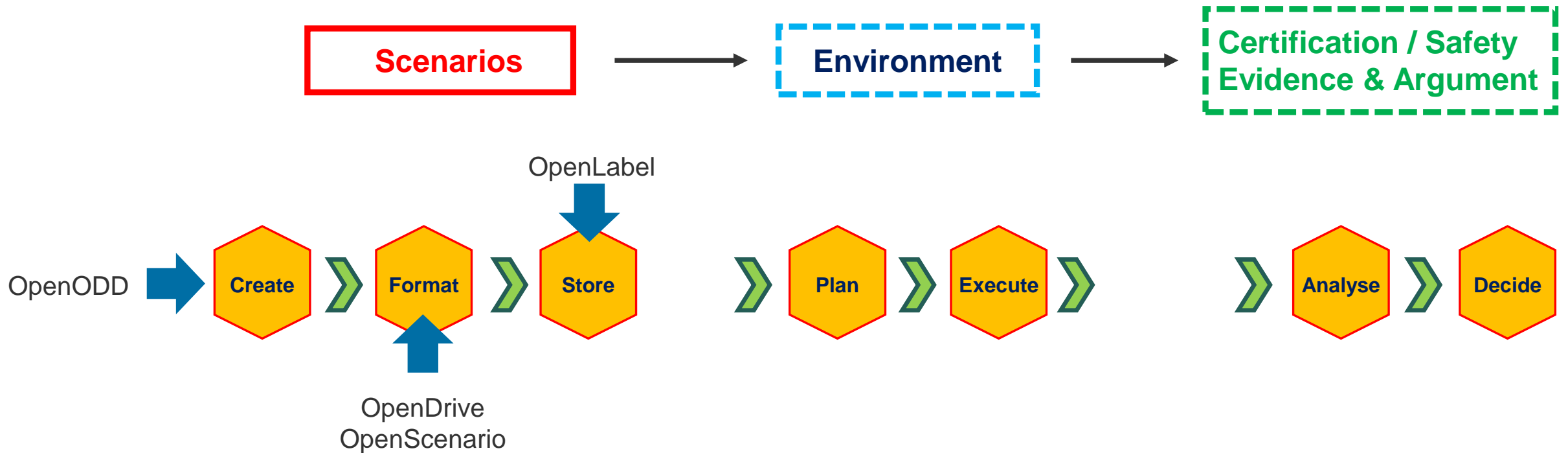
Scope and Objectives

ASAM OpenODD Concept Project: Scope and Objectives

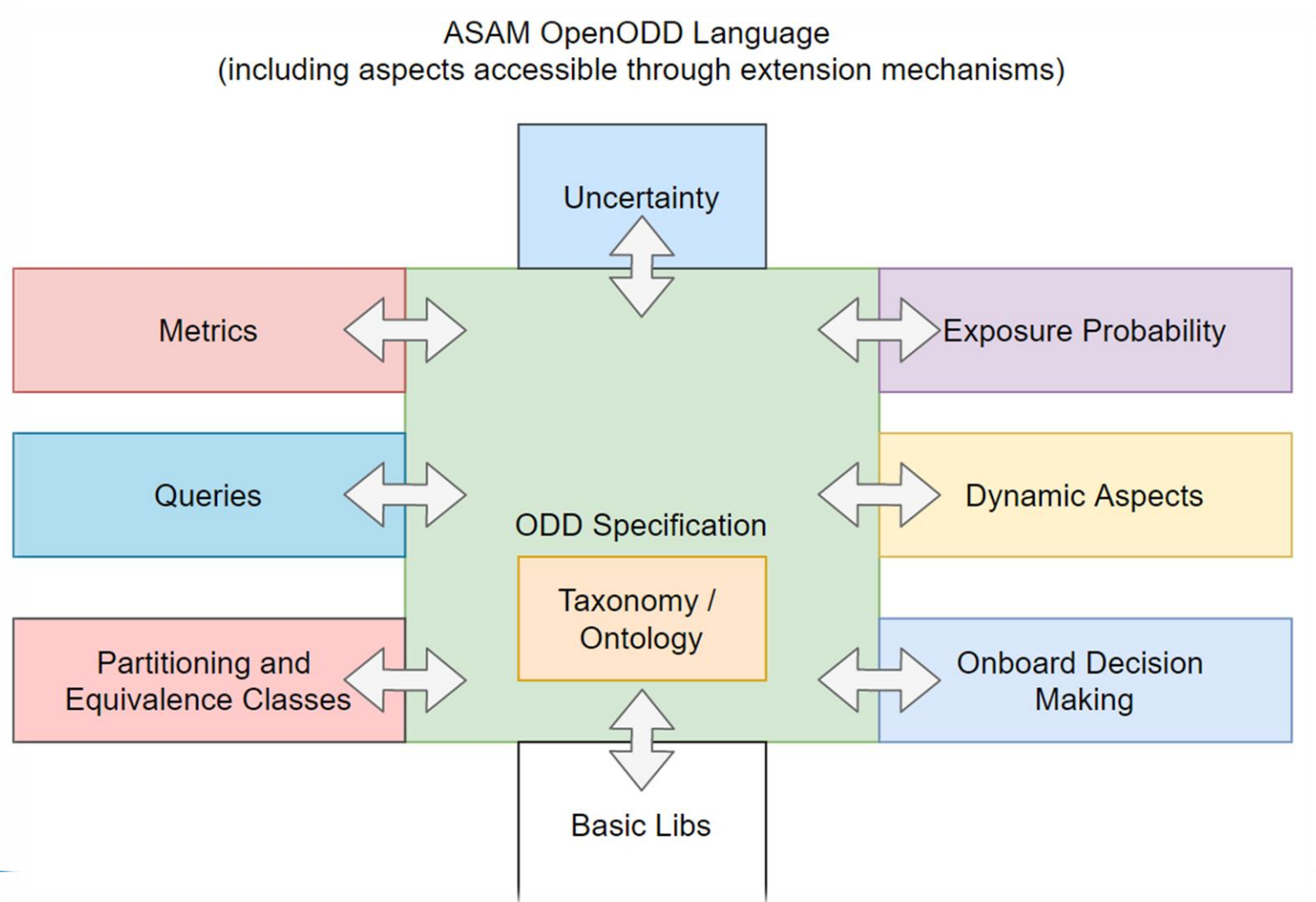
The aim is to provide a format that is capable of representing a defined Operational Design Domain for connected automated vehicles (CAV) for *simulation based testing*.

ASAM OpenODD Concept Project: Scope and Objectives

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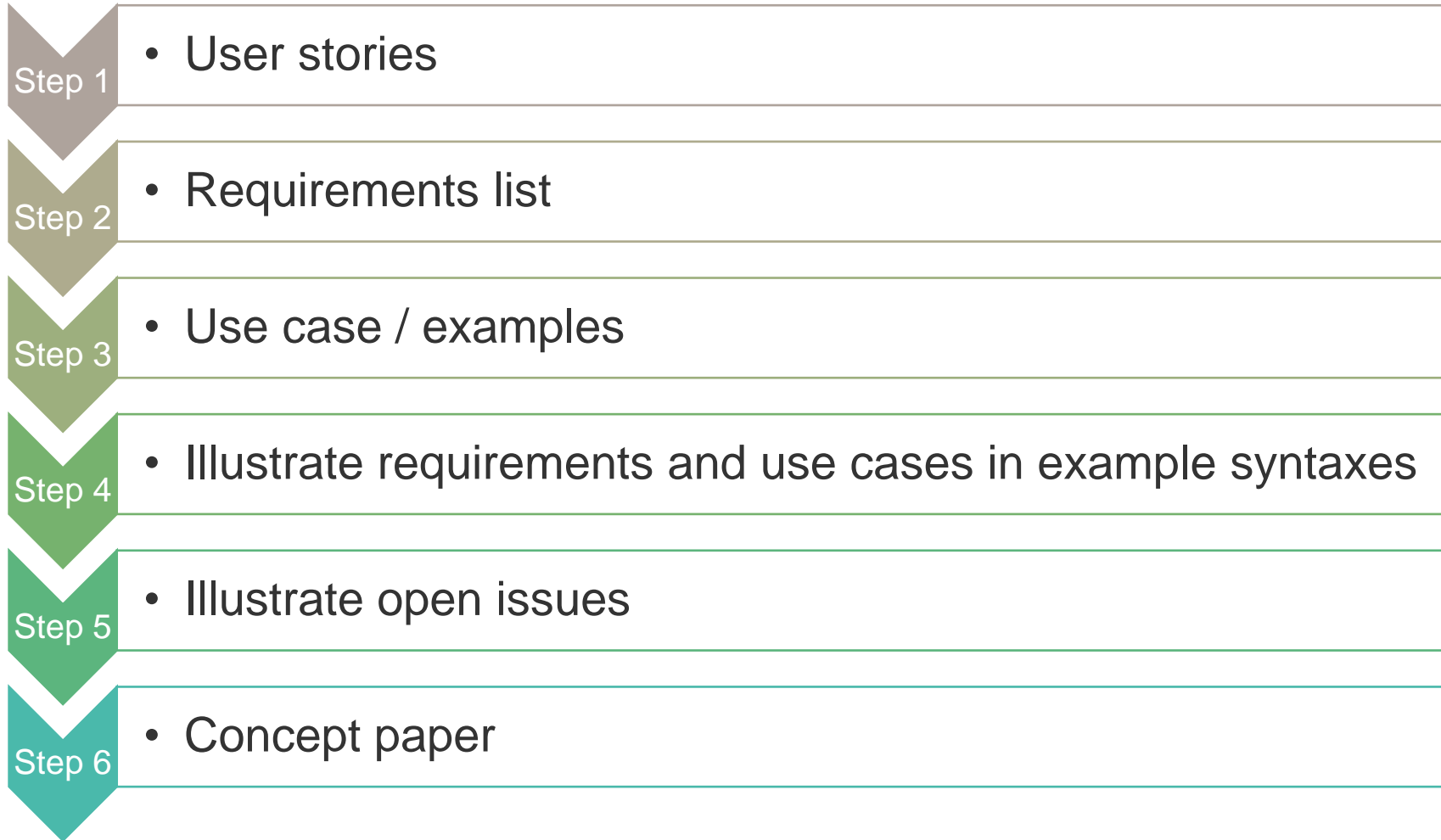
ASAM OpenODD Concept Project: Scope and Objectives



ASAM OpenODD Concept Project: work packages

- Four work packages
- **Work Package 1: Attributes:**
 - Ensure alignment with BSI PAS 1883, ISO 34503, and the ongoing ASAM OpenXOntology Project
- **Work Package 2: Specification/format**
 - Describe the semantic and syntactic description of the ODD description for format for simulation execution
- **Work Package 3: Metrics / Measurement**
 - Define and describes Metrics associated with ODD
- **Work Package 4: Uncertainty**
 - Define and describes uncertainty attributes associated with ODD

ASAM OpenODD Concept Project: workflow



ASAM OpenODD Concept Project: Requirement & Syntax illustration

REQUIREMENT: Human and machine readability

Example Use case:

An example ODD states that motorway is only suitable when there is no rain, up slope is not suitable as the vertical geometry.

Syntax 1

```
keep(road_type == motorway => odd_5.weather.rain == none)  
keep(geometry.vertical != up_slope)
```

Syntax 2

```
SUITABLE Motorway EXCEPT WHEN Rain  
UNSUITABLE Up_slope
```

Deliverables OpenODD Concept project.

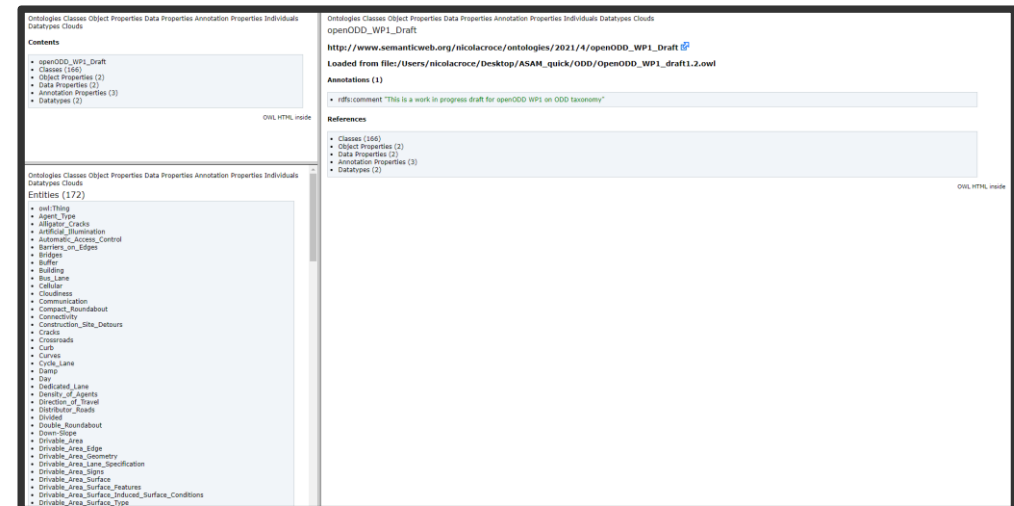
What was Released

Concept Paper

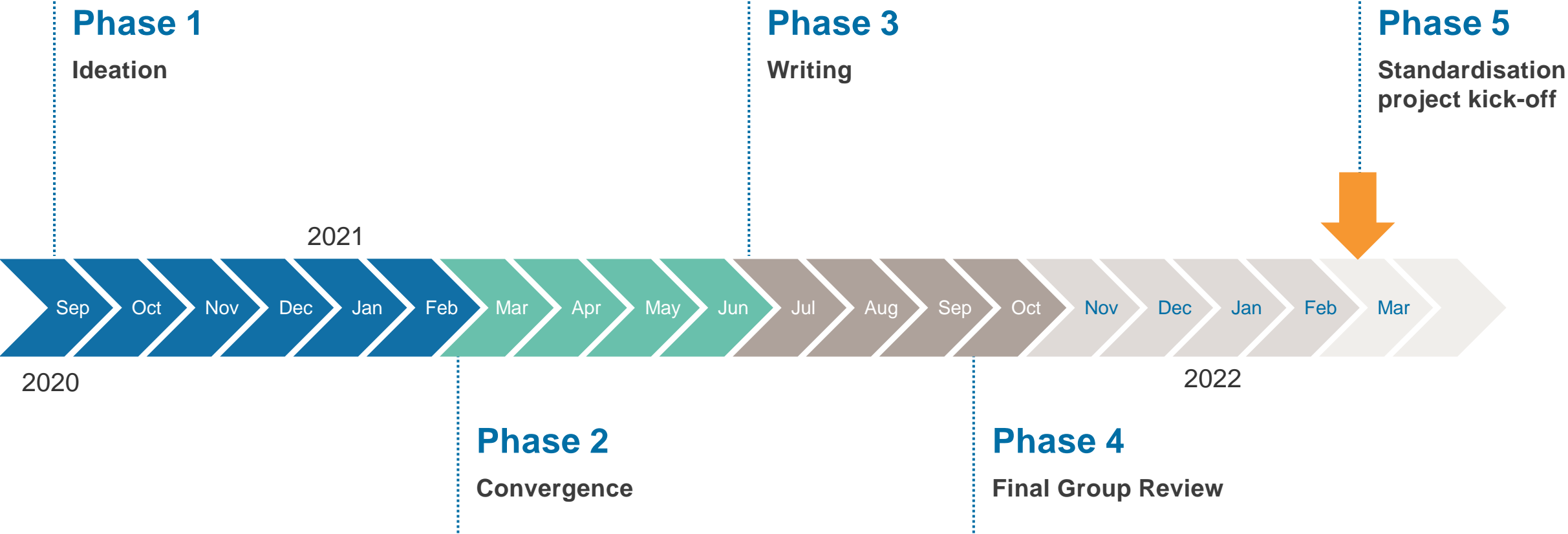
- Documentation
- Illustration in 2 example syntaxes

Ontology Web App

- Online portal with detailed ODD attributes and their ontological relationships



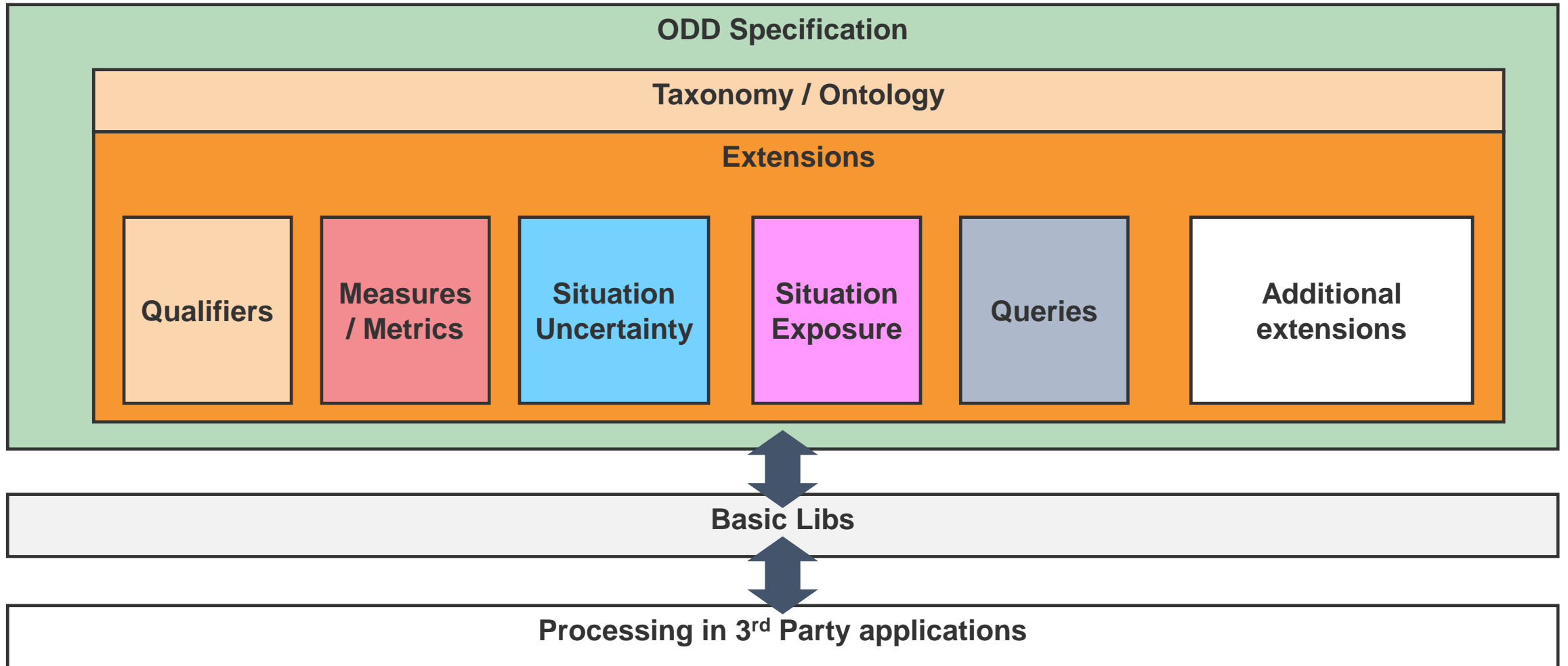
ASAM OpenODD Concept Project Timeline



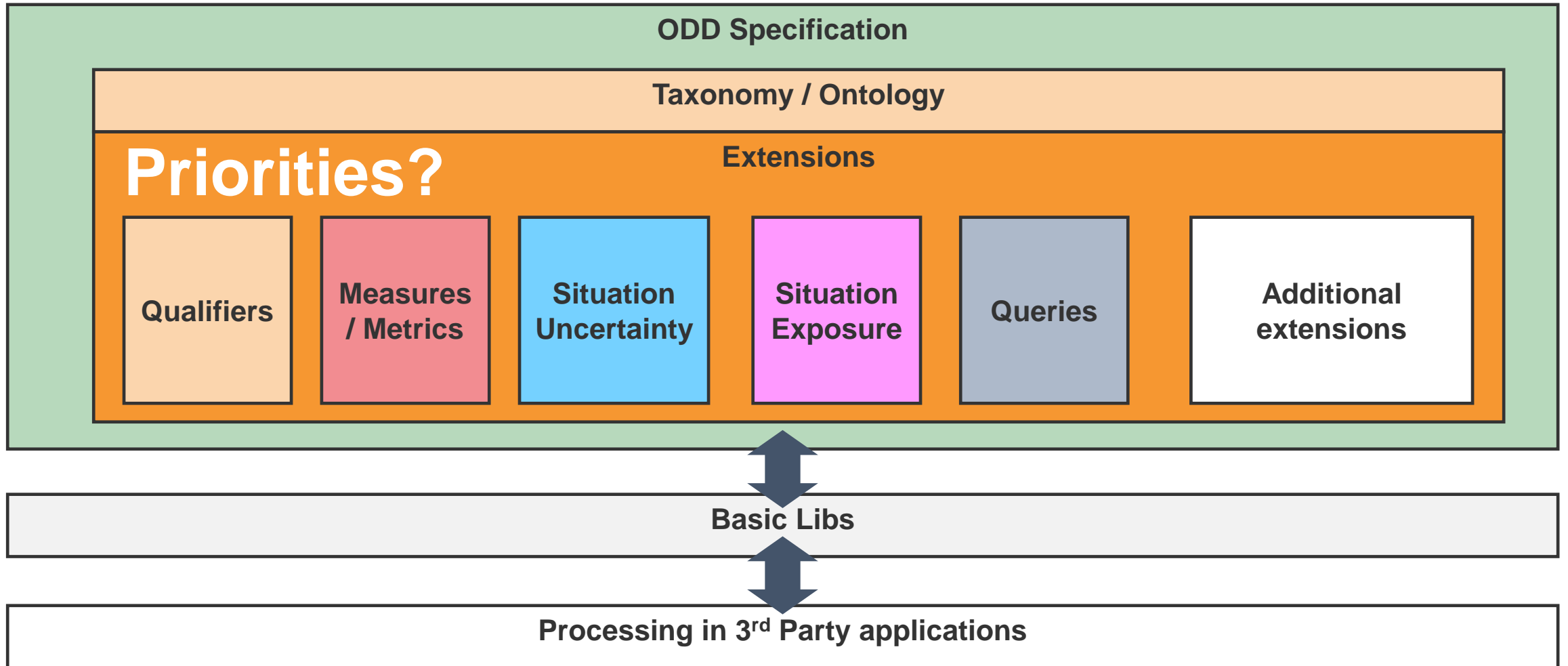
ASAM OpenODD V1.0.0 Standardisation Project

Key Next steps

ASAM OpenODD V1.0.0 Standardisation Scope



ASAM OpenODD V1.0.0 Standardisation Scope



ASAM OpenODD V1.0.0 Standardisation Project: Proposed Work Packages

- **Work Package 1:** Syntax
- **Work Package 2:** Semantics
- **Work Package 3:** Extensions
 - Prioritise which extensions and decide on additional “extension” focussed WPs
- **Work Package 4:** Applications

Thank you for your attention!

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