



OpenODD – A proposal for ODD definition format

Gil Amid

The Need – what problem are we solving ?

- The need: A format to define ODDs for various usages required in the process of developing, certifying and regulating ADS/Avs.
- While there are different activities around the world to enable ODD definition, there is no activity aimed supplying a standard FORMAT that will be integrated with the simulation, testing and certification world.

ODD – Various definitions

- **ISO 21448/SOTIF: Operational Design Domain (ODD)**

specific conditions under which a given driving automation system is designed to function.

Note 1 to entry: Conditions can be spatial, temporal, legal or environmental.

- **UK PAS 1883: Operational Design Domain**

operating conditions under which a given driving automation system or feature thereof is specifically designed to function safely.

NOTE 1 This includes, but is not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics.

NOTE 2 Driving automation system for the purpose of this PAS is the automated driving system (ADS).

- **UL4600: Operational Design Domain (ODD)**

The set of environments and situations the item is intended to operate within. This includes not only direct environmental conditions and geographic restrictions, but also a characterization of the set of objects, events, and other conditions that will occur within that environment.

NOTE: A system has a single ODD by definition. Assessment is made with regard to the entire ODD

ODD – No regulatory standard: UNECE ALKS Regulation:

- “*Automated Lane Keeping System (ALKS)*” for low speed application is a system which is activated by the driver and **which keeps the vehicle within its lane at the speed of 60 km/h or below** by influencing the lateral movement of the vehicle and controls the longitudinal movement of the vehicle for extended periods without further driver command. “
- “ALKS can be activated under certain conditions on roads **where pedestrians and cyclists are prohibited** and which, by design, **are equipped with a physical separation that divides the traffic moving in opposite directions and prevent traffic from cutting across the path of the vehicle**. In a first step, the original text of this UN Regulation limits the operational speed to 60 km/h maximum, in agreement with the broad automotive industry from all regions of the world, consulted and involved in this work. “

ODD related activities

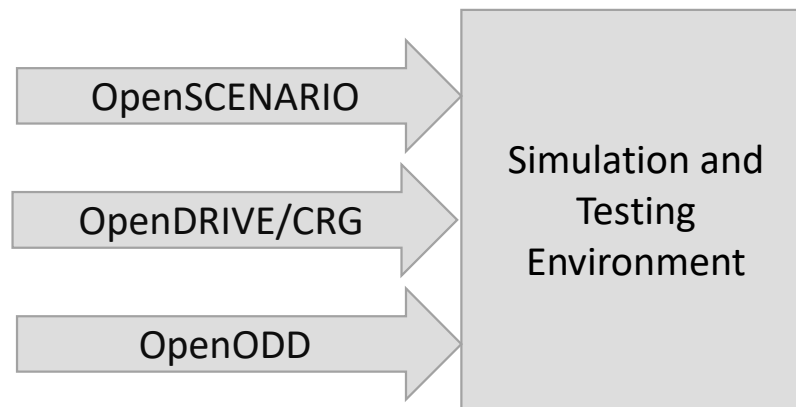
- Intensive work on ODD taxonomy:
 - UK PAS 1883 (S. Khastgir)
 - ISO WG09 – ISO 34503 (S. Khastgir)
 - SAE Orad
- UK's FiveAI described an ODD definition within their simulation control language
- UK/CATAPULT –Design consideration for ODD Ontology

USE cases

- ODD Definition will be used for:
- Regulatory purposes – specification
- ODD is used as a specification of the ADS
- Development, testing and validation: The ADS can only operate within ODD, and perform certain actions (MRM, MRC) when exiting ODD. These needs to be verified (Simulated, tested, etc)
- Different use case will require different levels of abstraction: (from “Center of London” to “two lane road with curves of radius XXX, sunny lighting conditions”)

OpenODD

- Looking at the use cases, one can conclude that an ODD definition format is required, such that it can be integrated with simulation and testing environment.
- Scenarios, Road topology, Surface, Environment, - all relate to the ODD definition.



Examples:

- Topology does not match ODD → Execute MRM
- Scenario includes “out of ODD” actors
- Surface of the road is outside of ODD
- Scenario includes dynamic changes to the environment- in order to test ODD

Proposal

- ASAM to define an OpenODD format.
- The format will utilize existing taxonomies(PAS 1883, ISO 34503)
- The format will be tuned for smooth integration with ASAM simulation domain standards.
- The format will enable to compile a full test, in which the scenario can interact with the ODD

