# Scenarios for regulatory certification: Requirements from the MUSICC project

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Transport Systems Catapult
November 2018

# Presentation Overview

MUSICC
Multi User Scenario Catalogue for Connected Autonomous Vehicles

1. Regulatory Activity
2. The MUSICC project: Multi User Scenario Catalogue for CAVs
3. Requirements
    1. High-level requirements for regulatory certification
    2. Workshop outputs
    3. Some details

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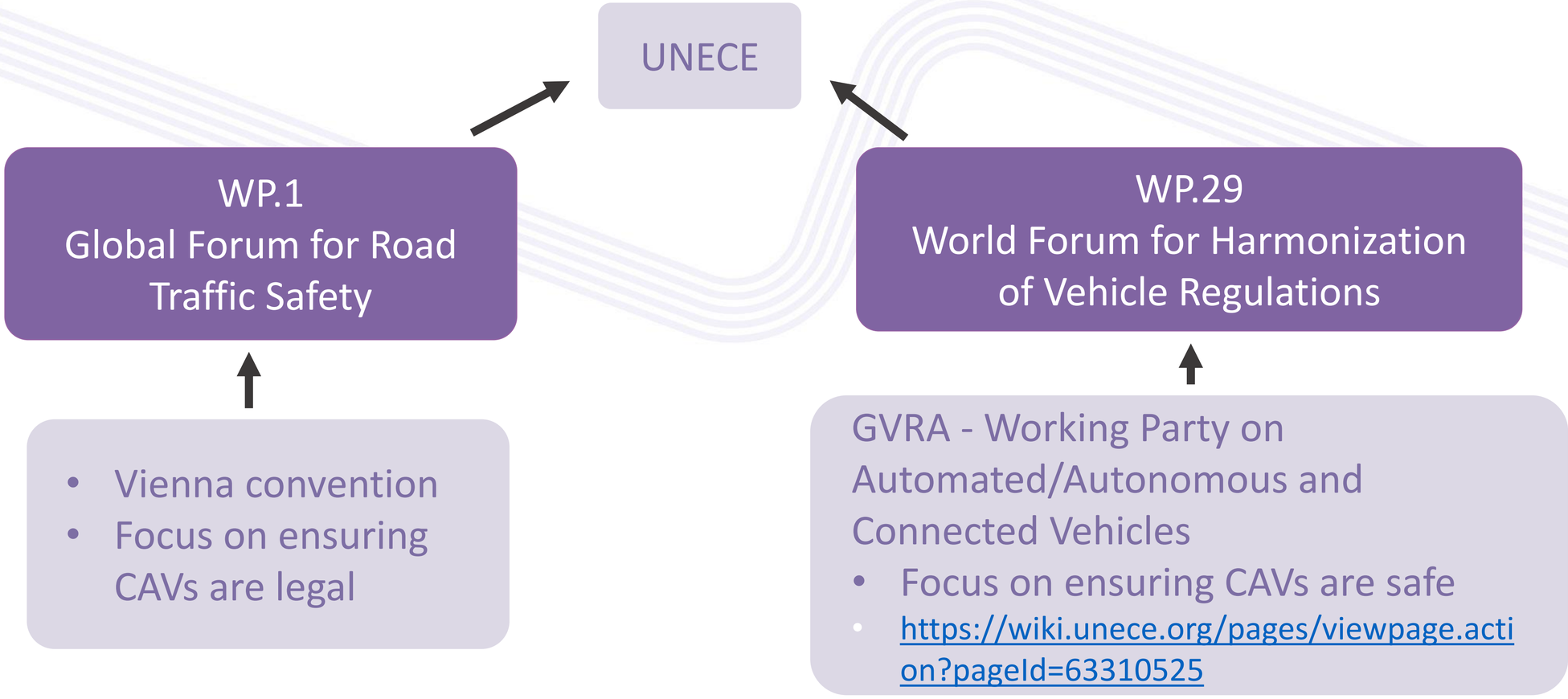
# UNECE WP.29

- TSC is working for the UK's Department for Transport (DfT)
- DfT is heavily involved with the UNECE regulatory process



# UNECE WP.29

MUSICC
Multi User Scenario Catalogue for Connected Autonomous Vehicles

- Within GRVA, there's a working group likely to be called Verification Methods for Automated Driving (VMAD)
- This is a rapidly evolving structure – was previously known as AutoVeh

- Likely to address:
  - Closed-road tests
  - Real-world test drive
  - Audit and simulation

- CAVs present a challenge for regulators
- Historically had a limited set of clearly defined tests, with clear pass/fail criteria
- Scenario-based testing is a way to bridge from there to CAV certification

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# Worldwide interest in *certification*

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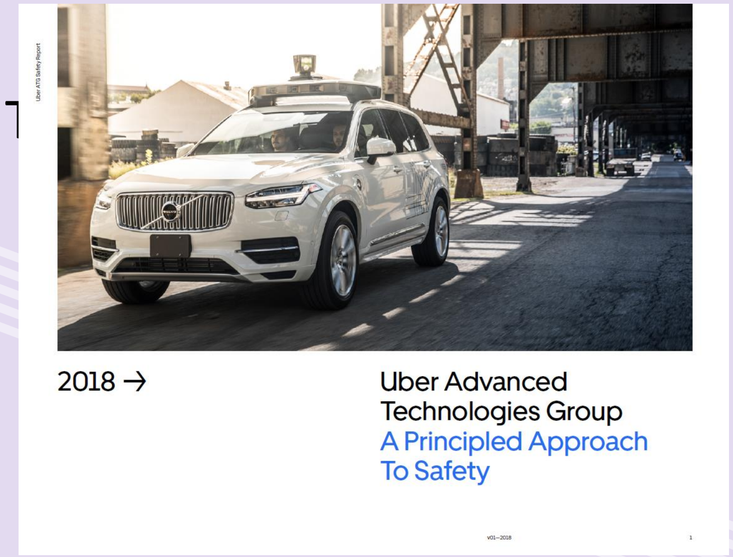
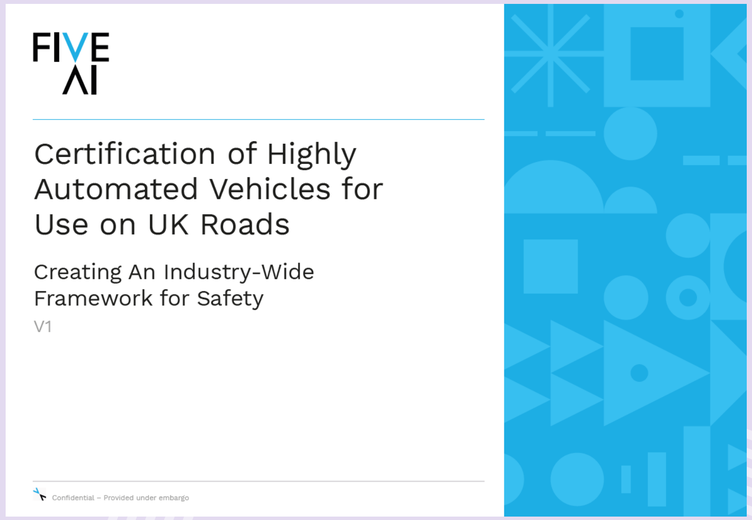
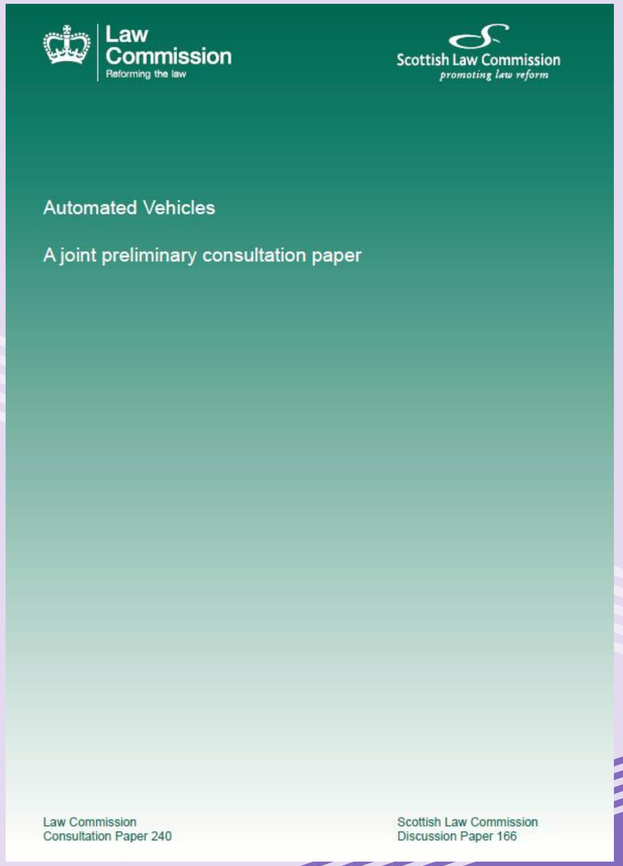


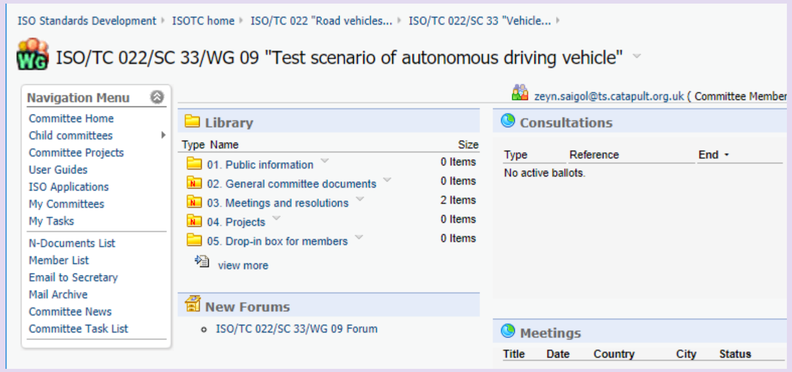

2nd November




6th November




8th November




1st meeting 18th July, 2nd on 12th October

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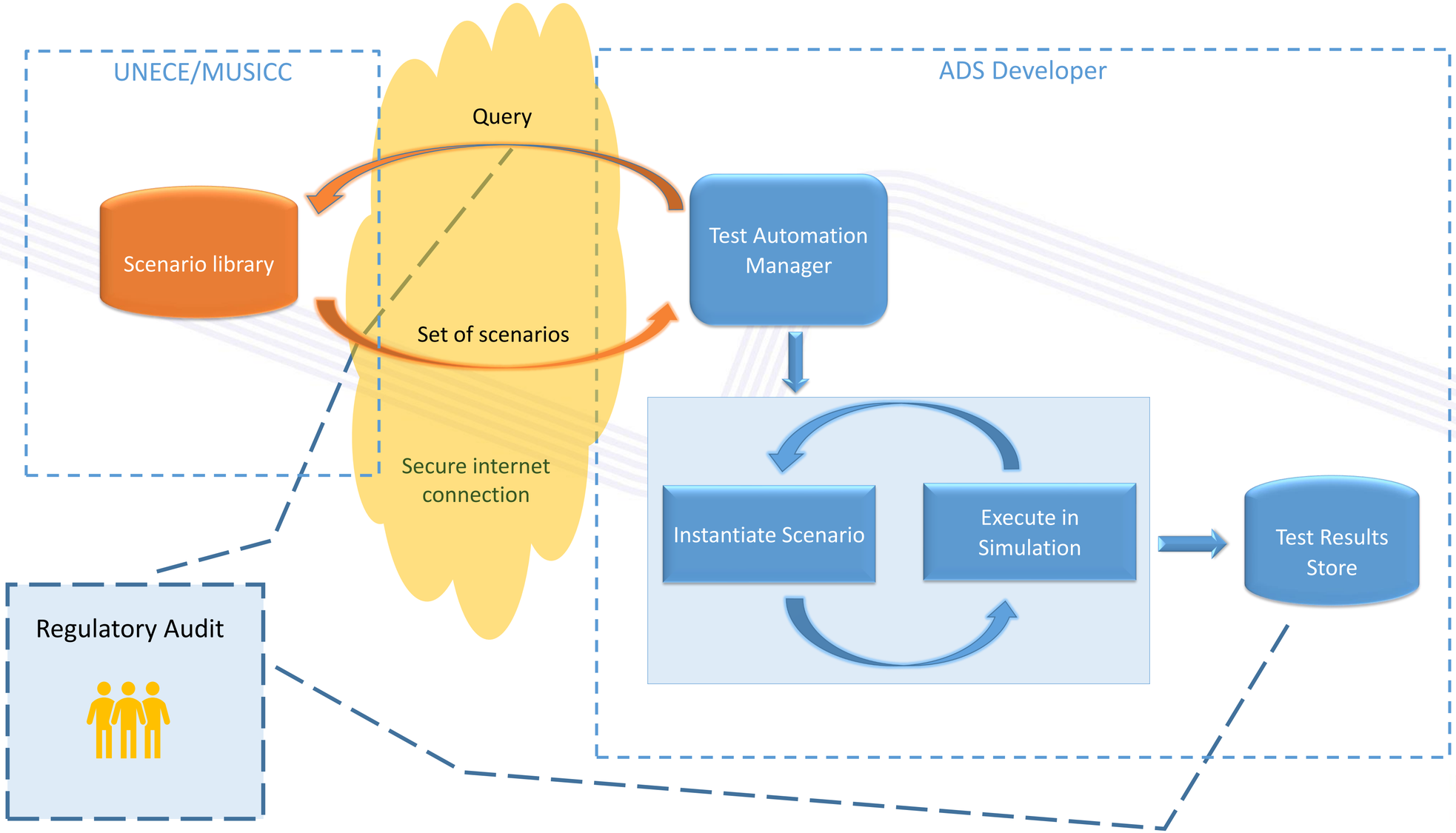
# Strawman for regulatory use of scenarios



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# MUSICC: vision and mission

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Multi User Scenario Catalogue for Connected Autonomous Vehicles

Vision:

- Open, extensible library of scenarios for CAV certification
- Supportive of simulation testing environments

Mission:

- 12-month proof-of-concept project
- Close collaboration with OEMs, ADS developers, organisations with expertise in CAV validation, and international regulators
- Define a scenario format based on a wide consultation
- Enable openly-accessible scenario platform

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# Project scope

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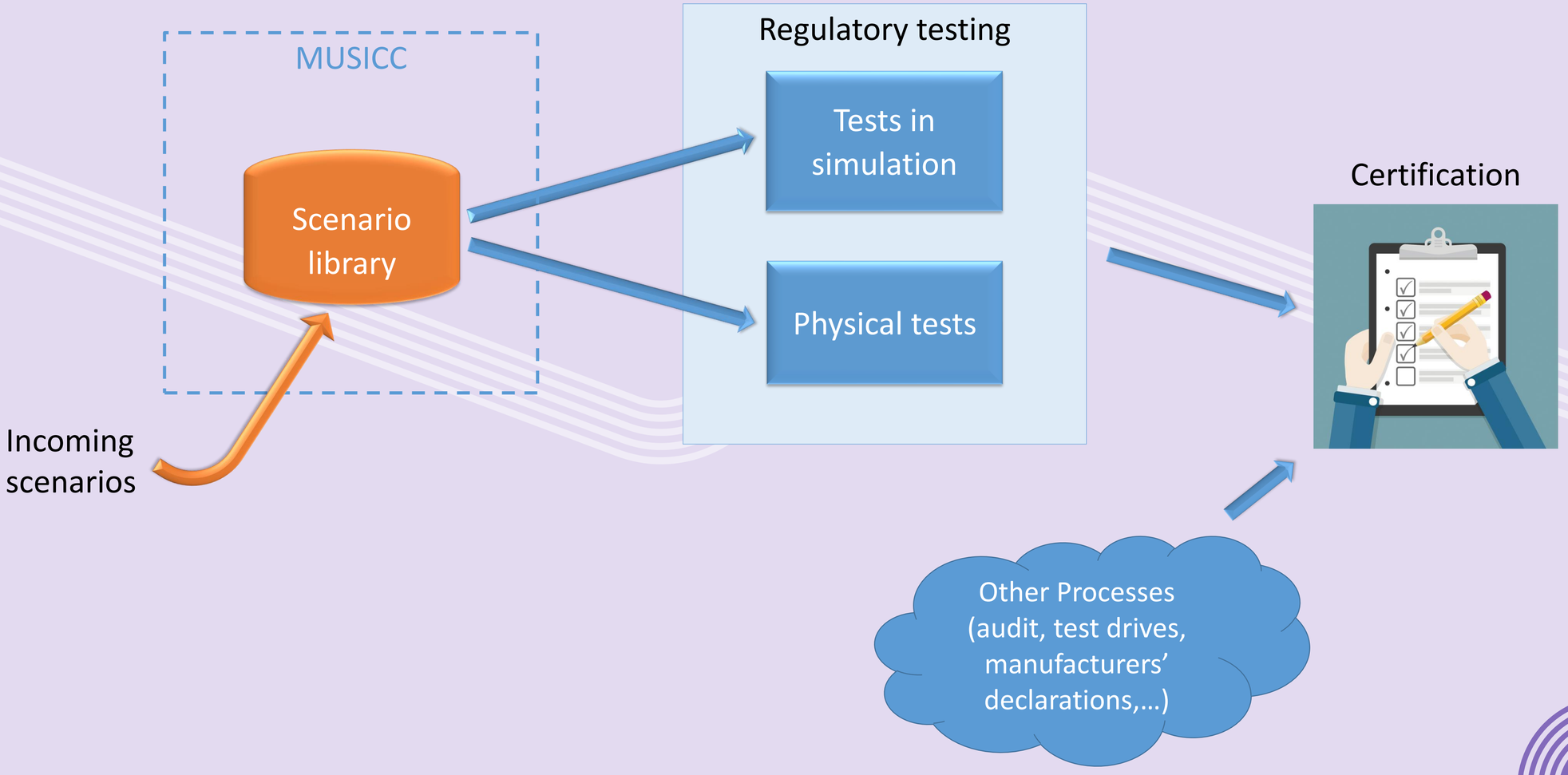


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# Why MUSICC?

MUSICC
Multi User Scenario Catalogue for Connected Autonomous Vehicles

- The MUSICC project was commissioned by the UK DfT, and aims to feed into the UNECE GRVA group looking at future CAV regulations

- Intend to align closely with ongoing international initiatives (PEGASUS, Enable-S3, CETRAN (Singapore), StreetWise, Foretellix, …)
- Regulatory certification requires:
  - A smaller, safety-focused set of scenarios (?)
  - An openly-accessible, non-commercial library

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# MUSICC Workshop

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Multi User Scenario Catalogue for Connected Autonomous Vehicles

- Held in London on 11th September
- 34 attendees, 7 countries
- OEMs, startup ADS developers, simulation tool developers, test experts
- (not regulators, aside from the project sponsor)

- As well as how to use scenarios in regulatory certification, covered some of the requirements for scenario representation

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# Scenarios for Certification

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## Neutrality / Fairness

- Work with different ADS implementations and different sensor types
- Not be influenced by commercial goals
- Shouldn’t constrain technology or features

## Require open access to scenarios

- Ensure all international regulators will always have free access to the scenario set
- Similarly, ensure free access to the scenario format

## Must work equally well across different regions

- For example, the UK drives on the left
- Signs, road markings, junction layouts will all differ across regions

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# High-level requirements / continued

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- Format which can be enhanced and extended easily
- Filterable database (e.g. all scenarios for AEB on highways in right-driving)
- Easy to interface into existing toolchains
- Must work within the wider regulatory regime
- Easy for humans to interpret the scenario
- Able to represent any real-world scenario that may occur
- Should support randomization
  - Ensure coverage, prevent ADS being designed to meet only the test scenarios
- Should support repeatability
  - Vital to be able to “replay” a scenario in the event of a failure. Perhaps random seeds need to be recorded.

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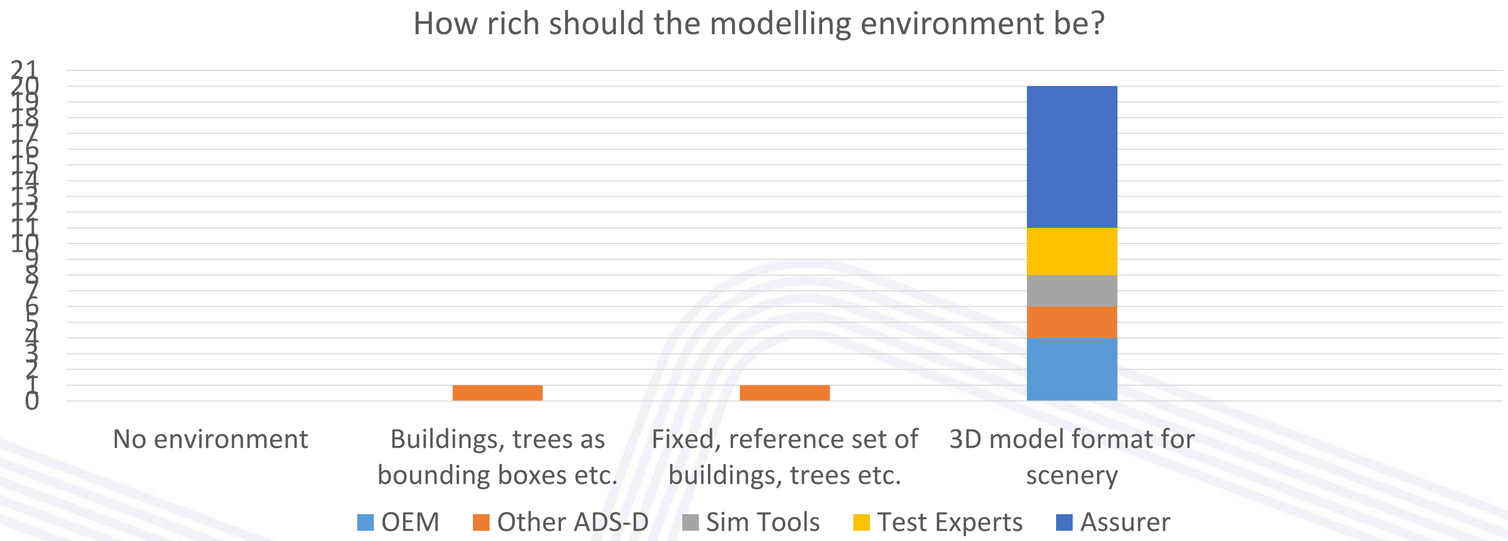
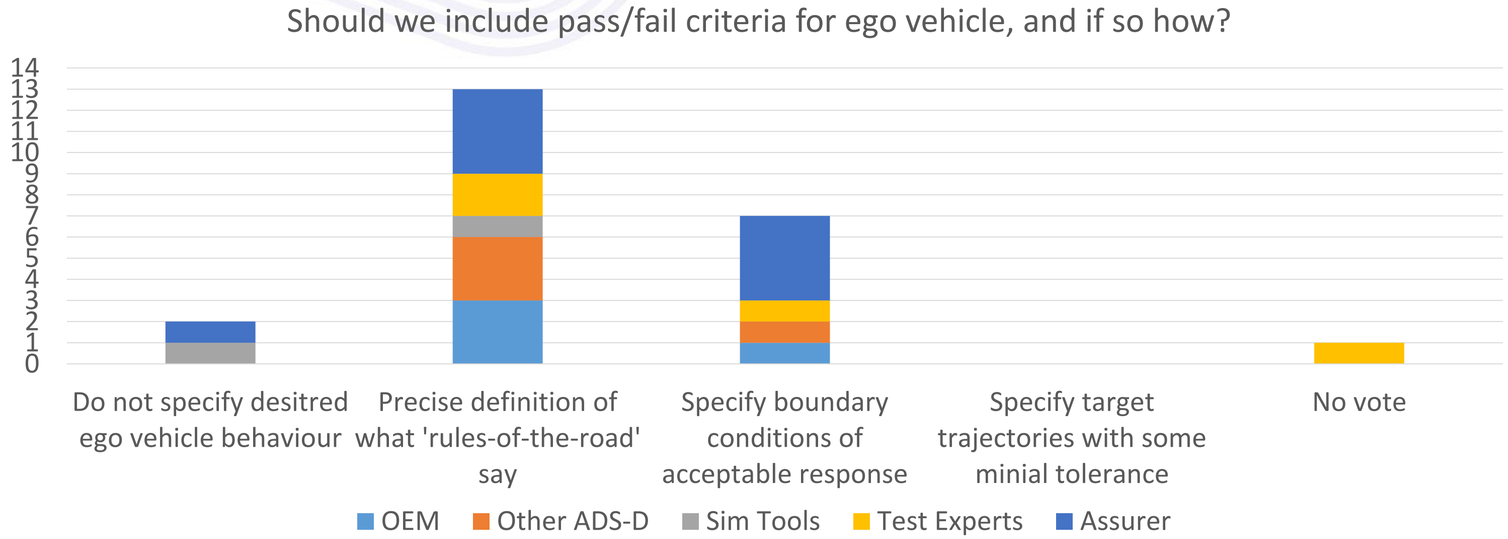
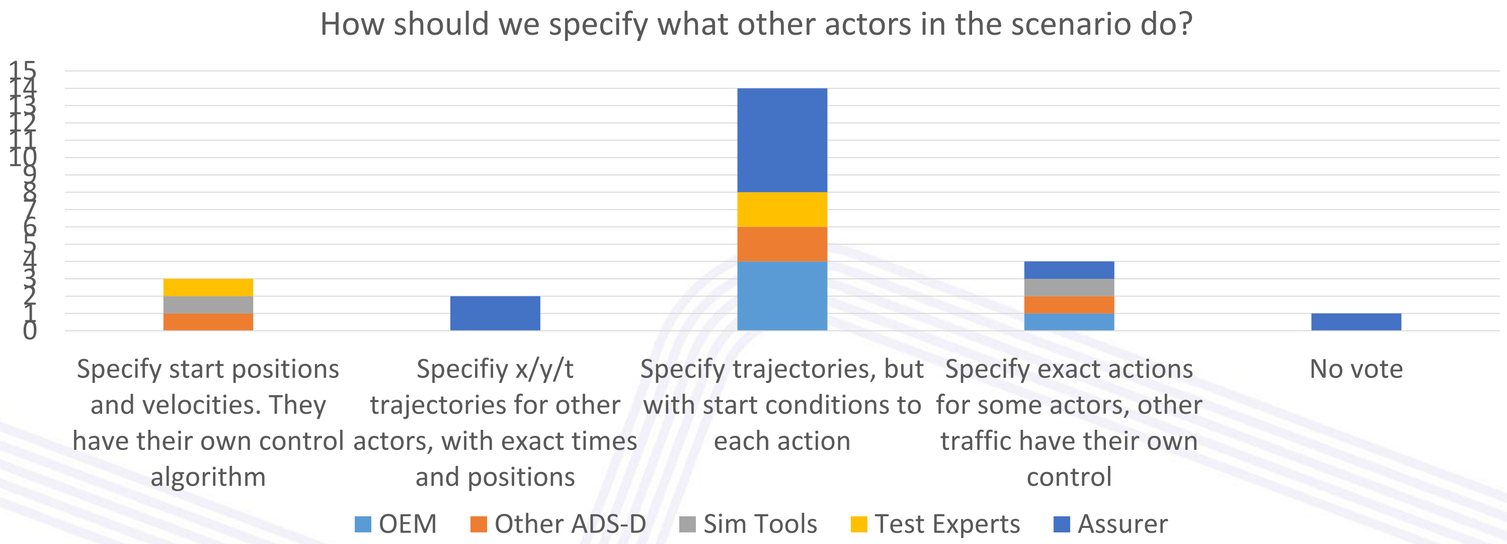
# Workshop outputs 1

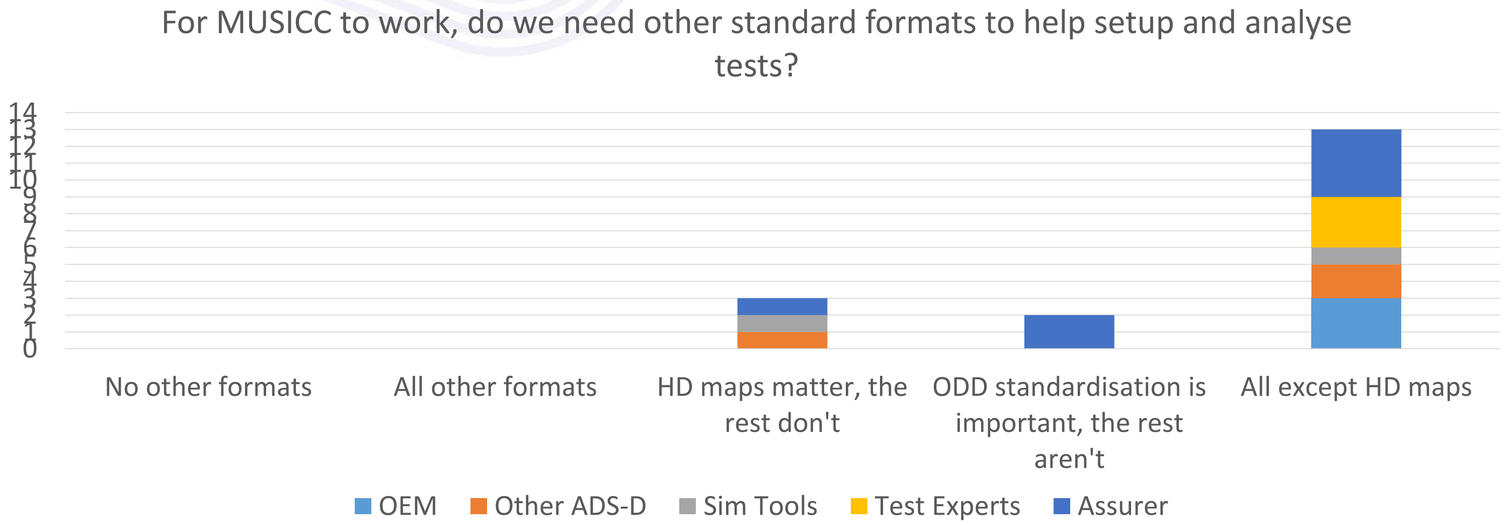


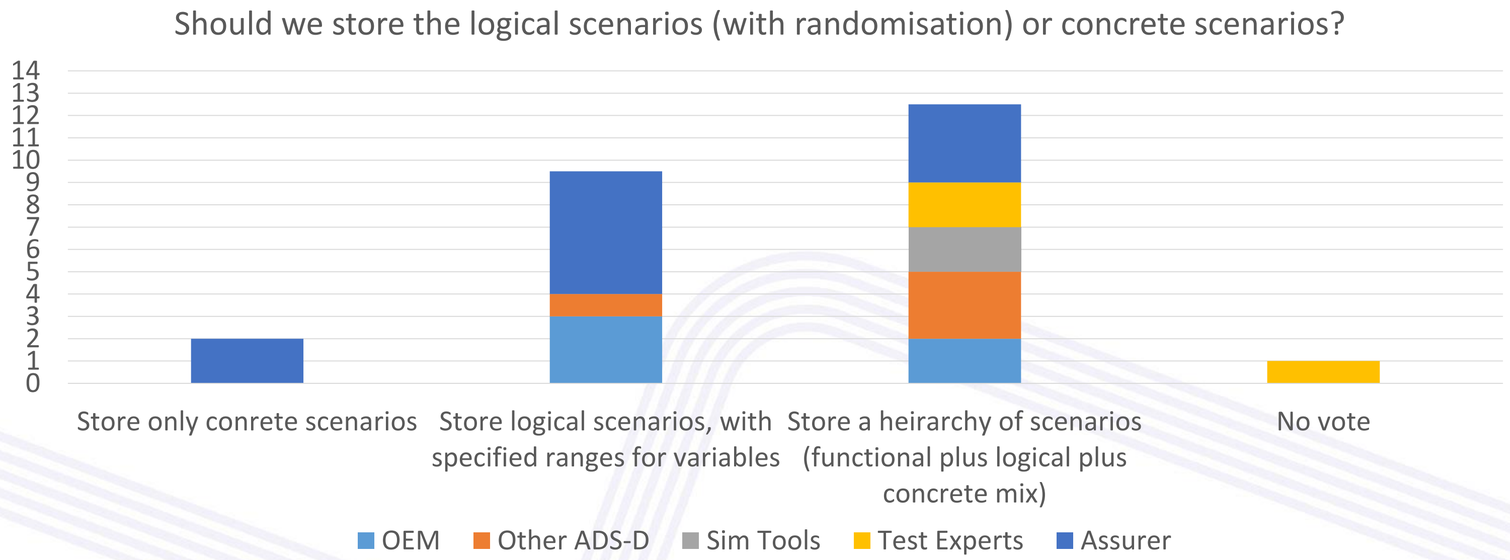
# Workshop outputs 2

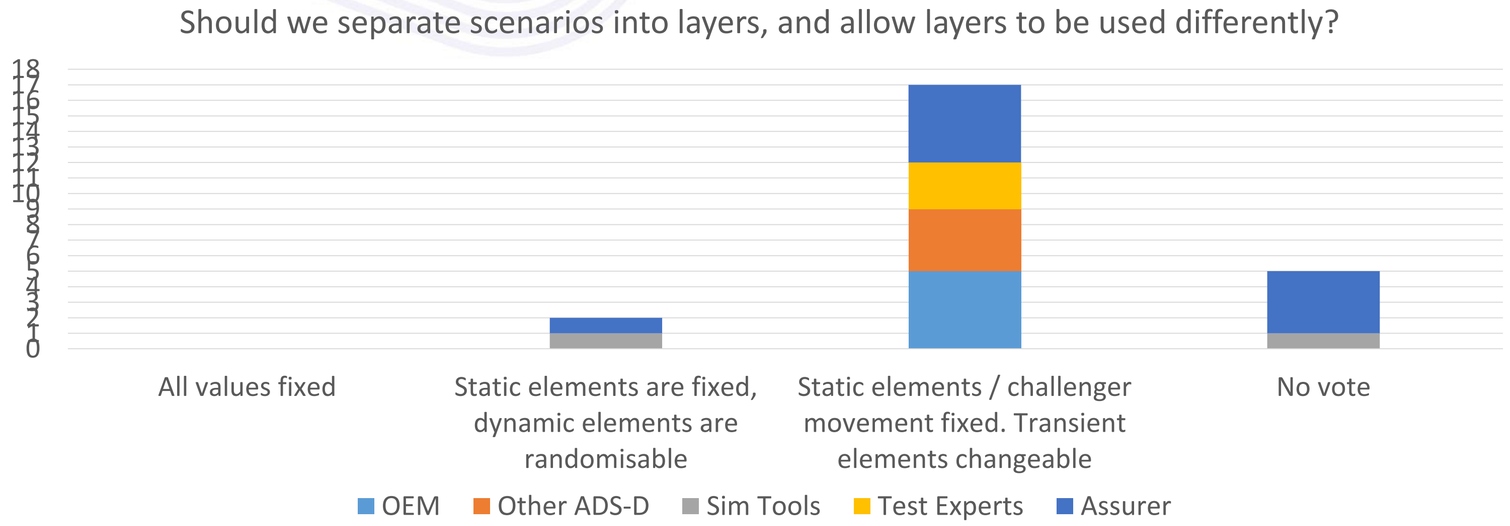



- HD maps
- ODD format
- Results format



# Workshop outputs 3



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# What we intend to do on MUSICC

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- Given the industry momentum of OpenSCENARIO, we will adopt it as our primary export format
- Internal format will be based heavily on OpenSCENARIO, with two additions:

METADATA
- Country(s) of applicability
- Road type
- Key characteristics (e.g. load shedding, snow, cut-in)
- ….

PARAMETER RANGES
- Likely to follow PEGASUS in defining uniform or Gaussian distribution
- Values to be randomly chosen on export of scenario

- Slight concern about representational limitations
- Slight concern about complexity of representation

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# Technical Notes

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- OpenSCENARIO does not clearly specify which direction a vehicle is travelling within a lane
  - Need to allow for overtaking in the “wrong” lane
  - Lane change across centre line, -1 to +1, is mathematically changing two lanes…
- Ideally want consistent method for including 3D models (OpenSCENARIO or OpenDRIVE?)
- Represent non-movement actions of vehicles (indicate, horn, …)
- High-quality documentation of the format
  - Or at least good examples covering a range of complexities

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# Thank you

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