# Safety Pool™ Scenario Database: Introduction

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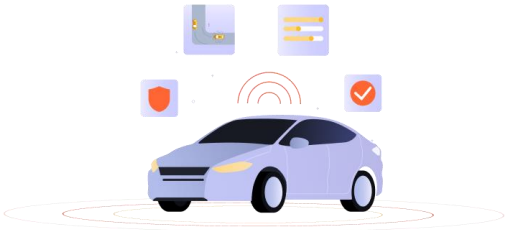
**Head of Verification & Validation, Intelligent Vehicles**
**WMG, University of Warwick, UK**



**UNECE VMAD SG1 23rd Session**
**16 May 2022**

# Evaluation Continuum

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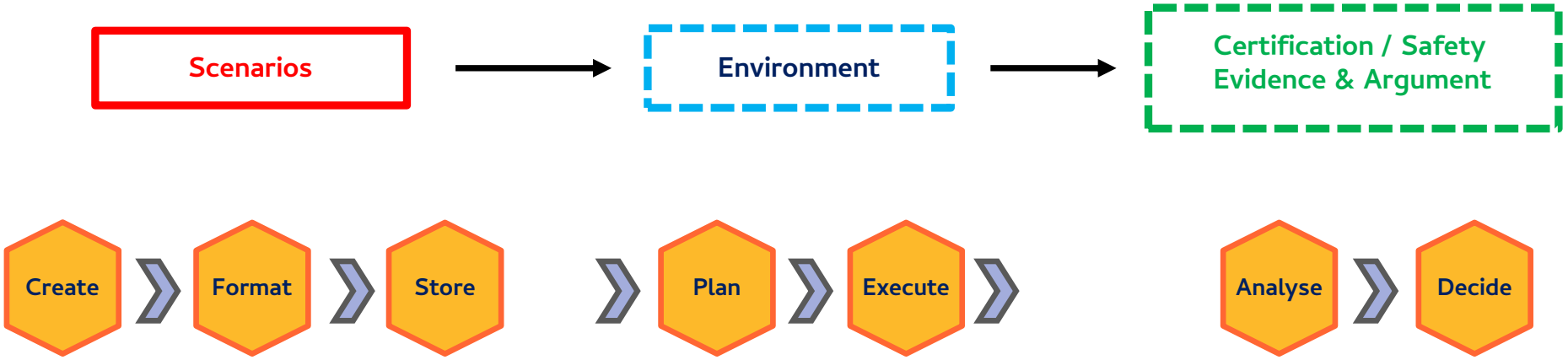

# Evaluation Continuum

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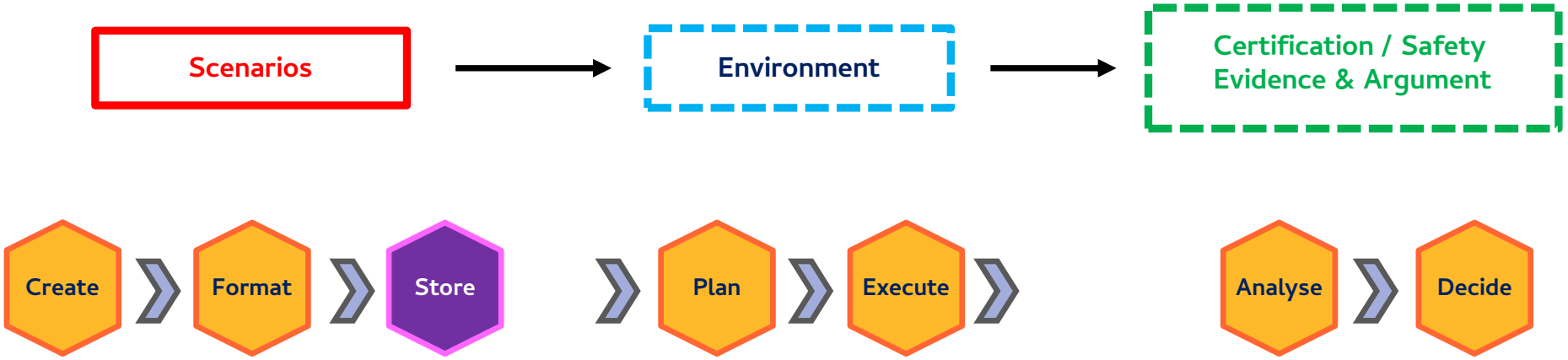

# The Vision

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**Safety Pool envisions a world where the safety of every Automated Driving System & ADAS can be transparently tested, validated, and certified through common processes and infrastructures shared across industry, academia, and policymakers across the globe.**

## Community

Reuniting Global stakeholders from industry, academia, government and policymaking worldwide.

## Technology

A set of shared software platforms where to exchange, test, and validate safety critical data and systems on a common ground.

## Informed Safety

Safety frameworks and guidelines to guide regulators.
Based on emerging automotive standards and informed by insights from Safety Pool technology platform

# A Multi-stakeholder platform

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CAV Developers

- Scenario Database
- Web App
- API

Governments & Regulators

Tier 1s & tech providers

Researchers

Safety Pool™ Database

WMG

- Home
- Scenarios
- Test Suites
- Testbeds
- Users
- Roles
- Settings
- Audit Log

# Welcome

The Safety Pool™ Scenario Database is an extensive collection of curated test scenarios for testing connected and autonomous driving technologies.

Search for scenarios

For user guides and technical resources, visit our Knowledgebase

## Safety Pool™ Scenario Database

### World's Largest Public Scenario Database

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## Safety Pool™ Scenario Database

### World's Largest Public Scenario Database

## Over 250,000 edge case scenarios

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# Safety Pool™ Scenario Database

## The Platform

# Features Map

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ODD & Behavior Tagging

Real World Route matching

Simulation Platform integration

Tag-based logical search

Tokenized Scenario exchange

Efficient Test management

# ODD & Behavior Tagging

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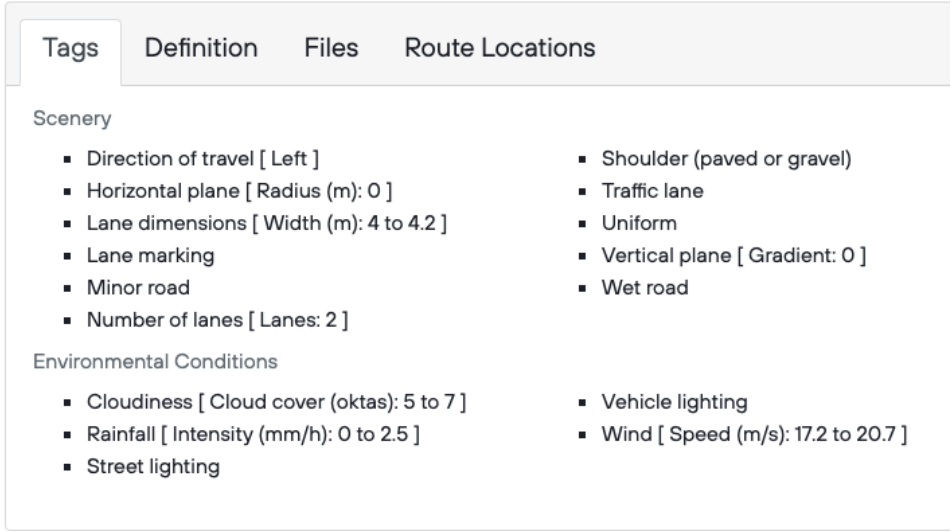
## Scenario Files are tagged along three dimensions

ODD Tags - Scenery, weather conditions, dynamic elements

Behaviors Tags - Maneuver types

Admin Tags - Authorship, version, function under test

Custom tags - tags can be extended with custom labels




Tags aligned with

ASAM bsi. ISO

# Tag-Based Logical Search

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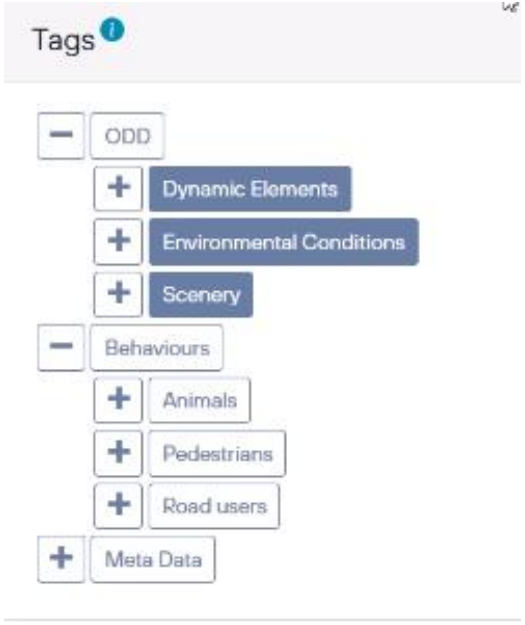
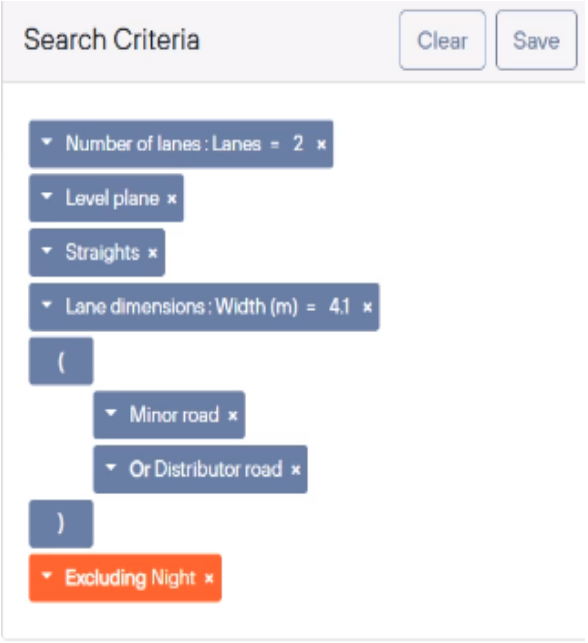
## Look for scenarios in your public and/or private libraries using Scenario Tags and logic search

### Choose the libraries of interest


### Search and filter along tags-values pairs




### Launch complex logical queries



# Real world routes matching

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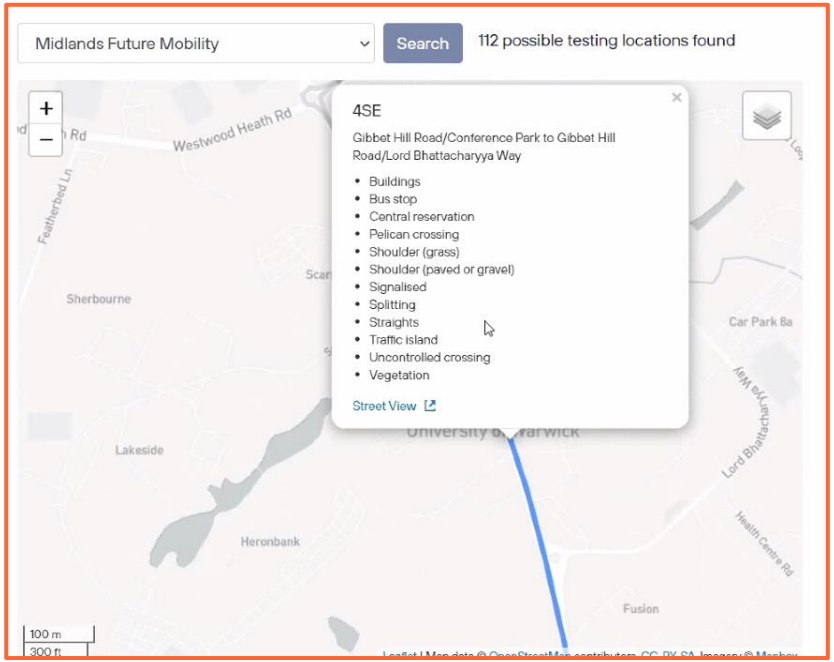
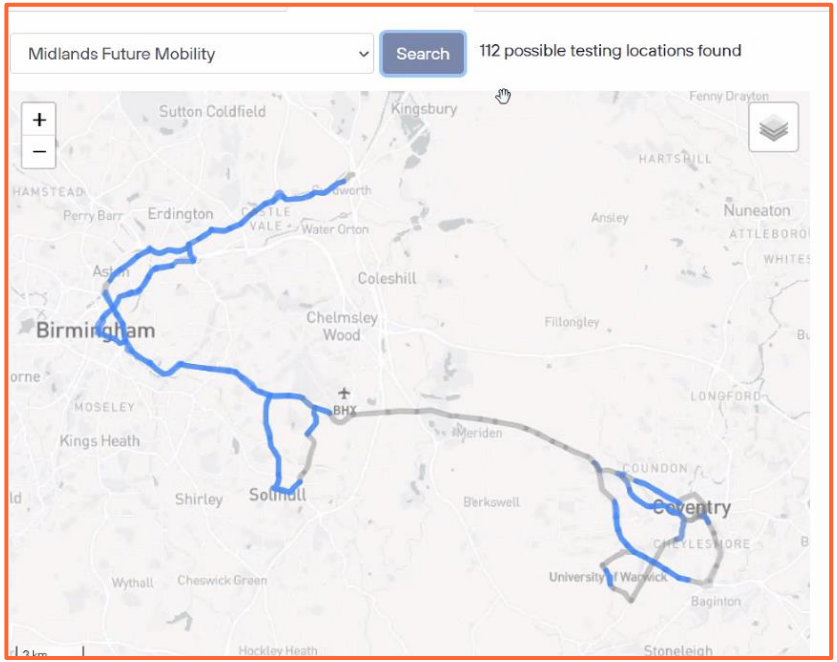
## Understand where scenarios can happen in real world routes based on ODD matching

Find out where specific scenarios could virtually take place in specific portions of mapped routes according to the intersection of ODD characteristics & tags



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# ← Scenario

Download | Add to Test Suite

stat19_1_82482

Tags | Definition | Files | Route Locations | Versions

Scenery

- Broken line
- Contaminated
- Drive on left
- Lane dimensions [ Width (m): 3.4 to 3.7 ]
- Level plane
- Normal roundabout
- Number of lanes [ Lanes: 2 ]
- Radial road
- Shoulder (grass)
- Straights
- Traffic lane
- Undivided road
- Uniform surface

Environmental Conditions

- Cloudiness [ Cloud cover (okta): 0 to 1 ]
- Day
- Sun elevation [ Angle (degree): 10 to 30 ]
- Sun to the right
- Wind [ Speed (m/s): 10.8 to 13.8 ]

Agents

- Cut-in
- Lane change left
- Vehicle

Meta Data

- Fatal collision

## General


URN

d025e967-a9eb-452e-bd13-af66ec99a318

Library

STATS-19

License

Safety Pool™ Test Script License

Version

1.0

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# ← Scenario

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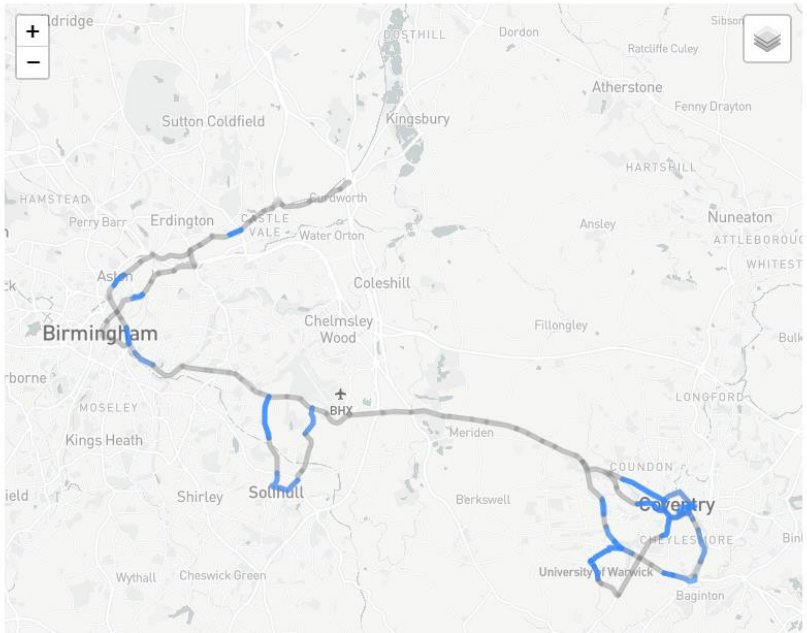
stat19_1_82482

Tags | Definition | Files | Route Locations | Versions

Midlands Future Mobility | Search | 38 possible testing locations found

This testbed does not support all of the tags for this scenario




## General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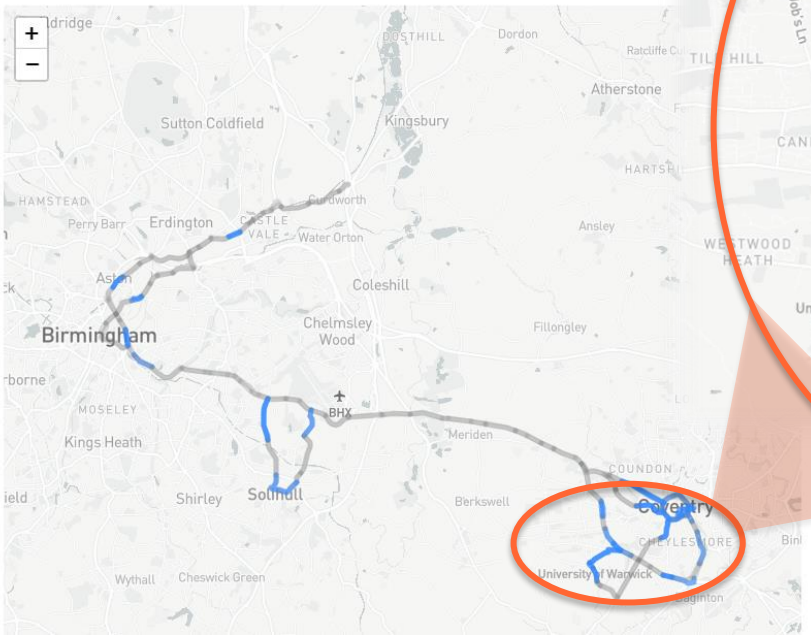


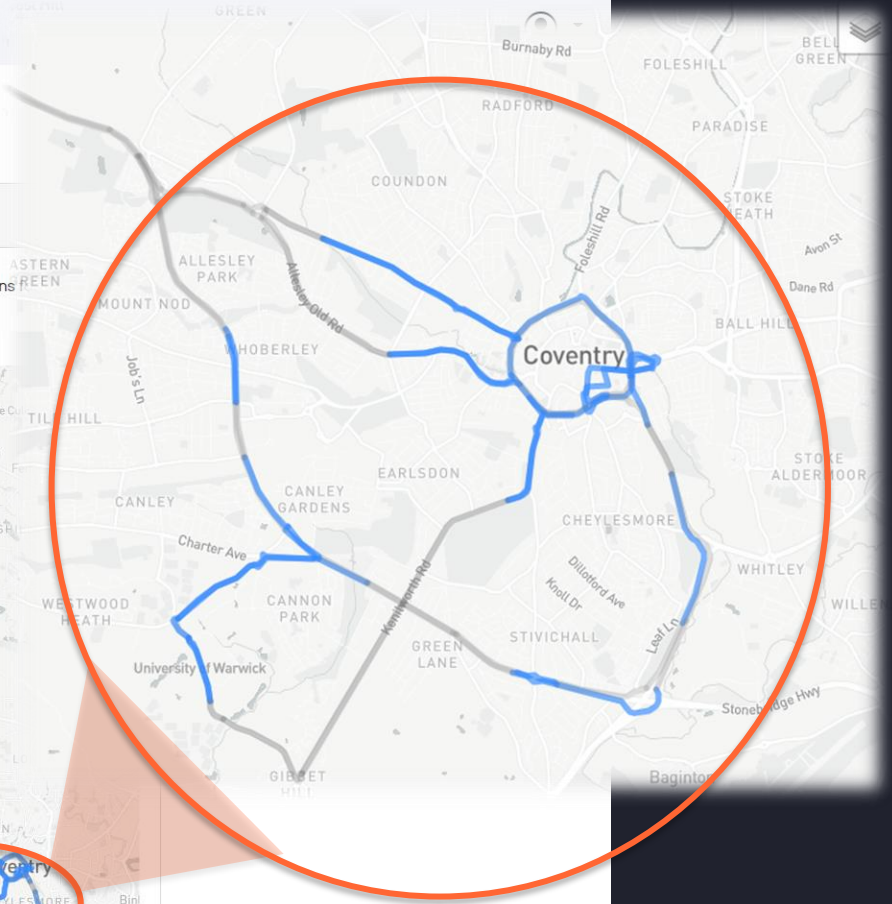

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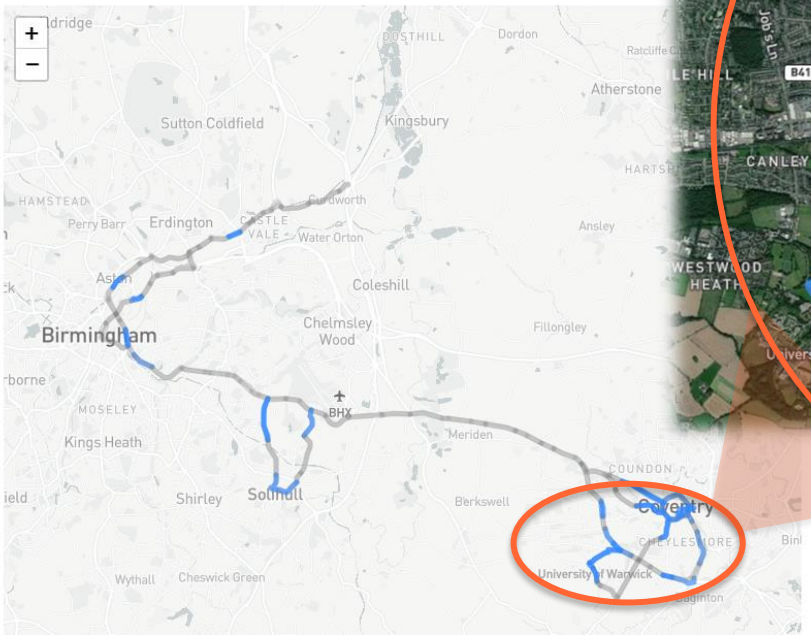


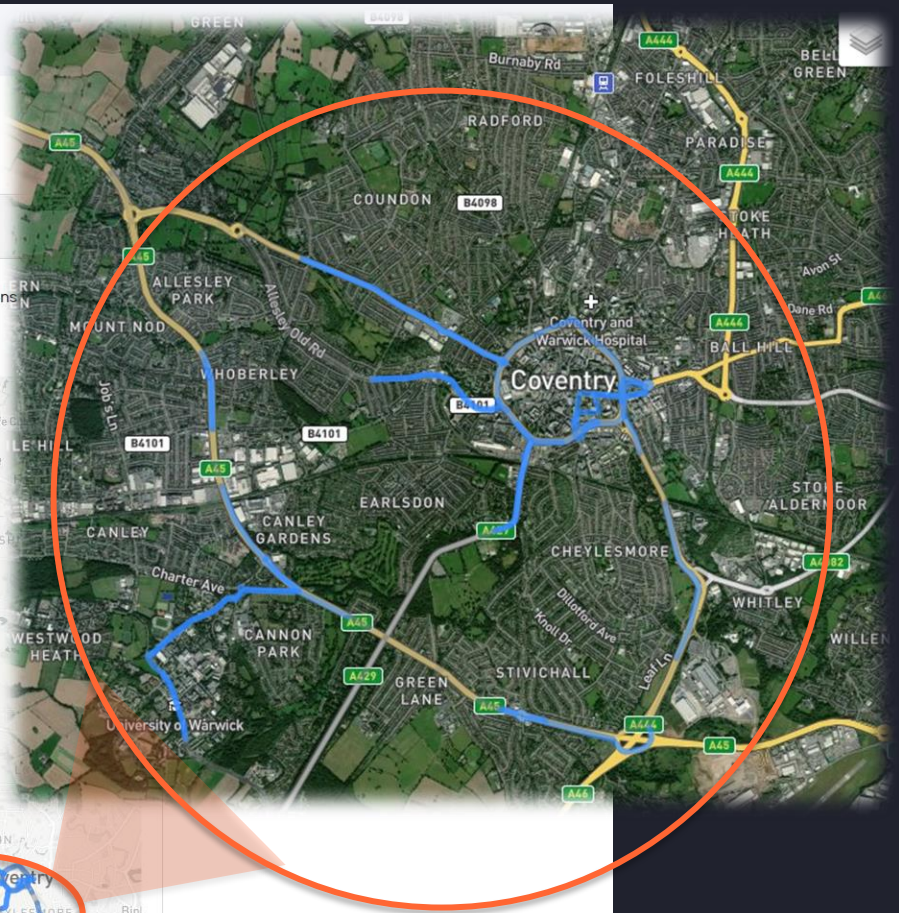

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← Scenario

Download | Add to Test Suite

stat19_1_82482

Tags | Definition | Files | Route Locations | Versi

Midlands Future Mobility | Search | 38 pos

This testbed does not support all of the tags for this scenario

5NW

Gibbet Hill Road/Lord Bhattacharyya Way to Kirby Corner Road/Gibbet Hill Road

- Bus stop
- Curves
- Number of lanes [ Lanes: 1 to 2 ]
- Roundabout
- Shoulder (grass)
- Shoulder (paved or gravel)
- Signalised normal roundabout
- Splitting lanes
- Straights
- Traffic island
- Uncontrolled crossing
- Vegetation

Street View

Version

1.0

# Simulation Platform Integration

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**Scenarios in Safety Pool scenario database are simulation platform agnostic and can be executed in a simulator platform.**

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# Safety Pool™ Scenario Database

## The Scenarios

# Safety Pool™
# Scenario Description Language

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**A two level SDL that bridges the gap between different stakeholders: from technology developers to regulators**

## SDL Level 1

a textual description of the scenario at a higher abstraction level to be used by regulators or system engineers

## SDL Level 2

level 2 is a formal machine-readable language which is ingested by testing platform e.g. simulation or test track

Link to research Paper about SDL

SDL documentation: https://docs.safetypooldb.ai/docs/sdl

# Safety Pool™
# Scenario Description Language

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## Safety Pool SDL is organized along three dimensions

### Dynamic Elements

provide description for the behaviours of all the moving objects in a scenario, which include road users, pedestrians and animals

### Scenery Elements

provide descriptions of the static elements within a scenario using junctions and roads as the building blocks

### Environment Elements

describe the physical conditions of the scenarios such as lighting, wind, cloudiness, etc. These characteristics are part of the ODD definition

# Safety Pool™
# Scenario Description Language

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## Alignment with Standardized SDLs and Custom SDLs

### OpenScenario

ASAM OpenScenario 1.x

Scenarios are released with an OSC1.x file attached, and OpenDRIVE file

Available

### BSI Flex 1889: NL - SDL

Natural Language SDL

Converters to BSI Flex 1889 are going to be available for functional and abstract scenarios (natural language definition)

Upcoming

### Custom SDLs

Custom or proprietary SDLs

Get assistance from Safety Pool technical team to build and support converters to your own proprietary SDL

support@safetypool.ai

# Scenarios Generation

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**Safety Pool™ Scenario Database gathers curated scenarios generated from multiple sources, from Knowledge-based approaches to data-based approaches**

## Knowledge/expert-Based Generation

Analytical hazard based approaches like STPA analysis

## Real world data generation

Scenarios extracted from data logs of real world drives with instrumented vehicles

## Accident Databases

Scenarios are generated from accident databases or insurance claims record

# The Scenarios Use cases

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**Safety Pool™ Scenario database targets and collects scenarios for multiple use cases and functions under test***

ALKS

Highway driving

Low Speed AD

Last mile delivery

Level 4 Autonomy

Trucking

*Organizations have access to a limited portion of the available scenarios. Further access will be granted based on contribution following the Tokenized Scenario Exchange scheme

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# Safety Pool™ Scenario Database

## Tokenized Scenario Exchange

# Tokenized Scenario Exchange

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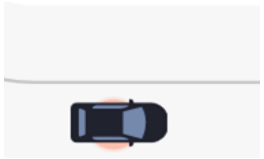
**An incentive-based mechanism to encourage scenario contributions, reward scenario diversity and relevance, and enable stakeholders to enlarge and enrich their test suites**

Submit Scenarios to the Public section

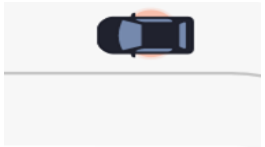


Scenarios are vetted for quality and validated

Scenarios get scored

- Similarity metric
- Criticality metric
- Volume

Safety Pool Tokens are poured into your account



Spend tokens to get access to more curated scenarios

# Private, Public and Restricted-Public Access

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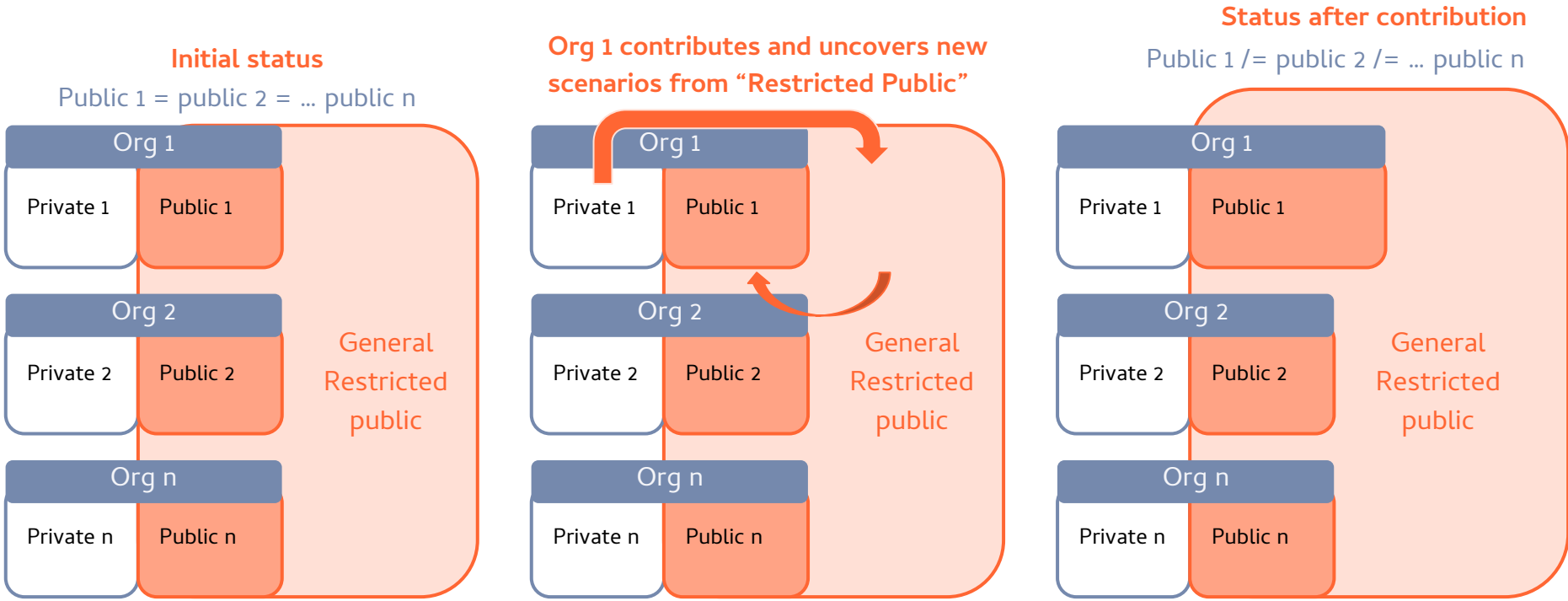
A fraction of the total amount of scenarios is available for each organization who joins Safety Pool Scenario Database. Further portions of the public section can be accessed based on contribution following the Tokenized Scenario Exchange logic



# Technology Stack

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**Secure, Scalable, Portable, Independent, low maintenance, industry standard. Rated as “low risk” by a recognized third party security certification entity.**


WebApp (Microsoft Blazor)


API (Microsoft ASP.NET Core)

Scenario Database - Microsoft SQL Server 2019


Containerisation - Kubernetes & Docker

Cloud Hosting - Microsoft Azure

# API

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**Use Safety Pool API to access scenarios and test suites from your private section and the public material you have access to. All through a single API key.**

RESTful API accessible and easy to use it with any language or tool

Extensive API documentation available for onboarded organizations

Retrieve scenarios, test suites or any other data you are entitled to based on your account permissions

# Using ODD Based Rules of Road in wider Safety Assurance

**Rules of Road**

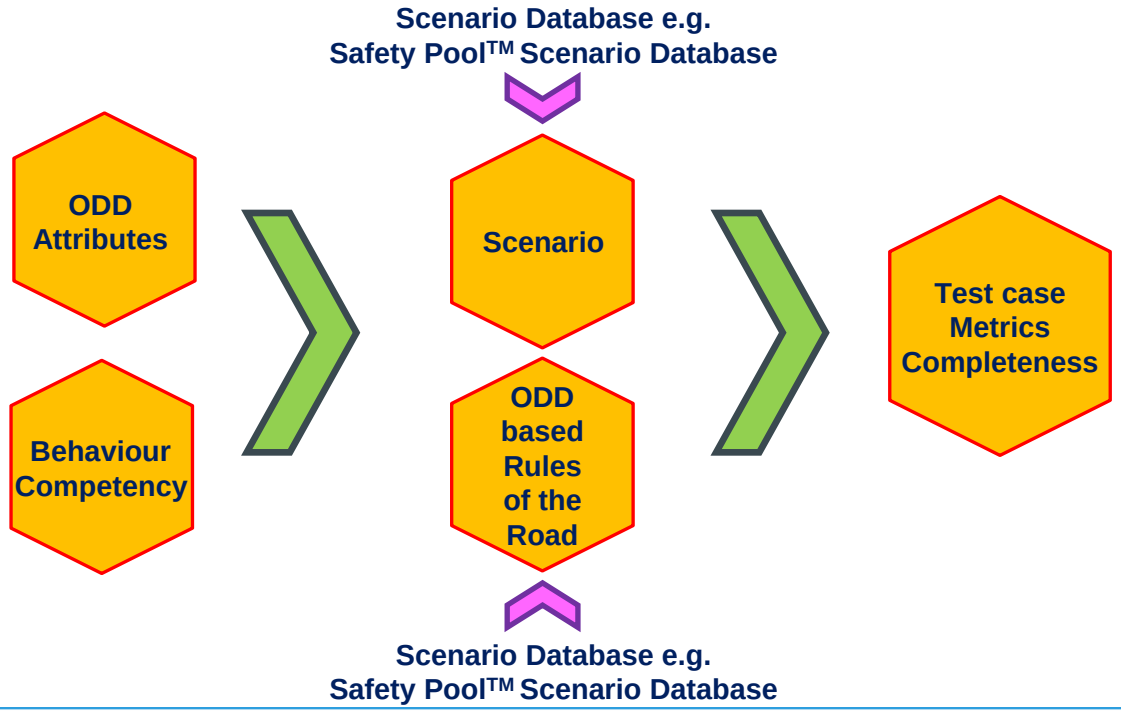
Each Rule of Road (anywhere) will always be a function of **ODD** and **Behaviour Competencies**.

**Scenarios**

Each scenario (irrespective of the system under test), will always have **ODD attribute** information and **Behaviour** information

Mapping using labels / tags

# Using ODD Based Rules of Road in wider Safety Assurance



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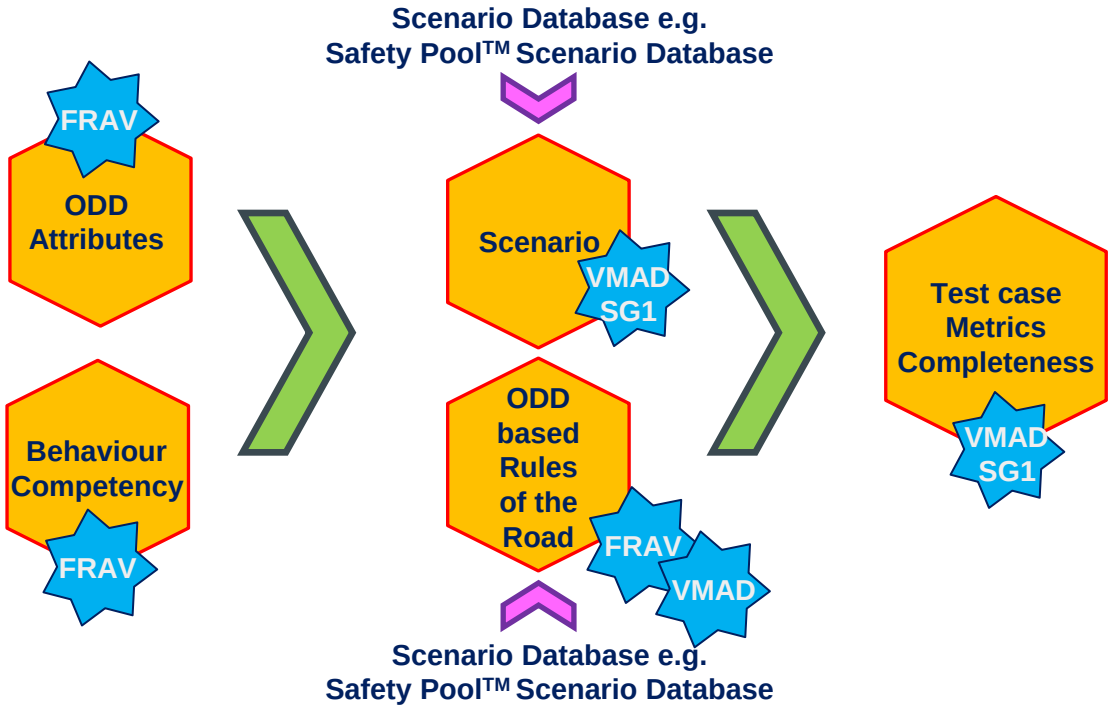

# Get Involved

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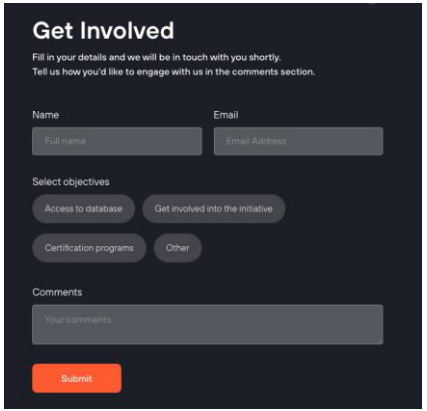
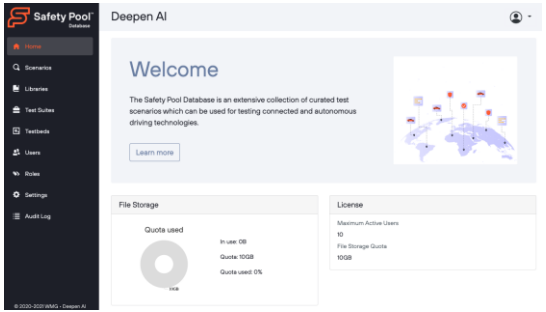
**Tell us about your use case (trucking, level 4 autonomy, ADAS, low speed shuttle, sidewalk robot) and most urgent scenarios needs**

Sign up @ www.safetypool.ai

Schedule a Demo

Get Access to Safety Pool™ Scenario Database

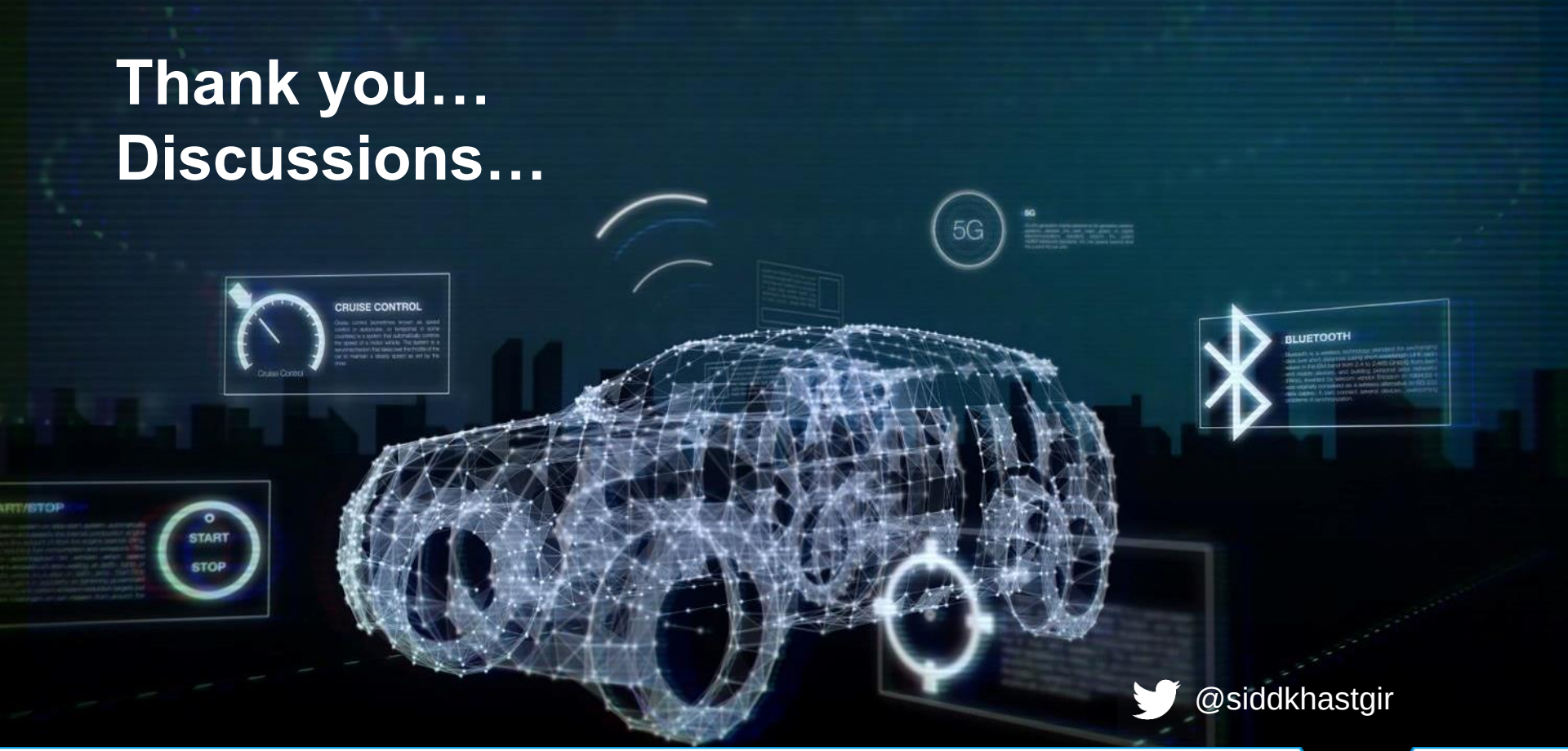



# Next steps

- Understanding the shape and form of scenario catalogue
- Safety Pool™ Scenario Database: a non-commercial scenario catalogue
- Linking FRAV and VMAD SG1

# Thank you…
# Discussions…




@siddkhastgir

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