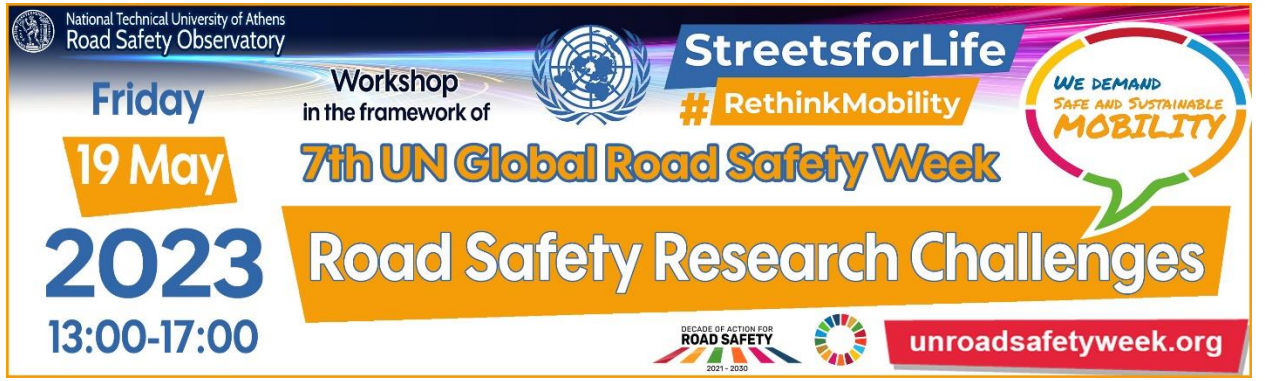

Driver needs and behaviour in automated traffic

Foteini Orfanou

Transportation Engineer, PhD Candidate

Together with:

Eleni Vlahogianni, George Yannis

The Drive2theFuture project

DRIVE2 THE FUTURE

- **Full project name:**
  Needs, wants and behaviour of "Drivers" and automated vehicle users today and into the future
- **Partners:**
  31 participants from 13 countries
- **Duration of the project:**
  36 months (May 2019 – April 2022) + 6 months extension (October 2022)
- **Operational Program:**
  H2020 "Smart, Green and Integrated Transport" Work programme 2018-2020MG-3.3-2018: "Driver" behaviour and acceptance of connected, cooperative and automated transport; Research and Innovation Action (RIA)

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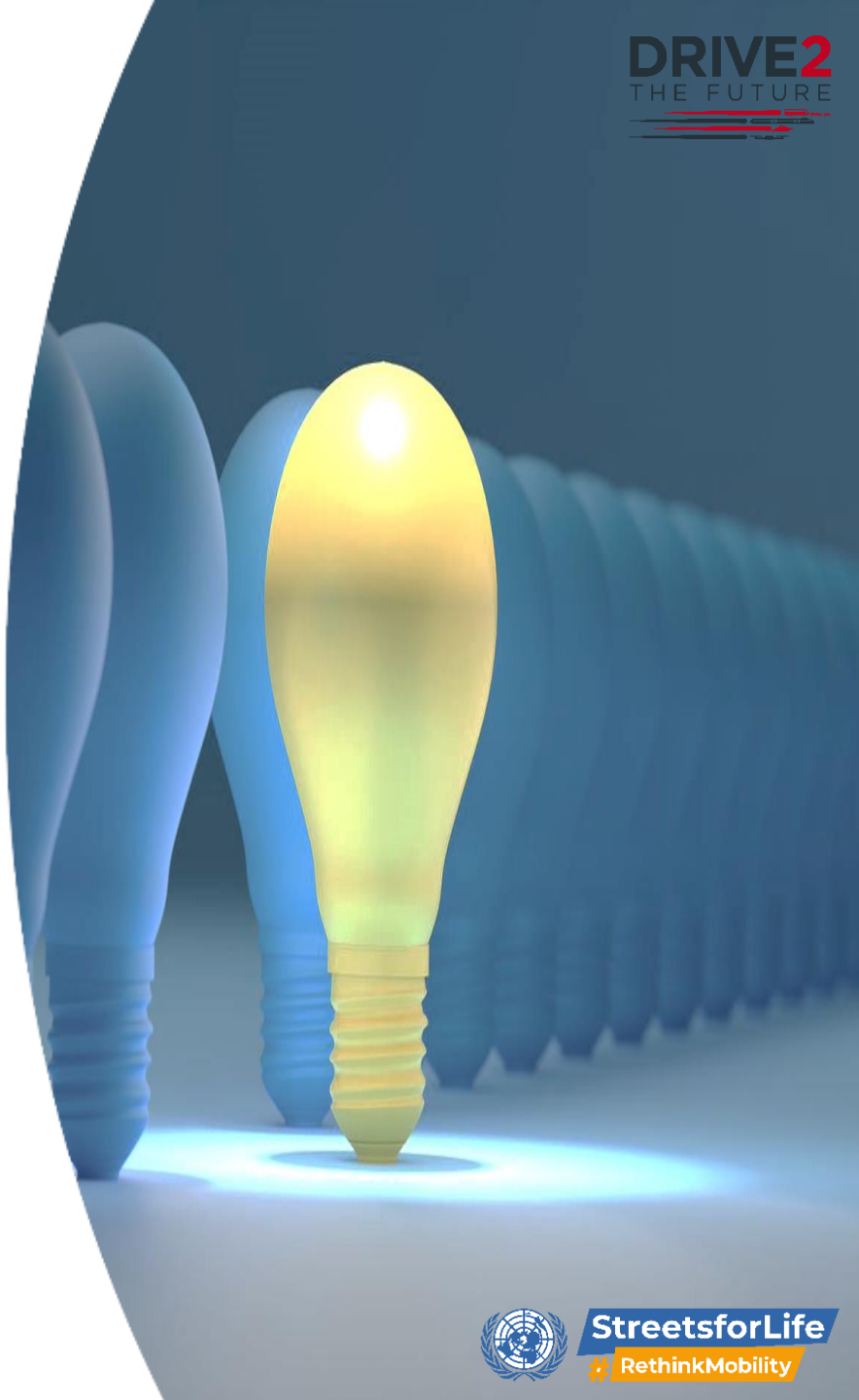
Background

- Automation brings **revolution** to the transportation systems
- **All transport modes** are moving towards the era of automation
- Understand and meet the needs of all user types and operators is significant
- Optimization of AVs market introduction is necessary
- **Penetration rate** of autonomous vehicles depends on:
  - User acceptance
  - HMI compliance to user needs
  - Safe behavior and interaction with other road users
  - Efficient training of AV users and operators



Objectives

- Identify and cluster
  - "drivers", travellers and stakeholders
- Model the behaviour of the automated "driver"
- Define the optimal HMI
  - for different users, transport mode and automation levels
- Identify training needs and develop training tools
- Perform demonstration pilots
- Assess the impact of proposed solutions for raising acceptance

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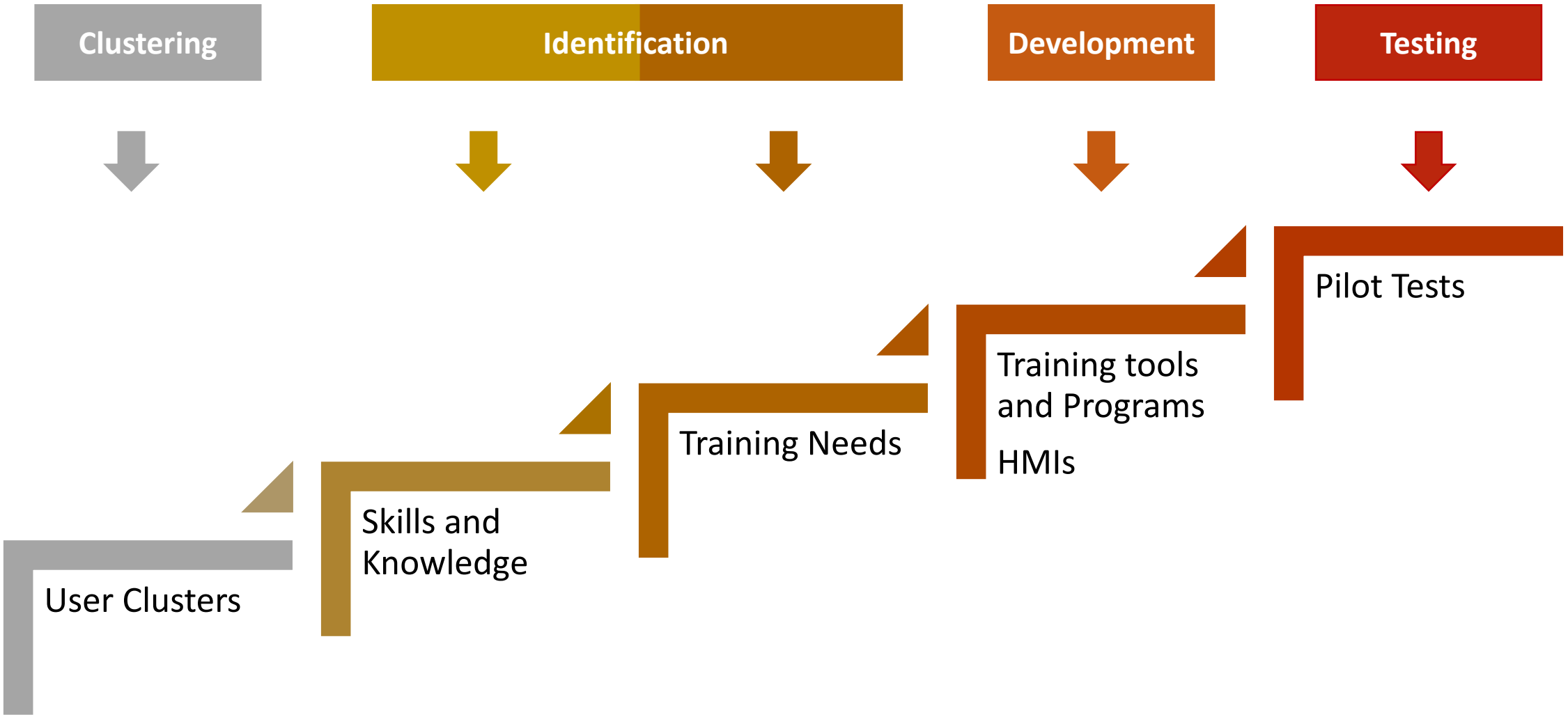
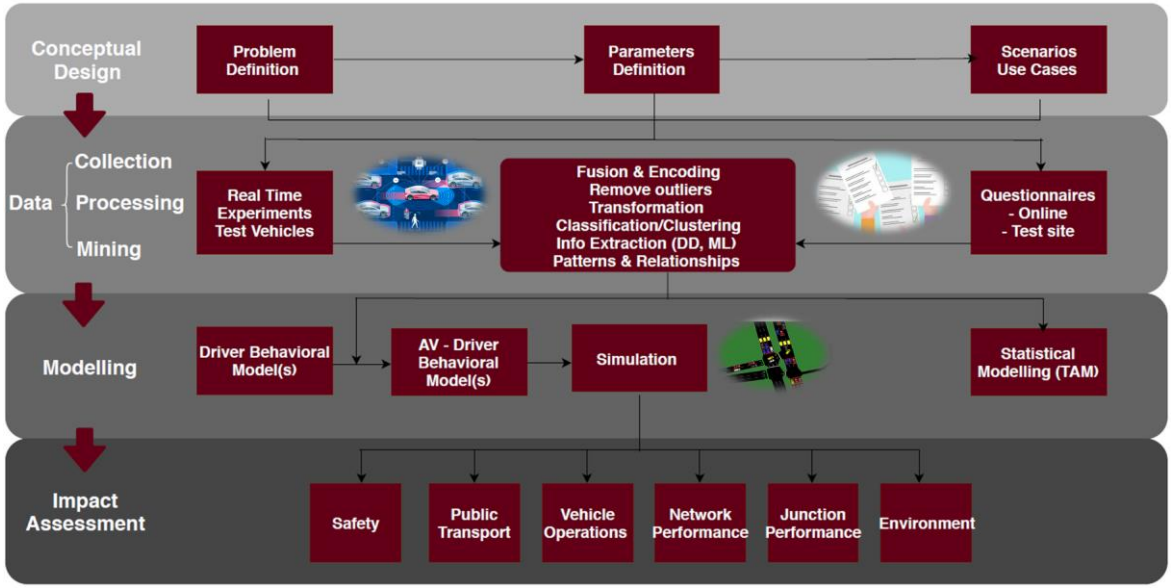
From skills to training programs



Methodological Framework

- Strong connection between the different steps of studying AVs.
- A holistic approach is necessary covering all aspects when analyzing automatic traffic
- Stepwise methodology including all processes:
  - Conceptual design
  - Data collection
  - Data processing/mining
  - Modelling
  - Impact assessment

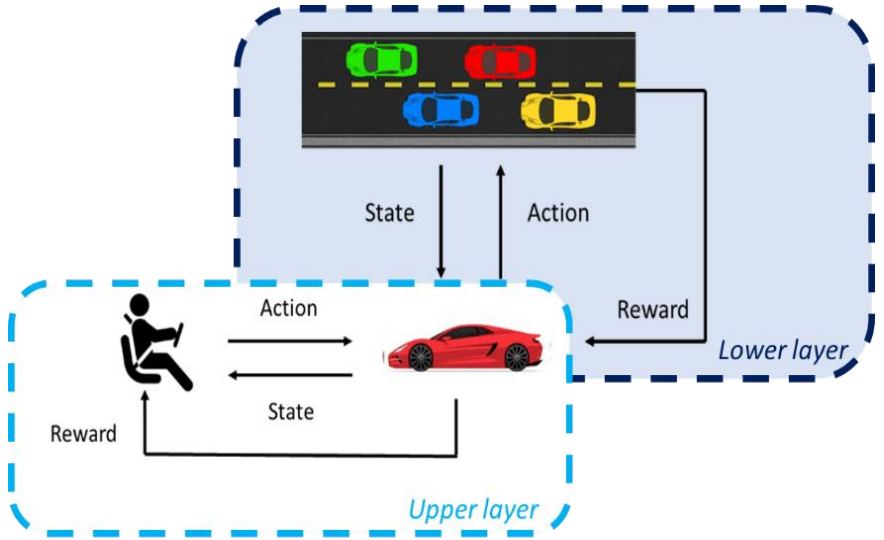


Simulation Modelling

- Two- layer microscopic AV behavioral model
  - Upper layer: interaction between the driver/user and the vehicle
  - Lower layer: interaction of the vehicle with the road environment

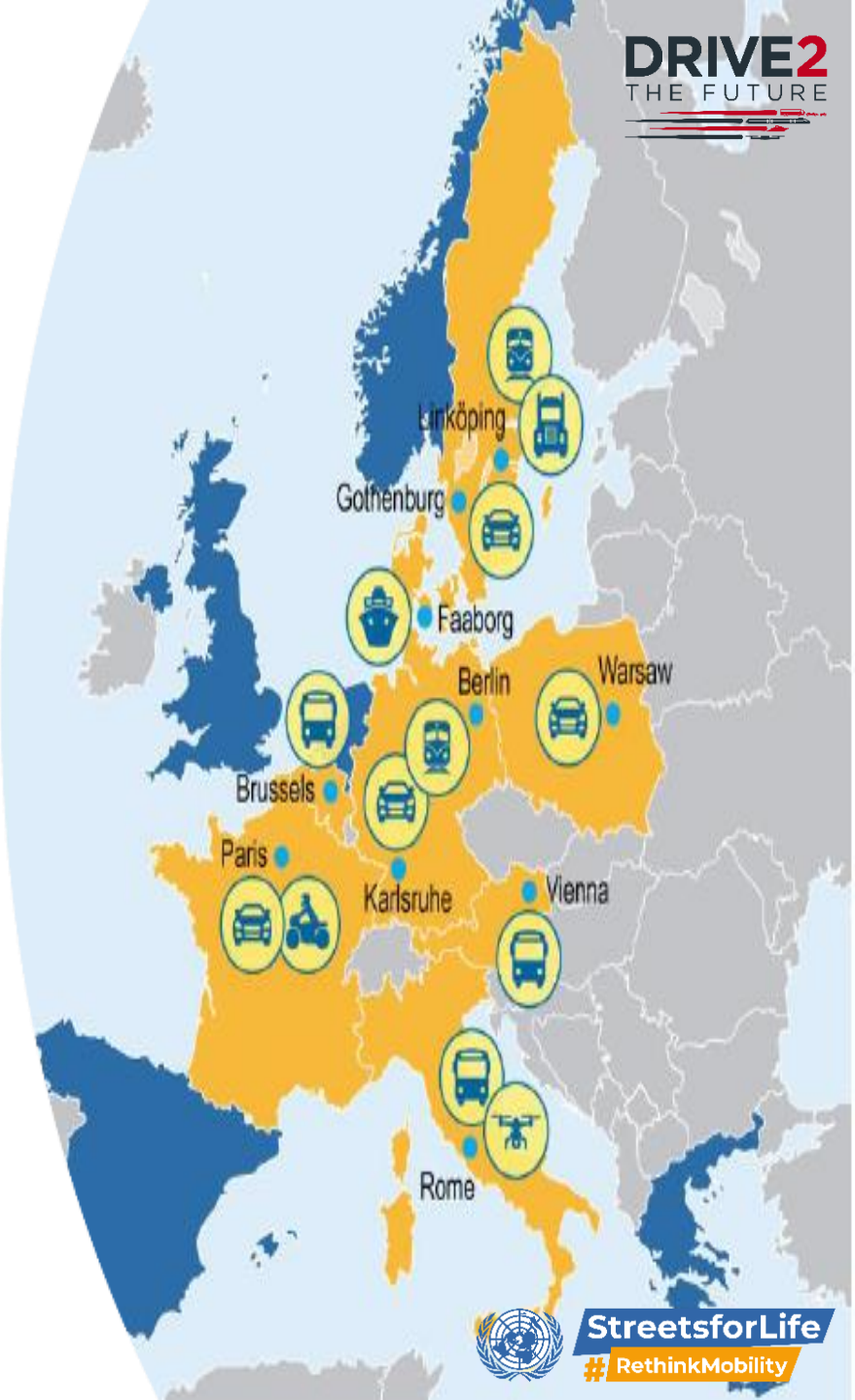
- Interaction between vehicle and the surrounding traffic:
  - Reinforcement learning algorithm
  - Real human driving trajectories collected via unmanned aerial vehicles (drones) in urban environment (city of Athens)
  - Quantification of safe driving profiles parameters

- Interaction between vehicle and pedestrian:
  - Inverse Reinforcement Learning algorithm
  - Automated vehicle (Level 3) and pedestrian
  - Data collected from virtual experiment (FZI pilot in Germany)



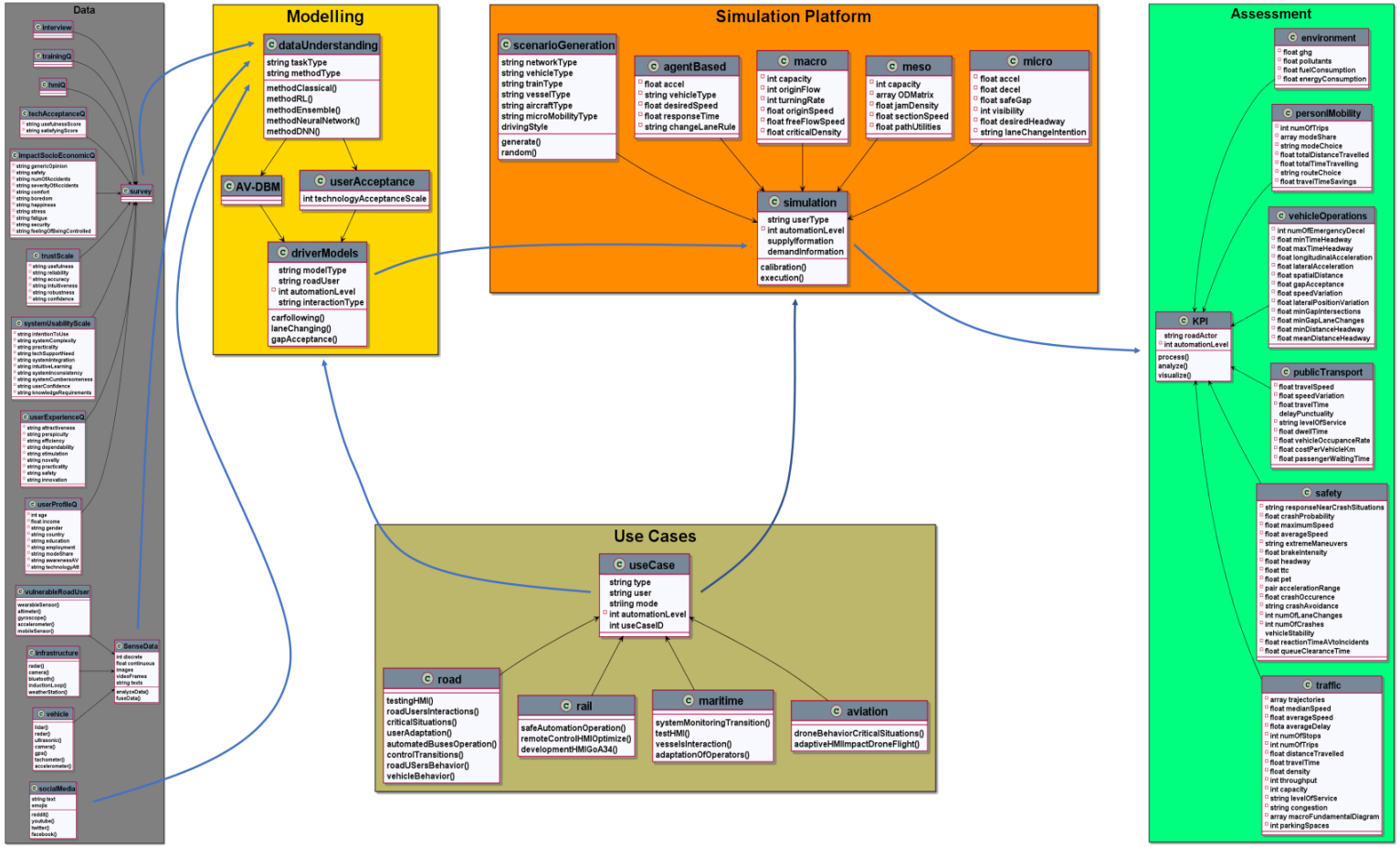
Pilots

- 12 pilots in 10 different cities
- Development of 3 pilot phases
- Development of HMIs tested during the pilots
- All transportation sectors and modes
- Interaction with non equipped vehicles and vulnerable road users
- Different levels of automation
- Assessment of AV's behavior and experience of the users and the participants
  - User surveys - Questionnaires
  - Direct observations
  - Event Diaries
  - User Interviews



Acceptance Suite

- Generic, conceptual data model framework
- Interrelations and paths between the steps are defined
- Components for each module are defined
  - 37 classes
  - More than 200 attributes
- Reference tool that can be used in national, European and international level



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- The development of user friendly HMIs according to users preferences and needs leads to increased acceptance of automated vehicles and higher penetration rates
- Suitable training programs for all type of drivers, operators and passengers of all modes bring about safer transportation of people and goods
- Behavioral models focused on investigating which AV behaviour increases trust by the driver, the passenger or other interacting road users → best vehicle performance based on all stimuli received.
- The suite can be exploited by operators for policy assessment based on the defined KPIs

Scientific and Social Impact

- Humanizing AVs through the formulation of safe and accepted driving profiles during the interaction with other road users
- Development of a complete simulation suite, incorporating a number of innovative tools
  - Exploited by researchers, car industry and technology providers
- Development of HMI toolkit, including a variety of tools
- Identification of skills and knowledge for an AV operation result in designing targeted training programs for all sectors and modes
- Raise public acceptance and market take up of automation services based on the pilot outcomes

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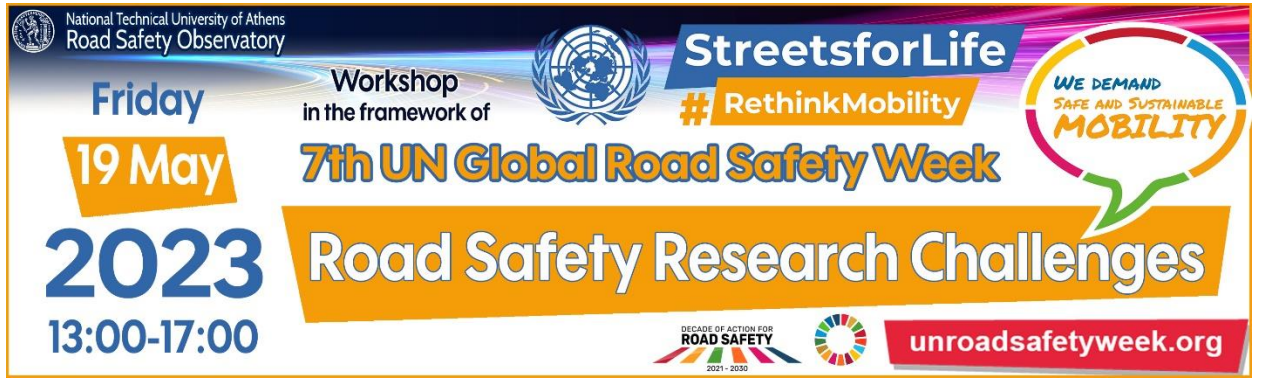
Future Challenges

- Extension of the AV behavioral models from passenger cars to other transport modes
- Development of HMIs capable of handling any emergency situation
- More pilot tests for autonomous transportation modes in the following sectors
  - Rail
  - Maritime
  - Aviation
- Further increase of user acceptance and trust in automation



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