Overview of Automated Driving Research in Europe

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OUTLINE

- Introduction
- **L3Pilot:** Pilot Testing
- **INFRAMIX:** Hybrid Infrastructure
- **SAFERtec:** Cyber-security / Security Assurance
- Conclusions

INTRODUCTION

- **Automation** in Road Transport is a hot topic worldwide
- Several aspects are important and require attention and further research
- There are **several gaps** esp. regarding:
  - Common evaluation framework and testing
  - Road infrastructure
    - Physical
    - Digital
  - Cyber-security
  - …

EUROPEAN PROJECTS

L3Pilot

- Testing of L3 automated vehicles functions

INFRAMIX

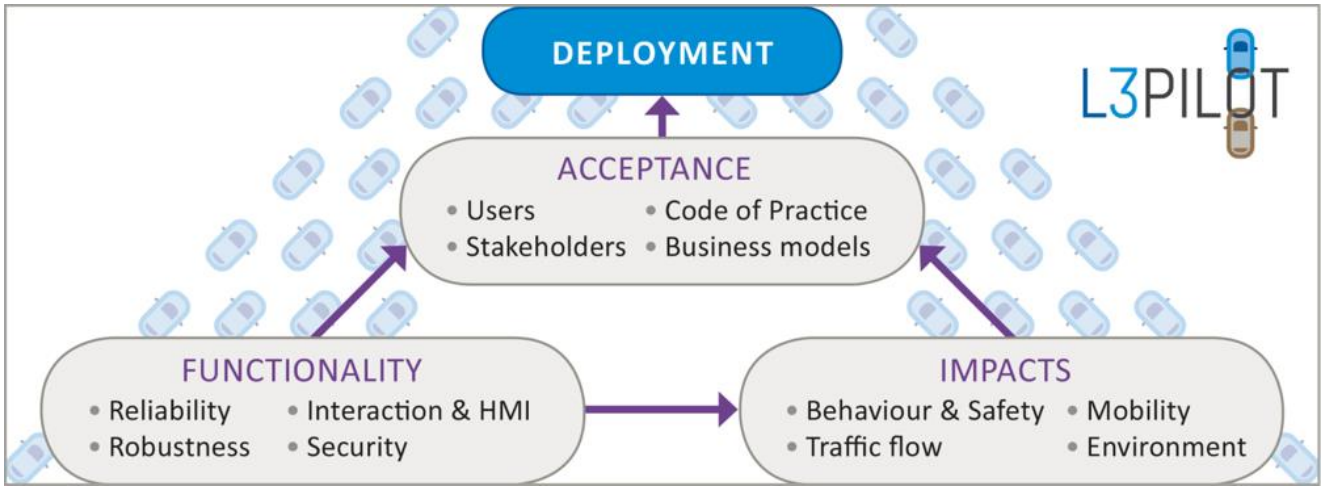
- Hybrid (Physical & Digital) Road Infrastructure

SAFERtec

- Cyber-security / Security Assurance

L3PILOT – OVERVIEW

- Large-scale piloting of AVs, mainly SAE Level 3 and some Level 4 functions (Sep 2017 – Aug 2021)
- 1,000 test drivers and 100 vehicles in 11 European countries

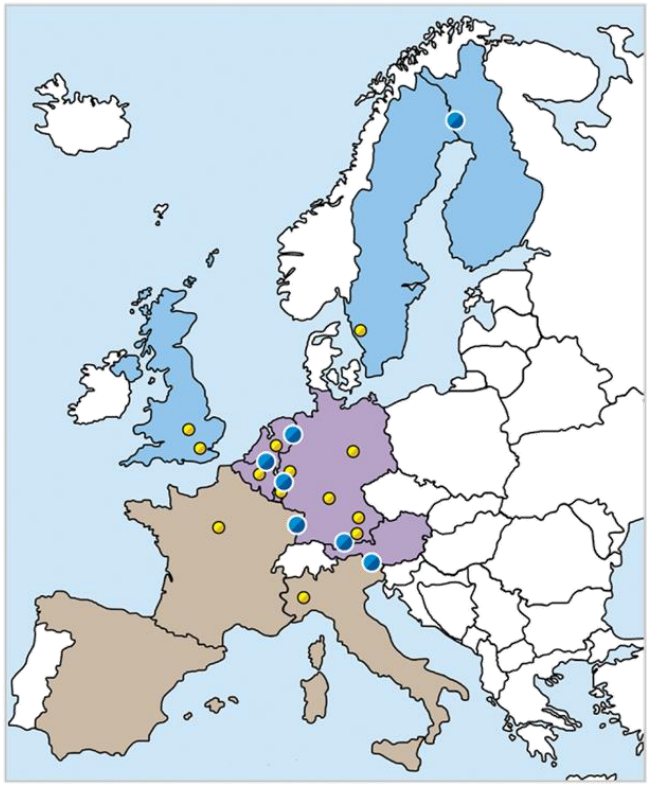


- Website: http://l3pilot.eu/

PILOT SITES

- Crossborder

Austria	Germany
Austria	Italy
Belgium	Germany
Belgium	Netherlands
Finland	Sweden
France	Germany
Germany	Netherlands



- Country, region - OEM

BE, Brussels;
NL - Toyota

DE, Aachen - Ford

DE, Ingolstadt - Audi

DE, Munich - BMW

DE, Offenbach - Honda

DE, Wolfsburg - VW

FR, Paris and other regions - REN, PSA

IT, Turin - CRF

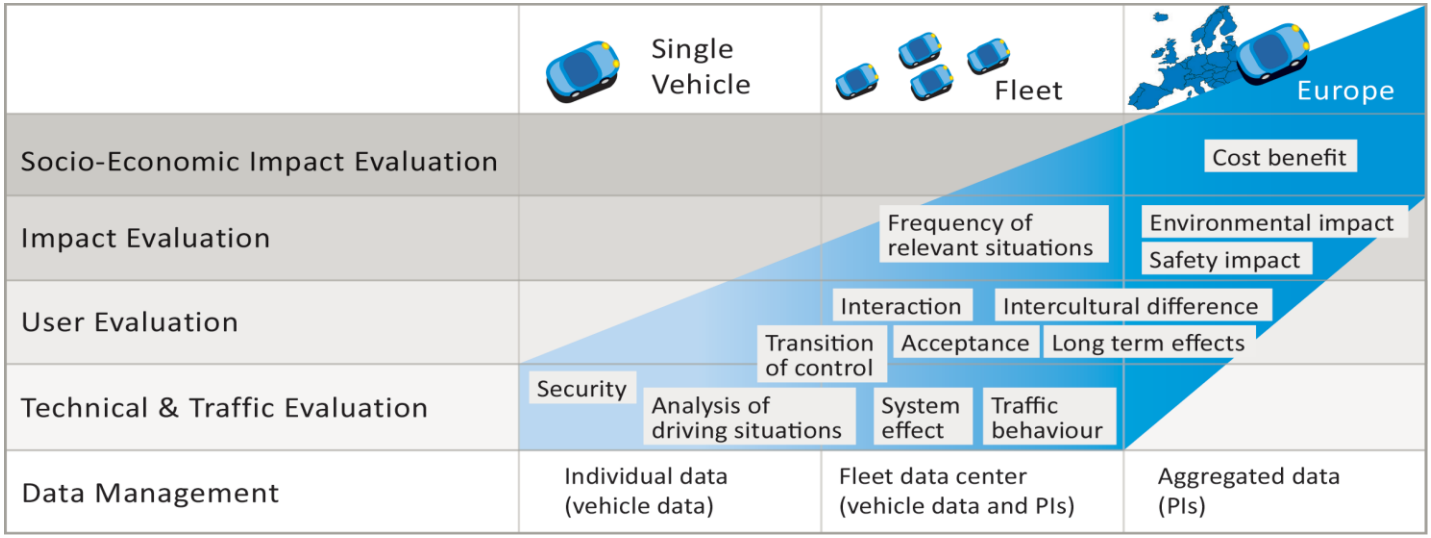
LU; NL - Delphi

SE, Gothenburg;
UK, London - Volvo

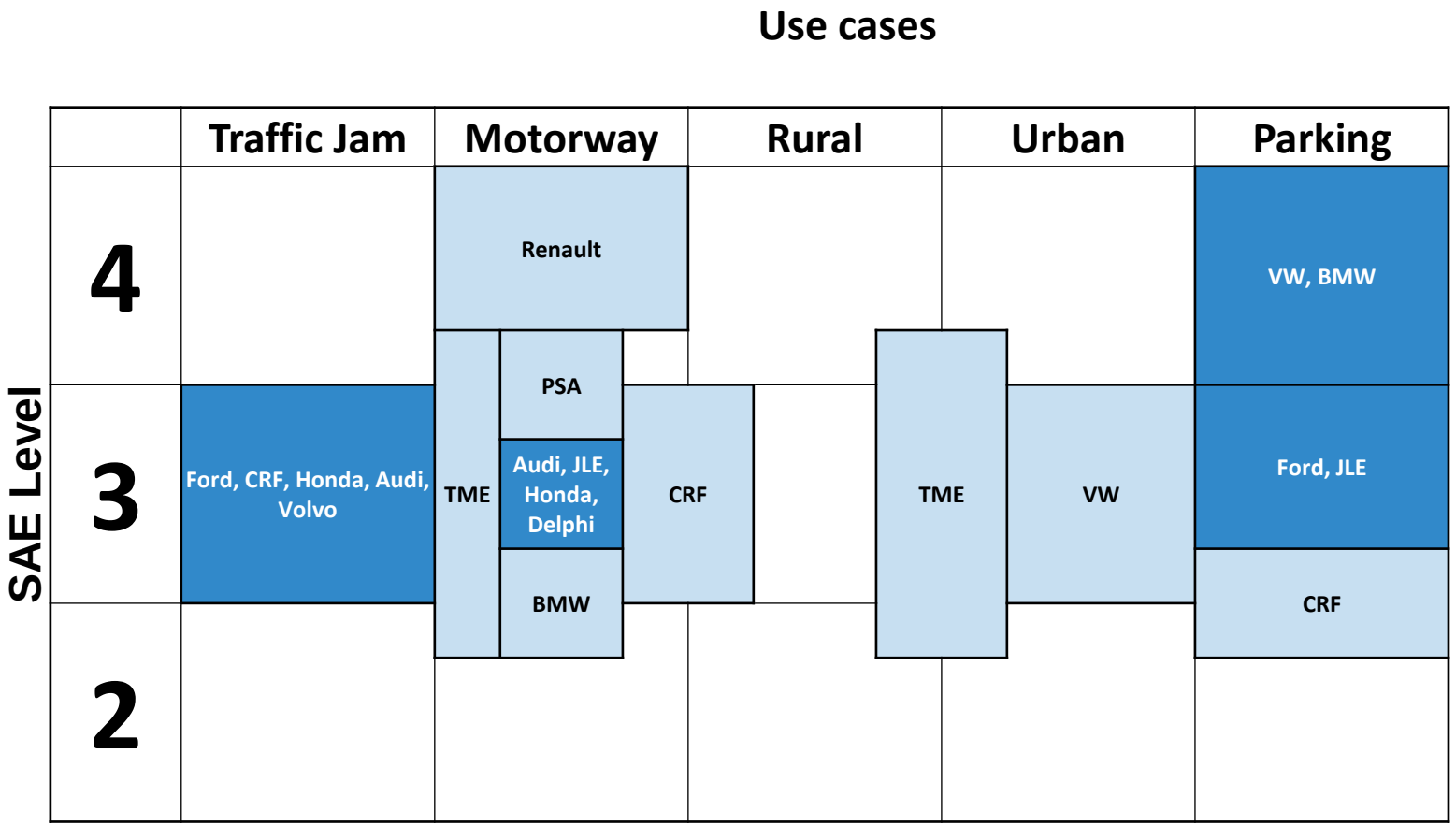
UK, Coventry - JLR

EVALUATION

- Evaluation of AD functions: technical, user acceptance, driving & travel behaviour
- Assessment of long-term effects of AD on user attitudes and acceptance
- Investigation of interactions between different traffic participants in different automation modes
- Assessment of readiness and reliability of AD functions
- Tools for the effective analysis, evaluation and impact assessment



USE CASES OVERVIEW



PREPARING ROAD INFRASTRUCTURE FOR MIXED TRAFFIC

INFRAMIX prepares road infrastructure for mixed vehicles traffic flows

(June 2017-May 2020) https://www.inframix.eu/

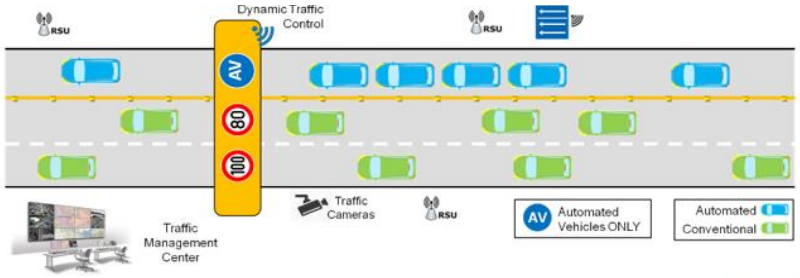
11 partners 2 highway real test sites, towards a “hybrid” road infrastructure:

- Design new and upgrade existing physical & digital road infrastructure elements
- Design novel signaling and visualization elements
- Design and implement novel traffic estimation, monitoring and control strategies
- Develop a co-simulation environment
- Develop hybrid testing system
- Evaluate user’s appreciation and acceptance
- Evaluate traffic safety
- Create a Road Infrastructure Classification Scheme

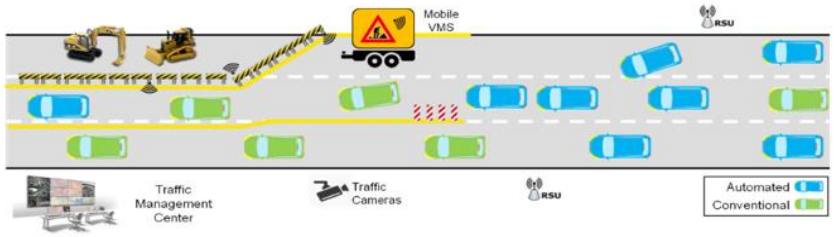
PREPARING ROAD INFRASTRUCTURE FOR MIXED TRAFFIC

Three traffic scenarios under investigation

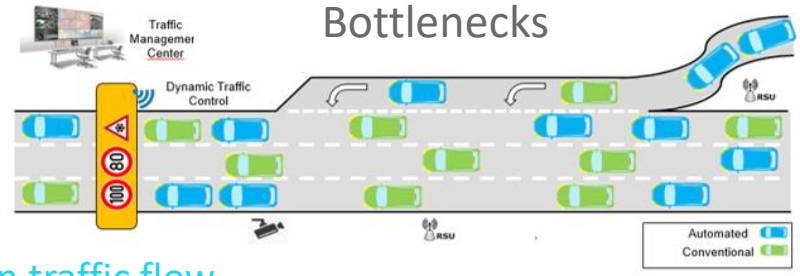
Dynamic lane assignment to automated driving



Roadworks zones



Bottlenecks



Selection criteria:

a) expected impact on traffic flow

b) expected impact on traffic safety

c) importance of the challenges faced, in the sense that if not handled in a proper and timely way, they will negatively influence the introduction of automated vehicles on the roads

d) ability to generalize on the results (applicable in other scenarios and environments)

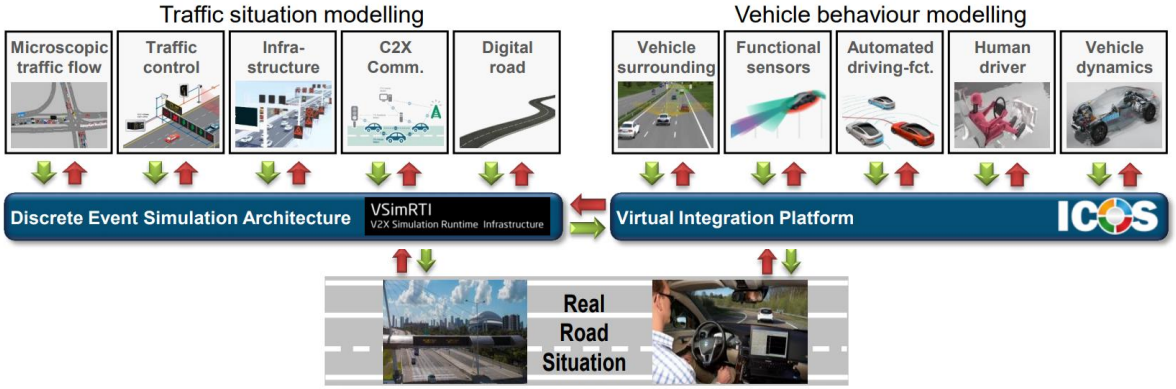
INFRASTRUCTURE EVALUATION & OPTIMIZATION

- Real tests in modern highways:

Girona (Spain)

Graz (Austria)

- Co-simulation environment



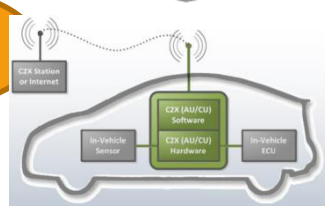
- Hybrid testing: coupling infrastructure elements and vehicles on real roads with virtual traffic environment

INFRAMIX IMPACT IN AUTOMATED ROAD TRANSPORT

Hybrid testing system	• Testing of new developments of connected and automated driving • Emulation of critical traffic situation in a safe artificial environment • Real-time communication with real-world vehicles
Road infrastructure for mixed traffic	• New pictogram code for traffic signs for mixed traffic • Novel traffic monitoring recommendations (wireless messages extensions)
Infrastructure Classification Scheme	• Indication of the infrastructure connectivity, automation capabilities, capability to host vehicles of different levels of automation and connectivity. • A guide of how to incrementally upgrade levels of infrastructure to avoid stranded investments. • Boost discussion at stakeholder's workshop

INFRASTRUCTURE-CONNECTED VEHICLES AND SECURITY ASSURANCE

Focus on V2I



- Today's vehicles integrate a large set of 3rd party components and applications
  - Numerous interfaces and an increased attack surface are exposed

To what extent are we 'sure' that the involved technology meets the requirements for

SECURITY | PRIVACY | RELIABILITY | SAFETY

- Quantification of assurance is complex and costly!
  - Typically relies on generic frameworks
  - Connected-vehicle-ecosystem details: not considered

EU SAFERtec to **design** and **experimentally evaluate** an agile assurance framework tailor-made for V2I settings

Industry

AIRBUS DEFENCE & SPACE, CRF, swarco, TOMTOM

SMEs

Autotalks, OPPIDA, commsignia

Research Institutes

ICCS, UNIVERSITY OF PIRAEUS

Project facts

Start date: January 2017
Duration: 36 months
Budget: 3.8 MEuros

WORK OVERVIEW & USE-CASES SCOPE

Now

January 2017	March 2017	June 2017	September 2017	December 2017	March 2018	....

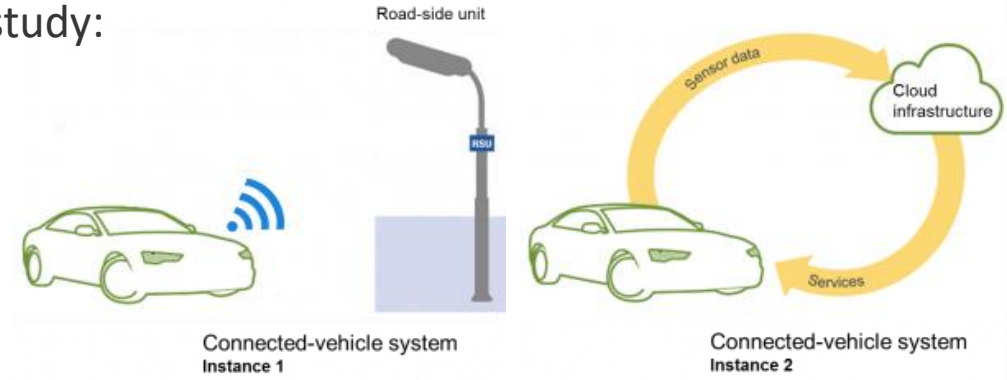
Modeling of V2I use-cases
Use-cases, attack modeling, risk analysis

To test the proposed framework

Development of the connected-vehicle system
Prototype vehicle with 3rd party HW/SW connected to infrastructure

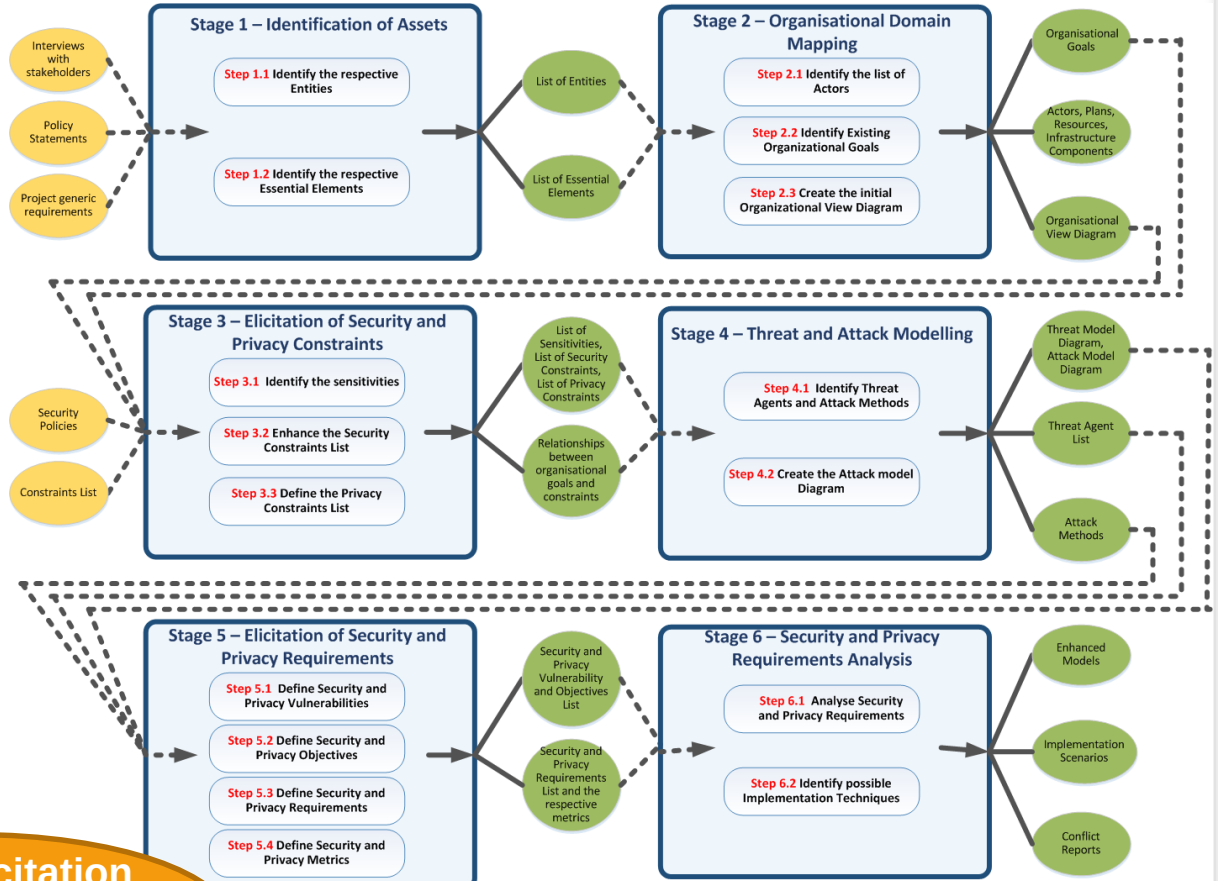
Design of a Security Assurance Framework
Innovative methodology to quantify V2I security/privacy assurance

- Under two general V2I instances we study:
  - Optimal driving-speed advice
  - Real-time traffic-hazard information
  - Priority request in intersection-crossing



A BIT OF TECHNICALITIES: REQUIREMENTS ELICITATION & MODELLING

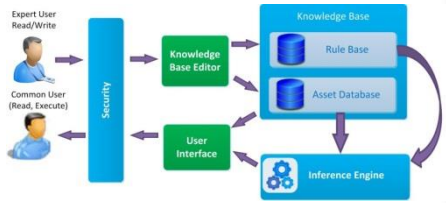
- A novel 6-stages approach integrating 3 methodologies (EBIOS, SecureTropos and PriS)
- **Input**: the high level description of the V2I considered use-cases
- **Output**: identified security and privacy requirements and countermeasures



Threat elicitation is based on ETSI standards

EXPECTED ACHIEVEMENTS AND IMPACT

- Innovative modeling work for the emerging risks/vulnerability
- Introduction of an agile security assurance framework tailored for V2I
- Experimental validation of the framework using a prototype vehicle and dedicated SW and HW
- Contribution to relevant standards
- Toolkit to enable (semi-)automated generation of assurance levels for Connected Vehicles



Assurance Framework Toolkit

Higher Level of Assurance (and trust) for Connected Vehicles and services

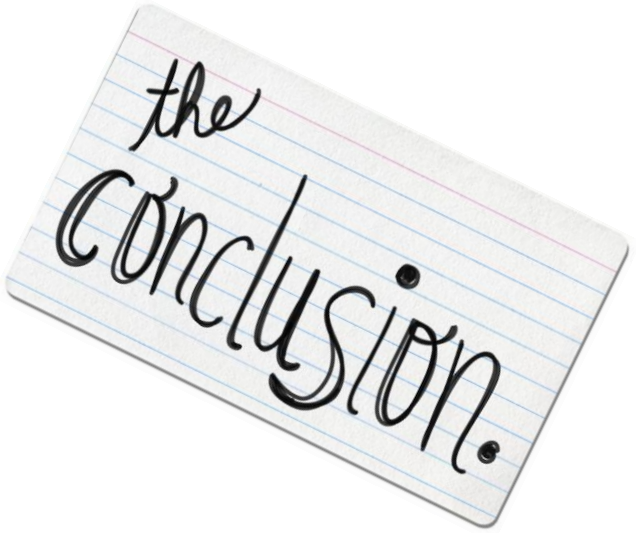
CONCLUSIONS (1)

- A **common evaluation framework** for AD functions (technical, user acceptance, driving & travel behaviour) is necessary
- **Assessment** of the long-term **effects**, **readiness** and **reliability** of AD functions is needed for proper deployment
- **Tools** for the effective analysis, evaluation and impact assessment are missing

- Road infrastructure must be **upgraded** for mixed traffic
- An **Infrastructure Classification** Scheme is needed
- **Simulation** and **hybrid testing** is of high value for future research
- Real implementation of **novel traffic monitoring** and **control strategies** for mixed traffic is necessary

CONCLUSIONS (2)

- Establishing vehicular connectivity comes with further **cyber-security, privacy and safety concerns**
- An under-explored area: **Automotive Security Assurance**
  - Degree of confidence that the realized automotive (cyber-)security controls will reduce anticipated risks
- EU SAFERtec advances the V2I security assurance research aiming to **increase trust** in connected vehicles/ITS



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