Use case webinar: Traffic Jam Chauffeur

Álvaro Arrúe – Applus IDIADA

Xavier Sellart – Applus IDIADA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824309.

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Agenda

- ✓ Álvaro Arrúe – Applus IDAIDA

- ✓ Xavier Sellart – Applus IDIADA

Agenda

- ✓ Introduction webinar
- ✓ Introduction HEADSTART project
- ✓ HEADSTART methodology in a nutshell
- ✓ Introduction use case: Traffic Jam Chauffeur
- ✓ HEADSTART method application to use case: Traffic Jam Chauffeur
  - Scenario selection and allocation
  - Testing of scenarios
  - Evaluation of test results
- ✓ Wrap-up

Introduction webinar

Webinar rules and process

- ✓ Webinar is being recorded
- ✓ Slides, voting results and recording will be shared and published on HEADSTART website

- ✓ Participants feedback gathered via www.slido.com with event code: *HEADSTART*
- ✓ Questions can be raised via www.slido.com with event code: *HEADSTART*

  The questions are gathered and where possible raised by the webinar moderator at fixed time slots during the webinar to the presenters.

Introduction webinar

- ✓ Goal of this meeting:

  Get external expert feedback on HEADSTART method applied to use case:

  Traffic Jam Chauffeur

- ✓ Feedback will be integrated in HEADSTART deliverable:

  D2.3 Assessment method for each of the use cases defined

- ✓ Special attention to HEADSTART Key Enabling Technologies (KETs):

  Communication V2X and **Positioning (GNSS)**

- ✓ HEADSTART KET – **Cybersecurity** will be discussed in separate webinar on Friday May 15th 10:00-11:30 CET. Link to registration on HEADSTART website.

HEADSTART

HARMONISED EUROPEAN SOLUTIONS FOR TESTING AUTOMATED ROAD TRANSPORT

Álvaro Arrúe – Applus IDIADA

Project coordinator

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824309.

HEADSTART project facts

- ✓ **Call identifier:** ART-01-2018
- ✓ **Type:** RIA
- ✓ **Duration:** 01.2019 – 12.2021 (36 months)
- ✓ **Budget:** 6M€
- ✓ **Consortium:** 17 partners
- ✓ **Coordinator:** Applus IDIADA, Mr. Álvaro Arrue, Project Manager
- ✓ **Dissemination Manager:** ICCS, Dr. Angelos Amditis, Research Director
- ✓ **Website:** https://www.headstart-project.eu
- ✓ **Social media:** / HEADSTART_EU
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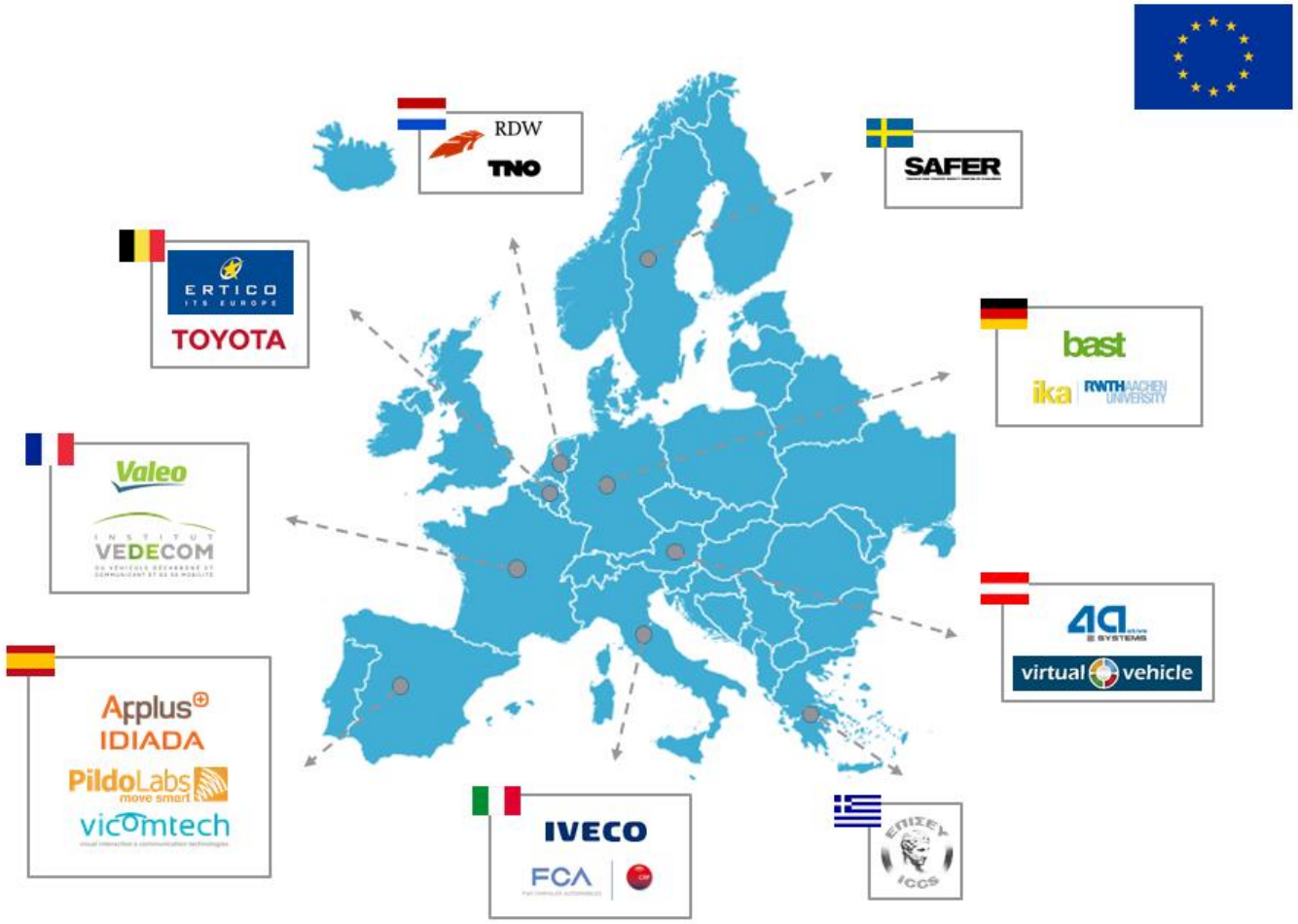
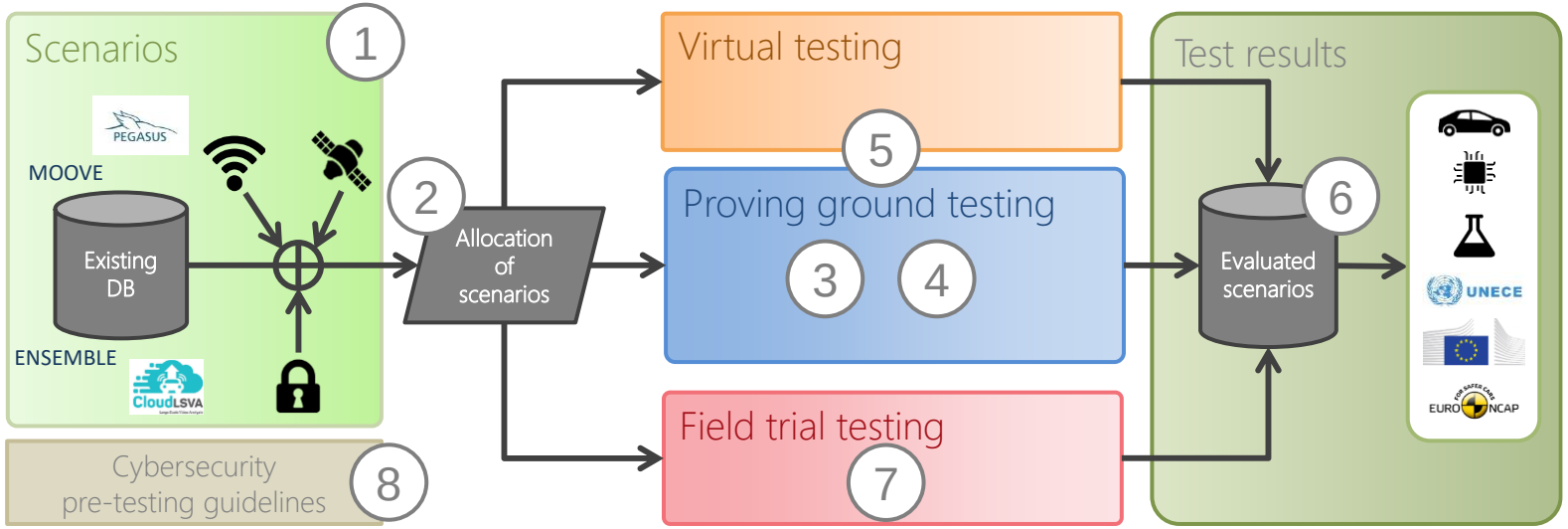
HEADSTART Consortium



Project's Concept

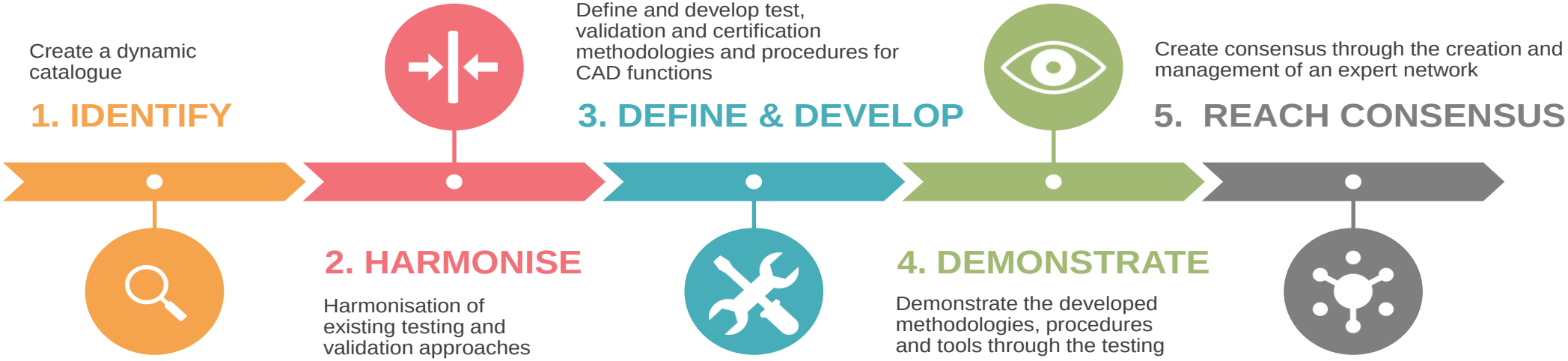


1. Integration of positioning, communications and cyber-security in CAD test scenarios
2. Comprehensive procedure for the allocation of test cases per testing platform
3. Selection criteria and specification for proving ground test scenarios taking into account criticality
4. Proving ground testing and evaluation
5. Correlation between simulation and proving ground results
6. Harmonised, open result compilation and sharing
7. Field trial test methodology description
8. Cyber-security principles and integration in the testing methodology

Project's Objectives

HEADSTART will define testing and validation procedures of CAD functions including:

- its key enabling technologies (i.e. communication, cyber-security, positioning)
- by cross-linking of all test instances such as simulation, proving ground and real world field tests
- to validate safety and security performance according to the needs of key user groups (technology developers, consumer testing and type approval)



HEADSTART methodology

Xavier Sellart – Applus IDIADA

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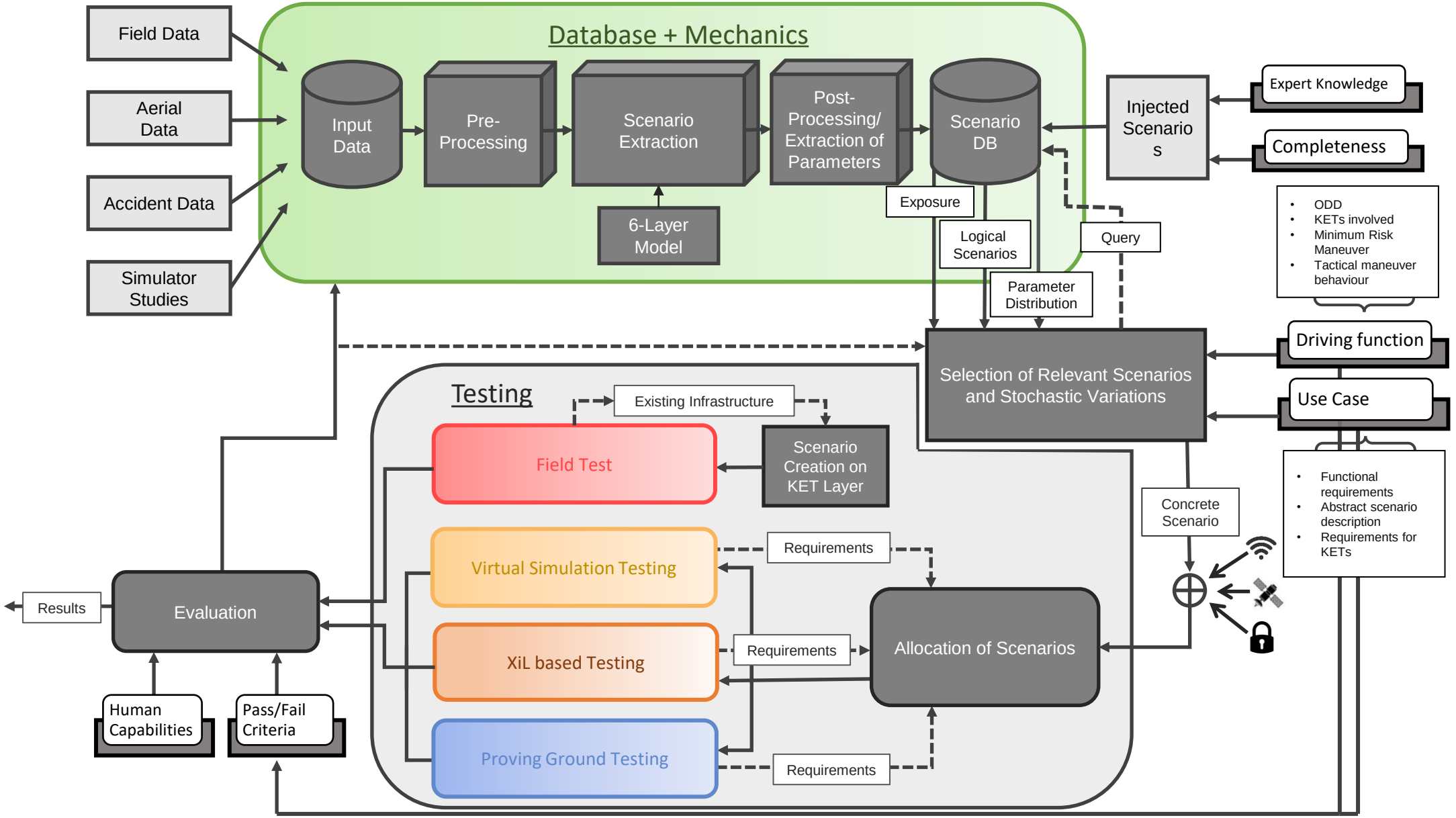
Field Data
Aerial Data
Accident Data
Simulator Studies
Database + Mechanics
Input Data
Pre-Processing
Scenario Extraction
6-Layer Model
Post-Processing/ Extraction of Parameters
Scenario DB
Exposure
Logical Scenarios
Parameter Distribution
Query
Injected Scenarios
Expert Knowledge
Completeness
ODD
KETs involved
Minimum Risk Maneuver
Tactical maneuver behaviour
Driving function
Use Case
Selection of Relevant Scenarios and Stochastic Variations
Functional requirements
Abstract scenario description
Requirements for KETs
Concrete Scenario
Testing
Existing Infrastructure
Field Test
Scenario Creation on KET Layer
Virtual Simulation Testing
Requirements
XiL based Testing
Requirements
Proving Ground Testing
Requirements
Allocation of Scenarios
Results
Evaluation
Human Capabilities
Pass/Fail Criteria

HEADSTART: WP1 use case overview

		Truck Platooning	Highway Pilot	Traffic Jam Chauffeur	Valet Parking	Urban Automated Shuttle
Requirements for testing KETs	How suitable is the use case to meet the requirements on testability of positioning in HEADSTART	3,8	3,6	2,6	4,3	4,5
	How suitable is the use case to meet the requirements on testability of communication in HEADSTART	4,8	3,4	1,9	3,5	3,5
	How suitable is the use case to meet the requirements of testability of cyber-security in HEADSTART	4,5	3,1	2,4	3,7	3,7
Requirements for testing	How suitable is the use case to meet the requirements regarding physical testing in HEADSTART	4,3	4,3	3,5	4,3	2,9
	How suitable is the use case to meet the requirements regarding proving-ground testing in HEADSTART	4,1	3,6	3,1	3,8	2,6
	How suitable is the use case to meet the requirements regarding field operational tests in HEADSTART	4,0	4,1	3,4	3,8	3,1
	How suitable is the use case to meet the requirements regarding model-based testing in HEADSTART	3,9	3,6	3,6	3,9	3,6
Availability of Scenarios ➔	How suitable is the use case to meet the requirements regarding definition and availability of scenarios in HEADSTART	3,3	3,8	3,5	3,0	2,6
Collaboration partners for this use case ➔	How suitable is the use case to meet the requirements regarding requirements on collaboration partners in HEADSTART	4,0	3,7	2,9	3,3	2,6
Relevance to key user groups	How suitable is the use case to meet the requirements regarding relevance to OEMs andTier1s in HEADSTART.	3,0	4,8	4,5	3,5	3,3
	How suitable is the use case to meet the requirements regarding relevance to type-approval authorities in HEADSTART	3,3	4,1	3,9	2,8	2,9
	How suitable is the use case to meet the requirements regarding relevance to consumer testing in HEADSTART	1,7	3,9	3,6	2,4	1,7
	Total Average Score	3,7	3,8	3,2	3,5	3,1

HEADSTART: selected use cases

Truck Platooning

Highway pilot

Traffic-jam chauffeur

- Objective of the "HEADSTART week" webinars

Use case: Traffic Jam Chauffeur

Xavier Sellart – Applus IDIADA

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Introduction use case: Traffic Jam Chauffeur

✓Traffic Jam Chauffeur refers to

The traffic jam chauffeur use case can be defined as conditional driving automation (L3) in traffic jam conditions, on highways and other structurally separated roads, with a speed range of 0 to 60 km/h.

✓Relevance of HEADSTART KETs:

- Communication V2X
- Positioning (GNSS)

✓Main safety and security assessment stakeholders:

- OEMs & TIERs
- Type approval authorities
- Consumer organisations (like Euro NCAP)

Introduction use case: Traffic Jam Chauffeur

✓To limit scope:

Conditional Driving automation as basis for discussion:

- Traffic Jam Chauffeur is capable of keeping the vehicle in the current lane and maintaining a safe distance to the vehicle in front of the ego vehicle.
- The driver must deliberately activate the system but does not have to monitor the system constantly. The driver can at all times override or switch off the system.
- In case of a takeover request to the driver from the system, the driver has sufficient time reserve to orientate himself and take over the driving task (tipically 10 seconds).
- In case the driver does not take over, the system will go to a reduced risk condition, i.e. bring the vehicle to a safe stop.

- Used as basis for discussion, but with outlook to higher levels of automation.

Introduction use case: Traffic Jam Chauffeur

- Question 1:

  Do you agree with statement below for traffic jam chauffeur:

  A. Traffic Jam Assistance offers a great deal of benefit on customers from SAE Level 2 and above.
  B. Traffic Jam Chauffeur offers a great deal of benefit on customers from SAE Level 3 and above.
  C. Traffic Jam Chauffeur offers a great deal of benefit on customers from SAE Level 4 and above.
  D. None of the statements above, because …

Introduction use case: Traffic Jam Chauffeur

✓ Communication

- Vehicle-to-everything (V2X) communication is not necessary for this use case. An example of an application of communication V2X for this use case could be a vehicle in front of the closest in path vehicle sending a signal to warn other road users is braking.

✓ Positioning

- In-lane positioning used for lateral control.
- Relative inter-vehicle positioning for distance keeping with other r

users and longitudinal control.

- Absolute positioning (through GNSS and Maps) e.g. for deciding ga

and speeds due to environmental and zone conditions.

Traffic-jam chauffeur

Introduction use case: Traffic Jam Chauffeur

- Question 2:

  Which are the most relevant parameters for the validation of the Traffic Jam Chauffeur Use Case :

  A. Positioning parameters
  B. Human Factors parameters
  C. Dynamic objects parameters
  D. Environmental conditions parameters (weather, light conditions …)
  E. Other: …

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Introduction use case: Traffic Jam Chauffeur

- ✓ Show survey results:
  - Q1
  - Q2

- ✓ Open questions

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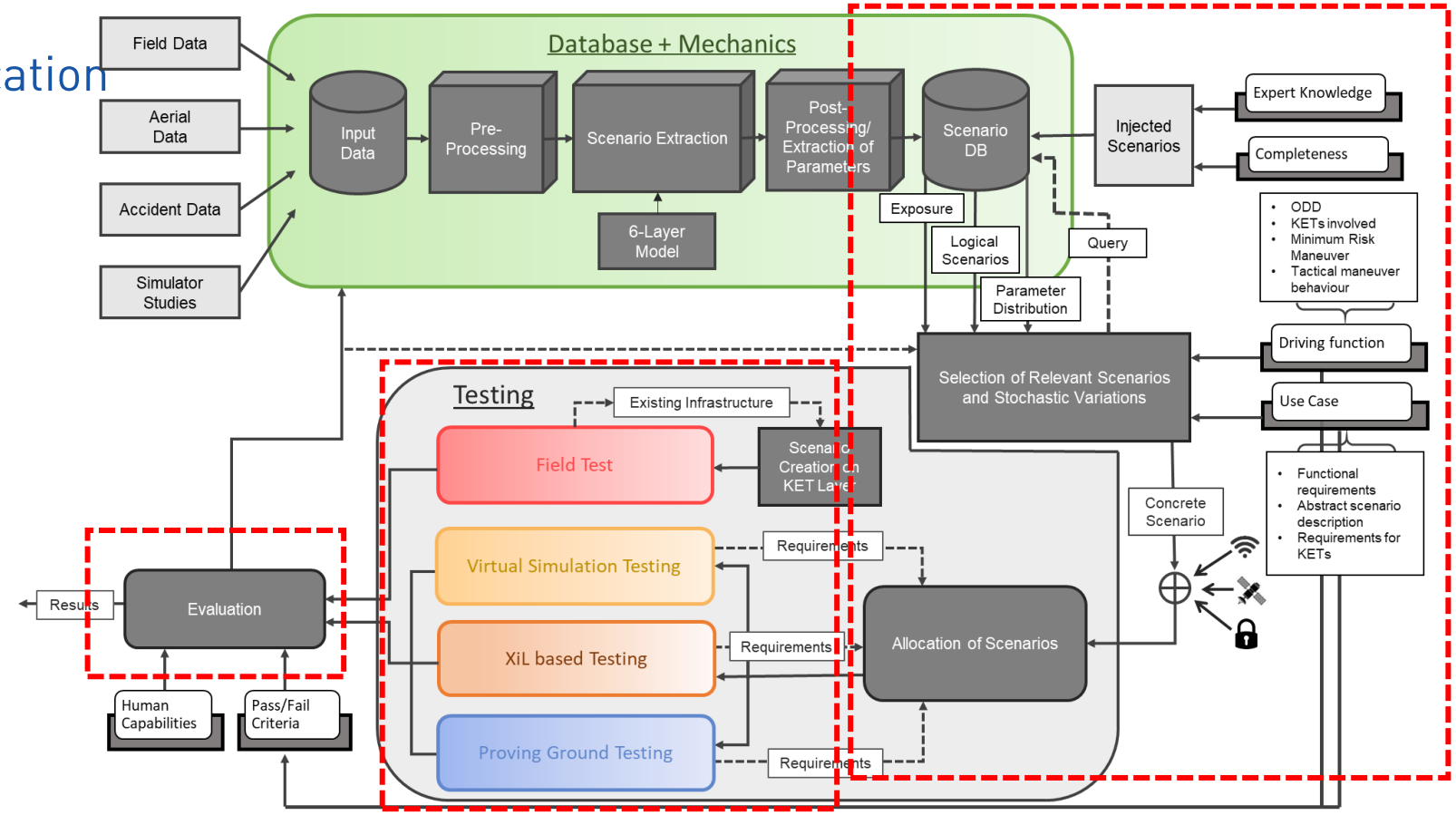
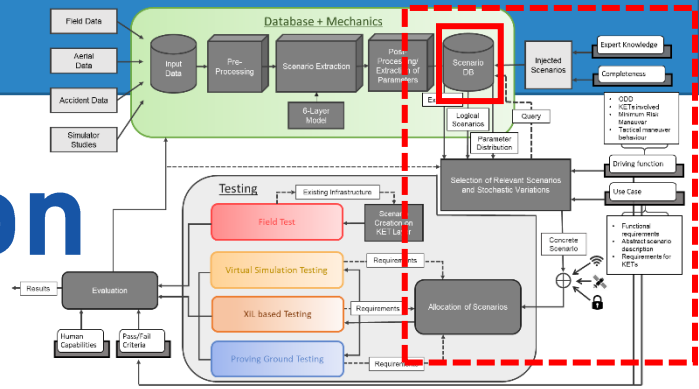
HEADSTART method

- ✓Scenario selection and allocation
- ✓Testing of scenarios
- ✓Evaluation of test results



Scenario selection and allocation



✓ Traffic Jam Chauffeur Influencing factors for scenario selection

- The vehicle's location in the world is required to determine whether the vehicle is on the ODD. Thus, road type classifications, e.g. via. vision sensors might be sufficient. Detection of highway-specific features such as traffic signs or features that indicate the vehicle is not on highway is possible.

- Leading vehicles in front of the ego vehicle should be detected with the highest possible dependability.

  Lane markings are also relevant static objects.

- Transform trajectory to a longitudinal and lateral vehicle movement up to 60 km/h. Realize a trajectory within given limits derived from lane, other objects and ego-vehicle width with the given and nominal performing actuators.

Scenario selection and allocation

✓ Question 3:

Ultimately the (traffic jam chauffeur) scenario database(s) should also include:

A. Communication V2X parameters
B. Positioning (GNSS) parameters
C. Cybersecurity parameters
D. Others missing parameters: …
E. None additional parameters needed.

Please provide as answer: the applicable numbers (multiple possible) and additional parameters.

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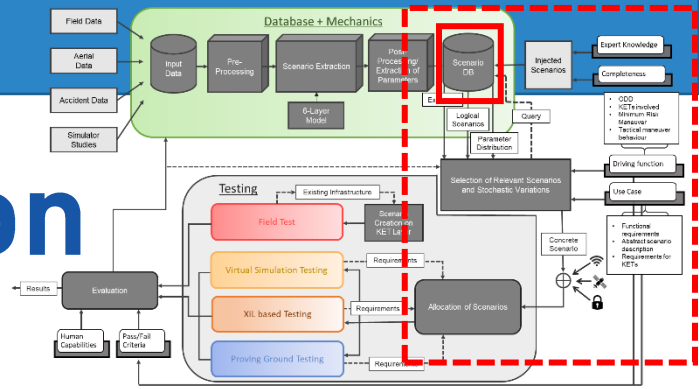
Scenario selection and allocation



✓ Scenario database

Databases can be representative for / contain information of:

- Various vehicle types
  - Passenger cars
  - Trucks
  - …
- Various configurations / automation levels
  - SAE levels
  - Platooning
  - …
- Regions of the world
  - Europe
  - United States
  - Japan
  - …

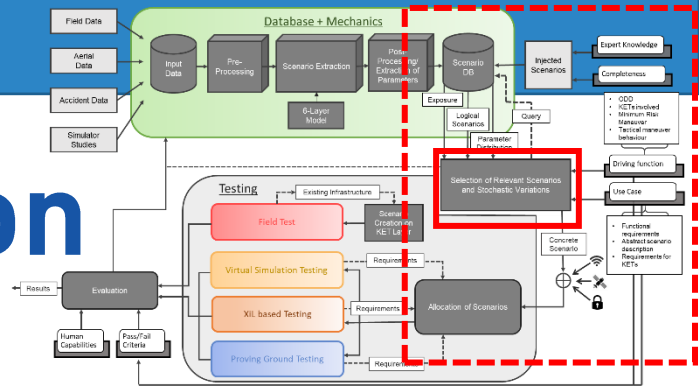
Scenario selection and allocation

- ✓ Question 4:

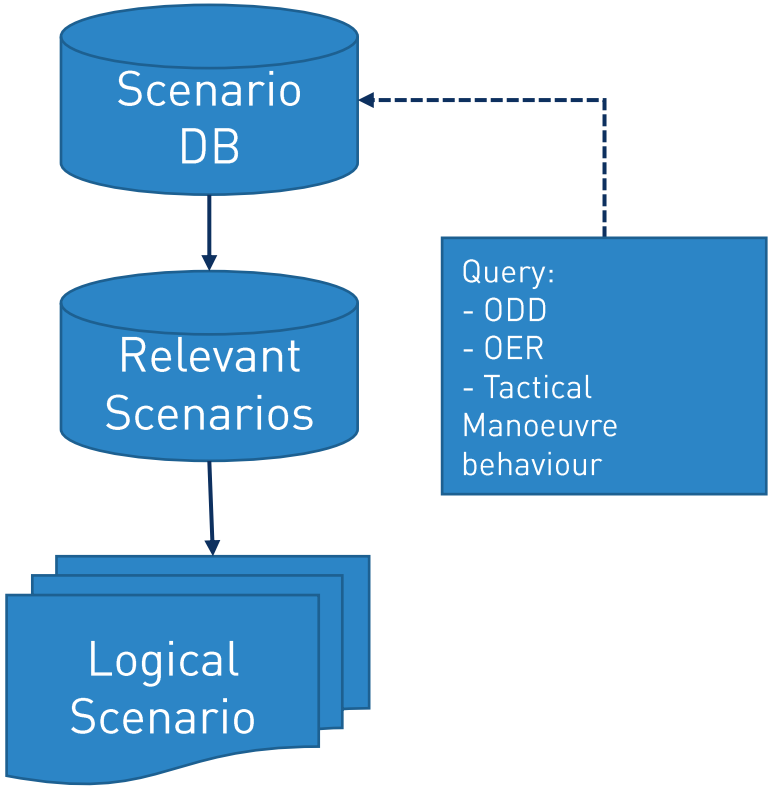
  Scenario database(s) needed:

  A. Single world database for all vehicle types and automation levels (incl. traffic jam chauffeur)
  B. World database per vehicle type and automation levels (incl. traffic jam chauffeur)
  C. Regional database for all vehicle types and automation levels (incl. traffic jam chauffeur)
  D. Regional database per vehicle types and automation levels (incl. traffic jam chauffeur)
  E. Other: …

Scenario selection and allocation

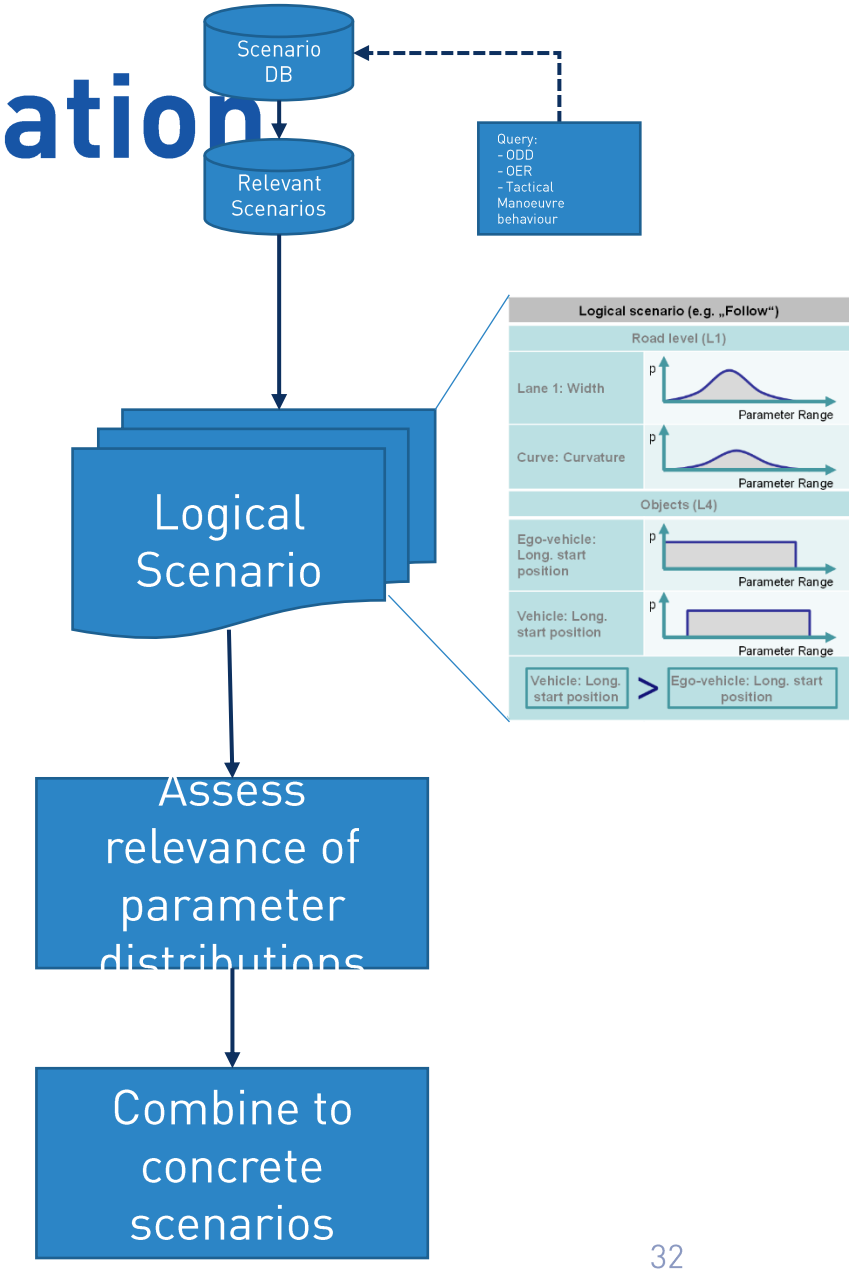


- ✓ Scenario selection – Filtering logical scenarios
  - Relevant logical scenarios filtered based on functional requirements
  - Functional requirements of a driving function should at least consist of the:
    - Operational Design Domain (ODD)
    - Object and Event Detection and Response (OEDR)
    - Tactical manoeuvre behaviour

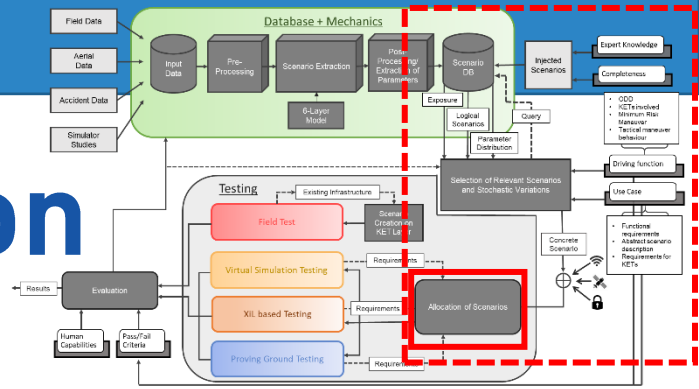


Scenario selection and allocation

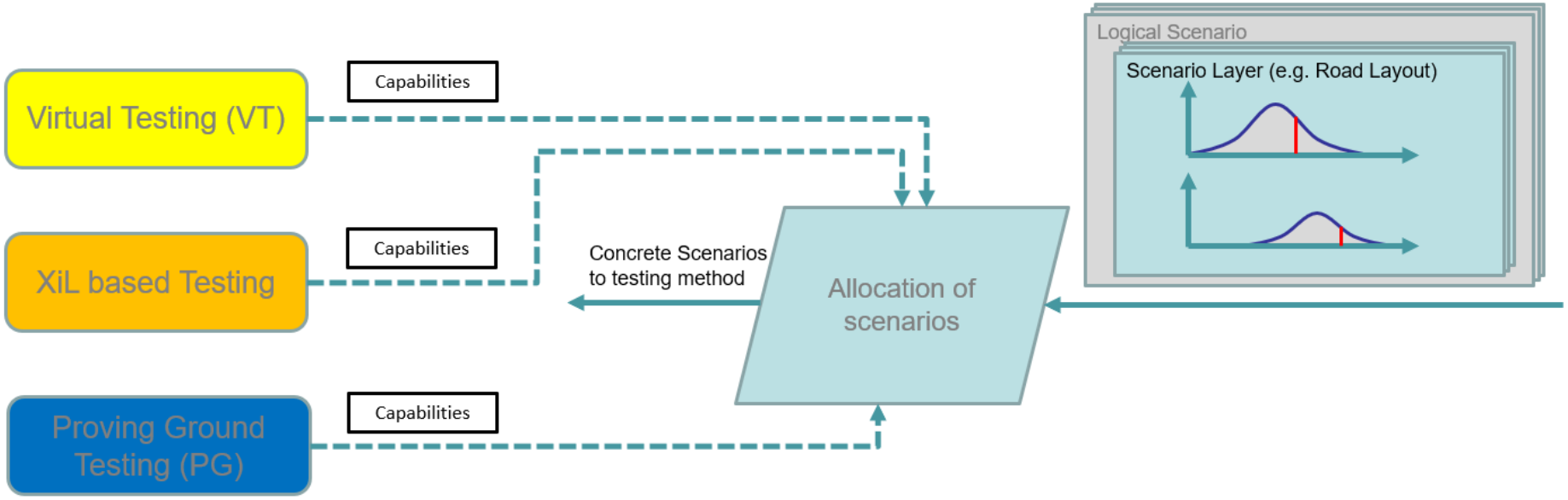
- ✓ Scenario selection – Parameter distribution
  - Gather all relevant logical scenarios with parameter distributions
  - Assess relevance of the parameters
    - Based on probably distributions
    - Taking potential parameter constraints into account
    - Considering prohibited parameter combinations
  - Combine to concrete scenarios



Scenario selection and allocation



- ✓ Scenario allocation
  - 3 test methods:
    - Virtual Testing (VT)
    - X in the Loop (XiL) based Testing
    - Proving Ground Testing (PG)



Scenario selection and allocation

✓ Question 5:

Which test method is offering the best capabilities for Traffic Jam Chauffeur verification:

A. Virtual Testing
B. Proving Ground Testing
C. XiL based Testing
D. Other: …

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Scenario selection and allocation

- ✓ Show survey results:
  - Q3
  - Q4
  - Q5

- ✓ Open questions

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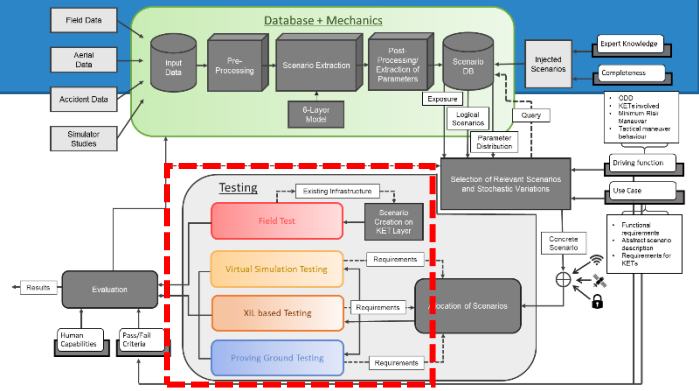
Testing of scenarios

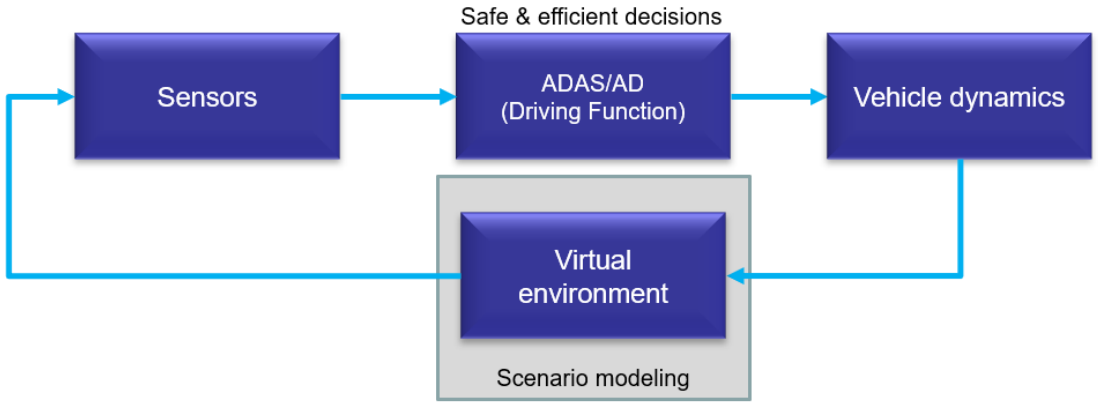


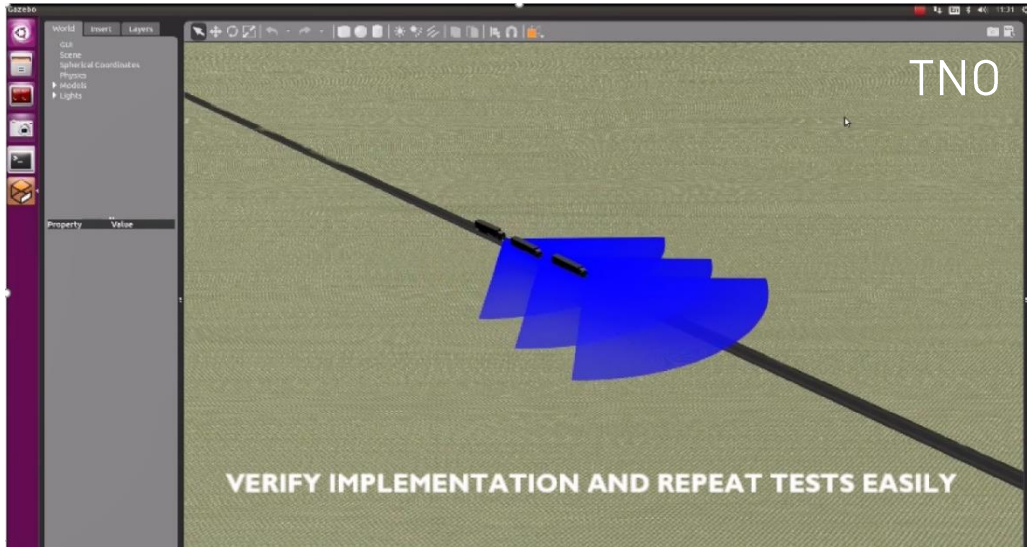
- ✓ 4 testing methods
  - Virtual Testing (VT)
  - XiL based Testing
  - Proving Ground Testing (PG)
  - Field test (public road)

Testing of scenarios

✓Virtual Testing (VT)

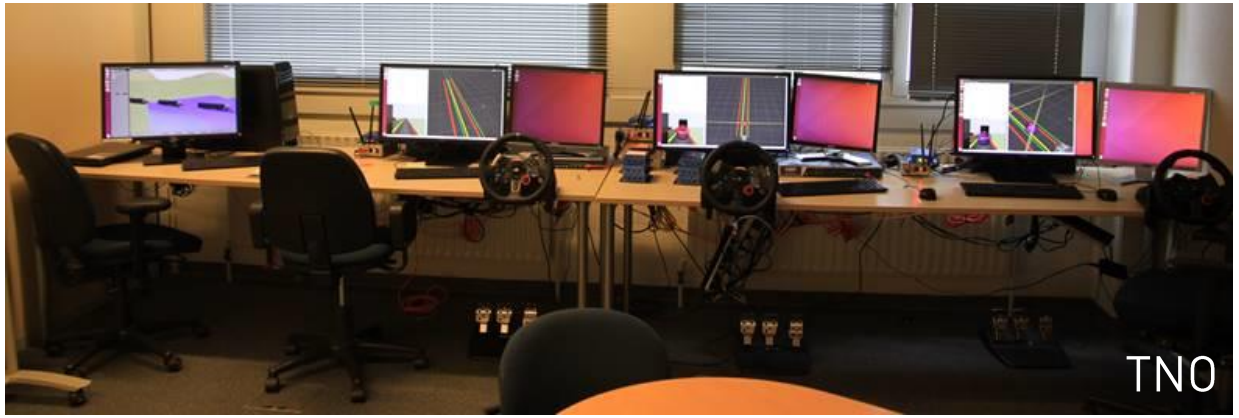
- Pros
  - Easy to evaluate and compare different systems under identical conditions
  - Large set of scenarios with parameters can be evaluated
- Cons
  - Model creation and validation expensive





Testing of scenarios

- ✓XiL based testing
  - Pros
    - Evaluation of critical components possible, for example Communication V2X components
    - Controlled and repeatable environment
  - Cons
    - Model creation and validation expensive
    - Interaction model – real parts



Testing of scenarios

✓ Question 6:

Which kind of minimum sensor fidelity level is necessary for the validation of Traffic Jam Chauffer in a cost and time effective manner:

A. Low (Object list based)
B. Medium (based on statistical failure rates)
C. High (based on physical principles)
D. Other: …

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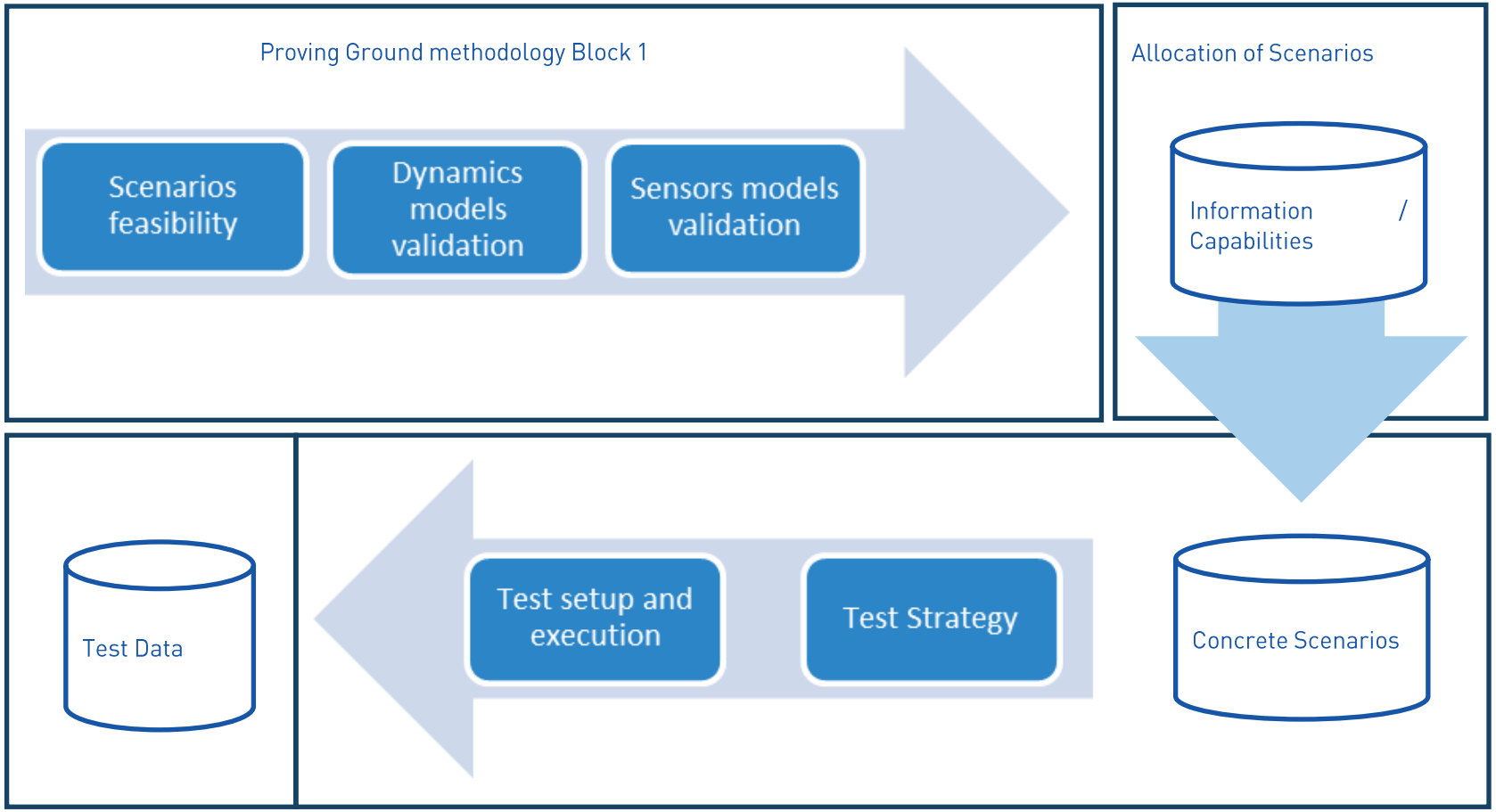
Testing of scenarios

- ✓ Proving Ground (PG)
  - Pros
    - Full system testing possible
    - Controlled and safe environment
  - Cons
    - Geofencing
    - Limits for Communication V2X and Positioning (GNSS) performance
    - Large space needed for truck testing, platooning in particular
    - Limited infrastructure features: bridges / tunnels / undulated roads
    - Limited V2I availability

Testing of scenarios

- ✓ Field test (public road)
  - Pros
    - Multi-actor testing in real environment
    - Geofencing testing
    - Results feedback into other testing configurations
  - Cons
    - Limited control over scenarios / Scenarios as they are encountered
    - Public road allowance / exemption

Proving Ground Test Method



Testing of scenarios

- ✓ Question 7:

  What is the most important role of the proving grounds for the validation of the Traffic Jam Chauffeur

  A. Validation of virtual environments (sensor models, dynamic models …)
  B. Sensors / Positioning / Perception in general testing
  C. Safety
  D. Others, …

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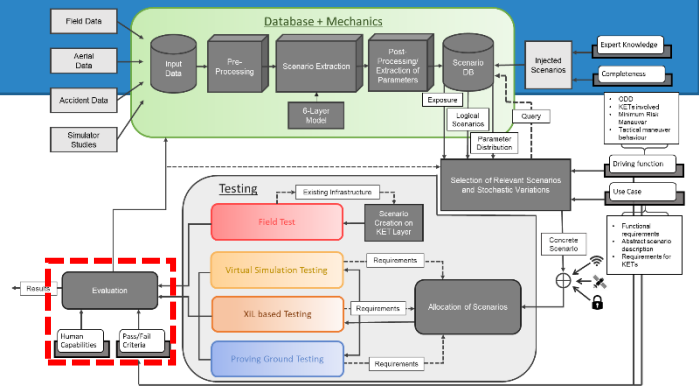
Testing of scenarios

- ✓ Show survey results:
  - Q6
  - Q7

- ✓ Open questions

Evaluation of test results



- ✓ Evaluation
  - Depends on
    - Driving function
    - Use Case
    - Stakeholder:
      - OEMs & TIERs
      - Type approval authorities
      - Consumer organisations (like Euro NCAP)

- ✓ Especially relevant for Traffic Jam Chauffeur
  - Proper traffic jam detection.
  - Correct Positioning GNSS

Evaluation of test results

✓ Question 8:

Which data do you think needs to be evaluated for Traffic Jam Chauffeur type approval:

A. Virtual Testing
B. Proving Ground Testing
C. XiL
D. Field Operational Test
E. Other, …

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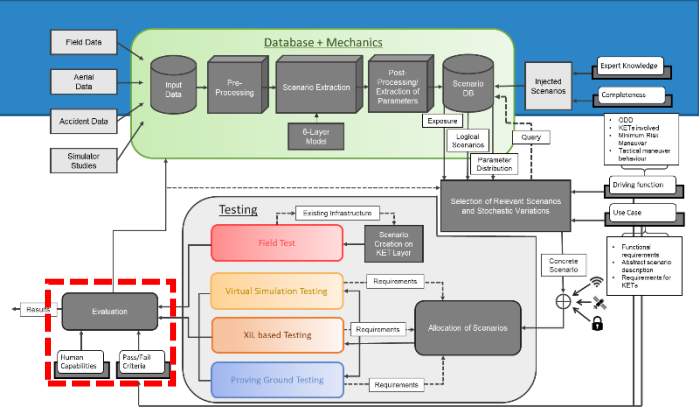
Evaluation of test results



- ✓ Additional benefits
  - Link of logged/recorded data as input for “scenario database”
  - Feedback loop to scenario selection

Evaluation of test results

✓ Question 9:

The biggest challenge for use case Traffic Jam Chauffeur is:

A. Type approval
B. Liability
C. Viable business case
D. Consumer acceptance
E. Other: ...

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Evaluation of test results

- ✓ Show survey results:
  - Q8
  - Q9

- ✓ Open questions

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Wrap-up

✓ Summary – Recap

✓ Slides, voting results and recording will be shared and published on HEADSTART website

✓ Feedback will be integrated in HEADSTART deliverable:

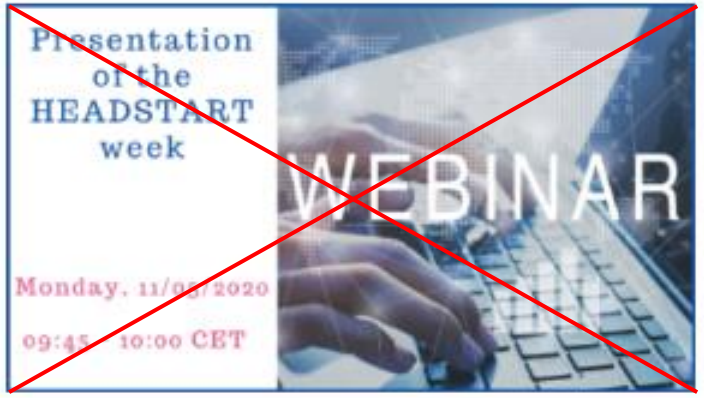
D2.3 Assessment method for each of the use cases defined

Wrap-up

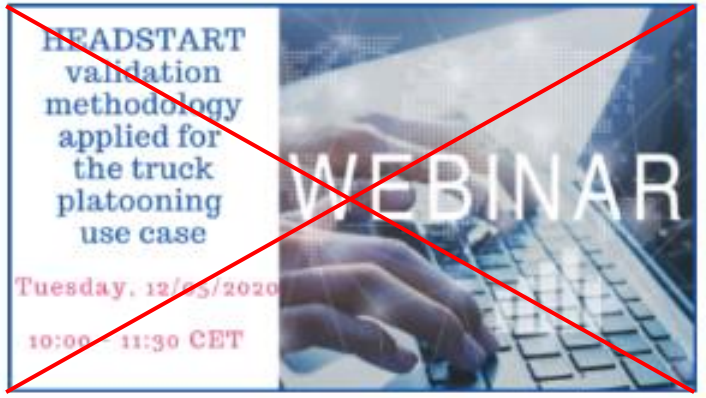
- ✓ Follow-up plans and next steps HEADSTART:
  - Definition of procedures and tools in HEADSTART WP3
  - Application and demonstration of method, procedures and tools in HEADSTART WP4
  - Wrt HEADSTART use case: Truck platooning
    - Cooperation with ENSEMBLE and individual OEMs

- ✓ Next HEADSTART sessions:
  - HEADSTART **Cybersecurity validation in automated driving** webinar on Friday May 15th 10:00-11:30 CET.
  - HEADSTART **Wrap-up & lessons from HEADSTART Week webinar** on Friday May 15th 11:30-11:45 CET.
  - HEADSTART WP2 & WP3 dissemination webinar in September (dates to be confirmed)


HEADSTART WEEK
1 WEBINAR PER DAY
The free webinars will take place from Monday, 11/05 to Friday, 15/05.


Presentation of the HEADSTART week
WEBINAR
Monday, 11/05/2020
09:45 - 10:00 CET


Overall methodology and processes for testing and validation of automated road vehicles
WEBINAR
Monday, 11/05/2020
10:00 - 11:30 CET


HEADSTART validation methodology applied for the truck platooning use case
WEBINAR
Tuesday, 12/05/2020
10:00 - 11:30 CET


Validation of use case: Traffic jam chauffeur
WEBINAR
Thursday, 14/05/2020
10:00 - 11:30 CET


Cybersecurity validation in automated driving
WEBINAR
Friday, 15/05/2020
10:00 - 11:30 CET


Wrap-up & lessons from HEADSTART Week Webinar
WEBINAR
Friday, 15/05/2020
11:30 - 11:45 CET

Cooperate with HEADSTART project

EXPERT GROUP PARTICIPATION

- Join as associated partner and our expert group
- Join the discussion group of your interest:
  - Cyber-security
  - Communications (V2X)
  - Positioning
  - Scenario selection
  - Consumer testing (NCAP)
  - Type approval
- Provide needs and requirements and evaluate project (intermediate) results

JOINT TESTING ACTION

- ✓ Joint cooperation between both projects for testing validation and certification purposes
- ✓ Align your project with the harmonized methodology and tools developed within HEADSTART
- ✓ Become one of our use cases!

Please let us know about your interest and join our distribution list.
Website: www.headstart-project.eu
Contact: info@headstart-project.eu

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- ✓Sign up to our newsletter:

  https://lists.iccs.gr/wws/subscribe/headstart-news

- ✓Get in touch with our partners

Thank you!

Any questions?

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