HARMONISED EUROPEAN SOLUTIONS FOR TESTING AUTOMATED ROAD TRANSPORT

THE HEADSTART approach

Virtual, 9 -10 September

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Applus IDIADA

Outline

- Safety assurance state-of-the-art
- The HEADSTART methodology
- The HEADSTART procedure
- Conclusions and next steps

Research projects that include CAV testing and safety assurance topics

Other projects:

- ✓ HoliSec
- ✓ MuCCA
- ✓ PROSPECT
- ✓ ESCAPE
- ✓ SetLevel4to5
- ✓ SAM
- ✓ Cooperative driving at traffic intersections
- ✓ Grand Cooperative Driving Challenge
- ✓ Coordination of CAVs over 5G
- ✓ ADAS & me
- ✓ Verification and Validation
- ✓ SAFE-UP

Initiatives involving safety assurance

- CAD initiatives of interest for HEADSTART
- 22 relevant initiatives found
- Classification into several topics:

Manufacturers associations

JAMA Japan Automobile Manufacturers Association, Inc.

ACEA European Automobile Manufacturers Association

PFA Filière Automobile & Mobilités

@OICA

Public authorities

Department of Transportation United States of America

National Transport Commission

UNECE

KETs

5GAA Automotive Association

CAR 2 CAR Communication Consortium

Consumer testing

Euro NCAP For Safer Cars

Other relevant initiatives

M city University of Michigan

PEARS

EATA European Automotive and Telecom Alliance

ECSEL JU

EGVI European Green Vehicles Initiative

ADVI Australia & New Zealand Driverless Vehicle Initiative

CETRAN

ERTRAC

European Truck Platooning

SIP 戦略的イノベーション創造プログラム

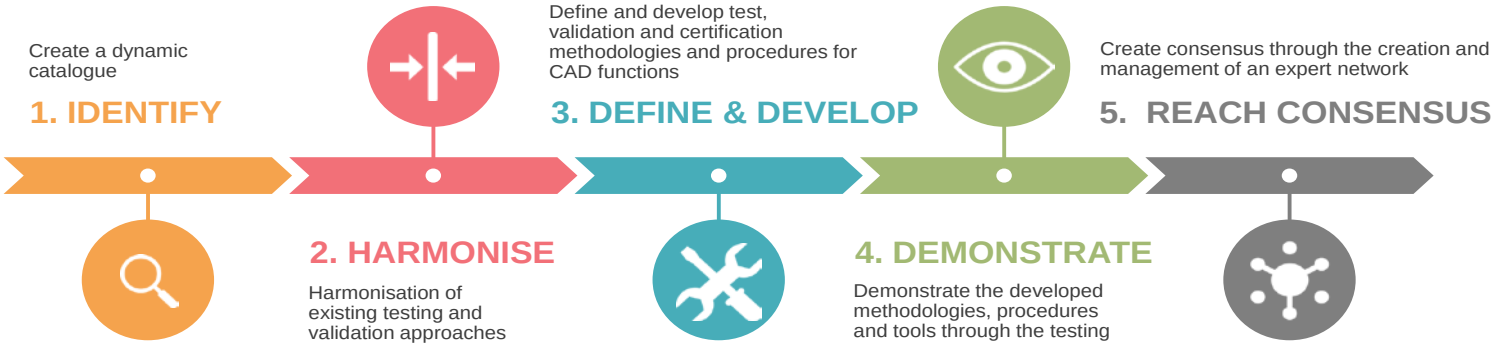
American Center for Mobility Connected. Automated. Validated.

Nouvelle France Industrielle (NFI)

The HEADSTART project

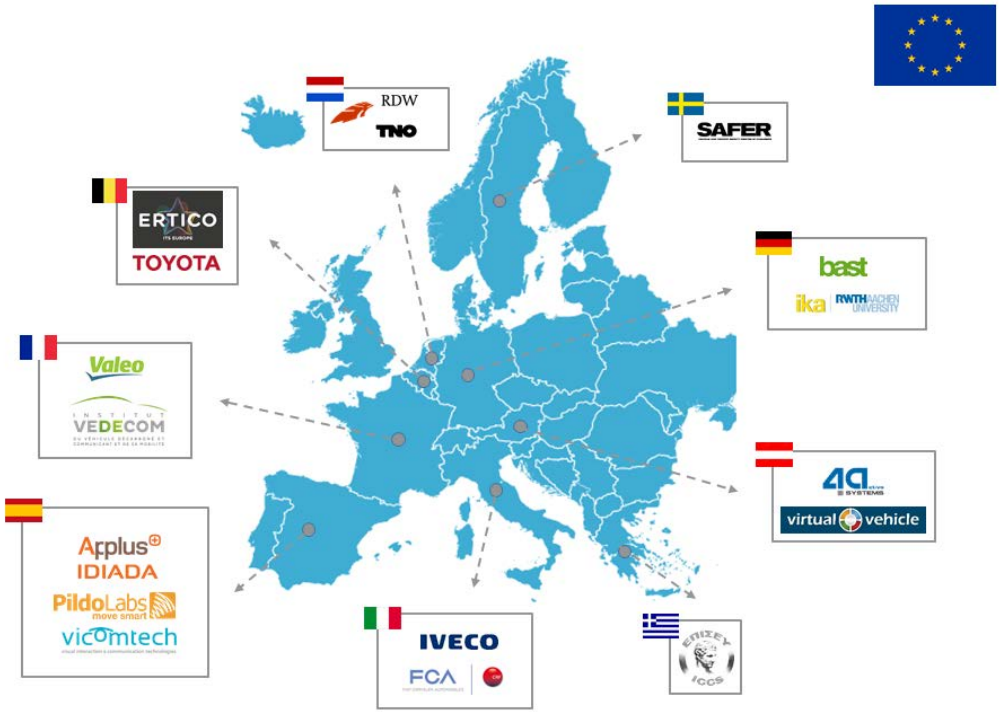
HEADSTART will define testing and validation procedures of CAD functions including:

- 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 Consortium

- ✓ **7 research centres**
- ✓ **2 Technical services**
- ✓ **3 Euro NCAP laboratories**
- ✓ **4 OEMs**
- ✓ **2 Tier-1s**
- ✓ **3 coordinators of H2020 ART calls**



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

Technical Results up to M18

List of **Deliverables** M1 – M18

Del. #	Deliverable Title	Leader
D1.1	State of innovation of existing initiatives and gap analysis	IKA
D1.2	Stakeholders and user group needs	VEDECOM
D1.3	Technical and functional requirements for KETs	SAFER
D1.4	Functional requirements of selected use cases	SAFER
D2.1	Common methodology for test, validation and certification	IKA
D2.2	Extension of the common methodology for the HEADSTART KETs	CRF
D3.1	Procedure pipeline definition	Virtual Vehicle

All finished deliverables available in

www.headstart-project.eu

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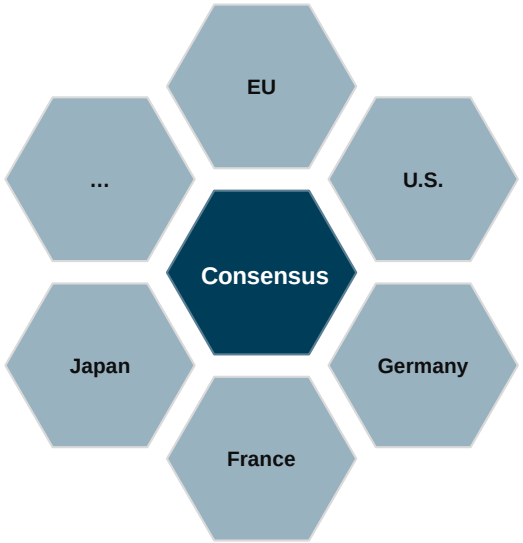
HEADSTART Methodology approach

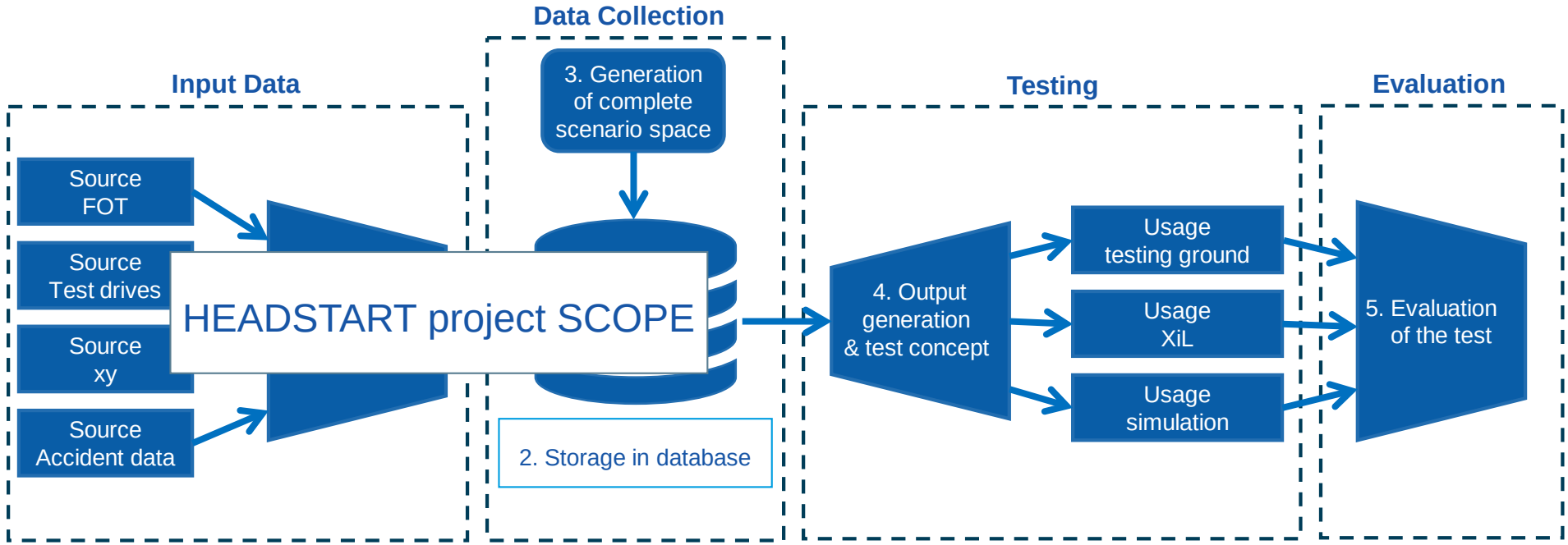
Where does the HEADSTART Methodology come from?

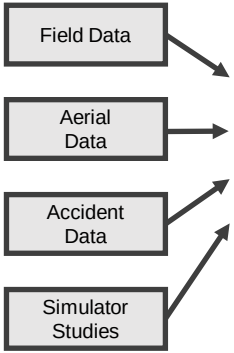
- ✓ State of the art analysis of international and national projects
- ✓ **Harmonization** of present and past projects
- ✓ Utilizing **common databases** to analyse data
- ✓ Testing of selected **relevant scenarios**

- ✓ **Inputs from:** PEGASUS, MOOVE, SAKURA, STREETWISE, ENABLE-S3 and many other projects…
  - ✓ Can be found in D1.1, D1.2, D1.3 and D1.4
  - ✓ www.headstart-project.eu



Overall Methdology

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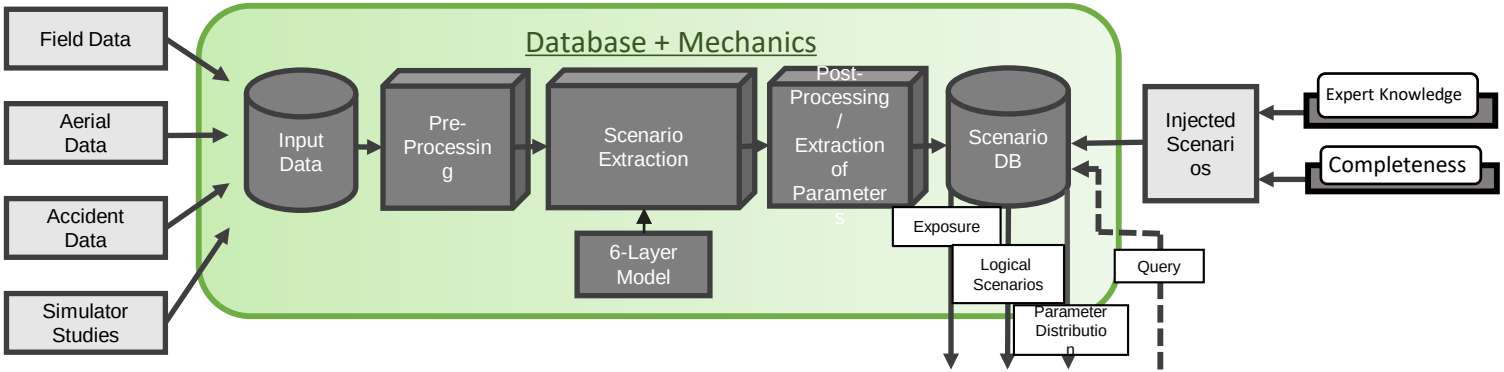
Aerial Data
Accident Data
Simulator Studies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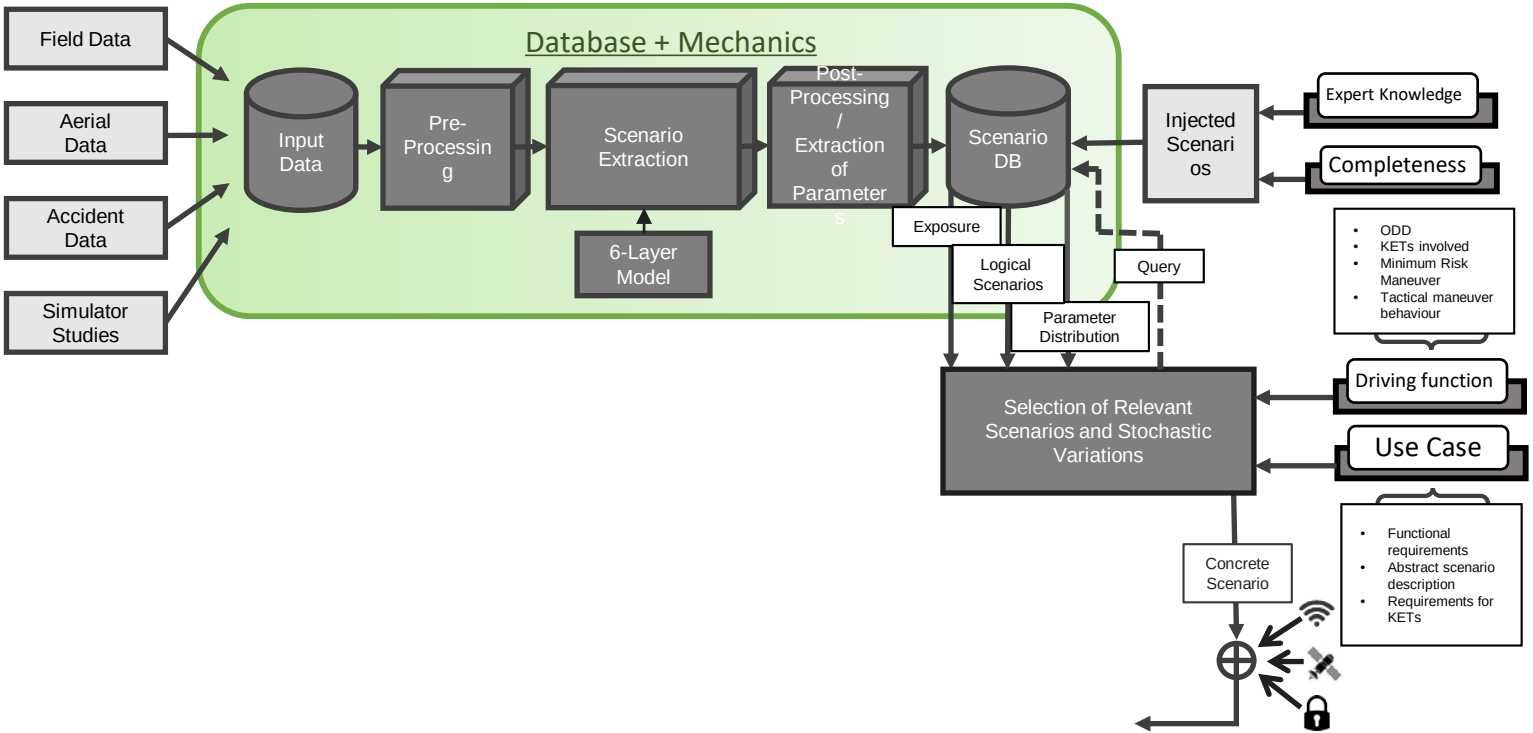
Simulator Studies
Database + Mechanics
Input Data
Pre-Processing
Scenario Extraction
6-Layer Model
Post-Processing / Extraction of Parameters
Scenario DB
Exposure
Logical Scenarios
Parameter Distribution
Query
Injected Scenarios
Expert Knowledge
Completeness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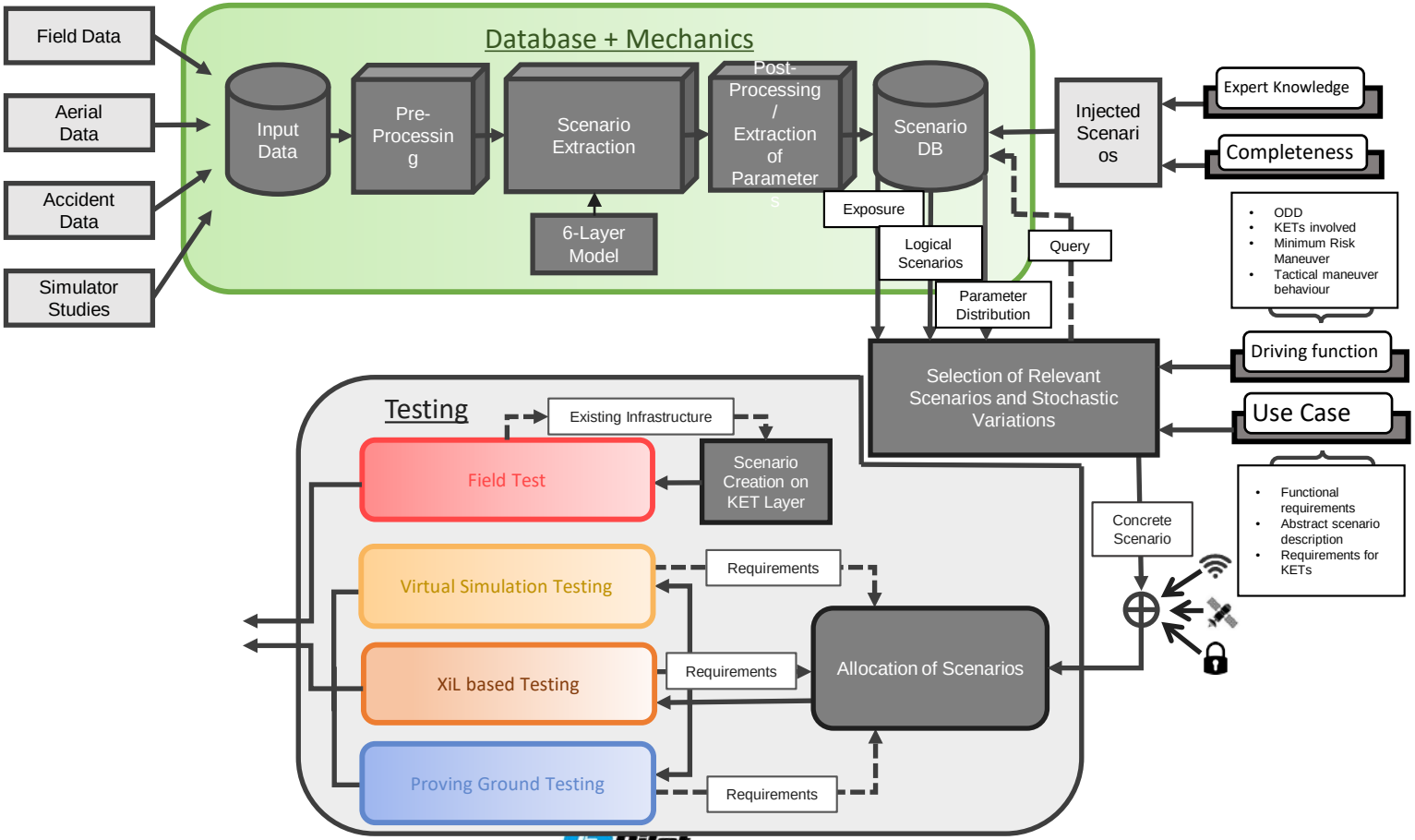
ODD
KETs involved
Minimum Risk Maneuver
Tactical maneuver behaviour
Driving function
Use Case
Selection of Relevant Scenarios and Stochastic Variations
Concrete Scenario
Functional requirements
Abstract scenario description
Requirements for KETs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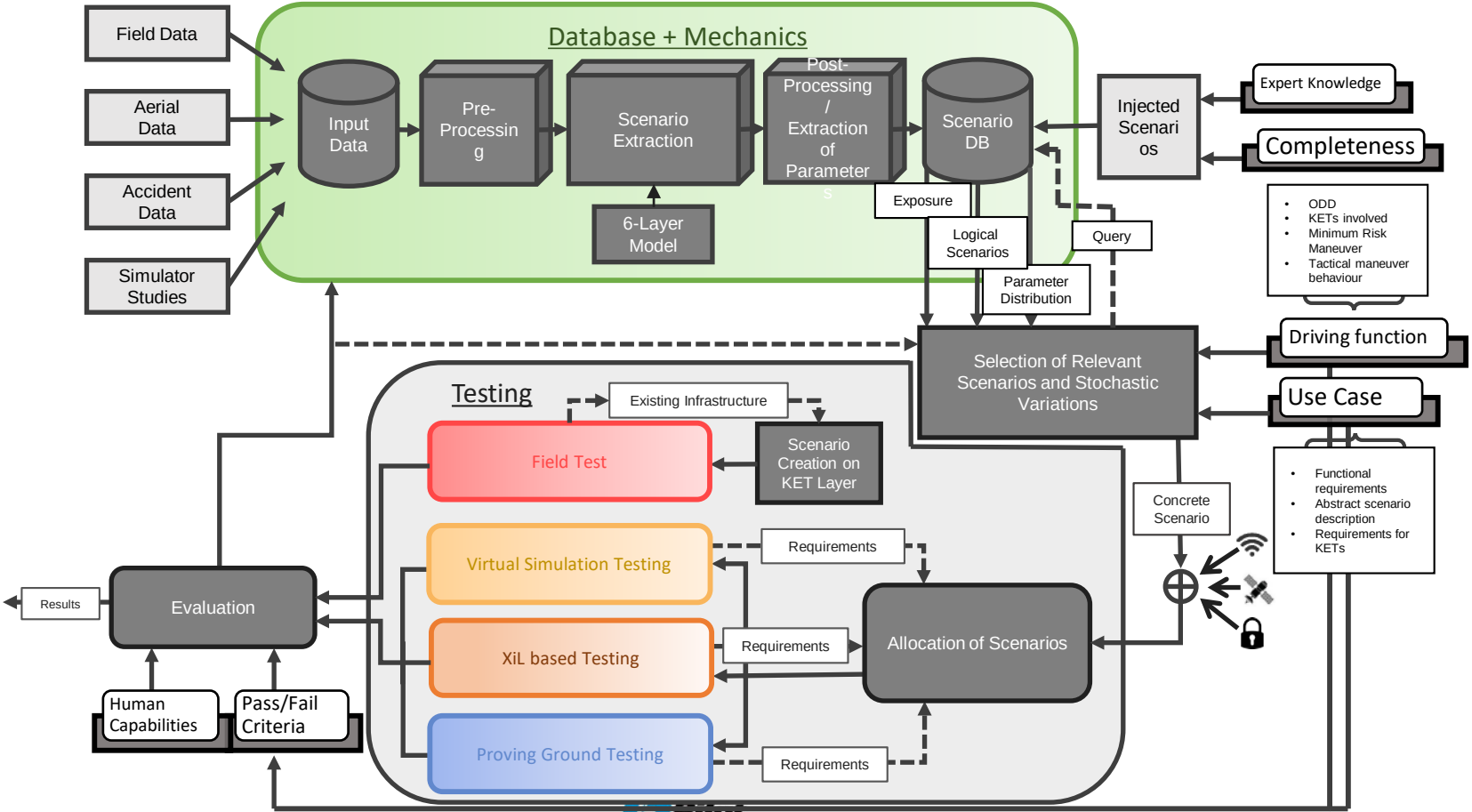
Scenario Creation on KET Layer
Virtual Simulation Testing
Requirements
XiL based Testing
Requirements
Allocation of Scenarios
Proving Ground Testing
Requirements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Requirements
Proving Ground Testing
Requirements
Allocation of Scenarios
Results
Evaluation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

Open Scenario – Open Drive

Layer 6

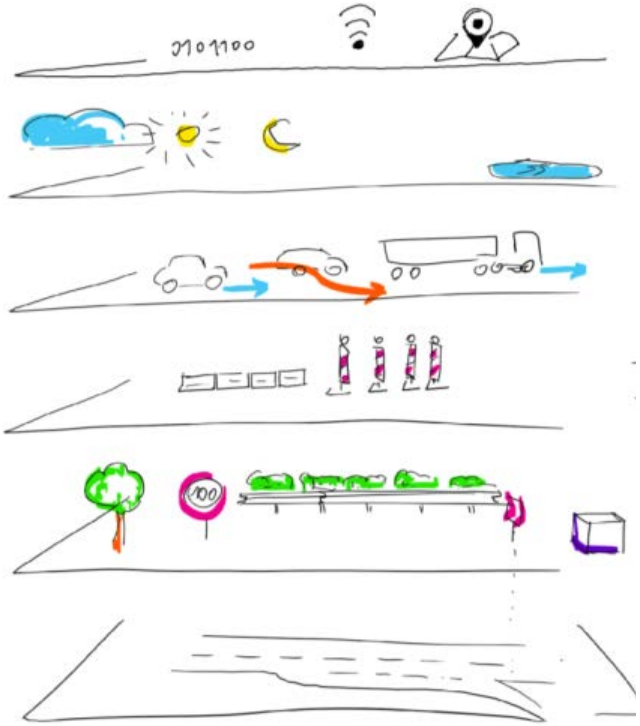
Layer 5

Layer 4

Layer 3

Layer 2

Layer 1



Digital information
e.g. V2X information on traffic signals, digital map data

Environmental conditions
e.g. Light situation, weather (rain, snow, fog)

Moving Objects (4a ➔ Ego ; 4b ➔ Others)
e.g. Vehicles, pedestrians, other moving objects

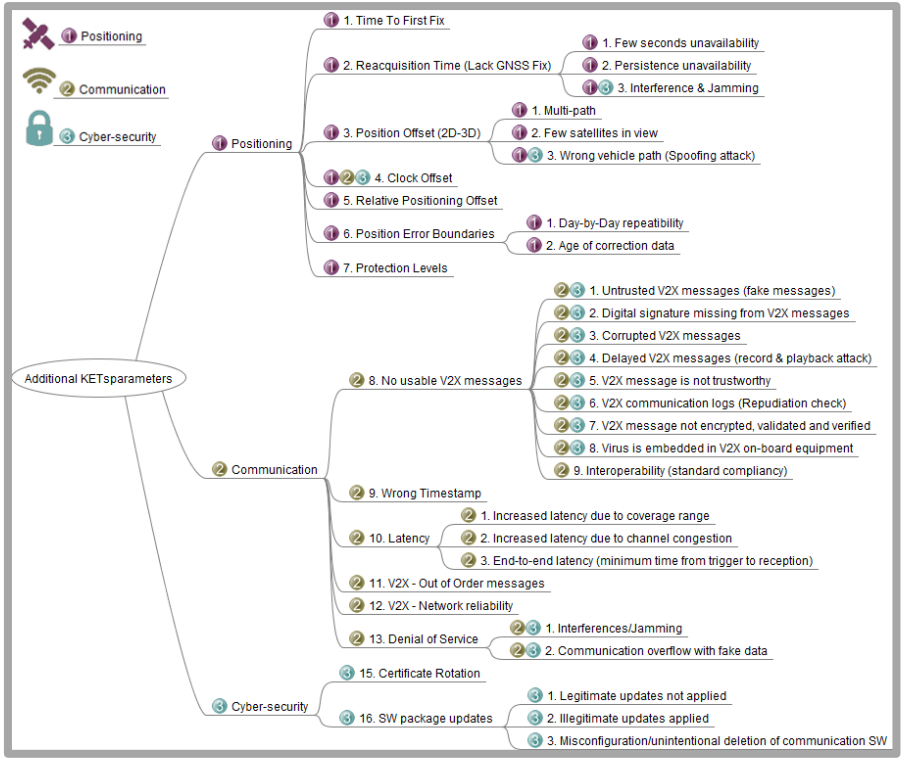
Temporal modifications and events
e.g. Road construction, traffic cones, fallen trees

Road furniture and Rules
e.g. Traffic signs, railguards, lane rules, bot dots

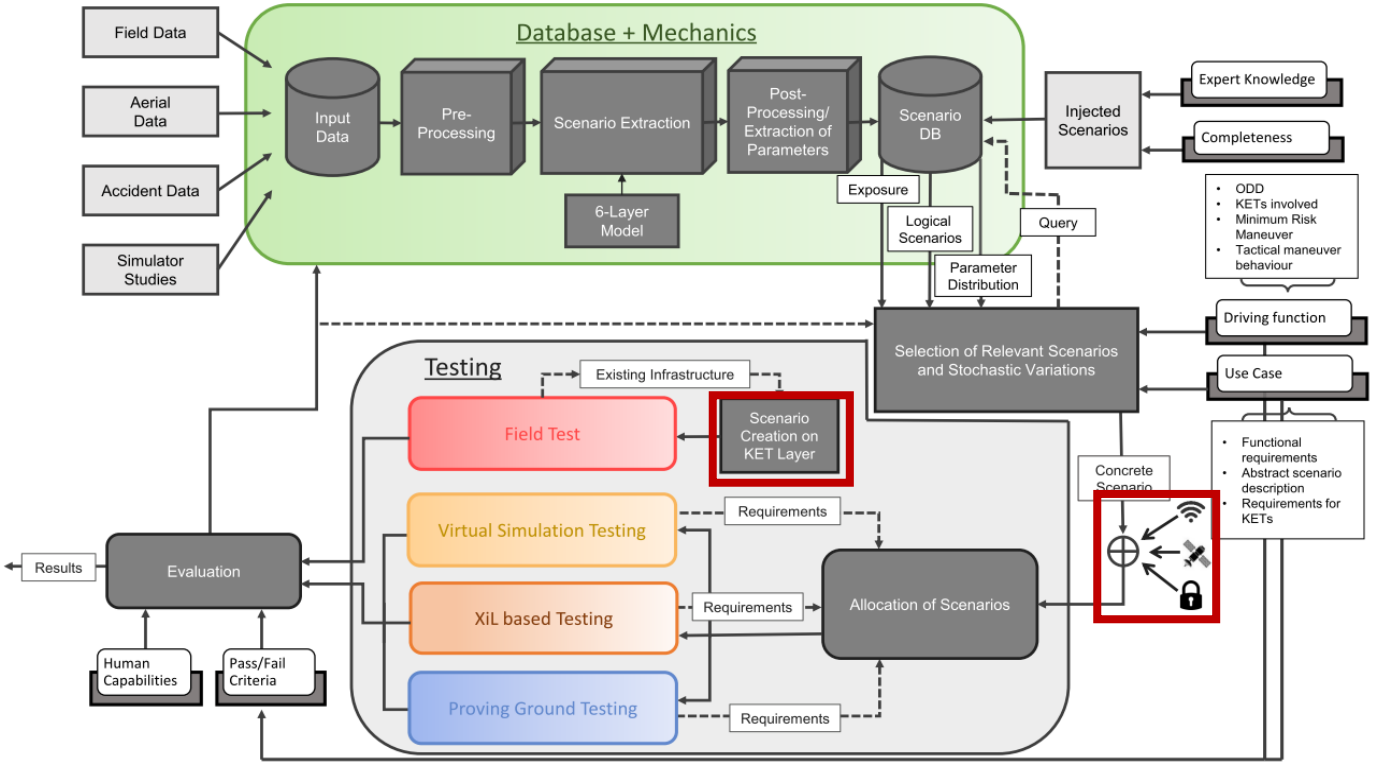
Road layer
e.g. Road geometry, road unevenness, lane logic

KETs within the methodology

- New information channels
  - V2X communication
  - Positioning dependent on other Layers
- Adding new parameters to be tested
  - Top-Level parameters to be arbitrary from the used hardware
  - Use V2X as “Sensor”
- Cyber-Security needs to be treated in a special way
  - Special treatment for in-depth analysis



KETs within the methodology



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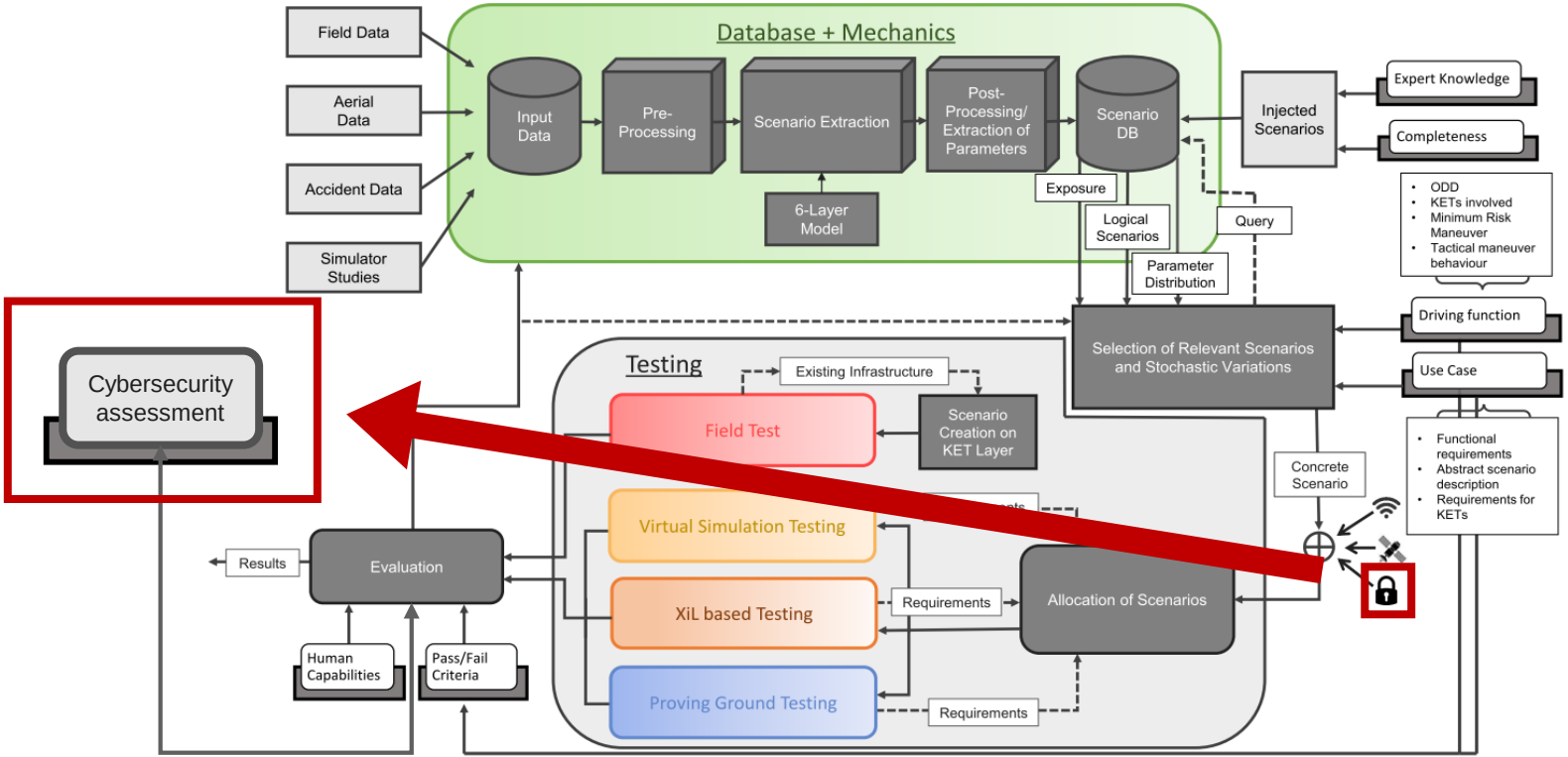

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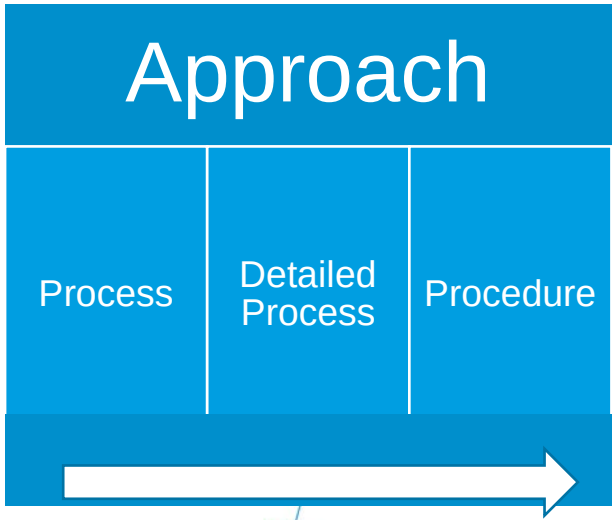
https://blog.triaster.co.uk/blog/procedure-vs-process-what-is-the-differen

Process vs. Procedure

- ✓ **A process** is a set of interrelated or interacting activities which transforms inputs into outputs. It's about **what to do.**
- ✓ **A procedure** is a specified way to carry out an activity or a process. It's about **how to do it**.

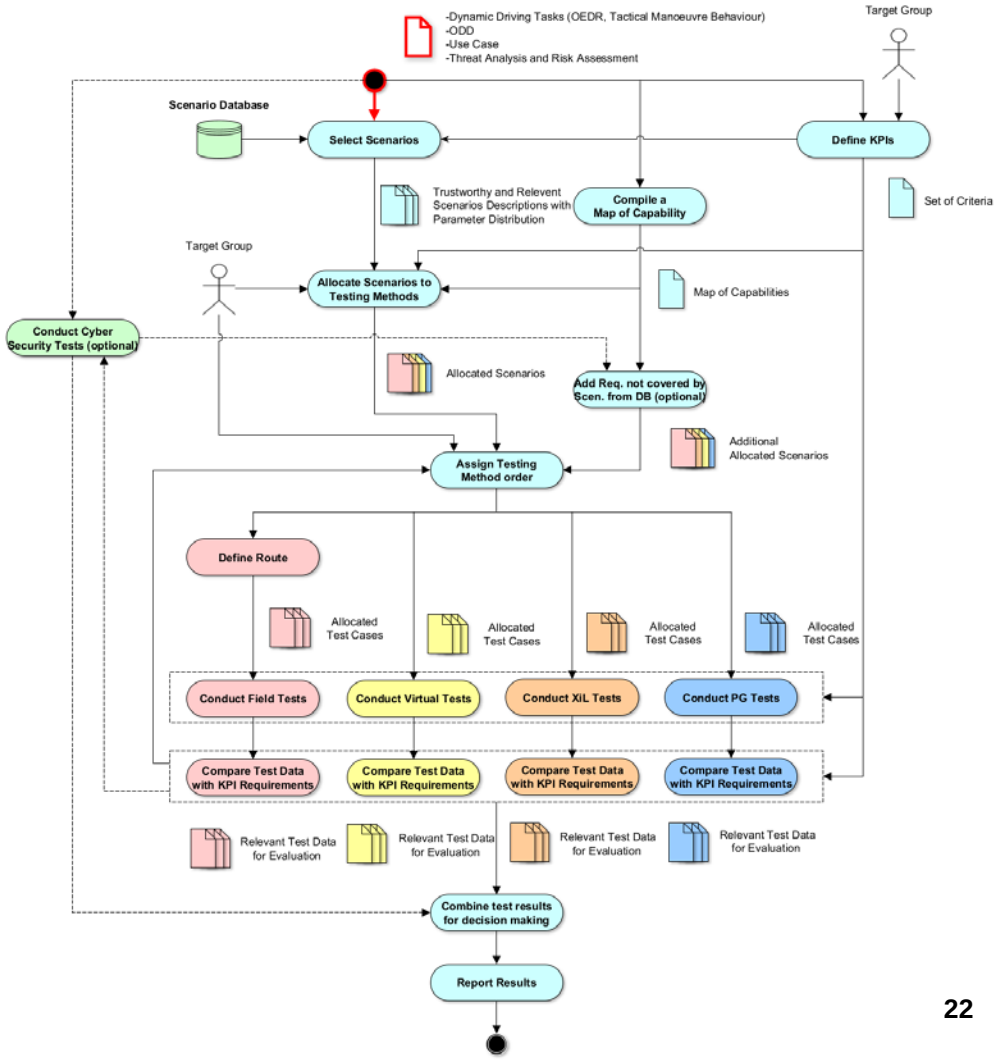
Methodology



Deliverable 3.1

High-Level Process

- ✓ Scenario Selection
- ✓ Scenario Allocation
- ✓ Testing Method Coordination
- ✓ Field Testing
- ✓ Virtual Testing
- ✓ XiL Testing
- ✓ Proving Ground Testing
- ✓ Cyber Security
- ✓ Evaluation

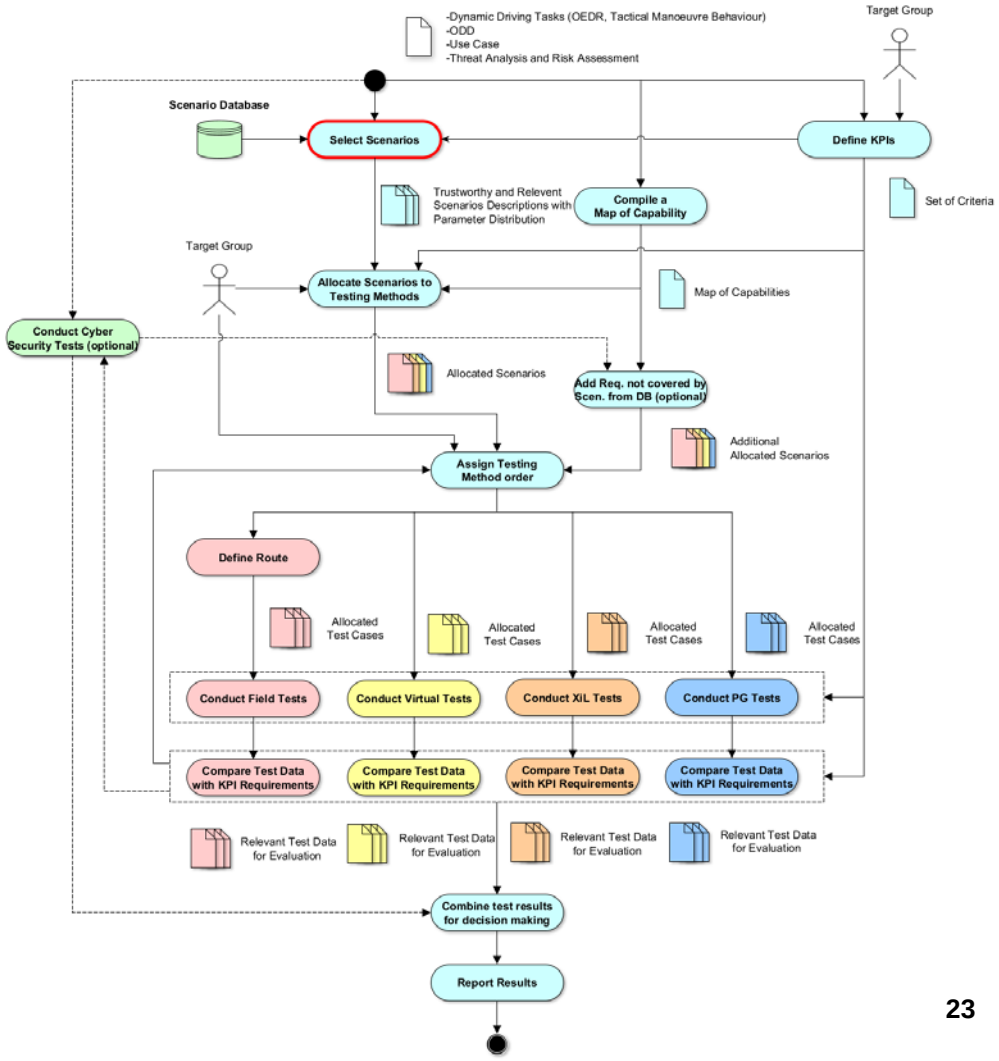


High-Level Process

Selected Example

✓ Scenario Selection

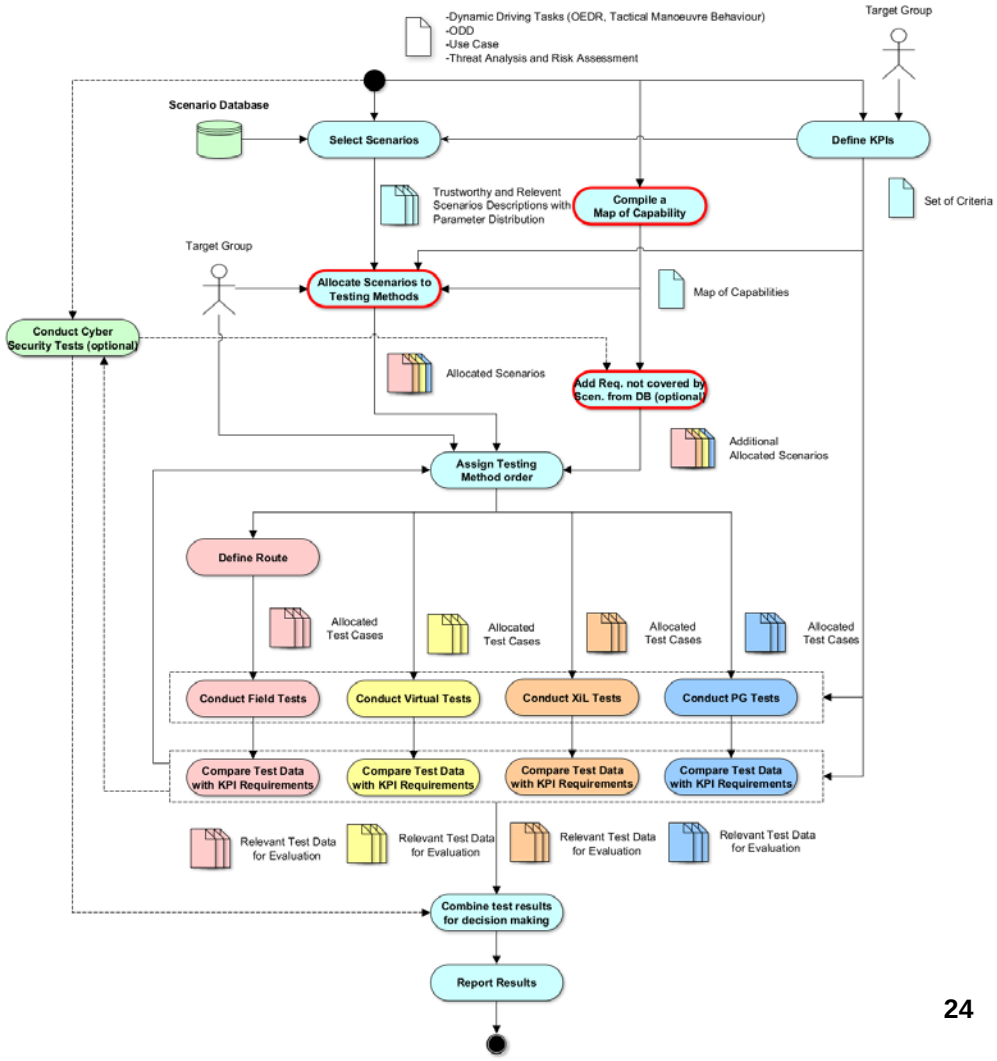
- Define a query
- Extract scenarios from database
- Include additional scenarios if ODD/functionalities are not sufficiently covered
- Assess relevance of parameters
- Make feasibility checks



High-Level Process

✓ Scenario Allocation

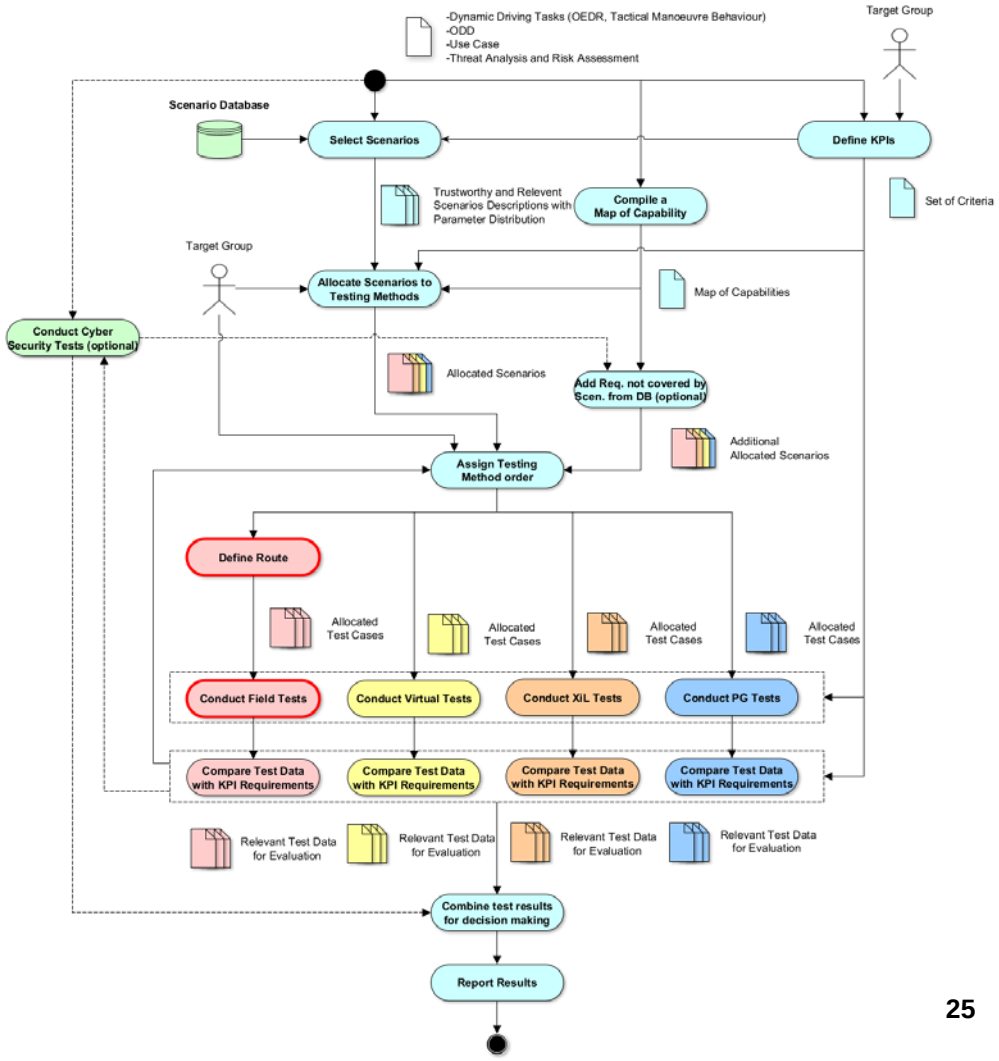
- Define capabilities of the testing methods
- Compare capabilities of testing methods with requirements of scenarios
- Allocate scenarios to testing methods
- If additional requirements available
  - add them to available scenarios if possible
  - or create separate scenarios



High-Level Process

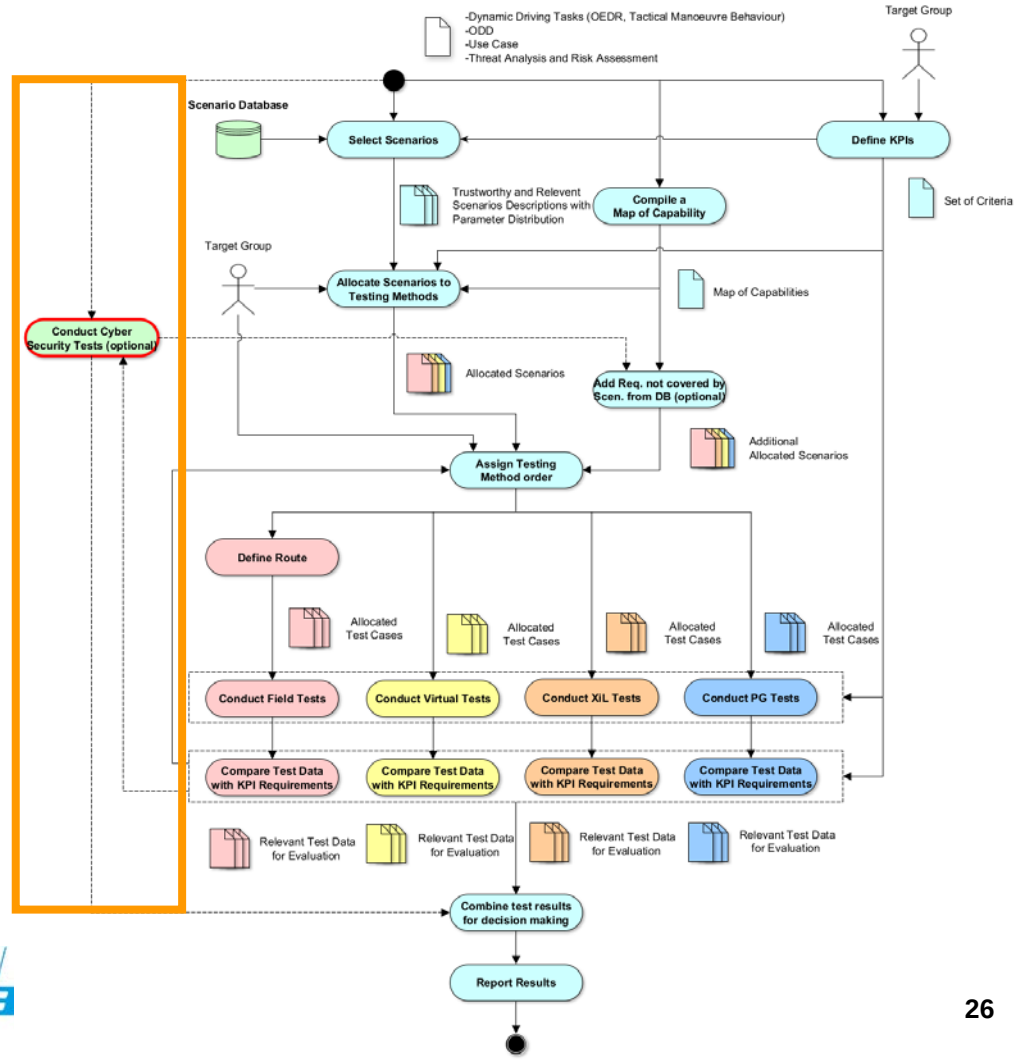
Selected Example

- ✓ Field Testing
  - Define route
  - Prepare testing strategy, equipment and infrastructure
  - Conduct field tests
  - Compare test data with KPI requirements



High-Level Process

- ✓ Cybersecurity
  - Optional side branch
  - **Based on common criteria**
  - Linked to the scenario allocation phase for additional requirements that can be allocated to testing methods

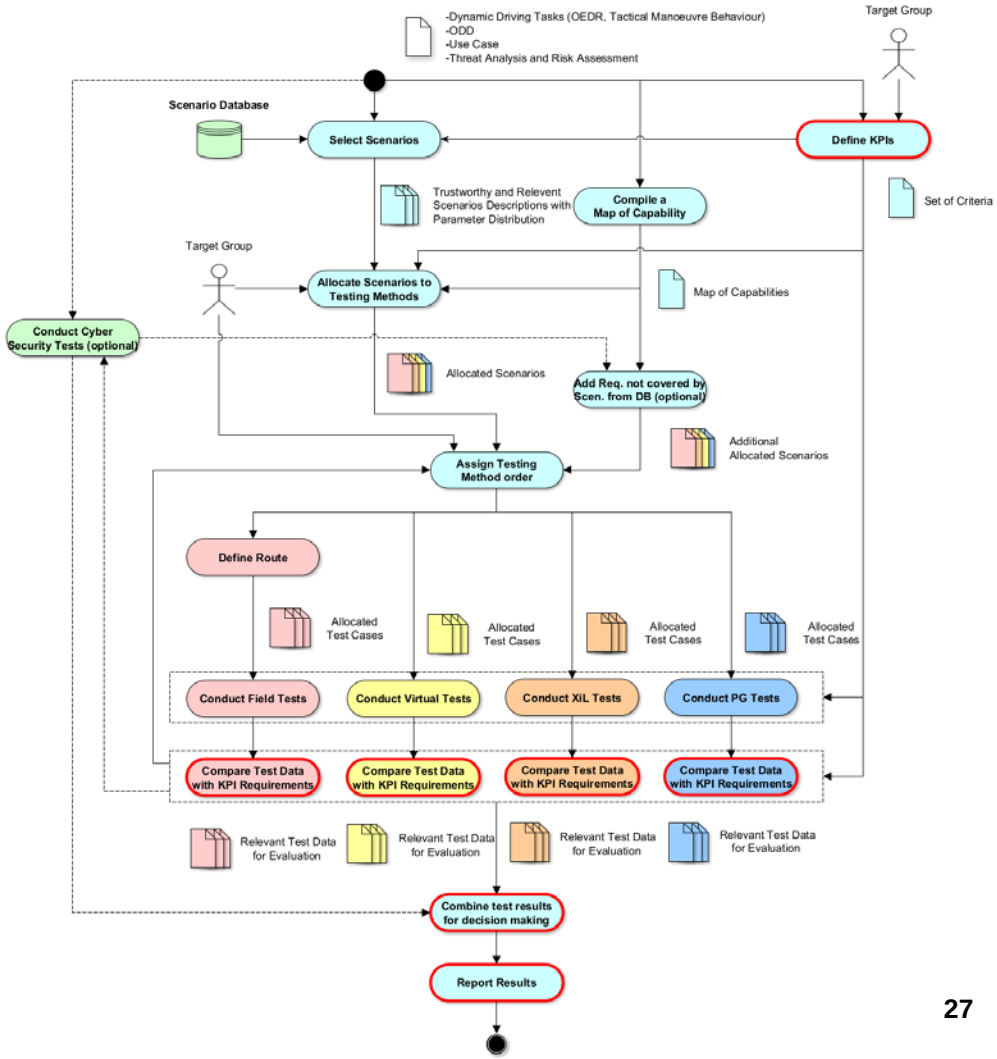


High-Level Process

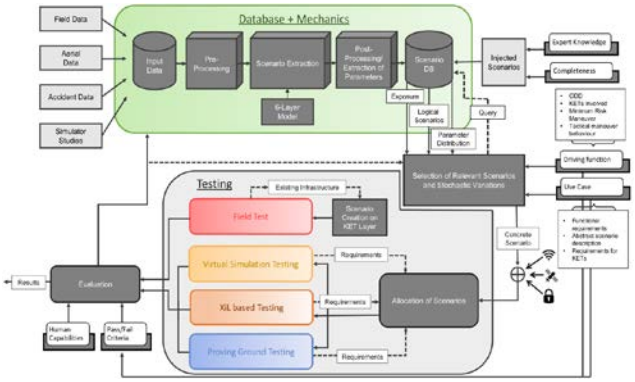
Selected Example

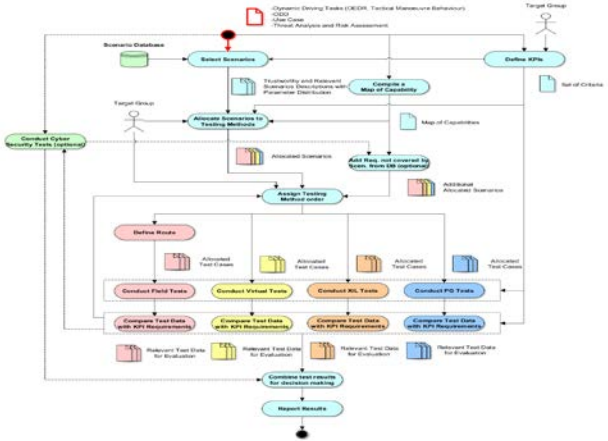
✓ Evaluation

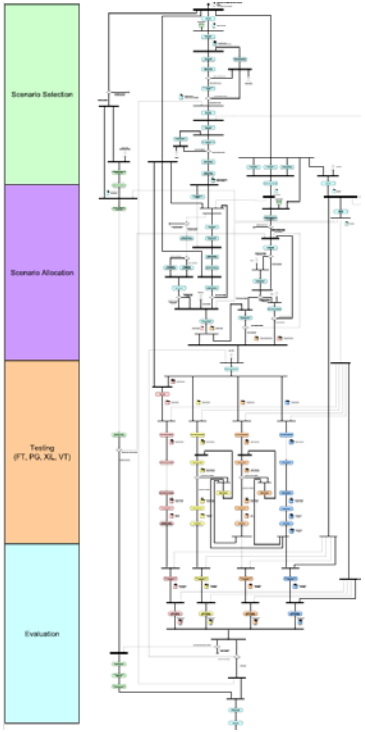
- Define key performance indicators (KPIs)
- Define KPI verification
- Compare test data with KPI requirements (for each testing method)
- Combine test results for evaluation



Methodology and procedure in a nutshell







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Conclusions

- ✓ The HEADSTART Methodology is a living process
  - Need for expert input to refine the methodology is welcomed
  - KETs have been considered in the whole process
  - Keep the Methodology harmonized and applicable for different databases
- ✓ Harmonization necessary for current and future technologies
  - Some KETS are naturally integrated (V2X + positioning)
  - Some require specific paths (cybersecurity)
  - Include other technologies in the process: e.g. human factors
- ✓ Standardisation efforts
  - Cooperation on Open Scenario extension/enhancement is ongoing
  - ODD description, scenario DBs queries still require standardisation

Cooperate with HEADSTART

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

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

Thank you for your kind attention.

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Colours

Primary colours

R 0 G 158 B 255	R 109 G 207 B 246	R 199 G 234 B 251
R 0 G 0 B 0	R 109 G 110 B 113	R 230 G 231 B 232

Secondary colours

R 0 G 105 B 145
R 198 G 63 B 57