



AI and HAD Test Automation

 nisar.ai | Dr.-Ing. Ke Zhu, Dr.-Ing. Michael Göller
Sept. 2024 @ Praxistagung Automatisiertes Fahren ADAC Testzentrum

Competition, after/beside Electrification is **HAD**

Challenge of Data-driven Development



Automation Level
Data and R&D Cost



Competition, after/beside Electrification is HAD

Challenge of Data-driven Development



Some of current approaches for

Improving efficiency in data-driven development

- Process transformation

- Previously: [Launching Agile Development](#) in Organizations

- Scenario Database and HAD Testing

- Previously: More scenario-based tests in [simulation](#)

Improving efficiency in data-driven development

■ Process transformation

- Previously: [Launching Agile Development](#) in Organizations
 - System and software engineering cycles are not aligned
 - Increasing coordination and communication effort

■ Scenario Database and HAD Testing

- Previously: More scenario-based tests in [simulation](#)
 - HAD still requires intensive physical tests
 - Gap between test in simulation and proving grounds

Our Approaches

■ Process transformation

- Launching Agile Development in Organizations
 - System and software engineering cycles are not aligned
 - Increasing coordination and communication effort

■ GenAI for Process Automation, Multi-Agent System (MAS)

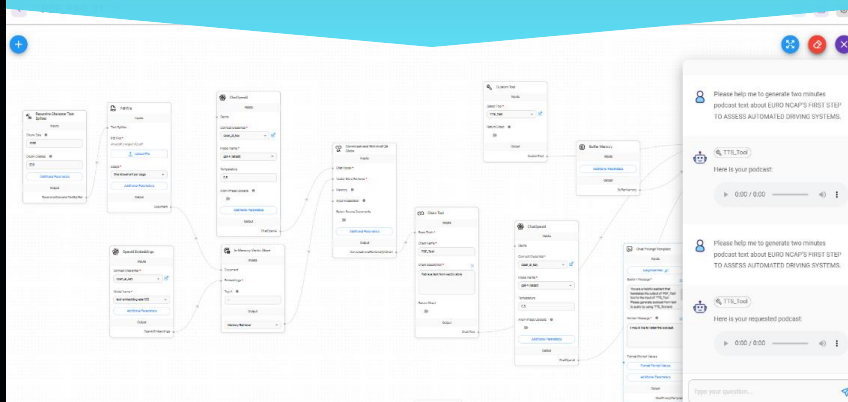
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■ XiL Automation, Networked Intelligent Mobile Test System (NIMS)

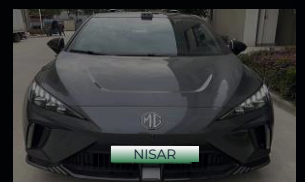
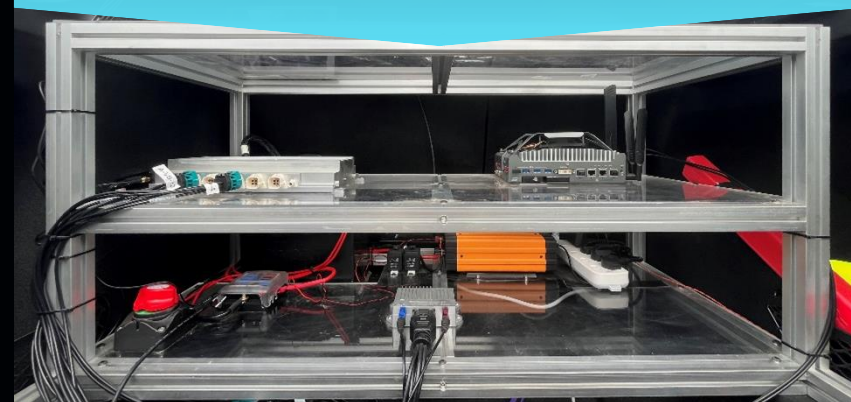
GenAI Multi-Agent System

Automotive & Industry Process Automation



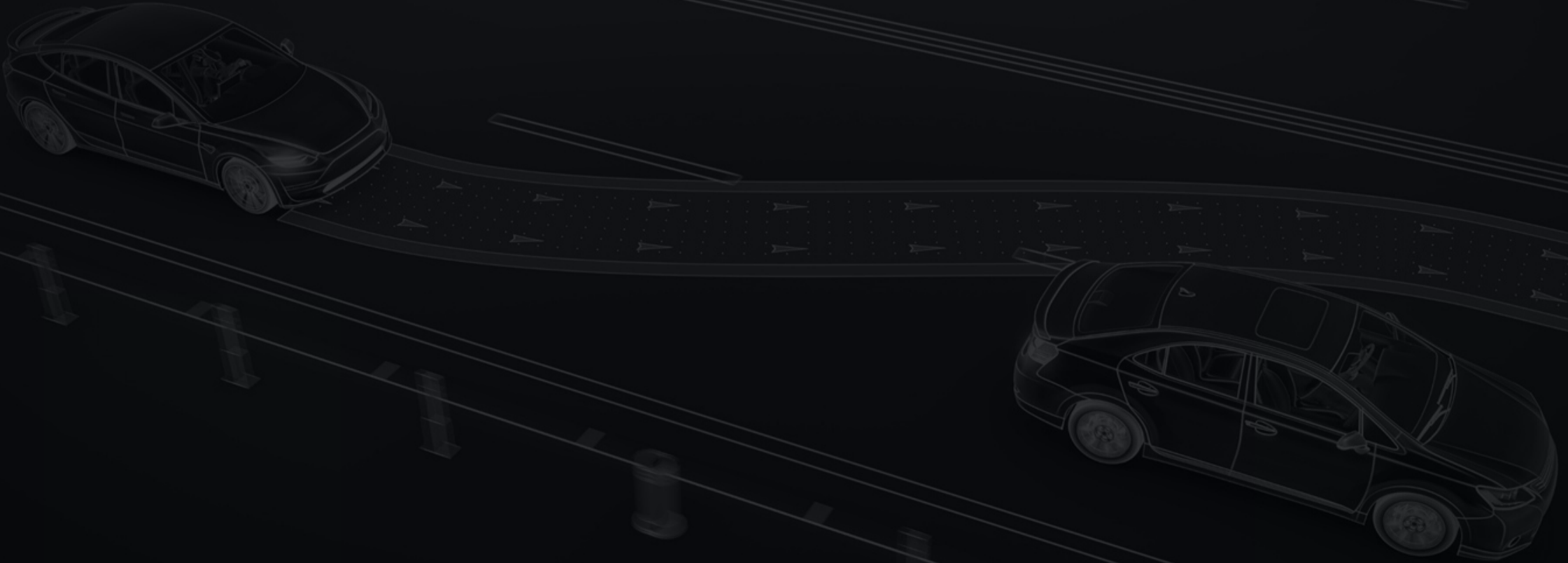
XiL Automation

SiL & HiL – Connectivity & Synthetic Data
ViL – Bridging Simulation & Proving Grounds



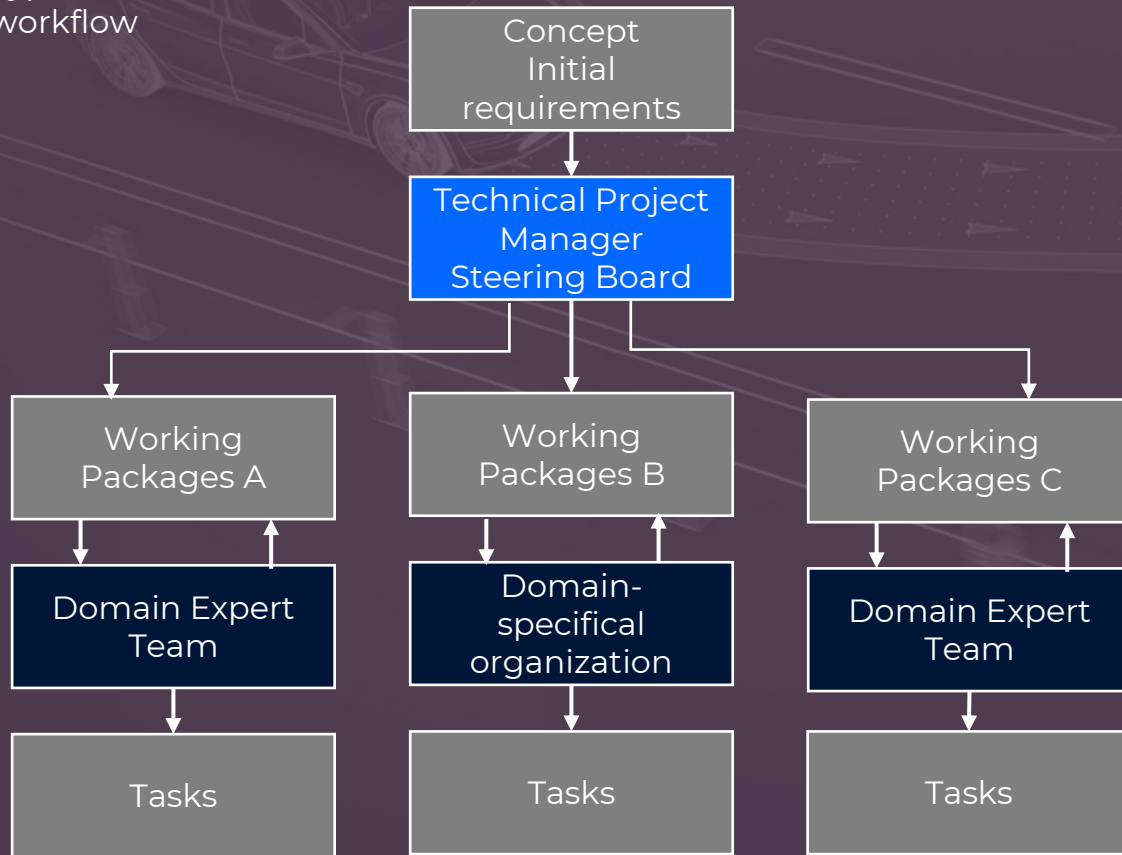
Process Automation with

Cooperative Multi-Agent System (MAS) to handle with complex process



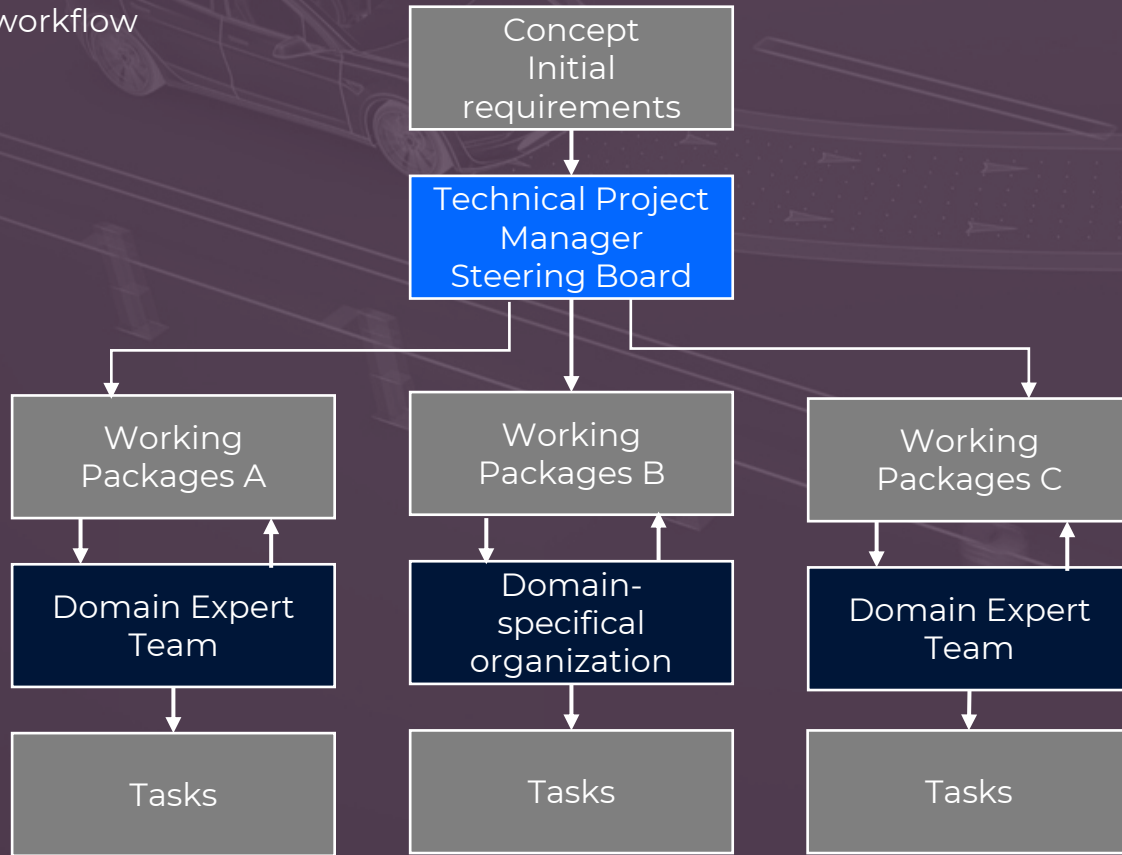
Cooperative Multi-Agent System (MAS) to handle with complex process

Typical human workflow

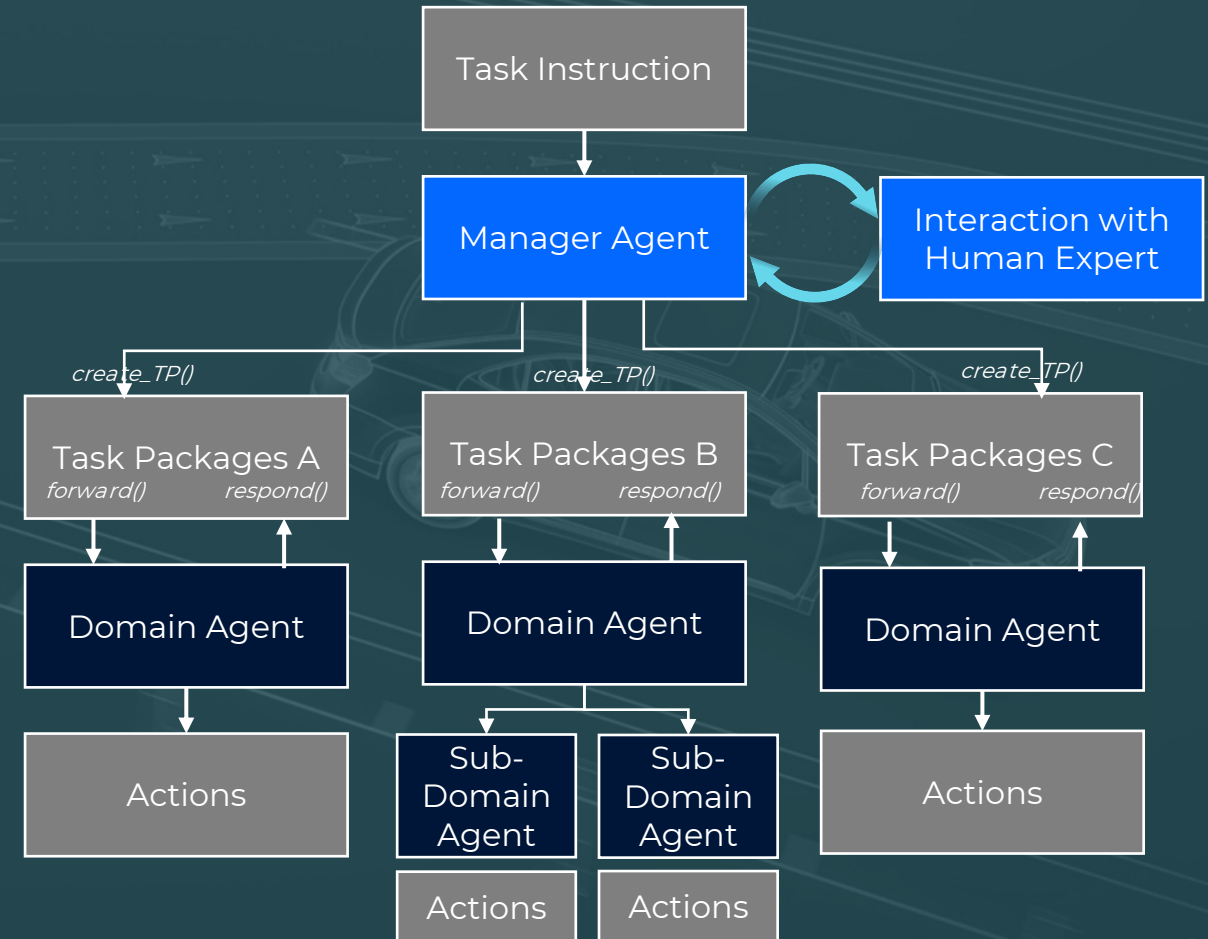


Cooperative Multi-Agent System (MAS) to handle with complex process

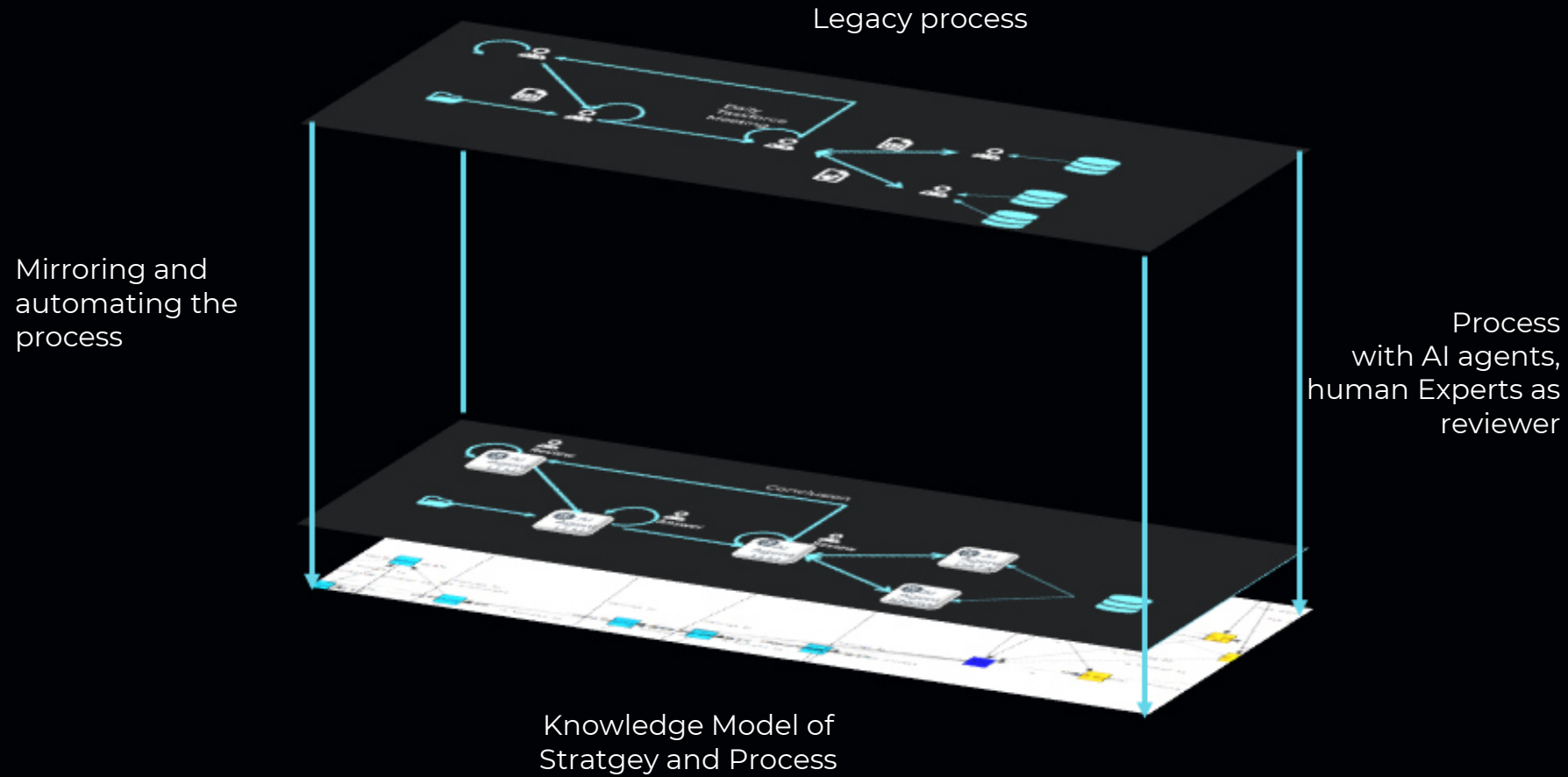
Typical human workflow



MAS Architecture

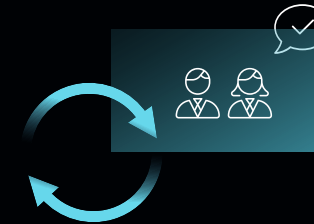
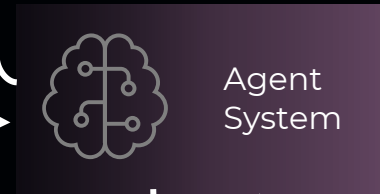
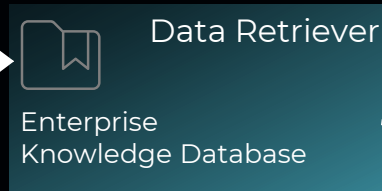
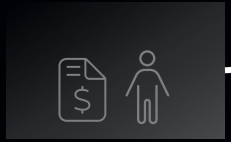
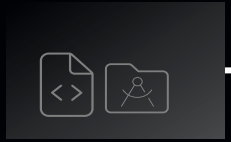


AI Agent with LLM and RAG – Retrieval Augmented Generation

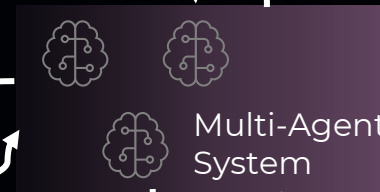


AI Agent with LLM and RAG – Retrieval Augmented Generation

Multimodal Data



Current project(s)

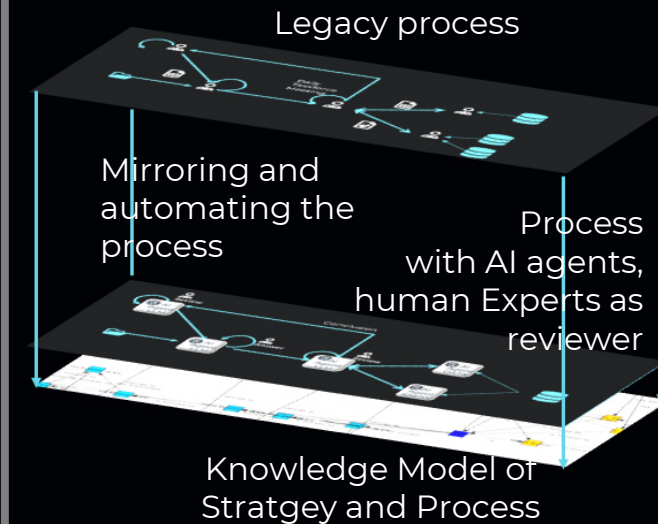


- Generation of answers with context
- Generation of questions and confirmation request

Legacy System



- Analysis of natural language and images/graphics
- Understanding and Breakdown of tasks
- Creation of new derived data

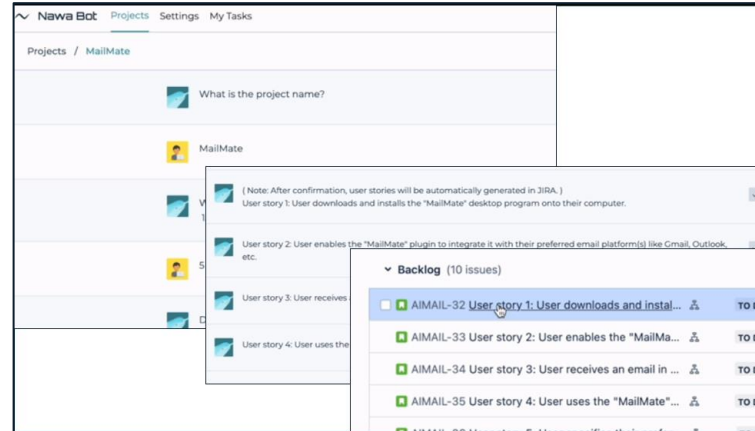


Multi-Agent System Use Cases – Our Referenc Projects

Quality Assurance



Requirements & Task Management



Regulations & Homologation Training & Reporting

Which tests are proposed for the AES?

Based on the provided context, it appears that the following tests are proposed for the Emergency Brake (AEB) system:

1. CCRs (City Centred Rear Impact) scenario
2. CCRm (Moving Base Rear Impact) scenario
3. CMRs (Moving Rear Impact) scenario
4. CMRm (Moving Base Rear Impact) scenario
5. Cut-in

These tests avoid collisions and are used to evaluate effectiveness.

What are key requirements for training data for complicity. Also give what is needed for companies to

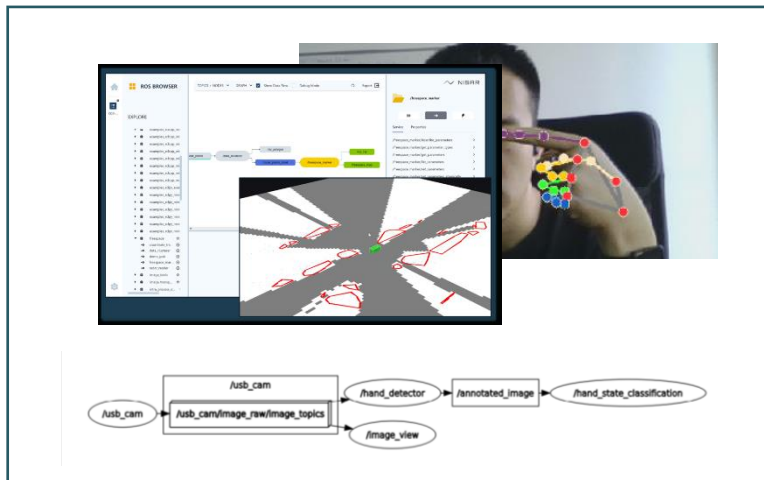
Sure, here are the key requirements for training data for compliance with the proposed AI Act:

- Data must be relevant and representative of the AI system's intended use and environment.
- Data must be diverse and inclusive, representing different groups of people, including those from underrepresented or marginalized communities.
- Data must be free from bias and discrimination, and not perpetuate existing social inequalities.
- Data must be accurate, complete, and up-to-date.
- Data must be obtained legally and ethically, with proper consent from all individuals involved.

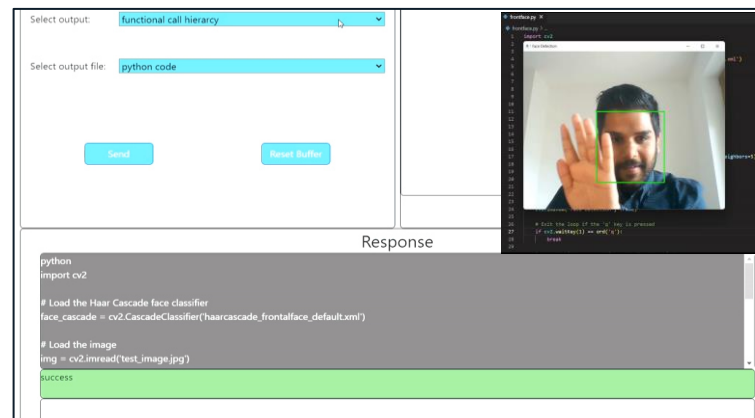
EURO NCAP

Artificial intelligence act

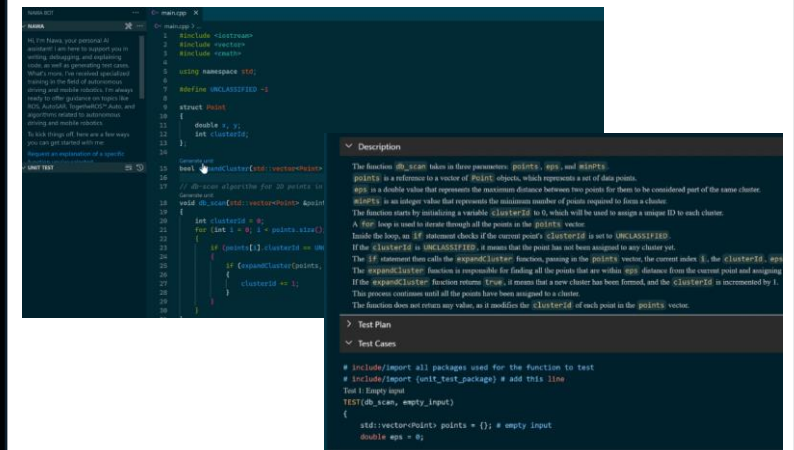
Processing of Data Streams



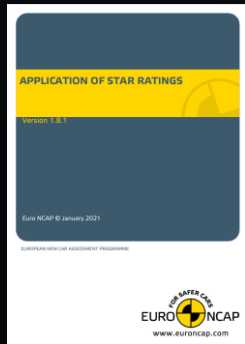
Architecture & Code Generation



Test case and scenario spec. generation



Application of MAS for iTraining



By PDF file found on Euro NCAP's official site., Fair use, <https://en.wikipedia.org/w/index.php?curid=10024063>

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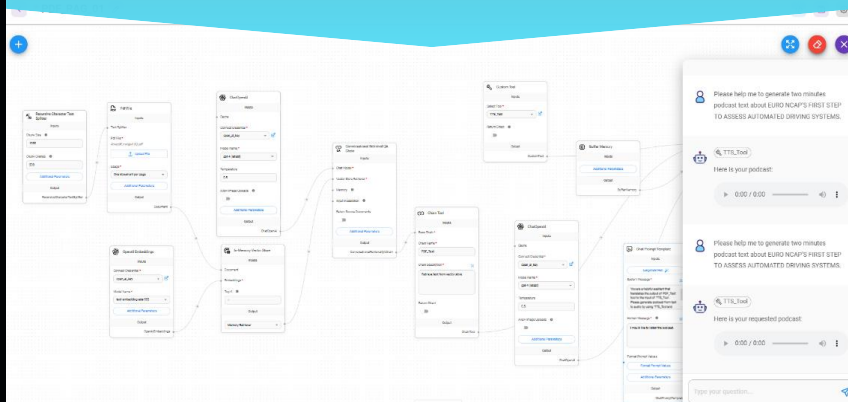
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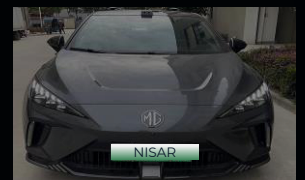
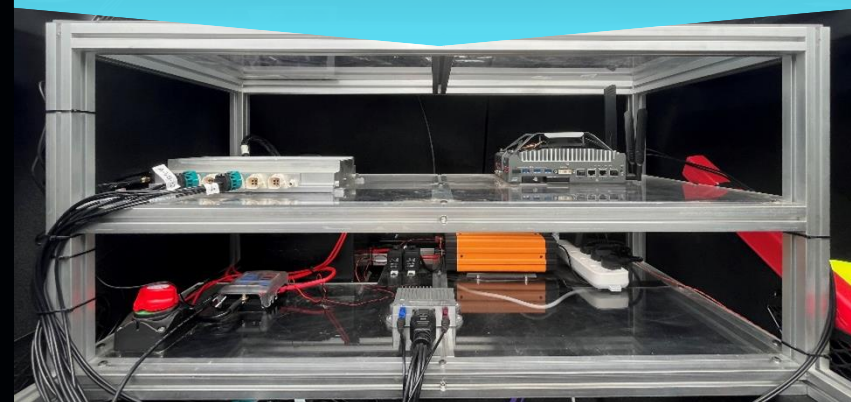
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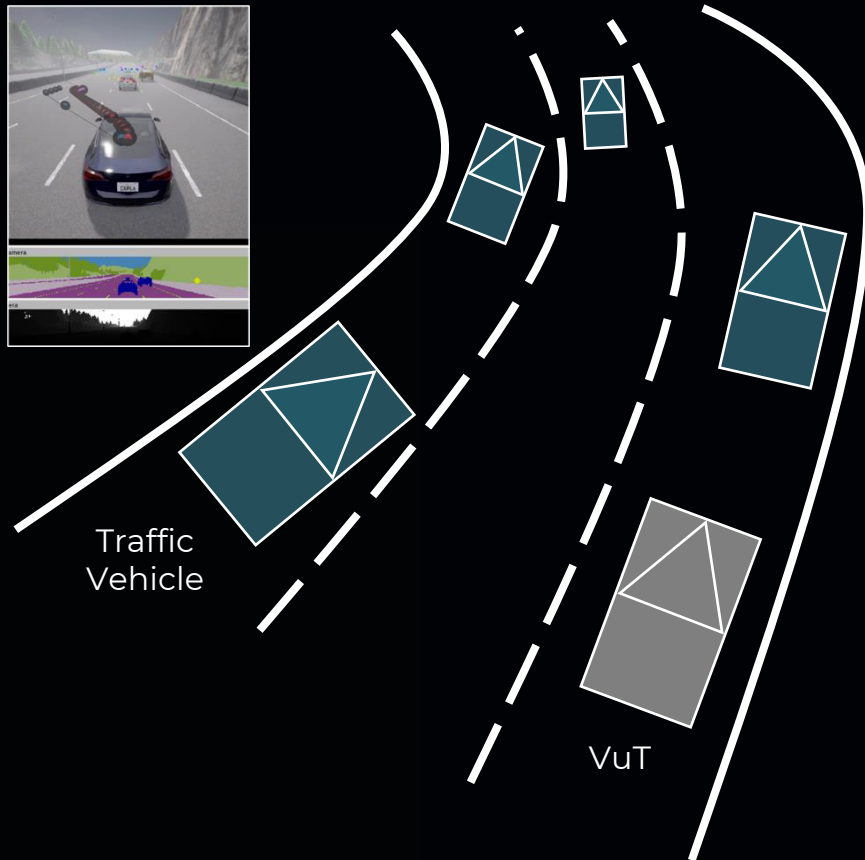
SiL & HiL – Connectivity & Synthetic Data
ViL – Bridging Simulation & Proving Grounds



Motivation: reproducing dynamic behaviour of traffic simulation on proving grounds

 Our system
  Vehicle under Test

Simulation



Motivation: reproducing dynamic behaviour of traffic simulation on proving grounds



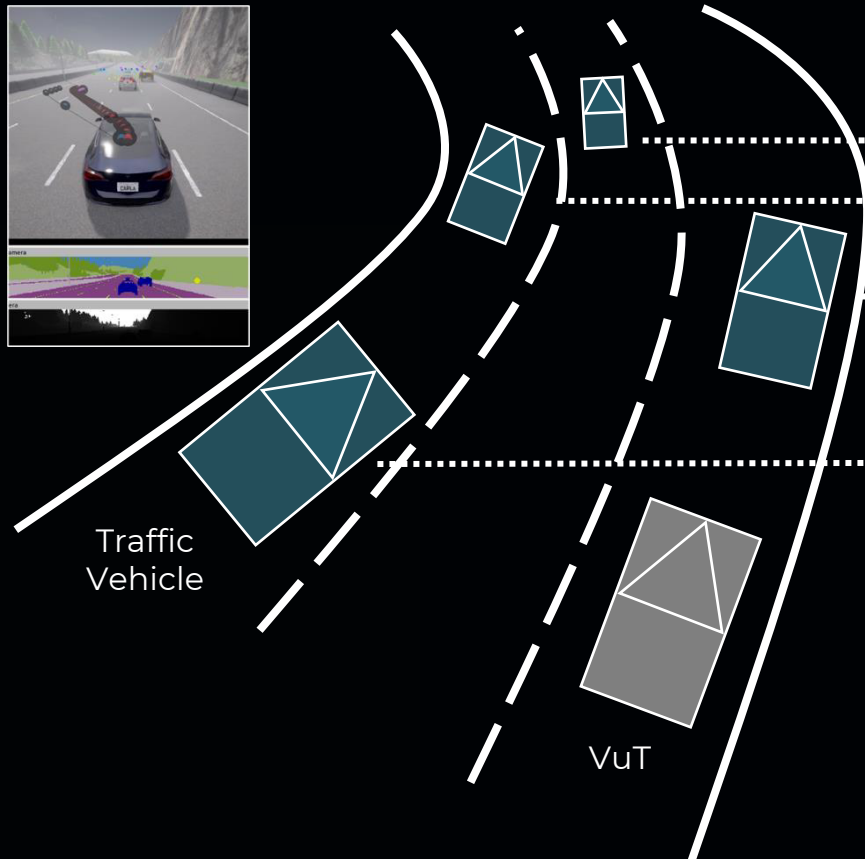
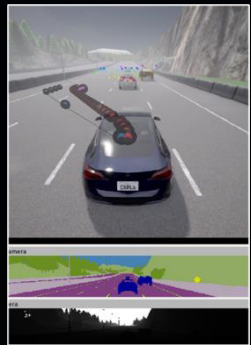
Our system



Vehicle under Test

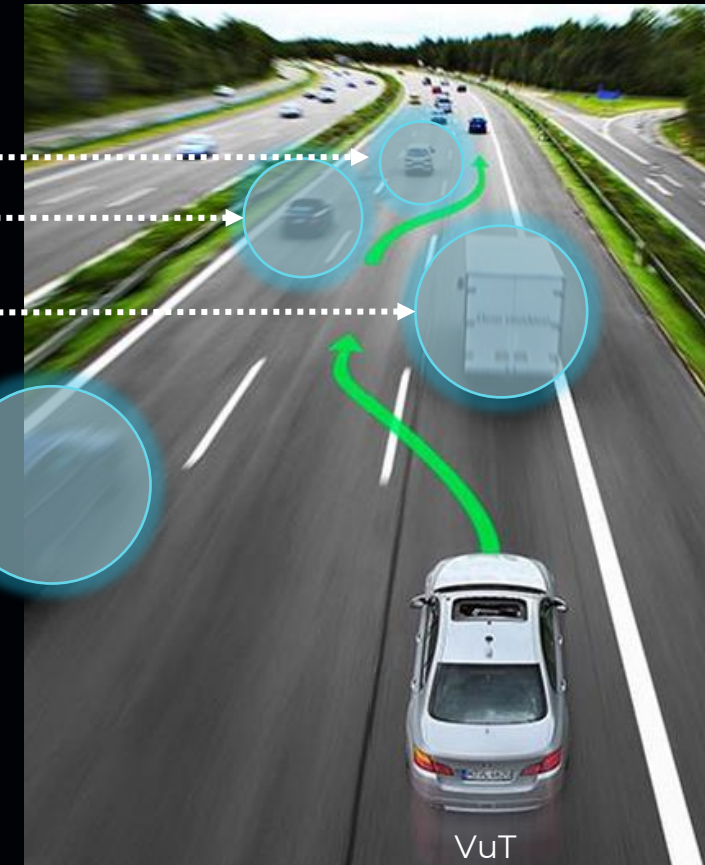
Simulation

Proving ground



Extraction / plan trajectories of peripheral vehicles from simulation

Reproducing the trajectories of peripheral vehicles in a proving ground





Perception in SiL

Current solutions - ViL: Absence of **perception** in the real world

Proving grounds

Simulation



Current solutions - ViL: Absence of **perception** in the real world



Perception in SiL

Proving grounds



Simulation



Current solutions

ViL: Absence of simulated traffic vehicles on proving grounds.
Perception will be tested in SiL

Bridging Simulation and Physical Testing

Current solutions, e.g. steering robots



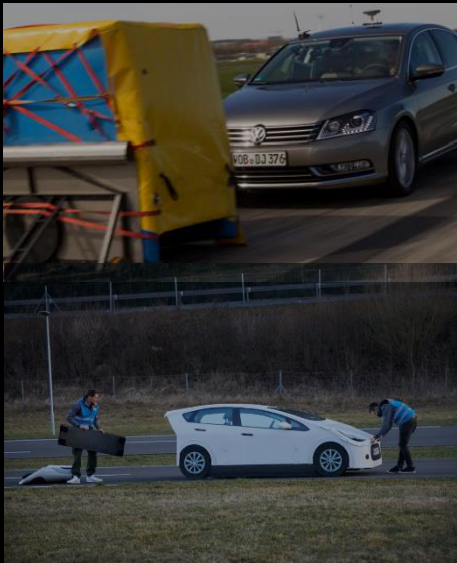
Dummy*
PTA, STA, BTA



Steering robot*

Bridging Simulation and Physical Testing

Current solutions, e.g. steering robots



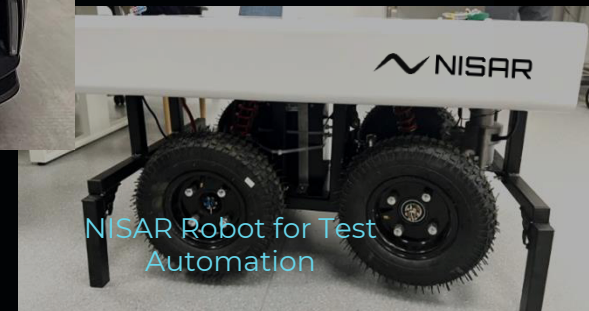
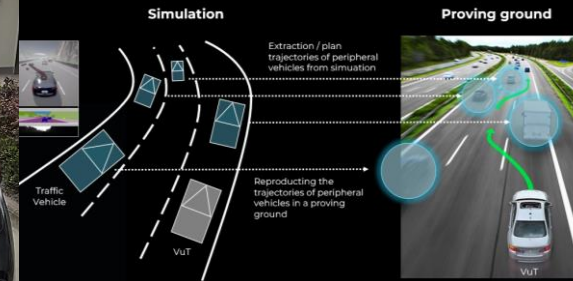
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Steering robot*

Our complementary solution

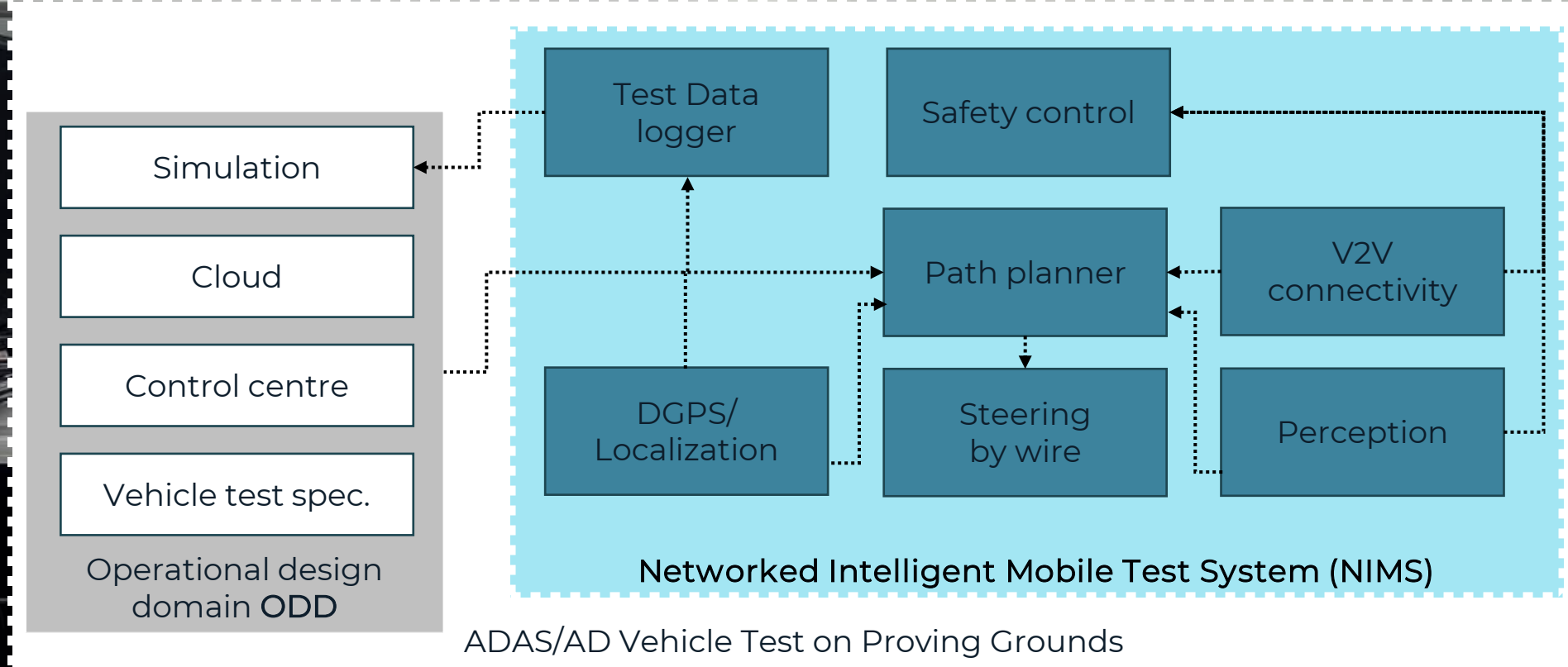
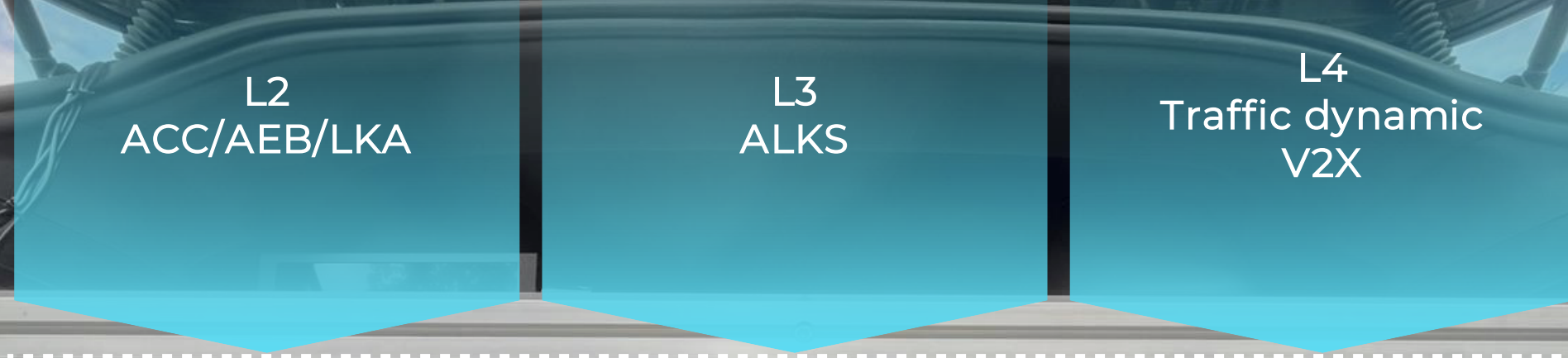
closing the gap between
simulation/cloud and proving grounds



Networked Intelligent
Mobile Test System (NIMS)

e.g. GVT, SOV

Our system architecture



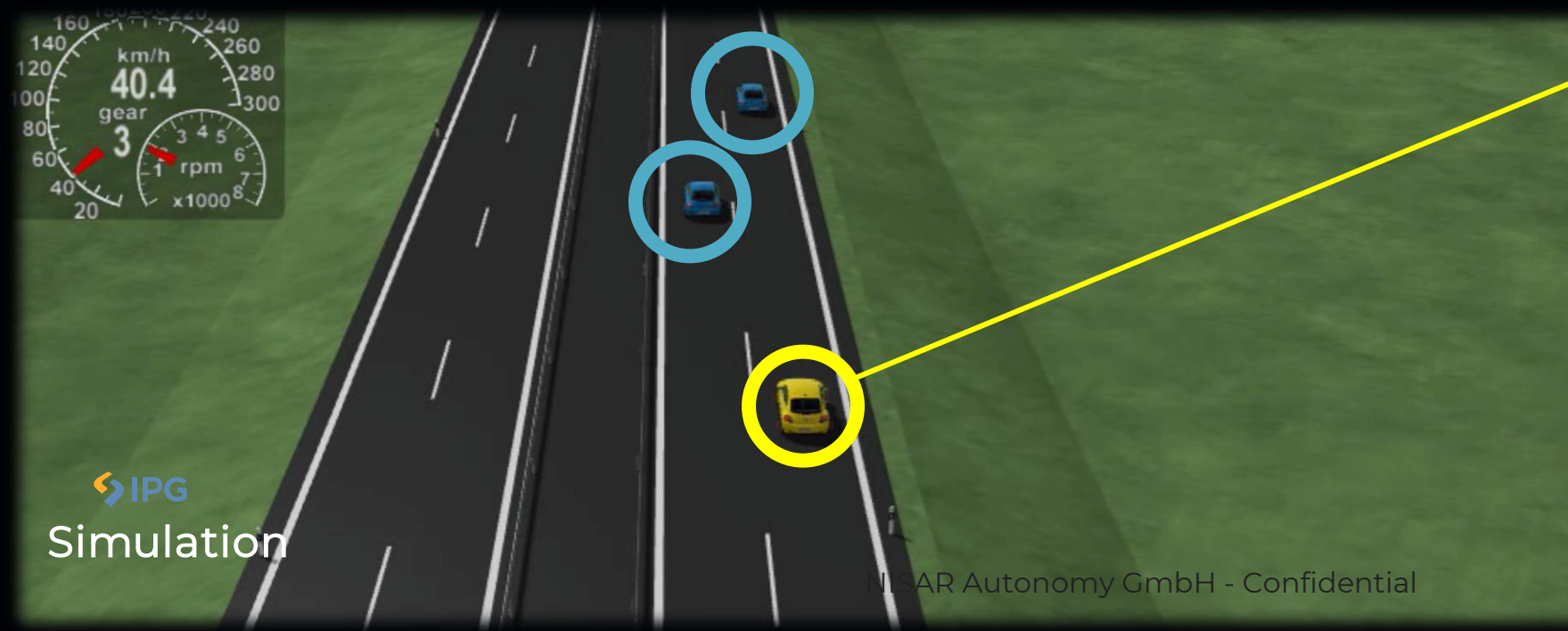
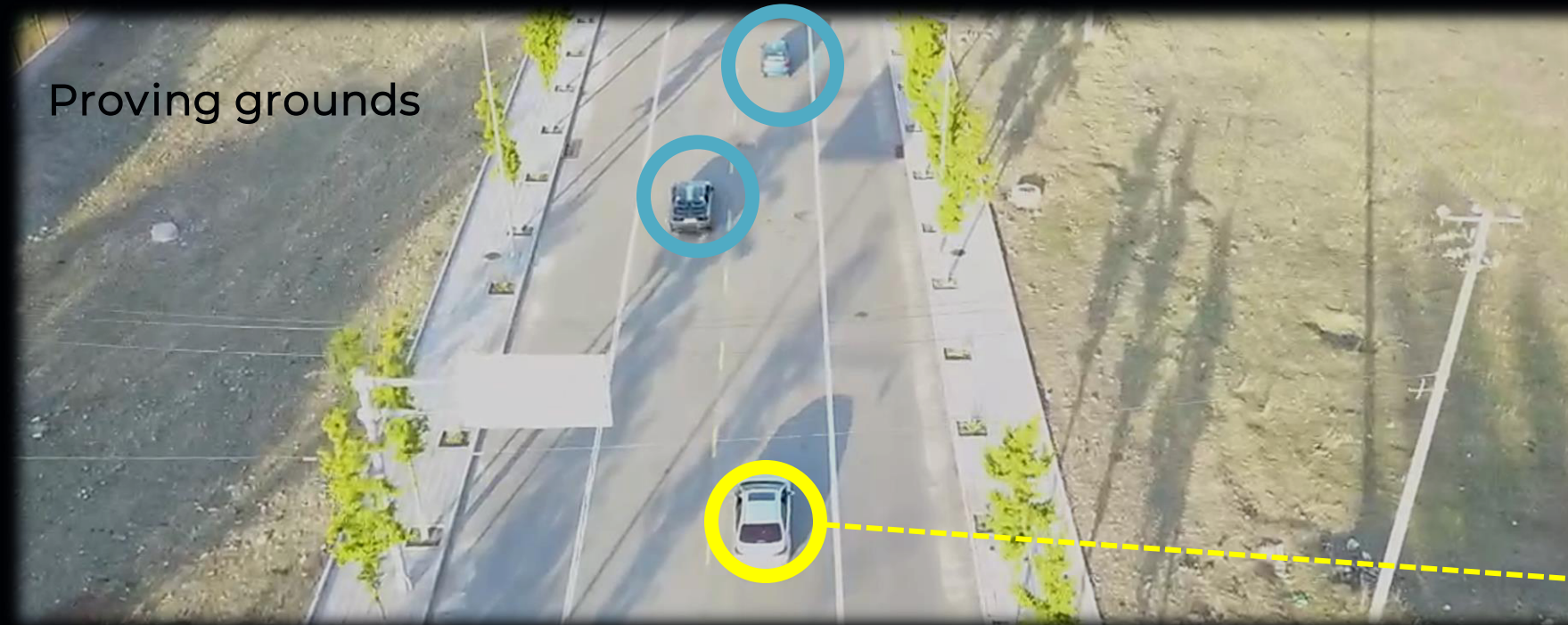
Our demo

Proving grounds

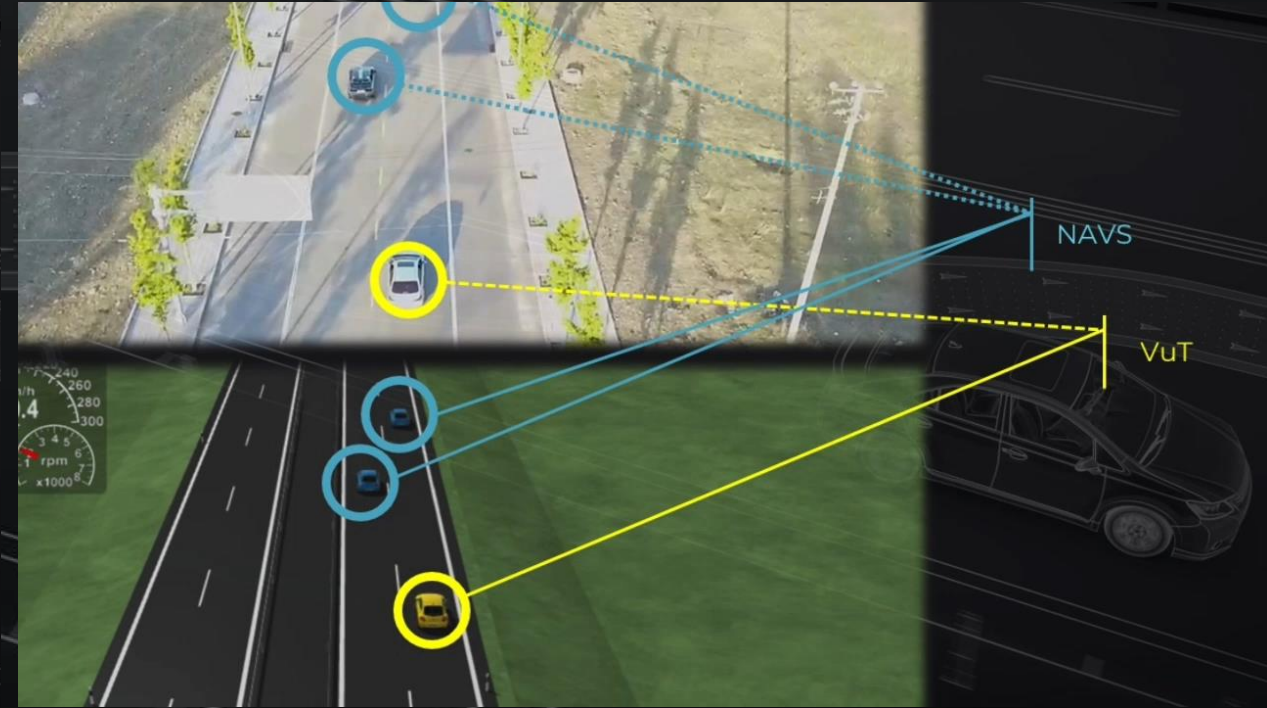
Reproduce designed ODDs with networked automated vehicles on proving grounds

VuT

Virtual homologation / vehicle tests:
Design ODDs and run tests in simulations



Simulation



Thank You

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NISAR Multi-Agent System (MAS) for Automotive Process Automation was recognized as one of THE TOP 5 startups under 100+ companies for GenAI Championship at the Open Bosch Award 2024 (18. Sept. 2024)

