

# KARYON: Kernel-Based Architecture for safety-critical control

Reliable Environment Perception  
From Simulation to Reality

KARYON Workshop, Borås, Sweden, 11.12.2014



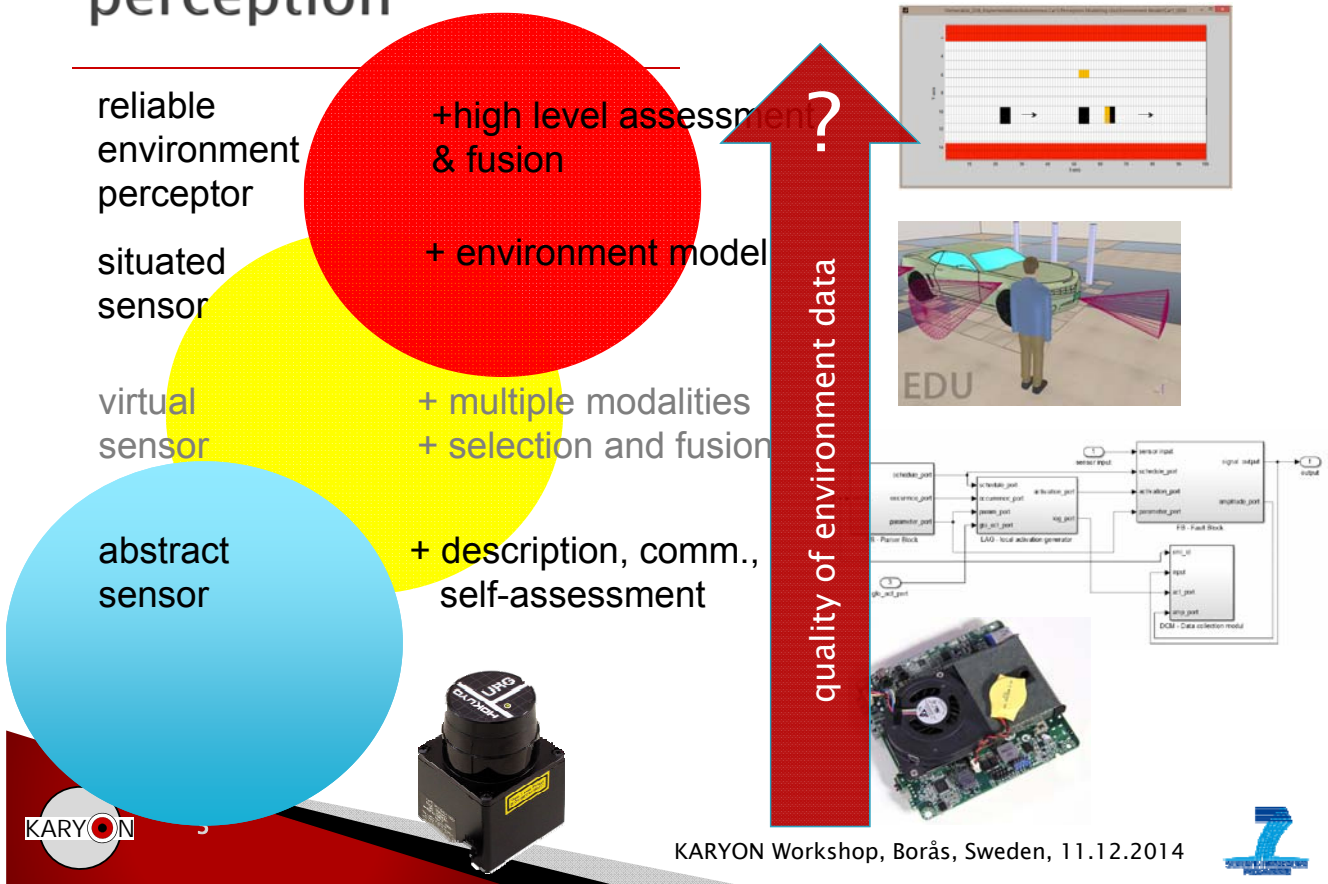
Kernel-Based ARchitecture for safety-critical cONTrol

## Reliable Environment Perception

- Assessing the quality of remote sensor data
- Evaluating and fusing remote sensor data in the local context
- Sharing information about environment
- Exploiting Mixed-Reality for Supporting the Development

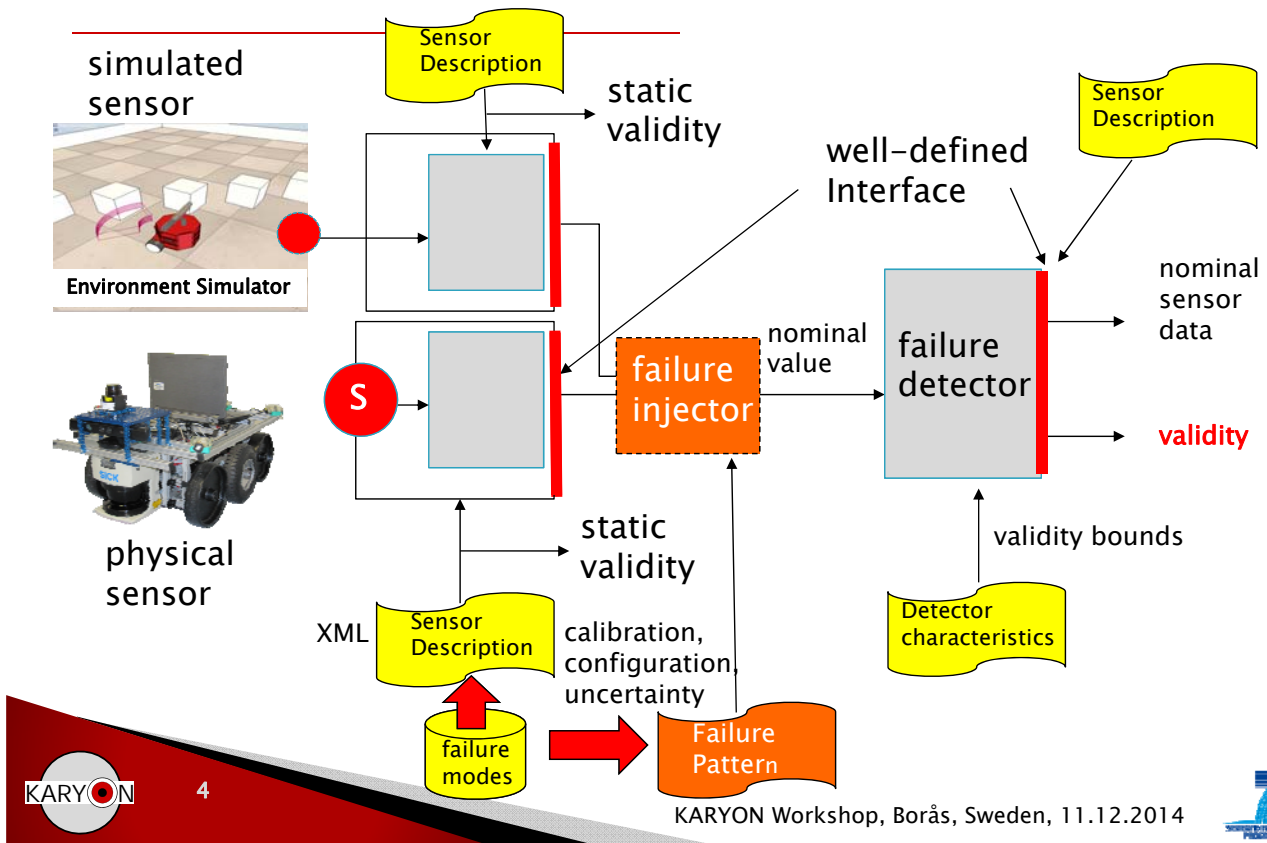


# The steps to reliable environment perception



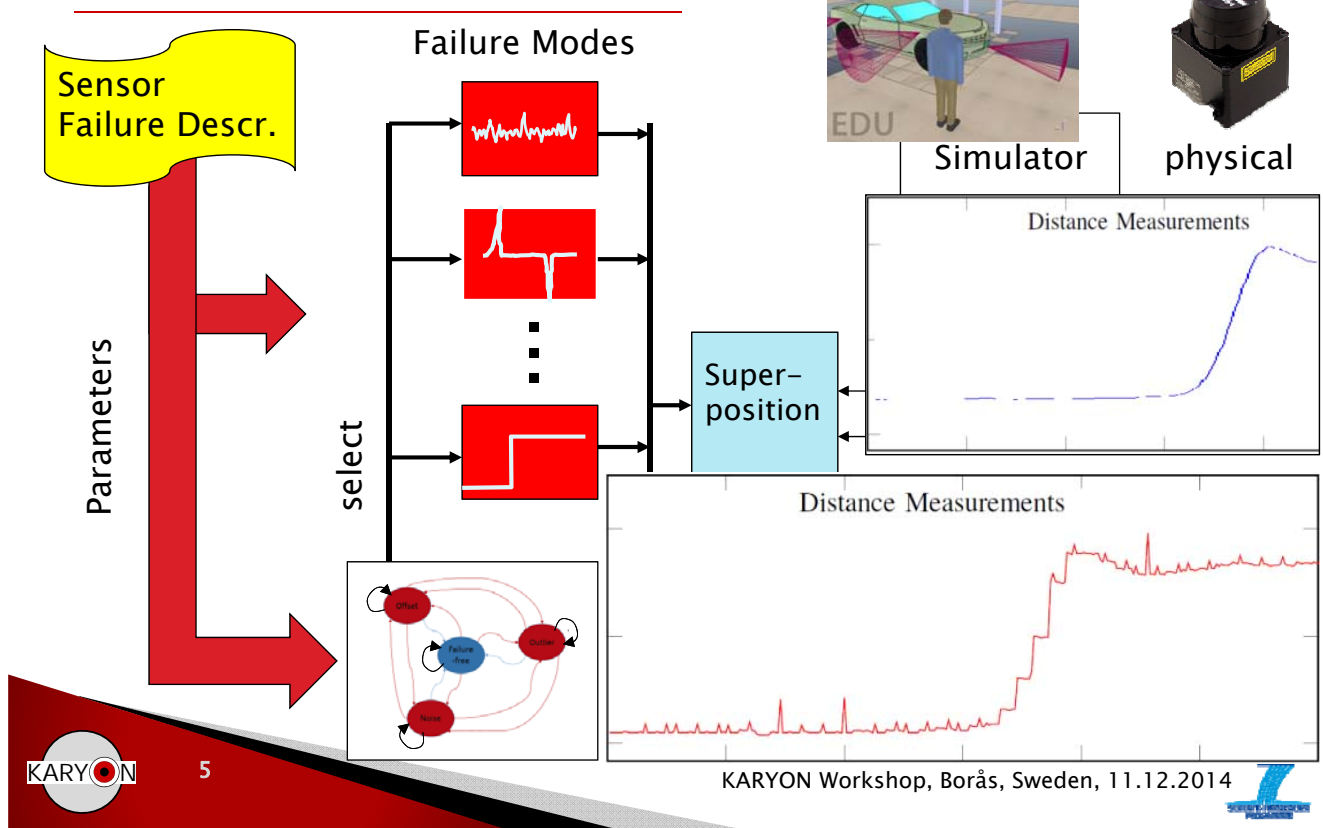
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## The Abstract Sensor Model

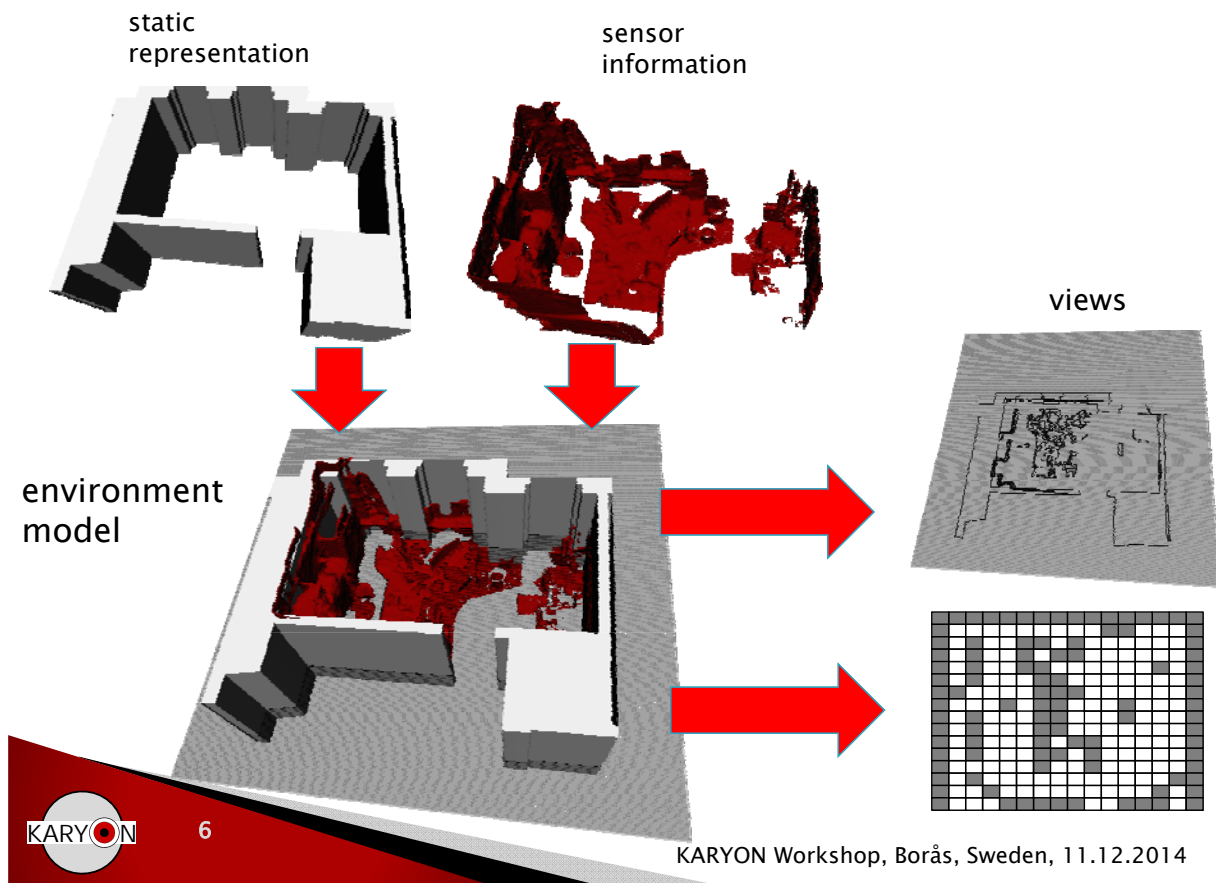


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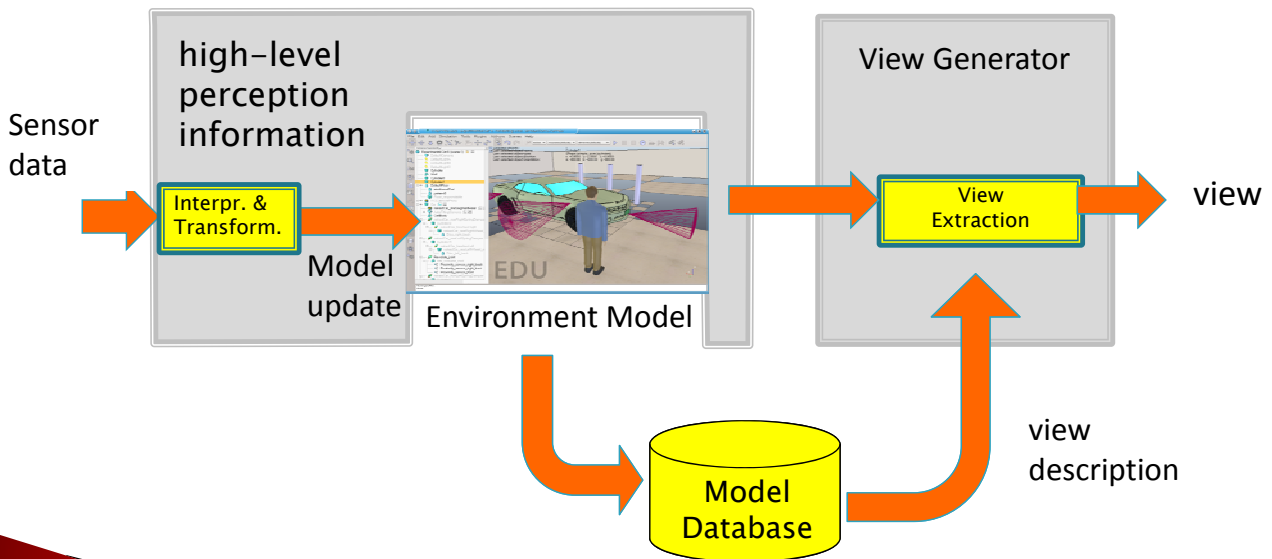
# Failure Injection Framework



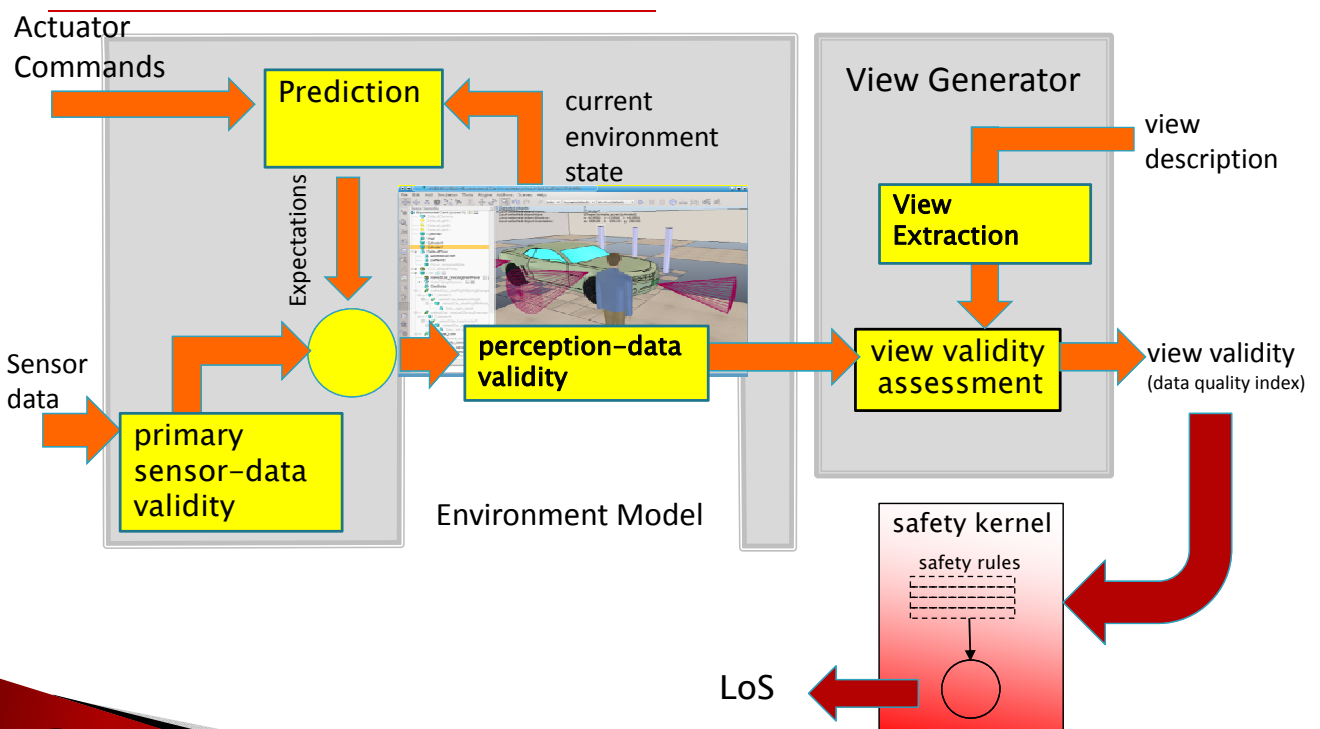
# Environment Model and Views



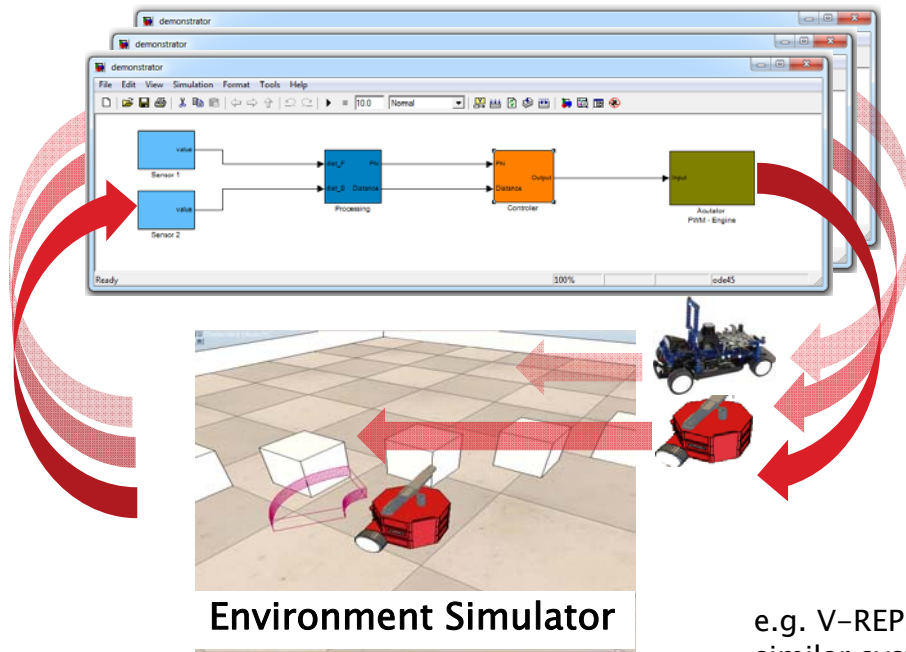
# Putting Sensor Data into Environment Context



# Validity Assessment in the Environment Context



# Mixing Reality – Putting a simulator in the loop



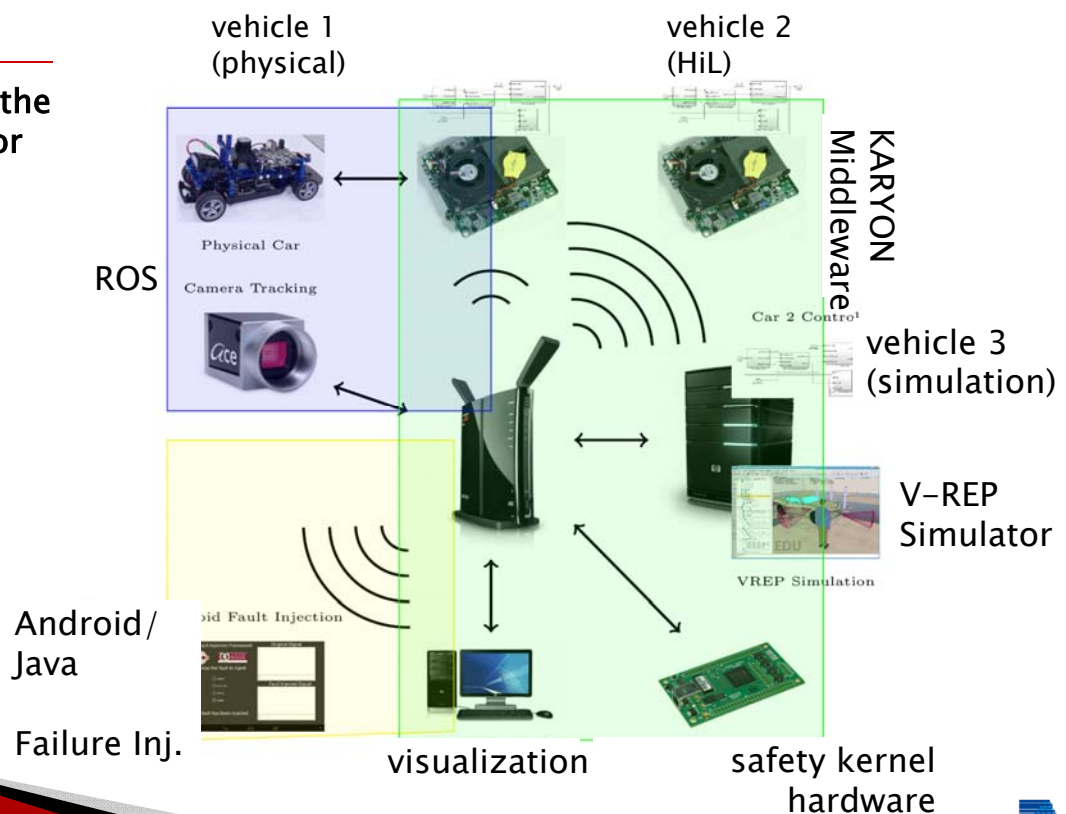
Interaction between Simulink and environment:

- The external action/perception loop is provided by an environment simulator.
- This allows testing and fine-tuning of the Simulink application.

e.g. V-REP, Flightgear, OpenRAVE or similar systems.

# Mixed Reality + Hardware and Software in the loop

Structure of the Demonstrator



# Summary

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- Abstracting sensor information enables decoupling of perception from control and forms the basis for using remote sensor data.
- Elaborated failure model and precise description of the sensor data processing allows assessing sensor data quality.
- The concept of data validity is the basis for health monitoring and constitutes the information being evaluated by the safety kernel.
- Mixed-Reality (and the middleware below) supports the design process and enables seamless mixing of simulated and real components.

