SET Level

Simulation-based Development and Testing of Automated Driving

Supported by:

Federal Ministry for Economic Affairs and Energy

on the basis of a decision by the German Bundestag

Architecture

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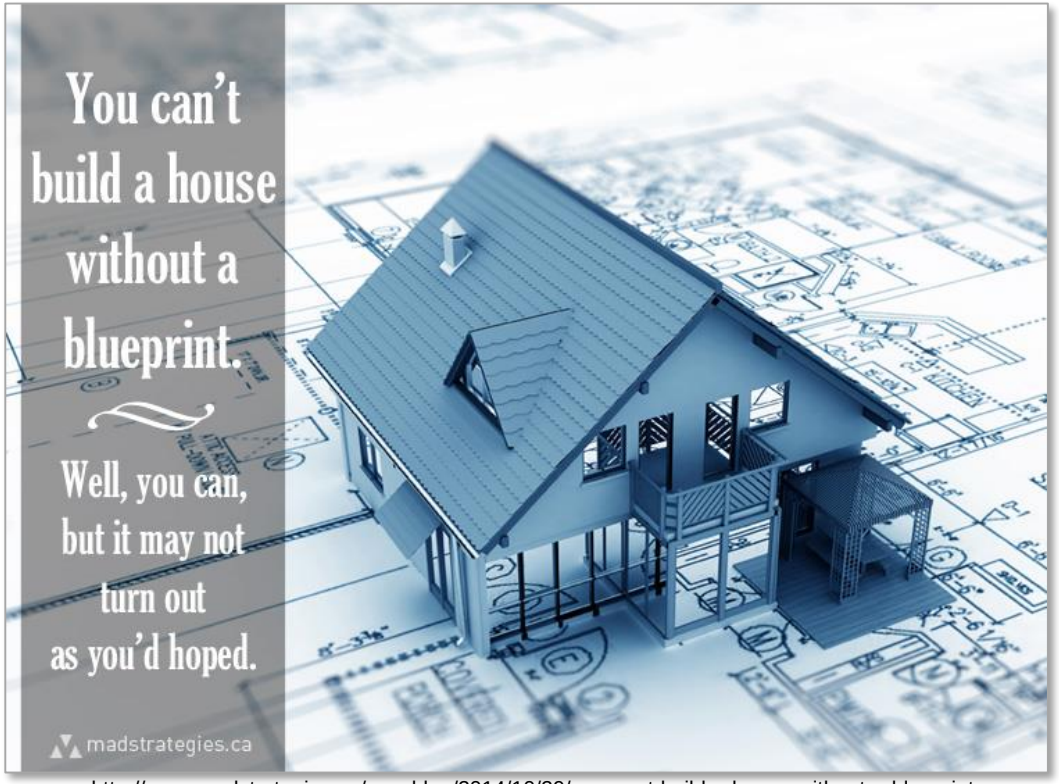
PROJECT of the PEGASUS FAMILY

Motivation
Why it is a good idea to have a blueprint



http://www.madstrategies.ca/ceosblog/2014/10/29/you-cant-build-a-house-without-a-blueprint

Usually we do not start from scratch, rather then we try to use what's already existing and improve what doesn't fit

Standards are helping when developing a blueprint …

Architecture challenge

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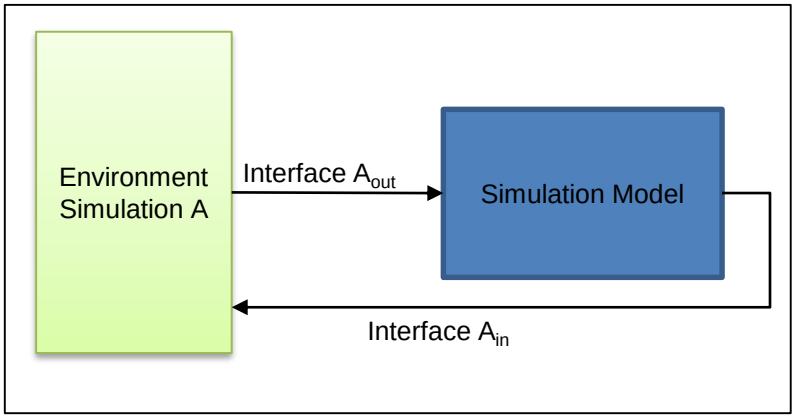
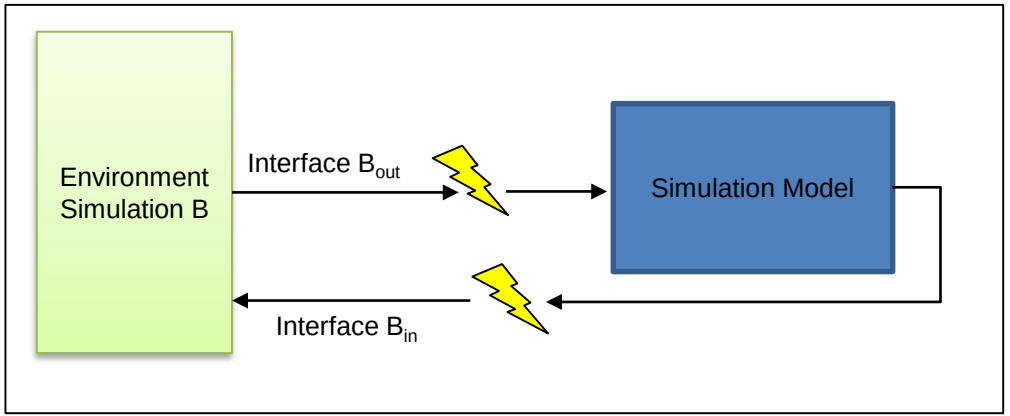
Project A



Project B



Without standardization of structure and interfaces, a simple reuse and exchange of simulation models is much more complex

Flexible and modular scenario-based simulation

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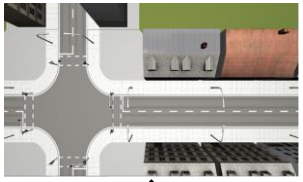
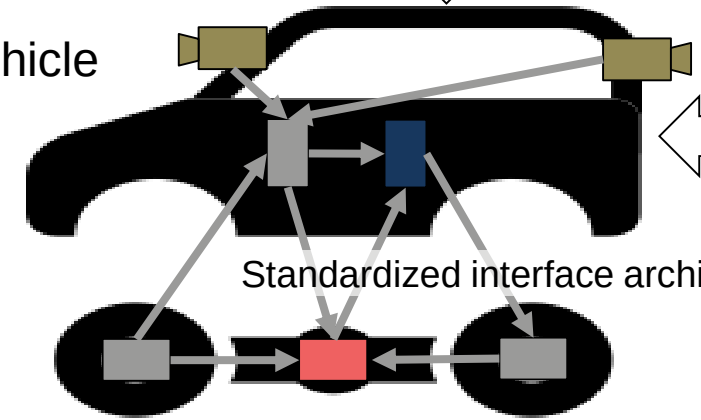
Simulated environment



Logical Scenario

… parametrizing and instructing …

Simulated vehicle

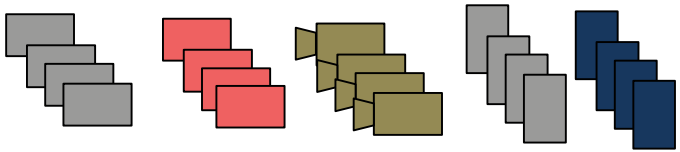


… parametrizing and instructing …

Concrete Scenario

Standardized interface architecture

Results

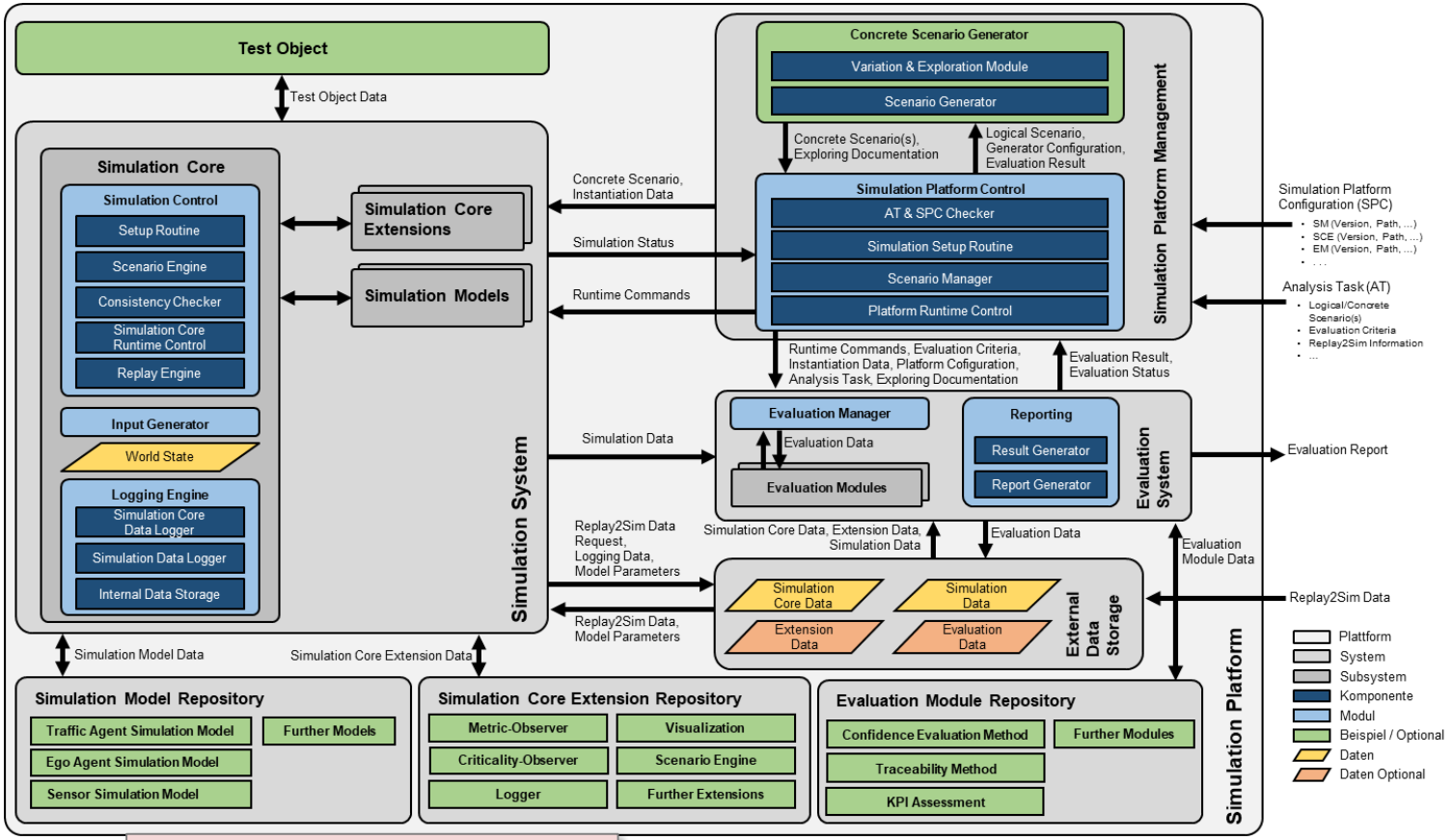


Simulation components

ssp System Structure & Parameterization (Modelica Association) http://ssp-standard.org

fmi Functional Mock-Up Interface (Modelica Association) http://fmi-standard.org

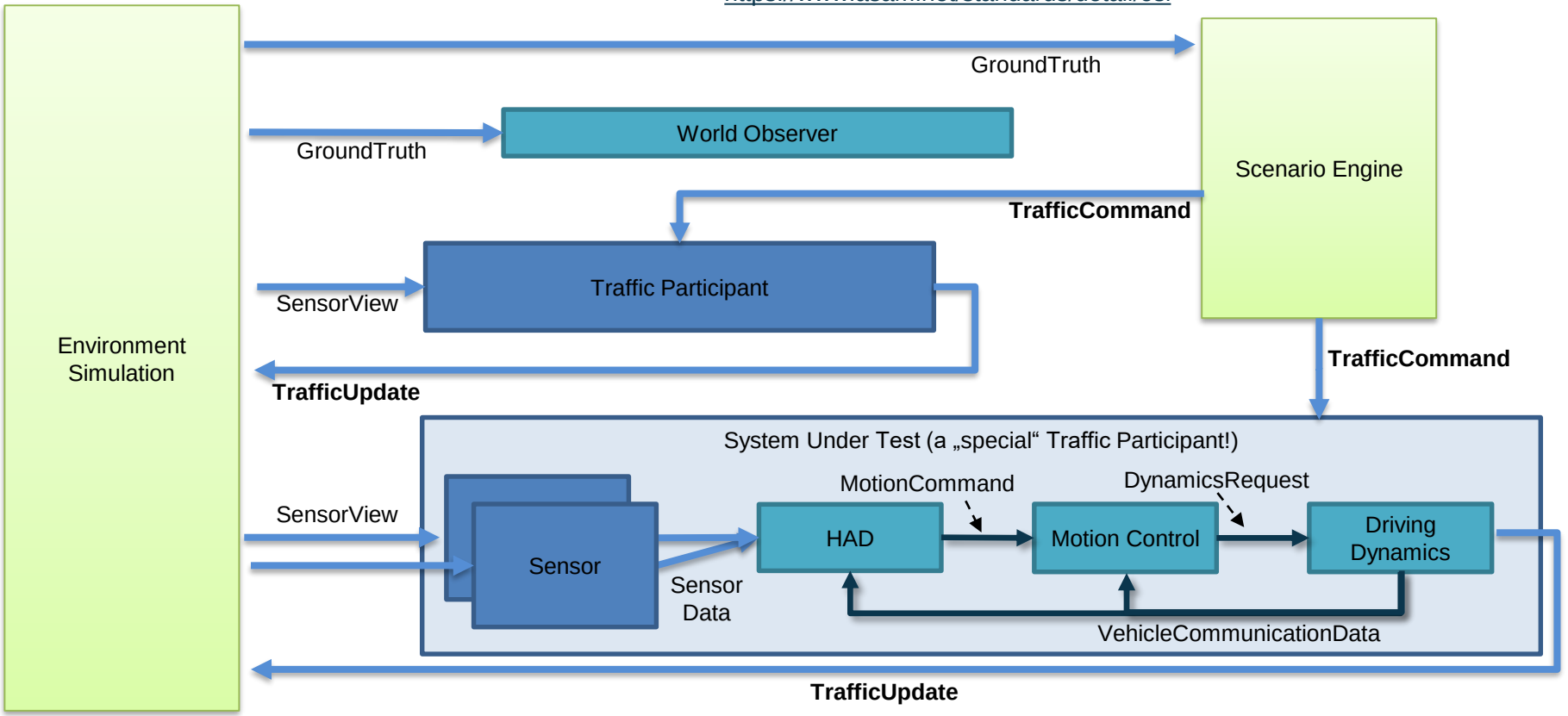
Simulation platform for scenario-based testing



See also: Demonstrators and concepts
Stream 1 (Test case description)

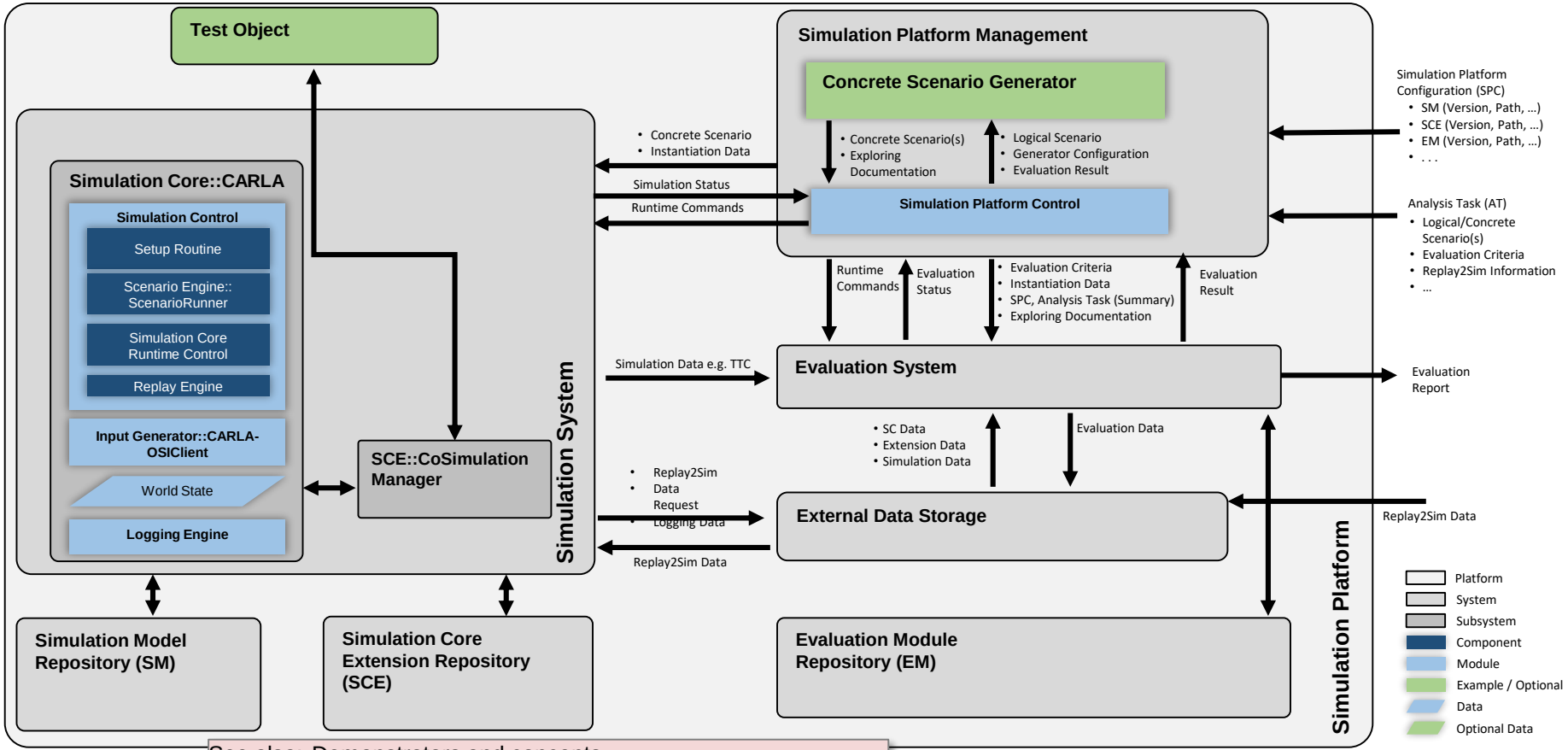
Standardized interfaces - Improved OSI

"Open Simulation Interface" (ASAM)
https://www.asam.net/standards/detail/osi



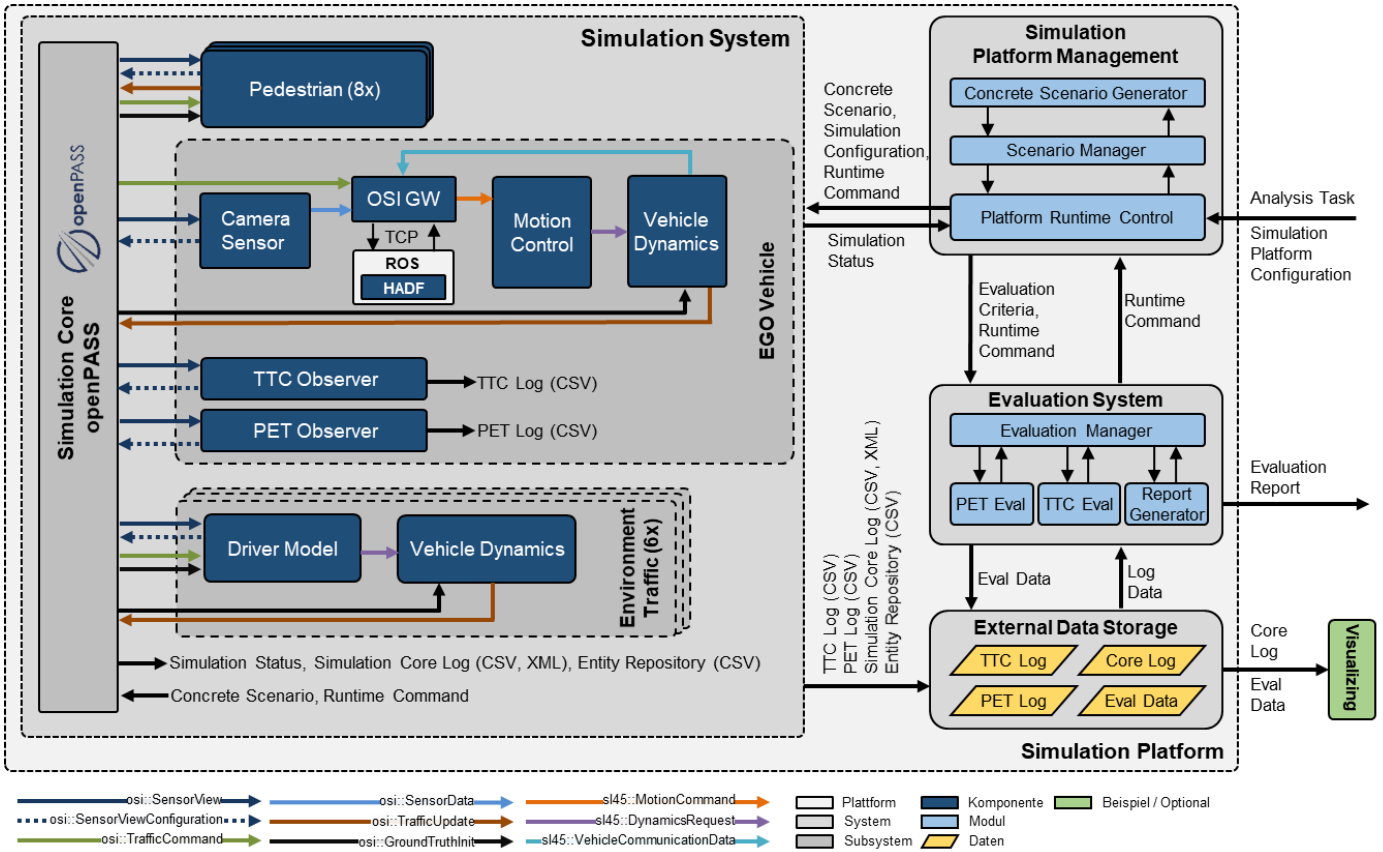
See also: Demonstrators and concepts
Stream 2 (OSI) + Stream3 (agent models)

Research implementation



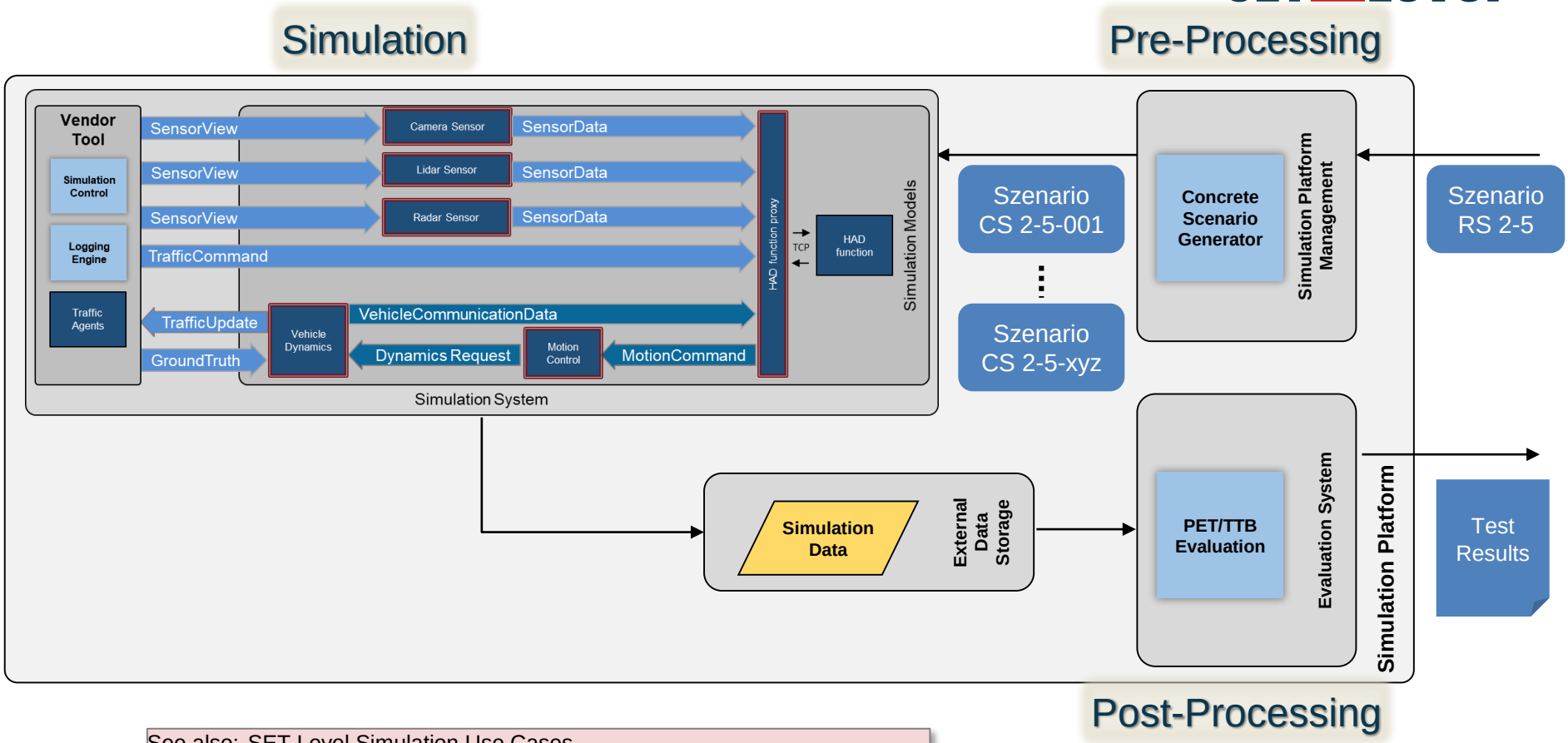
See also: Demonstrators and concepts
Stream 1 (Automated simulation of scenario sequences)

SUC 1 – Architecture



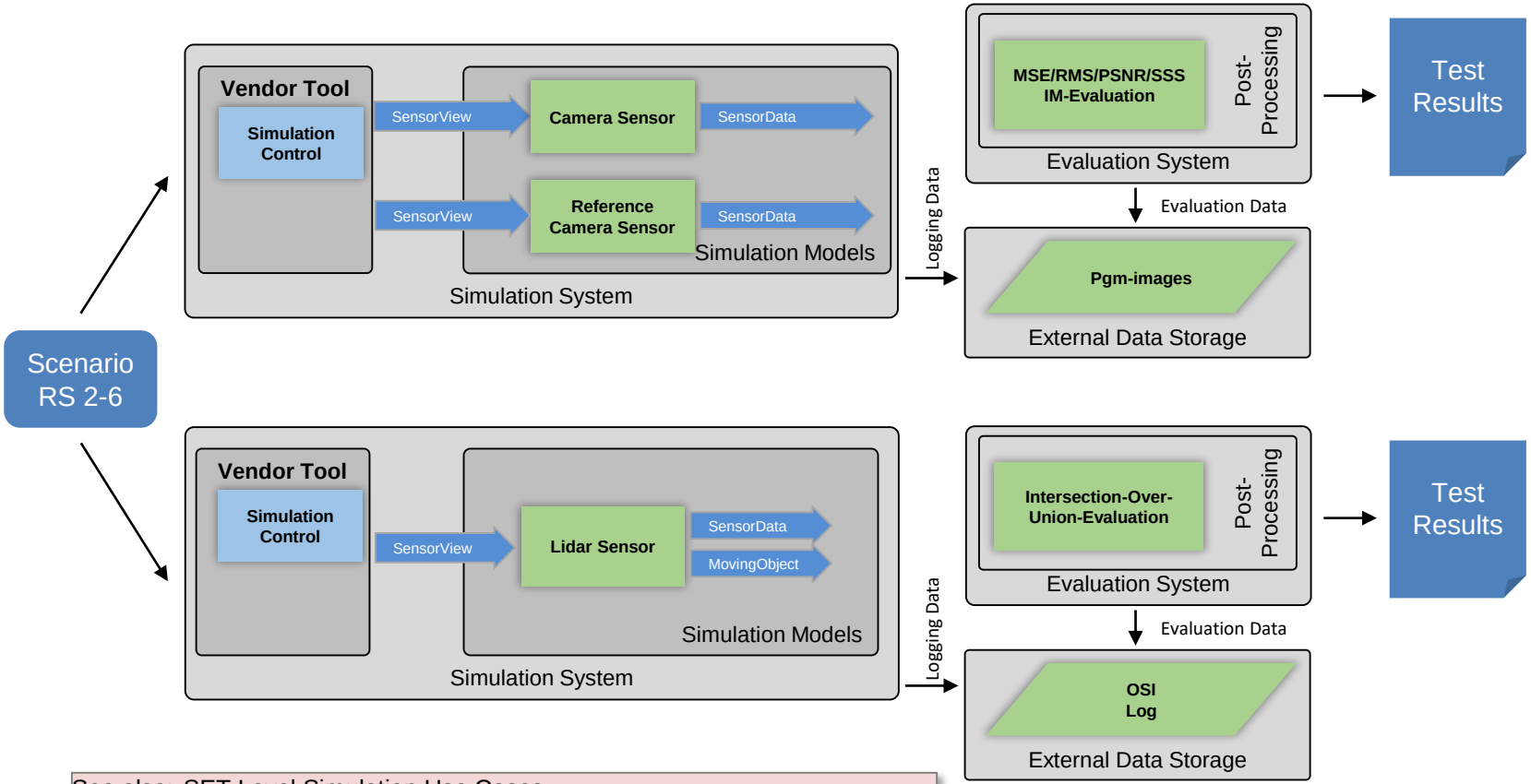
See also: SET Level Simulation Use Cases
Stream 1 (A closed-loop traffic simulation for criticality analysis)

SUC 2 – Architecture



See also: SET Level Simulation Use Cases
Stream 2 (A closed-loop simulation for integration test and validation)

SUC 3 – Architecture

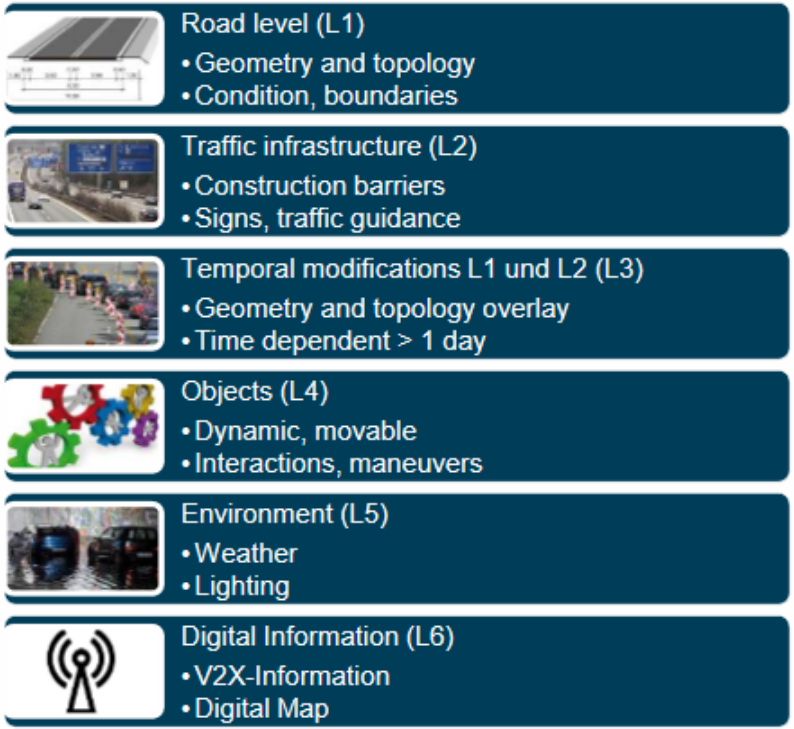


See also: SET Level Simulation Use Cases
Stream 3 (An open-loop simulation for integration test and validation)

Conclusions

- Reference architecture was successfully evaluated with SUC 1, SUC 2, SUC 3 and with research implementation
- The gained knowledge was transferred into the OSI standard, e.g.:
  - TrafficCommand
  - TrafficUpdate
  - LogicalDetectionData in SensorData

Simulation parameters

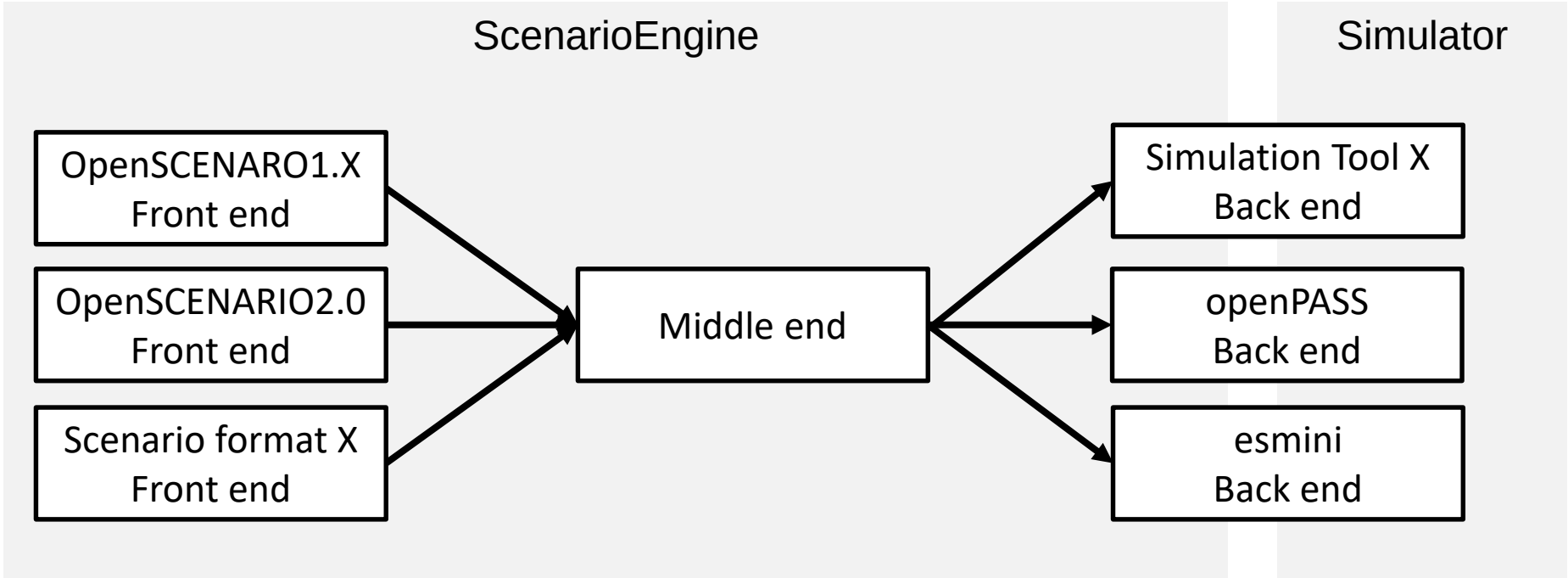
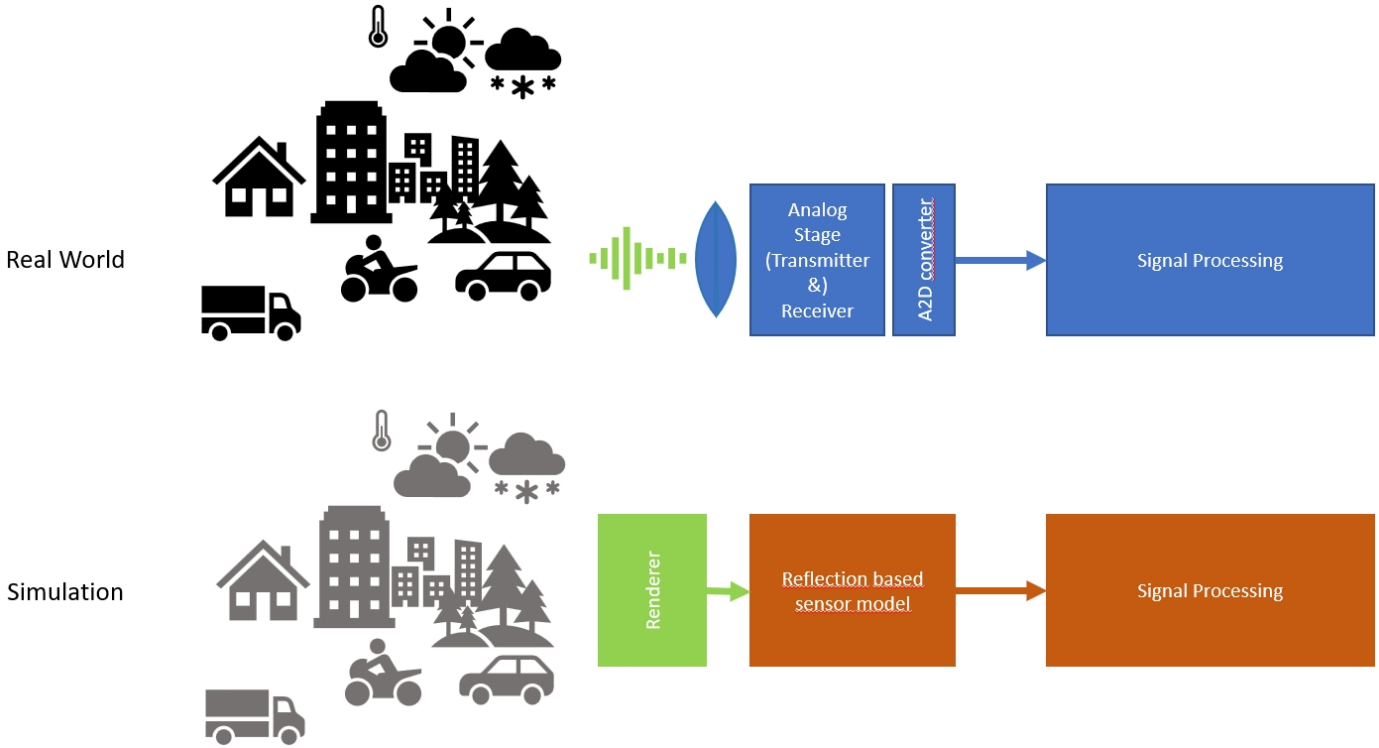


Source: PEGASUS Project

Examples for parameter families:

- Road level
  - Entrance Ramp Length
  - Number of Lanes
- Objects
  - Distance, Relative Velocity

Modular scenario engines



Interfaces for reflection based sensors