MathWorks
AUTOMOTIVE CONFERENCE 2023
India

Open Simulation Interface Using RoadRunner For Automated Driving Validation

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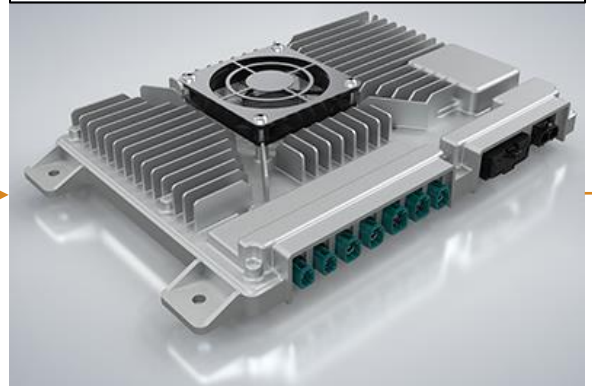
What is Virtual Simulation?

Real Environment

Domain Controller



Detections

Objects/Warnings

Virtual Environment

Sensor Model

Logic Model

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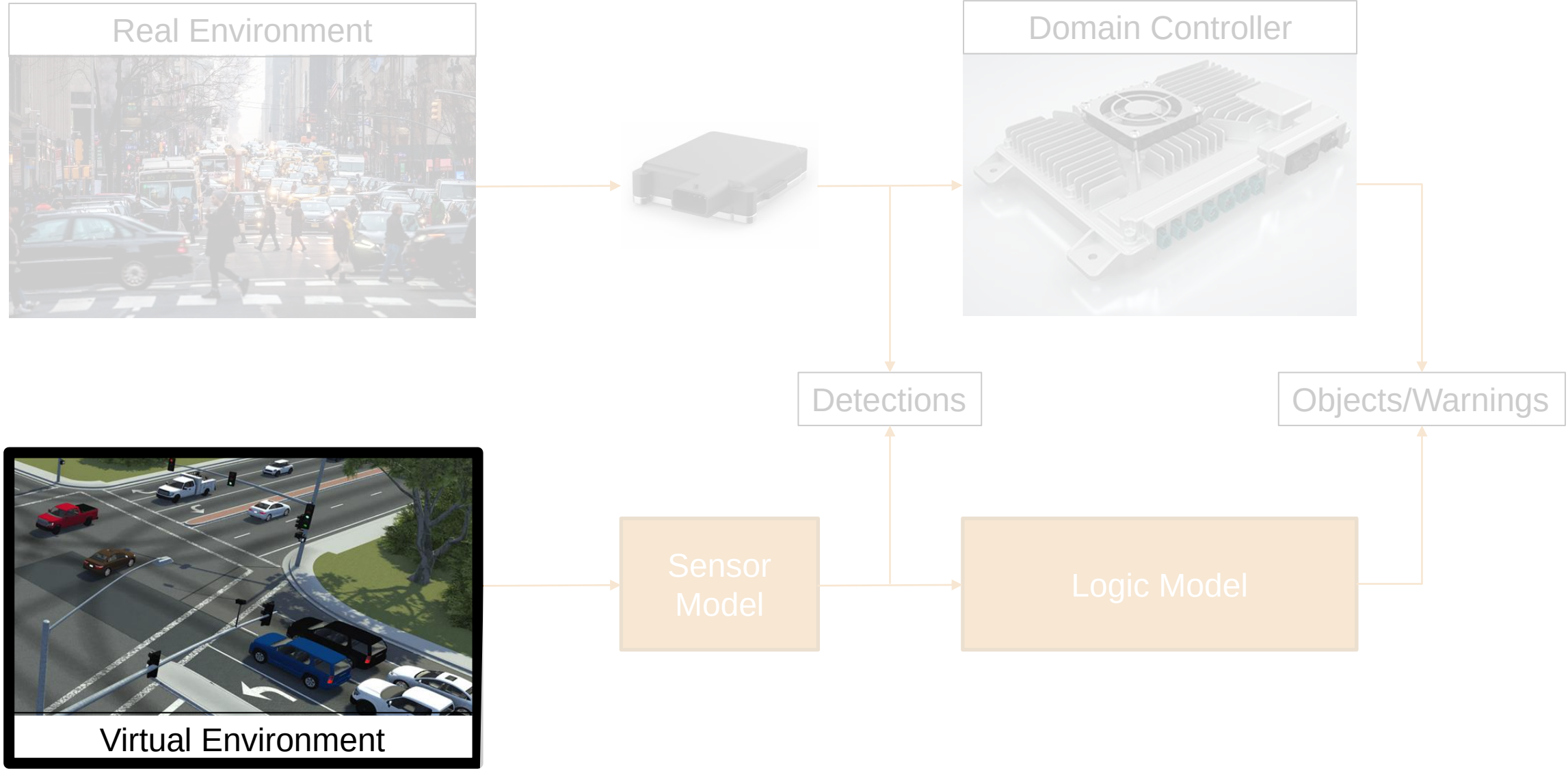
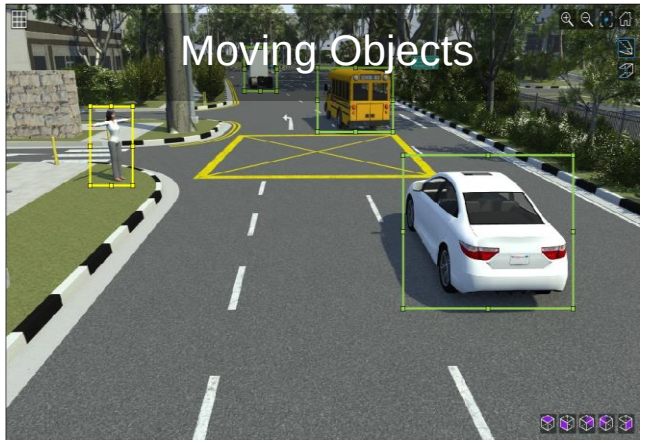
Virtual Environment

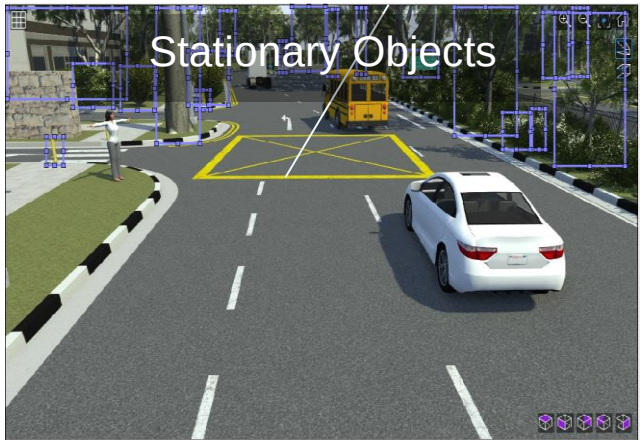


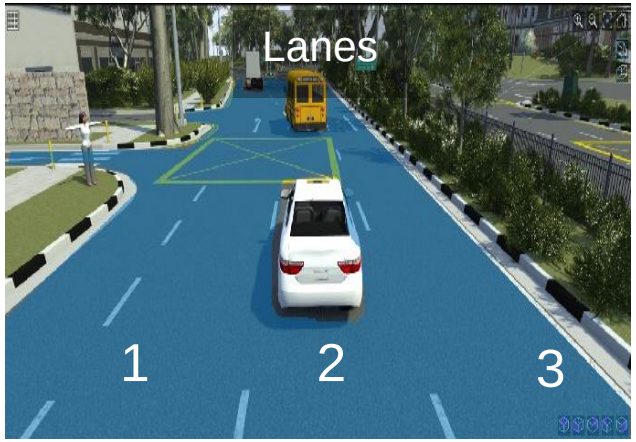
Virtual Environment

Environment Simulators mimic the real world by creating digital twin of all the assets in the real world thereby replacing many test drives on the road with virtual drives.

Virtual Environment







Introduction To Open Simulation Interface(OSI)

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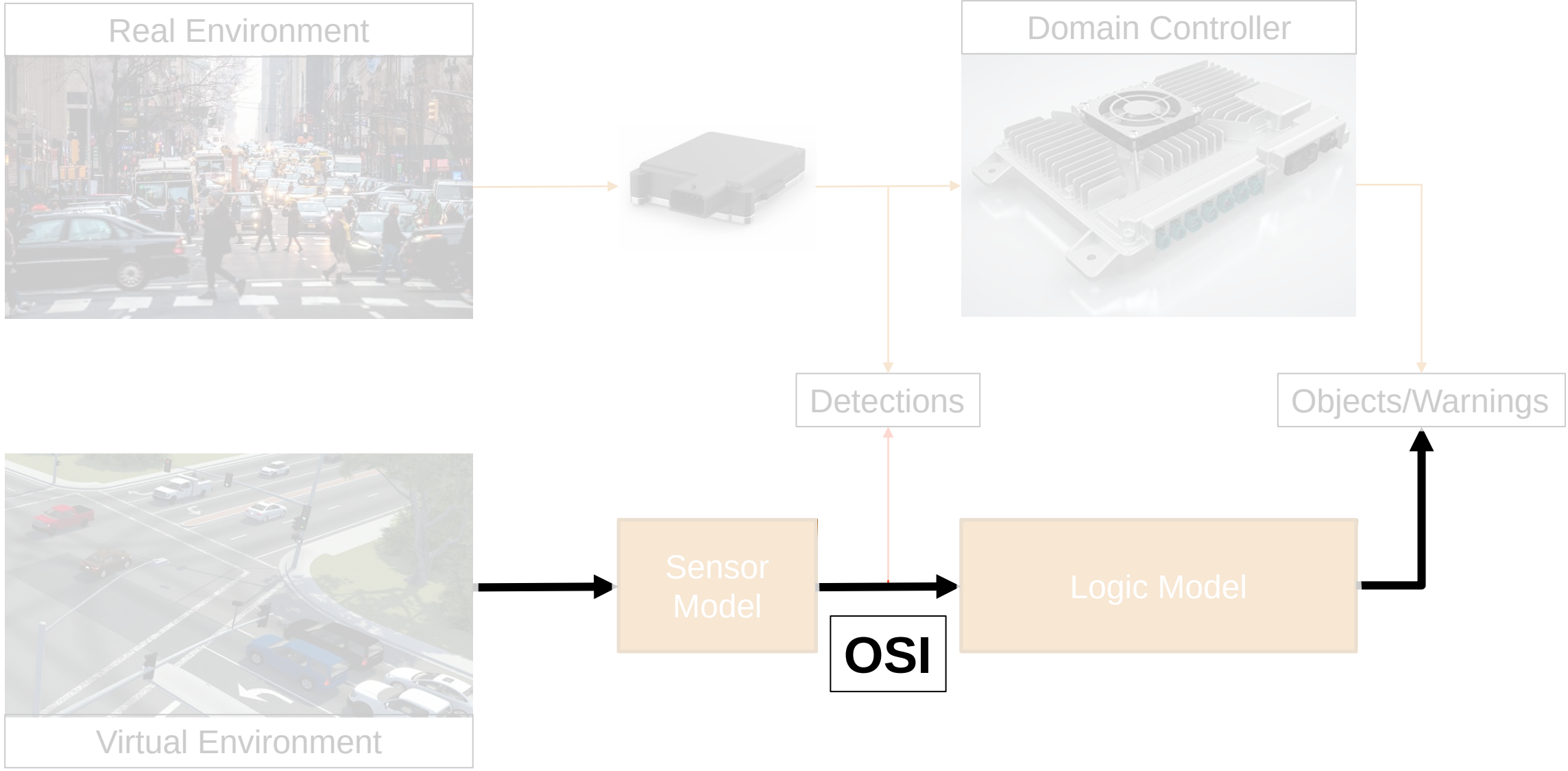
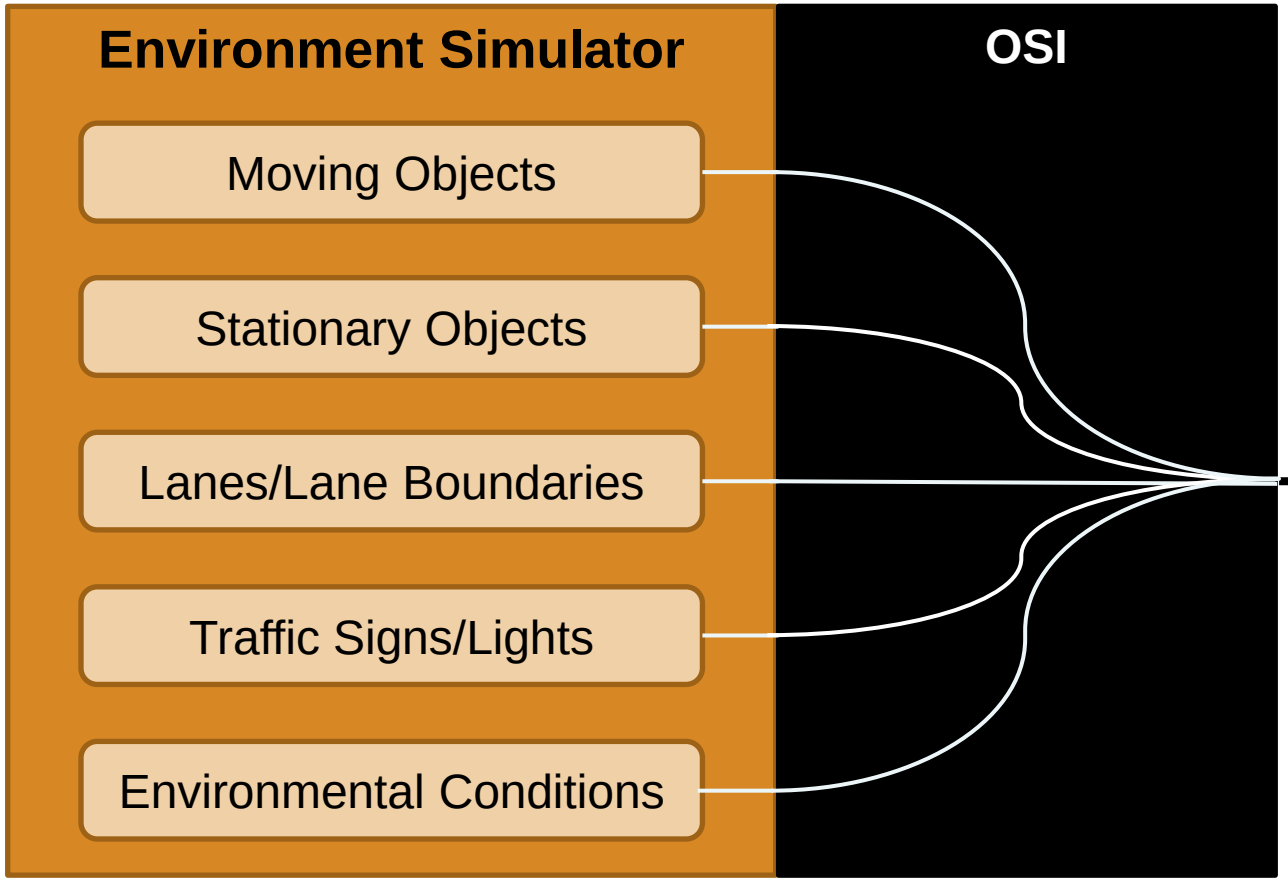
Open Simulation Interface



Open Simulation Interface

The Open Simulation Interface[1] (OSI) is a generic interface based on Google's protocol buffers for the environmental perception of automated driving functions in virtual scenarios[2]. All the assets from the Environment Simulators are packed into this OSI standard format. OSI supports a wide range of traffic participants from animals to trains and a variety of objects in the environment.



optional **Dimension3d** **dimension** = 1
The 3D dimension of the moving

optional **Vector3d** **position** = 2
The reference point for position

optional **Orientation3d** **orientation** = 3
e orientation of the m

4
e velocity of the movi

optional **Vector3d** **acceleration** = 5
The relative acceleration of the

optional **Orientation3d** **orientation_rate** = 6
The relative orientation rate of t

optional **Orientation3d** **orientation_acceleration** = 8
The relative orientation accelera

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OSI In Aptiv Virtual Simulation

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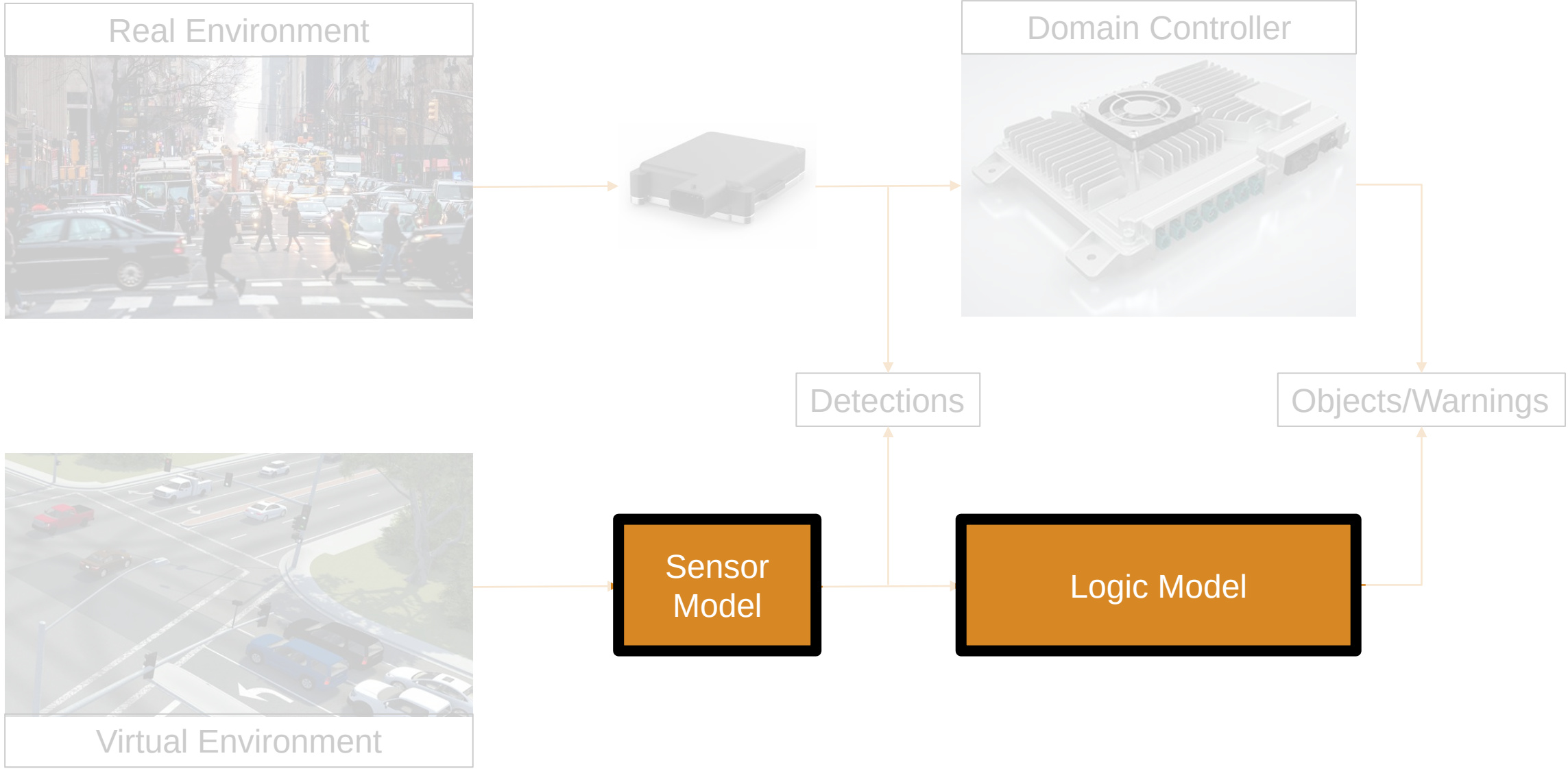
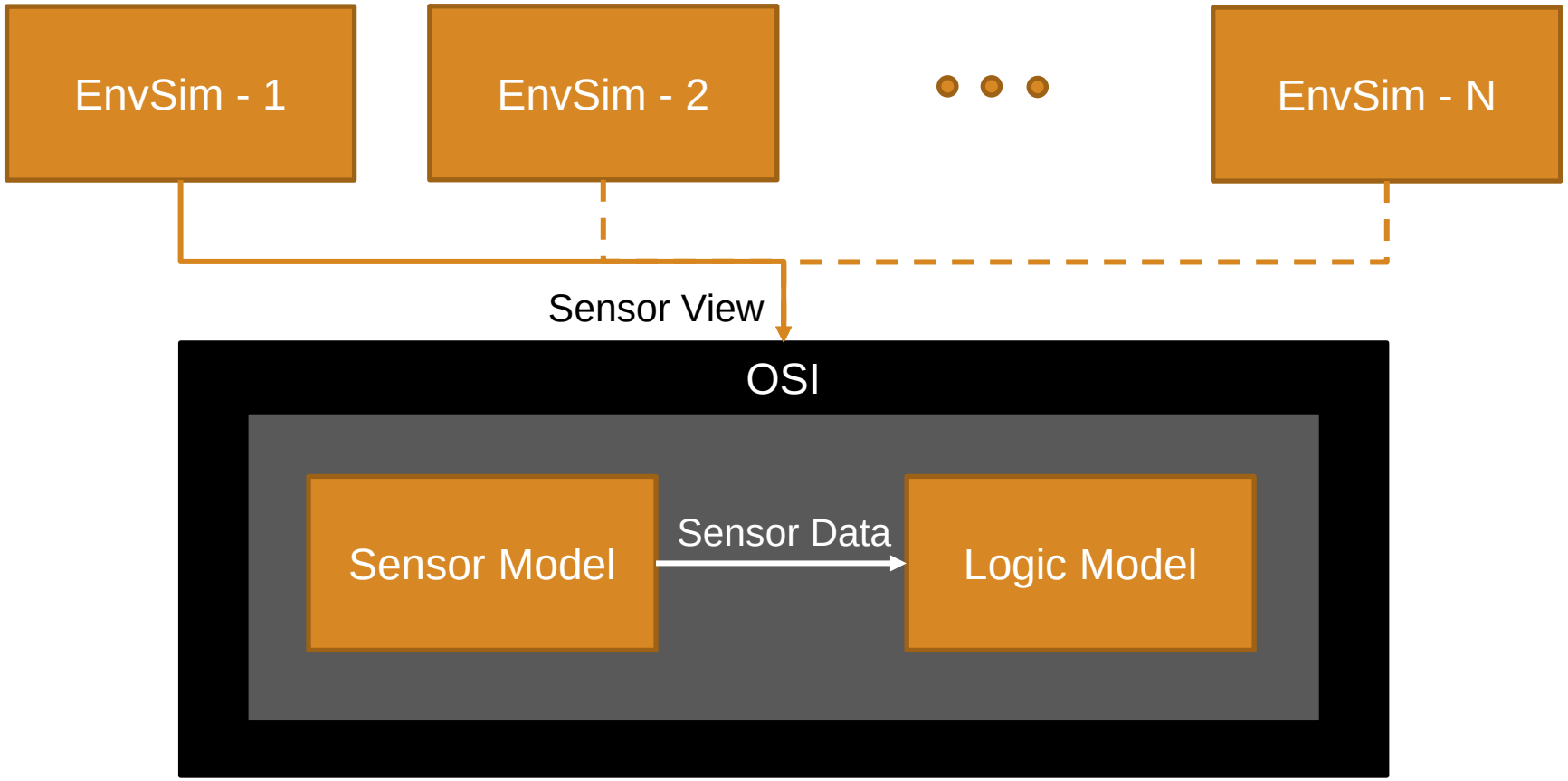
Virtual Simulation: OSI Based Models



Virtual Simulation: OSI Based Models



- Perception System models, Sensor Model and Logic Model are built with OSI at its core
- Different Environment Simulators can be used with Zero change to models

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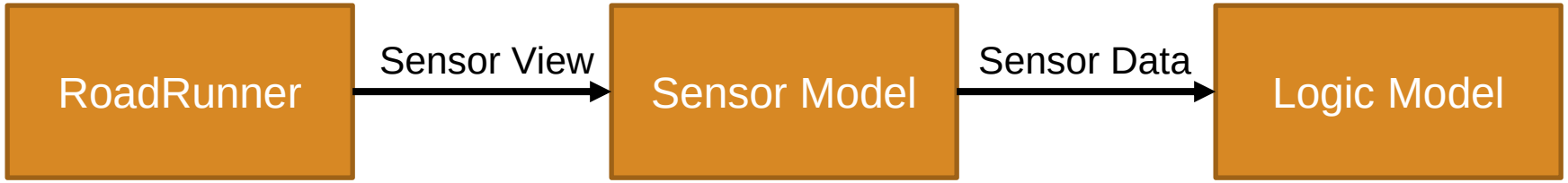
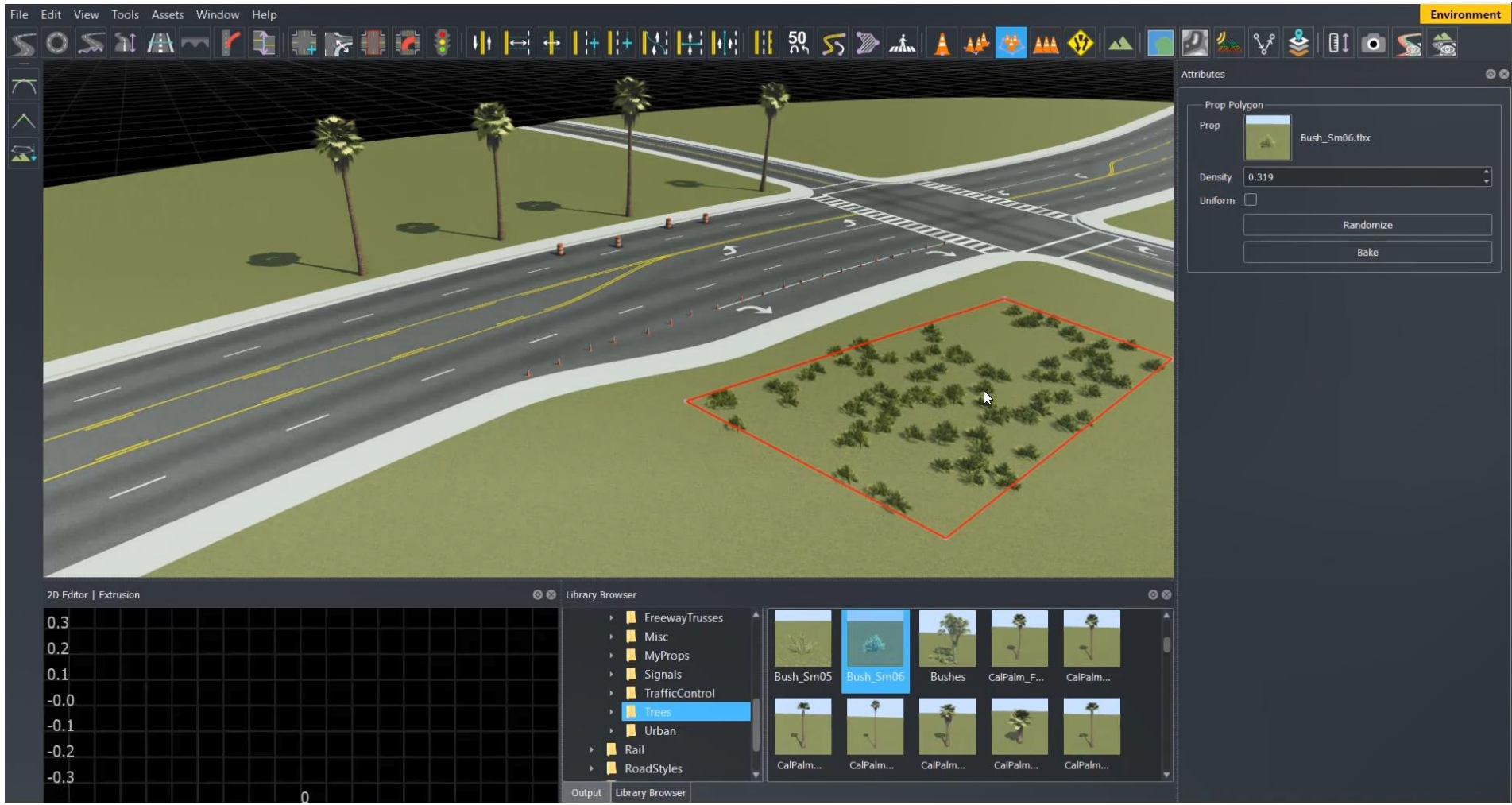
Virtual Simulation Using RoadRunner



- Developers, testers and system engineers can easily create custom scenarios using RoadRunner

Interactively design scenes with RoadRunner

- Author realistic roads and intersections
- Import/export OpenDRIVE
- Import HD maps
- Import Geographic Information System (GIS) files
- Export to common driving simulation environments



RoadRunner, RoadRunner Asset Library, RoadRunner Scene Builder

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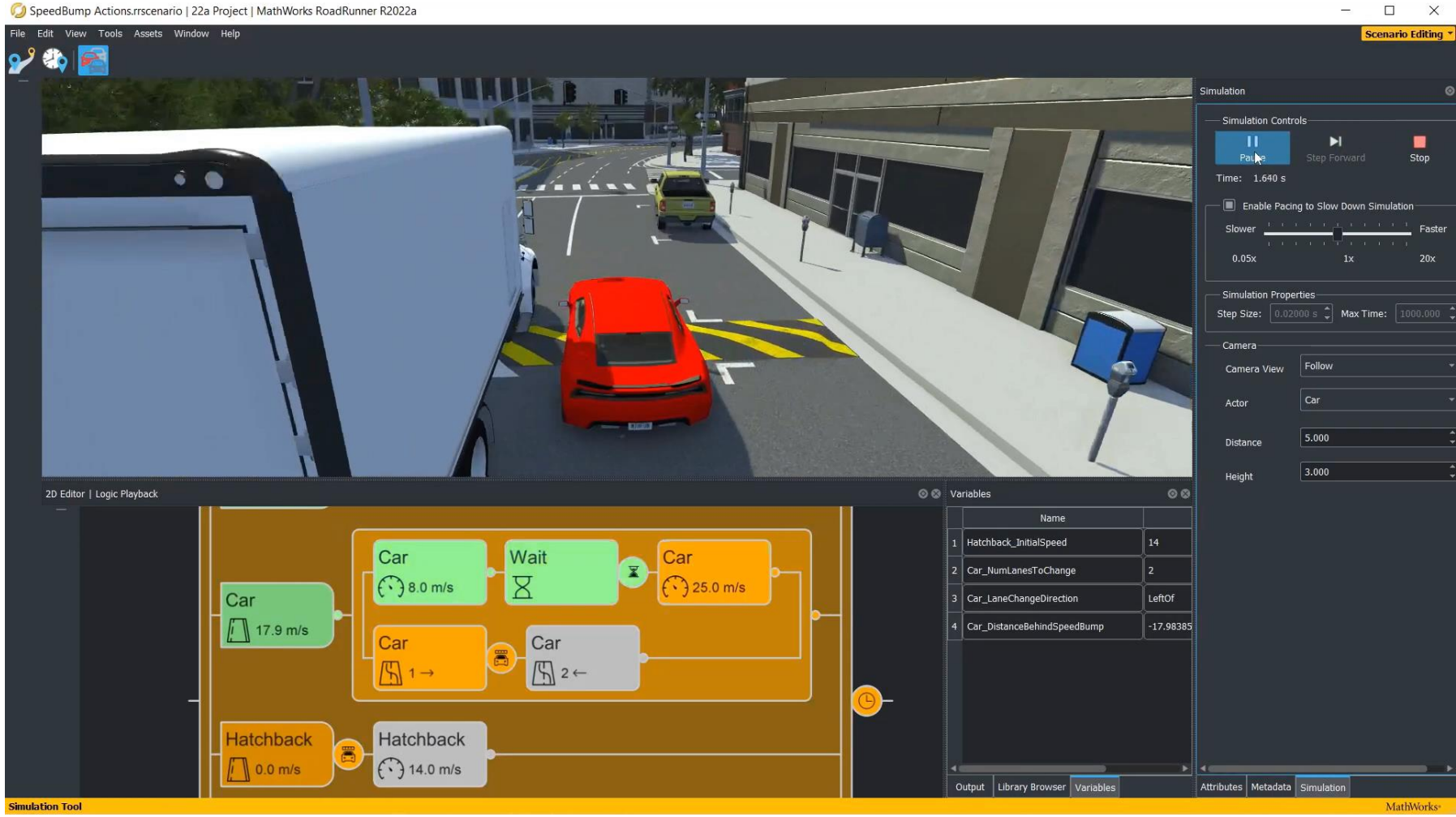
Interactively design scenarios with RoadRunner Scenario

- Add various vehicles and pedestrians
- Author trajectories
- Specify actions and logic
- Parameterize variations



[Scenario Edit Tool](#)

RoadRunner Scenario

Updated R2022b

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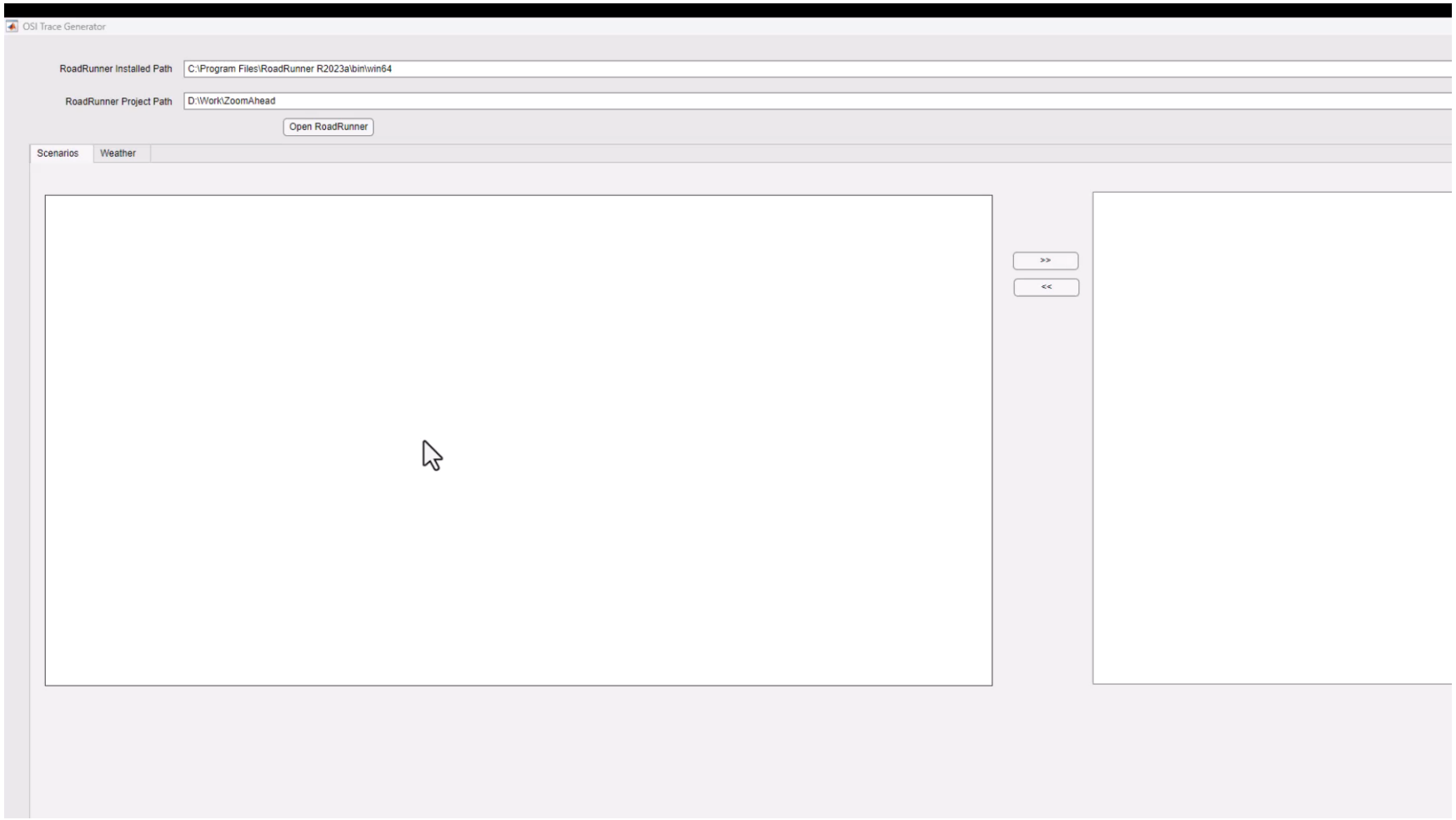
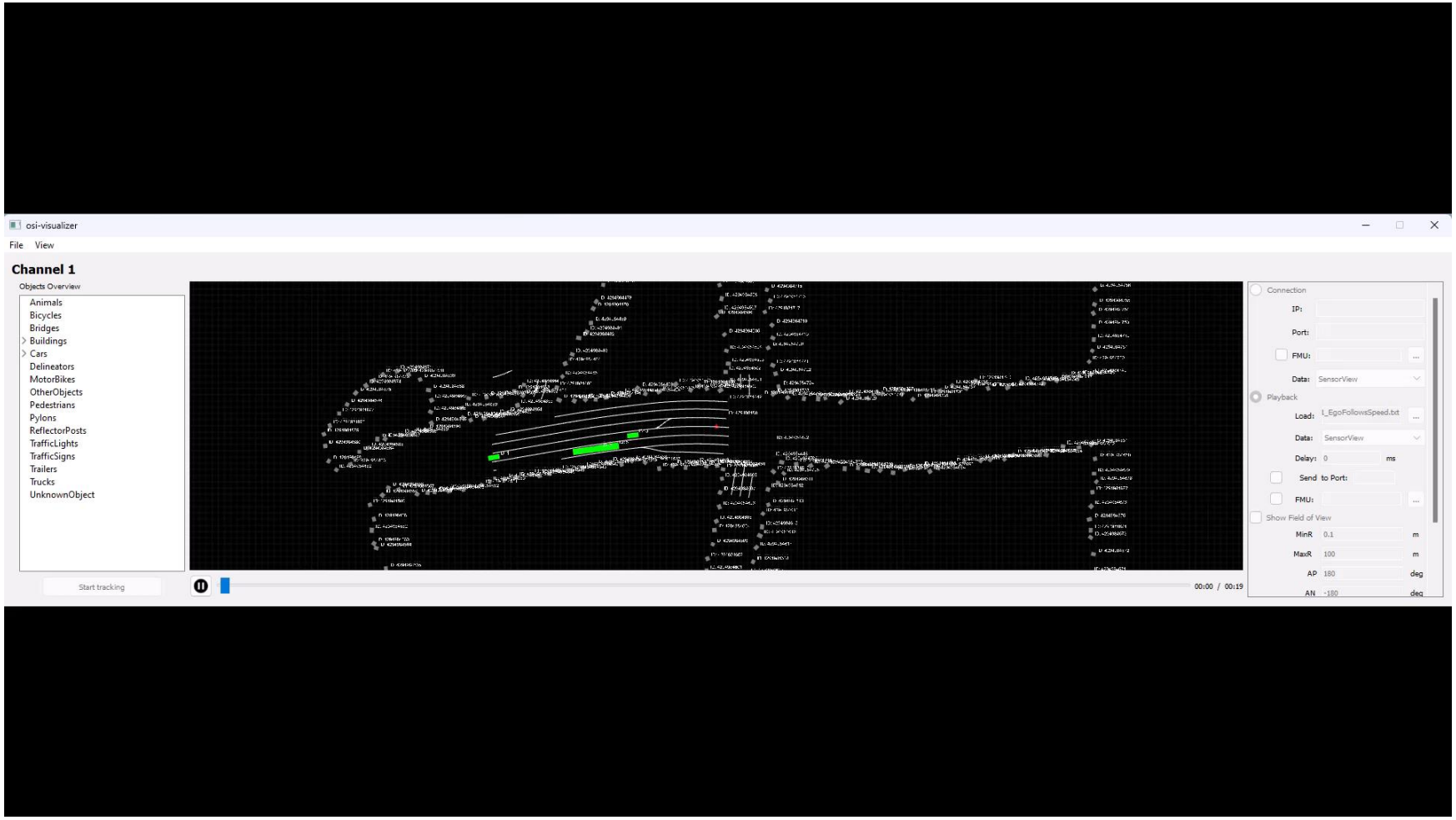
Attend the Master Class to learn more on scene and scenario creation

OSI Trace File Generation



OSI Visualizer



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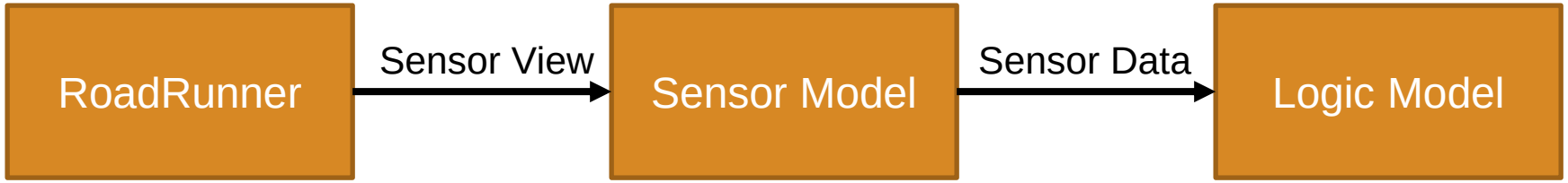
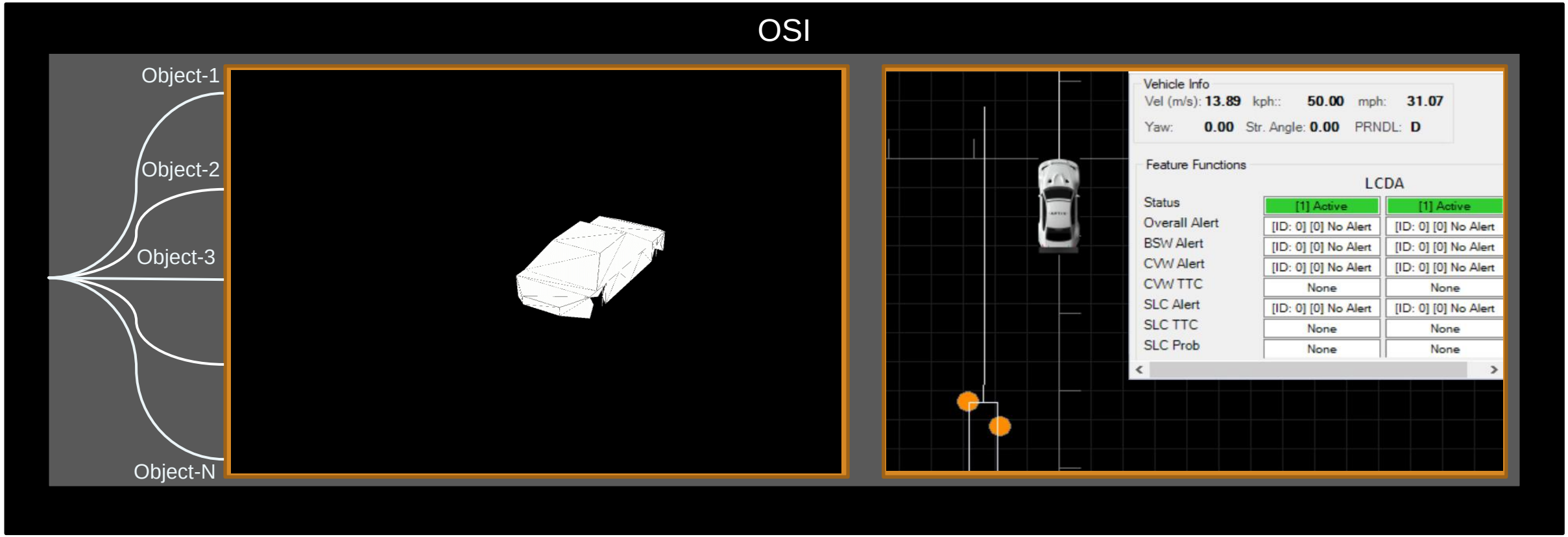
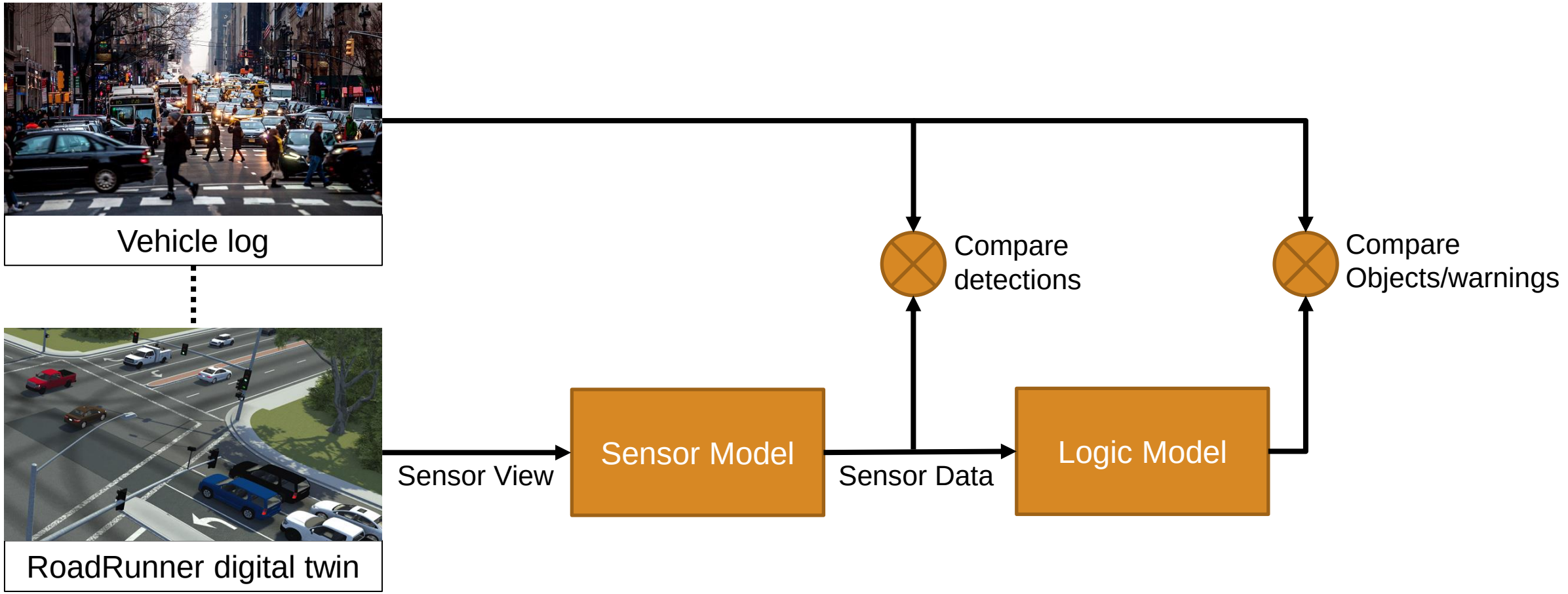
Virtual Simulation Using RoadRunner



- Developers, testers and system engineers can easily create custom scenarios using RoadRunner



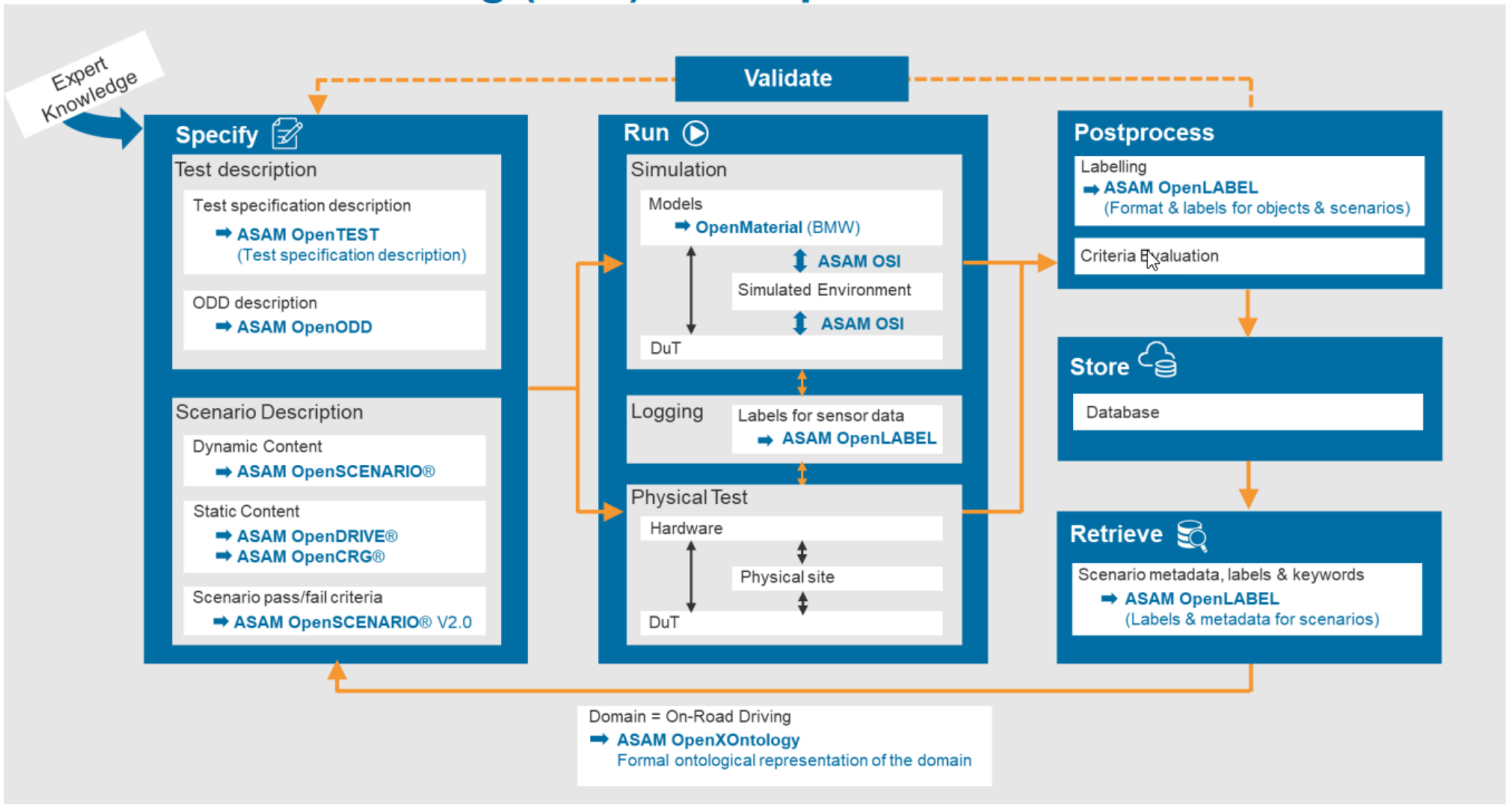
Virtual Simulation: Validation



- Digital twin of the real-world scenario is created in RoadRunner and fed into the models via OSI. The results are then compared:
  - To validate the models
  - To check the performance of updated SW/models

ASAM Standards

Scenario-Based Testing (SBT) with OpenX



MathWorks Support for ASAM OpenX Standards

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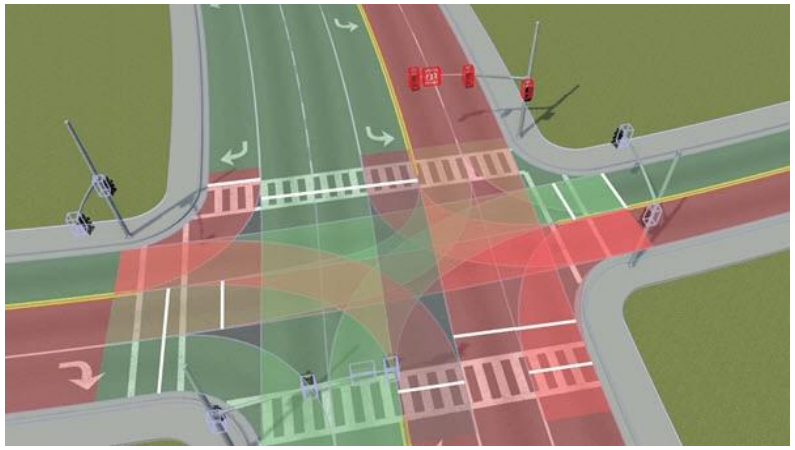
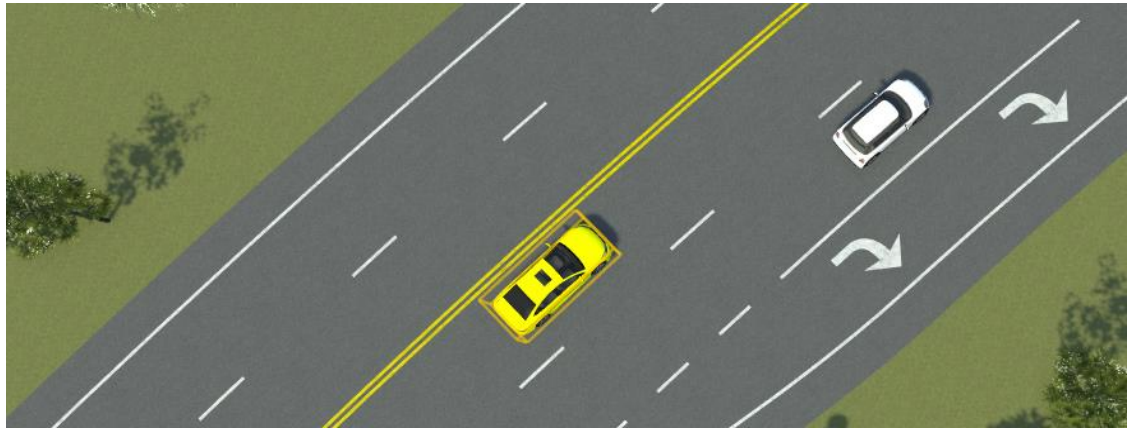
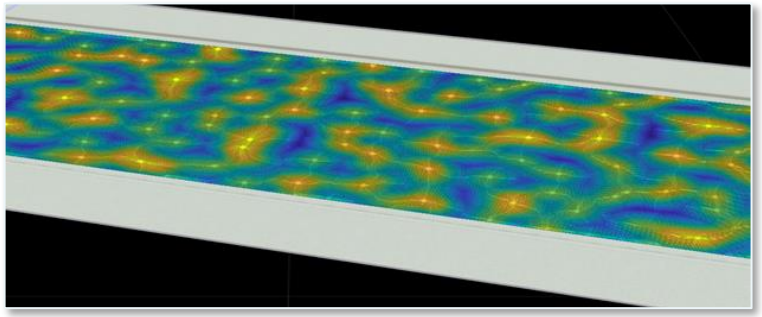
ASAM OpenDRIVE®



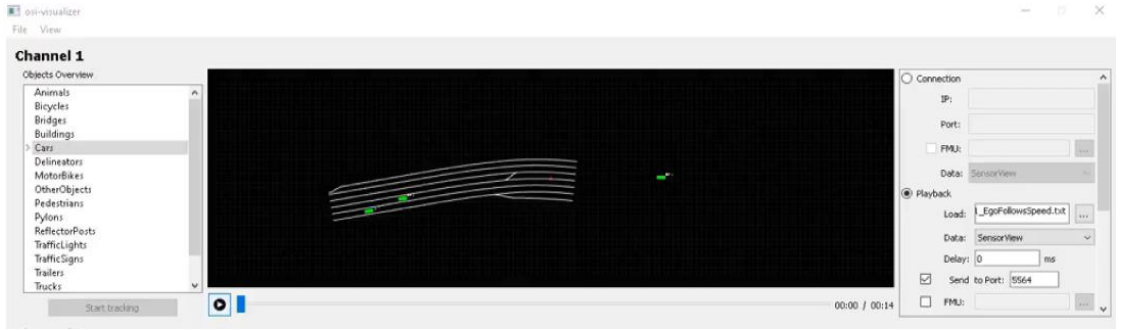
ASAM OpenSCENARIO ®



ASAM Association for Standardization of Automation and Measuring Systems



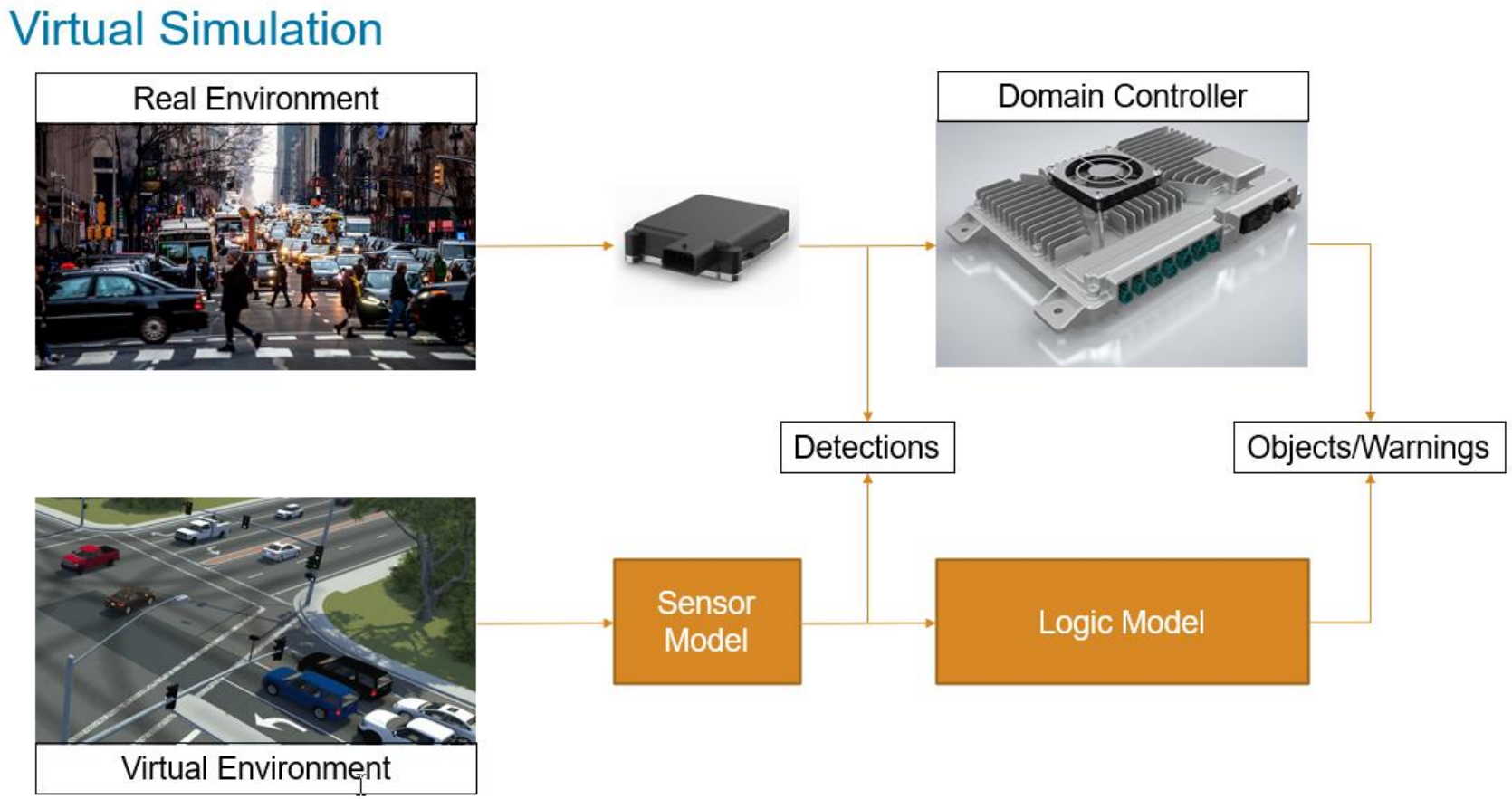
ASAM CRG ®



ASAM OSI ®

Summary

- OSI – Standardizing the interface between simulators and models
- Platform based approach for building models
- Easy and faster scenario creation using RoadRunner
- Collaboration with MathWorks has been very fruitful in integrating OSI to RoadRunner.



References

[1] Hanke, T., Hirsenkorn, N., van-Driesten, C., Garcia-Ramos, P., Schiementz, M., Schneider, S. & Biebl, E. (2017, February 03). A generic interface for the environment perception of automated driving functions in virtual scenarios. Retrieved January 25, 2020, from https://www.hot.ei.tum.de/forschung/automotive-veroeffentlichungen/
[2] https://github.com/OpenSimulationInterface/open-simulation-interface
[3] https://github.com/OpenSimulationInterface/osi-visualizer

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Country

Thank you