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Developing Simulink co-simulation with SUMO and CARLA

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Developing Simulink co-simulation with SUMO and CARLA

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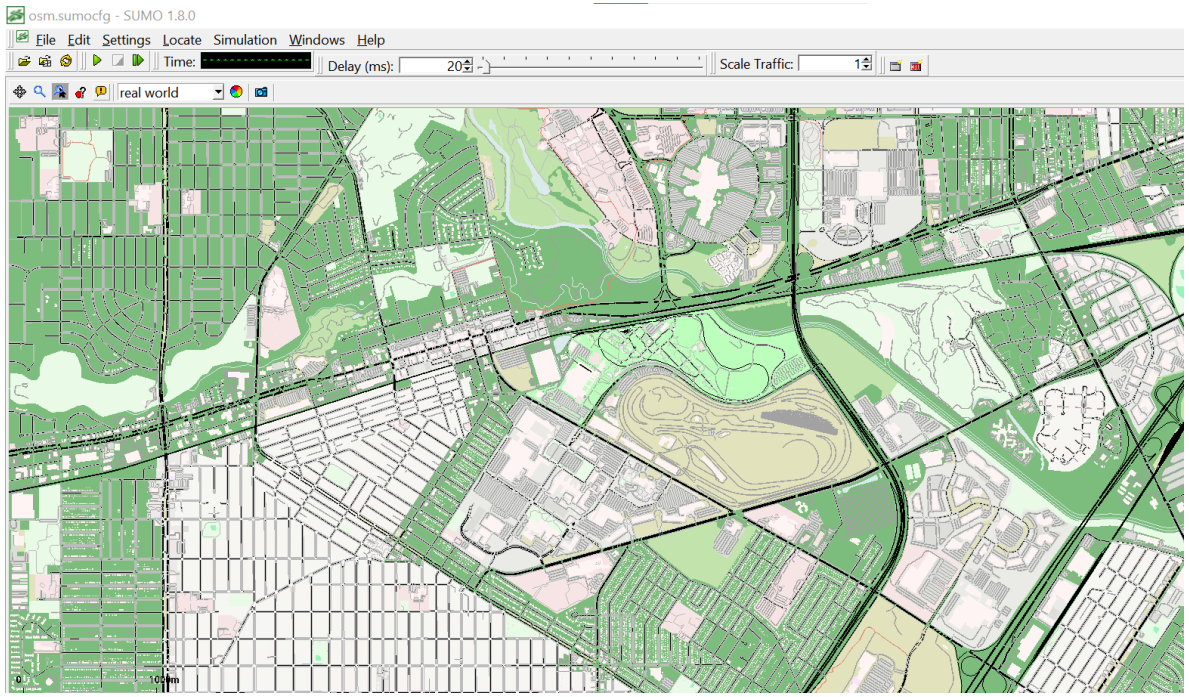
SUMO: Simulation of Urban Mobility
CARLA: Car Learning to Act
Both are open-source simulation software

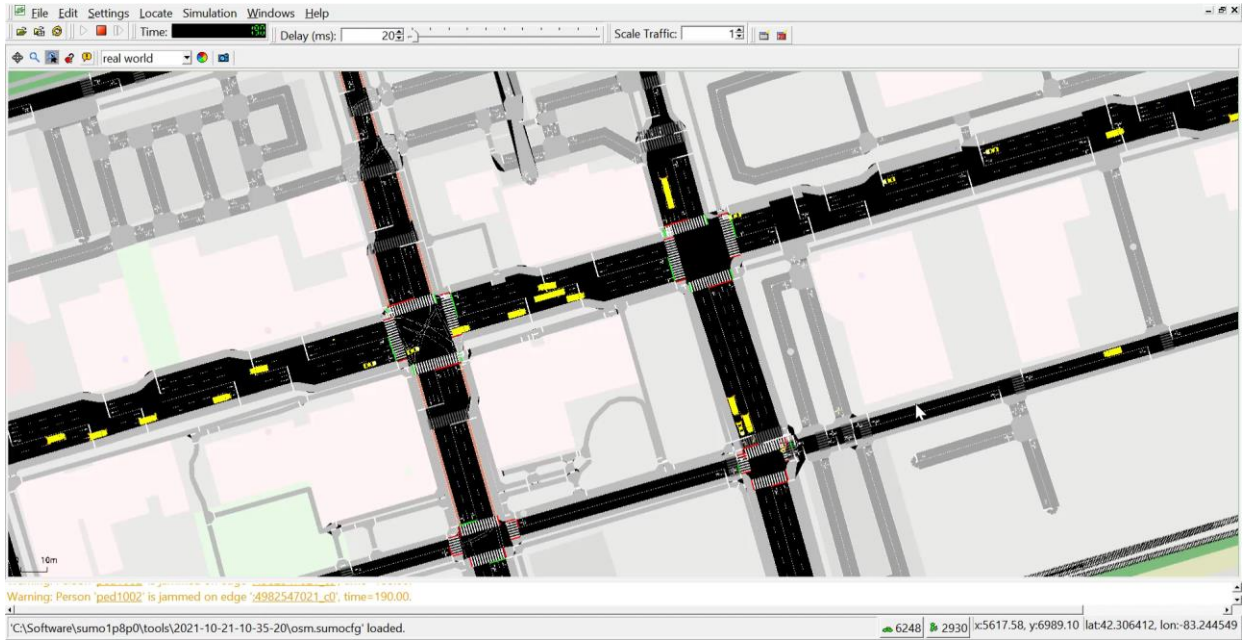
Developing Simulink co-simulation with SUMO and CARLA

- Introduction of SUMO and CARLA
- The motivation to develop this plug-in tool
- Capabilities and performance
- Benefits and use cases
- Summary

SUMO

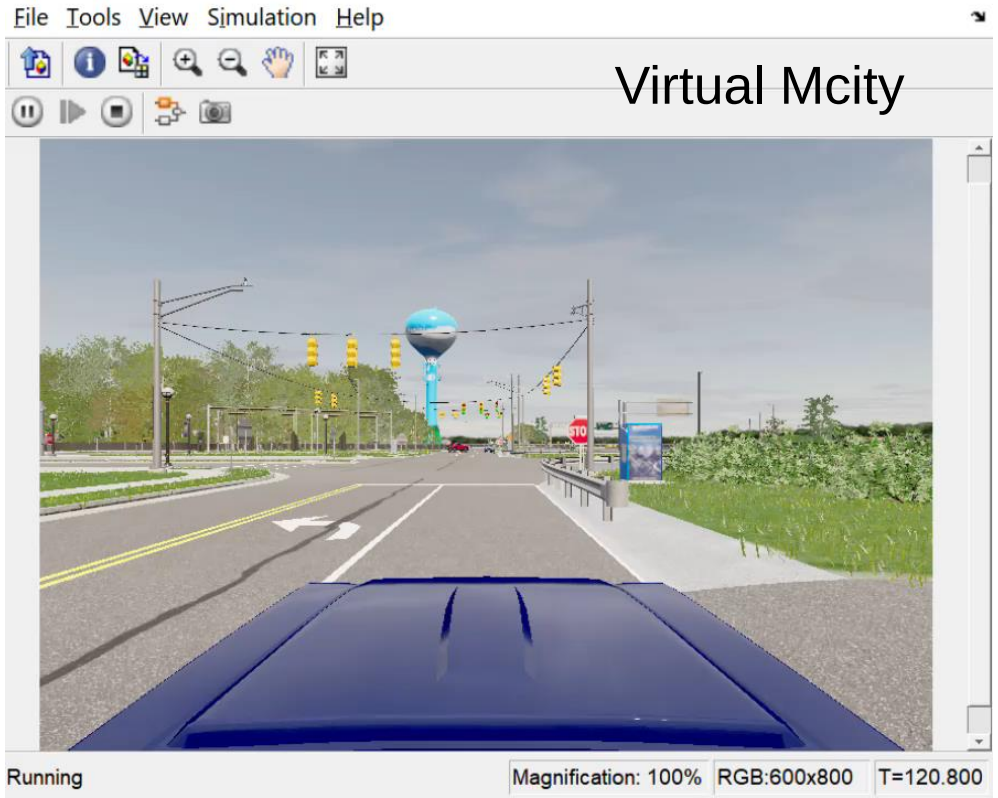
- **Simulation of Urban MObility**
- https://eclipse.dev/sumo/
- An open-source traffic simulation package
- 2D, fast simulation, convert/import real world map data





CARLA

- **Car Learning to Act**
- https://carla.org/
- Open-source simulator for urban driving
- 3D, model ADAS sensors , support custom-built virtual reality



Virtual Mcity

Courtesy of Quantum Signal AI, LLC

Connect and co-simulate

CARLA

SUMO

- Run as server/client
- Connect through TCP/IP
- Provide APIs in Python/C++

S-Function in C++

MATLAB
SIMULINK®

FASST

Ford Automated System Simulation Toolchain

EVV

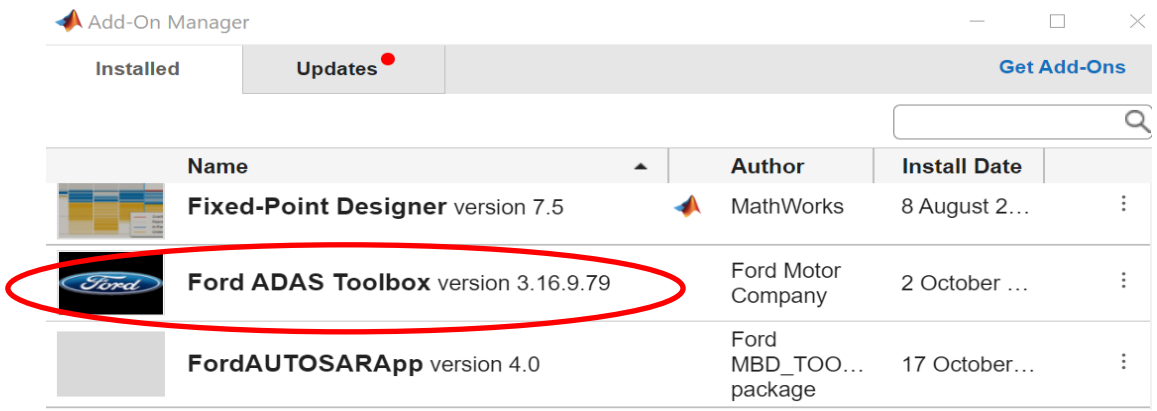
Electrified Virtual Vehicle

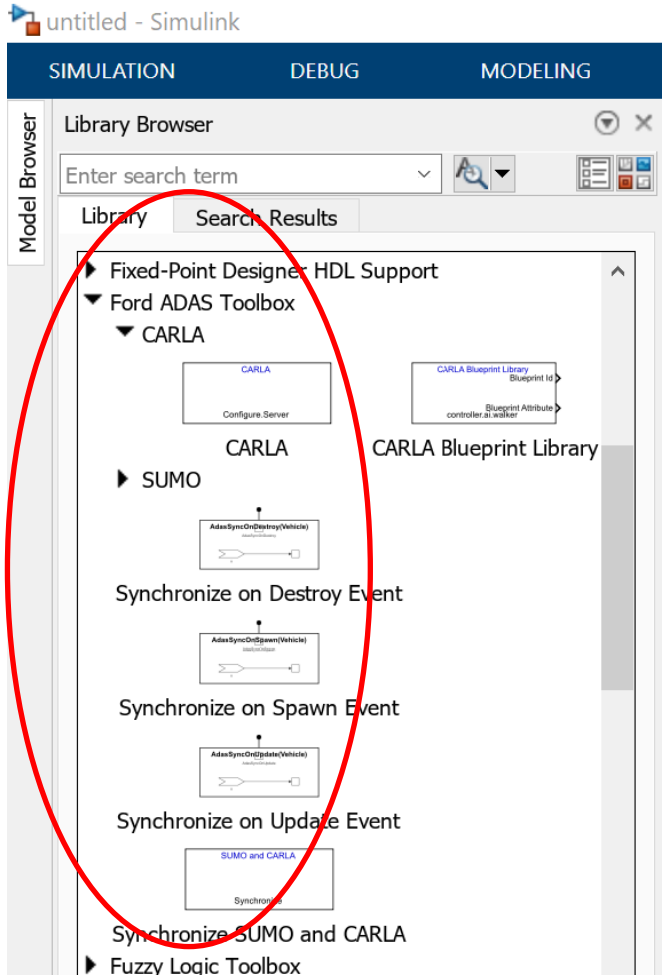
Collision Avoidance Driver Support (CADS) Controller Model

Simulink Corporate Vehicle Simulation Program

Motivation to develop the plug-in tool

- A generic toolbox in Simulink
- Co-simulate SUMO/CARLA with Simulink without coding
- Easy to control simulation and access actors
- Bring traffic scenario and ADAS sensors into Simulink
- Support multi-platforms/cloud platform, CI/CD

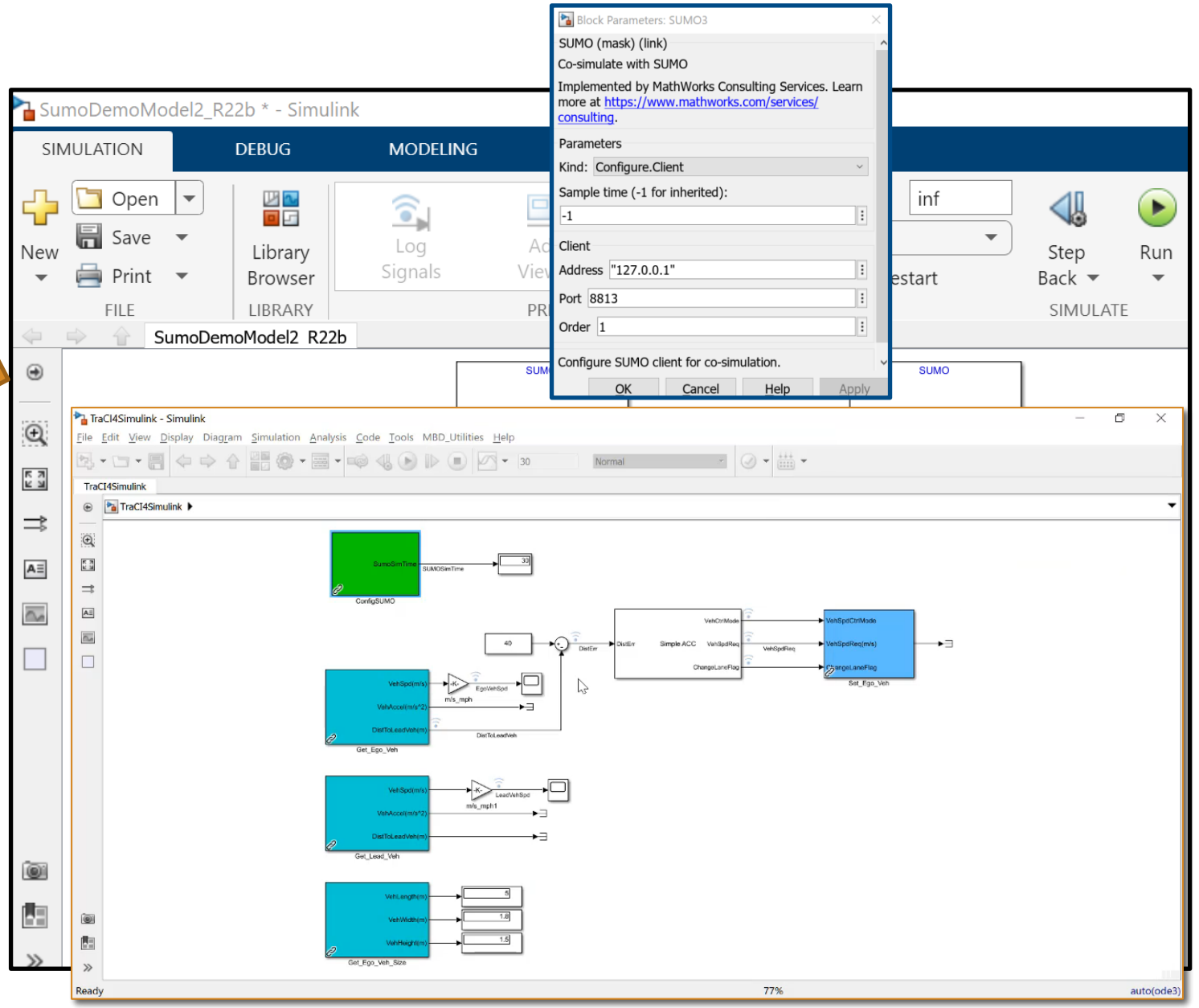




Use the plug-in tool

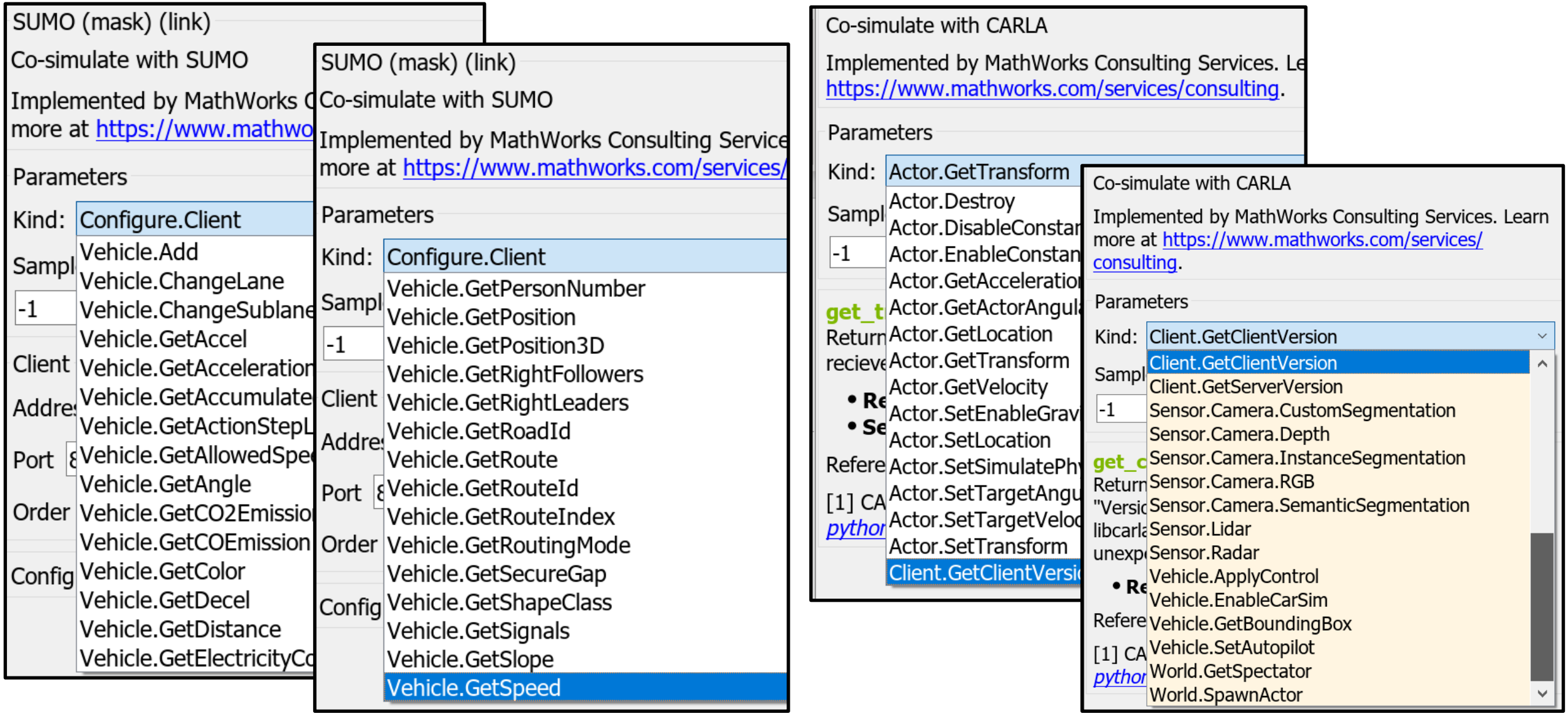
SUMO server

CARLA server



1. Launch the server
2. Add a Client block in the Simulink model to make it a client
3. Pressing “Run” in Simulink will connect the server and run the co-simulation
4. Use Get/Set blocks to read/write actor properties

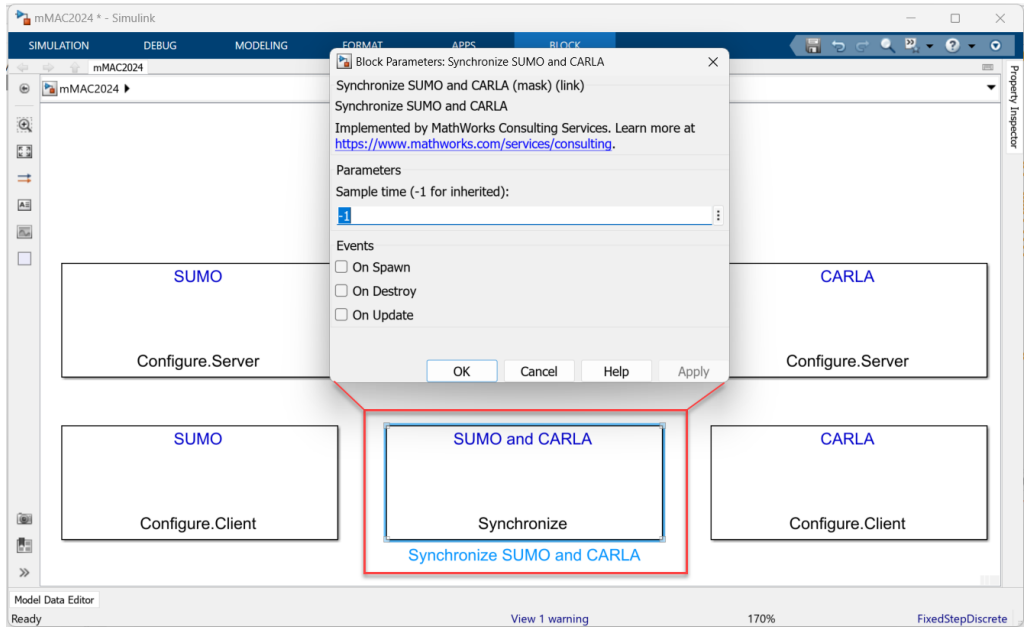
More functions to access actors



- Single Simulink block, dropdown list for functions, link to open-source document

Synchronize SUMO, Simulink and CARLA

Vehicle Data

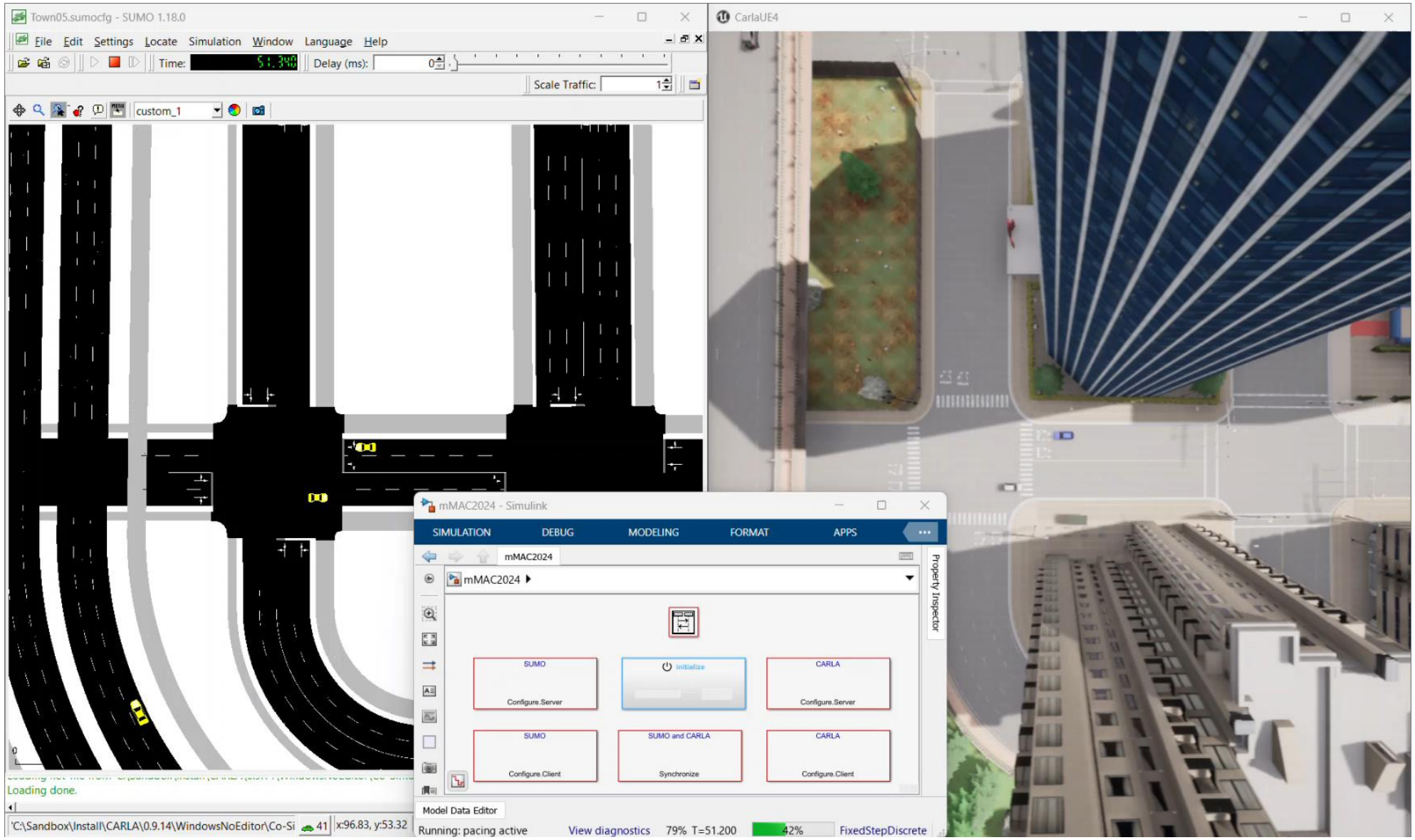


Vehicle Data

Sensor Data

- SUMO handles vehicle traffic
- CARLA handles visualization and sensors
- Simulink pulls vehicle data from SUMO, pushes to CARLA

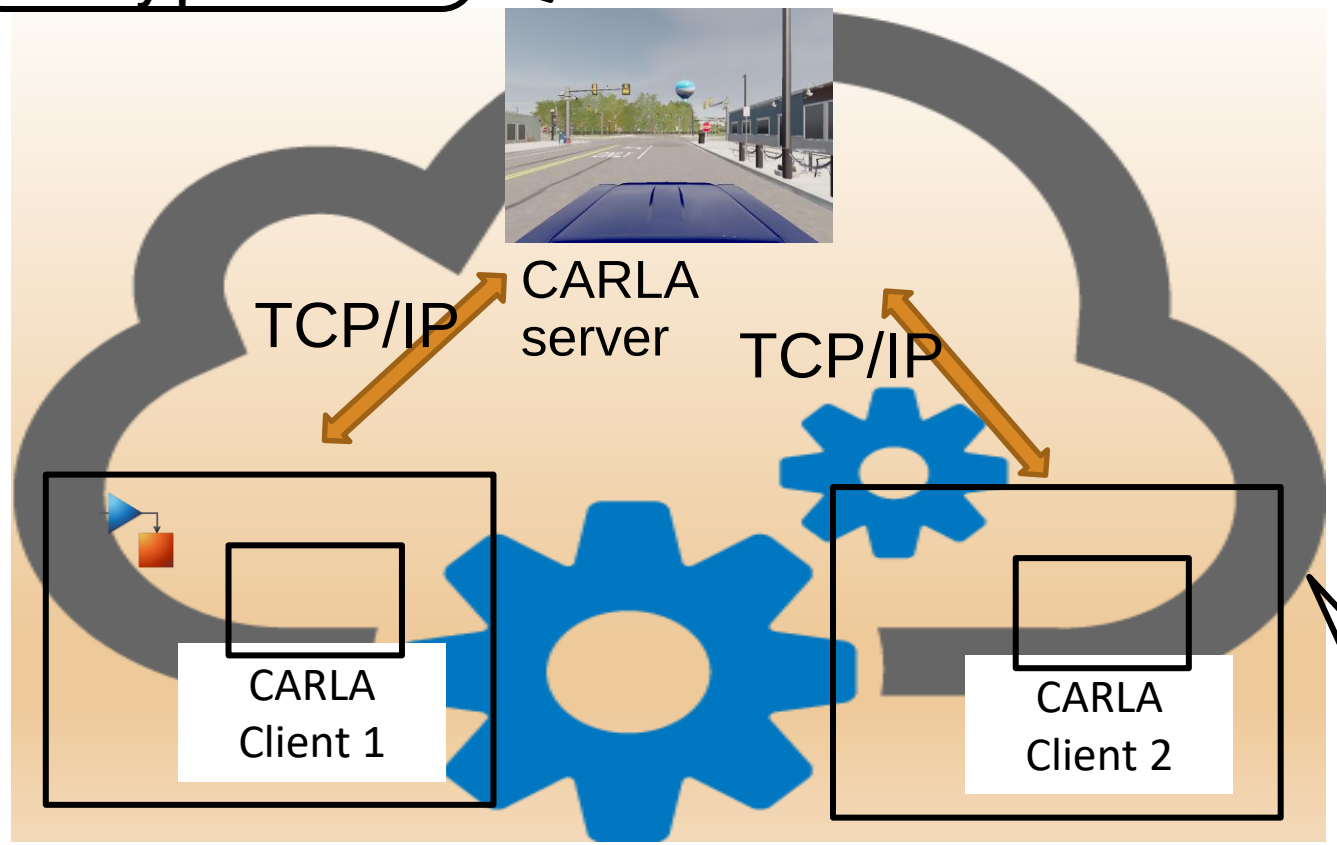
Synchronize SUMO, Simulink and CARLA



Support large scale simulation

- Co-simulation across machines and platforms

CARLA server can be launched on many platforms.

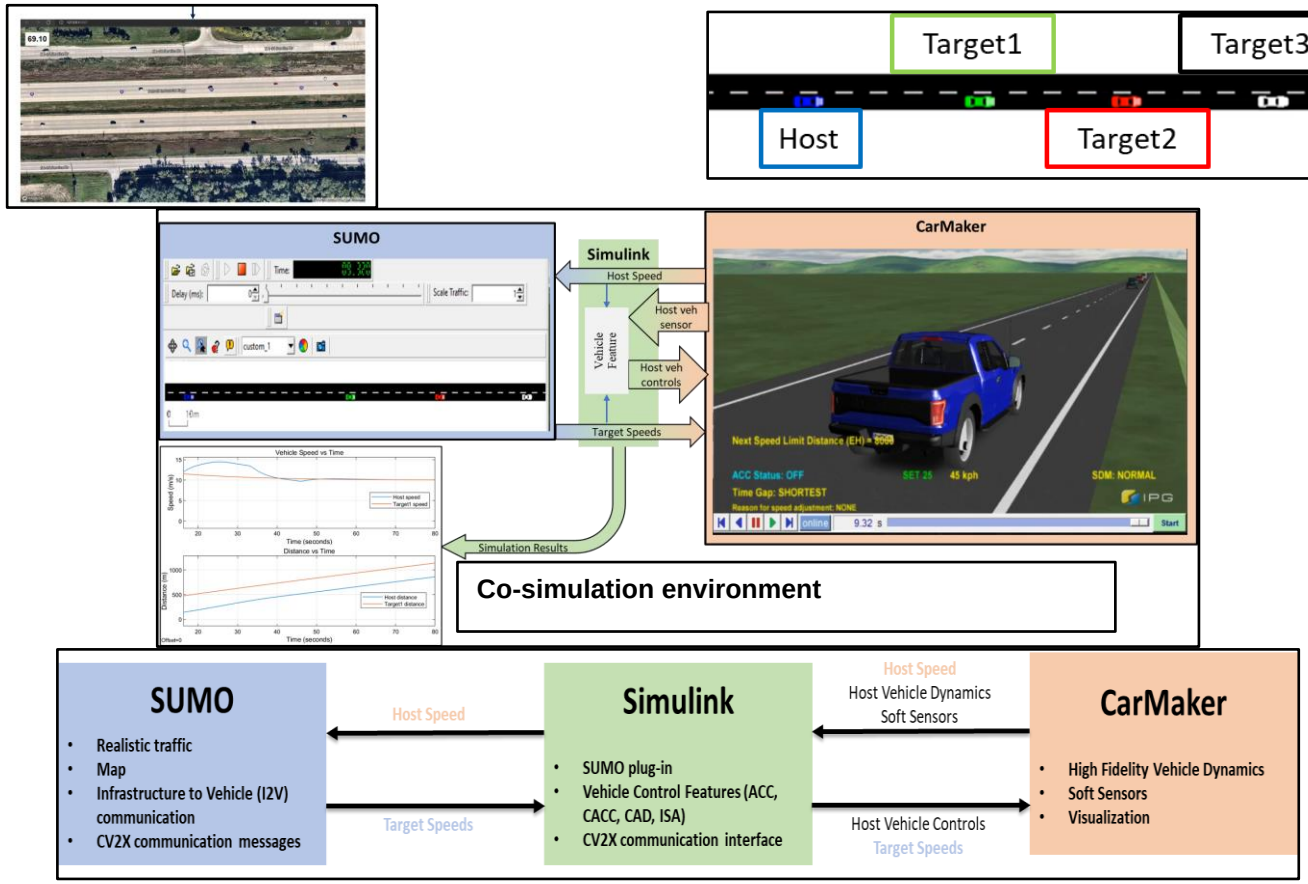


CARLA Client from Simulink is the synchronization orchestrator.

Other CARLA Client, e.g. from Scenario Runner

- Support cloud platform

Use SUMO plug-in for CACC development



Courtesy of

Ozgenur Kavas Torris

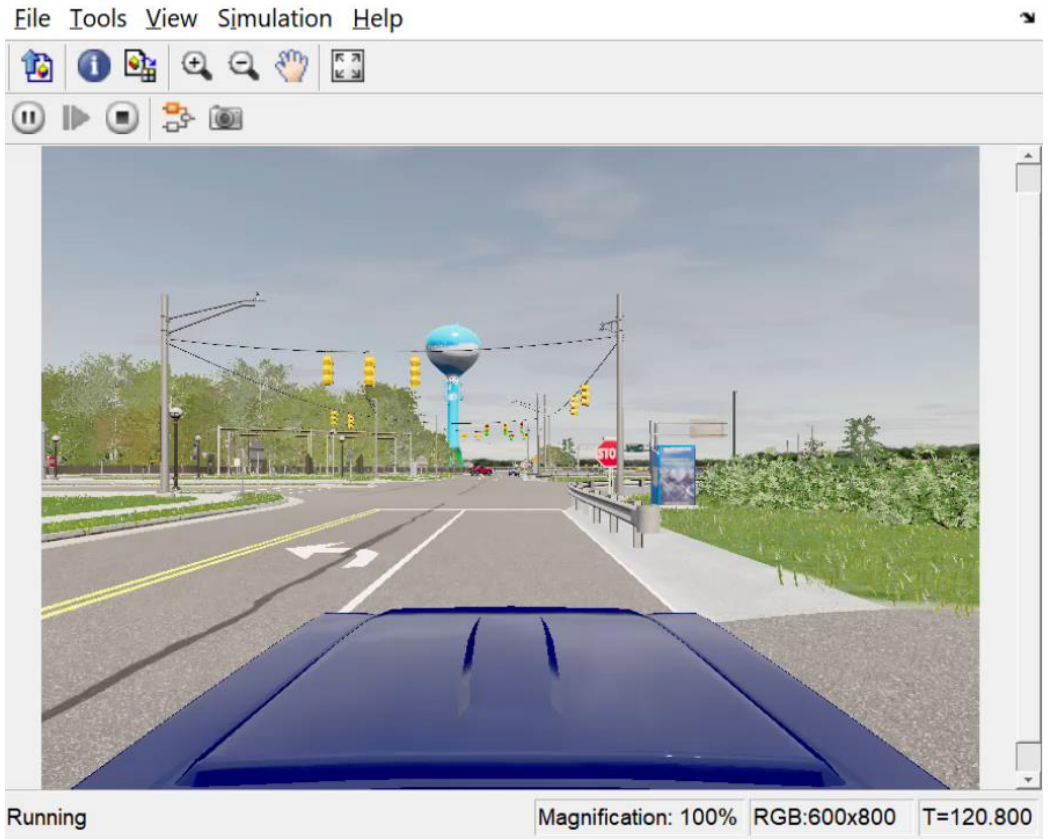
Ford R&AE

- Co-ordinated Adaptive Cruise Control (CACC) is developed in Simulink
- Require Infrastructure-to-vehicle (I2V) and Vehicle-to-Vehicle (V2V) communications
- Enable to use SUMO traffic simulation to develop CACC
- Easy to set up and access multiple target vehicles in SUMO
- Easy to simulate the interactions among multiple vehicles with CACC

Use CARLA plug-in for simulation at Mcity

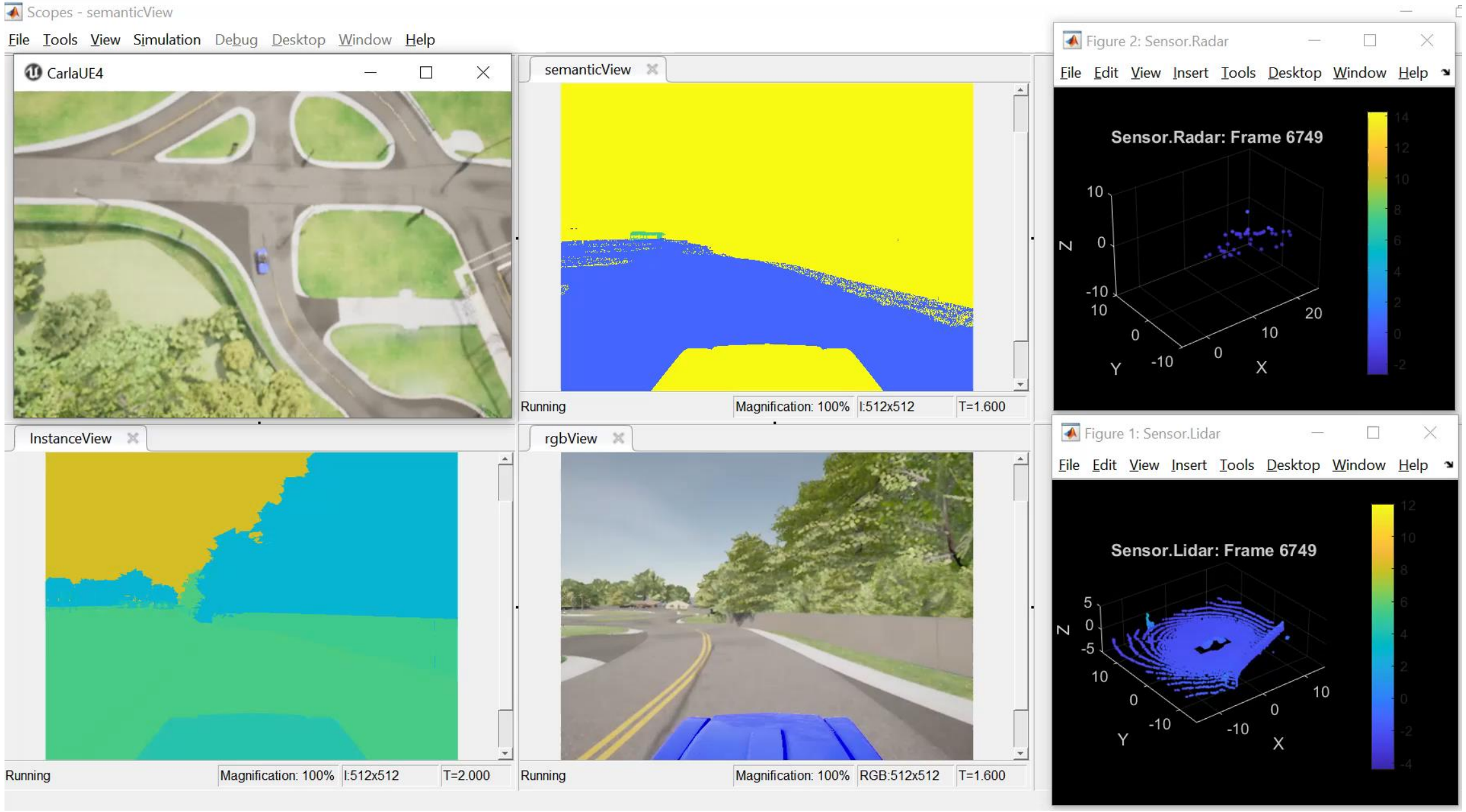
Mcity https://mcity.umich.edu/

Quantum Signal AI, LLC
https://quantumsignalai.com/



Courtesy of Quantum Signal AI, LLC

Bring CARLA Sensor data to Simulink



Summary

- A plug-in tool for Simulink has been developed.
- Enable to co-simulate SUMO/CARLA and Simulink with ease
- Enable easy access and control of the co-simulation
- Support ADAS sensors, multi-platforms/cloud platform

Working with the Mathworks Consulting Services

- Broad experience
- High competency
- Excellent quality
- Excellent service

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Thank you

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