



Saxton Transportation Operations Laboratory Research Tools to Advance Cooperative Driving Automation (CDA) Research

The Federal Highway Administration’s (FHWA) CDA Program aims to enhance road infrastructure capabilities, improve vehicle safety and efficiency, and advance research on connectivity between infrastructure, automated vehicles, and other road users. These efforts help shape the future of transportation and foster the development of an integrated intelligent transportation system where automated vehicles, infrastructure, and other road users seamlessly work together.

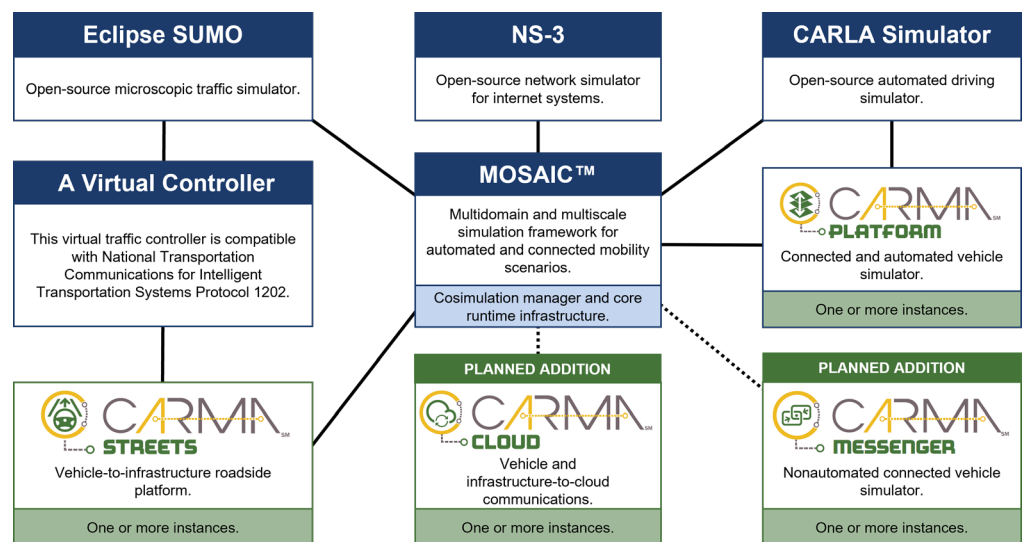
Simulations help users to understand and explore various models of transportation systems and technology. The CDA simulation environment leverages multiple simulation frameworks, including the CDASim anything-in-the-loop cosimulation tool,⁽¹⁾ CARLA Simulator,⁽²⁾ and Eclipse® SUMO™,⁽³⁾ to expand the capacity of CDA. The CDASim tool specifically supports the CARLA Simulator and Eclipse SUMO environments, both of which are open-source cosimulation tools available to the public.

CDASIM COSIMULATION TOOL

CDASim⁽¹⁾ establishes anything-in-the-loop capabilities for assessing CDA simulations, which involves constructing anything-in-the-loop capabilities through open-source software that is publicly accessible for customization to the customer’s CDA requirements. Anything-in-the-loop technology is based on the developed CDA simulation framework and contributes to building a comprehensive simulation environment that allows for further testing of automated driving systems and software, utilizing both vehicle and traffic simulators as illustrated in figure 1.

CDASim includes the following key benefits:

- Facilitates development, testing, and deployment of CDA algorithms and applications.⁽¹⁾
- Enables users to conduct thorough testing of autonomous driving systems and technology within safe, controlled virtual environments before real-world implementation.
- Evaluates the performance of CDA algorithms and applications.
- Helps users adapt and use CARMA Platform^{SM (4)} to support their CDA research.



Source: FHWA.

Figure 1. Diagram. CDASim cosimulation tool components. (See references 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.)

CARLA SIMULATOR

The CARLA Simulator⁽²⁾ facilitates the development, training, and validation of autonomous driving systems by providing software code, standardized protocols, and other digital resources tailored specifically for CARLA Simulator, all available to the public as open-source resources.

The CARLA Simulator includes the following key benefits:

- Enables comprehensive simulation of diverse traffic scenarios.
- Reduces costs linked to testing with physical vehicles and equipment.
- Accelerates development and deployment of autonomous driving systems.

ECLIPSE SUMO

Eclipse SUMO⁽³⁾ is an open-source program that enables users to simulate large-scale traffic scenarios. This program encompasses various modes of transportation, including buses and passenger vehicles. Users can design diverse traffic scenarios and utilize tools with additional features including route finding, visualization, and emission calculations.

Eclipse SUMO includes the following key benefits:

- Provides realistic and detailed traffic simulations.
- Explores different vehicle types and traffic scenarios.
- Empowers users to customize the program to align with the requirements of their specific projects and interests.
- Offers visualization tools to enhance the user's understanding of traffic patterns and scenarios.

GETTING STARTED

The tools discussed in the previous sections are available on GitHub, which enables collaboration and contribution that enhances users' understanding and accelerates market readiness of CDA technologies.

GitHub provides a platform for users to collaborate, gain experience with CDA, and customize the software for their specific needs.

For technical support, please reach out to the CARMA Support Services Help Desk at CARMASupport@dot.gov. Additionally, a section of frequently asked questions is available on GitHub that offers solutions to commonly known issues.

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