

Sim2Real Cybersecurity Testbed for Modern Automotive Architectures

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This paper introduces a unified testbed for evaluating the security of modern automotive networks through the integration of the CARLA driving simulator with a physical platform based on the open-source Toyota PASTA architecture. The proposed simulation environment facilitates realistic generation, manipulation, and visualization of Controller Area Network (CAN) traffic, including packet injection, message modification, cyberattack emulation, and JSON-based traffic import.

The physical testbed follows original CAN specifications and identifiers. It includes four software-identical Electronic Control Units (ECUs), connected via a CAN bus and housed in a modular structure designed to emulate key vehicle subsystems. Ethernet connectivity between driving simulator and the physical platform enables bidirectional communication, allowing virtual driving scenarios to dynamically interact with the physical ECUs and, conversely, for physical system responses to influence the simulated environment.

This tight coupling supports synchronized, high-fidelity testing of vehicle behavior under various CAN-based cyberattacks, offering a practical and extensible foundation for cybersecurity research in intelligent transportation systems.

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