VSimRTI Features

Wireless vehicular communication (V2X) helps to enhance safety and traffic efficiency. However, the simulation of V2X scenarios is a challenge because two different simulation worlds come together here: vehicular traffic and wireless network communication. To solve this problem, VSimRTI couples different simulators and enables the simulation of the various aspects of V2X-based future intelligent transportation systems. Consequently, VSimRTI simulations allow the analysis of V2X test cases before real field tests start.

The aim of the VSimRTI project is to make the preparation and execution of simulations as easy as possible for the users. Therefore, a lightweight framework for simulator integration was created that facilitates the simulation of V2X communication scenarios. All management tasks, such as synchronization, interaction and lifecycle management are handled completely by VSimRTI. Several optimization techniques, such as optimistic synchronization, enable high performance simulations. Special V2X features, e.g. traffic lights, roadside stations, and both CAM and DENM message types, are supported by VSimRTI. Moreover, various configuration options and enhanced user and developer documentation assure maximum usability.

VSimRTI concept

In contrast to existing fixed simulator couplings, the VSimRTI simulation infrastructure allows the easy integration and exchange of simulators. Thus, the high flexibility of VSimRTI enables the coupling of the most appropriate simulators for a realistic presentation of vehicle traffic, emissions, wireless communication, and the execution of V2X applications.
Depending on the specific requirements of a simulation scenario, the most relevant simulators can be used.

VSimRTI uses an ambassador concept inspired by some fundamental concepts of the High Level Architecture (HLA). Thus, it is possible to couple arbitrary simulation systems with a remote control interface. Attaching an additional simulator only requires that the ambassador interface is implemented and then the specified commands are executed. For immediate use, a set of simulators is already coupled with VSimRTI. For example, the traffic simulators VISSIM and SUMO, the communication simulators JiST/SWANS and OMNeT++, the application simulator VSimRTI_App, and several visualization and analysis tools are prepared for VSimRTI.

**Evaluation of V2X applications by VSimRTI**

VSimRTI has been used by various automotive companies and research institutes to evaluate V2X applications. The following two examples are a small excerpt from the wide range of simulation scenarios that VSimRTI has performed thus far:

The goal of the intelligent V2X-based navigation system is to recommend travel routes which avoid congested areas. In contrast to classical traffic management systems, V2X technology operates in near real-time. That means it is able to avoid congested roads and those which are about to become congested. The VSimRTI simulations helped to optimize the effectiveness of the algorithm and to reduce the travel time and vehicle emissions.

The V2X-based speed warning application aims to reduce accidents caused by bad weather conditions for example. Vehicles share information about dangerous road conditions such as ice roads or fog banks via V2X communication. This information helps to adapt speed, especially on road segments that are difficult to observe. To evaluate the application, an area with tight turns and often limited visibility in the Taunus Mountains was simulated. The VSimRTI results were used to improve the application and further reduce the number of speeding vehicles.

**At a glance**

The V2X Simulation Runtime Infrastructure – VSimRTI – is a lightweight framework which enables the preparation and execution of V2X simulations. It is the most flexible system available in the automotive research arena to dynamically simulating traffic flow. VSimRTI couples different simulators thus allowing the simulation of the various aspects of future intelligent transportation systems.

**Easy to integrate**

The easy integration and exchange of simulators enables the substitution of the most relevant simulators for a realistic presentation of vehicle traffic, emissions, wireless communication, and the execution of V2X applications

- High performance simulator coupling
- Optimized for V2X scenarios
- Various configuration options
- Detailed user documentation