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Development and testing of distributed functions with ETAS COSYM: Simulation and virtualization of vehicle systems

How can automated driving functions involving numerous electronically controlled vehicle systems quickly be brought to full-scale production while maintaining high quality and competitive prices? And what is the best design for complex drives with electric and combustion engines, vehicle batteries, catalytic converters, and automatic transmission? The following article addresses these questions.

To seamlessly develop and flexibly test new functions using MiL/SiL and HiL environments requires high-performance environments to generate virtual ECUs, as well as advanced tools to integrate and configure modular system models, and scalable platforms to execute simulations.

ETAS COSYM

COSYM enables efficient testing and validation of connected embedded systems in virtual environments. This tool offers an open simulation platform based on new software technologies (Fig. 1). At its core, it facilitates comprehensive MiL/SiL/HiL (XiL) system testing, paying particular attention to ECU networks. At the same time, COSYM offers a platform for state-of-the-art continuous integration processes in the development of systems and software, and includes tools for the following steps:

— Creating a system model, for instance by importing plant, function, and restbus models and coupling their signals. It also enables virtual networks to be created and linked to virtual and physical ECUs. The system model created does not, therefore, merely link model signals, but can also take network communication into account. If the virtual ECU is integrated at the microcontroller abstraction level, using ETAS ISOLAR-EVE, for instance, a much more precise simulation is possible than if it were integrated at the application software level.

— Configuring the simulation for MiL, SiL, and HiL environments, depending on the execution platform and time response behavior (real-time or synchronous with the simulation timescale).

— Conducting experiments with the aid of the proven ETAS experimentation environment.

— Using the XiL API or the native REST interface for automation, which enables state-of-the-art software implementation of continuous integration environments. COSYM thus allows users to create projects on the server and, in the future, also to conduct experiments. This tool is based on state-of-the-art software technology, with consistent separation of services and user guidance. The well documented REST services interface facilitates easy integration into one's own user guides or automation processes. COSYM will come with a web-based user interface as standard. Thanks to its service-oriented architecture, the platform can also be incorporated into integrated development environments (IDEs) such as Eclipse.

Market launch

COSYM will be launched in three phases within pilot projects. It has been available for ETAS LABCAR HiL systems since late 2017, making it possible to transfer HiL tests to purely virtual environments, for example on PCs. This can be done using plant simulations of the LABCAR model family, for instance. If the physical ECUs are replaced by virtual ECUs or appropriate functional models, it becomes possible to make the entire system virtual. In the second phase up to mid-2018, it will be possible to integrate virtual networks for all standard vehicle buses. In addition, both COSYM and LABCAR-MODEL will support virtual timescales as an alternative to real-time simulation.

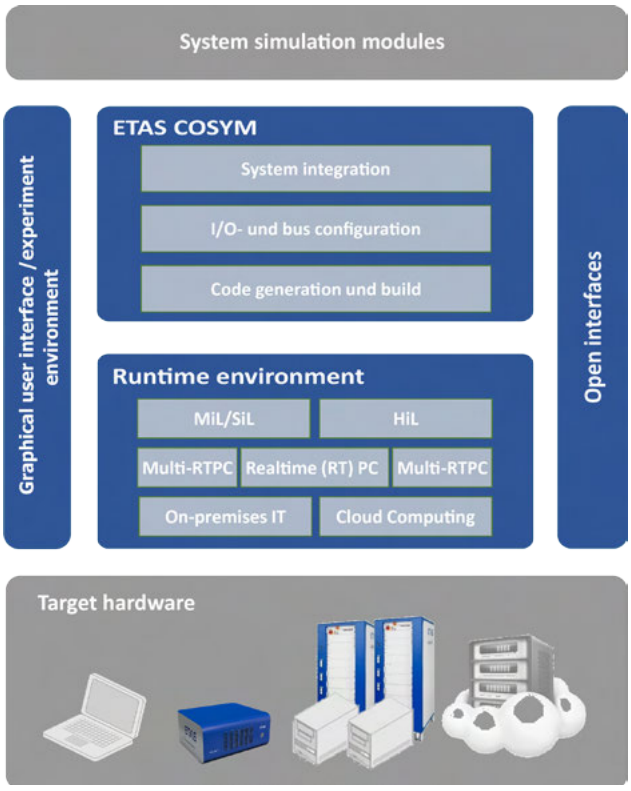

Fig. 1. Seamlessly developing new functions using MiL/SiL and HiL environments requires high-performance environments for generating virtual ECUs, tools for integrating and configuring modular system models, and scalable platforms for conducting simulations.

This makes testing significantly faster than using HiL in real time. Finally, beginning in mid-2018, phase three will lay the foundation for the calibration of complex systems in virtual environments.

The focus here is, on the one hand, on real driving emissions (RDE). On the other, it will thus be possible to adapt and train advanced driver assistance systems (ADAS) and driving automation applications in a virtual environment with the aid of measured data from road tests.

Outlook

In the medium term, the COSYM platform will be expanded for implementation on high-performance server infrastructures – including on premises, if desired, or in an external cloud. In order to better support the data-intensive development of systems for autonomous driving, there will also be a focus on integrating big-data solutions that allow users to quickly sift through large data sets for suitable measured data to compare or combine with simulations.

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