Model-based development and test of distributed automotive embedded systems

The Author

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Virtual Vehicle Competence Center

Located in Graz/Austria the Virtual Vehicle Competence Center (www.v2c2.at) has positioned itself as an independent, international platform for research and development in the automotive industry. It addresses the gap between academic research and the needs of industrial research and development departments. The Virtual Vehicle strives for full vehicle analysis using a multi-disciplinary approach and offers services and conducts research in the following areas: Active & Passive Safety, Thermo and Fluid Dynamics, Virtual Engineering, Virtual Manufacturing as well as Electrics/Electronics, Vehicle Software and Rail Systems. Its cooperation network comprises over 50 international industry partners including leading OEM's, tier 1+2 suppliers, and software vendors. As the main shareholder the Graz University of Technology (TUG) connects ViF to more than 20 institutes enabling technical innovations in virtual vehicle creation as well as offering access to funded projects.

Abstract

Current road vehicles are running with 100 millions lines of software code that have been developed conjointly by large teams from different institutions. The underlying hardware platform consists of up to 80 electronic control units (ECUs) exchanging more than 2500 signals (e.g., sensor values). These ECUs are responsible for the control of the car movement (including power distribution, engine control, car dynamics and vehicle stability, active safety) and therefore are deployed for safety-relevant operations, where a failure can harm people, environment or property and has therefore to be avoided. In parallel to that, the aggressive competition that occurs in the automotive domain leads to a high demand for improvements by the car manufacturers.

The scope of this talk will be to discuss the challenges related to the development of distributed automotive embedded systems. The first part will be focused on software engineering for automotive embedded systems. Starting with an overview of the methods for requirement engineering, component-based design and functional safety, the needs and methods for model-based integrated tool chains will be discussed in order to enhance product quality while reducing development time and costs. During a second part of the presentation, the focus will be set to automotive networks and to the expectations and challenges of the time-triggered communication architecture and more especially of the FlexRay technology. The discussion will focus on the migration from an event-based communication architecture with an "exactly once" semantic to a time-triggered communication architecture with the periodic update of a real-time image of the controlled system. Based on the deterministic behavior of the communication, new test and diagnosis approaches will be presented in order to improve the system reliability.