Reducing ECU development pain

Electronic and electrical (E/E) subsystems no longer have a simple scope within the vehicle. They are now highly integrated into the complete system and continue to grow in functional range and technical complexity. Validation is extremely challenging and ECU costs can quickly overrun budgets.

Front loading the development process by increasing the amount of testing using Virtual ECUs is a very real method to confront and alleviate this pain. Problems are found earlier and costs are significantly reduced because simulation is highly accessible and reduces the need for expensive test benches.

VSI overview

Volcano™ Vehicle System Integrator (VSI) is a simulation and execution environment for developing automotive embedded software. It is useful throughout the entire development lifecycle: modeling, coding, integration, calibration, diagnostics, testing – through to deployment and service.

Virtual ECUs

As an alternative to real ECU hardware, the VSI environment includes virtual ECUs that only require a PC for software development. Virtual ECUs are simulations of ECUs that are used exactly like real ECUs. They expose virtual I/O pins and automotive network interfaces that can be connected to normal verification tools and possibly other virtual ECUs.

CPU and peripheral simulation

Within VSI, cross-compiled software is executed on a simulated processor using specialized Instruction Set Simulation (ISS) with advanced support for peripheral modeling. The I/O surrounding peripherals and ECU circuitry are exposed for access from external tools.
Development tool connections

Users connect C/C++ software development tools to the VSI Virtual ECU in order to download their software for debugging, and they connect tools to either the virtual automotive network or directly to the software under test for verification and validation. The exposed tool connections adhere to industry standards so VSI fits naturally into established processes and methods.

Interactive or batch mode

Developers either interact directly with VSI or they invoke it in batch mode to run automatically. Since no hardware is required, VSI is ideal for regression testing in a continuous integration process where automated test suites run unattended on servers.

Software analysis

For analysis, VSI includes a powerful software analysis suite that automatically imports traced data, measures and acts upon it, and presents automotive-centric analysis views to the developer.

Stimulus, trace and fault injection

Unlike real hardware-based development, data is collected during execution without intruding on the software’s normal behavior – that is, without requiring source-level trace instrumentation. This is essential for repeatable, deterministic testing.

Advanced testing

The ability to automatically pause execution, inspect a given state, and manipulate the software with alternative data or behavior using scripts is a tremendously useful capability enabled by simulation. For validating safety and other advanced cases, software and hardware faults can be injected conditionally during a test.

“In-the-Loop” testing

Developers connect simulation models of the environment surrounding the ECU to I/O pins, the virtual network interface, or directly into software interfaces to perform co-simulation or “In-the-Loop” testing. To leverage Functional Mockup Interface (FMI), VSI automatically produces an FMU that the user can import directly into any tool that supports the FMI standard.

Support for AUTOSAR

While VSI is useful to developers utilizing any automotive software architecture, it is particularly well-suited for AUTOSAR-based projects. Mentor’s Volcano AUTOSAR toolset and its VSTAR AUTOSAR runtime are integrated into the VSI environment providing a complete AUTOSAR-aware solution for authoring, configuring, generating, debugging, and analyzing automotive embedded software.

Electronic exchange

Another major advantage of VSI’s hardware-less development environment is the ability to electronically exchange systems, tests, and results with suppliers, customers, and colleagues.

More about Mentor

Mentor, now a Siemens business, provides advanced systems engineering solutions with a leading portfolio of automation design tools and software, built on deep expertise in systems engineering, to help customers solve the most complex design challenges facing the industry. Solutions reside in three key areas for automotive electrical and electronic design: connectivity and networking; in-car experience; and subsystems and technology.