Convenient AUTOSAR-compliant development with SystemDesk

All-Round Integration

Software architects all over the world are using dSPACE SystemDesk to create the architectures for their ECU software. Why? Because of its clear views and convenient handling in development and configuration tasks. Its graphical representation of their entire overall model. And its easy integration into their existing tool chain.
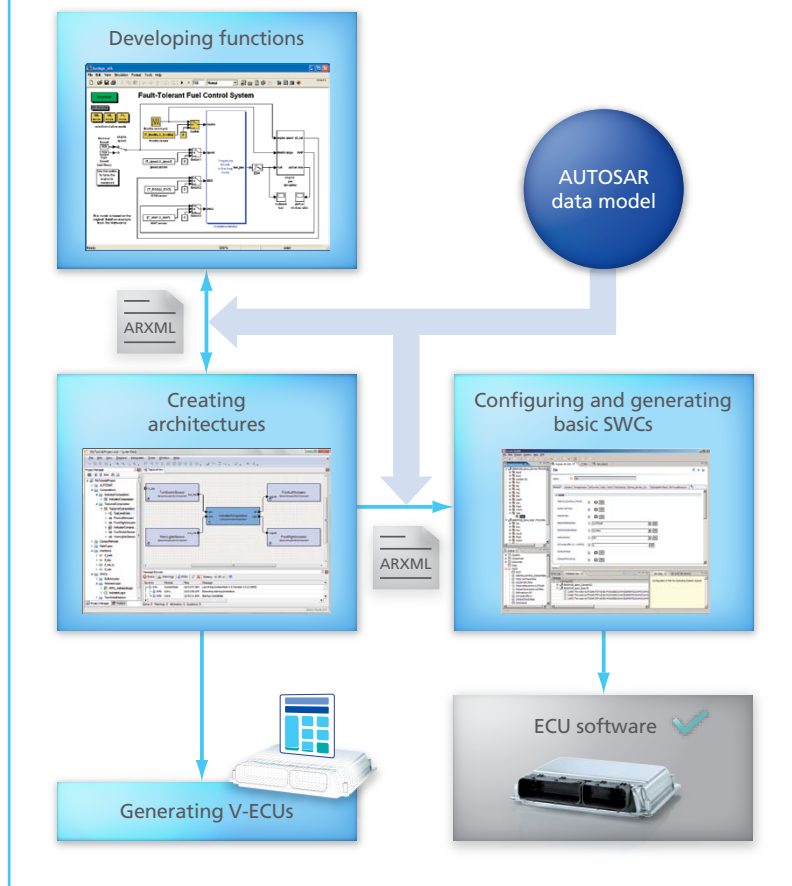
Figure 1: Standardized description formats allow iterative data exchange between different tools in the chain. SystemDesk also makes it possible to validate virtual ECUs at an early stage of the process.

Since its announcement in 2003, the AUTOSAR standard has become an important component in the development process for ECU software. The standard defines description formats for system architectures, software components and interfaces so that data can be exchanged reli-ably and consistently by all project stakeholders – between OEMs and their suppliers, between different development teams, and between different development tools.
In 2007, dSPACE published its system architecture software SystemDesk®. Right from the start, SystemDesk was completely oriented toward providing AUTOSAR support. All subsequent modifications to the standard were immediately incorpo-rated in the very next SystemDesk version, and the software has under-gone continuous further develop-ment. The latest version, SystemDesk 4.1, supports AUTOSAR R4.0, to-gether with complete support for the AUTOSAR R4.1 data model, and integrates seamlessly into AUTOSAR-based development.

The AUTOSAR Development Process

The AUTOSAR-based development process comprises several steps (fig-ure 1) that require different, special-ized software tools. Thanks to stan-dardized interfaces and exchange formats, the tools interact smoothly to guarantee users comprehensive data exchange.

The development process can be roughly divided into three steps:

1. The software architecture, includ-ing the individual software com-

ponents and interfaces, is created in SystemDesk.

2. The AUTOSAR description files for the software components are exported from SystemDesk and then imported into dSPACE Target-Link® for function development. The functions are integrated into the software components in SystemDesk.

3. The description files for the software architecture, including the software components, are exported from SystemDesk. The basic software is configured and generated with a tool such as EB tresos® from Elektrobit.

Structured Diagrams and Dialogs for High Usability

One particular challenge for system architects is to keep track of all the data elements, software components and connections involved in complex system architectures. SystemDesk diagrams visualize the architectures, making the relationships and depen-dencies in them easier to understand. Users can also define different views of their systems to organize how they access the software architecture or ECU topology.

Configuration dialogs provide a clear view of the attributes connected with individual AUTOSAR elements. The dialogs also ensure that all the data is in the correct format and automatically keep the relationships between data items consistent. Table editors help users enter large quantities of different mapping information (figure 2), for example, for mapping software components to ECUs or data elements to system signals.

Importing and Exporting AUTOSAR Description Files

The development of individual components and functions is usually distributed across different teams. For developers to exchange project information with others and inte-grate that information into their own workflows, compliance with the AUTOSAR standards is essential. SystemDesk 4.1 provides complete support for the AUTOSAR data model, guaranteeing the lossless import and export of AUTOSAR de-scription files. The scope and con-tents of exported descriptions can be adjusted to fit individual applica-tion cases: system architectures with one or more ECUs, for example, or data exchange between an OEM and different suppliers, or export to third-party tools.

Validating a Software Architecture

AUTOSAR defines numerous rules and restrictions that software archi-tects have to observe in order to produce correct models. A special SystemDesk mechanism validates project contents according to the AUTOSAR rules. At the push of a button, the mechanism checks for out-of-range values, incompatible data types, etc. Users can even select an individualized subset of rules and

Figure 2: SystemDesk 4.1 provides various ways to access AUTOSAR data: a project tree, diagrams with software components, dialogs with a mapping editor, and so on.
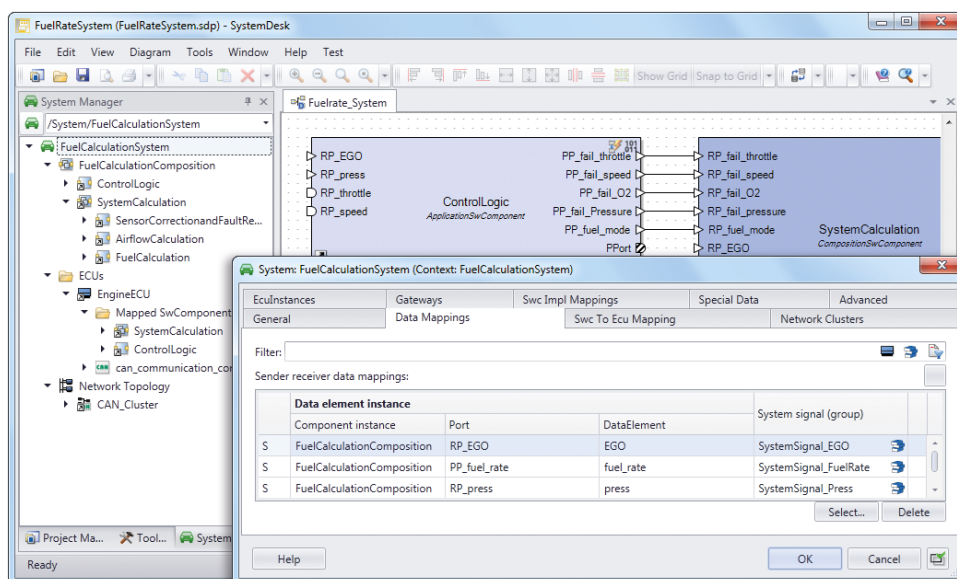
Figure 3: Virtual ECUs can run on dSPACE VEOS and on SCALEXIO. The same software is used to configure and handle them in both cases.

develop new rules themselves. Additional predefined rules in SystemDesk cover the requirements for data export and import between SystemDesk and dSPACE TargetLink, the production code generator, or EB tresos. Users have complete confidence that the descriptions they create can be processed correctly by downstream tools.

Automating Routine Tasks

With SystemDesk's open API interface, users can conveniently edit the software architecture by inserting additional software or customized scripts. This means that they can automate a wide range of tasks:

- Creating the project structure for a new software architecture
- Connecting ports named according to a defined schema
- Repetitive, routine tasks
- Generating a report on the current project

Virtual Validation of ECU Functions

SystemDesk 3.2 not only supports all the functions of a standard AUTOSAR development process, it also enables the generation of virtual ECUs (V-ECU) based on AUTOSAR R3.x. V-ECUs contain the same architecture as real ECUs. Like the final ECUs, V-ECUs contain software components, i.e., application software components and basic software components. V-ECUs are used to test the ECU software and validate its functions at an early stage. V-ECUs can be run on the PC-based simulation platform dSPACE VEOS® to perform function or integration tests even before a hardware prototype of the ECU is

available. They can also be used together with simulation models to enable the same simulation scenarios as those available with hardware-in-the-loop (HIL) simulation. Configuration and control are performed in a similar way to HIL simulation, with software tools such as dSPACE ControlDesk® Next Generation and dSPACE AutomationDesk®. Later on in the development process, the selfsame V-ECUs can be used alone, or networked with real ECUs, for hardware-in-the-loop (HIL) simulation on dSPACE SCALEXIO® (figure 3). "Virtual ECUs in Action" on page 52 gives details of how virtual ECUs are used in HIL simulation. With SystemDesk 4.2, users will also be able to generate V-ECUs based on AUTOSAR R4. Release of the new version is scheduled for the first half of 2014. ∎

	SystemDesk 3.2	SystemDesk 4.1	SystemDesk 4.2
AUTOSAR R3.0, R3.1 and R3.2	✓	–	–
AUTOSAR R4.0 and R4.1	–	✓	✓
Modeling software architectures and system architectures	✓	✓	✓
Generating V-ECUs for PC-based simulation on dSPACE VEOS	✓	–	✓
Support for application scenarios in conjunction with dSPACE TargetLink and basic software configuration tools	✓	✓	✓