

# Production Projects Under Control

- **New tool for model-based development at system level**
- **Planning, implementing, and integrating complex system architectures**
- **Support of AUTOSAR and generation of AUTOSAR RTE**

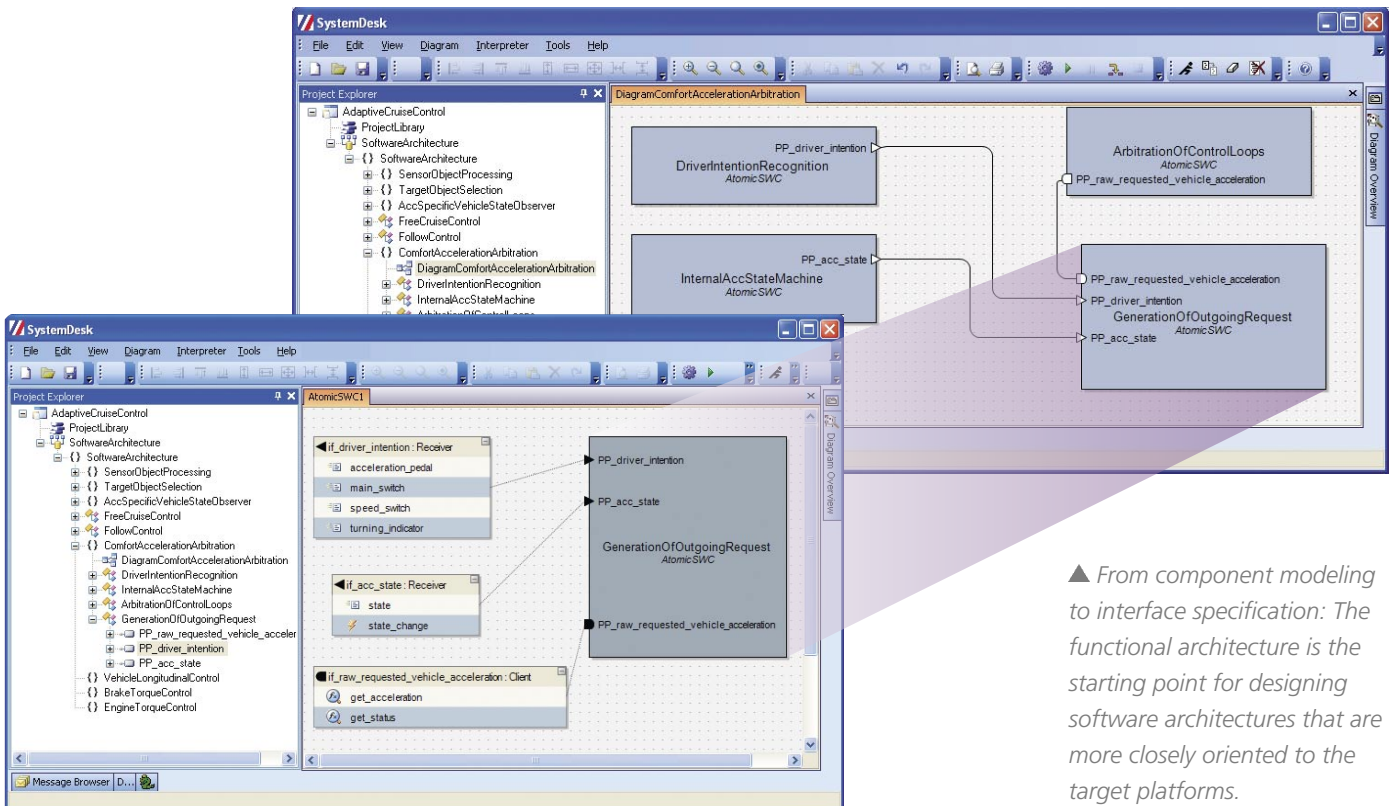
Modern electronic control units (ECUs) have such an enormous number of functions, and such a high level of networking, that handling several hundred software components for each ECU is not uncommon. Keeping track of such systems and coping with their complexity is a growing headache for vehicle manufacturers and suppliers. To help them face these challenges, dSPACE has added a new tool to its tool chain for developing automotive software: SystemDesk.

SystemDesk is a new architecture tool designed for model-based development right from system level. Developers working with SystemDesk can easily keep track of the planning, implementation, and integration needed for their complex system architectures and distributed software systems. SystemDesk is intended for vehicle manufacturers and their suppliers: The manufacturers produce the basic design of the distributed ECU software and extract the specifications that are relevant for each supplier. SystemDesk allows

system models to be imported and exported so that manufacturers and suppliers can use and maintain them jointly.

## ECU Software Design

The first stage in the development process is the function specification for the electric/electronic system, or functional architecture, which is independent of the real ECUs to come later. Later on, hardware topologies are defined, software modules are distributed on the



▲ From component modeling to interface specification: The functional architecture is the starting point for designing software architectures that are more closely oriented to the target platforms.

software, and the connections between software and buses are specified.

SystemDesk is designed specially for complex production projects. Such projects require facilities such as the following:

- Libraries for storing reusable objects
- Connection to version control systems
- A scripting-capable tool

To give users clarity even with large-scale models, there are various views of the multi-ECU software architecture, and selective display of model components.

### AUTOSAR Firmly Integrated

SystemDesk supports the AUTOSAR standard and others. For example, the interface descriptions of

```

TASK(Task1)
{
    EventMaskType events;

    while (1) {
        WaitEvent(RTEEvent1 | RTEEvent2);
        GetEvent(Task1, &(events));
        ClearEvent(events);
        if (events & RTEEvent1) {

            RUN1();
            SuspendAllInterrupts();
            Rte_Irv_AtomicSWC1_IRV1 = Rte_Irv_AtomicSWC1_RUN1_IRV1;
            ResumeAllInterrupts();

        }
        if (events & RTEEvent2) {

            SuspendAllInterrupts();
            Rte_Irv_AtomicSWC1_IRV1 = Rte_Irv_AtomicSWC1_IRV1;
            ResumeAllInterrupts();
            RUN2();
            SuspendAllInterrupts();
            Rte_Sig1c_AtomicSWC1_RUN2_Rte_Signal_3 = Rte_Sig1c_AtomicSWC1_RUN2_Rte_Signal_3;
            ResumeAllInterrupts();

        }
    }
    TerminateTask();
}
    
```

▲ RTE code generated by SystemDesk.

#### The Ideas Behind SystemDesk

- Master the complexity of the software development process
- Separate different aspects of system modeling, such as function development, software architecture, and hardware topology
- Reuse software components
- Support software exchange and integration
- Generate an AUTOSAR-RTE
- Connect to TargetLink, dSPACE's production code generator, for software component generation

AUTOSAR software components can be created, or existing software components loaded to SystemDesk for further processing. SystemDesk provides a run-time environment (RTE) based on dSPACE's years of experience in code generation and optimization with TargetLink, our production code generator. Software components from SystemDesk can be linked to basic software via standardized interfaces in the RTE generation.

### Connecting to TargetLink

SystemDesk works hand in hand with the TargetLink tool, which can be used to generate production code for the software components in SystemDesk architecture models. Function design is done with established tools such as Simulink®/Stateflow®, which are closely

integrated with TargetLink and also SystemDesk. A special TargetLink AUTOSAR module allows the generation of AUTOSAR-compliant production code.

### Complete Tool Chain

SystemDesk expands dSPACE's already extensive tool chain for developing and testing ECU software. The first version of SystemDesk is planned for release in summer 2007.

## Glossary

#### Software component –

Formal description plus implementation of a software module. The description comprises items such as ports, interfaces, data types, and C code. The use of communication macros and the formal description means that software components are easy to reuse.

#### Run-time environment (RTE) –

Automatically generated, optimized C code that implements communication between the software components and the function scheduling. It also provides the connections between software components and I/O interfaces. Exactly one RTE is generated for each ECU.