The global auto industry has been relying on dSPACE GmbH’s TargetLink code generator for 20 years to help its users quickly and automatically develop control software for everything from power windows to powertrains. Since its introduction in 1999, TargetLink has evolved in scope and capability as development projects become larger, more complex and increasingly involve the security and safety of the end user. Felix Engel, product manager for TargetLink, explains how the product has evolved and become more integrated with the software development process.

### What is TargetLink and what does it do?
TargetLink is a high-quality generator of efficient production code. It works directly with MathWorks and the Simulink/Stateflow graphical development environment. TargetLink also provides native support for AUTOSAR (short for Automotive System Open Architecture). AUTOSAR is the auto industry's long-running global development partnership to create open and standardized software architecture for automotive electronic control units.

### How has TargetLink changed?
The transformation began just a few years after TargetLink was released, and it has accelerated in the past five years. In the beginning, it was common for a function to be represented by a single software model. A project could be handled by a relatively small team that developed, tested and verified everything. TargetLink began in this environment as a powerful tool with which to automatically produce production-ready code.

As development projects expanded and grew more complex, they required larger teams. Simultaneously, the time available to complete these programs was shrinking. Industries have responded by breaking down these large systems into smaller software modules that can be developed and tested more quickly.

Isolating modules is an effective and agile way to build complex systems, especially when each module contains all operating options for a given task. But that isn't always the case. In many instances, modules interact with the activities of other modules. So to test one module, you frequently need to be able to determine which other modules are relevant to the assessment and plug them into the evaluation process. Server-based development tools called continuous integration servers have proliferated to support this technique.

Virtually all our customers are adopting this interactive approach. The process is greatly accelerated when module-to-module connections can be made automatically. TargetLink has evolved to address this need and has become a model-based product.

### What is a model-based approach?
In traditional software development, you simply write code that describes the behavior you want to achieve. A model-based approach begins with block diagrams that graphically show how the model is intended to operate and make decisions. TargetLink can quickly translate a block diagram into C code. It also links control engineers and software engineers involved with the development process, which accelerates overall integration. TargetLink's ability to perform code generation automatically enables developers to test more options within the same time frame and verify the quality of the final result.

This is how the auto industry is handling greater complexity in its software systems today: They are breaking down systems into smaller components that can be developed more quickly. By continuously advancing the capabilities of TargetLink, dSPACE is able to help them rapidly test how each module interacts with others it touches.

### Where do safety and cyber security come in?
Functional safety has become a central aspect of software development for the auto industry. Its importance is made evident by the introduction of advanced driver assistance systems (ADAS) such as blind-spot detection and automatic braking. And cyber security is an integral aspect of vehicle connectivity and autonomous-driving controls.

Safety and security haven't become more complex, but they are better understood. This in turn leads to a broader adoption. Also, safety is the foundation that is needed to build proper cyber security. The underlying philosophy is to test that software does what it is designed to do but also that it cannot be made to take unintended actions.

The key is to build safety and security into the software itself rather than make it an add-on element. Specific guidelines for integrating safety measures are detailed in ISO 26262. This standard was released in 2011 and revised in 2018. It describes best-practice design guidelines for safety- and security-related software, including where redundancy should be built in and which tools should be used. TargetLink, for example is explicitly certified by TÜV Süd.

### What's next for TargetLink?
Our market will continue to grow. Over the past 20 years or more, the trend in automotive has been from multiple control systems to electronics and now to today's microcontrollers. The global auto industry's move to electrification involves software functions that are still being developed today. The same is true for ADAS, and the industry really is just getting started on autonomous vehicles.

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