The AUTOSAR Adaptive Platform supports the dynamic deployment of application software

Adaptation Talent

Autonomous driving has extensive and complex requirements. This is where the adaptive AUTOSAR standard can help. The flexible, dynamic, and service-based platform makes it possible to intelligently provide new functions to an existing ECU. SystemDesk and VEOS are well-prepared for this new approach.

Highly automated and, even more so, autonomous driving significantly increase the requirements for an early and automatable validation process, because the test kilometers required for these validations far exceed the possibilities of real-time tests. The solution is software-in-the-loop (SIL) simulation. In contrast to testing real ECU components, this approach tests only the software part of the ECU, an option that is already available in the function development phase. However, to do this, function code must be compiled and executed.

Working with Virtual ECUs

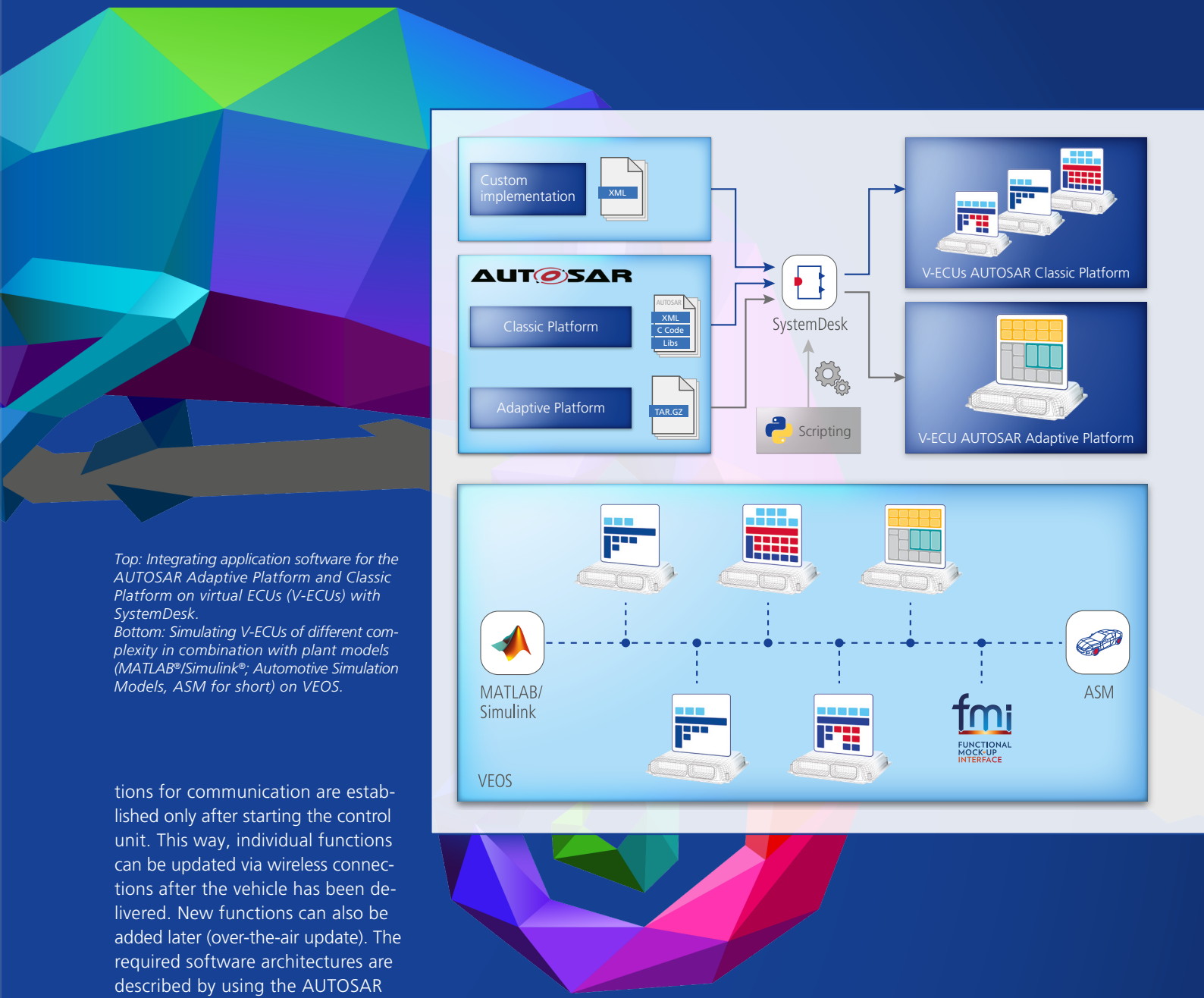
The code is executed on the VEOS simulation platform. Among other things, VEOS simulates virtual ECUs (V-ECUS): Their code corresponds as closely as possible to production code, provided it is independent of the target platform hardware. If code is developed in accordance with the AUTOSAR standard, it becomes platform-independent. For example, AUTOSAR defines a layer model for modularizing the software components of an ECU, which also includes standardized interfaces for basic functionalities. This way, ECU code can be implemented independently of the hardware.

Generating AUTOSAR-Compliant Software

With SystemDesk, dSPACE offers an authoring and system generation tool that facilitates the integration of ECU software components based on AUTOSAR descriptions. Everything can be integrated, whether it is individual components of the application software with the function code or the complete code including all required AUTOSAR basic software modules. Additionally, SystemDesk configures and generates an operating system specifically for simulation purposes. This makes it possible to accurately simulate the behavior of the ECU up to the configuration of different operating system tasks. Generating potentially missing basic software (or integrating externally supplied modules) also enables connecting to simulated bus systems, such as automotive Ethernet.

Service-Based Communication

Today, the AUTOSAR Classic Platform is the tool of choice when developing software for highly efficient control units. However, highly automated and autonomous driving require different framework conditions. In this specific use case, the communication between functions is no longer technically defined in advance and integrated into the generated code of a run-time environment (RTE). Instead, the definition specifies only who communicates with whom. The actual connec-



Top: Integrating application software for the AUTOSAR Adaptive Platform and Classic Platform on virtual ECUs (V-ECUs) with SystemDesk.
Bottom: Simulating V-ECUs of different complexity in combination with plant models (MATLAB®/Simulink®; Automotive Simulation Models, ASM for short) on VEOS.

tions for communication are established only after starting the control unit. This way, individual functions can be updated via wireless connections after the vehicle has been delivered. New functions can also be added later (over-the-air update). The required software architectures are described by using the AUTOSAR Adaptive Platform, which notably differs from the Classic Platform. However, some of the structure still remains. For example, the platform is still divided into an application layer and basic services, which each ECU must provide. It is also still independent of hardware interfaces thanks to an operating system that provides standardized interfaces (Portable Operating System Interface, POSIX for short).

Validating AUTOSAR-Based Virtual ECUs

The integrated simulation of environment models with virtual ECUs poses a validation challenge if some of these ECUs are developed on the Classic Platform and others on the Adaptive Platform. VEOS enables simulating both types in combination with environment models as well as routing intercommunication via a simulated Ethernet bus. Because the related software-in-the-loop approach is decoupled from real-time processes, development and integration of all kinds of virtual ECUs can be accelerated, which is particularly beneficial for functions for autonomous driving. ■

Efficient software development for the AUTOSAR Adaptive Platform with the dSPACE tool chain.