ETAS

DRIVING EMBEDDED EXCELLENCE

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Reach your goal faster

Rapid control prototyping (RCP) helps developers test and validate software functions in realistic conditions at an early stage of the process. RCP is one of the keys to reaching development goals faster, particularly in the case of new vehicle architectures, complex powertrains, and active driver assistance systems. The latest module from the ETAS ES800 product family – the ES830 real-time prototyping target – marks a major step forward in performance, flexibility and robustness when it comes to performing computationally intensive bypass applications – even on multiple ECUs simultaneously.

Today's electronic vehicle systems are expected to perform increasingly complex tasks. As well as controlling the interaction between electric motors, batteries, and inverters in hybrid drives. They are also used to control the distributed front and rear axle drives in electric vehicles and coordinate the sensors and actuators of active driver assistance systems. This ever-increasing complexity makes it more and more challenging for function developers to test new approaches and take them to a production-ready stage quickly. In many cases, rapid control prototyping can step in to fill this gap, offering a crucial intermediate step in the process of testing and comparing new approaches. The problem, however, is a lack of commercially available RCP hardware, especially when it comes to new software architectures and functions that involve more than one ECU.

Comprehensive coverage of rapid prototyping workflow

Rapid control prototyping requires flexible, versatile tools that provide access to ECUs and data buses in the vehicle. Bypasses are used to replace existing functions in ECUs, or to add new ones. The goal of RCP is to enable engineers to test prototype functions directly in the vehicle or on the test bench without any unnecessary delays – and that means not having to modify the ECU software beforehand or run through the time-consuming process of consulting the ECU manufacturer. It is also important that engineers have the ability to compare different variants (Fig. 1). A further key requirement is the option to replace real components with virtual hardware from simulation models. This enables tests to be carried out even before certain sensors or other components have been incorporated into the vehicle. Developers should also be able to inject erroneous signals and readings whenever they like to test and validate how the system behaves when things go wrong.

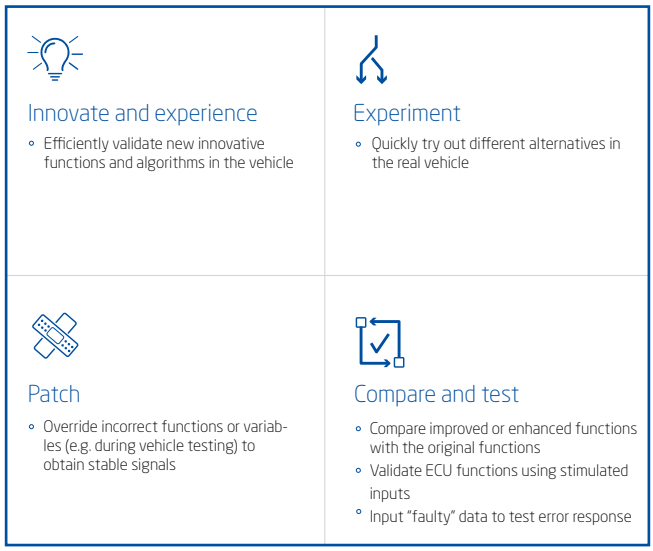

Fig. 1: Benefits of prototyping. (© ETAS)

The new ES830 prototyping module from ETAS has been designed to cover all these bases. It aims to make the function development process more efficient by creating a powerful and highly flexible experimental environment (Fig. 2). This allows engineers to test new developments at an early stage and experiment with different variants. It guarantees connectivity to established modelling tools as well as full compatibility with the popular ETAS INCA calibration and validation tool.

The ES830 module makes it possible to perform bypass experiments with two – and soon even four – ECUs at the same time. They are connected via the ETAS XETK or FETK ECU interfaces. An Intel Core 5 processor and 4 gigabytes of memory provide a five-to seven-fold increase in performance over the ES830's predecessor, the ES910. The ES830 also comes with a field-programmable gate array (FPGA) with an additional processor core to ensure real-time functionality even when calculating complex functions. The combination of the multiprocessor architecture and high-performance XETK/FETK ECU interfaces minimizes latency and jitter in bypass communication. As a result, the function executed on the prototyping target behaves in an almost identical manner to the function ultimately implemented on the production-ready ECU.

Maximum flexibility

The ES830 rapid prototyping target from ETAS forms an integral part of the fully modular ES800 family. Up to five modules can be connected up wirelessly, with a plug connection supplying power and providing fast and secure communication between the modules via Gigabit Ethernet and PCI Express (Fig. 3).

To ensure seamless integration in the automotive development environment, the ETAS ES800 family of products provides interfaces to all standard buses. The ES830 target itself comes with two Gigabit Ethernet ports, an I/O connector for querying status information, two USB2.0 ports, and two USB3.0 ports. In addition, interface modules of the ES800 product family provide the required number of CAN, CAN FD, FlexRay, LIN, XETK/FETK, and Gigabit Ethernet interfaces.

As well as flexible interfaces to standard vehicle buses, this solution also offers seamless integration in established ETAS tool chains. The ETAS INTECRIO integration and configuration platform can be used to integrate function models from ETAS ASCET, MATLAB®/Simulink®, and C code, allowing engineers to test and validate open- and closed-loop control and diagnostic functions under real conditions. The ES830 target's role is to compute the bypass applications in real-time and ensure the rapid exchange of data with the connected ECUs, either via the XETK/FETK interface for more demanding applications or via the bus interface (XCP) for simpler functions. ETAS also offers its EHOOKS tool to prepare ECUs and facilitate the integration of the required bypass hooks into ECU software. This allows additional internal bypasses to be implemented and operated in parallel with external ES830 bypasses, further boosting flexibility in the function development process.

The robust, high-performance RCP target ultimately forms the hub of the testing process for innovative ECU functions. Thanks to its considerable flexibility, it enables engineers to test multi-controller applications of future vehicle architectures in combination with one or more simulation models. This is becoming increasingly important as drive trains get more complex and vehicle architectures continue to evolve, especially when it comes to highly automated driving.

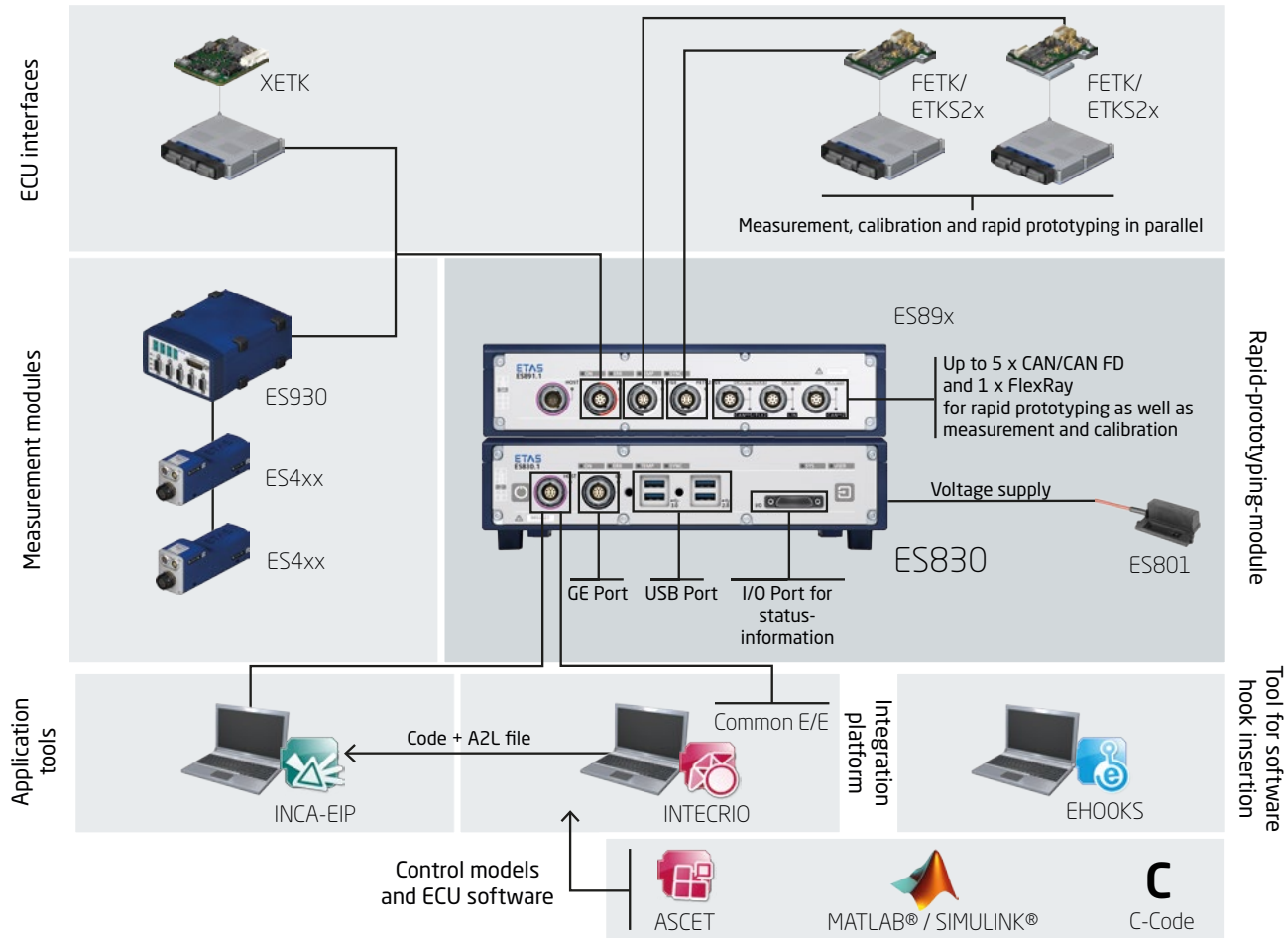

Fig 2: The centerpiece of the versatile ETAS prototyping environment is the new ES830 simulation target. (© ETAS)

Powerful and robust

Today's more complex applications benefit not only from the real-time capabilities and computing performance of the new rapid prototyping target, but also from a design that specifically caters to automotive requirements. The robust stack configuration eliminates annoying problems such as users plugging cables into the wrong ports and tests being aborted due to loose cables. The module stack is also reliably protected against vibration and shock and designed for use at temperatures between -40 °C and 70 °C. Even more importantly, however, this modular set-up offers a level of flexibility that makes this new tool equally appealing to engineers at all stages of the development process, from research and pre-development to full scale production. This flexibility stems from the wide-ranging support offered by the ES800 family of modules, which encompasses validation in the vehicle or on the test bench as well as function prototyping in the early stages before the production ECU is available.

The ES830 module has been specifically designed to offer an efficient experimental environment. Developers benefit not only from the bypass function and direct bus access, but also from the ability to perform measurement and calibration tasks in parallel on the respective ECU in conjunction with ETAS INCA. Thanks to the system architecture of the new prototyping target, engineers can reliably bypass highly complex and computationally intensive models while simultaneously achieving a very high bandwidth for ECU measurement and calibration procedures.

Summary

Embedded in a complete tool chain with INTECRIO and INCA and implemented as a robust stack system, the new ETAS ES830 rapid prototyping module represents the new hub of ETAS' prototyping solutions. Maximum flexibility is assured with interfaces to all standard bus networks including CAN, CAN FD, LIN, FlexRay, and Gigabit Ethernet as well as to XETK/FETK ECU interfaces, measurement modules, and all the other hardware solutions in the ETAS ES800 family.

Function developers can use the real-time RCP module in a wide range of test and validation scenarios from research and prede-

velopment right through to production. It is just as suitable for validating new functions under real conditions as it is for performing calibration or enhanced simulations. This new product reveals ETAS' determination to help users make rapid control prototyping as efficient as possible. Function developers can apply their creativity to innovative functions, testing and validating every aspect in bypass applications under real conditions. Thanks to its generous performance specifications and flexibility, this new solution supports even the most demanding forms of rapid control prototyping for new ECU platforms in future E/E vehicle architectures. To cater to these more complex applications, the ES830 RCP system offers the ability to create two parallel bypasses using the powerful XETK/FETK interfaces – and this will soon be upgraded to allow up to four bypasses. This is a good example of how ETAS strives to open up new avenues for function developers. In light of the rapidly increasing complexity of electronic vehicle systems – whether for hybrids, electric drives, or highly automated driving – this enhanced level of flexibility is exactly what developers need.

Fig. 3: The wireless connectivity and pluggable modular design of the ES800 family of products ensures fast and secure communication between modules. (© ETAS)

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