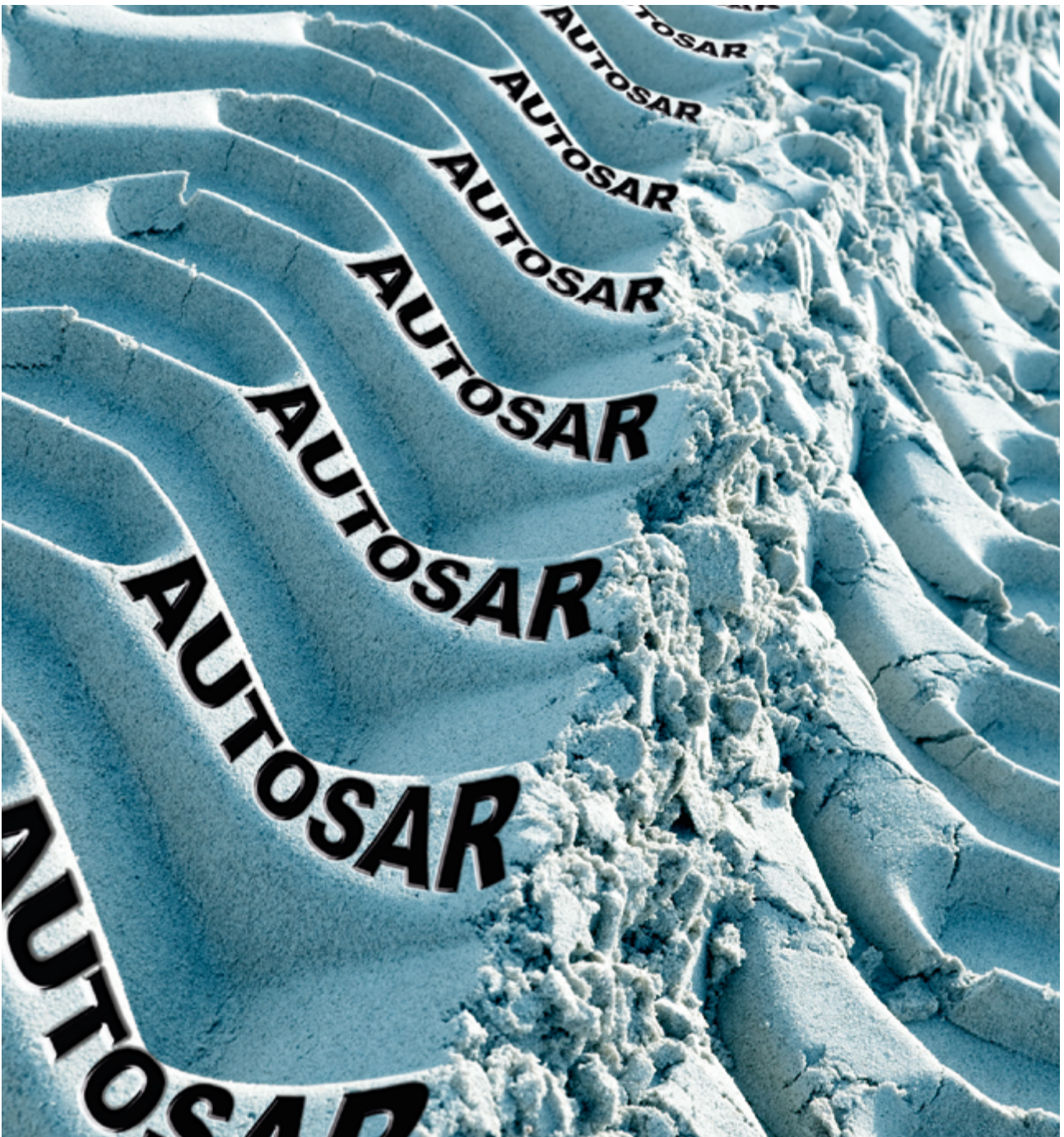


Translated article „Standard auf Abwegen,“ E&E 5.2016

Standard goes off-road

The AUTOSAR standard, originally conceived for automobiles, is now finding application in agricultural and construction vehicles. For cost and quality reasons, this makes a lot of sense. However, the manufacturers of these vehicles should plan implementation very carefully and precisely.



Thirteen years after its introduction, AUTOSAR (AUTomotive Open System ARchitecture) is one of the most important standards in the automotive sector. A crucial part of this success has been the fact that AUTOSAR-compliant software functions can be exchanged and also reused independently of the hardware and software providers.

Looking beyond road vehicles, the latest release was also designed for off-highway vehicles. A handful of manufacturers of agricultural and construction vehicles have already opted for the standard; others are waiting to see if AUTOSAR brings them benefits.

Almost 180 companies worldwide have now joined the AUTOSAR development partnership in order to further develop and use this standard for software architecture, interfaces, and methods for the configuration and generation of ECU software. The core concept is the AUTOSAR layer model, which makes it possible to use software components from various providers independently of the target hardware over several product generations.

Forward thinkers required

Before using AUTOSAR in the off-highway sector, there are some factors that need preliminary consideration. The control systems are essentially similar for automobiles, agricultural machines, and construction vehicles, especially as they all use the same microcontroller families. However, there are still differences: due to the lower quantities manufactured, the development costs per ECU are higher in the off-highway sector; manufacturers often compensate for this by reusing hardware and software designs based on "generic" ECUs. In this sector, vehicle manufacturers mainly develop software in-house, sourcing only the board support packages from tier-one suppliers.

In addition, the wide variety of add-on devices increases the already sizable vehicle variance, and software functions are also becoming more varied. Flexible software architecture and system configuration are required. Moreover, companies must comply with sector-specific standards such as the J1939, ISOBUS, Profibus, and CANOpen communication protocols as well as with ISO 25119 "Functional Safety for Tractors and Machinery for Agriculture and Forestry."

Reusability important

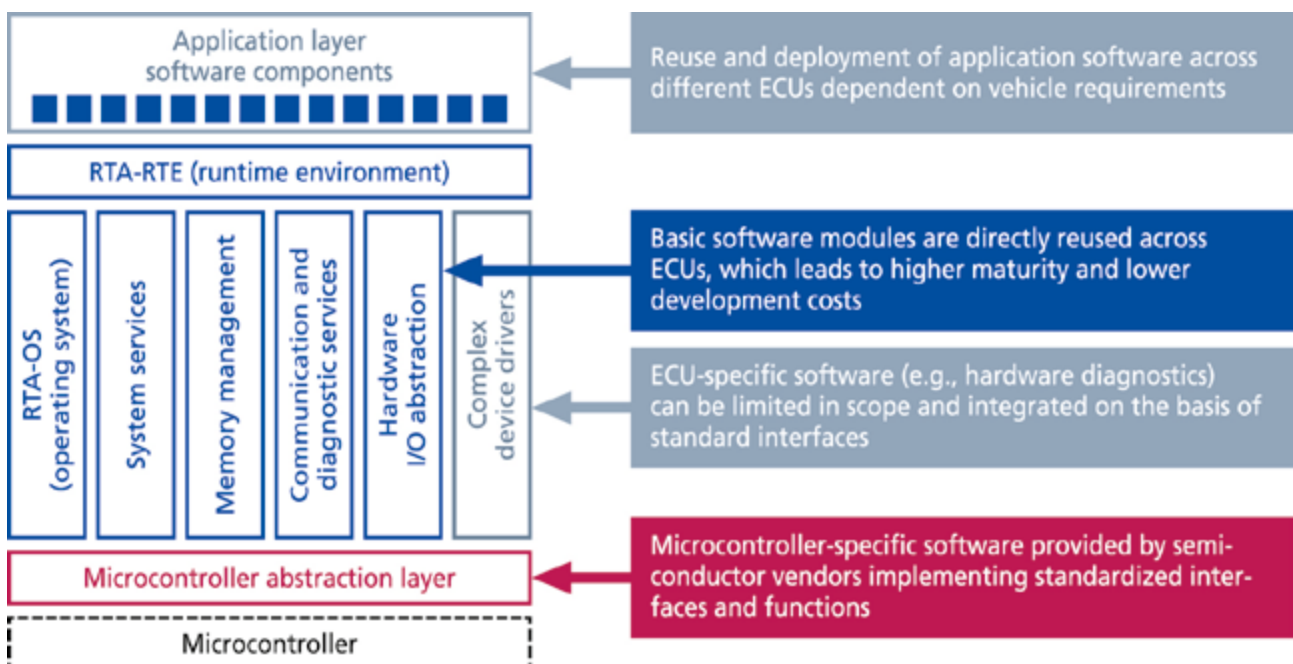
Alongside the differences, there is also common ground: for the purposes of quality and efficiency, the manufacturers of agricultural and construction vehicles are just like their automotive counterparts in seeking to reuse as many software components as possible. The AUTOSAR software architecture provides them with a suitable framework for achieving this goal – and that applies both to application-specific tasks, such as controlling individual devices, and to system services.

This includes aspects such as network management. AUTOSAR enables manufacturers to concentrate development on the system and the software functions that provide added value for the end customers, and simply purchase and use commercially available standard software for other functions.

Risks of modularity

This modularity harbors risks for functional safety. For example, errors in bought-in modules might disrupt safety-relevant functions. Before integrating software modules from various sources, this risk must be ruled out. A useful instrument here is ISO standard 25119, which defines measures designed to ensure that faults

The AUTOSAR software architecture's layer model makes it possible to use software components from various providers independently of the target hardware.



remain locally isolated through mechanisms such as software partitioning. In addition, multi-core systems, scheduling, and watchdog mechanisms secure the communication between ECU and software components.

AUTOSAR supports the measures defined in ISO 25119 through its own software partitioning mechanisms. Its use is advisable specifically in the case of general-purpose ECUs, which are mostly developed by various partners yet still have to fulfill the highest safety requirements. The standard provides a guideline, encourages companies to follow best practices in software development, and helps uncover weaknesses at the hardware level.

Consulting is a sensible option

To use AUTOSAR's safety mechanisms successfully, the development process should be well thought through and take into account the available resources and budgets. When these are limited and there is also a lack of experience, it makes sense to seek expert advice. ETAS's RTA (Real Time Applications) Solutions teams for the development of customized embedded software can look back on numerous successful off-highway and heavy-

duty projects and offer comprehensive support for migration to AUTOSAR. Fundamentally, there are compelling cost and quality reasons for manufacturers of agricultural and construction vehicles to have access to standardized AUTOSAR software components and a corresponding development environment. Support is also available from the COMASSO association, which already counts several commercial vehicle manufacturers such as Caterpillar, CNH Industrial, MAN, and Bosch Rexroth among its members. The association offers high-quality series-manufactured products and license-free reference implementations of AUTOSAR standard components. The initiative is also attracting increasing interest in the off-highway vehicle sector.

In summary, AUTOSAR offers manufacturers of agricultural and construction vehicles huge potential as regards developing embedded software flexibly and in high quality. Tangible cost reductions can be achieved by reusing and buying in mature software components. However, the functional safety aspects and the organization of the process chain must be planned in detail.

Authors

Jürgen Crepin & Daniele Garofalo, ETAS GmbH