Interview with Dr. Günther Heling about New Challenges for AUTOSAR

The aim of AUTOSAR is to simplify the development of vehicles with many ECUs. But what role will this standard play in the future, in view of a centralized vehicle electrical system architecture and the competition posed by Android and Linux? The German professional magazine Markt&Technik discussed these topics with Dr. Günther Heling, Head of Embedded Software and Systems at Vector.

Markt&Technik: Dr. Heling, AUTOSAR was introduced 15 years ago. How widely has the standard become established in the automotive industry since then?

Dr. Günther Heling: At the end of 2018, the AUTOSAR Classic variant achieved a market penetration of more than 70 percent. There are regional differences here. In Germany, all OEMs are on-board. In Europe, the market share is also high; Asia and the USA will follow after a time offset. The vast majority of new automotive manufacturers in China are choosing to use AUTOSAR.

How much upward potential do you still see?

OEMs typically switch over when they are updating to a new vehicle platform. This happens every seven years or so, on average. That is why I definitely expect more growth. However, AUTOSAR will never reach 100% penetration. And there is a simple reason for this: Some ECUs, such as small LIN nodes, have such low computing performance that AUTOSAR is not a good match at all. On the other hand, its use is very widespread in the Body area, because many of the ECUs come from different suppliers. Standardization by AUTOSAR makes a lot of sense in such
cases. In my area of responsibility, Embedded Software and Systems, we are currently getting around 1,000 ECU projects each year – and we continue to grow.

- In early 2017, the Adaptive variant of AUTOSAR, which offers flexible extendability, was introduced to complement the Classic variant. Will the two standards continue to be used in parallel, or do you expect a universal version to be offered in the future?

  The flexibility, dynamism and service orientation of AUTOSAR Adaptive offer many benefits, but they also come at a price. It requires significantly greater hardware performance and more memory space. Classic, on the other hand, gives me maximum efficiency. That is because Classic produces a system which, due to its static configuration, can be optimized to a high degree. Even if Adaptive were to represent just one more euro in investment, that would strain costs when summed over 80 or more ECUs. Another consideration is that service-oriented communication does not really make sense without an Ethernet connection. It is primarily smaller ECUs which do not satisfy this requirement. That is why it makes sense to split AUTOSAR into Classic and Adaptive versions.

- In the current vehicle generation, Ethernet connections make up just a small part of the electrical system. This could, however, change considerably with the introduction of a low-cost 10 Mbit/s variant.

  First, the system description is simplified by more widespread use of Ethernet in vehicle networks – and by the service-based communication it brings with it. This does not mean, however, that Adaptive needs to run on every individual node. That is because Classic ECUs can also be integrated into service-based communication. This gives OEMs a way to define a service on the system level without having to consider how it will be implemented in specific ECUs. Classic will certainly be run for a long time yet in certain ECU classes – a window lift ECU, for instance, will likely be retired in the same form that it went into production. There is simply no need for later functional updates in such ECUs. Furthermore, we assume that CAN and LIN will continue to play a significant role in networking that involves signal-based communication.

- The entire vehicle architecture is facing major changes – away from a large number of individual ECUs to a domain-based network or even a genuine server structure with a few large central computers in the car. What does this development mean for AUTOSAR?

  Adaptive will definitely be used in the central computers that we call the “vehicle brains”. It will also be used in domain ECUs and zone integrators which combine the functions needed for a specific vehicle area. The case is different for intelligent sensors and actuators. Classic will probably continue to be run in these. The idea of decoupling functional development from the computing hardware to a large extent has always been part of AUTOSAR. The transition to centralized computers which can distribute their resources to nearly any tasks is essentially just a continuation of this idea on an even higher abstraction level.

- The switch to a centralized network architecture could have a noticeable impact on the actual design process.

  Changes in the electrical system go hand in hand with a shift in responsibilities. In the case of central computers, OEMs will assume responsibility, because developments in this area differentiate them from the competition. While it is common for Tier-1 suppliers to deliver complete systems for many ECUs today, this is no longer the general rule for the "vehicle brains". Development tools also need to be adapted to the new structures. A tool such as CANoe, for example, has so far been designed for analyzing the network. However, if, in the future, relevant interactions occur primarily within a central control computer, then developers will need to be able to look deeper into such a system. That is something we are working on currently.

- Linux and Android systems are gaining a foothold, especially in the infotainment area. Will this create new competition for AUTOSAR?

  We see systems in the market which are well maintained and offer extensive libraries for infotainment applications. But we are refraining from working in that area. The development of such libraries is definitely not our goal. Instead, we are counting on a combination of two worlds – Linux/Android and AUTOSAR Adaptive. In suitable ECUs, a Hypervisor is also used, which, in principle, can create any desired number of partitions with widely varying safety levels. A Linux system would run on a partition for infotainment, for example, while AUTOSAR would be responsible for safety-related functions. Our observations have shown that OEMs are very cautious when it comes to partners as powerful as Google, for instance, in the case of Android. Infotainment applications are rather noncritical, but OEMs do not want to outsource core functions. AUTOSAR, on the other hand, was made by and for OEMs and suppliers. It is not an outside influence, rather it comes from within the industry itself. What runs there has been fine-tuned and operates properly – according to automotive rules.

- In your view, what effects will the growing electrification of vehicles have on networks and AUTOSAR?

  I should clarify one point from the outset: I do not believe that a functionality like an engine controller will be centralized on a server. Such specific control functions will continue to be performed locally in the vehicle. However,
the decision is made on the server on how much momentary torque should be made available. Nonetheless, the local control system regulates how the engine implements this physically, e.g., through fuel injection control. Consequently, from a server perspective, it is essentially irrelevant whether the vehicle has an electric drive system or a combustion engine. This suggests that electrification itself does not have any great influence on our work. However, electric vehicles do need additional ECUs, e.g., for charging management and battery management. And things are happening here. Over the past five years, Vector has even been developing ECUs in the area of charging communication, but only for small volumes.

> Are you able to find enough employees for all your projects?
We primarily grow organically. Last year, however, we acquired the Swedish company ARCCORE, which, in one stroke, added a workforce of around 70 people experienced in AUTOSAR. In addition, we have launched a special program for natural scientists. It targets college graduates who have not studied computer science or electrical engineering, but instead subjects such as mathematics, physics, chemistry and biology. We train these graduates, who have shown a special enthusiasm for the IT area, with in-house programming courses. We currently have around 20 participants. We have had positive experience with natural scientists in the past, and we wanted to further increase their ranks.

This interview was conducted by Dr. Ingo Kuss.