

## AUTOSAR moves forward

With the Automotive Open Systems Architecture (**AUTOSAR**) consortium achieving one of its major development objectives in May 2006, some companies are now piloting the standard, while others are continuing to review and plan a possible migration path. A validation and verification phase was expected to finish in the fourth quarter of 2006, and adoption as an industry-wide standard could follow.

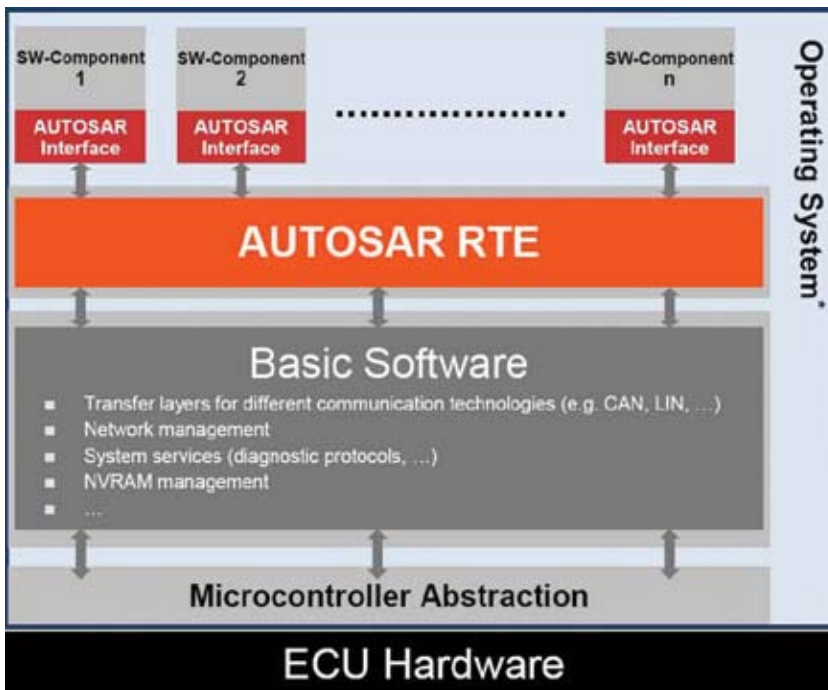
There are a number of ways automotive control systems engineers have been tackling the growing complexity of their systems. One of the ways proposed is to adopt universal standards and a common architecture. Standards for control systems should promote software reuse and ease integration. To reuse application software, it must be independent of the hardware it is hosted on, according to Karsten Hoffmeister, Product Manager for tresosECU provided by **3Soft** GmbH,

a member of the Dutch **Elektrobit** Group. A way to achieve that is through developing a standard for the interface between software and hardware, called a runtime environment (RTE), which is where AUTOSAR comes in.

An AUTOSAR-compliant RTE might be compared to personal computer operating systems, with all hardware drivers and services conforming to the standard, according to Eric Jensen of **Volkswagen** of America. All applications for unique functionality, such as powertrain controls, would be written to interface with this RTE without the developer having to write for a specific electronic control unit (ECU). The AUTOSAR RTE will allow independence of software from hardware, according to Jensen.

It may be hard to predict how quickly AUTOSAR will be adopted as a general standard, but it might be useful to compare it to other automotive standards developed prior to AUTOSAR. OSEK was developed as a standard in the mid-1990s and is widely used today—but not universally. Although AUTOSAR is more comprehensive than the OSEK standards, OSEK had many of the same goals when first introduced. According to Gary English, Manager of Core Software Architecture and Building Blocks for **Delphi** Electronics & Safety, “use of OSEK today depends on the customer and the product lines. A number of OEM customers require us to use OSEK, but not all,” though he reports global distribution. With regard to AUTOSAR, one can anticipate an adoption similar to OSEK. “We expect to see requirements for its use coming from the European OEMs first. The initial push is already being seen coming out of Europe,” said English.

Peter Jakobsson of the Automotive Business Unit of **NEC Electronics** (Europe) GmbH predicts that one or two OEMs may adopt AUTOSAR for the 2009 model year, but that it will take at least until 2015 before there is significant penetration in the industry. He predicts it will take that long because no OEM will change an existing function to AUTOSAR



AUTOSAR promotes reuse of software by defining interfaces that are hardware independent. Thus a software component that has been written to the AUTOSAR standard should work on any vendor's microcontroller provided it has been properly integrated into an AUTOSAR-compliant runtime environment. (Image courtesy of AUTOSAR.)

unless it makes a change for other reasons, such as to add or upgrade a feature or to adhere to regulatory requirements.

In fact, even for those that completely embrace it, "pure AUTOSAR will never exist," stated Hoffmeister. "There will always be custom tools and custom ECU software that will exist outside the AUTOSAR standard in any given vehicle."

A potential obstacle to industry-wide standards may be resistance from some OEMs and large Tier 1s who have, of necessity, created their own proprietary standards and architectures. Adopting the AUTOSAR standard and its architecture may seem risky because of the cost of the changeover and the potential loss of control. Another concern is that, since AUTOSAR is more comprehensive than most existing standards, writing software to it may make more demands on ECU computing resources, such as memory and bus bandwidth, than current developers may be used to.

For AUTOSAR to be widely adopted,

these concerns must be addressed and it must be shown that software components written by multiple organizations are cheaper to integrate, according to Hoffmeister. To demonstrate AUTOSAR, Volkswagen, **Hella**, 3Soft and NEC Electronics (Europe) are currently developing a fully functional body/comfort ECU for a Volkswagen series-production Passat.

A validation activity by the AUTOSAR consortium was expected to finish in the fourth quarter of 2006. It is expected that some modifications of the specifications released in May will occur as a result.

There may be other reasons for adopting AUTOSAR. English sees great advantage for Delphi for internal reasons as well as to satisfy external marketplace demands. Over the past four years, Delphi has recognized the need to commonize the software architecture across its many product lines. "We know for a fact that some subset of our customers will require AUTOSAR," he said. "So rather than duplicating effort and main-

taining our own proprietary common architecture in parallel, it makes sense to adopt this single standard even for customers who do not require AUTOSAR."

Jakobsson of NEC Electronics believes AUTOSAR will force current automotive microcontroller suppliers to act more like system developers since they must supply software drivers as well as the underlying hardware. They must now deliver an entire system that includes microcontroller, software, and configuration set—rather than a microcontroller and a user manual as in the past.

Hoffmeister believes that at a higher architectural level "adopting AUTOSAR will require a change in the development process thinking from one that is ECU centric to one that is functional specific." He believes that the OEMs and Tier 1s will need to plan and think in terms of functionality independent of hardware rather than what may be the current practice of finely tuning functionality after selection of the ECUs.

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The general mood seems to be one of cautious investigation. **BMW** reports it is too early to reveal its own plans regarding AUTOSAR but predicts its use by someone by 2008. **Honda** says it is investigating AUTOSAR while contributing as a member to the Japan Software Platform and Architecture (**JASPAR**) consortium formed in 2004. According to Honda, JASPAR is independent from AUTOSAR but conducts research on implementation of AUTOSAR's platform and architecture. **Continental** Automotive Systems reports a staged approach for migrating to AUTOSAR, from chassis and powertrain applications in 2008 to brake and safety systems in 2010.

English of Delphi, in a position as a Tier 1, reports having had discussions with OEMs from all regions, showing interest in what AUTOSAR is and how it might impact their business. **Freescal Semiconductor** also reports interest and direct inquiries from Asian OEMs regarding AUTOSAR.

*Bruce Morey*

## Collaboration rapidly gaining popularity

The auto industry was one of the leaders in the early stages of globalization, and now it is pushing the concept of collaboration forward. Collaboration takes many forms, linking design teams inside and outside the company, as well as tapping ideas from other industries.

Once considered a technique that fit only in specific jobs, collaborative group efforts are expanding rapidly. In an age when global communication is no longer an issue, group efforts are rapidly becoming the norm for automakers.

"Collaboration is a fundamental part of the design process," said Maryann Combs, Executive Director of **General Motors'** Electrical Controls and Software Group.

When companies begin to collaborate globally, they gain many benefits, observers agree. Along with the new ideas that often arise when disparate groups examine a project from different viewpoints,

there is the advantage of passing projects around different time zones.

"You won't be successful unless you're working globally," said David Robinson, President of Robert **Bosch** Body Electrical and Electronics Division. "There are big benefits to writing software 24/7."

Once companies have success in projects that link unrelated groups together, they typically add more in fairly short order. As more teams are linked together, they form loosely linked operations that range from internal groups to those in other cities or countries.

"Collaboration runs in concentric circles inside and outside your building," said Paul Camuti, President of **Siemens** Corporate Research.

The various types of collaboration are somewhat easier for huge corporations, since they can tap the knowledge of different divisions. Large, broad-based com-

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panies such as Siemens can use developments made in one field in another.

"We're doing a lot of signal processing and using other techniques to improve imaging in medical equipment," Camuti said. "The same technology is being used for pedestrian detection and blind-spot detection."

However, even major corporations often turn to outsiders to expand their knowledge base. Though there are a number of joint ventures signed each year, observers note that these collaborations must be made in a spirit of cooperation.

Companies must balance the benefits of sharing information with the problems that can arise by giving it away. There must be a fair amount of trust even in agreements that are governed by strict legal boundaries.

"Intellectual property is a big factor in collaborations," said Peter Pao, Lead of Executive Technology at **Raytheon**.

Veterans of the process noted that not every proposal ends in a positive outcome. If companies try to set too many



Convergence panelists addressing the total vehicle said collaboration is a mainstay of product development. (From left to right: Siemens' Paul Camuti, GM's Maryann Combs, Consumer Electronics Association's Connectivity Committee Chair Chris Cook, Raytheon's Peter Pao, and Bosch's David Robinson.)

rules, there is a chance those rules will get in the way. "If it takes longer to negotiate a nondisclosure agreement than the time allotted for the project, there probably won't be a good result," GM's Combs said.

Whether the development teams are internal or external, they require a change in management style. Keeping engineers focused on a project is never simple, particularly when they are located in different countries. "There are challenges to global collaboration, but there are also huge benefits," Combs said.

That is prompting many companies to focus on best practices, standards, and common tools.

"There is a cultural element, you need to manage programs differently," Camuti said. "The key focus for us is to have a common set of processes throughout the company."

Another facet of the changing environment is an increase in technical standards. Using common interfaces between hardware and software is one way to reduce the number of the relatively mundane elements of a design, making it easier for engineers to focus on higher-level aspects.

"When you're dealing with OEMs around the world, standardization is key," Bosch's Robinson said. "That's why AUTOSAR is so important."

*Terry Costlow*



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## FPGA usage expands for infotainment

As prices for field programmable gate arrays (FPGAs) and programmable logic devices come down, these programmable devices are seeing broader acceptance in the automotive markets. That is particularly true in the infotainment sector, where high speeds for digital-signal processing are opening doors for the technology.

Suppliers **Xilinx** and **Altera** are broadening their reach in automotive.

Altera will take a novel tack on video, partnering with **Sharp** to demonstrate a novel dual-view flat-panel display. Xilinx is addressing the need for more bandwidth to handle video and other data, showing a Media Oriented System Transport (MOST) controller at Convergence 2006. The company noted that its automotive industry sales are increasing at 50% per year.

Xilinx is addressing the MOST fiber-optic networking protocol with programmable logic devices (PLDs) that provide a scalable network, going up to a 25 Mbits/s data stream that enables both synchronous and asynchronous data transfer. MOST is popular in Europe as a fast network for moving video and audio data.



Xilinx is focusing on networking as it pushes for growth in automotive.

Though it has seen little acceptance by U.S. automakers, solid worldwide growth is expected. **ABI Research** predicted shipments of 6 million automotive MOST transceiver nodes in 2006, growing to more than 10.5 million in 2010.

The Xilinx chip employs a transceiver from the company's LogiCore library along with networking middleware and software interfaces. Intellectual property cores developed by **Mocean Laboratories**, a Swedish firm that specializes in the optical network, round out the offering.

Taking a different approach, Altera has teamed up with Sharp to demonstrate a dual-view LCD that lets two passengers watch different images simultaneously.

Two images are displayed on the screen. A novel glass technology makes it possible for both viewers to see only their image, which is displayed on the full screen.

"Sharp provides the dual-pane optical glass, and our FPGA runs all the algorithms," said Tapan Mehta, Automotive Business Manager at Altera. In operation, the driver might see a navigation screen while the passenger watches a video, or rear-seat passengers can watch two movies.

The Cyclone FPGA is used for its low cost and fast processing capability. Five modules take input from two incoming video signals, formatting each for the dual display. On an 800 x 480 pixel screen, each image will have resolution of 400 x 480 pixels. The two layers are offset by one pixel.

Memory bandwidth is a key aspect of the video-processing system since large volumes of data are being moved continuously. The display is divided into three 16-bit color image layers and two 8-bit palette layers, each created by an independent direct memory access controller.

*Terry Costlow*

## Infineon focuses on transmission control

**Infineon Technologies** AG aims to broaden its automotive reach by entering the transmission side of powertrain applications. The German chipmaker, which already has a presence in engine controllers, hopes increased growth in six-speed transmissions will create an opening for its expanded focus. Though some manufacturers have already adopted six-speed automatic transmissions, the company is among those who expect far more growth in the near term.

"Some observers predict that the drive for fuel economy will prompt U.S. car makers to shift to six-speed automatic transmissions, which offer from 3 to 8% better mileage than four-speeds," said Chris Wunderlich, Senior Staff Applications Engineer at Infineon Automotive Microcontrollers' Automotive, Industrial and Multimarket (AIM) Business Group.

That means transmissions will need more than the 4-6 solenoids to help con-

trol fluid flow so the clutches work properly. "In six-speeds, you need one PWM and as many as seven constant current of variable force solenoids," said Joe Funyak, Infineon's Global Product Marketing Manager for Transmission ICs (integrated circuits).

That in turn creates a need for more microcontrollers. Those controllers must provide far more precise control of the fluid flow. "For four-speeds, you don't care about accuracy, it's more on and off," said Shawn Williams, AIM Senior Staff Engineer, Automotive. Resolution of around 5% used to meet all requirements, but six-speeds require at least 2%, he added.

Infineon's TriCore line is being upgraded to address this market. In addition to providing speed and high resolution, the line is being augmented with more channels. That lets transmission engineers use a single processor to control many PWMs



Infineon's controllers offer resolution, multi-channel capabilities.

or variable-force solenoids, reducing parts counts.

The controller comes in plastic packages that can be mounted on or near the transmission as well as on a bare die that can be packaged for use inside the transmission casing. Infineon also offers switches and other devices that augment the controllers.

*Terry Costlow*