

## Software tools ease AUTOSAR compliance

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Automobiles of all types have evolved from basic transportation to elaborate “systems of systems,” which incorporate hardware and software components that give consumers a range of software-enhanced experiences. These range from the highly visual multimedia dashboard to the data-driven performance of fuel delivery, braking, and drivetrain systems. To meet market demands, automakers are launching new cars with the latest technologies, or they are substantially re-engineering older models to retain and expand their existing customer base.

This means that advances in automotive technology have led to exponential increases in *complexity*, *competition*, and *cost*. Within the automotive space, perhaps more than in any other industry, these three “Cs” are directly related to each other. Growing complexity derives both from the need to stay competitive within the supply chain and from the tremendous increase in software and systems engineering practices that play the biggest role in vehicle design—all of which impact cost. Specifically, the electrical, electronic, and software components determine 75% of a car’s value these days, with up to eighty electronic control units (ECUs) and ten million lines of code per vehicle.

The complex combinations of mechanical and electronic equipment that define today’s automotive products are essentially large systems comprised of smaller systems. Relying heavily on software for data-driven performance and competitive differentiation, these “systems of systems” require stakeholders to understand that decisions made during the conceptual design stages impact all other areas of engineering and development.

Never has this sort of detailed understanding of design, materials, suppliers, and processes been more critical. The auto industry has seen a dip in earnings over the past decade, with many bankruptcies or mergers and acquisitions impacting the bottom line. Along the way, rapidly rising prices for raw materials were another factor. To reduce costs and increase profit margins, automotive companies are seeking new ways to cooperate with each other.

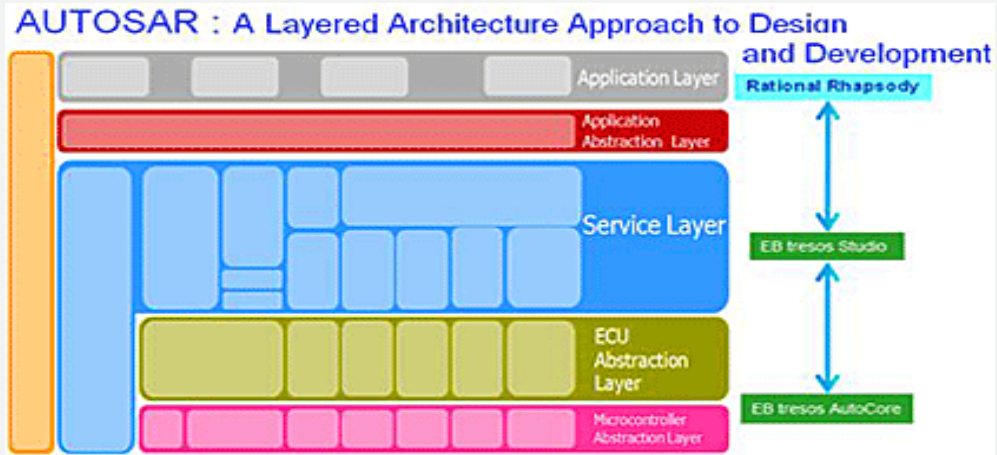
The remainder of this article will explore how the recent alignment of automotive manufacturers under the AUTOSAR initiative is beginning to improve on these industry-wide constraints, and, as an example, how **IBM** and its partner **Elektrobit** are advancing automotive design and development technology that helps businesses implement these new capabilities.

### The automotive industry responds with AUTOSAR

In order to manage the complexity and challenges throughout the automotive industry supply chain as well as the internal challenges businesses have in staying competitive, automobile manufacturers, suppliers, and tool developers jointly developed an open, standardized architecture called AUTOSAR. Established in 2008, **AUTOSAR (AUTomotive Open System Architecture)** is helping the industry at large with the following benefits:

- **Standardization of basic system functions** as an OEM wide “Standard Core” solution
- **Scalability** to different vehicle and platform variants
- **Transferability** of functions throughout the network
- **Integration** of functional modules from multiple suppliers

- Higher penetration of **Commercial-off-the-Shelf (COTS) software and hardware** components across product lines



**AUTOSAR is a layered architecture approach to design and development.**

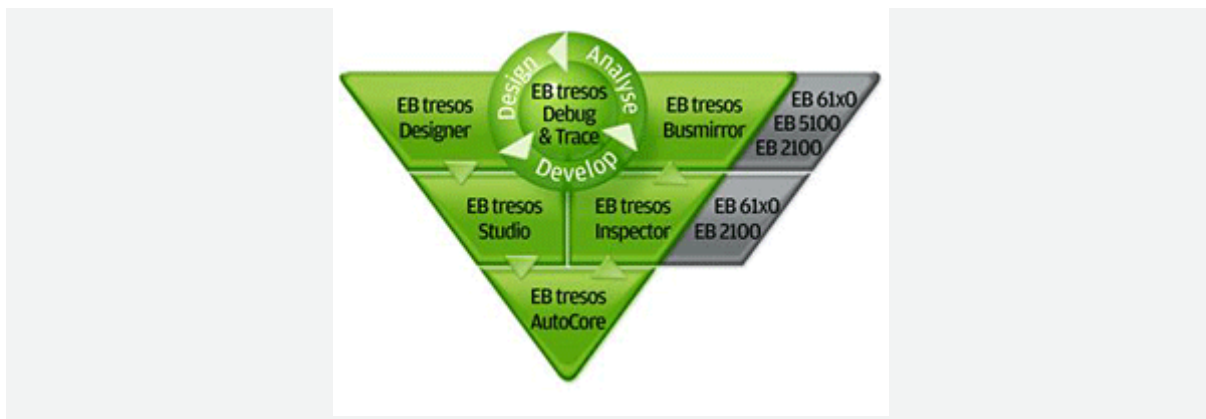
AUTOSAR provides incentives for manufacturers to replace their proprietary software/hardware interfaces with standardized interfaces to an independent architectural layer; this allows much easier component and integration testing, because hours and weeks of engineering around each interface are eliminated. Instead, manufacturers retain their ability to compete without requiring other vendors to take on the overhead associated with proprietary interfaces.

AUTOSAR compliant components ensure that the development and integration process functions as smoothly as possible, with reduced development time and costs as well as enhanced quality and efficiency.

Early indicators suggest that the vision around AUTOSAR is paying off. By 2014, more than 100 million ECUs with AUTOSAR technology are expected to be on the road. A **recent survey** of 150 German AUTOSAR experts indicates that within five years, more than 55% of all EE development projects will be based on AUTOSAR technology.

**Realizing the AUTOSAR vision**

Recently, IBM and information services company Elektrobit, which specializes in embedded software and hardware for the automotive industry, teamed up to integrate IBM Rational **Rhapsody** and Elektrobit **Tresos** into a single integrated development environment. This consolidation allows for early verification and testing of applications even before integrating them onto ECUs.



This type of integration is beneficial for the AUTOSAR community, especially for engineers seeking a comprehensive solution that spans all building blocks of an AUTOSAR compliant ECU. Automotive companies can leverage this environment to develop and test software, applications, and runtime environments more efficiently, because AUTOSAR-compliant components can be integrated into systems much faster and with less rework.

IBM provides requirements management and design tools tailored to AUTOSAR specification while Elektrobit contributes the basic software development tools and run time environments on which applications developed with Rhapsody will be executed when integrated onto the actual ECU. Through this integration, companies can achieve an effective marriage of tooling and run times, enabling them to treat software as “parts”—similar to the way mechanical components are treated.

### Tool requirements

Pretested integration between Rational Rhapsody, Elektrobit Tresos **Studio**, and Elektrobit Tresos **Win/AutoCore** enables developers to apply “continuous integration,” a well-established software engineering practice, to their AUTOSAR development process. The mantra is “integrate early, integrate often” in order to reduce late lifecycle integration risks.

For AUTOSAR developers, early detection of errors due to AUTOSAR simulation helps teams avoid costly re-designs in late development phases. With Elektrobit Tresos Win/AutoCore, developers can integrate down to lowest layer on Windows WS without deployment to actual hardware.

Early and continuous integrations are a key software engineering practice to reduce integration risks and improve time-to-market. With such integrated tools, developers can start testing their EE and ECU software from day one and incrementally add functionality while constantly testing the incremental code—translating into accurate delivery schedules and time-to-market benefits while keeping a constant check on quality.

Developers also benefit by having application design decisions based on validated ECU configurations. This means no more guesswork regarding ECU deployability, along with increased confidence that fewer software/hardware integration issues will emerge in later development phases.

### The solution at work

The world’s leading automotive suppliers and OEMs are developing AUTOSAR compliant systems today. TRW Automotive, for instance, a supplier of solutions to the global automotive market, supports the IBM and Elektrobit partnership and anticipates significant tangible benefits from the interoperability between Rhapsody and Tresos. The combined platform has provided TRW with a unified solution to bridge between EE and ECU electronic and software development, testing, and traceability.

The combined solution provides the AUTOSAR community with a way to connect system and software architecture definition and application development with ECU Run Time Environment (RTE) and Basic Software (BSW) configuration and deployment. The benefits: Automotive companies gain faster time-to-market, lower development costs, and higher quality with less risk—all of which benefit consumers who demand the latest

features in luxury and safety in their automobiles.

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