



Highlights

- Supports authoring of AUTOSAR systems, including structures and behaviors as well as code generation for AUTOSAR software component implementations; supports AUTOSAR ARXML exchange formats
 - Provides a unified approach, allowing AUTOSAR development to be linked to analysis, requirements, configuration and quality management
 - Facilitates integrated model-driven systems development, helping avoid expensive redesigns
 - Enables collaboration across the E/E and AUTOSAR development process with an open, extensible and scalable platform
 - Allows software reuse across automotive platforms and ECUs to help reduce development costs and shorten timelines
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Managing AUTOSAR development with IBM Rational software

Almost all innovative functions integrated into today's vehicles are delivered through the electric and electronic (E/E) system. E/E systems are composed of dozens of electronic control units (ECUs) with millions of lines of code running on them. Standardizing a common platform and development methodology for these ECUs and their related software represents an excellent opportunity for manufacturers and suppliers to achieve the efficiencies and cost savings that are integral to maintaining viability. This was one of the primary motivators behind the creation of the AUTomotive Open System ARchitecture (AUTOSAR) development partnership.

Taking a systems engineering approach

To leverage the benefits of AUTOSAR, the best choice for original equipment manufacturers (OEMs) and suppliers is to follow a systems engineering approach, incorporating the AUTOSAR methodology and other E/E engineering disciplines into a structured development process. Furthermore, OEMs and suppliers need to modernize existing engineering platforms and invest in tools that now also support AUTOSAR. A systems engineering approach based on the IBM Rational® software platform for automotive systems can help your organization achieve the following:

- Optimizing the benefits of the AUTOSAR approach
- Managing complexity with integrated model-driven systems and software development
- Improving requirements engineering
- Integrating quality management into engineering processes
- Managing change in a globally distributed environment
- Advancing product portfolio management
- Improving systems software delivery capabilities



Reusing assets for increased efficiency

One of the greatest advantages AUTOSAR offers is the separation between application software components on the one hand and basic software modules and the AUTOSAR run-time environment (RTE) on the other. This decouples application development from the underlying hardware, allowing software components to be moved from one ECU to another without changes, increasing reuse and providing new levels of flexibility.

While AUTOSAR itself allows specifying E/E network architectures with the ECU hardware and software components, it does not support the early phases of E/E engineering with

specifying logical vehicle functions and analyzing requirements. AUTOSAR also does not mandate a specific method for describing detailed behavior of software components.

Therefore, AUTOSAR development must be seamlessly embedded into an environment capable of supporting these aspects. At the same time, this environment must be capable of integrating AUTOSAR descriptions into the E/E engineering process. A powerful and extensible approach is to use the Systems Modeling Language (SysML), the Unified Modeling Language (UML) and UML profiles tailored to easily change from SysML to UML to AUTOSAR—and vice versa.

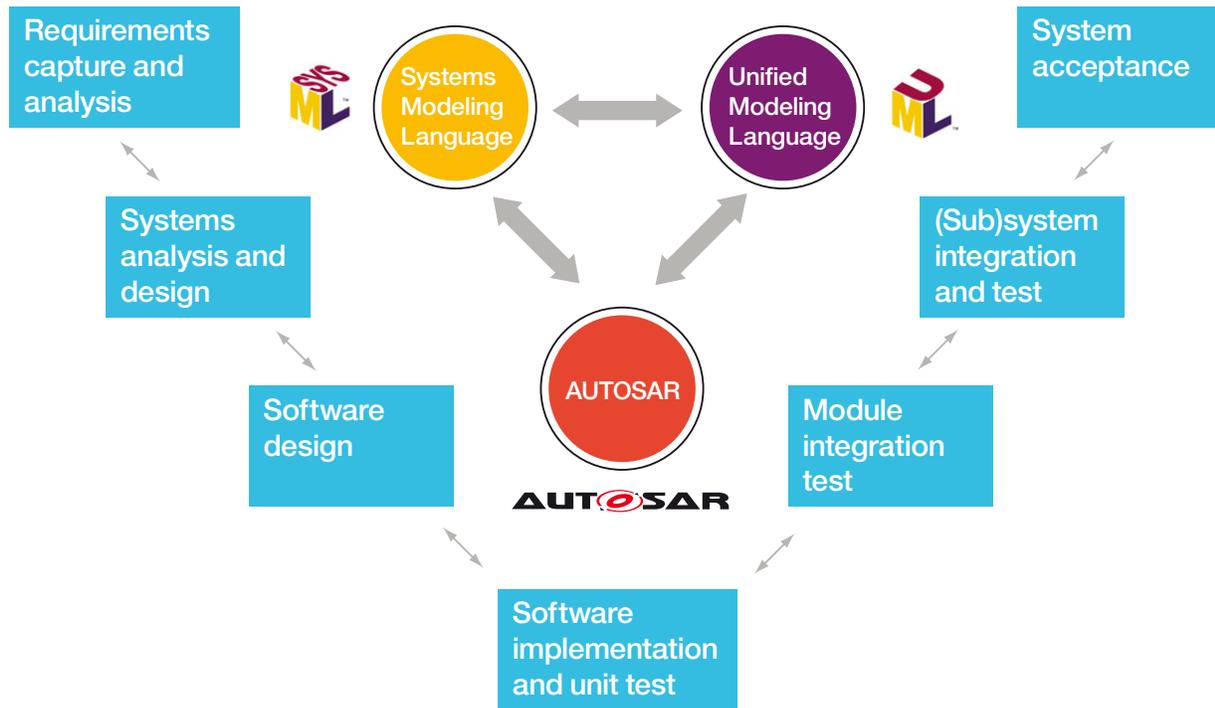


Figure 1: IBM Rational Rhapsody software supports a model-driven systems development approach based on SysML, UML and AUTOSAR input formats.

Gaining support for SysML, UML and AUTOSAR

IBM Rational Rhapsody® software supports SysML, UML and UML profiles as well as AUTOSAR input formats such as the AUTOSAR software component description, the AUTOSAR ECU description and the AUTOSAR systems description, for AUTOSAR Release 4.0 and beyond. Rational Rhapsody

software also supports the import and export of AUTOSAR XML (ARXML) exchange formats, allowing the exchange of AUTOSAR artifacts with other tools, including ECU configuration tools.

Rational Rhapsody software can generate C source code, making it what AUTOSAR calls a behavior modeling tool (BMT). This means that Rational Rhapsody software allows for

model-driven systems development covering virtually all development phases, from functional and logical design down to the technical architecture described in AUTOSAR. Furthermore, Rational Rhapsody software provides simulation capabilities allowing model-driven testing and the execution of models for verification and validation purposes.

Rational Rhapsody software isn't limited to modeling AUTOSAR input formats—it also supports mixed development programs. This enables manufacturers and suppliers to do practically all modeling within one environment, helping to eliminate gaps that might normally exist between tools. And when other modeling tools are integrated, Rational Rhapsody software can manage third-party models by providing containers that include models from other tools or existing C-code.

Driving AUTOSAR forward with model-driven systems development

This model-driven systems development approach based on SysML, UML and AUTOSAR results in a wide variety of benefits to its users:

- Models allow users to visually describe static structures and dynamic interactions of systems and system components, defining system behavior and system functionalities.
- Visual construction allows teams to express technical requirements in concise ways, helping improve system understanding and speed collaboration.
- The models can be used to experiment both in the early development phases and to verify and validate design decisions.
- Manufacturers and suppliers can potentially avoid expensive redesigns by analyzing E/E systems, a single ECU or selected software components as models before implementation.

Tapping into the collaborative power of a unified, integrated approach

IBM Rational Rhapsody software, IBM's solution for AUTOSAR, is integrated into the Rational software platform for automotive systems. This platform allows users to link AUTOSAR and other models to requirements, test and quality management while benefiting from extensive real-time collaboration capabilities. This is important because AUTOSAR development incorporates a diverse assortment of disciplines and teams and must be embedded in the broader E/E engineering life cycle. As an integral component of the Rational software platform for automotive systems, Rational Rhapsody software is supported by the other core tools described below.

IBM Rational Team Concert software

A comprehensive collaborative development environment, IBM Rational Team Concert™ software allows users to implement and automate the engineering workflows defined in the AUTOSAR methodology. These workflows can be integrated into existing engineering processes supporting other standards such as ISO 26262 or following practices as outlined in CMMI (Capability Maturity Model Integration) and Automotive SPICE (Software Process Improvement and Capability dEtermination). In addition, Rational Team Concert software provides data management of E/E artifacts including configuration and change management; work item and build management; and integrated project planning, project management and reporting. Because Rational Team Concert software is integrated with Rational Rhapsody software, modeling and authoring works hand in hand with collaboration, configuration and artifact management. This close integration is key to successful reuse across engineering teams.

IBM Rational DOORS software

IBM Rational DOORS® software is a requirements engineering tool that helps reduce costs and improve quality by optimizing requirements definition and management. This software helps manage requirements from the vehicle level down to E/E requirements, including unique requirements relevant to AUTOSAR development and related to AUTOSAR artifacts. These requirements can be connected to help ensure traceability along the engineering phases. AUTOSAR models and model elements in Rational Rhapsody software can be linked to requirements in Rational DOORS software so that traceability can be achieved.

IBM Rational Quality Manager software

IBM Rational Quality Manager software integrates with Rational Team Concert, Rational DOORS and Rational Rhapsody software, enabling the management of E/E testing and quality-related assets. This allows tests cases, test results, identified errors and related change requests to be referenced and linked to E/E and AUTOSAR configurations, requirements and models. This software also automates model-driven testing activities provided by Rational Rhapsody software. Additionally, Rational Quality Manager software helps teams collaborate through information sharing, automation to accelerate schedules and reporting on metrics for informed decisions.

Why IBM?

IBM, an AUTOSAR Premium Member, offers an integrated, comprehensive solution, with tools to help manage the vehicle development life cycle. The AUTOSAR-related workflows and assets can be efficiently managed in the engineering life cycle. Our AUTOSAR solution is embedded in an open, extensible and scalable platform, making it agnostic regarding the underlying AUTOSAR basic software and run-time environment and configuration tools. Because of the standard exchange formats defined by AUTOSAR and realized in our solution, we can deal with just about any basic software and RTE software provider.

You can also benefit from a wide variety of related IBM automotive engineering capabilities. In fact, IBM engineers are currently developing and maintaining AUTOSAR basic software components for a global automotive supplier. IBM consultants are also helping a leading OEM get ready for AUTOSAR by streamlining E/E development processes based on CMMI assessments. IBM Rational personnel can help you efficiently introduce and deploy our AUTOSAR solution based on the IBM Rational software platform for automotive systems.

For more information

To learn more about the IBM Rational software platform for automotive systems, contact your IBM representative or IBM Business Partner, or visit:

ibm.com/software/rational/solutions/automotive

Additionally, financing solutions from IBM Global Financing can enable effective cash management, protection from technology obsolescence, improved total cost of ownership and return on investment. Also, our Global Asset Recovery Services help address environmental concerns with new, more energy-efficient solutions. For more information on IBM Global Financing, visit: ibm.com/financing



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