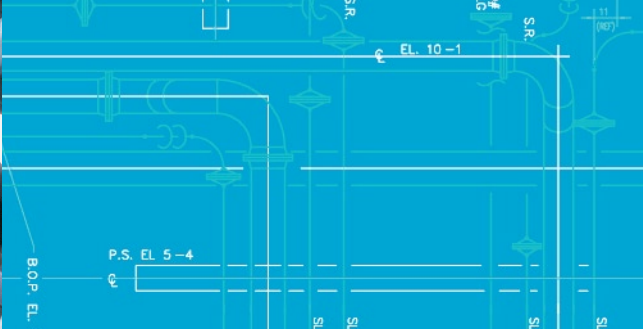Rational® software

The Rational Rhapsody family from IBM.

Solutions for collaborative, model-driven development

Model-driven development helps build a competitive edge

How do systems engineers and software developers creating embedded and realtime applications meet demands for complex, robust deliverables — especially when there is little time to produce, let alone test, the systems and software before they go into production?

In fields such as automotive electronics, avionic controls, next-generation wireless infrastructures, consumer electronics, medical devices and industrial automation, systems engineers and software designers face intense global competition. The IBM Rational® Rhapsody® family of products helps meet these challenges.

Now you can more quickly develop and deliver the high-quality solutions your customers need. The powerful, flexible modeling capabilities of the Rational Rhapsody family of products provide a systems and software development solution that operates across the requirements, specification, design, implementation and testing phases of the development lifecycle.

Rational Rhapsody solutions are designed to accelerate development, manage complexity, enhance testability, reduce costs and improve quality by leveraging the Object Management Group's (OMG's) Systems Modeling Language (SysML)/Unified Modeling Language (UML) environment. Throughout the process, the advanced systems design and analysis capabilities of the Rational Rhapsody family can help reduce complexity, drive productivity and keep system engineers and software developers collaborating to produce better-quality results, faster.

As a leading environment for SysML/UML model-driven development (MDD), the Rational Rhapsody family addresses the needs of both systems engineers and software developers. Winners of several prestigious embedded industry awards, Rational Rhapsody solutions are recognized as top MDD solutions by engineers and developers in a wide variety of industries ranging from automotive and aerospace to medical and transportation.

Enable faster, more agile software development

The SysML/UML-compliant Rational Rhapsody family provides products that can be extended for domain-specific modeling, creating a collaborative development environment that allows both large and small teams to communicate effectively and productively. Integrated requirements management and traceability features can help ensure that product design meets stakeholder requirements. Model-driven testing capabilities help reduce defects early in the process and help ensure validation against requirements.

Rational Rhapsody solutions can accelerate development by generating full applications, not just code frames, that can be built and tested on a host platform before hardware is available. These applications can then be quickly retargeted to the hardware — empowering developers to leap ahead of their competition.

MDD technology also enables professionals to achieve virtually unparalleled productivity gains over traditional, document-driven approaches because it enables users to graphically specify the system design and architecture and then simulate to validate the system as it is being built. With MDD, engineers and developers have the tools they need to produce a system specification designed to be complete, correct and unambiguous. The Rational Rhapsody family's support for model-driven architecture (MDA) enables engineers and developers to rapidly turn a platform-independent model (PIM) to a platform-specific model (PSM) that targets a realtime, embedded operating system or simple scheduler.

Rational Rhapsody solutions promote an agile design approach in which users repeatedly execute and validate software on the host environment and then bring it down to the embedded target for testing. Rational Rhapsody solutions lend themselves to a design approach in which software can be constantly executed and validated on the host environment to discover defects early in the development process.

An industry-leading solution enhances quality and productivity

The Rational Rhapsody MDD environment for embedded software, systems and testing concentrates on product depth for a truly world-class experience — one that has been hailed by critics as a top modeling product for systems, software and testing. By integrating and automating the systems and software engineering process to achieve deployable systems, the open architecture of Rational Rhapsody solutions facilitates new levels of quality and productivity.

Rational Rhapsody solutions provide a flexible environment that an organization can tailor for its current domain and tool chain by extending the language to its domain-specific modeling. In addition, customization is available through powerful application programming interfaces (APIs), enabling development automation to increase productivity and integration with tools such as configuration management or other modeling capabilities.

In addition, Rational Rhapsody solutions provide engineers and developers with the capability to generate full applications for embedded target hardware — including behavioral diagrams — helping to reduce development time and enabling end users to meet challenging time-to-market pressures. Innovative code visualization paired with powerful reverse-engineering capabilities enable the integration of legacy code and reuse of existing intellectual property.

"As embedded software and systems developers' project demands continue to become more complex amid unrelenting time-to-market pressures, VDC expects that modeling tools that can efficiently integrate legacy code within new designs will increasingly be placed at a premium."

— Chris Rommel, analyst, VDC Embedded Software Practice

Rational Rhapsody solutions for systems engineers

The Rational Rhapsody family of products gives systems engineers the tools to specify a system correctly—and to communicate the system more effectively to all stakeholders in the development process. Simulation capabilities also enable engineers to drastically reduce errors in the model early in the process, when the cost of fixes is significantly lower than during testing or deployment. Rational Rhapsody solutions for systems engineering are designed to be:

- **Intuitive.** The IBM Rational Rhapsody Designer for Systems Engineers package presents its features in a layout designed to appear natural and with a workflow designed to feel intuitive.
- **Correct.** By leveraging the SysML/ UML environment, systems engineers can clearly and unambiguously

capture requirements and design. The software's check-model capability is designed to ensure that the model and its interfaces are complete and correct. And the built-in simulation environment in the IBM Rational Rhapsody Developer and Rational Rhapsody Designer for Systems Engineers tools helps ensure that the design is free from behavioral errors.

- **Managed.** The IBM Rational Rhapsody Gateway Add On solution provides a powerful traceability solution that uses a bidirectional interface between the model and leading requirements management and authoring products— helping to ensure that the design covers requirements.
- **Automatic.** At the push of a button, using the ReporterPLUS feature of the IBM Rational Rhapsody Tools and Utilities Add On automatically produces customizable systems engineering specification documents.

Rational Rhapsody solutions for software developers

Rational Rhapsody solutions are designed to allow software developers to work in a comfortable, intuitive environment—including Eclipse. Rational Rhapsody solutions can generate applications in C, C++, Java™ and Ada languages for 8-, 16-, 32- and 64-bit applications using a realtime framework. This can allow rapid retargeting of code to a different realtime operating system (RTOS) or even to no RTOS at all. Rational Rhapsody solutions for software development are designed to be:

- **Efficient.** Software development can begin on the host to validate functional behavior early—even before target hardware is available. After the target is available, the developer can more efficiently use target resources by focusing on debugging target-specific issues.
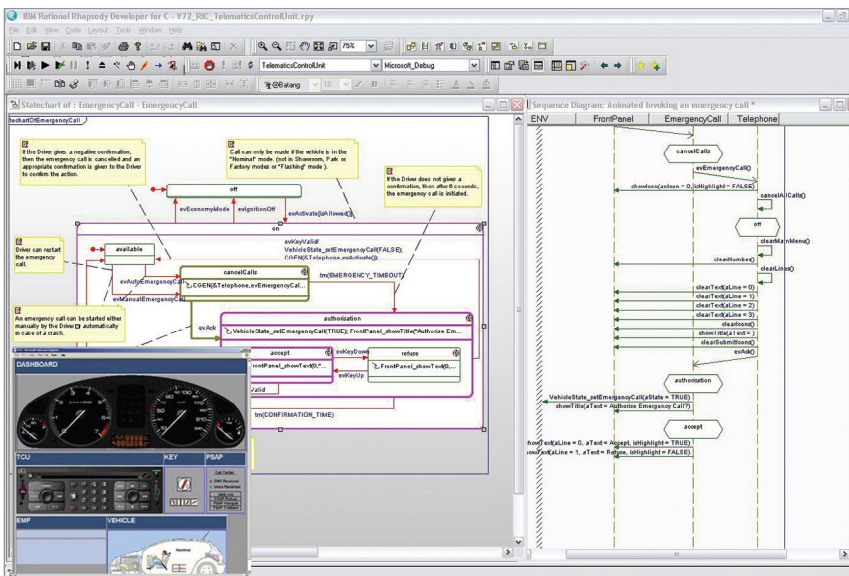

Figure 1: Advanced simulation in Rational Rhapsody products offers early identification of errors through design-level debugging.

- **Automated.** Combined with a realtime framework, Rational Rhapsody Developer generates code from structural and behavioral model views, along with build artifacts, to produce an executable application for C, C++, Java or Ada more quickly than manually typing code.

- **Opportunistic.** Development projects rarely start from scratch; they're usually based on existing code and leverage third-party libraries. Rational Rhapsody solutions graphically represent existing code and leverage external code within the model to build and document applications and improve team communication.

- **Flexible.** Rational Rhapsody solutions enable a code-centric workflow, easing MDD adoption. Whether changes are made in the model or within the code, they are dynamically updated in both. Developers who prefer a model-based approach can design at a higher level of abstraction, analyze and validate the design at the graphical level, and produce code and documentation automatically. A combination of approaches is also possible.

- **Feature rich.** The Rational Rhapsody family provides a feature-rich solution for designing, developing, testing and implementing robust, high-quality code in an environment that has multiple domain-specific language capabilities.

The Rational Rhapsody family across industries

Rational Rhapsody solutions use the industry's leading modeling language—SysML and UML—as well as specific domain extensions for C developers and developers working with the Department of Defense Architecture Framework (DoDAF) in the United States and the Ministry of Defence Architecture Framework (MODAF) in the United Kingdom. This enables systems and software engineers to work in the language best suited to the project's needs, virtually regardless of industry or embedded device. For industry-specific development, Rational Rhapsody solutions are designed to be:

- **Consistent.** Because the diagrams in a Rational Rhapsody model are interrelated, changes to an element in one diagram are automatically propagated across the model, enhancing data consistency across systems.

- **Traceable.** The IBM Rational Rhapsody for DoDAF, MODAF, and UPDM Add On solution uses standard DoDAF and MODAF diagrams and notations to support the design, construction and analysis of compliant DoDAF or MODAF architectures. This enables engineers and developers to validate their architecture by simulating the model, automatically generating the derived products and comprehensive DoDAF or MODAF documentation while achieving traceability.

- **Reusable.** Rational Rhapsody support of AUTOSAR for automotive systems and software applications is one of the first AUTOSAR-specific MDD environments to leverage SysML and UML. Now automotive engineers can reuse specifications for common vehicle features across multiple product lines, improving time to market while increasing brand consistency.
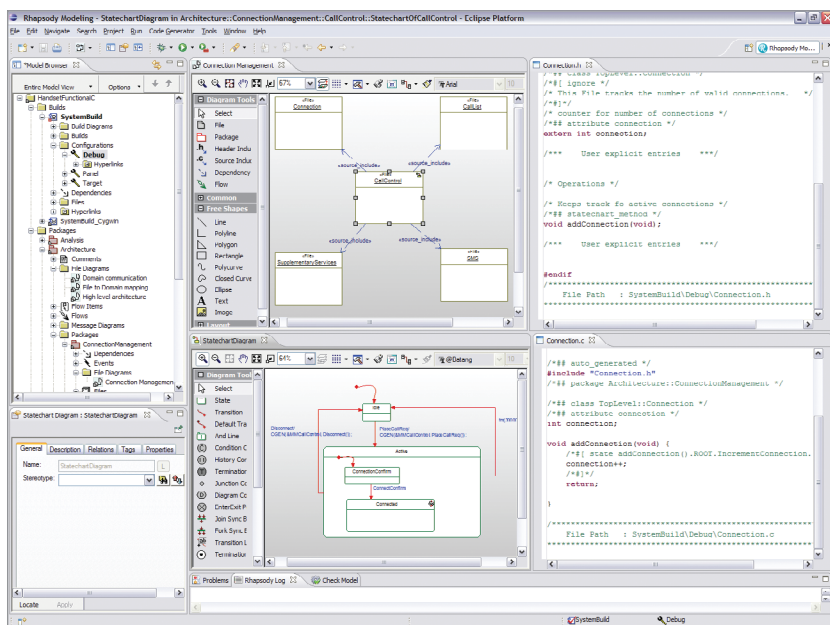

Figure 2: Rational Rhapsody solutions integrate into the Eclipse environment, creating a powerful platform for model and code development and debug.

Management and traceability for integrated requirements

The Rational Rhapsody family of products delivers integrated requirements management and traceability solutions for even the most complex projects, providing users with the requirements capture, traceability and analysis capabilities they need. Rational Rhapsody Gateway Add On provides a bidirectional interface to requirements management products, including IBM Rational DOORS®, IBM Rational Requisite Pro, Microsoft® Word and Microsoft Excel software, enabling comprehensive traceability analysis.

Rational Rhapsody solutions capture project requirements using requirements diagrams, use-case diagrams, sequence diagrams, activity diagrams and state charts. Users then create traceability links from the model to the requirements, automatically providing comprehensive traceability, impact analysis and coverage documentation.

Model-driven testing to support quality design

Rational Rhapsody model-driven testing (MDT) is a new paradigm that brings the benefits of MDD to the testing process. MDT allows engineers to iteratively simulate a design to locate errors early in the process, automate tedious testing, incorporate requirements-based testing to validate the design against requirements, and use IBM Rational Rhapsody Automatic Test Generation Add On capabilities to automatically create coverage tests from the design. The graphical panel feature in the solution brings the design to life with a mock-up or prototype that simulates the design with elements such as knobs, meters or buttons, enabling early validation and communication of functional behavior.

Using the IBM Rational Rhapsody TestConductor Add On solution, engineers and developers can create unit test cases graphically using UML sequence diagrams, state charts, activity diagrams or flowcharts. And they can develop test cases in code. Not only do graphical test cases help customers and project stakeholders better understand code tests, but they also help communicate intended behavior more effectively. The solution creates a unified repository with requirements, implementation and test cases all stored within the same environment.

Rational Rhapsody TestConductor Add On automates the testing process by automatically creating a test architecture, driving inputs into the system under test and monitoring outputs to automate the validation of the design against the requirements on host or target. Developers can manually create a suite of test cases for unit testing or regression testing, or they can leverage sequence diagrams created during simulation.
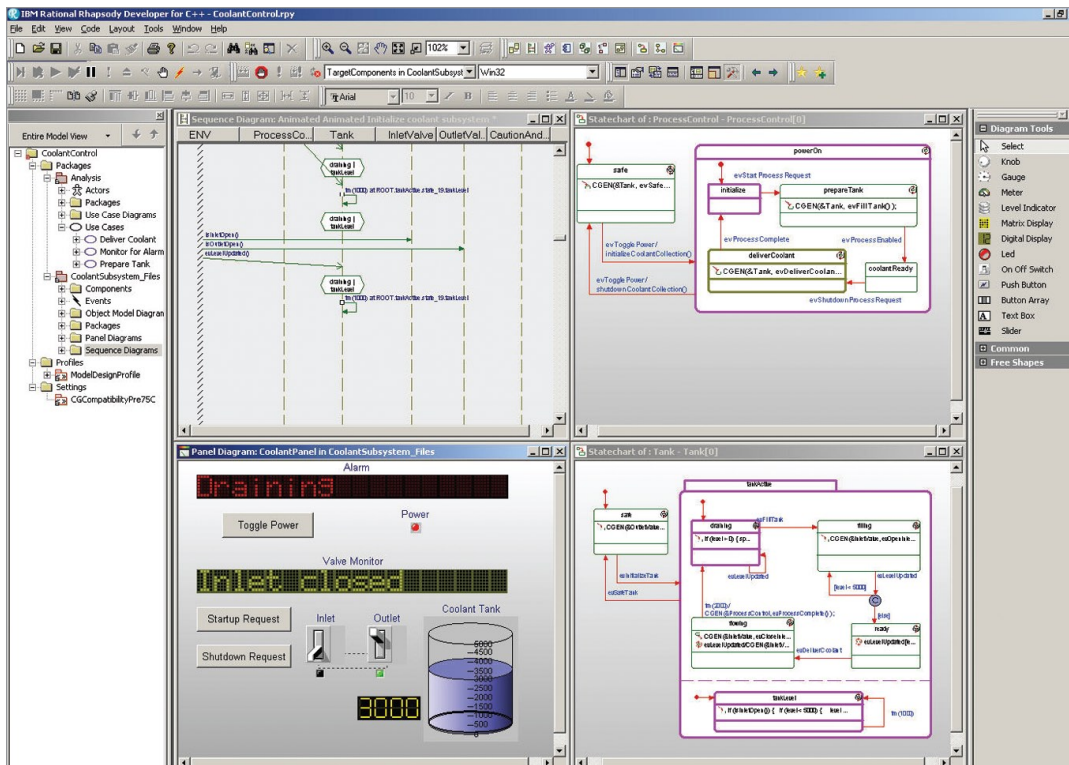

Figure 3: Using realistic graphical panels, designers can iteratively simulate and debug software.

For additional target testing, Rational Rhapsody TestConductor Add On test cases can be exported and run for verification using IBM Rational Test RealTime software to enable code coverage, performance and memory profiling integrated with validation testing. The verification results are stored within the Rational Rhapsody solution, and the MDT activities are exportable to Rational Test RealTime to create a comprehensive, model-based testing solution, helping to ensure that goals for quality and robustness are met during the design phase.

Collaborative development with enhanced documentation

Rational Rhapsody helps simplify the delivery and maintenance of design documentation over the life of a project with customizable documentation generation to synchronize design, documentation and code. ReporterPLUS can generate documentation in text, HTML, rich text format (RTF), Microsoft Power-Point or Microsoft Word directly from the design. For formal reports and design reviews, wizard-based document generation tools can help you easily update or regenerate documentation each time the design changes.

The configuration management interface used throughout the Rational Rhapsody family promotes concurrent, collaborative engineering and enables developers and engineers to create, review, share and modify models across a project, organization or globally distributed team via the Internet. Rational Rhapsody solutions interface with popular configuration management products including IBM Rational Team Concert™, IBM Rational ClearCase® and IBM Rational Synergy software, helping to ensure that project data is synchronized under configuration control.

"Model-driven development with UML and SysML has become essential for improving productivity and quality of embedded software development. [Rational] Rhapsody provides features that enable embedded developers to validate their designs early and improve productivity. [Rational] Rhapsody's unique support for both code-centric and model-centric workflows should help traditional coders more easily adopt model-driven development, and its support for strategic software asset reuse will enable organizations to more effectively leverage their intellectual property."

— Dr. Jerry Krasner, Embedded Market Forecasters

Why IBM?

The Rational Rhapsody product family offers MDD environments for systems engineers and software developers throughout the product development lifecycle — from requirements capture to implementation and system acceptance testing. Based on industry-standard SysML/UML languages and generating full behavioral C, C++, Java and Ada languages from model-based designs, Rational Rhapsody solutions promote early validation of design behavior through simulation and execution to identify design errors when they are introduced — and less costly to fix.

Rational Rhapsody products address a broad range of system, software and test development challenges. Designed for ease of use, early design validation and increased productivity — including integration within the Eclipse platform — these solutions can help embedded and realtime developers more quickly and easily build and deliver the complex, robust, high-quality products that today's marketplace demands.

For more information

To learn more about the IBM Rational Rhapsody family of products, contact your IBM representative or IBM Business Partner, or visit:

ibm.com/software/rational