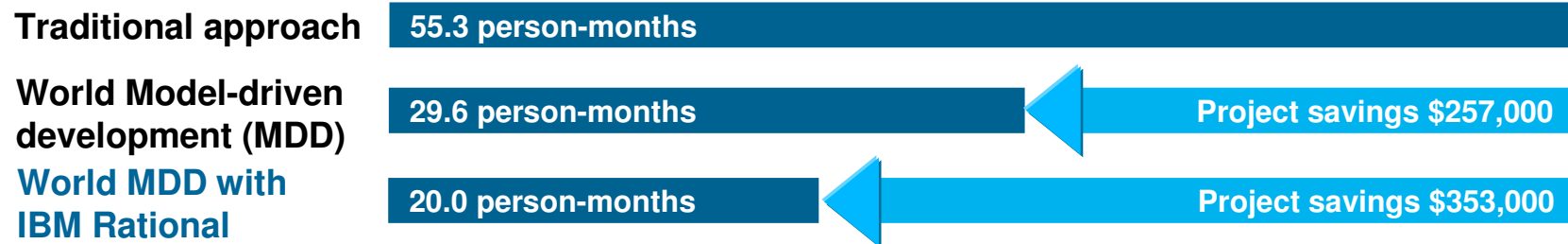IBM

IBM Rational Rhapsody Case Studies

Tap into Pools of Productivity
To free up time for innovation with automation & integration

**Average Developer time lost to delays in design completion**

Traditional approach — 55.3 person-months

World Model-driven development (MDD) — 29.6 person-months — **Project savings $257,000**

World MDD with IBM Rational — 20.0 person-months — **Project savings $353,000**

Source: *2011 EMF Study*

A move to architecture & design best practices and integrated solutions will _significantly_ free up time for innovation

Embedded Market Leadership

- VDC data shows IBM/Rational as the market leader of standard language-based, embedded software / system modeling tools for the 2011 calendar year*.

percent of dollars 2011
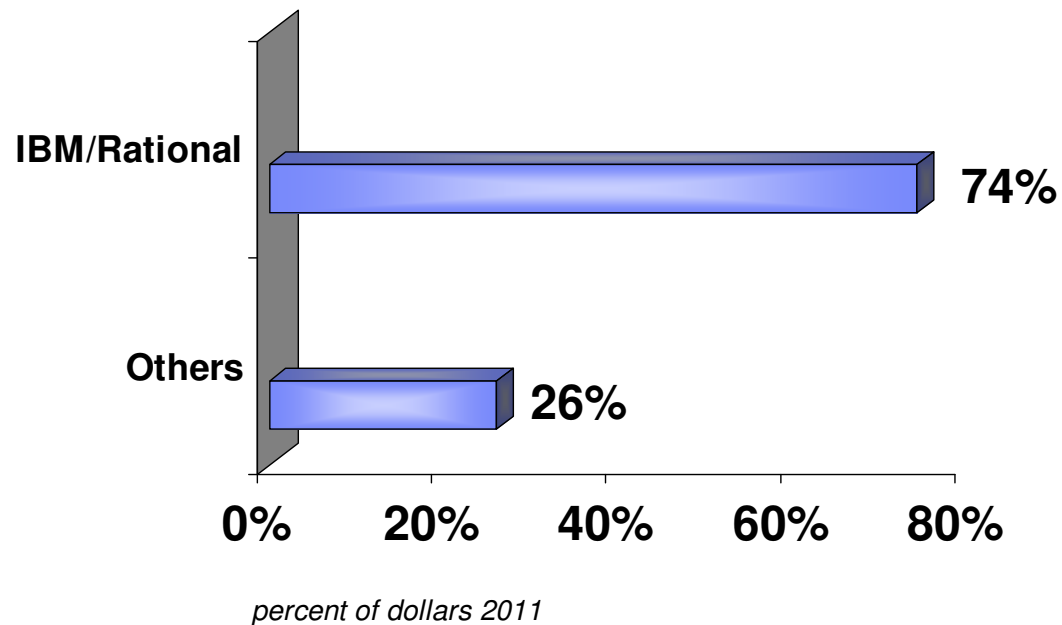
•Source: 2012 Software & System Lifecycle Management Tools Market Intelligence Service, Volume 1: Software & System Modeling Tools – April 2012, VDC Research

The Quantified RoI (1 of 2)

Business Challenge	Rational Solution (Product/Feature)	Business benefit Examples in italics below,	Customer Examples (links to references)
Improve productivity across product development team	Automated generation of full production code for C, C++, Java, and Ada allows developers to focus on model level structural and behavioral design Seamless host/target development enabling development and test before hardware available Automated test generation based on system and software requirements understanding can be leveraged to improve the overall productivity of the testing effort, right from the start.	- *Speed and time to value* - *Faster delivery of software components that are in synch with the design* - *Improved quality and certainty of delivered product meeting customer needs*	Alps Electric Co., Ltd. - Development cut by 50-60% Valtech India Systems Pvt. Ltd. - Increased productivity by 40 percent
Pressure to reduce time-to-market	Early exploration and validation with stakeholders of alternative solutions based on requirements combined with automation of code, test and documentation generation reduce the cost of development. Opportunities to reuse design elements is greatly increased removing the recurring build-from-scratch situations. Continuous verification and validation during development reduces late stage testing time	- *Products and components delivered faster with improved quality* - *Products meet market demands*	Brockwell Technologies, Inc. -improvement in time-to-market up to 40 percent -Kyocera - New product development time reduced by 30% Ikerlan-IK4 - Reduced development time by factor of 10 for each product variant
Cost to develop new products and services is out of control	Early exploration of alternative solutions based on requirements combined with automation of code, test and documentation generation reduce the cost of development. Further opportunities to reuse design elements is greatly increased removing the recurring build-from-scratch situations.	- *Reduced overall product costs – matches requirements, automation reduces build time, reuse drives efficiency in new design* - *Intellectual capital retention, reducing % attrition* - *Reduced knowledge management costs*	iPLON GmbH - "pre-production defects down by 25 % leading to savings of about €10000 per product."

The Quantified RoI (2 of 2)

Business Challenge	Rational Solution (Product/Feature)	Business benefit Examples in italics below,	Customer Examples (links to references)
Managing increasing design complexity	Systems and software are visualized both structurally and behaviorally at various levels of abstraction.	*Graphically specified systems and software designs to abstract away complexity* *Cost savings – labor, upfront capital, infrastructure optimization, training, reduction of redundant processes*	Tata Consultancy Services Ltd. -Established stakeholder understanding with 90 percent concurrence across sites iPLON GmbH - Developers able to support new platform in 4 weeks vs 12 before
Costly quality issues (recalls, penalties, reputation)	Simulation and automated test generation combine to ensure that quality is determined early on and throughout the development cycle.	*Continuous validation through simulation of the system as it is being built* *Improved product quality with continuous error checking*	Valtech India Systems Pvt. Ltd. - Reduces defects from initial usage by 75 percent Alps Electric Co., Ltd. -Defects reduced by almost 70 percent -Kyocera - 80% of design defects detected before production

A European defense company

What if your design team could work across national borders to simulate complex processes and identify potential issues early in the development cycle?
A European defense company changes the game for product development by providing its transnational staff of missile systems engineers with advanced process modeling capabilities, allowing them to detect, share and resolve problems well before production.

The Opportunity

As if the complexities of developing missiles and missile systems weren't enough, this multinational defense contractor also faced a range of collaborative and business challenges. Its design teams are widely dispersed and its documentation procedures were informal and inadequate, leading to an overreliance on the specific knowledge of individual engineers and designers. Communication and traceability across the company's engineering organizations were compromised in a highly competitive business environment that compels compliance with stringent documentation and development traceability requirements. The company needed to improve and standardize its process for defining, communicating and analyzing design requirements for each missile system it engineered and designed.

What Makes it Smarter

Collaboration is not rocket science; it's nothing more than making sure everyone's working with the same information. However, as rocket scientists at this defense contractor will attest, collaboration is essential. The missile developer deployed a model-based systems engineering platform as a means for widely distributed design and engineering teams to analyze and communicate the software, mechanical and electrical requirements of its various missile systems. Using simulation and executable modeling, these engineers and designers are now able to define, test and verify all the complex requirements of each missile system, allowing them to correct errors much earlier in the development phase and accelerate the entire development lifecycle. Every phase of development is now documented and accessible to every design team, improving time to market, eliminating redundancies and reducing development costs.

Real Business Results

- Reduces typical system design time by 70 percent, speeding time to market, increasing customer satisfaction and providing a critical differentiator in a highly competitive market

- Speeds identification of design incompatibilities, helping to avoid critical programming delays

- Eases identification and communication of defects in the system, component requirements and designs

Solution Components

- IBM Rational® DOORS®
- IBM Rational Rhapsody®
- IBM Rational Rhapsody Gateway

We're now able to define and model all the requirements of a complex missile system very early in the development process. This differentiates our delivery capabilities in a highly competitive global marketplace.

European defense company – real world results
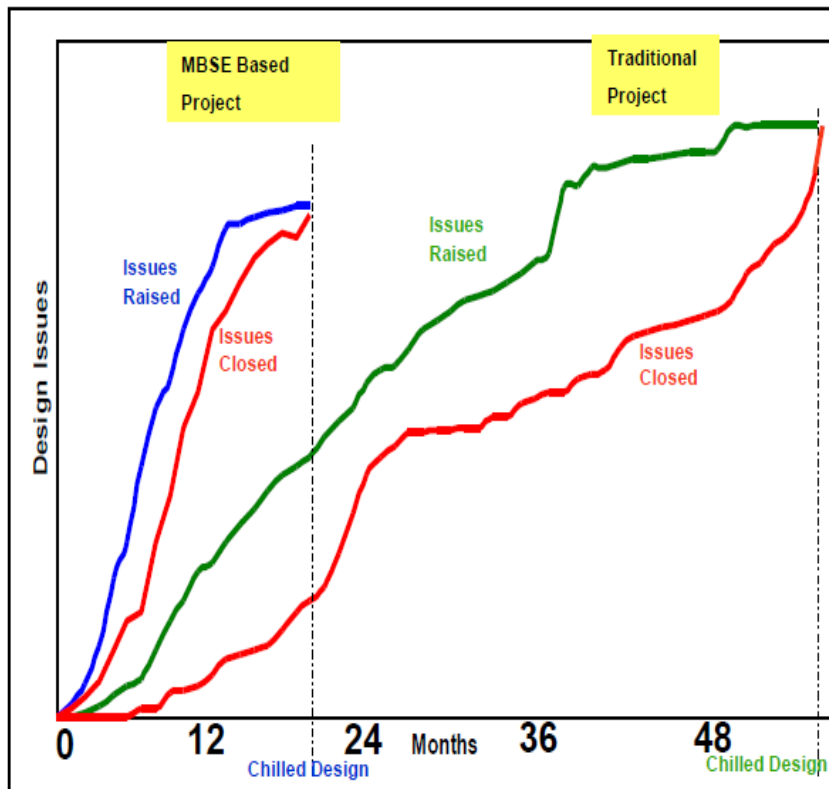
- Model Based System Engineering Project (MBSE)
  - Close collaboration with customers
  - Facilitated workshops based around prioritized Use Case Analysis
  - Issues resolved within days/weeks

- Traditional (Textual Requirements)
  - Regular customer design reviews
  - Design studies main source of issue resolution
  - Issues resolved within Weeks/Months
  - Several Design issues remained at "Design Chill"

A military vehicle contractor

What if you could build safer, more reliable and more efficient military vehicles?
A military contractor is more responsive to the military's needs requirements and shrinking government budgets when it introduces a model-driven development approach to underwater vehicle system design.

The Opportunity

The US military is using more than 450 unmanned military vehicles to perform delicate and dangerous tasks that include surveillance, rescue and recovery, and mine detection. Commercial interests use similar vehicles for tasks such as servicing deep-sea oil platforms. To build these vehicles faster and with limited budget resources, the engineering teams at this military contractor needed to incorporate changing requirements earlier in the design phase of vehicles to reduce costs and meet performance expectations.

What Makes it Smarter

There is no room for failure at one mile underwater, even for an unmanned vehicle. This defense contractor is delivering safer and more efficient underwater vehicles through sophisticated modeling that enables detailed prototyping and detection of errors in advance. By integrating systems modeling with mechanical analysis modeling, the contractor created a conceptual design engineering platform that can handle a broader range of requirements and configurations needed to build different kinds of vehicles. Through the advanced mathematical modeling enabled by the solution, engineers can quickly create design comparisons and understand design impacts on final outcomes earlier in the development process. For example, if a submersible motor must function at a certain speed to meet military requirements, the solution determines how the choice of different materials for the motor will affect performance and costs.

Real Business Results

- Reduced vehicle weight in a single demonstration by 3 to 4 percent, resulting in vehicle cost savings of 0.6 percent

- Saved more than USD200,000 during execution of design proposals and studies that resulted in the awarding of a USD1 million contract

- Increased ability to reuse components and parts on multiple vehicles, further reducing development and production times

Solution Components
- IBM® Rational® ClearCase®
- IBM® Rational ClearQuest®
- IBM® Rational Rhapsody®

The new reality in the military is that faster and cheaper development is required, but the performance demands are the same or even greater. By integrating systems modeling with mechanical analysis modeling, we're able to create designs that incorporate requirements earlier in the process. That's saving us time during development and helping us make more cost-efficient submersibles.

Brockwell Technologies, Inc.

What if we could improve national defense by analyzing weapons before they are built?
Brockwell Technologies, Inc. is using predictive modeling to ensure it is developing error-free, higher-quality weapons systems.

The Opportunity

Because of its work in the demanding weapons systems development arena, Brockwell Technologies, Inc. needed to better visualize applications and systems to identify and fix design flaws early.

BTI
BROCKWELL TECHNOLOGIES, INC

Solution Components

• IBM Rational® Rhapsody®

"Because weapon systems are so interconnected, we often face the challenge of how to change one system without affecting the integrity of another. With our new modeling tool, we can prototype systems to see how they function and whether they impact others, before going on to production."
Tim Brockwell – Founder, Brockwell Technologies, Inc.

What Makes It Smarter

Connecting all stages in the development cycle – from system requirements to computer codes, to testing and risk management – is creating more robust models that help the company visualize how well a weapon system will function. Through predictive modeling and simulations, engineers are identifying design flaws early on and continuously throughout the development process before the products are mass-produced. As a result, they are improving safety and reducing the time it takes to get new products to military clients.

Real Business Results

• Enhanced the company's efficiency by allowing it to address problems early

• Decreased time-to-market of new products by 40%

• Improved reliability and safety of weapons systems through early simulation of designs

• Allowed simulation early in the development cycle to help ensure the reliability and safety of the weapons systems

Israel Aerospace Industries Ltd.

Saves product development time with a data relationship hub for integrated engineering

The need:

As a leader in developing aerospace technology, Israel Aerospace Industries (IAI) uses a wide variety of applications from specialized vendors across multiple engineering disciplines. During product development, engineers working on projects need access to and awareness of data created across the different engineering disciplines. As product complexity grows, engineering processes must be executed across a complex development environment with greater awareness and more rapid response to changing requirements from various engineering teams.

The solution:

IAI is evaluating a data relationship hub for integrated product engineering. This first-of-a-kind project with IBM Research and IBM's PDIF solution team collects and maintains relationships among engineering elements, providing a holistic view and enabling search, impact analysis, traceability, interconnectivity rule-checking and common base-lining among the various engineering tools. IAI is building a scalable "virtual" system for product development across a multi-vendor application landscape with new insight for managing product complexity and expanded capabilities for exploring and navigating product definition data.

What makes it smarter:

- Identifies relationships between data elements and provides intelligence by revealing knowledge previously hidden across disparate data to foster vendor collaboration and reduce costs due to inefficiency

- Makes the most of previously developed product designs and information by retaining and reusing relationships among data objects

- Works with diverse data types to enable cross-functional product coordination and reduces the risk of engineering failures

"The relationship hub will help to shorten development time by enabling data continuity across inter-disciplinary processes to deliver the high level of product development quality and reliability required in the aerospace industry."

— *Dr. M. Winokur, Corporate Director, Eng. and Development, IAI*

Solution components:

- IBM® Rational® DOORS; System Architect; Rhapsody; Publishing Engine

- IBM Research Developed Assets

- IAI and third party tools

Schleuniger

Shortens time to market while gaining an efficient system development process

The need:

Schleuniger trades in a domain where usability and flexibility are key features that customers look out for. It must be possible to retrofit the machines, and the changeover must be swift and simple. To accomplish its business goals, Schleuniger needed a solution that would focus on modular construction, intuitive operation and reusable platforms.

The solution:

Driven by the rising demand for greater quality and flexibility of the fully automatic machines, Schleuniger engaged IBM® Business Partner EVOCEAN GmbH to introduce IBM Rational® Rhapsody® software into its development processes. The new solution simplified development, reduced complexity and increased the degree of flexibility.

The benefits:

- Delivers products to the marketplace more quickly

- Gains the ability to create reusable platforms, which reduces development costs

- Developers find it easier to communicate, documentation is always up-to-date, and the development process is a lot more efficient

Solution components:

- IBM® Rational® Rhapsody®

Business Partner:

- EVOCEAN GmbH

Schleuniger®
To Be Precise.

Invensys Rail Dimetronic

Can your processes keep your business on track, even in the face of high-speed change?
A railway systems developer speeds innovation and solution deployment with a unified platform for modeling, testing, tracking and documenting highly iterative, multi-stage development processes.

The Opportunity

Invensys Rail Dimetronic develops signaling systems used by railway operators throughout Europe to coordinate train movements, speeds and schedules. The EU, meanwhile, is establishing a single set of railway system standards, called European Rail Traffic Management System (ERTMS), across Europe, which sets standards for signaling system providers, including requirements for safety, end-to-end process traceability and testing. Those standards are continually evolving, as are the unique requirements of railway operators. Keeping pace with those ERTMS standards while simultaneously meeting unique customer needs and ensuring its systems' integration with other railway technologies required that Invensys Rail Dimetronic modernize its development processes, from code management to change management.

What Makes it Smarter

With trains capable of traveling 350 km/hr., the margin of error for railway operators is akin to that of air traffic controllers, and the stakes are just as high. Solutions from signaling systems providers are among a select class of solutions that must operate with virtually 100% reliability or risk loss of life. Invensys Rail Dimetronic incorporated system intelligence into its solution development process by deploying an automated application development platform that leverages actual signaling system usage results to model system reliability and to highlight areas requiring improvement. As ERTMS standards or customer needs change, developers now analyze and evaluate those changes to form a plan of attack, quickly modeling, configuring, validating and demonstrating the integration of components within the signaling systems software. This ability to model code changes in real-time is key to isolating and correcting errors affecting every customer and ERTMS requirement early in the design process. Developers from numerous autonomous teams, who share code management responsibilities, track changes and generate reports through automated requirements management capabilities and a web-based interface. This allows the company to comply with ERTMS traceability and safety standards and assure customers that the system has been adequately analyzed, tested and documented.
.

Real Business Results

- Reduces time-to-market for signaling systems products by 40%

- Facilitates 100% compliance rate with ERTMS standards for code traceability and safety

- Reduces cost and risks of development and documentation.

Solution Components

- IBM Rational Rhapsody
- IBM Rational DOORS
- IBM Rational Synergy
- IBM Rational Change
- IBM Rational Publishing Engine
- IBM Software Services

"Innovation and process flexibility are important in allowing us to differentiate our offerings. We're now able to ensure that our design can be rapidly adapted, not only to customer needs, but to changing ERTMS requirements, at a reasonable cost."

Francisco Lozano
ERTMS Program Manager

A Leading Electronic Device Manufacturer

What if an electronics company could figure out a smarter way to get the software "brains" into its innovative devices?
This electronics manufacturer uses a collaborative, model-driven software engineering process to find 95% of software bugs while products are still in development, leading to faster time to market and higher quality devices

The Opportunity

To become and remain a leader in the electronic device industry, which is characterized by rapid technological innovation, a company must be capable of more innovative and timely new product development than its competitors in the global marketplace. As part of its innovation goals, this electronics company, which makes everything from cameras to printers, scanners and copiers, wanted to implement a fast, responsive and quality-focused design and development process for innovative new products. The company wanted to implement best practices and tools in design and project management to help improve product development capability, productivity and time to market, while reducing development costs.

What Makes it Smarter

Inside every electronic device, from your Smart Phone to your digital camera, is embedded software that makes these innovative devices function. This electronic device manufacturer is now able to synchronize the entire design, development and implementation process for embedded software in its products – from concept through product shipment – with a single integrated engineering framework solution. The framework includes diagnostic assessment methodology and best practices for problem resolution, as well as an embedded software development factory. Visualization and reusable design modules help find any errors or "bugs" early in the design process, instead of during product testing. Better quality control means earlier product launches, and meeting shipping and order deadlines to get devices on the shelves – keeping customers happy and staying ahead of the competition.

Real Business Results

- Improves quality control and time-to-market of new products using visualization during the design process, removing 95% of "bugs" before the testing process

- Expected to increase business unit revenue by 25% in 2015 as compared with that of 2010

- Lowers overall development costs by enabling the reuse of software assets through the use of model-driven methodology

- Improves customer satisfaction through higher quality products, and by meeting projected launch and shipping dates of new product lines and models

Solution Components

- IBM Rational Rhapsody; IBM Rational DOORS
- IBM Global Services - Application Services (GBS-AIS and/or AMS): GBS App Innovation Svcs: Business Application Modernization; AMS Services: Business Application Modernization

The engineering process can now be visualized, and progress on tasks confirmed. This enables the company to develop high quality deliverables quickly in an increasingly complex developing environment, leading to increased competitiveness, and higher customer satisfaction.

A Leading Auto Manufacturer

What if a manufacturer could develop a complex new product and bring it to market in half the usual time required?
A leading North American automotive manufacturer deployed a suite of advanced collaborative and modeling solutions to design, prototype and build an extended-range electric vehicle in just 29 months – half the usual time.

The Opportunity

This leading automotive manufacturer needed to rapidly develop and deliver to market a new electric vehicle that was attractive to consumers and that delivered a broader, resounding message to the market about the company's renewed vitality and ability to compete.

What Makes It Smarter

Creating a new vehicle from scratch and getting it to market in record time requires creativity, coordination across the enterprise, and the tools to maximize team effectiveness and bring it all together. The solution this auto maker implemented simulates real-world driving conditions and consumer preferences, which enabled it to create a new extended-range electric vehicle in half the time usually required to bring an automobile to market. The result: an exciting, smarter automobile that requires minimal gasoline and delivers new levels of internet connectivity and smartphone-inspired controls. And a company that's got its mojo back.

Real Business Results

- Reduced development time for new powertrain technology by 50%

- Improved vehicle efficiency through a software-controlled battery pack and engine management systems, making it more attractive to consumers

- Established the manufacturer as a key competitor in the burgeoning electric vehicle space

- Increased the manufacturer's collaborative capabilities, which are vital for similar products where time-to-market is critical

Solution Components

- IBM Rational® Software
- IBM Global Services – Application Services
- IBM Rational® Professional Services

"Bringing a new car to market in record time in the midst of an economic downturn was a huge challenge. But it was one we were able to meet because of the dedication of our development team and the increased collaboration and advanced modeling capabilities of the suite of solutions we deployed."

A German Automotive Industry Supplier

What if you could correct errors in a prototype before it was even produced?

A German automotive industry supplier is using a model-driven development environment to increase efficiencies and speed time-to-market.

The Opportunity

The company was utilizing a variety of disparate development tools in a fragmented development environment that hampered team coordination, made access to information difficult and reduced efficiency. The company wanted an integrated solution in order to improve efficiency, meet tight deadlines and speed time-to-market.

What Makes it Smarter

The design of in-vehicle electronic systems is a complex process requiring the coordinated efforts of multiple teams developing components that must ultimately work together. By implementing an integrated, model-driven development environment, members of the development team can better understand complex product requirements. The solution connects all developers engaged in the process and provides them with a unified view of all relevant information, data, pieces and parts in the development process. With simulation capabilities, the solution provides new insights by enabling the simulation of physical attributes of products – such as the keyless entry system technology – at the prototype stage in real time. Through prototyping, the team has a powerful tool to help detect and correct errors prior to live production so the software can be error-free when embedded in the final product. The result is vastly improved time to market, major reductions in developments costs and increased efficiencies – all of which enhance the company's ability to compete in a highly competitive market.

Real Business Results

- Enabled simulation at the prototype stage to see how an embedded system will interact with other systems so errors can be detected and corrected prior to production
- Enabled collaboration and coordination among multiple, geographically dispersed teams to meet time-to-market goals
- Contributed to business wins by increasing the company's engineering capabilities
- Reduced training and maintenance requirements by eliminating multiple tools

Solution Components

- IBM® Rational® Rhapsody
- IBM Rational DOORS

"The model-driven development environment provided by the solution is enabling us to better manage the complex architectures of our products and to avoid a fragmented development environment. We're now delivering our products to market faster and more cost effectively than ever before."

A Swiss Medical Engineering Company

Can virtual modeling improve product development?
A healthcare organization specializing in medical ventilation systems is using virtual modeling and collaboration to radically transforms its product development cycle.

The Opportunity

The complexity of designing intensive care ventilators requires long and expensive development time. The process jeopardized launch dates for new products, thus, a new production system was needed to address this issue.

What Makes It Smarter?

A groundbreaking prototype simulation system is supporting the development of new products and allowing a medical engineering company to visualize products before they are built. The virtual system allows for the quick development of models, which can then be re-used in other simulations. This saves the cost of creating a new prototype each time, driving significant efficiencies. The system also improves teamwork with enhanced collaboration features that facilitate efficient group testing, minimize product development errors, and streamline production.

Real Business Result

- Reduced development time for prototypes 50%, with corresponding reductions in cost
- Reduced development errors 50%
- Simplified patient-centered care by optimizing product design and functions

Solution Components

- IBM Rational® Software: Rational Rhapsody
- IBM Business Partner: EVOCEAN

"Faster development of prototypes is revolutionizing our industry, helping us to visualize new medical products faster and more efficiently."

EWE Group – BTC Embedded Systems AG

Smarter energy metering for sustainable energy supply

What's smart?

- Real time visualization of energy usage
- Empowering consumers with information to help reduce their energy consumption
- Enables consumers to save costs and reduce peak energy loads

Smarter business outcomes

- On time delivery of high quality, robust system
- Consumers reduced energy costs by 10% typically
- EWE recognized with environmental and innovation leadership awards

How Rational enables smarter products

- Model-based development manages the complexity of developing an interconnected system
- Model Driven Testing helps improve quality and reduce product development costs

Think Rational

One of many ways Rational enables a smarter planet.

"Rational Rhapsody with TestConductor solution provided all the needed features, functions and workflows to manage complexity and automate testing for on time and high quality delivery of our trio Smart Box Meter system "

Kyocera Mita Corporation (KMC)

What if you could find up to 80% of design errors prior to production, while reducing new product development time by 30%?
This global copier manufacturer implements a Model Driven Development process that allows reverse modeling and simulation, reducing development time, and lowering costs by reducing development and production errors.

The Opportunity

Digital copiers now provide multiple integrated capabilities beyond copying. Known as Multi Functional Printer/Peripherals (MFP), such devices require extremely complex and huge size of embedded software with source code of millions of lines. It is paramount to remain competitive by reusing existing software assets as much as possible. However, repetition of add-on development using existing software led to bloated and complicated applications, preventing efficient responses to the needs of new functionality or products.

What Makes it Smarter

Enabling faster architecture design and decision-making in new product design by utilizing existing software codes and advanced technologies is the key to maintaining a competitive position for a company with limited development resources compared with the industry's leaders. An innovative Model Driven Development (MDD) solution gives KCM the ability to improve development productivity and reduce costs significantly in many ways. A key to MDD is the simulation process, which can find design errors prior to physically building and testing the copier product. This can provide a significant cost advantage to the manufacturer since approximately 80% of design errors are not found until a copier is actually built and used. The company can now evaluate performance and make architecture decisions before investing the time and money to physically build the actual products.

Real Business Results

- Models created through reverse modeling for existing systems are now available for use in new product development based on MDD, contributing to a 30% shorter development time and lower costs

- Provides engineers and development teams with critical insights into how a given architecture and/or design turns into a specific behavior/performance in the actual system

- Model simulation allows system performance to be quantitatively measured on models

Solution Components

- IBM Global Business Services: GBS Strategy and Change: Technology Strategy
- IBM Research Tokyo
- IBM Yamato Laboratory
- IBM Rational Rhapsody v 7.5

"MDD enables existing design information/knowledge and software codes to be used as assets by turning them into models to be used for new product development.

-- Keiji Itsukushima
Senior GM, Corporate R&D Division

ALPS Electric Co., Ltd.

Improved development process accelerates product life cycle

The need:

To stay ahead in the challenging and competitive automotive industry, ALPS Electric needed a way to speed products, such as air-conditioning and keyless entry systems, through the life cycle and testing process to hit the finish line with improved workflow, quality and shorter lead time to product shipment. The company wanted a process integrating development and test that truly empowered their development staff.

The solution:

Leveraging the capabilities of IBM Rational software, ALPS Electric created a core solution, Model-Based and Test-Driven Development (MBTDD). MBTDD is a new development method that allows developers to focus more on high-value-added work such as development of models and test scenarios. In the new method, developers take end-to-end responsibility for their deliverables, allowing the company to drastically improve product quality and immediate development cost savings. Moreover, the rapid MBTDD cycle increased efficiency, quality and accountability while improving employee satisfaction and moving products faster.

What makes it smarter:

- Allows engineers to find errors early in the design life cycle and before final integration testing. This improves the quality and efficiency of development processes, resulting in shorter lead time to product shipment.

- Automated code generation and test execution reduced overall development effort in the creation of real-time and embedded systems and software.

- Enables diverse teams to collaborate to validate functionality early in the development process enabling the environment to deliver innovative, high-quality products.

"After conducting trials of many products in the market since the 1990s, we finally found a more suitable development method for embedded software. We've used this solution in over 30 projects, and it worked every time."

— *Satoshi Hayasaka,*
Automotive Division
ALPS Electric Co., Ltd.

Solution components:

- IBM® Rational® Rhapsody®
- IBM Rational Statement

Perfecting the Art of Electronics

ALPS.

19

iPLON

Smarter solar power solutions

What's smart?

- Remote management and control of photovoltaic systems
- Collection and analysis of power consumption data

Smarter business outcomes

- Savings of approximately €10,000 per product due to 25% defect reduction
- Reduced development time for a new product line by 60% (five months down to two months)

How Rational enables smarter products

- Model driven development to accelerate reuse of subsystems and software
- Model driven testing to improve quality and reduce product development cost

Think Rational

One of many ways Rational enables a smarter planet.

"Rational Rhapsody enables our system engineers and software developers to improve productivity, quality and communication by abstracting complex designs graphically, automating the development process and finding defects early."

iPLON GmbH

Increasing the efficiency of embedded software development

The Need:

This German technology services provider needed a way to reduce the complexity of manually coding the embedded software used for systems that remotely manage and control photovoltaic systems. The company wanted to decrease product defects, improve traceability, increase reuse of software modules and ensure consistent product quality.

The Solution:

The company implemented a new software development environment that uses model-driven development for real-time and embedded systems engineering. The new environment helps the company test models early to identify potential problems, meet all product requirements, create reusable subsystems and source code modules, and ensure consistent, high quality of software.

What Makes it Smarter:

▪ With the new software development environment, the company is building intelligent systems that facilitate the remote management and control of photovoltaic systems while collecting and analyzing power consumption data.

▪ The remote management and control system is part of a highly instrumented solution that integrates photovoltaic cell installations from multiple vendors.

▪ The monitoring and control capabilities are distributed across the set of photovoltaic installations and interconnected with centralized remote data collection and analysis systems that are accessible over the Web.

"We now improve productivity, quality and communication by abstracting complex designs graphically, automating the development process and finding defects early."

— *Victor Thamburaj, iPLON CEO*

Solution component:

▪ IBM® Rational® Rhapsody® V7.x

iPLON®
The Infranet Company

Eaton and UPS

Hydraulic hybrid delivery vehicles

What's smart?

- Innovative technology for urban delivery trucks in stop-and-go traffic

- Smart software to optimize energy usage and reduce greenhouse gases

Smarter business outcomes

- 60-70% increase in fuel economy, according to EPA

- 40% reduction in CO_2 emissions

How Rational enables smarter products

- Software modeling to optimize system performance

- Automatic generation of in-vehicle software code

Think Rational

One of many ways Rational enables a smarter planet.

"The suite of Rational tools, including Rhapsody, DOORS, ClearCase and ClearQuest, provides Eaton an integrated software framework that allows us to deliver innovative products more quickly and efficiently."

Leading electronics company

What if your product could deliver performance and reliability beyond the quality guaranteed to customers?
This leading electronics company uses an innovative model-driven development solution that detects hidden defects early in the development process, leading to higher quality products and faster time to market.

The Opportunity

As one of the leading providers of state-of-the art home washing machines, this electronics company in South Korea wanted to remain ahead of its competitors by delivering the highest quality products and bringing them to market rapidly to meet customer demand. With its existing software design method, the company found it difficult to detect errors and accelerate its development process for its home washing machines.

What Makes it Smarter

One size doesn't fit all when it comes to today's washing machines. Consumers look for myriad of features when purchasing a washing machine including size, cleaning ability, energy efficiency, ease of use, and most of all —reliability. To remain competitive, this electronics company uses a model-driven development (MDD) solution to deliver high quality, state-of-the art washing machines its customers demand. The solution enables the client to seamlessly validate the software design by synchronizing the design and development process for the embedded software in its washing machines. It provides dynamic modeling and iterative testing that systematically finds even the most difficult to detect errors, accelerating the client's time to market. Reusable software design and simulation testing help the client find errors early in the development process rather than in the marketplace, improving product quality and ultimately reducing warranty related issues.

Real Business Results

- Increases cost savings by 30 percent with reuse of software assets

- Improves detection of hidden defects by 45 percent with modeling, automated testing and simulation capabilities

- Realizes 30 percent return on investment by improving quality control and time-to-market for new products

Solution Components

- IBM Rational® DOORS®
- IBM Rational Rhapsody®
- IBM Software Services for Rational
- IBM Business Partner Bitek System Inc.

The solution has enabled us to respond quickly to customer demands with higher quality products, freeing us to spend more time and money to develop new innovative technologies.

European manufacturer of miniaturized wireless systems

Develops innovative devices for hearing-impaired students

The need:

When a European manufacturer began development on a new transmitting device for instruction in classrooms with hearing-impaired students, it needed to develop complex software for the device within a very short time and use existing internal resources. A comprehensive analysis showed that the only way to reach the goals was to use the Model Driven Development (MDD) method.

The solution:

The company used the MDD method for an incremental and iterative production process, graphical displays of the new application in reusable models and code generation from models to the target platform. As a result, the company was able to quickly prototype and validate the product's software and user interface before the hardware component was available.

What makes it smarter:

- Automatically adjusts the output of listening FM receivers to ambient noise, and uses intelligent voice-activity detection to boost speech and test scores of hearing-impaired children

- Incorporates a new transmitter that can be used by teachers in regular schools as well as schools for the hearing-impaired

- Measures speech and background noise levels simultaneously to provide optimal sound transmission

Model-driven development was a critical success factor in developing the company's innovative wireless transmitter.

Solution components:

- IBM® Rational® Rhapsody®

- IBM Business Partner EVOCEAN GmbH

An Energy System Supplier

What if you could customize products without incurring additional time and cost?
An energy system supplier develops leading-edge wind turbines unique to each customer's geographical environment while lowering development costs by 25 percent by using a revolutionary model-driven development that reuses software assets to enable innovation.

The Opportunity

Harnessing the power of wind as a sustainable energy is growing in popularity and is expected to make up as much as 12 percent of the global power supply by 2020. To meet customer demands and remain competitive in the growing marketplace, this energy system supplier wanted to develop a new line of wind turbines that could be deployed in a range of conditions across the world with integrated control and monitoring capabilities. However, the business faced a problem of variability in developing and maintaining multiple versions of the turbines, challenging product development in terms of cost, efficiency and time to market.

What Makes it Smarter

Improving the performance of sustainable power systems based on wind-generated energy requires innovation. This company developed a new line of wind turbines that changed the level of efficiency in wind energy conversion by using a cutting-edge, model-driven development (MDD) and software product line engineering solution. Leveraging the reuse of software assets, the solution enabled the client to rapidly customize the variations in its new line of wind turbines to accommodate market needs and environmental differences, such as built in heating mechanism for those in extreme climates. Using the MDD approach, the company developed and optimized the central systems that control the new line of wind turbines and their interconnected communications systems. The central control systems automatically collected and analyzed data from the turbines to control individual subsystems, perform diagnostics and manage wind farm power generation remotely, which is critical because wind farms are generally in isolated areas. The control systems automatically adjusted the turbines to optimize productivity based on input regarding wind direction and speed, temperature and other factors. Furthermore, remote access to wind turbine data such as generated power, rotor rpm, electrical data, temperature of main components, mechanical sensors status, and wind conditions helped establish benchmarks and identify irregularities, enabling timely intervention to prevent unplanned outages or secondary damage.

Real Business Results

- Lowered development costs by 25 percent by enabling early detection of errors in the design process
- Decreased product development time by a factor of 10 for each product variation
- Reduced product development time by 90 percent for each customized wind turbine model
- Improved wind-energy conversion by automatically adjusting the turbines based on environmental factors to optimize productivity and increase uptime

Solution Components

- IBM Rational® Rhapsody®
- IBM Software Services for Rational
- IBM Business Partner BigLever Software Inc.™-Gears™

With the reuse of software assets to optimize the control systems and quickly customize turbine variations, we are able to keep up with new emerging standards, market requirements and client needs.

An auto parts manufacturer in Japan

What if the safety of auto parts could be guaranteed early in the development lifecycle?
Eschewing spreadsheets for a unified development solution, this auto parts manufacturer can pinpoint the impact of design changes early on, enabling game-changing improvements in product safety and quality while accelerating time to market by 20 percent.

The Opportunity

The overall quality and safety of new cars is of paramount concern in the automotive industry. Because a single design flaw in embedded software can mean a time-consuming and expensive redesign process, auto parts manufacturers must get their designs right the first time, ensuring that they meet the numerous requirements set forth by international standards. However, this auto parts manufacturer used spreadsheets to track design changes against project requirements, limiting its visibility of the development process and hindering its ability to validate the quality and safety of products prior to production.

What Makes it Smarter

Because passenger safety is at stake, there is absolutely no room for error in the design of auto parts. Identifying the optimal design early in the process helps manufacturers deliver higher quality parts that cause fewer problems on the road. By embracing a unified development process that integrates software traceability with change management, this auto parts manufacturer can validate the quality and safety of products early in the development lifecycle. The new solution integrates project requirements and design documentation from multiple sources, enabling developers to run what-if scenarios that quickly pinpoint the fiscal and functional impact of every potential change. By using the solution to validate changes before they are made, the company can modify products early in the development lifecycle to manage standards compliance, reduce costly product redesigns, and help prevent recalls once the product is already on the market.

Real Business Results

- Reduced the total development cost of each product by as much as 10 percent
- Accelerated time to market by 20 percent thanks to an improved development process and a reduced need for product redesigns
- Achieved compliance with international quality and safety standards while maintaining strong relationships with major automobile manufacturer customers

Solution Components

- IBM® Rational® DOORS®
- IBM Rational Insight
- IBM Rational Quality Manager Standard Edition
- IBM Rational Rhapsody®
- IBM Rational Team Concert™
- IBM Software Services for Rational

Not only can a unified development process help auto parts manufacturers be vigilant about quality and safety early in the development lifecycle, it can help them avoid time-consuming and expensive product redesigns later on.

An aircraft manufacturer in the United Kingdom

What if the safety and efficiency of aircraft components could be guaranteed earlier in the development lifecycle?
On the wings of a First-of-a-Kind (FOAK) solution that helps it integrate and analyze component design criteria across multiple engineering domains, this aircraft manufacturer gained the ability to quickly identify optimized component designs.

The Opportunity

To bring safe, high-quality aircraft to market, manufacturers need to design efficient components that work together in harmony. They must carefully consider design criteria across multiple engineering domains before identifying optimal component designs. Previously, this aircraft manufacturer's multiple business units worked in isolation, and employees relied on instinct to design components. The lack of collaboration caused engineers to periodically miss design dependencies between components, which translated to costly and time-consuming modifications later in the development lifecycle.

What Makes It Smarter

Designing high-quality aircraft components that work seamlessly together can be an intricate puzzle. By using a First-of-a-Kind (FOAK) architecture optimization solution, this aircraft manufacturer can quickly solve the puzzle on the first try. The new solution captures and integrates component design criteria from its multiple business units and presents a holistic view of the data across mechanical, electrical and software engineering domains. By using the solution to analyze component dependencies across domains and run what-if scenarios with an array of architectural hypotheses, engineers can pinpoint optimal component designs early in the development lifecycle. And because the manufacturer gets its component designs right the first time, it can avoid costly modifications and production delays.

Real Business Results

- Accelerated the development lifecycle while elevating the overall quality and safety of finished aircraft

- Avoided exorbitant redevelopment costs and production delays by eliminating the need to modify components later in the development lifecycle

- Facilitated a highly efficient design that will meet criteria requirements for safety and efficiency while reducing cabling weight by 5 percent

Solution Components

- IBM® Rational® Rhapsody® Design Manager
- IBM ILOG® CPLEX® Optimization Studio
- Aerospace and Defense: Integrated Industry Framework
- IBM Research

By establishing a holistic view of architecture criteria across multiple engineering domains, aircraft manufacturing companies can quickly verify the validity of architectural hypotheses, pinpoint optimal component designs and ultimately create safer, more efficient aircraft for airline companies and their passengers.

Rational solution for Systems and Software Engineering

On-target product and process management via integration on an open platform

Open Services for Lifecycle Collaboration

REQUIREMENTS MANAGEMENT
Manage all system requirements
with full traceability across the lifecycle
Rational DOORS

QUALITY MANAGEMENT
Achieve "quality by design" with an
integrated, automated testing process
Rational Quality Manager

ARCHITECTURE & DESIGN
Use modeling to validate requirements, architecture
and design throughout the development process
Rational Rhapsody

COLLABORATION, PLANNING & CHANGE MANAGEMENT
Collaborate across diverse engineering disciplines and development teams
Rational Team Concert

Application Lifecycle Development

Rhapsody offers integrated workflows to suit user-specific needs:

- *Iterative requirements engineering* with **Rational DOORS** or **Requisite Pro**

- *Enterprise systems delivery* with **Rational System Architect**

- *Collaborative development* with **Rational Team Concert**

- *Test management and execution control* with **Rational Quality Manager**

- *Embedded software testing* with **Rational Test RealTime**

- *Team-based configuration management* with **Rational ClearCase** or **Synergy**

- *Automated reporting and documentation* with **Rational Publishing Engine**

- *Requirements import* with **Microsoft Word** or **Excel**

- *Embedded platform development* and multi-core extensions with **Wind River Workbench/VxWorks** and other embedded IDEs/RTOSs

- *Product Line Engineering* with **BigLever Gears**

- and many others…