IBM Rational Solution for Systems and Software Engineering
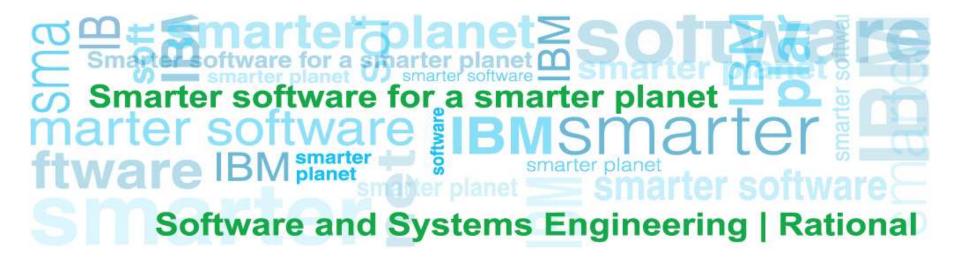
Reduce the Time, Cost and Risk of Developing Products and Systems

Thomas Konrad

Complexity Creates Development Challenges
Leading to cost overruns, schedule slips and quality issues

Poor requirements engineering = failed projects

Paper-based and manual processes hinder efficiency

Complex architecture is difficult to textually explain

Functionality is poorly distributed across components

Hardware/software integration is often late

Many organizations lack formalized practices

Silos of people, process, and projects

Geographic Barriers

- Poor communication
- Language, culture, time
- Process gaps resulting in rework

Organizational Barriers

- Weak collaboration
- Poor project governance and LOB oversight
- Security of IP

Infrastructure Barriers

- Incompatible tools
- Unreliable access
- Lengthy on-boarding
- Inflexible integration

Overcoming Complexity

How do you foster innovation, manage increasing complexity and establish a collaborative, responsive lifecycle approach in developing systems?
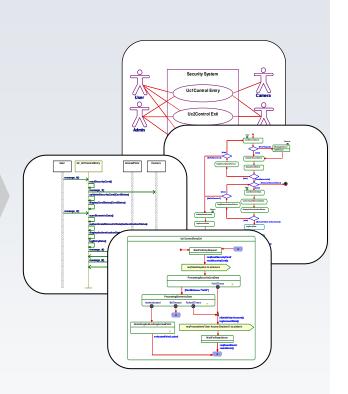

Specifications

Interface requirements

System design

Analysis & trade-off

Test plans

Moving from manual methods to an automated, visual approach

IBM Rational Solution for Systems and Software Engineering

- **Specify, design, implement and validate complex products and the software that powers them** with an integrated set of tools, practices, and services.

- **Improve quality, predictability and consistency** with best practices and process guidance.

- **Assess and manage changes** throughout your systems lifecycle.

- **Unify software, electrical and mechanical engineering** through a federated, linked data approach.

- **Increase agility** in embedded software development.

**IBM Rational Solution
for Systems and Software Engineering**

- Architecture, Design and Development
- Requirements
- Systems and Software Engineering
- Quality
- Change/ Configuration Management

Best Practices and Services

Open Lifecycle Integration

Jazz.

Systems Engineering	Embedded Software Engineering
• Optimize design alternatives	• Develop against changing requirements
• Link design and test	• Reduce compliance overhead
• Manage change across domains	• Integrate HW/SW development
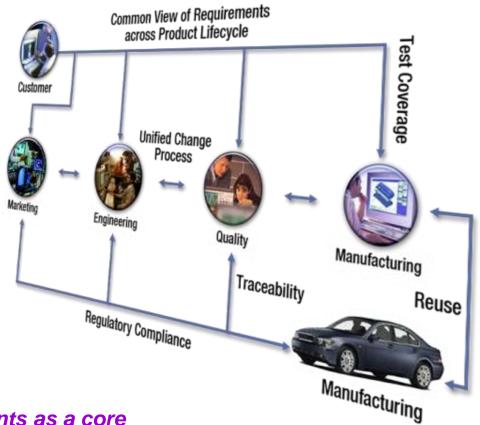
Requirements Engineering
Capture, analyze, and manage requirements across the lifecycle

- Capture and document customer and market needs

- Avoid customer-required features from 'falling through the cracks'

- Better control of "scope creep"

- Build what business needs the first time

- Use traceability to prove compliance

Common View of Requirements across Product Lifecycle

Customer

Marketing

Engineering

Unified Change Process

Quality

Manufacturing

Test Coverage

Reuse

Traceability

Regulatory Compliance

Manufacturing

Formalize management of requirements as a core development competency
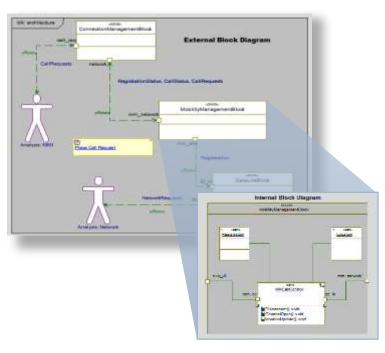
Systems Modeling and Analysis

Visually develop complex systems using a structured approach across all design disciplines

- **Manage growing system complexity through architectural and behavioral modeling**

- **Earlier design verification by simulating systems behavior with executable models**

- **Manage functional allocation between software, hardware, and mechanical components**

- **View impact of proposed changes**
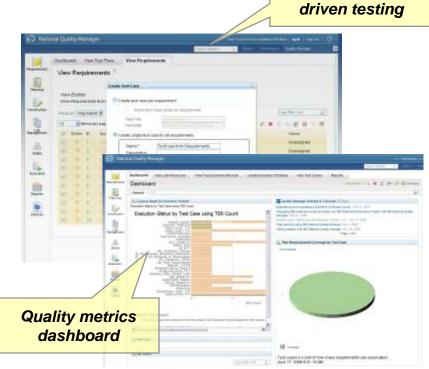
- **Model-based Testing**

"IBM Rational DOORS and Rational Rhapsody allow us to better manage complex architectures of our products, and help us prevent our development environment from becoming fragmented."

Gervin Fadda, Body and Security Business Unit
Continental Automotive Group

Systems engineers focus on big picture to ensure requirements can be satisfied

Quality Management
Deliver enduring quality with improved efficiency
with a lifecycle approach to quality management

- Make high quality decisions based on quantitative information

- Integrate defect tracking and change management

- Smooth the information flow between testers and developers

- Improve quality by managing complexity across multiple product configurations

Requirements-driven testing

Quality metrics dashboard

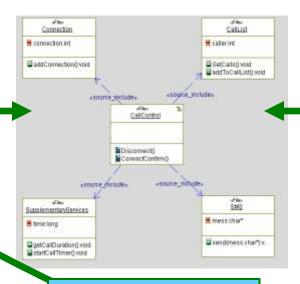*Reduce errors through automated reuse of information*

"*We have greater control to improve processes, greater test coverage and traceability, plus, vastly improved navigation and user friendliness.*"
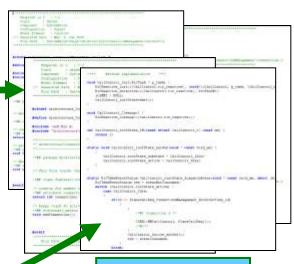
– Beta test participant

Embedded Software Development

- **Design efficient embedded source code**
  - ▸ Specify and create from the system requirements
  - ▸ Generate complete C, C++, and Java applications

- **Unite the architecture and code**
  - ▸ Simultaneously work with the system design, software and target platform
  - ▸ View how a change in any one area is reflected in the others

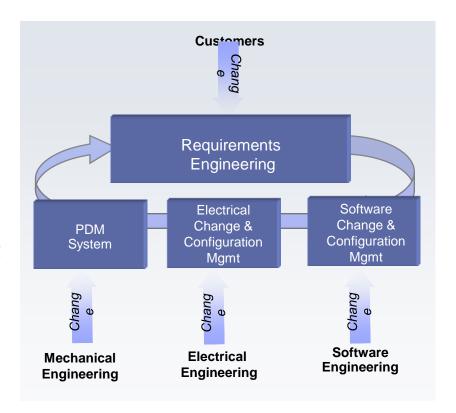**Architectural View**

Source Code

Change & Configuration Management
Synchronize changes across mechanical, electronic and software disciplines and throughout the supply chain

- Reduce the time to propagate changes throughout the entire development team

- Improve management of multiple engineering disciplines

- Understand impact of requirements & product changes

- Leverage existing investment in Product Data Management (PDM), and software development platforms

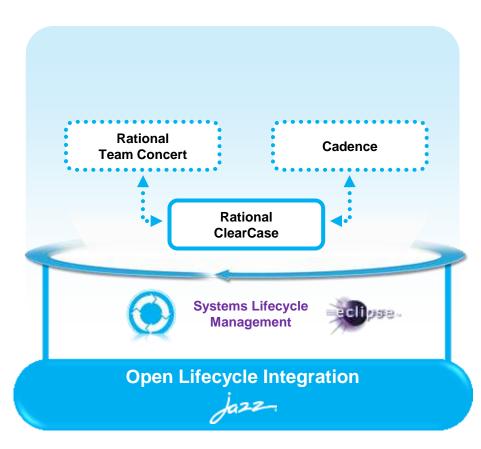*Enhance the ability to manage project costs*

Customers

Change

Requirements Engineering

PDM System

Electrical Change & Configuration Mgmt

Software Change & Configuration Mgmt

Change

Change

Change

Mechanical Engineering

Electrical Engineering

Software Engineering

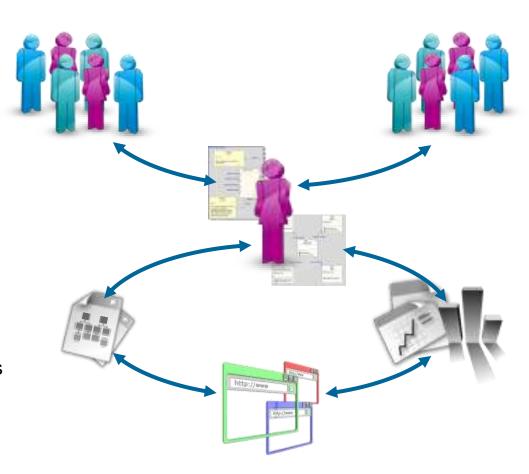# Extended SCM capabilities in SSE through IBM Rational ClearCase

- **Enhanced Rational ClearCase integrations with Rational Team Concert**

- **ClearTeam Explorer unified client**

- **Enhanced Cadence integration for EDA (Electronic Design Automation)**

- **Improved Rhapsody, RSA Integrations for Software and System Designers**

- **Enhanced Eclipse and Visual Studio Integrations**

Strengthen co-development of hardware and software

Rational Team Concert

Cadence

Rational ClearCase

Systems Lifecycle Management

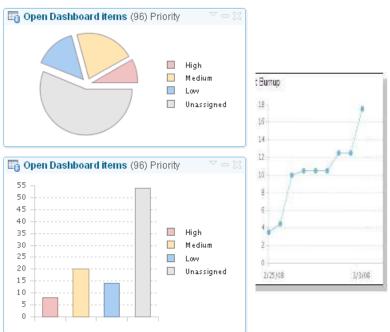Open Lifecycle Integration

jazz

Collaborate and Communicate throughout Development

- **Collaborate across teams and geographies**
  - Reduce time and risk associated with parallel development
  - Enable integrated design, sharing and review across diverse engineering teams

- **Enhance productivity**
  - Share views
  - Link work items
  - Automatically execute design reviews

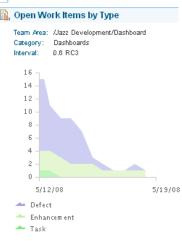- **Automatically generate detailed reports and documentation**

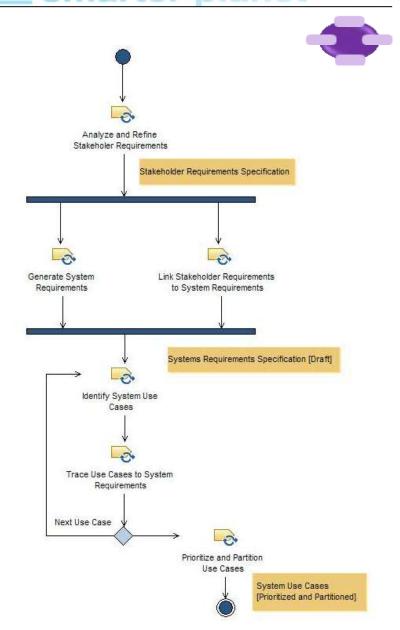# Collaborate, plan and manage change across the lifecycle

Capabilities

- Integrated planning, change management, collaboration, SCM
- Dashboards and metrics with real-time status
- Enhanced systems engineering support
- In-context collaboration; Work item search and query
- Process guidance when and where needed; eSignatures
- Customizable security for external collaboration
- Mobile application development support

Benefits

- Increase visibility and collaboration across stakeholders, system engineers, contributors & diverse lifecycle disciplines
- Ensure secure collaboration with ecosystem partners
- Link, access & trace artifacts created across lifecycle activities
- Respond efficiently to change
- Enforce policy, desired processes, compliance requirements
- Blend and customize agile, iterative and waterfall processes for incremental adoption. Automate process enactment.
- Integrate your SCM of choice with RTC planning and change management: *RTC, ClearCase, Synergy, Open Source*

Process Management and Enactment
The engine of lifecycle management

- **Improve quality and predictability** by leveraging proven practices and patterns of success

- Quickly and easily **compose** right-sized project/team processes and **deploy process, methods and tools to project**

- Surface process guidance in-context directly within practitioner tools to **speed on-boarding, process adoption and return on investment in Rational tools**

- **Simplify compliance** with pre-defined methods and mappings to industry standards and regulations

- **Unify process management and enactment** with integrated process, methods and tools

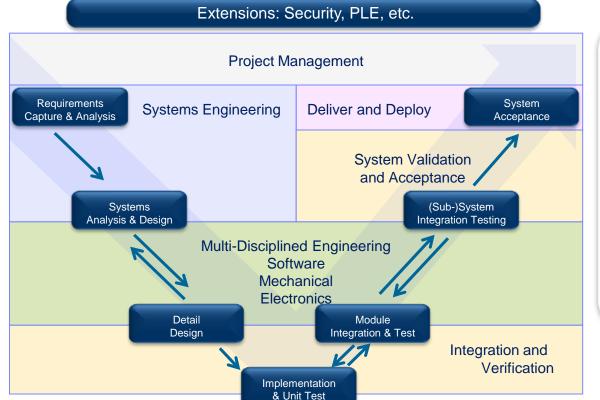- **Increase productivity** and turn "know-how" into competitive advantage

Analyze and Refine
Stakeholer Requirements

Stakeholder Requirements Specification

Generate System
Requirements

Link Stakeholder Requirements
to System Requirements

Systems Requirements Specification [Draft]

Identify System Use
Cases

Trace Use Cases to System
Requirements

Next Use Case

Prioritize and Partition
Use Cases

System Use Cases
[Prioritized and Partitioned]

Leverage the expanding ecosystem across the lifecycle
Partnering for Success

Ecosystem

Extensions: Security, PLE, etc.

Project Management

Systems Engineering

Deliver and Deploy

Requirements Capture & Analysis

System Acceptance

System Validation and Acceptance

Systems Analysis & Design

(Sub-)System Integration Testing

Multi-Disciplined Engineering
Software
Mechanical
Electronics

Detail Design

Module Integration & Test

Integration and Verification

Implementation & Unit Test

Foundation: Change, Version, Lifecycle, Asset Management

BigLever SOFTWARE, INC.

EB

INCHRON
THINK REAL-TIME

MathWorks

methodpark

Mentor Graphics

SIEMENS PLM SOFTWARE
SIEMENS

WIND RIVER

NATIONAL INSTRUMENTS

SPIRENT

TestPlant

WIND RIVER

ManageWare

321 Gang

ESG

gebs
software solutions

15

Accelerate delivery, reduce cost by managing complexity in product development

*New cross-discipline lifecycle capabilities with the Rational Solution
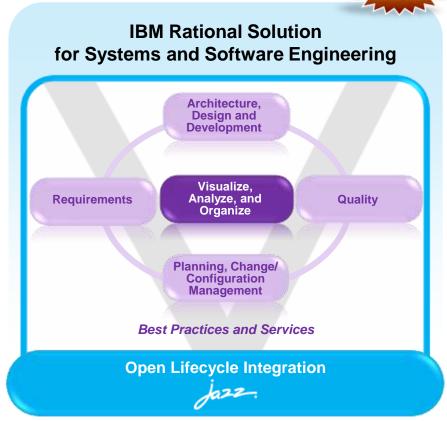for Systems and Software Engineering*

NEW

How?

New capabilities that extract additional value from the web of linked engineering artifacts in the Rational Solution for Systems and Software Engineering

What's new?

IBM Rational Engineering Lifecycle Manager (RELM)

Visualize, analyze and organize engineering artifacts across multiple disciplines and tools to:

- See the bigger picture in a single view

- Extract key threads of interest for engineering tasks

- Make more informed, timely engineering discussions

- Improve cross-discipline collaboration

**IBM Rational Solution
for Systems and Software Engineering**

Architecture, Design and Development

Requirements

Visualize, Analyze, and Organize

Quality

Planning, Change/ Configuration Management

Best Practices and Services

Open Lifecycle Integration

Jazz.

"The beta version of RELM showed us that it has potential to be a very valuable tool and approach to solving challenges in the engineering of complex products."

Simon Bradley, Vice President
*Head of Global Innovation Network,
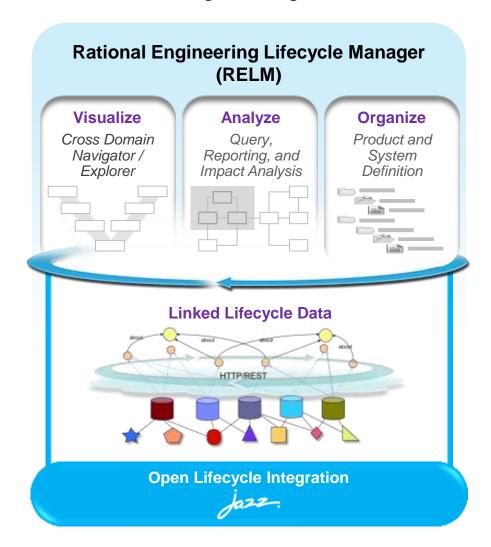Systems and Products Architecture, EADS*

Rational Engineering Lifecycle Manager (RELM)
Extending the Rational solution for systems and software engineering

- Uses a Linked Data approach that enables

    - ✦ *Visualization* – across many sources of data

    - ✦ *Organization* – information in context

    - ✦ **Analysis** - answer questions using that contextualized information

- Allows stakeholders to:

    - manage growing complexity

    - derive more valuable knowledge from the available data

    - make timely and correct engineering and business decisions

Rational Engineering Lifecycle Manager (RELM)

Visualize	**Analyze**	**Organize**
Cross Domain Navigator / Explorer	*Query, Reporting, and Impact Analysis*	*Product and System Definition*

Linked Lifecycle Data

HTTP/REST

Open Lifecycle Integration

Jazz.

Next generation development adoption model
What is your next step?

Smarter Product Innovation

Exploit multi-dimensional traceability and data visibility
views by product, process, project, and role
multi-discipline impact analysis and reporting

Incrementally automate other disciplines
tool-to-tool traceability
impact analysis between disciplines

Address discipline offering biggest ROI
requirements, quality,
design, change management
configuration management

Automate individually	*Automate incrementally*	*Automate across all disciplines*

Engineering Disciplines

High impact initiatives to accelerate delivery today

Product and systems organizations

1. Implement cross-discipline systems engineering

Typical target
25% lower variance in cost/schedule performance

2. Implement model-based systems engineering

Typical target
50% reduction rate of lifecycle scrap and rework

3. Integrate tools and data to support common processes

Typical target
50% lower cost of compliance

Brian Wells
Vice President of Corporate Engineering
Raytheon