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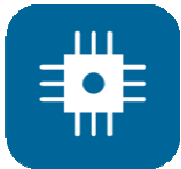
Reduce the Time, Cost and Risk of Developing Profitable Products and Systems

Charles-Henry JURD, Rational European Systems Tiger Team

Organizations developing smarter products aspire to be innovative

Product innovation enables companies to leapfrog their competition, grow demand, and increase value

INSTRUMENTED

They have the ability to measure, sense and see the exact condition of everything

INTERCONNECTED

They enable people, systems and other products to communicate and interact with each other in entirely new ways

INTELLIGENT

They can respond to changes quickly and accurately, and get better results by predicting and optimizing for future events

Hint: **think software**

Smart products transcend "one-size-fits-all" products enabling customers to get exactly what they want – tailored to their unique needs

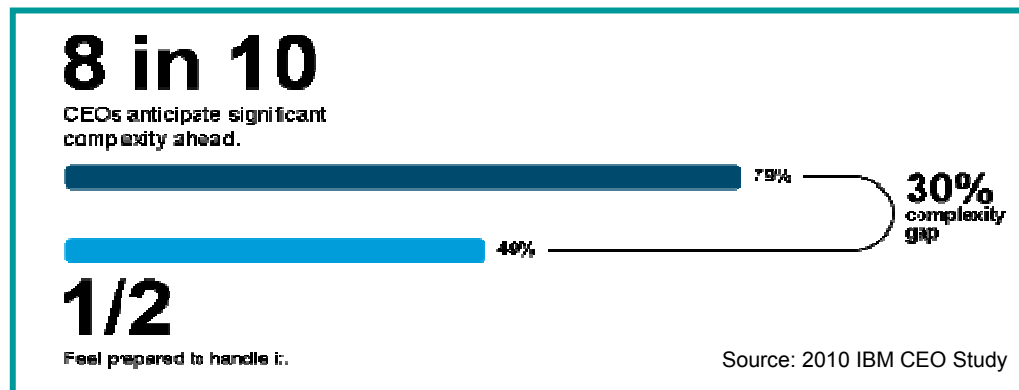# The nemesis of product innovation is complexity

New Surgical Robotic System

- Powered by 1.4 million lines of code
- 3-6 weeks mitral valve procedure recoveries compared to 3-6 months
- Less invasive, breastbone stays intact

Trends in Automotive Engineering

- F-35 jet fighter ~10M lines of code (2x the F-22)
- Average 2010 Ford auto ~ 10M lines of code
- Average luxury auto ~ 100M lines of code

8 in 10

CEOs anticipate significant complexity ahead.

79%

30% complexity gap

40%

1/2

Feel prepared to handle it.

Source: 2010 IBM CEO Study

Introduction of SW brings complexity yet few are prepared to handle it

IBM Rational Solution for Systems and Software Engineering

Specify, design, implement and validate complex products and the software that powers them with an integrated systems lifecycle management solution

- Manage requirements across lifecycle and disciplines

- Translate requirements into a system design

- Build in quality from concept to launch

- Collaborate and communicate throughout development

- Recapture intellectual property

- Control the system with optimized software

- Visualize, analyze and organize cross-domain engineering data
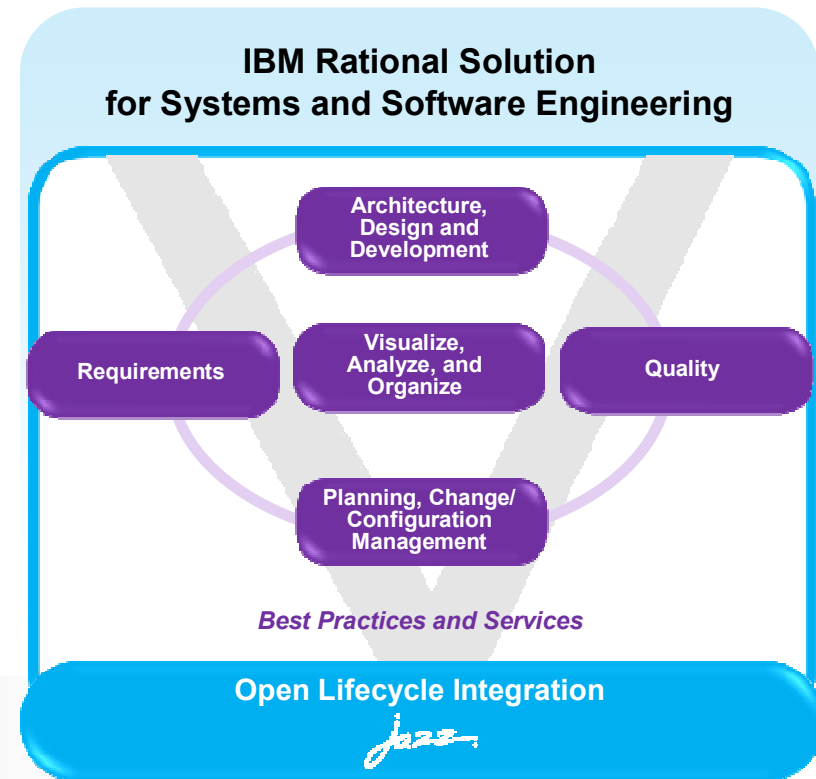
THE FOUNDATION

- IBM Rational Solution for Systems and Software Engineering
  - IBM Rational Engineering Lifecycle Manager
  - IBM Rational DOORS
  - IBM Rational Quality Manager
  - IBM Rational Team Concert
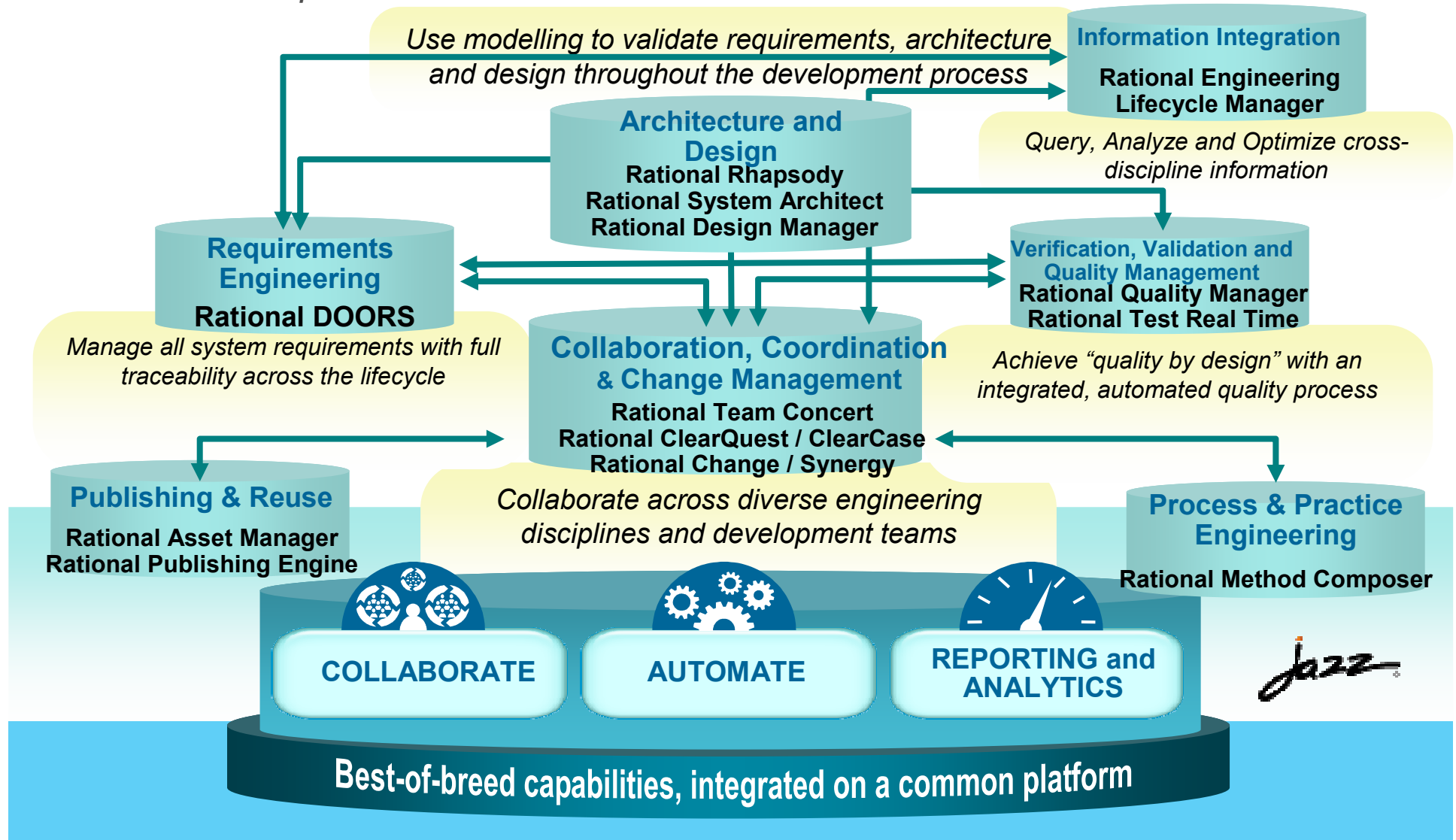 - IBM Rational Rhapsody with Design Manager

**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

"Our ability to maximize the breadth of the IBM software let us provide NASA with demand-based statistics while maintaining control of the costs."

- Joseph Dress, Requirements Management, Constellation Software Engineering, Corporation

4

Solution Offering	Key Capabilities
Requirements Engineering and Traceability	End-to-end, live traceability to source, mission and system/subsystem requirements.
Model-Based Systems Development	Model requirements, system functionality, realization, trade studies, execution, validation
Technical Work Management	Manage collaboration, change, shared repository, configuration
Information Integration	Query, Analyze, Integrate and Optimize the use of engineering information across platforms and systems
Automated Work Products	Generate requirements, design, specification documents
Measuring Engineering Effectiveness	Automatic collection, tracking, reporting, dashboards
Integrated Systems and Software Engineering	Flow-down of requirements and models, embedded development
PLM Integration across the Development Lifecycle	Sharing models and data among systems, software, electrical, mechanical domains, model integration
Safety-Critical Software Development	Instrument comprehensive traceability and change management to meet standards

Rational Engineering Solution Platform
Built on a core product set

Use modelling to validate requirements, architecture and design throughout the development process

Information Integration

Rational Engineering Lifecycle Manager

Architecture and Design
Rational Rhapsody
Rational System Architect
Rational Design Manager

Query, Analyze and Optimize cross-discipline information

Requirements Engineering

Rational DOORS

Verification, Validation and Quality Management
Rational Quality Manager
Rational Test Real Time

Manage all system requirements with full traceability across the lifecycle

Collaboration, Coordination & Change Management

Rational Team Concert
Rational ClearQuest / ClearCase
Rational Change / Synergy

Achieve "quality by design" with an integrated, automated quality process

Publishing & Reuse

Rational Asset Manager
Rational Publishing Engine

Collaborate across diverse engineering disciplines and development teams

Process & Practice Engineering

Rational Method Composer

COLLABORATE   **AUTOMATE**   **REPORTING and ANALYTICS**

jazz

Best-of-breed capabilities, integrated on a common platform

Open Services for Lifecycle Collaboration (OSLC)
Working to standardize the way software lifecycle tools share data

Open Services for Lifecycle Collaboration
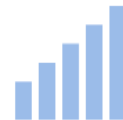Lifecycle integration inspired by the web

- Community Driven – @ **open-services.net**
- Open specifications for numerous disciplines
  - Including ALM, PLM, and DevOps
  - Defined by scenarios – solution oriented
    - Inspired by Internet architecture
- A different approach to industry-wide proliferation
  - Based on W3C Linked Data

Inspired by the web   **Free to use and share**   **Changing the industry**

GET INVOLVED AND CONTRIBUTE!

Leverage the expanding ecosystem across the lifecycle
Partnering for Success

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
EB
INCHRON — THINK REAL-TIME
methodpark
Mentor Graphics
SIEMENS PLM SOFTWARE — SIEMENS
WIND RIVER

NATIONAL INSTRUMENTS
SPIRENT
TestPlant
WIND RIVER

TECH·AP
COMPLIANCE
adn
AdaCore
Sopra group

Invensys Rail Dimetronic
*Speeds innovation with a unified platform
for multi-stage development processes*

The need:

- Modernize development processes

- Ensure systems integration with other railways
  while meeting railway standards

The solution:

- Incorporated system intelligence into its development process

- Deployed an application development platform to:

  – Model system reliability

  – Highlight areas requiring improvement

The benefits:

✓Reduced time-to-market for signaling systems products
by 40 percent

✓Facilitated 100 percent compliance rate with ERTMS
standards for code traceability and safety

✓Reduced cost and risks of development and documentation

*"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

Solution components:
- IBM® Rational® Rhapsody
  - IBM Rational DOORS
  - IBM Rational Synergy
  - IBM Rational Change
- IBM Rational Publishing Engine
  - IBM Software Services

Smart products need to be safe

- As products become smarter, and more embedded in our daily lives, safety becomes more important

- IBM Rational industry solutions help produce safety-critical systems and software

- Aerospace and Defense

  - DO-178C best practices, templates and tooling

  - Extended support for Defense Architecture Frameworks

- Automotive

  - AUTOSAR and ISO-26262 best practices, templates and tooling

- Medical Devices

  - FDA 21 CFR Part 11 and IEC 62304 best practices, templates and tooling

Extending the solution for safety critical development in aerospace

As unmanned vehicles expand into commercial areas (e.g., oil exploration, border patrol, etc.), *will safety and compliance regulations significantly raise costs?*

- Unmanned vehicles are becoming ubiquitous

  – Model-based systems engineering helps optimize architectures to reduce cost

Key Value Points

- Best practices to support DO-178B/C standard and additional DO-178C supplement documents.

- Out of the box tool templates for DOORS to ensure requirements are properly managed and traced

- Rational Team Concert process and work item templates for DO-178C to allow designers, QA groups to properly manage the project

Open Lifecycle Integration

Jazz

• Out of the box DO-178B/C checklists to ensure engineers are doing the right work necessary for audit

Extending the solution for functional safety in automotive engineering

As manufacturers move forward with semi – autonomous passenger cars, how can we make sure these systems work safely every time we use our cars?

- IBM Rational solution for Automotive Engineering helps lowers the cost of compliance by helping projects work efficiently when using standards such as ISO-26262

Key Value Points

- Best practices to support the current released version of ISO-26262

- ISO-26262 practice content covering testing/validation and real-time dynamic analysis support with IBM Business Partner INCHRON

- Rational Team Concert process and work item templates for ISO-26262 to allow designers, QA groups to properly manage the project

- Out of the box tool templates and views to ease customer adoption of ISO-26262

- Process customization guide to help end users adopt our industry practices within their environment.

Open Lifecycle Integration

Jazz
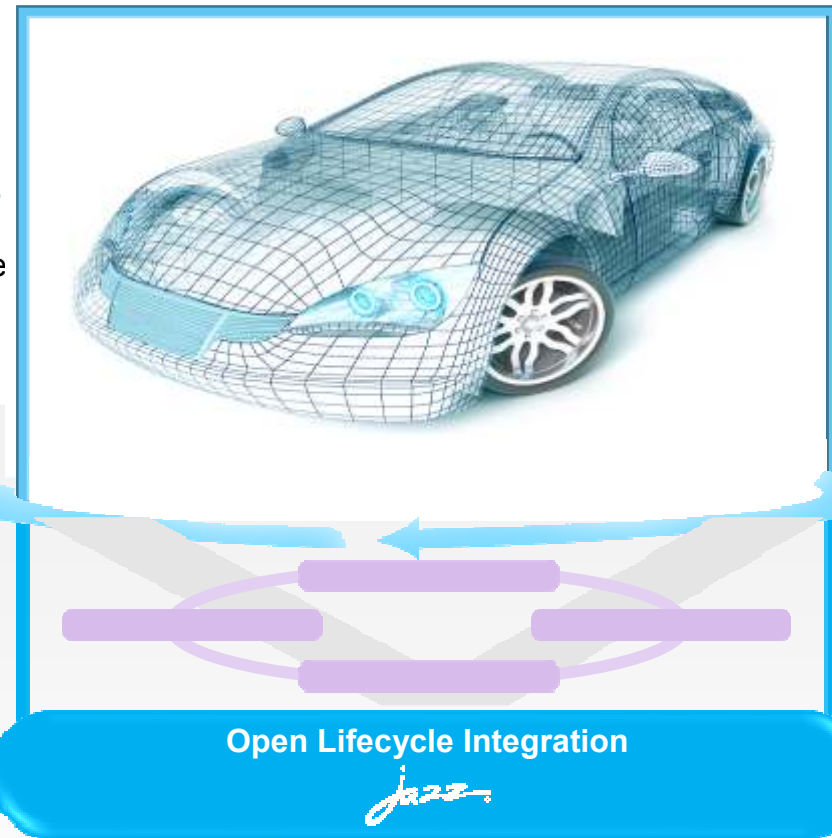
- Qualification Kits for ISO-26262 and IEC 61508 including "TUV fit for purpose certificate" to meet ISO-26262 tool qualification criteria

- Comparable support for AUTOSAR architectural standards

Extending the solution for medical device development

Will a robot ever perform surgery autonomously?

- **Advanced medical robots**
  - Very complex products
  - Strictly regulated
  - Fiercely competitive market
  - Need to reduce time to market and cost

Key Value Points

- Process compliance support
  - FDA 21 CFR Part 11
  - Specific process support (e.g. IEC 62304)

- Product compliance guidance for development traceability

- Tool-related assets for clients to provide evidence of regulatory compliance

- Agile adoption support for incremental migration to agile work practices

Open Lifecycle Integration

Jazz

"Improved collaboration accelerates our development time."

- Diagnostic Grifols

Introducing Rational Engineering Lifecycle Manager
New cross-lifecycle capabilities for Systems and Software Engineering

How?

New capabilities that deliver views of your cross-lifecycle engineering data – enabling your multi-disciplinary engineering teams to be more productive and make better decisions.

What's new?

IBM Rational Engineering Lifecycle Manager

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

- Manage growing complexity

- Extract key threads of interest from a web of related engineering artifacts

- Make timely and correct business and engineering decisions

- Improve collaboration across engineering disciplines

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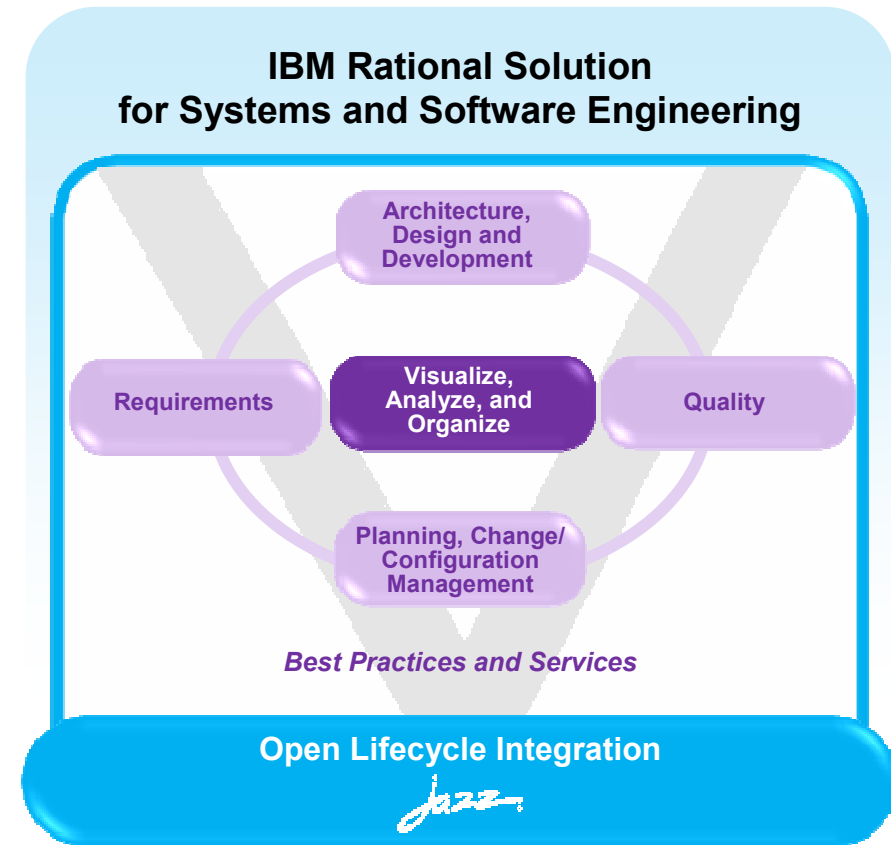
"IBM Rational Engineering Lifecycle Manager is the first tool of its kind. RELM fills a large gap to help manage complexity in fast-paced, multi-team, multi-disciplined complex systems development."

- 321 Gang, IBM Premier Business Partner

Maximize the value of your software investments with IBM Rational Lab Services

- Provides best practices from lessons learned to maximize ROI

- Becomes your trusted advisors based on years of experience and industry knowledge

- Offers a clearer understanding of how the toolset applies to your unique environment, processes and industry

"Reduced 75% testing time/test cycle by automating creation and execution of tests from the design model or target platform."

- A Defense Research and Development Organization

Tailored services to address your unique needs	
FastTracks	Used to accelerate installation and migrations.
QuickStarts	Rapidly implement tools using pre-defined activities and deployment templates.
Assessments	Proven methodologies to gather customer requirements and environment context. Delivers guidance on best practices for the customer's context.
Deployment Packages	Deployment options based on proven practices are tailored to support the customer's context and usage model.
Commercial Assets	Packaged tools and services providing solutions to specific customer environments; tool integrations, extensions and other automation.

Resources for more information

- **Rational Solution for Systems and Software Engineering**
    - **Video – SSE Solution Overview** (3:55 min)*
        - Link with full SSE Solution Video Series
    - **SSE Solution Brochure** with customer examples (Solution Overview)
    - DEMO: SSE Solution Demo Video Series
    - Webcast: **New Approaches to Systems Engineering and Embedded Software Development**
    - Podcast: Systems & Software Engineering Practices – Unleash the Potential!

- **Client Stories**
    - Invensys Rail Dimetronic (video, case study)
    - General Motors (case study and videos)
    - Raytheon (video)
    - Ericsson (video)

- **Web pages**
    - IBM Rational solution for systems and software engineering
    - Aerospace and defense solutions
    - Automotive solutions
    - Medical Devices solutions
    - Jazz.net Community site: Systems Engineering and Embedded Software Development
    - Self Assessment on System Engineering
        - *Tips to increase profit margins* by Aberdeen Group
    - Systems Engineering for Dummies ebook

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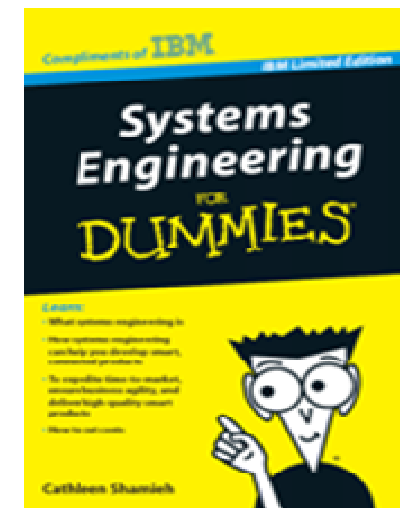
www.ibm.com/software/rational