Turning Product Development Into Competitive Advantage:

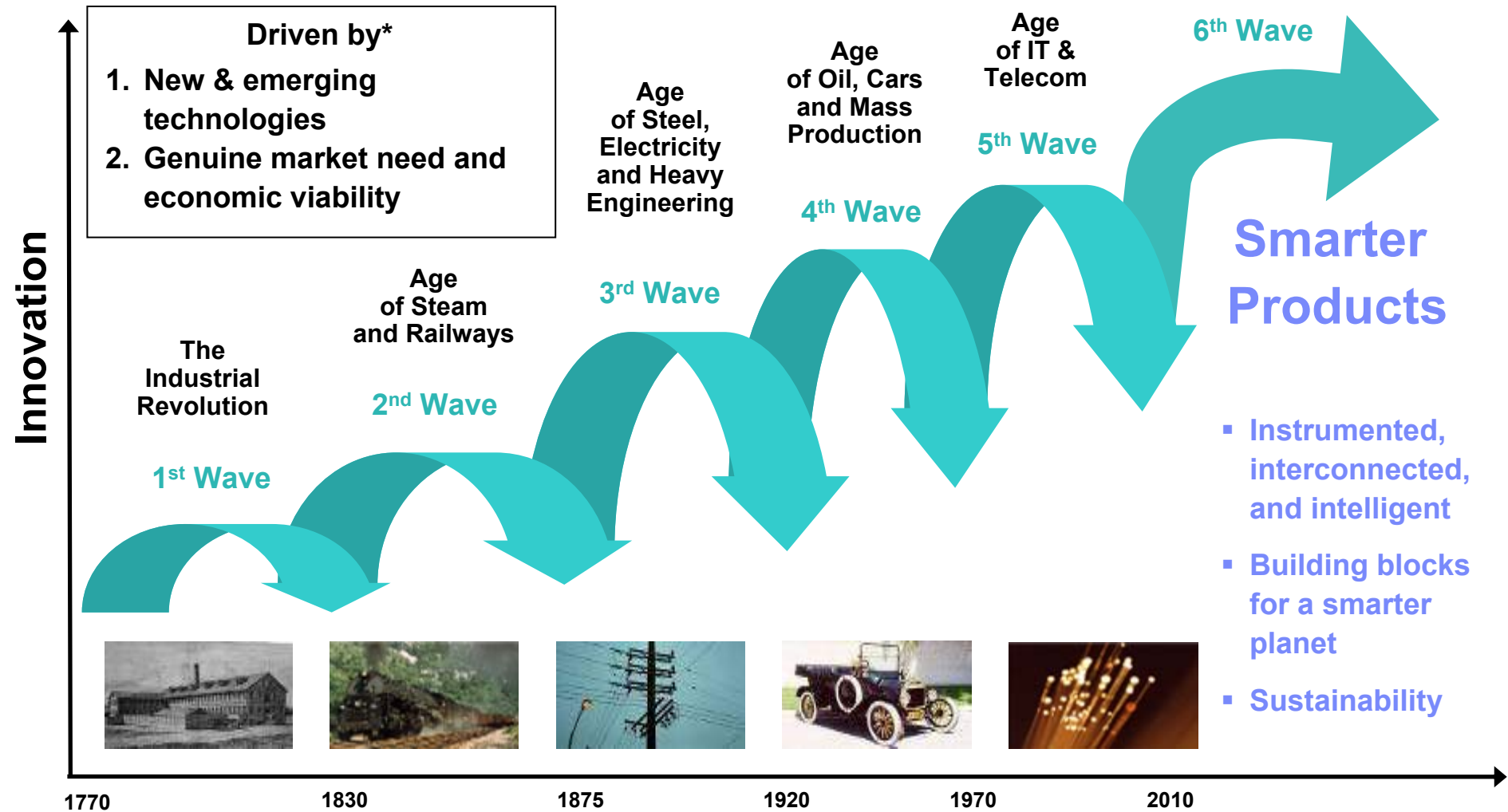# IBM Rational Solutions for Systems and Software Engineering

Andrew Foster
Offering Strategy & Delivery
Rational WW Solutions for Systems & Software

Rational. software

We are ushering in a new wave of innovation

Innovation

Driven by*
1. **New & emerging technologies**
2. **Genuine market need and economic viability**

The Industrial Revolution

1st Wave

Age of Steam and Railways

2nd Wave

Age of Steel, Electricity and Heavy Engineering

3rd Wave

Age of Oil, Cars and Mass Production

4th Wave

Age of IT & Telecom

5th Wave

6th Wave

Smarter Products

- **Instrumented, interconnected, and intelligent**
- **Building blocks for a smarter planet**
- **Sustainability**

| 1770 | 1830 | 1875 | 1920 | 1970 | 2010 |

*Source: "Next Generation Green: Tomorrow's Innovation Green Business Leaders", Business Week, Feb 4, 2008

What hinders innovation? In our customers' words

Customer Speak!

Evolving Business Models

The marketplace is in constant flux - adapting to customer needs, accelerating the speed to enter new markets, adopting new technologies, integrating into new ecosystems.

I need to transform product development to be more collaborative while removing redundant activities

Increasing Product Complexity

Increase in product intelligence enabled by software has led to an exponential leap in product capability, which drives a commensurate increase in risk and complexity.

I need for mechanical, electrical, and software engineering to all be on the same page

Extension of the Enterprise

Disconnected product development applications and processes hinder collaborative product development among an extended design chain of departmental, partner and supplier teams.

I need a way for all my design and supply partners to participate in a unified process for product development

Disconnect with Operations

Operational and support services are becoming an increasingly strategic profitability lever, yet products aren't being designed with support requirements in mind
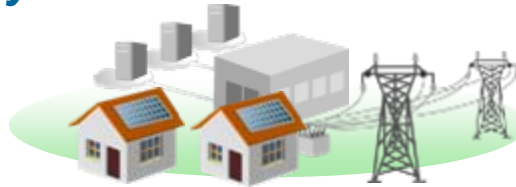
I need to ensure that the products I build can be profitably supported and maintained over their lifetime

Delivery of smarter products and services will require new investments in software and systems

Connect multiple products and services into a *"system of systems"* **to deliver unique value**

Leverage *systems engineering* **to accelerate time to market, improve quality and reduce costs**

Develop a core competency in *software delivery* **to produce products that are differentiated**

# Market Insights driving IBM's Point of View on the Embedded and Complex Systems Business

1) Companies have an increased need for innovation to unleash new business value

2) Software is the invisible thread of today's product and service innovation

3) The convergence of physical assets and IT applications requires a new "Systems of Systems" approach for integrating products and services

4) Software driven innovation across product lines is complex and difficult which can lead to costly failures and quality issues at a systems level

5) Best-in-class product & service companies are those that build a strong competency in systems engineering and software development
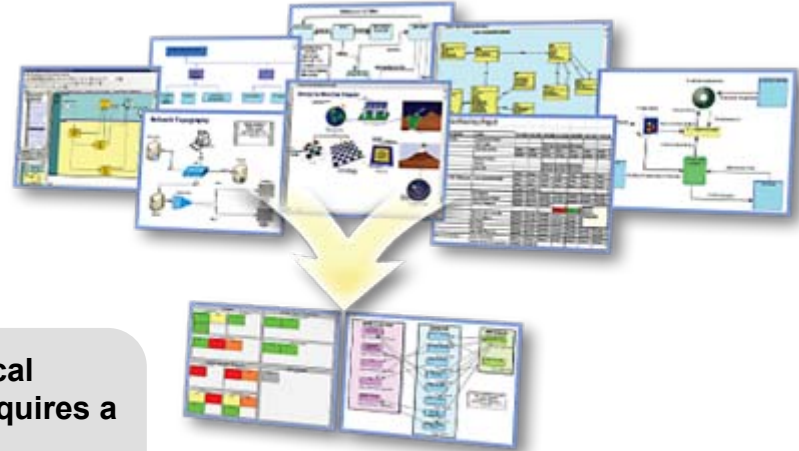
Complexity Creates Development Challenges
Leading to cost overruns, schedule slips and quality issues

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	**Organizational Barriers**	**Infrastructure Barriers**
▪ Poor communication	▪ Weak collaboration	▪ Incompatible tools
▪ Language, culture, time	▪ Poor project governance and LOB oversight	▪ Unreliable access
▪ Process gaps resulting in rework	▪ Security of IP	▪ Lengthy on-boarding
		▪ Inflexible integration

The Emergence and Impact of Supporting Requirements
It's not just about product features and functions
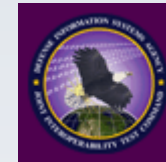
- **Human-Machine Integration Requirements**

  We must understand the role humans play in emerging technology systems

- **Regulatory Compliance Requirements**

  Government and Industry Controls

  Internal Business Controls

- **Non-Functional "ility" Requirements**

Maintainability

Interoperability

Scalability

Reliability

Requirements Engineering Best Practices

Best in class companies…

- Engineer requirements:
  - From the beginning of the product and system lifecycle
  - Through every phase of development
  - Across all disciplines of mechanical, electronic and software
- Ensure traceability across all levels of requirements

- Mature from an isolated to a collaborative environment

- Invest the same focus and rigor on engineering requirements as in managing mechanical Bill of Materials

- Integrate Requirements Engineering closely with System Engineering, Change, Product and Portfolio Management, and Quality Assurance

IBM Customer Success
Hydraulic hybrid delivery vehicles - Eaton & UPS

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

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."**

"Smarter" often means More Complex

The systems engineering challenge:

▶ Eaton's – maybe the world's – most complex hydraulic hybrid system ever

▶ Unproven, complex and mixed domain technologies must interoperate and depend on each other (electrical, mechanical, hydraulic, human, safety, etc.)

▶ *Manual attempts to specify the system fell short*

High-Pressure Accumulator

Hydraulic Drive Assembly

Pump/ motor

Low-Pressure Accumulator
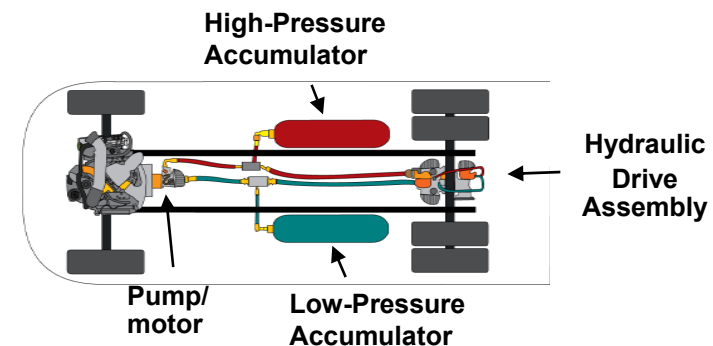
The software development challenge:

▶ Controlling this system requires relatively complex software for the pump motor and associated monitors

▶ Eaton's Hybrid Power Group had little experience developing and testing code of this type

▶ *Eaton needed to directly tie its software development to the overall systems design*

Eaton's Approach

Needs: ► *Overcome major complexity challenges*

► *Reduce cost of prototyping and developing the vehicles and their software*

Solution: Eaton extended its Rational environment to achieve:

- ▸ Sharpened focus on requirements and how they define the systems
- ▸ Visualization of complexity through collaborative systems design, simulation & testing
- ▸ Iterative software engineering to specify and create tuned, accurate source code
- ▸ Designed-in quality by ensuring that the system works at every stage of development
- ▸ Lifecycle traceability to prove that all requirements have been satisfied

World's First
Hydraulic Hybrid
Delivery Vehicle

Watch the YouTube video

IBM's vision for systems engineering and software development
Built on a core product set

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

Rational Rhapsody

Rational DOORS

Rational Quality Manager

Manage all system requirements with full traceability across the lifecycle

Rational Team Concert

Achieve "quality by design" with an integrated, automated quality management and testing process

Collaborate across diverse engineering disciplines and development teams

Collaborate   **Automate**   **Report**

Mechanical, electronic and software processes

jazz.
Innovation through Collaboration

IBM's solution for systems engineering and software development

- Provides a modern, multi-disciplinary, collaborative solution for delivering smarter systems and products

- A collection of assets and services to enable the successful deployment of system engineering solutions

- Provides support for 9 Systems Engineering Practices and 6 Embedded Software Practices that help our clients gain measured improvement for reducing time to value and reducing engineering costs in their own projects

- Provides a model for incremental adoption with measurable return on investment at each and every stage

- Forms the basis for a range of Industry accelerators

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

Rational Rhapsody

Rational DOORS

Rational Quality Manager

Manage all system requirements with full traceability across the lifecycle

Rational Team Concert

Achieve "quality by design" with an integrated, automated quality management and testing process

Collaborate across diverse engineering disciplines and development teams

Collaborate Automate Report

Rational CLM Workbench for Systems and Software Engineering

jazz
Innovation through Collaboration

Extend the Solution to Meet Your Needs

The Rational solution can be tailored to meet virtually any systems development workflow :
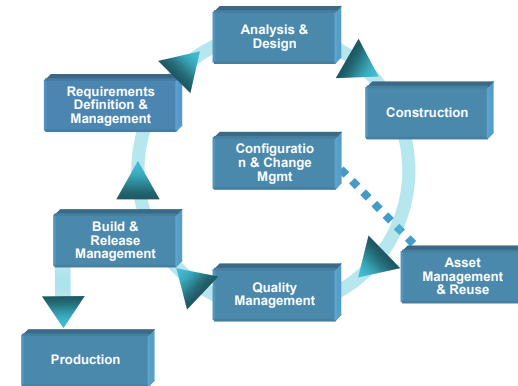
▶ *Automated reporting and documentation* with **Rational Publishing Engine**

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

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

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

▶ *Domain specialization with industry-specific profiles such as AUTOSAR, Android, functional safety, and defense architecture frameworks*

▶ *Embedded platform development* with **Wind River Workbench/VxWorks**

  ▪ Support also exists for **Green Hills Integrity, QNX Momentics/Neutrino** and many other embedded platform operating system environments

▶ and many others…

Industry Accelerators

Industry accelerators **build on the core systems solutions offering to bring focus and customization to address industry specific needs**

DODAF

ISO ISO 15288
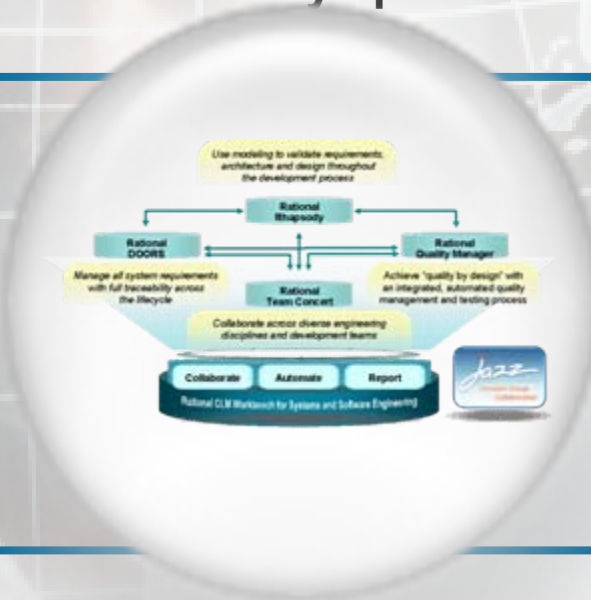
Automotive SPICE©

ISO ISO WD 26262

Targeted solutions **using your vocabulary and supporting your regulations and compliance standards to address your specific challenges**

Systems and Software Practices
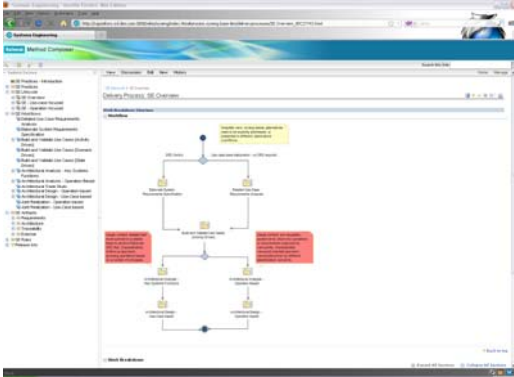
- Rational Solution for Systems and Software Engineering provides a new level of combined process and tool support for key activities and key deliverables within the development lifecycle
  - ▶ Based upon the proven experience with Harmony and RUP
  - ▶ Extendable through the IBM Rational Practice library

- Rational delivers process support by way of
  - ▶ Practices, Dashboards, Workflows, Tool mentors, Tool integrations, Sample artefacts
    - 9 Systems Engineering Practices
    - 6 Embedded Software Practices
  - ▶ RTC 3.0 process templates
    - Including specific tool guideline for Requirements Change Handling that exploits the RTC 3.0 Doors 9.3 integration based on OSLC
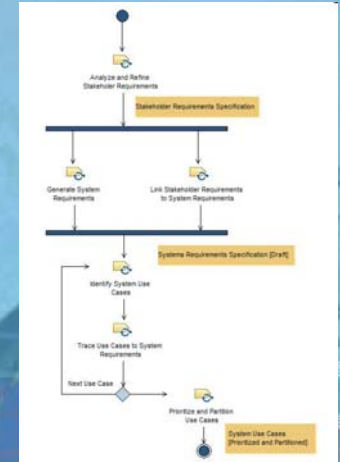
Accelerate the adoption of common process support, practices and tools so reducing the time to value for your own improvement initiatives

Accelerate the integration and test of engineering methods and tools reducing costs and risk for project teams

Integrated Product Management
Leveraging a broad set of cross-IBM solutions

GBS

Strategically <u>transform</u> business processes to build new capabilities, save costs, accelerate product introduction, and create new markets

| BUSINESS PLANNING & TRANSFORMATION |

Rational.

Adopt an advanced <u>systems engineering</u> approach to manage all product interrelationships across engineering disciplines and build a strong competency in <u>software development and delivery</u>

| PRODUCT & SYSTEMS DEVELOPMENT |

Industry Frameworks

Optimize the design and supply chain by automating business processes that <u>leverage existing investments</u> in best-of-breed applications & data

| DESIGN CHAIN COLLABORATION |

Tivoli

Ensure that product and asset maintenance and support is treated as a <u>strategic business process</u> that drives profitability

| ASSET MANAGEMENT & OPERATIONS |

Business Partners ecosystem for Systems

SmartBear SOFTWARE — Automated code review integrated with Rational Team Concert workflow

zeligsoft — Extends Rational Software Architect with software defined radio industry toolkit

BigLever Software, Inc. — Develop, deliver and evolve a product line portfolio

Prolifics — Automated Team Build-Deploy-Test for WebSphere from Rational Team Concert

ARS Software Engineering — INTELLIGENT TRANSPORT SYSTEMS — Research and development of technology business consultancy, system integration

STONEWORKS SOFTWARE — Trace, control, manage product requirements across engineering domains

ascendant TECHNOLOGY — Offerings and assets designed to maximize IT spend through people and process optimization

BSD GROUP — Architecting, designing, implementing and maintaining suitable software change management solutions

ZenSOFT services — Architecting, designing, implementing and maintaining suitable software change management solutions

blackduck — Find and manage open source approvals

DeviceAnywhere by Mobile Complete — Execute mobile handset tests.

cmlogic empowering change — Enable bidirectional JIRA change management integration

WIND RIVER — Embedded software quality lifecycle management

cadence™ — Electronic design data management

INCHRON THINK REAL-TIME — Software model simulation

A few of over 150 Ready for Rational active integrations

IBM

Ensure Success with Rational

Rational. software

Process and methodology	Implementation services	Training and mentoring	Technical services

Process and methodology

- Process framework workshops

- *Rational Harmony* family of Best Practices and Processes

- Process training

Implementation services

- Adoption quick starts

- Deployment support

- Project architecture workshops

- Project management

- Planning support

- Escalation/risk mitigation

Training and mentoring

- Product familiarity

- Product expertise and specialization

- Technology transfer

- Adoption mentoring

- e-Learning

Technical services

- Measured Capability Improvement Framework (MCIF)

- Product optimization and customization

- Tool configuration

Summary

- **Complexity can rapidly increase as you develop products and systems**

- **Maintaining the various systems relationships manually is very difficult – maybe impossible**

- **IBM's *solution for Systems and Software Engineering* automates the building of structures and dependency relationships to:**
  - Manage increasing complexity
  - Ensure designs and products meet market demands and industry requirements
  - Perform effective impact and change analysis across different disciplines and subsystem views
  - Enable collaboration across the entire development organization

Learn more at:

- IBM Rational software
- IBM Rational Software Delivery Platform
- Process and portfolio management
- Change and release management
- Quality management
- Architecture management

- Rational trial downloads
- Leading Innovation Web site
- developerWorks Rational
- IBM Rational TV
- IBM Business Partners
- IBM Rational Case Studies