



IBM Software Group

# Rational 솔루션이 어떻게 MDSE를 지원하는가?

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Rational. software



Innovation for a smarter planet

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# IBM Rational MDSE Solution

MDSE

(Model Driven Systems Engineering)

- 1 What is MDSE?
- 2 IBM Rational MDSE Solution
- 3 IBM Rational Harmony Process
- 4 고객 사례 – Boeing
- 5 Q&A

0



# IBM Rational MDSE Solution

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- 5 Q&A**



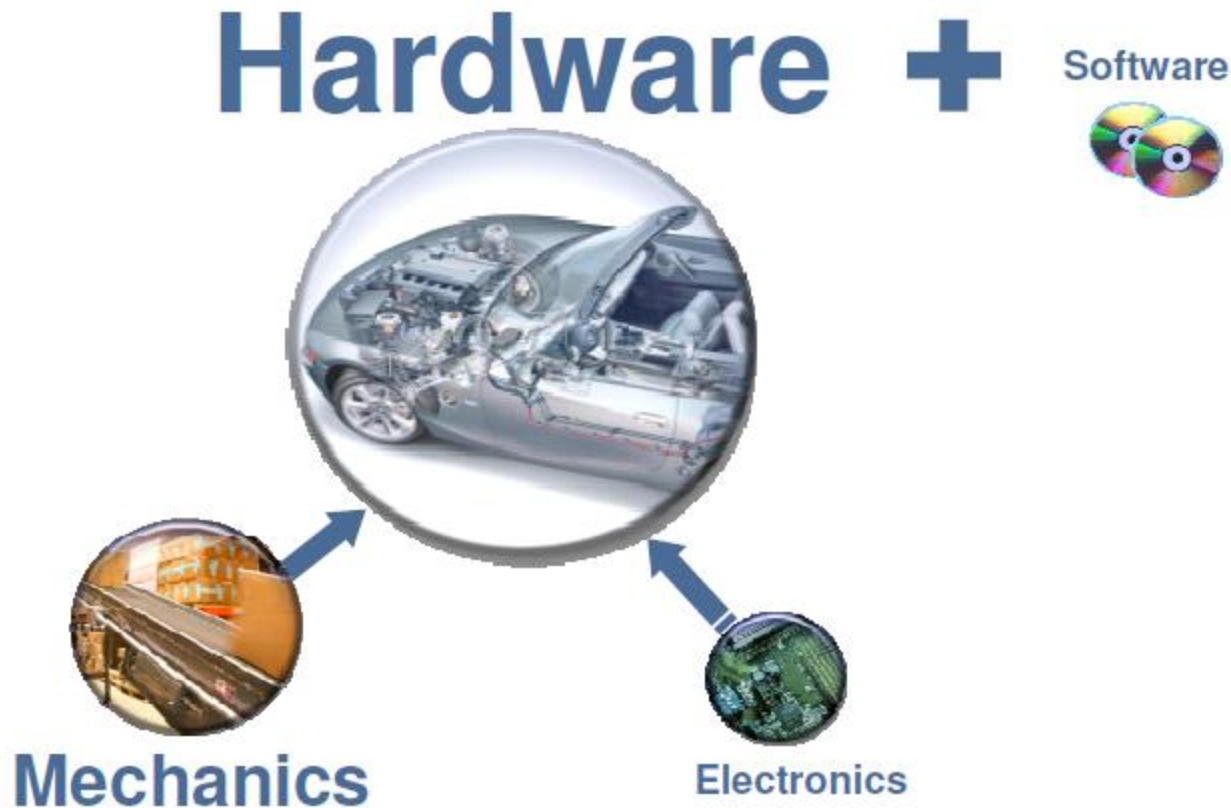
# Let's define what we mean by a "System" - Version A

*From a Software Company Point of View*

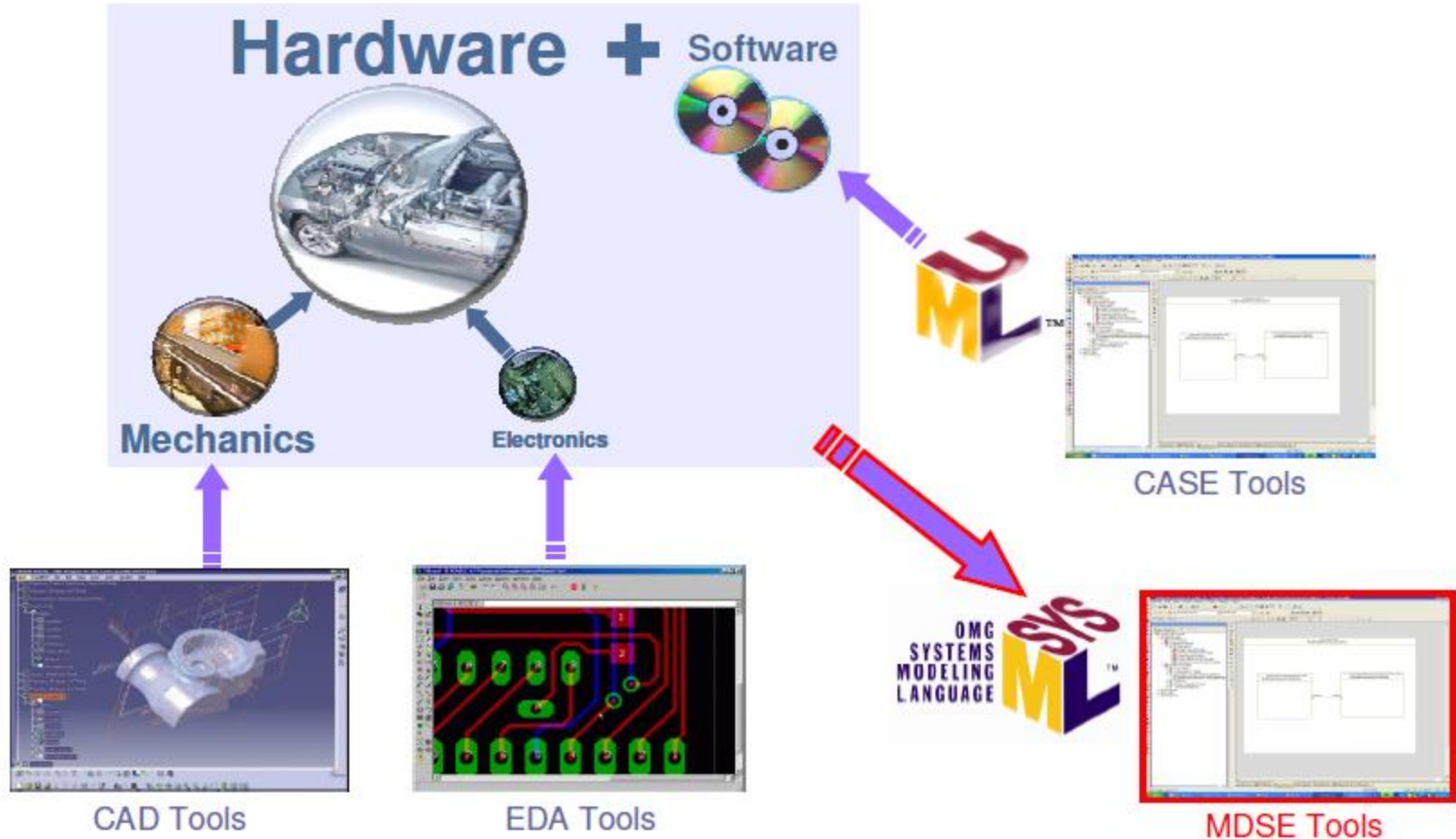


# Let's define what we mean by a "System" - Version B

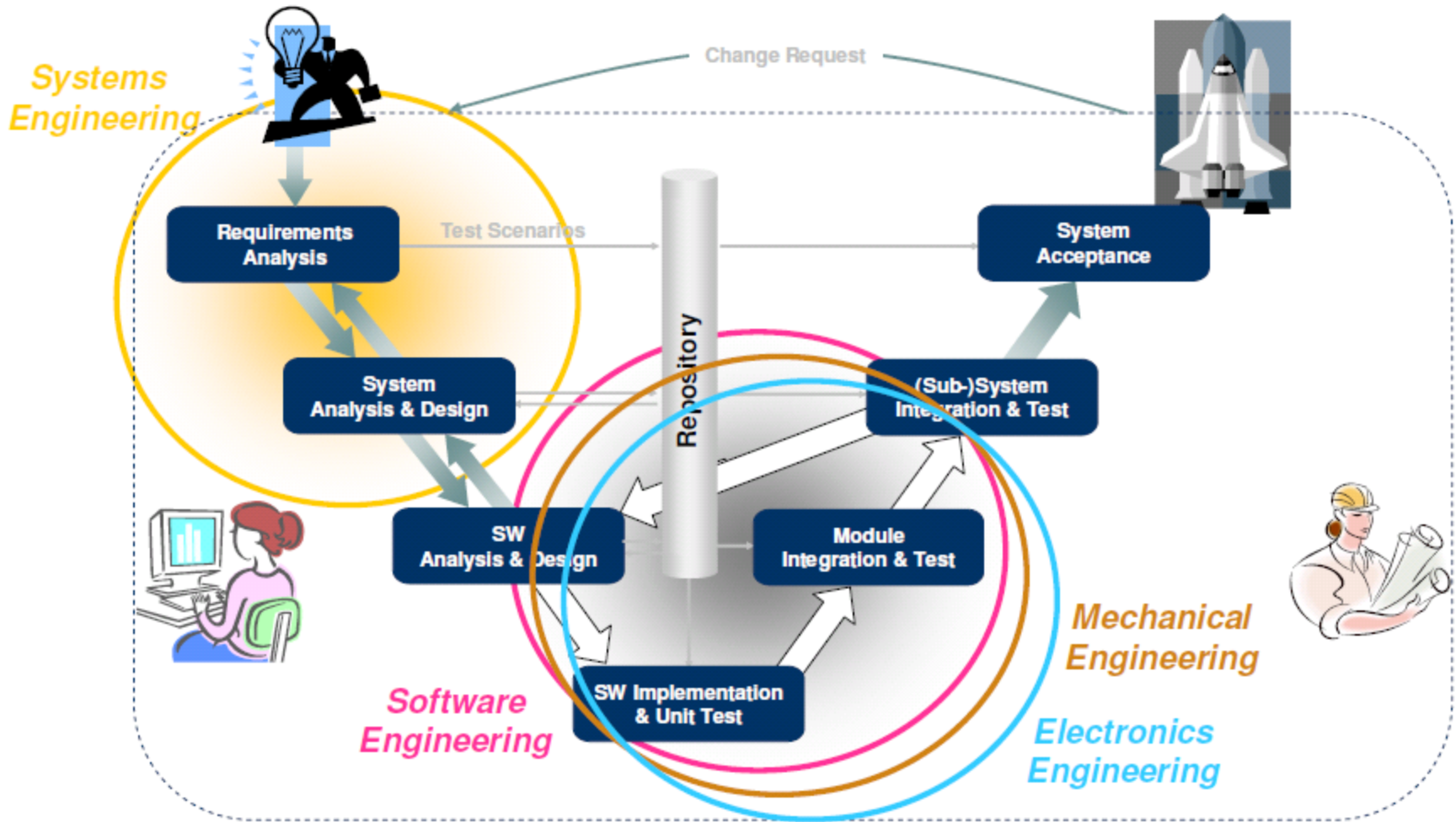
*From a Systems Company Point of View*



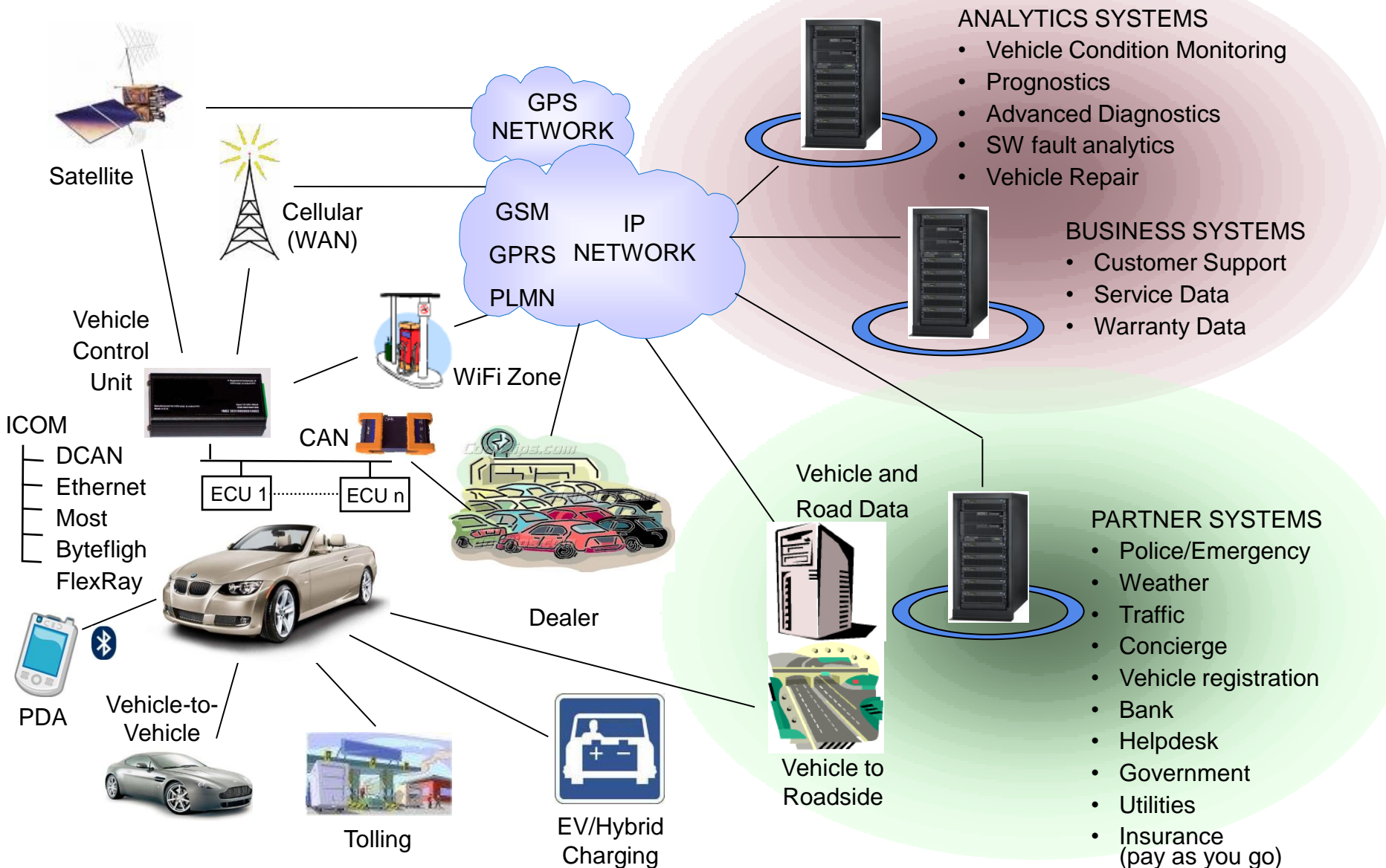
# Model Driven Systems Engineering (MDSE) addresses these challenges!



# Systems Development Process



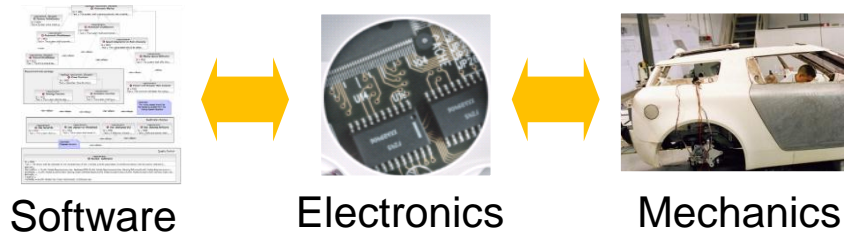
# The Connected Vehicle – ‘A System of systems’



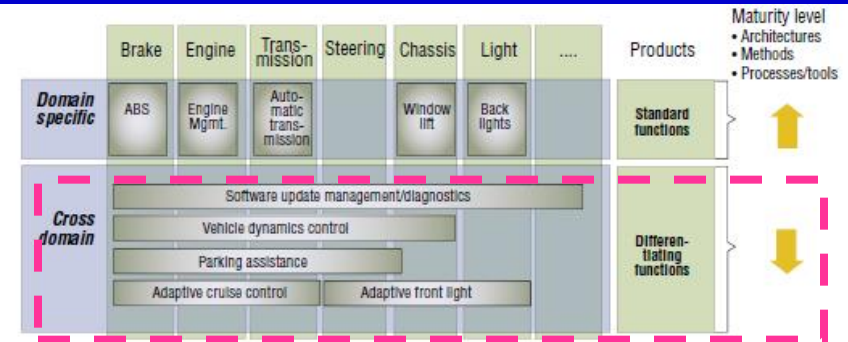


# Increasing complexity of systems makes hard to maintain quality and cost (example of Auto industry)

## Inter-relationship across software / electronics / mechanics

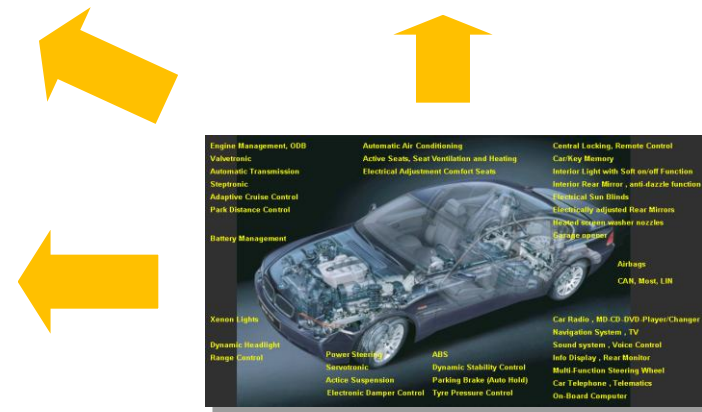
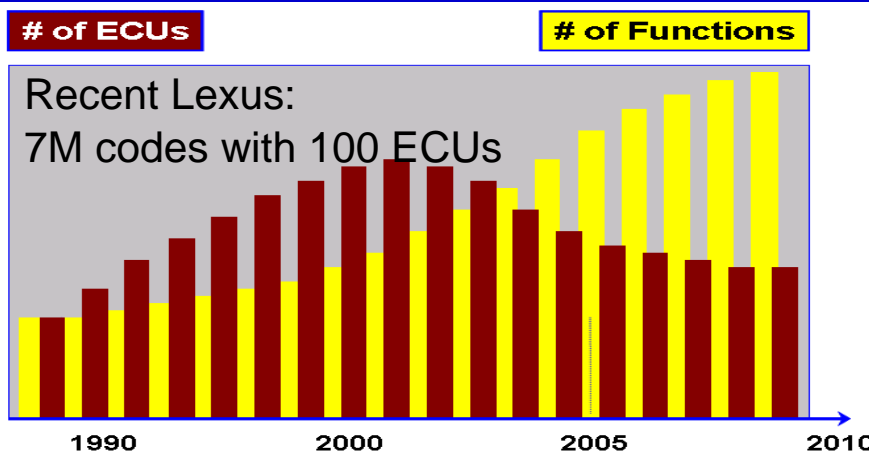


## Cross-domain design functions for differentiation



Source: IBM Institute for Business Value.

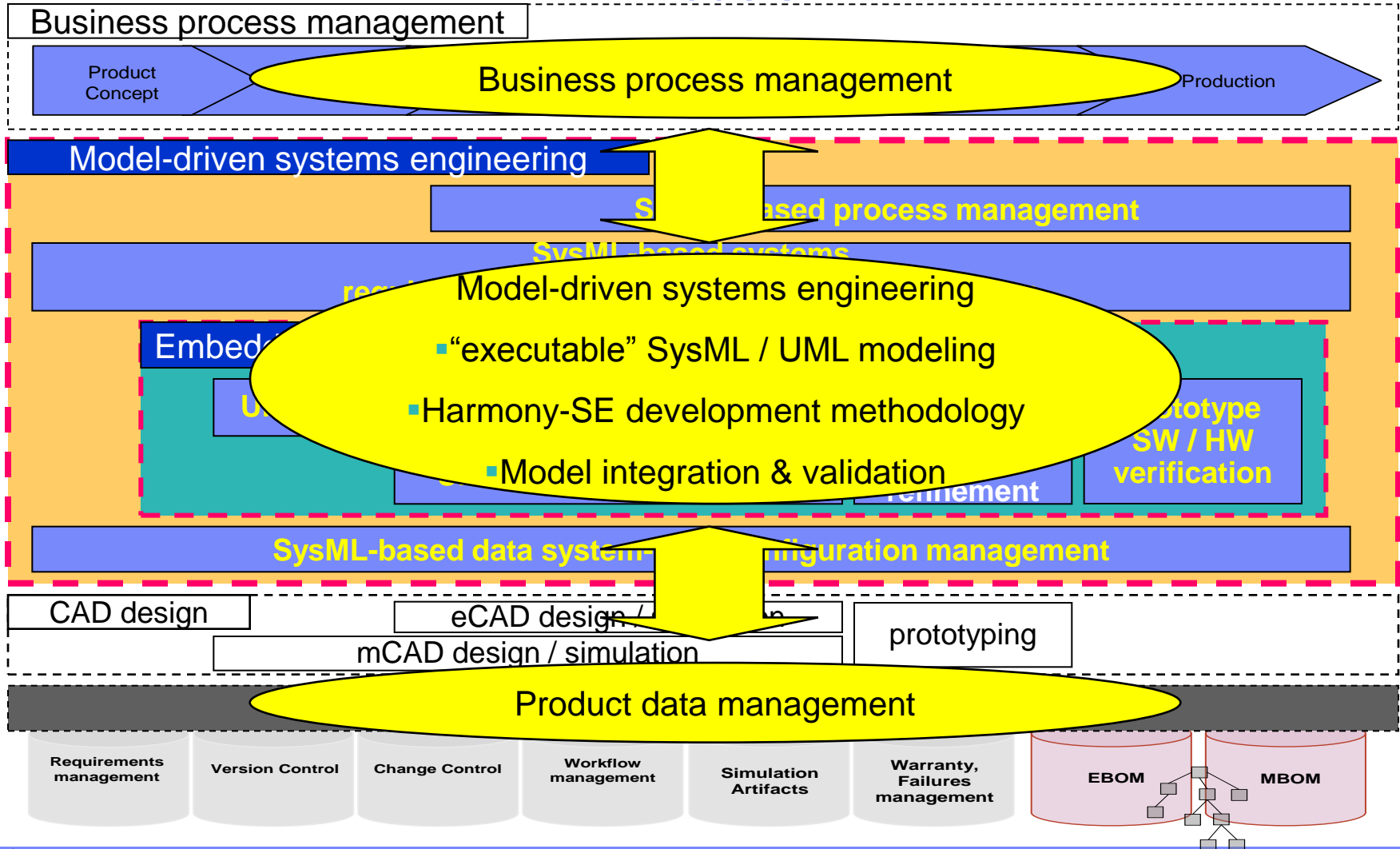
## Rapid increase of SW on complicated electronics



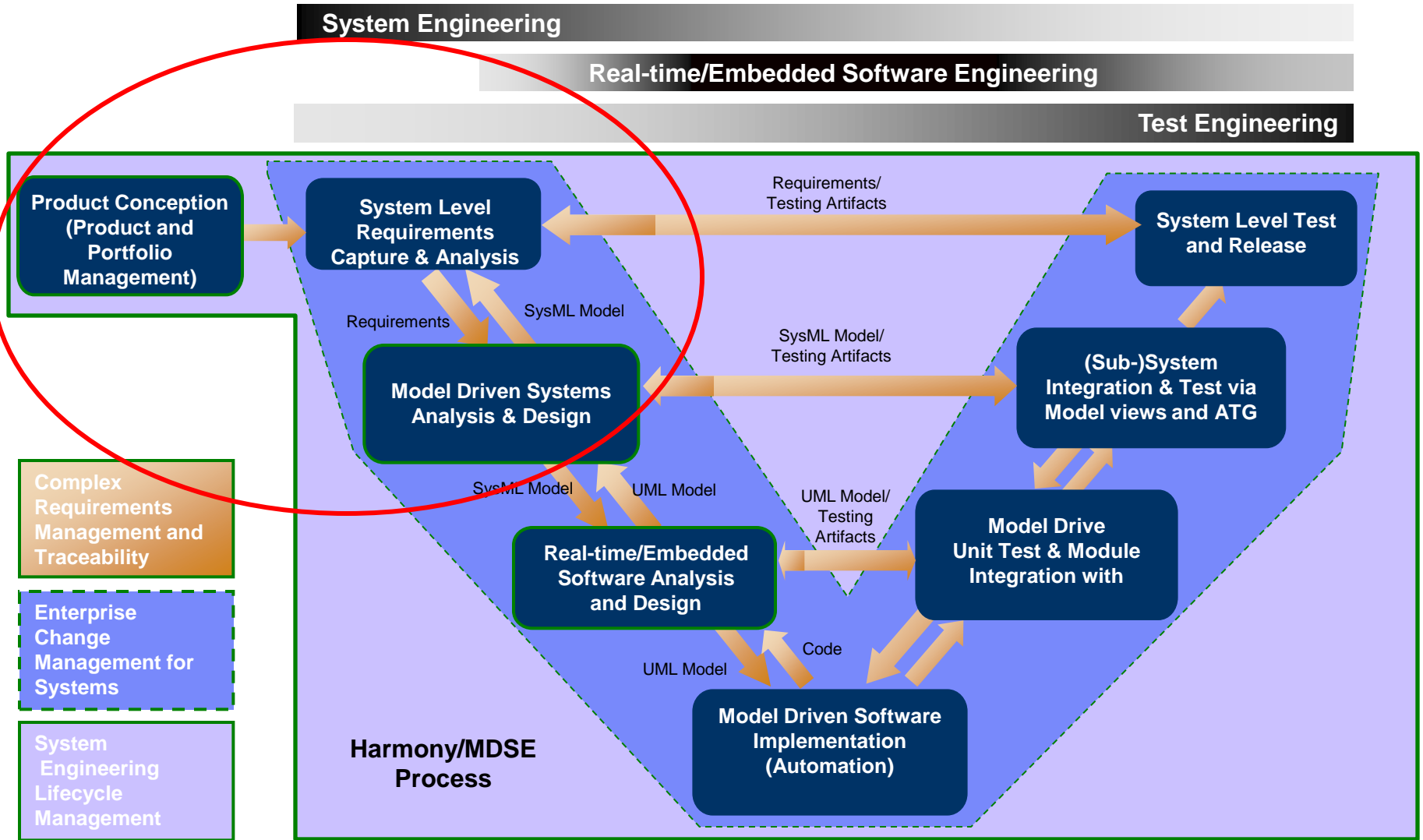
## Increase of complexity for differentiation



MDSE will introduce new methods and tools to transform PLM by connecting business process and product data by "executable models".



# Rational MDSE Solutions



# IBM Rational MDSE Solution

MDSE

(Model Driven Systems Engineering)

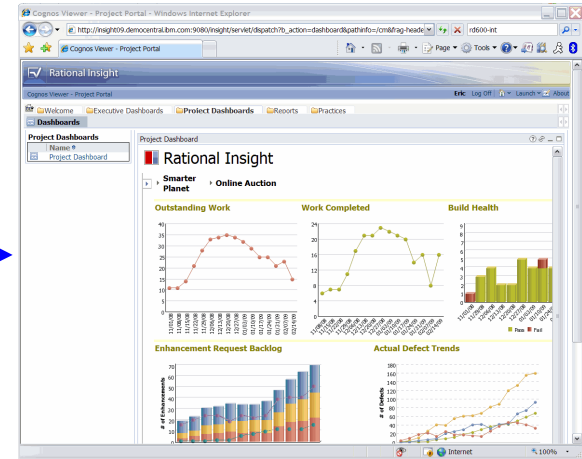
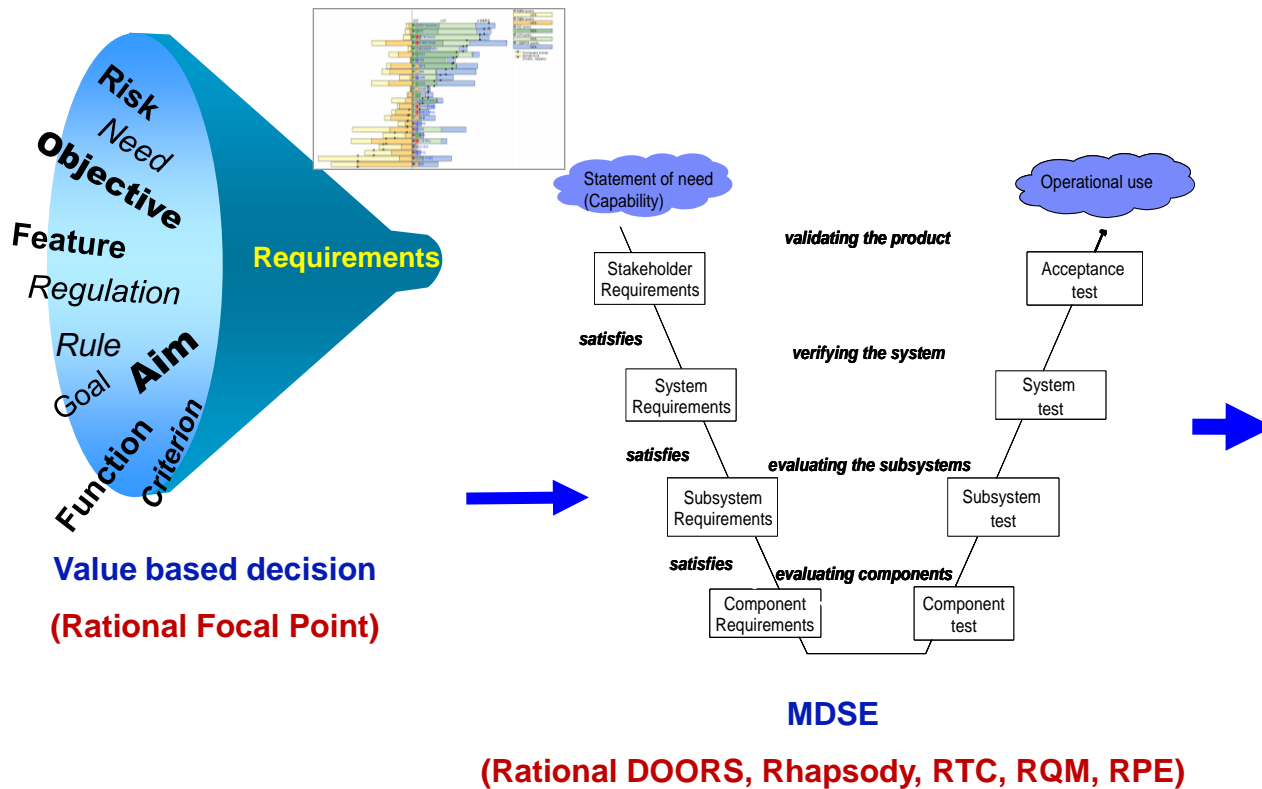
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- 2 IBM Rational MDSE Solution
  - 1) **PPM(Product & Portfolio Management)**
  - 2) Way Jazz?
  - 3) System Workbench
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- 3 IBM Rational Harmony Process
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2.1



# Visual development

- PPM 솔루션으로 고객의 Needs, 경쟁사 정보, 각종 분석을 통해 요구사항을 선택함
- RM 솔루션으로 체계적인 요구사항 관리(추가, 변경, 검증)
- PPM 솔루션으로 프로젝트의 진행사항을 실시간으로 파악함



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# 2.1



# IBM Rational MDSE Solution

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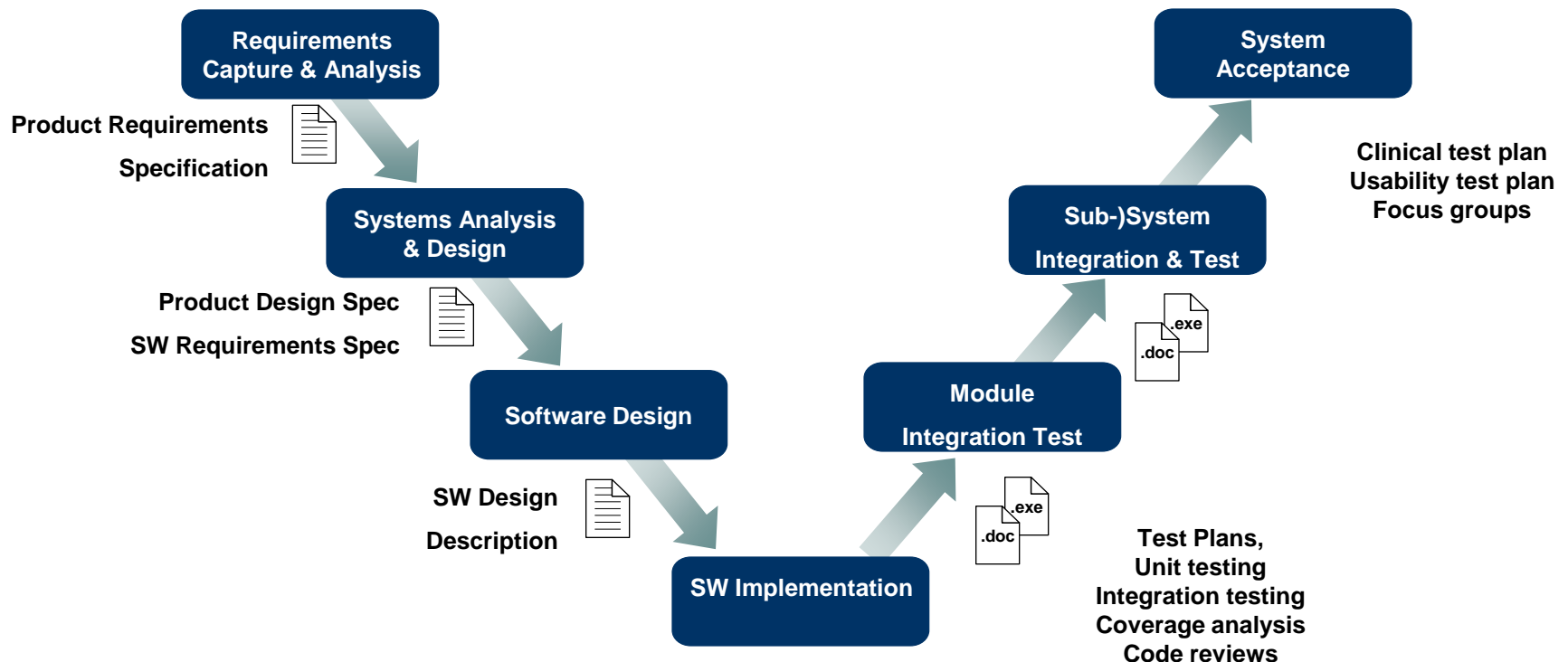
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# 2.2



# Traditional systems development - how it should work

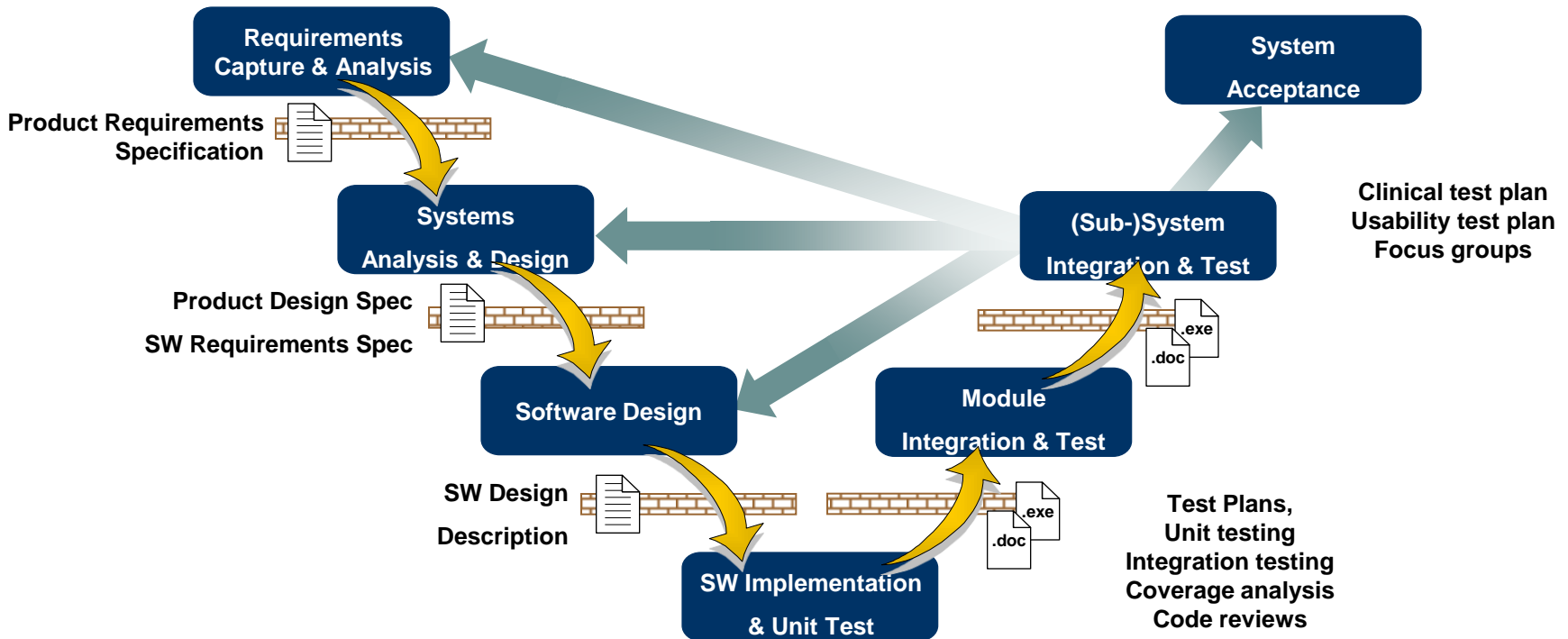
- Traditional development assumes design input is fully defined
- Design output is verified against design input iteratively





# Traditional systems development - how it actually works

- In the traditional V, work is serial, and team members are disconnected and often waiting on the work of others, leading to delays
- Artifacts handed off from the previous process step are informal and not tested, leading to poor quality



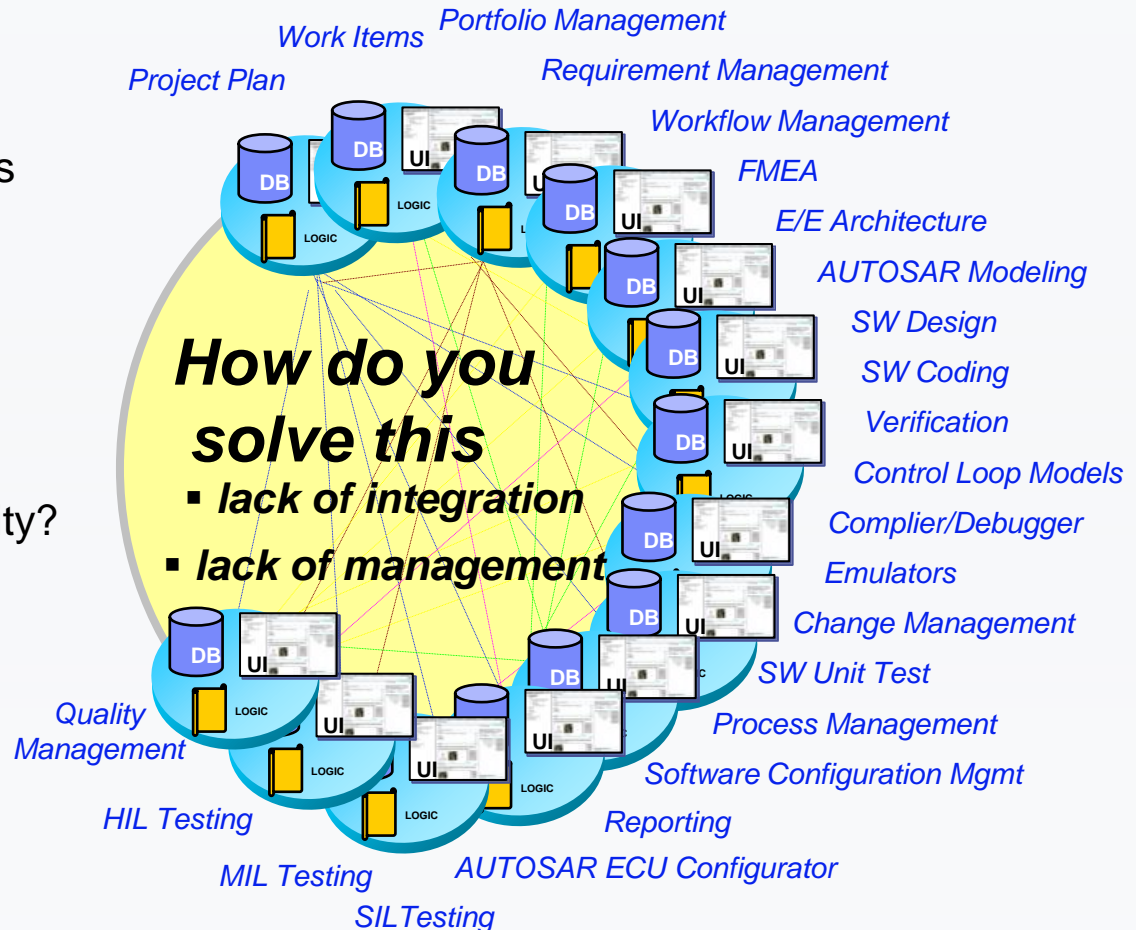
# Electric/Electronic/Software engineering environments are highly fragmented - *the challenge to connect them is increasing exponentially*

## ■ Traditionally, each tool came with its own

- ▶ **UI** - Web and desktop presentations of views and tasks
- ▶ **Logic** – Workflow, process, search, query, scale, security and collaboration
- ▶ **Storage** – individual files on workstation or servers: how to ensure availability and traceability?

## ■ Resulting in...

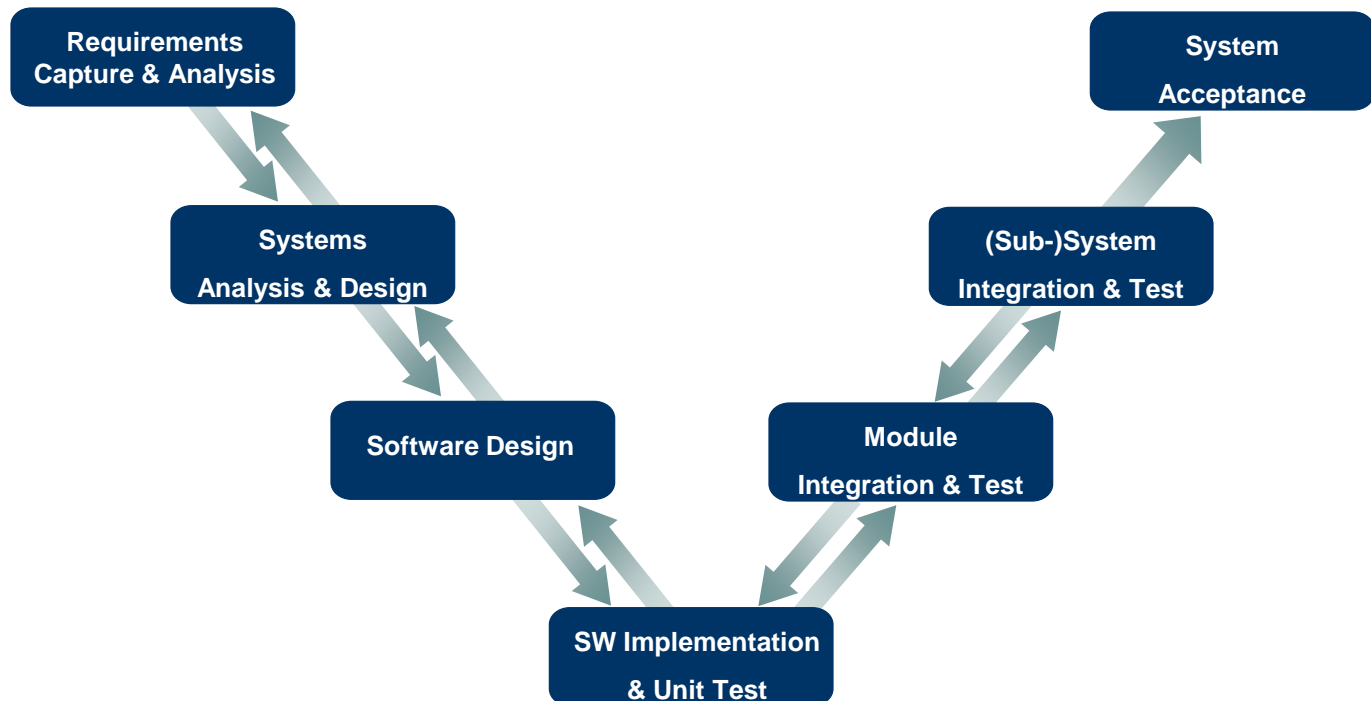
- ▶ Brittle integrations
- ▶ Silos everywhere
- ▶ High cost to maintain and administer
- ▶ Low re-use



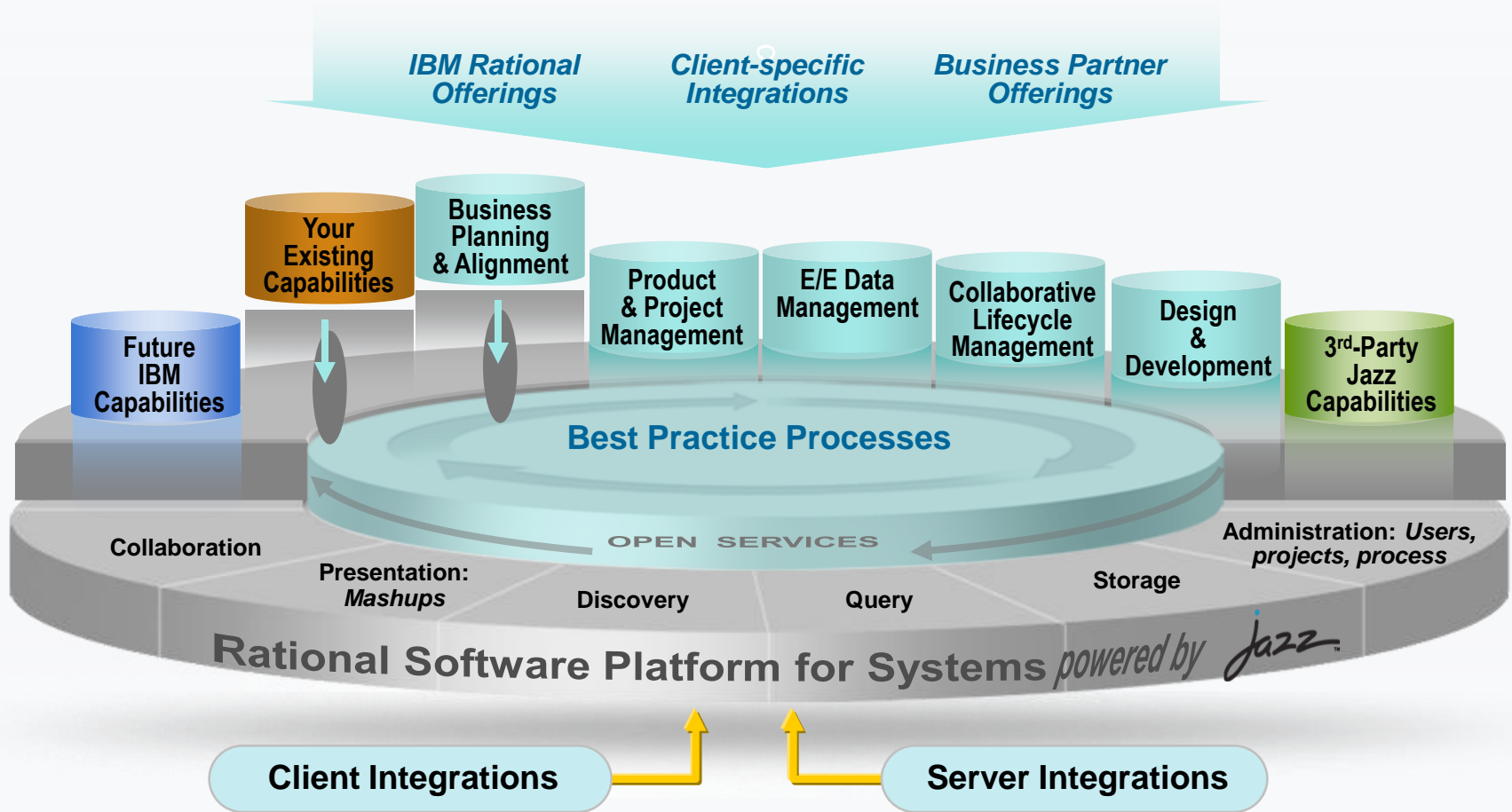
# Delivering systems innovation

*with agility, quality, and speed*

- **Needed** – Removal of development barriers with transparent team collaboration and industry leading tool interoperability



# Future E/E engineering capabilities will be seamlessly integrated *Based on standard and open technologies such as OSLC*



## Rational Platform For Systems Advantages

- **Open architecture based on an open standard**
- **Allows any third party to integrate**
- **Allows freedom of choice to select the best capability rather than the one size fits all approach of some PLM vendors**
- **Allows cross domain visualization of data**
- **Eliminates “clone and own” approach to data sharing**



## IBM Rational MDSE Solution

MDSE

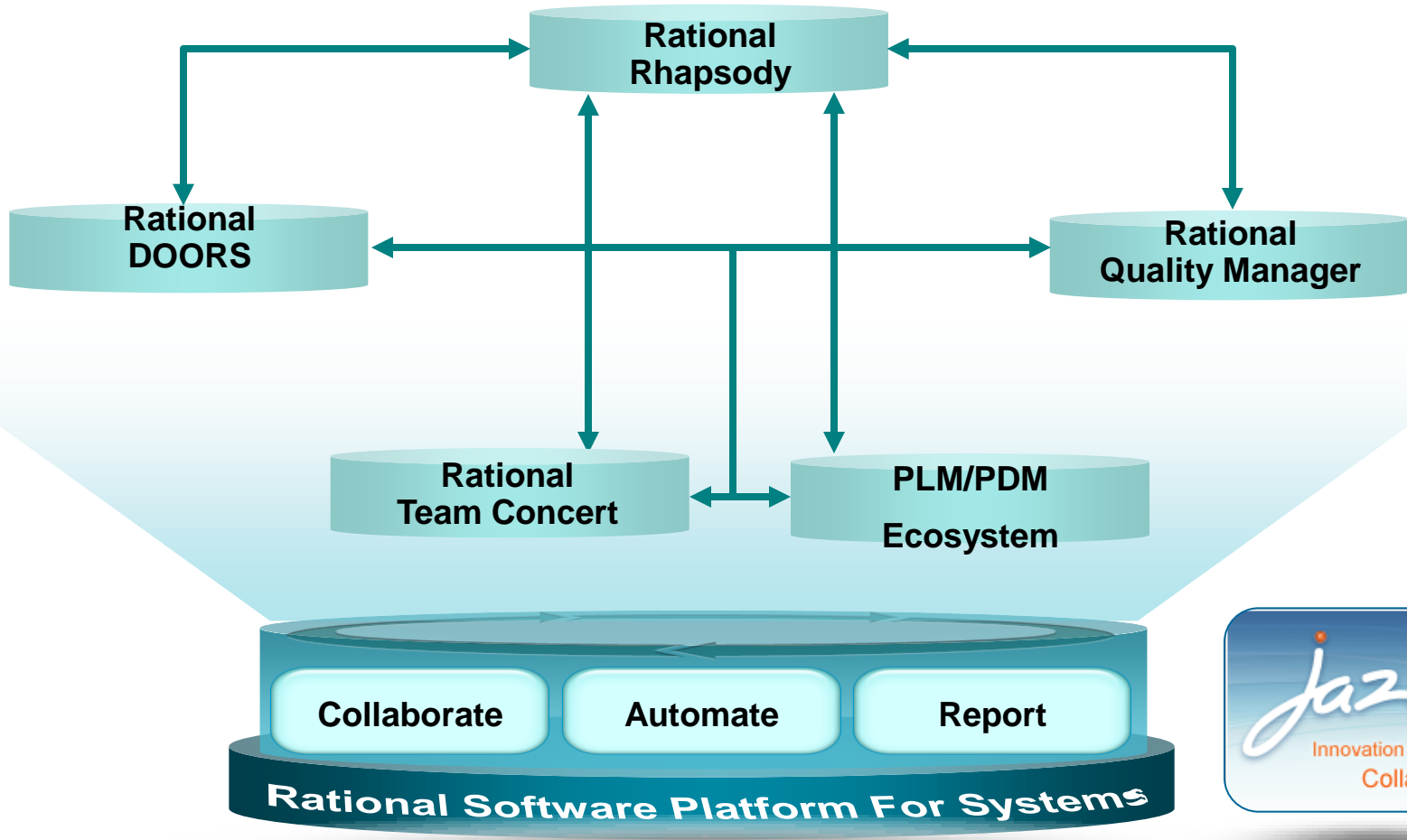
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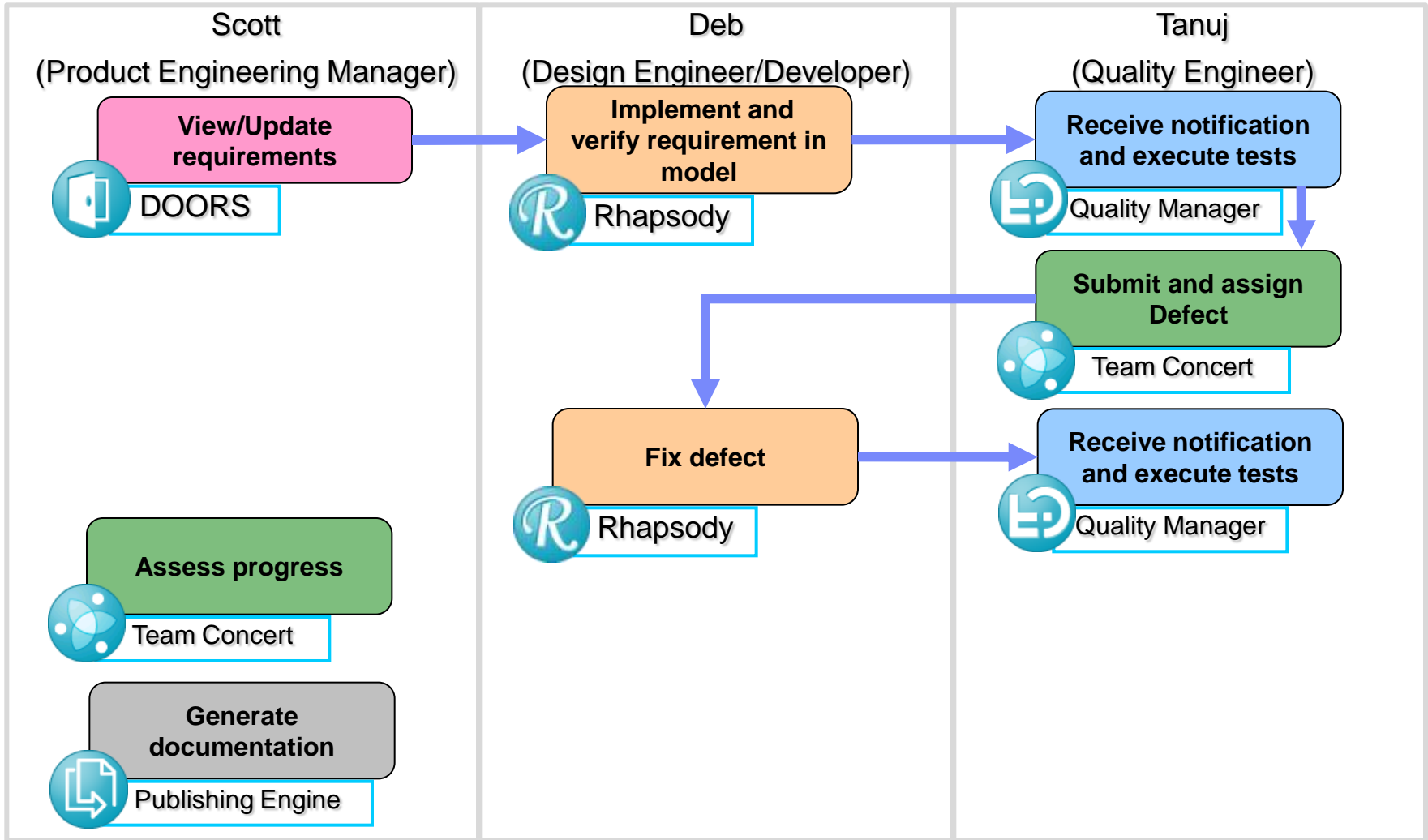
2.3



# Rational Platform for Systems



# Example usage scenario



Rational Solution

DOORS
Rhapsody
Team Concert
Quality Manager
Publishing Engine





# Systems delivery collaboration and management hub using Rational Team Concert



Process Description

Process enabled

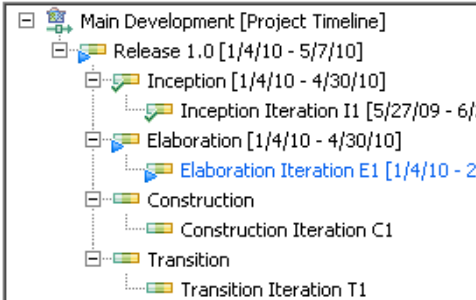
**Harmony Process** The Harmony Process is a collection of best practices guidance including complex requirements management, model drive systems analysis and design with SysML, model driven embedded software design, and finally automated testing and ties back to requirements.

Integrated plan & work management

Fully collaborative

Timelines

The project timeline defines a start and end date along with additional timelines can be defined to track secondary activities.



Team aware

Iteration1

Team Area: Parking Lot Team | Iteration: Elaboration Iteration E1 (1/4/10 - 2/12/10) | [2 Closed](#) | [6 Open](#)

Team Member	Item	Duration	Priority	Count
Andy Closed items: 1   Open items: 2 Load: 48 / 60   +12 h Estimated: 100%	Update Use Case Model Based on Changes to Functional Requirement 25	4 days	High	13
	Allocate Actions To Sub-Blocks	2 days	Medium	9
Dan Closed items: 0   Open items: 1 Load: 24 / 60   +36 h Estimated: 100%	Given new subsystems specification based on requirement 24, implement required changes to software subsystem design and verify	3 days	High	14
	Failing Test Case "Admit authorised user : Barrier did not close after admitting authorised user"	-	Unassigned	16
Susan Closed items: 0   Open items: 1 Load: 16 / 40   +24 h Estimated: 100%	Do detailed review of Functional Requirement 25	2 days	Medium	12
	Update Test Case to verify and validate functional requirement and design changes relative to functional requirement 25	3 days	High	15



# Manage requirements across lifecycle and across disciplines



using Rational DOORS

User Requirements

Technical Requirements

Design

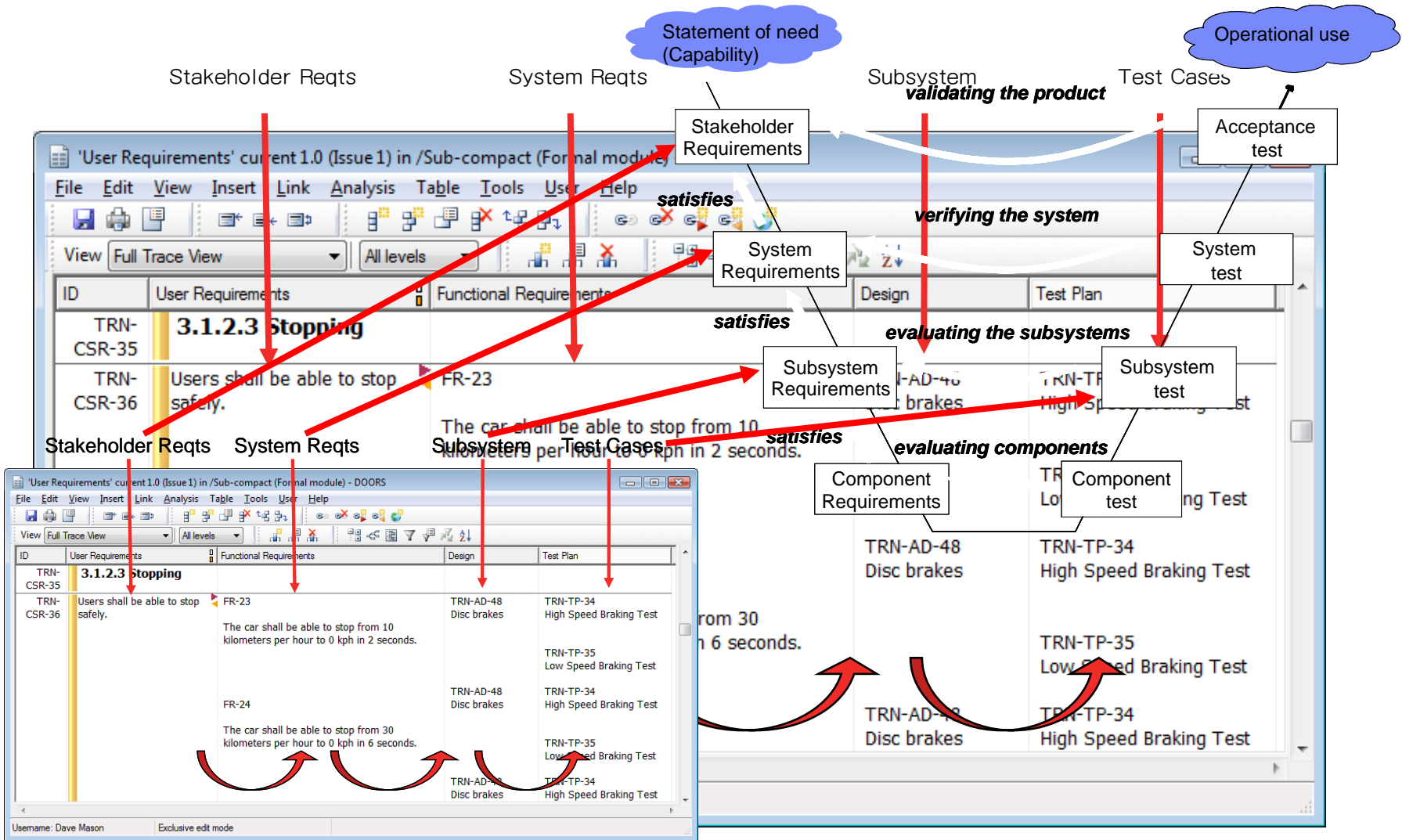
Test Cases

ID	User Requirements	Functional Requirements	Design	Test Plan
TRN-CSR-35	<b>3.1.2.3 Stopping</b>			
TRN-CSR-36	Users shall be able to stop safely.	<p>FR-23</p> <p>The car shall be able to stop from 10 kilometers per hour to 0 kph in 2 seconds.</p> <p>FR-24</p> <p>The car shall be able to stop from 30 kilometers per hour to 0 kph in 6 seconds.</p>	<p>TRN-AD-48</p> <p>Disc brakes</p> <p>TRN-AD-48</p> <p>Disc brakes</p> <p>TRN-AD-48</p> <p>Disc brakes</p>	<p>TRN-TP-34</p> <p>High Speed Braking Test</p> <p>TRN-TP-35</p> <p>Low Speed Braking Test</p> <p>TRN-TP-34</p> <p>High Speed Braking Test</p> <p>TRN-TP-35</p> <p>Low Speed Braking Test</p> <p>TRN-TP-34</p> <p>High Speed Braking Test</p>

- Build the right product because the requirements are visible at all times



# Process mapping with DOORS



“전체 수명주기의 산출물들간의 개별 요구사항 추적성 도구”



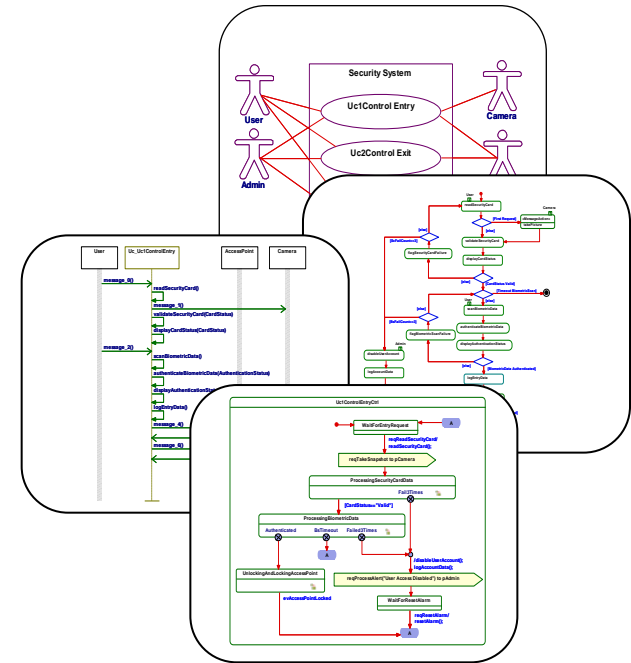
# Modern approaches for describing systems are evolving *to better manage complexity and reduce time-to-market*

Past



- Specifications**
- Interface requirements**
- System design**
- Analysis & trade-off**
- Test plans**

Future

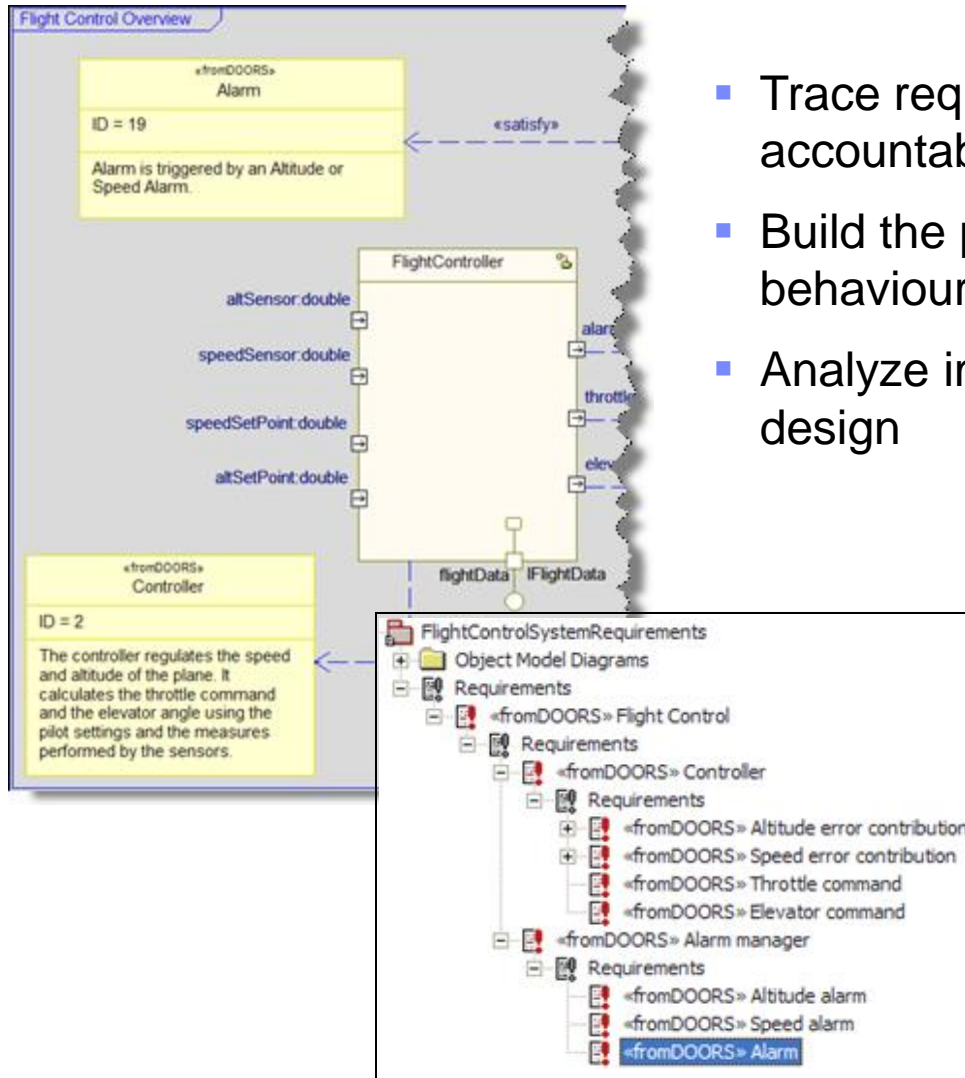


*Moving from manual methods to a model-driven approach*



# Model driven analysis and design for Systems Engineers

## using Rational Rhapsody and Rational DOORS



- Trace requirements in either direction for full accountability and understanding
- Build the product right with structural and behavioural analysis and design
- Analyze impact of changes in requirements or design





# Confirmation of analysis and design for Systems Engineers using Rational Rhapsody

- Find errors early in the process with advanced model execution capabilities

The screenshot displays the Rational Rhapsody environment for a C++ project. The main workspace shows a sequence diagram titled "Sequence Diagram: Animated Normal Operation" with participants :Builder, :Reader, :Command, and :Writer. A statechart for "Builder - Builder[0]" is also visible, showing a state "running" with a "count++" operation and a timer "tm(500)".

Annotations on the screenshot include:

- Model execution enables iterative development:** A callout pointing to the "Entire Model View" tree on the left, which lists various model elements like CommandDown, Hyperlinks, Instances, Operations, SuperClasses, and Collaboration Diagrams.
- Requirements test through execution:** A callout pointing to the statechart diagram, which illustrates the execution flow and timing of the model.
- Correct specification hand-off to software:** A callout pointing to the "Features of Builder[0]" window, which shows the instance name "Builder[0]" and a table of attributes.

Name	Value	Type
count	0	int

At the bottom of the interface, there are windows for "Call Stack", "Event Queue", and "Executable is Idle". The status bar at the bottom indicates "GE MODE" and the date/time "Thu, 1, Mar 2007 6:21 PM".



# Build in quality from concept to launch



*using Rational Quality Manager*

- Execute often to validate functionality and verify correctness
- Automatically create and execute tests from the design model or target platform
- Manage test cases, while prioritizing the features and functions to be tested

The screenshot displays the Rational Quality Manager interface. The top navigation bar includes 'Home', 'View Test Plans', 'TestPlan\_CashRegiste...', 'TestCase\_01\_SD\_InitC...', and 'Execution Result'. The main content area is titled 'Execution Result' and shows a 'Test Case Result' for 'SD\_tc\_0' executed on 10/20/31, Monday, April 27, 2009. The test result is 'Passed'.

On the right side, a sequence diagram titled 'SDTestScenario\_0' is shown. It features two lifelines: 'TCon\_CashRegister.ItsCashRegister:CashRegister' (labeled as «SUT») and 'TCon\_CashRegister.ItsTC\_at\_hw\_of\_CashRegister:TC\_at\_hw\_of\_CashRegister' (labeled as «TestScenario»). The diagram shows a sequence of events: 'evStart()' is called on the SUT lifeline, followed by a message 'show(aMsg = Ready)' sent from the SUT to the TestScenario lifeline, and finally 'evEnd()' is called on the SUT lifeline.

Below the test case result, there are several summary tables:

Environment Info	
Test executed on machine:	JCKLSSLAIVE
Test executed by user:	Administrator
Used OS version:	Windows 2000 /Windows XP
Used Rhapsody version:	7.5, build 1155117
Used TestConductor version:	2.4, build 1406

Tested Project	
Project:	CppCashRegister
Active Component:	TRhg_CashRegister_Comp
Active Configuration:	DefaultConfig

SDs used in test	
TRhg_CashRegister:SDTestScenario_0	

Summary Info		Summary: passed
Total number of SDs used:	1	
Total number of SD instances in test:	1	
Total number of executed SD instances:	1	
Total number of PASSED SD instances:	1 (100%)	
Total number of FAILED SD instances:	0 (0%)	
Total number of ACTIVE SD instances:	0 (0%)	
Total number of NOT ACTIVE SD instances:	0 (0%)	

At the bottom left, the 'Result Details' section lists files: 'TCon\_CashRegister\_\_SD\_tc\_0\_0.html', 'TestConductorAdapter20844.out', 'TestConductorAdapter20845.err', and 'TestLog20843.log'.



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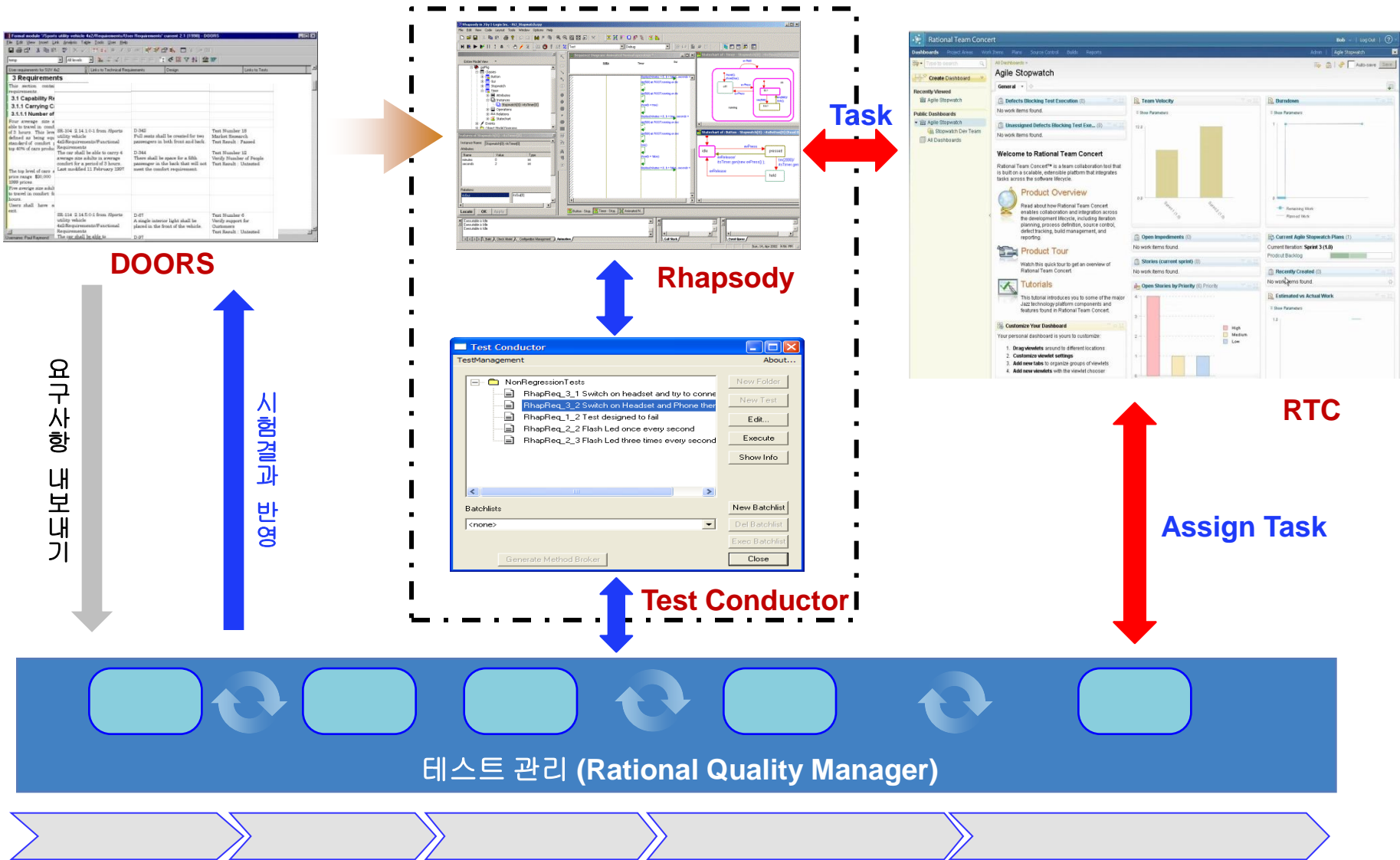
# 2.4







# Requirements based test on CLM



# CLM Solution Artifacts

## Data Source

**IBM Rational DOORS 9.2**

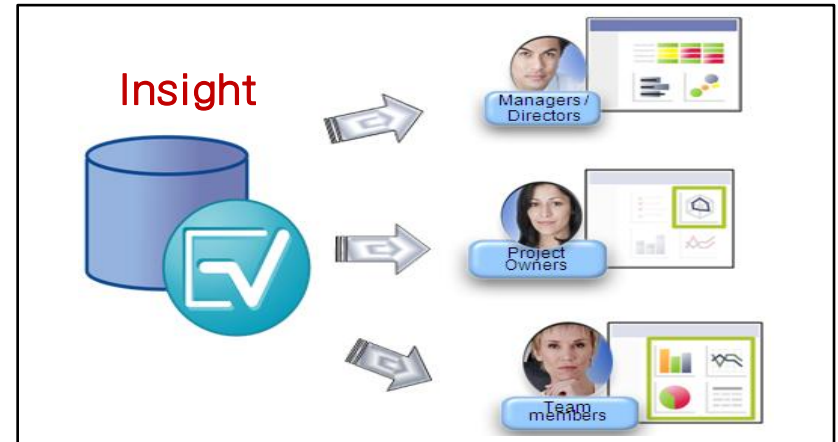
**3 Requirements**

Requirement ID	Description	Test Case ID	Test Case Description	Test Case Result
3.1.1.1	Number of seats	D-342	Full seats shall be created for two passengers in both front and back.	Test Result: Passed
3.1.1.2	Interior lighting	D-344	There shall be space for a fifth passenger in the back that will not meet the comfort requirement.	Test Result: Unmet
3.1.1.3	Interior lighting	D-347	A single interior light shall be placed in the front of the vehicle.	Test Result: Unmet

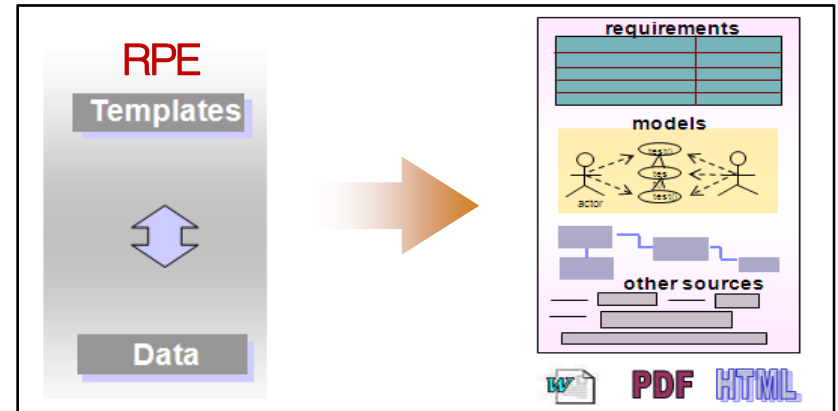
  

**IBM Rational Rhapsody**

## Dashboard



## Automatic Report Generation



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# Rational Harmony

A family of domain-specific processes for building better software and systems

- **Harmony/SE**
  - Systems Engineering



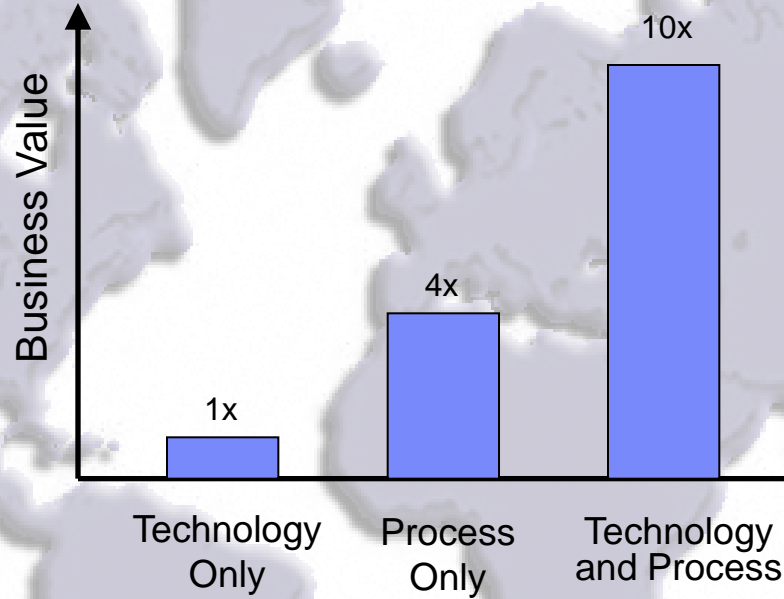
## The Importance of Process & Best Practices

“...The quality of a product is largely determined by the quality of the process that is used to develop and maintain it ...”

*based on:* Shewhart, Juran, Deming and Humphrey



# Combination of Technology and Process Results in 10x Business Value

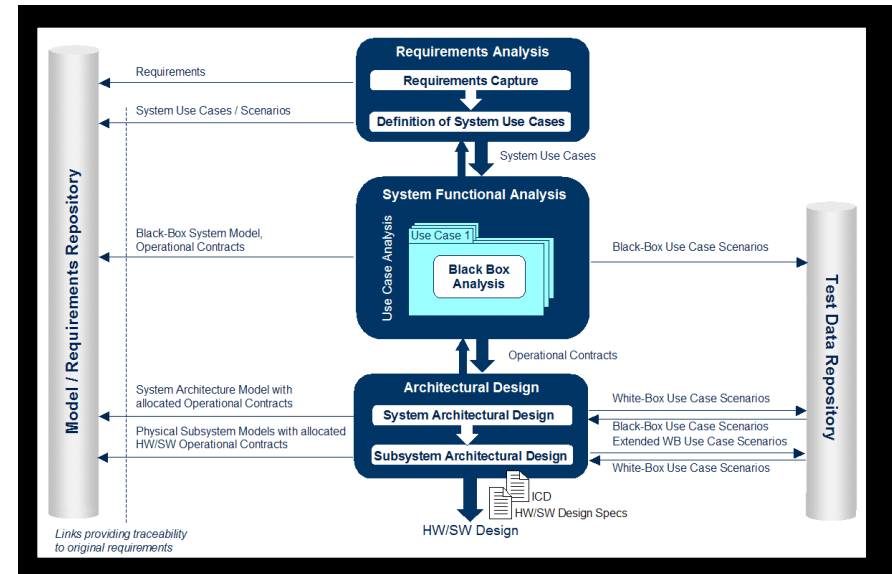


Source: London School of Economics – McKinsey Survey



# Systems Engineering Harmony/SE

- A model-based development process built upon the UML 2.1 and SysML languages
- Step-by-step guidance to evolve requirements into a solution
- Tool mentors specific to DOORS, Change, Synergy, and Rhapsody plus other Rational tooling
- Process Content/Methods may be tailored with EPF Composer or RMC





# Adoption Made Easy

## Role-based Guidance Available as a Website

The screenshot shows a web browser window titled "HarmonyITSW - Microsoft Internet Explorer". The page header includes the Telelogic logo and "Harmony/ITSW". The left sidebar contains a navigation tree with the following items: Introduction to Harmony/ITSW, Getting Started with Harmo, Core Principles, Harmony/ITSW Role Set (expanded), Analyst (selected), Any Role, Architect, Developer, IT Administrator, Process Engineer, Project Manager, Request Implementor, Request Reviewer, Request Verifier, Stakeholder, Team Lead, Tester, and Toolsmith.

The main content area is titled "Harmony/ITSW Role Set > Analyst" and "Role: Analyst". It contains the following text:

This role leads and coordinates requirements elicitation and documents and maintains the different levels of stakeholder and system requirements.

Synonyms: Systems Analyst, Systems Engineer, Requirements Engineer, Business Analyst, Requirements Analyst

Role Sets: [Harmony/ITSW Role Set](#)

Buttons: [Expand All Sections](#) [Collapse All Sections](#)

The "Relationships" section shows a diagram with an "Analyst" role icon on the left. Two lines branch out from the Analyst icon: one labeled "performs" pointing to a row of five chevron icons, and one labeled "responsible for" pointing to a row of six document icons. The "performs" row includes: Define Vision, Detail Stakeholder Requirements, Detail System Requirements, Find and Outline Stakeholder Requirements, and Generate System Requirements. The "responsible for" row includes: Glossary, Stakeholder Requirements Specification, System Requirements Specification, Traceability Matrix, Traceability Record, and Vision.



# Example Guideline in Harmony

## Example on Traceability

**Guideline: Traceability**

Traceability is a term used to describe the establishment and maintenance of relationships between artifacts such as a requirement and a design class or a requirement and a test case, so that one can analyze the completeness of work done and assess the impact of changes.

Expand All Sections Collapse All Sections

**Relationships**

**Related Elements**

- Design the Solution
- Create Test Cases
- Create Individual Harmony/ITSW Documents in DOORS
- Requirements
- Detail Stakeholder Requirements
- Find and Outline Stakeholder Requirements

Back to top

**Main Description**

**Introduction**

Traceability (Concept: Traceability) needs to be implemented throughout any development. This must include vertical traceability, between levels of abstraction (for example, from a System Requirement to one or more Stakeholder Requirements) and horizontal traceability (for example from a Test Case to a System Requirement).

**Uses of Traceability**

Traceability information is fundamental to impact analysis, particularly in assessing the impact of a proposed change.

It is also fundamental to coverage analysis, both in the sense of ensuring that all relevant items at one level of specification or development are adequately reflected at the next level, and also to assist in assessing test coverage.

For completeness, each requirement stated at one level of abstraction, must *satisfy* one or more requirements at the next higher level. Similarly, each requirement must be *tested by* at least one test.

**Traceability Relationships**

The following diagram shows the basic traceability relationships recommended.



## What Harmony Can Do For Our Customers?

- **Communicate best practices across the organization**
- **Connect the dots... people, process, and tools**
- **Support continuous process improvement and compliance**
- **Increases ROI on IBM Rational and Rational tools**



## Benefits of the MDSE and the Rational Harmony Processes

- ✓ **Help you build a world-class development organization**
- ✓ **Guidance from concept to delivered system**
- ✓ **Repeatable high quality software and systems development**
- ✓ **Bi-directional interface between the systems software groups**
- ✓ **Audit trail for regulatory agencies**
- ✓ **Continuous Process improvement**



## Best Practices for Positioning MDSE and Harmony

- **Pitch Harmony along with a tool solution such as DOORS, Rhapsody, RQM, etc. (10x ROI, Tool Mentor Benefits)**
  - and/or -
- **Position Harmony as an improvement to existing Best Practices for Systems Engineering and Embedded Software development**
  - and/or -
- **Position Harmony as a tool & process training aid/accelerator**
  - and/or -
- **Can also position as process/workflow tool...similar to RUP or RMC sale**

***To help grease the skids, identify at least one Process Champion to work with during the sales cycle***



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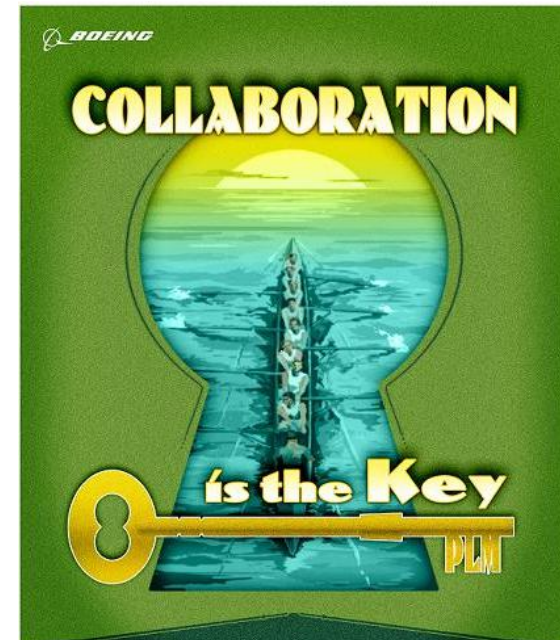
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# Leveraging the Boeing Engineering Manifold for System/Software Engineering

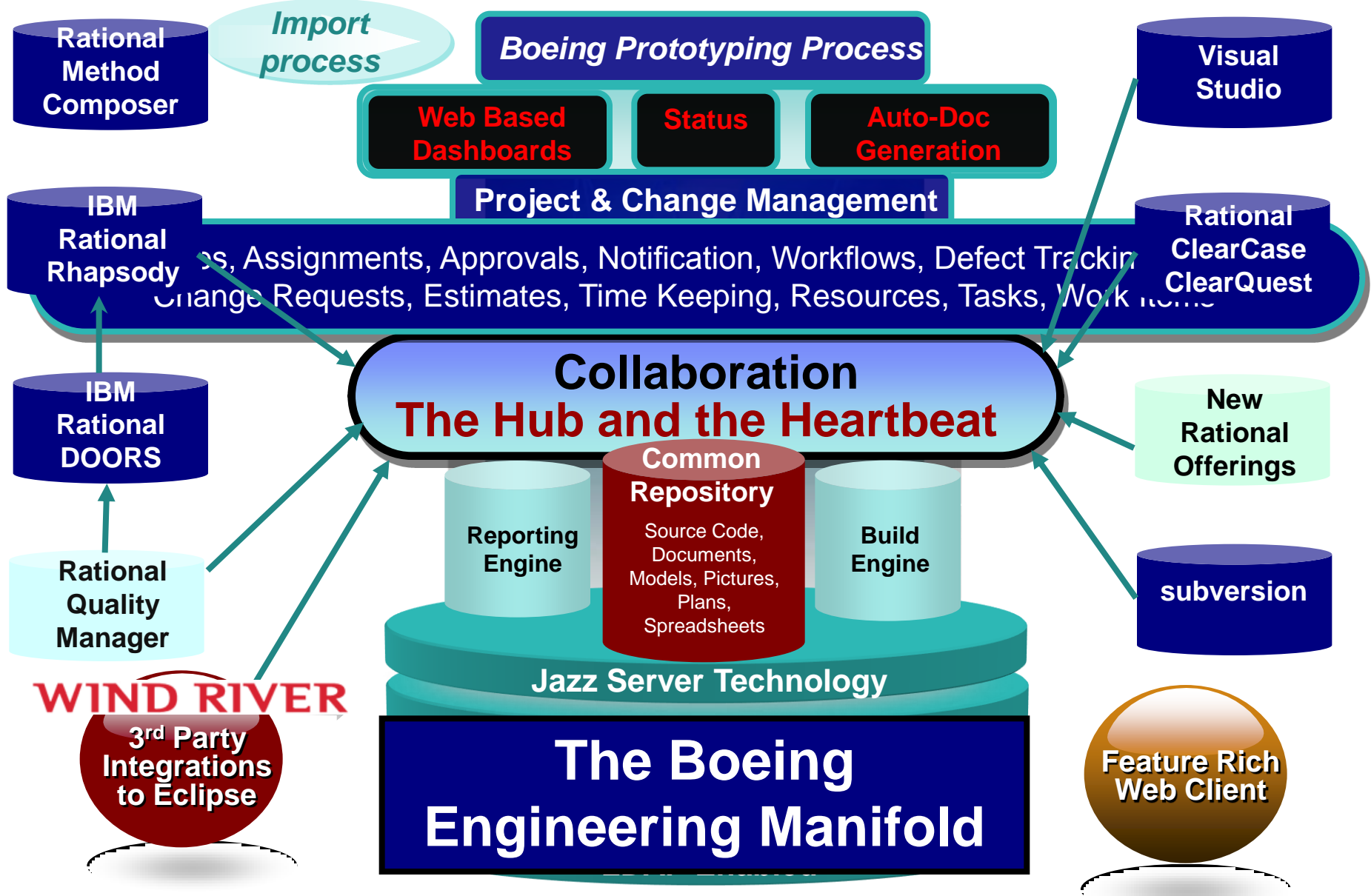
May 6, 2009



*Boeing National Account Team - Jason Meshell (Rational), Bill Leep (GBS)*

*"RationalLogic" Technical Team - Rachel Huang, Gavin Arthurs, Mark Cesario, Ricardo Camacho, Kathy Culver, Ed Mayer, Doug Ishagaki*







## Whether You Are Building:

*Business-Critical Applications*



*Mission-Critical Systems*



*New Products*



– Rational Harmony –

Connecting People, Process, and Tools

**Thank You**



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### Learn more at:

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- [IBM Rational Software Delivery Platform](#)
- [Process and portfolio management](#)
- [Change and release management](#)
- [Quality management](#)
- [Architecture management](#)
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