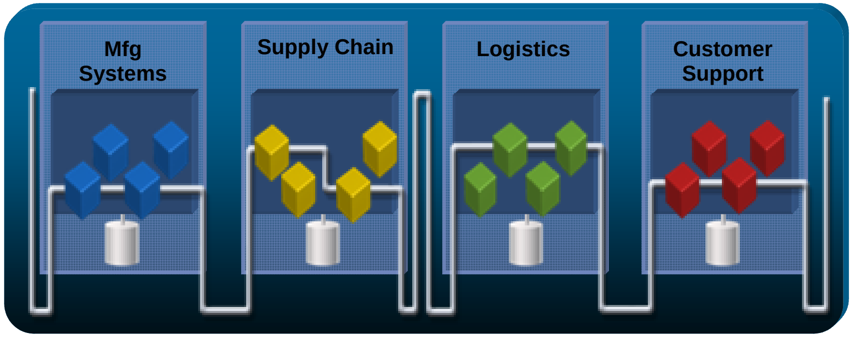
Rational Systems Strategy

Go to IBM

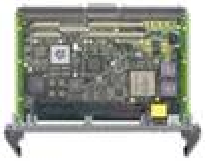
Landscape of Software and Systems Development

IT domain



- Provides support for the business operations and end-user services
- Development hands-off to operations

Systems domain



- Creates a tangible *product* delivered to customer (combination of electronics, mechanical and software)
- Development hands-off to manufacturing

Each domain has unique characteristics

Standards & technology skills & culture project scale & duration development process constraints

Business Realities in Systems and Device Development

66%	Device software designs completed over budget
24%	Projects canceled due to unrecoverable slip in schedule
33%	Produced devices do not meet performance or functionality requirements
2x	Software content in devices is doubling every two years

*Software related downtime costs industry almost **$300 billion** annually.*
Only 34% of software projects succeed.

Sources: EMF, IDC, Standish CHAOS Report, Comparative Economic Normalization Technology Study

Development Pressures

The 4 most common laments of the development executive

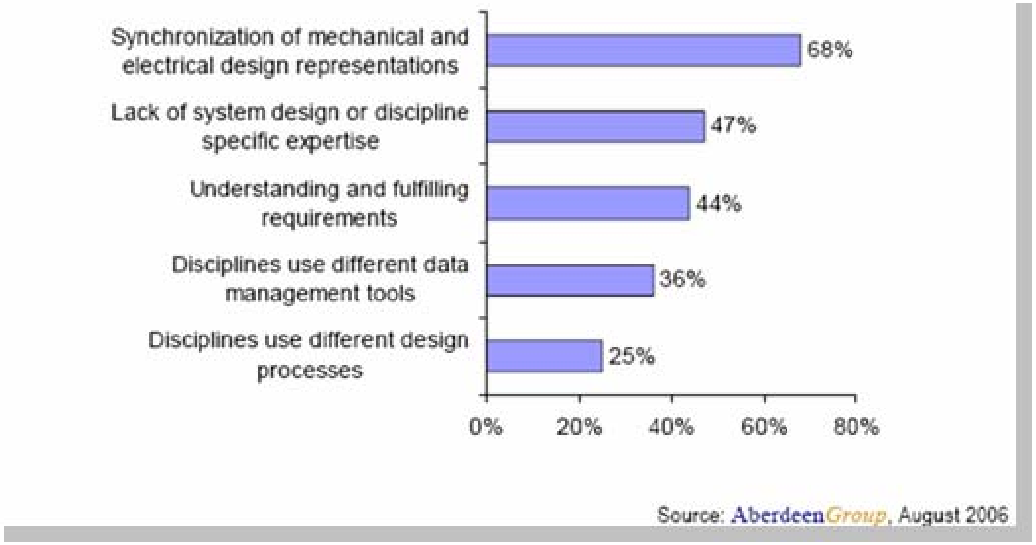
I'm being asked to:

- Deliver product faster (a lot faster!)
- Increase product innovation
- Improve quality
- Reduce cost

Systems Development Lifecycle Processes

Current industry-standard

- Requirements are a bottleneck
- Long time to running system
- Brittle system architecture
- Document-based milestones
- ***Project risk is back-end loaded!***



Source: AberdeenGroup, August 2006

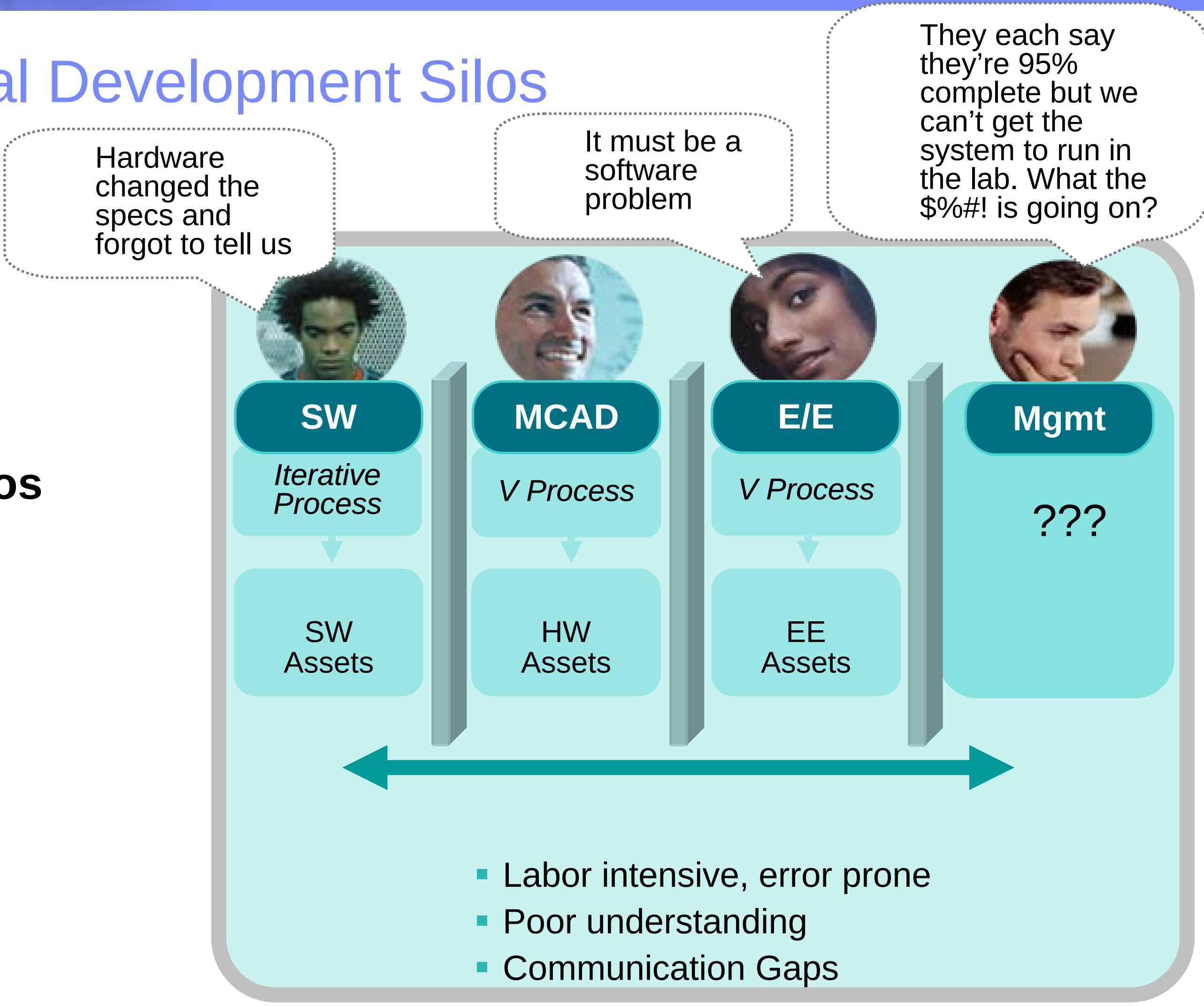
Need to reduce cycle time

Key Problem: Vertical Development Silos

Gaps between silos

- **Inconsistent processes**
- **Poor collaboration and traceability between silos**
- **Separate tool chains**

- **Results:**
  - ***Integration problems***
  - ***Waterfall process***
  - ***Greater project risk***
  - ***Difficult to measure***



Hardware changed the specs and forgot to tell us

It must be a software problem

They each say they're 95% complete but we can't get the system to run in the lab. What the $%#! is going on?

SW

Iterative Process

SW Assets

MCAD

V Process

HW Assets

E/E

V Process

EE Assets

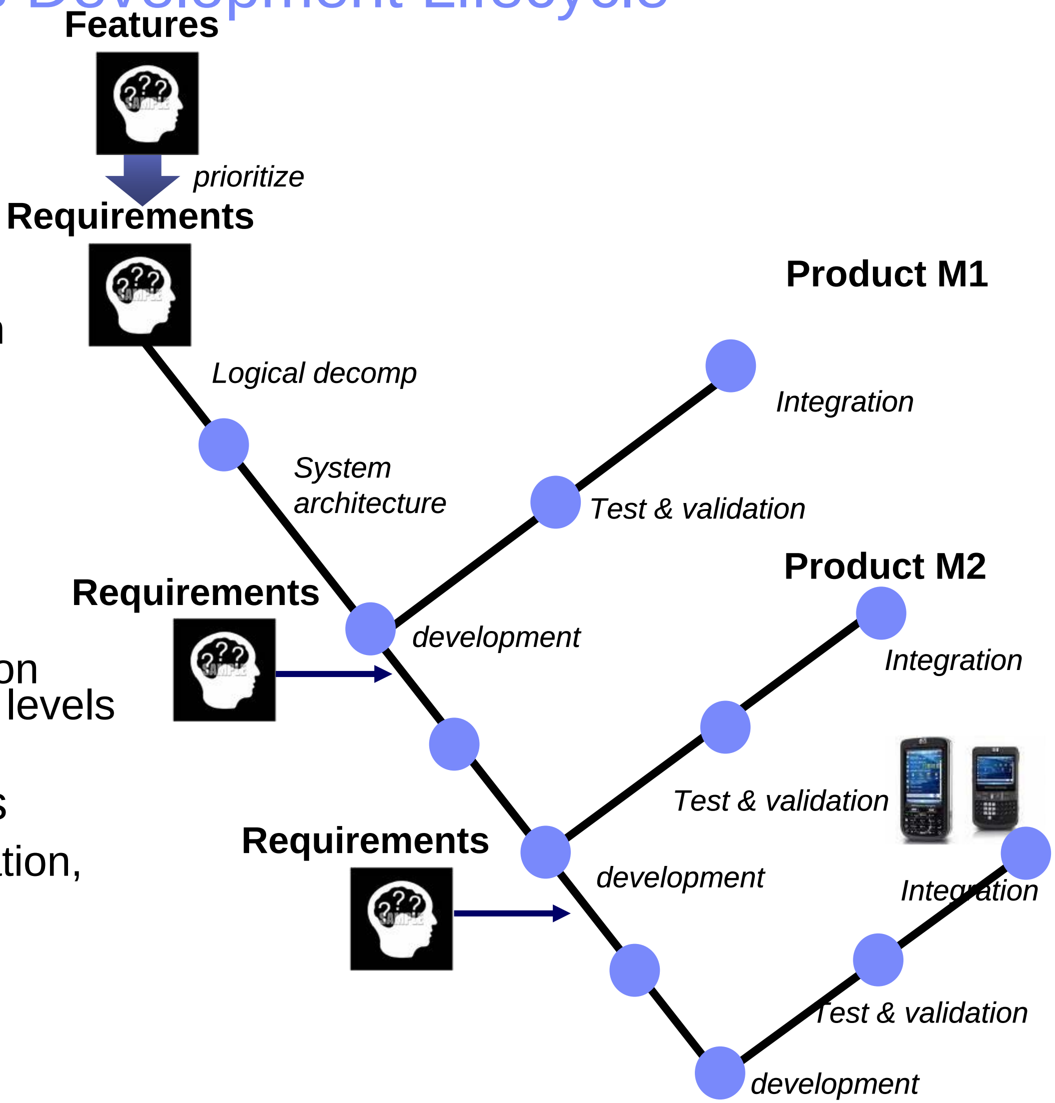
Mgmt

???

- Labor intensive, error prone
- Poor understanding
- Communication Gaps

Evolving Integrated Systems Development Lifecycle

- Prioritize customer needs
  - Decision support for product & portfolio management
- Early validation & integration
  - Joint HW/SW simulation & verification
- Manage requirements change
  - Common requirements process and tools across domains
- Flexible system architecture
  - Model-based techniques for abstraction & automation at system and software levels
- Integrated workflow across domains
  - Open infrastructure to support integration, collaboration and governance
- ***Project risks are resolved early***
  - ***Risk-driven iterative systems engineering process and services***



Rational Support for Systems Development Lifecycle

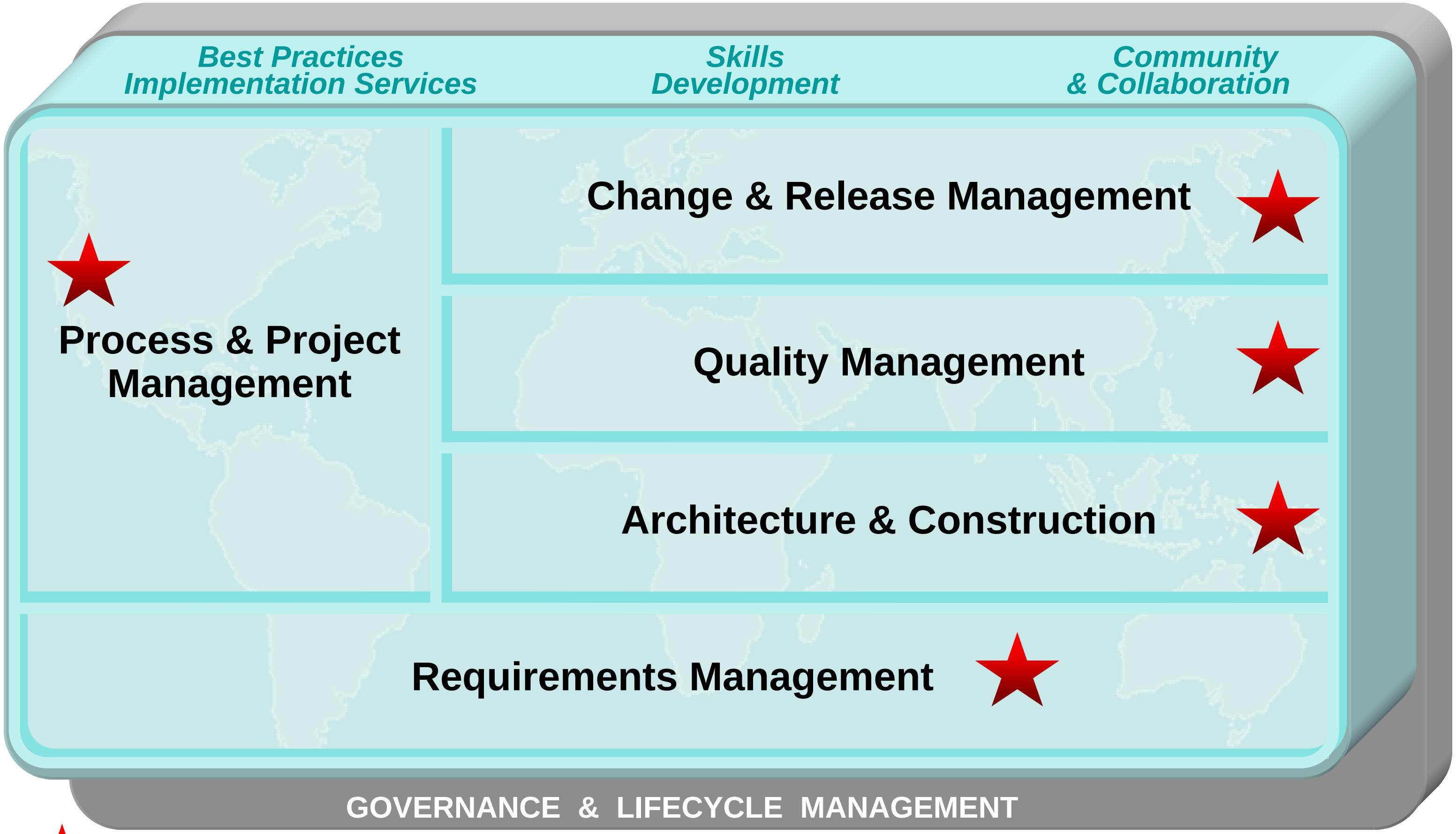
1 Software & Systems Delivery Platform

2 Product Lifecycle Management

3 Systems Engineering & Architectural Frameworks

IBM Rational software offering

Specific platform capabilities targeted at systems domain ★



Best Practices Implementation Services

Skills Development

Community & Collaboration

★ **Process & Project Management**

Change & Release Management ★

Quality Management ★

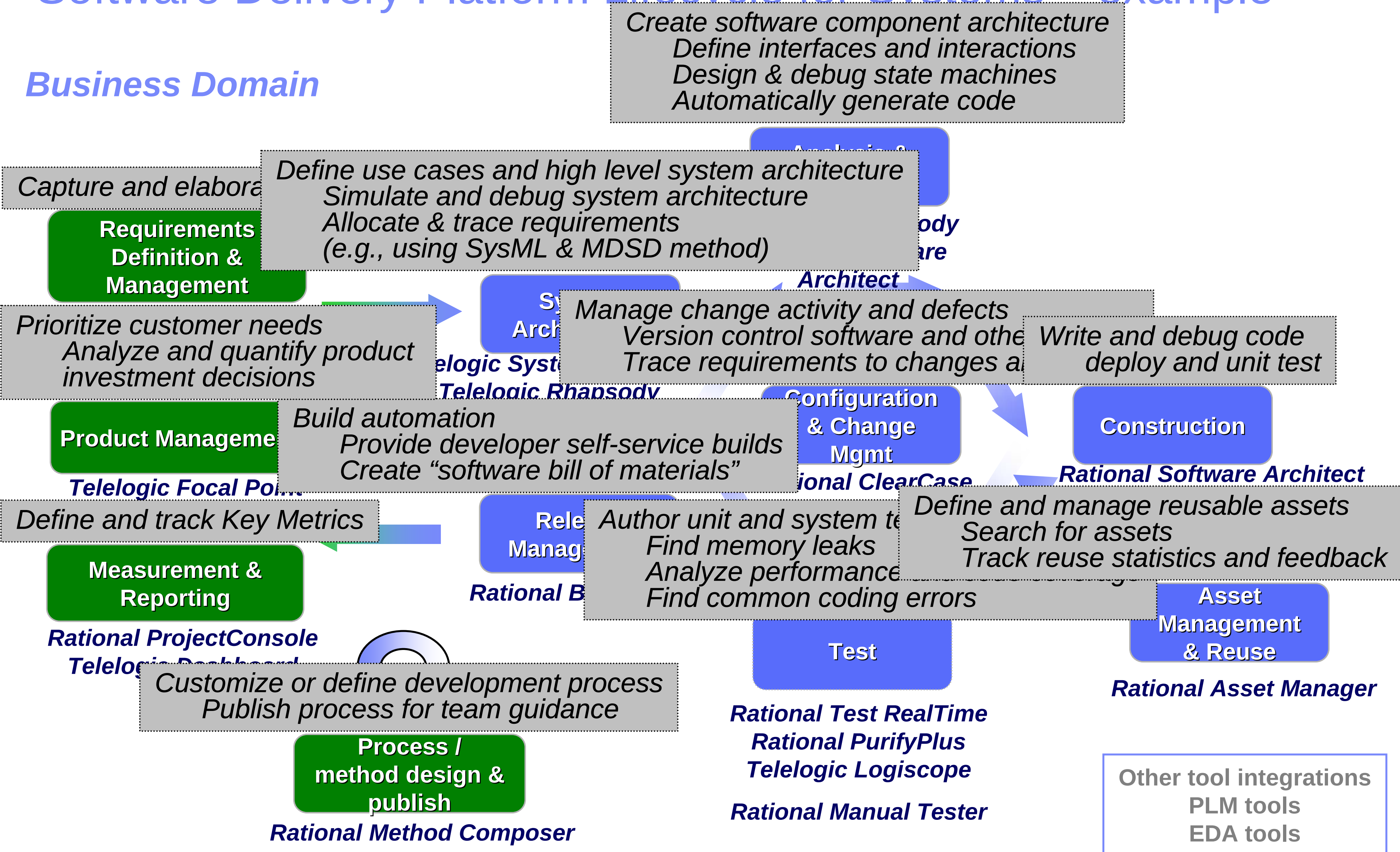
Architecture & Construction ★

Requirements Management ★

GOVERNANCE & LIFECYCLE MANAGEMENT

★ Telelogic portfolio adds key new capabilities

Software Delivery Platform Lifecycle for Systems – example



Create software component architecture
Define interfaces and interactions
Design & debug state machines
Automatically generate code

Business Domain

Capture and elabora

Define use cases and high level system architecture
Simulate and debug system architecture
Allocate & trace requirements
(e.g., using SysML & MDSD method)

Requirements Definition & Management

Prioritize customer needs
Analyze and quantify product investment decisions

Product Manageme

Telelogic Focal Poi

Define and track Key Metrics

Measurement & Reporting

Rational ProjectConsole
Telelogic Dashboard

Customize or define development process
Publish process for team guidance

Process / method design & publish

Rational Method Composer

Sy Arch

elogic Syst
Telelogic Rhapsody

ody
are
Architect

Manage change activity and defects
Version control software and othe
Trace requirements to changes a

Write and debug code
deploy and unit test

Build automation
Provide developer self-service builds
Create "software bill of materials"

Configuration & Change Mgmt

ional ClearCase

Construction

Rational Software Architect

Rele Manag

Rational B

Author unit and system te
Find memory leaks
Analyze performance
Find common coding errors

Define and manage reusable assets
Search for assets
Track reuse statistics and feedback

Asset Management & Reuse

Rational Asset Manager

Test

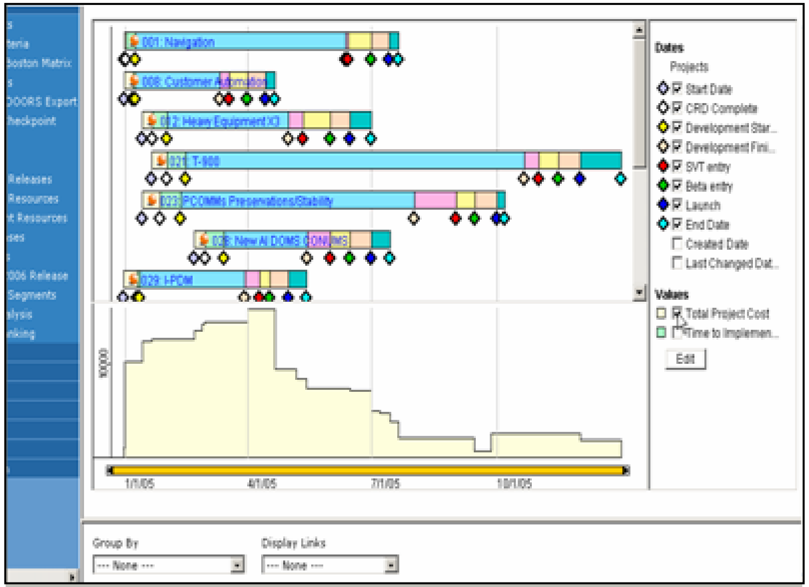
Rational Test RealTime
Rational PurifyPlus
Telelogic Logiscope

Rational Manual Tester

Other tool integrations
PLM tools
EDA tools

Product Portfolio Management

Telelogic Focal Point



Dates

Projects

☑ Start Date
☑ CRD Complete
☑ Development Star...
☑ Development Fini...
☑ SVT entry
☑ Beta entry
☑ Launch
☑ End Date
☐ Created Date
☐ Last Changed Dat...

Values

☑ Total Project Cost
☐ Time to Implemen...

Group By: --- None ---

Display Links: --- None ---

> ***"A week shorter lead-time can be worth millions to us in the form of increased sales figures. With support from Focal Point we make better decisions, faster, during the entire development process."***
>
> ***- Sony Ericsson***

Capabilities

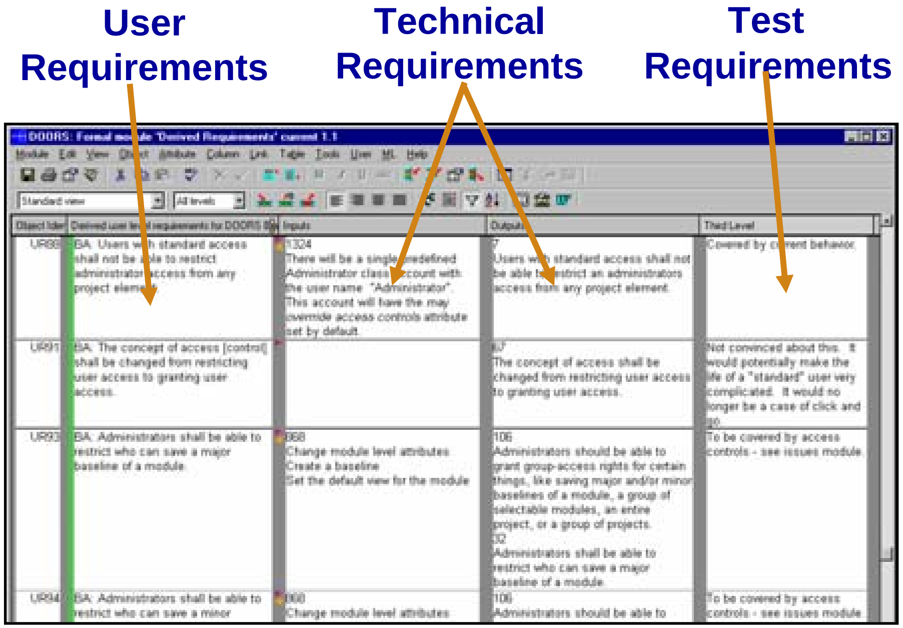
- Subjective and objective prioritization of product requirements & features
- What-if analysis enables understanding of impacts resulting from various scenarios on value metrics
- Configurable visualizations of product pipeline information, including costs, benefits & headcount.

Benefits

- Clear visibility of the product portfolio to facilitate better, faster decision-making
- Improved understanding of product portfolio performance
- Increased customer satisfaction with product releases which equates to increased revenue

Requirements for Complex Systems

Telelogic DOORS


User Requirements

Technical Requirements

Test Requirements

DOORS: Formal module 'Derived Requirements' current 1.1

Object Ider	Derived user level requirements for DOORS 8x	Inputs	Outputs	Third Level
UR89	BA: Users with standard access shall not be able to restrict administrator access from any project element.	1324 There will be a single predefined Administrator class account with the user name "Administrator". This account will have the may override access controls attribute set by default.	7 Users with standard access shall not be able to restrict an administrators access from any project element.	Covered by current behavior.
UR91	BA: The concept of access [control] shall be changed from restricting user access to granting user access.		67 The concept of access shall be changed from restricting user access to granting user access.	Not convinced about this. It would potentially make the life of a "standard" user very complicated. It would no longer be a case of click and go.
UR93	BA: Administrators shall be able to restrict who can save a major baseline of a module.	868 Change module level attributes Create a baseline Set the default view for the module	106 Administrators should be able to grant group-access rights for certain things, like saving major and/or minor baselines of a module, a group of selectable modules, an entire project, or a group of projects. 32 Administrators shall be able to restrict who can save a major baseline of a module.	To be covered by access controls - see issues module.
UR94	BA: Administrators shall be able to restrict who can save a minor	868 Change module level attributes	106 Administrators should be able to	To be covered by access controls - see issues module.

> ***"DOORS provides the most robust and automatic traceability of requirements throughout a project lifecycle. Traceability is evident down to the source code level."***
>
> ***Great American Insurance***

Capabilities

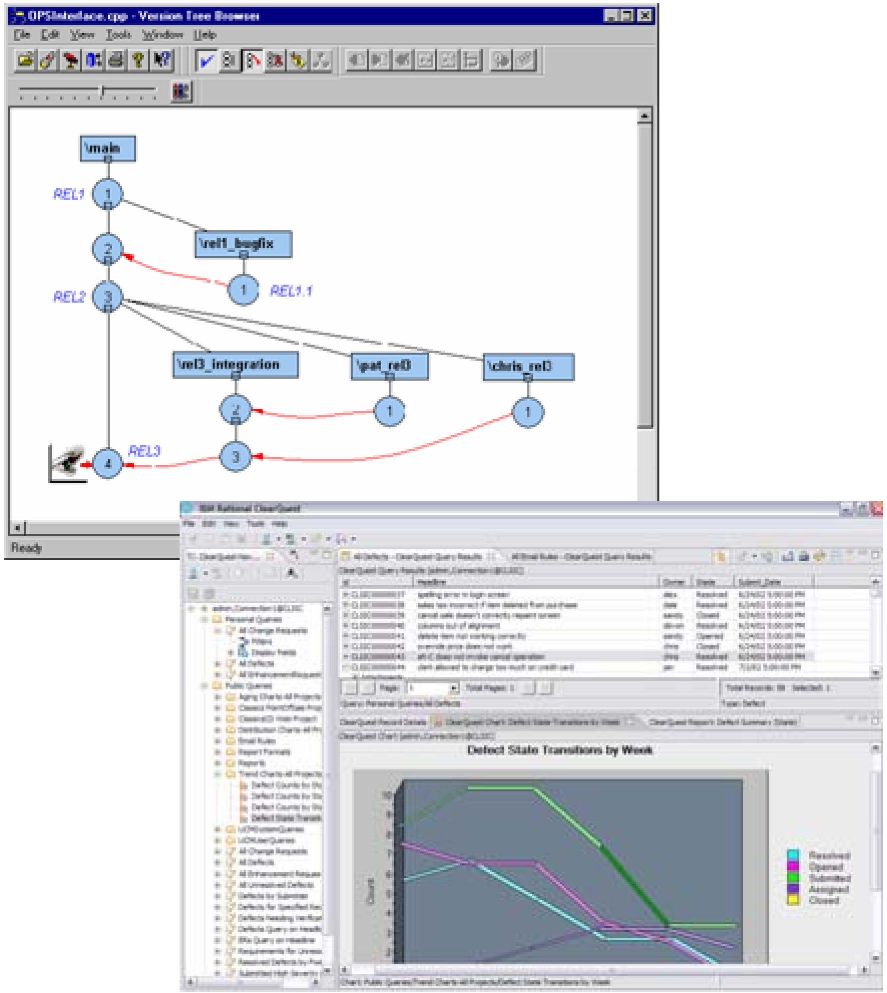
- Combined document and spreadsheet views
- Lifecycle impact and coverage analysis via a single view
- Dynamic views to focus on the relevant information in context

Benefits

- Centralized requirements capture, refinement, and traceability
- Improve information visibility and collaboration between team members
- Ensure conformance to customer needs and compliance with relevant industry or government regulations

Flexible & Comprehensive Change Management

IBM Rational ClearCase & ClearQuest



Capabilities

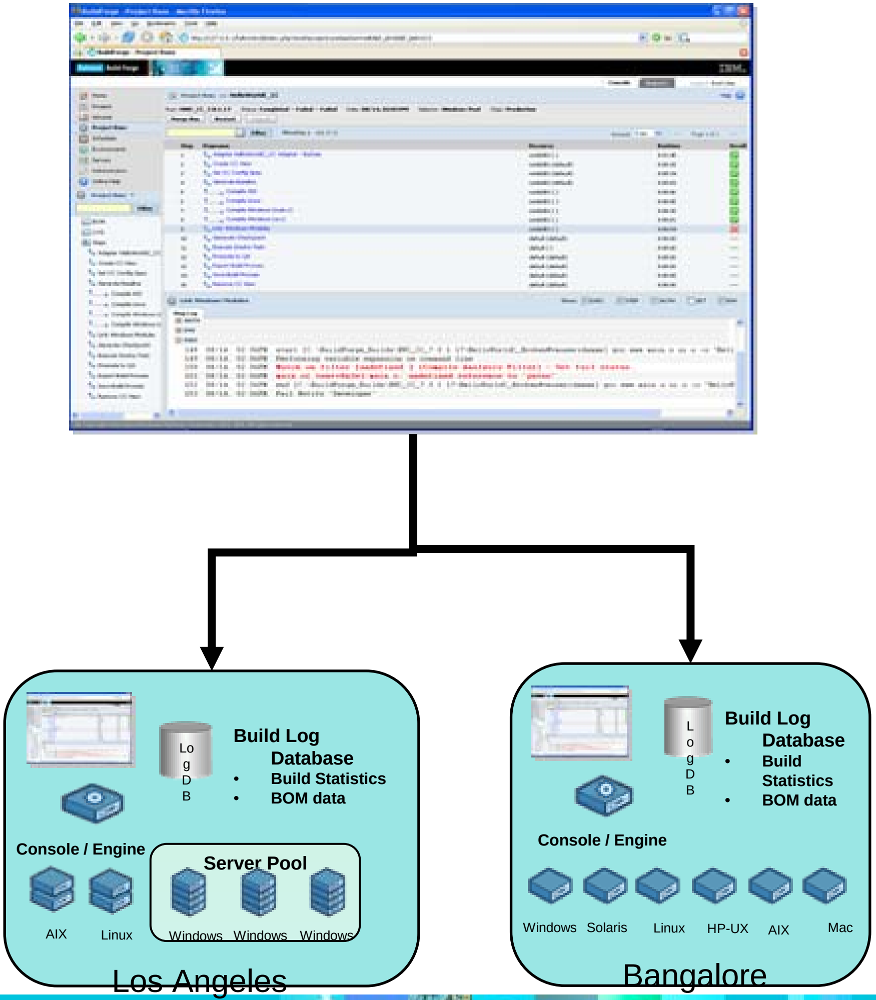
- Integrate requirements, defects, activities, builds and tests in a single change management environment
- Cross platform support for distributed, mainframe and midrange environment
- Sophisticated branching and visual merge tools for parallel development
- Large ecosystem of 3rd party integrations

Benefits

- Fully customizable to adapt to any process and integrate with other tools
- Highly scalable solution for globally distributed development
- Ensure compliance with governance policies & standards
- Greater visibility into project status throughout the lifecycle

Build and Release Management

IBM Rational Build Forge



Build Log
Database
- Build Statistics
- BOM data

Console / Engine

Server Pool

AIX Linux Windows Windows Windows

Los Angeles

Build Log
Database
- Build Statistics
- BOM data

Console / Engine

Windows Solaris Linux HP-UX AIX Mac

Bangalore

Capabilities

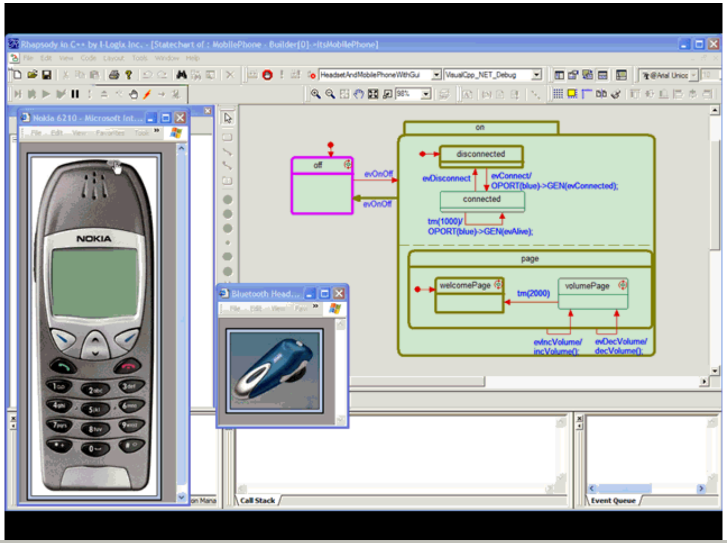
- Automate build and release workflows
- Developer self-service, iterative development and parallel build processes
- Web-based architecture for global access
- Dynamic configuration and management of build servers

Benefits

- Integrates easily with other asset repositories
- Incorporate and gradually replace existing custom scripts
- Reduce developer time spent on builds
- Reduce issues related to inconsistent or incorrect software builds
- Generate complete bill-of-materials for auditability

Model-Driven Development for Embedded Systems

Telelogic Rhapsody



> ***"Since documentation is often an afterthought in software development, we wanted a tool that facilitates design, documentation, and implementation. Rhapsody does it all"***
>
> ***Böwe Bell & Howell***

Capabilities

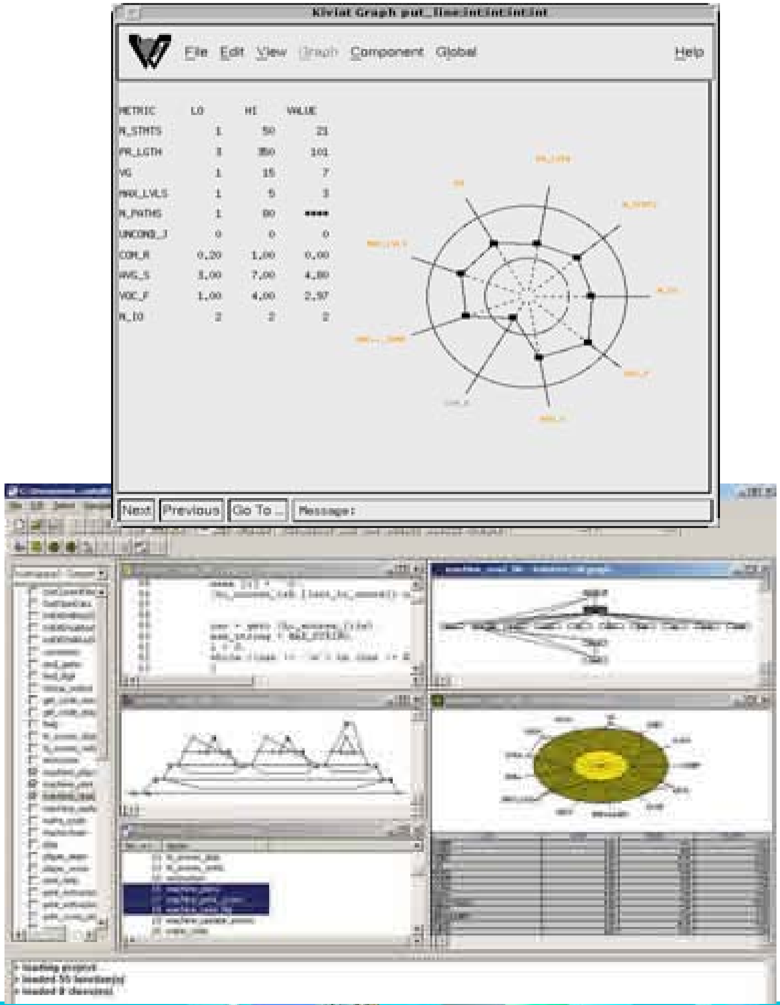
- Systems design and software development with UML 2.0, SysML, DoDAF and AUTOSAR
- Validate and verify designs with model based simulation and test throughout the process
- Produce complete C, C++, Java and Ada applications; developing in either the code or model while ensuring the two remain in sync

Benefits

- Optimized communication and collaboration ensures the right product is built
- Eliminate defects early and increase quality by iteratively testing the design as it is built
- Reduce development time by automatically generating applications and documentation

Code Quality Analysis

Telelogic Logiscope



Kiviat Graph put_line:int:int:int:int

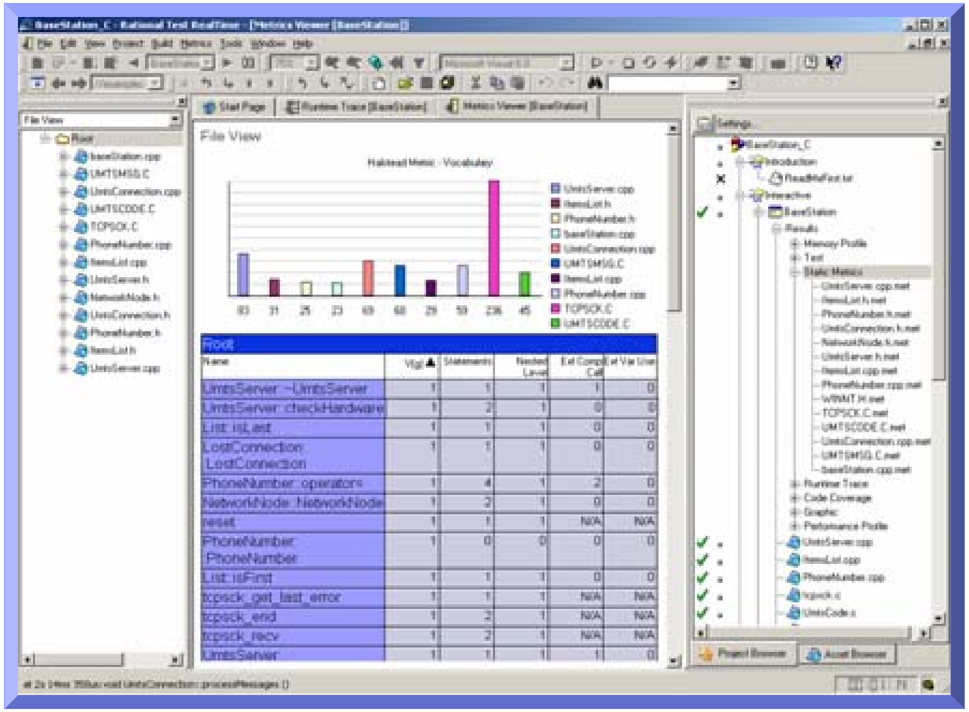
METRIC	LO	HI	VALUE
N_STMTS	1	50	21
PR_LGTH	3	350	101
VG	1	15	7
MAX_LVLS	1	5	3
N_PATHS	1	80	****
UNCOND_J	0	0	0
COM_R	0.20	1.00	0.00
AVG_S	3.00	7.00	4.80
VOC_F	1.00	4.00	2.97
N_IO	2	2	2

- **Capabilities**
  - Static code quality analysis with rule checking for C, C++, Java, Ada
  - Quality auditing and visual reports
  - Compare against industry-standard “quality models”
  - Code coverage analysis

- **Benefits**
  - Early identification of coding issues
  - More consistent application quality
  - Continually audit and enforce code quality through automated checks
  - Define and check organization-specific coding rules

Run-Time Analysis

Rational Test RealTime / PurifyPlus



Root

Name	V(g) ▲	Statements	Nested Level	Ext Comp Call	Ext Var Use
UmtsServer::~UmtsServer	1	1	1	1	0
UmtsServer::checkHardware	1	2	1	0	0
List::isLast	1	1	1	0	0
LostConnection::LostConnection	1	1	1	0	0
PhoneNumber::operator=	1	4	1	2	0
NetworkNode::NetworkNode	1	3	1	0	0
reset	1	1	1	N/A	N/A
PhoneNumber::PhoneNumber	1	0	0	0	0
List::isFirst	1	1	1	0	0
tcpsck_get_last_error	1	1	1	N/A	N/A
tcpsck_end	1	2	1	N/A	N/A
tcpsck_recv	1	2	1	N/A	N/A
UmtsServer	1	1	1	1	0

UmtsConnection::processMessages ()

Capabilities

- Runtime analysis (memory leaks, performance, code coverage)
- Component, functional, and performance testing
- Cross-platform test execution & support for wide variety of processors, compilers, RTOSes (TestRT only)
- Test planning & reporting
- Integration with CQ Test Management

Benefits

- Ensures reliability, functionality, scalability
- Reduces cycle time
- Accommodates multiple skill sets, roles

Rational Platform Benefit for Systems Delivery

- Reduce project risk
- Build more flexible and reusable architectures
- Find problems earlier in the development process
- Enable auditable process and accountability
- Simplify change & release management
- Support global development and delivery
- Enact collaborative process across systems engineering and product development
- Enable greater reuse of IP

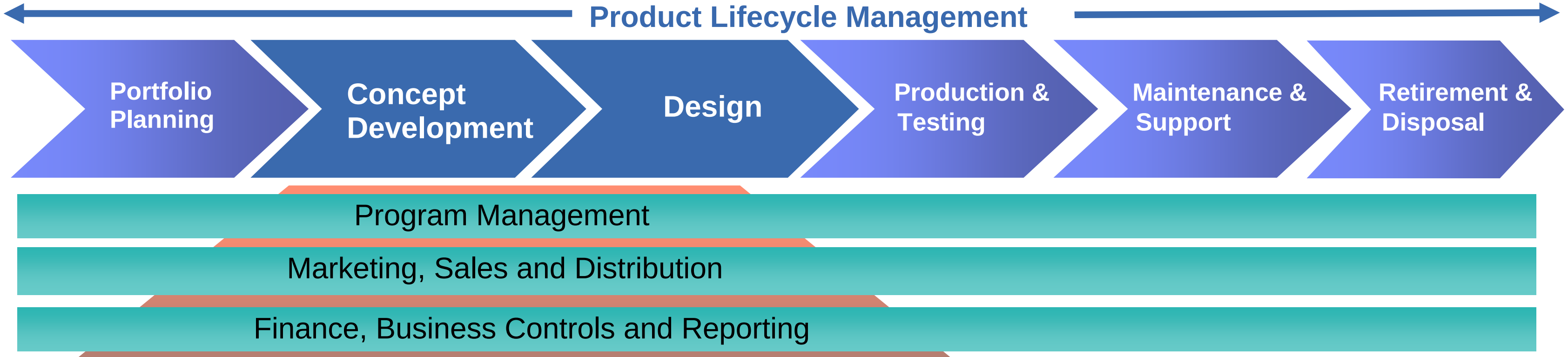
Product Lifecycle Management

1 Software Delivery Platform for Systems

2 **Product Lifecycle Management**

3 Systems Engineering & Architectural Frameworks

Product Lifecycle Management covers a broad set of vital business processes



Product Lifecycle Management

Portfolio Planning

Concept Development

Design

Production & Testing

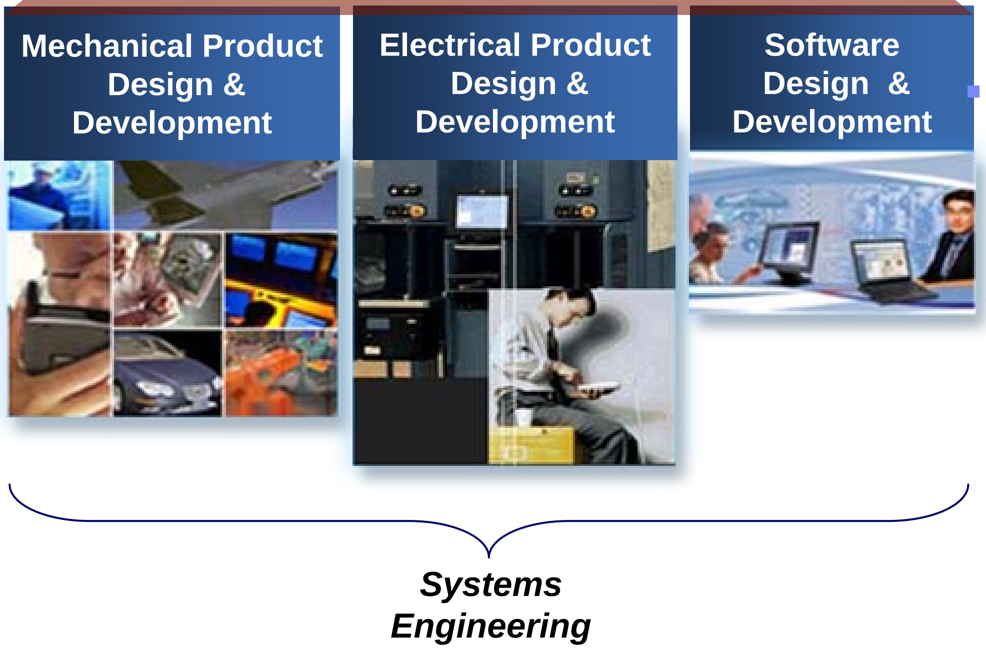
Maintenance & Support

Retirement & Disposal

Program Management

Marketing, Sales and Distribution

Finance, Business Controls and Reporting



Mechanical Product Design & Development

Electrical Product Design & Development

Software Design & Development

Systems Engineering

PLM enables an enterprise to efficiently manage its products, partners, and suppliers throughout the product lifecycle

Rational in PLM and Systems Engineering

Requirements Management

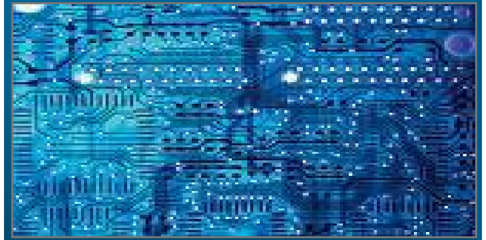
Systems Engineering

Integrated Change Management

Requirements management and system design across system of systems and down to the component level

Integration of requirements, configuration and change management with leading PLM vendors

Electronics



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Software

Software and Systems Development Governance

Process & Product Management

Architecture management

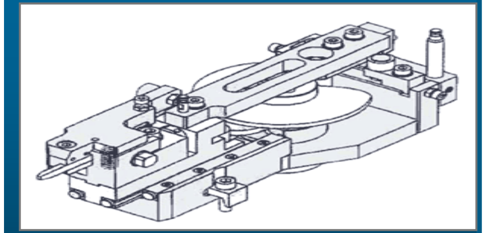
Quality management

Requirements management

Change & release management

Open technology, open standards & community innovation

Mechanical



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Integration, Collaboration & Workflow Infrastructure

Product lifecycle management

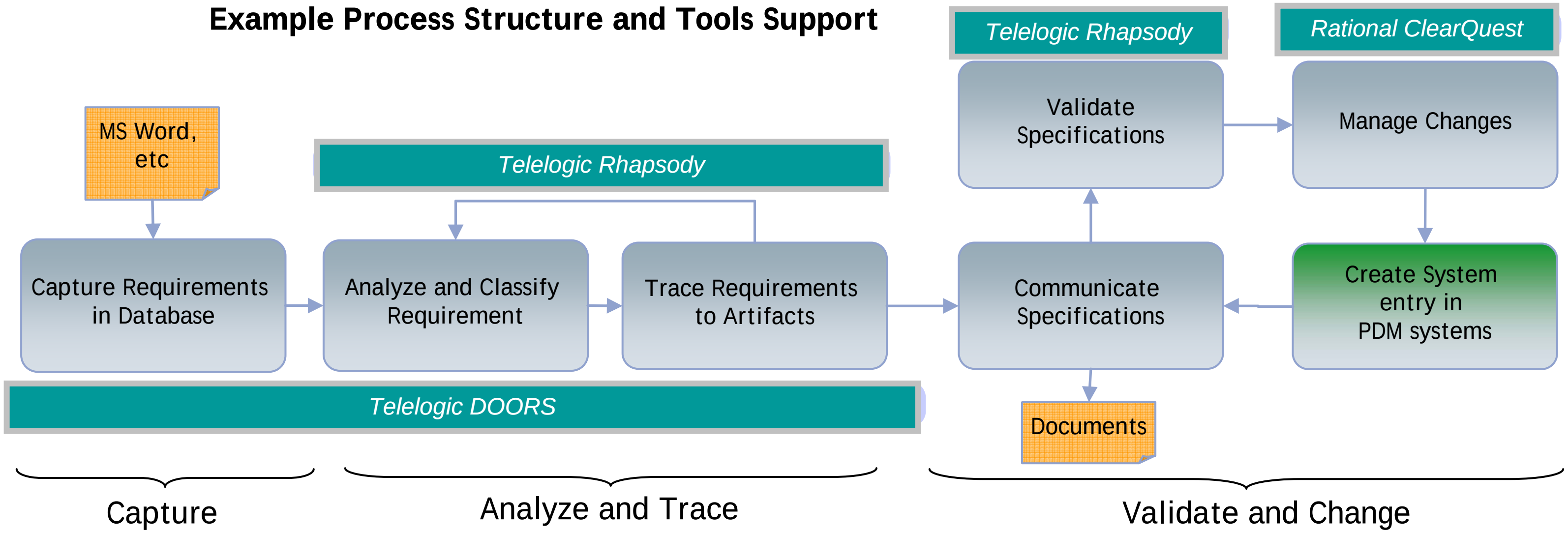
Coordinate processes and tool chains across domains

- Design and publish lifecycle processes
  - Ensure compliance and traceability of development processes
- Capture, prioritize and manage product requirements across all stakeholders
  - Facilitates trade-off decisions up front
  - Provides common view of requirements
- Integrate PLM processes across domains (and suppliers) using SOA
  - Integration & automation of PLM processes
  - Common workflow for communication and tracking of changes across domains and suppliers
  - Consistent view of versions and changes reduces h/w – s/w mismatches

Requirements Management Process

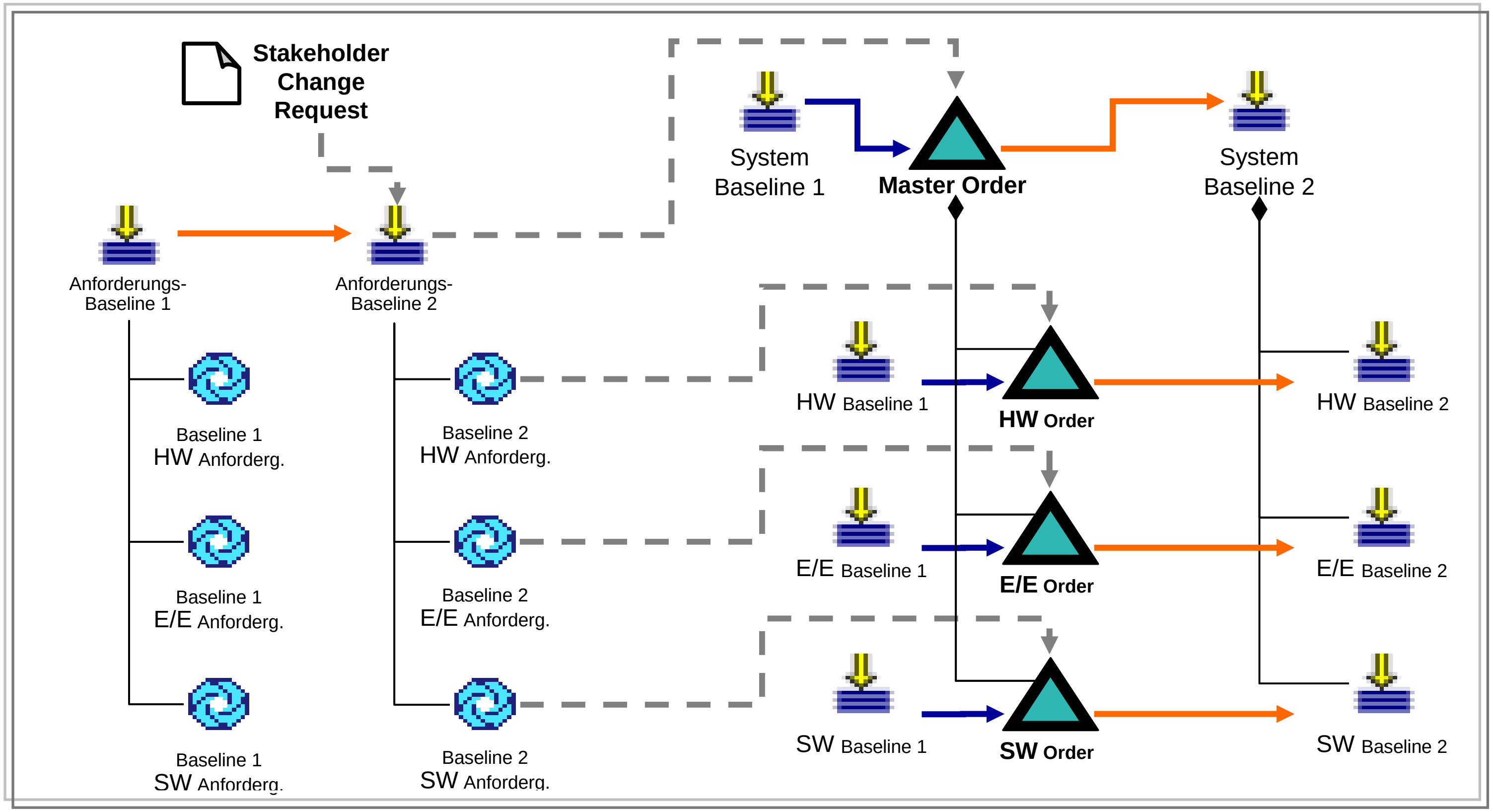
- Manage and prioritize customer/market inputs and product/portfolio decisions
- Systematic capture of all requirements for the product and related processes
- Integration of requirements management tools with product lifecycle tools enables traceability of requirements through all domain-specific artifacts
- Systems Engineering models for consistency verification, simulation, trade-off analysis, etc.

Example Process Structure and Tools Support

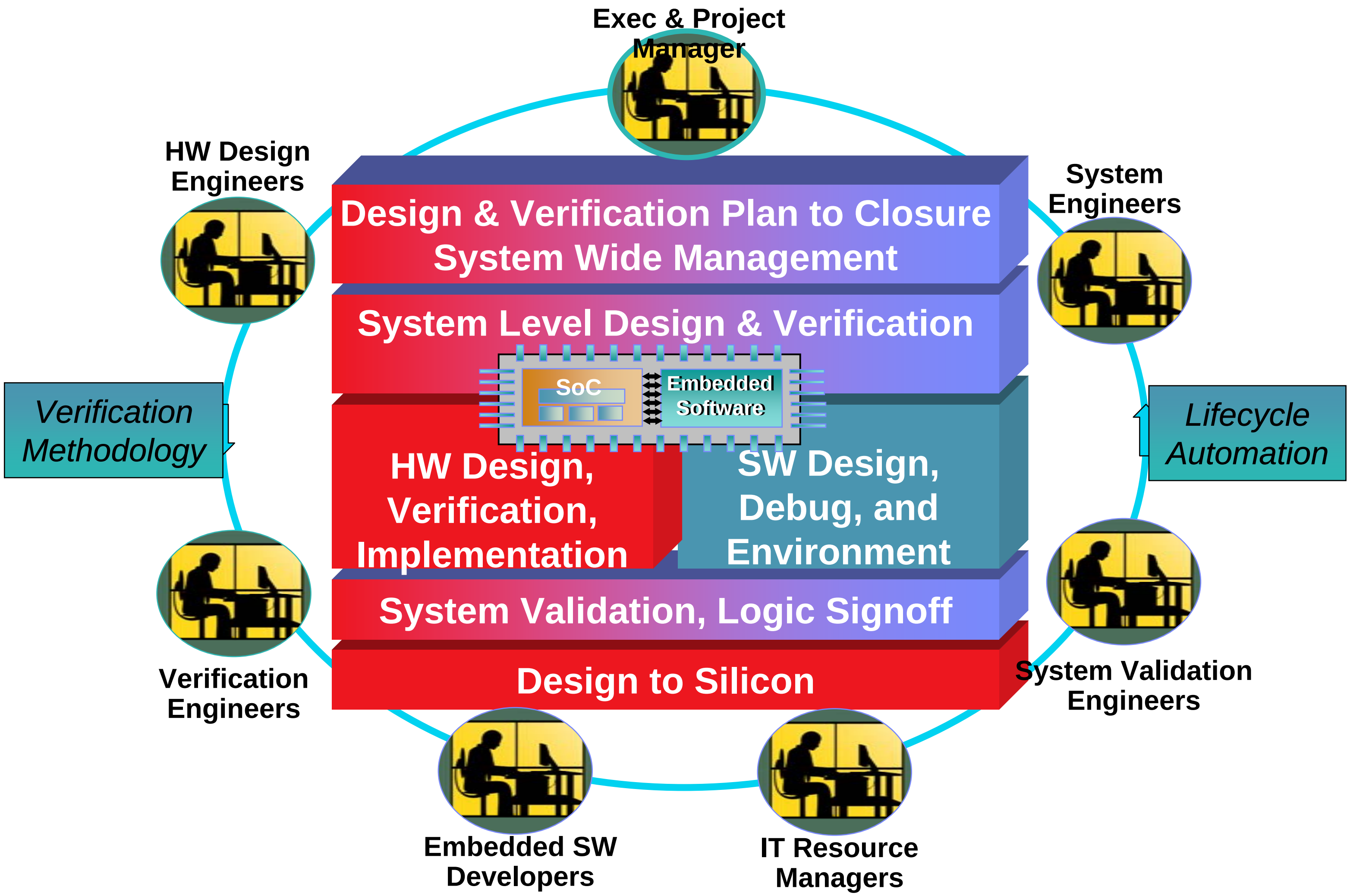


Integrated Change Management Process
Automotive example

- System level change request is being broken down into requests for the particular domains
- After execution: new baselines from each of the domains are aggregated to a new system baseline and the change request is closed

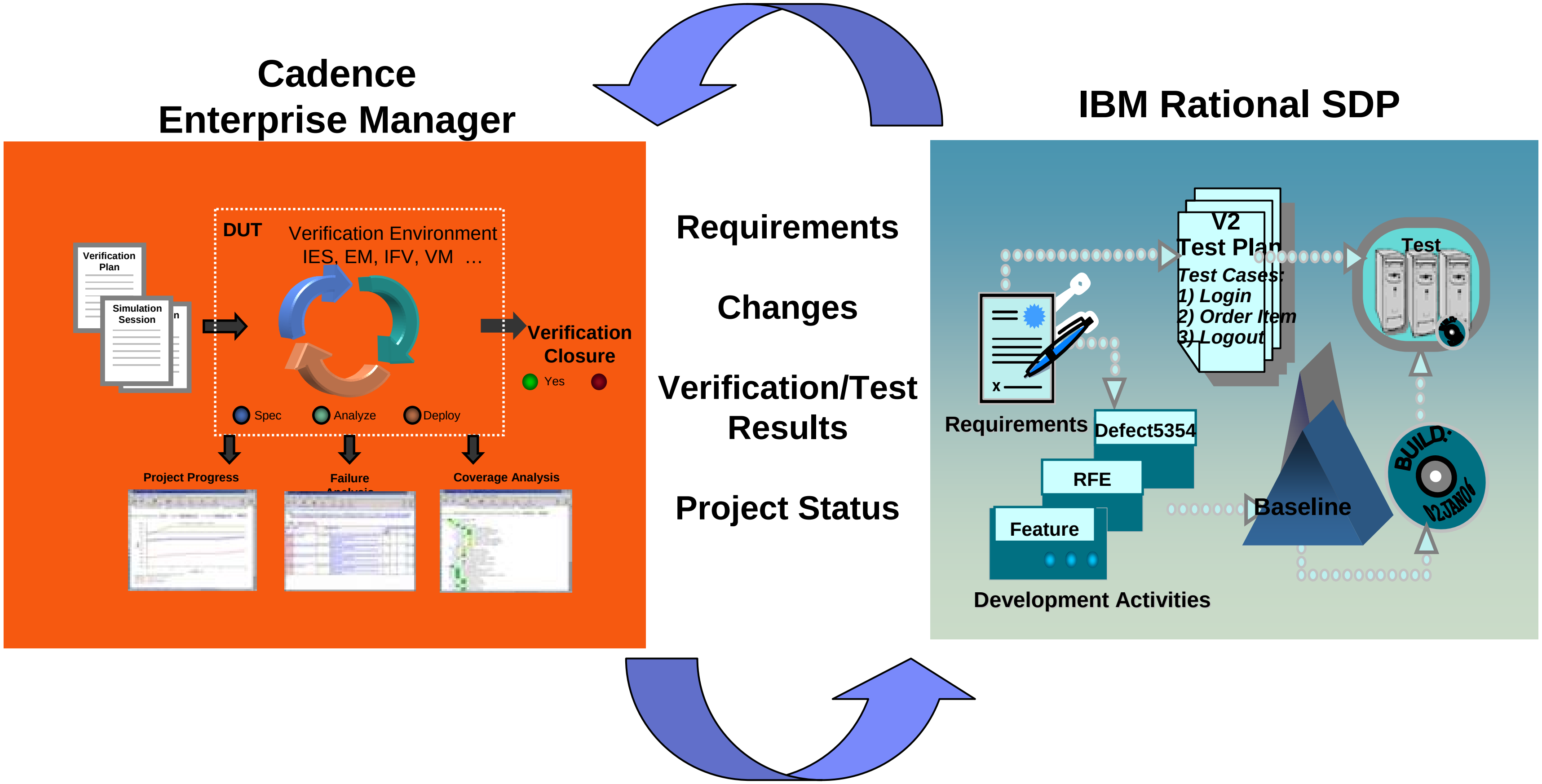


Joint Early Verification of Electronics & Software



Cadence – Rational Integration

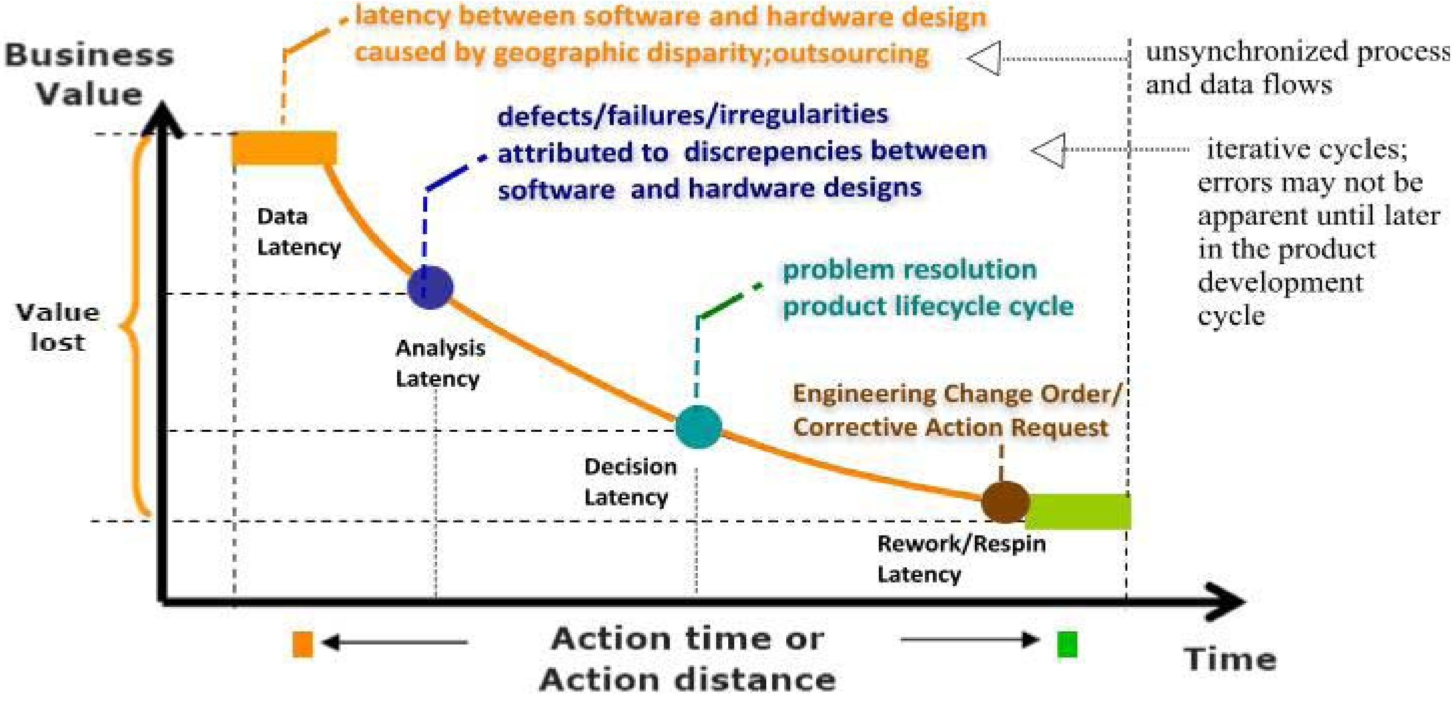
Link the EDA and software development teams to accelerate product delivery



PLM / EDA Integrations

- Telelogic DOORS – MatrixOne
- Telelogic DOORS – PTC Windchill
- Rational ClearQuest – MatrixOne (demo only)
- Rational ClearQuest – Oracle Agile
- Rational ClearCase – PTC Windchill
- *Rational ClearQuest – UGS TeamCenter (Q2 2008)
- *Rational ClearQuest – PTC Windchill (Q2 2008)
- **Rational ClearQuest – Cadence Enterprise Manager – trying to formalize plan
- **Rational ClearCase – Cadence

Net Value: *Remove Latency and Increase Parallelism To Reduce Development Cycle Time*



🟧 Disaggregated business process creates time and information gaps; out of synch process creating opportnity for increased risk of a business process failure;

🟦 Unsynchronized data means no cross check between SW/HW engineering teams; errors then increase cycle time and product cost; may reduce product quality and time to market across the ecosystem;

■ Lack of synchronized information increases frequency of respin/rework, ECO and Corrective action resolution cycles; iterations add cost which then aggregates;

🟫 Respin cost, time to value and risk increase with each additional cycle needed

Source ConneKtedMinds ©2007

Systems Engineering and Architectural Frameworks

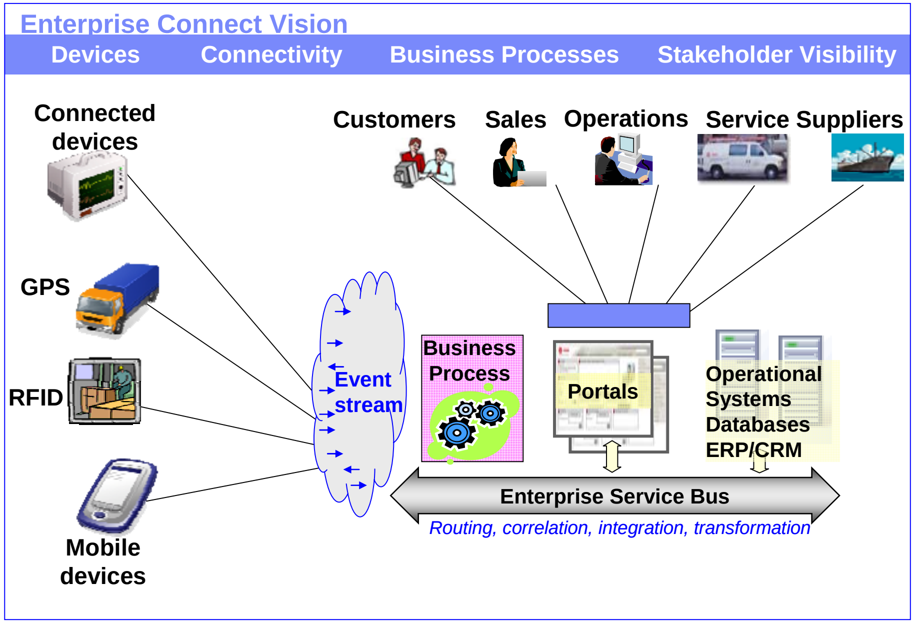
1 Software Delivery Platform for Systems

2 Product Lifecycle Management

3 Systems Engineering & Architectural Frameworks

Driving Innovation in Systems & Devices

Integrating Systems & IT



Enterprise Connect Vision

Devices | Connectivity | Business Processes | Stakeholder Visibility

Connected devices

GPS

RFID

Mobile devices

Event stream

Customers

Sales

Operations

Service Suppliers

Business Process

Portals

Operational Systems Databases ERP/CRM

Enterprise Service Bus

Routing, correlation, integration, transformation

Integrate remote sensors and devices into IT applications to innovate & improve efficiency

retail, banking, transportation, media

Integrate IT infrastructure with embedded devices to differentiate products

automotive, communications, defense

How do you manage such a complex development activity?

What is Systems Engineering?

- **Systems Engineering** (**SE**) is an interdisciplinary field of engineering, that focuses on the development and organization of complex artificial systems. Systems Engineering integrates other disciplines and specialty groups into a team effort, forming a structured development process that proceeds from concept to production to operation and disposal. Systems Engineering considers both the business and the technical needs of all customers, with the goal of providing a quality product that meets the user needs.

Basically Systems Engineering requires …

- a set of structured processes
- collaboration across a team of different disciplines
- understanding / communicating business and technical needs
- consideration of non-functional goals such as quality, performance

A Good Architecture Framework Guides the Development Process

Model-Driven Systems Development is an Architecture Framework with process guidance

Model Level	Viewpoints				
	Worker	Logical	Information	Distribution	Process
Context	UML Organization View	System Context Diagram	Enterprise Data View	Enterprise Locality View	
Analysis	Generalized System Worker View	System Analysis Model (Subsystem Diagram)	System Data View	System Deployment Model (Locality View)	System Process View
Design	System Worker View	• System Design Model (Subsystem/Class Diagram) • Component views	System Data Schema	System Deployment Model (Descriptor View)	Detailed Process View
Implementation	Worker Role Specifications and Instructions	Deployment diagram at Implementation level for each configuration			

Actionable Architecture

Requirements Management

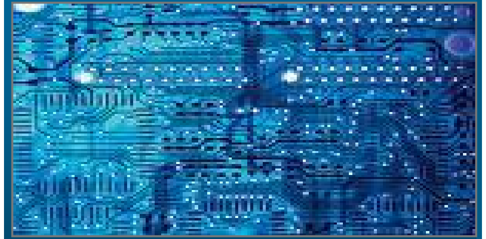
Systems Engineering

Integrated Change Management

System design down to the component level.
Clear and validated specs for development teams and suppliers.

Trade-off and impact analysis across domains.
Greater flexibility and collaboration between SE and development

Electronics



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Software

Software and Systems Development Governance

Process & Product Management

Architecture management

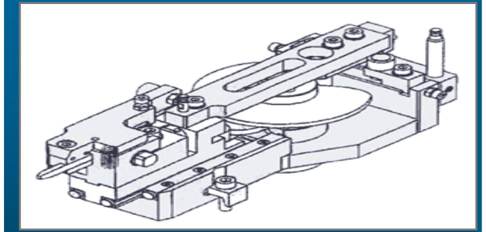
Quality management

Requirements management

Change & release management

Open technology, open standards & community innovation

Mechanical



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Future: The Frictionless Engineering Environment

Integrated Systems Engineering Leveraging SOA & Jazz

Extending Collaboration Through System Level Design

Learn more at:

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