



L'importanza di un processo robusto di Requirements Management

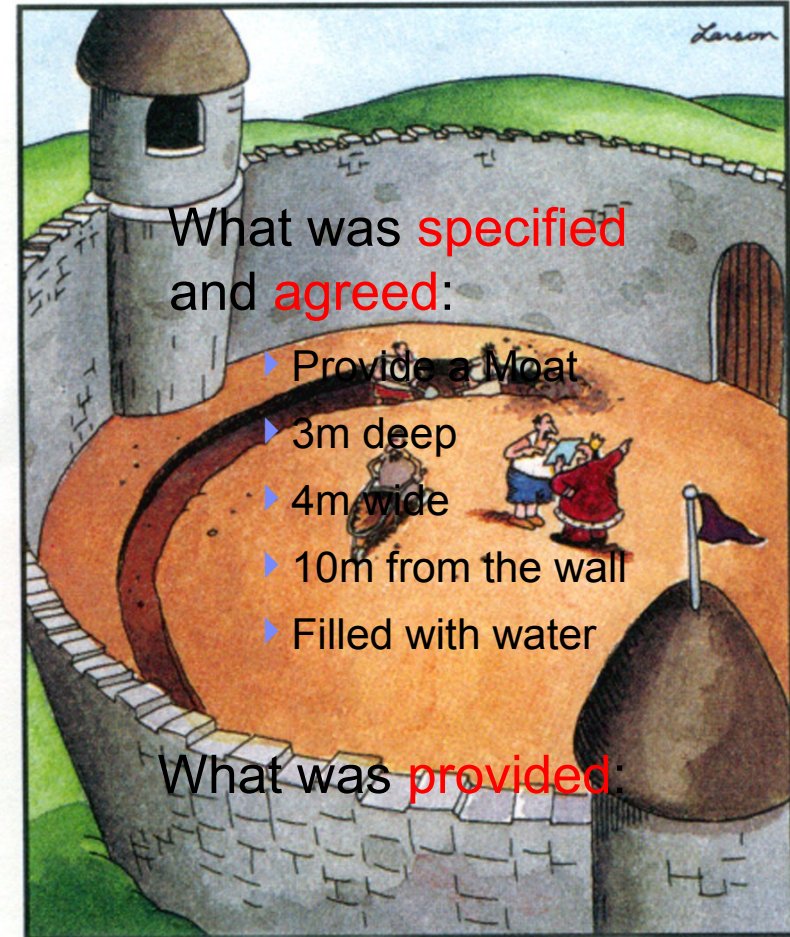
Gianluca Monticone – Senior Systems Specialist



What is Requirements Management?

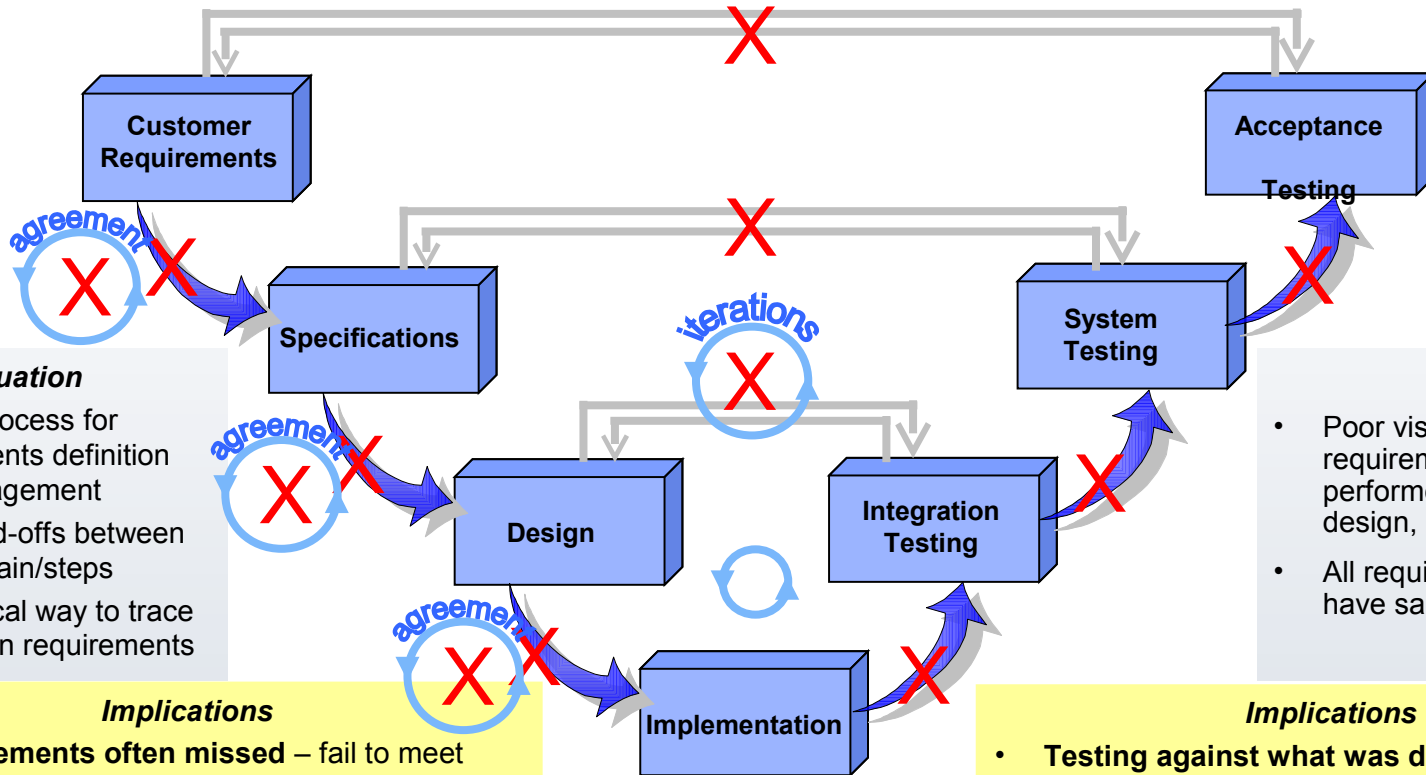
*“The purpose of **requirements management** is to establish a **common understanding** between the customer and the ... project ... This agreement with the customer is the basis for **planning** and **managing** the ... project.”*

The Capability Maturity Model for Software (CMM®) from the Software Engineering Institute at Carnegie Mellon University. - www.sei.cmu.edu/cmm



Suddenly, a heated exchange took place between the King and the moat contractor, and hence, requirements management was born.

Today's Typical Siloed Systems Engineering Process



- Situation**
- Ad hoc process for requirements definition and management
 - Poor hand-offs between supply chain/steps
 - No practical way to trace changes in requirements

- Situation**
- Poor visibility to clear requirements so tests are performed against the design, not the requirements
 - All requirements appear to have same priority

- Implications**
- **Requirements often missed** – fail to meet stakeholder and business needs, missed schedules and cost targets
 - **Lack of traceability** – can't demonstrate compliance/V & V
 - **Lack of impact analysis** – can't react to changing contractual requirements

- Implications**
- **Testing against what was designed, not what the customer asked for** – rework after acceptance testing fails, induces schedule slip, more cost
 - **Business impact not used to drive testing** – increased business risk since high priority requirements may be pushed to end of process and dropped

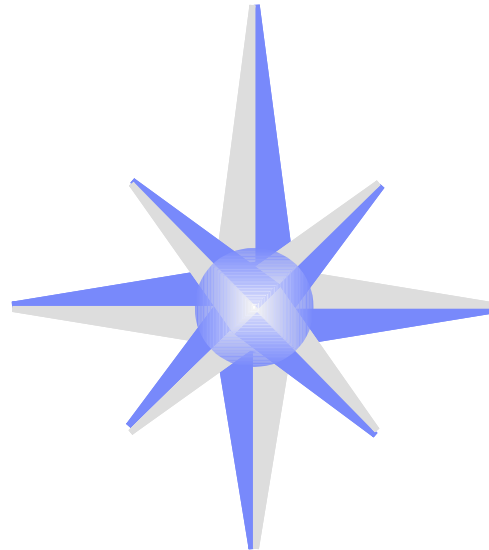


So how do I fix this mess? And stop being late and over budget?

4 Principles for Effective Requirements Lifecycle Management

Recognize the needs of all stakeholders

N



Automate your requirements process

W

E

Use abstraction to manage complexity

Integrate requirements across the lifecycle

Principle 1: Recognize the needs of all stakeholders

Avoid Premature Details at Top Levels

Problem

State what the stakeholders want to be able to do: **Capabilities**

Solution

State what the system must do: **Function**

Principle 1: Recognize the needs of all stakeholders

An Exercise in clear and concise descriptive writing?

The system shall perform at the maximum rating at all times **except** that in emergencies it shall be capable of providing up to 125% rating **unless** the emergency condition continues for more than 15 minutes **in which case** the rating shall be reduced to 105% **but** in the event that only 95% can be achieved **then** the system shall activate a **reduced** rating exception **and** shall maintain the rating within 10% of the stated values for a minimum of 30 minutes.



Principle 1: Recognize the needs of all stakeholders

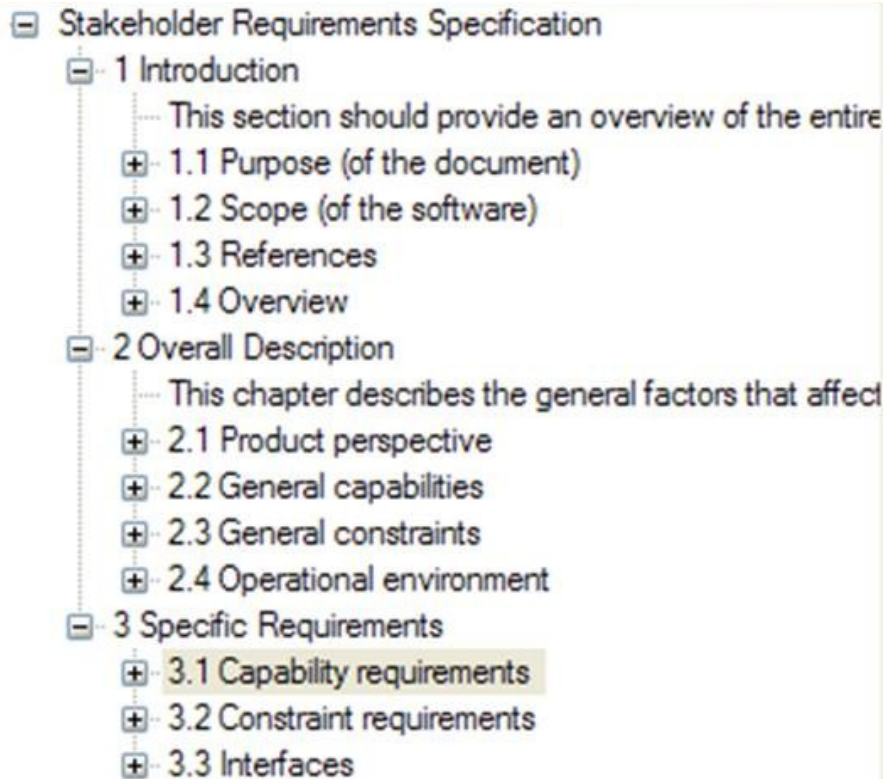
Seven Criteria for Requirement Statements

Each requirement statement should be:

1. **Individual:** each statement is a single traceable element
2. **Unique:** each statement is uniquely identified
3. **Clear:** each statement is clearly understandable
4. **Precise:** each statement is precise and concise
5. **Abstract:** does not impose a solution on the next layer
6. **Quantified:** each statement has acceptance criteria
7. **Testable:** each statement can be validated/verified

Principle 1: Recognize the needs of all stakeholders

Document Structure



Structure helps:

- Understand context
- Assess completeness
- Identify repetition/conflict
- Navigate/search requirements

Principle 1: Recognize the needs of all stakeholders

Structure and Templates

Hamony/ITSW Stakeholder Requirements Specification

- 1 Introduction**
- 1.1 Purpose (of the document)
- 1.2 Scope (of the software)
- 1.3 References
- 1.4 Overview

- 2 Overall Description**
- 2.1 Product perspective
- 2.2 General capabilities
- 2.3 General constraints
- 2.4 Operational environment
- 2.4.1 Assumptions

- 3 Specific Requirements**
- 3.1 Capability requirements
- 3.2 Constraint requirements

Hamony/ITSW Stakeholder Requirements Specification

1 Introduction

This section should provide an overview of the entire document and a description of the software.

1.1 Purpose (of the document)

This section:

- (1) defines the purpose of the document
- (2) specifies the intended audience

1.2 Scope (of the software)

This section:

- (1) identifies the software to be developed
- (2) explains what the product is not
- (3) describes relevant boundaries
- (4) should be consistent with the project charter

1.3 References

This section provides a list of references used in the document.

Hamony/ITSW Stakeholder Requirements Specification

2.2 General capabilities

<Actor> shall be able to <Act> <Action_Subject> whilst <Qualification> <Qualification Subject>.

<Actor> shall be able to <Act> <Action_Subject> within <Performance> of <Event> whilst <Qualification> <Qualification Subject>.

2.3 General constraints

<Actor> must be able to <Act> <Action_Subject> less than <Performance> <Qualification Subject>.

<Actor> shall not be placed in <Regulation>.

Name	Description	Type
Admin	Hamony/SE Project Administration Folder	Folder
Analysis and Design	Hamony/SE Analysis and Design Folder	Folder
Planning	Hamony/SE Project Management Folder	Folder
Requirements	Hamony/SE Requirements Folder	Folder
Subsystems Data	Hamony/SE Subsystems Data Folder	Folder
Verification	Hamony/SE Verification Folder	Folder
Glossary	Hamony/SE Glossary	Formal

Document Structure

Boiler-plate text

Requirement templates

Project templates

Principle 1: Recognize the needs of all stakeholders

Attributes



Identification



Type



Performance



Priority



Status

Principle 1: Recognize the needs of all stakeholders

Virtually unlimited user-defined attributes

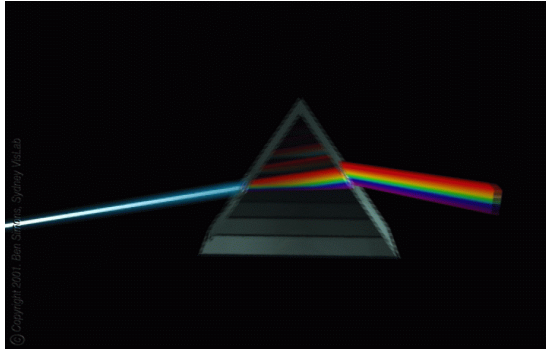
- Nearly unlimited number of attributes in a spreadsheet-like view
- Values can be calculated for metrics collection
- A value or attribute may be displayed in any column

The screenshot displays the Rational DOORS software interface. The main window shows a spreadsheet view of user requirements for an SUV 4x2. The spreadsheet has columns for Object Identifier, User requirements for SUV 4x2, Allocated Budget, Spent, Remaining, and Risk. The requirements are organized into sections: 4.1.4 Fuel economy, 4.1.5 Safety, 4.1.6 Noise levels, and 4.1.7 Ease of Access. A detailed attribute window for Object 42 (Baselined) - DOORS is open, showing a list of attributes and their values.

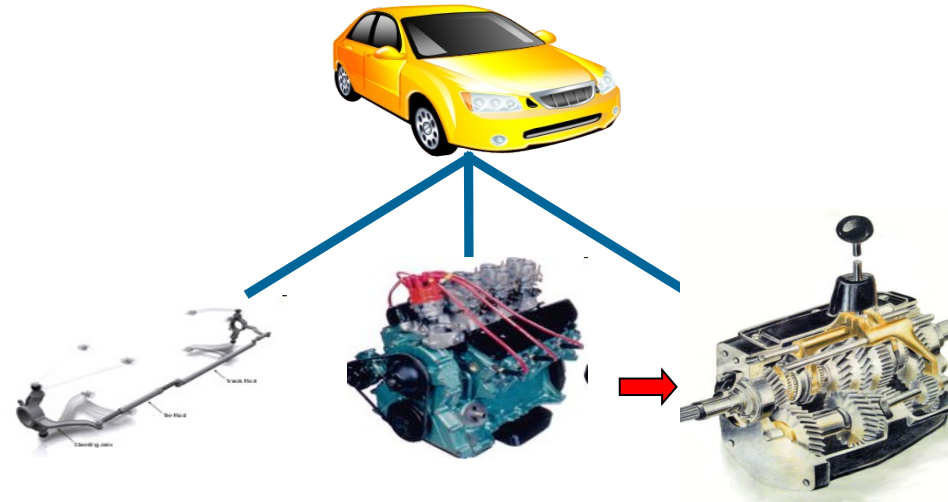
Attribute	Value
Created On	11 February 1997
Created Thru	Manual Input
Critical Issues	
Criticality	Medium
Detailed requirement	
History count	0
Last Modified By	Dave Mason
Last Modified On	23 November 2007
Object Heading	
Object Number	4.1.5.0-2
Object Short Text	
Object Text	Users shall be able to travel at th...
OLE	False

Principle 2: Use abstraction to manage complexity

Building a Requirements Hierarchy



Decomposition



Design-driven



Transformation



Allocation

Principle 2: Use abstraction to manage complexity

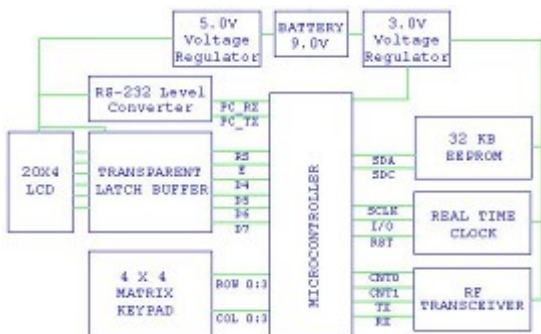
Why is Traceability Important?

Why are we building this?



Where is this implemented?

How do I test this?

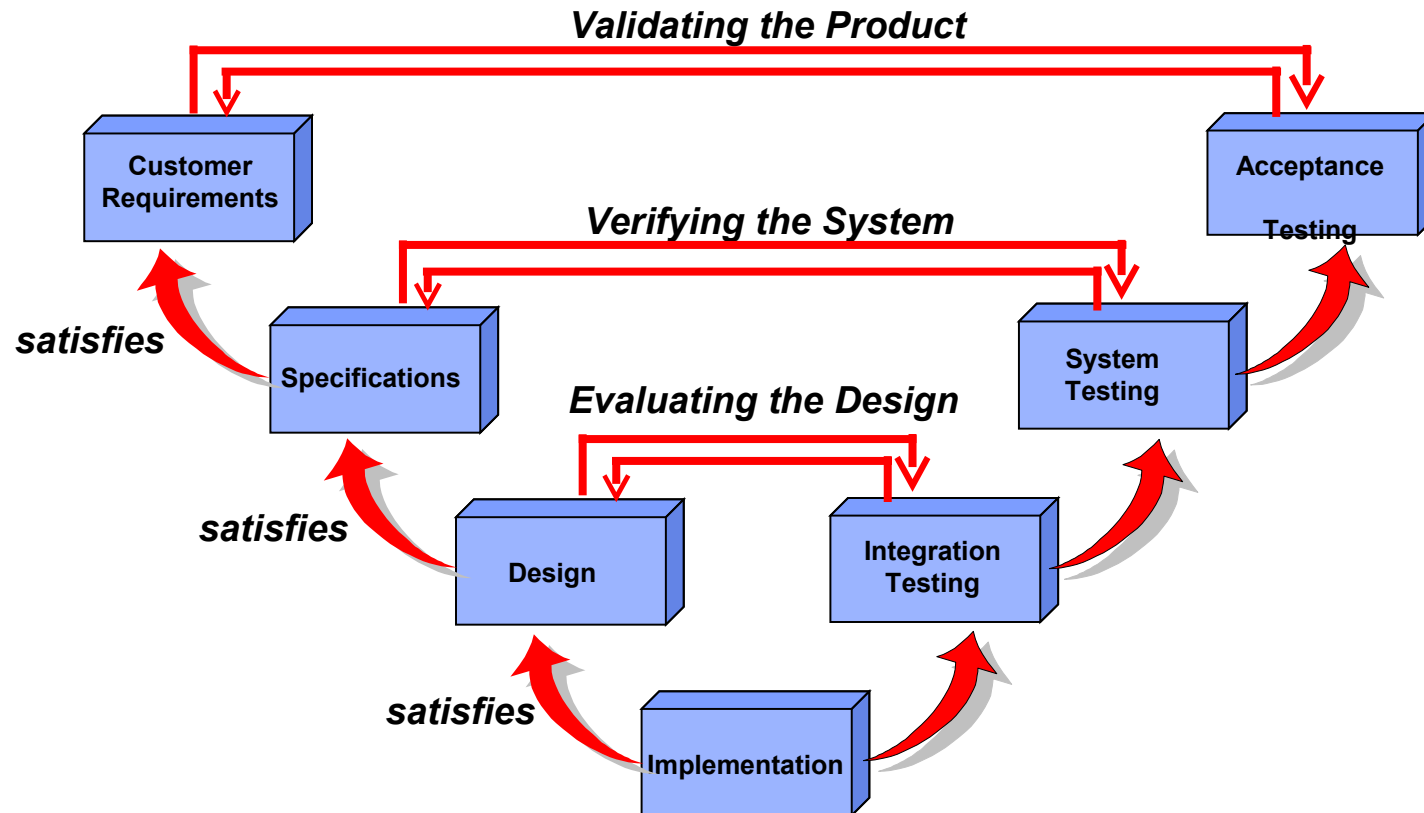


Can we show these answers? (Governance)



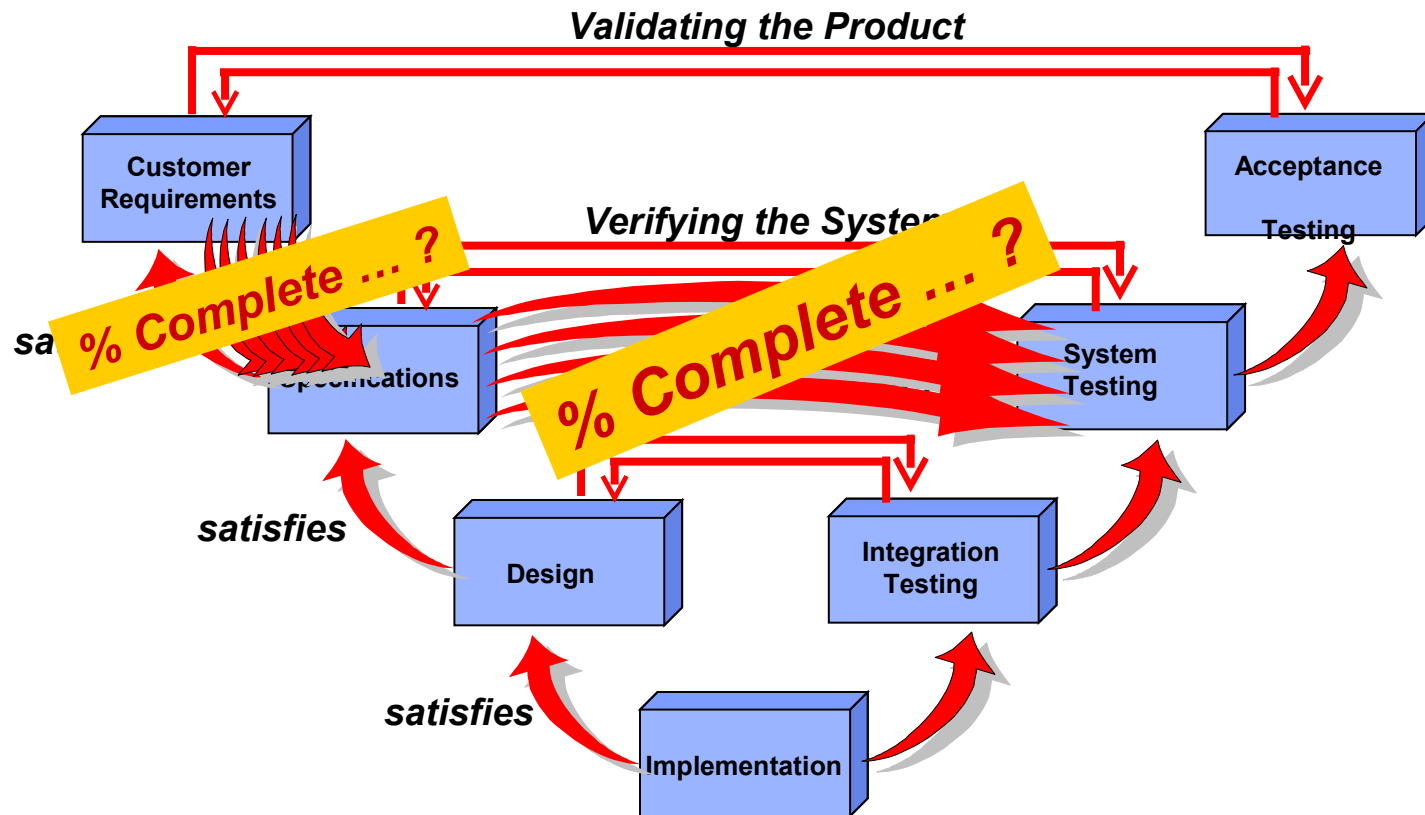
Principle 2: Use abstraction to manage complexity

Create, review and use traceability



Principle 2: Use abstraction to manage complexity

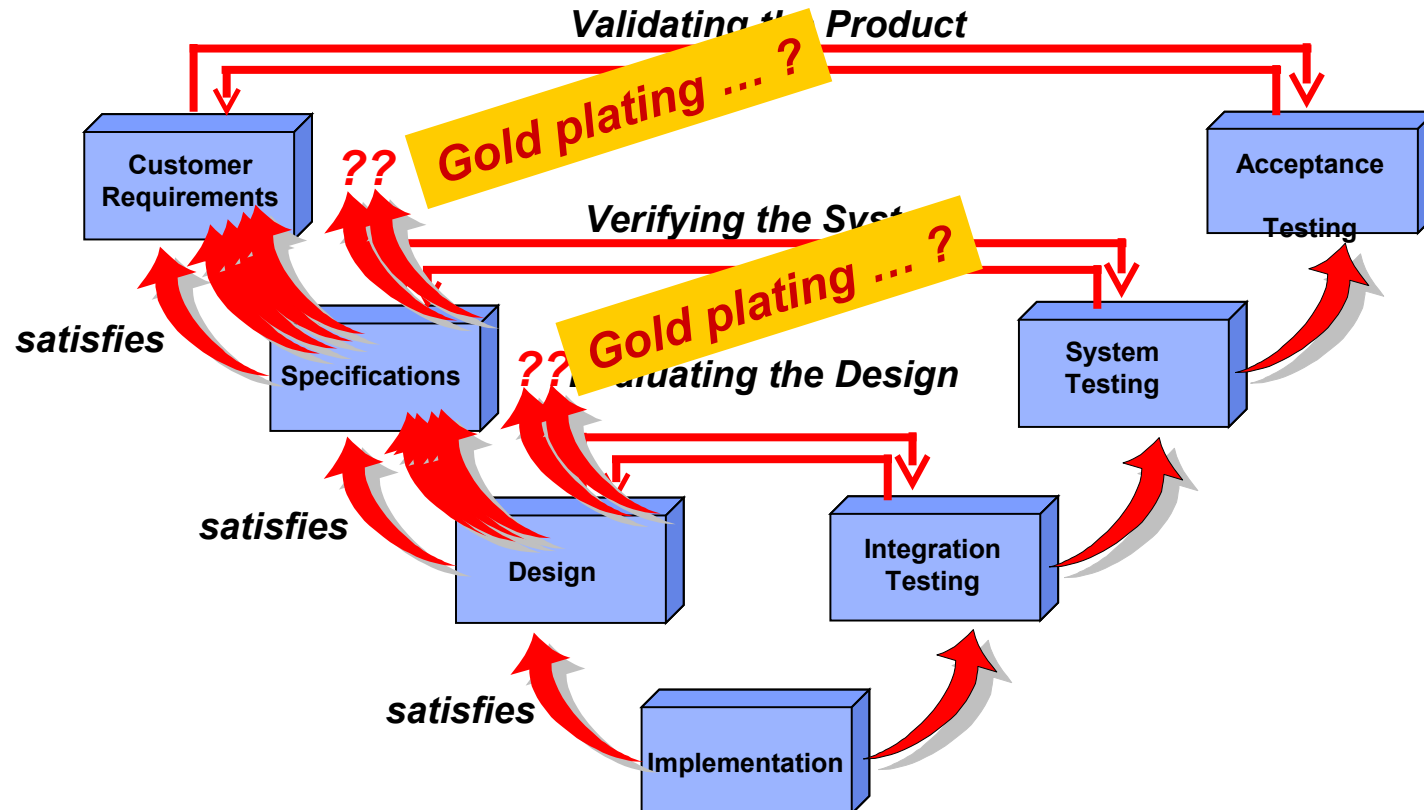
Create, review and use traceability



Coverage Analysis – Top Down

Principle 2: Use abstraction to manage complexity

Create, review and use traceability



Coverage Analysis – Bottom Up

Principle 2: Use abstraction to manage complexity

Multi-Level Traceability - Info transparency allows you to take control

Complex traceability made as simple as drag and drop

Trace through multiple levels of documentation in a single display

Product Reqs

System Reqs

Design

Software Requirements

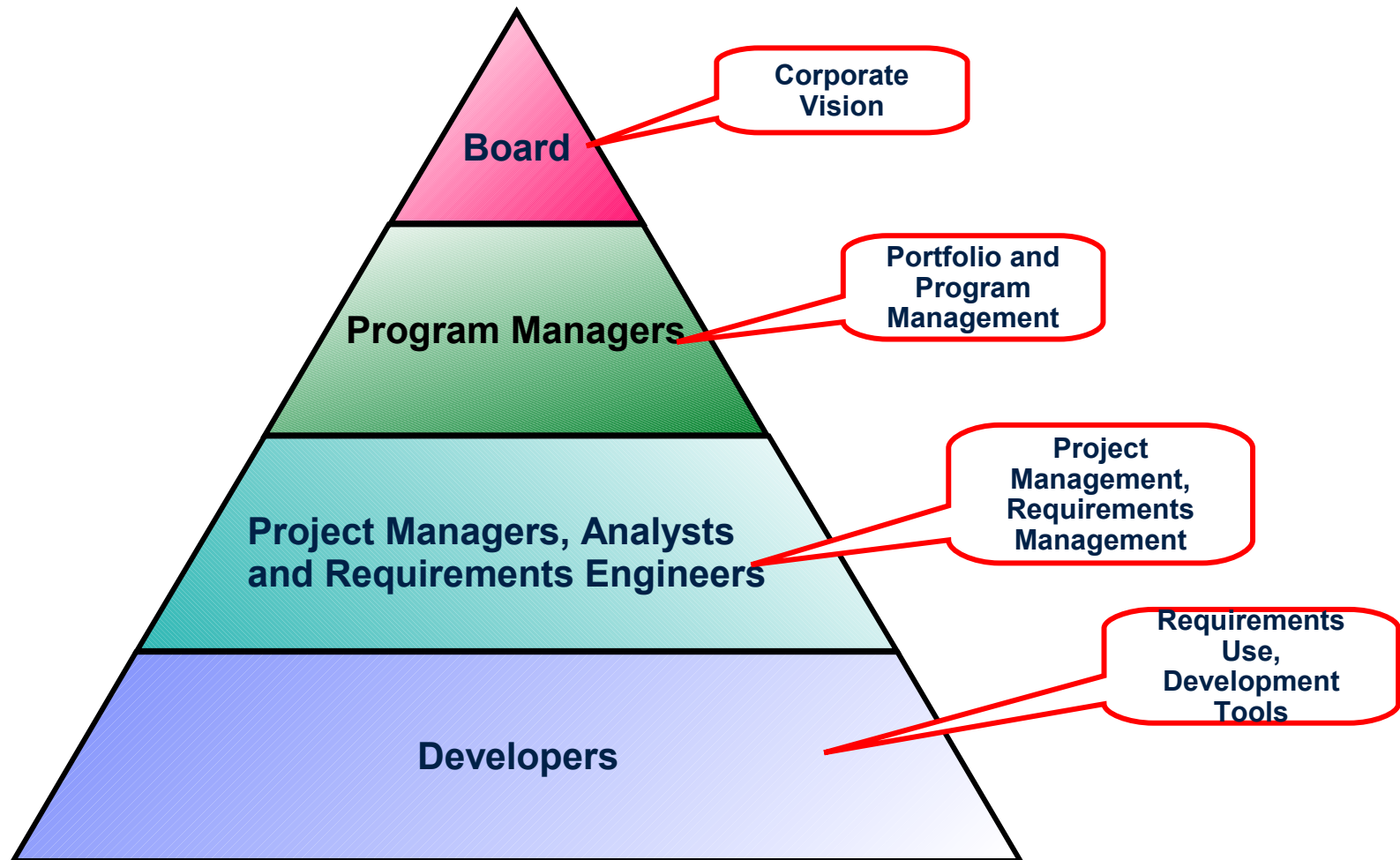
Test Plans

The screenshot displays a software tool interface with a menu bar (File, Edit, View, Insert, Link, Analysis, Table, Tools, Discussions, User, Help) and a toolbar. Below the toolbar is a navigation pane with tabs for 'Marketing Features', 'System Requirements', 'System Design', 'Software Requirements', and 'Software Test Plan'. The main content area is divided into five columns corresponding to the labels above. The 'Product Reqs' column shows a tree view of features. The 'System Reqs' column shows a requirement 'SR-45'. The 'Design' column shows a system overview diagram. The 'Software Requirements' column shows a requirement 'SRS-81'. The 'Test Plans' column shows a test plan 'STP-32' with a timing diagram for a Manchester Code telegram.

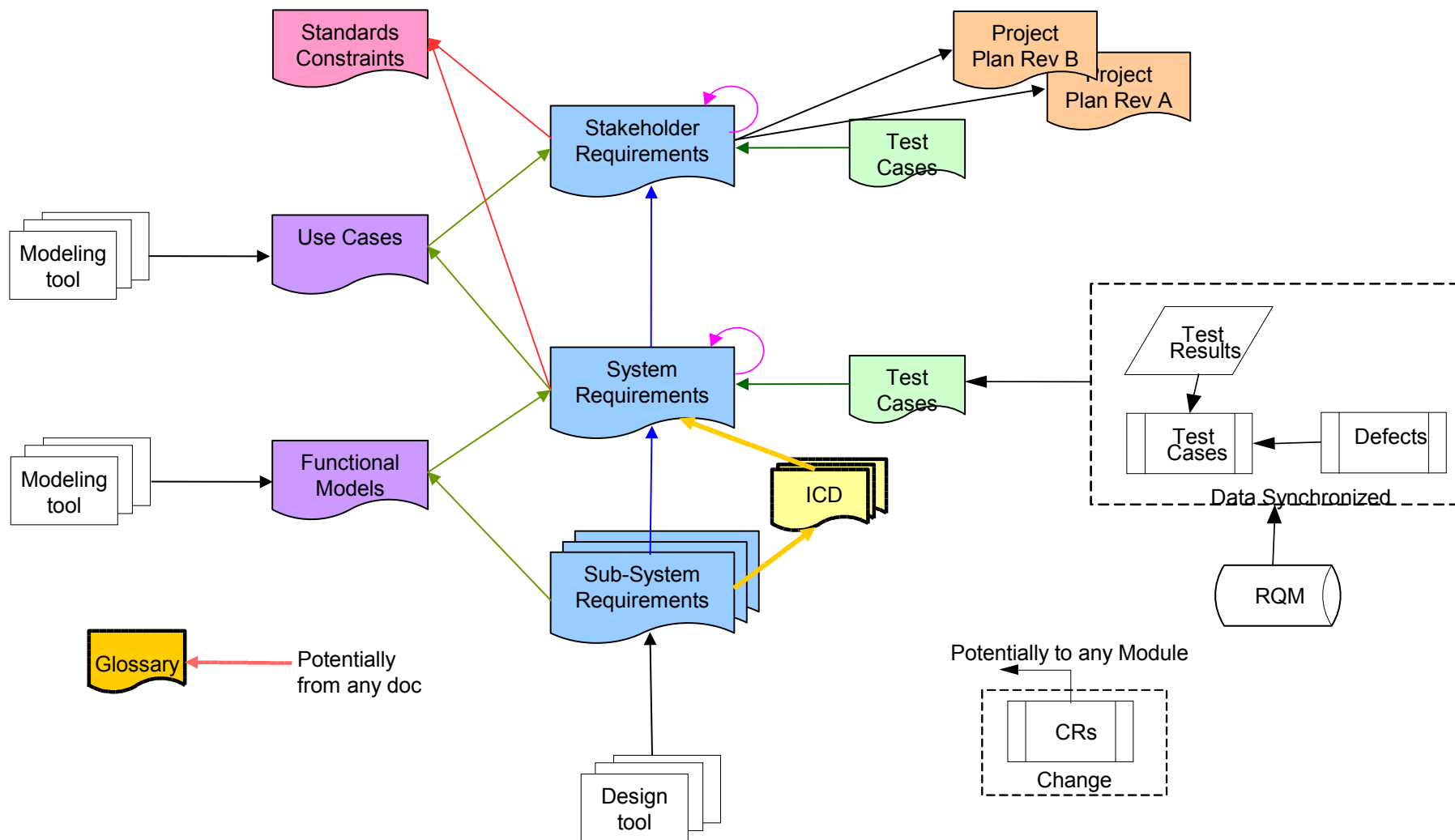
Make maintaining traceability an asset rather than an overhead

Principle 3: Integrate RM across the lifecycle

RM across the Enterprise



Principle 3: Integrate RM across the lifecycle



Principle 4: Automate your requirements process

Measure the requirements process

- CMMI, ITIL and other process assessment frameworks expect measurement
 - ▶ CMMI needs RM to get to level 2
 - ▶ Need **measurement** to understand efficiency and consistency
 - ▶ Key to continuous process improvement

Metrics Collection	Total NC	Total C	Agreed C	Delta NC	Delta C	Allocated NC	Allocated C	Proven NC	Proven C	Deleted NC	Deleted C
24 21/5/05 - 22/5/05											
24.1 21/5/05 - 21/5/05											
24.1.1 /01 - Period ending now - real time/Reqts - Standard view	4	13	0	0	0	3	10	1	4	0	0
24.1.2 /01 - Period ending now - real time/Reqts - 01 - Data Entry	4	13	0	0	0	3	10	1	4	0	0
24.2 22/5/05 - 22/5/05											
24.2.1 /01 - Period ending now - real time/Reqts - Standard view	0	0	0	0	0	0	0	0	0	0	0
24.2.2 /01 - Period ending now - real time/Reqts - 01 - Data Entry	0	0	0	0	0	0	0	0	0	0	0

Principle 4: Automate your requirements process

Effective Requirements Mng realizes quantifiable savings
and with a tool you are able to measure

Example: how to measure and results

- Development releases consisting of typically 8000 requirements used to take 6 months
- Phase 1 - Application of robust process and tool enforcement reduced this period to 12 Weeks over a period of 1 year
- Phase 2 - Continuous process improvement for a further 12 months reduced this period to 6 weeks
- Over time, defect removal and effectiveness was 55% at phase 1, 88% at phase 2 and still improving
- Defects undetected end up with the customer – the figures represent huge improvements in cost of re-work, quality and customer satisfaction



Principle 4: Automate your requirements process

Use a Requirements Management Tool

Document structure

Car user requirements

- 2 User types
 - 2.1 Nationalities

The car will be used in the following countries: UK, USA, Northern Europe, Eastern Europe, Japan, Russia, Australia.
 - 2.2 User sizes

People come in all shapes and sizes. The car must be suitable for people maximum and minimum sizes 1.3 m to 2 m weighing 25 kilograms to 140 kilograms.
- 3 Requirements
 - 3.1 Capability Requirements
 - 3.1.1 Carrying Capacity
 - 3.1.1.1 Number of people

Four average size adults shall be able to travel in comfort for a period of 4 hours. This level of comfort is defined as being equivalent to the standard of comfort provided by the top 30% of cars produced in 2006.

The top level of cars are those in the price range £13,000 to £30,000 at 2006 prices.

Five average size adults shall be able to travel in comfort for a period of 4 hours.

Attributes

Car user requirements	Percentage cost	Progress
1 Introduction	0.172835	0
This module contains the user requirements for a new car to be commercially available by 1 August 2006.		0
2 User types	1.370889	0
2.1 Nationalities	0.642687	0
The car will be used in the following	0.769025	0

Filter to focus

ID	Car user requirements
TRN-CSR-3	2 User types
TRN-CSR-4	2.1 Nationalities
TRN-CSR-5	The car will be used in the following countries: UK, USA, Northern Europe, Eastern Europe, Japan, Russia, Australia.
TRN-CSR-6	2.2 User sizes
TRN-CSR-7	People come in all shapes and sizes. The car must be suitable for people maximum and minimum sizes 1.3 m to 2 m weighing 25 kilograms to 140 kilograms.

View related information

Car user requirements	In-links (System Requirements)
3.1.2.1.1 Forwards	
Users shall be able to travel at speeds up to 200 kilometers per hour.	<p>TRN-SR-5 The car shall be able to move forwards at all speeds from 0 to 220 kilometers per hour on standard flat roads with winds of 0 kilometers per hour, with 280 BHP. Not Set</p> <p>TRN-SR-26 The car shall have a mechanism to enable it to be moved forwards or backwards. Not Set</p>

View historical information

3.1.1.1 Number of people	<p><i>(Next object differs.)</i> Deleted object 'TRN-CSR-12' follows here:- Four average size adults shall be able to travel in comfort for a period of 4 hours. This level of comfort is defined as being equivalent to the standard of comfort provided by the top 30% of cars produced in 2006.-</p>
Five average size adults shall be able to travel in comfort for a period of 4 hours.	<p>Five average size adults shall be able to travel in comfort for a period of 4 hours. <i>(Previous object differs.)</i></p>
Two average size adults and 3 average size children shall be able to travel in comfort for a period of 3 hours. This could be accomplished with a three seat arrangement.	<p>Two average size adults and 3 average size children shall be able to travel in comfort for a period of 3 hours. This could be accomplished with a three seat arrangement.</p>
This level of comfort required is defined as being equivalent to the standard of comfort provided by the top 30% of cars produced in 2009.	<p><u>This level of comfort required is defined as being equivalent to the standard of comfort provided by the top 30% of cars produced in 2009.</u></p>
Users shall have easy entry and exit.	<p>Users shall have easy entry and exit.</p>

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Recognize the needs of all stakeholders

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W

Rational DOORS

E

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S

Integrate requirements across the lifecycle

Please note

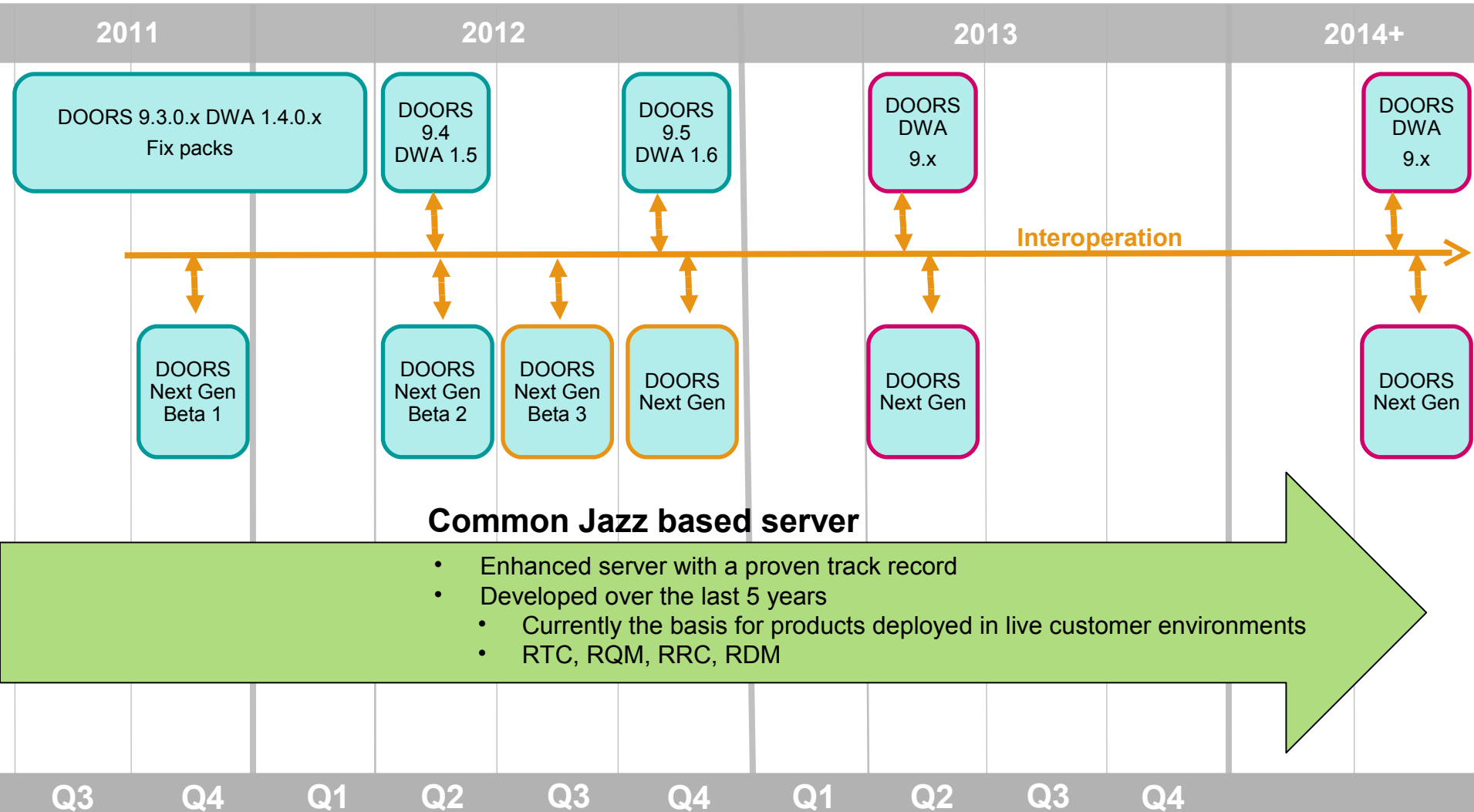
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Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision.

The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results similar to those stated here.

DOORS Roadmap



Common Jazz based server

- Enhanced server with a proven track record
- Developed over the last 5 years
 - Currently the basis for products deployed in live customer environments
 - RTC, RQM, RRC, RDM

Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4

STATUS: — Released — Planned — Conceptual

Investing in current DOORS 9 deployments



2011

2012

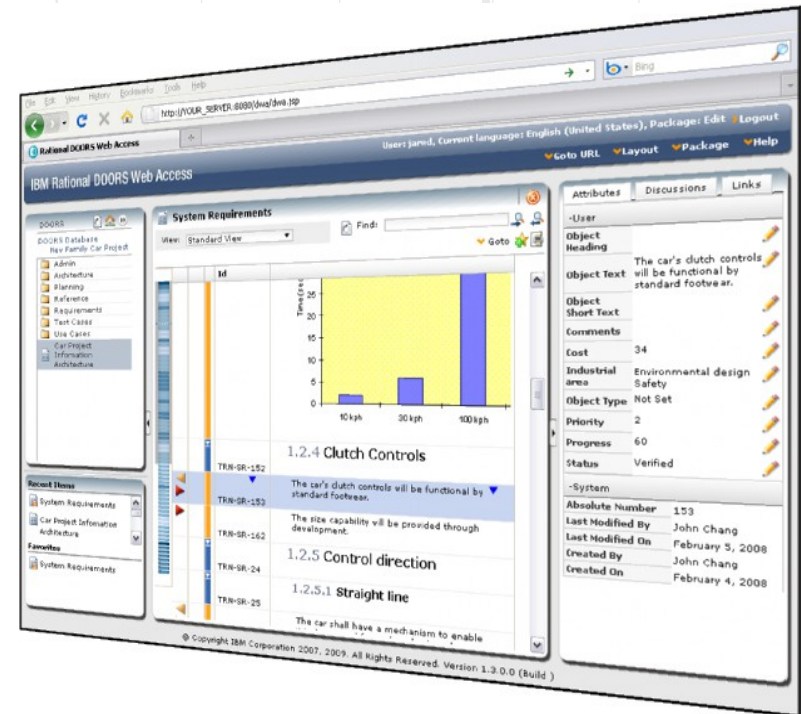
2013

2014

2015...

IBM Rational DOORS 9.4 and DWA 1.5

- DOORS – HP Quality Center (March 2012)
- Upgrade RIF to the latest version ReqIF
 - Data exchange between DOORS 9 and DOORS Next Generation
 - Improved support for your supply chain
- Security Enhancements
 - Move authentication / authorization from the client to the DOORS server
- Transition integrations from synchronization to linked lifecycle data
 - Improved visibility of lifecycle attributes and traceability
 - New integrations to RQM, Design Manager (beta)
 - Linking between different RM databases
 - Document generation
 - Run user defined templates without an RPE license
- Usability Improvements



STATUS: — Released — Planned — Conceptual

Future releases of DOORS 9.x –candidate themes



2011

2012

2013

2014

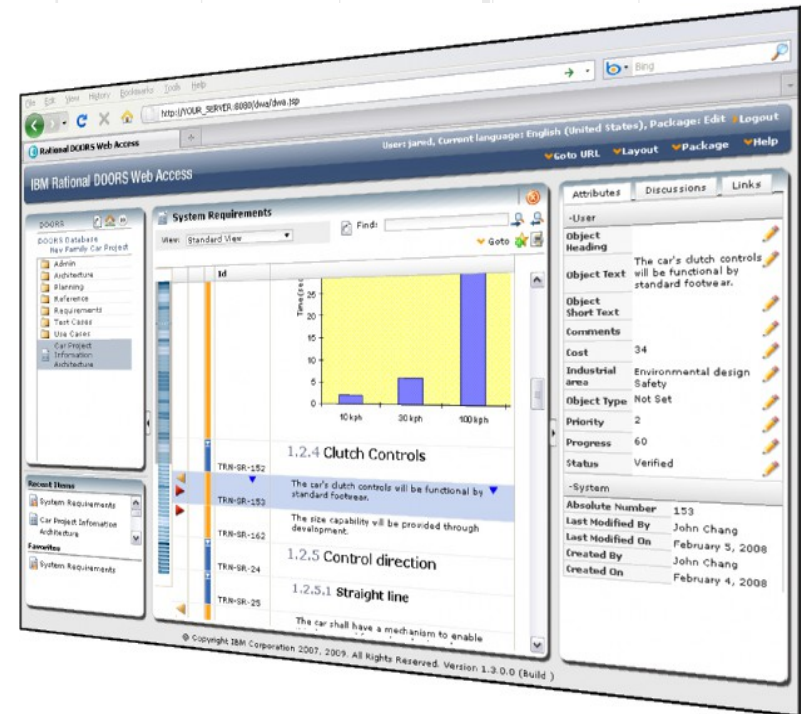
2015...

DOORS

- Usability Enhancements
- Reporting over system engineering metrics
- Database-wide query
- Richer OSLC Integrations
- Additional Integrations

DOORS Web Access

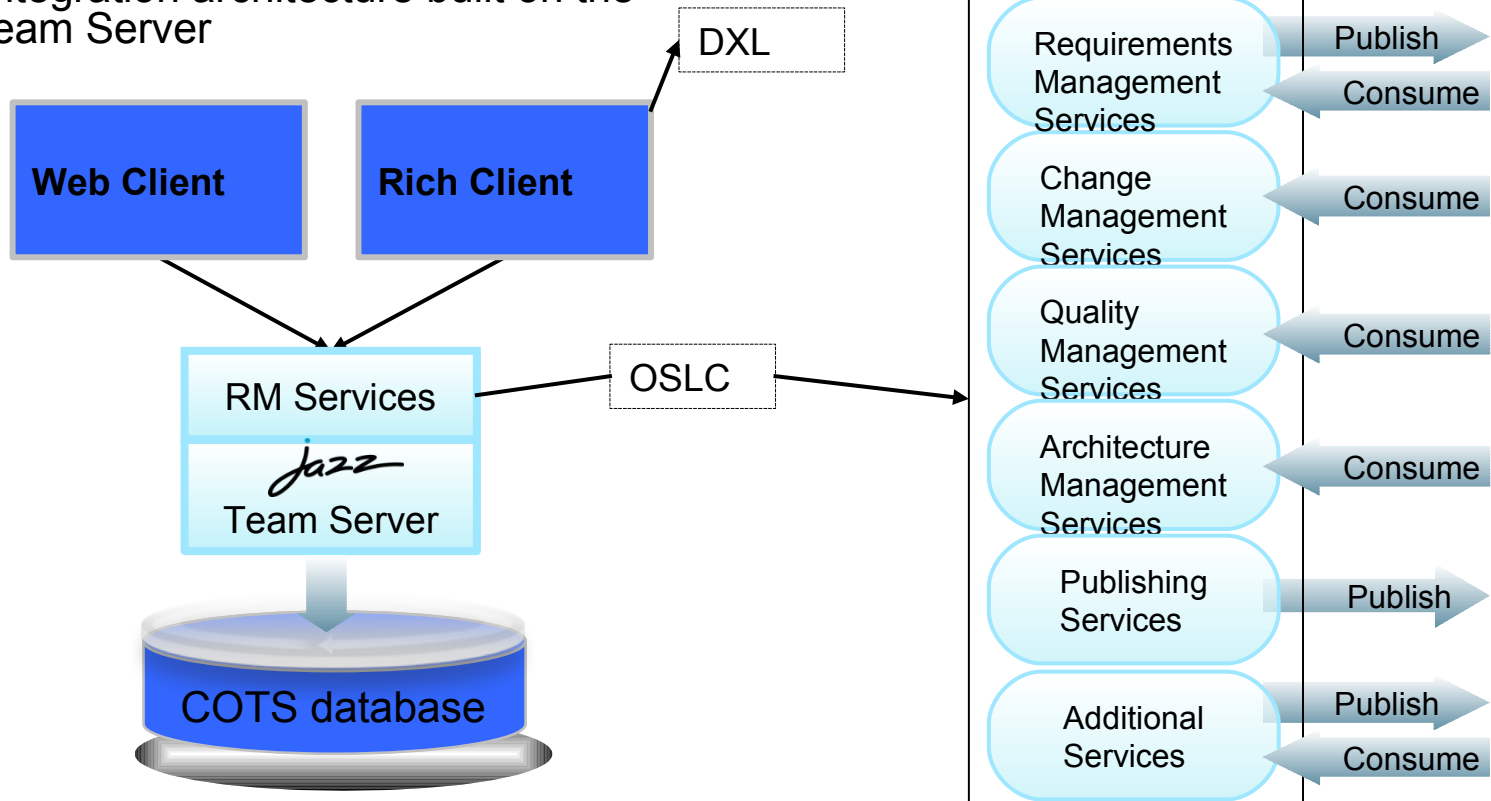
- Persistent user preferences
- Document generation



Architectural Plan for Rational RDM Tools

- Requirements visibility and traceability across the lifecycle
- Open integration architecture built on the Jazz Team Server

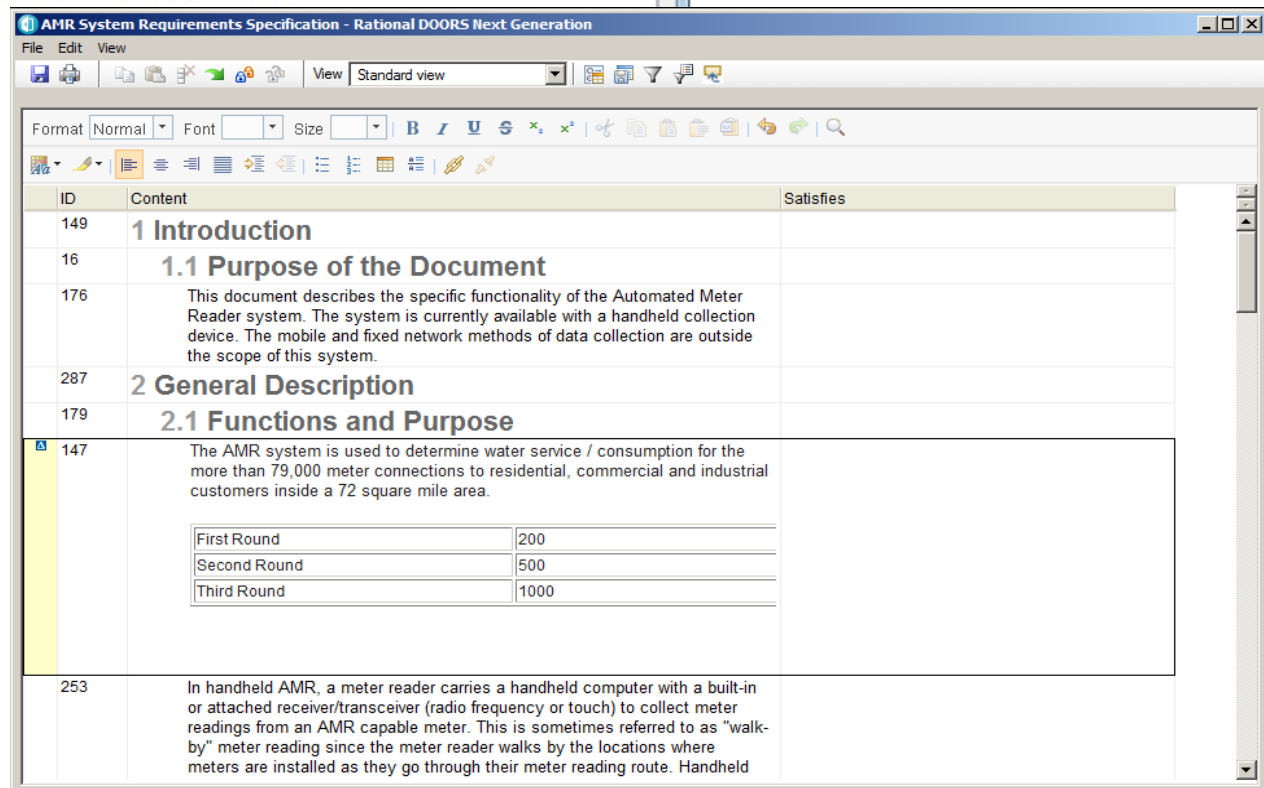
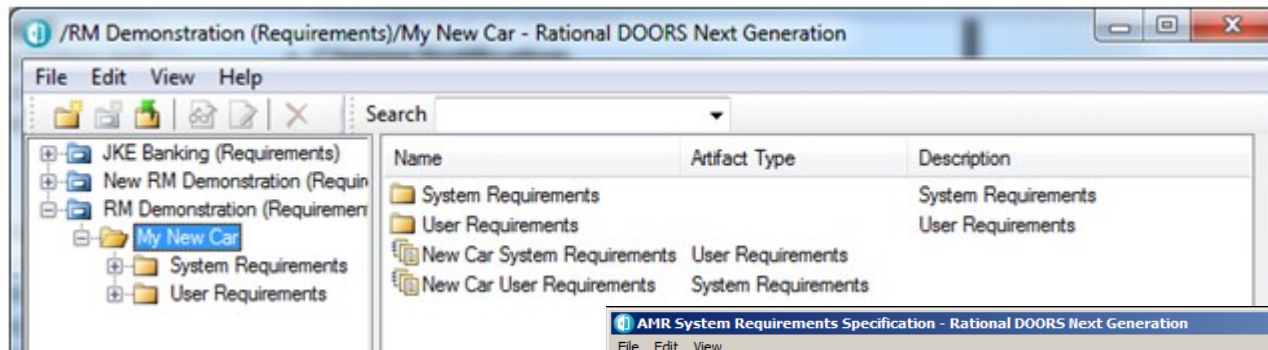
- Integrations using Open Services for Lifecycle Collaboration (OSLC)



- JEE application server (Tomcat, WebSphere)
- Relational Database (DB2, Oracle, MS SQL server)
- Optional: LDAP-enabled directory server for users/groups
- Optional: clustering via WebSphere
- Browser support (various versions of IE, Firefox)
- Rich client application support varies across individual applications

Familiarity for existing DOORS users

DOORS Next Module view (rich client)



Familiar look and feel minimizes transition training for existing users

Familiarity for existing DOORS users

DOORS Next Module view (rich client)

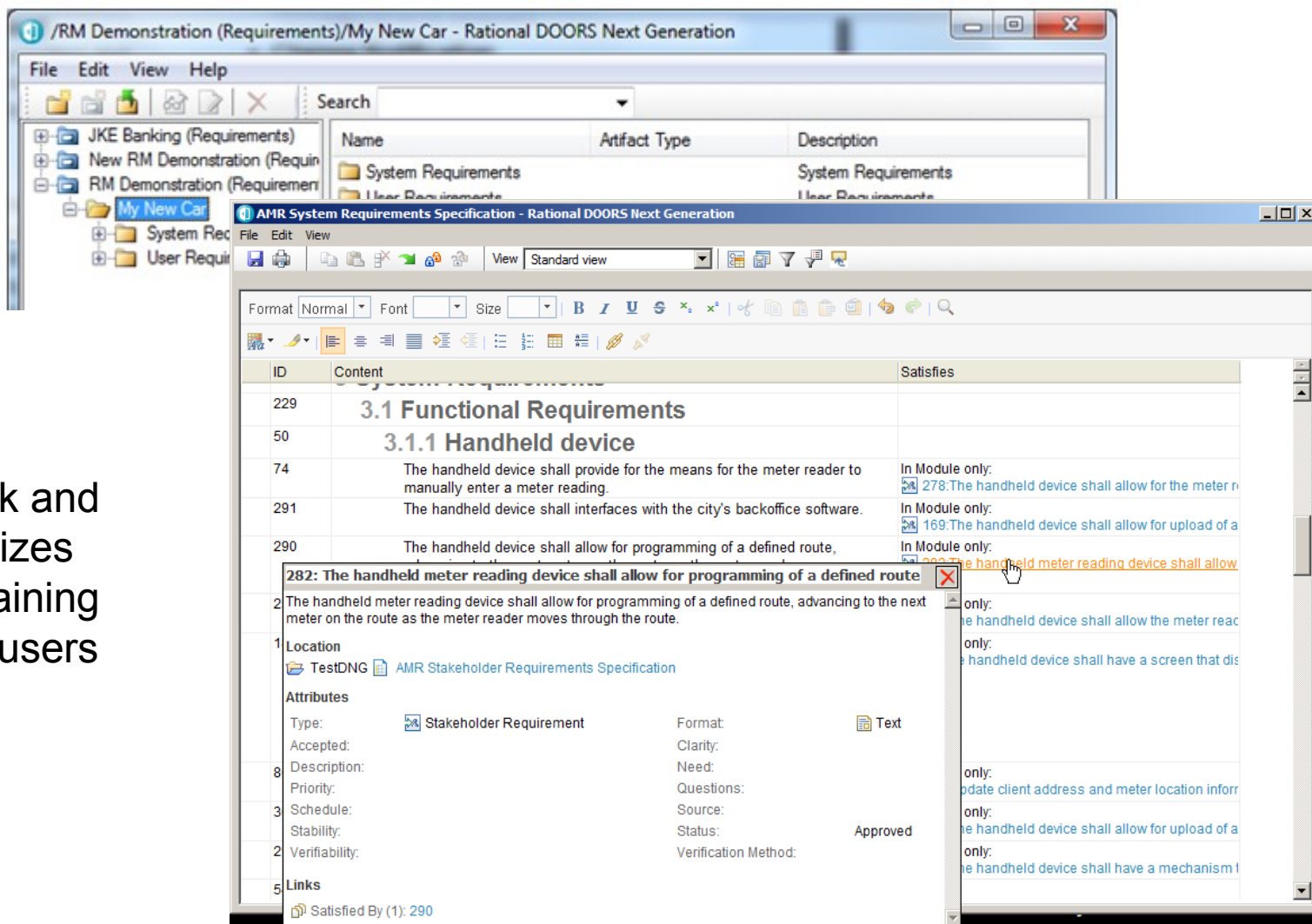
The screenshot displays the Rational DOORS Next Generation interface. The top window shows a project tree with folders like 'JKE Banking (Requirements)', 'New RM Demonstration (Requ...', and 'My New Car'. The bottom window, titled 'AMR System Requirements Specification - Rational DOORS Next Generation', shows a table of requirements.

ID	Content	Satisfies
229	3.1 Functional Requirements	
50	3.1.1 Handheld device	
74	The handheld device shall provide for the means for the meter reader to manually enter a meter reading.	In Module only: 278:The handheld device shall allow for the meter r
291	The handheld device shall interfaces with the city's backoffice software.	In Module only: 169:The handheld device shall allow for upload of a
290	The handheld device shall allow for programming of a defined route, advancing to the next meter on the route as the meter reader moves through the route.	In Module only: 282:The handheld meter reading device shall allow
258	The handheld device shall have the ability to search for accounts by Last Name, Service Address, Meter Number, and Unread Meters.	In Module only: 158:The handheld device shall allow the meter read
189	The handheld device shall have a screen capable of displaying the number of accounts that have been read and unread. Display information shall include: total number of accounts in collection route, number of read accounts, number of unread accounts, the address of each account. For completed (read) accounts, the display information shall include: the date and time of the last reading, summary of usage data, and the id of handheld reading device.	In Module only: 37:The handheld device shall have a screen that dis
80	The handheld device shall allow the meter reader to enter information about meters relocated on a particular route.	In Module only: 235:Update client address and meter location inform
30	Information captured via the handheld device shall be downloadable via either cable hookup or wireless signal.	In Module only: 169:The handheld device shall allow for upload of a
298	The handheld device shall be able to recharge using solar power.	In Module only: 161:The handheld device shall have a mechanism f
54	The handheld device shall include a leak indicator.	

Familiar look and feel minimizes transition training for existing users

Familiarity for existing DOORS users

DOORS Next Module view (rich client)



Familiar look and feel minimizes transition training for existing users

Fully functional Web client

DOORS Next Generation Module view (web client)

Modern web look and feel minimizes adoption cost for new and casual users

Filter Pane

Module

Properties

The screenshot displays the DOORS Next Generation web client interface. The main content area shows a list of requirements artifacts for the project "DOORS Next Generation Beta 1 (Requirements)". The selected artifact is "149: Automated Meter Reader System Requirements". The interface is divided into three main sections:

- Filter Pane (Left):** Contains a "Create Requirement" button, "Saved Filters", and "Modules" sections.
- Module (Center):** A table listing requirements artifacts with columns for ID and Primary Text. The selected artifact is expanded to show its content.
- Properties (Right):** A sidebar showing the "Overview" of the selected artifact, including project information, team ownership, creation/modification dates, and type/format.

ID	Primary Text
150	1 Introduction
151	1.1 Purpose of the Document
152	This document describes the specific functionality of the Automated Meter Reader system. The system is currently available with a handheld collection device. The mobile and fixed network methods of data collection are outside the scope of this system.
153	2 General Description
154	2.1 Functions and Purpose
155	The AMR system is used to determine water service / consumption for the more than 79,000 meter connections to residential, commercial and industrial customers inside a 72 square mile area.
156	In handheld AMR, a meter reader carries a handheld computer with a built-in or attached receiver/transceiver (radio frequency or touch) to collect meter readings from an AMR capable meter. This is sometimes referred to as "walk-by" meter reading since the meter reader walks by the locations where meters are installed as they go through their meter reading route. Handheld computers may also be used to manually enter readings without the use of AMR technology as an alternate but this will not support comprehensive data which can be accurately read using the meter reading electronically.
157	<AMR Artist Rendition>

Showing 66 Artifacts

IBM Rational DOORS Next Generation

DOORS concepts improved and much more....



Definition

- Rich-text documents
- Diagrams: Process, Use Case
- Storyboards, UI sketching & flow
- Project glossaries
- Templates



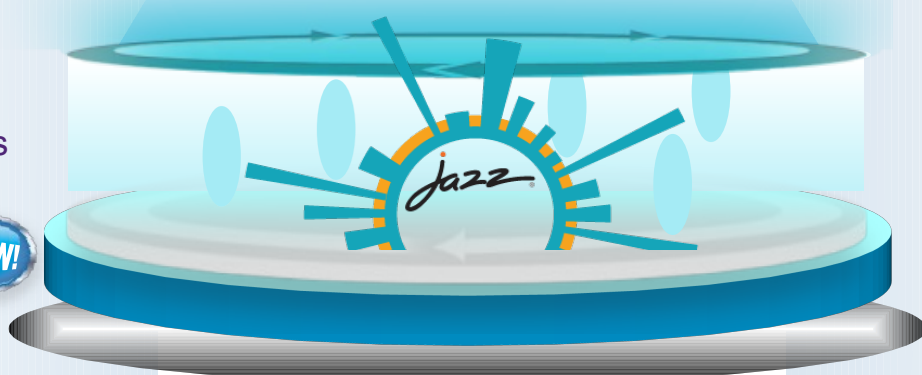
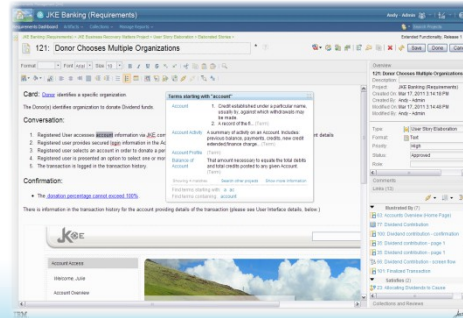
Visibility

- Customizable dashboards
- Analysis views
- Collections
- Milestone tracking & status



Collaboration

- Review & Approval
- Discussions
- Email Notification



Management

- Structure, Attributes/Types
- Traceability, Filtering, Tags
- Baselines, Change History
- Reuse (reqs & types)
- Reporting Metrics & Doc.



Lifecycle

- Central requirements, test, & development repository
- Common administration and role-based user licensing
- Warehouse reporting



Planning

- Integrated planning
- Effort estimation
- Progress tracking

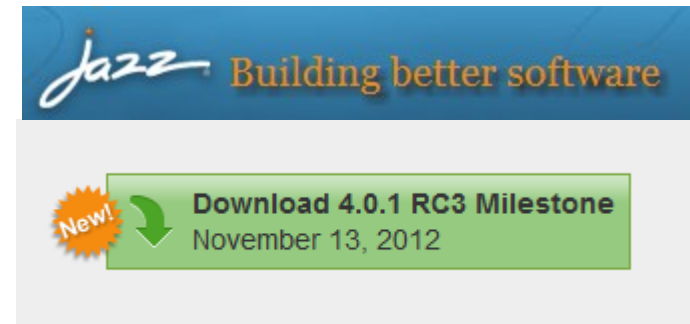
Adopt DOORS Next Generation at your own speed

Both Products can be used in parallel to ensure pragmatic low-risk stepwise migration

- Continue to work with DOORS and DWA
 - Gain the benefits of DOORS 9.x and future 9.x releases

- Use DOORS Next Generation with DOORS 9.x
 - “Recognizably DOORS” to aid adoption
 - Use DOORS Next Generation for new projects as it meets your needs
 - Data Import / Export between DOORS Next Generation and DOORS 9.x projects
 - Bi-directional linking between DOORS Next Generation and DOORS 9.x
 - Support for distributed RM development and Supply Chains

- Participate in DOORS & DWA beta programs (already ended)
 - Follow DOORS Next Generation on jazz.net
 - Participate in the beta, managed or unmanaged
 - Download milestone releases
 - Participate in development discussions
 - Submit defects/enhancements



Rational DOORS Next Generation 4.0.1

Date	Type	Version
2012/11/13	Milestone	Rational DOORS Next Generation 4.0.1 RC3
2012/11/03	Milestone	Rational DOORS Next Generation 4.0.1 RC2
2012/10/19	Milestone	Rational DOORS Next Generation 4.0.1 RC1
2012/10/04	Milestone	Rational DOORS Next Generation 4.0.1 M4
2012/09/04	Milestone	Rational DOORS Next Generation 4.0.1 M3
2012/08/16	Beta	Rational DOORS Next Generation 4.0.1 Beta 4

What's next?

■ **Track 14,45 – 15,30**

- ▶ Gestione della qualità nel ciclo di vita di un prodotto: gestione attività, requisiti, modellazione, pianificazione ed esecuzione dei test.

■ **Demo point 15,00 – 17,00**

- ▶ Gestione tracciabilità e generazione automatica di documentazione in ambienti complessi. Generazione documentale da DOORS e Rhapsody con RPE per documenti di requisiti e architettura sistema



Further information:

“Requirements Engineering” by Hull, Jackson and Dick, Edition 2, Springer 2005

“10 Principles of Requirements Management” by Professor Ken Jackson

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