

L'importanza di un processo robusto di Requirements Management

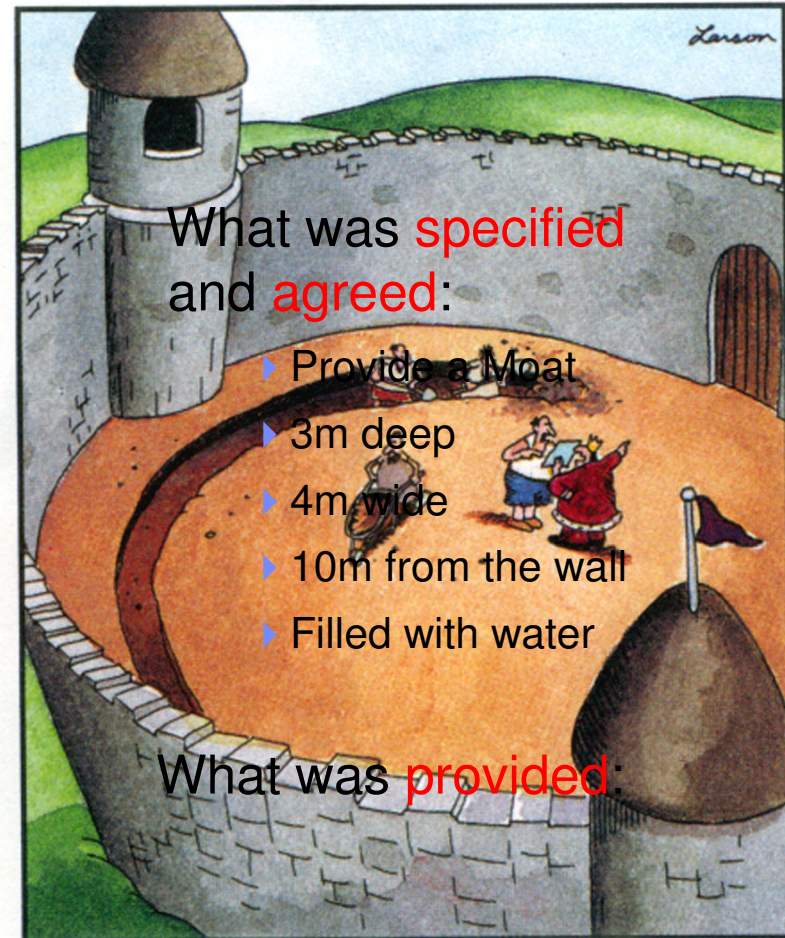
Gianluca Monticone – Senior Systems Specialist



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



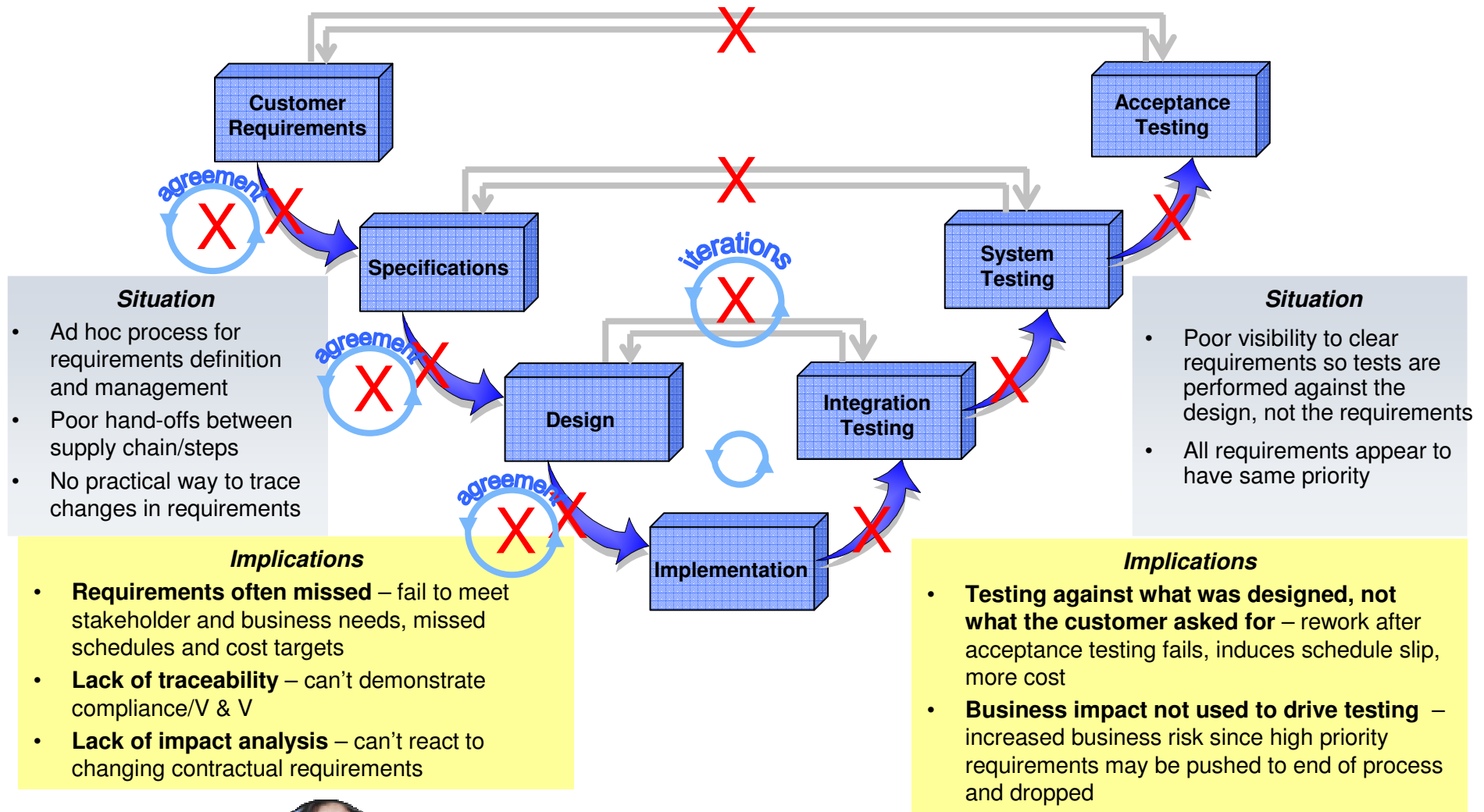
What was **specified** and **agreed**:

- ▶ Provide a Moat
- ▶ 3m deep
- ▶ 4m wide
- ▶ 10m from the wall
- ▶ Filled with water

What was **provided**:

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



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

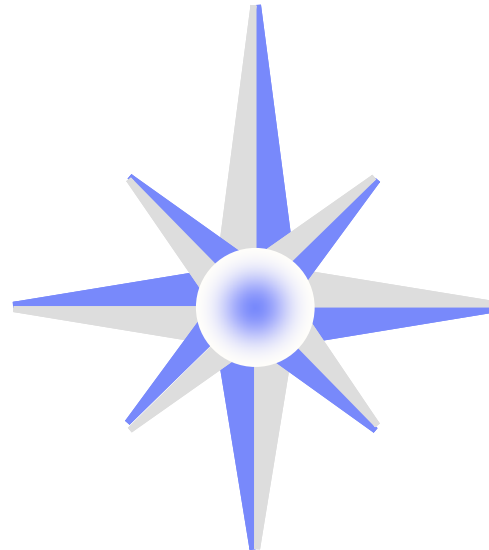
4 Principles for Effective Requirements Lifecycle Management

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

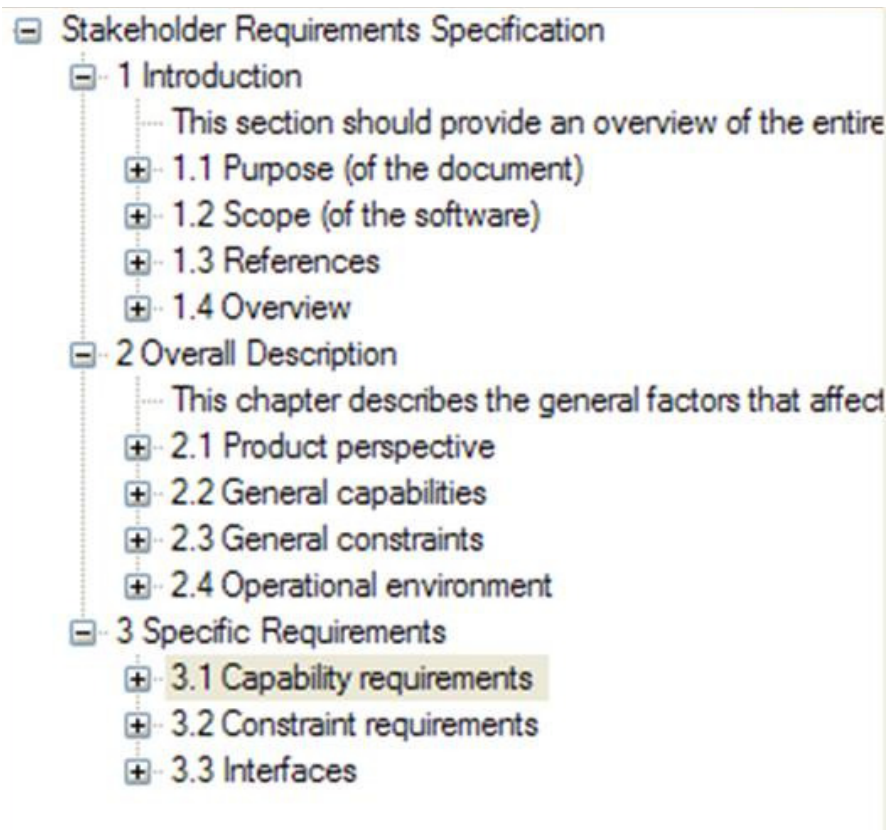
Seven Criteria for Requirement Statements

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 boundaries
 (2) explains what the product does and does not do
 (3) describes relevant business processes
 (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

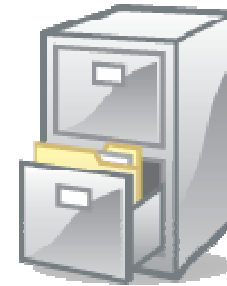
Project templates

Principle 1: Recognize the needs of all stakeholders

Attributes



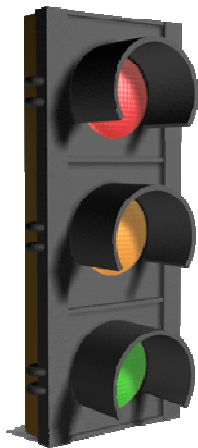
Identification



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

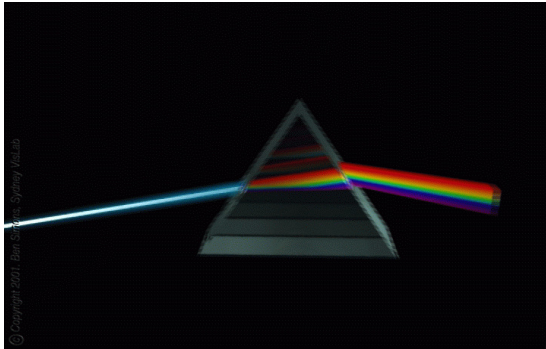
The screenshot displays the Rational DOORS interface. The main window shows a spreadsheet view of user requirements for an SUV 4x2. The spreadsheet has columns for Object Identifier, User requirements for SUV 4x2, Allocated Budget, Spent, Remaining, and Risk. The requirements are organized into sections: 4.1.4 Fuel economy, 4.1.5 Safety, 4.1.6 Noise levels, and 4.1.7 Ease of Access. A dialog box titled 'Object 42 (Baselined) - DOORS' is open, showing the 'Attributes' tab. The dialog lists various attributes and their values, such as 'Created On' (11 February 1997), 'Created Thru' (Manual Input), 'Critical Issues' (Criticality), 'Detailed requirement' (Medium), 'History count' (0), 'Last Modified By' (Dave Mason), 'Last Modified On' (23 November 2007), 'Object Heading' (4.1.5.0-2), 'Object Number' (4.1.5.0-2), 'Object Short Text' (Users shall be able to travel at th...), 'Object Text' (Users shall be able to travel at th...), and 'OLE' (False). The dialog also includes 'View/Edit...' and 'Previous/Next' buttons.

Object Identifier	User requirements for SUV 4x2	Allocated Budget	Spent	Remaining	Risk
SOW 37	4.1.4 Fuel economy				
SOW 38	Users shall be able to obtain fuel consumption better than that provided by the 95% of cars built in 1996.				
SOW 39	Users shall be able to accelerate from 0 to 100 Kilometers per hour in 10 seconds.				
SOW 364	Users shall be able to accelerate from 0 to 100 Kilometers per hour in 8 seconds.				
SOW 40	4.1.5 Safety				
SOW 41	Users shall be able to travel in safety in accordance with the Road Research Laboratories Safety standards dated 1 January 2005.				
SOW 42	Users shall be able to travel at the same level of safety as provided by the best 10% of cars being developed to be built in 2008.				
SOW 43	4.1.6 Noise levels				
SOW 44	4.1.6.1 Interior				
SOW 45	Users shall be able to hear only a very low level of noise inside the car.				
SOW 46	4.1.6.2 Exterior				
SOW 47	Users shall be able to cause only a very low level of external noise with the car.				
SOW 48	4.1.7 Ease of Access				

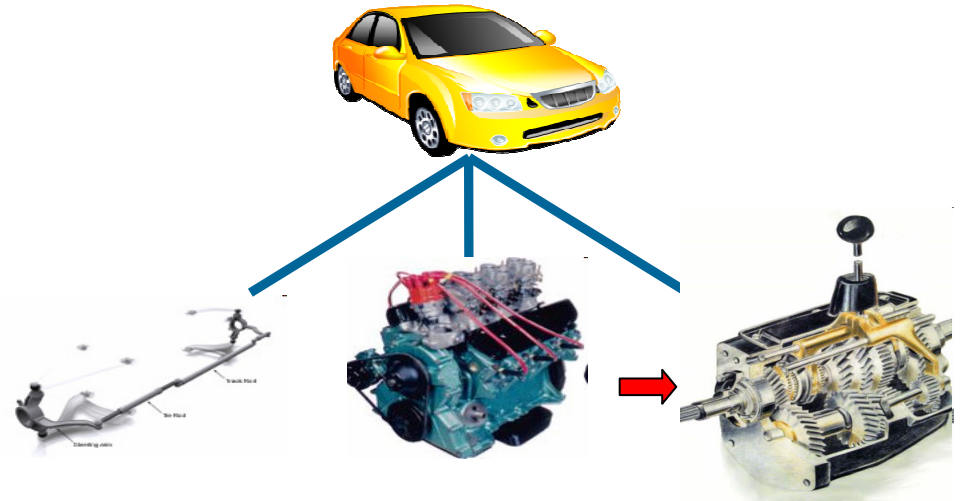
Attribute	Value
Created On	11 February 1997
Created Thru	Manual Input
Critical Issues	
Criticality	Medium
Detailed requirement	
History count	0
Last Modified By	Dave Mason
Last Modified On	23 November 2007
Object Heading	4.1.5.0-2
Object Number	4.1.5.0-2
Object Short Text	Users shall be able to travel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

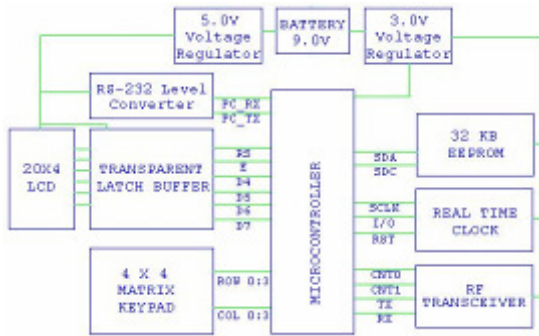
Why is Traceability Important?

Why are we building this?



Where is this implemented?

How do I test this?

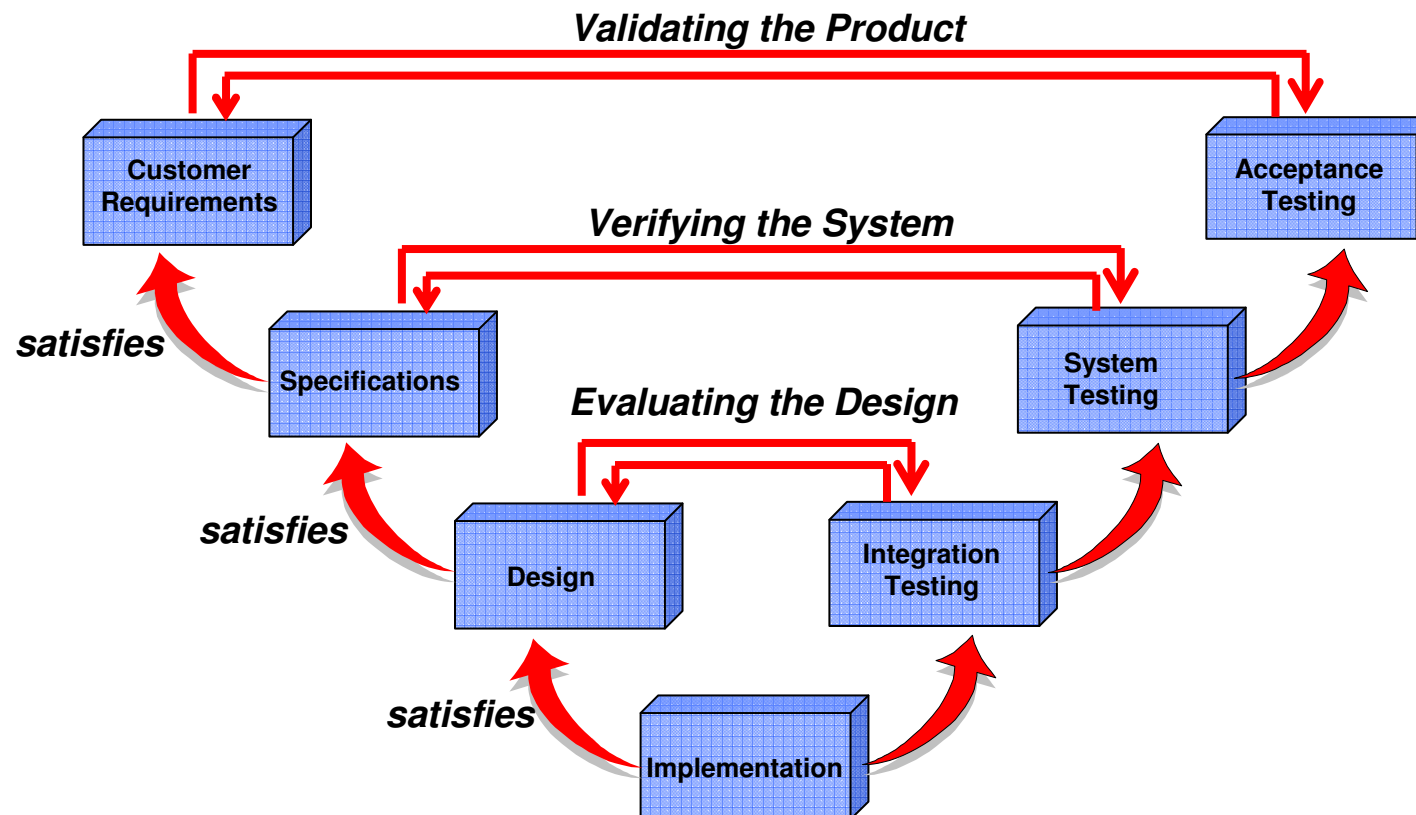


Can we show these answers? (Governance)



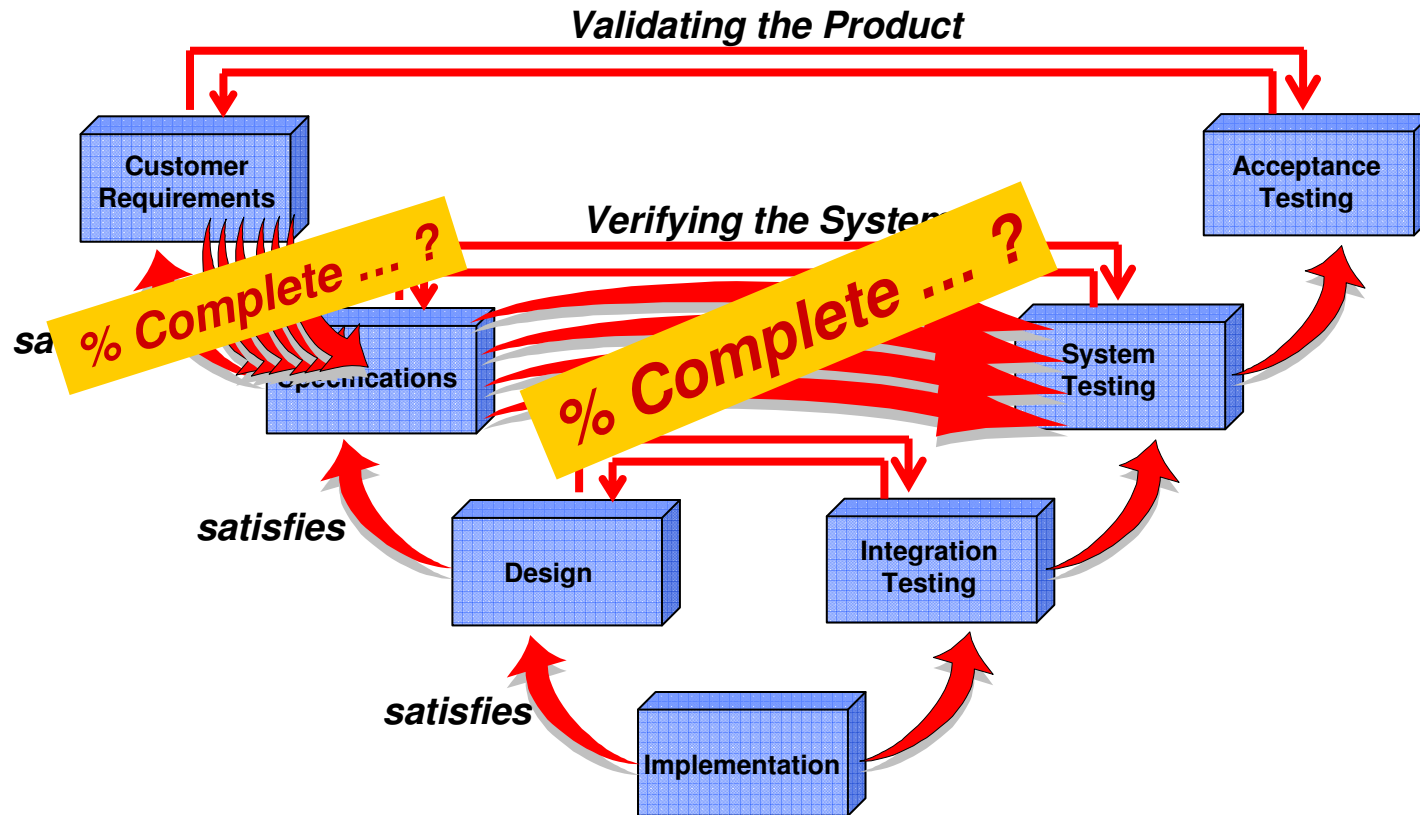
Principle 2: Use abstraction to manage complexity

Create, review and use traceability



Principle 2: Use abstraction to manage complexity

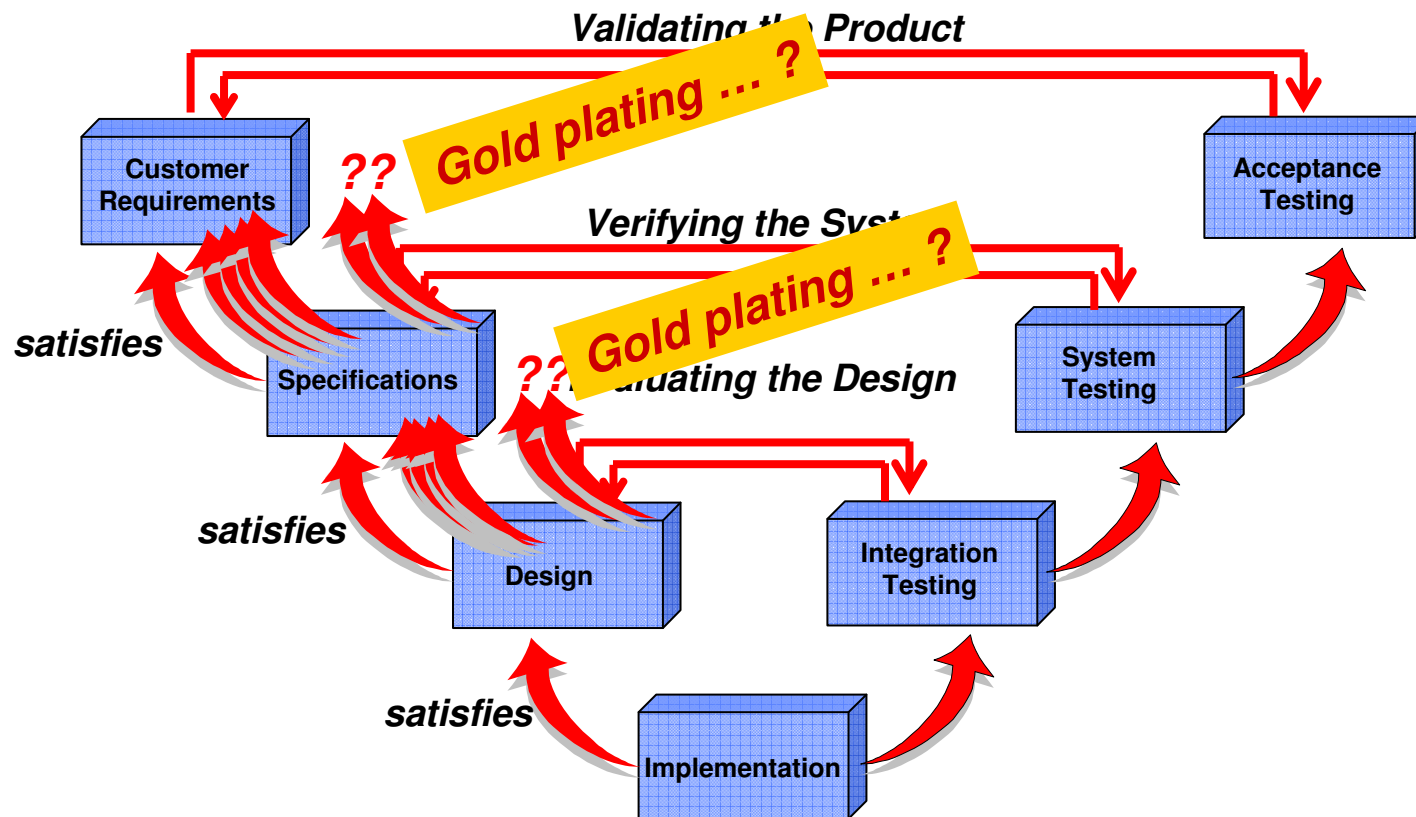
Create, review and use traceability



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

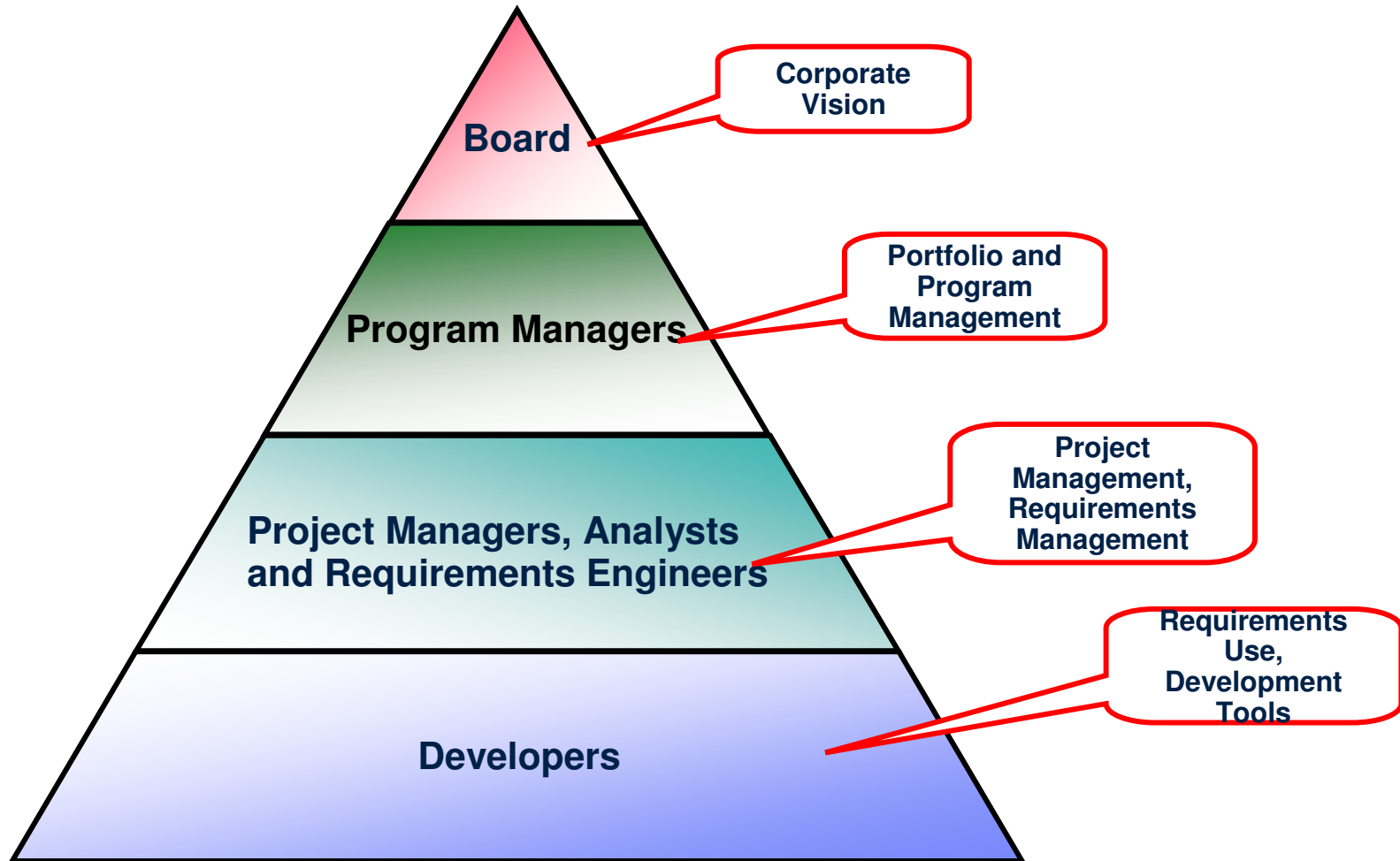
The screenshot shows a software application window titled "'Product Definition' current 0.3 (Second Internal) in /Transmissions (Formal module) - DOORS". The interface is divided into five vertical panes, each representing a different level of abstraction:

- Product Reqs:** Shows "3 Product Features" and "3.1 Features". A specific feature is described: "Manual mode holds the current gear or allows for driver selected shifts."
- System Reqs:** Contains requirement "SR-45: The system must provide a manual mode for the driver to select a gear."
- Design:** Displays a "System overview diagram" with images of a gear assembly and electronic components.
- Software Requirements:** Contains requirement "SRS-81: The CSCI will support 2 fundamental states labelled 'Manual Mode' and 'Auto Mode'."
- Test Plans:** Contains requirement "STP-32: Use the Testword code 758 to switch from Manual to Auto mode and check the state message identifies the correct state of the system." Below the text is a timing diagram for a "Telegram" using "Manchester Code", showing "Start", "Separation", and "Testword (A... 0 Hex)" fields.

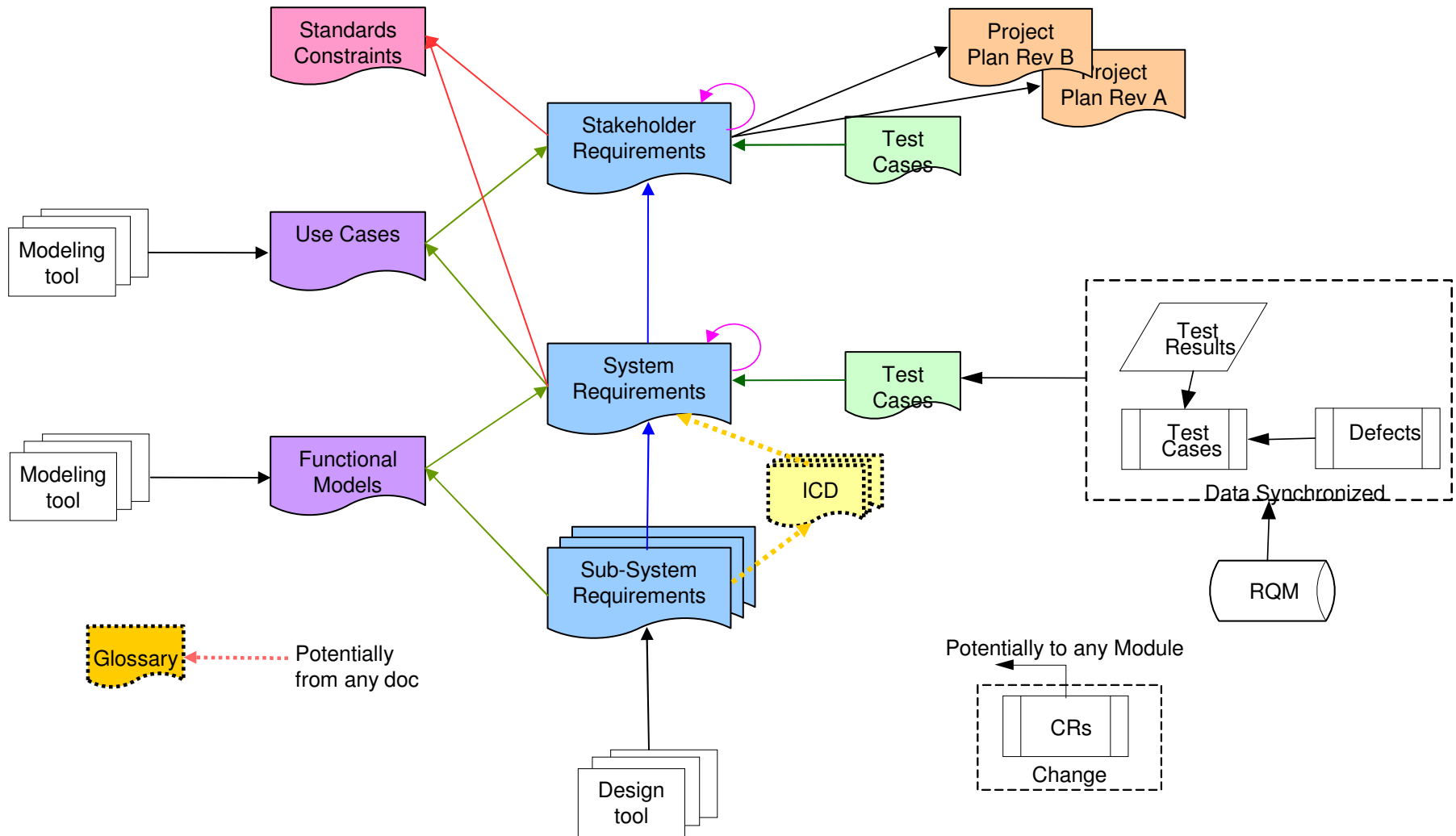
Make maintaining traceability an asset rather than an overhead

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

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

3.1.2.1.1 Forwards

Users shall be able to travel at speeds up to 200 kilometers per hour.

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

TRN-SR-26
The car shall have a mechanism to enable it to be moved forwards or backwards.
Not Set

View historical information

3.1.1.1 Number of people

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

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.

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.

Users shall have easy entry and exit.

3.1.1.1 Number of people
(Next object differs.)
~~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.~~

Five average size adults shall be able to travel in comfort for a period of 4 hours.
(Previous object differs.)

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.

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.

Users shall have easy entry and exit.

4 Principles for Effective Requirements Lifecycle Management

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N

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Rational DOORS

E

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Please note

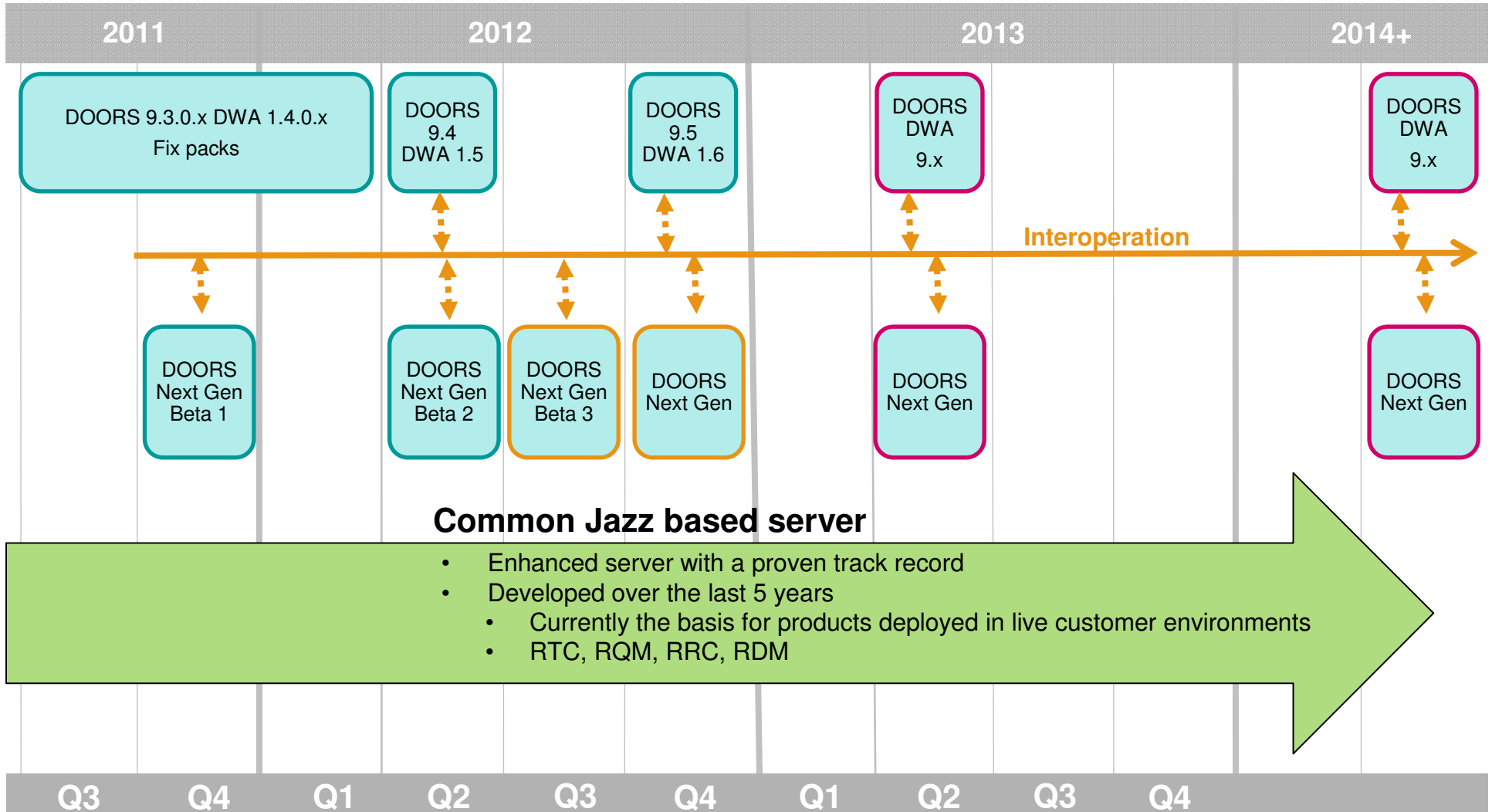
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Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision.

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

STATUS: — Released — Planned — Conceptual

Investing in current DOORS 9 deployments



2011

2012

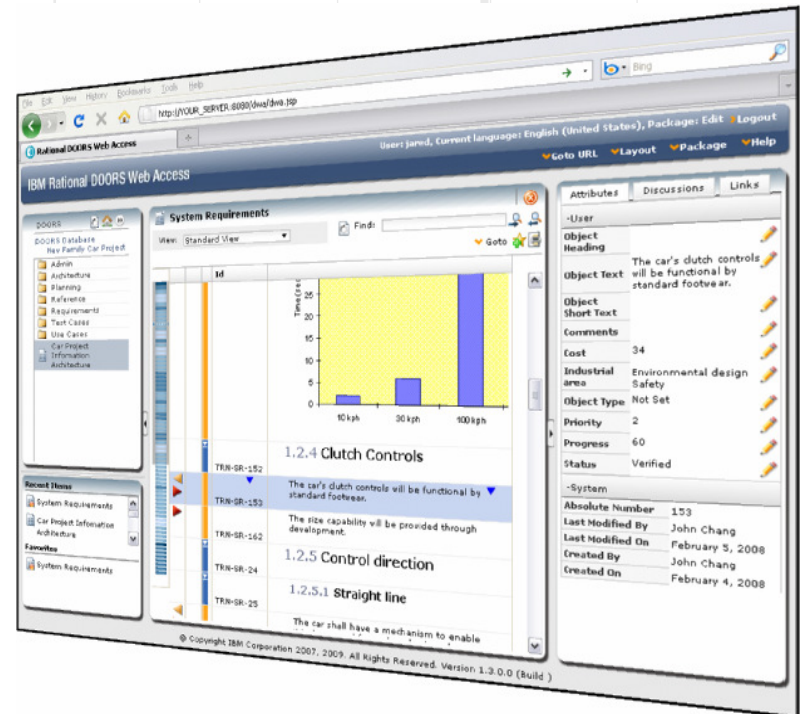
2013

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

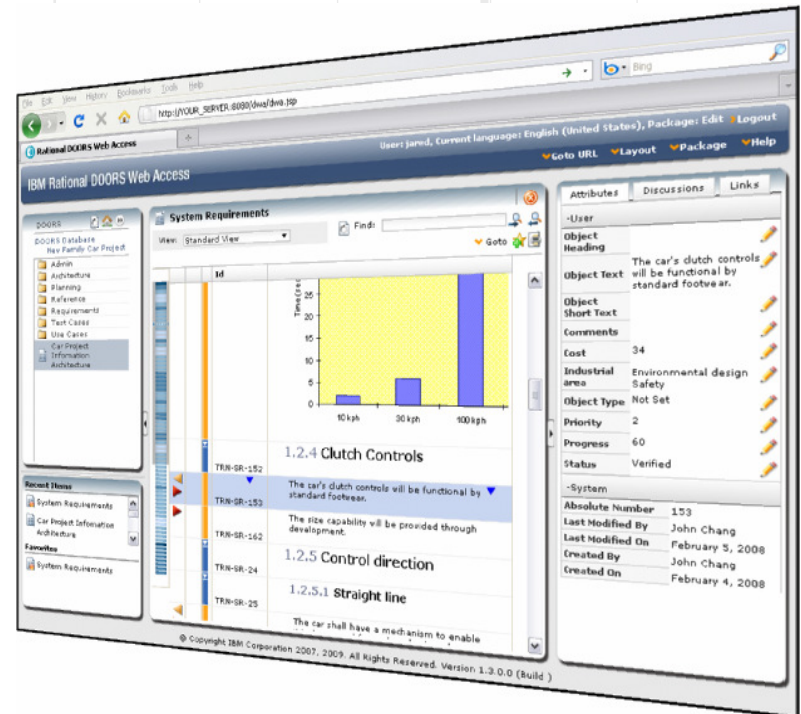
2015...

DOORS

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

DOORS Web Access

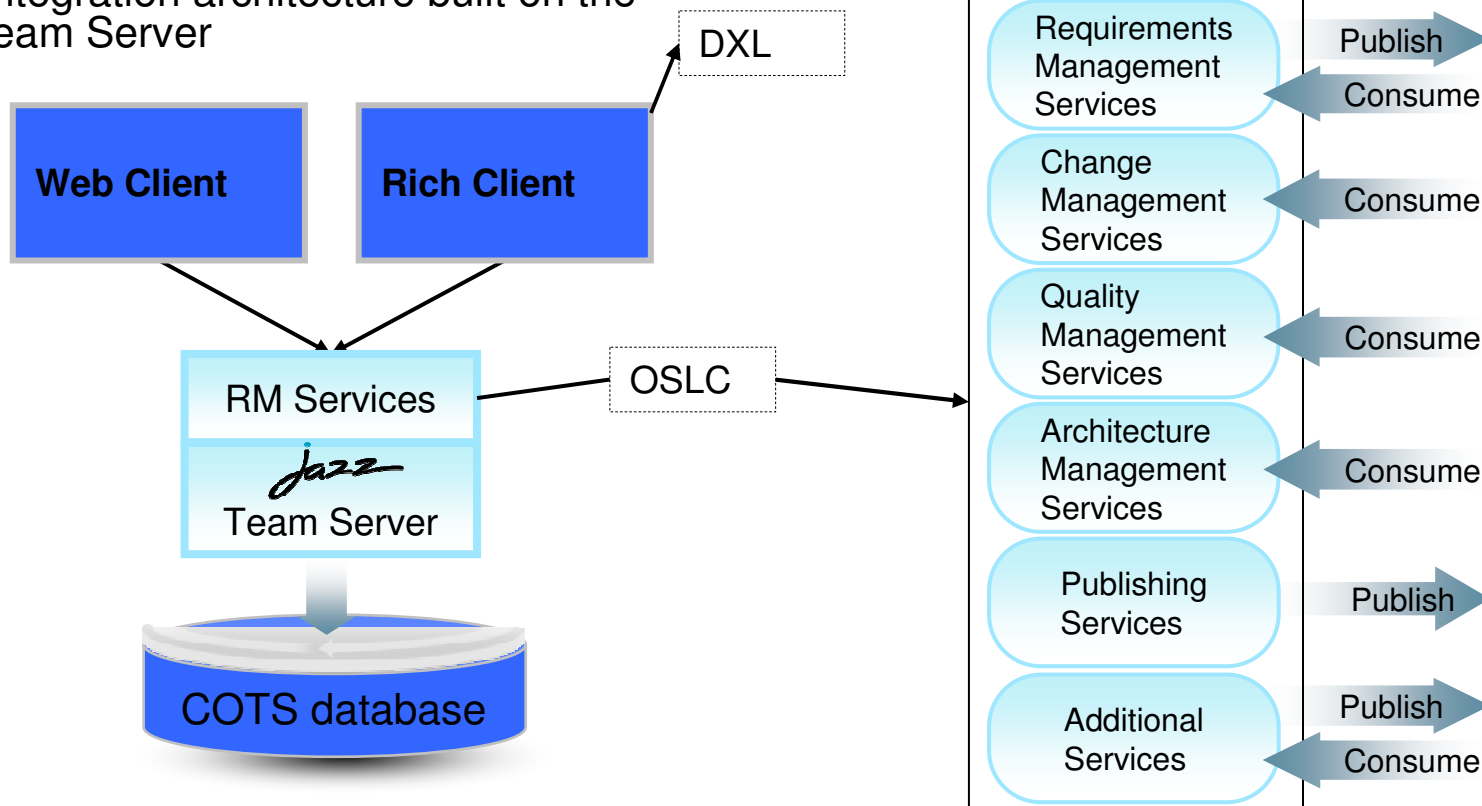
- Persistent user preferences
- Document generation



STATUS: — Released — Planned — Conceptual

Architectural Plan for Rational RDM Tools

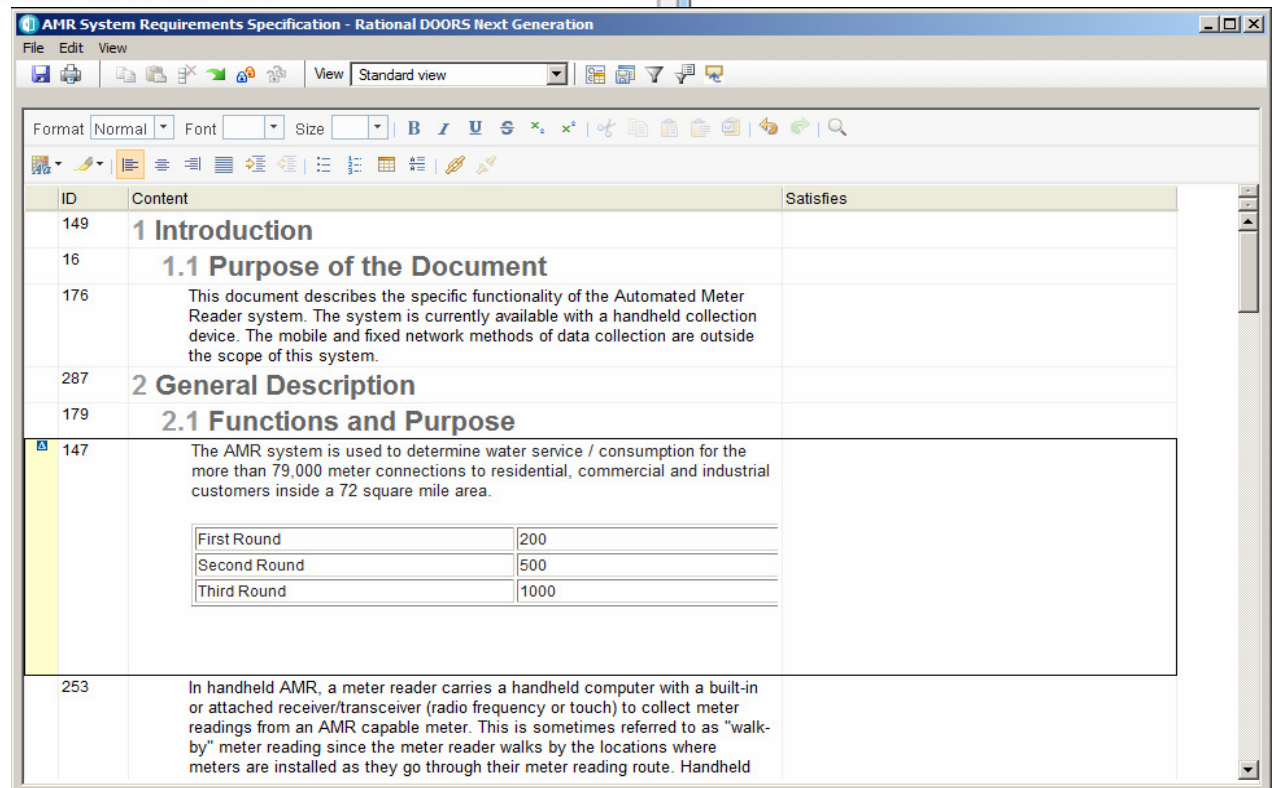
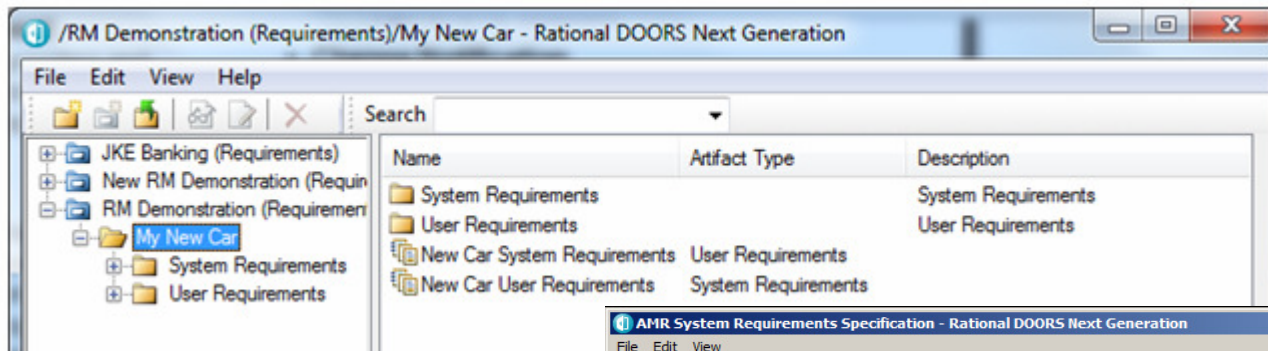
- Requirements visibility and traceability across the lifecycle
- Open integration architecture built on the Jazz Team Server
- Integrations using Open Services for Lifecycle Collaboration (OSLC)



- 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

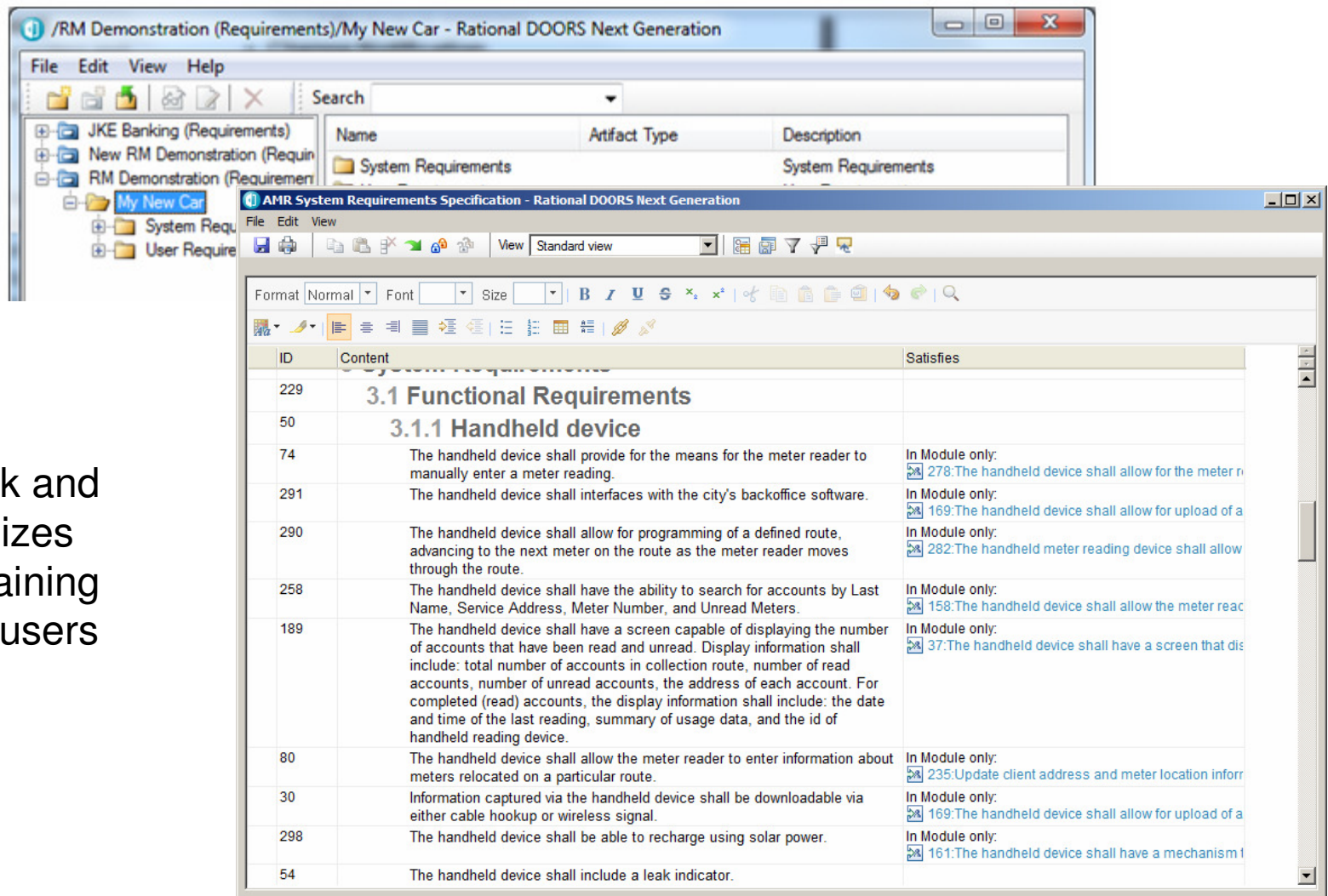
DOORS Next Module view (rich client)



Familiar look and feel minimizes transition training for existing users

Familiarity for existing DOORS users

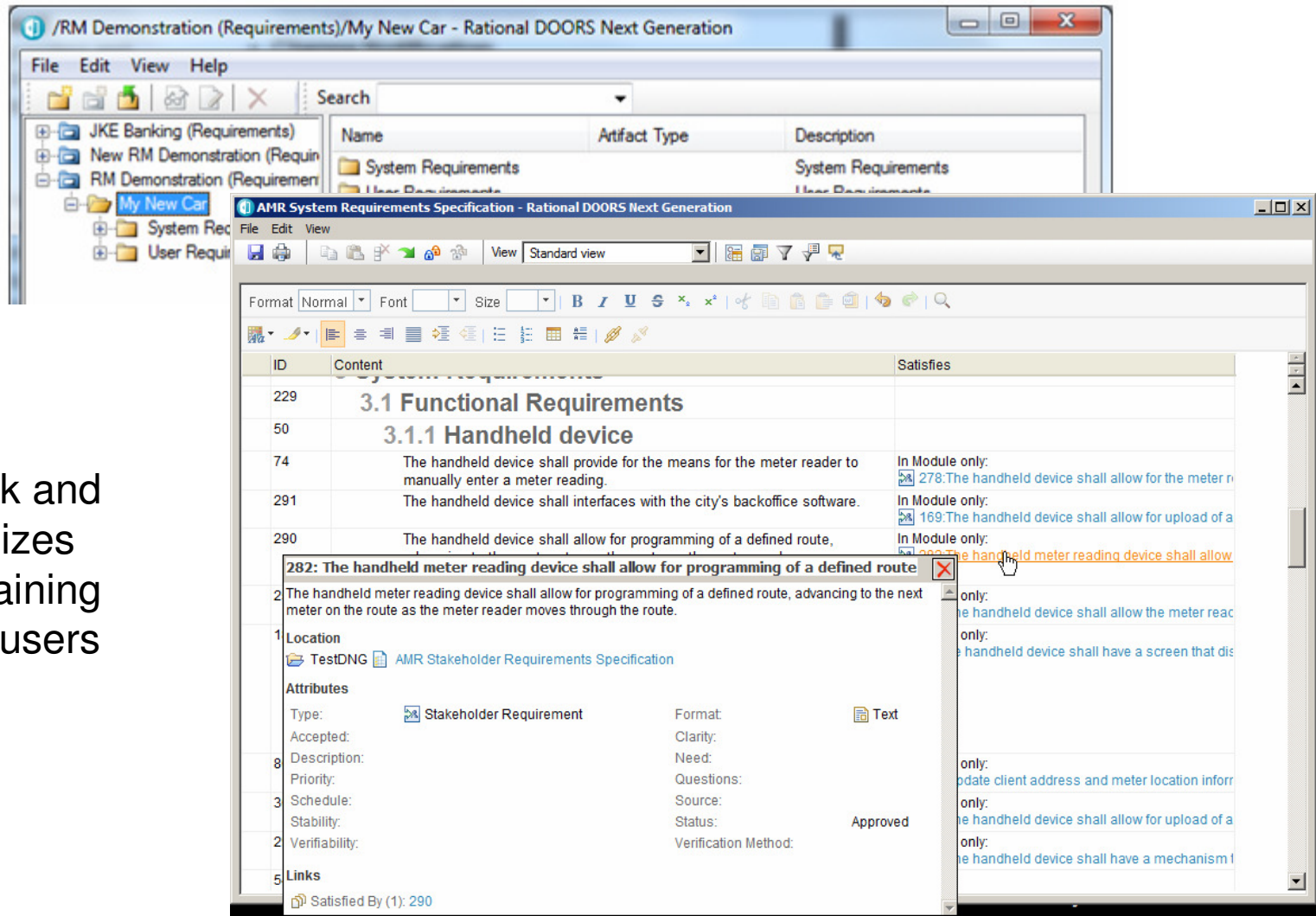
DOORS Next Module view (rich client)



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 module '149: Automated Meter Reader System Requirements'. The artifacts are listed in a table with columns for ID and Primary Text.

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>

Annotations in the image point to three key areas:

- Filter Pane:** Located on the left side of the interface, it includes a 'Create Requirement' button, 'Saved Filters', and 'Modules' sections.
- Module:** The central area displaying the list of requirements artifacts.
- Properties:** A panel on the right side showing details for the selected artifact, including 'Overview', 'Description', 'Project', 'Team Ownership', 'Created On', 'Created By', 'Modified On', 'Modified By', 'Type', and 'Format'.

IBM Rational DOORS Next Generation

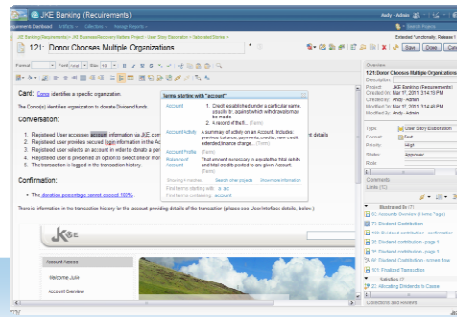
DOORS concepts improved and much more....

Improved!

Definition

NEW!

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



NEW!

Visibility

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

NEW!

Collaboration

- Review & Approval
- Discussions
- Email Notification



Management

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

NEW!

Lifecycle

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

NEW!

Planning

- Integrated planning
- Effort estimation
- Progress tracking

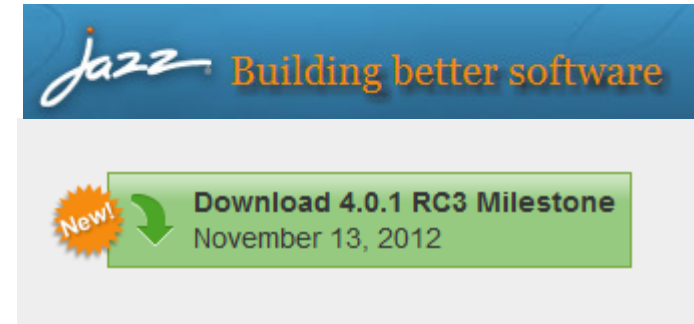
Adopt DOORS Next Generation at your own speed

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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