IBM

The role of integrated requirements management in software delivery.

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Introduction

Chances are your company is growing increasingly dependent upon software. Software is probably running your business processes. Or perhaps you embed it into the "smart" products you manufacture. Or maybe software *is* your business and you produce products, business applications or components for systems that others create, such as cell phones or networks.

If these descriptions sound accurate, you're probably feeling pressure to produce newer, better capabilities within a shorter timeframe. And if you can improve your ability to quickly deliver high-quality, business-driven results through your software applications, you can help strengthen your competitive position.

But innovation and speed alone will not place your organization at the head of the pack. Now more than ever, it's critical for companies to align software investments with their overall strategy and goals to solve real business problems. Whether you are implementing a new enterprise resource planning (ERP) package or running an e-commerce Web site, you want to avoid becoming yet another statistic in the software project failure saga that continues to make front-page news.

This paper is about the critical role that a discipline called integrated requirements management can play in helping to ensure that your business goals and IT investments are continuously aligned—whether you are sourcing, integrating, building or maintaining software. It also looks at ways that automated IBM Rational® products can work together to help you use requirements in the very best way.

What is integrated requirements management?

The integrated requirements management discipline recognizes that requirements do not exist in a vacuum. Via process, product and technology integrations, integrated requirements management gives all team members the ability to trace back to requirements with every lifecycle activity, enabling them to ensure that the application they are creating is aligned with business goals. It provides a way to keep requirements up to date as business demands change and to predict what software will be affected when a business process changes.

Team members can see how many of their requirements have associated test cases, and they can keep track of how many use cases—requirements used to analyze and design new applications and upgrade existing ones—they have designed and coded. Moreover, they can use all this information to plan a project, make sound decisions as a project evolves and report on a project's progress.

The lasting benefits of integrated requirements management

Requirements management has been a software engineering best practice for some time. What IBM has seen through its work with thousands of customers is that continuously integrating requirements across the software delivery lifecycle provides lasting value for an organization along four major fronts:

- *Accurate requirements capture. During the early stages of a project, integrated requirements management helps you discover what your business really needs and enables you to describe a solution to fulfill that need.*
- *Continuous visibility and alignment. As a project proceeds, proper requirements management helps ensure that all team members have clear visibility into those business needs and their associated requirements, reducing the amount of time wasted on the wrong version of the requirements specifications and properly aligning the product with customer requirements.*
- *Impact and cost analysis. As requirements for the project evolve, the whole team can analyze the potential and actual impacts that changes will have on everything from business goals to development activities, helping to ensure that the software you are creating continues to align with your actual business needs.*
- *Traceability and compliance. As a project nears completion, you can make sure that nothing has fallen through the cracks and verify that your final product truly satisfies all of the requirements that key stakeholders specified for the solution.*

Helping you meet new IT challenges

In addition to these fundamental advantages, integrated requirements management provides vital support for coping with the new challenges that IT organizations face as they transition to service-oriented architectures (SOAs), implement new ERP systems, engage in globally distributed development and operate within new regulatory environments.

Providing governance support for SOAs

For businesses to get the full benefits from the flexibility, economies of scale and efficiency that an SOA can bring, they need to institute governance policies, standards and procedures to ensure that component services—as well as the larger applications that run them—comply with these measures. Using integrated requirements management solutions, teams can express these governance measures as requirements and then leverage the resulting traceability throughout the service creation lifecycle (traceability is discussed in more detail later in this paper). This helps ensure that the service will remain compliant and compatible with the SOA technology. And you must still take business and user requirements into account when you create or enhance any service for an SOA.

Keeping ERP projects on track

Fundamentally, ERP projects, such as an SAP implementation, are enterprise integration projects. Given their scope, complexity and impact, these projects require a comprehensive approach to manage stakeholder needs, business requirements and implementation. All these requirements need to be documented, communicated and tracked throughout the project's multiple phases. Traceability is also paramount to ensure that the ERP implementation matches business needs.

Unifying global teams

In this age of globally distributed development, requirements provide an important way to keep teams in sync and aligned with business goals, regardless of differences in location, time zone, language, process and technology.

Supporting a wide spectrum of IT governance and risk management initiatives

Good requirements management practices deliver benefits to all kinds of projects, including projects aimed at improving governance for security measures, compliance with external and internal regulations and standards, service management, software delivery practices or data management within an IT organization. Often these initiatives require audit trails to ensure that projects meet regulatory requirements as well as company-mandated business and software requirements. Integrated requirements management can provide the necessary auditing processes to meet all of these requirements.

Building and evolving effective integrated requirements management capabilities

To manage requirements effectively, it is important to understand both their relative importance and their interdependencies. The IBM Rational view of requirements is expressed via the IBM Rational Unified Process®, or IBM RUP®, an automated, Web-based framework that provides comprehensive guidance for all phases of the software development and delivery lifecycle.

The RUP methodology places business needs at the top of the development pyramid. Business needs include big-picture requirements that correspond to a business opportunity or issue, such as cutting the time it takes to process an insurance claim or reducing customers' delivery windows. These requirements drive a majority of software projects. And they can come directly from stakeholders or they can be discovered while making business process or model improvements.
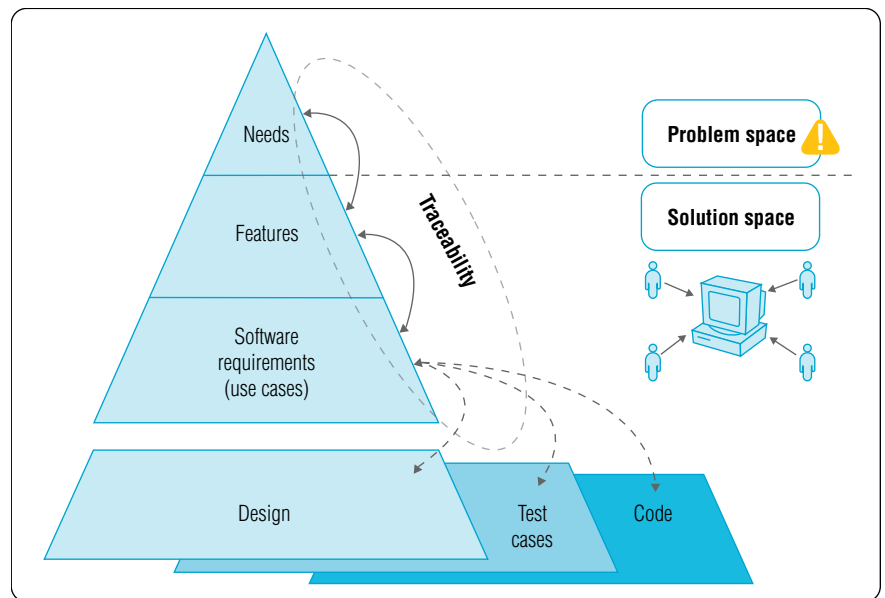

Figure 1: The RUP requirements hierarchy places business needs at the top of the software development pyramid.

Improving visibility with enhanced traceability

Integrated requirements management provides the traceability to track these critical business needs—as well as all other requirements—across the entire software delivery lifecycle. It helps you keep track of relationships to ensure that you have not missed anything important and to understand the impact of changes on various requirements. Many government agencies and certification programs require such visibility, including the United States Food & Drug Administration (FDA), the International Organization for Standardization (ISO) 9001 and the Capability Maturity Model Integration (CMMI).

IBM Rational RequisitePro® software provides a traceability view with multiple levels, linking needs, use cases, features, supplemental requirements and design elements. And the application uses red lines to indicate a change in a linked item—called a suspect traceability link—warning users that related requirements may need to change.
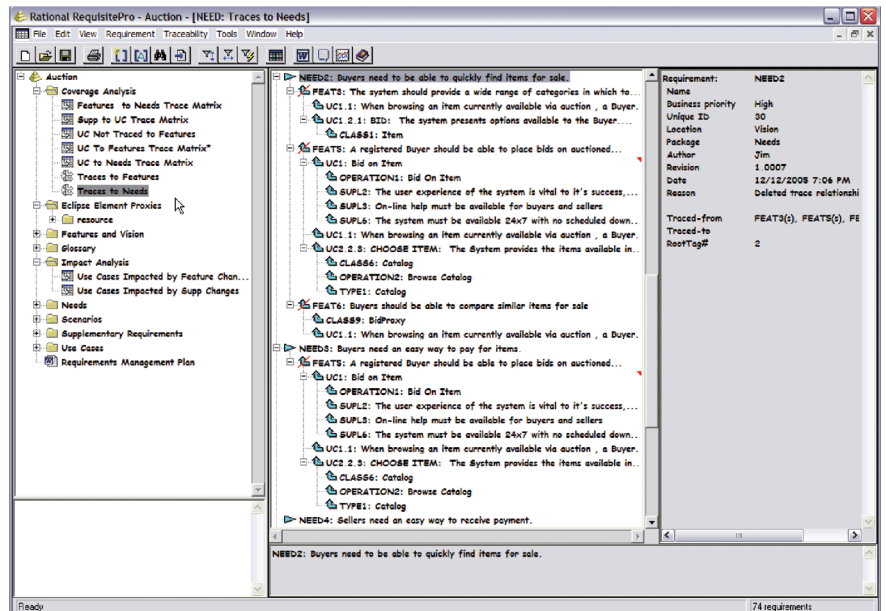

Figure 2: IBM Rational RequisitePro software provides a multilevel traceability view.

Integrated requirements management goes a step beyond traditional requirements management by tracing the relationships between requirements and other lifecycle artifacts—not just other requirements. Therefore, when you integrate a requirements management tool such as Rational RequisitePro with other lifecycle tools in the Rational integrated requirements solution for business modeling, architecture, design, coding and test, the benefits can be enormous. Teams can make decisions based on big-picture cost and benefit analyses rooted in hard data instead of guesswork. And, as noted earlier, they can assess how a change will affect everything from business goals to testing activities, and then make intelligent decisions about resource allocation.

Leveraging integrated requirements management in your environment
Now that you have a basic understanding of integrated requirements management, let's look at how this method can be applied during the software development and delivery lifecycle and how components of the Rational integrated requirements management solution support this effort. These activities reflect the iterative development approach embodied in RUP.

Bridging the gap between business needs and IT with business modeling
Business modeling is the best practice for bridging the gap between business needs and what IT actually delivers. By creating clear process models as a preliminary step in the project process, stakeholders on both sides are able to understand how the business works and where the challenges lie. The business modeling process also creates a record that can quickly bring stakeholders' successors up to speed.

Graphical business models give you a comprehensive picture of the functionality the project requires and how your new project should fit into existing processes. Including business modeling tools in an integrated requirements management program can provide important advantages, such as:

- *Speeding up requirements development. You can use elements of the business models to jump-start the requirements effort. For example, the tasks you define can become candidate use cases.*
- *Providing a more comprehensive view. Combining your text-based requirements with visual business models yields a much more comprehensive picture of the new application within the current process environment.*
- *Delivering monitoring tools. Tracing software requirements to the business models gives you powerful monitoring and control mechanisms that you can apply throughout the entire project lifecycle, which helps you keep projects on track, prevent scope creep and assess actual outcomes against requirements.*

The Rational integrated requirements management solution offers two ways to take advantage of business modeling capabilities:

- *Unified Modeling Language (UML) business modeling functionality is built into the IBM Rational Software Modeler and IBM Rational Software Architect products.*
- *IBM WebSphere® Business Modeler software creates easy-to-understand visual business process models that aid in understanding both the present and future business environments, which may be a preferable approach for business analysts.*

When integrated with Rational RequisitePro, all of these products can help you link requirements directly to business process elements.

Improving project evaluation and estimation

The discipline of project portfolio management helps chief information officers (CIOs) and their management teams analyze and assess the merits of proposed projects based on preliminary requirements. Then, for applications that get a green light, a portfolio management tool can provide ongoing assessment data

about the project's progress, potential business value, relative resource consumption and other critical considerations — all the way through deployment and beyond. And managers can use the tool to develop a project plan that includes a breakdown of required work, resource allocation and scheduling information.

An integrated approach to requirements management and portfolio management allows you to consider the requirements for various projects as you evaluate them, as well as assign work and track financial information based on requirements. The integration between Rational RequisitePro and IBM Rational Portfolio Manager software supports this high level of traceability, and together, these products can provide a comprehensive picture of project status and relative business value.
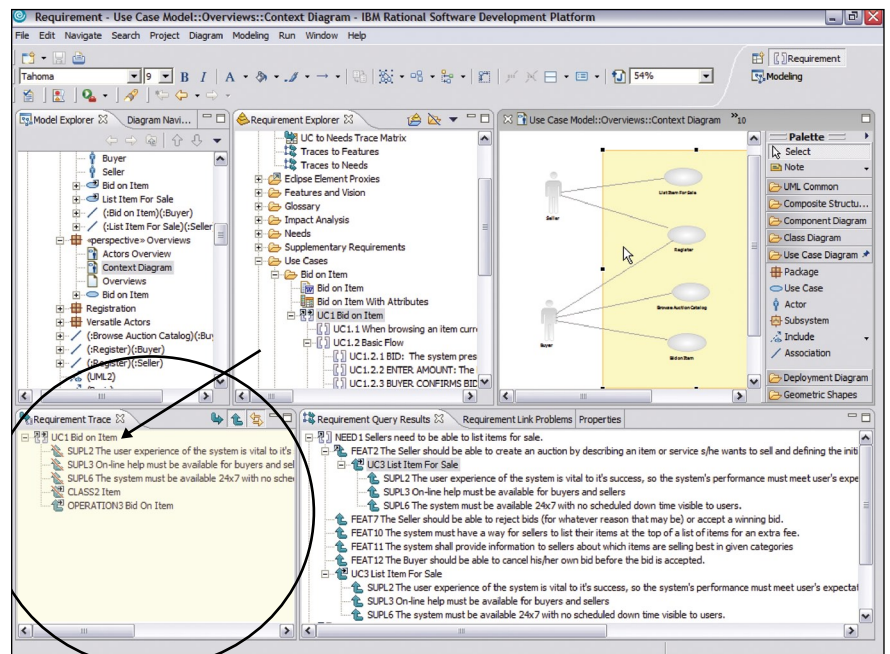

Figure 3: By integrating Rational RequisitePro software with the Rational Software Architect or Rational Software Modeler application, you can trace back from a design element to the original use-case requirement.

Creating traceability between use cases and architecture, analysis and design

By encompassing a series of scenarios that vary according to user behavior, use cases tell the story of how the system interacts with users. And because they focus on user actions, use cases are user centric, providing a basis for

both system design and interface design. Architects and designers create use-case realizations (classes, attributes, operations and class interactions) as part of the early design of the system. Interface designers use a similar technique, depicting user/GUI interactions (screen appearance, content and navigation) for different scenarios. Along with nonfunctional requirements, use cases also help define the application's architecture.

Integrating Rational RequisitePro with either Rational Software Architect or Rational Software Modeler can enable analysts, architects and designers to maintain traceability among the original use-case requirements, their use-case realizations and subsequent design elements for these realizations—from within their design tools.

Supporting data modeling and deployment

Integrating requirements management and data modeling capabilities is helpful in several important ways. First, it promotes greater understanding of logical data models, especially for business users; data architects can create requirements-based diagrams for review without overwhelming business users with details of the entire model. When it comes to physical data modeling, requirements help provide specifications for data server objects and performance, as well as constraints for the target data server. Architects can also help ensure that their data structures continue to meet requirements as they undergo modifications, because the links between requirements and objects in logical and physical data models are clearly visible. Rational RequisitePro integrates with the IBM Rational Data Architect application, a tool for data modeling and design, to provide these capabilities.

Testing to verify requirements have been met

The main purpose of testing is to ensure that your application will do what it is supposed to; in other words, to make sure that it fulfills its requirements. Since use cases are user-oriented, step-by-step specifications of what an application should do, they provide an excellent basis for writing test cases. When you employ use cases to develop test cases, your testers can create test cases early in the project, before any code is written, and begin testing the first prototypes for alignment with requirements. Testers also get a clear understanding of the application, as well as a logical basis for the testing process.

It is a straightforward process to translate various combinations of use-case flows of events directly into scenarios and test cases, which can then be linked back to the use cases for reporting on test-case coverage and change impact.

Rational RequisitePro integrates with IBM Rational ClearQuest® software, which encompasses test planning, execution and reporting. Testers can create test plans and test cases, and then attach those cases to test scripts that they create using IBM Rational Functional Tester or IBM Rational Manual Tester software.

Conclusion

As we have seen, IT organizations can reap great benefit from using an automated, integrated solution to gather and manage requirements, trace design elements and tests back to the requirements, and easily modify requirements and all related artifacts as project development proceeds. By tracing from requirements to business models and keeping requirements aligned with business processes and goals, you can help ensure that the software you produce is the solution that your business really needs.

The products in the IBM Rational integrated requirements management solution provide development teams with continuous traceability to requirements from within their familiar desktop environment. Whether your team is developing traditional business applications, services or both, integrated requirements management can help them keep their projects compliant and on track. As business conditions change—and the code changes as well—multiple project teams located anywhere around the globe can continue to amend and track requirements accurately, assess the impact of changes against the requirements, and maintain the level of risk control and visibility they need to achieve success.

The following table shows all of the IBM and IBM Business Partner products that are integrated with Rational RequisitePro, and the capabilities that the integration provides.

IBM Rational Software Delivery Platform and IBM Business Partner capabilities for integrated requirements management	
Product	Capability
IBM Rational RequisitePro	Create and manage requirements throughout the software development and delivery lifecycle
IBM Rational Software Architect	Draw use-case diagrams and link requirements to design elements and code
IBM Rational Software Modeler	Draw use-case diagrams and link requirements to design elements
IBM Rational ClearQuest	View requirements, trace enhancement requests to requirements and trace test assets to requirements
IBM WebSphere Business Modeler	Define business process requirements and trace business model elements to business and system requirements
IBM WebSphere Integration Developer	View and link requirements for SOA application development and other integration projects
IBM Rational Application Developer	View requirements from within an integrated development environment (IDE) and trace requirements to code
IBM Rational Systems Developer	Manage and trace requirements for complex systems
IBM Rational Data Architect	Collect data requirements and trace database designs to requirements
IBM Rational Portfolio Manager	Associate work, financials and status to requirements
IBM Rational Test Manager	Trace test cases to use cases and other requirements
IBM Rational Unified Process and IBM Rational Method Composer	Get in-context process help from within Rational RequisitePro
IBM Rational SoDA®	Generate integrated reports
Raven (IBM Business Partner)	Evaluate business use cases for quality and automatically generate activity diagrams that are visible within Rational RequisitePro
iRise (IBM Business Partner)	Define requirements in iRise by prototyping, and manage them in Rational RequisitePro

For more information

For more information about integrated requirements management and the IBM Rational Software Delivery Platform, visit:

ibm.com/software/rational