Rational® software

Aligning business and IT through connected requirements.

Unifying the development process

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Contents

Overview

Whether you are producing a product, an application, a system or a process, requirements drive the application development process. A connected requirements approach to the application development lifecycle strengthens your requirements management capabilities by unifying the requirements definition process and integrating requirements management with the complete application development environment, techniques and best practices. No matter what you are building, this approach can help you improve time-to-market, increase quality and reduce costs.

The connected requirements approach ensures that the goals of the business and the needs of the customer are prioritized into requirements that remain persistent during the entire application development lifecycle—from planning through deployment. It serves as the framework for the use of products and technologies that are designed to allow you to optimize team performance align the development process with your organization's business goals and meet auditing and regulatory compliance requirements.

Introduction

Today's application development environment has become increasingly complex. Too often this complexity results in overruns and, in some cases, outright failure. The problem is an outgrowth of a number of factors that are impacting today's development world. For example, IT has to frequently coordinate widely distributed project teams as companies become increasingly global in their scope—this geographic and functional separation makes collaboration more difficult and limits visibility into the application development lifecycle.

Applications are becoming increasingly complicated in order to cope with fast-changing business requirements and competitive pressures. Adding to the problem is the need to comply with government-mandated regulatory and audit directives such as Sarbanes-Oxley, the United Kingdom's Companies Act, Basel II Accord, HIPAA and others.

As a result, IT organizations are having a hard time meeting their customers' expectations. Your customers ask for one thing, but somewhere along the way, due to spiraling complexity, breakdowns in communication and a lack of visibility into the development process, the original request gets lost, modified or misinterpreted before it makes it to the final release. Not only is the customer unhappy, but IT is seen as being out of alignment with the company's business processes and goals.

A well-implemented requirements management process serves as a proxy for the customer during the development cycle, ensuring that client objectives are front-of-mind.
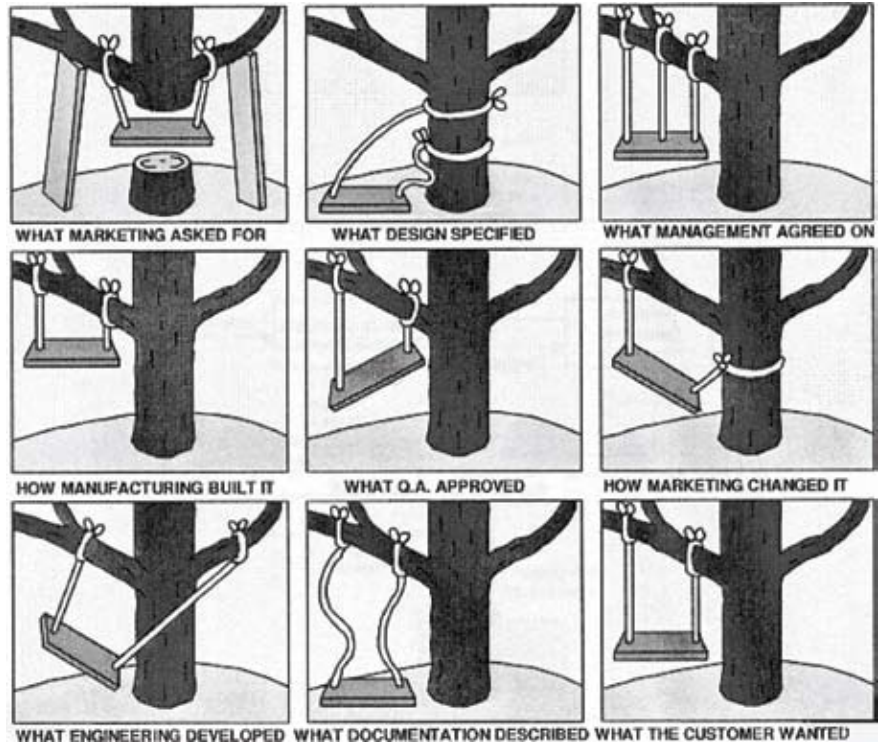

Figure 1: Are you meeting your customers' needs?

At the root of the problem is a lack of effective requirements management—a discipline that should permeate every step of the application development lifecycle. If a project is marred by problems with requirements capture, planning and prioritization and is characterized by distributed requirements with poor traceability, it's doomed from the start.

Connected requirements to the rescue

Fortunately, managing requirements has improved by focusing on what is variously referred to as requirements-driven development or "connected requirements." Connected requirements, a descriptive term, emphasizes the fact that this approach links the complete requirements process with the entire application development lifecycle.

Connected requirements described

No matter what the project, requirements drive the development process. Whether you are developing a product, system or application, adopting a connected requirements approach helps you verify that the goals of the business and your customers' needs are prioritized into requirements that remain persistent and auditable throughout each phase of the development process. The basic idea is that requirements serve as a proxy for the customer during the project's entire lifecycle.

Connected requirements are not tied to any particular methodology—the basics remain the same whether a traditional waterfall or the newer agile methodology is used. Essentially, you are creating a contract between the IT organization and the business. By focusing on requirements, IT can respond quickly and effectively to business changes brought about by shifts in the marketplace, competitive pressures or new government mandates.

Requirements can change unexpectedly, and those changes can impact every stage of the development process. With the connected requirements approach, a change request generates flags that indicate all the pieces of the project that will be impacted.

The "V" model, shown in Figure 2, illustrates how requirements flow through the entire process. It corrects the misconception that the requirements process happens only at the front end—that you just ask the customer and other stakeholders what they want and then go about building the system. In reality, requirements change, sometimes unexpectedly and those changes can impact every stage in the process. With the connected requirements approach, a change request generates flags that indicate all the pieces of the project that will be impacted—from up-front requirements to back-end test cases. In fact, the consequences of a change can be traced all the way back to the organization's business processes, not just processes within IT.
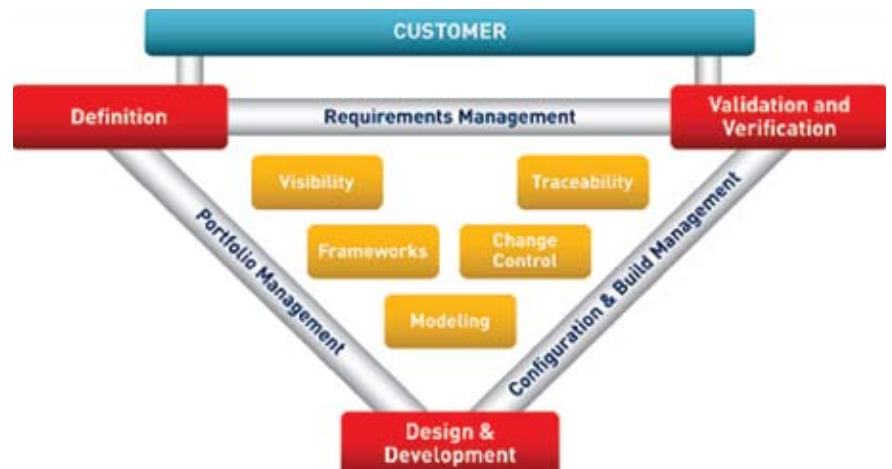

Figure 2: A connected requirements approach to application development

The connected requirements process integrates, automates and accelerates development by unifying the various individual requirements processes associated with different phases of the development lifecycle into a connected process.

Specifically, a connected requirements approach:

- *Captures the voice of the customer.*
- *Defines customer requirements.*
- *Prioritizes the requirements—i.e., differentiates between essential requirements and those that would be nice to have but are not vital to the success of the project.*
- *Defines requirements in sufficient detail to drive the development process.*
- *Provides a level of traceability that satisfies governance, compliance and auditing requirements.*
- *Uses requirements to guide the implementation of hardware, software, electronics, embedded systems, etc.*
- *Validates requirements during test.*
- *Provides optimal change management capabilities.*

The connected requirements approach links the requirements with all the activities in the application development lifecycle. At the same time, it integrates, automates and accelerates development by unifying the various individual requirements processes associated with different phases of the development lifecycle into a connected process.

A connected and integrated requirements framework drives the entire development lifecycle and provides end-to-end development management. Unifying all requirements and making them available in a repository optimizes information exchange among stakeholders. The entire development team can respond more rapidly and accurately to changes in customer requirements no matter when they occur in the process.

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With connected requirements, you can leverage user, function, software and systems requirements to iteratively model systems and software. Initially, the software is modeled to align it with the customer requirements. It can then be refined through analysis, design and implementation, while retaining the original link to the voice of the customer. This approach is not only essential for the success of embedded systems development; it is becoming increasingly important for companies taking a model-based approach to developing complex IT projects.

Because the requirements flow through every step in the development process, impact analysis enables IT to completely understand the ramifications of a change and present possible alternatives to the customer. Connected requirements allows teams to record and manage systems and business change requests as well as changes that impact all project artifacts (beyond just the source code) that may involve an increasing number of contributors and stakeholders.

Defining and managing requirements

Requirements definition and management is an essential step in the development process to ensure that your project meets your customer's needs, complies with the contract and stays on schedule and within budget. The discipline is also required by standards, regulations and quality improvement initiatives such as Capability Maturity Model Integration (CMMI). The impact of a poorly expressed requirement can be devastating—it can have a domino effect that leads to time-consuming rework, inadequate deliveries, exceeded budgets and compliance problems.

The best requirements are technically and legally possible and are complete and clear. They are consistent, i.e., not in conflict with other requirements. You are able to verify that the system meets the requirements, and the requirements are traceable—they can be uniquely identified and tracked. In addition, the requirements should be modular and can be modified without excessive impact. They should also be design-independent.

To organize and manage your requirements, there are a number of steps you can take.

First, you structure the requirements to avoid duplication and omissions. Next, you manage and link customer needs, requirements and contractual documents and capture specifications and requirements in a centralized requirements repository.

You also want to manage non-functional requirements or constraints that specify performance, interface, security, safety, etc. The text versions of both functional and non-functional requirements should be augmented with visual modeling—this includes everything from simple white board drawings to elaborate slide presentations. In addition, you can ensure that requirements are testable by clearly mapping them to test cases—making sure that each requirement is clearly verifiable from the start makes it easier to meet the requirement and demonstrate that you have done so.

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In many cases, you can realize better requirements management by reducing the number of requirements. It's a rare project that can accommodate all customer requests, marketing ideas and business suggestions and still meet budget and deadline objectives. By collaborating with your stakeholders, you can bridge the gap between business objectives and development constraints by jointly prioritizing the project's requirements.

Of course, a repeatable and reliable change-control process is essential (see "Managing change with connected requirements" below). In addition, capturing and tracking metrics and trends using a management dashboard (see "Measuring and managing performance" below) allows you to quickly monitor and respond to project management activities such as progress, growth and volatility of the actual requirements.

Another valuable aid to requirements management is the development of a repository of examples of good (and bad) requirements and documents in the form of templates and industry standards. You can include examples of requirements from each project that reflects the organization's domain expertise to build a corporate knowledge database. This also leads to the smart reuse of requirements. Good requirements written for a previous project become available for future use, and links accompanying the requirements allow analysts to access the original requirement at any time. This provides reusing teams with notification of any changes—such as updates and bug fixes—made to the original requirements.

All in all, requirements definition and management are among the most important activities associated with any project. They are key to satisfying your customers' needs with a high-quality development that is on time and within budget.

Traceability—another key capability

Traceability, and in particular, roundtrip traceability is key to the requirements-driven development and connected requirements approach. Traceability is essential to determining the impact of changes on the various phases of the development process, and to satisfying compliance or regulatory constraints.

At a fundamental level, traceability allows you to identify and control changes and determine who made them. These is not an overhead function—by helping you meet your schedules, manage your development processes more effectively and prepare for audit, traceability has a direct, positive impact on the cost and efficiency of the project. It allows you to gauge the results of changes that occur anywhere in the development process.

Highlights

A "top down" approach to traceability is costly and ineffective. Roundtrip traceability improves accuracy and reduces cost by implementing both top-down and bottom-up approaches.

Often traceability is accomplished through a top-down approach. Best practices and tools are used to link code to features and requirements as soon as they are made. However, for most quality, audit and test validation procedures, top-down traceability fails to analyze what was actually produced. Because of this, it fails to confirm that the expected requirements, fixes or requests have been delivered as planned, at least not until the testing phase when making changes is extremely costly.

Roundtrip traceability takes both a top-down and bottom-up approach. The bottom-up approach uses advanced build analysis and reporting. This allows team leaders and testers to confirm that planned features and bug fixes were actually implemented within the build or test phase. The team can be confident that they have a stable, consistent and approved configuration.

Figure 3: Roundtrip traceability helps improve the predictability and quality of application developments for those development processes that require total control over content and traceability (such as the waterfall methodology) and for agile teams who must deliver stable, documented releases frequently and efficiently.

Highlights

Connected requirements supports a consistent, repeatable, centralized change control process and audit trail for change requests, including requirements changes, defects, issues and approvals.

Managing change with connected requirements

Connected requirements helps ensure a stable, transparent, reliable and repeatable process, essential to successful change management. This process is available to all stakeholders and supports the capture, analysis and approval of changes to requirements. It also links changes to existing or new requirements. Connected requirements supports a consistent, repeatable, centralized change control process and audit trail for change requests, including requirements changes, defects, issues and approvals.

The tight integration of requirements management and change management makes it easy to manage and report on requirements implementation. This helps ensure that your projects deliver the right functionality on time and within budget. Requirements and change management integration also allows development-specific data to be expressed in terms that are relevant to the business.

A consistent and integrated approach based on a scalable, flexible requirement change process is crucial when changes impact the agreed-upon baseline of requirements and specifications that form the foundation of the project. The traceability features of the connected requirements approach allows the impact of these changes to be analyzed and dealt with throughout every aspect of the development process.

Configuration management is also critical to realizing the benefits of connected requirements. This approach supports parallel development, distributed development, factoring and versioning, and encourages reuse through a single repository. A repository that contains a single version of the truth of what is happening minimizes rework and enables traceability from requirements to code.

Advanced build analysis and testing allows team leaders and testers to confirm that planned features and bug fixes were actually implemented within the build.
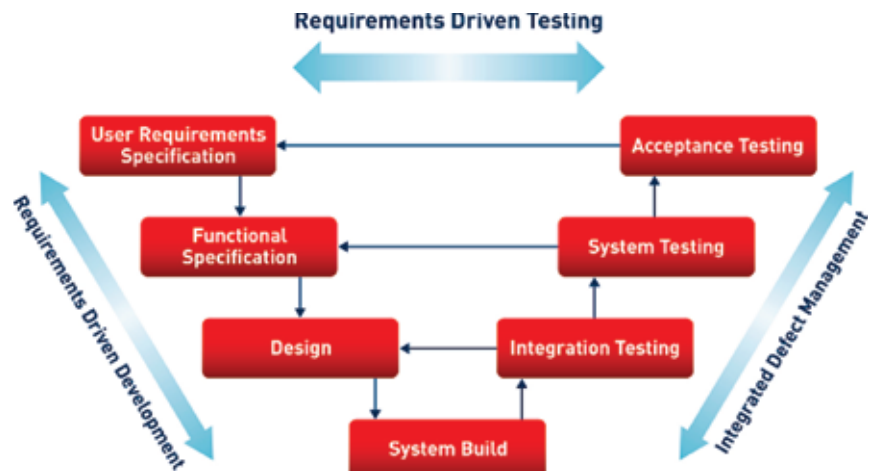
Verification and validation

This capability verifies and validates that applications were built, tested and prepared for delivery according to the requirements. Connected requirements provides a framework for the use of products that automatically relate development activities to customer needs, helping to ensure that the team is working according to the latest decisions and priorities.

No matter what your development environment—agile or waterfall—your team is ultimately responsible for reporting implementation progress with each build tested. The connected requirements approach allows you to validate the build during testing—a bottom-up approach. Advanced build analysis and testing allows team leaders and testers to confirm that planned features and bug fixes were actually implemented within the build. The verification and validation process is shown below.

Figure 4: Verification and validation

Measuring and managing performance

Connected requirements also make it possible to provide management with high-level status information regarding how well the development team is

With appropriate measurement data collected from a requirements repository, project managers can review actual progress versus planned, as well as other progress and quality indicators.

meeting its objectives. Alerts and metrics help project managers and other stakeholders track deadlines, requirements, project assignments and other aspects of application development. With appropriate measurement data collected from a requirements repository, project managers can review actual progress versus planned, as well as other progress and quality indicators.

Managers can view each step in the development process and understand how the different roles and components interact. Regular alerts help project managers react quickly to slippages in schedules and budgets and to make the needed corrections before problems have a significant financial impact on the schedule or the project. The requirements visuals should be tailored to support the indicators, graphs and status information that project managers need, as illustrated in Figure 5.

Figure 5: Detailed requirements status

Taking the connected requirements approach to application development can help you improve information visibility, communication and collaboration, even if your development teams are widely dispersed geographically and functionally.

The connected requirements approach can help you to prioritize requirements according to a wide range of criteria and visualize the results in a way that highlights the best requirements.

How you benefit from connected requirements

By taking the connected requirements approach to application development, you can realize a number of both short-term and long-term benefits.

Because your requirements are prioritized and remain persistent, compliant and auditable through every phase of the development lifecycle, you can:

- *Improve information visibility, communication and collaboration, even if your development teams are widely dispersed geographically and functionally.*
- *Find errors earlier, potentially reducing the overall number of mistakes.*
- *Enhance your development productivity and efficiency.*
- *Satisfy both your internal and external customers.*
- *Verify that the development project meets the organization's business objectives.*

By unifying requirements using the connected requirements approach, you can promote collaborative communication between your team and all stakeholders. You can bridge the gaps in the application development lifecycle that often exist between project planning, requirements definition, analysis, design, implementation and verification. Connected requirements enable the virtually seamless flow of information across a unified development team.

This approach is dedicated to fulfilling customers' needs and expectations. It allows you to respond more rapidly to changes in customer requirements as well as unexpected shifts in processes, technology and the marketplace. You are able to prioritize requirements according to a wide range of criteria and visualize the results in a way that highlights the best requirements. This allows you to see which requirements deliver the best value for the time and money spent on their development, which, in turn, enables you to increase the value of the development in relation to its cost.

Highlights

The IBM Rational portfolio offers products to support a connected requirements approach across all stages of development.

IBM products and connected requirements

IBM products that support the connected requirements approach include the following:

IBM® Rational® DOORS®, an advanced solution for requirements management, is designed to increase the quality of systems engineering and business-critical IT projects by improving requirements communication and collaboration.

IBM Rational Focal Point™ provides analysis and decision support capabilities that enable the evaluation and prioritization of business requests. Prioritized requirements can then be synchronized with DOORS for further refinement and lifecycle traceability.

IBM Rational System Architect® can help you to build an enterprise architecture—an integrated collection of models and documents across four key architecture domains: business, information, systems and technology. Business objectives in DOORS can be realized as business process models in System Architect, and resulting IT application requirements can be further defined and traced in DOORS.

IBM Rational Tau is a comprehensive Unified Modeling Language (UML) 2.1 modeling environment that is designed to tightly integrate with DOORS to enable requirements to drive system design while automating best practices for design, development and testing.

IBM Rational Change is a solution for change request tracking and reporting that is designed to simplify the change management process and enable organizations to respond systematically to change requests from internal and external sources. It includes a change management process for requirements through integration with Rational DOORS software.

IBM Rational Synergy is a task-based configuration management solution designed to help development teams work faster and easier by accelerating the release management and build management processes, increasing the efficiency of limited development resources and uniting distributed development teams. Requirements in IBM Rational DOORS can be tracked through to software implementation tasks in the Rational Synergy solution.

IBM Rational Dashboard leverages existing IBM Rational Change and Rational DOORS data to display project status information in a graphical, multi-view format, so project managers can focus on decision-making rather than manually gathering data and compiling reports.

The connected requirements approach can help large- and medium-sized systems and software development organizations overcome their development challenges by integrating disparate tools into an ecosystem that manages and organizes the complete product, system or application development effort. IBM, a market leader in requirements management, places requirements at the heart of its solution for successful development. This solution centralizes a unified set of requirements to

drive the complete development process, from initial customer need to product deployment, helping our customers optimize their development processes to build and deliver the products their customers want.

Conclusion

No matter what product, application or project you undertake, requirements drive the development process. By taking a connected requirements approach to the development lifecycle, you can significantly strengthen the requirements management process. Connected requirements helps you unify the requirements definition process and integrate requirements management with the products and techniques that will support you in delivering applications that are on time, within budget and error free.

For more information

To learn more, please visit:

ibm.com/software/rational