Applying RMTrak

Adapting a Requirements Management Process Using RMTrak

Overview: *The key to successful requirements management is a process of capturing, documenting, modeling, implementing, verifying, and validating product/project requirements. RMTrak ensures the accuracy and completeness of this process by letting you quickly and easily trace and track requirements while writing, editing, and formatting documentation as you always have. Additionally, RMTrak assists in effective control of document re-use across multiple projects and sub-projects.*

RMTrak is RBC Product Development's new requirements management (RM) tool for tagging, tracing, allocating, and verifying product/project requirements. It's a simple, non-intrusive program that captures, tracks, and manages requirements in your documents. RMTrak lets you use the tools you're already familiar with, like Microsoft® Word with its powerful word processing features, to create, format, and edit your documents.

RMTrak was designed to work with your existing requirements management process. This document provides an overview of the general concept of requirements management and how you can use RMTrak to enhance it, whether you're new to requirements management or an experienced RM expert.

Requirements Management (RM)

Product development and other "major project" companies frequently deal with requirements management. Their Clients, developers, and industry standards determine the many requirements necessary to successfully complete a product or project. The Company must then keep track of each requirement, ensure it correctly meets project needs, and know when it's been successfully implemented and tested. Since large projects can have tens of thousands of requirements that can change over time, this is often a difficult and tedious chore—especially when several different projects must share common documentation.

Studies indicate U.S. product development companies spend millions of dollars on failing projects. Additionally, over half of the products developed in the U.S. come in late and over budget or are lacking in some of the key requirements needed to make the product successful. These organizations fail because they have difficulties implementing the product's numerous requirements, which can be forgotten or left behind. Many of these projects end up cancelled and result in a significant waste of Company resources and expenses—not to mention the loss of market share and life-cycle profitability for a product.

The key to a successful project is having an accurate and thorough collaborative requirements management process. One key to successful collaborative requirements management is finding the right tool to help you.

Note: Your organization's project may or may not include product development. Many organizations, and most of the organizations using RMTrak, are familiar with product life-cycles. However, if your organization is not developing a product, the phrase *project life-cycle* may seem more appropriate than *product life-cycle*. For these reasons, the words *project* and *product* are used interchangeably in this document.

The Requirements Management Process

RMTrak helps you with your requirements management process, which involves capturing project requirements, conceptualizing them, documenting them, validating them, then using your requirements management tool (RMTrak) to help you implement, test, and close them.

Requirements management can be divided into different tasks:

- Exploring and determining product requirements through observation, task analysis, etc.
- Creating a conceptual model of the product as seen by the system's eventual users. This model should capture the semantics of the real world and provide the foundation for an abstract description of the requirements.
- Documenting requirements and describing the components of the conceptual model(s). The resulting documents may act as contracts between the organization and their Client.
- Validating requirements by evaluating, analyzing, and testing requirements documents for completeness and accuracy.
- Managing requirements by developing a set of procedures to assist in maintaining the requirements throughout the project life-cycle. These may include planning, traceability, impact assessment of changing requirements, and others.
- Implementing requirements using the requirements documents, concept models, and requirements management processes as guidelines.
- Verifying requirements by testing implemented requirements for accuracy, completeness, and functionality.

These tasks are further described below:

Requirements Capture (Getting It)

Capturing requirements is the first activity you'll typically carry out when initiating a new project or when introducing a new development into an existing project. The requirements capturing process needs to focus on collecting objective, measurable project outcome information. You can gather requirements from industry standards, Clients, experts, and other resources. These requirements might be numerous and will likely need updating throughout the project's life-cycle.

Requirements Modeling (Getting It Organized)

Requirements modeling is the process of developing an executable model of your project's requirement management process using flow and process diagrams.

The model's components need not contain the actual requirements but should correspond to them as they are listed in requirements documents. The model should emphasize how requirements and processes relate to each other.

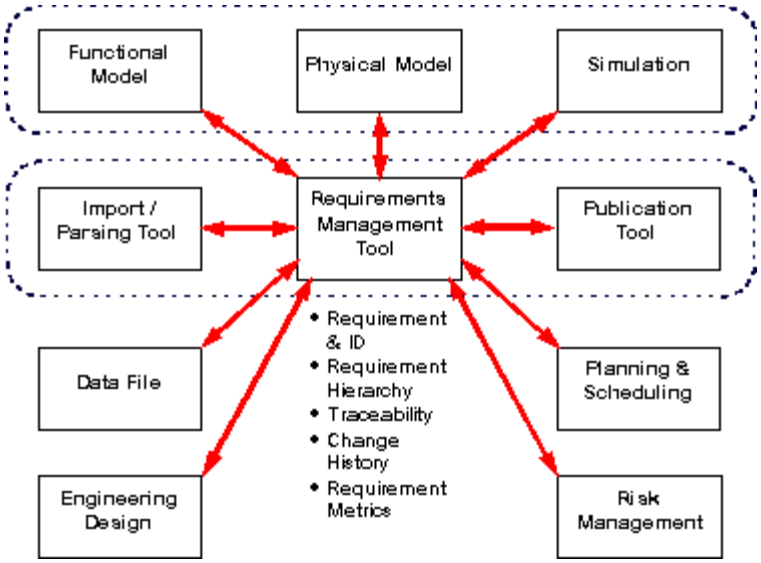

Figure 1: The relationship between requirements management tools and models

Requirements Documentation (Getting It Down)

Requirements documentation is the process of creating requirements documents that are well structured, complete, coherent, consistent, correct, and which fit their purpose. This effort should be carried out before you commit your design and development resources. You should complete documentation updates and reviews each time a project requirement changes, and after requirements are implemented/tested (cleanup).

There are many types of requirements documents, including:

- **Customer Requirements Documents**
  Documents describing the Client's requirements for the project
- **Regulatory Requirements Documents**
  Documents describing the industry standards and regulatory requirements that must be followed for the project
- **Product Requirements Documents**
  Documents describing the combined (customer, regulatory, etc.) detailed requirements using the research performed by team members
- **Software Requirements Specifications**
  Documentation containing a functional decomposition of the software requirements for the project
- **Software Design Descriptions**
  Documentation describing how the software design will implement the requirements contained in the Software Requirements Specification

- **Software Verification Test Procedures**
  Documentation of white-box testing[1] procedures used to verify that the software requirements are being correctly implemented
- **Software Verification Test Reports**
  Documentation that details the results of the software verification testing and produced as a result of executing the Software Verification Test Procedures
- **Hardware Requirements Specifications**
  Documentation containing a functional decomposition of the hardware requirements for the project
- **Hardware Design Descriptions**
  Documentation describing how the hardware design will implement the requirements contained in the Hardware Requirements Specification
- **Hardware Verification Test Procedures**
  Documentation of white-box testing procedures used to verify that the hardware requirements are being correctly implemented
- **Hardware Verification Test Reports**
  Documentation detailing the results of the software verification testing and produced as a result of executing the Hardware Verification Test Procedures
- **Product Validation Test Procedures**
  Documentation of black-box testing[2] procedures used to validate that the product requirements are being correctly implemented and the product meets its intended use
- **Product Validation Test Reports**
  Documentation detailing the results of the product validation testing and produced as a result of executing the Product Validation Procedure

The exact types of documents and their exact position within the product life-cycle will be different for each organization.

Documents are usually ordered so requirements from one document flow down into the next document. With each lower layer, the information becomes more detailed and specific.

[1] According to Webopedia.com (http://www.webopedia.com/TERM/W/White_Box_Testing.html), white-box testing is "A software testing technique whereby explicit knowledge of the internal workings of the item being tested are used to select the test data. Unlike black box testing, white box testing uses specific knowledge of programming code to examine outputs. The test is accurate only if the tester knows what the program is supposed to do. He or she can then see if the program diverges from its intended goal. White box testing does not account for errors caused by omission, and all visible code must also be readable."

[2] According to Webopedia.com (http://www.webopedia.com/TERM/B/Black_Box_Testing.html) black-box testing is "Also known as *functional testing*. A software testing technique whereby the internal workings of the item being tested are not known by the tester. For example, in a black box test on a software design the tester only knows the inputs and what the expected outcomes should be and not how the program arrives at those outputs. The tester does not ever examine the programming code and does not need any further knowledge of the program other than its specifications."

One possible hierarchy is shown below. This particular hierarchy can be used in a regulated environment, such as medical device design, and involves a project with hardware and software components only. This hierarchy reflects RMTrak's default document types and their terminal status.

> **Tip:** Terminal documents are documents that do not require any additional documentation stemming from its contents and thus their requirements do not trace any further downward.

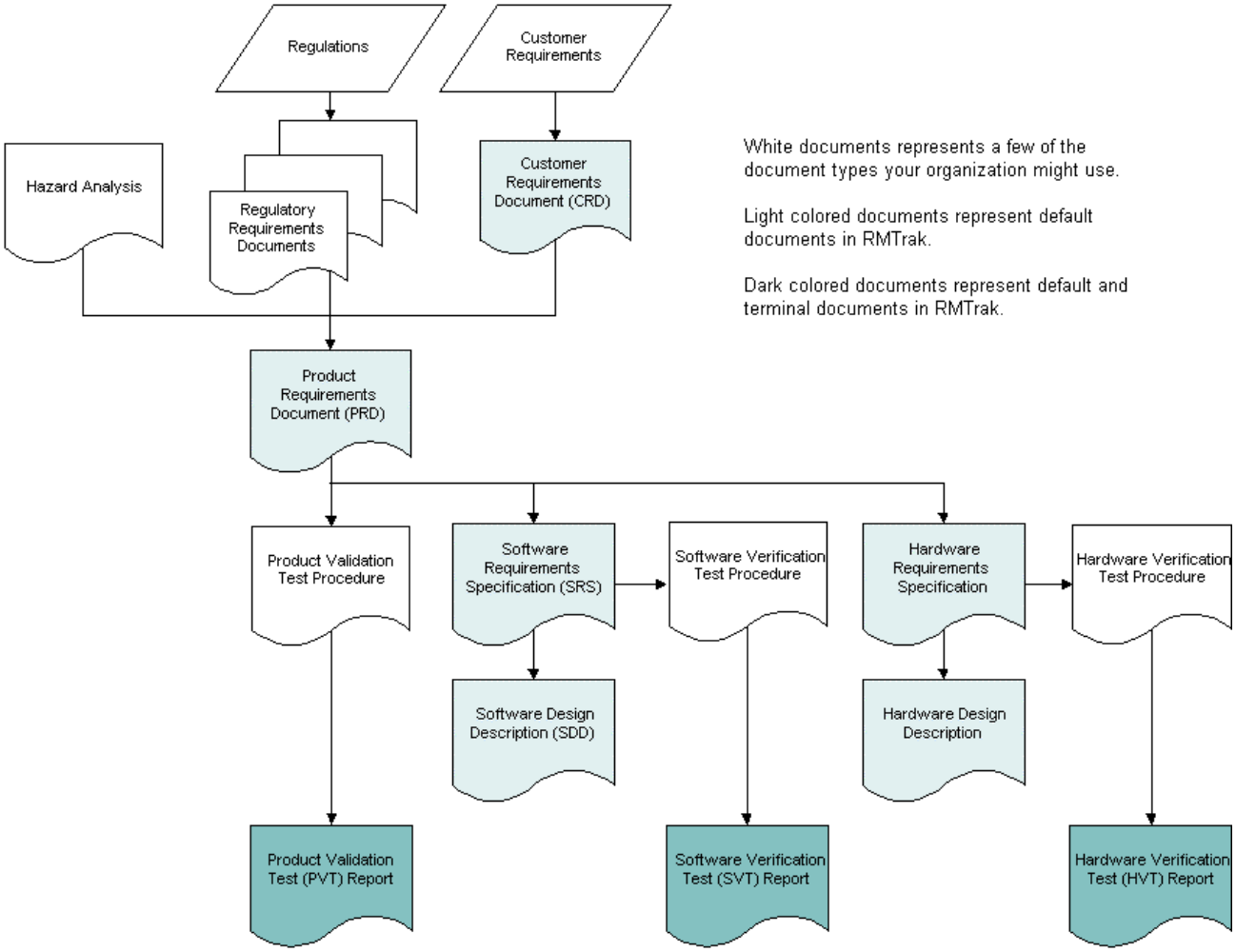

Figure 2: Documentation hierarchy

Experienced organizations typically create many documents to capture the needs of varied end users. However, organizations are often limited in their ability to relate information in one document with information in other documents. Additionally, these documents are often difficult to edit and redistribute to the entire project team once changes are made. The end result of using documents to capture requirements information is often a delayed, extended, over budget, or cancelled project.

The challenge facing many project teams today is how to combine the convenience of capturing requirements in a document with the power of database data handling. To meet this challenge, RMTrak provides a robust yet easy-to-use requirements management platform and toolset for:

- Developing and/or extracting customer input on hardware and software requirements
- Creating a document-like hardware and/or software requirements specification with the power of a database reporting mechanism
- Managing requirements implementation, changes, and testing throughout the hardware/software life-cycle
- Communicating working requirements and project status to the entire development team

Requirements Validation (Getting It Confirmed)

Requirements validation is the process of making certain each requirement outlined in the requirements documents complies with the standards, procedures, and objectives originally intended for the requirement.

Requirements Management (Getting It Monitored)

Requirements management is primarily concerned with:

- Monitoring and managing the changes to requirements during a project's life-cycle
- Recording trace information in the requirements documents
- Ensuring all requirements are implemented

Requirements management is simplest and easiest when accompanied by a requirements management tool. RMTrak can save time and resources by monitoring requirements for your organization, tracking changes, and generating reports that show you the current results during each stage of development.

Requirements Implementation (Getting It Done)

Requirements implementation is the process of creating hardware and software while using the requirements documents, concept models, and requirements management processes as guidelines.

Requirements Verification (Getting It Right)

Requirements verification is the process of testing each implemented requirement to make sure it performs according to the specifications contained in the requirements documents.

RMTrak can also be helpful during this phase by marking "closed" all successfully tested requirements. This lets you generate reports showing that these requirements have been successfully implemented.

Requirements Management Tools

Requirement management tools provide a way to track your project's requirements and when each one has been completed. RMTrak works with your organization's requirements documents and their listed requirements to organize requirements, help you model requirement flows, generate status reports, and to recognize when requirements have changed during a project and when they've been successfully implemented and tested.

Unlike other requirements management tools, RMTrak was designed with two main features in mind:

- Allowing you to create documents as you usually do, without hindrance, while assisting with requirement identification and tracking
- Keeping important information about document requirements within the documents rather than in the data repository (database)

Instead of than requiring you to tag or create documents that conform to a standard, RMTrak is flexible and lets you configure your RMTrak project to match the information you'll be adding to it. The only potential difference is that your documents will now need to include tags. The purpose of the tags is to mark as "requirements" the most important information within the documents.

RMTrak is easy to use yet maintains the full functionality found in high-end collaborative requirements management tools. It helps you:

- Capture, organize, and manage your projects' numerous and complex requirements
- Ensure the proper resources are committed to your project
- Stay in control of schedules, resources, and deliverables
- Manage the impact of changes on your project objectives
- Meet your customers' needs
- Accelerate time-to-market
- Avoid unnecessary and costly overruns and revisions
- Use the documents and processes your organization already has in place with little to no additional work
- Use the familiar and powerful Microsoft® Word application to create, format, and edit your documents
- Generate detailed requirements views and reports

Summary

RMTrak was designed for business developers, program managers, project engineers, and support staff who need a full-featured, easy-to-use requirements tracing and reporting tool. RMTrak can benefit your organization by facilitating:

- The ability to quickly meet your customers' needs, thereby improving customer satisfaction, and accelerating time-to-market
- Implementation of a simple requirements management process using an entry-level solution with a familiar Microsoft® Word document format
- Establishment of a simple requirements management process capturing, organizing, and managing your needs from concept development to final production
- Organization and tracing of requirement details to ensure proper resources are committed to the project during the requirements development phase
- Establishment of links between multiple process documents
- Assignment of attributes to your information, such as task assignment, priority and status, and modification of these over time to reflect any changes in your project
- Control of your schedules, resources, and deliverables
- Impact assessment of changes to your project objectives, thereby helping your team members to understand their responsibilities and the impact of changing requirements on their project
- Tracking of your requirements to avoid unnecessary and costly revisions
- The quick tagging of documents and rapid location of specific information using keyword searches
- Easy report generation, including requirements traceability, orphan, childless, unallocated, suspect, closure, and summary reports (RBC Product Development can also quickly develop custom plug-in report formats that fit your organization's specific needs)
- Simple navigation between reports and requirement documents using hyperlinks
- Tag filtering so you can use documents in multiple projects without confusing their requirements

Additional Information

RBC Product Development is dedicated to helping you succeed. If you need additional information about applying RMTrak, please don't hesitate to contact us or visit our RMTrak Web site.

RMTrak Web site: http://www.RMTrak.com

General inquiries: RMTrak@rbccorp.com

Technical Support: RMTrak.Support@rbccorp.com

Resources

This document consulted the following sources. Please visit them to learn additional information about the requirements management process.

David A. Jones, Raytheon Systems Company. "Executable Requirements Management Model: A Requirements Working Group Information Report." *Incose*. <http://www.incose.org/rwg/98_paper_exec/index.html> (May 1998).

Didar Zowghi, ed. "Requirements Engineering: Scope." *Joint Research Center for Advanced Systems Engineering*. <http://www.jrcase.mq.edu.au/~didar/seweb/scope.html> (Oct 1995).

RBC Product Development. "Making the Business Case for RMTrak." RBC White Papers. RBC Product Development. 2002.