



Requirements Management from the Trenches

Best practices & other helpful ideas

Introduction

From the trenches

Call us industry veterans.

One of us was previously a solution architect at IBM with a 14-year stay at Big Blue and a 25-year track record in technology overall. The other has spent more than 20 years in the IT field, the last 17 of those years specializing in IBM's Rational tool suite. Collectively, we've worked in industries spanning federal and state governments, defense, banking, insurance, the automotive sector, and even NASA.

So in all the time we've been involved with technology, we've watched things like IoT, AI, connected products and the onslaught of data change the engineering process. Dramatically. We've worked with INCOSE guidelines and know first-hand how compliance and safety have made requirements a nightmare. We know that delivering a reliable digital product begins, and ends, by threading quality assurance, validation and testing throughout the requirements authoring process.

And yes, we've both worked under the pressures of release deadlines and getting new products to market before anyone else... with the added pressure of minimizing revisions and costs by zeroing in on requirements out of the gate.

Unfortunately, we've all seen requirements get rushed through development channels, and then felt the backlash as inaccuracy takes over. Maybe that's why the Project Management Institute says 47% of failed projects are due to poor requirements, and that requirements errors cause 50% of product defects and 80% of the rework to fix them.

Ron Felice,
Product owner

Jason Epstein,
Systems Engineer

Copyright © 2020 ClearObject Inc. All Rights Reserved.
Brand, product and service names referred to in this document are the trademarks of their respective companies.
ClearObject Inc. | 8626 East 116th Street, Suite 300 | Fishers, Indiana 46038

+1 (888) 850-2568 Toll Free | www.clearobject.com

Publish date 2/2020, version 1

The harder truth

Having been under the microscope of product engineering and requirements management, we've also arrived at some other harsh realities beyond the ones we just touched on.

1. **The compliance environment has never been more complex,** especially with a heightened emphasis on safety and the countless guidelines of industries and markets around the globe. If you want to uphold your company's reputation, stay competitive, and avoid the mess of not meeting compliance, optimizing its effectiveness is a must.
2. **The level of frustration with requirements management tools has never been higher.** Current tool set offerings or older versions, the exasperation stems mostly from users not knowing how to use the tools they have. The problem is, in most such cases, existing tools are rarely updated or replaced.
3. **Requirements management is not our favorite thing to do.** But it's our job. And, to make your job easier when it comes to authoring and managing requirements, we say focus on best practices- plus any other helpful ideas to get requirements right the first time.

From being in the trenches ourselves, this paper is about all the ways we've learned to improve requirements management.

Best Practices & Other Helpful Ideas

Four criteria

We get it. Not everyone in product development is a fan of IBM. But the knowledge experts there have developed software engineering tools for a long time, and they have a keen sense of what development groups are up against requirements-wise for digital products that are becoming increasingly connected all over the world.

No matter the industry, IBM's view is that deeper insights into data and broader visibility into product engineering changes are the best benchmarks for authoring product requirements. IBM adds that shared tools for requirements collaboration in global operations are equally essential. We at ClearObject agree with each point.

Of course, Watson AI is also now part of the equation, and it (as well as other solutions for AI) should clearly be deemed as a best practice approach. With requirements analysis taking up only 2% of total design time according to IBM's own engineers, Watson AI helps product engineering teams reduce errors, reduce costs by minimizing errors and rework, and strengthen requirements overall to develop and release new products quickly.

Keeping Watson AI in mind, as well as Watson IoT, IBM ELM, RQA, and DOORS/DOORS Next, IBM cites four criteria as being critical to requirements management and successful engineering outcomes on a first attempt: **Requirements Traceability, Variant Management, Engineering Compliance,** and **Agile Management.**

Again, we agree with these four criteria and the various elements of each. But we've also learned a few things of our own to make requirements management better, and have included them here and in the list that follows.

The importance of atomicity

For traceability, variant management and compliance requirements, one thing we've learned –and firmly stress – is that atomicity is of significant importance. This is also a key tenant of a quality requirement. If as engineers we fail to create atomic requirements, we're creating a nightmare situation for ourselves across all three of these pillars. We are then stuck trying to answer questions like: Which part of this requirement are we actually tracing to, and which part of this requirement is satisfied by this downstream requirement, or is implemented by this line of code or is validated by this test?

When engineering leaders create a proper atomic requirement, no interpretation is necessary, and all ambiguity is removed.

Requirements Traceability

IBM's core best practice: Link individual artifacts to test cases for total visibility of changes in product engineering requirements as they happen.

Our experience:

- Create and maintain relationships across your development lifecycle, meaning the relationships between requirements, work items, architecture, design and test plans. The stronger this loop, the better. (This is the tenant of IBM ELM.)
- Connect a new product's stakeholders to the requirements that concern them.
 - Especially since a stakeholder's input can help reduce errors and rework, they must be able to weigh in on critical decisions throughout the requirements process.
 - Such stakeholder connections work best when you have a single system that also connects data, conversations, and decisions.
- For requirements changes, don't just acknowledge them, understand them.
 - Use traceability analysis to ensure all parties comprehend the impact of a change.
 - Reiterate that impacted change areas can be modified as necessary.
- Where possible, automate bi-directional requirements traceability. This helps minimize risk and ensure quality in the requirements being authored and implemented.

Variant Management

IBM's core best practice: Digitally manage the entire version and variant process while monitoring the progression of the system through a shared dashboard.

Our experience:

- In a shared dashboard, generate dynamic views that meet stakeholder needs for requirements, such as compliance, gap analysis, cost or test status.
 - This eliminates the overhead of manual information gathering and report building and lets engineering team members focus on design work.
 - With a more traditional approach to requirements management, the core requirement would be copied once for each variant it supported. The copy of the requirement would then be modified, with the parametric data corresponding to the implementation of that variant. Should that core requirement change, then each copy would have to be updated manually, with no easy way to effectively ensure that this is done.
- This traditional approach is highly error prone and should be avoided at all costs.
- With variant management of requirements, each variant is maintained as part of its unique configuration. The core requirement consistency is maintained across variants and only the varying parameters need to be modified.
 - The unique traceability information for requirement variants is also maintained in a consistent and manageable way. Ensuring that you will always have visibility into the impact of requirements changes across all versions and variants of your products.

Engineering Compliance

IBM's core best practice: Incorporate industry standards and regulations into requirements to achieve compliance early on, notably by building compliance into the product engineering lifecycle from end-to-end.

Our experience:

- Automate transparency and traceability to meet regulatory, compliance, process, reporting and audit requirements.
 - Example: ISO 26262 (automotive), traceability/accountability for software changes in real-time.
 - Support compliance with safety-critical standards.
 - Improve the management of project scope.
- Taking ISO 26262 as an example standard, ISO 26262 explicitly states that requirements traceability between development artifacts must be ensured. This means engineers must be able to trace requirements to other development artifacts that are needed to ensure that these requirements are actually fulfilled. This also means traceability down a hierarchy of safety requirements (e.g. Functional Safety Requirements, Technical Safety Requirements, etc.), system requirements, hardware requirements and software requirements, as well as design and implementation artifacts, and artifacts that describe verification activities and their outcomes, just to name a few.

Agile Management

IBM's core best practice: Streamline product engineering processes and enable global collaboration and a single source of truth, including showing teams the "value of their efforts" in real time.

Our experience:

- Collaborate internally with all stakeholders and engineering team members and externally with manufacturers, designers, regulators, suppliers, etc.
- Establish a central requirements repository to act as your single source of truth.
 - Keep large and diverse teams synchronized throughout the requirements process. This speeds consolidation, monitoring and analysis and ensures consistent and accurate information.
 - A single source of truth further helps all parties better understand the impact of requirements changes.
- Use AI and analytics to more effectively manage requirements (IBM DOORS/DOORS Next/RQA). AI helps you:
 - Reduce ambiguity and improve requirements accuracy (and ultimately product quality).
 - Capture, trace, analyze and manage requirements more accurately.
 - Enhance operational data/customer insight to improve engineering decisions.
- Consider cloud-based managed services to:
 - Work more effectively across disciplines, time zones, and supply chains. This shortens requirements review cycles and improves collaboration even when different time-zones are involved.
 - Get a more secure environment for collaboration and data sharing
 - Ensure engineering environment reliability and uptime (follow-the-sun support for global operations).
 - Scale collaboration as needed, quickly, anywhere in the world.

IBM ELM Managed Services by ClearObject

In tandem with IBM's ELM effort, IBM worked with ClearObject to create the cloud-based IBM ELM Managed Services by ClearObject offering, which features a complete integration layer for ELM structured by IBM. With end-to-end integration between core engineering functions for Requirements as well as Test, Workflow Management, and Systems Design (MBSE), these managed services give engineering product development teams a hosted ELM-based quality requirements management configuration and solid architecture managed across the lifecycle of enterprise scale. As Software as a Service (SaaS), entire product development organizations can also participate globally and evaluate developed concepts without having to dedicate their own IT resources. In all, ClearObject's IBM ELM managed services help engineering leaders limit risk, control costs and drive innovation.

About ClearObject

ClearObject is a digital transformation leader in Internet of Things (IoT) Engineering and Analytics. As IBM Watson IoT and Google Cloud Business Partners, we deliver global embedded software development environments for our customers, and design and deliver unique data analytics digital products that help them recognize the value of their data. Our objective is clear: help the world's best companies build intelligence into their products and gain intelligence from them. The future is clear. Do you see it?

www.clearobject.com

About the Authors

Ron Felice is a Product Owner in ClearObject's Engineering Product Development R&D group. Prior to ClearObject, he was a solution architect at IBM, where he worked for 14 years, a senior software engineer for General Motors, a software engineer for Pi Technology USA, and an information/test specialist for HP Enterprise Services. He has worked in the technology sector for 25 years overall. Ron is also an IBM Certified Solution Architect – Watson IoT Continuous Engineering V1. He earned a BS in Computer Science from Wayne State University, and an MS in Software Engineering from Central Michigan University.

Jason Epstein is a Systems Engineer for ClearObject's Managed Services Operations and has worked in the IT field for more than 20 years. For the past 17 years, he has specialized in the IBM Rational tool suite as a Rational administrator and consultant. Prior to those roles, he provided support for 400+ users of the Rational software as a technical analyst. Jason is both Scrum Fundamentals Certified and Scrum Master Certified. His industry experience spans federal and state governments, defense, banking, insurance, the automotive sector, and NASA.

Contact Ron and Jason at www.clearobject.com/contact

**clear
object**