

WHITE PAPER

# Using Root Cause Analysis and Helix ALM for Powerful Defect Prevention

## Introduction

One of the most effective ways to improve product quality and reduce development costs is to find the root causes of recurring defects and correct them – permanently. Unfortunately, many product development teams use inefficient and costly manual methods to identify the origins of these defects.

In this paper, we'll discuss how an automated product development solution, such as Helix ALM, can reduce time spent on root cause analysis (RCA), root cause corrective action (RCCA), code reviews and other quality improvement efforts – all while cutting development costs and improving time to market.

## What Is Root Cause Analysis?

At the most basic level, root cause analysis is a process used to identify the underlying cause of a defect or failure. As it relates to product development, RCA is a systematic process for categorizing and analyzing defects that have occurred pre-release, post-release, or both. When done properly, RCA reveals the points in the development process that are causing significant and recurring defects.

RCCA is where corrective actions are put in place to address problems identified during RCA. These corrective actions are placed as far upstream in the process as possible, because catching failures upstream saves rework, time, and money by preventing the problem from happening.

A critical part of implementing the corrective action is to assess the effectivity of the correction. This assessment provides information about whether the action corrected the underlying problem partially, completely, or not at all.

For example, if a software development team is repeatedly discovering defects after their application is released to the customer, they might learn from a root cause analysis that the defects stem from vaguely worded requirements. They could then take the corrective action of adding a step to their process to review requirements for vague language.

It is important to note that the purpose of RCA isn't to assign blame, but rather to identify the source of problems so that they may be corrected. If RCA is perceived as an attempt to assign

blame, it will be met with resistance and won't be as effective in identifying the root cause of issues.

Many organizations use manual methods to perform root cause analyses, but automated solutions, such as Helix ALM from Perforce Software, can help make the RCA process faster while exposing gaps and errors that might otherwise have been missed.

## What Is the Value of RCA?

The primary benefit of root cause analysis is that it identifies fundamental problems in the development process, allowing teams to enact corrective measures that fix those problems and prevent them from recurring in the future. As a result, there is less rework and fewer defects in the released product.

RCA helps transform a team that is constantly putting out fires and appeasing disappointed customers into one that solves problems before they occur or escalate. More importantly, it reduces the frequency of problems recurring over time within the environment where the RCA process is used. Companies can use what they learn from RCA to reduce costs, identify failure points in their processes, improve safety and reliability, and accelerate their time to market.

### REDUCE COST

A study by the National Institute of Standards and Technology (NIST) showed that the cost of fixing defects increases exponentially the later in the development process they are found. If a defect is caught in the implementation stage, it will cost five times more than it would cost to fix it in the design stage. If the defect isn't caught until after release, it will cost 30 times more.

Skyrocketing development costs aren't the only financial impact that defects can have. If a defect makes it into the release, customers may lose faith in the product and perhaps even the company, resulting in lost revenue. And if a defect results in harm or violates industry regulations, the company could face substantial fines, lawsuit damages, and other deleterious financial effects.

To go back to our earlier example, if the root cause of a defect is poorly written requirements, adding a step that reviews requirements for vague language will save development time and provide testable requirements. Instead of a requirement that states, "the application must load in a timely manner," which is not measurable, the requirement would be clarified in the new review step to state, "the application must load in five seconds or less." The added specificity helps the developer create the right product, and tells the tester exactly how it should perform. The product gets to market faster, and is a better quality product as a result of the additional review step.

### IDENTIFY FAILURE POINTS

RCA is especially helpful for teams that believe they have a good development and QA process, but still have recurring defects in every release. Clearly, something is broken, but what is it, why is it happening, and where does it occur in the development cycle? RCA helps answer these questions and identify the real (root) cause and not just the obvious (direct) cause.

For example, management might assume defects are getting into releases because the testing team isn't doing its job well. Perhaps the defects are in a module for which one specific tester was responsible, so the tester is identified as the direct

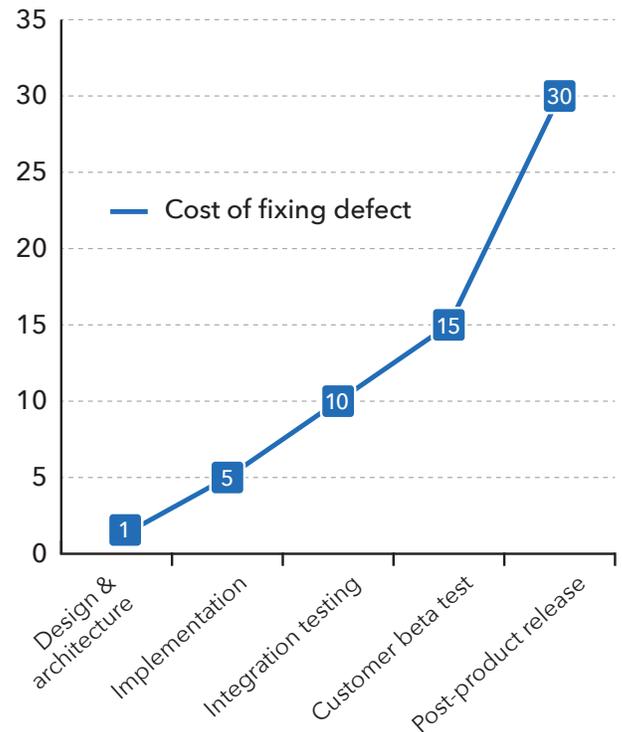


Figure 1: The cost of fixing defects rises the later they are discovered in the development cycle (NIST study)

cause of the problem. Without RCA, it would seem that replacing the tester would solve the issue. But if the root cause is the way the requirement or test case was written, then replacing the tester won't help.

### IMPROVE SAFETY AND RELIABILITY

Because root cause analysis helps significantly reduce the number of defects in future releases, it can be particularly beneficial to companies in quality-critical industries, where product safety and reliability are especially important. Establishing and maintaining a good RCA process can strengthen the defect prevention processes and help avoid costly product recalls, regulatory actions, and user harm.

## ACCELERATE TIME TO MARKET

When the root cause of a defect is identified and corrective action is taken, subsequent releases of the product spend less time in testing, and the product goes to market sooner with fewer uncaught defects. In this way, companies can reduce their time to market and extend their competitive advantage. The higher the product's quality is early in the development cycle, the fewer defects will exist to be found and fixed later.

## How Does Helix ALM Support RCA?

Helix ALM can speed and simplify the RCA process by enabling teams to define, capture, and follow the links between requirements and other project artifacts. With Helix ALM, the data needed to track a problem to its root cause in the process is just a few clicks away. Helix ALM also makes it easy to analyze the impact of corrective actions taken in response to a root cause analysis.

## AUTOMATES TRACEABILITY REPORTS

Traceability enables teams to quickly identify the impact of a defect or change request, easily address that impact, and keep the project on track. Because of all the information traceability reports gather about a project, they are valuable tools for helping to identify the root cause of a defect.

Traceability with Helix ALM is an inherent process that doesn't require much overhead. Because much of it is automatic and creating a manual link requires only a mouse click or two, linking artifacts becomes a natural and mostly invisible part of the team's daily work. The value

of linking is that there is no question whether a specific requirement or user story has been met.

Likewise, defects in an artifact are linked back to specific requirements or user stories, so figuring out where in the process a defect originated is simple. With Helix ALM, the defect is automatically linked to the test case. If a defect is recorded as a part of a test run, that means the run failed. That failure is linked through the test case to the requirement. Having the defect linked via test runs and test cases back to the affected requirement makes it possible to quickly identify the root cause of the defect.

## EXPOSES ISSUES THAT DON'T HAVE TEST CASES

Helix ALM can help users identify issues without test cases in two ways:

1. By viewing links in issues
2. By viewing links in the Issues list window

When viewing an issue, a triangle indicator on the Links tab means a test case was created for that issue. The user can click the tab to view the links and verify that a test case was created.

The screenshot shows the 'Analyze Traceability' interface. At the top, there are navigation buttons for 'Links', 'Relationships', and 'Rows/Columns'. Below this is a 'Settings' section with 'Row/Column Settings' and 'Columns contain' options. The main area is a matrix with requirements listed on both the rows and columns. The requirements are: BR-6 (0), BR-7 (4), BR-8 (12), BR-9 (10), FR-10 (1), FR-11 (1), FR-12 (1), FR-13 (1), and FR-14 (1). The matrix shows various relationship types indicated by arrows (up, down, left, right) and some cells are empty.

	BR-7 (4)	BR-8 (12)	BR-9 (10)	FR-10 (1)	FR-11 (1)	FR-12 (1)	FR-13 (1)	FR-14 (1)
BR-6 (0)								
BR-7 (4)								
BR-8 (12)								
BR-9 (10)								
FR-10 (1)								
FR-11 (1)								
FR-12 (1)								

Figure 2: Helix ALM automatically analyzes traceability

## DELIVERS VISIBILITY ACROSS THE ENTIRE PROCESS

Helix ALM can be implemented for the entire product development lifecycle for the end-to-end management of requirements, test cases, and defects. With Helix ALM, managers and teams gain greater visibility into their product development process.

Helix ALM allows users to manage defects, features, and test cases, and trace them to requirements. Teams can then design, test, and manage their product release inventory, all with electronic signatures, audit trails, and greater management reporting. As a result of this greater visibility, organizations can easily trace issues back to their root cause.

## REVEALS PROCESS ISSUES

In addition to helping track down the root cause of code defects, Helix ALM can also help you fix process issues. With Helix ALM, you'll see how often each step in your process is touched, updated, or changed in some way.

For example, perhaps defects are making it into the release because requirements keep changing. Helix ALM can show how often a requirement changes, and how recently it was changed.

Helix ALM can also identify issues and test cases that lack requirements, which may indicate unrequested features that developers have added, or features that were requested late in the process.

## ASSISTS IN CLOSING THE LOOP

Once you've identified an underlying process or development issue, and proposed a solution,

Item Type	Number	Summary	Relation	Suspect	Status	Date
Issue	20	Test Run - 1...	Peer*	Mark	Open	3/3/2
Test C...	10	Requirement...	Peer	Mark	Ready	3/3/2
Test Run	137	Requirement...	Peer	Mark	Failed	3/3/2

Figure 3: Quickly view related items in Helix ALM

you need to ensure that your solution actually corrected the problem. Helix ALM can help here as well.

First, Helix ALM provides a variety of built-in reports that let you evaluate all the artifacts and see if the trend you wanted to correct is being modified. For example, seeing a chart of defects versus version found can help you ensure that defects are being corrected before the release rather than after it.

Similarly, if you discover that many defects are being generated from a common subsystem, you might add a new custom field that captures each key component under test to easily review and report on defects by component. Using this information, you can more easily identify suspect areas before release.

## RCA + Helix ALM = Powerful Defect Prevention

Root cause analysis is a powerful tool for improving product quality and correcting fundamental process problems. Companies use RCA to strengthen their development processes and achieve significant time and cost savings.

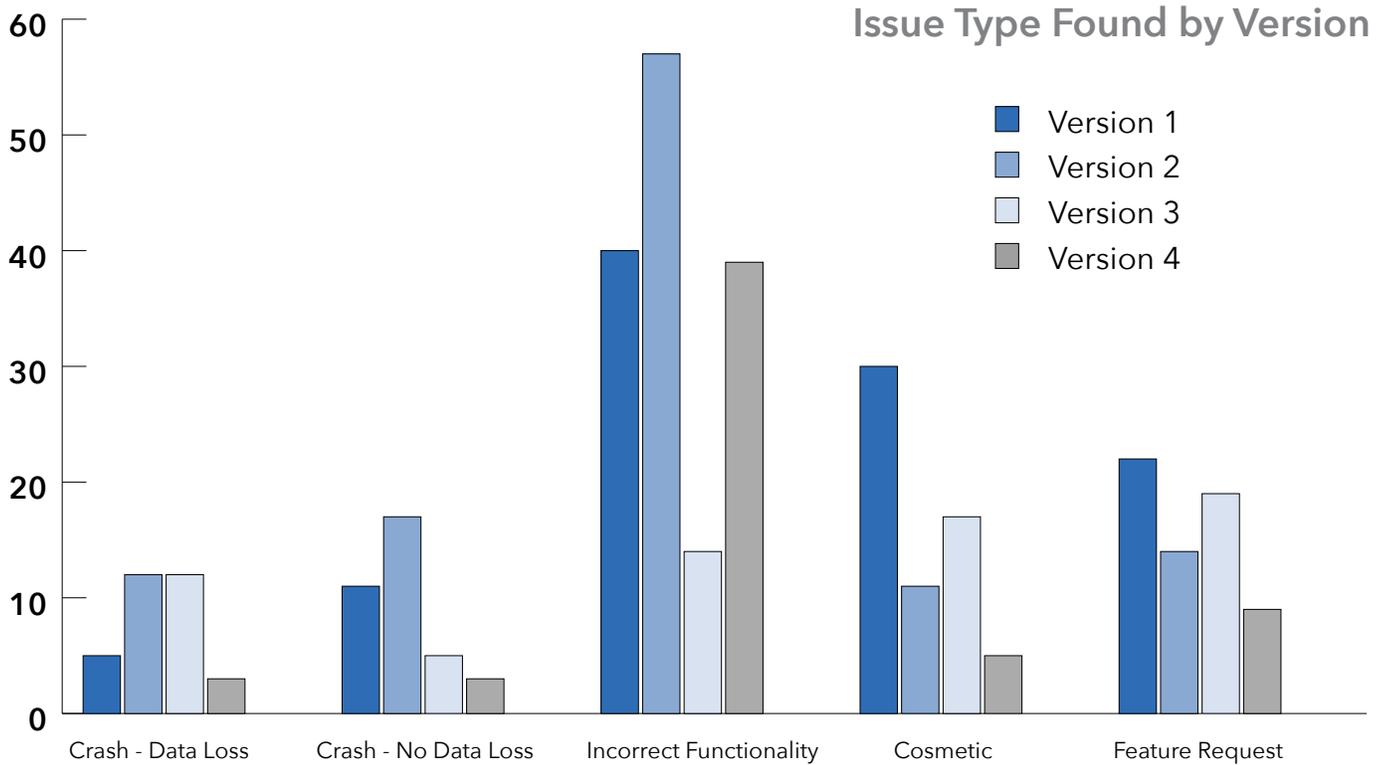


Figure 4: Helix ALM provides built-in reports to track a correction's impact

Helix ALM makes the RCA process faster and easier by putting vital data just a few clicks away and automating traceability matrices and other key reports. With Helix ALM, managers can easily analyze the impact of corrective actions and continually evaluate their effectiveness as processes continue to change and grow in complexity.

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