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WHITE PAPER

A PRACTICAL ROADMAP TO HIGHER QUALITY

Have you ever heard of a company that doesn't want to deliver quality? Are there any IT organizations that refuse to test or even review their deliverables? Hopefully, the answer is a resounding no. People and companies want to do the right thing. The desire for quality exists everywhere. But how quality is implemented, how much it costs and the extent of its benefits vary significantly from organization to organization. Despite their best intentions, and often without realizing it, many companies are spending too much for results that are less than optimal. Tradeoffs between schedules, resources and budgets force many projects to settle for "good enough," gaining as much quality as project constraints and current practices allow. But is "good enough" really good enough?

Build quality in—don't bolt it on

Almost all software is shipped or installed into production with residual defects. These defects range from minor nuances to potential disasters. When encountered, their customer and business impact can be enormous. According to the National Institute of Standards and Technology, "estimates of the economic costs of faulty software in the U.S. range in the tens of billions of dollars per year and have been estimated to represent approximately one percent of the nation's gross domestic product (GDP)." Immediate, direct costs from a production defect can include lost productivity, financial damage, rework costs, and even injury or loss of life. Equally important are the long-term, less-obvious impacts that occur when a defect causes customers to lose faith in the organization or company. These impacts can include damage to a hard-earned market positioning, loss of a key reference, loss of future business from affected customers, loss of the customers themselves and ultimately, loss of reputation and market share.

Production is clearly the most expensive place to find a defect and as we can see in Figure 1, the cost of defect identification and correction rises quickly as a project moves through the development life cycle. Quality initiatives that focus on catching errors in the later stages of the life cycle incur disproportionately greater costs to reach the same level of quality as initiatives that take an earlier and broader view of quality assurance.

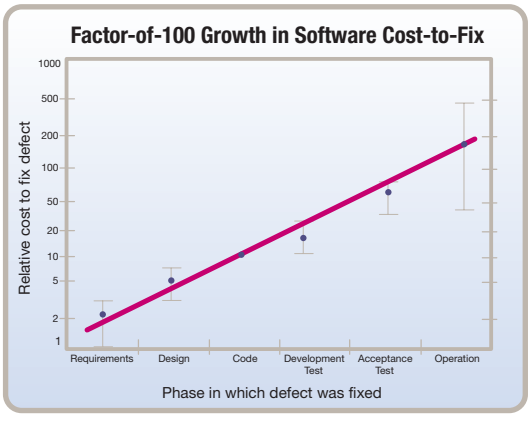

*Figure 1. Cost to Fix**

Worse yet, later-stage quality initiatives tend to be less efficient at catching the defects that reach them. As shown in Figure 2, most bugs are not caught until well past their point of introduction. Clearly, the best time to implement quality is early. Unfortunately, many organizations still follow development practices that relegate quality assurance efforts to the final stages of the development process, thereby increasing the cost of defect removal and the risk of unidentified defects making their way into production.

When implementing their quality initiatives, organizations approach quality as either a "bolt-on" or a "built-in" attribute. The "bolt-on" philosophy treats quality as something that can be added after the fact. It develops deliverables as quickly as possible and relies on the testing and quality control efforts that follow to catch and correct the defects that were created along the way. In contrast, the "built-in" approach focuses on integrating quality assurance efforts throughout the development process to avoid creating defects in the first place. The combination of prevention and early detection greatly reduces the cost of achieving low defect levels and significantly cuts the risk of defects reaching production. Numerous studies validate that "built-in" quality produces the best results with the lowest costs over the long run.

How does an organization achieve "built-in" quality? It properly implements and integrates the fundamental components of a quality program—methodology, tools, metrics, expertise and process improvement—throughout the development life cycle. The market abounds with solutions to assist this effort. Many solutions support widely known quality methodologies such as Total Quality Management (TQM) and Six Sigma or follow process standards such as ISO 9001 and CMMI. Following a methodology brings best practices and lays the foundation for incorporating the other components of a quality program into daily development activities.

1 "CeBase Software Defect Reduction Top-10 List," Basili, Victor and Boehm, Barry, Presentation, January 10, 2001, page 5 (adapted).

Stage Introduced	Requirements	Coding/Unit Testing	Integration	Beta Testing	Post-product Release	Where Introduced Percentage
Requirements	**5.0%**	8.0%	2.3%	0.2%	0.2%	15.6%
Coding/unit testing		32.0%	40.5%	4.5%	4.5%	81.5%
Integration			**2.3%**	0.4%	0.4%	3.0%
Where found percentage	5.0%	40.0%	45.0%	5.0%	5.0%	100.0%

Figure 2. Distribution of bugs found based on introduction point.[2]

But methodologies can be daunting. The difference between current and desired practices can be substantial. Few companies have the luxury of stopping their current work efforts to perfect their quality processes. Fortunately, it is possible to move from "bolt-on" quality to "built-in" quality in stages. A step-by-step approach concentrates on addressing current quality needs while progressively adding the capabilities needed to reach the organization's ultimate quality goals. This paper will explore different paths for achieving these results. It will examine common quality approaches, methods for implementing those approaches, how to select a quality partner and how Micro Focus can assist in your quality-improvement efforts. The goal of this white paper is to help readers find the most pragmatic and beneficial path for achieving their quality objectives.

Quality in theory: Common quality initiatives

Given the importance and difficulty of integrating quality into everyday work efforts, it is not surprising that a large number of standards, roadmaps, philosophies, processes and methodologies have appeared to guide quality improvement efforts. In some cases, such as Six Sigma, the entire methodology focuses on quality; in other cases, quality control and improvement are incorporated within a broader methodology. While the approaches differ, the intent is the same—driving improvements that produce consistent, high-quality results. This section examines the similarities and differences between a few of the most common quality approaches.

ISO 9001

ISO 9001 is not a quality methodology per se, but rather a standard for quality management. It sets in place a system to deploy a quality policy and ensure verifiable objectives. Developed by the International Organization for Standardization (ISO), it has been adopted by thousands of companies across more than 100 countries. To achieve ISO 9001 compliance, organizations ensure their quality processes conform to the coverage requirements and performance criteria set by the standard. Heavily process-oriented, the ISO 9001 standard focuses on all aspects of quality within an organization, setting requirements for the full quality life cycle, from research and requirements to product delivery and auditing for compliance with quality controls. ISO 9001 is applicable to more than systems development. Its breadth enables it to support quality efforts in industries ranging from consulting to forestry, manufacturing and even tourism. Organizations can implement ISO 9001 by assessing their current quality processes against the standard and correcting any gaps, or by implementing a commercially available methodology that is certified to the standard.

2 "Planning Report 02-3: The Economic Impacts of Inadequate Infrastructure for Software Testing," prepared by RTI for the National Institute of Standards & Technology, May 2002, page 6-10 (adapted).

Total Quality Management

TQM is the philosophy of proactive, continuous quality improvement. It also takes a full-life-cycle approach to quality. TQM principles stress that quality can and must be managed, problems should be prevented rather than just corrected, quality must be measured, and quality improvements made through process improvements. TQM sets a performance standard of "defect free." These core tenets are widely adopted and incorporated in many quality programs and methodologies. Like ISO 9001, TQM's audience is much broader than strictly IT, although its principles are directly applicable to IT quality-improvement efforts. TQM advocates using a structured methodology as the basis for process improvement. Once processes are in place, their performance can be measured, variation reduced and a strategy for continuous improvement put into place.

Six Sigma

Originally developed by GE, Six Sigma is a highly disciplined methodology designed to encourage the development of near-perfect products and services. It focuses on three elements of quality: customers, process and employees. Six Sigma aims to delight customers by delivering quality in every attribute that influences customer perception. Similarly, it looks "outside-in" to take the customer's view when assessing and improving processes. Finally, it believes quality is the responsibility of every employee, requires full employee involvement in customer satisfaction efforts and seeks to incorporate its principles throughout the company's culture. Improving quality through continuous process improvements, Six Sigma sets a standard of no more than 3.4 defects per million opportunities. It monitors processes for capability, level of defects, variation and stability. While applicable to IT, Six Sigma is a company-wide quality initiative. It is typically implemented on a large scale, backed by extensive training, development of "black belt" and "green belt" specialists and formation of Six Sigma teams.

Capability Maturity Model Integrated

In contrast to the previous approaches, Capability Maturity Model Integrated (CMMI) is a process improvement approach designed expressly to support the entire range of system development and support activities. Developed by the Software Engineering Institute at Carnegie Mellon University, CMMI provides IT organizations with the essential elements of effective processes and can be used to guide process improvement, integrate organizational functions, set improvement goals and priorities, guide quality efforts, and provide a model for appraising current processes. It consists of five stages of successively increasing process maturity: initial, managed, defined, quantitatively managed and optimized. To move through the model, organizations deploy progressively more robust processes in 11 key areas, add metrics to measure and manage those processes and, at the optimizing level, focus on continuously improving those processes. While not specifically a quality methodology, CMMI integrates quality processes and measurements throughout its model and encourages the use of best practices. Given the scope of CMMI, IT organizations choosing to follow the model tend to move up the levels over many years and rely heavily on training and the services of specialists to guide their improvements.

Common requirements of quality approaches

While the major quality approaches follow different paths to reach their objectives, they share several common traits. First, they all aim to provide high quality consistently and predictably. Almost any development team can deliver high-quality results on an individual project through superhuman efforts—but gaining significant, long-term improvements across an IT organization requires all teams to deliver quality on a regular basis with a sustainable investment of effort. Second, these approaches do not rest on their laurels by achieving and stopping at a pre-defined level of quality. Each one follows a cycle of continual improvement that analyzes current results, looks for variances (good and bad), identifies the root causes of

those variances, makes adjustments, executes the process, measures results and repeats the cycle. Continuous improvement efforts ensure that quality keeps getting better and its delivery becomes ever more efficient, cost-effective and predictable. Finally, these approaches rely on a combination of formalized processes, automation and metrics to achieve their results.

Formalized processes

Formal processes are the heart of any methodology. By describing tasks, steps, roles and deliverables, they are the embodiment of best practices. They ensure consistency across individuals, teams and organizations, and they provide the foundation for continuous improvement activities.

Automation

Testing and quality assurance tools provide greater speed, productivity, consistency and efficiency. Automated tools are far faster and more thorough than people—especially when performing tedious, repetitive tasks, such as generating test data, executing tests and reviewing test results. They facilitate tasks, such as tracing program logic and metrics collection, that are difficult to perform manually.

Metrics

Measurement provides the means to identify, quantify and report on the results of quality initiatives. Methodologies use metrics to capture performance baselines and measure the improvements that result from quality efforts. They are the essential information source for justifying quality investments and enabling continuous process improvement.

Quality in practice: How do you get there?

The major quality methodologies provide a tantalizing vision of the perfect quality initiative and the benefits that an organization can obtain once it reaches that vision. But for most organizations, achieving that vision will take a major investment of time, money and resources over a number of years. Reaching a high level of "built-in" quality requires following a methodology and implementing the right mixture of formal processes, tools, metrics and expertise. Each organization is different, and the balance of formality and the mix of components will necessarily vary for a small IT organization supporting back-office business applications compared to a massive development team creating the software for next-generation computers. In the real world, achieving the perfect quality vision cannot come at the expense of an organization's day-to-day responsibilities.

So how does an organization implement an effective quality improvement initiative? The market offers a large array of quality solutions in the form of methodologies, tools and consultants, but they must be deployed in a cohesive manner to be effective. Fundamentally, organizations can choose one of three major paths.

Choice 1: Formal implementation of a full-scale methodology

This approach aims for a total overhaul of existing quality practices through an implementation of an industry-standard methodology. An organization can choose to follow one of the quality-specific methodologies or adopt a full life-cycle methodology with a heavy emphasis on quality. Companies tend to implement this approach as a "big bang" effort under the auspices of a major consulting firm or a group of quality specialists. Although customizable, these methodologies are generally process-heavy and require the use of specific metrics and tools.

Advantages

This approach brings in across-the-board best practices. In a single effort, an organization can move to the highest levels of quality maturity.

Disadvantages

Rolling out quality improvements in a single, large-scale step is costly, disruptive, time-consuming and resource-intensive. It requires a significant level of change that is often resisted by developers and testers alike.

Choice 2: Do it yourself (ad hoc)

At the opposite end of the scale, an organization can opt to implement its own quality-improvement initiative. This approach relies on internal teams to research and improve their own quality processes. These teams may work individually, implementing new quality tools and processes when merited by the situation, or collectively under the guidance of a quality organization charged with implementing tools and standards. Improvement efforts can move as slowly or quickly as organizational needs dictate. In contrast to the previous approach, the level of use of methodology, formal processes, tools and metrics is left to the discretion of the implementers.

Advantages

By using existing internal resources, this approach encounters less resistance and requires lower additional budget investment.

Disadvantages

This approach will bring improvements in quality; however, the results are generally sub-optimal when compared to other approaches. Teams frequently lack sufficient best practice expertise to implement the most effective tools and processes. Inconsistencies in processes, tool and metric usage across the organization inhibit effective continuous improvement.

Choice 3: Staged improvements

This approach falls midway between the previous two choices. It brings in methodology, tools, metrics and expertise, but works toward the eventual quality goals in stages rather than by overhauling the entire organization at once. The IT organization selects one or more immediate quality needs, such as an upcoming package release or an issue such as high-defect levels on a particular application, and brings in qualified consulting assistance to address the need. The consultants use their methodologies and expertise to solve the immediate issue while simultaneously implementing tools, metrics and process improvements to raise the level of the surrounding quality process. Subsequent projects build from this base, bringing the IT organization up to its desired level of quality maturity at its own pace and providing immediate benefits at each step. This approach is especially powerful if combined with a roadmap—customized to the organization's specific needs and characteristics—to guide quality-improvement efforts to a clearly defined final destination.

Advantages

This approach is the easiest to implement, least disruptive and provides immediate benefits that justify further improvements. Using outside experts provides experience, best practices along with supporting methodologies, tools and metrics.

Disadvantages

Since it is implemented in steps, this approach takes time to reach its final quality goals. It requires investment in tools and services; however, it offsets these investments with benefits gained from addressing immediate needs.

The bottom line

For most organizations, the staged improvement approach is the most practical choice for achieving short- and long-term objectives. Staged improvements address the common requirements of the major quality methodologies, but focus on gaining immediate results. Quality improvements don't require adopting a formal methodology; significant benefits are possible through automation, process improvement and use of experienced resources. However, methodologies promote tighter integration of quality into other development practices, ensure correct and consistent deployment of tools, and enable faster knowledge transfer from experts to practitioners. The staged improvement approach enables IT organizations to make their own decisions on how far, how fast and how detailed they wish to go with their quality initiatives while implementing the formal processes, automation and metrics that build toward Six Sigma, TQM or other major quality methodologies.

Selecting a partner

Achieving "built-in" quality is a journey best made with a guide. Whether solving immediate quality concerns or implementing a large-scale quality improvement initiative, working with a qualified partner offers tremendous benefit. The right partner brings the resources, expertise, tools and best practices to reduce risks, ensure that project objectives are met, and expedite successful adoption of the approved tools and processes. The market abounds with prospective quality-improvement partners, but a little research will show that their capabilities are not equal. To ensure optimal results, consider the following areas when evaluating partners:

Expertise

When embarking on a quality-improvement effort, there is no substitute for "Been there, done that!" An experienced partner knows how to optimally solve the toughest quality problems and how to avoid costly pitfalls and diversions. The perfect partner has a long track record of successful project delivery backed by certified quality specialists with in-depth knowledge of methodologies, tools and best practices. Knowledge of advanced techniques, such as continuous integrated testing or optimized testing, helps target improvement resources to the areas of highest benefit.

Right combination of components

Seek a partner with a full arsenal of quality-improvement tools. These components include methodologies to bring in processes and best practices, technology to automate quality assurance, testing and management tasks, expert resources to deliver the project and transfer skills, and solution roadmaps to guide execution. The ideal partner can provide all of the components needed for an effective improvement effort, ensuring depth of knowledge in the optimal use of each component and the highest degree of integration in the final solution. The partner should be willing to mix and match components to assure the best fit with project requirements.

Packaged and custom solutions

Every organization has different quality needs, but common themes prevail. The ideal partner will offer pragmatic solutions that address a broad range of quality objectives and delivery needs. These solutions should include assessment services to evaluate vulnerabilities and opportunities for improvement, resources to execute ongoing quality efforts, specialized packages to address production readiness and other recurring quality assurance needs, and improvement services to upgrade quality processes, implement quality methodologies and increase automation. The partner must be willing to customize solutions to meet specific needs. For example, delivery options should include experts to guide execution by internal employees, trained resources to perform the execution, up to full oversight and management of a QA function either on- or offsite.

Long-term vision, immediate results

As described in this paper, organizations receive the greatest benefit by building toward their final quality objectives through a series of efforts that provide immediate results while implementing progressive improvements to quality capabilities. To be successful, this approach requires a clear vision of the final objective and a roadmap to coordinate the individual projects as they move toward the vision. This vision may be as simple as achieving a targeted reduction in defect levels or as all-encompassing as achieving ISO 9001 certification, implementing Six Sigma or reaching level 5 in CMMI. Select a partner who is able to support, or help develop, the long-term vision, but also willing to identify and work on immediate, tactical quality efforts. Ensure that the partner produces a custom roadmap for accomplishing short- and long-term objectives and benefits.

Willingness to transfer skills

Unless fully assimilated by the organization's quality and development teams, efforts to achieve sustainable improvements in quality will fail as individuals revert to previous practices. Avoid

this risk by choosing a partner who will implement tools and formal processes to underpin its quality improvements and is committed to supporting that foundation through the transfer of skills and best practices.

How Micro Focus can help

Micro Focus Quality Solutions provide practical answers to a diverse set of short- and long-term quality needs. Using a unique blend of technology, expertise and best practices, our solutions drive sustainable gains in business value by addressing immediate demands while increasing the maturity and effectiveness of an organization's quality practices through automation, process improvements and knowledge transfer. Whether assessing security vulnerability, checking the production readiness of an ERP release or outsourcing testing management, our solutions generate tangible results quickly and effectively, reducing cost, risk and defect rates. Longer-term business benefits include higher productivity, increased customer satisfaction and closer alignment between IT and business objectives.

By Ian S. Hayes

Ian S. Hayes is founder and president of Clarity Consulting, Inc. (www.clarity-consulting.com). As an industry analyst and management consultant, he actively advises Fortune 1000 companies on enhancing IT value by better targeting IT investments, improving the effectiveness of IT execution, optimizing the sourcing of IT activities and establishing measurement programs that tie IT performance to business value delivered. Author of three books, he has chaired numerous industry conferences, and his articles have appeared in publications such as Business Week, Computerworld, Optimize, Information Week, AD/Trends, Enterprise Application Integration Journal, The Manufacturer, Software Magazine and the Cutter IT Journal.

To learn more about Micro Focus's Quality Solutions, visit: www.microfocus.com

About Micro Focus

Micro Focus, a member of the FTSE 250, provides innovative software that allows companies to dramatically improve the business value of their enterprise applications. Micro Focus Enterprise Application Modernization and Management software enables customers' business applications to respond rapidly to market changes and embrace modern architectures with reduced cost and risk.

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