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Moving Up the QA Maturity Ladder

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The QA Maturity Assessment approach involves interviews of key stakeholders to determine the current state of maturity. Analysts and QA leadership then develop a list of objectives that will align QA objectives with those of the parent company and bring it to higher maturity. Once the gaps between the higher and the existing maturity levels are determined, analysts provide a prioritized list of concrete actionable recommendations to bridge the gaps, and create a project schedule to achieve the higher maturity levels.

Increasing the efficiencies of QA practices is shown to provide more than 100 percent return on investment within the first three years. Add this to increased business opportunities, higher customer and employee satisfaction, and an overall boost in productivity, and the benefits of having a mature, optimized QA organization become invaluable.

“If you do not change direction, you may end up where you are heading.”

– Lao Tzu



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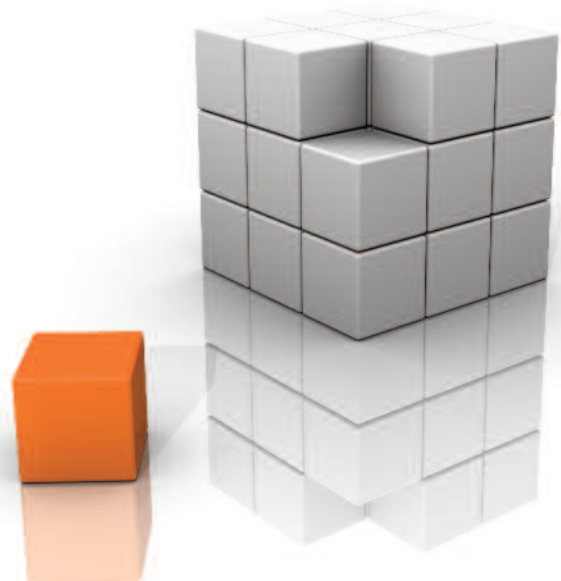
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White Paper: Moving Up the QA Maturity Ladder

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How Much Can a Bug Cost?

- **\$100** to fix a bug during QA
- **\$1,000** to fix one during beta testing
- **\$10,000** to fix a bug that a customer finds

See, e.g., Steven J. Vaughan-Nichols, "The Misery of Debugging," *SD Times* (October 15, 2003), <http://www.sdtimes.com/content/article.aspx?ArticleID=27456>.

Benefits of Mature QA

- Lower costs
- Greater efficiencies
- Greater productivity
- Higher quality
- Better customer satisfaction
- Better employee morale
- Measurable ROI

Introduction

As businesses continue to experience the expansion of software into nearly all their processes, their reliance on information technology (IT) continues to grow. In 2006 the MIT Center for Information Systems Research surveyed 103 U.S. and European companies and found that 34 percent of them have digitized all their core business processes.¹ This situation has forced the IT department to become more accountable and to align itself with its parent company's business needs, priorities, and objectives. In the past, IT departments functioned more or less independently from the rest of the company, but they are increasingly being asked to demonstrate the business value of many of their projects. This means that before an IT department begins a new project, it must consider all the consequences, especially what happens to costs if, as a result of inefficient quality assurance (QA) practices, it does not deliver a quality product.

On a larger scale, reports from the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) and the Sustainable Computing Consortium estimated in 2006 that software defects would cost companies \$300 billion. Compare this number to the mere \$600 billion invested in software and you feel the full impact of the cost of defects.² Further, an IDC study published in June 2008 reports that a staggering 40 percent or more of all software applications are released with one to ten critical defects.

QA in software development is absolutely critical to a project's success. Just ask Dr. Linda H. Rosenberg, chief scientist for Software Assurance for Goddard Space Flight Center, NASA. She credits NASA's mission success record to the agency's QA engineers.³ Even organizations without space missions can achieve real benefits from a mature QA environment. When an IT project finishes on budget and on time, which it does more reliably with mature quality assurance, it can translate to bottom-line profitability for the whole organization.

With so much riding on their software projects, IT departments are looking for ways they can improve the quality of their products. Many have found that undergoing a maturity assessment can help get them there.

¹ Jeanne Ross, Peter Weill, and David Robertson, *Enterprise Architecture as Strategy* (Harvard Business Press, 2006), 2.

² Susan Kunz, "Forget Time-to-Market: It's All About Time-to-Money," *SD Times* (August 15, 2006): www.sdtimes.com/SearchResult/29480.

³ Rosenberg, "What is Software Quality Assurance?" *CrossTalk: The Journal of Defense Software Engineering* (May 2002): www.stsc.hill.af.mil/crosstalk/2002/05/rosenberg.html.



What is a QA Maturity Assessment?

A maturity assessment is an objective evaluation of the QA department with the goal of moving it down the path to ever-greater efficiency. Because IT workers are already over-burdened, many IT managers outsource the maturity assessment to avoid creating even more pressure. An outside person can also bring a fresh perspective, extensive knowledge of industry best practices, and the experience to tailor this knowledge to the unique business objectives of the company.

The QA assessment, done right and with an adequate amount of executive support and departmental follow-through, provides tangible results. With a noticeably diminished defect count and a commensurate improvement in quality, productivity, and time to market, the company can experience a return on investment (ROI) of 100 percent or more.⁴ In this way, the cycle of continuous process and quality improvement begins.

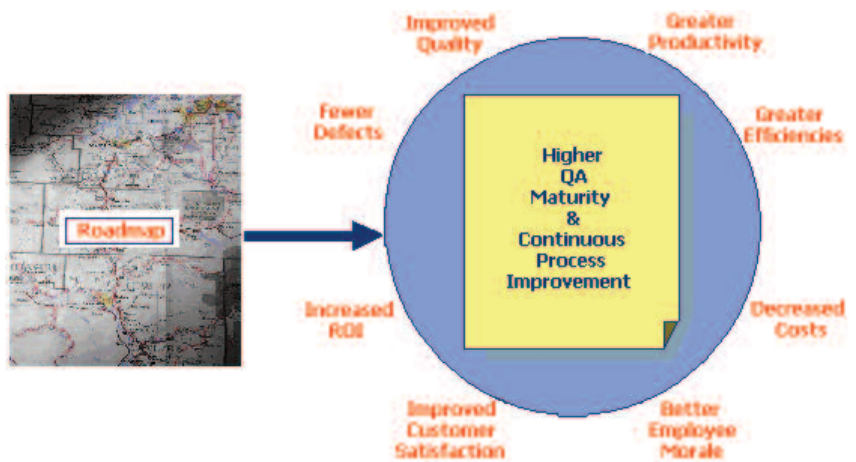
Five Capability Areas

- Process
- Tools
- Metrics
- Strategy
- People

Five Maturity Levels

- 1 – Ad hoc
- 2 – Repeatable
- 3 – Proactive
- 4 – Integrated
- 5 – Optimized

Figure 1: Roadmap to Efficient Quality Assurance



The QA Maturity Model and the Assessment Process

For the maturity assessment, which takes place in three phases, the analyst adheres to a model that describes five capability areas in the QA environment. Each area is divided into multiple components, which are in turn divided into multiple activities. (See Figure 2.)

⁴ See, e.g., Rolf W. Reitzig, "Calculating CMMI-Based ROI: Why, When, What, and How?" slide 9 (2006): <http://www.dtic.mil/ndia/2005cmmi/monday/reitzig.pdf>.



Figure 2: The Hierarchy of the Maturity Model

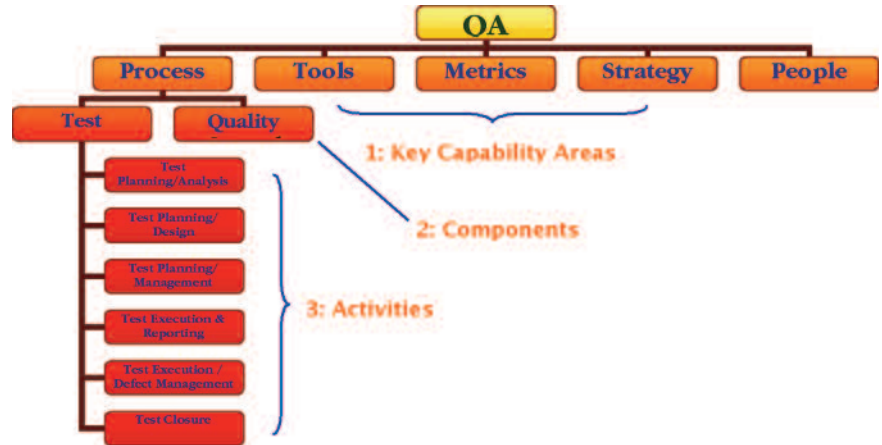


Table 1 shows the detail for one activity, **Test Execution and Reporting**, from one component, **Test Process**, in the capability area of **Process**, along with the criteria in each maturity level that must exist for this activity to be ranked at that level.

Table 1: Components and Activities

Component: Test Process				
Activity: Test Execution & Reporting				
Level 1	Level 2	Level 3	Level 4	Level 5
Ad hoc	Repeatable	Proactive	Integrated	Optimized
Test execution and reporting are not done according to any planned process or schedule. Success depends on the skills and attitudes of the testers. Testing is usually intertwined with debugging.	Test execution and reporting activities (e.g. executing test cycles, reporting progress, tracking time) are an integral part of QA, and are defined, documented, stored, communicated, and enforced. Daily status reports, test logs, defect logs, progress reports, etc., are created.	A single common test execution and reporting process is defined, and guidelines for tailoring this process for specific projects or organization units are established. Peer reviews of test execution and reporting work products occurs.	Test execution and reporting process performance results are consistently evaluated, and process improvements occur often. Reviews and inspections of the work products and deliverables are an integral part of the overall process.	Test execution and reporting process activities are optimized providing for consistent results, with a focus on defect prevention. Quality control based on quality measurement sampling techniques is incorporated.

See the appendix for definitions of all five capability areas and the five maturity levels.



Before actually beginning the assessment, the analyst works with QA leadership to determine the pain points experienced by the people working in QA as well as by executive management and the business and technical teams that interact with quality assurance. Are QA resources stretched too thin? Are there too many defects in the production system? Is customer satisfaction low due to poor quality software?

Armed with this information, the analyst and QA leadership develop a list of objectives that will align QA with the objectives of the parent company and bring it to higher maturity. These objectives guide the assessment throughout all three phases.

Phase 1: Current State Assessment

To figure out where you want to go, you have to know where you're starting from. In the first phase of the maturity assessment, the analyst systematically examines the existing QA environment, conducting a series of in-depth interviews and reviewing documentation.

Assigning Weights: Example

Say that Organization A is undergoing a QA assessment, and the analyst is in the process of evaluating the **Process** area. **Process** has two components: **Test Process** and **Quality Control Process**. The Test Process is somewhat more critical in the development lifecycle at this organization than is Quality Control Process, so the analyst assigns it a weight of **80 percent** and Quality Control Process a weight of **20 percent**.

At the end of this discovery period, the analyst modifies the maturity model by assigning weights to each component and to each activity within the components according to their importance in the organization. He or she then compares the findings to the descriptions in the maturity model and scores the discrete activities in each of the five QA areas and enters the scores into a maturity calculator. This calculator helps the analyst derive a weighted average score for each component. (See sidebar and Table 2.)

Table 2: The Maturity Calculator

Process Capability Area					
Components	Activities	Component Weight	Activity Weight	Activity Score	Component Score
Test Process		80%			2.95
	Test Planning/Test Analysis		15%	2	
	Test Planning/Test Design		20%	3	
	Test Planning/Test Mgt		5%	2	
	Test Execution & Reporting		30%	4	
	Test Execution/Defect Mgt		15%	4	
	Test Closure		15%	1	
Quality Control Process		20%			.4
	Peer Reviews		100%	4	

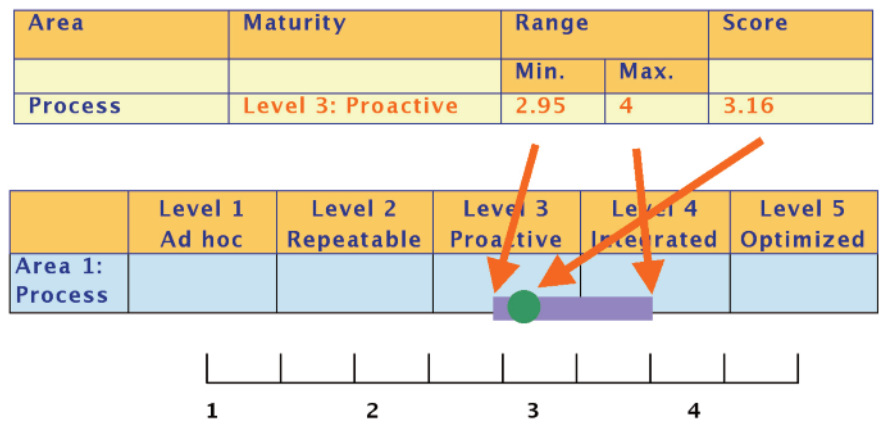


The formula for arriving at the component score (CS) is:

$$CS = \text{Sum}(\text{Activity Score} \times \text{Activity Weight} \%)$$

Figure 3 shows the maturity levels of the two components in the example as a range, spanning levels 3 and 4. (The lower of the component scores marks the lower end of the maturity range, while the higher marks the upper end.) The weighted mean, which in this case sits at **3.16**, determines the maturity level: **Level 3 Proactive**.

Figure 3: Deriving Maturity Level



Phase 2: Gap Analysis and Recommendations

Next, using the objectives worked up during the preliminary phase and looking at the current state of the organization, the analyst and QA leadership target the maturity levels that the capability areas can reasonably achieve within the given timeframe. Comparing the current state with this targeted future state puts the gaps between the two in clear relief. The analyst then makes specific, actionable recommendations for moving QA to a higher maturity level, basing these recommendations on industry best practices and modifying them to meet the specific needs of the organization.

Occasionally, some of the QA's capability areas may sit more than a level apart — for example, **Metrics** might be at Level 2 while **Process** is at Level 4. In these cases, the analyst takes a closer look. If the two areas are highly interdependent, as Metrics and Process are, then some of the earlier steps on the roadmap will be aimed at raising the capability area at the lower level up closer to that of the other area. For example, Level 2 Metrics would need to move to at least a Level 3. If the intention is to raise Process to Level 5, then Metrics would first have to move to Level 4.



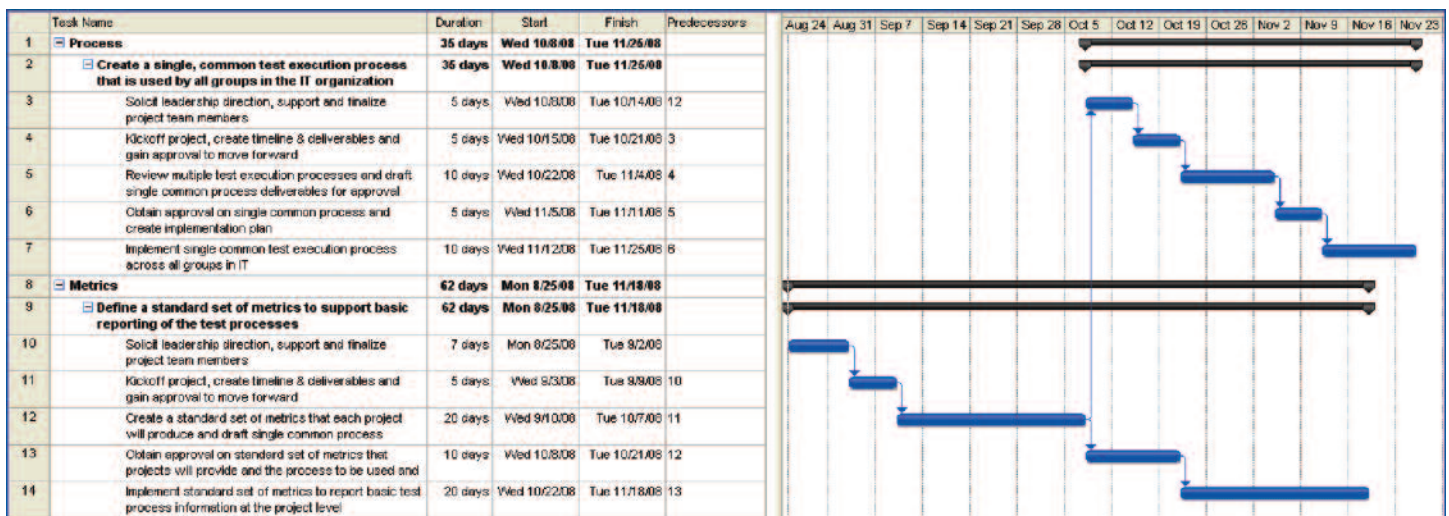
Phase 3: Roadmap

In the third phase, the analyst prioritizes the recommendations that came out of the previous phase, breaks them down into discrete tasks, and calculates the estimated efforts and costs to complete the tasks. The analyst creates a schedule of tasks with important milestones. In other words, the analyst creates the roadmap. It is this piece that helps QA move up the maturity ladder.

Because of interdependencies between capability areas — it is likely that one or several tasks for one recommendation must be completed before the tasks for another recommendation can begin — the ordering of tasks is critical.

Figure 4 illustrates the importance of this interdependence. This figure shows the roadmap for two recommendations that belong to the capability areas of **Process** and **Metrics**. The recommendations for these areas are listed on lines 2 and 9. Lines 3–7 and 10–14 are the detailed tasks required to accomplish the recommendations. Because this particular organization does not have a standard set of metrics in place yet to support basic reporting of test processes, **Metrics** tasks on lines 10, 11, and 12 must be completed before any of the tasks for the recommendation can begin.

Figure 4: The Roadmap





Conclusion

But how does the cost of the maturity assessment compare to the return on investment (ROI)? According to the results of several studies, the ratio of benefit to cost of organizations that moved up on the maturity scale ranges from 2:1 over 3 years to 2.5:1 over 1 year, with benefits amortized over less than six months. On average, these organizations reported a 20 percent reduction in project costs, 37 percent improvement in schedule, a 14 percent increase in customer satisfaction, a 62 percent increase in productivity, and a 50 percent increase in quality.⁵

Of course, improving quality can do more than reduce costs. Increased quality and productivity offer remarkable business opportunities. Time savings resulting from increased maturity free up resources to work on more productive tasks. Better quality products and faster time to market give the organization a significant competitive advantage. Customer satisfaction increases, while turnover and training costs decrease. Employee morale improves due to increased success, advancement opportunities, and more interesting work.

By ensuring that the QA department works efficiently using repeatable, effective processes, it will be able to achieve consistent results. The maturity assessment is a powerful tool that can help transform QA and help it to reach new heights.

⁵ See, e.g., Rolf W. Reitzig, "Calculating CMMI-Based ROI: Why, When, What, and How?" slide 9 (2006): <http://www.dtic.mil/ndia/2005cmmi/monday/reitzig.pdf>.



Appendix

Table A1: Key Capability Areas

Area	Definition
1 Process	The set of interrelated lifecycle activities that transform inputs into outputs. Examples are the test process and the on-boarding process for testing resources.
2 Tools	Various types of software that carry out particular testing process functions, such as test management, test data generation, or test execution.
3 Metrics	The set of measurement scales along with the method used for measurement. These together are the basis for measuring the effectiveness and efficiency of the testing processes.
4 Strategy	Test policy and strategic plan dictating the organizational structure and responsibilities, setting the operational approach, and defining the elements that an organization uses to provide delivery of consistent quality and value for the products and services they provide to their clients.
5 People	The defined jobs, roles, and responsibilities with the necessary testing competencies and capabilities to perform and support the QA processes defined by the strategy.

Table A2: Maturity Levels

Levels	Organizational Characteristics
Level 1: Ad hoc	A tendency to overcommit to their customers, to abandon what processes they have in times of crisis, and to be unable to repeat their successes with any regularity.
Level 2: Repeatable	Following their processes during times of stress most of the time. For example, these organizations have adopted test plans, employ risk management techniques, and monitor and control the test process throughout the project lifecycle.
Level 3: Proactive	Consistently achieving success with a standard QA process. They have created test organizations, view testing as a profession, and have begun to realize the need for quality control review processes as a critical component for overall quality management.
Level 4: Integrated	Having established quantitative objectives for both product quality and process performance. Quality control reviews and inspections of related work products have become part of the testing process, and quality is no longer seen as a task to do after development.
Level 5: Optimized	Being fully optimized with continuous focus on fine-tuning and on making process improvements as a matter of business course even if the original sponsors leave the organization. They practice defect prevention and quality control.



: white paper :

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