Cultivating Software Quality Engineers

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Abstract

How did you learn to be an effective SQA Engineer? Chances are, you didn't learn it in college. Recent graduates might have only a single class or a single lecture about software testing, with no mention at all of activities to prevent defects, enable development productivity, or deliver required product quality. If you're currently working as an SQA Engineer, you probably taught yourself.

This presents a clear challenge to companies needing to grow their SQA Engineering organizations. Few job candidates will have all the needed skills and experience when they begin, and hiring only senior-level SQA engineers is not sustainable. In addition, not all individuals interested in SQA will take the initiative to learn the necessary job skills on their own. Internal training programs can also be a risky investment if SQA Engineers have no incentive to stay with a company in an SQA role, or see an SQA Engineer job only as a stepping-stone to a career as a Developer, Project Manager or Scrum Master.

Cambia Health Solutions recently began a comprehensive program to grow SQA engineering capability and capacity. The initiative ranges from recruiting and cultivating interns interested in SQA, to offering training programs and coaching to newly hired and existing SQA Engineers, to providing a clear career path within SQA to keep people in the profession, help them advance in their careers, and ensure the company benefits from the investment made in them.

This paper presents several elements of the program, including training and coaching for SQA Engineers, developing new job descriptions and career paths, and partnering with HR and hiring managers to identify and qualify good job candidates. Examples of new employee onboarding, test automation training, and career path advancement will be reviewed. Integrating social media elements into the program is also discussed.

Biography

Tim Farley has 25 years experience in software quality assurance. He has led teams working on products ranging from critical medical devices to iPhone apps. For the past 10 years, Tim has focused on test automation, tools, and enabling software organizations to improve their predictability, productivity, and product quality. Tim first presented a paper at PNSQC in 1996 about creating "intranet" sites, which has since proven to be a pretty good idea.

Tim has degrees in Computer Science and Anthropology from Brown University.

1 Why Aren't There More SQA Engineers?

For most recent computer science graduates, software quality assurance (SQA) wasn't something they were taught in school. Unless they were in a specially tailored Masters program, testing and quality assurance may have been covered in a single lecture, or, if they were lucky, a single class on the subject. Their professors may have just assumed that their students picked up quality assurance and testing skills while completing programming assignments.

Some recent graduates may have had an internship that included software quality assurance and testing. Whether they completed their internships with a favorable view of SQA would depend largely on the assignments and mentoring they received. Interns that spent most of their time doing manual testing or were paired with manual tester mentors probably won't be interested in pursuing a career in SQA. Indeed, some may assume from this experience that manual test execution is all there is to SQA and that they want no part of it.

Many people have fallen into SQA accidentally because they were subject matter experts (SMEs) for the software being developed. While this can be extremely useful for functional testing focused on end user acceptance, it is not especially helpful for prevention-oriented software development activities, or for testing that is focused on software structure. These untrained SQA engineers may not consider enabling development productivity a part of their job and may only focus on final product validation for end users.

To ensure an adequate supply of capable SQA Engineers, companies will have to do more than hope that their staff have picked up the skills to do the job, or that their new hires are each willing to take the initiative to learn their craft. Companies need to start with college outreach to ensure candidates get the right impression about the profession, are given the right assignments during internships, receive the right onboarding when hired, and continue to receive the right training and promotions to keep them in a career in SQA.

2 Initiative to Create SQA Engineers

In 2013, Cambia Health Solutions began a comprehensive program to address this need. Cambia Health Solutions, the parent of a family of 25 companies focused on creating a customer-centered and sustainable healthcare industry, initiated several training programs to address the needs of current staff and new hires that may have gaps in their experience with software testing and quality assurance, and college interns that may be considering a career in SQA. The initiative also created a better-defined career path to keep trained staff in SQA positions, and provided opportunities to bring together SQA Engineers across the Cambia family of companies to share best practices, find support among their peers, and build a strong culture of quality.

2.1 Identifying the SQA Body of Knowledge

The initiative began by identifying the business needs for SQA and testing. The bulk of Cambia companies practice agile software development, in which responsiveness is a key enabler for efficient delivery. SQA Engineering staff members need to be active participants and collaborators throughout development to ensure errors are prevented and developers receive immediate feedback about their latest work. SQA Engineers need to have a variety of skills to be effective in this role, including the ability to write and understand code, define requirements, improve the testability of software solutions, develop quality and testing strategies, automate tests, and create and use metrics.

Based on these needs, the Quality Engineering & Specialized Testing (QUEST) team, the quality practices team that works across the Cambia family of companies, began identifying the body of knowledge (BOK) that SQA Engineers would need in order to participate effectively on development teams and meet development team member expectations. The BOK was assembled from a variety of sources, including:

- The experiences of QUEST team members
- Review of SQA Engineer BOKs from several sources, including IEEE, ASQ and ISTQB
- Review of SQA and testing professional certificate programs
- Review of SQA Engineering job descriptions from a variety of companies, including Amazon, REI, Microsoft, and Intel.

2.2 Aligning SQA Body of Knowledge with Job Descriptions

The QUEST team reviewed the current SQA Engineering job descriptions for Cambia. There were significant gaps in the skills, experience, and expectations for the family of SQA Engineering jobs based on the desired BOK. The progression from SQA Engineer I to II to III to IV seemed haphazard and in some aspects overly specialized, as if the job description had been written for a specific individual.

Anecdotally, this seemed to be affecting the decisions SQA Engineers were making about whether to remain in SQA Engineering roles. Being an SQA Engineer was often viewed as a stepping-stone to another career rather than a career in and of itself. After some time in the position, SQA Engineers would move out of SQA and into Project Manager, Scrum Manager, or Developer positions.

The QUEST team rewrote the SQA Engineering job descriptions to align better with industry standards, improve coherence with company needs, and provide a clear career path within SQA to keep skilled SQA Engineers within that role in the company. The career path was defined as:

- SQA Engineer I – Beginner. No experience in software testing or quality assurance. Cambia expects to train you to do the job.
- SQA Engineer II – Competent SQA professional with broad knowledge of SQA and testing methods, tools and processes. Typically at least 3 years experience.
- SQA Engineer III – SQA Project Leader able to create, manage and execute software quality and testing strategies. Able to coach/mentor other SQA Engineers and continuously improve processes. Typically at least 5 years experience.
- SQA Engineer IV – SQA Enterprise Leader able to identify new business opportunities, initiate improvements and innovate across multiple project teams and Cambia companies. Typically at least 7 years experience.

Cambia Human Resources and the Compensation Committee reviewed and approved the revised job descriptions, then presented them to the Cambia Leadership Team.

QUEST team management reviewed the new job descriptions with each development team manager to ensure that they understood the intent of the new positions and how the new positions supported a defined career path. The QUEST team also recommended that each manager work to define training goals and career objectives for each of their SQA Engineers based on the new job descriptions and career path. The intent was not to have managers identify and demote SQA Engineers that were not performing to new job requirements, but to address skills gaps and ensure continued growth in the profession.

2.3 Identifying Training to Support SQA Career Path

The QUEST team identified the training needed for SQA Engineers at each job level so that SQA Engineers could remain effective in their current positions and acquire the skills and experience needed to advance to the next SQA Engineering position. Since each position builds on the knowledge and

experience gained in the previous one, it was clear that some foundational training would be required for everyone working in an SQA role. This would ensure that all SQA Engineers have the same understanding of essential concepts and terminology that they could build upon while furthering their careers.

Creating a comprehensive training program was larger than the QUEST team could accomplish on its own within the time available. The QUEST team numbered only 6 at the time, and development of the training materials was only one of many quality practice initiatives being driven by the team. In order to be successful, the QUEST team needed to prioritize which training materials could be provided by 3rd party vendors and which needed to be developed in-house because of their focus on Cambia-specific practices.

During the development of the Cambia SQA Engineer BOK, the QUEST team became familiar with the SQA Engineer certification programs offered by several organizations. The QUEST team reviewed the content of these certification programs against the Cambia BOK and business priorities to see if any of the certification training programs could be used to provide basic SQA training. This would allow the QUEST team to focus on the Cambia-specific practices. There were differences in what was covered by the various certification programs.

- Some programs emphasized auditing
- Some programs emphasized compliance with government and regulatory requirements
- Some programs emphasized only specialized testing, such as security or reliability

In the end, the QUEST team selected the International Software Testing Quality Board (ISTQB) Software Testing Foundations certification training offered by Skillsoft. It covered the essential skills with an emphasis on testing. The QUEST team would then fill in the gaps for newer methodologies, tools and processes, such as Test-Driven Development (TDD) and scrum. SQA Engineers could take the classes online at their own speed, or participate in weekly QUEST-led classroom sessions that included reviews of course content and discussions of additional examples.

Taking the exam for certification was left to individuals to decide for themselves. For Cambia, the top priority was that all SQA Engineers acquire a common body of knowledge. Becoming certified SQA Engineers was not required. For those interested in attaining the certification, the QUEST team offered to pay the certification exam fee for the first 20 individuals that completed the training. Otherwise, completion of training would be tracked as part of individual performance objectives for each SQA Engineer.

2.4   Building Management Support

QUEST team management met with the managers of all Cambia development teams to ensure that they understood the requirements for the new SQA Engineering job descriptions and the expectation that all SQA Engineers complete the ISTQB Software Testing Foundations course by the end of 2014. Development managers were encouraged to include completion of the training in the yearly performance objectives for their SQA Engineers. QUEST monitored participation in and completion of the training through onsite class attendance and Skillsoft reporting.

QUEST team management also met with HR and executive management to ensure that training could be completed during regular working hours and to establish the expectation that acquiring new and needed skills was part of the job. The QUEST team scheduled training sessions at a variety of different times, including at lunch and towards the end of the day, to minimize the impact on project schedules.

2.5   Creating a Common Foundation for SQA Engineers

2.5.1 ISTQB Software Testing Foundations

All SQA Engineers and SMEs involved in customer acceptance testing received Skillsoft accounts for ISTQB training. The QUEST team scheduled weekly onsite and online training sessions to review the ISTQB training videos. These sessions typically ran one hour. Though the Skillsoft training runs about 14 hours in total, the QUEST training sessions ran significantly longer due to the added discussions, company-specific examples, and supplemental topics, including TDD and scrum.

2.5.2 Onboarding

Another major component of the training program was to establish a common understanding of fundamental software testing and quality assurance concepts. This was accomplished through a more formal onboarding process for SQA Engineers. Onboarding, which had previously been left up to the individual companies and development teams to plan and execute, would now be a repeatable process with defined content and learning objectives. While targeted at new employees, the QUEST onboarding program was also used to train existing SQA staff. The topics covered were specific to Cambia and helped to establish the "Cambia way of the working" in the minds of the SQA Engineers. Topics included:

- Software Quality Assurance & Testing
- Agile Team Participation for SQA
- Metrics for SQA
- Tools for SQA

The *Tools for SQA* onboarding session focused on the use of Rally for workload, defect and test management throughout Cambia.

Onboarding sessions typically ran 90 minutes and featured several in-house developed 3-5 minute videos to explain key concepts. Discussion questions were developed for each concept, with the discussion led by QUEST team members. While most onboarding session were open to anyone, some special onboarding sessions were requested so entire teams could attend and target the discussions to their particular projects, processes, and problems.

2.5.3 Programming Proficiency

While new SQA Engineers were required to be programming proficient, it was not the case for existing SQA Engineers. Many had no programming skills or even an appreciation for how software worked. This prevented these engineers from participating fully in test automation efforts or participating in conversations with Developers about the impact of software changes, design for testability, and regression testing. This lack of programming proficiency would also hamper their efforts to advance their careers in SQA.

The QUEST team began addressing the programming proficiency gap by introducing a series of training courses focused on automated testing. Using FitNesse as the test automation platform, the QUEST team was able to introduce automated testing concepts to non-technical SQA staff and provide a transition from manual testing to automated testing. The series advanced from basic automated test design, to writing test cases, to creating automated tests, and finally to creating the underlying fixture code that implemented the automated tests. The QUEST team also developed several reusable fixture frameworks that allowed teams to engage in automated testing and become programming proficient starting with very little technical knowledge.

Each programming proficiency class ran 90 minutes. This allowed for a reasonable amount of content to be delivered, and also minimized project disruptions and made it more likely that SQA staff could attend. Survey Monkey was used to collect feedback from participants to ensure that the right content was being

delivered at the right pace, and that SQA Engineers were learning something that could be applied immediately to their jobs.

2.5.4 Getting Started Guides

The QUEST team also developed a series of Getting Started guides to supplement the more formal training sessions and allow SQA Engineers to continue to learn at their own pace. Each Getting Started web page focused on a specific topic and provided:

- Installation & Setup Instructions
- How To Instructions
- Contacts for Further Help
- Related Topics List

The QUEST team developed content for over 30 Getting Started topics, including: Git, Jenkins, Maven, JMeter, Selenium, FitNesse, Automated Testing, Regression Testing, and Quality Strategy Development.

The Getting Started web pages were implemented in SharePoint, and while not implemented as true Wikis, the pages and their content were treated as such and were updated frequently by QUEST team members and other SMEs across the Cambia family of companies. In addition to the Getting Started pages, the QUEST web site also includes templates, examples, recorded training sessions, and a training schedule calendar.

2.5.5 Best Practice Exchanges, Meetups & Quality Town Halls

The QUEST team also worked to establish support structures for the approximately 100 SQA Engineers across the Cambia family of companies. There is no centralized SQA team at Cambia. All SQA Engineers are members of project development teams at each of the separate companies. While some Cambia companies are large with many SQA Engineers, others are small startups with perhaps only a single SQA Engineer for the entire company. Making sure that these individuals felt supported in their efforts to grow their skills was an essential part of the program.

The QUEST team created new Best Practice Exchanges (BPEs) and Meetups focused on SQA, Testing, QA Lead Practices, Continuous Delivery, JMeter and FitNesse. These teams met anywhere from once a week to once a month, and were in addition to the weekly ISTQB and Onboarding sessions. The QUEST team also hosted quarterly QA Town Hall meetings where SQA Engineers from across all the companies could meet and discuss a single topic, such as training or metrics, with a series of speakers, exercises, and discussions.

Together, these provided a solid base for supporting SQA Engineer I and II staff. Support for SQA Engineer III staff included more peer support and coaching for SQA Managers, SQA Project Leads, and specialists in performance testing and test automation. QUEST team members paired with SQA Engineers to provide training, work through problems on their projects, and create quality and testing strategies and test automation solutions. The QUEST team also created space in their team area to co-locate project SQA Engineers learning test automation tools, programming languages and project planning.

2.6   Intern Outreach & Hiring Support

Cambia participates in the PDX Cooperative Education Program (PCEP) supported by Portland State University. This program cycles participants through 4 six-month internships at 4 different companies in at least 3 different positions (Development, SQA, and Operations). The QUEST team participated in recruitment fairs, interviewed internship program candidates, and hosted interns on the QUEST team. QUEST team management also met with other PCEP interns working in SQA positions throughout Cambia to talk to them about their experience and aspirations, and present a positive image of SQA Engineering as a career.

The QUEST team worked with Human Resources to screen, interview, and recommend skilled SQA Engineer candidates. The QUEST team provided questions for non-technical staff to conduct initial phone screens of SQA Engineers. The QUEST team also interviewed SQA Engineers for project teams, including project teams hiring their first SQA Engineer.

The QUEST team hopes that these efforts will help to minimize skills gaps by ensuring that qualified candidates are recognized, approached, and hired for full time SQA Engineering positions.

3 Impact

It is still early to measure the impact the initiative has had across the Cambia family of companies. However, there has been significant participation in the program since its start in February of 2014:

- Over 100 SQA Engineers have registered for ISTQB training through Skillsoft.
- Over 50 SQA Engineers have participated in weekly ISTQB training sessions.
- Over 75 SQA Engineers participate in at least 1 regularly scheduled BPE meeting.
- Over 40 SQA Engineers have participated in at least 1 Programming Proficiency class, with most taking several classes in the series.
- Most SQA Engineer job posting reuse language and requirements from the Cambia SQA Engineer Job Family Descriptions.
- QUEST team members have participated in screening and interviewing job candidates for positions across the Cambia family of companies.
- QUEST has provided Human Resources with initial screening questions for SQA Engineering candidates.

The QUEST team is currently establishing metrics to track whether this level of participation translates into more capable SQA Engineers that remain in SQA roles at Cambia companies.

4 Future Work

4.1 SQA Engineer IV Training & Support

Most of the training and coaching to date has been focused on supporting SQA Engineer I, II and III staff. The QUEST team saw this as having the greatest potential impact. The QUEST team expects to expand the focus of the initiative to SQA Engineer IV staff in 2015.

4.2 Accelerated Onboarding

The QUEST team is considering combining several onboarding sessions into a day long *Boot Camp* to quickly bring new SQA Engineers up to speed. A day long programming proficiency *Boot Camp* may also be created. The QUEST team is assessing the need for accelerated training for non-SQA Engineers that are engaged only in customer acceptance testing.

4.3 Social Media Engagement

The QUEST team is investigating using social media to provide support and motivation to SQA Engineers. Hubbub, part of the Cambia family of companies, provides gamification services to help motive people to lead healthy lifestyles. This includes joining teams to find support for completing activities, competing against other teams, and receiving reminders of goals and progress. The same service could be used to help motive SQA Engineers to complete ISTQB training, complete the programming proficiency series of classes, or attend BPE meetings. Rewards could also be incorporated to increase motivation.

The QUEST team may also post training videos for SQA and testing concepts to social media sites like YouTube. Creating a training concept channel on YouTube would help self-select SQA Engineering candidates and establish in their minds that Cambia is a company with a commitment to software quality matching theirs. Over time, this could increase the flow of qualified candidates to the Cambia family of companies.

Content created for the QUEST team web site for weekly topics and weekly quality quotes may also be made available to other companies as a service. This too would help to establish the Cambia brand for software quality, build common knowledge of fundamental SQA concepts and practices, and ultimately increase the number of qualified candidates interested in working at Cambia.

4.4   Self-Study

While many SQA Engineers read blogs about SQA and testing, they are not as engaged in reading books and technical journals. The QUEST team is investigating several options to engage SQA Engineers in reading to learn more about their craft, apply lessons learned from others, and broaden their knowledge of the field. Options include:

- Continuing to populate the Cambia Technical Library with physical books and journals.
- Replacing physical books and journals with e-readers.
- Offering Safari Books Online accounts to all SQA Engineers
- Offering access to the IEEE Digital Library to all SQA Engineers

Currently, the QUEST team only offers reading lists and recommendations through their web site, with links to purchase personal copies of books and reprints of articles.

4.5   University Partnership

The QUEST team may investigate partnering with Portland State University for the creation of a continuing education SQA and testing certificate program. Such programs have been successful for the University of Washington and Bellevue College in the Seattle, WA, area with programs focused on supporting Microsoft and other companies needing SQA Engineers experienced with .Net and C#. The QUEST team may also investigate partnering with Portland State University to create an SQA track within the computer science undergraduate or Masters degree programs.

4.6   Program Metrics

The QUEST team is creating several baselines against which program progress can be measured, including:

- SQA Engineers Engaged in Creating Automated Tests
- Projects Meeting Milestone Requirements for SQA Deliverables
- Projects Meeting Test Case Management Requirements
- SQA Engineers with Defined Career Path Objectives
- SQA Engineers Transferring from SQA Engineering Jobs
- SQA Engineers Participating in Best Practice Exchanges

The QUEST team will chart the trend for each of these over the next several years using a combination of surveys, queries of our test management systems and automated test repositories, and collaboration with Program Management and Human Resources. The QUEST team will also track the cost of ensuring adequate SQA Engineering staff for the Cambia family of companies, including:

- Cost of creating and delivering training
- Cost of building communities of practice
- Cost of developing, enhancing and supporting SQA career paths, and interviewing and hiring practices

The QUEST team will also work with SQA Engineers and their managers to determine whether these efforts have had any unintended side-effects, including demotions, unexpected transfers from SQA Engineering positions, and any changes in the frequency of SQA Engineering promotions.

5 Conclusion

Ensuring sufficient SQA engineering capability and capacity is essential to the continued growth of the Cambia Health Solutions family of companies. This can only be ensured by actively working to attract the right candidates, train them well, and provide a clear career path that keeps them SQA. Cambia has created a comprehensive program to increase the likelihood that qualified SQA Engineers will choose to work at Cambia, will learn to be competent SQA Engineers by working at Cambia, and will choose to stay with Cambia because of their growth potential in the profession.

The program includes training, peer and management support, and the overall development of a culture of quality that recognizes the value of outstanding SQA Engineers. It leverages 3rd party as well as in-house developed training to provide a solution tailored to the specific needs of the business. And it recognizes the good work of SQA Engineers across the Cambia family of companies to encourage others to strive to emulate their success.

This is how Cambia Health Solutions grows SQA Engineers.

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