



Enhancing Software Quality Using Quality Assurance Practices in the Project Life-Cycle

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Abstract: Due to the widespread acceptance, and use of software systems in various areas like ecommerce, banking, medical etc software bugs are proving to be costly and sometimes fatal. To avoid software bugs Software Quality Assurance (SQA) involves in the entire software development process - monitoring and improving the process, making sure that any agreed-upon standards and ensuring that problems are found and removed. . This paper emphasizes the importance of Software Quality Assurance in the product life cycle and also discuss how it improves the Software Quality.

Keywords: SQA, Black Box Testing(BBT), White Box testing(WBT).

1. Introduction

Achieving a high level of product quality is the prime objective of every organization & Quality can be defined as characteristic or attribute of something. By attribute, we mean something which we can measure and compare it with some known standards. Functionality, Portability, Usability, Reliability, Maintainability & Efficiency are the Quality attributes of software

- **Functionality:** Functionality is defined as the required functions available in the software.
- **Portability:** Portability is how easy is to transfer the software to another environment.
- **Usability:** Usability is how easy to use the software.
- **Reliability:** Reliability is the ability of software to function under given environmental conditions for particular amount of time by taking into account all precisions of the software.
- **Maintainability:** Maintainability is how easy to modify the software.
- **Efficiency:** Efficiency is how efficient is the software.

Objective of this paper is to outline the Quality Assurance activities for enhancing software quality.

2. Software Quality Assurance

Software Quality Assurance as a planned and systematic pattern of actions necessary to provide adequate confidence that the item or product conforms to established technical requirements[1]. SQA does this by checking that:

- Plans are defined according to standards;
- Procedures are performed according to plans;
- Products are implemented according to standards.

Software Quality Assurance is more challenging than Software Testing because solving problems is a high-visibility process while preventing problems is a low-visibility process. During Software Testing we know what the problem is and we are trying to fix the problem, which is easier than preventing the problem before it occurred.

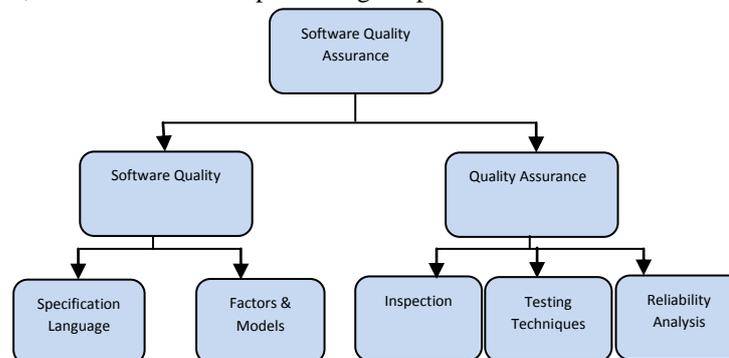


Fig 1 Software Quality Assurance

3. Role of SQA staff

Persons involved in SQA staff are: Software engineers, project managers, customers, sale people etc

Role of Engineers involved in Quality Assurance work:

- apply technical methods and measures
- conduct formal technical review
- perform well-planned software testing

SQA staff should concentrate on those items that have a strong influence on product quality. They should check as early as possible that the:

- Selection of an appropriate life cycle.
- Development team members have defined tasks and responsibilities.
- Documentation plans are implemented.
- Documentation contains what it should contain.
- Documentation and coding standards are followed.
- Standards, practices and conventions are adhered to.
- Metric data is collected and used to improve products and processes.
- Reviews and audits take place and are properly conducted.
- Tests are specified and rigorously carried out.
- Use appropriate tools, techniques and methods.
- Software is stored safely and securely.
- Proper records are kept of all activities.
- Staff are properly trained.
- Risks to the project are minimised.

4. Architecture of SQA

SQA Component	Activities
1. Planning from the project initiation and planning stage	<ul style="list-style-type: none"> • Review and plan the project in its entirety • Create the QA plan
2. Management of the Project lifecycle activities and components	<ul style="list-style-type: none"> • Create a defect removal and defect injection prevention
3. Refactoring the Management of all SQA components	<ul style="list-style-type: none"> • Instigate Software Quality improvement

5. Quality Assurance Activities

Following are the activities of Quality Assurance:

5.1 Formal Technical Review

Cost of defect fixing after the release of the product is around 60-100x & the Purpose of conducting review is to minimize the defect ratio as early as possible in Software Development life cycle. In Review artefacts of software product (Technical specifications, designs, source code, user documentation, support and maintenance documentation, test plans, test specifications, standards etc) are examined by project stockholders, user representatives, or other interested parties for feedback or approval. Review can be formal or informal. Informal reviews are referred as walkthrough and formal as Inspection.

Walkthrough: Method of conducting informal group/individual review is called walkthrough, in which a designer or programmer leads members of the development team and other interested parties through a software product, and the participants ask questions and make comments about possible errors, violation of development standards, and other problems or may suggest improvement on the article, walkthrough can be pre planned or can be conducted at need basis and generally people working on the work product are involved in the walkthrough process.

The Purpose of walkthrough is to:

- Find problems
- Discuss alternative solutions
- Focusing on demonstrating how work product meets all requirements.

Roles in a walkthrough:

Leader: who conducts the walkthrough, handles administrative tasks, and ensures orderly conduct.

Recorder: who notes all anomalies (potential defects), decisions, and action items identified during the walkthrough meeting.

Author: who presents the software product in step-by-step manner at the walk-through meeting.

Advantages of Walkthrough:

- Senior people get new ideas and insights from new people.
- Improves Quality
- Enables observation of different approaches to software analysis, design, and implementation. Reduces risk of discontinuity & useless code since several people become familiar with parts of software that they may not have otherwise seen.

Disadvantages of Walkthrough:

- Meetings can be extremely time consuming and can be hard to manage when participants are separated by many time zones.
- There is real lack of diversity in any code walk-through with the author driving the process.
- Walk through tend to be rather shallow with little time allowed to look for the more subtle problems within the code.

Inspection:

An inspection is a formal, rigorous, in-depth group review designed to identify problems as close to their point of origin as possible. Inspection is a recognized industry best practice to improve the quality of a product and to improve productivity, Inspections is a formal review and generally its need is predefined at the start of the product planning.

The objectives of the inspection process are to

- Find problems at the earliest possible point in the software development process.
- Verify that the work product meets its requirement
- Ensure that work product has been presented according to predefined standards
- Provide data on product quality and process effectiveness
- Inspection advantages are to build technical knowledge and skill among team members by reviewing the output of other people
- Increase the effectiveness of software testing.

Inspection Process

Following are review phases:

- Planning
- Overview
- Preparation
- Examination meeting

Roles in an Inspection

Leader: The inspection leader shall be responsible for administrative tasks pertaining to the inspection.

Recorder: The recorder should record inspection data required for process analysis.

Reader: The reader shall lead the inspection team through the software product in a comprehensive and logical fashion.

Author: author plays the following roles:

- The author shall be responsible for the software product meeting its inspection entry criteria
- For contributing to the inspection based on special understanding of the software product.
- Performing any rework required to make the software product meet its inspection exit criteria.

Inspector: Inspectors shall identify and describe anomalies in the software product.

Advantages of Inspection

- Most programs run correctly first time after inspection.
- Error reduction by a factor of 5.
- Improvement in productivity by 14% to 25%.
- Percentage of errors found by inspection is 58% to 82%.
- Cost reduction of 50%-80%.
- Increased morale, reduced turnover.
- Better estimation and scheduling (more knowledge about defect profiles).
- Better management & recognition of staff ability.

Disadvantages of Inspection

- Examines a product once its author has finished it.
- Focus on small part of a design, not the whole thing.
- All reviewers must agree on the result.
- Enough people so that all the relevant expertise is available.

5.2 Control of Change:

SQA provides formal management of changes to the software and documentation.

Need of Control on Change:

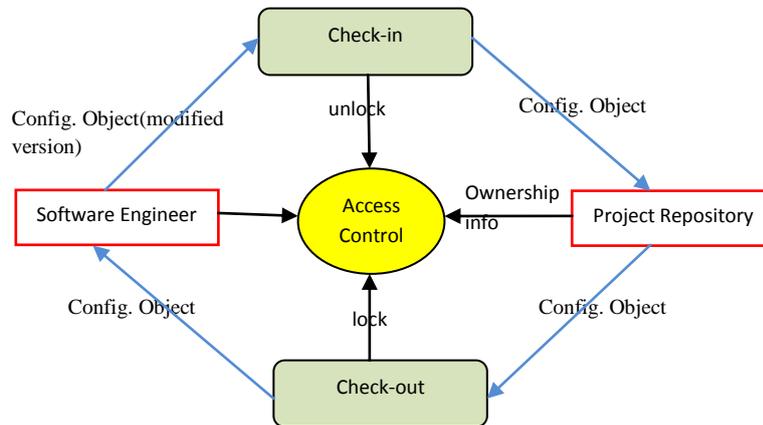
- Manage the structure of a software system over its lifetime
- Bring order to the chaos of continually evolving software systems.

Change committee includes

Senior Developers & Engineers.

- Determines desirability of a change
- Detect conflicting/overlapping changes.
- Estimate the cost & impact of changes.
- Schedule changes relative to software releases.
- Tracks the change process.

Access & Synchronization control



Access control ensures the software engineer is authorized to check out & synch. Control locks the object at check-out & unlocks at check-in.

Benefits of Control on Change

- Prevent unauthorized access to assets.
- Coordinate, track and manage change activities.
- Account for and report the progress of development efforts.
- Ability to deliver revisions, updates and cross-platform versions, faster.
- Improved customer satisfaction.
- Less time wasted fixing old code.
- Confidence that each release addresses all the requested changes.

5.3 Software Testing

Testing is the process of detecting errors by running the actual software and verifying that it works as it should. It is by far the most popular QA activity.

Need of Software Testing

Formal technical reviews are cheaper and more effective than testing, but are often ignored.

Effective testing lies in intelligently choosing the relatively few test cases that will actually be executed

- Test all requirements and features defined in the requirements spec. and functional spec.
- Focus on scenarios that users are likely to encounter in practice.
- Test cases should not be redundant.
- Analyze the program's design and code to find potential weak areas.
- Analyze all points at which data enters the system and look for ways to attack it.

Approaches for test case design are generally divided into two broad categories:

Black Box Testing

The tester has limited knowledge of the inner workings of the item being tested & Test cases are based on the specification of the item's external behaviour.

White Box Testing

The tester has knowledge of the inner workings of the item being tested & Test cases are based on the specification of the item's external behavior & knowledge of internal implementation.

5.4 Record Keeping & Reporting

- Collect outputs & reports of SQA activities.
- Disseminate reports to software managers.

- Maintain archive of SQA reports.
- Maintain log of software development activity (especially testing) to satisfy legal requirements.
- Maintain institutional memory of the software development effort.

6. Advantages of SQA

Following are some advantages of SQA:



Fig 2 Advantages of SQA

7. Conclusion

Software development is complex and is error prone. Many problems that are faced during software development can be tackled, by adopting Quality assurance practices in the product life cycle. Software Quality Assurance as a planned and systematic pattern of actions necessary to provide adequate confidence that the item or product conforms to established technical requirements. Software Quality Assurance is more challenging than Software Testing because solving problems is a high-visibility process while preventing problems is a low-visibility process. Software Quality Assurance activities used in product life cycle for improving software quality are Formal Technical Review, Control on Change, Software Testing, Record Keeping etc. SQA activities in the product cycle Provide Feedback, Monitor & Maintain Standards, Evaluate Performance level etc.

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