Quality Assurance Process for Web Applications

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ABSTRACT- *The purpose of this paper is to introduce the quality assurance process for developing web applications. Web Applications have grown tremendously during the past decade or so. Development of web applications seems similar to traditional software development, however, methods and tools for testing web applications usually lack and as a result, quality of a web application is highly impacted. This paper focuses on quality assurance metrics and then discusses the quality assurance process for web applications.*

KEYWORDS- Quality Assurance, Quality Metrics, Functionality Testing, Usability Testing, Interface Testing, Compatibility Testing, Performance Testing, Security Testing, Performance Measures

I. INTRODUCTION

Use of computers and internet has grown tremendously in the recent years. This tremendous growth has resulted in increase of a service that we use over the internet known as WWW. Today, businesses from all fields rely on web applications for their day to day operations. Therefore, it has become more important that the data that those businesses have is secure, free of errors and above all, the web application is fully functional and should run 24 hours a day, 7 days a week, and 365 days a year. To ensure this, development of web applications need to go through a process which we know as quality assurance. Quality assurance techniques must be applied to each and every web application so that it remains fully functional even during critical hours. This challenge is difficult to meet in today' world because unlike software, web applications need to change over time in order to meet customer demands. Not only customer demands are coped with, but changing platforms also need to be taken care of during development. Another challenge is that for web development, developers usually get less time as compared to desktop software.

The purpose of writing this paper is to review software quality assurance techniques for development of Web Applications. We will start with introduction of Web Applications. After that we will discuss different quality assurance techniques by use of which we can get quality web application.

II. RELATED WORK

Several studies have been done regarding quality assurance of web application. Filippo Ricca et. al [7] have described testing techniques for web applications in their paper. For web applications, they described techniques such as page testing, hyperlink testing, Definition-use testing, All-uses testing, and All-paths testing. Qasim [2], in his study, has tested an online dictionary for quality assurance. He gave input wrong words to website and checked if the website can figure out the correct word. Saleem et. al [3] have done a literature review of quality assurance procedures for web services. Nikfard et. al [8] have discussed different testing approaches of web applications in their study. Di Lucca et. al [9] also discussed testing approaches for web applications in their study. They discussed and proposed a test model for web application. They discussed test strategy for client pages, server pages. Integration test strategy was also on the cards.

III. WEB APPLICATIONS

Before diving into main topic of quality assurance process of web applications, we take a brief look at the definition of web application. Any application that requires a web browser for interaction is termed as web application [1]. Web applications may be a simple game as well as a complex application such as Spreadsheet program. One benefit of a web application is that the client doesn't need to install the software on its end in order to run the application. Client only needs a browser to access it.

IV. WHAT IS QUALITY ASSURANCE

Before discussing quality assurance techniques for development of expert systems, we need to arrive at the definition of quality assurance. According to the model known as Deming's Triangle (1981), the quality is measured by following three participants.

i. The product itself
ii. The user, how he or she uses, installs, and maintains the product and what he or she expected from the product
iii. Instructions for use, training (both user and repairer), warranty, services provided along with product and availability of its parts.

Some of above mentioned participants don't fit with the web application domain e.g. availability of parts, however most of them do.

V. QUALITY METRICS OF WEB APPLICATION

The quality metrics of web applications are given below [2] [3].

Reliability: A web application is not trusted if it does not produce consistent results. It means that the application must not fail if it is tested time and again. In an ideal situation, the application must be one hundred percent free from failure. Authors view, test results and operation description of the tool form basis for evaluating reliability.

Compatibility: It is the measure of the ability of the tool to operate on different platforms and Operating systems etc. For increasing the quality of the software it is necessary that the tool is compatible with different platforms and CPU architectures.

Efficiency: A system is thought to be efficient if it has ability to use its resources sensibly. It means that if the system takes too much space on hard disk or takes too much time to perform an action, it won't be considered efficient. Performing its task with minimum usage of resources is the key characteristic of an efficient system.

Interoperability: It measures the extent to which a system is able to communicate with other systems. Coordination with external systems is very much necessary for successful exchange of information with other systems.

Code maintainability: This parameter measures how much flexible the code of the tool is for correction of defects or changing it. Code maintainability is too much important and for doing this it is necessary that the code has been properly documented. Moreover, consistent programming language and code standards must be adopted to achieve code maintainability.

Effectiveness: It measures the extent to which a tool is able to measure and report the defects in web application. A tool will be considered if it produces the desired results.

Complexity Measures: By complexity measures we mean the degree to which a tool is able to measure the complexity of a web application.

Performance Measures: In performance testing, the test tool evaluates the tasks performed by web application. Here, the web service is tested on the basis of its performance and response

Traceability: This parameter depends on tracing the requirement throughout its life i. e from its specification to its development, deployment and use. It tells everything about the requirement like its purpose and the factors on which the requirements depend.

Performance: In web applications, performance plays an important role in web applications as the success of the entire application depends on it.

Security: The security implementations of a web service determine how successful the application is. This is the factor, if ignored can cause serious damage to the users and business.

Ease of use: This factor affects the web applications in a sense that it helps its clients to give a friendly interaction. Complicated and difficult web applications usually negatively affect the applications and are not able to win a positive feedback of its users.

SE optimization or page strength: Another quality metric for quality assurance is about the page rank in the popular search engines. It is necessary to increase the page rank of website so that search engines provide link to your website at the top of search results. This will help boost the business.

Portability: A good web application is able to perform its job on different devices without having effects on its performance. The more familiar it is, to different computing environments, more frequently will it be approached by its users.

VI. QUALITY ASSURANCE PROCESS OF WEB APPLICATIONS

Quality assurance of web applications revolves around the testing of six areas which are Functionality Testing, Usability Testing, Interface Testing, Compatibility Testing, Performance Testing, and Security Testing.

Functionality Testing: To ensure that web application is fully functional is all aspects, we need to check the following.

Table 1 Areas to check while testing functionality

Links	Outgoing links
	Internal links
	Links that go to another section on same pages
	Orphan pages
	Checking for broken links in all above mentioned links
Forms	Check all validations
	Check Default Values
	Wrong input
	Links for update form, edit form, delete form, etc. (if any)
Cookies	Cookies are encrypted or not?
	Check application behavior after deleting cookies

Database	Check data integrity while editing, deleting, and updating forms
	Check if data is being retrieved and updated correctly

Some tools such as Selenium, Windmill, and twill [4] can be used to check functionality of web application.

Usability Testing: Usability refers to how much easy a user feels while using the web application. In order to test usability, navigation, content and any other thing that might help the user in some way should be checked. Dark colors should be avoided as they don't help the user in any manner. Images and other non-text things should be properly placed so that they don't distract user. "Contact us" and "Search" should be placed at a prominent place so that user can find them easily.

Interface Testing: Main interfaces in a web application are Web server and application server interface and Application server and Database server interface. It should be checked if interactions between these interfaces are being executed properly and errors (if any) are being handled correctly. If any error occurs, it should be displayed to the user.

Compatibility Testing: The most important feature of any web application is compatibility because users run web application on different platforms and different browsers. A web application should be thoroughly tested on different web browsers and different operating systems. Many web applications have a mobile version when a user accesses them from a mobile device. If any issues arise while accessing web application on a mobile device, they should be addressed and resolved. Another aspect is printing. It should be ensured that while printing something from a web application, the text, images, and other items should align properly and fit to the page size selected by the user before printing.

Performance Testing: Performance testing is done in order to check how the web application (or system) will behave under different circumstances such as during normal usage and high usage. For this purpose, we need to do Load testing and Web Stress testing. Under load testing, we need to test the web application when a large number of users are accessing the web application at the time. We need to check if the web application sustains during the peak hours. Can our web application handle large user requests, simultaneous database access requests, etc.? Under web stress testing, system is checked beyond its capacity. Objective of web stress testing is to see how system behaves during stress and how it recovers from crashes [5].

Security Testing: To test security of web application, we need to check specific URLs that should not be accessible to a particular user. For example, we are viewing a document that has ID=123 in its URL at the end. If document with ID=124 is not accessible to us, then upon changing the URL, appropriate error message should be displayed. CAPTCHA should be used to prevent automatic traffic.

Other forms of security testing are Dynamic Application Security Testing (DAST), Static Application Security Testing (SAST), and Application Penetration Testing [6].

VII. CONCLUSION AND FUTURE WORK

This paper focused on quality assurance techniques for web application. One such technique is testing and we focused on different testing techniques through which we can achieve quality web application. As a future work, I would like to do a research regarding how much weightage a quality metric has towards developing a quality web application. Also, I would like to do a research on a particular web application, both in terms of quality metrics and in terms of testing techniques. A research on functional and non-functional testing procedures of a web application is also on the list.

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