

Challenges in testing web Applications

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Abstract

The very special nature of Web applications and unique software testing challenges need tools and methods that can match up to the new needs. Mechanized testing via special purpose Web testing software offers the potential to meet these challenges.

Dimensions of Quality

There are many dimensions of quality, and each measure will pertain to a particular challenge in varying degrees. Here are some of them:

- **Time:** changes often and rapidly? How much has it changed since the last upgrade? How do you highlight the parts that have changed?
- **Structural:** How well do all of the parts of website hold together. Are all links inside and outside working? Do all of the images work? Are there parts of the system not connected?
- **Content:** Does the content of critical pages match what is supposed to be there? Do key phrases exist continually in highly changeable pages? Do critical pages maintain quality content from version to version? What about dynamically generated HTML pages?
- **Accuracy and Consistency:** Are today's copies of the pages downloaded the same as yesterdays? Is the data present accurate enough? How do you know?
- **Response Time and Latency:** Does the server respond to a browser request within certain parameters? In an E - commerce context, how is the end-to-end response time after a SUBMIT? Are there parts of a site that are so slow that declines the user to continue working on it?
- **Performance:** Is the Web-Browser connection quick enough? How does the performance vary by time of day, by load and usage? Is performance adequate for E-commerce applications? Taking 10 minutes to respond to an E-commerce purchase is clearly not acceptable!

Impact of Quality

Quality is in the mind of the user. A poor-quality, one with many broken pages and faulty images may result in poor customer relations, lost corporate image, and even in lost revenue. Very complex situations can sometimes overload the user.

The combination of complexity and low quality is potentially lethal to the business. Unhappy users will quickly depart for a different site! And they won't leave with any good impressions.

Dynamic Validation

Confirming validity of what is tested is the key to assuring quality and the most difficult challenge of all. Here are four key areas where test automation will have a significant impact on operational Testing. Individual test steps may involve a variety of checks on individual pages in the following key areas:

- Page Consistency
- Form Consistency
- Page Relationships
- Performance Consistency and Response Times

Test Suites

Typically you may have dozens or hundreds of tests, and you may wish to run tests in a variety of modes:

- **Unattended Testing.** Individual and/or groups of tests should be executable singly or in parallel from one or many workstations.
- **Background Testing.** Tests should be executable from multiple browsers running "in the background" on an appropriately equipped workstation.
- **Distributed Testing.** Independent parts of a test suite should be executable from separate workstations without conflict.
- **Performance Testing.** Timing in performance tests should be resolved to the millisecond; this gives a strong basis for averaging data.
- **Random Testing.** There should be a capability for randomizing certain parts of tests.
- **Error Recovery.** While browser failure due to user inputs is rare, test suites should have the capability of desynchronizing after an error.

Content Validation

Apart from how it responds dynamically, the content should be checkable either exactly or approximately. Here are some ways that content validation could be accomplished:

- **Structural.** All of the links and anchors should match with prior "baseline" data. Images should be characterized by byte-count and/or file type or other file properties.
- **Checkpoints, Exact Reproduction.** One or more text elements -- or even all text elements -- in a page should be markable as "required to match".
- **Gross Statistics.** Page statistics (e.g. line, word, byte-count, checksum, etc.).
- **Selected Images/Fragments.** The tester should have the option to rubber band sections of an image and require that the selection image match later during a subsequent rendition of it. This ought to be possible for several images or image fragments.

Load Simulation

Load analysis needs to proceed by having a special purpose browser act like a human user. This assures that the performance checking experiment indicates true performance -- not performance on simulated but unrealistic conditions. There are many "http torture machines" that generate large numbers of http requests, but that is not necessarily the way real-world users generate requests.

Sessions should be recorded live or edited from live recordings to assure faithful timing. There should be adjustable speed up and slow down ratios and intervals. Load generation should proceed from:

- Single Browser Sessions. One session played on a browser with one or multiple responses. Timing data should be put in a file for separate analysis.
- Multiple Independent Browser Sessions. Multiple sessions played on multiple browsers with one or multiple responses. Timing data should be put in a file for separate analysis. Multivariate statistical methods may be needed for a complex but general performance model.

Load and Performance

When the actual business processes change, these become a difficult area requiring the guess work to be redone and different loads to be configured on servers. If all the web services reside on a single server this would be fairly simple. Usually this is not the case and the load is scattered on different servers and the balancing needs to be adjusted based on the effected server after understanding the peak loads of the different services residing on the different servers. This can be further broken down into Performance Testing covering scalability, throughput (time to connect, time to first byte and time to last byte) on individual services Occasionally, a good test case would be to simulate the lack of shared memory between the 'caller' and 'object'. Traditional load/performance testing tools can be used to test the individual services in isolation after benchmarking typical loads thus verifying concurrent access.

Security

The transport security is provided via HTTPS and the web services themselves do not really provide authentication models. Upon completion of the transaction, if the session is not closed then a potential hacker could use the session ID to steal the information that becomes critical for the business. All information processing facilities are monitored for security events. If any occur, they are investigated and acted upon immediately, as required by our Incident Response Plan. All exceptions must be agreed between The Security Team, The Management, The System Administrators and The clients before they can be allowed to occur.

This may include using Message level Security instead of Transport Level Security where the information related to security is encapsulated in the message, which makes it more flexible for the intermediate processes. Even more risky for services using HTTP as opposed to HTTPS. In cases like these, verify that the authentication data is encrypted or hashed. This may be applicable to both synchronous as well as asynchronous hashing algorithms. In low volume transactions, this might still be a low priority test case when the decrypt key is sent via a non-electronic fashion. Essentially, the security for web services is at a nascent stage, which was same for the w3 when it started.

Conclusion

In future, companies should concentrate more on their core business and use services provided by experts in a specific area without re-inventing the wheel making Service Oriented Architecture (SOA) a reality. This will call for more stringent testing methodologies considering the scope involved in testing these services in an integrated manner.

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