

Access Computer Consulting plc
The Critical Phases of Web Testing

1. Introduction

This document serves as a preliminary report on critical phases in Web testing.

We understand 'critical phases' to signify the stages in a typical Web testing methodology that are a minimum requirement to implement a successful Web testing project.

By identifying these phases, a Web testing project can then be designed and implemented with speed and cost effectiveness as the defining criteria.

As a point of reference however, we will start by taking note of all the phases of an in-depth Web testing project. This is to provide a degree of flexibility if the document or the subsequent testing project design phase requires amendment.

2. The Requirements of Effective Web Testing

Web testing evolution mirrors the development of the Internet in terms of an ever-shorter development cycle and an increasingly complex set of design parameters.

However, a set of key requirements has emerged from the chaos of ad-hoc testing in the early days. These are:

- * **Code Quality Verification**
- * **Compatibility**
- * **Navigation**
- * **User Interaction**
- * **Usability and Accessibility**
- * **Performance**
- * **Scalability**
- * **Reliability**
- * **Post Implementation**

However, in order to comply with the underlying criteria of speed and cost effectiveness, it is possible by using automated software tools and a minimum of manual (subjective) assessment to effectively perform Web testing by targeting these critical areas:

- * **Navigation**
- * **User Interaction**
- * **Performance**
- * **Reliability**

It seems impossible to focus on some areas while ignoring others and yet if we consider the fact that the majority of software applications now include automatic HTML validation tools (e.g.: Dreamweaver), Code Quality Verification in most cases can be bypassed.

Furthermore, the very nature of Web testing ensures that some test cases in one category may actually be duplicates of test cases in another category. This is perfectly acceptable from a high-level test design perspective such as the one proposed because an overall assessment can be extrapolated from a reduced series of test cases.

3. Navigation

Site navigation is the key to success or failure of virtually every site on the Web. Regardless of how innovative a Web site is, the message will be lost if visitors are unable to find what they are looking for. Every page in a site should answer three basic questions: "Where am I?", "Where can I go from here?", and "What will I find along the way?". When done correctly, navigation testing reveals many of the potential functional and performance problems that could frustrate visitors and cause them to abandon the site.

a- Links:

Internal links take a visitor to another page within a Web site. Absolute links (URL's) provide the entire file address for a Web page e.g. C:/directory/subdirectory/page1.html) while relative URL's only lead to another page relative to the location of the current page (e.g., subdirectory/page2.html).

In general, relative URL's should be used rather than absolute ones since this will render the site less prone to broken links and generally more robust. Most link-checking tools do not differentiate between absolute and relative links and so many problems are simply overlooked.

b- External Links:

External links point to Web sites owned and maintained by other organisations. However it is very risky to point to any page other than another Web site's home page as other Web site developers may change directory structures without informing one's own organisation. This is easily verified and almost always overlooked.

c- Redirects:

Redirects are used to make a site more user friendly by displaying a custom error page in the event that a link can't be found. Unfortunately, redirects have potential drawbacks. One is the link to the redirect may itself be broken and another is that they require constant maintenance due to the changing nature of information. A link, if redirected, must go to the correct final destination and is not itself redirected.

d- Frames and Framesets:

Frames provide Web site developers with the ability to define one or more independently scrollable sections within a single browser window. When two or more frames are contained on the same page, they're called a frameset. Frames and framesets are also the source of many potential navigation problems and care must be taken that pages using frames are displayed correctly, that they download in an acceptable period of time, that they can be printed correctly and finally that if a user enters a site from anywhere else other than a home page that all frames containing menus can be seen.

e- Internal Search Engines

Internal search engines help a visitor locate specific information within your Web site. Search engines tend to require more resources than many other transactions and as such, are often one of the first categories to deteriorate when a site experiences an increase in workload.

4. User Interaction

The combination of more sophisticated user demands and rapid improvements in technology is a key force driving the changes in transactional Web sites. The advent of client-side scripting languages and dynamic Web pages provides developers with the tools they need to improve the interactive experience between users and computers.

Forms for example allow a user to submit almost any type of information to a Web server for immediate processing. Customers now have the possibility to enter and submit credit card information and initiate and track product shipments. While there are many benefits to providing users with the ability to manage their own transactions, there are also many potential problems. This flexibility makes the data processing on the client and the server more complicated, which in turn calls for more testing.

a- Forms

Forms are formatted documents that contain blank fields which users can fill in with data. Electronic forms are especially common on the Web because the HTML language has built-in support for displaying form elements such as text fields and check boxes. However, due to the nature of HTML, using a browser's Back, Forward, Go, History, Reload and Resize buttons can cause Web site's forms to become confused. Information may be lost entirely or added to the Web site's database multiple times.

Attention also needs to be paid to the POST and GET functions by which information is transmitted from the form on the Web page back to the server. The GET command appends the

data to the URL, and is therefore, subject to a finite length. The danger is to end up with truncated data.

The POST command transmits the data from the form after the URL and header information is sent to the server and so is not subject to the same size limitations.

b- Streaming Content

The Internet was conceived around the "pull" concept, whereby a browser must ask for a Web page before a Web server can send it. Using the "push" model, on the other hand, a Web server no longer has to wait for a browser to request a page. Instead the server automatically pushes the page to the browser. While the majority of sites use the "push" model, it has two significant drawbacks that can cause problems. The first is that to take advantage of "push" technology, users must be logged on to the Internet. This is not useful for people who do not have the possibility of continuous access to the Internet. The second is that the "push" model calls for an almost insatiable need for bandwidth. Systems can quickly be overloaded if proper tests are not performed. In a more general sense, the "push" model promotes scores of unwanted windows popping up on screen while the user navigates the site. This is often undesirable and must be kept to a minimum if any at all during the users visit.

c- Processing Credit Cards

Every time a credit card purchase is made over the Internet, an electronic process takes place to execute the financial transaction. This transfer process is also where a major portion of the cost to support an e-commerce site arises, because fees are charged on a per-transaction basis. Credit card transmissions over the Internet are normally encrypted using the Secure Socket Layer (SSL) protocol. This Internet connection option will eventually include built-in support for Secure Electronic Transactions (SET) protocol, which prevents anyone other than the cardholder and the acquiring bank from seeing the card number. Great care must be paid to the implementation of a system using these protocols for obvious security reasons. Over and above that requirement a testing project that has for focus Credit Card transactions must make sure that an appropriate message is displayed if the card holder enters any invalid information (i.e.: cancelled credit cards, cards with insufficient funds, false or incorrect names).

5. Performance

Although Internet bandwidth and Web server capacity have improved in recent years, Web site performance problems continue to challenge developers and testers. The combination of complex Web-based applications and the dynamic characteristics of Internet traffic can cause significant degradation in Web site performance.

Financial organisations are especially vulnerable to this sort of problem. Consider for example what happens to an online broker's site when an interest rate increase is announced. Few sites are able to cope with a sudden and massive increase in Internet traffic

A series of different categories of performance tests have been created to permit a tester to gauge whether a Web site performance characteristics would be able to survive the unpredictable nature of the Internet. Some of the most important are:

a. Smoke Testing

This quick test is used to evaluate whether or not a software release is ready for testing. This can be as simple as performing a few manual functional tests with a stopwatch and a 56 K modem. The results of a smoke test can be used as entry criteria for more rigorous testing.

b. Load Testing

Load testing is used to model the anticipated real-world performance of a Web-site over a short period of time. The results of a load test can help you determine whether a specific combination of hardware and software (e.g., Web server, application server, database, network bandwidth, etc.) will allow your Web site to meet its performance requirements. When implemented early in the development cycle, load testing may be used to help determine the feasibility of a particular architecture.

c. Stress Testing

Stress testing is used to determine if one's combination of hardware and software has the capacity to handle an excessively large number of transactions during peak operating hours. Stress testing is also used to determine what will happen when the maximum capacity is actually reached.

6. Reliability

Reliability testing targets already established Web sites that experience problems from a functional or performance perspective. Reliability is often measured by the Mean Time To failure (MTTF), Mean Time To Recovery (MTTR), or the number of outages that last for a certain interval during a specified period of time. For example, the number of outages that exceed 1 hour each month.

Alternatively, the degree of "acceptable" failure for a particular resource can be specified as "memory leakage on any server must not exceed 10 KB per day" or "at any given time, not more than 2% of external links can be broken" or even as "no more than 5% of network data packages can be lost".

Three basic tests can be used to check reliability. These are:

a. Low Resource Testing

Low resource stress testing is a type of robustness testing that seeks to verify if an application can continue to function correctly under reduced system resources such as low memory. Applications that require large amounts of resources to operate correctly have a higher probability of failure.

b- Volume Testing

Volume testing is used as a form of load testing where extremely large volumes of input data are submitted to the Web site under test in order to see how it performs. A positive by-product of volume testing is its ability to uncover rare functional errors. A large volume of data, for example, may contain instances of input data that someone who is performing regular functional testing may not have considered. Processing this data often reveals defects that are not found until the Web site is in production.

c- Peak Loading

Peak loading can be used to estimate the frequency with which a Web site will crash due to load spikes. For example, if the Web site is able to handle the typical daily peak load without a problem, the chances of the site failing more than once a day due to the volume of traffic is relatively small.

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