



Testing Web-based Systems

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What is Web-based System?

- Web-based software systems consist of a set of web pages and components that interact to form a system which executes using web server(s), network, HTTP, and a browser, in which user input affects the state of system.
- These are typical programs that operate on the Internet, interacting with the user through a browser.



Some related terms

- **Web page:** The information that can be viewed in a single browser window.
- **Website:** A collection of web pages and associated software components that are related semantically by content and syntactically through links and other control mechanisms. They can be dynamic and interactive.

Some related terms cont ...

- **Web application:** A program that runs as a whole or in part on one or more web servers and that can be run through a website.
- Web applications need the presence of a web server in simple configuration or multiple servers in more complex settings.
- Such applications are called **web-based applications**.

Some related terms cont ...

- Similar applications, which may operate **independent of any servers** and rely on operating systems services to perform their functions, are termed **web-enabled applications**.
- Now a days, with the integration of technologies for development of such applications, there is a thin line separating web-based and web-enabled applications.
- So, they are collectively referred to as **web applications**.

Traditional software vs. web-based software

- Web systems are based on the client-server architecture wherein a client typically enables users to communicate with the server.
- ▶ Therefore, these systems share some characteristics of client-server architecture.
- ▶ However, there are a number of aspects of web systems that necessitate having the different techniques to test them.

Traditional software vs. web-based software

cont...

- ▶ Clients of the traditional client-server systems are platform-specific.
 - This means that a client application is developed and tested for each supported client operating system.
 - But the web client is operating within the web browser's environment.
 - Web browsers already consist of operating system-specific client software running on a client computer.
 - But these browsers need to support HTML, as well as active contents to display web page information.

Traditional software vs web-based software

cont ...

- For this purpose, browser vendors must create rendering engines and interpreters to translate and format HTML contents.
- In making these software components, various browsers and their releases introduce incompatibility issues.

Traditional software vs web-based software

cont...

- ▶ Web-based systems have a more dynamic environment as compared to traditional client-server systems.
 - In client-server systems, the roles of the clients and servers and their interaction are predefined and static as compared to web applications, where client side programs and contents may be generated dynamically.

Traditional software vs web-based software

cont...

- Moreover, the environment for web applications is not predefined and is changing dynamically i.e. hardware and software are changing, configuration are ever-changing, etc.
- Web applications often are affected by these factors that may cause incompatibility and interoperability issues.

Traditional software vs web-based software

cont...

- ▶ In the traditional client-server systems, the normal flow of control is not affected by the user.
 - But in web applications, users can break the normal control flow.
 - For example, users can press the back or refresh button in the web browser.

Traditional Software vs web-based software

cont...

- ▶ Due to the dynamic environment, web systems demand more frequent maintenance.
- ▶ The user profile for web systems is very diverse as compared to client-server systems.
 - Therefore, the load on web access due to this diversity is not predictable.

Challenges in Testing for Web-based Systems

- ▶ Diversity and Complexity
- ▶ Dynamic environment
- ▶ Very short development time
- ▶ Continuous evolution
- ▶ Compatibility and interoperability

Types of Testing for Web-based Systems

- ▶ Interface Testing
- ▶ Usability Testing
- ▶ Content Testing
- ▶ Navigation Testing
- ▶ Configuration/Compatibility Testing
- ▶ Security Testing
- ▶ Performance Testing

Interface Testing

- ▶ Web model must be checked to ensure all interfaces.
- ▶ Interface between client and server
- ▶ Two interfaces on server side :
 - Web server and application server interface
 - Application server and database server interface
- ▶ Check for error messages, roll backs
- ▶ Errors must be cached, handled, and displayed

Interface Testing cont..

- ▶ Check for :
 - The user interruption in between transactions
 - Connection to the web server is reset in between
 - Compatibility of the server with software, hardware, network, and data base.

Usability Testing

- ▶ We can lose users because of a poor design.
- ▶ It is not a functional testing
- ▶ The web application is reviewed and tested from a users point of view
- ▶ Take help from use case diagrams

Usability Testing

cont ...

- Check that form controls such as boxes and buttons are easy to use, appropriate to the task, and provide easy navigation for the user.
- Check Spelling errors
- Check the misleading links

Usability Testing cont...

- ▶ For validation, perform a scenario based usability testing with the help of use cases
- ▶ Take help from end users :
 - In form of a questionnaire
 - As they use, answer, and give feedback

Content Testing

- ▶ The content seen on the web pages has a strong impression on user.
- ▶ Affects the next visit to web page.
 - If these contents are not satisfactory to him, he may not visit the web page again.

Content Testing

cont ...

- ▶ Check the web application contents(input fields) for :
 - Completeness(existence)

Check that certain information is available on a given web page, links between pages exist or even check the existence of the web pages themselves.
 - Correctness(semantic)

Web application content may need to be checked against semantic conditions to see if they meet the web document.
 - Validation on each field for :
 - specified lengths
 - mandatory fields
 - default values
 - wrong inputs

Content Testing

cont ...

- ▶ Therefore contents should be
 - Correct
 - Visible
 - Flexible to use
 - Organized
 - Consistent

Content Testing

contd...

- ▶ This type of testing targets the testing of **static** and **dynamic** contents of web application
- ▶ **Static contents** can be checked as part of verification.
- ▶ For instance, forms are the integral part of any web site.
- ▶ Forms are used to get information from users and to keep interacting with them.

Content Testing

cont...

- ▶ First check all the validations on each field.
- ▶ Check for the default values of fields and also wrong forms if any, form delete, view or modify the forms must also be checked. inputs to the fields in the forms.
- ▶ Options to create forms if any, form delete, view or modify the forms must also be checked.

Content Testing

contd...

Static testing may consider the following points

- ▶ Various layouts.
- ▶ Check forms for their field validations, error message for wrong input, optional and mandatory fields with specified length, buttons on the form, etc.
- ▶ For tables, check that actually a table is present and has the expected number of rows & columns and the pre-defined properties.

Content Testing

cont...

- ▶ Grammatical mistakes in text description of web page.
- ▶ Typographical mistakes.
- ▶ Content organization.
- ▶ Content consistency.
- ▶ Data integrity and errors while you edit, delete, modify the forms.

Content Testing

cont...

- ▶ Content accuracy and completeness.
- ▶ Relationship between content objects
- ▶ Text contents
- ▶ Text fragments against formatting expectations.
- ▶ Graphics content with proper visibility.

Content Testing

cont...

- ▶ Media contents to be placed at appropriate places.
- ▶ All types of navigation links like internal links, external links, mail links, broken links to be placed at appropriate places.
- ▶ All links on a web page are active.

A check list for content verification may be prepared.

Content Testing

cont...

- ▶ There may be **dynamic contents** on a web page also.
- ▶ Largely **dynamic testing** will be suitable in testing these dynamic contents.
- ▶ These dynamic contents can be in many forms.
- ▶ One possibility is that constantly changing contents are there, e.g. weather information web pages or online news paper.
- ▶ Another case may be that web applications are generated dynamically from information contained in a data base or in a cookie.

Content Testing cont...

- ▶ Many web applications work interactively in a manner, that in response to a user request for some information,
 - interact with some DBMS,
 - extract the relevant data,
 - create the dynamic content objects for this extracted data and
 - send these content objects to user for display.
- ▶ In the same manner, the information can be generated dynamically from cookies also.

Content Testing

cont...

- ▶ The problem in the design of these dynamic contents is
that there may be many errors due to its dynamic behaviour.
- ▶ Therefore, testing of these dynamic contents becomes necessary to uncover the errors.
- ▶ Changing contents on a web page must be tested
whether the contents are appearing every time in the same format.
Moreover, there is consistency between the changed content and static content.

Content Testing

cont...

- ▶ Test all database interface-related functionalities for all dynamic content objects.
- ▶ Check
 - if all the database queries are executing correctly,
 - data is retrieved correctly, and
 - also updated correctly.
- ▶ Load testing or performance testing can also be done on database.

Content Testing

cont...

- ▶ Cookies are small files stored on the user machine.
- ▶ These are basically used to maintain the session, mainly the login sessions.
- ▶ The testing of the entire interface with these cookies must also be tested.

Content Testing

cont...

- ▶ Test the application by enabling or disabling the cookies in browser options.
- ▶ Test if the cookies are encrypted before writing to user machine.
- ▶ Check the effect on application security by deleting the cookies.

Summary

- Discussed the terminologies associated with testing of web-based applications.
- Explained the differences between traditional software vs. web-based software.
- Presented the challenges in testing of web-based Systems.
- Discussed the following types of testing for web-based systems:
 - ▶ Interface Testing
 - ▶ Usability Testing
 - ▶ Content Testing



References

1. Naresh Chauhan, Software Testing: Principles and Practices, (Chapter – 15), Second Edition, Oxford University Press, 2018.



Thank You