

Comparative Study of Automated Web Testing Tools

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Abstract—Testing is major component of any software engineering process meant to produce high quality application. Testing aims at finding errors in the tested object and giving confidence in its correct behavior by executing the tested object with input values. The objective of the research is to conduct a comparative study of automated testing tools such as the Quick Test Professional, selenium, watir, Sahi etc. based on criteria such as the efforts involved with generating test scripts, cap ability to play back the scripts, result reports, speed and cost. The fundamental goal is to analyze the features supported by these functional testing tools that aid in minimizing the resources in test script maintenance and increasing efficiency for script reuse.

Keywords: Selenium, TestComplete, Wet, Sahi, SoapUI

I. INTRODUCTION

Testing is major component of any software engineering process meant to produce high quality application. Testing aims at finding errors in the tested object and giving confidence in its correct behavior by executing the tested object with input values .Web applications are the fastest growing classes of software systems today. Web applications are being used to support wide range of important activities: business transaction, scientific activities like information sharing, and medical systems such as expert system-based diagnoses. Web applications have been deployed at a fast pace and have helped in fast adoption but they have also decreased the quality of software[12]. Therefore, all entities of web application must be tested. In order to make web based application to be widely and successfully adopted, testing methodologies must be flexible, automatic, and be able to handle their dynamic nature.

“Web testing is the name given to Software Testing that focuses on testing the web applications.” In Web-based application is completely tested before going production environment. This could help to address the issues in web application before exposed to public like the Functional issues, web application security, web services issues, integrations issues, environment issues and its ability to handle traffic is checked[14]. There are two ways of testing that are manual and automation testing.

Manual testing carried out by the testers. Testers test the software manually for the defects. The problems with manual testing are, it is very time consuming process, not reusable, has no scripting facility, great effort required, and some errors remain uncovered .Automation testing covers all the problems of manual testing .Automation testing automates the steps of manual testing using automation tools such as selenium, TestComplete, watir etc .It increases the test execution speed, more reliable, repeatable, programmable, comprehensive, and reusable[3].

The intention of this research is to carry out a comparing and studying the concepts, builds and features of automated tools such as the Ranorex and the Automated QA TestComplete [1] based on criteria such as the hard work involved with generating test scripts, capacity to playback the scripts, end result reports, and expenditure. The elementary objective is to investigate the features supported by these two functional testing tools that aid in minimizing the resources in script maintenance and increasing efficiency for script reuse.

II. WEB TESTING TOOLS

A. Selenium

First, Selenium is one of the most popular automated testing suite. Selenium is designed in a way to support and encourage automation testing of functional aspects of web based applications and a wide range of browsers and platforms. Selenium suite is comprised of 4 basic components; Selenium IDE, Selenium RC, WebDriver, Selenium Grid. Selenium IDE is Firefox add-on for record-and-playback web application tests[9].

Advantages:

- Selenium IDE is very easy to use, flexible, and Programming language experience is not required.
- It has the capability to convert the test to different programming languages such as html, java etc.
- In Selenium IDE, user can debug and set breakpoints [5].

Disadvantage:

- Selenium IDE is Firefox plugin, thus its support is limited to Firefox only.
- It will not support iteration and conditional statement, no error handling, no database testing.

B. TestComplete

TestComplete is a functional automated testing platform developed by SmartBear Software. TestComplete gives testers the ability to create automated tests for Microsoft Windows, Web, Android (operating system), and iOS applications. Tests can be recorded, scripted or manually created with keyword driven operations [3] .

Advantages:

- Keyword Testing, Scripted Testing, Test Record and Playback, Distributed Testing, Access to Methods and Properties of Internal Objects, data driven testing, Bug Tracking Integration[14].
- Extensions and SDK : Everything visible in TestComplete panels, project items, specific scripting objects, and others are implemented as plug-ins. These plug-ins are included into the product and installed on your computer along with other TestComplete modules. You can create your own plug-ins that will extend TestComplete and provide specific functionality for your own needs. For example, you can create plug-ins or use third-party plug-ins .It provides support for custom controls, Custom keyword test operations, New scripting objects, Custom checkpoints ,Commands for test result processing, Panels, Project items[5].

Disadvantages:

- It is not recommended that you use the debug version of Flash Player to test applications compiled with TestComplete's FlexClient library, as this may cause some errors when testing such applications.
- Does not have support for keyword driven tests.

C. WET

WET Web Tester is a web testing tool that drives an IE Browser directly and so the automated testing done is equivalent to how a user would drive the web pages. The tool allows a user to perform all the operations required for testing web applications – like automatically clicking a link, entering text in a text field, clicking a button etc. One

may also perform various checks as a part of the testing process by using Checkpoints [2]. The latest version of WET is 1.0.0.

Advantages:

- WET UI : Preliminary Script development can be done using the WET UI which is easy to use. Using the WET UI, a tester can create Test Definitions, Object Repositories and the first draft of the test scripts.
- Scripting using Ruby : WET uses Ruby, an object oriented scripting language, which in turn gives WET a powerful scripting ability
- Object depot : The Object depot (aka Object Repository) allows a tester to map all the application's objects into centralized repositories. This helps in a higher maintainability of scripts.
- Object identification using multiple parameters : Many web pages are designed in such a way that the same page has elements with similar attributes – For example, there may be text fields with the label 'name' – one may be for the User's name while the other may be for the Developer's name. WET allows a tester to identify even these kind of objects by letting to search for objects using multiple parameters.
- Slick HTML results : After the tests are completed, the results are printed out in neat HTML Format
- Integrated Data table support – Testers can write data-driven tests by using the Integrated data table support. Data tables can either be as Excel files or XML format.

Disadvantages:

- Supports only the IE browser. Cannot be used for compatibility testing.
- The Simulated browser view of WET doesn't work accurately for a complex page. For these sort of pages, one has to view objects in a tree view only. No integration with SCM / bug tracking tools and does not have support for keyword driven tests

D. *Screenster*

It is an UI based functional and regression testing tool for web applications, works on all Windows OS that requires all major browsers and Java6 or high. A very good screen validator uses to give 10x productivity without a single line of code. During operation, it takes screenshot on each and every step and compares them to baseline[7].

Advantages:

- It allows Cross browser testing. Record and playback option is available.
- There is no need to read manual as it has very interactive interface. Guaranteed correctness of layouts and rendered UI.

E. *SoapUI*

A Cross-platform free open source functional testing tool for service-oriented architectures (SOA) and representational state transfers (REST), written in Java language. Its user-friendly interface acquires various features, mainly used for API testing facilitates to easily and quickly perform functional/regression and load testing, supports all protocols and technologies related to the particular application[14].

Advantages:

- User friendly interface. SoapUI NG pro comes loaded with powerful and easy to use reporting functionality.

- Multi-Environment support: If one is working in different environments, such as Staging and Production, this feature will be a major time-save. Test debugging is easy.

Disadvantages:

- Cost is of License and maintenance is high.

F. *Sahi*

It is an open-source cross-platform web application testing tool, written in Java and JavaScript, released under an Open Source Apache License 2.0. It is available in Pro v5.1.2 is used to test multiple browsers applications (holds many AJAX and dynamic content) under web 2.0.Sahi Pro identifies elements very easily[12] .

Advantages:

- Sahi's recorder works on all browsers and not just on Firefox.
- Sahi does not need waits for AJAX or page loads. It makes the scripts simpler and more reliable.
- Sahi's architecture makes it run on any browser technically, and if there are problems with browsers they are mostly easy to fix.It can be easily integrated with existing build setups via ant or batch files.
- Sahi traverses across frames and iframes without the tester having to know about them.

Disadvantages:

- Support for multiple languages and Sahi does not command the same visibility that Selenium does and it takes a little longer to convince clients and management.

G. *Watin (Web Application Testing in .Net)*

A cross-platform web application testing tool, latest version is 2.1, and developed in C# language. Due to the influence of Watir, Watin tested a web application written in .Net in December 2005[10].Now, it has become a user-friendly and stable framework with much functionality, supports all main HTML elements and dialogs (modal and modeless). Also, supports native Page and Control model, testing of AJAX website, screenshots of webpages .

H. *Watir (Web Application Testing in Ruby)*

An open-source (BSD) cross-platform web application testing tool, pronounced as water. It is an easy and flexible automation tool of Ruby libraries for web browsers automation. Ruby enables you to link to databases, export XML files, read files and spreadsheets, and organize your code as reusable libraries[2,10]. Watir drives Internet Explorer, Firefox, Chrome, Opera and Safari browsers in the same ways how others do.

Advantages:

- No external server needed to run a test. It has Great API, Tests can often be run through alternative tools watir-webdriver, webrat, celerity and more all more-or-less support the watir API.Only works in ruby (not jruby), But watir-webdriver does work in both ruby and jruby (see above point)
- Haven't really had much issue dealing with AJAX, watir always seems to know when the page is "loaded" .Typically runs faster than a comparable selenium test and better support for headless browsers, see Celerity.

Disadvantages:

- Each browser's implementation is a little bit different, This can mean inconsistent test results between browsers, but it hasn't really been much an issue for me.
- It doesn't seem to be as widely used as selenium, a little bit harder to find engineers (finding good ones is pretty much impossible)

I. QTP (UFT)

QTP (Quick Test Professional) a Windows based software testing tool used to test the applications on the web or desktop, best for "Functional" and "Regression" testing, given by Hewlett Packard (HP). Its UI is called as an Integrated Development environment (IDE) comes with various functionalities which motivates tester towards testing. QTP uses VB Script language to run the script and supports Web, Java (Core and Advanced), .Net, Flex, Web Services, WPF, Delphi, Power Builder, Stingray 1, Terminal Emulator, SAP, Oracle, Siebel etc. QTP was only working on Windows operating system, but UFT 12.0 supports Safari on a remote Mac, Internet Explorer[11].

Advantages:

- It is easy even for a non-programmer to understand QTP and start adding test cases. Support for record and playback and ability to edit scripts after recording.
- Excellent Object Identification process / mechanism, Support for different addins like Java, Oracle, SAP.
- Ability to let you enhance the existing tests even without the AUT (Application under test) through active screen. Supports all popular Automation frameworks - Keyword driven testing approach, Data driven testing approach, Modular testing approach, Hybrid frameworks etc.
- QTP comes with an inbuilt IDE, which is simple and easy to use. QTP uses VBScript which is English-like
- Microsoft Object model can be implanted in QTP easily (Example – Word document object, Excel Object, Outlook Object, ADO objects, File system objects, DOM etc)
- Easy to maintain different types of suites viz. Smoke, Sanity, Regression etc.
- It comes with loads of inbuilt properties and methods in QTP as well as inbuilt functions in VBScripts Support for XML. Use of Database files are easier and provides a variety of methods to play around with rows and columns. Easy to maintain test iterations and data driving the tests through configurations.

Disadvantages:

- Cost of License and maintenance is high. Cannot run multiple threads or instances.
- Slow in execution when compared to even open source tools like selenium.

J. Ranorex

A Windows based GUI testing tool to test the desktop, web and mobile based applications and to handle any kind of modern and dynamic GUI application, given by Ranorex GmbH. It supports technologies; .NET, Winforms, WPF, Java, SAP, HTML5, Flash, Flex, Silverlight, iOS, Android, Windows Apps (Native/Hybrid), etc. Although Ranorex is user-friendly and affordable, it can be used by any organization and small testing team[13].

Advantages:

- GUI Object Recognition ,Object-based Capture/Replay functionality .
- Test Automation Library for .NET. Test Development Environment (called Ranorex Studio)makes code completion, debugging and test project management possible. Flexible Test Automation Interface.

III. WORK PROPOSED

By taking into consideration of all information we can draw a comparative bar chart for the same that will be utilized further to understand comparison between selenium, QTP, SoapUI, Testcomplete on the basis of different parameters like capability of tests scripts generation, script reusability, cost, execution, test result report, easy learnability, speed .

Following is given Figure 1 in terms of bar chart for comparison among several testing tools on basis of several parameters:

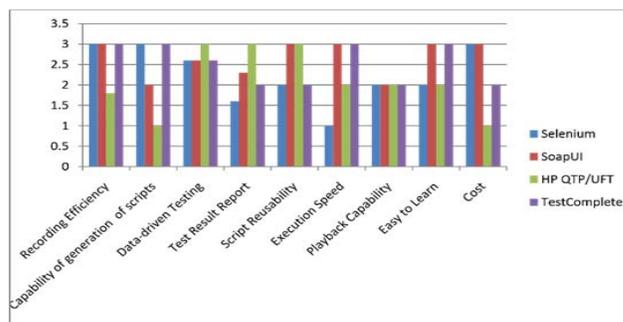


Fig .1: Comparison Graph based on selected parameters results

Following table 1 is given where comparison among various testing tools is given :

S.No .	Author Name	Publish in	Testing tool	Type of testing	Advantage	Disadvantages
1.	SaurabhDwivedi, Ms. Garima Gupta[12], 2015	IJSRD	Selenium Sahi	S/w testing framework for web application Functional testing	Easy to use,opensource,convert test to different language., debug & set breakpoints. Recorder works, integrated with existing build setups, provides bug fixes	not support iteration & conditional statement, error handling, Database testing. does not command easy visibility, does not let user create test cases in other languages
2.	Tarik sheth,Dr.Santoshkumar singh,[13]2015	IJSRD	Janova Ranorex	Functional testing	hosting a test tool in the Cloud significantly boosts performance of test execution up to 20 times	API is ruby only, inconsistent test results between browsers
3.	R.Beulahan d, Dr. M.Soranamageswari[7],2015	IJARCCCE	WinRunner Quick test professional	Functional GUI testing tool	Considerably increase power & flexibility of tests without any prog.,Use multiple verification types to ensure sound functionality,Maintain tests and build reusable scripts,Validate applications across browsers.	It does not support web based applications, .NET applications, people soft/CRM ,IEBEL, XML Applications

4.	TarannamBharti,Er.vidhuDutt [3],2015	IJCST	Test complete Selenium QTP	Functional automated testing	Keyword Testing, built-in code editor that helps testers write scripts manually, Distributed Testing, Data-driven testing, Bug Tracking Integration	It is not recommended that to user to use the debug version of Flash Player to test applications compiled with testComplete's FlexClient library, as this may cause some errors when testing such applications.
5.	Meenu, Yogesh Kumar,[14] 2015	JETIR	Soap UI HP UFT Selenium Test Complete	SOA, web services Test automation	Powerful and easy-to-use reporting functionality, Multi-Environment Support, testing a Moving Target or Refactoring, in built SQL builder, Test Debugging. Object repository, UFT is best when it comes to navigation, results validation and reports etc, QTP is integrated with Quality Center so different high quality dashboards can be configured.	Usability testing can't be done(Look & Feel),Takes some time initially for setup so not really encouraged for small projects. UFFT is costly, licensing cost is not done with one time purchase but it stretches over years to come, Though the scripting time is less, the execution time is relatively higher
6.	NishaGogna,[2],2011	IJCSE	WET Selenium WATIR	S/w testing framework for web application, Functional testing	No external server needed to run a test, Better support for headless browsers, Tests can often be run through alternative tools... watir-webdriver, webrat Slick HTML results, the Object depot allows a tester to map all the application's objects into centralized repositories, Object identification using multiple parameters, WET handles Win32 pop ups quite reliably.	only works in ruby, inconsistent test results between different browsers, need plugins for Active X and flash
7.	AbhaJain, Manishjain, Sunil Dhankar[4],2014	IJEMS	Ranorex, Quick test professional	Functional testing	GUI Object Recognition, Object-based Capture/Replay functionality, Test Automation Library for .NET, Flexible Test Automation Interface	complicated for starters, should have separate solutions or templates for web/forms/flex projects.
8.	NehaDubey ,Mrs. SavitaShawani,2014[1]	IJECS	Ranorex, TestComplete	Functional testing	GUI Object Recognition, Object-based Capture/Replay functionality, Test Automation Library for .NET, Flexible Test Automation Interface.	complicated for starters, should have separate solutions or templates for web/forms/flex projects.
9.	Harpreet Kaur, Dr. Gagan Gupta,2013 [5]	IJERA	Selenium QTP TestComplete	Software testing framework for web application	Easy to use, open source, convert test to different language., debug & set breakpoints.	not support iteration & conditional statement, error handling, Database testing.

IV. CONCLUSION

From the table 1 we can find the best testing tool based on the type of application need to be tested, budget, and the efficiency required. If your test automation requirements are getting fulfilled with Test Complete, there is no need to go for QTP at a higher cost. Both these tools solve the same purpose, it is just that QTP is a versatile tool for a critical and more risky Application Under Test (AUT). Selenium can also be used if you don't want to spend on testing tool. In conclusion, QTP is the best tool among them all.

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