

Comparative Study of Automated Testing Tools: Selenium and Quick Test Professional

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ABSTRACT

Software testing is one of the most important phase of software development. Automated testing is an effective testing process that reduces the effort of manual testing. But it is important to select a best suitable tool for testing. The main objective of the paper is to conduct a comparative study of automated tools such as Selenium and Quick test professional (QTP). The main objective of this paper is to evaluate and compare the automated software testing tools to determine their usability, maintenance and effectiveness. There is wide variety of software testing tool in the market with features like web Testing, Window application, etc.

Keywords: Software Testing, Manual Testing, Automated Testing, Selenium, QTP.

1 INTRODUCTION

Software testing process is to identify all the defects existing in a software product. It is the process of exercising or evaluating a system to identify differences between expected and actual results. It is the process of exercising or evaluating a system or system component to verify that it satisfies specified requirements or to identify differences between expected and actual results[4]. The major objective of the tester is to find the defects in the software. The success of the tester is on the level of defects identified during testing phase. Testing a product is to removal of faults to increase the software quality[1]. Manual testing is the basic method of testing done on any software. Testers manually test the product for the defects. It requires a tester to play the role of an end user and use mostly all the features of the application to ensure the correctness of product. They follow a written test plan that leads them through a set of important test cases. The problem with manual testing are, it is very time consuming process, not reusable, has no scripting facility, more effort required and some errors remain uncovered[2]. The problem is very critical because testing is generally the last phase of any development process and so the time for testing will never be sufficient. Hence the automated testing is being done.

Automation testing is testing a system with different data sets without a tester. Simply automated testing is that automating the manual testing process. Automation is the use of strategies, tools, and artifacts that augment or reduce the need of manual or human involvement or interaction in repetitive or redundant tasks[1]. Automation testing covers all the problems of manual testing using automation tools such as Selenium and Quick Test Professional. It increases the execution speed of test, reliable, repeatable, easy programming, comprehensive, and reusability. Manual testing is preferred to review the application requirements, and to create the High Level Design Documents and Low level design documents. Automation testing is done for graphical user interfaces and the flow control of the application.

In this tester runs the script on the testing tool and testing is done. The tester may or may not know the inside details of the software module under test. Therefore either white box testing or black box testing can be used[1]. The software testing tools can be compared on the basis of parameters such as recording efficiency, Capability of generation of scripts, Data-driven testing, Script reusability, execution speed, play back capability, Cost, and Easy to learn.

2 METHODOLOGY

2.1 Automated software testing tools

When we start research for the right automated software testing tool, it is important to create list of requirements when choosing a tool for evaluation. If we don't have a list of requirements, we may waste time in downloading, installing and evaluating tools that only meet some of requirements or may not meet any of them. This

paper evaluates the two major tool vendors that are Selenium and Quick Test Pro (QTP) on their test tool characteristics, test evaluation capability, scripts reusability, play back capability, and vendor qualification[1].

As the automation testing has more advantages over the manual testing, various companies are engaged in developing various automated test tools for several applications. There are two types of test tools.

- Open source test tools
- Commercial test tools

Open Source test tools – These tools can be downloaded from the internet or can be obtained by the vendor without any charge. Users can use the tools at free of cost. e.g. Selenium. Commercial test tool is the commercial software for sale. User should pay for it to use the software. Costs may be as per the functionality of the test tool. e.g. Quick test Professional. QTP has inbuilt function library. It forms the backbone of the automation in framework. All the coding logic is in the form of a user-defined VB scripts. All these functions are stored in function library. The common scripts are reused easily. When applications are modified by changing some properties of the objects, the same script can be used on the new build. QTP has an Object Repository.

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2.1.1 Selenium

Selenium IDE is a free and open source add-on for Firefox web browser. Selenium supports a variety of languages that include Java, Python, PHP, C#, Ruby and even pure JavaScript. Selenium is at present the most powerful Open Source Automation tool available and it is based on java scripting to a large extent. It is more suited for agile methodology of coding and testing[1].

In this paper we analyzed the Integrated Development Environment of Selenium, a software testing tool and also performed functional testing of web application www.google.com.

2.1.2 Quick Test Professional

Quick Test Pro (QTP) is a graphical interface record-playback automation tool. It is a tool used for automation of functional and regression tests for various software applications and environments. HP Quick Test Professional uses VBScript scripting language to specify the test procedures and to manipulate the objects and controls of the application under test. Quick Test Professional also enables us to test Java applets and applications, and multimedia objects on Applications as well as standard Windows application, Visual Basic applications and .NET framework applications. It works by identifying the objects in the application user interface or a web page and performing desired operations (such as mouse clicks and keyboard events). Although HP Quick Test Professional is usually used for —UI Based Test case Automation, it also can automate some —Non-UI Based Test cases such as file system operation and database testing[1].

In this paper we analyzed the Integrated Development Environment of QTP testing tool and also performed function testing of web application www.goodreads.com.

3 EVALUATION STUDY

For this study we use the Testing tools Selenium and Quick Test Professional. There are number of open source web testing and application tool available in the market. Although the main functions of the tools are similar, they vary in functionality, features and usability. In the above mentioned aspects, we have selected the two web testing tools for comparison.

We will discuss the following parameters with the current version of Selenium 2.0.0. and Quick Test Professional 10.0. Comparison between these tools is made on the basis of following parameters[3].

3.1 Recording Efficiency

Both tools are recording and playback type tools. Recording commands are inserted to check the application works as intended. These commands are called verification points or check points. Selenium gives very easy access to controls. The Application is started when the Record button is selected. Selenium records the user actions as they are performed and then exports them as reusable script in one of many programming language.

It's not possible to execute the Recorded script against the other browsers by using Selenium IDE; it only runs only on Firefox.

QTP does not provide easy access to controls. When the Record button is hit, the Application is started. It records all the actions as performed by user. But we cannot insert the checkpoint during recording. We can only insert these after recording. QTP provides three kinds of recording that is context sensitive mode, analog mode, low level recording.

There is no way to pause the test in the middle. So 99% testers use the context sensitive mode because it only stores the actions of application that is under test by ignoring system error messages[3].

3.2 Capability of generation of Scripts

Selenium can generate scripts in Java, C#, Ruby, Python, PHP, JavaScript. If any application is based on any of them, then Selenium can easily generate the corresponding scripts.

QTP generates only VBScripts. Applications based on the VBScript, QTP can be used to generate the script. QTP also has in-built report generation dashboards[11].

3.3 Data Driven testing

Selenium IDE does not have in-built features to create data-driven tests. Selenium can able to provide Data driven tests by multiple options available in the form of Selenium IDE User Extension or Add-On for creating Data Driven tests[8]. QTP supports Data Driven test by using inbuilt data tables which have functionality like excel sheet and easy to edit and update. Using the data tables reduces efforts of maintaining excel sheets and easy mapping of columns to the input elements. We can insert data table parameters into our test so that it will run several times on different sets of data. Each tests run on a different set of data is called iteration[3].

3.4 Test Result Reports

It is important to generate reports for the execution of Test scripts for performing effective analysis whether test scripts have passed or failed while running a test suite.

Selenium IDE has no native support to exporting recorded test case and test suite of web software application. It can able to provide the function by a plug-in —Test Results Plug-in[9].

QTP gives execution summary of the test. It shows the test steps in hierarchy tree and also provides the summary of each test step. It also provides information about checkpoints that applied during testing. These result reports are user friendly and easy to understand[3].

3.5 Reusability

Reusing testing logic repeatedly is the ultimate goal of test automation. Automation tools stores the scripts used and can able to reuse when needed. Selenium has a recording feature and it is stored for the purpose of playback. But it has no built-in Object repository.

3.6 Execution speed

Selenium has a lesser execution speed comparing to QTP in our case. QTP automates faster than Selenium as it is a fully featured IDE. The execution speed can be calculated by taking total test run time of each user screen (i.e. start test run time + end test run time).

3.7 Playback Capability

When script is played back, it replays the user actions that performed by the user during recording. If object is not —run dialog box, which gives us two options. Three modes are:

Verify mode: it saves results in new run result folder for later comparison.

Debug mode: save the results in temporary run results folder overwriting the earlier results.

Update Run mode: when we needed to run the test to update the checkpoints go to — automation menu and select — update run mode.

3.8 Easy to learn

QTP takes lesser time than Selenium because it has more features, and Selenium is more complicated than QTP. QTP is easier and takes few times to learn.

QTP works with Quality Centre (QC).QTP provides functional, regression and also web service testing. Selenium is used for web based applications and needs quite a bit of expertise.

3.9 Cost: Selenium is an open-source and there's no licensing or renewal cost for this tool. It's free of cost. Quick Test Professional is available through single-seat licenses, as well as floating or concurrent licenses. It is more expensive for licenses and maintenance

4 COMPARISON FEATURES OF SELENIUM AND QTP

FEATURES	SELENIUM	QUICK TEST PROFESSIONAL
License cost	Open source and free of cost	Licensed and very Expensive
Application support	Web applications only	Client server applications (like built in TCL/TK and PowerBuilder)
Browser support	Supports IE, Firefox, Opera, Safari, etc.	TCL/TK and PowerBuilder)
Operating System/Platform	Windows PC, MAC, UNIX platforms.	Windows Platform only.
Object Oriented Language support and Scalability Usage	Supports Java, .Net, Perl, PHP, Python, C# and Ruby. Needs a quite Expertise.	Supports VBScript or JavaScript. Easy to learn.
Technical support	No official technical support.	Good technical support via phone, mail, web forum.
Test Development Environment	Test scripts can be developed in various IDEs like Eclipse, Visual Studio, Net beans, etc.	Developed only in QTP.
Support for File Upload	Not available	Supports all kinds of File upload
Database Applications	Not so convenient.	Very well with Database applications.
Report Generation	Integration with Jenkins can give good reporting.	Quality Center has built-in dashboards.

5 EVALUATION STUDY

My research work comprises of the analysis of different automated web testing tools based on the functionality and features each one support. For our comparative study we use the current version of each open source tool and the demo of commercial one

Features	Explanation
Cross platforms.	To what degree tool support operating system
Cross –Browsers	How many browsers tools able to work with
Record-Playback.	The ability of tool to record scripts to be run under different conditions.
Script-language.	Programming language used to edit testing scripts or for the creation of testing scripts
Ease of Learning.	Working with GUI easy or not
Data-Driven Framework.	The ability of tool to reduce efforts.
Programming skills.	Require programming skills or based on predefined steps
Online-Support.	Provide support or not for sudden situations and troubleshooting
Training-Cost (USD).	The cost of tool training cost if exist
Debugging support.	Does the tool has the mechanism to handle error and provide debug or not
Report Generation.	Effective analysis for test script

6 COMPARISON OF FEATURES OF TOOLS

The features below used for the evaluation process for distinguishing the capability of each tool versus the others [20]. Each parameter is listed with the up to date value based on intensive searching at tool's support website and last research papers. Table below list all evaluation parameters with the meaning of parameters.

Table 2: Comparison of automated testing tools based on the listed features

Tools/Criteria	Selenium	SoapUI	HP QTP/UFT	TestComplete
Pricing (USD)	Open source and Free of cost	Open source as well Commercial licensed version available that costs 499	Licensed and very Expensive i.e. 8000	Licensed and it costs 1999
Cross Platform	Windows, Linux, Unix, MAC	Window XP and later	Windows Only	Windows 7 and later
Application support	Web applications only.	Web applications as well as Client server applications	Client server applications, Mobile applications	Web, Desktop, and Mobile applications

Browsers-support	Chrome-Firefox-IE-Opera	IE-Firefox-Chrome	IE-Firefox-Chrome	IE-Firefox-Opera-Chrome
Record-Playback	Support	Support	Support	Support
Script-Language	Ruby-java-.Net-python-C#-perl-PHP- java script	Groovy or JavaScript	VB Script	VBScript- C#-Jscript
Script Creation Time	High	High	Less	High
Ease of Use	Experience needed	Easy to learn in a short time	Easy to learn in a short time	Experience needed supports five languages. QTP can support other languages but through add-ins.
Technical support	No official technical support	Good technical support via phone, mail, web forum.	Good technical support via phone, mail, web forum.	Good technical support via phone, mail, web forum.
Data-Driven Framework	Excel-CSV	Excel files, XML, JDBC	Excel files-text files-XML-DB files	CSV-Excel-SQL
Programming skills	Required	Partially	Partially	Required
Online-Support	Strong Support	Strong Support	Licensed	Strong Support
Training-Cost (USD)	350	99	250	449
Debugging support	Strong	Strong	Strong	Strong
Report Generation	HTML	HTML	HTML	HTML,XML
Product Support	Open Source Community	Smartbear support with support forums	Dedicate HP support along with support forums	Smartbear support with support forums

For the purpose of rating the comparison parameters, we have used 3-point scale i.e. 3,2,1 as Good, Average, and Bad respectively. In this, we will divide the each parameter into sub criteria to make clear distinguish and for easy rating. We assign the points to sub criteria based on their functionality. The total value of parameter is calculated by taking average of sub criteria values.

7.1 Recording Efficiency

Sub Criteria	Selenium	Soap UI	HP UFT	TC	Comment
Insert Commands	3	3	1	3	In QTP, we cannot insert commands while Recording
Recording Types	3	3	3	3	Both tools provide the facility to record the mouse movements, screen co-ordinates, keystrokes, and, objects and their properties
Access to record controls	3	3	1	3	The recording toolbar of TC always present at the application under test. So we can easily use the controls from it. This is not the case with QTP.
Pause	3	3	1	3	QTP does not provide this facility while recording.
Auto Documentation	3	3	3	3	Both tools provide this Facility

For Selenium, the value of Parameter is $3+3+3+3+3/5 = 15/5 = 3$

So, Selenium is good in this parameter.

For SoapUI, the value of parameter is $3+3+3+3+3/5 = 15/5 = 3$

SoapUI is good in recording efficiency.

For QTP, the value of Parameter is $1+3+1+1+3/5 = 9/5 = 1.8$

So, QTP is average in this parameter.

For TC, the value of parameter is $3+3+3+3+3/5 = 15/5 = 3$

TC is good in recording efficiency.

7.2 Capability of generation of Scripts

We assign pt. 4 to TC because it supports five languages but there are so many other languages which are not supported by it.

Sub Criteria	Selenium	SoapUI	HP UFT	TC	Comment
Languages	3	2	1	3	QTP supports only VbScript but TC supports five languages. QTP can support other languages but through add-ins.

7.3 Capability of generation of Scripts

We assign pt. 4 to TC because it supports five languages but there are so many other languages which are not supported by it.

Sub Criteria	Selenium	SoapUI	HP UFT	TC	Comment
Languages	3	2	1	3	QTP supports only VbScript but TC supports five languages. QTP can support other languages but through add-ins.

7.4 Data- driven Testing

Sub Criteria	Selenium	SoapUI	HP UFT	TC	Comment
Access data from external sources	3	3	3	3	Both provides the access to different external sources like excel sheet, database etc.
Change the data in external sources without affecting the scripts	3	3	3	3	Both tools can keep the scripts separated from data.
Way of testing	2	2	3	2	QTP has inbuilt data tables which provides more easy way to DDT and for explanation read sec. 3.3 using a Selenium IDE Add-on called Sel Blocks to create Data Driven tests

For Selenium, the value of Parameter is $3+3+2/5 = 8/3 = 2.6$

So, Selenium is good in this parameter.

For SoapUI, the value of parameter is $3+3+2/5 = 8/3 = 2.6$

SoapUI is good in recording efficiency.

For QTP, the value of Parameter is $3+3+3/5 = 9/3 = 3$

So, QTP is good in this parameter.

For TC, the value of parameter is $3+3+2/5 = 8/3 = 2.6$

TC is good in recording efficiency.

7.5 Test Result Reports

Sub Criteria	Selenium	SoapUI	HP UFT	TC	Comment
Report Presentation	1	3	3	2	QP gives executive summary of results. TC gives results in single pane. See fig. selenium, BASIC REPORTING
Info about applied checkpoints	3	3	3	3	All four provide this info
Graphical info of previous runs	1	1	3	1	Only QTP gives info about previous and current runs in pie charts

For Selenium, the value of Parameter is $1+3+1/3 = 5/3 = 1.6$

So, Selenium is bad in this parameter.

For SoapUI, the value of parameter is $3+3+1/3 = 7/3 = 2.3$.

SoapUI is good in recording efficiency.

For QTP, the value of Parameter is $3+3+3/3 = 9/3 = 3$

So, QTP is good in this parameter.

For TC, the value of parameter is $2+3+1/3 = 6/3 = 2$

TC is average in recording efficiency

7.5 Script Reusability

All the tools have smart recognition features which permit reuse of the script on a new build. Selenium has a recording feature and it is stored for the purpose of playback. But it has no built-in Object repository. SoapUI offers two options for reusability of the test scripts i.e. use the script library, use the run test case step. In Test Complete, scripts can be called from one another and can be reused. QTP allows creation of reusable actions which can be called from other actions and also passing parameters from one action to other actions. QTP can also create copy of existing actions in new actions. The difference is that QTP has object repository concept which is different from the name mapping and it is the most powerful feature of QTP which helps in script reuse. Because of this, we rank the QTP and SoapUI as good (pt. 3), and Selenium and TC as average (pt. 2).

7.6 Execution Speed

The speed of TC is more than QTP as mentioned in sec 5.6. So we rank Selenium and SoapUI as good (3pt), QTP as average (2pt) and TC as good (3pt).

7.7 Playback Capability

In our study, these tools play backed the scripts efficiently. Sometimes, Test Complete did not recognize the objects but the same was also encountered with Selenium, Soap UI, QTP, too. So, we rank this parameter for all four tools as average (2pt).

7.8 Easy to Learn

Selenium comes with different variants, hence needs more time to learn. SoapUI Pro offers the automated, simple-to-use approach required. QTP has more features and is more complex than TC, so it takes more time to learn than TC. Because of this, we rate the SoapUI, and TC as good (3pt) and Selenium & QTP as average (2pt).

7.9 Cost

Selenium and SoapUI tools are open source testing tools. These are free of cost. QTP is more costly than TC. The cost of QTP is three or four times of TestComplete cost. Because of this, we rate the Selenium and SoapUI as good (3pt), TC as average (2pt) and QTP as bad (1pt). Their respective costs are mentioned in sec 5.9.

7.10 Comparison graph based on results

The overall comparison graph is shown in Fig 9. This graph is based on parameters value that has been calculated previous.

CONCLUSION

One can select a 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 the three.

Automated software testing has become necessity of companies because it saves both time and money. QTP and Test Complete both are very good tools for test automation, Test Complete has easy to use UI and efficient playback. Using one of them can be decided based on the application features and scope of testing. TestComplete will be best to use for applications with lesser security needs. QTP is best where data security is needed even while testing.

You should now be able to verify and test APIs using a tool like SoapUI. Your chances of securing the delivery of high quality APIs will be drastically improved, compared to when testing the services using your own, homegrown API clients. You will save a lot of time and be able to focus on the real problem, testing, instead of the problem of creating your test tool.

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