

Comparative Analysis of Automated Software Testing Tools

Majid Khan, Abdus Salam, Javed Iqbal, Syed Irfan Ullah

Abstract: *The most significant segments of software development is software testing. Automated software testing is an effective testing process that reduces the effort and cost of manual testing. However, it is difficult to select a suitable software testing tool from the huge list of freely available tools. The main contribution of this work is to conduct a comparative study of three readily available automated software testing tools such as QTP, Silk4j and Load Runner. The selected tools are evaluated and compared on the basis of their usability, maintenance and effectiveness. For this purpose we have taken an existing JAVA based applications to perform automated testing on these three tools. The results will assist testers to effectively select the best automated software testing tool for related applications.*

Keywords: *significant segments, However, Automated software, QTP, JAVA based,*

I. INTRODUCTION

Software testing is the process of detecting the differences between existing and required situations (that is, bugs) and to evaluate the features of the software item [1]. In other words it is the process of executing a program to find errors. Software testing is an activity that should be done throughout the entire software development process. The objective of software testing is to indicate that a computer program will perform proposed functionality correctly. This testing process adds some value to a program and hence testing incurs some cost. While adding value through testing means raising the quality or reliability of the computer program. Raising the reliability of the program means finding and removing errors. Hence, software testing is one of the crucial activities for software quality assurance.

The goal of testing process is to uncover as many defects as possible with as little testing efforts to minimize the cost associated with testing and with software failures. In other words, we want to write test cases that have a high likelihood of uncovering the faults that are the most likely to be observed as a failure in normal use. It is simply impossible to test every possible input-output combination of the system; there are simply too many permutations and combinations. As testers, we need to consider the economics of testing and strive to write test cases that will uncover as many faults in as few test cases as possible.

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II. LITERATURE REVIEW

There are number of open source automated software testing tools available in the software market for testing web-based and window-based applications. Although the core functions of these tools are similar, they differ in functionality, Features, and usability. Shaveta et al.[3], conducted a comparative study of automated software testing tools such as the Mercury Quick Test Professional and the Mercury Load Runner. The comparison criteria is based upon the efforts involved in generating test scripts, capability to playback the scripts, result reports, speed and cost. Their fundamental goal is to analyze the features supported by these two functional testing tools that aid in minimizing the resources in script maintenance and increasing efficiency for script reuse. Rifa Nizam Khan and Shobhit Gupta [4] have evaluated four major software testing tool vendors that are IBM's Rational Functional Tester (RFT), Quick Test Pro (QTP), Silk Test and LoadRunner on their test tool features, test performance ability, test resorting ability, scripts re-usability ability, play back ability and seller qualification.

Amandeep et al. [7], conduct a comparative study of automated tools such as Selenium free source, HP Quick test professional (QTP) and Test Complete (TC). The authors evaluated and compared three automated software testing tools to determine their usability and effectiveness. The authors have not highlighted the specific testing type and not mentioned enough information about the selection of automated testing tools. The authors have only illustrated the weaknesses and strong areas of these tools. Their study has also not determined the parameters of the automatic testing tools.

III. METHODOLOGY

There are lot of automated testing tools exist on the market available commercially or freely as open source. The automated software testing comparison study is conducted focusing on tools description and common features concerning each of the activity. In this study, the selected testing tools that perform the automated testing using record scripts and then playback these scripts as an important feature in testing automation [18].

3.1. Automated Software Testing Tools

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 [2]. Automated testing is the process of testing software with different data sets without human involvement. In other words automated testing is automating the process of manual testing. Automated testing covers all the problems



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of manual testing using automated tools such as Quick Test Professional (QTP) [2], Record and Replay (R&R) [3,4], RFT, Silk Test and Load Runner [5]. This increases the speed of testing process, reliability, repeatability, easy programming, comprehensiveness, and reusability.

Software developers might find problems in performing testing since it is somewhat difficult for them to manage both the development of a module and testing of it [5]. The use of automated testing tools tries to solve this problem to some extent and provides a convenient way to perform testing. There are two types of Testing tools [15], i) Open source test tools, and ii) Commercial test tools. Open source test tools- These test tools are free of cost for the users. These can be obtained from their official websites through internet or can be downloaded by the merchant free of cost. Commercial test tools- These test tools are costly. Because some companies settled their own tools and use their scripting language.

3.2. Quick Test Professional

Quick Test Pro (QTP) is a graphical interface based, record & playback automated testing tool. It is a tool used for automation of functional and regression tests for various software applications and environments. HP's 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, Java, Visual Basic applications and .NET frame work 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's Quick Test Professional is usually used for "UI Based" test case automation, it can also automate some "Non-UI Based" test cases such as file system operation and database testing [6].

3.3. Silk 4jTest

It is a code performance testing tool used across web, mobile and business applications. First advanced by Segue Software and later it is attained by Borland in year 2006. In year 2009 Borland was picked up by Micro Focus

International. It also embodies an object oriented language like C++. It can also ensure database authentication by DB Tester. Silk Test held extensions like: Windows GUI, DOM, Java, IE, Google chrome, Firefox, and .NET.

3.4. Load Runner

HP's Load Runner is a test automation product from Hewlett-Packard for application load testing: examining system behavior and presentation while generating real load. Load Runner works by creating virtual users which take the place of actual users'. The operative user such as Internet Explorer, transfers requests using the HTTP protocol to IIS or Apache web servers. Load Runner can make thousands of simultaneous operators to put the application through the severities of actual user load, although gathering information from key setup mechanisms. Production would be examined in aspect to realize the motives for specific conduct. Load Runner supports numerous set of instructions packages for load testing: such as Database, GUI Virtual Users, Java Replay, DCOM, Remote Access, .NET Record ,Remote Desktop, Network, Internet Application, Web 2.0, Web and Multimedia and Wireless.

IV. EVALUATION STRATEGY

There are number of open source and commercial window application tools available in the software market. Although the core functions of these tools are similar, however, they differ in functionality, features, and usability. With the above mentioned aspects, three automated testing tools that are Load Runner, Silk4j and Quick Test professional/Unified Functional Testing were in this study. The current versions of 12.50.1096.0 (Loadrunner), 12.52.6851.0 (HP QTP/UFT), and 16.5.0.7764 (Silk4jTest) were used. Comparison between these tools was made on the basis of different parameters. These parameters were record-playback capability, script generation capability, script languages support, application support, technical support, data-driven testing capability, report generation capability, debugging support, easy of learning, and license and training cost. Table 1 below lists all evaluation parameters with brief explanation of each.

Table 1: Evaluation Parameters.

Parameter	Explanation
Pricing	License cost of the tools if paid
Cross platforms	To what degree tool supports operating system
Application support	Which type of application are supported by tools
Cross-Browsers	How many browsers tools able to work with
Record-Playback	The ability of tool to record scripts to be run under different condition.
Script-language	Programming language used to edit testing scripts testing scripts
Ease of Learning	Working with GUI easy or not
Technical support	Tools provide any technical support or not

Data Driven Framework	The ability of tool to reduce efforts
Programming skills	Require programming skills or based predefined steps
Training cost	The training cost for tool 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 with tool
Product support	Tools supported by which software company

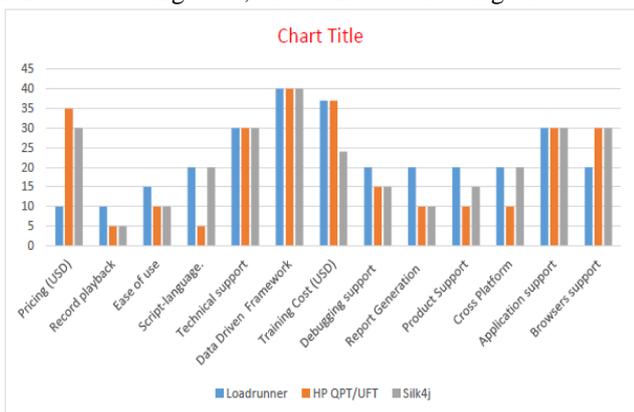
The comparison results of automated testing tools based on the listed features are given in the Table 2.

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

Test Criteria	Load runner	HP QTP/UFT	Silk
Pricing (USD)	0.56/Day	Licensed and very Expensive i.e. 8000	3,557.40
Cross Platform	Windows and Linux	Windows Only	Windows and Linux
Application support	Mobile application, client server application, network and web	Client server applications, Mobile applications	Windows ,enterprise, web and mobile application
Browsers support	Chrome and Firefox	IE-Firefox-Chrome	IE, Firefox and Chrome
Record playback	Support	Support	Support
Ease of use	Easy to learn	Easy to learn in a short time	Easy to learn
Script-language	Multiple script language support	VBScript	Multiple script language support
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 files, text files, XML, DB files	Excel files, text files, XML, DB files	Excel files, text files, XML, DB files
Training-Cost (USD)	3750/- 15 days training	3750/- 15 days training	2,400/-
Debugging support	Strong	Strong	Strong
Report Generation	Html	Html	Html
Product Support	Dedicate HP support along with support forums	Dedicate HP support along with support forums	

V. RESULTS AND ANALYSIS

For the purpose of rating the comparison parameters, we have used 3-point scale i.e. 30, 20, 10 as Good, Average, and Bad respectively. The value of different parameters was calculated using this 3-point scale. It results the different value for different parameters with selected automated tools. The calculated value of parameters is used for result and analysis of this comparative study. There is an overall comparison graph based on the result for all three automated functional testing tools, shown in the following chart.



VI. CONCLUSION

One can select a testing tool based on the type of application needed to be tested, financial plan, and the competence required. Loadrunner, Silk4j and HP UFT all three are very good tools for automated testing. Each tool has its own advantages and disadvantages. Loadrunner has easy to use UI and efficient playback. Loadrunner is best to use for applications with lesser training needs. It's a multi-language automated testing tool. Silk4j does not provide data security while testing. HP's UFT is best where data security is needed even while testing. But a major disadvantage of HP's UFT is its cost. As HP's UFT is a commercial tool, we need to pay a higher cost for this tool.

Silk4j is not just a functional API testing tool but also lets us perform non-functional testing such as performance and security test. There is no issue of high cost. Silk4j is also available as Silk Tester, which includes several time saving features aimed at making your testing faster and easier. QTP's advanced version can be used with lesser cost than Loadrunner and Silk4j. In conclusion, Loadrunner is the best tool among these three tools. This comparative study is helpful for users who want to select best tool among these four tools according to their requirements.

REFERENCES

1. IEEE, "IEEE Standard 610.12-1990, IEEE Standard Glossary of Software Engineering Terminology," 1990.
2. S. Rajeevan, and B. Sathiyar. "Comparative Study of Automated Testing Tools: Selenium and Quick Test Professional." International Journal Of Engineering And Computer Science, Vol. 3, No. 7, pp. 7354-7357, 2014.
3. Adamoli, D. Zapanuks, M. Jovic, and M. Hauswirth, "Automated GUI performance testing," Software Quality Journal, Vol. 19, No. 4, pp. 801-839, 2011.
4. R. N. Khan, and S. Gupta. "Comparative Study of Automated Testing Tools: Rational Functional Tester, Quick Test Professional, Silk Test and Loadrunner", International Journal of Advanced Technology in Engineering and Science, Vol. 3, No. 1, 2015.
5. <http://www.differencebetween.net/technology/software-technology/differences-between-qtp-and-rft/> (Dec-2015).
6. H. Kaur, and G. Gupta, "Comparative Study of Automated Testing Tools: Selenium, Quick Test Professional and Testcomplete." International Journal of Engineering Research and Applications, pp. 2248-9622, 2013.
7. Kaur and H. S. Sohal. "Automatic Test Case Generation with Silk Testing." International Journal of Computer Applications, Vol. 79, No. 15, 2013.
8. L. White and B. Robinson. "Industrial real-time regression testing and analysis using firewalls" Proceedings of 20th IEEE International Conference on Software Maintenance, pp. 18-27, 2004.
9. S. K. Shaveta, and N. Snehlata "Comparative Study of Automated Testing Tools: Quick Test Pro and Load Runner" International Journal of Computer Science and Information Technologies, Vol. 3, No. 4, pp. 4562-4567, 2012
10. Kuhn, D. Richard, and Michael J. Reilly. "An investigation of the applicability of design of experiments to software testing." Software Engineering Workshop, 2002. Proceedings. 27th Annual NASA Goddard/IEEE. IEEE, 2002.
11. Poston, Robert M., and Michael P. Sexton. "Evaluating and selecting testing tools." Software, IEEE 9.3 (1992): 33-42.
12. Börjesson, Emil, and Robert Feldt. "Automated system testing using visual GUI testing tools: A comparative study in industry." Software Testing, Verification and Validation (ICST), 2012 IEEE Fifth International Conference on. IEEE, 2012.
13. Tuszynski, Tobias, et al. "Evaluation of software tools for automated identification of neuroanatomical structures in quantitative β -amyloid PET imaging to diagnose Alzheimer's disease." European journal of nuclear medicine and molecular imaging (2016): 1-11.
14. Kos, Tomaž, Marjan Mernik, and Tomaž Kosar. "Test automation of a measurement system using a domain-specific modelling language." Journal of Systems and Software 111 (2016): 74-88.
15. Alégroth, Emil, Robert Feldt, and Pirjo Kolström. "Maintenance of automated test suites in industry: An empirical study on Visual GUI Testing." Information and Software Technology 73 (2016): 66-80.
16. Charest, Thomas, Nick Rodgers, and Yan Wu. "Comparison of Static Analysis Tools for Java Using the Juliet Test Suite." 11th International Conference on Cyber Warfare and Security: ICCWS2016. Academic Conferences and publishing limited, 2016.
17. Fraser, Gordon, et al. "Does automated unit test generation really help software testers? a controlled empirical study." ACM Transactions on Software Engineering and Methodology (TOSEM) 24.4 (2015): 23.
18. Shafique, Muhammad, and Yvan Labiche. "A systematic review of state-based test tools." International Journal on Software Tools for Technology Transfer 17.1 (2015): 59-76.
19. Candea, George, Stefan Bucur, and Cristian Zamfir. "Automated software testing as a service." Proceedings of the 1st ACM symposium on Cloud computing. ACM, 2010.
20. Parin, Chris, and Alessandro Orso. "Are automated debugging techniques actually helping programmers?." Proceedings of the 2011 International Symposium on Software Testing and Analysis. ACM, 2011.
21. Cadar, Cristian, et al. "Symbolic execution for software testing in practice: preliminary assessment." Proceedings of the 33rd International Conference on Software Engineering. ACM, 2011.