Analysis and Comparison of Performance Testing Tools

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Abstract- *The fact cannot be denied that in 21st century Software Testing plays a key role in software development and web application performance testing is gaining wide attention due to popularization of web applications rapidly and with that comes a big frailty. With the wide use of web application, performance problems particularly related to speed, response time, load time and poor scalability multiply. Also web applications are difficult to test in comparison to traditional applications especially in terms of Performance testing. So, Performance testing comes into play which is done by performance testing tools to ensure that the system runs for longer period of time without any deviations. Based on the factors on which a person wants to measure the performance of the system, the tool for testing is chosen i.e. the scope and quality of tools differ from one another. This research focuses on the study and evaluation of differences between the two tools used for performance testing namely Apache JMeter and HP LoadRunner. The objective is to understand the behaviour of various performance testing tools and determining the usability and efficiency. This research is undertaken with the aim of providing basic information about the tools on the basis of their properties and characteristics. This is done by analyzing the various parameters set in context of determining their performance. The findings are also supported with the justification by conducting an experimental survey. These tools show different behaviour under different parameters and depending upon the application (budget, time, nature, future prospects of software system under consideration that has to be tested) and tester's interest, each tool has its own importance. An empirical study is carried out on the basis of various parameters namely response time as a performance testing parameter.*

Keywords- Performance Testing, Web Applications, Apache JMeter, HP LoadRunner.

I. INTRODUCTION

In software, performance testing is the method of determining how a system reacts under a particular workload or task. In general, performance testing tests the speed, stability, and scalability of an application hence determines the performance of the system as these parameters do matter a lot in determining the performance of an application. It is the testing, which is performed, to check how the components of a system are performing in a particular situation. Resource usage, scalability and reliability of the product are also validated under this testing. This includes all time-related parameters for example load time, access time, run time, execution time, success rate, failure frequency, mean time between failures and overall reliability of software [1]. Performance testing can be performed as a benchmark test or load test and is carried out by exercising the system under test by feeding it the largest tasks it can operate with. It is the process of testing the capabilities of system in peak load where maximum number of concurrent users accessing system at same time [2].

There are different factors that govern the performance of a web application like throughput, response time, latency, resource utilization. The common bottlenecks of performance include CPU utilization, memory utilization, network utilization, operating system limitations and disk usage and the software that has less performance bottlenecks makes up for the good performance of it, as bottlenecking is often caused by one faulty section of code. To fix a bottleneck issue we find the section of code that is causes the slow down and try to fix it there.

II. LITERATURE SURVEY

Research work begins in vacuum and the related literature is worthwhile for an effective research.

Giuseppe A. Di Lucca, Anna Rita Fasolino [3] presented the main differences between Web-based applications and traditional ones and presented that Software testing is a difficult task and testing Web-based applications may be even more difficult, due to the peculiarities of such applications. B.M. Subraya and S.V. Subrahmanya [4] did a study on object driven performance testing of Web Applications which used the process of decomposition i.e. different parts of the Web site is tested with different parameters under different condition and stress level. Shikha Dhiman, Pratibha Sharma [5] did a comparison of web service testing tools and stated that performance testing to be done is a

must and it is used to determine the responsiveness, throughput, reliability, and/or scalability of a system under a given workload. So, proper tool must be selected in order to test the performance of the system.

J. Križani, A. Grguri, M. Mošmondor, P. Lazarevski [6] analyzed and compared several existing tools which facilitate load testing and performance monitoring, in order to find the most appropriate tools on the basis of some criteria such as ease of use, supported features, and license and put selected tools in action in the real environment, through several web applications and concluded that performance monitoring is an important part of software lifecycle. Daniel A. Menascé [7] focused mainly on load testing and stated that one way to assess IT infrastructure performance is through load testing, which lets you assess how your Web site supports its expected workload by running a specified set of scripts that emulate customer behaviour at different load levels. DipikaKelkar, KavitaKandalgaonkar [8] focused on the study and evaluation of differences in responses given by tools used for performance testing. The main objective of their study was to understand the behaviour of various performances testing tools and determining the accuracy of responses.

Dr.Shahid Nazir Bhatti,Rabiya Abbas,Zainab Sultan [9] did a comparative testing of automated load testing tools and after comparison and analysis, they deduced that anyone can choose the testing tool on the basis of budget and nature of software that has to be tested and each tool has its own benefits and drawbacks. Muhammad Dhiauddin ,Mohamed Suffian,Fairul Rizal Fahruraz [10] focused on the study and evaluation of response time differences given by three tools used for performance testing. Their findings clearly showed that different performance testing tool gave different response time when conducting load testing on same webpage. Ping Li, Dong Shi, JianPing Li [11] used the testing tool named LoadRunner to analyze how to detect the shortage of Web system performance precisely and did research based on traditional Web system performance testing theory.

III. OVERVIEW OF PERFORMANCE TESTING TOOLS

Performance test is vital to authenticate the responsiveness, scalability, and reliability features of software under test which is done by various performance testing tools namely Apache JMeter and HP LoadRunner.

A. Apache JMeter

It is an Apache product [6] that is used as a load testing tool for analyzing and measuring the performance of web applications to examine overall server performance under heavy load. Apache JMeter is an open source software, a java desktop application which is created to load test functional behaviour and measure performance of sites. It is one of the innovative software products which offer web application testing capabilities with a set of tools and integrations. The tool supports simulation of heavy load on a server by creating tons of virtual concurrent users to web server and developers can test performance and functionality of web applications and measure their compatibility and load strength across different platforms. The open source framework of it allows developers to download the code and make modifications in it according to application development requirements so developers can introduce customization. Apart from being an open source tool, ease of use, platform independency, robust reporting, ultimate testing and flexibility of it makes it an amazing tool.

B. HP LoadRunner

HP LoadRunner is a software testing tool, a product of HP which is used to test applications calculating system behaviour and performance of applications under load. Load Runner is used for real-time performance and fastens the release cycle of the application system [12]. An idea of an end to end system performance before going live is given by HP LoadRunner so that it can be verified that the new or upgraded applications meet the performance requirements. Performance testing is implemented using load runner from HP which is the most widely used load testing tool in market and the only tool which supports various development tools and technology and large number of communication protocols to conduct performance testing. Load runner uses the principle of simulating virtual user on subject application. Virtual users (VUsers) replicate clients request and await corresponding response to pass a transaction. Since number of VUsers run on a single computer, LoadRunner reduces the hardware requirements and it also allows to the developer to control all the VUsers from a single point of control. Apart from this, the tool is designed to support a vast selection of applications i.e. developers can test a variety of applications using this tool.

IV. OBJECTIVE

This study evaluates the performance testing tools namely Apache JMeter and HP LoadRunner. The objective of this research is to provide basic information about tools on the basis of their properties and characteristics, to measure how an application currently performs and to analyze the test results

based on the empirical study which is conducted on the basis of parameters namely usability testing parameters, technical requirement parameters and performance testing parameters.

V. COMPARATIVE ANALYSIS OF PERFORMANCE TESTING TOOLS

This section represents a comparative analysis of selected tools on the basis of features and parameters that are based particularly on the functionality as well as architecture of the tools and cover all the aspects of tool usability. The tools are executed simultaneously. The tests are conducted at the same instance of time at same network speed and when the tests are performed, different parameters like response time, throughput and latency etc. are retrieved and, on the basis of that comparison is made out. In this study namely Apache JMeter and HP LoadRunner are evaluated. Table 1 gives the basic information about the selected tools.

Table 1: Feature Comparison

Feature	Apache JMeter	HP LoadRunner
Platform	Supports Windows PC/MAC/UNIX platforms.	Supports Microsoft Windows and Linux OS.
Architecture	Master: JMeter GUI, controls each slave. Slave : JMeter server, receives command from the master and sends a request to the server. Target: web server under test, get requests from the slaves.	Virtual User Generator: automated performance test script (VUser Script). Controller: load generator and test execution. Analysis: analyse the results.
Community	Open Source software community.	Official forum on HP site.
Cost/Pricing	Free.	Licensed, paid.
Scripting	Here the script is a graphical tree of nodes with limited editing capabilities.	C (primarily) and Java.
Scenario composition	One script can contain multiple thread groups to form a scenario.	Scenario constitutes separate scripts configured together.
Protocol coverage	HTTP and Java related protocols along with FTP.	HTTP based protocols that have a broad coverage.
Benefits	Gives accurate results. Provides GUI and has many features that can be used while testing. Vast set of options for result analysis. Good for different tests to be run simultaneously.	Automatically traces client/server performance while testing. Best for performance testing when there is actual load. Can handle large number of users at the same time. Checks resources for improving performance.
Drawbacks	Takes more time to setup as it involves many steps.	Can have some configuration and installation issues.

The Table 1 draws the line of comparison between the platform, architecture, community, cost, scripting, scenario composition, protocol coverage, benefits and drawbacks of the two selected tools i.e. Jmeter and LoadRunner. The experimental approach was carried out which evaluated the performance of tools based on the usability testing parameters, technical requirement parameters and performance evaluation parameters.

Table 2: Usability Test Parameters Result

Usability Testing Parameter	Apache JMeter	HP LoadRunner
Friendly Interface	More.	Less.
Installation	Less time.	More time.
Terminology	Easy.	Difficult.
Tutorial availability	Good.	Good.

From Table 2, it is clearly depicted that when it comes to friendly interface as a usability test parameter, Apache JMeter is a clear winner as it is easier to work on as compared to HP LoadRunner. Installation as a parameter shows that Apache JMeter takes very less time as compared to HP LoadRunner. Apache JMeter is easier to understand the terminology used as compared to HP LoadRunner hence Apache JMeter is the winner. A lot of tutorials are available online to learn and use and there is a draw between the two tools in tutorial availability as a parameter.

Table 3: Technical Requirement Parameter Results

Parameter	Apache JMeter	HP LoadRunner
Cost	Open source, free.	License, paid.
Browser support	Chrome, Firefox.	Chrome, Firefox.
Supported language	Java.	C, JavaScript, VB.
Platform	Supports Windows PC/MAC/UNIX platforms.	Supports Microsoft Windows and Linux OS.

Table 3 draws the line of comparison between Apache JMeter and HP LoadRunner on the basis of Technical Requirement Parameters.

Comparison between Apache JMeter and HP LoadRunner is also done by the results obtained for the Performance Testing Parameters on which an experimental approach is carried out as shown in the table below. Here, we take Average Response Time as a means of comparison. Average response time for Apache JMeter is far better than LoadRunner. HP LoadRunner checks more options or attributes during request and response which is good as compared to Apache JMeter.

Table 4: Average Response Time

Tool	Targeted website	Results generation	Average Response Time (ms) at 11:00 AM
Apache JMeter	Web Tours	From Summary Report.	498
HP LoadRunner	Web Tours	From Analysis Report.	2128

From Table 4 and Figure 1, it is depicted that amongst the two selected tools, tool with highest response time is HP LoadRunner and the one with lowest response time is Apache JMeter. Therefore, taking into account average response time as the parameter for comparison, we can say that Apache JMeter has better performance than HP LoadRunner in terms of response time.

To conclude, we can say that though there is no clear line of comparison between these two tools as one is better than the other in one sense or other, still if we take one single parameter as the basic ground of comparison here, average response time, Apache JMeter is better than HP LoadRunner can be concluded from the above observations.
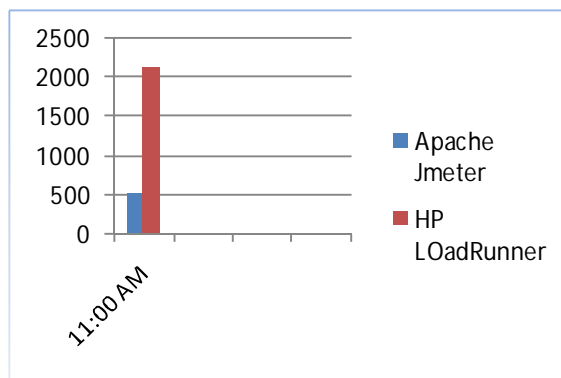

Figure 1: Average Response Time Result

VI. CONCLUSION AND FUTURE SCOPE

The two software performance testing tools compared in this research on the basis of different parameters are HP LoadRunner and Apache JMeter. Both tools are equivalently good for performance testing and depending upon

the application (budget, time, nature, future prospects of software system under consideration that has to be tested) and tester's interest, each tool has its own importance. Both tools show different behaviour under different parameters i.e. these tools are compared side by side on the basis of the requirements and expectations set out for an ideal performance testing tool. In this paper, performance testing tools namely Apache JMeter and HP LoadRunner are evaluated on the basis of properties and characteristics of the tools individually, since the tools only partially overlap in feature sets, and each one offers something the other ones do not. Both the tools are good for automation and it is not possible to make out a clear comparison between them as one tool has something in it which other lacks like JMeter surpasses LoadRunner because of its extensibility by virtue of being open source and LoadRunner license comes at a massive price. But LoadRunner supports a large number of protocols while JMeter has a limited exposure to different protocols. LoadRunner gives us a real time run result, as if a real end user is performing the task which is hard to rely when using JMeter. Mainly it depends upon the application to be tested like if we are using .net based applications, LoadRunner is a better choice but for java based applications, JMeter is prominent and average response time for Apache JMeter is far better than LoadRunner. Taking into account the above work comparison of the two tools puts more weight on Apache JMeter so, Apache JMeter is better than HP LoadRunner.

For future work, this research work can be extended to more software testing tools with different web services and different parameters which can be responsible for more realistic results.

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