A Comparative Analysis of Web Performance Testing Tools: Neoload, Loadstorm And Loadimpact

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Abstract- *In today's 21st century innumerable software applications are developed as a web based application which runs in a web browser. Today, softwares are coded as web based applications which help to access data from any part of the world with the help of the internet. As the web applications have become more common and complex, the need for testing the performance of web applications is also increasing. But to perform manual testing in most of the cases is time consuming, hectic and more prone to errors. For better results and to save money and time, automation testing is required. For automation testing, there is wide variety of testing tools available in the market. The testing tools can be open source and proprietary. The testing tools used for this research are proprietary tools. The main objective of this paper is to implement the web performance testing tools namely Neoload, LoadImpact and LoadStorm in different web browsers namely Google Chrome, Microsoft Edge, Mozilla Firefox and analyze their performance on the basis of different common performance testing parameters as average throughput, average response time, error rate.*

Keywords- web, application, performance, software, automation, testing parameters

I. INTRODUCTION

A web application is any application that uses a web browser as a client. Most web applications are based on the client-server architecture where the client enter information while the server stores and retrieves information. The different web applications have their own features and benefits however most common feature of all web applications is that it can be as simple as a message board or a guest sign-in on a website or as complex as a word processor or a spreadsheet. YouTube, Facebook, Gmail etc. are some examples of web applications [1]. There are some web applications which drive more traffic and engagement of users at the same time. So it becomes essential to measure the performance of the web applications. The performance of web applications is the response time it takes to process the user's request; it simply means how fast a web application can perform some specific task. The performance of web application depends upon some parameters like throughput, response time, error rate, concurrent users, request per second etc.

As web applications become more common and complex, the need for testing the performance of web applications is likewise increasing. Performance testing is used to ensure that web applications perform well under their expected workload. The goal of performance testing is not to find bugs but to eliminate the performance bottlenecks. The Web performance testing can be performed manually as well as in an automated way. In this rapid changing era and highly competitive business environment, manual testing has made it difficult for organization to analyze their web sites and applications. As manual method of testing is time consuming, hectic, and more prone to errors. So to test easily the huge amount of web applications automation testing is used. The Features of automation testing are:

- Automation testing saves money as well as time.
- Manual efforts are reduced by automation tools.
- It is less prone to errors because it requires less human intervention.

As automation testing is performed with testing tools, so choosing the best tool is not an easy task itself. There are wide verities of performance testing tools available in the market. The testing tools can be open source and proprietary. Choosing a testing tool here it is vital to consider parameters as opposed to the cost. The main objective of this research paper is to implement, evaluate and compare the web performance testing tools namely Neoload, LoadStorm and LoadImpact on the basis of throughput, average response time, error rate

The research paper has been organized into different sections. Section I gives the introduction about web applications, performance testing, need of performance testing, methods used to test the performance of web applications. Section II gives the literature survey related to the study. Section III describes the objectives of the study. Section IV presents the overview of the web performance testing tools used in the performance evaluation. Section V

discusses the results of the implementation and section VI describes the conclusions and future scope of the study.

II. LITERATURE SURVEY

The study has been carried out using research papers, books, and the internet sources.

Rigzin Angmo and Monika Sharma [5] Studied the Performance testing tools namely Selenium Suit. In this study selenium-webdriver and water-webdriver are analyzed. And it is concluded that Watir-webdriver is a very firm testing tool that uses a great browser automation engine. The performance of these testing tools are evaluated and compared. By performance evaluation it is clear that selenium- web driver is a better tool than water- webdriver. Watir is suitable under certain specific situations, but selenium web-driver is a better choice in various conditions like using domain specific language.

Vandana Chandel et al. [6] gave a comparative analysis of automated testing tools namely Apache JMeter, Load Runner, and QTP (Quick Test Professional). These testing tools are compared on the basis of their performance, speed, throughput and efficiency. It is concluded that Apache JMeter is the tool to go forward with. It has simple, clean user interface. And it is free of cost, have complete portability and 100% JAVA pure application.

Sandeep Bhatti, Raj Kumari [2] presents a comparative study of different load testing tools for testing web applications. These load testing tools are compared on the basis of different measurements as language used, operating system, protocol, development year, language support, browser support and tool architecture. From this analysis, it is concluded that Neoload is the best tool for load testing due to its script less design and visual programming.

S.M.K Quadri and Sheikh Umar Farooq [3] described goals, principles and limitations of software testing. To perform testing effectively and efficiently, everyone involved with testing should be familiar with the software testing goals, principles, limitations and concepts related to it. When the testing principles are implemented in a real world software development environment to accomplish testing goals to maximum extent. Then there arises some limitations. These testing limitations will validate the research and will pave a way for future research.

Abhijit A Sawant et al. [4] explained software testing, need for software testing, software testing goals and principles. Software testing levels like unit testing, integration testing, system testing, maintenance testing are described. Further software testing principles such as black box testing, white box testing and software testing techniques like reliability testing, performance testing, correctness testing are explained in detail at last it gives the difference between software testing and debugging. And concluded that testing is not only used to locate defects but also correct them.

III. OBJECTIVES

The specific objective of this research paper is to implement the web performance testing tools namelyNeoload, Loadstorm and LoadImpact and analyze their performance on different browsers (Google Chrome, Microsoft Edge and Mozilla Firefox) on the basis of performance parameters average throughput, average response time and error rate.

IV. WEB PERFORMANCE TESTING TOOLS: NEOLOAD, LOADIMPACT AND LOADSTORM

The implementation is done on the available hardware and software configuration of the system. The minimum requirements for experimental setup are windows 2000, an Intel Pentium 4 processor or later with memory 256MB and disk 16GB. The environment in which implementation is performed is Microsoft Windows 10, 64-bit with memory 4GB, processor Intel Core i3 CPU530 @2.45 GHz and disk 500GB. The implementation is carried out using testing tools Neoload, LoadImpact and LoadStorm.

The implementation is divided into three cases on the basis of browsers used. It evaluates the performance of the testing tools namely Neoload (ver. 5.1.1), LoadStorm (Loadstorm pro) and LoadImpact (ver. 3.0) in three different browsers i.e. Google Chrome (62.0.3202.62), Mozilla Firefox (50.0.1), Microsoft Edge (ver. 41.16299.15.0) with three different web applications as financial (sbi.co.in), social (facebook.com) and educational (hpuniv.nic.in) websites. The tools are compared on the basis of common parameters of the three tools. The parameters are average throughput, average request response time and error rate. The basic information about the selected testing tools namely Neoload, LoadStorm and LoadImpact are tabulated in table 1.1.

Table 1.1: Basic Information of Web Performance Testing Tools

Sr. No.	Testing Tools / Features	Neoload	LoadImpact	Loadstrom
1	Development Language	JAVA	JAVA	JAVA
2	Operating System	Microsoft windows, Linux and Solaris	Microsoft windows, Linux	Microsoft windows
3	Protocol	JSON and SPDY	TLS, SSL	HTTP
4	Development Year	1.0/first version in 2005	2008	2001
5	Latest Version	6.1.2	3.0	Loadstorm pro
6	Language Support	AJAX, .NET, J2EE, FLEX, SOAP	XML, JAVA	JAVA
7	Browser Support	Multi Browser	Multi Browser	Multi Browser
8	Tool Architecture	Controller and Load Generator.	Load testing tool and page analyzer	Loadstorm cloud engine.

V. RESULTS AND DISCUSSIONS

The implementation is divided into three cases on the basis of browsers used. The first case is in which the testing tools are implemented in Google chrome with three websites and their performance is analyzed in terms of throughput, request response time and error rate. The second and third cases are implemented on Mozilla Firefox and Microsoft edge.

Case 1: Web browser Google Chrome (ver. 62.0.3202.62) is used to test average throughput, average request response time and error rate on testing tools Neoload, LoadImpact and LoadStorm with different URLs (sbi.co.in; facebook.com; hpuniv.nic.in).

Throughput: Throughput is the average net data transfer rate in bytes per second. There are two important metrics in bandwidth consumption- download and upload speed. These bandwidth speeds are not constant; they fluctuate based on how much load is placed on the network.

Throughput (T) = (No. of bytes) * 8 / (Finish Time – Start Time) bps

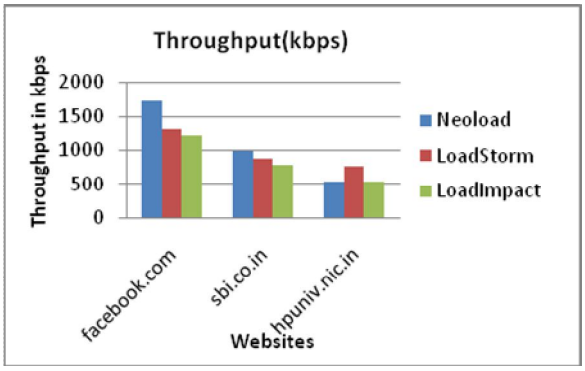

Figure 1.1: Throughput of Testing Tools in Chrome

From figure 1.1 it is seen that Neoload shows the highest throughput for social website because upload and download speeds are almost equal for social website and network parameter. While in case of financial website (sbi.co.in), download speed is more than the upload speed that is why the throughput for financial website is less. There are fewer viewers to view educational site mentioned above as compare to the other two websites, so it shows the least throughput.

Error Rate: Error rate is the degree of errors encountered during data transmission over a communication or network connection. The higher the error rate**,** the less reliable the connection or data transfer will be.

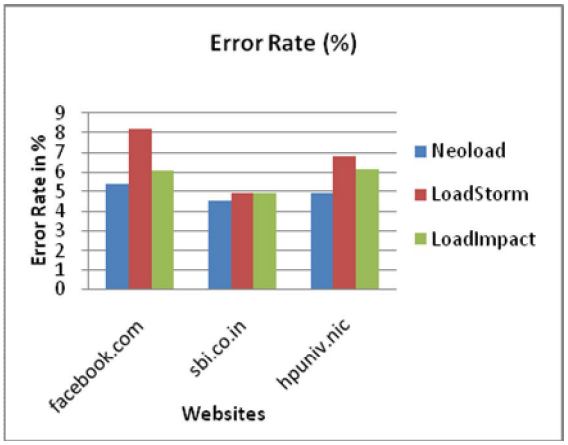

Figure 1.2: Error Rate of Websites shown by Testing Tools in Chrome

From figure 1.2, it is found that Neoload shows the least and LoadStorm shows the highest error rate among these three testing tools. From the above analysis it can be concluded that Neoload is the best tool and LoadStorm is worst in terms of recording errors.

Request Response Time: The total amount of time it takes to respond to a request for service. That service can be anything from a memory fetch, to a disk IO, to a complex database

query, or loading a full web page. The request response time is directly proportional to the number of users.

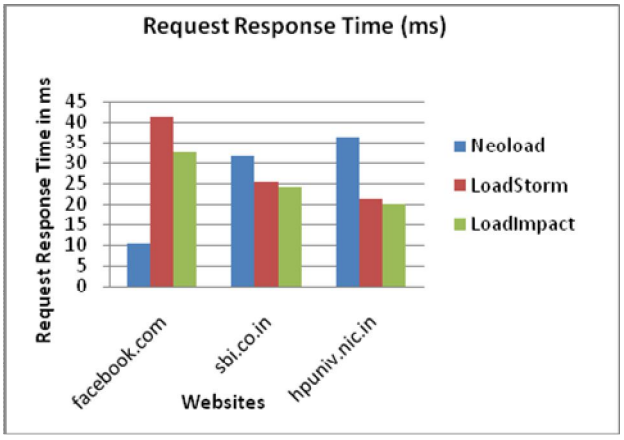

Figure 1.3: Request Response Time taken by different Testing Tools in Chrome

From figure 1.3, it is observed that LoadImpact comes out to be the best testing tool as it took least request response time among these three.

Case-2: Web browser Microsoft Edge (ver. 41.16299.15.0) is used to test average throughput, average request response time and error rate on testing tools Neoload, LoadImpact and LoadStorm with different URLs (sbi.co.in; facebook.com; hpuniv.nic.in).

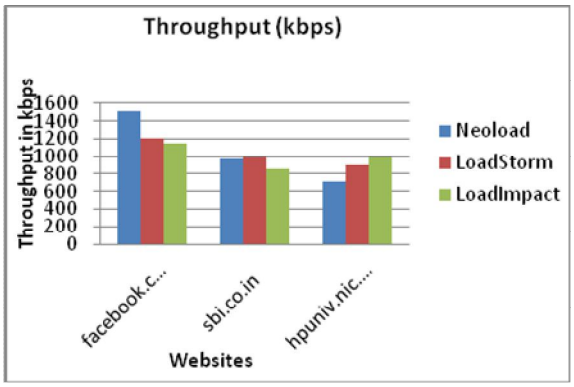

Figure 1.4: Throughput of websites shown by Testing Tools in Edge

From figure 1.4, it is observed that Neoload shows the highest throughput while LoadImpact shows the lowest throughput for all the three websites. So it can be concluded that Neoload is the best tool than the other two tools in terms of measuring throughput.

Figure 1.5: Error Rate Websites recorded by Testing Tools in Edge

From figure 1.5, it is depicted that Neoload shows the least error rate while LoadImpact shows the highest error rate for the given websites. So the testing tool which shows the least error rate comes out to be the best tool among these three i.e. Neoload.

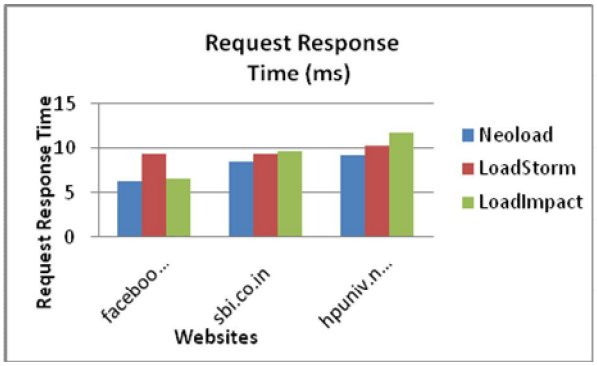

Figure 1.6: Average Request Response Time of websites recorded by testing tools in Edge

From figure 1.6, it is concluded that Neoload took least average request response time while the LoadImpact took the highest for all of the three web sites, so Neoload comes out to be the best testing tool as compare to the other two tools in terms of measuring request response time.

Case-3: Web browser Mozilla Firefox (50.0.1) is used to test average throughput, average request response time and error rate on testing tools Neoload, LoadImpact and LoadStorm with different URLs (sbi.co.in; facebook.com; hpuniv.nic.in).

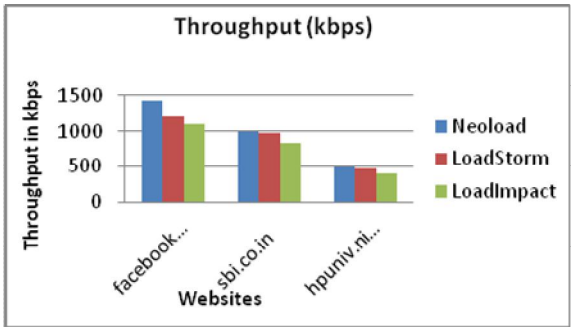

Figure 1.7: Throughput of Websites recorded by Testing Tools in Firefox

Figure 1.7 show that Neoload shows the highest throughput for the three websites while LoadImpact shows the least. So Neoload is said to be the best tool in terms of measuring throughput.

Figure 1.8: Error Rate of Websites recorded by Testing Tools in Firefox

From figure 1.8, it is depicted that Neoload shows the least average error rate while the LoadImpact shows the highest average error rate for the given web sites. So Neoload with least error rate becomes the best tool among the three in terms of recording error.

Figure 1.9: Average Request Response Time of websites recorded by Testing Tools in Firefox

From figure 1.9, it is concluded that Neoload shows least request response time while the LoadImpact shows the highest for all of the three web sites. So in terms of recording the request response time Neoload comes out to be the best tool among the given testing tools.

From the results as shown above, it is observed that different tools give different results in all the browsers. To give a clear view of this research, we took an average of results based on three parameters as throughput, error rate and request response time.

Table 5.1: Average Throughput (kbps) of Websites in Three Web Browsers

Testing Tools / Websites	Neoload	LoadImpact	LoadStorm
facebook.com	1550.15	1207.21	1197.77
sbi.co.in	990.35	887.67	925.12
hpuniv.nic.in	575.41	432.11	395.29

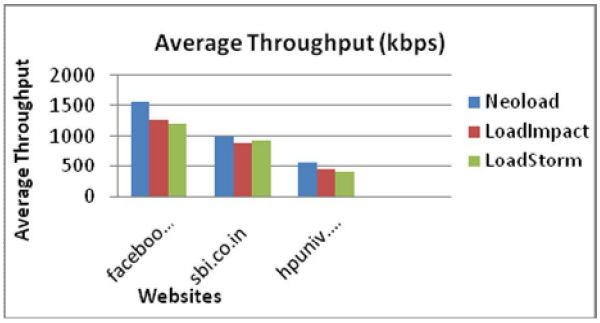

Figure 2.1: Average Throughput of all the websites in all the web browsers

From figure 2.1, it is concluded that Neoload shows the highest average throughput for all the websites in all the browsers. And the least average throughput is shown by LoadStorm.

Table 5.3: Average Error Rate (%) of Websites in Three Web Browsers

TestingTools / Websites	Neoload	LoadImpact	LoadStorm
facebook.com	3.2	4.4	4.8
sbi.co.in	2.9	4.1	5.2
hpuniv.nic.in	5.8	6.5	6.1

Figure 2.2: Average Error Rate of all the websites in all the web browsers

From figure 2.2, it is concluded that highest error rate is shown for "hpuniv.nic.in" by all the tools. And Neoload comes out to be the best tools among these three as is shows least error rate for all the websites.

Table 5.4: Average Request Response Time (ms) of Websites in Three Web Browsers

Testing Tools / Websites	Neoload	LoadImpact	LoadStorm
facebook.com	1144.01	1277.56	1322.02
sbi.co.in	1435.35	1647.43	1895.64
hpuniv.nic.in	1885.89	1934.12	2135.73

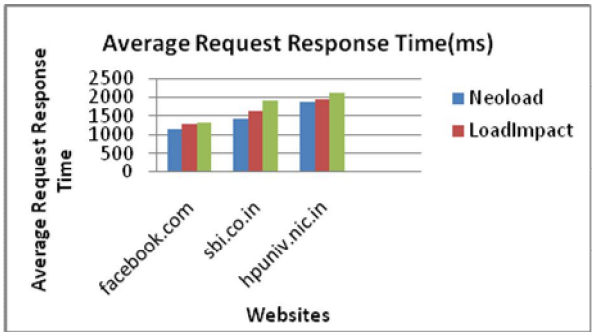

Figure 2.3: Average Request Response Time of all the websites in all the web browsers

From figure 2.3, it is concluded that on the basis of average request response time Neoload performs better than the other two testing tools.

VI. CONCLUSIONS AND FUTURE SCOPE

Performance testing is a type of testing intended to determine the responsiveness, throughput, reliability, and/or scalability of a system under a given workload. It is performed using automation testing tools. There is wide variety of web performance testing tools available in the market. In this paper the web performance testing tools namely Neoload, LoadStorm and LoadImpact are evaluated on the basis of parameters average throughput, average request response time and error rate. From the implementation results, it is concluded that performance of Neoload is better in terms of average throughput, average error rate and average request response time for all the web applications in all the browsers. The second best performance is shown by LoadStorm. LoadImpact shows the least performance in terms of the given parameters. In future performance evaluation can be done by taking more parameters and more web browsers or different testing tools for more realistic results.

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