

Comparison between Automated and Manual Approaches to Performance Testing of Java Web Applications

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Abstract:- Today performance of a web application holds the key to user satisfaction, how quickly and smoothly the web application responds to user requests thus becomes very crucial. This paper intends to focus on evaluating Java web application's performance using automated and manual performance testing approaches. This work will make use of best in class performance testing tools to evaluate the performance of the Java web application and further attempt to compare these automated analyses with results of manual performance tests conducted by a group of users. This work will enable to evaluate the performance of our application thus indicating how well the application responds to concurrent user requests, which are generated automatically by scripts as well as those created by physical concurrent users under manual test. Thus the paper will also give a comparative study between the two approaches.

Keywords:- Automated Performance Testing; Manual Performance Testing; Performance Testing; Jmeter Performance Testing.

I. INTRODUCTION

If the web pages take too long to open due to considerable number of concurrent users, the users may get irritated and may choose not to use the service anymore. Therefore, nowadays performance testing constitutes one of the most important and critical phase in the testing cycle for any web based application.

It has become even more crucial that we carry out more and more research in this field as stable and robust web applications that can handle considerably huge concurrent user loads are defining the digital revolution around the globe. This work comprises of initially developing a Java web application using the standard Java web development tools. The focus then will be to test the performance of the Java web application using Apache Jmeter tool for load testing. This tool will enable to generate scripts for various actions the virtual users will perform on the Java web application. The load that is the number of virtual users can be adjusted as needed.

Similarly a manual performance test will also be carried out with the same number of physical users as the virtual users generated by Apache Jmeter. These physical

users will perform exactly the same actions as listed in the Jmeter scripts for virtual users. This work will enable to do a comparative study between the automated and manual approaches to performance testing of Java web applications. The test results will also help us ensure that our Java web application performs satisfactorily during high user load at peak business hours.

II. RELATED WORK

In the paper [1] by Samrat Naik Gaonkar the performance testing is carried out on a Java web application using Apache Jmeter and later the performance of the web application is improved by identifying the bottlenecks in the application and fixing the same. Rijwan Khan and Mohd Amjad in their paper [2] discuss the importance of performance testing of web applications. They perform load test on their web application using HP ALM- LoadRunner version 11 in order to verify if the performance of the application meets the customer requirements mentioned in the Service Level Agreement for application development. They analyze the reports generated to reach to a conclusion. In our research work we try to take this work one step ahead by comparing the reports with the reports of the manual performance testing approach.

A lot of research has also gone into the various performance testing tools, trying to evaluate the tools to find the most suitable one. Shikha Dhiman and Pratibha Sharma in their paper [3] compare three such tools namely Apache Jmeter, Grinder and HttpRider. In this paper they focus on the importance of the performance/load testing tools. The paper says that the performance testing tools automate testing process making it easier. Thus the automated load testing tools reduce the cost, time and effort required compared to manual testing.

The comparison made by the paper between the three testing tools on parameters like response time, throughput and latency recorded by them during testing, helps us to choose a performance testing tool based on our specific requirements.

Similarly paper [4] compares another set of three such tools namely NeoLoad, loadstar, WAPT. Another research paper [5] presents a new approach for performing load testing of web applications by simulating realistic user

behavior with stochastic models of user behavior. The models are constructed from sample data and take into account effects of session history on user behavior and the existence of different categories of users. Papers [6], [7], [8], [9] also emphasize on the role of performance testing in software development and different ways to evaluate the performance of a web application under test.

III. JAVA WEB APPLICATION UNDER TEST

This research work focuses on the e-commerce domain. A Java web application is developed for an online gym store. Figure 1 below shows the system architecture for this application.

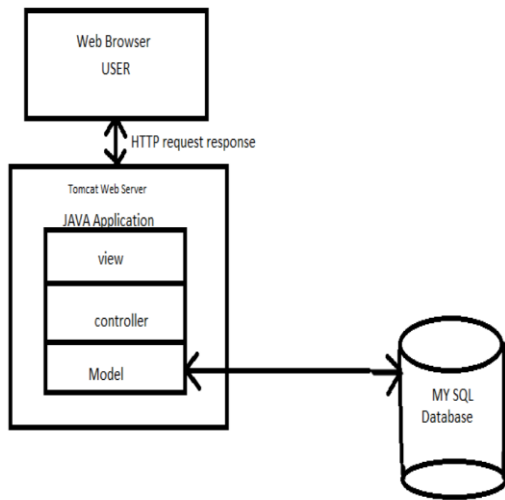


Fig 1:- Java web application system architecture

Figure. 2 below depicts the flow of control within the application.

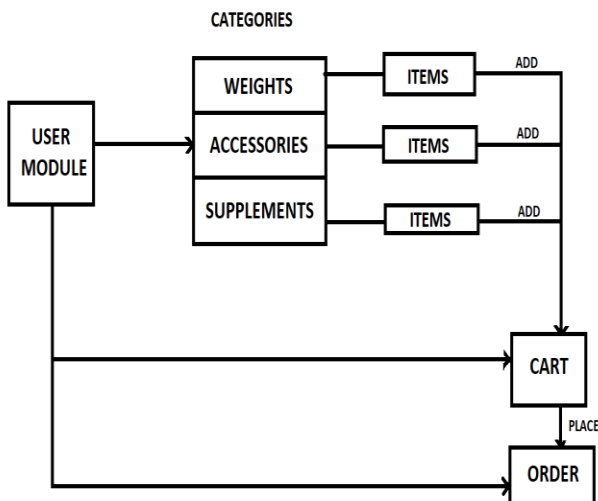


Fig 2:- The control flow within the Java web application.

IV. AUTOMATED PERFORMANCE TESTING USING APACHE JMETER

The tool used for carrying out the automated performance testing in this work is Apache Jmeter (version 2.1). It can be used to simulate a heavy load on a server hosting a web application to test its strength and to analyze overall performance under different load types [10]. See Figure. 5 below for the list of actions to be performed in the Jmeter script rendered from Apache Jmeter 2.10.

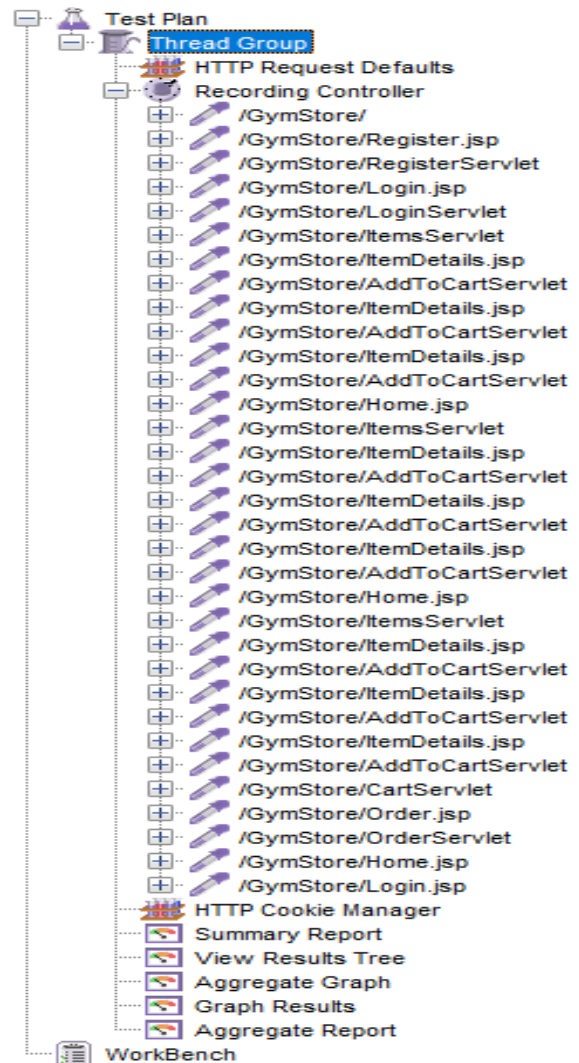


Fig 5:- List of actions to be performed in the Jmeter script. Source: Apache Jmeter version 2.10

The aim here is to formulate scripts for Apache Jmeter for the Java web application under test. The script will have the list of actions the virtual users will perform once the load test is started.

Once the script is ready the Apache Jmeter is loaded with the number of concurrent virtual users that will perform the actions. We have selected 30 users in this study. These users will be added all at a time since the ramp up time is selected to be 0. Thus the application will experience a virtual load of 30 users performing the set of actions given to them simultaneously. Table 5.2.1.1 shows

the stress test results for 30 users. This data is rendered by Apache Jmeter Version 2.10.

The tables depict the average, minimum and maximum times taken in milliseconds to successfully

complete each action performed by the Jmeter script. They also show an error percentage in the test, in case any of these actions fail. Fig. 5.2.1.2 shows the graphical representation for the stress test results for 30 users r. This data is also rendered by Apache Jmeter Version 2.10.

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	KB/sec	Avg. Bytes
/GymStore/	30	3	1	20	4.01	0.00%	60.6/sec	102.51	1732.0
/GymStore/Register.jsp	30	8	2	17	4.49	0.00%	61.1/sec	160.15	2684.0
/GymStore/RegisterSe...	30	582	50	1010	219.19	0.00%	24.4/sec	14.06	589.0
/GymStore/Login.jsp	60	14	1	56	11.37	0.00%	6.2/sec	9.99	1649.0
/GymStore/LoginServlet	30	424	32	1087	230.40	0.00%	15.3/sec	19.65	1311.7
/GymStore/ItemsServlet	90	338	27	1134	255.10	0.00%	14.5/sec	64.00	4526.3
/GymStore/ItemDetails...	270	14	1	113	13.54	0.00%	41.0/sec	56.30	1405.0
/GymStore/AddToCart...	270	352	73	1331	161.49	0.00%	40.0/sec	177.46	4544.3
/GymStore/Home.jsp	90	9	1	24	5.53	0.00%	11.6/sec	14.89	1311.7
/GymStore/CartServlet	30	312	36	932	198.68	0.00%	10.9/sec	84.32	7926.7
/GymStore/Order.jsp	30	12	2	41	10.53	0.00%	11.6/sec	13.72	1216.0
/GymStore/OrderServlet	30	2205	1601	3027	315.97	0.00%	6.2/sec	5.01	829.7
TOTAL	990	239	1	3027	416.16	0.00%	101.4/sec	272.07	2746.8

Table 1:- Performance test results for 30 users. Source: Apache Jmeter version 2.10

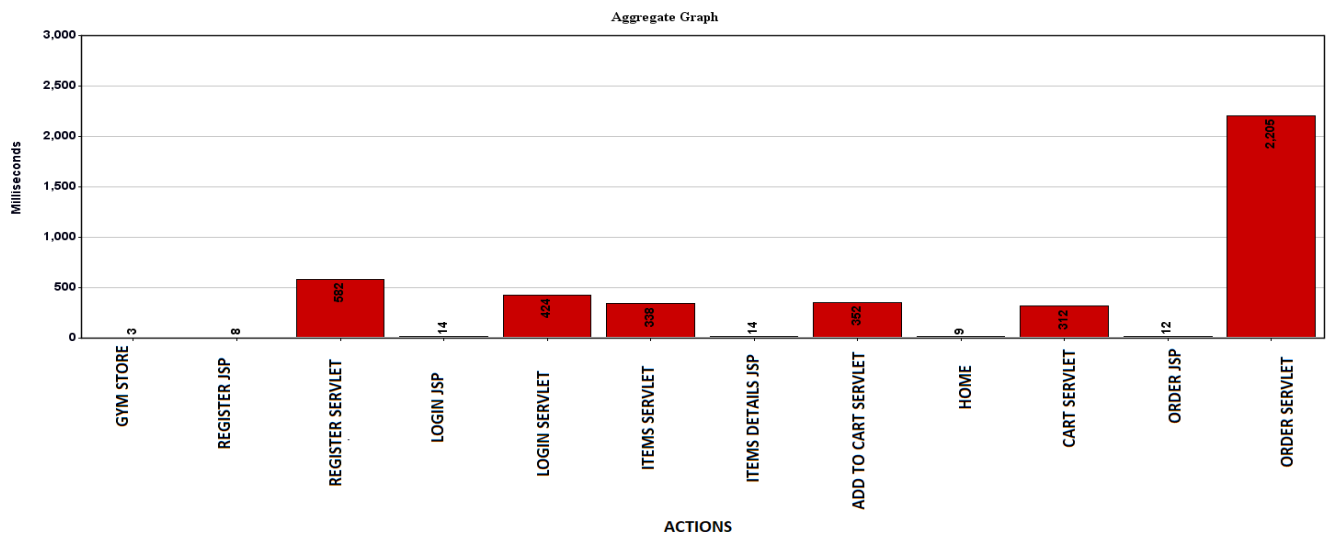


Fig 7:- Graphical representation for the stress test results for 30 users. Source: Apache Jmeter version 2.10

➤ Manual Performance Testing Using Physical Users

An experiment was arranged where 30 users concurrently accessed the web application using machines connected via LAN. The same set of actions were carried out as present in the Jmeter script in the same order. The

time taken by each user to complete the entire set of actions successfully was recorded using a timestamp entry being saved in database on completing the last action for each user. Table 2 below shows the manual stress test results for 30 users.

<i>Users</i>	Time for Completion (in seconds)
User 1	53.11
User 2	46.13
User 3	61.42
User 4	54.31
User 5	41.00
User 6	62.12
User 7	71.37
User 8	56.34
User 9	58.22
User 10	48.32
User 11	49.89
User 12	52.45
User 13	68.34
User 14	56.98
User 15	59.86
User 16	61.23
User 17	63.33
User 18	61.34
User 19	82.46
User 20	53.76
User 21	51.24
User 22	59.56
User 23	54.19
User 24	48.74
User 25	46.29
User 26	47.66
User 27	54.69
User 28	64.12
User 29	67.28
User 30	49.63

Table 2:- Manual performance test results for 30 users.

V. COMPARISON BETWEEN THE RESULTS OF AUTOMATED VS. MANUAL TESTING

It is seen in the automated performance testing that it takes on an average 4.27 seconds to finish the entire stress test, whereas in the case of manual performance testing it takes on an average 56.84 seconds to finish the load test.

Clearly it takes more time for the Manual performance testing, this can be attributed to the time taken in entering the data like user details while registering a new user, for typing in the login credentials, also the time taken to correct any mistakes while making these entries. Since in automated performance testing the parameters for filling the forms are saved in the script no time gets wasted in typing in the data during new user registration or while logging in. The involvement of human interaction increases

the time taken for the manual stress test compared to the automated stress test.

VI. CONCLUSION

In this research work we carried out performance testing of our Java web application using the automated and manual approaches. Although the manual stress test takes more time to complete due to the human interaction involved compared to automated, but it gives a good replication of the real world scenario in which the application would operate in future. It is observed that the automated performance testing is a much easier approach to implement which is more accurate and less time consuming and hassle-free compared to manual approach. Hence automated performance testing should be the preferred approach in most of the situations.

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