

Performance Testing on Web-based Application using LoadRunner

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Abstract: - Software development life cycle (SDLC) has many phases and testing is one of them. Testing plays an important role in the quality of the product. As most of the businesses are now web application oriented, it is become more important to ensure the quality of website or web-based application. Testing takes place from the first phase to complete life cycle of the software. Web testing process includes the basic functionality of the application, user interface, accessibility, performances on the heavy traffic etc. There are many testing challenges or factors involved in web-based applications. Many tools and techniques are developed by software industries to minimize those testing challenges. In this research work, LoadRunner testing tool is used to determine the responsiveness, throughput, reliability and scalability of a system under a given workload. The plan was applied to the performance testing phase of the online flight tickets booking web application. After analyzing the load testing results, proposed the improving measures, and also found the defect of the system when the massive users access the system and guided the system improvement using the test result.

Keywords: - Web application, LoadRunner, Vusers, Vuser scripts.

1. Introduction

The software is a collection of related programs and procedures along with their documentation. In a software development, testing consumes a lot of time and it also called the most costly phase of software development. Testing describes that developed software meets its quality standards or not? [1].

Developing of a website does not end with combine media with software code. Infact website work never completely finished. At the point when all the plan is done, you need to test the website first before sending it to the World Wide Web for the world to see. With the improvement of web innovation, the web is ending up increasingly vital in our lives so it has even turned into a fundamental component. The utilization of the Web has never been constrained to PCs; it has been opened to advanced gadgets like mobiles, tablets etc. [2].

Performance describes how much time required for system or component to meets its requirements. Responsiveness and adaptability are essential measurements for performance testing. Responsiveness describes the capacity of application to meet its goals for reaction time or throughput. The response time is that time which taken by the application or system for event execution. The throughput of a system means number of events processed in specific interval of time [3].

Scalability means software continues meets its response time or desired output while function's demands are high or low. Any system asset, software, hardware or network bandwidth capacity that spots characterizing limits on information stream or preparing speed makes a bottleneck. In Web applications, bottlenecks specifically influence execution and versatility by constraining the measure of information throughput or confining the quantity of utilization associations and exchanges. These issues happen at all levels of the software design, including the system layer, the Web server, the application server, and the database server [4].

LoadRunner works by making virtual users who replace genuine users of web application, for example, sending demands utilizing the HTTP convention to IIS or Apache web servers. Request from numerous virtual client customers are produced by Load Generators in order to create load for different servers which are under test [8].

A. Introduction to Web application architecture

Web Performance Testing is used to identify the genuine execution of a web application and expected execution that the application could provide, distinguishing, in addition, conceivable bottlenecks and giving valuable guidance to settling the issue (tuning of hardware parts, alteration of programming or tuning system parameters) [6].

For better understanding the web application performance testing it is quite important to understand the architecture of web application (Figure 1). Its architecture includes:

- Web browser play station where client use the application or request to the server,
- HTTPs which provide the client to server connection for information exchange,
- Web servers are used to control the request from client and forward them to appropriate application server,
- Application servers are used to store the application code and control the request from web server. Also give the response of the request,
- Database store the data of the application for security and provide the access only for the authorized users.

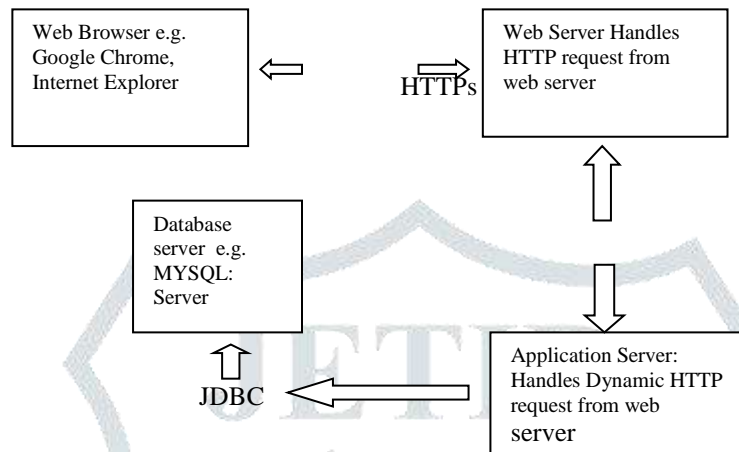


Fig 1: Web application architecture

2. Introduction to load testing

Load testing is used to examine that the application works fine when multiple user access the web application and make transactions whether it can handle all the transaction or not. This paper selected the web application of online air ticket booking as the test object, which is running on local host IIS (Internet Information Services) introduced the process of the performance testing using the LoadRunner as test tools, and found out restriction factor of the system operation based on the analysis of the test results, and then put forward the system improved scheme [8].

For example: whenever the holiday or weekends, the pages of the ticket booking sites will answer slowly, users always wait anxiously. So the performance test of these web application systems before release is very important, the load testing is the important part of the performance testing. A web sites system looks perfect, and the functions can accurately be realized. However, some problems can be found by load and stress testing, such as pressure resistance of system and the user experience. The effective implementation of the system load testing can predict bottleneck during the congested traffic, and can solve the problem before releasing the system.

3. Proposed Work

A. Install a web application environment on local host

The web application under study, Online Air Ticket Booking, allows the users to register and Login from client side. Users can search for the Flights from the one place to another place which are available on user defined date and book number of seats, after selecting the number of seats user allowed to make payment. The application uses the Xampp local server along with PHP.

This application supports HTTP, HTTPS, FTP, FTPS, SMTP, NNTP and various other protocols that are used in web application communication.

A web server is responsible for providing a response to requests that come from users. When a request comes from client to server takes that request from users and process it and send response back to users.

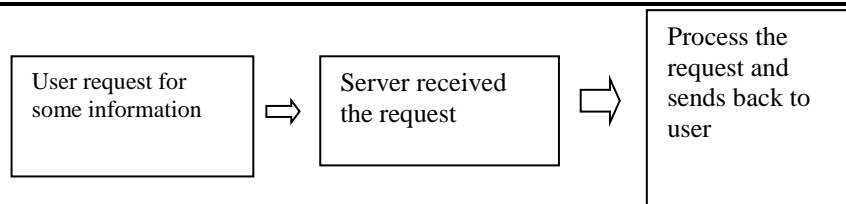


Fig 2: client server architecture

B. Load Testing Tools LoadRunner

Once your web application condition is good to go, you should concoct an approach to create the massive amount of user activity that web application figure it out. The old strategy for gathering up everybody in the workplace for a major execution test won't cut it any longer. You need to use software to reproduce the load. There are various tools available that are LoadRunner, NeoLoad and JMeter. In this paper authors used LoadRunner.

LoadRunner is a free open-source multi-platform tool which supports load testing of web applications and includes functionality to test the applications based on following protocols: HTTP, JDBC (for database), etc. Being open-source, enhancements can be incorporated in LoadRunner based on the specific requirements of the test, which makes it quite a useful and flexible tool. In LoadRunner, user workloads are defined by virtual user which specifies the concurrent users and the requests that would be sent by virtual user.

Testing steps in LoadRunner:-

1. Planning the Test
2. Creating the Vuser scripts
3. Creating the Scenario
4. Running the Scenario
5. Analyzing Test Results

- **Planning the test:** During planning section all the load testing objectives are accomplished step by step for better results with a clear vision of testing scenarios.
- **Creating the Vuser scripts:** Vuser script is the collection of all the action or the activities which will be done by the Vusers. All the action done by a Vuser calculated as transactions.
- **Creating the scenario:** A scenario describes the events that occur throughout a testing session. It includes an inventory of machines, scripts, and Vusers that run throughout scenario. LoadRunner user can develop scenario with the help of LoadRunner Controller. In user created scenarios, user need to describe how many Vuser or load generator are required for script. In web testing, user must need to set a final state for scenario which has to be achieved at the end. LoadRunner can automatically design the scenarios for web testing.
- **Running the scenario:** LoadRunner user can instruct multiple Vuser that they can use the server to perform their tasks simultaneously. In the initial stage, user set the how the entire scenario, Vuser groups, or individual Vusers will execute.
- **Analyzing Test Results:** During scenario execution, LoadRunner records the performance of the application under different loads in the form of graph as well as in table form.

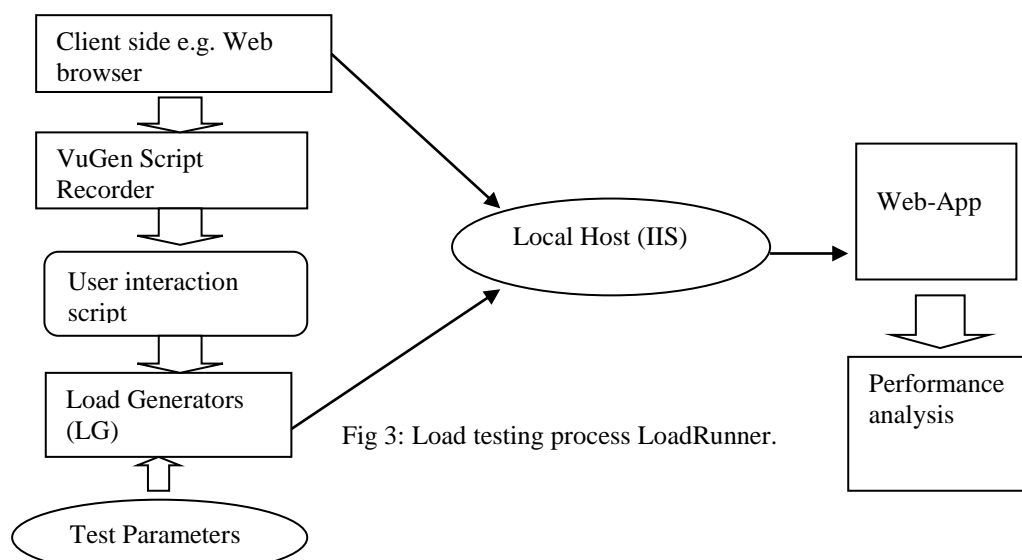


Fig 3: Load testing process LoadRunner.

IV. RESULT AND DISCUSSION

An essential matter of this work pertains to the measurement and modeling of the web application performance. [Result can be display in many forms like in table or graphical representation. However, it's mandatory to understand, what is meaning of numbers in the table and curves of graph mean. LoadRunner is used to display the result in the form of table and graph. Due to this approach these analysis summary are good for checking the progress of the designed test. The load test went fine and the load test successfully executed without any issue with respect to its throughput, number of transaction and hits per second.

Test scenario result

In the Load testing of this Web application, we created different test scenario as below in order to perform load testing. The test scenarios were formulated keeping the overall objectives of the applications into consideration.

Table 1: load testing of Login-Scenario for up to 50 users.

Maximum Running Vusers:	Total Throughput (bytes):	Average Throughput (bytes/second):	Total Hits:	Average Hits per Second:	Number of Transactions Failed
2	14,259,021	70,940	1,045	5.199	0
5	37,510,516	164,520	2,750	12.061	0
10	90,013, 566	276,115	6,600	20.245	0
15	139,156,990	527,110	10,260	38.864	0
20	187,522,227	429,113	13,750	31.465	0
25	255,025,004	691,125	18,700	50.678	0
30	238,507,108	792,382	17,590	58.439	0
35	313,531,686	567,992	22,990	41.649	0
40	359,999,913	631,579	26,398	46.312	2
45	386,965,081	754,318	27,081	52.789	3
50	427,451,196	791,576	791,576	58.046	5

The above table describes the behavior of web application in terms of total throughput, average throughput(bytes/sec), total hits ,average hits per second and the most important factor of measuring performances of web application is number of transaction failed.

The results are useful however they show that web application won't be ready to support huge amount of users at satisfactory response times, giving poor performance. On the behalf of functionality provided by the web application, an affordable performance objective is to sustain forty to fifty users with a session response time of five seconds while no assume time. Considering appreciate objective, the web application performance has got to be improved. The plan is to identify bottlenecks and remove it. The bottleneck could be a software resource such as the Application Server, the database or it could a hardware bottleneck such as IIS, CPU.

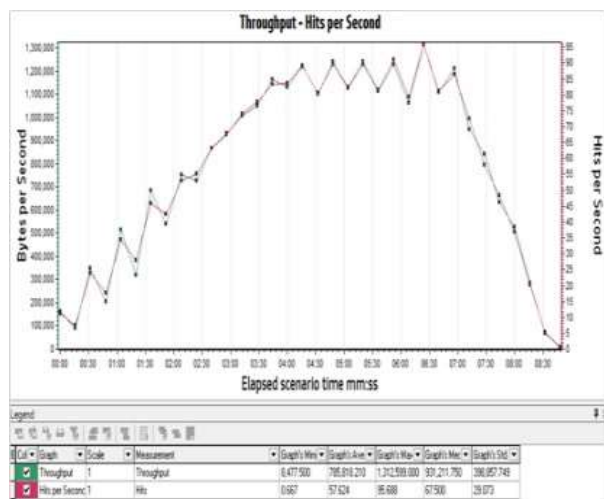


Fig 4:Throughput-Hits/second of 50 User

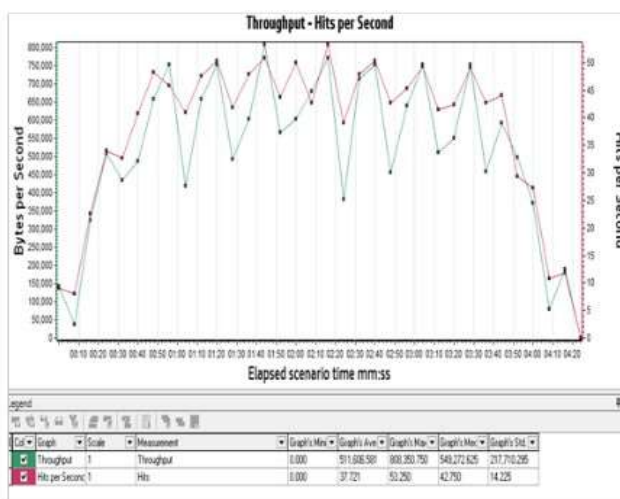


Fig 5: Throughput-Hits/second of 10 User

Transaction Summary

Transactions: Total Passed: 558 Total Failed: 2 Total Stopped: 0 Average Response Time

	Pass	Fail	Stop
Total	558	2	0
None	558	2	0

Transaction Name	SLA Status	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail	Stop
Action Transaction	🟢	0.179	0.468	1.943	0.249	0.779	478	2	0
None	🟢	0.179	0.468	1.943	0.249	0.779	478	2	0
user and Transaction	🟢	0	0	0.001	0	0	40	0	0
None	🟢	0	0	0.001	0	0	40	0	0
user init Transaction	🟢	0.001	0.001	0.003	0.001	0.002	40	0	0
None	🟢	0.001	0.001	0.003	0.001	0.002	40	0	0

Service Level Agreement Legend: 🟢 Pass 🚫 Fail 🟡 No Data

Fig 6: Transactions summary of 40 User

Transaction Summary

Transactions: Total Passed: 665 Total Failed: 5 Total Stopped: 0 Average Response Time

	Pass	Fail	Stop
Total	665	5	0
None	665	5	0

Transaction Name	SLA Status	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail	Stop
Action Transaction	🟢	0.182	0.537	2.393	0.298	0.939	565	5	0
None	🟢	0.182	0.537	2.393	0.3	0.939	565	5	0
user and Transaction	🟢	0	0	0	0	0	50	0	0
None	🟢	0	0	0	0	0	50	0	0
user init Transaction	🟢	0	0.007	0.168	0.028	0.004	50	0	0
None	🟢	0	0.007	0.168	0.028	0.004	50	0	0

Service Level Agreement Legend: 🟢 Pass 🚫 Fail 🟡 No Data

Table 7: Transactions summary of 50 User

V Conclusion and Future Work

Internet expanding rapidly, Web applications is becoming increasingly important sources of revenue. A literature survey revealed that users are not tolerant of delays of more than 10 seconds when using the main objective of this paper was to design and implement performance test and execute it against a web application. The test was implemented using performance testing tool LoadRunner which is a free solution for this approach. As more and more web technologies have moved a long way to create web application. Web testing plays an important role. We analyze our web application that it works fine when we gradually increase the number of virtual user but as the number of virtual user exceeds 40 to 50 the number of failed transaction increase. So we conclude that this type of testing as scale down testing that means web application working fine up to 40 virtual users so if we want 4000 user can use our web application without any problem we have to scale up our server and hardware configuration hundred times.

This research work can be further enhanced by compare more testing tools and along with new protocols or update. It will be helpful to find out the best tools for performance testing of the web applications. Further, some different metrics can be used for performance evaluation so that comparison could be more realistic and reliable.

References

- [1] G. J. Myers, T. M. Thomas and C Sandler, "the Art of Software Testing", John Wiley & Son 2004.
- [2] S. Sharmila, E. Ramadevi, "Performance Evaluation And Comparison Of Web Application Testing Tools WAPT Pro and Apache JMeter", International Journal for Scientific Research Development, Vol. 3, Issue 5, August, 2007.
- [3] D.A. Menasce, A.F. Almeida, "Challenges In Scaling E-Business Sites", Computer Measurement Group Conference, Vol. 10, Issue 15, December, 2000.

- [4] S. Sheetal, S.D.Joshi," Identification Of Performance Improving Factors For Web Application By Performance Testing", International Journal of Emerging Technology and Advanced Engineering, Vol.2, Issue 8, August 2012.
- [5] Y.M. Rasal, S. Nagpure., " Web Application Performance Testing Using Reactive Based Framework", International Journal of Research in Computer and Communication Technology, Vol. 4, Issue 2 ,February 2015.
- [6] R. Khan, M. Amjad, D. Pandey , "Load Testing Of Web Applications Using Hp LoadRunner", International Journal of Emerging Trends & Technology in Computer Science, Vol. 5, Issue 3, June 2016.
- [7] P. Sharma, " Web Application Testing (Major Challenges and Techniques)", International Journal of Modern Trends in Engineering and Research, Vol. 1, Issue 4, October – 2014.
- [8] P. Fageria, M. Kaushik, "Research of Load Testing and Result Based on Load Runner", International Journal of Civil Engineering Vol. 1, Issue 5, April 2014.
- [9] Z. Hui-li, L. Shao-bo , " Research of Load Testing and Result Application Based on LoadRunner", National Conference on Information Technology and Computer Science, September 2008.
- [10] J.K. Geetha, Monika, "Web Application Testing: A Survey", International Journal of Recent Technology and Engineering, Vol.1, Issue 6, January 2013.
- [11] G. Graef , M. Gaedke, " An Evolution-oriented Architecture for Web Applications", International Journal of Scientific & Engineering Research, Vol. 12, Issue 13, August 1999.
- [12] R.S. Freedman, "Testability of Software Components", IEEE Transactions on Software Engineering, Vol.17, No.6, April 2004.
- [13] Haroon, Shakirat, Oluwatosin , "Client-Server Model, Journal of Computer Engineering", Vol. 16, Issue 1, February 2014.
- [14] V. Nandal, K. Solanki, " literature review of performance testing on web-based application using loadrunner" Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org, Volume 5, Issue 2, February 2018.

