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Comparative Study of Load Testing Tools

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ABSTRACT: Software testing is an essential part of delivering quality assured and reliable software in SDLC model. Nowadays, most of the software applications are web applications that run on web browser. As there is exponential growth of web applications, it is important to test these applications to ensure that they can perform well under heavy loads. Load testing as a part of software testing is used for monitoring performance of web applications. It is used to define the maximum amount of work a system can handle without performance degradation. It design and simulate user traffic which can be used to test your application infrastructure for performance, reliability and scalability. In this paper main focus is on discussing various load testing tools that are useful for testing performance of system under heavy loads. To choose the best tool for analyzing performance of system various parameters such as response time, memory utilization, hits per second etc are used.

KEYWORDS: Load testing, Web applications, Performance Monitoring and Load Testing Tools

I. INTRODUCTION

Software testing is one of most important part in software development life cycle. It is essential in each stage of software life cycle. There is 40% work on software testing in software development. Software testing is used to detect and correct the defects or bugs in software [1].

As use of web applications growing, it is important to measure performance of web applications. Most of the applications have large amount of traffic of users. Performance testing is a non functional type of testing used to determine the performance of system. It improves the performance of application before deployment. Performance characteristics have many aspects such as workload, Number of users, hardware configuration, CPU utilization etc. There are various types of performance testing such as load testing, stress testing, volume testing, endurance testing, spike testing, scalability testing. Among these load testing is widely used. Most of the performance analysts rely heavily on load testing. Load testing generally refers to a process of assessing performance of system while putting demand on system [2].

It is important to specify load requirements before testing begins. Due to exponential growth of web -applications, vast number of users assesses web applications. To handle such a large number of users, it is important to monitor the performance of web applications. So process of monitoring and testing performance of web applications under normal load and anticipated peak load condition is done by load testing .Various load testing tools are used for monitoring performance of web applications under load. Various issues are related with tools while performance testing such as tools installation, tools set up response time, test environment [3].
In this paper, section II has discussion about performance testing types and III about web application that have to test using load testing tool. Section IV is about load testing tools and section V describes final conclusion.

II. PERFORMANCE TESTING TYPES

Performance testing is important for analyzing and monitoring performance of web applications. There are various types of performance testing [4] that is used to measure performance that is how well the system performs when

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applying load. It validates and verifies scalability, speed and stability under different load conditions. Some of them are described below:

TABLE I. TYPES OF PERFORMANCE TESTING

S.NO	TYPE	DESCRIPTION
1.	LOAD TESTING	Load testing refers to putting demand on system and analyze performance
2.	STRESS TESTING	Refers to large numerical inputs, large queries and for handling errors under heavy loads. Prevent system from crash
3.	VOLUME TESTING	Refers to testing with certain amount of load
4.	ENDURANCE TESTING	Refers to put a load on a system for a period of time and check performance
5.	SPIKE TESTING	Refers to increase the load suddenly and analyze the behavior whether it degrade or handle the changes in load
6.	SCALABILITY TESTING	Refers to ability of system to work under changing in size or volume as desired

III. LOAD TESTING ON WEB APPLICATIONS

Web applications can be defined as computer programs consisting of client-server architecture that allows visitors to Submit and retrieve data over the Internet using their web browser and presented to the user within their browser dynamically by web application through server in specific format [5]. Environment consists of different operating systems, browsers and network connection.

Load testing is performed on web applications by simply increasing virtual users for maintaining required load [7]. Each time when user visit, script recorder record information and creates related interaction script [6]. Recorded scripts are replayed by load generator. Replay process consisting of hardware and software statistics like CPU, memory, response time, throughput of system etc. these statistics are monitored and collected by conductor and then load testing report will be generated by analyzing all statistics [10]. Time limit is required to evaluate system performance. If task is not completed within given time limit and conditions then failure report is generated. Fault in running environment can cause failure. Response time, think time, throughput, platform, scalability etc are the parameters that affect load testing.

IV.LOAD TESTING TOOLS

Load testing tools are used for testing the web applications under different load conditions. There are numerous different users accessing at same time so it is important to test the web applications so that performance improves and identify that which element degrade the performance of web application. There are various load testing tools available for testing web applications. Some of load testing tools are:

- LOADRUNNER
- NEOLOAD
- WAPT
- SOASTA CLOUD TEST

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- LOADSTORM
- LOADSTER
- APACHE JMETER
- HTTPERF
- LOADUI
- LOAD IMPACT

1.) LOADRUNNER: It is performance testing tool developed by Hewlett - Packard for executing large number of tests or virtual users concurrently. It prevents application performance problems before deployment of new system or upgrading system [7]. Load Runner goes through various step while performing load testing i.e. test plan, test scripts create running scene, analysis of results etc. Virtual user generator (VuGen), controller and analysis are main components of load runner. VuGen is used to create virtual users and for setting up test scripts such as log in and exit. Test plan of multiple users are generated using controller. System's error can be quickly identified using analysis tools and make modification if required. Analysis tools gives result in various forms and allows to see summaries or details of load test for finding problems .Hardware and software costs can be reduced by accurately predicting application scalability and capacity. It is compatible with Microsoft windows and Linux operating system.
2.) *NEOLOAD:* NEEOLOAD is developed by Neotys, a French company and written in java language. It is a performance measuring tool used for improving and optimizing performance of website under heavy load by increasing traffic on website [8]. End results can also be evaluated by using this tool. A huge number of virtual users simulated concurrently. Testing is performed more accurately and frequently by using this tool. It is used for both mobile and web applications. By use of this tool, we come to know about capacity of applications and amount of users it can handle. Controller and load generator are two main components of Neoload. Controller allows user to create, record scenarios, run tests and analyze the results by providing graphical interface. Controller also used to manage load generator. Load generator is used to run scenarios by sending requests. This tool is compatible with Microsoft Windows and Linux operating systems.
3.) *WAPT:* WAPT is best effective tool that provides load, stress and performance testing of web applications. It measures and analyzes performance of any web application under various different load conditions and environments. It can test the web application with browser and operating system. It is cost effective tool for testing web application. Performance information can be collected directly from server and database by using WMI and SNMP interfaces [8]. This tool provides information in detail about various virtual users. Test creation and execution is performed by GUI. Graphs and reports are created to analyze the performance characteristics of web application under different load conditions. Operating system compatibility, browser, windows compatibility are various challenges that WAPT faces during testing. Operating system with which this tool is compatible Microsoft windows server
4.) *SOASTA CLOUD TEST*: This tool is widely used for mobile applications and websites. This tool allows number of users use web application at same time. This tool has ability to know actual performance of website under heavy load by increasing traffic. Cloud platform is required for cloud test. Task scheduling, monitoring and resource management are basic problems handled by cloud test. Lot of information need to be collected and has to configured manually and very complex to use. It is compatible with Linux, Mac operating system.
5.) *LOADSTORM*: It is a cloud based load testing tool for measuring performance of web applications in which own load test plans, testing criteria and scenarios can be generated. There is no need of scripting knowledge. It can generate up to 50000 users. It is a simple tool easy to afford. Parameters like response time, throughput, and requests per second and concurrent users are defined by real time graphs in this tool. You can create your own test plans and scenario. It allows sending huge amount of request per second with the help of cloud infrastructure. It is compatible with windows operating system. Various graphs and reports are used to measure the performance.
6.) *LOADSTER:* This tool is effectively used to identify performance bottlenecks in web applications. It is HTTP desktop based load testing tool in which scripts are recorded in web browser. GUI can be used to modify scripts. Large number of virtual base users can be simulated with control over network bandwidth. HTML report is generated with graphs after execution of test [8]. This tool is compatible with windows
7.) *APACHE JMETER*: It is a desktop open source load testing tool for testing web application and also expanded to create functional test plan and integrated with test plan. It is application that supports java platform and works under UNIX and windows operating system. This tool check performance and analyze working under different conditions by loaded itself into server. JVM or higher is required to run. In APACHE JMETER performance is tested on both static

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and dynamic resources [9]. Its multithreading framework allows concurrent and simultaneous sampling of different functions. In this tool, GUI is used to building faster test plan and debugging. JMETER looks like a browser but actual it is not a browser.

8.) *Httperf:* Httperf is a tool developed by David Mosberger to monitor the performance of web applications and important to define server name and number of requests. These requests are used to load the server. This tool is widely used in HTTP servers. The goal of this tool is to identify how many responses a particular server can generate. It summarizes the overall performance by HTTP GET request generated from server. Efficiency can also be analyzed with the help of response rate. It supports HTTP protocol and compatible with windows and Linux.

9.) *LOADUI:* LOADUI is open and cross platform load testing tool for testing various protocols and also for analyzing and measuring performance of web applications. Plug-ins is used to add LOADUI at run time [10]. It supports all standard protocols. It can create, upload and distribute load tests in real time. It enables load testing faster and accurate using graphic interface. There is automatic updating in this tool. It is not required to restart it again and again if there is need of change and modify the application.

10.) *LOAD IMPACT*: LOAD IMPACT is cloud based performance testing tool for web application testing and mobile application testing. It can test up to 1.2 million concurrent users simultaneously. It creates traffic to websites analyzes and improves performance of any web application. It is supported with windows and Linux operating system

TABLE II. LOAD TESTING TOOLS

S. no	Name of tool	Language Use	Operating system	Protocol	Development year	Developer	Language Support	Browser Support	Tool Architecture
1	**LoadRunner**	C	Microsoft Windows and Linux	HTTP based protocols	11.52/ first vesion in 1989	Hewlett - Packard	VB, VBscript, java, javaScript, c#	Multi browser	VuGen, Controller, Load Generator and Analysis.
2	**Neoload**	JAVA	Microsoft Windows, Linux and Solaris	JSON and SPDY	1.0/first version in 2005	French Company Netosys	AJAX... NET,J2EE,FLEX, Silverlight,SOAP	Multi browser	Controller and Load generator
3	**WAPT**	JAVA	Microsoft windows server 2003/2008/ 2012, windows XP/Vista/7	HTTPS/SSL	WAPT 3.0/2003	Gras Alex	ASP.NET,JAVA	Multi browser	.Load engine and distributed architecture consist of server and database
4	**SOASTA Cloud Test**	JAVA	Linux, Mac operating system.	Web socket	2006	Ken Gardner	JAVA	Multi Browser.	Client Server, Maestro load engine
5	**Load storm**	JAVA	windows	HTTP	-	Roger and Scot	JAVA and Ruby on Rails	Firefox, IE, Chrome, Safari	EC2 cloud
6	**Loadster**	HTML	windows 7/vista/XP	HTTP	-	-	HTML	Multi Browser	Loadster Cloud engines
7	**Apache Jmeter**	JAVA	Unix and Windows	HTTP, FTP, JDBC, SOAP LDAP, TCP JMS, SMTP POP3, IMAP	2.12 / November 10, 2014	Stefano Mazzocchi	Java, Bean shell, JavaScript, Jexl	JVM1.4	Supports plug-in architecture
8	**Httperf**	Ruby	Windows and Linux	HTTP/1.1 and SSL	2006	David Mosberger	Ruby	Multi Brower	Request generators and URL generators
9	**LoadUI**		Cross platform	REST, AMF, JMS, JDBC	2010	Smartbear	JAVA,JAVAFX, Groovy	Multi Browser	Generator and Runner
10	**Load Impact**	JAVA	Windows and Linux	TLS,SSL	2008	Ragnar Lonn	XML,JAVA	Firefox, IE, Chrome, Safari	load testing tool and the page analyzer

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V.CONCLUSION

In this paper, large number of load testing tools is described for testing web application. Load testing is concerned with analyze performance of web applications under different normal load testing conditions and anticipated peak conditions and analyze which factor degrade the performance. Load testing tools are used for monitoring the performance of system. From the above tools it is analyzed that Neoload is best tool for load testing due to its script less design and visual programming. This tool has property of automatic detection and handling of application specific parameters. Drag and drop functions for if statements and loops. It records HTTP traffic between server requests and response. It analyzes results using real time graphs and statistics. So from the properties of mentioned tools in Table II, Neoload is chosen as best tool for load testing.

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