



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 2, February 2016

A Comparative Study on Load Testing Tools

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ABSTRACT: Load testing helps us to identify the performance of the system under heavy load. This is achieved with the help of a Load Testing Tool. This paper mainly focuses on comparing load testing tools-Apache JMeter, HP LoadRunner, WebLOAD, The Grinder on the basis of parameters like Server Monitoring, Unlimited Load generation, ease of use, cost, etc. The primary objective is to study these load testing tools and identify which one of them better and more efficient.

KEYWORDS: Apache JMeter, HP LoadRunner, WebLOAD, The Grinder, parameters for comparison.

I. INTRODUCTION

A software project must have gone through various testing while it was under development. But to know whether or not your software can handle the number of end users load testing is done.

Load testing is the process of putting demand on a software system or computing device and measuring its response. Load testing is performed to determine a system's behavior under both normal and anticipated peak load conditions to identify the maximum operating capacity of an application as well as any bottlenecks and determine which element is causing degradation.[3]

As the Microsoft guide *Performance Testing Guidance for Web Applications* states:

A load test enables you to measure response times, throughput rates, and resource-utilization levels, and to identify your application's breaking point, assuming that the breaking point occurs below the peak load condition.[2]

Based on the actual customer behaviour load testing can measure your website's QOS performance. Nearly all the load testing tools and frame-works follow the classical load testing paradigm: when customers visit the web site, a script recorder records the communication and then creates related interaction scripts. A load generator tries to replay the recorded scripts, which could possibly be modified with different test parameters before replay. In the replay procedure, both the hardware and software statistics will be monitored and collected by the conductor, these statistics include the CPU, memory, disk IO of the physical servers and the response time, throughput of the System Under Test (short as SUT), etc. and at last, all these statistics will be analyzed and a load testing report will be generated[3]. This paper is mainly organized in four sections. First section provides the background information about load testing. Introduction of the available tools taken for this study is given in section two and comparison parameters are described in section three. Study concluded in section four.

II. AVAILABLE TOOLS

There are many tools available in the market. Some of them are free while others are paid but each tool has a trial version. In this paper we will discuss about four tools namely:

1. WebLOAD
2. Apache Jmeter
3. HP Load Runner
4. The Grinder

To know which tool satisfies our need we need to know more about each tool. Hence now we will give a comparative study of each tool.

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1. WebLOAD

Description: WebLOAD is a load and performance testing tools that lets you perform load and stress testing on any internet application using Ajax, Adobe Flex, .NET, Oracle Forms, HTML5 and many more technologies.[5] Load can be generated from the cloud and on-premises machines. WebLOAD's strengths are its ease of use with features like DOM-based recording/playback, automatic correlation and JavaScript scripting language. The tool supports large-scale performance testing with heavy user load and complex scenarios, and provides clear analysis on the functionality and performance of the web application. [5][6]Fig.1 explains how WebLOAD works under load.

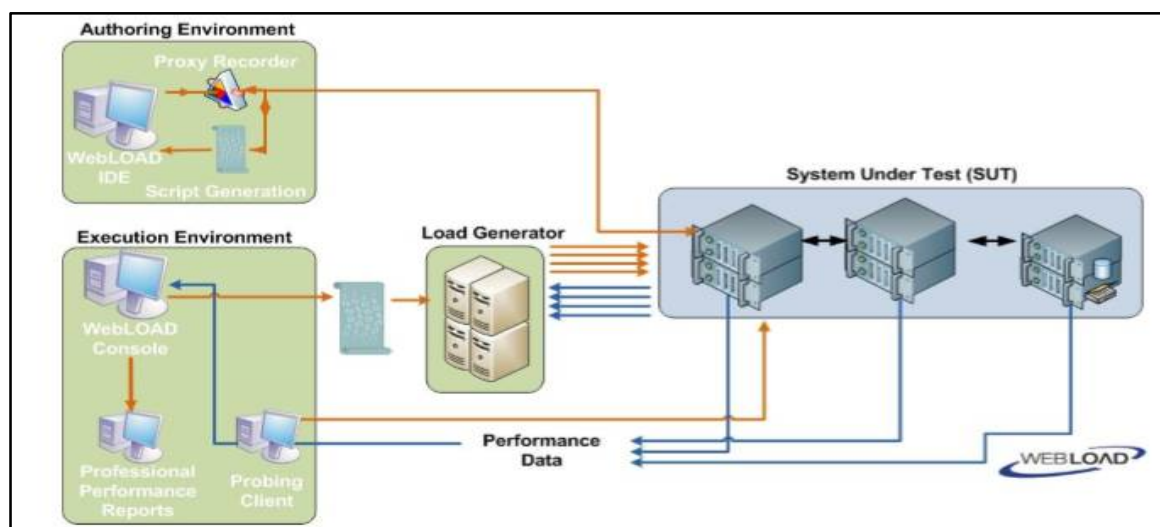


Fig.1. Workflow of WebLOAD [13]

WebLOAD System Requirements: WebLOAD can run both in Windows and Linux.

Key Features of WebLOAD:

1. Test creation is easy.
2. Provides real world load simulation
3. Automatic correlation of dynamic values
4. Results can be recorded for future reference
5. Power of JavaScript
6. Automatic bottleneck detection
7. Cloud load generation.[6]

2. Apache JMeter

Description: It is a open source performance testing tool and a Java platform application that can be integrated with test plan or functional plan. This tool can be loaded into a server or network so as to check on its performance and analyze its working under different conditions. It is of great use in testing the functional performance of the resources such as Servlets, Perl Scripts and JAVA objects. [5] Apache Jmeter executes its actions as shown in Fig.2

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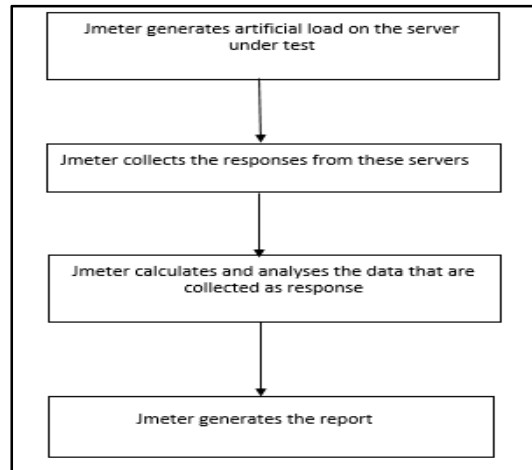


Fig.2 Work Flow of Apache Jmeter

Apache JMeter System Requirements: Jmeter can run on Unix and Windows

Key Features of JMeter:

1. JMeter being Java platform can run on any Operating System.
2. JMeter can execute in distributed mode thus making it scalable.
3. JMeter supports HTTP, SMTP, POP3, LDAP, JDBC, FTP, JMS, SOAP, TCP protocols out-of-the-box.
4. Multiple pre-processors and post-processors are implemented around sampler providing advanced setup, teardown parametrization, and correlation capabilities.
5. Multiple built-in and external listeners to visualize and analyze performance test results
6. Integration with major build and continuous integration systems are possible.[7]

3. HP Load Runner

Description: It is a performance testing tool which is useful in understanding and determining the performance and outcome of the system when there is actual load. This tool enables you to gather all the required information with respect to the performance and also based on the infrastructure. The LoadRunner comprises of different tools namely; Virtual User Generator, Controller, Load Generator and Analysis.[5]How LoadRunner creates and manages the artificial traffic is explained in Fig.3.

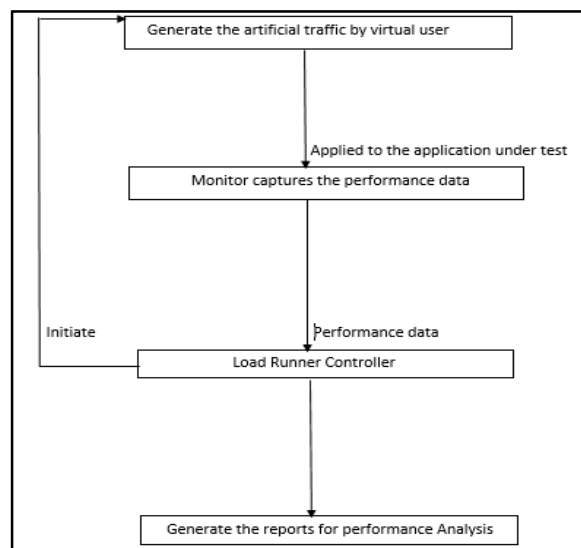


Fig.3 Workflow of HP Load Runner

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LoadRunner System Requirements: Can run on Microsoft Windows and Linux

Key Features of LoadRunner

1. Interactive Recording and Scripting is possible.
2. Browser-based and native mobile applications can be tested using the most advanced network behavior and service virtualization in the industry.
3. We run simple, elastic, and realistic tests from multiple geographies.
4. Tests can be performed by scaling load testing in the cloud up and down to simulate the demands of business applications.
5. Performance testing can be integrated into your development environment including IDE, continuous integration, and build systems.
6. Application performance bottlenecks can be identified using non-intrusive, real-time performance monitors that leverage application-layer and code-level data for root cause and analytics.[8]

4.The Grinder

Description:The Grinder is a free Java-based load-testing framework available under a BSD-style open-source license developed by Paco Gomez and is maintained by Philip Aston.The Grinder consists of a Grinder Console; that controls various Grinder agentsand monitors results in real time, and Grinder Agents; load is created by load generators.[5]Fig. 4 explains how The Grinder works under load testing environment.

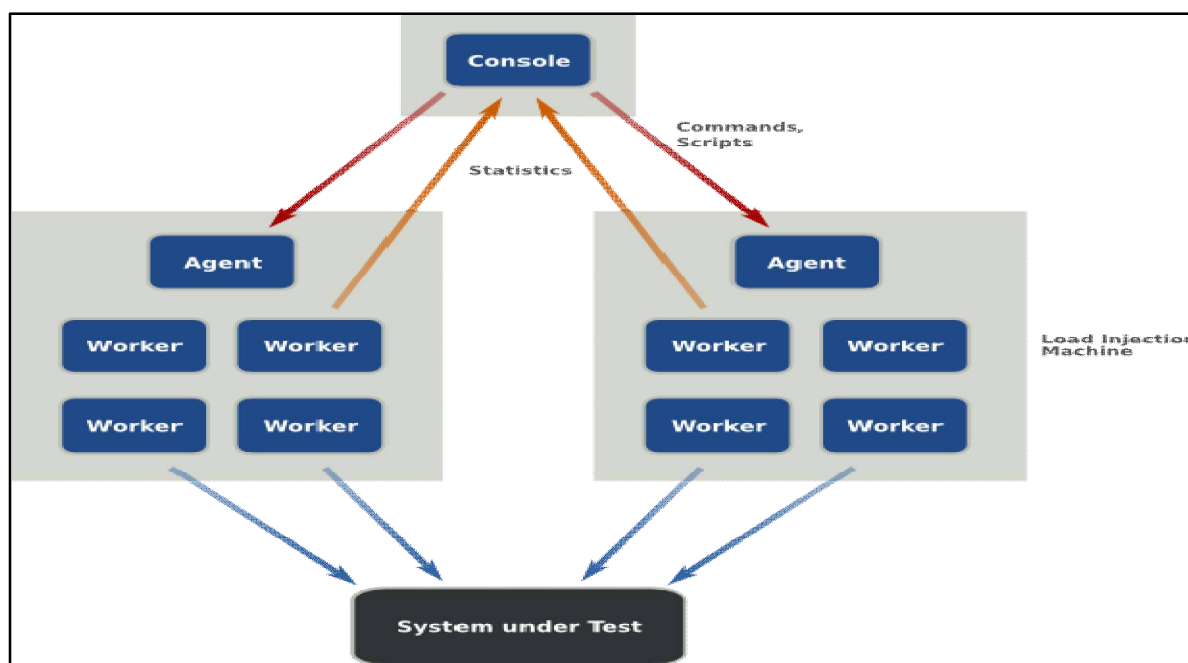


Fig.4. The Grinder [21]

Key Features of The Grinder:

1. TCP proxy to record network activity into the Grinder test script
2. Distributed testing that scales with an the increasing number of agent instances
3. Power of Python or Closure, combined with any Java API, for test script creation or modification
4. Flexible parameterization, which includes creating test data on the fly and the ability to use external data sources like files and databases
5. Post-processing and assertion with full access to test results for correlation and content verification
6. Support of multiple protocols.[7]



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III. PARAMETERS FOR COMPARISON

1. **Server Monitoring:** Server Monitoring is a process to monitor server's system resources like CPU Usage, Memory Consumption, I/O, Network, Disk Usage, Process etc. Server Monitoring helps understanding system's resource usage which can help you better your capacity planning and provide a better end-user experience.
2. **Generate unlimited load:** Number of virtual users that can be created to generate load.
3. **Can run in batch (non-interactive) mode:** Batch processing is the execution of a series of programs ("jobs") on a computer without manual intervention. Jobs are set up so they can be run to completion without human interaction. All input parameters are predefined through scripts, command-line arguments, control files, or job control language.
4. **Ease of Use:** This is determined on the basis of the ease in installing the tool, setting up simple tests and running the tests.
5. **Tool is cross-platform:** Is the tool capable to run on different OS like Windows, Linux, etc.
6. **Cost:** The cost associated with the creation of virtual users to generate load.
7. **Technical level:** The technical level knowledge or expertise required to run the tests in the tool.
8. **Stability:** How much stable the system is when there is heavy load or large file downloads

Paramter	Load Runner	Jmeter	The Grinder	WebLOAD
Solaris Monitoring	Negative	Neutral	Neutral	Positive
Unlimited Load Generation	Negative	Positive	Positive	Positive
Server Monitoring	Mixed	Neutral	Neutral	Positive
Batch Mode	Negative	Positive	Positive	Positive
Ease-Installation	Negative	Positive	Positive	Positive
Ease-Script Writing	Positive	Positive	Mixed	Positive
Ease-Running Tests	Neutral	Positive	Neutral	Positive
Cross Platform	Negative	Positive	Positive	Negative
Cost	Negative	Positive	Positive	Negative
Technical Level	Positive	Positive	Negative	Positive
Stability	Neutral	Negative	Neutral	Positive



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ITEM	Load Runner	Jmeter	Grinder	WebLOAD
Unlimited Load Generation	Number of virtual users are restricted	Number of users are dependent on the hardware so large load can be generated.	Number of agents are limited.	Can generate hundreds of thousands of virtual users.
Server Monitoring	Native performance counters for Windows hosts and performance counters available via rpc.rstatd are used for Solaris	Wrapper scripts are used as no built in monitoring is present.	Wrapper scripts are used to synchronize tests.	Has built in monitoring
Batch Mode	Multiple specific scenarios cannot be run from command line that are adequate for single tests.	Supported out of the box from a single agent.	Supported by running a single agent from the command line.	Can be run from command line.
Ease-Installation	Installation takes a lot of time	Just a tar file has to be unpacked	Just a tar file has to be unpacked	Database management system has to be installed
Ease-Script Writing	Positive	Positive	Mixed	Positive
Ease-Running Tests	User Interface of the controller is complex	User interface is easy to understand thus makes tests easy to run.	Tests have to be handled manually within the console of the User Interface	Tests are run easily due to great User Interface
Cross Platform	Poor at measuring non-Windows server statistics.	Being Java based it is platform-independent.	Being Java based it can run wherever there is JVM.	Except WebLOAD Load Machines that runs on Windows and Linux, rest can run on Windows Platform.
Cost	Six figures are to be paid for a license making it too costly.	Open source under Apache	Open source under Grinder	Cost is a fraction of LoadRunner.
Technical Level	No technical barriers	No Developer skills are required	Users need to know how to write Jython/Python code	Understanding of JavaScript Agendas.
Stability	Crashes occasionally under heavy load	Unstable under huge load.	Has memory issues when large files are downloaded.	More stable than other tools.

IV. CONCLUSION

Load Runner is highly developed which has strong support and many features, but at great cost. Also, it has limited ability to monitor server statistics outside windows. Grinder uses Jython scripting hence it has rapid script



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development. It simplifies coding of the complex tasks and has socket based agent/controller communications. Grinder has no scheduling that means load is either all or nothing and if there is a large file to be downloaded then in such scenarios there are memory failures. Less technical expertise is required in Jmeter .Jmeter has availability of startup scripts and more availability in the User Interface. But it has limited feedback in the UI and has memory issues when very large files are downloaded. WebLOAD supports JavaScript. User can simulate various system and connection configuration, create a single test script that includes multiple IP protocols. Load generation and traffic simulation can be done both in J2EE and .NET. But these advantages are acquired at a cost. WebLOAD cannot do load testing with multiple hosts where load testing is only focused on metrics like requesting concurrent users. Thus after comparing all the tools we can say that Jmeter is the best tool that can be used to test the load as it is free, great load generation and easy UI.

V. ACKNOWLEDGEMENT

We would like to thank Mr. Vinod M Bothale, Group Director, Sci/Engr G, Geoportals and Web GIS Services for giving us this opportunity to work and helping us throughout the paper. We would also like to thank our honorable principal Dr. Alka Mahajan of SIES Graduate School of technology for her immense support and encouragement.

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BIOGRAPHY

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