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# Performance Testing: A Comparative Study and Analysis of Web Service Testing Tools

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*Abstract - Testing is very important phase of SDLC where the software is examined properly and modifications are proposed. In present era Software testing is the process of validating and verifying the correctness of software. Thus we can say that testing is necessary for performance provided by software. Performance testing is used to determine the responsiveness, throughput, reliability, and/or scalability of a system under a given workload. Web service is widely used concept nowadays due to rapidly popularization of Web services and less literature is available regarding web service's performance. Web applications are difficult to test in comparison to traditional applications especially in terms of Performance testing such as unpredictable load, response time etc. In this study comparison of three performance testing tools i.e. Apache Jmeter, Grinder, HttpRider must be done on the basis of their response times.*

*Keywords: Software Testing, Testing Tools, Apache Jmeter, Grinder, HttpRider, Performance Testing, Web Application, Response Time.*

## I. Introduction

**A. Software Testing:** Software testing is an important phase of software development life cycle (SDLC). Software Testing identify faults, which when removed increases the software quality which intern increases the reliability of the software. It is the process of analyzing and evaluating components of the system or a system itself by manual or automatic means to verify that specified requirements are satisfied. In Software testing the difference between expected and actual results is analyzed [1]. Automation testing overcome most of the problems occurred in manual testing. The tester can perform testing with and without the knowledge of the inside details of the software module under test. In white box testing input is given to the system and it is analyzed that how the input is processed to generate the desired output. Black box testing involves testing of software based upon expected output without knowing the internal structure or coding of the program [2]. The main purpose of software testing is to evaluate an

attribute or capacity of program or product and to determine that it satisfies its quality (QOS). The testing of software also include the testing of software quality factors like usability, efficiency, reliability, security, capability, maintainability, compatibility and portability etc [3]. The software testing tools can be compared on the basis of parameters such application supported, programming language, operating support, platform independence, version detail [4].

**B. Performance testing:** Performance Testing is done to determine the response time and throughput of any web application [5]. Performance testing tools are used to determine the time required to perform a task by the system [6]. Performance testing is to check whether system meets its non-functional requirements identified in Software Requirement Specification (SRS) document or not. In today's scenario where there are many websites on internet it becomes necessary to test them for performance before launching [7]. For a website performance tests can check for its speed, reliability and load handling capacity. There are different types of performance tests: Stress test, load test, strength tests and volume test [6]. Test tool enables the testers to create, manage and execute test for a particular environment, maintained for specific test for a particular application [8]. Several issues have been observed related to tools when conducting performance testing such as tool's compatibility with the software under test, its installation, setup, flexibility in testing[6]. In this study, three different performance testing tools are used for testing performance of the same web site which are compared and analyzed on the basis of response time.

**C. Web Application:** It is software that runs in a browser and multiple users can access them simultaneously. A web application relieves the developer from the responsibility of building a client for a specific type of computer or a specific operating system as the client runs in a web browser. Therefore web application can run on any machine, running any operating system with a browser supporting the particular application [9].

There is a huge amount of shift towards web services technology in various sector of IT industry. Web services can perform various operations from simple request to a complex one and can be described as the software component which can be accessed through various programming interfaces. Such interfaces specified in an Extensible Markup Language (XML) format called Web Services Description Language (WSDL). Web Services Description Language (WSDL) description along with their input and output parameters can be taken as reference for testing by service interface via black box testing. Web services provide the reusability mechanism by reducing the development time and cost so it is the basis for building of the web services. It has been concluded that web services due to their pervasive distribution must offer reliability and security. Therefore they need to be thoroughly tested before deployment [8].

The study in this paper is based on Simple Object Access Protocol (SOAP) web services. Simple Object Access Protocol (SOAP) defines a protocol specification which is used to exchange structural information over a computer network [10]. It is basically used in implementation of web services and relies on Extensible Markup Language (XML) for its message format. HTTP or SMTP is used as communication protocol supporting message negotiation in transmission. Web Services Description Language (WSDL) is an XML format describing the interfaces for the web services, operating on messages containing information either document oriented or procedure oriented. It specifies the location of the service, the operations or methods [11].

This paper consists of 5 sections: Section 1 forms the basis of the study i.e. Introduction, Section 2 gives an overview of testing tools, Section 3 gives comparative study of selected tools/observations/simulations, Section 4 gives results and discussion and Section 5 gives conclusion and future scope and then references.

## II. Testing Tools: A Brief Overview

Software testing is an important to determine the quality of the software. The main aim of testing is verification, error detection and validation in order to find the problems and fix them to improve the quality of the software products [8]. Testing Tools automate the process of testing and are targeted to specific test domain [4].

Testing tools are used to make testing easier and help simulate test environment for a system under testing. They automate testing process and make it easier. Manual testing is costlier, requires too much effort and is very time consuming. While automated testing with the help of tool reduces the cost, time and effort required. There are different types of testing tools like functional testing tools, black-box testing tools and white- box testing tools, bug tracking tools, performance testing tools and many others. Performance testing tools are used for different types of performance testing like load test, stress test, volume test and strength test. Testing tool enables the testers to create, manage and execute test in a particular environment, maintained for specific test for a particular application [12].

**A. Apache Jmeter:** Apache Jmeter [8] is developed by Apache Software Foundation (ASF). Project that can be used as a load testing tool for analyzing and measuring the performance of a variety of services, with a focus on web applications. Jmeter can be used as a unit test tool for JDBC database connections, FTP, LDAP, Web services, JMS, HTTP, generic TCP connections and OS Native processes. It can be used for some functional testing as well.

It can be used to simulate a heavy load on a server by generating multiple user threads at the same time to test its strength or to analyze overall performance under different load types. It also supports recoding browser session through proxy server and replays it to give different performance parameters like response time, throughput, latency, response bytes and load time. It also gives different representations of the results either as a tree or table or graphs. These views are also simultaneously available for use. Test plans can be stored in XML format and can be reused [12]. It can also be used for some functional testing. Jmeter architecture is based on plug-in. Its other features are implemented with plug-ins. Off-site developers can easily extend Jmeter with custom plug-in [4].

**B. Grinder:** The Grinder is an open source testing tool for stress, load, capacity, performance testing of web sites. The grinder makes it easy to coordinate and monitor the activity of processes across a network of many load injection machines from a central console. The Grinder works on any hardware platform and any operating system that supports J2SE 1.5 and above. The Grinder can simulate web browsers and other devices that use HTTP and HTTPS. The Grinder can be used to test Web Service interfaces using protocols such as SOAP and XML-RPC. The grinder collates data from worker processes. Data can be saved for import into a spreadsheet or other analysis tool. The Grinder records statistics about the number of times each test has been called and the response times achieved. Any part of the test script can be marked as a test. Scripts can declare their own statistics and report against them. The values will appear in the console and the data logs. Composite statistics can be specified as expressions involving other statistics. During test monitoring pre-defined charts for response time, test throughput and also display the number of invocations, test result (pass/fail), average, minimum and maximum values for response time and tests per second for each test [13].

**C. HttpRider:** HttpRider [12] is a lightweight, open source testing tool for performance and stress testing of web sites. It is written in c#. It records http scenarios by creating http requests using Fiddler proxy and can create multiple user threads. It helps user to customize automation parameters like query string and post parameters. It binds them to a customized data source in order to mimic non-identical requests. It records all the requests generated through the browser and then replay it with multiple concurrent users. Also requests can be edited as the convenience of the user. It also enable user to save scenarios to the disk.

### III. Comparative Study of the Selected Tools

**A. Environment used:** All the tools are executed on an Intel Core i3, 2.7 GHz processor machine with 3GB RAM, Microsoft Windows 8 with the internet speed 2mbps. The comparison is made between three tools with the same script recorded with the tool itself. Testing of the tools require installation, setting up test environment, then selecting the parameters and analytical survey. The sample website <http://webservices.daehosting.com/services/TemperatureConversions.wso?WSDL> is tested on the selected tools.

**B. Approach Followed:** The tests were conducted at the same instance of time at a same network speed. All the tools are executed simultaneously to record the requests through the browser with the help of a proxy server. This recording will act as a script for tests. These tests are performed on the same site which acts as an input to the tool. When the tests are performed, different parameters like response time, throughput and latency are retrieved. The performance of the tool was evaluated on the basis of performance parameter called response time. According to the response time best tool is selected from them.

**Table 1. Presents the comparison of the tools based on their technical requirements:**

S. no	Tool name	Requirements	OS Support	Programming language	Version used
1	Apache Jmeter	Java 1.5 or higher virtual machine	Windows , Linux, Mac	Java	Apache Jmeter 2.9
2	Grinder	Java 1.5 or higher virtual machine	Windows, Unix	Java	Grinder 3.11
3	HttpRider	.net framework	Windows	Asp.net	HttpRider 1.0

These three tools vary from each other based on the technology they are developed in, the operating system in which they are supported and their requirements which need to be fulfilled before installation. Apache Jmeter and Grinder are developed in Java while http rider is developed in .net. Apache Jmeter can run on Windows, Linux and Mac while grinder can run on windows, unix and http rider can run on windows.

The observed results showed that each tool had its own architecture and internal processes which form the basis of comparative study of tools in terms of response time. The observed response time of various tools is shown in Table 2 and 3.

**Table 2. Presents the values of different parameters as obtained by the tools first time:**

S. no	Tool name	Response time(ms)	Throughput	Latency
1	Apache Jmeter	1148	1.662/min	1148
2	Grinder	1109.45	-	-
3	HttpRider	1016.32	-	-

It can be observed from Table 2 that for http rider response time is minimum i.e.1016.32 ms as compared to Grinder and apache jmeter while Apache Jmeter gives three parameters i.e. Response time, throughput and latency, grinder and http rider only gives response time.

**Table 3. Presents the values of different parameters as obtained by the tools second time:**

S. no	Tool name	Response time(ms)	Throughput	Latency
1	Apache Jmeter	1471	1.643/min	1470
2	Grinder	1050	-	-
3	HttpRider	1015.36	-	-

It can be observed from Table 3 that for http rider response time is minimum i.e.1015.36 ms as compared to Grinder and apache jmeter while Apache Jmeter gives three parameters i.e. Response time, throughput and latency, grinder and http rider only gives response time.

#### IV. Results and Discussion

In open source web service tools i.e. Apache Jmeter, Grinder, HttpRider it is evident that each tool had its own architecture and internal processes which form the basis of comparison study of tools in terms of response time. The average response time observed for various tools is shown in Table 4

**Table 4. Presents average response time for website**

Tool Name	Apache Jmeter	Grinder	HttpRider
Average Response Time(ms)	1309.5	1079.725	1015.84

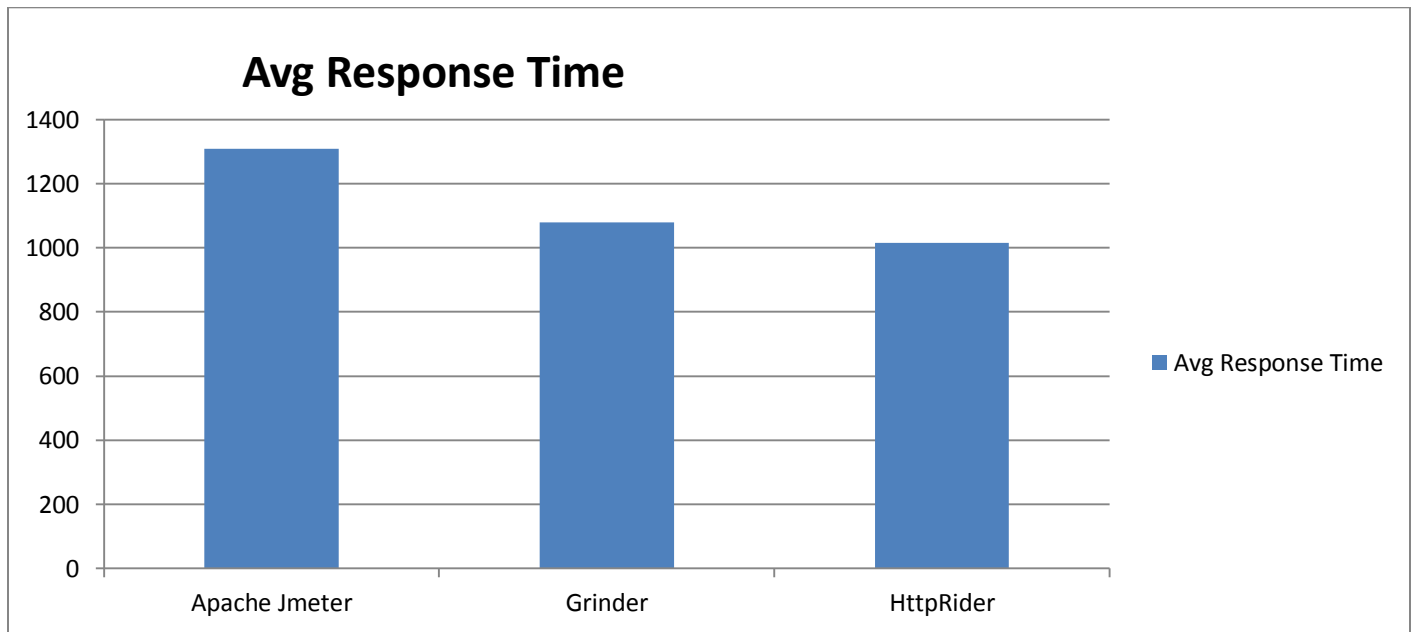


Figure 1 shows average response time observed

The analysis showed that response time for Http rider is better than (Apache jmeter, Grinder) other tools which are used for observation.

#### V. Conclusion and Future Work

Testing a web service is challenging activity that involves many characteristics such as response time, throughput and latency etc. The same web service has been tested for performance with these web service testing tools such as Apache Jmeter, Grinder, HttpRider and results has been compared. The Comparison helps in the selection of the best tool. This research work can be extended to more tools, more web services and different parameters to provide more realistic results.

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