



A Comparative Study of Web Service Testing Tools

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ABSTRACT-With the increase in adaption of web services, Quality of Service (QoS) has gained more importance as a parameter. Various web services have led to the development of multiple evaluation and measurement of techniques/tools. Quality of Service (QoS) is one of the most important criteria for evaluation of such tools/techniques. The performance of the real time network can be measured by Quality of Service (QoS) measurement, which can be facilitated by these tools. The comparative study of various such tools help in promotion and usage of various open source web services testing tools towards such a goal. This paper describes five most popularly used open source tools and their comparative study along with performance based on response time.

Keywords - Web Services, QoS, Testing Tools, Performance, Open-Source Software.

I. Introduction

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. Quality of service is a key for developing service-based software systems and testing is necessary for evaluating the functional correctness, performance and reliability of services [1]. Cesare et al have concluded that web services due to their pervasive distribution must offer reliability and security. Therefore they need to be thoroughly tested before deployment [2].

Web services technology is heterogeneous in nature. The heterogeneity of the technology makes it an ideal option to host and deploy services in flexible manner, whether it is an inter-organizational or intra-organizational service.

The conformance to the performance requirement is most important criteria for evaluating the system and is directly proportional to the trust of service user. There are several open source test tools available in market having multiple features and functionality. Shariq et al. have concluded that several studies are available which have compared various web services testing tools from functionality, features and popularity [3].

The Quality of Service (QoS) provided by each depends on various parameters such as response time, throughput etc. These parameters create a study which can be compared to evaluate the quality of product. Response time is the time in which the system responds for a particular transaction request. It is an interval between request and first response that is received by the user [4]. 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 [5]. 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 [6].

The organization of this paper consists of following sections: Section 1 Lays the Basis of The Study, Section 2 Provides an overview of Testing Tools considered for study, In Section 3 Comparative Study of the Selected Tools has been given. Section 4 gives the result and discussion and Section 5 Concludes the study along with scope for future work.

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 [7]. Quality of the product is evaluated by comparing the observed test results with expected results. Testing Tools automate the process of testing and are targeted to specific test environment. The environment may be functional, performance or exceptional testing etc. Functional testing tools are used to test the web application that involve the GUI. Various functional testing tools are available for testing the web application GUI objects and functionality automatically [8].

Test tool enables the testers to create, manage and execute test for a particular environment, maintained for specific test for a particular application. For this research five open source web service testing tools such as Soapui Pro, Wcf Storm, Apache Jmeter, Wizdl, and WebInject have been used to evaluate and validate the testing tools.

A. Soapui Pro

Soapui Pro[9] developed by Smart Bear under the General Public License (GNU) is an open source web service testing tool based on java work under the cross platform. It offers easy-to-use GUI that makes it simple to work with Soap and Rest based web services. Soapui pro offers more efficiency and usability. It contained everything that existed in Soapui and added productivity and time saving features.

B. Wcf Storm

Wcf Storm [10] is a free and open-source tool for testing web services. It was developed by Erik Araujo. It is developed in F# language and is available for free to use. Wcf Storm allows testing web services written using technologies like .Net, Java, etc. Storm supports dynamic invocation of web service methods even those that have input parameters of complex data types and also facilitates editing/manipulation of raw soap requests. The GUI is simple and user friendly. Multiple web services can be tested simultaneously so it saves time and accelerate testing schedule.

C. Apache Jmeter

Apache Jmeter [11] 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.

Jmeter architecture is based on plug-in. Most of its "out of the box" features are implemented with plug-in. Off-site developers can easily extend Jmeter with custom plug-in

D. Wizdl

Wizdl [12] is a .NET utility written in C# that allows you to quickly import and test web services within the comfort of a Windows Forms GUI. It supports calling complex web services that take arrays and deeply nested objects as parameters. Being pointed at web service it dynamically creates an interface where the required data can be entered and execution of service can be done. The tool allows saving the data as an Extensible Markup Language (XML) file which can be loaded later for regression testing.

E. WebInject

WebInject [13] tool is used to test Web applications and its services. It gives us the report of testing results in real time, and monitor applications efficiently. This tool also supports a set of multiple cases, and it has the ability to analyze these cases in reasonable time.

Its architecture includes WebInject Engine and Graphical User Interface (GUI), where the test cases are written in XML files and the results are shown in HTML and XML files. Optionally it can be used as standalone test runner which can be integrated and called from other test applications. WebInject is written in Perl and can be run on any platform supporting Perl interpreter. Binary executable of WebInject is only available on MS windows but if willing/required to run on any platform then Perl interpreter is must to run it from Perl source code.

III. Comparative Study of the Selected Tools

This section represents the comparison of five open source web service testing tools along with their observed results. The comparison can add to help for the researcher to determine the efficiency of suitable test tool for their needs. Weather web service is used to compare the selected test tools.

A. System Requirements

All the test cases were run on an Intel Core i3 2.40 GHz processor machine with 3GB RAM, Microsoft Windows 7 Home Basic, and 2Mbps Internet connection.

The comparison is made between five tools with the input of same web service i.e. the weather report. Testing of the tools requires configuration which in turn includes installation, setting up test environment, data collection, selection of parameter and analytical survey. The sample web service i.e. weather forecast is tested on the respective configure tools.

B. Approach Followed

The tests were conducted at the same instance of time at a same network speed. The test cases include two types of input i.e. valid test cases and invalid test cases. The performance of the tool was evaluated on the basis of critical parameter called response time. The observed results were collected and compiled for the analysis and evaluation to determine the efficiency of the tool. Table I gives the test case for response time of testing tools for valid input (zip code '02111'), Table II gives the test case for response time of testing tools for invalid input (zip code '11111') and Table III gives the test case for response time of testing tools for valid input (country 'India & city 'New Delhi').

TABLE I
RESPONSE TIME OF TESTING TOOLS FOR VALID INPUT (ZIP CODE '02111').

S.N	Tool Name	Input	Results											Response Time	
			Zip Code	Success	Response Text	State	City	Weather City	ID	Description	Temp	Humidity	Wind	Pressure	Time
1.	Soapui Pro	02111	True	City Found	MA	Boston	Boston	10	Mostly Sunny	32	56	NW 10	29.89F	3720 ms	758
2.	Wcf Storm	02111	True	City Found	MA	Boston	Boston	10	Mostly Sunny	32	56	NW 10	29.89F	2515.3 ms	-
3.	Apache Jmeter	02111	True	City Found	MA	Boston	Boston	10	Mostly Sunny	32	56	NW 10	29.89F	1998 ms	758
4.	Wizdl	02111	True	City Found	MA	Boston	Boston	10	Mostly Sunny	32	56	NW 10	29.89F	3000 ms	-
5.	Web Inject	02111	True	-	-	-	-	-	-	-	-	-	-	3514 ms	-

All the testing tools were given the same input in the format of Zip Code '20111' and the results are tabulated in Table I. The testing tools provide weather report in the form of Status, State name, Name of City, Weather forecast, Temperature, Humidity, Wind and Pressure. The main important observed factor was the time taken for response. It was seen that Apache Jmeter took minimum time. However all the tools gave same result values except WebInject which only identified the Zip Code.

TABLE II
RESPONSE TIME OF TESTING TOOLS FOR INVALID INPUT (ZIP CODE '11111').

S.N	Tool Name	Input	Results											Response Time	
			Zip Code	Success	Response Text	State	City	W. City	ID	Des.	Temp	H	W	P	Time
1.	Soapui Pro	11111	False	City could not be found in our weather data. Please connect cdyne for more	-	-	-	-1	-	-	-	-	-	3886 ms	707
2.	Wcf Storm	11111	False	City could not be found in our weather data. Please connect cdyne for more	-	-	-	-1	-	-	-	-	-	4180.8ms	-
3.	Apache Jmeter	11111	False	City could not be found in our weather data. Please connect cdyne for more	-	-	-	-1	-	-	-	-	-	1860 ms	707
4.	Wizdl	11111	False	City could not be found in our weather data. Please connect cdyne for more	-	-	-	-1	-	-	-	-	-	4000 ms	-
5.	Web Inject	11111	False	-	-	-	-	-	-	-	-	-	-	14079ms	-

All the testing tools were given the same input in the format of Zip Code '11111' and the results are tabulated in Table II. Since the input given was invalid input, so the results could not be retrieved as clear from the blank spaces in the results but gives response message. An important point to note is the ID field value i.e. -1 which shows that the Zip Code was not valid. It was seen that the WebInject took minimum time.

TABLE III
RESPONSE TIME OF TESTING TOOLS FOR VALID INPUT (COUNTRY 'INDIA' & CITY 'NEW DELHI')

S.N	Tool Name	Input		Results									Response Time	
		Country	City	Loc.	Time	Wind	Visibility	Temp.	Dew Point	Humidity	Pressure	Status	Time	Byte
1.	Soapui Pro	India	New Delhi	New Delhi/Palam, India(VIDP)28-34N077-07E233M	Dec 23,2013-09:30AM EST/2013:12.23 1430 UTC	From the WSW (250) at6MPH (5KT):0	Less than 1 mile: 0	55F(13c)	53F(12 C)	93%	30.12 in.Hg(1020 hpa)	Success	2361 (ms)	1015
2.	Wcf Storm	India	New Delhi	New Delhi/Palam, India(VIDP)28-34N077-07E233M	Dec 23,2013-09:30AM EST/2013:12.23 1430 UTC	From the WSW (250) at6MPH (5KT):0	Less than 1 mile: 0	55F(13c)	53F(12 C)	93%	30.12 in.Hg(1020 hpa)	Success	2293 ms	-
3.	Apache Jmeter	India	New Delhi	New Delhi/Palam, India(VIDP)28-34N077-07E233M	Dec 23,2013-09:30AM EST/2013:12.23 1430 UTC	From the WSW (250) at6MPH (5KT):0	Less than 1 mile: 0	55F(13c)	53F(12 C)	93%	30.12 in.Hg(1020 hpa)	Success	1284 ms	1015
4.	Wizdl	India	New Delhi	New Delhi/Palam, India(VIDP)28-34N077-07E233M	Dec 23,2013-09:30AM EST/2013:12.23 1430 UTC	From the WSW (250) at6MPH (5KT):0	Less than 1 mile: 0	55F(13c)	53F(12 C)	93%	30.12 in.Hg(1020 hpa)	Success	3000 ms	-
5.	Web Inject	India	New Delhi	-	-	-	-	-	-	-	-	Success	2321 ms	-

In the given table the five tools were tested with input as country and city and the results can be seen as tabulated in Table III. With the country and city name as input, the testing tools provide the weather report in the form of location, time, wind, visibility, temperature, dew point, humidity, pressure and status as output via keeping the input same for all five tools. The results so obtained shown that Apache Jmeter took minimum time. An exceptional behavior of WebInject was seen which only identified the input and give result for response time only.

IV. Results and Discussion

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 I, II, and III. Since from value observed in all tables it's clear that Apache Jmeter took 1998ms, 1860ms and 1284ms response time for table I, II and III respectively. Out of which Table I and III used for valid inputs and Table II used for invalid input. The behavior shown by Apache Jmeter with respect to response time clearly showed that it took minimum time as output.

Also the results of test cases are summarized to calculate average response time of each tool for web service i.e. weather report. This is represented in Table IV.

TABLE IV
AVERAGE RESPONSE TIME OF TESTING TOOLS

Web Service Name	Average Response Time (ms)				
	Soapui Pro	Wcf Storm	Apache Jmeter	Wizdl	WebInject
Weather Report	3322.33	2996.36	1714	3333.33	2414

The observed data can also be represented as a graph which is given below.

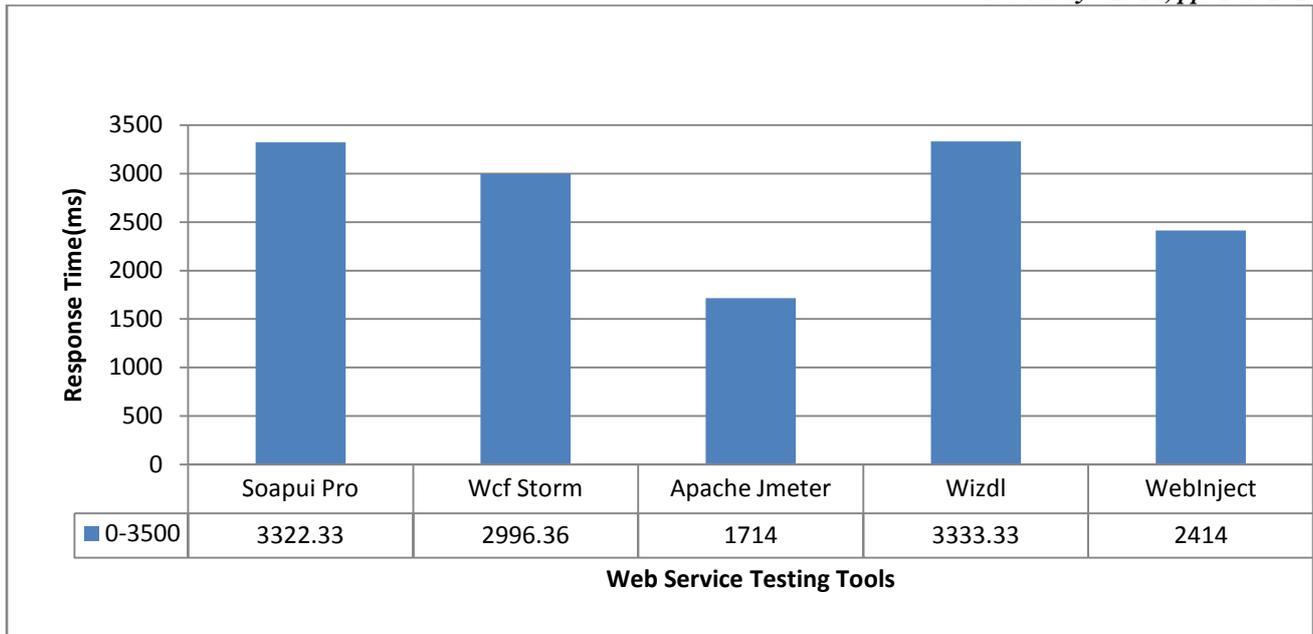


Fig. 1 Graph of Average Response Time of Testing Tools.

The analysis showed that response time for Apache Jmeter is better than (Soapui pro, wcf storm, Wizdl, Web inject) other tools which are used for observation.

V. Conclusions and Future Work

Web service testing is challenging activity which has many characteristics that can be exploited fruitfully for testing purposes. The experimentation of the approach used in this paper is based on real service implementation to retrieve and store data. The parameter results of different web service testing tools such as Soapui Pro, Wcf Storm, Apache Jmeter, Wizdl, and WebInject have been analyzed. The same web service i.e. Weather report has been tested for performance with these testing tools and results has been compared. The Comparisons help in the selection of the best tool. This research work can be extended to more tools and different parameters to provide more realistic results.

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