

Performance Testing in Cloud Environment

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ABSTRACT

In the software development applications, one of the major challenges of success or failure is the performance evaluation. Software engineering is not only about the software development processes but also about the effective delivery, deployment and maintenance of the application to the actual users. Software engineering benchmarks like performance, scalability, security, usability and fault tolerance can also be employed in the cloud environment. The study has focused on a number of the precept factors of performance measures of e-commerce sites and it additionally explored how internet applications are tested for performance and the way it is evaluated. SaaS (Software as a Service) has eased the way of software engineering practices in cloud environment.

General Terms

Software Testing, Performance Testing, E-Commerce, Testing Tools

Keywords

Software testing; cloud computing; web testing; performance; JMeter; response time; throughput

1. INTRODUCTION TO WEB TESTING

The growing number of web applications have continuous impact on our lives. Since the internet is itself heterogeneous and distributed, the growing number of web applications adds to its complex nature. Due to the challenges of the dynamic behavior, complexity and diversity also makes the testing of web systems a challenge [1]. So the proper testing of web applications is needed to ensure reliability, robustness and high performance [2].

Internet shopping in India is developing at a quick way. In the meantime, there is an extraordinary rivalry in online business space, in particularly among pinnacle two gamers or players to be specific Snapdeal and Amazon. Internet shopping sites report campaign advertisements, promotional sales, and deals, there is regularly an unlimited surge of buyers to those sites and again the foundation behind these retail sites aren't sufficiently capable to deal with such vast volume. For example, consider the case of Flipkart's website getting crashed due to the innumerable amount of hits on Big Billion Sale. To be able to compare the performance of the e-commerce applications or websites from each physical vicinity, cloud primarily based performance testing will be one of the important key resolutions. To find the performance of web applications, various cloud performance testing tools are available. The choice of selection of tool solely depends upon certain parameters like software application architecture, requirements, specifications and many more.

1.1 Client – Server Paradigm

Client server is used for computer networking that utilizes client and server devices each designed for specific purpose. Figure 1 shows the Client server paradigm that can be used on internet as well as Local Area Network (LAN).

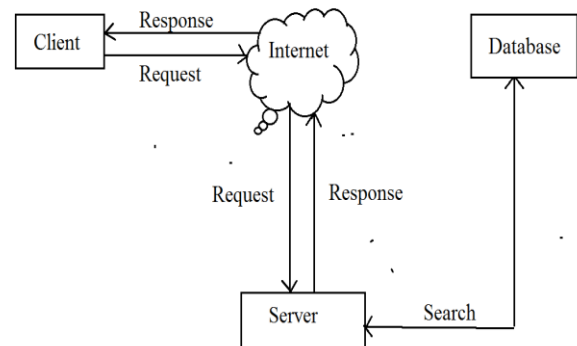


Fig. 1 Basic Client server model

Client server paradigm consists of following three components.

1. Client/Workstation

These are the computers which subordinate to the servers. They send demand to the server to get to shared projects, documents and database from the server.

2. Server

A server administrations the demand from the workstation and can perform many capabilities as a principal repository of documents, applications and database. It makes for less demanding administration and reinforcement since it is not needy to individual client setups, but rather can be all around and consistently implemented over the system.

3. Networking Device

Network devices connect workstations and servers. They ensure that requests to and from workstations are routed properly to correct server.

2. CLOUD BASED TESTING

The main idea behind the cloud computing is to share the computing resources among a community of users. Basically, the cloud can be described as on demand computing, for anyone with a network connection. In other words, cloud computing is the delivery of computing services over the internet.

Cloud computing can lessens the cost value and quality of owning and working PCs and systems and networks. On the off chance that an association uses a cloud supplier, it does no longer need to invest in data innovation framework, or to purchase equipment or programming licenses. Cloud administrations can frequently be altered and adaptable to utilize, suppliers can offer propelled administrations that an individual and small organization won't not have the cash or mastery to create.

Software testing has been and until date continues to be being captive to the cloud environment. A Part of this innovation of cloud computing known as virtualization is the back bone for this. There are various factors that prompted the development of cloud computing.

Web administrations made the web programmable. They empowered the engineers to have a look at the web as the class library or an object model [3]. Protocols like Simple Object Access Protocol (SOAP), JavaScript Object Notation (JSON), and XML boosted the boom of APIs on the web. Nowadays every prevalent search engine say Google, Bing; social networking websites like Facebook, twitter have exposed API's to developers. With the increasing popularity, the performance must not compromise. For this, performance testing should be consistently performed [4]. The major factor behind the cloud computing is virtualization which can be defined as the creation of the virtual version of something like storage, users, operating system or network resources [5]. Figure 2 lists the various advantages of using cloud computing.

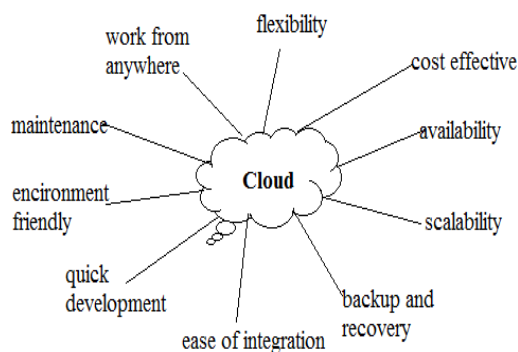


Fig. 2 Advantages of cloud computing

Cloud Computing is developing at a phenomenal speed. With this time, there's certain to be a development in call for Cloud Testing. New cloud test ought to be founded on a web based business situation (i.e. web based shopping) and characterize web associations as test drivers. A cloud test ought to examine the limit of a framework amid evolving load. The clients are more disappointed and to a great degree vocal on interpersonal organizations by offering poor purchasing knowledge to screenshots [6].

SaaS (Software as a Service) is the most widely used form of cloud computing [7]. It provides all the functions of a sophisticated traditional application, but through a web browser, not a locally installed application. It removes the problems of servers, storage, application development or other IT concerns.

3. CONCEPTS IN PERFORMANCE TESTING

Web applications' performance is also a big issue in today's busy network environment. The users want to access the webpages and data as soon as possible without any kind of delay. This leads to the need of the high performance of web systems. Performance testing helps the developers to find the bottlenecks in the applications. In performance testing, various parameters like response time, throughput, resource utilization, deviations against the required output are analyzed. With the evaluation of these parameters, it is

possible to say whether the application can be released or need improvement. Problems of the web software can be due to code, network connectivity, server or database [8].

3.1 Parameters

- **Throughput:** The number of transactions or requests completed per unit time.
- **Response Time:** The time interval between the request sent and the response received.
- **Resource utilization:** The time for which a resource like CPU, memory or network is busy.
- **Deviation:** the deflection of the actual output to the desired output.

3.2 Types

3.2.1 Load Testing:

It has main focus on validating the performance of the software with varying loads. It finds the number of simultaneous users that can be handled in a manner free from imperfections or defects. The website should be able to handle a number of simultaneous users, large input data, multiple incoming connections etc. It also include capacity testing which measures the maximum load the web application can handle without failing.

3.2.2 Stress Testing:

Stress means to go beyond the limits. Stress testing is done to check the system for the stress point, the point beyond which the application starts behaving abnormally. It allows to find the bottlenecks like insufficient memory or server crash, server due to which the system starts behaving abnormally. These tests are designed to determine under what conditions an application will fall, how it will fall, and how gracefully it may recover from the failure. Some example of recovery methods are saving checkpoints in which the system restarts or recovers from the last saved state after crashing or failure.

3.3.3 Others:

Below are some other types of performance testing that can be performed on cloud:

- Browser Performance testing in Cloud
- Latency test
- Targeting infrastructure test in Cloud environment
- Failover testing
- Capacity test
- Soak or endurance test over Cloud
- Spike testing

4. POPULAR PERFORMANCE TESTING TOOLS

After the examination of the significance of the performance testing of the web application expanding, it is a smart to assess a portion of the well-known Performance testing tools. Automation in Cloud based testing offers Cost Effectiveness, Benefits of Virtualization, additional collaboration, quicker Testing response and lessened IT organization effort [9].

4.1 Mercury Interactive's WinRunner:

It is a tool used for performing functional /regression testing. It automatically creates the test scripts by recording the user interaction on GUI of the software. These scripts can be run repeatedly whenever needed without any manual intervention. The test scripts can also be modified if required because there is support of Test Script Language (TSL) with a 'C' like syntax [10]. There is also provision for bringing the application to a known state if any problem has occurred during automated testing. WinRunner executes the statements

by default with an interleaving of one second. But if some activities take more time to complete, then it synchronizes the next test cases automatically by waiting for the current operations to be completed [11].

4.2 Mercury Interactive's Load Runner:

This tool is used for performance and load testing of a system. Generally, the tool is helpful for client/server applications of a various parameters with their actual load like response time, the number of users, etc. The major benefit of using this tool is that it creates virtual users on a single machine and tests the system on various parameters [12]. Thus, performance and load testing is done with minimum infrastructure.

4.3 Apache's JMeter:

This is an open-source software tool used for performance and load testing [13]. JMeter's capabilities rapidly expand as developer stake advantage of its pluggable architecture. The primary goal of further developments will be:

1. Addition of web sockets
2. Addition of FTPS and SFTP protocols
3. Enhancements to web services protocols (SOAP architecture)
4. Enhancements to JMS protocol implementation

5. IMPLEMENTATION OVERVIEW OF CASE STUDY

The terribly high cost of business tools for performance testing has set off the advancement of open source testing devices for testing on the web applications. These tools are fully featured with significant reliability and relevant to most of the load testing applications. The tools simulates an exceptional many clients interfacing with net, utility and database information servers; make realistic models simulating numerous enterprise conditions; and deliver a vault of information to investigate and produce consequences during development of software program. Open source tools are manifestly on hand at no charge that introduces an enormous value savings while not getting testing tools commercially.

For experimental setup, two websites named labqashop (<https://www.snapdeal.com>) [14] and nopcommerce (<https://www.amazon.com>) [15] have been taken into consideration and for the purpose of simulation, open source

Performance testing tool JMeter is employed. These websites have been investigated on the basis of three execution Parameters such as throughput, deviation and average response time. During testing, the subsequent test consequences as a graphical representation using JMeter Performance testing tool are observed. By observing this, It can be realised that amazon site is outlined with high throughput, less request error rate and high average response time when contrasted with other shopping sites.

Test Plan: A test plan represents a progression of steps that JMeter will execute while run. A complete test plan can consist of one or more thread groups, logic controllers, listeners, timers, assertions and configuration elements. Some of the terminologies employed in JMeter can be described as follows:

Workbench: The workbench simply provides a place to temporarily store test elements while not in use. When a test plan is saved, workbench items are not saved with it.

Virtual users: These are the processes which simulates the no of users or connections to your server application. The number of threads represent the virtual users.

Load Servers: These are used to run the virtual users request.

Loop count represents the number of times to execute the test.

Consider a scenario with following parameters:

No of virtual users: 100

Ramp up Period: 100

Loop Count: 10

Ramp up period describes JMeter how long to take to "ramp-up" to the complete range of threads selected. If there are 100 threads and the ramp up period is taken as 100 seconds, then JMeter will take a hundred seconds to induce all the hundred threads up and running. Each thread will begin 1(i.e. 100/100) second after the previous thread was started [16]. Consider 30 threads with a ramp up period of 120 seconds, then there will be a delay of 4 seconds between each successive thread. Ramp up period ought to be sufficiently long to stay away from too substantial a workload toward the begin of a test and sufficiently short that the last threads begin running before the initial ones wrap up.

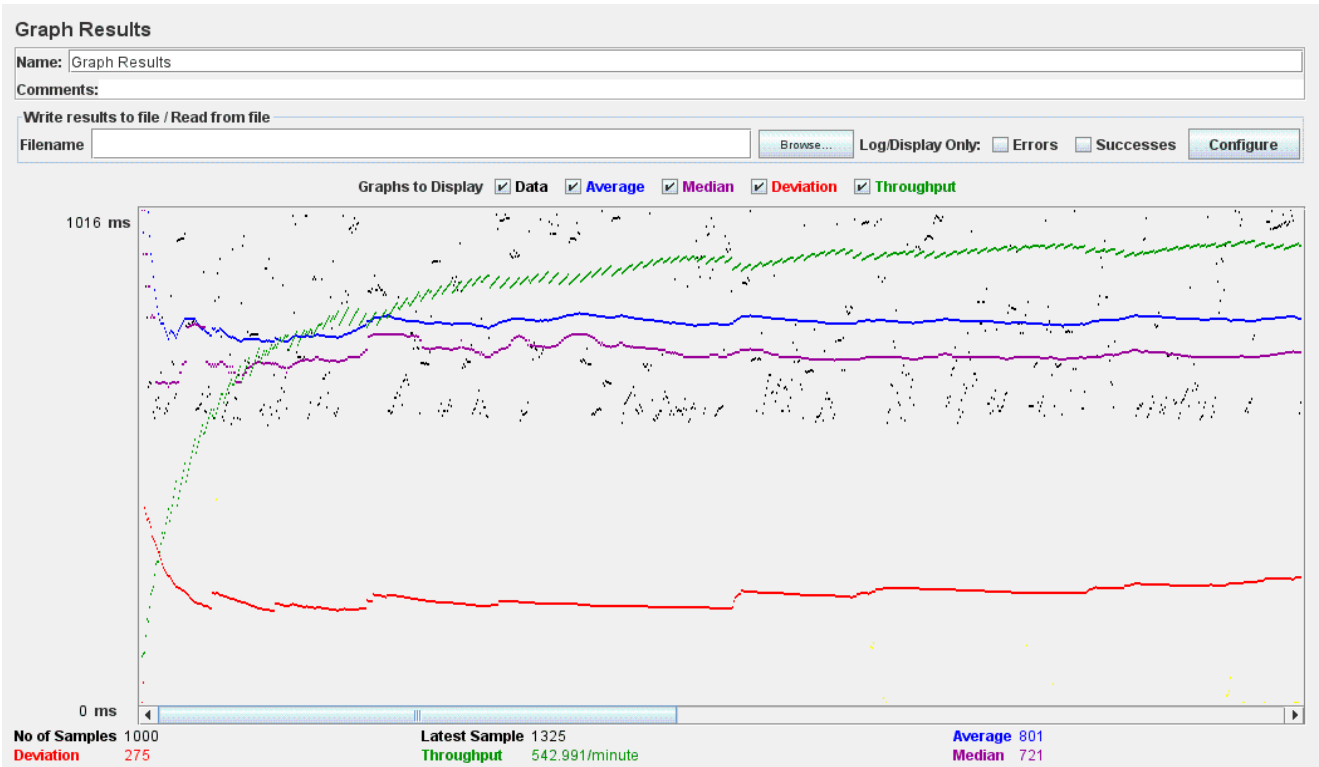


Fig. 3 Snapdeal graph results

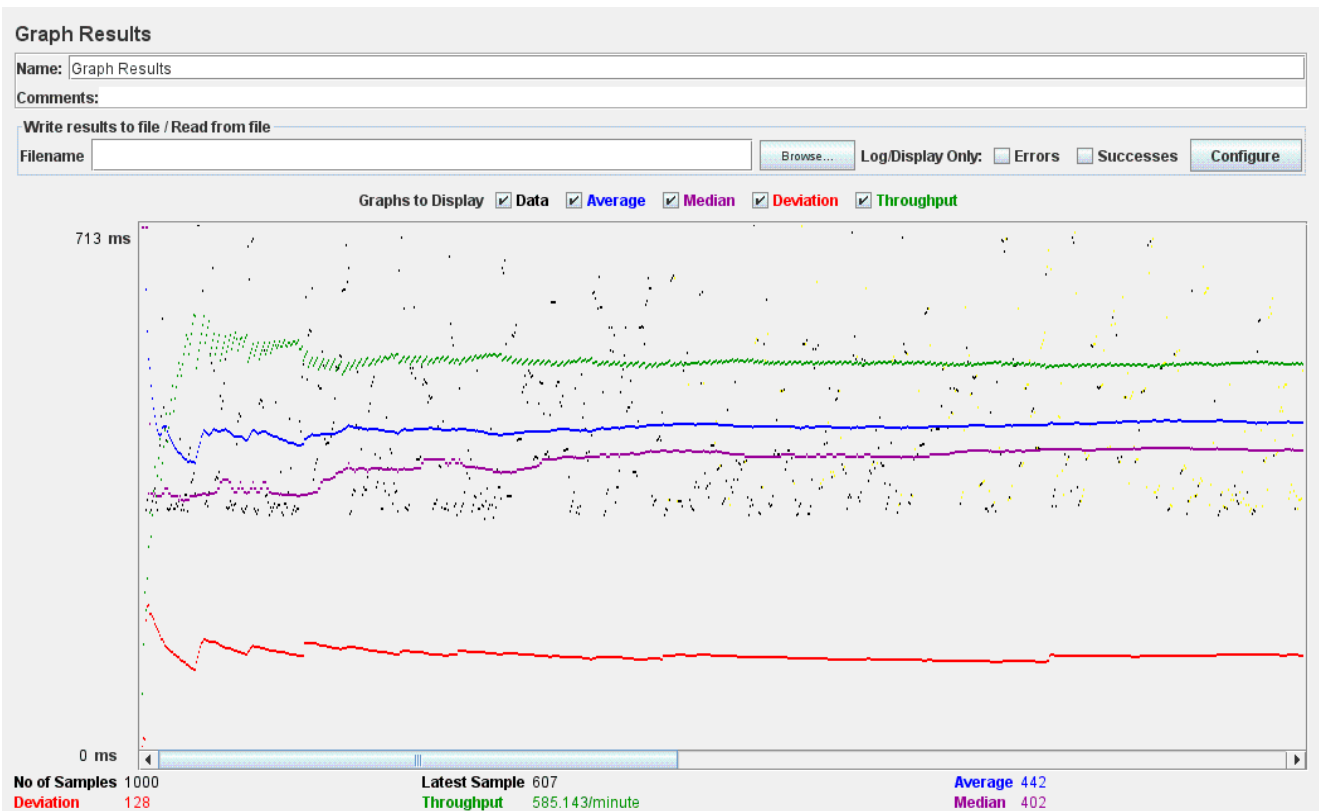


Fig. 4 Amazon graph results

The following Figure 3 represents the Graph Results with throughput (542) and deviation (275) for the e-commerce website snapdeal.

The following Figure 4 displays the Graph Results with throughput (585) and deviation (128) for the online shopping website amazon.

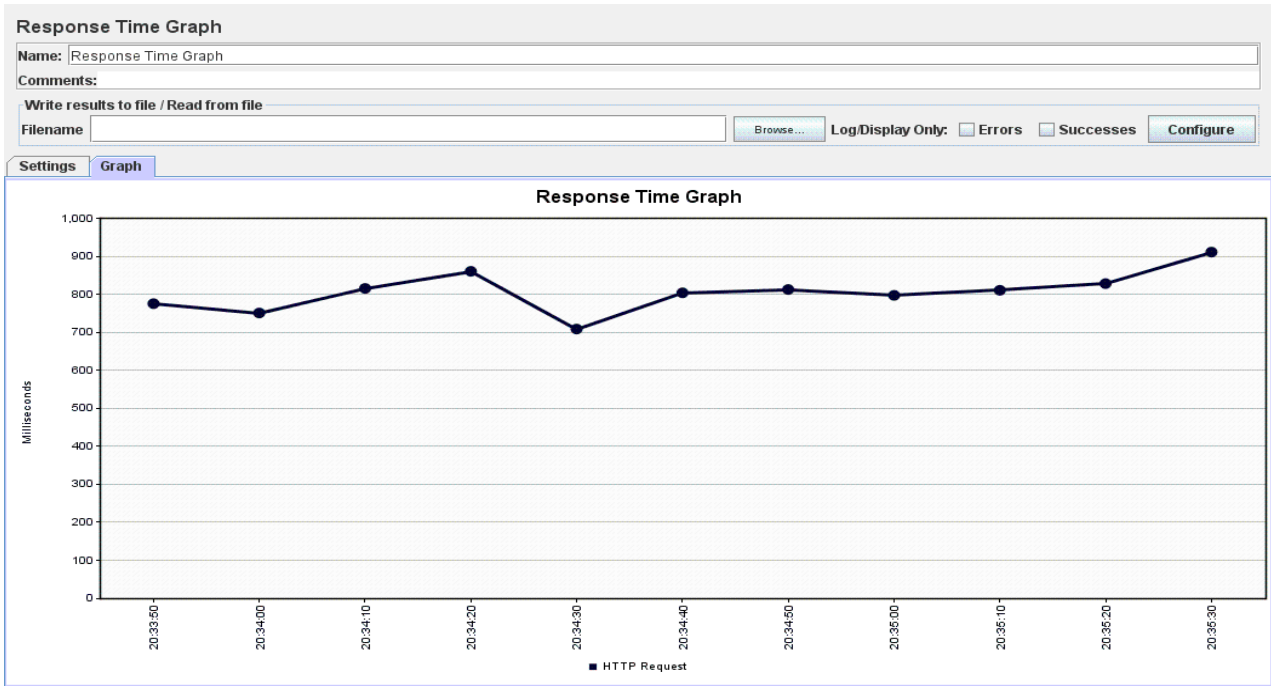


Fig. 5 Snapdeal Average Response Time Graph

The following Figure 5 describes the snapdeal’s Response Time graph with the above mentioned parameters.

The following Figure 6 shows the Response Time graph of amazon with the above mentioned parameters.

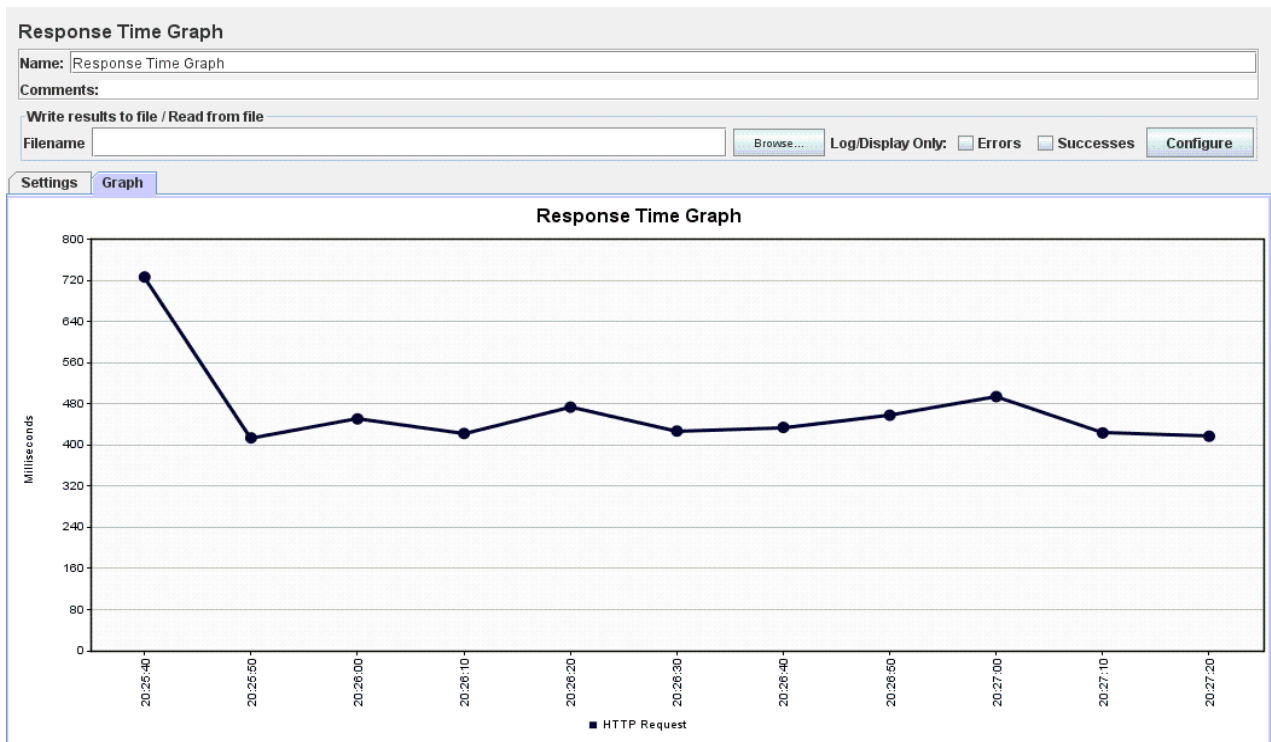


Fig. 6 amazon Average Response Time Graph

This study has focused on a number of the principle components or aspects of the performance of online shopping e-commerce websites and it talked about how web application performance testing is being performed and the way it’s been evaluated. It also explored and demonstrated the general accomplishment in

the zone of performance testing of web applications. Cloud-based execution testing can give colossal advantage to business by lessening improvement cost, exertion, and time [17]. Accordingly, associations can advance concentration their assets and vitality in establishment business territories.

For a good performance, smaller deviation is preferred. Higher the value of throughput, better is the performance of application. With this assessment comes about, it is observed that the amazon would get more consumer loyalty and satisfaction. The above values is dependent on various factors like current load server, internet speed etc.

6. CONCLUSION

The purpose of this work is to discuss modern web application performance testing from a theoretical and a practical perspective, with an emphasis at the latter. The cloud based software applications are needed to find a peak performance measure which is more challenging than the normal or average performance of the software. For example, an online-commerce website may expect only normal performance everyday but it may require qualitative peak performance on festival or promotional offer day which lead to the requirement of the peak load testing for better reliability.

The research has only started and it will move only forward. Future work may revolve around reducing the overhead and memory. Since Jmeter does not support javascript in web applications. It can affect the accuracy of simulation. A Significant study can be done in software engineering practices in cloud computing.

7. REFERENCES

- [1] R.S.Pressman, "Software Engineering A Practitioner's Approach", Oxford University Press International Edition, ISBN-13:978-0-19-80-6184-7.
- [2] Wikipedia. Web testing — Wikipedia, The Free Encyclopedia. https://en.wikipedia.org/wiki/Web_testing, 2017. [Online; accessed 11-October-2016].
- [3] Shakti Kundu. "Web Testing: Tool, Challenges and Methods", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 2, No 3, March 2012.
- [4] Neha Thakur, "Performance Testing in Cloud", White Paper Submitted for STC 2010
- [5] S. Nachiyappana, S. Justusb, "Cloud Testing Tools and Its Challenges: A Comparative Study", 2nd International Symposium on Big Data and Cloud Computing, Procedia Computer Science 50 (2015) 482 – 489
- [6] Jerry Gao, Xiaoying Bai, Wei-Tek Tsai," Cloud Testing-Issues, Challenges, Needs and Practice", Software Engineering : An International Journal (SEIJ), Vol. 1, No. 1, september 2011
- [7] Akash Shrivastva, Shubham Gupta, Rinki Tiwari, "Cloud based Testing Techniques", International Journal of Computer Applications, Volume 104 – No.5, October 2014
- [8] Ms. S. Sharmila, Dr. E. Ramadevi," Analysis of Performance Testing on Web Applications", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 3, Issue 3, March 2014.
- [9] FungayiDonewell Mukoko, Abhaya, Kaushal Kumar, Ankush Jain, "Cloud Based Performance Testing", Journal of Software Engineering and Simulation, Volume1 ~ Issue 2 (2013) pp: 01-08
- [10] Naresh Chauhan, "Software Testing Principles and Practices", McGraw-Hill International Edition, ISBN 007-124083-7.
- [11] Performance testing tools available at <http://www.softwaretestinghelp.com/what-is-performance-testing-load-testing-stress-testing/>
- [12] Isha Arora, Vikram Bali, "A Brief Survey on Web Application Performance Testing Tools Literature Review", International Journal of Latest Trends in Engineering and Technology, Vol. 5, Issue 3, May 2015.
- [13] Dr. Niranjnamurthy M, Kiran Kumar S, Anupama Saha, Dr. Dharmendra Chahar, "Comparative Study on Performance Testing with JMeter", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, Special Issue 2, October 2016.
- [14] Snapdeal Online e-commerce website. <https://www.snapdeal.com/>, 2017. [Online; accessed 08-January-2016].
- [15] Amazon Online e-commerce website. <https://www.amazon.com/>, 2017. [Online; accessed 08-January-2016].
- [16] Performance Testing: Types, Process & Important Metrics available at <http://www.guru99.com/performance-testing.html>
- [17] V. Janani, K. Krishnamoorthy, "Evaluation of Cloud based Performance Testing for Online Shopping Websites", Indian Journal of Science and Technology, Vol 8(35), December 2015.