

Mobile Web Application Testing Methods and Tools: An analysis

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ABSTRACT: The ever increasing demand of mobile devices has given a push to software developers in taking the popular web applications to mobile environment. The smartphone industry has been steadily developing and growing since then, both in market size, as well as in models and suppliers. Every one-second delay in page load decreases customer satisfaction by 16% and page views by 11%, according to Aberdeen Group Research. The mobile application must be tested for all possible problems and in all kinds of environments so that when bugs emerge they can be fixed. A proxy server is a computer or usually set of computers that act as an intermediary between a client computer and a web server. It enables client computers to make indirect requests through it for resources or services such as web pages, videos, PDF files, etc. The ideal load time for a mobile site is *one second*. A fast site leads to easier discovery, better user retention and longer site visits. This paper discusses about the most popular load testing tools (i) Loadrunner (ii) NeoLoad (iii) Silk Mobile. The mobile website <https://m.ebay.in/> has been tested and the results were tabulated and analyzed.

KEYWORDS: Constant, Custom, Peak, Proxy server, Ramp-up, tPacketCapture.

I. INTRODUCTION

The e-commerce mobile websites / Applications are the future of the world, growing at the exponential rate. It requires a lot of investment and also requires an extensive testing. The e-commerce applications have been in existence since a long time now and there has been a lot of failure in this field. These failures have led to heavy losses which could have been avoided with better testing techniques. Testing is a crucial step in the development process that allows us to ensure the quality of the application. A fast site leads to easier discovery, better user retention and more and longer site visits. On average, 74% of people will *abandon* a mobile site if it takes longer than *five seconds* to load, yet the average mobile page on the web still takes 6 to 10 seconds to load, according to *Kinsta*. As the number of people using their smartphone to shop increases, the company will introduce the most convenient payment option for the public say the mobile payment system. Load Test is the simplest form of performance testing. A *load test* is usually conducted to understand the behavior of the application under a specific expected load. This load can be the expected concurrent number of users on the application performing a specific number of transactions within the set duration. This test will give out the response times of all the critical business transactions. If the database, application server, etc are also monitored, then this simple test can itself point towards the *bottleneck* in the application. This paper discusses about three popular top most load testing tools. Phases for mobile performance testing mobile website have been discussed. Each tool has its own metrics. The metrics common to all three tools have been tabulated in a separate table.

II. RELATED WORK

PROXY SERVER

A proxy server is a computer that functions as an intermediary between a web browser and the Internet. It improves the web performance by storing a copy of frequently used webpages. When a browser requests a webpage stored in the proxy server's collection, it is provided by the proxy server, which is faster than going to the web. Proxy server also

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improves the security by filtering out some web content and malicious software. Proxy servers are used mostly by networks in organizations and companies. Fiddler is a free and open-source packet analyzer. It is used for network troubleshooting, analysis, software, communications protocol development and education. Fiddler captures HTTP and HTTPS traffic data between browsers and servers. These data are extremely valuable for troubleshooting, performance tuning and system monitoring.

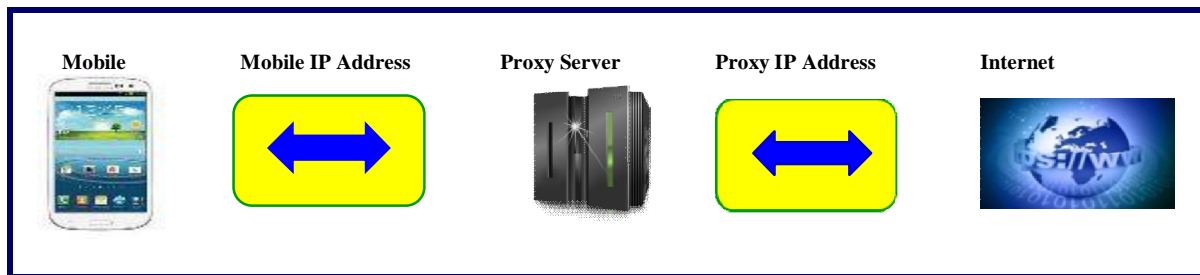


Fig-1 Proxy Server

ADVANTAGEOUS OF PROXY SERVER:(i) To share Internet connection on a LAN. (ii)To speed up Internet surfing. (iii) To hide the IP address of the client computer so that it can surf anonymous, this is mostly for security reasons. (iv)To implement Internet access control like authentication for Internet connection, bandwidth control, online time control, Internet web filter and content filter etc. (v)To bypass security restrictions and filters. (vi)To scan outbound content, e.g., for data leak protection. (vii)To circumvent regional restrictions.

III. MOBILE APPLICATION TESTING

Mobile application testing is time consuming and most expensive. There are trade-offs that we need to consider and choices that we need to make regarding the mix of different techniques and methods that will be used in mobile app testing. Each testing method we consider will have pros and cons associated with it, and we will likely find that there is not a single testing method that is completely satisfying. Rather, we will need to consider a testing strategy that combines different testing options that as a whole, provide the best overall testing result, balancing the trade-offs between cost, quality, and time-to-market. In this paper, we examine various testing options for mobile applications. Performance Testing is particularly important in Web Testing as the web application is revealed to large number of audience.

PHASES FOR MOBILE LOAD TESTING:

The following are the phases for Load testing : (i)Planning (ii) Develop Load Test Scripts (iii)Execution (iv) Reporting.

DEVELOP LOAD TEST SCRIPTS:

With the increasing importance of mobile as a platform, several leading performance tools have started supporting mobile performance testing. Mobile applications can be **recorded in many ways**:

- i. Recording directly from the device itself
- ii. Recording with emulators
- iii. Recording on a desktop web browser (for pure HTML applications)

IV. TOOL RESULTS AND DISCUSSION

MOBILE APPLICATION RECORDING OPTIONS: When it comes to Mobile testing, one method does not fit all. Whether we have access to a physical device, application or device emulator, or traffic capture from any available Mobile device cloud; the methods used for capturing application usage will vary with each deployment model.

Virtual User Generator supports the following Mobile application scripting methods:

- PCAP traffic recording

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- Mobile Device Emulator
- Proxy recording
- TruClient Mobile (for mobile-web applications)

TPACKETCAPTURE (tPacketCapture)

tPacketCapture does packet capturing without using any root permissions. tPacketCapture uses Vpn Service provided by Android OS. We can capture the network traffic of any app on a mobile device by installing tPacketCapture, which records traffic as a **.pcap** file. We can transfer the .pcap file to a computer, and open it with VuGen, which will generate a vuser script.

HP LOADRUNNER - REAL DEVICE TESTING

We have record network traffic using tPacketCapture and is saved in the form of .pcap file. We have transfer the .pcap file to the computer. It can be opened by HP Loadrunner. In our test we have used an Android device with the following configuration:

Device : HONOR7 : OS : Android V 6.0 Marshmallow :RAM : 3.0 GB

CPU: Hisilicon Kirin 935 (CPU Frequency 4*A53 2.2GHz + 4*A53 1.5GHz with big.LITTLE technology) :

Battery Capability 3100 mAh(typical), 3000 mAh(minimum) :

Network WCDMA 900/2100; GSM 900/1800; LTE FDD B3; TD-LTE B40.

We have short- listed the HP Load Runner results and is shown in table -1

Table-1 HP LOADRUNNER –Results

Measurement	Value
HTTP Responses per Second	7.915
Total Hits per sec	4,008
Average Hits per Second:	9.498
Total Errors	2
Average transaction response time	9.978 sec
Total throughput	776,63,348 Bytes/ sec
Average throughput	1,84,036 bytes/sec
Total users launched	10
Total action errors (average)	0.005

SILK MOBILE:

Silk Mobile’s testing tools enable us to test real devices and mobile emulators in a way which replicates the real end user experience. Without the need to jailbreak, use real devices and gestures which include drag and drop, zoom, script and multi-touch. Silk Mobile supports all types of recognition. Native Object Recognition for Android and iOS enables testers to build fast, robust, repeatable automation scripts to run on multiple devices. Connect multiple devices to test machines and run tests in parallel to reduce execution time and speed up validation. Faster mobile application testing means better productivity.

Due to smaller screen size and different input methods (touch screen) of mobile devices, many Web applications look different when loaded on a mobile device compared to a browser on a PC. From a load testing perspective such applications should be treated as two separate applications, even though they might share some components on the back-end. Silk Performer fully supports performance testing of mobile Web and native apps. It offers simulation capabilities for a variety of mobile devices, such as iPhone, iPad, Android, Windows Phone, and Blackberry, but other mobile browsers can also be simulated with custom profiles.

RECORDING MOBILE APPS WITH A BROWSER:

1. Click Start Here on the workflow bar. The Outline Project dialog box appears.
2. In the Name text box, enter a name for your project.
3. Enter an optional project description in Description.
4. In the Type menu tree, select Web Browser -> Mobile Devices.
5. Click Next to create a project based on your settings.
6. On the Workflow - Model Script dialog box, click Record with browser. The Record a mobile application to generate a script dialog box appears.
7. From the Mobile Device list, select the device that you want to simulate.
8. Select an Application Profile. Due to the multitude of technologies that browser-based applications are based on, different application types are available for selection.

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9. In the URL text box, type the URL of the application under test.
10. When we are done with configuring our mobile device's browser proxy settings: If we have already configured a certificate or if we do not need to record over a secure connection, click Start recording and skip the following step. If we want to record over a secure connection and we have not yet configured the Borland CA certificate or the certificate of the system under test, click Record over a secure connection on the Workflow - Model Script dialog box and proceed with the following step.
11. On the Configure secure recording dialog box, select if we want to use the Borland CA certificate or if we want to use the certificate of the system under test. If you are unsure which approach to use, refer to Secure Connections and Certificates. If we selected Configure Borland certificate:
 - a. Click Install Borland CA certificate.
 - b. Follow the Certificate Import Wizard instructions.
 - c. Click Start recording. If you selected Configure server certificate:
 - a. In the Server certificate field, locate the server certificate you want to use.
 - b. In the Pass phrase field, enter the pass phrase that is to be used, if the server certificate you want the Recorder to use is protected with a pass phrase.
 - c. Optional: Check the Send root CA during SSL handshake check box to have the Recorder send the root CA certificate during the SSL handshake. The root CA certificate may be requested by a client to authenticate the certificate authority that signed the Recorder server certificate.
 - d. Optional: In the Root CA certificate field, locate the root CA certificate that we want to use.
 - e. After we have completed configuring the server certificate, click Start recording.
- The Silk Performer Recorder dialog opens in minimized form, and the client application starts.
12. Using the client application, conduct the kind of interaction with the target server that we want to simulate in our test. The interaction is captured and recorded by the Recorder. A report of your actions and of the data downloaded appears on the Actions page.
13. To end recording, click the Stop Recording button.
14. Enter a name for the .bdf file and save it. The script can be generated without issues. After selecting the workload type click Run. The following table summarises the results for two workload types namely (i) Dynamic (ii) increasing .

Table-2 SILK Mobile RESULTS

Workload model:	Dynamic	Increasing
Number of transactions:	18	20
Average number of transactions/sec:	0.00	.10
Number of errors:	48	0
Throughput[kB]:	168449	9741
Average throughput[kB]/sec:	31.43	46.39
Number of hits:	22480	899
Average number of hits/sec:	4.19	4.28
Trans. (busy) failed[s] :Minimum[s]:	909.92	18.66
Trans. (busy) failed[s]:Average[s]:	1,138.92	28.47
Trans. (busy) failed[s] :Maximum[s]:	1,463.38	43.25
Average page time[s]	7.20	1.17
Average document downloading time[s]:	1.85	0.31
Average server busy time[s]:	0.45	.09

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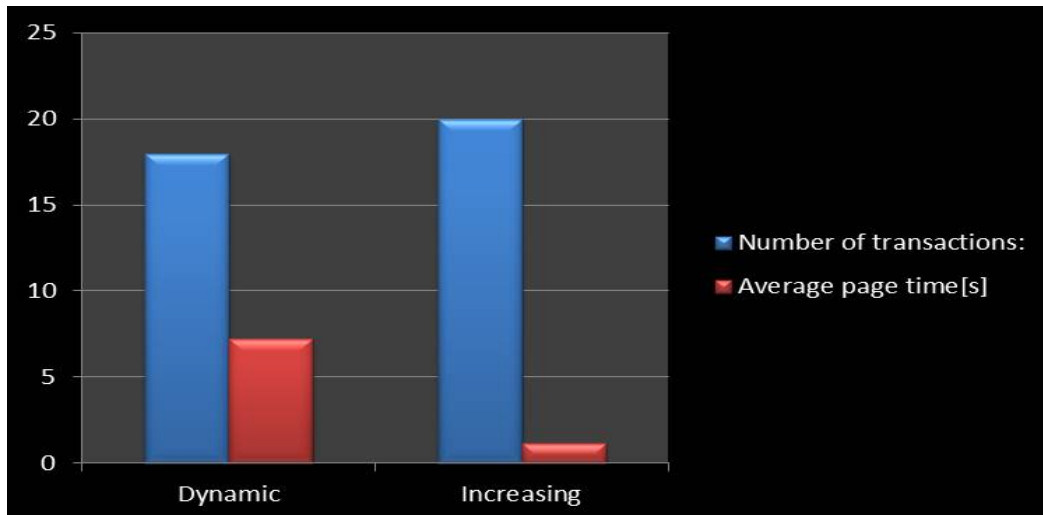


Fig-2 Silk Mobile

NEOLOAD

Users expect mobile services to be relevant and user-friendly, and to perform well. The limitations of the medium impose significant challenges to designing and testing products that meet all of the users' expectations. Performance is a crucial contributor to a trustworthy mobile user experience. With NeoLoad, mobile applications—with their specific features—can be load tested to ensure end-users perceive them properly. NeoLoad makes it possible to check the mobile applications performance issues on the server side and prevent: (i) Variations in response times (ii) Delays and drops in delivery of packets (iii) Applications crashes

RECORDING AN HTTP APPLICATION IN PROXY MODE

NeoLoad allows recording a scenario using just a desktop browser. The NeoLoad Recorder, seen as a proxy by the browser, records each HTTP request and response to and from the server. To record an application in Proxy mode.

1. In the Design section of NeoLoad, click Start Recording.
2. In the Start Recording dialog box, specify a new Virtual User.
3. In Protocols, select: WebSockets to record the WebSockets requests, Adobe RTMP to request the RTMP requests.
4. To record in proxy mode, check the Proxy mode option.
5. In Launch browser, you can select the recording browser.
6. In Identify as, we can choose to simulate another recording browser.
7. Click OK. The application starts in the selected browser.
8. In the recording bar, classify your navigation steps by Container.
9. To terminate your record, click Stop.
10. Configure our scenario further in the Post-recording Wizard.

STANDARD MODE

CONSTANT: Generates a fixed number of Virtual Users.

RAMP-UP: Generates a number of Virtual Users that increases throughout the test. Useful for checking the server behavior under an increasing load. The increase time frame may be set within precision of 0.1 time unit.

PEAK: Generates a fixed number of Virtual Users with periodic phases of high load. Useful for checking whether the server recovers its normal behavior after a load peak. The time periods may be set within precision of 0.1 time unit.

CUSTOM: Allows you to set the load to be applied by plotting the Virtual User variation curve. We may import the curve using a CSV file. The file must be in the format Time (seconds) <separator> Number of users.

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For the recorded scenario we have obtained the results for (i) Constant (ii) ramp-up (iii) Peak.

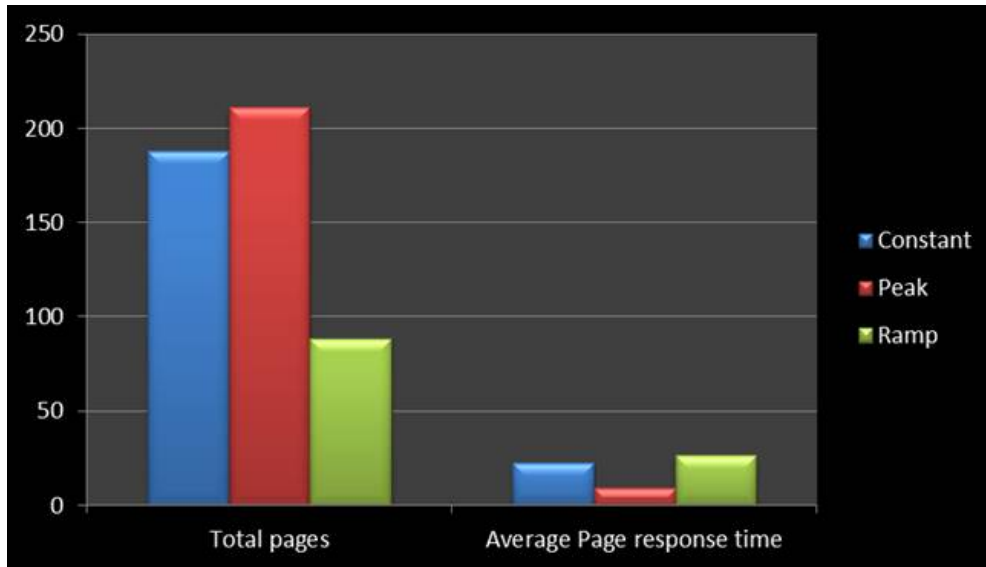


Fig-3NeoLoad

From the above table and Bar charts we find that (i) HP LoadRunner returns 9.978 secs for Average transaction response time and the total throughput being 776,63,348 Bytes/ sec . (ii) Silk Mobile outputs Average page time for the work loads Dynamic, Increasing are 7.2s and 1.17s respectively. Similarly for the work loads dynamic, increasing the Number of transactions are 18 and 20 respectively. (iii) NeoLoad results in for the work

Work Load	Constant	Peak	Ramp
Average pages/s	0.3	0.4	0.1
Average requests/s	1.6	2.0	0.7
Total pages	188	211	88
Total requests	937	1179	400
Average Request response time	9.14 s	4.51 s	6.45 s
Total request errors	36	63	57
Error rate	3.8	5.3	14.2
Average Page response time	22.8 s	9.4 s	26.4 s
Total throughput	10.31 MB	7.15 MB	3.0 MB
Average throughput	0.14 Mb/s	0.10 Mb/s	0.04 Mb/s
Total users launched	10	15	10
Total iterations completed	10	15	10
Total action errors	0	0	0
Alerts total duration	0%	18.2%	0%

Table-3 NEO LOAD RESULTS: Statistics Summary

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loads Constant, Peak and Ramp types the Average Page response times are 22.8s, 9.4s and 26.4s and the Total pages 188, 211 and 88 for the same type of work loads. The same jQuery based website has been tested with the same number of virtual Users. In our test we observed that the minimum response time is returned by *Silk Mobile for increasing type work load* and is **1.17 s** and the maximum response time is returned by *Neo Load* for the *Ramp* type work Load and is **26.4 s**. In our study we have found that there has been a lot of difference in Response Time between Performance Testing Tools. Why such a difference? This may be due to the tool's technology. An ideal load time for a mobile website is *one second*. As different tools have different strengths and drawbacks, so the selection of best tool largely depends on factors like project requirements, availability of skilled resources and budget etc.

V. CONCLUSION

Through this paper Mobile website testing tools and Methods has been presented and analyzed. Only three tools have been used for the study but there are huge number of mobile web application testing tools available and it can be used for the web/mobile web application testing. Some details about proxy server and its advantages and a detailed description about mobile testing methods have been discussed. A famous jQuery based E-commerce website have been tested with Performance/ Load testing tools Loadrunner, Silk Mobile and NeoLoad. The results for three tools have been presented with various tables and graphs. The minimum response time is returned by Silk Mobile for increasing type work load and is 1.17 s and the maximum response time is returned by Neo Load for the Ramp type work Load and is 26.4 s.

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