Mobile Performance Testing
Abstract

This whitepaper is to provide insight about the approach for Mobile Performance Testing to collect Server Side, Network & Device Performance Metrics. Tools used in this approach are HPE Load Runner, HPE Mobile Center, tPacketCapture Android Application, SeeTest Automation.

Why Mobile Performance Testing?

“As long as you have a Cell Phone you’re never alone”
Stanley Victor Paskavich

A Nasscom and Akamai report, published on 17 August 2016, claims India will have over 730 million internet users and 702 million smartphone users by 2020. This makes smartphone internet usage 96% of overall internet usage, leaving only 4% to Personal Computers. In 2010 Steve Jobs termed this as “Post PC Era”.

In this era, for every business it is important to have their own High Performance Mobile Application to survive in competitive market conditions. According to a survey by Akamai, 47% of consumers expect web pages to load in two seconds or less and 20% expect mobile apps to load instantly. The findings of a 2015 mobile app user survey conducted by Dimensional Research showed that 80% of app users will only attempt to use a problematic app three times or less and 36% said that an app with slow performance issues made them have a lower opinion of the company. With this increased usage of Mobile Internet and high performance expectations from consumers, it is inevitable that Mobile Performance testing is of utmost importance.
In Traditional Performance Testing of Browser based - web applications, we solely concentrate on Server side performance, because Client side performance is not impacted by how many users are using the website concurrently. While this being true with Mobile devices as well, there are few more new attributes added to performance impacting factors.

Client side/Mobile Device resource utilisation

It is important for a Native Mobile Application to optimise the CPU usage, Memory usage, Number of HTTP calls over internet, Battery utilisation to achieve a better user experience, resulting better user rating. So, measuring Mobile Application Performance will not be complete without Mobile Phone resource utilisation stats.

Network Dependency

Unlike PCs with stable broadband network connectivity, Mobile phone relies on Mobile Networks, which will vary based on Geography, Varying Signal Strength, Network Bandwidth (2G/3G/4G LTE), Packet Loss etc. having definite impact on performance. So, for mobile performance testing it is important to simulate similar network conditions and measure the performance impact of the same.

Script recording challenges

For typical web based application scripting, Load Runner set up a proxy after browser and captures the HTTP Request – Response traffic. Now the same approach will not work directly for mobile performance testing because:

1) LoadRunner being a PC based tool (Windows/Linux), cannot be installed on Mobile Devices running Android or iOS.

2) For Native Applications, setting up proxy at Browser level will not work, as they do not depend on browsers for network HTTP Request/Response

Mobile Performance Metrics to be collected

In Mobile Performance testing we need to capture...

Server side performance stats

- Server Response Time
- Server Side Resource utilisation (CPU, Memory, Heap Utilisation, Session count, Load balancer stats etc.)

Mobile Device Performance Stats

- Network impact on performance
- Response Time in respect of user experience (including Page Rendering Time)
- Mobile Devise Resource utilisation (CPU, Memory, Heap Utilisation, Battery consumption stats etc.)

What is new in Mobile Performance Testing?
HPE LoadRunner protocol support for Mobile performance testing

Web HTTP/HTML protocol:

**Used for:** Server side Performance Testing & Metrics collection

**How to record script?**

To capture Mobile HTTP/HTML traffic using this protocol, we have to change the recording approach a bit compared to our approach for recording normal PC – Browser based Web Applications.

To record Mobile HTTP traffic, instead of selecting Browser option (default selection) in Start Recording window, we have to select either of below 2 options...

1) Remote Application via LoadRunner Proxy

**Pre Requisite:** LoadRunner – VuGen Machine & Mobile device should be connected to same WiFi enabled LAN network having access to internet.

**Approach:**

1) In VuGen select “Remote Application via LoadRunner Proxy” option in Start Recording window instead of “Browser”

2) After selecting first option, VuGen will ask for “LoadRunner proxy listens on port” - Port number can be set to any 4 digit number or also can be used the default one - 8080

3) Check “Display recording toolbar on client machine”

4) Click on “Start Recording” – VuGen will start listening to any traffic traversing through it proxy set on VuGen PC – defined port set on point 2.

5) Now, as VuGen is listening to the requests, we have to set the Mobile Device going through VuGen machine.

6) In mobile device, we must connect to the same WiFi enabled LAN network to which our VuGen machine is also connected.

7) While connecting to the WiFi network in mobile device, we must set Custom Proxy with IP of the VuGen Machine and Port Number as LoadRunner proxy Port number.

8) Now, whatever traffic flows to and fro this Mobile device will be captured at VuGen and script will be created once we stop the recording.

9) While Recording we can use Recording toolbar to put comment or transaction or perform other recording time options

10) Once Script is generated, we can perform Correlation, Parameterisation, Error Handling, Transaction Naming etc. like any other Web Script

11) We can use LoadRunner Network virtualisation to simulate Different types of Mobile Networks, during scenario creation using controller or Performance center.

**Advantages:**

1) Can be used without any help from any other tool irrespective for Mobile OS – iOS/Android/Windows

2) Advantages of Web HTTP/HTML protocol can be used

3) Do not require the Mobile device to replay the script or during execution

4) Network impact on performance can be measured using HPE Network Virtualisation

**Limitations:**

1) Cannot be used if we require to create script for a mobile device which is not connected to the same Network

2) Mobile device performance metrics will not be measured

2) Captured Traffic File Analysis

**Pre Requisite:**

1) Packet Capture applications enabled with saving captured traffic in PCAP format should be installed on Mobile Device (Ex. - tPacketCapture application can be used for Android mobile).

2) Permission/approvals should be taken from concerned stakeholders to install WireShark in LoadRunner – VuGen Machine.

3) WireShark should be installed in VuGen machine.

**Approach:**

1) Using Packet Capture applications installed on mobile device, capture the Network traffic related to the Application under test in PCAP format & transfer the file to VuGen machine

2) In VuGen Select “Captured Traffic File Analysis” option in Start Recording window instead of “Browser”

3) Browse the recorded PCAP file

4) Click on “Start Recording” – VuGen will analyse the PCAP file using WireShark and generate the script.

5) Once Script is generated, we can perform Correlation, Parameterisation, Error Handling, Transaction Naming etc. like any other Web Script

6) We can use LoadRunner Network virtualisation to simulate Different types of Mobile Networks, during scenario creation using controller or Performance center.

**Advantages:**

1) Mobile device need not to be on the same network as VuGen machine

2) Advantages of Web HTTP/HTML protocol can be used

3) Do not require the Mobile device to replay the script or during execution

4) Network impact on performance can be measured using HPE Network Virtualisation.
Limitations:

1) Have dependency on other packet capturing tool, having capability to same captured traffic in PCAP format. Selection of tool is again dependent on mobile OS.

2) Have dependency on WireShark tool to enable VuGen able to analyse PCAP file format

3) WireShark installation requires exceptional approval from concerned stakeholders & corporate network security team

4) Mobile device performance metrics will not be measured.

TruClient – Mobile Web protocol

Used for: End-to-End Performance Testing & Metrics collection for Mobile Browser based applications.

Approach:

1) Being a TruClient protocol, records / simulates GUI level User actions / events, and not the protocol level communications

2) To create a TruClient – Mobile Web script, we will need to select a Mobile Device simulator from the List of devices provided in VuGen Mobile Setting window, which appears after clicking on Develop Script option

3) Based on the Mobile Device selection, Mobile Browser – OS – OS version – Screen Resolution gets selected, which will be used to create the script

4) Once Mobile Settings are selected, script can be developed following same TruClient script preparation steps and all TruClient customisations can be applied to the script

5) We can Use LoadRunner Network virtualisation to simulate Different types of Mobile Networks, during scenario creation using controller or Performance center.

Advantages:

1) No Mobile device is required for recording/ replay of the script

2) Advantages of HPE TruClient technology can be used

3) Network impact on performance can be measured using HPE Network Virtualisation.

Limitations:

1) Can be used for Mobile based application testing only, Mobile Apps cannot be scripted.

2) Mobile device performance metrics will not be measured, as Mobile device is not used to execute the script

TruClient – Native Mobile Protocol

Used for: End-to-End Performance Testing & Metrics collection for Mobile native Applications including Mobile Performance metrics.

Approach:

1) Being a TruClient protocol, records / simulates GUI level User actions / events performed at Real Mobile device, and not the protocol level communications

2) To create a TruClient – Native Mobile script, we will need to provide below details to VuGen
   - Mobile Center Server address
   - Mobile Center User Login credentials and SSL details
   - Mobile Device ID attached to Mobile Center
   - Application to be tested

3) Mobile Center is integral part of TruClient - Native Mobile protocol. Mobile Center is a HPE product working in master slave concept. Master part is called as Server and the Slave is called as Connector. Mobile devices are connected to connectors and Connectors are connected to Mobile Center Server. This can be integrated to LoadRunner using TruClient - Native Mobile protocol script. Mobile Center can:
   - Connect multiple Mobile devices, supports iOS, Android, Windows devices
   - Mirror the Mobile Device screen
   - Capture User Actions for TruClient script
   - Replay TruClient Script in connected device (any device, not necessarily the same device which was used to record the script)
   - Measure Mobile Resource utilisation during Replay/Execution

4) Once Required details are provided and Mobile Center mirrors the Mobile Device, script can be developed following same TruClient script preparation steps and all TruClient customisations can be applied to the script

5) During replay/execution actual mobile Network of the connected device is used, simulating actual network conditions.

Advantages:

1) Actual end user experience using actual mobile device can be measured in this protocol

2) Network impact on performance can be measured using actual mobile device

3) Mobile Center connecter component enables simulating different geographies

4) Mobile Performance metrics & Server Performance metrics both can be measured

5) Advantages of HPE TruClient technology can be used.

Limitations:

1) To generate multiple virtual user equal number of Mobile devices will be required, making it more costly.

2) Mobile Center licence needs to be procured on top of LoadRunner Licence, making it more costly.
Experitest SeeTest Automation an alternate to HPE Mobile Center

SeeTest Automation can be considered as an alternative to HPE Mobile Center.

**Features of SeeTest Automation**

1) Connect Mobile devices, supports iOS, Android, Windows devices
2) Mirror the Mobile Device screen
3) Capture User Actions and creates script
4) Replay Script in connected device
5) Measure Mobile Resource utilisation during Replay/Execution
6) Can create LoadRunner C-Vuser script, for the seetest automation scripts
7) Provides LoadRunner add on using which LoadRunner C-Vuser scripts can be executed on real devices connected through SeeTest Automation
8) Supports multiple device connection enabling concurrent connection.

**Advantages over Mobile Center**

1) Licencing cost much less compared to Mobile Center
2) Can be used for Mobile Automation testing as well, without depending on any other tool like QTP

**Limitations**

1) LoadRunner licence for C-Vuser protocol will be required to integrate with LoadRunner
2) Basic licence does not allow concurrent connection to multiple Mobile devices, and requires additional licence for each of the mobile device to be connected.
Suggested Scenario preparation approach for Mobile Performance testing

1) Capture concurrent usage metrics of any application for all access channels like PC – Web Applications, Mobile Browser based web applications, Mobile native Applications

2) Capture in scope business flows for each of the access channels, and also capture Work Load Model for each of the identified Access channel – business flow combination

3) Capture Network simulation requirement in terms of Geography, Packet loss, Signal strength, network bandwidth, network connection type etc.

4) Create Web HTTP/HTML script to simulate “Synthetic” Load on server

5) Use HPE Network Virtualization to simulate real life network condition

6) Use Mobile Center (TruClient – Native Mobile protocol) or SeeTest Automation (C-VUser protocol) to simulate real Mobile device load and capture Mobile device performance metrics – restrict the number users to minimum simulating all required type of devices only

7) Use TruClient - Web / TruClient – Mobile Web protocol only when web Http/Html protocol cannot be used

8) Run Test simulating maximum load on server using Synthetic load & only required load using Real Mobile device, running in parallel

9) Correlate the Synthetic Load & Real Mobile load results to identify probable performance bottleneck.
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