Significance of Performance Testing for Mobile applications

Kanagalakshmi Murugan

Independent Researcher

Abstract

In today's Digital world mobile devices have become an inherent part of our lives, some key reasons why mobile apps become so important are Convenience and efficiency, Enhanced Communication, Banking, Online shopping, Customer engagement, Education and Learning, Health and Fitness, Entertainment, etc.They simplify tasks, conserves time, enhance social connections, contribute to business growth, provide educational opportunities, offer various forms of entertainment, and encourage healthier living It is decisive for businesses to prioritize the performance of their apps on mobile platforms. Mobile performance testing plays a significant role in ensuring that apps are optimized for seamless functionality, faster loading times, and an overall enhanced user experience. Assuring the quality of Mobile Applications is highly recommendable as poor performance will lead to major financial loss. Asmobile applications are constantly evolving, with new features, updates, and user demands regularly monitor and optimize performance becomes in evitable

Keywords: Performance Testing, Mobile Application, Mobile Performance Testing Approach

1. *Introduction*:

In the fast-revolving world the importance of mobile applications in everyday life become an integral part of how we conduct business, socialize, educate ourselves, banking and even monitor our health everything comes in our palm size device the mobile. As technology continues to evolve, the role of mobile applications in shaping our daily lives is only expected to grow.The usage of mobile device and apps is not only with younger generation but the older generation is using the mobile apps efficiently. Mobile Application performance is very important to decide whether mobile application project is a success, or a failure and it can only be achieved when developing organization done proper and efficient Mobile Application Testing. Key importance is to develop an application with all required features and functionalities by the user, but more difficulty is to have an efficient mobile testing approach before Mobile Application is delivered to its users. Mobile computing is the next step in the evolution of computing where mobile devices become the client device rather than a PC (Personal Computers).Theabundance usage of personal mobile devices has changed consumer’s expectations about access to information. The expectation of the end-users able to find details on products anytime, anywhere. At the same time their expectations for performance for the mobile apps are increasing and the applications they are accessing are becoming even more critical to the business. online consumers will abort a site after waiting 5 seconds.

2. Importance of Mobile Performance Testing:

For businesses that are running through mobileapplications, performance is gaining more importance than ever before. Mobile applications are necessary elements that cause viewpoint to our smartphone. Mobile applications make our gadgets convince our needs and wants. Bad quality of the mobile apps undermines the marketing. Users expect a fast, fantastic and friction-less experience while browsing the apps on mobile device. A little delay or a temporary glitch can make Users go impatient and move to your competitors' websites.

A mobile application (or mobile app) is a software application designed to run on smart phones, tablet computers and other mobile devices. By establishing clear performance metrics, you can set benchmarks, track improvements, and identify areas where optimization is required. This data will help you make informed decisions regarding the application's performance

3. *Various types of Mobile Applications*

There are three different types of mobile applications

- Mobile Web Applications
- Mobile Native Applications
- Mobile Hybrid Applications

Mobile Web Applications

Web application are not real applications; they are websites that, in many ways, look and feel like native application interfaces with external systems/servers.Protocol: Wireless Application Protocol (WAP) or Hyper Text Transfer Protocol (HTTP)

Mobile Native Applications

Native app is one that is built for a specific platform (e.g., iPhone or Android) using their code libraries and accessing hardware features of the mobile device Applications are installed on the device accessed through icons on home screen

Mobile Hybrid Applications

Built with a combination of web technologies and hosted inside a native application that utilizes a mobile platform's WebView.Platform independent (Android, iOS,..)

4. *Challenges of Mobile performance testing*

- Great range of smartphones and tablets with different screen sizes and resolutions; different hardware configurations
- Different mobile operating systems, such as Android, Windows phone, IOS
- Different versions of operating system, such as Android, iOS etc

5. *Mobile Performance Test Strategy*

1. Define the Performance Test Objectives

Lack of mobile apps performance testing goals is the most common reason why app development and performance testing fails. When your mobile performance testing objectives are clear, well-defined, and aligned with your business app goals, the testing process becomes smooth and effective.

2. Definethe KeyPerformanceIndicators to the business

Your plan needs to set and achieve the benchmarks for performance testing. It's how you will sustain a competitive advantage and identify if the testing execution was successful or not. While your strategic goals establish the objectives for app testing, KPIs will help you know how far you are from achieving them. These KPIs can help you measure the effectiveness of your testing and to identify the performance test and monitoring. This helps the business to understand the need the tools to achieve the performance testing outcomes

- Average Response Time
- Peak Response Time
- Error Rate
- Concurrent Users
- Requests per Second
- Throughput

3. Identify and Prioritize Key Scenarios

A common reason why most app performance testing fails is due to poorly defined scope. Every performance tester should define the scope of performance testing features. Not defining your scopeat the beginning will bring down the confident that the client have on us and we cannot meet the deliverables. Identifying the critical scenariosensure that we test crucial app features first. Once that necessary features work appropriately, you can move on to test secondary features or scenarios.

4. Test Your App with Emulators, Simulators, and Real Devices in a Testing Environment

Testing environment plays avital environment in performance testing. A testing environment evaluates your app on virtual testing devices such as Simulators and Emulators. Simulators and Emulators mimic smartphones, which helps QA testers run the software application to get a rough idea about how your app would run on the actual devices.

Although virtual testing devices closely mimic end-user devices and are cost-efficient, they cannot replace real devices. Ensure you test your app with real users on real devices. Getting dedicated devices for performance testing will help us to achieve or meet the deliverables

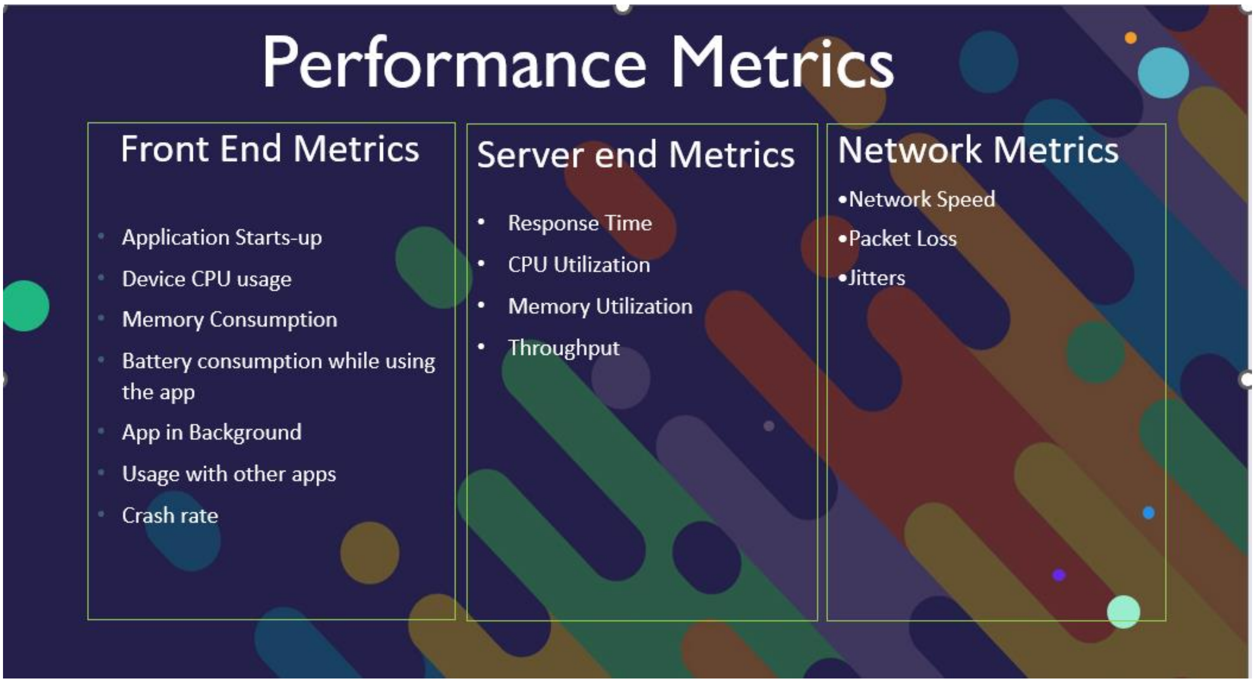
Real devices allow you to get a first-hand experience and feel of device interfaces. You will assess the performance device-specific functions that may not otherwise be available simulators and emulators such as camera permission, GPS. Additionally, you can test over a wide range of screen resolutions and across different geographical locations and networks. More importantly, real devices provide more accurate and reliable results than virtual testing devices.

5. Align the Testing Approach with Your Application Development Methodology

App testing is often a continuous exercise over the lifecycle of an app. Aligning your testing approach with your application development methodology can help make your objectives and testing benchmarks more intentional and far-reaching. It also helps keep everyone in the development team accountable for your long-term app vision and strategy and gain insights into how your plan is performing over time.

Lastly, it allows everyone to easily collaborate, communicate while ensuring everyone is on the same page

Performance Metrics to be attained



Performance Metrics

Front End Metrics

- Application Starts-up
- Device CPU usage
- Memory Consumption
- Battery consumption while using the app
- App in Background
- Usage with other apps
- Crash rate

Server end Metrics

- Response Time
- CPU Utilization
- Memory Utilization
- Throughput

Network Metrics

- Network Speed
- Packet Loss
- Jitters

App Start up Load Time

Mobile app load time refers to how long it takes for an app to fully launch and become interactive once a user hits the icon to open it[1]. Ideally, the load time should be under 3 seconds to display content to users. Average screen rendering time is the time your app takes to load its content: images, text, videos, and animations. It doesn't do your app any good to have excellent response time with slow render times. Users will uninstall or abandon your app.

Screen rendering times differ with application complexity. A time range from 1 second for light apps to 3 seconds for complex apps is excellent. Slow screen rendering time can result from inaccurate screen dimensions, inconsistent fonts, unscaled images, excessive blocking scripts, etc

Device CPU Usage:

The CPU (Central Processing Unit) is the unit responsible for carrying out all the instructions of an application.When CPU usage is high, the user may experience sluggishness or higher battery usage (among other symptoms). Since CPU usage is a shared resource, abusing it may prevent other services that are running at the same time to work correctly. This can affect the user experience and proper functioning of the OS (plus the applications that run in parallel)

Memory Consumption

50.6 % of users will uninstall your app if it takes too much space on device memory. Memory-sucking apps prompt memory warnings, performance issues and quickly drain battery power. Even if your app launches fast but still uses a significant percentage of the user's CPU. Users will terminate it due to poor user experience.

High memory usage apps are also prone to termination by operating systems when operating and competing with other background apps. Test and observe app functionalities to reduce your app's memory footprint before deploying the app to end-users. For instance, push notifications have been found to increase memory consumption in Android apps.

Battery Usage

Battery life is a critical feature of any mobile device. Apps that compromise battery usage don't last long, and neither will your business. Heavy battery usage riks users. They won't think twice about uninstalling your app if they realize it eats up battery no matter its significance. Mobile app battery consumption testing optimizes your app only to consume low battery power when and if necessary. Your app should also minimize background activity.

App in Background

Users expect apps running in the background to be retrievable and remain in the same state it was before. If your app isn't retrievable in the background, data is inevitably lost upon retrieving the app. And this means poor user experiences – a big turnoff for users.

Usage with Other Apps

Imagine using an app that restricts other apps? Frustrating, right? When test-running your app in parallel with other apps, it mustn't interfere with other apps. If it does, users will quickly uninstall it and leave negative reviews. Switch between apps to monitor how your app interacts with other apps.

App Crashes

Users hate when apps crash, slow down or freeze, even for a few seconds. Frequent app crashes can quickly lead to business failure or prove costly. The crash rate is the average crashes per app load. The typical crash rate for mobile is 1 – 2% but may vary widely depending on the app type of app, app usage, maturity, etc. Always aim for 98% crash-free users.

Application Response Time

Server-side load is the time elapsed when a user puts in a request to your app and the server responding to that request.

Factors that can cause server-side load include a lack of server resources, overloaded servers, memory leaks, and end-users network connection speeds. It can be resolved using reliable and fast web hosting, using CDN, optimizing databases, monitoring PHP usage, configure caching, or minifying scripts.

CPU Utilization:

In addition to throughput and response times, another key performance indicator of an application's performance is often referred to as utilization.

Resource utilization is a way to track how busy various resources of a computer system are when running a performance test.

Memory Utilization:

By Monitoring the memory during load test can helps us to identify any memory leaks. The memory should get released after the load test is completed, if the memory is not released after the load test will lead to poor performance. Optimizing the memory will help us to evaluate the performance and will avoid the cost for additional usage of memory. For example if the services uses 15 % of memory and if the allocated memory is 80% then we can reduce the additional pods.

Throughput

Throughput measures the volume of requests/responses/traffic your app can handle in relation to time. Have a throughput goal that your application needs to operate on – a specific number of requests per hour. Test with light and heavy real-time users. High throughput means that more transactions are completed during a given amount of time.

App performance can be affected by the network bandwidth and network latency. So, it can't be overstated how much testing your app under varying network conditions can ensure good app quality and improved app performance. Mobile devices connect to the internet through Third-party network carriers meaning that bandwidth and the networks' latency can vary.

Taking network carrier differences into account allows your team to optimize the app performance to improve user experience.

How to Setup a Mobile App Performance Test Environment

A testing environment is a setup of software and hardware on which your testing team executes test cases. Ensure you do the following for your app performance testing environment:

Understand your App and Test Environment

Before setting up the performance testing environment, it's critical to understand the mobile app to be tested, the operating systems or devices to be tested, and the different geographic locations.

Besides, the tester should be conversant with the test environment and both app and testing architecture. Any disparity between them can increase production costs and affect time to market.

Isolate the Environment

Ensure that no other activity is carried out in the performance test environment when actively using the system. Any interference can jeopardize the test accuracy and pose issues when implementing a new bottleneck.

What's more, having users simultaneously access the platform increases the server load and affects app performance with slow processing. Consequently, real-time app users won't complete tasks when executing a performance task.

Conclusion:

In this study we have explored the various essential information related to the mobile performance testing strategies, identifying the environment, the metrics that needs to be monitored and the challenges on getting the hardware configuration. By implementing the performance testing with different mobile operating systems, network conditions 2G, 3G, 4G, 5G ,wifi and with different screen size, resolution.in this paper demonstrate promising improvements in mobile app performance and deliver exceptional performance and user satisfaction.

References:

1. Secure Software Integration and Reliability Improvement, 2009,HeejinKim;ByoungjuChoi;W. Eric Wong
2. Mobile Application Testing Tools and their Challenges,Jan 2019,Usman Ali, Khawaja Sarmad Arif
3. Mobile Performance Testing: A Comprehensive Tutorial, Rachel Harrison, Derek Flood, David Duce

4. Importance of Performance Testing - QAFox Sunaina Joshi, 2019
5. 10.1109/INFTECH.2008.4621694, 18-21 May 2008, Mabel Vazquez Briseno
6. Importance Of Mobile Application Testing, https://www.linkedin.com/pulse/importance-mobile-application-testing-katherine-is-/, Katherine I. July 20,2017
7. (Mobile Media&CommunicationJingwen Zhang, Christopher Calabrese, Jieyu Ding Featherstone, Mingxuan Liu, 2017)
8. An end-user-centric test generation methodology for performance evaluation of mobile networked applications - Al-tekreeti - 2019
9. New Industry Benchmarks for Mobile Page Speed - Think With Google, Daniel An/February 2018
10. Performance Testing of Android Apps, Feb 14, 2018, Jonathan Lipps