Real Devices vs. Emulators
The Pros and Cons of Different Mobile Testing Environments
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Introduction

As testing on mobile devices continues to be explored, to mature and grow, so do the problems that it can reveal. Many things that started off or were branded as simple because of past experiences with desktop-based applications, quickly revealed themselves to be major hurdles and roadblocks. With the rise in popularity of smartphones, tablets, and everything in between, there are many manufacturers both small and large who have entered this market, causing a flood of devices to be released in a very short period of time.

With so many devices in the market, how can companies possibly test them all? Trying to purchase one of every device quickly grows out of hand when it comes to the logistics of it. There is also the problem of needing more than one device to run different tests at the same time.

This white paper is going to discuss two of those testing solutions: emulators and using real devices. It will talk about the abilities and limitations of both approaches and offer some best practices when deciding between the two.

Problems Faced Today

To understand the scale of the problems faced by mobile testers before emulators and real device testing, we will start with a mobile device and compare it to a desktop. A desktop only has one of three operating systems (usually) installed on it. On mobile devices, however, there are multiple operating systems, all with various versions of themselves running across different devices. Even within a closed system such as iOS, there are different versions of iOS. In a mobile environment, there are new versions of its operating systems released at a much faster rate than their desktop equivalents (measured in months rather than years).

There are also different versions of the applications, often built by different developers. The "look-and-feel" of an app running on Android OS 4.1 can be completely different from the same app running on version 4, released nearly a year earlier. And it may be completely different in future updates, sure to come in the following year.
Mobile devices also have features that are unique, such as the ability to receive a phone call while you are using the application or SMS integration. Different devices handle interruptions differently, so these mobile-specific variations must be coded for and tested.

Various operating systems, operating system versions, application versions, and hardware and multiple mobile device features make mobile testing its own beast.

**What are Emulators?**

Emulators are hardware or software designed to functionally replicate other computer hardware. A good example is the Android Development Kit for Eclipse, which allows you to simulate your application on any Android device using any computer on which it is installed.

**Why use Emulators?**

Emulators have many benefits over using actual devices. One of the biggest reasons is cost. Many emulators can be used for free, compared to real devices that can cost hundreds of dollars to purchase. If you have multiple people on your team who need the device, they can use it at no extra cost to you in most cases.

Another reason to use emulators is the ease of maintenance for emulators compared to real devices. A real device can break, get lost, or have a myriad of other problems due to it being a physical object. The emulator is usually on your computer and only requires you to either download it again, or apply an update to it. With some emulators, you can also change the specifications of the device without grabbing another emulator. The RAM and resolution of the display are a couple examples of things that you can change without having to purchase another device.

Emulators tend to have faster response times since they are usually hosted on your local machine. Testing processes can take a long time and seconds quickly add up when running long tests. A fast device allows for more testing in a shorter period of time.

*The Android SDK includes an emulator.*
How to Use Emulators

Emulators tend to come with the Software Development Kit (SDK) from the manufacturers of the device or of the device OS. To acquire them, you usually just need an internet connection to download it from their website.

What are Real Devices?

Real devices, as the name suggests, are the actual phones, tablets, and other mobile gadgets that consumers can go out and purchase.

Why Use Real Devices?

Real devices have many advantages over emulators. Testing on real devices eliminates false positives that might be possible on emulators. This is because emulators cannot simulate battery life, network traffic, carrier-specific problems, or a myriad of other conditions that can occur in the real world. Simply put, emulators have the problem of being too perfect an environment.

Real devices can sometimes have specific hardware and software features that cannot be replicated with emulators. They also represent the true user experience when testing the application. Real devices will also reproduce defects that the device itself may have due to the handset or its environment. Real devices can simulate interrupts such as text messaging or phone calls. Finally, and often most importantly, real devices demonstrate functionality and performance using real carrier networks over publicly available networks, something that emulators just can’t reproduce.
How to Use Real Devices

Real devices need to be purchased from carriers to retain their network functionality and keep their real world quirks. This can be pricey but thanks to the ever growing popularity of cloud services, some companies host public clouds of devices and also provide the required software to test on these devices. This alleviates the problem of having to keep up new devices and updates and helps bring the cost down significantly. Local private clouds can also be deployed for companies to manage their own devices. These local clouds also come with the manual and automation testing software required to drive the devices.

Best Practices

All of this brings us back to our original question on whether or not to use real devices or emulators. There have been many pros and cons outlined in this paper, with many (if not all) of them being important considerations for this decision. In short, emulators provide a solution that is cheap and gives you quick testing and results whereas real devices give you a much more thorough and accurate solution. Speed is a great quality to have as you do not always have the luxury of time, but rushing through a problem to create a solution can cause more problems.

After examining both methods, it is suggested that a hybrid approach, toward real devices, is applied when performing mobile testing. Emulators should be applied where appropriate for their few advantages over real devices, which is typically during development unit testing. It is very important to be as close to real conditions as possible when testing, making real devices the ideal choice in most situations. By using both methods when they are appropriate, you get the best of both worlds. You also help to mitigate the short comings of both. Mobile devices and the testing of them is an ever and rapidly evolving field. Being flexible is a welcome, if not essential, quality to being able to survive, adapt, and overcome the challenges of this ever growing frontier.