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TEST CASES AND TESTING STRATEGIES FOR MOBILE APPS –A SURVEY

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Abstract - *There has been tremendous growth in the use of mobile devices over the last few years. This growth has fuelled the development of millions of software applications for these mobile devices often called as 'apps'. Current estimates indicate that there are hundreds of thousands of mobile app developers. As a result, there has been an increasing amount of software engineering research conducted on mobile apps to help such mobile app developers. Now a days mobiles are using for computing rather than for just calling, Automation has become the important part of software development speedy life cycle. Manual testing will take large amount of time and complicated for complex application. This paper civilize on some mobile automation testing tools and different types of mobile apps, like hybrid , native and web apps. This paper has also defines test cases and testing strategy issues in mobile applications.*

Key Words: **Mobile Apps, Test cases, software engineering, Testing Strategy.**

1. INTRODUCTION

Now a days mobile phones are not only used for just calling, those are also used for computing purpose and the demand of smart phone is increasing exponentially, Due to internet and smart phone devices all desktop web apps are now building for mobile devices. Basically, there are three types of Mobiles apps native apps, hybrid apps and web apps. Native apps are installed on device and have specific icon to start e.g. Games, these apps are standalone apps. While hybrid apps also installed on device but it needs internet to use it e.g. Facebook, WhatsApp. Web apps are deployed on some servers and we access those by browser[3].

A mobile OS typically starts up when a device powers on, showing a screen with icons that present information and provide application access. Mobile operating systems also covers cellular and wireless network connectivity, as well as phone access[24].

In the fast growing world the cell phone is not only a device to make and receive telephone calls but also a multipurpose personal gadget. There are more technological improvement and the propagation on mobile devices with different Operating Systems like Apple iOS, Andriod, Windows Phone, Blackberry, Symbian etc. In the fast growing world there are new challenges for hardware manufactures to stay in the competition. Also the application developer needs to deliver best Apps over variety of platforms within a quick time..

However, recently researchers have begun to focus on software engineering issues for mobile apps. For example, the 2011 Mining Software Repositories Challenge focused on studying the Android mobile platform . Other work focused on issues related to code reuse in mobile apps , on mining mobile app data from the app stores , testing mobile apps and teaching programming on mobile devices . Therefore, we feel it is a perfect time to reflect on the accomplishments in the area of Software Engineering research for mobile apps and to draw a vision for its future[1].

Testing of mobile applications incorporates many of the problems inherent to software testing in general. However, mobile devices also have qualities that differentiate them from conventional computers and therefore create testing challenges that are either unique to or more relevant in the case of mobile applications[4].

A comprehensive mobile testing strategy that includes device and network infrastructure, optimized selection of target devices, and an effective combination of manual and automated testing tools to cover both functional and non-functional testing is essential for getting your mobile applications to market on time and within budget.

Rest of the paper is organized as follows. Section 2 presents types of Mobile Apps and Mobile OS. Mobile Apps linked to SE is presented in section 3. Mobile testing and its significance in applications, mobile apps testing, Testing strategies are discussed in section 4. Test cases for testing Mobile Apps and automation tools are presented in section 5. Finally section 6 summarizes this paper.

2. Mobile Apps:

2.1 Definition for mobile apps:

A mobile app is a software application specifically designed to use in small, wireless computing devices, such as smartphones ,phablets and tablets, rather than desktop or laptop computers[21].Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

2.2 Types mobile apps

There are many ways to build mobile applications for mobile devices. There are three basic mobile apps types , native apps, mobile websites, and hybrid apps[20].

The below figure shows, how the three types of apps compare in design and architecture. It shows also how the apps would access a database or web service API to load data.

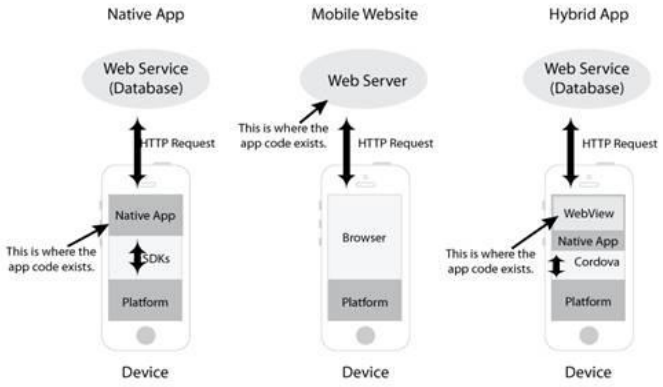

Figure : Native apps, mobile websites, and hybrid app architectures compared side by side

Native apps are using the default language for the mobile platform, Java for Android and Objective C or Swift for iOS .Native apps are execute and compiled directly on the device. Using the platform SDK (API), the app can communicate with the platform to load data or to access device data from an external website using http requests. Mobile websites are applications that are accessed through the mobile browser and these apps work well on a mobile device . Sometimes they are called Web Apps. A hybrid app is a mobile app that contains a web view to run a web application inside of a native app, using a native app wrapper that can communicate with the web view and native device platform . This means web applications can run on a mobile device and have access to the device, such as the camera or GPS features[20].

3. Mobile OS

All desktops or laptops are controlled by Windows or Linux operating system , a mobile operating system is the software on which other programs can run on mobile devices. A mobile operating system is also called as a *mobile OS*, it is an operating system that is specially designed to run on mobile devices such as mobile phones, phablet, smartphones, tablet computers and other handheld devices[22].

The operating system is accountable for finding the functions and features available on device, such as keyboards, WAP, email, text messaging and more. The mobile OS will also determine which third-party applications can be used on your device. Some popular mobile operating systems 1. Android OS (Google Inc.), Bada (Samsung Electronics), BlackBerry OS (Research In Motion), iPhone OS / iOS (Apple), MeeGo OS (Nokia and Intel),Palm OS (Garnet OS), Symbian OS (Nokia),webOS (Palm/HP), Windows Mobile (Windows Phone 7)[22].

4. Mobile apps linked to SE:

Software engineering is the "application of a systematic,well-organized, scientific approach to the development, and maintenance of software, and the study of these approaches" . The term 'Software Engineering' first appeared in the year of 1968 NATO Software Engineering Conference. While software development and Software Engineering are used reciprocally, the former is a more general term for programming an application and the latter involves more analysis of the process to find where the developer(s) can improve. By using the same Software Engineering principles to create the same mobile application on different platforms, the applications can be created at a fast rate and more efficiently [2].

These powerful development tools and frameworks greatly make things easier the task of developing a mobile application. However, they are mainly focused on the individual developer who is trying to create an application as quickly as possible. For small and medium-sized mobile applications that can be built by a single developer, they represent a vast improvement on the previous generations of tools, and encourage developers to adhere to the important principles of abstraction and modularity that are built into the platform architectures. However, as mobile applications become more complex, moving beyond low-cost recreational applications to more business critical uses, it will be necessary to apply software engineering processes to assure the development of secure, high-quality mobile applications. While many "classic" software engineering techniques will transfer easily to the mobile application domain, there are other areas for new research and development. The remainder of this paper identifies some of these areas[2].

5. Mobile Testing

There are broadly 2 kinds of testing that take place on mobile devices[23]:

a. Hardware testing: The device including the internal processors, internal hardware, screen sizes, space or memory, camera,, sd card resolution, radio, Bluetooth, WIFI etc. This is sometimes referred to as, simple "Mobile Testing".

b. Software or Application testing:"Mobile Application Testing" is a software application that work on mobile devices and functionality of mobile devices also tested. In mobile applications, there are some basic differences that are very much important to understand:

- **Native apps**: A native application is created for use on a platform like smart phones, phablets and tablets.
- **Mobile web apps** are server-side apps to access website/s on mobile devices using different browsers like chrome, Firefox by connecting to a mobile network or wireless network like WIFI.
- **Hybrid apps** are combinations of native app and web app. They run on devices or offline and are written using web technologies like HTML5 and CSS.

5.1 Significance of Mobile Application Testing

Testing applications on cell phone is more challenging than testing web apps on desktop due to

- **Different range of mobile devices** with different screen sizes and hardware configurations like hard keypad, virtual keypad (touch screen) and trackball etc.
- **Wide varieties of mobile devices** like Lenovo, Blackberry, HTC, Samsung, Apple and Nokia.
- **Different mobile operating systems** like Android, Symbian, Windows, Blackberry and IOS.
- **Different versions of operation system** like iOS 5.x, iOS 6.x, BB5.x, BB6.x etc.
- **Different mobile network operators** like GSM and CDMA.
- Frequent updates – (like android- 4.2, 4.3, 4.4, iOS-5.x, 6.x) – with each update a new testing cycle is recommended to make sure no application functionality is impacted.

5.2 Types of Mobile App Testing:

To address all the above technical aspects, the following types of testing are performed on Mobile applications.

- **Usability testing**– To make sure that the mobile app is easy to use and provides a satisfactory user experience to the customers.
- **Compatibility testing**– Testing of the application in different mobiles devices, browsers, screen sizes and OS versions according to the requirements.
- **Interface testing**– Testing of menu options, buttons, bookmarks, history, settings, and navigation flow of the application.
- **Services testing**– Testing the services of the application online and offline.
- **Low level resource testing**: Testing of memory usage, auto deletion of temporary files, local database growing issues known as low level resource testing.
- **Performance testing**– Testing the performance of the application by changing the connection from 2G, 3G to WIFI, sharing the documents, battery consumption, etc.
- **Operational testing**– Testing of backups and recovery plan if battery goes down, or data loss while upgrading the application from store.
- **Installation tests–** Validation of the application by installing /uninstalling it on the devices.
- **Security Testing–** Testing an application to validate if the information system protects data or not.

5.3 Mobile Application Testing Strategy

The Testing strategy should formulate the quality and performance guidelines. A few points in this area:

a) Selection of the devices – Users should analyze the market and choose the right devices which are widely used. (This decision mostly relies on the users. The users or the app builders consider the popularity factor of a certain devices as well as the marketing needs for the application to decide what handsets to use for testing.)

b) Emulators – The use of emulator is very much useful in the initial stages of development, as they allow fast and efficient checking of the app. Emulator is a system that runs software from one environment to another environment without changing the software itself. It duplicates the features and work on real system.

Types of Mobile Emulators

- Device Emulator- provided by device manufacturers
- Browser Emulator- simulates mobile browser environments.
- Operating systems Emulator- Apple provides emulators for iPhones, Microsoft for Windows phones and Google Android phones

6. Test Cases for Testing a Mobile App

Mobile application testing requires special test cases which should cover following scenarios.

- **Requirement of Data** – For installation ,first verify if the user with limited data plan will able to download it.
- **Requirement of Memory** – For memory requirement again download, install and run app.
- **Functionality of the application**– make sure application is not crashing due to network failure or anything else
- **Battery usage**– It's essential to keep a track of battery consumption while running application on the mobile devices.
- **Application speed-** the response time on different devices, with different memory parameters, with different network types etc.

6.1 Two kinds of automation tools are available to test mobile apps:

a)Object based mobile testing tools– automation by mapping elements on the device screen into objects. This approach is independent of screen size and mainly used for Android devices.

- Eg:- ranorex, jamo solution

b) Image based mobile testing tools– create automation scripts based on screen coordinates of elements.

- Eg:- Sikuli, Egg Plant, RoutineBot

7. CONCLUSIONS

Now a days, due to popularity of mobile apps, and the impact that research can have on developers from both small and large organizations, combined with the abundance of publicly available data, interesting research opportunities still left to be explored, and a vibrant community being built around it, software engineering research for mobile apps is a great place for young researchers to start. Mobile apps are software developed for use on mobile devices and made available through app stores. App stores are highly competitive markets with a rapidly increasing number of apps, and developers need to cater to a large number of users due to low margins per sale.

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