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Challenges in Mobile Application Testing: A Survey

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ABSTRACT

The number of mobile applications and users of mobile application has increased exponentially last few years. Quality of the mobile application has a direct impact on the business success of the application. Every user of mobile applications, irrespective of mobile OS (android, apple, windows or blackberry), expects the quality as the major factors. Companies and organization launches new mobile applications often to create the communication channel to conduct business improve marketing communications and reach out to customers. These companies and organization also expects the high quality mobile applications to prevent revenue loss and damage to brand reputation. Quality includes varies factors such as responsive, problem-free functionality, simple user interface, secure mobile data usage etc. In order to maintain the quality, software testing is mandatory.Testing mobile applications is more complex and time consuming compared to traditional desktop andweb applications. This paper highlights the challenges in Mobile Application Testing and recommendation to address those challenges.

Keyword: Mobile Application testing, Challenges in mobile App Testing

1. INTRODUCTION

A mobile application is defined as an application that runs on a mobile device and is context aware [1] or application as self-contained software designed for a mobile device and performing specific task for mobile users [2]. In general mobile applications are two types: 1. Standalone mobile applications 2. Mobile web application. The standalone applications are installed in the device (Specific device model or General to all mobile) and work in device only. For example ToDo application, we can store some important points, date, appointment details etc. This application can be installed in any android mobiles and its context is only with in that mobile. Mobile web application has two parts, client UI is installed in the mobile devices that will communicate to the server for all operations. For example, Facebook app. Most of the modern mobile applications are become more complex, movingbeyond inexpensive recreational applications to more businesscriticaluses, it will be essential to apply software engineeringprocesses to assure the development of secure, high-qualitymobile applications. In order to maintain the quality, software testing is mandatory. Testing mobile applications is more complex and time consuming compared to traditional desktop and web applications. Mobile application testing requires special test cases and techniques. The wide variety of mobile technologies, platforms, networks and devices presents a challenge when developing efficient strategies to test mobile software.

This paper highlights the challenges in mobile application testing and recommendation to address those challenges. The following sections are divided as follows: Section 2 presents the key elements of mobile application testing. Section 3, includes the literature review. Challenges in mobile application testing are discussed in section 4.Industry recommendations are listed in Section 5. Finally conclude the paper.

2. MOBILE APPLICATION TESTING

Testing mobile application is different from traditional software test. Because the complexity is more in mobile application testing. In order to maintain the quality of the mobile application, testing should consider the following key elements

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Key elements to consider for effectively testing applications are –

1. Type of application (Banking, Gaming, Social, Business or Education etc)
2. Target Audience
3. Target Device

   Target devices for testing a mobile application should balance the need to use a representative sample of the expected device population with the need to optimize duration and cost of testing.

   Use of device simulators can be highly effective in the early stages of product development when features are under development. Simulators are useful to familiarize the test team with various application features. Simulators can be effectively used for testing basic application functionality. Testing on physical devices is essential to understanding application behavior such as touch response and user experience. Stable, defect-free (based on simulator testing) features can then be tested on physical devices. Device usage can be optimized by distributing test cases across various types of devices [8].

4. Network Environment

   Almost all applications rely on network connectivity to provide useful functionality. In test environments, Wi-Fi networks can be easy to set up and can be cost effective, unlike cellular connectivity that can be both unreliable and expensive.

   Network simulation tools provide a cost effective and easy to use option to simulate cellular networks using a WAN/Wi-Fi connection. These tools can be used to simulate various network speed/bandwidth options (2G, 3G, and 4G), connectivity issues, and bandwidth variations [8].

5. Distribution Channel

   Most apps are distributed through open and public app stores. Each has their own set of rules and regulations, from marketplace guidelines to enterprise policies which prohibit types of content [9].

6. Automation Testing Tools

   Automated testing provides a mechanism to consistently repeat a test procedure and verify application results. It can be effective both for regression testing as well during development (to ensure that new features are not resulting in unintended changes to existing features).

   However, automation requires a significant initial investment (in a test tool as well as scripting) and the ROI is realized when the same automated test is executed multiple times with negligible incremental cost. Therefore, it is important to judiciously select candidate test cases for automation [8].

7. Types of Testing

Most common types of mobile application testing are performance, security, usability, compatibility, network testing.

3. LITERATURE REVIEW

Wasserman[1], presents an overview of important softwareengineering research issues related to the development ofapplications that run on mobile devices.

Amalfitano et.al.[2], presents the main challenges and open issues in the field of mobileapplication testing for the Android platform, with an emphasis on advances in thefield. Also present suitable and effective principles, guidelines, models, techniques, andtechnologies for Android application testing and conclude with an outline of futureperspectives.

Muccini et.al[3], provides an overview on testing of mobile applications, challenges in mobileapplication testing and research directions

Arzensek and Hericko[4], present criteria for selecting mobile application testing tools based on identified challenges and issues, testing approaches and strategies. Also presents the proposal for a simpler and quicker way of selecting the appropriate tool for testing mobile applications.

Manish and Vivek [10] presents the key challenges in automation testing of mobile applications and its best practices in the industry.

4. CHALLENGES IN MOBILE APPLICATION TESTING

4.1. Device Proliferation

There are many different mobile devices, made by different vendors, which have different hardware and software settings. The number of variations is even larger if we add all the devices that have a modified mobile operating system. The vendors modify the operating system to create a better user experience for the user, or increase the functionalities of a device. Due to these variations, mobile applications can run and behave differently [3]. The diversity of mobile devices can also increase the costs and duration of the testing process. If we would want to test across all devices, the buying and maintaining costs of mobile devices would be enormous. If we take into account the time spent for testing, the complexity of the challenge increases. Testing techniques that maximize the diversity coverage while minimizing the devices being tested need to devised [3].

4.2. Resource Utilization

Mobile applications use the resources of mobile devices, which are very limited. Despite the rapid development of mobile devices, it is important that the consumption of resources is monitored and controlled at all times [3]. The resources of mobile devices include: the central processing unit, RAM, memory, touch screen, battery, as well as different modules and sensors. During the testing process, we focused on the central processing unit, RAM and memory. Because the battery and the screen constitute a different set of challenges, we treated them individuality. The central processing unit, RAM and memory are components of the SoC (System-on-a-Chip) which includes other controllers and components that form a complete system. The excessive use of resources can reduce the performance of mobile devices and can cause malfunctions in the mobile application. During the testing process the consumption of resources must be constantly monitored [4].

4.3. Connectivity

One of the more important challenges in mobile software testing is the connectivity of mobile devices with various mobile networks and devices. Unlike desktop applications, which use fixed network connections, mobile applications connect to mobile networks, which can vary in speed, security and reliability [5]. Usually the types of mobile networks are 2G, 3G, 4G and various wireless networks. Mobile applications rely heavily on mobile a network, which is why the challenge of mobility can have an impact on: reliability, performance, security and the correct operation of the application and/or its functionalities. The nature of the challenge demands testing in different environments. The mobile applications are tested in:

- environment with a constant connection to the mobile network,
- environment with a variable connection to the mobile network and
- environment without a connection.

Based on the difficulties and requirements of the testing procedures, different testing approaches are recommended. Because the application's reliability, performance, security and correct functioning strongly depend on the available connection type, functional and extra functional testing has to be performed in different connectivity scenarios and networks [3].

4.4. Security

The mobile and personal nature of smartphones makes it a very vulnerable device to security threats. Security testing for mobile applications comes in three tiers – physical end-point device security, enterprise level security for devices (Mobile Device Management - MDM) and application security. Security check lists include password locked keypads, policy enforcements via MDM solution, remote data wipe in the event of non-compliance / theft / accidental loss of the device, application security checks via tools and vulnerability exploitation exercises. Security testing requirements of the mobile application includes evaluating OS specific vulnerabilities, application specific vulnerabilities, network vulnerabilities, storage vulnerabilities, data vulnerability and physical security of devices [6].

4.5. Functionality

Functionality testing includes user interaction, and transaction testing. It is essential across all valid use cases and boundary /special conditions because it ensures a good user experience. Some of the critical factors to evaluate include ease of navigation and screen transitions, response speed of the device and application, ability to customize and personalize the application and the intuitiveness of the touch interface. Such testing must be done among various user groups against benchmarks to ensure adaption and quality feedback about the application's functionality[7].

4.6. Performance and Usability

While application stability and performance are of prime importance, they are dependent on a variety of other factors ranging from the mobile device to load and application response, server utilization and network conditions. A number of test tools such as Shunra, Keynote, Neotys, Gomez, SDK Tools andLoadRunner are available for performance testing. Selecting the right tool based on the scope of thetest and costs is critical [7].

4.7. Upgrades

Rapid platform upgrades means keeping pace with them and validating the impact of the upgrades on the applications as soon as possible. [7].

Other factors affecting the Quality of Mobile Applications

The following factors that will greatly influence the quality of the mobile application.

- Strict Timeline:

* Usually the mobile applications are developed by small team of developers. This small team works on strict timelines and uses powerful development tools to develop the applications faster to deliver in the market. This makes the developers miss some of the important test activity of the mobile application.

- Lack of knowledge:

* Lack of knowledge in the mobile platform and application development environment, leaving the applications prone to new kinds of bugs.

5. RECOMMENDATION

Despite of the challenges in mobile application testing, industry experts suggest the following plan of activity that addresses the challenges in the testing process.

1. Creating a comprehensive test strategy.
2. Careful selection of target devices. (mix of simulators and physical devices can maximize test coverage without the need to test every feature on each device)

3. Scalable test infrastructure.
4. Selection of suitable testing tools that maximize automation can ensure a cost effective mobile testing process.

a. Factors such as support for applicable mobile platforms, script reusability and total cost of ownership should be taken into account when selecting automation tools.

5. Use of Wi-Fi networks for the majority of testing in combination with network simulation tools can reduce the cost and complexity of testing on various cellular networks.
6. Combining the solutions to mobile specific aspects of application testing with traditional best practices and testing processes can effectively address the challenges of mobile application testing.

6. CONCLUSION

Mobile application testing remains challenging task in the modern industry. Still it creates many scopes for research to improve the testing strategy and testing tools. This paper ignites the spark of new researchers to understand the complexity and testing challenges of mobile application. The aim is to stress the real time challenges faced in mobile testing. Testing is done in different ways as mentioned through different tools. Moreover, it is difficult decision for the test engineers to decide about the automation or manual testing. To conclude, this paper throws lights to the researchers to study and analyze the different challenges of mobile testing for different environments.

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