An approach towards solving the emerging technological implications of Mobile Apps

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Abstract : *In the last few years, testing of mobile application has become very important and a point of concern for the app developers. So in this vibrant market where innovation in the field of mobile technology is taking place on everyday basis, it has become very difficult to cope up with this new eco-system. Mobile application testing is very important component of software development life cycle. As development of software application is a very complex process and hence the possibility of bugs and errors cannot be ruled out.*
Companies that successfully implement mobile strategies engage both customers and employees in new ways, and create an environment of personal interaction that enhances sales and productivity
The extensive choice of browsers, operating systems, devices and applications make it possible for enterprises to develop new, interactive and highly personal ways for customers and employees to access products, services and applications. Mobile devices are at the same time sources of rich information, powerful entertainment and purchasing platforms, and important work tools.
Keywords: *Mobile Applications and Testing Strategy*

I. INTRODUCTION :

This paper will discuss various elements of an effective mobile application testing and suggest ways to optimize testing of mobile applications. Mobile application Testing is somewhat similar to software testing but the testing will be done a mobile device instead of testing the system/application.

Testing mobile applications is different and more complex than testing traditional desktop and web applications. Mobile applications need to be tested on a variety of software platforms and versions, on diverse hardware and form factors, and under different network connectivity conditions. Moreover, the rapid pace of mobile OS updates, the frequent introduction of new devices and the customer expectation of quick upgrades require additional test cycles.

Mobile app testing suggests testing an application on hand-held devices and differs from mobile testing in that it focuses on features and functionality of the tested application only while the other closely focuses on mobile devices' native application features like SMS, Call, Media Player, etc.

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. It is somewhat similar to software testing but the testing will be done a mobile device instead of testing the system/application.

II. MOBILE APPLICATION TESTING

Mobile application testing is a process by which application software developed for hand held mobile devices is tested for its functionality, usability and consistency. Mobile application testing can be automated or manual type of testing. Mobile applications either come pre-installed or can be installed from mobile software distribution platforms.

Mobile Application Testing is a process to find out the errors occurred during app development. Testing also ensures that user expectations are met and applications execute properly. It is equally important to conduct device testing to make sure mobile applications perform well across several different platforms and devices.

Types of Mobile Testing
• There are broadly 2 kinds of testing that take place on mobile devices:

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

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2. *Software or Application testing:*
- The applications that work on mobile devices and their functionality is tested. It is called the "Mobile Application Testing" to differentiate it from the earlier method. Even in the mobile applications, there are few basic differences that are important to understand:

In order to understand the complexity of testing mobile apps, it is important to understand various aspects of an application that need to be tested.
Some of these aspects are specific to mobile applications while others are applicable for testing any type of software.

The specific types of testing required for each application depends on various factors such as:
- The type of application (banking, gaming, social, or business)
- Target audience type (consumer, enterprise) and volume
- Distribution channel (e.g. Apple App Store, Google Play, direct distribution)

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.
- *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.
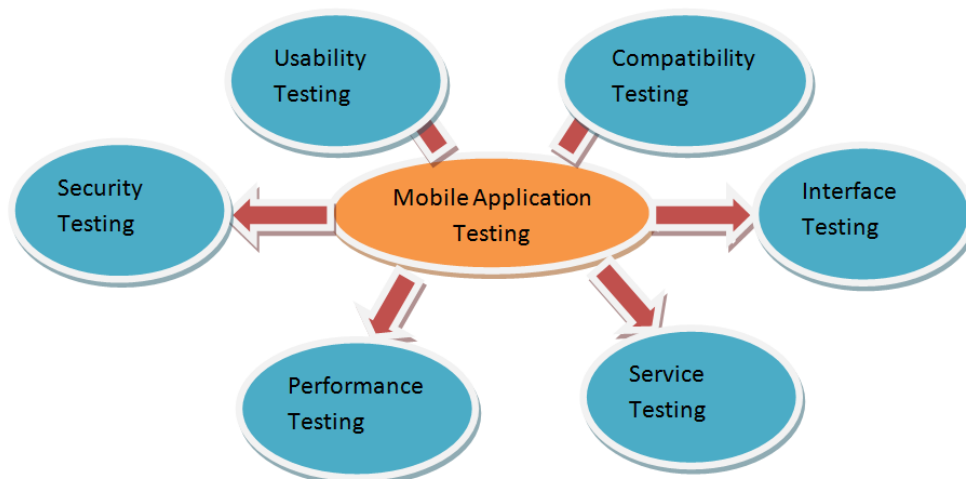- *Security Testing*: Testing an application to validate if the information system protects data or not.

Fig 1. Types of mobile application Testing

III. **STEP-BY-STEP MOBILE APPLICATION TESTING PROCESS**

Fig 2: Mobile Application Testing Process.

1. *Identified Types of Testing* – It was a mandatory requirement that the application has to work in all iOS and Android devices as the end consumers can have diverse devices. To ensure that the app worked in all the devices we selected combination of manual testing, automation testing and testing in cloud simulator – Device Anywhere.

2. *Performed Manual and Automated Testing* –The development process followed for this project was SCRUM and each sprint was two weeks long. Every two weeks development team delivered a logically completed product to the QA team and QA would run their test cases on the build. Regression was a challenge because in each build QA had to ensure that previously completed items were still working. To accomplish this, QA team had automated basic set of functionality using Expertise and ran the automation script on each build which saved good amount of time. We used JIRA to file and track defects.

3. *Provided 24 hours of QA Support* – We follow a SCRUM development model (QA team is integral part of the development team throughout the project). We provided 24 hours QA support during the development phase since we had onsite as well as offsite teams working on this project. This ensured timely and steady progress in the app implementation.

4. *Beta Testing* – After this initial setup, once the particular build was moved from the QA bucket, user acceptance testing was conducted for this QA/ST build. This was achieved by asking the beta users (a set of hundred students from the University) to browse every single page within the mobile app. This ensured that every bug was fixed before the app was released. And that the app captured all necessary features and functionality.

5. *Performance Testing* - The functionality, performance (stability, responsiveness, resource usage, stability parameters as per standards) and user interface for the delivered build was thoroughly tested.

6. *Device Testing* – The app was tested across multiple OS versions/devices using the Device Anywhere simulation tool and also physically tested in our dedicated mobile application testing labs.

7. *Maintained Test Case Sheet* –During the whole process the QA team maintained the test case sheet (with all functionality implemented), at last certified the build to release. The entire end-to-end mobile application testing process involved collective effort between onsite and off- site teams.

8. *Generated Test Summary Report* – Finally QA manager generated the test summary report. This is a management report which provides details of any important information uncovered by the software system under test and statistics derived from incident reports. The report also records different types of testing performed and how long did it take to complete the testing. This helps to improve any future test planning. This final document indicates whether the software system under test is fit for use and has met acceptance criteria defined by project stakeholders.

IV. SIGNIFICANCE OF MOBILE APPLICATION TESTING

Testing applications on mobile devices is more challenging than testing web apps and desktop due to following differences:

1. *Different range of mobile devices* with different screen sizes and hardware configurations like hard keypad, virtual keypad (touch screen) and trackball etc.
2. *Wide varieties of mobile devices* like HTC, Samsung, Apple and Nokia.
3. *Different mobile operating systems* like Android, Symbian, Windows, Blackberry and IOS.
4. *Different versions of operation system* like iOS 5.x, iOS 6.x, BB5.x, BB6.x etc.
5. *Different mobile network operators* like GSM, CDMA, WCDMA and LTE etc.
6. *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.

V. CHALLENGES IN MOBILE APPLICATION TESTING

Some of the challenges in mobile application testing are:

- Lack of Physical devices
- Variety of mobile devices (touch, feature , flip ,tablet)
- Different Operating systems (iOS, Android, Windows)
- Mobile network operators
- Different screen size, resolution
- Inadequate process
- Continues launch of new devices into the market

The Test strategy should make sure that all the quality and performance guidelines are met.
A few pointers in this area:

1) *Selection of the devices* - Analyze the market and choose the devices that are widely used. (This decision mostly relies on the clients. The client 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.)

2) *Emulators* – The use of these is extremely useful in the initial stages of development, as they allow quick 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:
1. Device Emulator
2. Browser Emulator
3. Operating systems Emulator

Mobile Applications goes on:

Multiple Handsets - i Phone, Android Apps Mobiles, Blackberry, Nokia, Windows Mobile

Multiple Carriers – Vodafone, Airtel, Aircel, Idea,Virgin, Tata, BSNL, MTS.

Multiple Platforms - Android, i Phone Apps, Palm, Pocket PC, Brew, J2ME, Windows Mobile and Symbian.

Mobile Platforms and Extension:

Mobile Platforms	Extension
Android	.apk
iPhone	.ipa
Bada	.jad
Symbian	.sis
Windows	.xap

QA of Mobile Applications Depends upon:
- Version/Build Number.
- Handsets.
- Test locations.
- Testers.
- Carriers.
- Test Plan Numbers.
- Test Plan Status. \

Automation Process:
- Define objectives and strategy for functional test automation.
- Identify test cases and test data suitable for test automation.
- After the successful testing cycle, create automation on one sample device.
- Create framework around automation to replicate across multiple devices.
- Execute the Automation across multiple devices.
- Identify defects and follow-up for resolution.
- Quality Metrics Management and Process Improvement.
- Extend the solution to monitoring aspect if needed.

Some tools that are being used to test code quality in general for mobile applications are as follows:

Cross-Platform Testing tools for Android and iOS devices:
- **Appium** - Mobile device automation for functional testing
- **Testdroid** - Mobile App and Game test automation on real Android and iOS devices
- **Perfecto Mobile** - Mobile device automation for functional testing.
- **SOASTA TouchTest** - Mobile test automation for functional testing of native & hybrid apps
- **Testin** - This tool let you test your apps across 300+ devices. This cloud based solution comes with automated testing features such as automated compatibility, functionality, UI & performance testing.
- **Ubertesters** - This is a freemium tool which helps you conduct more structured and well organized Mobile QA process. Some of the features of Ubertesters are In-app bug editing, marking, reporting and user feedback, Multi-platform support, Over-the-air (OTA) app distribution, Build management etc. Ubertesters also offers in-the-wild app testing services with its global community of professional testers.
- **Crashlytics** - This is a free tool available for both- iOS and Android devices.

- **Ranorex** - This is a cross device app testing tool through which you can record one test and run it on multiple devices and languages. You can test your iOS, Android and Windows 8 Apps with this tool.

VI. CONCLUSION

If the mobile testing is done in a proper manner, the number of bugs can be significantly reduced and apart from that, proper mobile application testing lets you identify the bugs right at beta stage of the development lifecycle. This saves your app the reputation on the market, and makes it possible to succeed and reach your business goal. The term **mobile testing** is pretty broad and it's important to break it down into specific types of testing for a better overall understanding of the subject.

As more and more software development focuses on smartphones, a new industry is building up to help developers create and rapidly deploy mobile applications , so testing of the mobile application is the requirement of current trend to ensure the quality of product.

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