



Mobile Applications Testing Challenges and related solutions

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Abstract: Mobile is becoming the dominant digital driver in the world due to fast growing mobile applications and their usage among people. Mobile applications are used in almost all domains and that kept far behind the desktop in usage. Due to intense usage of mobile applications, efficiency of them matters. Efficiency of mobile applications is checked using appropriate testing techniques. Testing techniques used to check mobile applications are totally different than traditional software applications. This paper will mainly focus on challenges of mobile application testing strategies. After discussion of the challenges of testing strategies, the paper will give probable solutions to them.

Keywords: Mobile Application, Performance Testing, Automated Testing, Functional Testing, Test Metrics

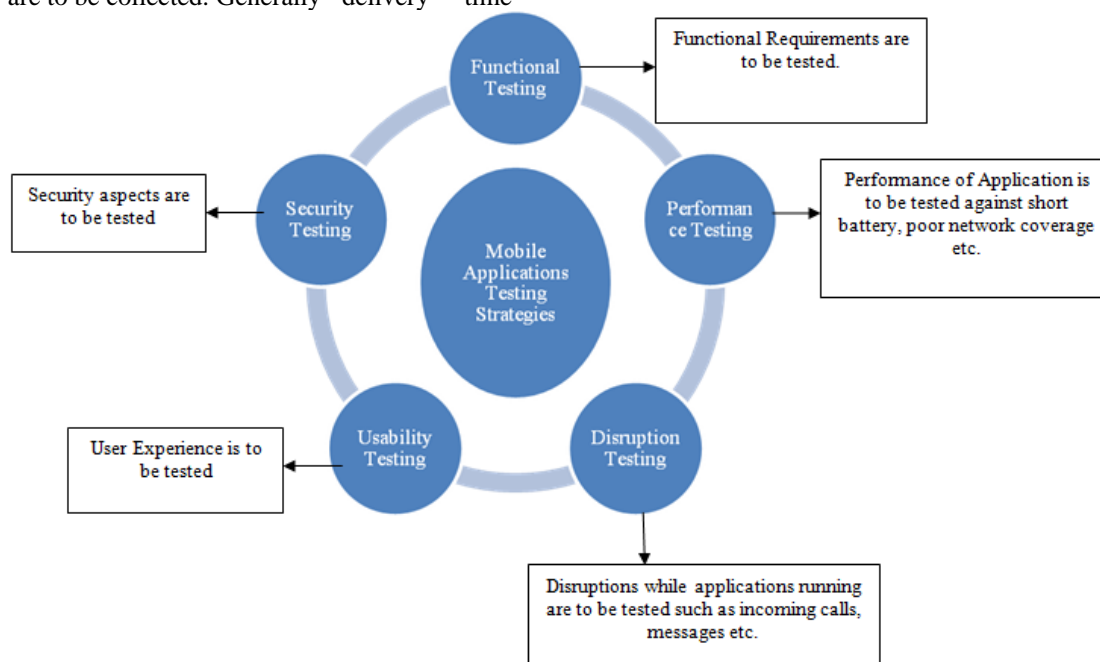
I. INTRODUCTION

Mobile application usage in India has grown up at very hasty way and in future this rate will boost more than this tempo. For the successful implementation and usage of any mobile application, performance and error free execution is very vital and that is achieved by applying appropriate testing on an application. Mobile Application testing can be done either manually or by using software tools. Manual testing has several limitations such as: entail more time and resources; performance testing is quite impossible, question of accuracy, etc. Properly planned software based automated testing greatly reduce time; omit human errors and helps in business values by increasing testing efficiency, effectiveness, accuracy, speed and coverage.

The mobile Application development environment is totally different than traditional software development environment [1, 2, 3]. Mobile application development environment, there is an intricacy in identifying precise requirements and related stakeholders from whom requirements are to be collected. Generally delivery time

of mobile applications is very short and frequent expectations and requirements of customers changing so there is a huge chance to get erroneous applications and in such circumstances testing of functional requirements of applications become crucial. Functionalities of mobile applications affect in several other conditions also such as short battery, poor network coverage, and concurrent access by multiple users. Mobile Applications also get disturbed by many disrupts such as incoming and outgoing calls and messages, media power on/off, etc. User experience is very important towards any mobile application so usability testing can play a vital role while testing mobile applications. Several mobile applications transmit sensitive data over insecure internet in that case testing of security aspects of mobile applications is very important. Figure-1 describes different testing strategies for Mobile Applications Testing.

Section-II of the paper will describe the challenges associated with all testing strategies. Section-III will cover the related solutions for them.



II. CHALLENGES OF MOBILE APPLICATION TESTING STRATEGIES

Functional testing, ensuring that mobile application works according to the expectations of users [4][13]. The functional testing life cycle consists of several stages like software development life cycle [11] which includes test requirement gathering, planning, execution and test metric collection. Following table shows the challenges of functional testing at different stages of the testing life cycle.

Table 1. Challenges of Functional Testing

Challenge(s)	Functional Testing Life Cycle Stage
<ul style="list-style-type: none"> Describe complete and lucid test requirements Manage dynamic changes to requirements 	Test Requirement Gathering
<ul style="list-style-type: none"> Complexity in understanding test plan 	Test Planning
<ul style="list-style-type: none"> A large amount of time for setup test environment 	Test Execution
<ul style="list-style-type: none"> Decide appropriate and efficient mechanism to determine the quality of testing 	Test Metric Collection

The performance of the mobile application is very much crucial [6,7,10] as it is invisible in nature. Performance testing does stress testing based on data management. Application performance can affect when running on low power and network coverage is very poor. Following are the main challenges of performance testing based on response time, stress, low battery and network unavailability:

- Maintain the good performance of an application in data overload situations
- Maximizes performance in low battery situation
- Maximizes availability of an application in network unavailability case

The Mobile application can also affect in many interrupts situations such as incoming and outgoing calls and messages. The main challenge is to provide availability of an application in this case.

User satisfaction [5, 7,14] is the key for any product or application and that is very vital for mobile application. Maintain response time in any situation is the main challenge of this category.

Mobile based applications are available in all domains and several domains like banking and financial contains sensitive data that lead to data larceny [8,9,12,15]. As far as security of the mobile application is concern following challenges dominated:

- To identify vulnerability specifically to the device
- To identify vulnerability specific to the OS
- Fragile encryption and hosting control
- Insecure data storage

III SOLUTIONS OF TESTING STRATEGIES CHALLENGES

The challenges of testing strategies discussed in the previous section have a certain level of solutions. If the solution is to be used effectively, the challenge can be overcome to a certain extent. The following table describes the solutions of the above mentioned challenges.

Table 2. Possible Solutions of Testing Challenges

Challenge	Possible Solution(s)
To describe complete and lucid test requirement and manage dynamic changes	<ul style="list-style-type: none"> By preparing appropriate “story” and “to do” columns. Where “story” represents a user story and “to do” represents the task By note down issue during test requirement
Difficulty in understanding test plan	<ul style="list-style-type: none"> By focusing on the overall goal of an application rather than detailing on it By determining which kind of tests will be needed during the application development By plan out of how much automated and manual testing will be needed and where to emphasize more
Large amount of setup time	<ul style="list-style-type: none"> By establishing knowledge a repository with problem and possible solutions By choosing an appropriate automated tool for repetitive kind of tests
Efficient mechanism to determine the quality of testing	<ul style="list-style-type: none"> By identifying set of process/product metrics which are to be tracked on a continuous basis By Designing shared dashboard for above metrics
Performance of application in data overloads situation	<ul style="list-style-type: none"> By suggesting workload profiling tools that groups similar queries and execute them at

	<p>once.</p> <ul style="list-style-type: none"> By generating metrics related to processor, memory and network in order to identify the weakness of any situation
Maximizes performance in low battery situation	<ul style="list-style-type: none"> By generating test case that identifies the critical situation of battery and automatically run battery killer applications
Maximizes availability of an application in network unavailability	<ul style="list-style-type: none"> By generating test case that identifies network unavailability situation and run an application from a cache of the device
Availability of an application in interrupt situation	<ul style="list-style-type: none"> By generating test case that identifies running application and turn off notifications
Maintain response time of an application	<ul style="list-style-type: none"> By generating end to end application latency metrics
Vulnerability to Specific Device	<ul style="list-style-type: none"> By scanning devices based on common flaws and identifying root causes of them
Vulnerability to OS	<ul style="list-style-type: none"> By scanning OS based on common flaws and identifying root causes of them
Fragile encryption and hosting control	<ul style="list-style-type: none"> By identifying weaknesses of encryption and providing a mechanism that does not allow anyone to modify cookie and environment variable By testing sever side security measures that d not allow unauthorized user to access information
Insecure Data Storage	<ul style="list-style-type: none"> By testing data storages measures such as username, e-mail and

	password. The main intention of testing to verify their encryption.
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IV CONCLUSIONS

Testing of mobile applications is very crucial in the modern era as all kinds of transactions rely on mobile applications. Mobile application development is totally different than that of traditional software development so standard testing techniques are not adequate for that. The paper has described different testing strategies in context to mobile applications and addressed their challenges. The content of challenges described in the paper is very vital for mobile applications testers and researchers in testing domains. Challenges of mobile application testing strategies have been covered from several aspects such as functional, performance, usability, interrupt and security. The paper also described

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