

# A Proposed Framework for Testing Mobile Cloud Based Applications Using Mobile Testing as a Service (MTaaS)

Engr. Ali Ahmed

Computer & Software Engineering Department  
Bahria University, Karachi Campus  
Karachi, Pakistan  
aliahmed.bukc@bahria.edu.pk

Huma Ali Ahmed

Department of Computer Science  
Newports Institute of Communications & Economics  
Karachi, Pakistan  
huma.simran@gmail.com

**Abstract**—In this fast running growth of mobile cloud computing (MCC) and its development work grows day by day. Mobile cloud computing plays a dynamic role in technology for mobile devices. The MCC has been initiated as a reliable technology for the upcoming mobile services. MCC incorporates many tracks related to mobile environment and try to overcome the issues related to the security, performance, and architecture etc. This research paper gives a proper overview for mobile cloud applications development and testing issues. We are basically highlighting the issues of mobile cloud computing and try to propose some possible and reliable framework and testing methods with the help of mobile testing as a services (MTaaS) in this research paper. This framework can enhance the testing procedure for cloud based mobile applications.

**Keywords**—Mobile computing, Cloud computing, Mobile cloud computing, Mobile devices, Mobile cloud applications development, Mobile testing as a service

## I. INTRODUCTION

Mobile devices are now increasingly plays a major role in our daily life and becoming an essential need for us. It is now convenient and reliable communication medium for every person and it is not a bounded communication tool. Mobile users experience a lot of various services with the help of their mobile applications like Google apps which you can run on your devices very easily. Now there is a fast growing development of mobile computing and it plays a commanding development in the growing lives of information technology world. Some of the mobile devices face a lot of issues and challenges in their resources. Now a days, cloud computing gives some advantages for the users by their provided infrastructure. With the bang of mobile based applications and also the support of cloud computing, mobile users can integrate their devices over the cloud network. Cloud computing also facilitates the mobile users with the new types of services like gaming apps etc. This paper presents the overview on the upcoming trends and testing issues rise in MCC.

## II. CLOUD COMPUTING

Through the Internet cloud computing platform gives the reliable resources and services. These services of cloud allow a single person or a business to use some kind of software and hardware that can be managed by another business. Cloud computing includes storage of files, many of the social networking sites, web mails, and all the online business applications. The advantage of cloud computing is that it allows the access to data information and the computer based reliable resources from anyplace to anywhere hence a network connection should be available [1]. Cloud computing model provides many kinds of resources, such as data storage, user applications, and networks. Cloud computing provides most of the developers and information technology departments with the ability on how to concentrate on which matters are the most important and to avoid things like procurement, maintenance, network speed and capacity. As cloud computing has now become popular, many of the different cloud services and the methods of deployment provides us with unusual levels that how to control, make it supply, and manage.

## III. MOBILE COMPUTING

Mobile computing is basically a technology which allows the transmission of data from source to destination; also it transfers videos and voice etc. Through the help of any wireless device or computer without having to be connected with any physical link [2]. Some of the principles of mobile computing are stated below:

### A. Mobile Portability

It provides the movements of devices from one place to another within the mobile computing environment.

### B. Mobile Connectivity

In mobile connectivity it is able to stay continuously with the minimum amount of downtime without affected by movement of other devices.

### C. Connecting Social Interactivity

It provides collaborative connectivity with the other users at least with the same environment.

### D. Individuality

In the individuality phase it adapts the technology suite within their individual needs.

## IV. MOBILE CLOUD COMPUTING

MCC is a blend of mobile computing and cloud computing that also works for wireless networks. It works in a rich environment and for mobile users it provides computational resources to facilitate the customers, network operators and cloud computing providers [3]. In the track of mobile applications it is the new pillar for mobile apps where the data processing and storage are transfers from cell phones to resources. The basic structural design of MCC is illustrated in Fig. 1.

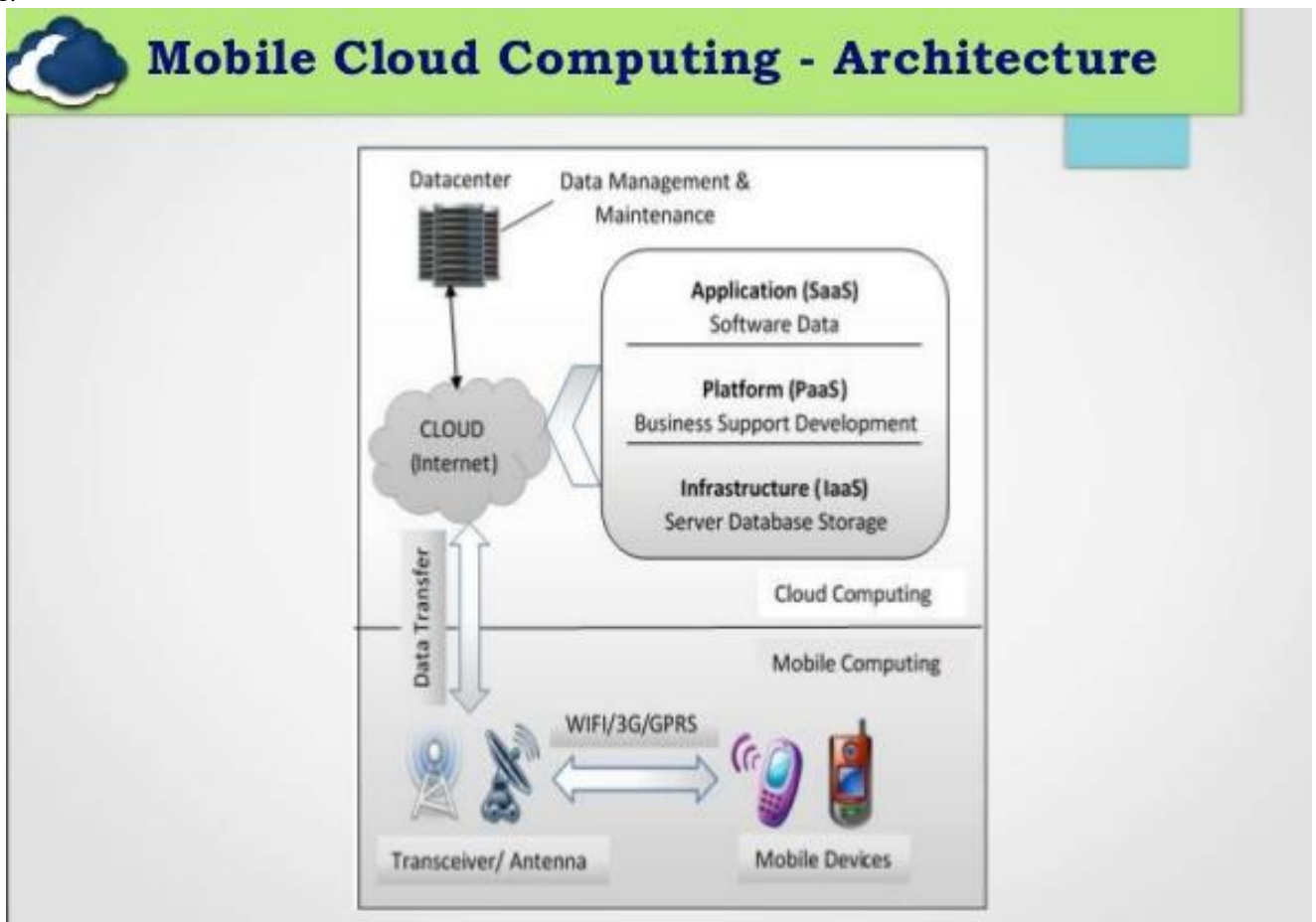


Fig. 1. Structural Design of Mobile Cloud Computing

#### A. Characteristics of Mobile Cloud Computing

Some of the mobile cloud computing characteristics are stated below:

1. Scalability
2. Reliability
3. Agility
4. Security
5. Reduced maintenance
6. Reduced cost

#### B. Challenges of Mobile Cloud Computing

Some of the mobile cloud computing challenges are stated below [4]:

1. Limitations of bandwidth and communication medium latency
2. Security issues
3. Signal disturbance and noise
4. Low computing backbone

Fig. 2 illustrates the comparison between testing procedure for cloud based MTaaS and traditional mobile testing [5].

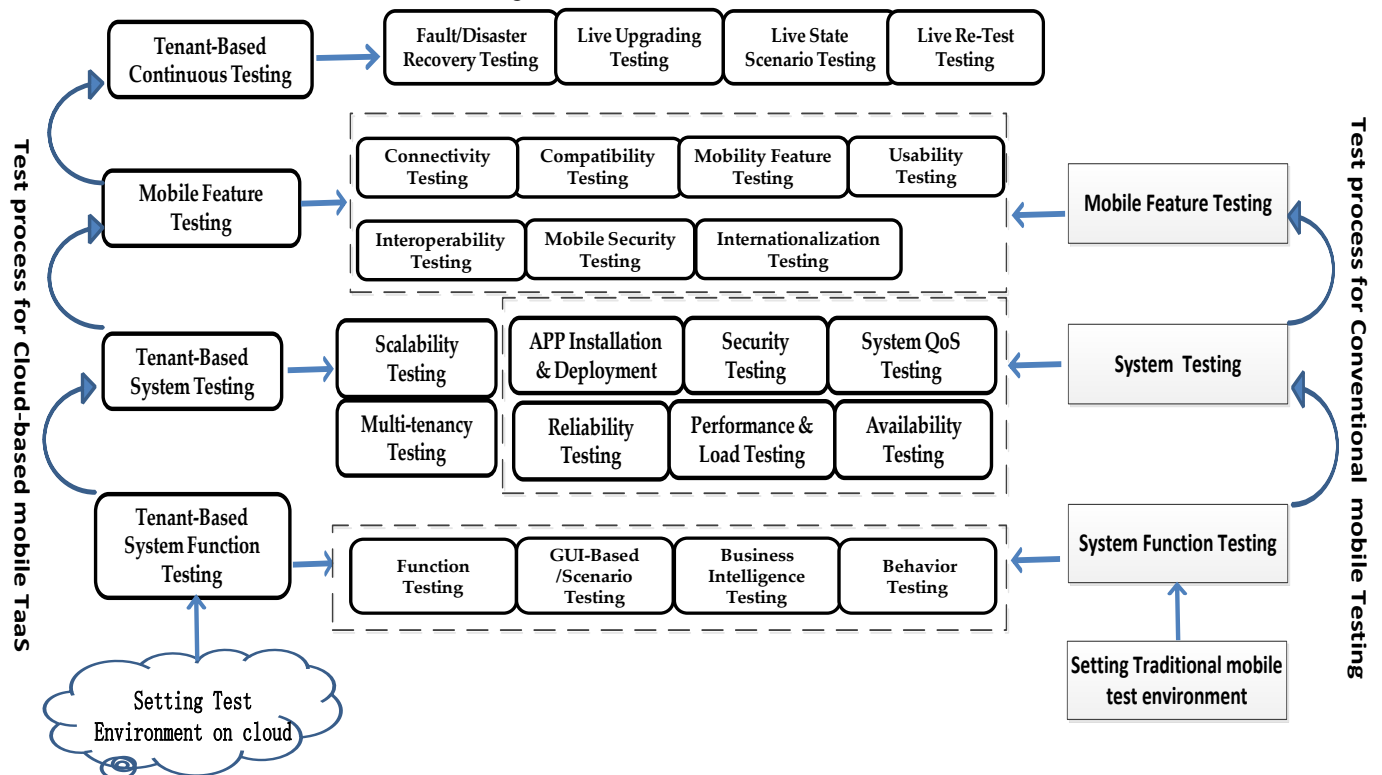


Fig. 2. Comparative Analysis of Process of Testing for Cloud Based MTaaS and Traditional Based Mobile Testing

Some of the tasks for cloud based mobile TaaS testing process are stated below:

*A. Task 1*

Set up the testing environment over the cloud, run and control test, monitor and tracking, interact with the server of TaaS as well as its essential mobile emulation cloud.

*B. Task 2*

In task 2, the system functional tenant based testing includes different types of tenant based features and functions.

*C. Task 3*

Scalability, multi-tenancy system checks, and quality of service (QoS) etc.

*D. Task 4*

It targets usability testing and mobility feature based testing etc.

*E. Task 5*

The validation of mobile systems including upgrading and recovery based on tenant based testing [6].

Cloud-based mobile TaaS has a variety of new testing environment, testing process and techniques etc. in comparison with conventional mobile testing as described in Table 1.

Table 1. A Comparison of Conventional Mobile Testing and Cloud-Based Mobile TaaS

	Conventional Mobile Based Testing	Cloud-Based Mobile Testing as a Service
Primary Objectives	Authenticate the excellence of mobile applications on mobile operation environments of specified mobile devices or from different web browsers.	It provides on-demand testing services on cloud; leverage a scalable cloud based mobile testing environment to assure pre-defined given service-level agreements (SLAs) and QoS.
Testing Focuses	Diverse software errors in its structures, functions, behaviors, user interfaces, and connections to the external systems. System non-functional requirements such as reliability, scalability and security.	Customization, multi-tenancy, and configurability. SaaS scalability (including both horizontal and vertical scalability). Connectivity to its external contexts, interoperability and portability.
Execution of Testing	Offline testing must be done in a test lab before the product deployment.	In private testing environment the major chunk is offline testing; we need on-demand test execution in a virtual cloud based test environment.
Testing Environment	In the testing environment a pre configured test lab is available with purchased hardware/software and tools.	A virtual scalable mobile test environment based on cloud environment with diverse computing resources and tools; supporting web browsers on different mobile platforms and devices.
Testing Process	Enterprise-oriented test processes for each project.	Crowd sourcing-based process; well-defined TaaS processes by TaaS vendors; emphasis on tenant-based testing, service component testing, etc.
Testing Techniques	Apply black box and white box well known testing techniques at unit level or at the system level.	It needs original continuous techniques of testing. Latest solutions for testing is to compact with multi-tenancy.
Testing Tools	Use limited testing solutions and tools with the purchased licenses.	On-demand usage of diverse test tools with shared licenses in a cloud environment based on pay-as-you-use.
Project Cost	Required hardware/software (license) costs in a test lab, plus the cost of engineering.	It is based on a pay-as-you-test service costs pre-defined SLA.

## V. MOBILE TESTING AS A SERVICE

Mobile testing as a service provides on-demand testing service for mobile based apps and software as a service (SaaS) is to maintain the validation process and software quality. In

quality based engineering process by leveraging a cloud based scalable and reliable architecture of mobile testing to assure the pre-defined service level agreements [7]. MTaaS offers novel big business framework for different mobile based validation services for software by using the pay-as-you-

testing model to accomplish the goal of cost reduction and cost sharing in the resources of mobile based computing, cloud based computing, networking and the structure of storage.

#### A. Requirements and Needs for MTaaS

Some of the requirements and needs for MTaaS are stated below:

#### B. Various Infrastructures of MTaaS

In MTaaS we have three types of infrastructures; first is emulation based testing on cloud, second is simulation based testing on cloud and last is device based mobile testing on cloud.

##### 1. Emulation Based Testing on Cloud

In emulation based testing the mobile based SaaS instances which are on a cloud validate themselves by using large scale mobile emulation over the cloud. Testing approach in emulation based testing is usually contains inexpensive approaches because we don't need real mobile devices. At the end this approach has flaws and limitations in testing.

##### 2. Simulation Based Testing on Cloud

Simulation based testing provides mobile application servers which are available on cloud and validate themselves by using mobile simulators over the cloud. But this approach never requires real mobile devices. On the hand other it has some difficulties in validating few features of system.

##### 3. Device Based Mobile Testing on Cloud

In device based testing real devices needs to be purchased that will use to validate the software apps like mobile based SaaS and web applications [8]. Well configured mobile devices set up to meet the mobile based testing services according to the requirements of on-demand test service. Various mobile TaaS infrastructures with models are discussed in Table 2.

Table 2. An Evaluation Assessment between Cloud-Based MTaaS Perspectives

Approaches / Perspectives	Emulation Based Testing on Clouds	Mobile Testing in Crowd Sourcing	Device Cloud Based Mobile Testing
Mobile TaaS Service Model	Service model for emulation based mobile TaaS	Service model for crowd based sourcing	Model for remote mobile based TaaS service
Billing and Business Models	Pay-as-you-use for device emulators and other testing services	Crowd sourcing cost models	Pay-as-you-use for remote devices and other testing services
Mobile Testing Environment	Emulation-based mobile TaaS infrastructure	Environment of ad-hoc mobile testing, and TaaS architecture	Shared mobile TaaS infrastructure
Mobile Devices Costs	Only use emulators, no device costs	No costs on mobile devices since it uses mobile devices from crowded testers	Device rental costs
Mobile End-To-End Transaction Testing	Emulation-based end-to-end transaction testing	End-to-end transaction testing in crowd sourcing	Large-scale device oriented end-to-end transaction testing
Mobile Usability Testing	No coverage on real mobile user experience	Easy to support usability testing	Scalable test coverage on real mobile devices
Mobility and Location-Based Testing	No reallocation service testing, using emulators only	Easy to perform location service testing by crowded	Limited location service testing

1. Mobile based on demand testing
2. Easy connectivity and mobility
3. Configuration and control of mobile testing infrastructures
4. Customization support
5. Monitoring and tracking
6. Coverage analysis

		testers	
QoS Testing for Performance, Reliability and Availability	Emulation-based QoS testing at the limited scale	Ad-hoc QoS testing using crowd sourcing, at the risk of low testing quality and an uncertain validation schedule	Large-scale QoS testing
Mobile Security Testing	Emulation-based security testing only	Ad-hoc security testing only in crowd sourcing	Diverse device based security testing
Scalable GUI Testing	Emulation-based, limited scale	Scalable GUI testing based on number of users	Large scale GUI testing on real devices
Mobile App Function Testing	Emulation-based function testing, hard to test functions related to real devices	Ad-hoc mobile function testing	Diverse device based function testing

#### VI. PROPOSED FRAMEWORK FOR TESTING MOBILE CLOUD BASED APPLICATIONS USING MOBILE TESTING AS A SERVICE

This proposed framework is a mixture of cloud computing and mobile cloud computing. Basically we have designed this model for testing cloud based mobile applications using MTaaS. MTaaS provides on-demand testing in its interface for mobile based applications usually. In this model, we have proposed the testing environment for the testers so they can easily test the applications with the help of this framework. Even they can maintain the test cases and also with the help of this framework a tester can make the reports and rectify the bugs which can harm the applications. Fig. 3 illustrates the said concept.

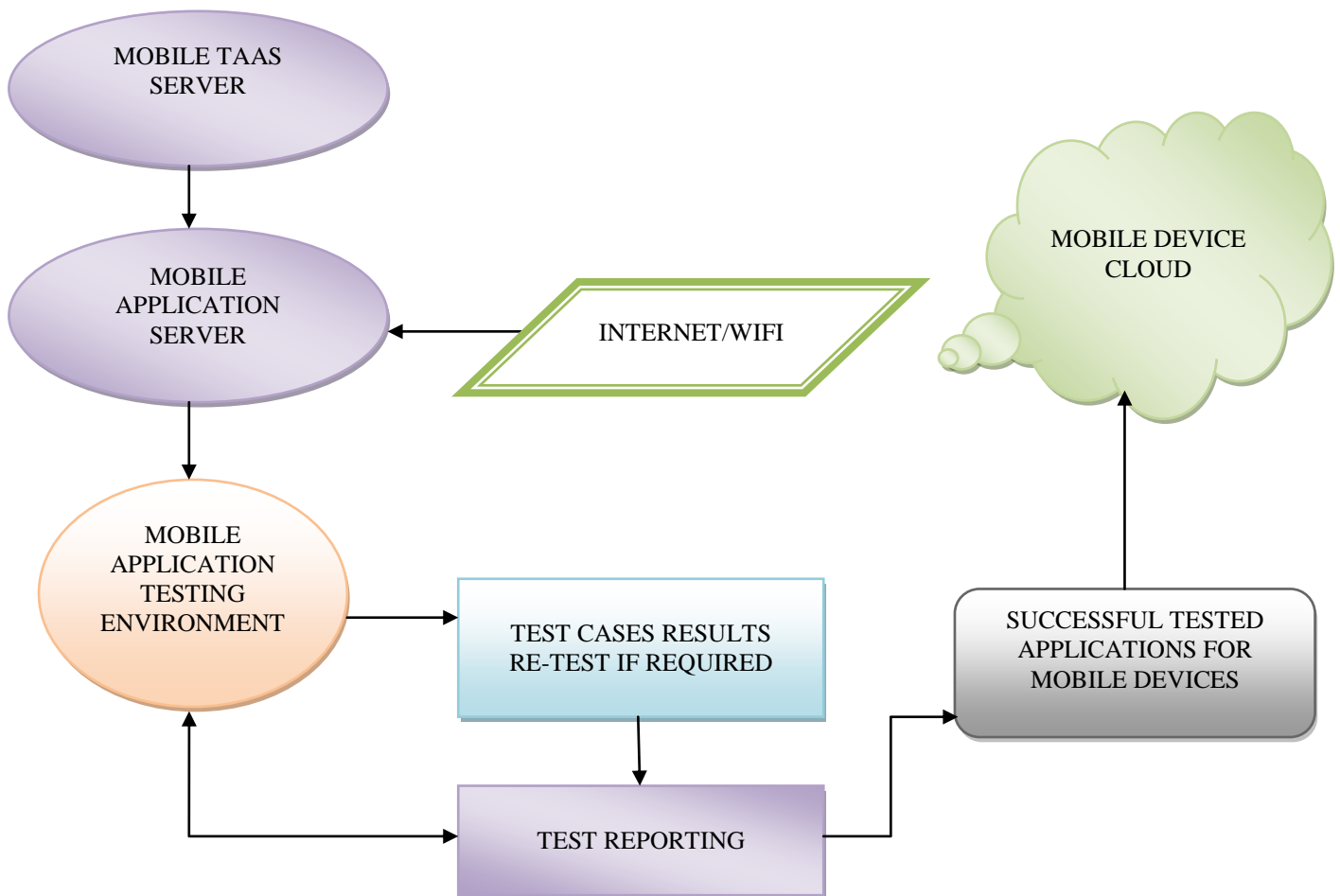


Fig. 3. Framework for Testing and Updating Cloud Based Mobile Applications

## VII. CONCLUSION AND RECOMMENDATIONS

This research paper proposed that the mobile cloud computing and cloud computing are dependent on each other; they can work together and provide scalable resources. We use MTaaS which offers on-demand testing services for mobile applications. With the help of this framework, we can facilitate the cloud based mobile applications by making test plans and especially we can generate the test reports. For future work, we can add more reliable resources in the architecture of this model and we can add more features which can help this framework to work well and become easy for cloud based mobile applications testing.

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