

# Mobile Cloud Computing: Security Issues and Considerations

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**Abstract**—There is no doubt about what exactly cloud computing is, but the explosive growth and improvement of mobile devices and applications with the emerging of cloud computing, introduced the concept of mobile cloud computing to be as the future potential technology for different mobile services. The use of mobile cloud computing overcomes performance related obstacles e.g. bandwidth, storage capacity and battery life, as well as environment related issues e.g. availability, scalability and heterogeneity. Despite the amazing advancement and huge advantages achieved by mobile cloud computing, the users of mobile cloud computing are still below expectations because of the associated security and privacy risks. These risks are playing significant role in preventing single user and organizations to adopt mobile cloud computing environment. This paper reviews the concept of mobile cloud computing as well as the security issues inherent within the context of mobile application and cloud computing with more focus on the security considerations to adopt mobile cloud computing.

**Index Terms**—mobile application, cloud computing, mobile cloud computing, security issue

## I. INTRODUCTION

Mobility refers to portability or possibility of moving to different locations and across multiple times using different types of mobile devices. The internet and mobile technologies have increased the popularity of mobile application in modern society. Mobile application refers to any software applications that run using mobile devices. Mobile device is portable device that has two main attributes mobility and network wireless connection i.e. Tablets, smart phones, laptops and PDAs. However, the use of mobile devices to run software applications has some associated limitations including limited computing ability and processing power, and limited storage capacity. To overcome these drawbacks, the idea of cloud computing is presented, as the use of external computing resources (software and hardware) which are provides a service over Internet or network. The idea behind the

concept of cloud computing is to share computing resources rather than using local servers or personal devices to handle the required applications [1]. Cloud computing is one of the most prominent technology between IT professional as it provides flexibility and elasticity in the space occupation. The cloud also offers better support for software applications. In cloud computing the background servers is used to complete different computing and storage tasks. Thus, plenty of mobile device functions are not required to be processed in the device itself any more. Thus, computing and storage with the small screen size, mobile devices can complete several tasks similar to what can be completed on mainframes [2]. Mobile devices became very popular because for its support to different applications in our modern live such as learning, banking, social network, games, audio, image and video processing etc. Cloud computing has gained so much popularity in the last years. Because it offers services, computing ability and storage space over the Internet. Mobile cloud computing is Internet-based services and applications that accessed using mobile devices. The context of mobile cloud computing is different comparing to mobile computing because in mobile cloud computing the devices run cloud based Web applications not as mobile computing native apps [3].

## II. MOBILE APPS

A mobile app is a software application that designed specifically to be used on small, portable and wireless computing devices, such as tablets, PDAs and smartphones rather than desktop computers. Mobile apps are computer software programs that can be downloaded and manipulated directly using any type of mobile devices. There are different types of mobile apps:

**Native App**, Native mobile app is developed for the use on a specific device or platform. A native mobile app is a software application that is implemented (coded) in a specific programming language for the use in specific mobile devices, such as Java for Android operating systems and Objective C for iOS. This type of mobile

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apps provides high degree of reliability and fast performance.

**Web App**, Mobile web app stored on a remote server and distributed through the internet using different browsers. Mobile web apps are not real mobile apps; they can be referred as really websites that look and feel such as mobile native apps. Mobile web apps are running using browsers because they are written in HTML5.

**Hybrid App**, Mobile hybrid apps are similar to mobile native apps, because they run on the device, and they are written using different web technologies (HTML5, JavaScript and CSS). Mobile hybrid apps run in a native container. Mobile hybrid apps leverage the browser engine of the devices but not the browser to render the HTML and process the JavaScript locally [1].

### III. CLOUD COMPUTING

Cloud computing can be simply defined as storing and accessing data and software application over the Internet rather than local computer hard drive. Cloud computing is usually referred as the cloud, which is typically defined as a type of Internet-based computing, that relies on sharing computing resources instead of personal devices or local servers to handle applications. Thus, all applications, storage and servers are through the Internet to an organization's computers and devices [3]-[5].

#### A. Cloud Computing Services

The cloud computing service models are:

- **Software as a service (SaaS)** end user software applications are delivered as a service. Infrastructure and platform are abstracted, and can manage and deploy with less effort. In this model users can purchase the ability to access and use the service or application that is hosted in the cloud.
- **Platform as a service (PaaS)** the application platform refers to where uses services and applications can be deployed. Users can purchase the access to the platforms and allow them to deploy the required software on the cloud. The network access and operating systems are not managed by the users.
- **Infrastructure as a service (IaaS)** physical infrastructure is abstracted to provide storage, computing and networking as a service to avoid the extra needs and expenses for dedicated systems. User manages and controls the systems in terms of the storage, applications, operating systems and network connectivity, but they do not manage and control cloud infrastructure [3].

#### B. Cloud Computing Deployment Models

The use and deployment of cloud computing can differ depending on customer requirements. The following different cloud computing deployment models are identified based on particular characteristics that support the requirements of users and services of the clouds in specific ways:

**Public Cloud**, in this cloud model the service provider makes different types of resources, such as storage and

applications, available to the public users through the Internet. In the public cloud model the cloud service provider offers the cloud infrastructure to the public on a commercial basis that enables cloud consumer to deploy and develop the needed service with very little cost.

**Community Cloud** is multi-tenant infrastructure with collaborative effort in which the cloud infrastructure is shared between number of organizations with similar requirements and interests from specific group with common computing concerns e.g. audit requirements, security, performance, etc.), whether managed internally within the group or using third party that hosted internally or externally. That will help in limiting the capital expenditure costs for its establishment as expenses are shared among group of interested organizations.

**Private Cloud** referred as internal cloud or corporate cloud. In this type of cloud the cloud infrastructure is deployed, and maintained for a particular organization. In which that the operations might be locally in house or with a third party. Private cloud is a marketing term describes the protection of computing architecture by a firewall. The idea behind the design of this type of cloud model enables organization to have control over their applications and data rather than rely on third-party.

**Hybrid Cloud**, the concept behind hybrid cloud is the merge between of at least one public cloud and one private cloud. Thus, the cloud infrastructure consists of several cloud models of any type. The hybrid cloud elements are bound together, but they remain as unique entities, that enable hybrid clouds to provide the advantage of multiple deployment models at once. Where, the clouds have the ability to allow applications and data to travel from one cloud to another through their interfaces [4]-[6].

### IV. MOBILE CLOUD COMPUTING

The main concerns of mobile devices are their performance (processing power), storage capacity and battery life. While cloud computing offers an infinite computing resources. A new infrastructure platform has been created to combine both the cloud computing and mobile devices that called mobile cloud computing (MCC). The cloud performs the heavy tasks computing intensive and storing huge amounts of data, thus the data storage and data processing occur outside of mobile devices. Mobile cloud applications move the data storage and computing power into the cloud and away from mobile devices. The data storage and computing power moved into centralized powerful computing platforms located in clouds. Mobile cloud applications leverage the information technology architecture to extended battery life, improved performance and the capacity of data storage, improved scalability, reliability and easily integration [7] and [8].

### V. MOBILE CLOUD COMPUTING APPLICATIONS

Mobile cloud computing has many applications since it combines the advantages of both the mobile and cloud computing to offer the best facilities and services for

mobile users. Mobile cloud computing supports different types of applications including mobile learning, mobile Healthcare, Mobile Government, mobile commerce, mobile banking and Mobile game:

**Mobile Learning** or in short M-learning is the use of mobile device in the learning process considering the mobility and wireless connection to provide learning anywhere, at any time on the right way. Cloud-based M-learning overcome the limitation of high cost of devices and network and limited learning resources. Moreover, Cloud-based M-learning improved the communication quality between learners and their instructors.

**Mobile Healthcare** or M-healthcare minimizes the limitations of traditional medical treatment such as storage capacity, information privacy, computation speed and medical errors. M-healthcare supports users with convenient and easy access to medical resources e.g. staff profile and patient information. M-healthcare provides on-demand services for healthcare organizations [6].

**Mobile Government** (M-Government), is the extension of e-Government to mobile platforms to utilize the government applications and services using mobile cloud computing. M-Government involves the deployment of government's administration and services on mobile devices to provide the government services anywhere at any time [6].

**Mobile Commerce** or in short M-Commerce allows business models to use mobile devices in commerce. In general, M-Commerce applications applied for specific tasks that require type of mobility e.g. mobile shopping, mobile payments, mobile financial, mobile ticketing, mobile transactions.

**Mobile Banking** (M-Banking) refers to any task or operation those related directly or indirectly to banking services such as back account transactions, payments, balance check and SMS banking. M-Banking most often performed via mobile Internet or SMS. Cloud based M-Banking applications address several M-Banking applications issues e.g. storage capacity.

**Mobile Game** or in short M-Gaming is very potential market producing revenues for service providers. M-gaming can completely offload game engine requiring large computing resource e.g., graphic rendering to the server in the cloud, and gamers only interact with the screen interface on their devices [9] and [10] demonstrates that offloading (multimedia code) can save energy for mobile devices, thereby increasing game playing time on mobile devices [6] and [9].

## VI. MOBILE CLOUD COMPUTING SECURITY ISSUES

Since the first major mainframe attack in 1980s, security has been considered as very important issue for computing systems in general. Although computing system have improved a lot started from centralized computing to distributed, Internet, mobile reached mobile cloud computing but security is still considered to be critical barrier for most of these computing systems where, the threat and attacks have never been totally eliminated. Associated with this improvement in

computing system the cyber threats have grown exponentially. As the computing has been moved surrounding mobile cloud computing, the attacks and malware shifted their targets toward mobile cloud computing [10] and [11]. The users of mobile cloud computing have serious concerns regarding their data and information security in cloud. The data security is critical factor for the users to move their data to the cloud as all kinds of attacks those are applicable for data and network equally applies to mobile cloud computing. The following are some common data security issues in the cloud [12] and [13]. Data theft , User authentication, Data protection, User information privacy , Violation of privacy, rights, Loss of physical security, Handling of encryption and decryption keys and Lack of standard to ensure data integrity. Also, there are some possible attacks at the user device on the client side: Device data theft/stolen devices, Attacks via wireless devices, Misuse of access privileges, and Vulnerabilities within the devices, design and operating system and third-party applications. In respect of information security in the cloud, the most common information security issues are: System security of server, Database security, Networking security, System and storage protection, Information stealing by mobile malware, Information flow control, information leakage because of poorly written third party applications.

## VII. MOBILE CLOUD COMPUTING SECURITY CONSIDERATIONS

The operational context of mobile cloud computing includes download data and information from the cloud server to the clients mobile device, the transmission of sensitive information to the cloud server and also the storage of clients private information in the cloud as remote server with no control from the mobile users. To reduce the possibilities of cloud attack it's necessary to consider [14] and [15]: Carefully plan the security aspects privacy, confidentiality and integrity of cloud computing before implementing them. Understand the type of cloud computing environment provided by the cloud provider. Understand how to disable insecure feature and enable high security one in the used device. Understand operating system specific differences. Take into consideration differences and limitations of different platforms from device to device. Assess security and risk using backend systems. Distinguish between traditional applications and mobile application's backend infrastructure. Know where and how the mobile application will connect to cloud. Protect secure and sensitive information in transit. Maintain accountability over the information privacy. Encrypt data using encrypted data containers, secure areas and key chain. Ensure that the provided cloud computing solution applications and other resources satisfy privacy requirements and organizational security. Maintain

control over security of applications and data deployed in different cloud computing environments [16]-[18].

### VIII. CONCLUSIONS

In this work investigates the concept of mobile cloud computing as its relatively new concept with enormous prospects. Mobile cloud computing presents huge number of benefits for different type of users, however, the security threats associated with the mobile cloud computing approach may slow down its use. This work mainly focused on the security issues embedded in the use of mobile cloud computing such as common data and information security issues on the cloud and possible attacks at the user device on the client side. This paper also highlighted some security consideration on the adoption of mobile cloud computing. The idea behind this work is to identify the main mobile cloud computing security issues and consideration as they are preventing mobile users using the cloud services. This work is useful of mobile service providers in which they can improve their used cloud security mechanism and minimize single user and organization mobile cloud computing security concerns

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