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SECURITY ISSUES IN MOBILE CLOUD COMPUTING (MCC)

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ABSTRACT

As we all witness the incredible growth of mobile device in past 10-15 years. We can see several thousands of mobile applications available in market which runs on different platforms. With this drastic growth of mobile technology there are various characters of mobile technology that impedes them to provide efficient services. Cloud computing has gained significant attention in last few years. Mobile computing is now integrated with cloud computing to harness the advantages of cloud and overcome underlying challenges of mobile devices. After integration of mobile and cloud computing, there are various security issues that need to be addressed while working on cloud environment. This paper describes few security issues and their possible solutions in mobile-cloud integration. Also overview of cloud computing including its types, features, applications and hierarchy in discussed.

KEYWORDS: – Cloud computing, Cloud services, Mobile computing, Mobile cloud computing, Mobile Applications, Mobile Cloud computing security issues

INTRODUCTION

People all over the world are baffling for Mobile devices. With their ever increasing popularity, the services offered by the providers are hindered with its underlying challenges that include diverse OS version running on mobile devices, diversity of devices, reduced time to market and run time environment. For overcoming these challenges mobile computing has integrated with cloud computing. Cloud computing is currently much in demand. According to Goldman Sachs the cloud infrastructure and platform market is expected to expand at a 19.62% CAGR from 2015 to 2018, reaching \$43B by 2018 as shown in figure 1. Also in recent market analysis forecasts that the global market for cloud infrastructure and platforms is

expected to grow from \$21B to \$43B by the end of the forecast period.

In this paper an introduction to advent of cloud computing concept including its types, features, applications and hierarchy in discussed. In next section of the paper overview of mobile cloud computing, advantages of mobile cloud computing and its various security issues along with their possible solutions proposed by various authors is conferred.

CLOUD COMPUTING

Cloud computing can be thought of as a total solution that delivers IT as a service. Cloud computing is also known as on-demand computing in which shared resources and information are provided to computers and other devices on demand. Cloud computing has now become highly demanding service due to its various advantages like high computing power, cheap cost of services, high performance, scalability, accessibility, availability etc. Every year there is a growth rate of 50 % of cloud vendors. Let's take a real life example to explain cloud computing concept of having a meal at home versus ordering the meal from home. Even though objective is purely the consumption of a meal, the approach used is significantly different. If the approach used is to prepare a meal at home then the entire headache of arranging the ingredients required and for preparing the meal is solely yours and after having the meal, cleaning the surrounding also belongs to you. But if the approach used is ordering the meal

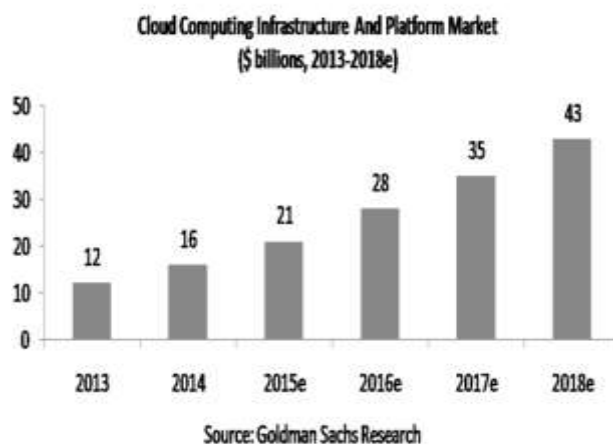


Figure 1: Growth chart of cloud computing infrastructure [1]

Public clouds	<ul style="list-style-type: none"> Public clouds provide services to everyone. Public clouds share virtualized resources publicly. These clouds are suited in that environment where confidentiality and security is not of much concern.
Private cloud	<ul style="list-style-type: none"> A private cloud is a cloud which is solely dedicated to a specific organization and is available to users existing in the organization in a private network. This cloud is not shared with other organizations. Private cloud is used in purely confidential and secured environment.
Hybrid clouds	<ul style="list-style-type: none"> Hybrid clouds are a combination of private and public clouds. In this some services are available to all and some services are available to users only existing in the organization.
Community cloud	<ul style="list-style-type: none"> This cloud is for exclusively used by a specific community of users from organisations that have shared concern.

Figure 2: Types of cloud [2]

over the phone or online ordering using some web interface, then we can relate it to cloud computing approach. Here we are taking catering as a service from the restaurant management. The onus of possessing the ingredients, preparation for the dish, cooking the dish, sending it to the address all falls on restaurant administration. This example can be viewed as principles of cloud computing –“on demand availability”, “As-a-service”, “pay for the usage”. There are three types of clouds as shown in the figure 2.

FEATURES AND APPLICATIONS OF CLOUD COMPUTING

Following are some of the features of cloud computing [2]:-

1. On-request self-service. Clients can use computing capabilities directly without any direct interaction with the service providers.
2. Broad network access. Capacities are accessible over the network and accessed through standard components that advance use by heterogeneous slight or thick customer platforms such as cell telephones, tablets, and PDAs and other routine or cloud-based services.
3. Resource pooling. The supplier's registering assets are pooled to serve numerous purchasers utilizing a multi-occupant model, with distinctive physical and virtual assets powerfully relegated and reassigned by interest. Assets incorporate capacity, preparing, memory, system data transfer capacity, and virtual machines.
4. Rapid flexibility. Capacities can be quickly and flexibly provisioned for boundless and can be

acquired in any amount whenever needed.

5. Measured service. Usage of resources can be observed, controlled and enhanced through metering capacities. Cloud services are frequently however not generally used in conjunction with, and empowered by, virtualization innovations. Cloud computing has been credited with increasing competitiveness through cost reduction, greater flexibility, elasticity and optimal resource utilization. Figure 3 shows procurement of cloud in different fields to accomplish their business objectives.

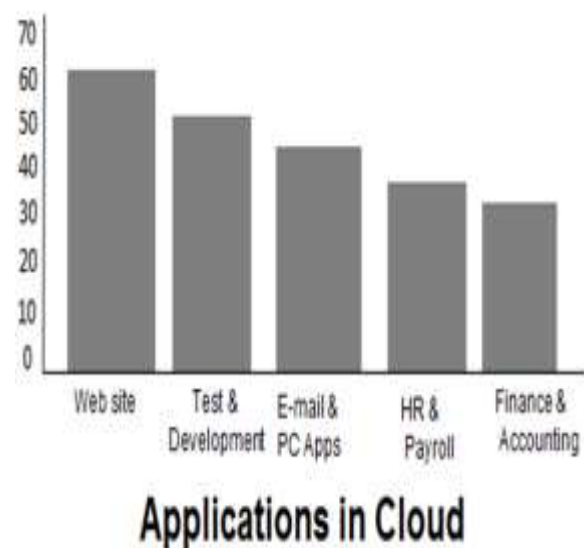


Figure 3: Applications of cloud in different fields [3]

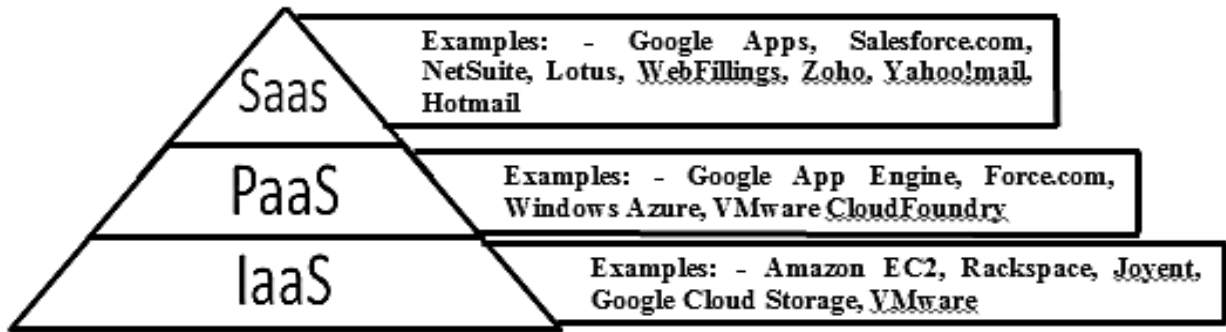


Figure 4: Cloud services paradigm [4]

CLOUD SERVICE HIERARCHY

The cloud computing infrastructure and platform includes Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). The hierarchy of these services is shown in figure 4.

IaaS: - It is a base layer including cloud infrastructure having servers, storage, network and operating systems

PaaS: - It provides platform for creating a soft wares having database, operating system, middleware and tool.

SaaS:- It provides complete and finished soft wares on demand. It will be available either on license or pay per use basis.

MOBILE CLOUD COMPUTING (MCC)

Mobile Cloud Computing idea can be portrayed as the accessibility of Cloud Computing assets and services for mobile devices. The combination of cloud computing and wireless communication over portable computing devices such as mobile device, PDAs, Laptops etc., has established the framework for a novel computing model, called mobile cloud computing, which permits clients an online access to boundless processing power and storage capacity. This concept can be depicted in figure 5.

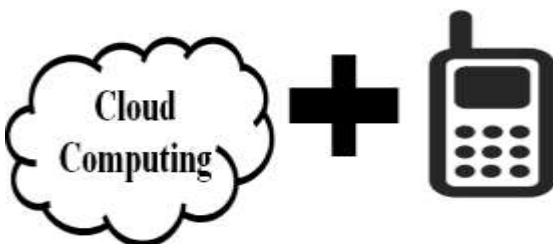


Figure 5: Mobile cloud computing concept

Various advantages of integrating the mobile computing with cloud are as listed below:-

1. Prolonged battery life
2. Upgraded data storage capacity and processing power
3. Enriched synchronization of data
4. Enhanced unwavering quality and adaptability

5. Simplicity of integration

MOBILE CLOUD COMPUTING SECURITY ISSUES OVER THE CLOUD

There are various challenges that are Mobile communication issues, Computing issues, Network Access Management issues, Quality of Service issues, Service Convergence issues, security issues etc. Out of all these challenges, security is considered to be a perilous obstacle for cloud computing in its path to triumph. The focus of this paper is on major security issues in mobile cloud computing. On the basis of services provided by Mobile cloud computing security issues can be viewed as three layers as shown in the figure 6:-

1. Backbone layer	This layer is related to security surveillance in cloud physical system
2. Infrastructure layer	This layer is related to monitoring VMs in cloud, storage verification, Evaluation and Audits,
3. Application and Platform layer –	This layer is related to user management, key management, authentication, authorization, encryption and data integration.

Figure 6: Cloud Service Security layers

As Mobile cloud computing is a combination of cloud computing and mobile computing. So the security issues are classified into two classes: - Cloud security and Mobile Network user’s security. Cloud security:-The enormous information residing on the cloud must be secured enough so that its integrity, authentication and digital rights are reserved. Mobile Network User’s Security: - The mobile applications running on the devices and the user credentials over the network are of concern under mobile network user security.

Sr/No.		Solution proposed
1.	Cloud Security Solutions	Itani [5] proposed an energy efficient integrity verification scheme for mobile clients which verify the integrity of the file stored on the cloud server using an incremental message authentication code.
2.		Jia et al proposed [6] outsourcing data and security management on cloud by proxy re-encryption and identity based encryption schemes.
3.		Hsueh proposed a scheme [7] for smart phones for security, integrity and authentication of mobile user data by storing the traditionally encrypted files with user credentials hosted by an adversary who can utilize user credentials to impersonate the user later on.
4.		Zhou and Huang [8] proposed a scheme which offloads the processing and storage intensive encryption and decryption operations on the cloud without revealing any information about the data contents and the security keys.
5.	Mobile Network User's Security Solutions	Zang et al. [9] proposed a scheme an elastic mobile application model and covered the security aspects of the proposed model. The proposed security model deals with the secure installation of elastic application, authentication among web lets, secure migration of web lets, and authorization of web lets while using external web services. The proposed model safeguards the modification of a web let only at installation time with the help of a developer signed hash value.
6.		In [10], Xiao and Gong proposed a scheme to generate automatic dynamic credentials with the mutual coordination of mobile devices and cloud. The generated credentials are used to protect the mobile user from different type of attacks. The proposed scheme considers cloud as a fully trusted component to implement the solution accurately.
7.		In [11], Chow et al. proposed a policy based cloud authentication platform that addresses the client device authentication issue using implicit authentication. To achieve privacy, mobile clients apply hash function on data (except GPS location) with a self-generated key and transfer the generated information to the data aggregator. An unusual pattern can be detectable without disclosing the noticeable user information. The mobile client has to apply a hash function on frequent generated information to achieve privacy.
8.		In [12], Huang proposed secure data processing model for MobiCloud that provides enhanced security and privacy protection for mobile users with the help of multi-tenant secure data management, trust management. To provide strong security services to the user, the storage domain module and cloud trusted domain module are physically isolated. If the cloud trusted domain module is hosted by a trusted third party, there is an issue of scalability.

Figure 7: Proposed solutions for handling security issues

SECURITY SOLUTIONS FOR MOBILE CLOUD COMPUTING

Figure 7 shows the proposed solutions for the security issues in mobile cloud computing.

CONCLUSION AND FUTURE WORK

As we all know that cloud computing is briskly evolving as a new model for providing many services on demand basis. This rapid development is combined with mobile computing which is at its ever increasing growing phase. In this paper overview of cloud computing along with features, applications, services and types are discussed. This paper also gives brief introduction to mobile cloud

computing and discusses security issues concerned with mobile cloud computing in detail along with literature review of the solutions proposed by some of the authors is also discussed. For future work there is need to explore more security issues because cloud computing concept is here to stay for a while and to find more solutions for existing security issues

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