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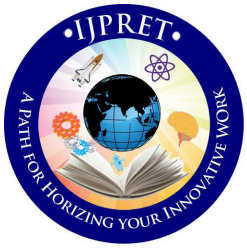

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A PATH FOR HORIZING YOUR INNOVATIVE WORK

CLOUD COMPUTING IN MOBILE AND ITS SECURITY

P. A. PATIL[1], PROF. R. R KEOLE[2]

1. M.E.H. V. P. M.COET, Amravati,
2. Asst. Prof. H.V.P.M.COET, Amravati.

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Corresponding Author

Ms. Patil P. A.

Abstract

Cloud computing is an emerging concept combining many fields of computing. The foundation of cloud computing is the delivery of services, software and processing capacity over the Internet, reducing cost, increasing storage, automating systems, decoupling of service delivery from underlying technology, and providing flexibility and mobility of information. Despite increasing usage of mobile computing, exploiting its full potential is difficult due to its inherent problems such as resource scarcity, frequent disconnections, and mobility. Mobile cloud computing can address these problems by executing mobile applications on resource providers external to the mobile device.

Introduction

Once the exclusive domain of networked computers at universities and other large organizations, home PCs and modem connections have opened the Internet, evolving it into the information superhighway that we know today. This commercial availability of Internet service, which has allowed individuals access to the vast and multi-faceted resources thereon, has radically changed the flow of information.

As the Internet has evolved, however, we have seen the emergence of "Cloud computing." Organizations have begun to leverage the connectivity created by the Internet to optimize the utility of computing. Ever-cheaper and more powerful processing and storage capabilities are allowing data centers to act as viable, large scale central computing hubs. Simultaneously, increasing network bandwidth and reliable yet flexible network connections make it possible for clients – both individual and enterprise – to utilize high quality services which reside solely on these remote central hubs. These services will often include data storage (and real time access) or processing (by remote software and computing resources). This possibility, however, forces clients to re-think the data protection schemes developed for the point-A-to-point-B data flow.

In recent years, applications targeted at mobile devices have started becoming abundant with applications in various categories such as entertainment, health, games, business, social networking, travel and news. The popularity of these are evident by browsing through mobile app download centers such as Apple's iTunes or Nokia's Ovi suite.

The reason for this is that mobile computing is able to provide a tool to the user when and where it is needed irrespective of user movement, hence supporting location independence. Indeed, 'mobility' is one of the characteristics of a pervasive computing environment where the user is able to continue his/her work seamlessly regardless of his/her movement.

The combination of cloud computing, wireless communication infrastructure, portable computing devices, location-based services, mobile Web, etc., has laid the foundation for a novel computing model, called mobile cloud computing, which allows users an online access to unlimited computing power and Storage space.

"Mobile cloud computing is a model for transparent elastic augmentation of mobile device capabilities via ubiquitous wireless access to cloud storage and computing resources, with context-aware dynamic

adjusting of offloading in respect to change in operating conditions, while preserving available sensing and interactivity capabilities of mobile devices."

The security and privacy protection services can be achieved with the help of secure cloud application services. In addition to security and privacy, the secure cloud application services provide user management, key management, encryption on demand, intrusion detection, authentication, and authorization services to mobile users. There is a need for a secure communication channel between cloud and the mobile device. The secure routing protocols can be used to protect the communication channel between the mobile device and cloud.

2. Cloud Computing

The 'Cloud' is a broad, loosely-defined construct that encompasses all resources made available through the Cloud computing paradigm. It refers both to services accessed via, and delivered through, the Internet and the hardware and systems software in remote datacenters that provide those services .Cloud computing changes the way we think about computing by decoupling data processing, data retention, and data presentation in effect, divorcing components from location.

2.1 Architecture of Cloud Computing

Cloud computing provides a new computing paradigm that delivers IT as a service.

The objectives of the new computing paradigm are to increase capacity and capabilities at runtime without investing in new infrastructure Cloud computing permits customers to utilize cloud services on the fly in pay-as-you-go manner through the Internet. The services may be Infrastructure as a Service (IaaS), Data storage as a Service (DaaS), Communication as a Service (CaaS), Security as a Service (SecaaS), Hardware as a Service (HaaS), Software as a Service (SaaS), Business as a Service (BaaS), and Platform as a Service (PaaS). There are various layered architectures available for cloud computing to provide the aforementioned services as a utility. There are three models by which Cloud computing services are delivered: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS), each with different benefits and limitations. IaaS is the foundation of all Cloud services (i.e. the bottom layer) and is overlaid with PaaS (the middle layer) and SaaS (the top layer), respectively.One such cloud computing layered architecture is presented in Fig. 1.[3]

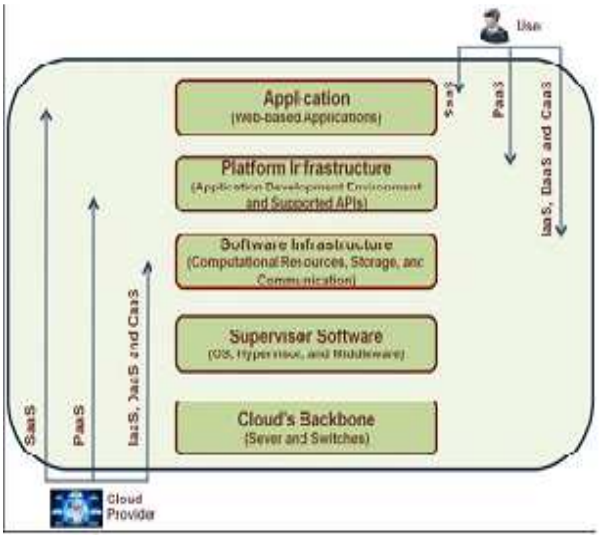

Fig 1. Layered architecture of cloud computing[3]

2.2 Deployment Models

In addition delivery models, there are three deployment models for Cloud computing: public, private, and hybrid. “Public Cloud” describes Cloud computing in the traditional, off-site sense, while “private Cloud” emulates Cloud computing on private networks. However, the “hybrid Cloud” - a combination of public and private Cloud offerings - will be typical for most enterprises [2]

3. Mobile Cloud Computing

Mobile cloud computing was defined in a 5 March 2010 entry in the Open Gardens blog as "the availability of cloud computing services in a mobile ecosystem. This incorporates many elements, including consumer, enterprise, femtocells, transcoding, end-to-end security, home gateways, and mobile broadband-enabled services." (A femtocell is a small cellular base station.) As an inheritance and development of cloud computing, resources in mobile cloud computing networks are virtualized and assigned in a group of numerous distributed computers rather than in traditional local computers or servers, and are provided to mobile devices such as smart phones, portable terminal, and so on. Mobile cloud computing would be based under the basic cloud computing concepts. These are also valid requirements for mobile cloud computing. For example, a mobile computing cloud also needs to be aware of its availability and quality of service and enable diverse mobile computing entities to dynamically plug themselves in, depending on the requirements and workload.

3.1 Architecture for Mobile Applications in Cloud Environment

We will look at a open source project for mobile cloud platform called openmobster. Its architecture is as given in the Fig.2

3.2 Benefits of Mobile Cloud Computing

Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing apps and mobile computing to not just smart phone users but a much broader

range of mobile subscribers. In this section, we enlist the possible benefits of Mobile Cloud Computing.[14]

1) Mobile Cloud Computing will help to overcome limitations of mobile devices in particular of the processing power and data storage.
2) It also might help to extend the battery life by moving the execution of commutation-intensive application 'to the cloud'.
3) Mobile Cloud Computing is also seen as a potential solution for the fragmented market of mobile operating systems with currently eight major operating systems.
4) Mobile Cloud Computing can increase security level for mobile devices achieved by a centralized monitoring and maintenance of software,
5) It can also become a one-stop shopping option for users of mobile devices since Mobile Cloud Operators can simultaneously act as virtual network operators, provide e-payment services, and provide software, data storage, etc. as a service.
6) A number of new technical functionalities might be provided by mobile clouds. In particular, provisioning of context- and location-awareness enables personalization of services is an attractive functionality.
7) Mobile Cloud Computing might open the cloud computing business that is currently almost exclusively addressing businesses to consumers since they will significantly benefit from the above described options.

3.3 Connection protocols

The current mobile cloud computing research uses a variety of connection protocols for communication including WiFi, Bluetooth, and 3G, though the majority has employed WiFi for many reasons.

1) WiFi

WiFi (wireless Ethernet 802.11b) and Bluetooth both operate in the unlicensed 2.4 GHz ISM band. WiFi was initially intended as replacement for cabling for resource and peripheral sharing (such as printers, shared storage devices) among PCs, terminals etc. for wireless local area networks (WLANs). WiFi has a longer range, with a radius within 100m and supporting up to 11 Mbps data rates.

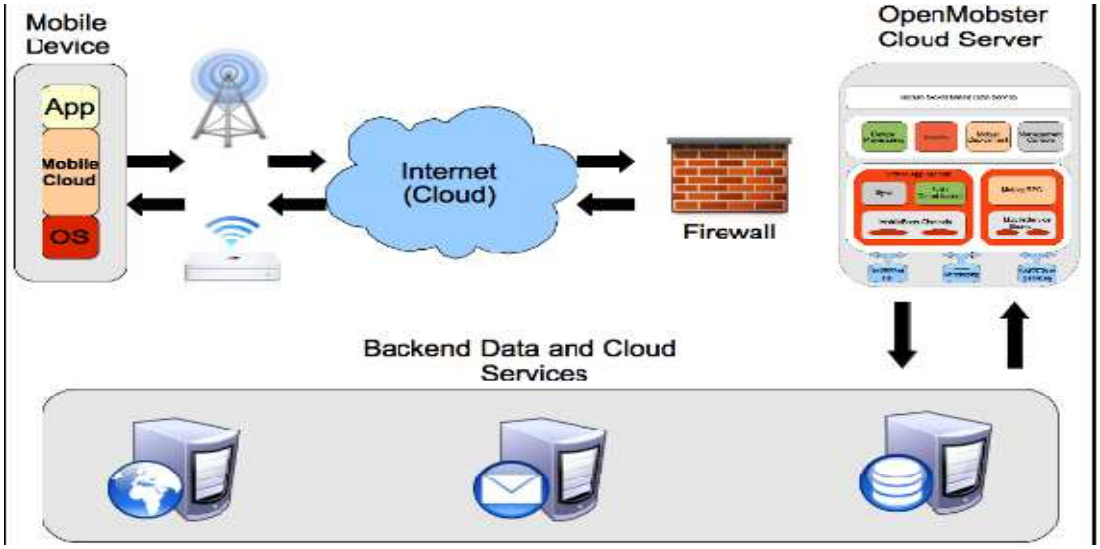

Fig 2 The open mobster architecture for MCC[14]

2) Bluetooth

Bluetooth on the other hand, was intended for nonresident equipment and applications such as wireless headsets etc

wireless personal area network (WPAN), and is characterized by its low power requirements and low-cost transceiver chips The range for Bluetooth is typically in a radius of 10 m, depending on the device class, power, and physical obstacles in the environment. However, according to Bluetooth specifications, future versions will be faster up to 24 Mbps and consume less energy.

3) 3G

3G (third generation mobile telecommunications) is a technology for mobile service providers and it shares the basic business model with that of the telecommunications services model. The infrastructure is owned and managed by the service provider and sold to customers typically on a monthly usage basis. Although the focus of cellular technology has been voice telephony, data services has also started to attract attention. Mobile broadband access of several Mbps is available via recent 3G releases such as 3.5G and 3.75G , although this is substantially lower than the data rate

of WiFi.

IV Security

Cloud computing security (sometimes referred to simply as "cloud security") is an evolving sub-domain of computer security, network security, and more broadly, information security. It refers to a broad set of policies, technologies, and controls deployed to protect data, applications, and the associated infrastructure of cloud computing

A) Cloud Security Control

Cloud security architecture is only effective if the correct defensive implementations are in place. Efficient cloud security architecture should recognize the issues that will arise with security management. The security management addresses these issues with security controls. These controls are put in place to safeguard any weaknesses in the system and reduce the effect of an attack. While there are many types of controls behind cloud security architecture, they can usually be found in one of the following categories.

***a) Deterrent Controls*:** These controls are set in place to prevent any purposeful attack on a cloud system. Much like a warning sign on a fence or a property, these controls do not reduce the actual vulnerability of a system.

***b) Preventative Controls*:** These controls upgrade the strength of the system by managing the vulnerabilities. The preventative control will safeguard vulnerabilities of the system. If an attack were to occur, the preventative controls are in place to cover the attack and reduce the damage and violation to the system's security.

***c) Corrective Controls*:** Corrective controls are used to reduce the effect of an attack. Unlike the preventative controls, the corrective controls take action as an attack is occurring.

***d) Detective Controls*:** Detective controls are used to detect any attacks that may be occurring to the system. In the event of an attack, the detective control will signal the preventative or corrective controls to address the issue.

B) Mobile cloud security

Securing mobile cloud computing user's privacy and integrity of data or applications is one of the key issues most cloud providers are given attention. Since mobile cloud computing is a combination of mobile networks and cloud computing.[6]

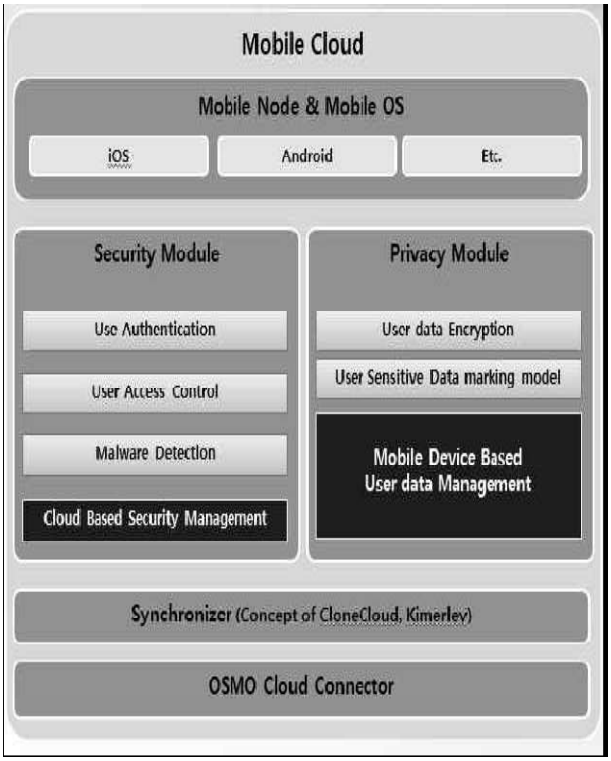

Fig3:Mobile Cloud Security Architecture overview

Numerous security vulnerabilities and threats such as malicious codes are known to the different mobile devices such as Smart phones, PDAs, cellular phones, laptops, and the like. Some applications to these devices can cause privacy issues for mobile users.

***a) Security for mobile applications*:** The simplest ways to detect security threats will be installing and running security software and antivirus programs on mobile devices. But since mobile devices are constrained with processing and power limitations, protecting them from these threats could be more difficult compared to regular computers. Several approaches have been developed transferring threat detection and security mechanisms to the cloud

***b) Privacy*:** Providing private information such as indicating your current location and user's important information creates scenarios for privacy issues. For example, the use of location based services (LBS) provided by global positioning system (GPS) devices. Threats for exposing private information could be minimized through selecting and analyzing the enterprise needs and require only specified services to be acquired and moved to the cloud. [1]

V Conclusion

The concept of cloud computing provides a brand new opportunity for the development of mobile applications. Native (offline) and Web (online) applications are the two extremes of mobile applications. The former type is using capabilities of mobile devices, but the integration with the cloud is poor. Mobile cloud computing will be a source of challenging research problems in information and communication technology for many years to come. A never ending issue will always be security in cloud computing related to multi-tenancy, concurrency, scale and distribution. Direct concerns arise from aspects such as lacking control over data and code distribution in distributed

infrastructures, potential data loss. Indirect issues arise from providing virtually unlimited computational resources to perhaps untrustworthy entities.

VI Future Work

In the future, we will focus on the investigate more application scenarios that require data sharing between cloud private domain and public domain.

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