A Review on Mobile Cloud Computing

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Abstract—Cloud computing is the trend in which resourcesare provided to a local client on an on-demand basis, usually by means of the internet. Mobile cloud computing (MCC) is simply cloud computing in which at least some of the devices involved are mobile.

Keywords— *Cloud computing, Mobile cloud computing, smartphones, mobile applications.*

I. INTRODUCTION

This paper represents a review on an important paradigm Mobile Cloud Computing (MCC). Smart phones, tablets, and cloud computing are converging in the new, rapidly growing field of mobile cloud computing. In less than four years, there will be 1 trillion cloud-ready devices. Learn about the devices (smart phones, tablets, Wi-Fi sensors), the trends (more flexible application development, changing work patterns), the issues (device resource poverty, latency/bandwidth, security), and the enabling technologies that come along with a more mobile, device-loving cloud environment.

To better understand mobile cloud computing, it helps to know about cloud computing in general. (See Resources for links to detailed discussions of cloud computing.) The two key features important here are:

Cloud computing enables convenient, on-demand network access to a shared pool of configurable computing resources (such as networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

There are three basic models of cloud service: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

1. Infrastructure as a Service (IaaS)

This is based on the provisioning of computing resources which are more hardware oriented. With infrastructure as a service, the user is able to run and manage own operating systems including applications by using virtualization technologies. Additionally he can make use of storage systems and network devices like e.g. firewalls.

The management of the underlying infrastructure is done by the service provider of the cloud, though the user has full control over operating system, application and storage and also has partial control over network devices.

Examples:-Amazon EC2 for computation power, Amazon S3 for storage provisioning.

2. Platform as a Service (PaaS)

Platform as a service (PaaS) is a category of cloud computing services that provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app.

The management of the underlying infrastructure & operating system is in the hands of the service provider.Though the user has full administrative control over the applications he wants to host on the cloud system.

Examples: Google App Engine, Force.com, salesforce.com, IBM smart cloud & Microsoft Azure.

3. Software as a Service (SaaS)

Software as a service (SaaS) permits users to subscribe and use application software in the cloud. It mainly focuses on the provisioning of application.

The management of the underlying infrastructure, operating system and the configuration of the application is completely done by the service provider.

Examples: Google Docs, Microsoft Office Web Apps and Apple iWork.com

The advantages of cloud system, which might lead to savings in time and energy consumption also helps in Mobile Cloud Computing. MCC, essentially, an integration of Cloud Computing and mobile computing has evolved as a primary solution to augment the computing capabilities of mobile devices. MCC is a technique where most of the data storage and data processing takes place outside mobile device and this concept is known as offloading. Broadly, the offloading decisions are of two types:

Full Offloading: All the tasks are migrated from mobile node to remote cloud server.

Partial Offloading: Some of the computational intensive tasks are migrated from mobile node to remote cloud.

II. ADVANTAGE AND CHARACTERSTICS OF MOBILE CLOUD COMPUTING

1. On-demand self-service:

The End user can provision computing capabilities as needed, such as server time and network storage, automatically without the requirement for human interaction with each service provider.

2. Flexibility:

One of the major characteristics of mobile cloud computing is that you can access your data from anywhere in the world, using any mobile device. It does not matter where you are, as long as you connected to the internet you can access both applications as well as data from your mobile device.

3. Rapid Elasticity:

Capabilities can be rapidly and elastically provisioned, in some cases automatically without the need of human interaction.

4. Real time data availability:

Another advantage of mobile cloud computing is that you can get access to real time data, whenever you want and wherever you want. Given that the data and applications are managed by a third party, updating your data as well as accessing it in real time is easily possible. Moreover, it can be accessed multiple persons simultaneously.

5. Multiple platforms:

Unlike traditional applications, mobile cloud computing allows for multiple platform support. In other words, whatever the platform may be, you can easily access the data and applications stored in the cloud.

6. No upfront costs:

In most cases, cloud applications have minimal or no upfront cost. It is very much a pay-for-use service which has helped to grow adoption of the model, especially for SMBs. Without hefty fees for licensing and upgrades, the cost of adoption is less of a barrier when cash flow is an issue.

7. Consumers have access to more features on their mobile phones:

Cloud computing has changed the mobile market by making previously unthinkable applications possible, such as location-based social networks and home security tools. There's no telling what kinds of features we'll have access to in the near future. The possibilities are endless.

8. Resource pooling:

Computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand, e.g. storage, processing, memory, network bandwidth, virtual machines.

III. ISSUES IN MOBILE CLOUD COMPUTING

- Operational level issues
- End user level issues
- Service and application level issues
- Privacy, security and trust.
- Context Awareness
- Data Management

Some other issues also included low bandwidth, service availability, traffic congestion and handling wireless connectivity with highly heterogeneity.

IV. CHALLENGES IN MOBILE CLOUD COMPUTING

Mobile cloud computing poses challenges due to the intrinsic nature and constraints of wireless networks and devices. These challenges complicate the design of distributed processing more so than fixed cloud computing.

A) Architectural issues:

A reference architecture for heterogeneous MCC environment is a crucial requirement for releasing the power of mobile computing towards unrestricted ubiquitous computing.The template is designed so that author affiliations are not repeated each time for multiple authors of the same affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization). This template was designed for two affiliations

B) Resource poverty of mobile devices versus fixed devices

One of the challenges in MCC environment is presented by the resource-poor nature of mobile devices. To offset device limitations, resources can be added to the cloud infrastructure to provide smooth and continuous user experiences for advanced applications. Although mobile technology has improved significantly over the past several years, there is a significant cost of mobility for a given cost and level of technology available.

C) Division of Application Services

In order to dynamically shift the computation between mobile devices and cloud, applications needed to be split in loosely coupled modules interacting with each other .These modules are dynamically shift between mobile devices and cloud on the basis of some parameters like battery level of mobile device, monetary costs, security or network bandwidth.To tackle this challenge fast optimization based technique can be used.

D) Limited Energy source:

Mobile devices are generally less powerful and consume more energy. Limited Battery life is a biggest issue in mobile cloud computing. It is a challenge in MCC environment to handle the limited battery life of mobile device.

V. CONCLUSIION AND FUTURE RESEARCH

Mobile Cloud Computing is a mobile technology which combines the benefits of both mobile computing and cloud computing, consequently empowers the mobile user by providing a seamless functionality. MCC provides a capability of developing enhanced mobile applications, since it allows the transfer of the processing overhead to the clouds over the internet. Some inherent challenges of mobile device like its energy level are discussed in this paper can be taken up for future work

REFERENCES

[1]. Liu, Qingfeng, Xie Jian, Jicheng Hu, Hongchen Zhao, and Shanshan Zhang. "An optimized solution for mobile environment using mobile cloud computing." In 2009 5th International Conference on Wireless Communications, Networking and Mobile Computing, pp. 1-5. IEEE, 2009.

[2]. Pandey, Suraj, Linlin Wu, Siddeswara Mayura Guru, and Rajkumar Buyya. "A particle swarm optimization-based heuristic for scheduling workflow applications in cloud computing environments." In *2010 24th IEEE international*

conference on advanced information networking and applications, pp. 400-407. IEEE, 2010.

[3]. Zhu, Kai, Huaguang Song, Lijing Liu, Jinzhu Gao, and Guojian Cheng. "Hybrid genetic algorithm for cloud computing applications." In Services Computing Conference (APSCC), 2011 IEEE Asia-Pacific, pp. 182-187. IEEE, 2011.

[4]. Fernando, Niroshinie, Seng W. Loke, and Wenny Rahayu. "Mobile cloud computing: A survey." Future Generation Computer Systems 29.1 (2013): 84-106

[5]. Yang, Lei, Jiannong Cao, Yin Yuan, Tao Li, Andy Han, and Alvin Chan. "A framework for partitioning and execution of data stream applications in mobile cloud computing." ACM SIGMETRICS Performance Evaluation Review 40, no. 4 (2013): 23-32.

[6]. Verma A., & Kaushal S. (2014, March). Bi-criteria priority based particle swarm optimization workflow scheduling algorithm for cloud. In Engineering and   Sciences (RAECS), 2014 Recent Advances in (pp. 1-6). IEEE.

[7]. Rodriguez, Maria Alejandra, and Rajkumar Buyya. "Deadline based resource provisioning and scheduling algorithm for scientific workflows on clouds." IEEE Transactions on Cloud Computing 2.2 (2014): 222-235.

[8]. Kalra Mala, and Sarbjeet Singh. "A review of metaheuristic scheduling techniques in cloud computing." Egyptian Informatics Journal 16.3 (2015): 275-295.

[9]. Wang, Xiumin, Jin Wang, Xin Wang, and Xiaoming Chen. "Energy and delay tradeoff for application offloading in mobile cloud computing." IEEE Systems Journal (Volume: PP, Issue: 99) (2015).

[10]. Lin, Xue, Yanzhi Wang, Qing Xie, and Massoud Pedram. "Energy and performance-aware task scheduling in a mobile cloud computing environment." In 2014 IEEE 7th International Conference on Cloud Computing, pp. 192-199. IEEE, 2014

[11]. Lin, Xue, Yanzhi Wang, Qing Xie, and Massoud Pedram. "Task scheduling with dynamic voltage and frequency scaling for energy minimization in the mobile cloud computing environment." IEEE Transactions on Services Computing 8, no. 2 (2015): 175-186.

[12]. Shiraz, Muhammad, Mehdi Sookhak, Abdullah Gani, and Syed Adeel Ali Shah. "A study on the critical analysis of computational offloading frameworks for mobile cloud computing." Journal of Network and Computer Applications 47 (2015): 47-60.

[13]. Chen, Xu. "Decentralized computation offloading game for mobile cloud computing." IEEE Transactions on Parallel and Distributed Systems 26, no. 4 (2015): 974-983.

[14]. Ghouma, Hager, and Muhammad Jaseemuddin. "Context aware resource allocation and scheduling for mobile cloud." In Cloud Networking (CloudNet), 2015 IEEE 4th International Conference on, pp. 67-70. IEEE, 2015