International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Mobile Cloud Computing

Pooja N. Dharmale[1], P. L. Ramteke[2]

[1]Department of computer science and information technology, ME First year, HVPM's COET, SGBA University, Amravati, India

[2]Department of computer science and information technology, HVPM's COET, SGBA University, Amravati, India

Abstract*: With an explosive growth of the mobile applications and emerging of cloud computing concept, the Mobile Cloud Computing (MCC) has become a potential technology for the mobile service users. The concepts of Cloud computing are naturally meshed with mobile devices to enable on-the-go functionalities and benefits. The mobile cloud computing is emerging as one of the most important branches of cloud computing and it is expected to expand the mobile ecosystems. As more mobile devices enter the market and evolve, certainly security issues will grow as well. Also, enormous growth in the variety of devices connected to the Internet will further drive security needs. MCC provides a platform where mobile users make use of cloud services on mobile devices. The use of MCC minimizes the performance, compatibility, and lack of resources issues in mobile computing environment.*

Keywords: Mobile computing**,** Cloud Computing, Mobile Cloud Computing, Applications of MCC, Challenges for MCC.

1. Introduction

Mobile Cloud Computing (MCC) is the combination of cloud computing, mobile computing and wireless networks to bring rich computational resources to mobile users, network operators, as well as cloud computing providers[4][5]. The ultimate goal of MCC is to enable execution of rich mobile applications on a plethora of mobile devices, with a rich user experience [6]. MCC provides business opportunities for mobile network operators as well as cloud providers. More comprehensively, MCC can be defined as "a rich mobile computing technology that leverages unified elastic resources of varied clouds and network technologies toward unrestricted functionality, storage, and mobility to serve a multitude of mobile devices anywhere, anytime through the channel of Ethernet or Internet regardless of heterogeneous environments and platforms based on the pay-as-you-use principle [7]." 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. This paper concentrate on the challenges of mobile cloud computing, MCC advantages, MCC disadvantages.

"Mobile Cloud Computing at its simple concept that refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device. Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing applications and mobile computing to not just Smartphone users but a much broader range of mobile subscribers". Cloud computing can be defined as a model for enabling ubiquitous, convenient and on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort from the user side and minimal service provider interaction. Cloud is not simply the latest term for the Internet, though the Internet is a necessary foundation for the cloud, the cloud is something more than the Internet.

2. Applications of Mobile Cloud Computing

Some of the applications of mobile cloud computing are Google's Gmail drive, Maps and Navigation systems for Mobile, I- cloud from Apple Moto Blur from Motorola (with a special feature called remote wipe), Amazon's new "cloud-accelerated" Web browser Silk. Silk is a "split browser whose software resides both on Kindle Fire and EC2. The applications reinforced by mobile cloud computing include mobile commerce, mobile learning, and mobile healthcare and other areas. Mobile applications extended extensive share in a global mobile market. Various mobile applications have engaged the recompenses of Mobile Cloud Computing. The following are the few inferences[2].

2.1 Mobile Commerce

Mobile commerce (m-commerce) is a buying and selling of products using mobile devices. The m-commerce applications normally used to achieve some tasks that necessitate mobility (e.g., mobile transactions and payments, mobile messaging, and mobile ticketing). The m-commerce applications have to face various complications (e.g., low network bandwidth, high complexity of mobile device configurations, and security). Subsequently, m-commerce applications are integrated into cloud computing environment to solve these issues.

2.2 Mobile Learning

Mobile learning (m-learning) is an electronic learning (e-learning) and mobility. However, traditional m-learning applications have limitations in terms of high cost of devices and network, low network transmission rate, and limited educational resources. Cloud based m-learning applications are presented to solve these limitations, for example utilizing a cloud with the large storage capacity and powerful processing ability, the applications offer learners with much comfortable services in terms of information size, processing speed.

2.3 Mobile Healthcare

Mobile Cloud Computing in medical applications is used to minimize the limitations of traditional medical treatment (e.g., small physical storage, security and privacy, and medical errors). Mobile healthcare (m-healthcare) offers mobile users with appropriate help to access resources easily. m-Healthcare provides healthcare organizations a diversity of on-demand services on clouds rather than standalone applications on local servers.

2.4 Mobile Banking

Mobile Banking is an uprising in traditional banking services, where user can avail the bank services provided to them through their mobile despite of location and time. Transaction can be done even if user is busy in his routine work via SMS or the mobile Internet but can also use special programs, called mobile applications, downloaded to the mobile device.

2.5 Mobile Game

Mobile game (m-game) is a prospective market producing incomes for service providers. M-game 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 demonstrates that offloading (multimedia code) can save energy for mobile devices, thereby increasing game playing time on mobile devices.

3. Advantages of mobile cloud computing

Cloud computing is known to be a promising solution for mobile computing due to many reasons such as flexibility, multiple platform etc.

3.1 Improving data storage capacity and processing power

Storage capacity is also a constraint for mobile devices. MCC is developed to enable mobile users to store/access the large data on the cloud through wireless networks. First example is the Amazon Simple Storage Service (Amazon S3) which supports file storage service. Another example is Image Exchange which utilizes the large storage space in clouds for mobile users [9]. This mobile photo sharing service enables mobile users to upload images to the clouds immediately after capturing. Users may access all images from any devices. With cloud, the users can save considerable amount of energy and storage space on their mobile devices since all images are sent and processed on the clouds.

3.2 Reliability

One of the major advantages 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.

3.3 Scalability

The cloud service providers can expand their cloud services with less effort and modification to infrastructure. They can easily add applications and services without any concern about resource usage.

3.4 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 by multiple persons simultaneously.

3.5 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.

3.6 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.

4. Disadvantages of Mobile Cloud Computing

4.1 Security

One of the major concerns with cloud computing is the security of data. Often mobile users will provide sensitive information through the network, and if not protected, can lead to major damages in the case of a security breach.

4.2 Performance

Another major concern with mobile cloud computing is with regard to its performance. Some users feel performance is not as good as with native applications. So, checking with your service provider and understanding their track record is advisable.

4.3 Connectivity

Internet connection is critical to mobile cloud computing. So, you should make sure that you have a good one before opting for these services.

5. Challenges of 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.

5.1 Variable reliability, less throughput, larger latency

Unlike fixed broadband where a physical link supports consistent network bandwidth, wireless connectivity is characterized by variable data rates and intermittent connectivity due to gaps in coverage. The dynamic nature of application throughput demands, subscriber mobility and uncontrollable factors like weather can cause bandwidth capacity and coverage to vary. Moreover, mobile broadband networks generally have longer network latency than fixed broadband.

5.2 Limited energy source of mobile devices

Another fundamental challenge arises from the fact that mobile devices are generally less powerful and use batteries, whose capacity is fundamentally limiting. It is therefore important to maximize battery life through the careful partitioning of application functions across servers and devices. The display element and cellular connectivity are the two biggest contributors of energy use in a smartphone[8]; application-rich devices tend to have larger battery packs to run larger displays and sophisticated applications. Non-display applications (for example, audio podcast, utilities like virus scanning and so on) would likely be well suited for mobile cloud computing, as these applications do not require display usage.

5.3 Variable reliability, less throughput, larger latency

The challenges presented by the resource-poor nature of mobile devices are, in one sense, drivers for adoption of mobile cloud computing. In an effort to offset device limitations, resources can be added to the cloud infrastructure to provide seamless 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. A comparison of a Dell Inspiron 580 desktop with the iPhone 4 and iPad, for example, reveals this trade off cost of mobility.

5.4 Resource poverty of mobile devices versus fixed devices

The challenges presented by the resource-poor nature of mobile devices are, in one sense, drivers for adoption of mobile cloud computing. In an effort to offset device limitations, resources can be added to the cloud infrastructure to provide seamless 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. A comparison of a Dell Inspiron 580 desktop with the iPhone 4 and iPad, for example, reveals this trade off cost of mobility.

6. Conclusion

Mobile cloud computing will become a huge market and that will attract the attention of criminals who want to make an easy profit by finding and exploiting weaknesses in mobile cloud ecosystems. Mobile cloud computing (MCC) is an emerging and futuristic technology because of variety of advantages and applications it offers to mobile subscribers. MCC offers data storage and processing capabilities to the resource limited mobile users which makes it very potential technology in future. We have mainly focused on highlighting the challenges of MCC like, Variable reliability, less throughput, longer latency, Limited energy source of mobile devices, and Resource poverty of mobile devices versus fixed devices. Mobile cloud computing is one of mobile technology trends in the future since it combines the advantages of both mobile computing and cloud computing, hence providing optimal services for mobile users.

7. Acknowledgement

This paper has benefited from conversation with many different people-far more than can be acknowledge completely here, still we would like to particularly thank, HOD of CS&IT department for his support and guidance.

References

[1] Ranbijay Kumar, Dr. S. Rajalakshmi. Mobile Cloud Computing
[2] H. T. Dinh, C. Lee, D. Niyato and P. Wang, "A survey of mobile cloud computing: architecture, applications, and approaches", Wireless Communications and Mobile Computing - Wiley, (**2011)** October.
[3] S. O. Kuyoro, F. Ibikunle and O. Awodele, "Cloud Computing Security Issues and Challenges", International Journal of Computer Networks (IJCN), vol. 3, Issue 5, (**2011)**.
[4] Abolfazli, Saeid; Sanaei, Zohreh; Ahmed, Ejaz; Gani, Abdullah; Buyya, Rajkumar (1 July 2013). "Cloud-Based Augmentation for Mobile Devices: Motivation, Taxonomies, and Open Challenges". *IEEE Communications Surveys & Tutorials* **99**.
[5] Fangming Liu, Peng Shu, Hai Jin, Linjie Ding, Jie Yu, Di Niu, Bo Li, "Gearing Resource-Poor Mobile Devices with Powerful Clouds: Architecture, Challenges and Applications";, *IEEE Wireless Communications Magazine*, Special Issue on Mobile Cloud Computing, vol. 20, no. 3, pp.14-22, June, 2013.
[6] Abolfazli, Saeid; Sanaei, Zohreh; Gani, Abdullah; Xia, Feng; Yang, Laurence T. (1 September 2013). "Rich Mobile Applications: Genesis, taxonomy, and open issues". *Journal of Network and Computer Applications*. doi:10.1016/j.jnca.2013.09.009
[7] Sanaei, Zohreh; Abolfazli, Saeid; Gani, Abdullah; Buyya, Rajkumar (1 January 2013). "Heterogeneity in Mobile Cloud Computing: Taxonomy and Open Challenges". *IEEE Communications Surveys & Tutorials* (99): 1–24. doi:10.1109/SURV.2013.050113.00090.

[8] Carroll and G. Heiser. An Analysis of Power Consumption in a Smartphone. In Proceedings of the 2010 USENIX Annual Technical Conference. 2010.
[9] E. Vartiainen, and K. V. -V. Mattila, "User experience of mobile photo sharing in the cloud," in Proceedings of the 9th International Conference on Mobile and Ubiquitous Multimedia (MUM), December 2010.