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MOBILE CLOUD COMPUTING VIS-À-VIS ECO FRIENDLINESS FOR SUSTAINABLE DEVELOPMENT

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Abstract:

Cloud Computing is a kind of virtualization where all the IT resources are available through the internet and networked services. Cloud Computing is a kind of utility computing which can scale out and matter the workload demand. Mobile Computing is the ability to use computing capability without a predefined location as well as connection to a network to publish and or subscribe to information. Actually, the combination of mobile computing and cloud computingarehelpful for potential mobile services. Mobile Cloud Computing deals with so many advantages to the conventional mobile services and mobile computing. Though it has some challenges and issues but ultimately it deals with several opportunities in the area of sustainable green computing which are discussed in a very brief manner in this paper.

Key Words: Cloud Computing, IT, Information Services, Mobile Informatics, MCC, Mobile Cloud Computing & Energy Informatics.

1. Introduction:

Mobile Cloud Computing is actually extension of Cloud Computing application in the mobile services or Mobile applications using Cloud Computing devices [1-5]. Mobile Cloud Computing at its simplest refers to an infrastructure where both the data storage and data processing happen outside of the mobile device [6-7]. Mobile Cloud more than computing power and data storage away from mobile phones and into the Cloud, bringing applications and mobile computing to not just smart phone uses but a much broader range of mobile subscribers' *(according to Mobile Cloud Computing Forum)*. Mobile applications or simply mobile apps may be much smarter with higher computing, storage and communication fault tolerance than regular Cloud Computing does. Practically mobile apps may use the cloud for better application development as well as hosting [8-9].

2. Objectives:

This paper is a basic overview based on theoretical and conceptual paper and deals with so many aim and objectives such as—

- ✓ To know basics about the Cloud Computing; including its features and advantages and opportunities.
- ✓ To learn about the basics of Mobile Computing with its features and need, requirement.
- ✓ To predict the possible integration of these two fields based on unification of scientific theories.
- ✓ To study about the contemporary issues related to Mobile Cloud Computing and its applications in information processing.
- ✓ To analyze the security issues related to Mobile cloud computing.
- ✓ To discuss the challenges, opportunities and future potentials related to Mobile Cloud Computing as a sustainable information processing technology.
- ✓ To study eco-friendliness of Mobile Cloud Computing processes for sustainable green computing.

3. Mobile Computing:

Mobile Computing is actually a Human Computer Interaction process in which computer is expected to be transported during normal usage. Mobile Computing virtually involves mobile communication, mobile hardware and mobile software, Mobile Computing is not depends on a particular place and may be run remotely with sophisticated support of network or network technology [10-12]. Mobile Cloud Computing is deals with three major facets; where the major is Mobile Communication and here adhoc and infrastructure network and communication properties, protocol and data formats [13-14].

4. Cloud Computing:

Cloud computing services refer to set of IT-enabled services delivered to a customer as services over the Internet on a leased basis and have the capability to extend up or down their service requirements or needs. Usually, cloud computing services are delivered by third party vendors who own the infrastructure. It has several advantages include scalability, elasticity, flexibility, efficiency, and outsourcing non-core activities of an organization. Cloud computing offers an innovative business concept for organizations to adopt IT enabled services without advance investment. Being a model for enabling convenient, on-request network accessibility to a shared pool of IT computing resources like networks, servers, storage, applications, and services, cloud

computing can be quickly provisioned and released with negligible management exertion or service provider interaction [15].

In the cloud deployment model, the services like platform, networking, storage, and software infrastructure are provided as services that scale up or down depending on the demand. The Cloud Computing model has three main deployment models which are: (1) Private cloud model used to describe offerings that imitate cloud computing on private networks. (2) Public cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provided on a self-service, fine-grained basis over the Internet, via web applications/web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis.(3) The hybrid cloud model is a merger of two or more kinds of cloud deployment models such as private, public or hybrid. The participating clouds are bound together by a standard set of protocols. It enables the involved organization to serve its requirements in their own private cloud and in the case of critical needs cloud bursting for load-balancing occur they can avail services from the public cloud [16].

5. Mobile Cloud Computing: Combination of Two Major Fields:

Mobile Cloud Computing is a kind of combination of cloud computing as well as mobile networks to bring benefits for mobile subscriber or user, network operators and obviously Cloud service providers. The integration of Cloud Computing into the mobile environment and overcomes the problems related to performance, scalability or availability, security [17-19]. During last some years, the need and importance of mobile based services are increased and the potentiality of cloud computing into mobile era create a new healthy dimension i.e. Mobile Cloud Computing. Today many mobile phone and digital service providers are working on better Mobile Cloud Computing practice.

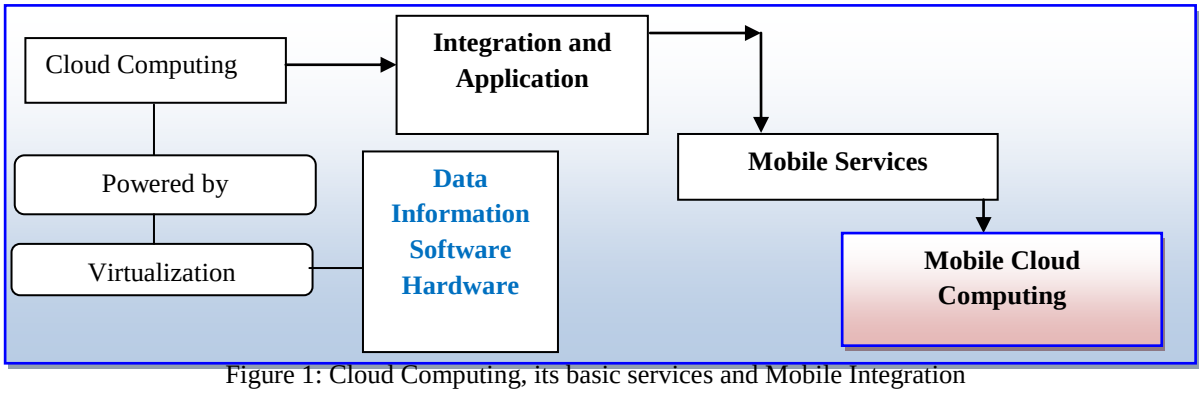

Figure 1: Cloud Computing, its basic services and Mobile Integration

Mobile Cloud Computing results very prominent output like heavy better life, storage system and bandwidth i.e. Performance. Superior Environment i.e. heterogeneity, scalability and availability and another is security in the conventional mobile computing. In Mobile Cloud Computing, Cloud Computing exists when tasks and data are kept on the internet rather than on individual devices, providing on demand access [20-21]. The main advantages in Mobile Cloud Computing is that, it's comes with several opportunities and benefits and particularly the hardware benefits; as such services are only offered inside the cloud or virtualization [22-23]. Today many services related to Mobile Cloud Computing are available like- E-Mail, Maps and navigation system, voice search, spoken web and so on. Some example of services and providers of Mobile Cloud Computing are listed in figure 2.

Mobile Cloud Computing is comes with so many advantages and benefits such as—

- ✓ Battery is one of the important matters in mobile devices. There are so many tools and systems are proposed and introduced over the period but most of the cases such requirement are new hardware and computing devices. Hence, it is helpful that, only Cloud Computing solution to the mobile promotes conventional mobile computing services. Actually, Mobile Cloud Computing also permits less execution time on mobile device and thus promote power consumption;

Company / Providers	Services Available
Google	G-Mail
Google	Maps and Navigation Systems
Apple	Mobile Me
Microsoft	Live Mesh
Motorola	Moto Blur

Figure 2: Some Mobile Cloud Computing service providers and their services

- ✓ Storage is also an important matter in mobile services and mobile computing; but Mobile Cloud Computing as deals with virtualization and so also remotely software and application are sharable and there is no need of heavy storage system directly to the concerned mobile device or computer as it is powered by remote storage systems. Hence the user can access the needed content like picture

depending upon need and most of the companies offer such services free of cost [20, 24-25]. Many of the services providers provide the opportunities of direct photo uploading and storage in the cloud when used. Some popular service providers are

- ✓ Amazon Simple Storage Services;
- ✓ Image Exchange Systems;
- ✓ Flickr;
- ✓ Shozu;
- ✓ Facebook

- ✓ Uploading and downloading content such as text, image, audio, video are become easy and reducing time [26-27]. Hence Cloud Computing in mobile based services financially helpful and round o 'clock available with minimum time. Thus, Mobile Cloud Computing is time saving tool.
- ✓ Mobile Cloud Computing (MCC) also promotes the reliability with such services. One can get direct services through the cloud back up. It reduces the chance of data and application lost on the mobile devices. It is also a sophisticated security keeper for better user and service providers. In most of the cloud services, authentication and security service is provided before uploading and downloading content. Hence Mobile Cloud Computing or MCC is also improving reliability.
- ✓ The MCC uses cloud computing part of the model as a service, cloud platform as a service, and cloud infrastructure as a Service.

6. Securities and Mobile Cloud Computing:

- ✓ Though Cloud Computing is deals with so many opportunities and possibilities but also deals with so many challenges and issues; and out of these, Security is the major concern. It is very much essential that, every Mobile Cloud Computing user need to ensure about the integrity of the information stored on the cloud. Authentication and verification is very much needed in all the access. There are several authentication mechanisms is there is market; but it is essential to keep in mind the requirement and mobile environment. Log in ID, Password, PINS, Authentication request. Use of antivirus is very much essential to keep the up to date and reliable.

  Today we can see so many contents which are including video, image, audio and e-book on the web and most of them are without maintaining copyright and hence illegal. Thus, it is better to use better encryption and decryption for better Mobile Cloud Computing.
- ✓ Several mobile tolls such as cell phone, PDA and Smartphone may also deal with the so many security threats as well as their vulnerability and thus these things are essentials to take care.
- ✓ Use of Cloud computing model through mobile devices supports to increase the security through detection of malicious software in cloud itself before they enter the software of mobile device.
- ✓ Cloud computing section of the cloud computing model can use computing resources so that be responsible in decreasing on-device resource consumption to save energy.
- ✓ Cloud computing section of the cloud computing model can simplify the internal hardware complexity of mobile devices.

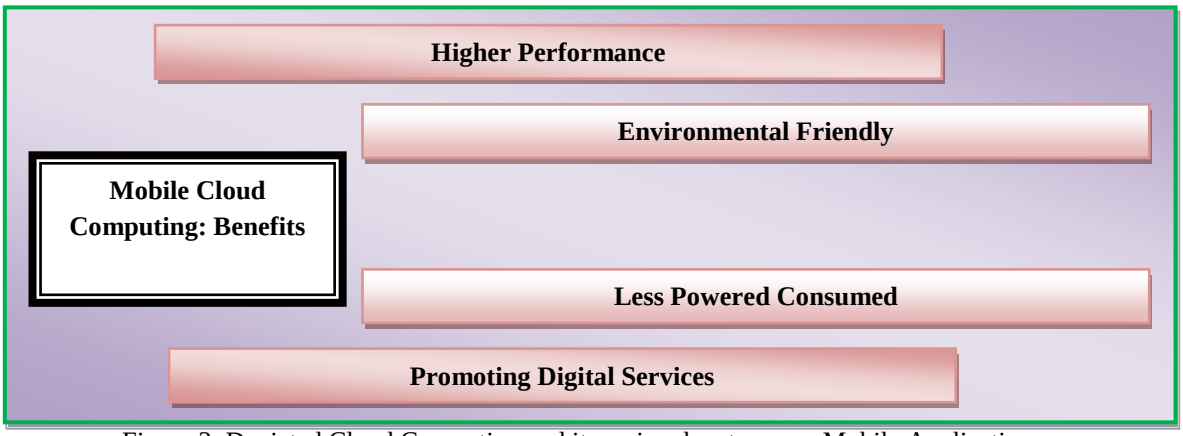

Figure 3: Depicted Cloud Computing and its main advantages on Mobile Applications

7. Challenges and Opportunities for Mobile Cloud Computing:

The challenges, opportunities and future potentials related to Mobile Cloud Computing as a sustainable information processing technology.

- ✓ Challenges posed by MCC are privacy, personal data management, identity authentication, and potential attacks. The security issues are a major hindrance in the mobile cloud computing's adaptability [28].
- ✓ Energy efficiency has always been critical for mobile devices and the importance seems to be increasing. Use cases are developing towards always on-line connectivity, high speed wireless

communication, high definition multimedia, and rich user interaction. Development of battery technology has not been able to match the power requirements of the increasing resource demand.

- ✓ The requirement of high network bandwidth for faster connections and data exchanges between mobile devices and the cloud service provider creates challenge of using MCC in many applications.

8. Mobile Cloud ComputingProcesses for Sustainable Green Computing:

Performing mobile computing processes using remote devices through cloud computing model will certainly reduces power consumption in mobile computing processors. Eco-friendliness of Mobile Cloud Computing processes for sustainable green computing. It is found that using cloud computing model based power-aware scheduling techniques, variable resource management, live migration, and a minimal virtual machine design, overall mobile system efficiency can be vastly improved in a data center based Cloud with minimal performance overhead [29].Cloud computing based mobile computing processes allow virtualization of mobile device operations and hence reduce power consumptions. In virtualization, one physical server hosts multiple virtual servers/mobile devices. Virtualization enables mobile devices to strengthen their cloud based server infrastructure by hosting multiple virtual servers on cloud using less consumption of electricity.

9. Findings

- ✓ In Mobile Cloud Computing communication no longer run on a particular private network; some run over very less secure public carrier networks.
- ✓ Privacy, data ownership, data access and security are very important security issues as far as Mobile Cloud Computing is concerned.
- ✓ Mobile Cloud Computing is deals with so many limitation which includes cloud service cost, scalability, mobile network, service availability, heterogeneity, issues in computing offloading and so on.
- ✓ Mobile Cloud Computing become easy and proper tool not only industries but also business, education and corporate houses.
- ✓ Mobile device based Cloud Computing processes are eco-friendly so that they support sustainable green computing.

10. Conclusion:

The main aim these days, for adopting mobile Cloud Computing is the ability to deploy applications access multiple carrier networks, under a single commercial agreement. Mobile Cloud Computing becomes popular tool among the common mass for its efficient uses, reliability, power management and cost saving approach. Ultimately a better Mobile Cloud Computingpromotesutility a better mobile Cloud Computing promote utility computing and hence service oriented architecture web based application and data storage services. UltimatelyAPI or Application Programming Interface offer a transparent access to mobile services and allied domain.Mobile Cloud Computing processes are eco-friendly so that they support sustainable green computing.

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