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Offloading Methods in Mobile Cloud Computing

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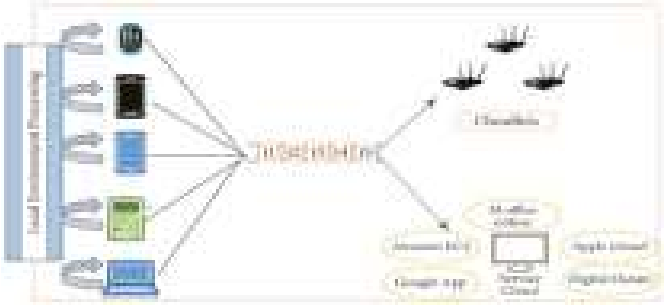
Abstract - Based on user behavior and demand, the computational tasks are first offloaded from mobile users to the mobile edge network and then executed at one or several specific base stations in the mobile edge network. The MEC architecture has the capability to handle a large number of devices that in turn generate high volumes of traffic. In this work, we first provide a holistic overview of MCC/MEC technology that includes the background and evolution of remote computation technologies. We further discuss the challenges and potential future directions for MEC research.Offloading works as the fundamental feature that enables MCC to relieve task load and extend data storage through an accessible cloud resource pool. Several initiatives have drawn attention to delivering MCC-supported energy-oriented offloading as a method to cope with a lately steep increase in the number of rich mobile applications and the enduring limitations of battery technologies. However, MCC offloading relieves only the burden of energy consumption of mobile devices; performance concerns about Cloud resources, in most cases, are not considered when dynamically allocating them for dealing with mobile tasks. The application context of MCC, encompassing urban computing, aggravates the situation with very large-scale scenarios, posing as a challenge for achieving greener solutions in the scope of Cloud resources. Thus, this article gathers and analyzes recent energy-aware offloading protocols and architectures.

Introduction - Cloud Computing is an emerging paradigm which caters to the use of a number of remote servers that are hosted on internet, to store and manipulate data. There is no need to keep huge data and its transactions on a local or personal computer. As per NIST (National Institute of Standards and Technology), Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of computing resources that can be rapidly provided with minimal management efforts. As the Cloud Computing uses pay as you demand strategy, it is considered to be the most economical way of using the network services. Cloud Computing is described as a distributed system that gives computing services via the TCP/IP. The main benefits of Cloud Computing are on demand self-service, ubiquitous network access, location independent resource pooling and transfer of risks. Certain additional advantages are lower costs, ease of utilization, quality of service and reliability. The problem areas include risk of data confidentiality, complete dependency on internet connection and quite vulnerability to infiltration. However, the Cloud Computing has played a vital role in today's world. There are two types of Cloud Computing models namely Deployment Model and Service Model. The Deployment model consists of Public Cloud, Community Cloud, Private Cloud and Hybrid Cloud. It mainly deals with the provision of internet to a particular number and type of users. On the other side the Service Model takes into account the infrastructure, software, platform and desktop as a service in cloud computing.

Mobile Computing is a paradigm that transmits data, voice and video through a computer or any wireless enabled device. The major components involved are Mobile Communication, Mobile Hardware and Mobile Software. The Mobile communication is the term which is used for seamless and reliable communication. This includes devices such as protocols, services, bandwidth and other portals. The Mobile Hardware includes hardware devices like laptops, mobile phones and palm tops. Mobile Software is the program that runs on the mobile device. It deals with the characteristics of mobile applications. It includes all the features of mobile communication. Mobile Cloud Computing is an integration of cloud computing technology with mobile computing to make mobile devices resource-full in terms of computational power, memory, storage and energy. According to the Mobile Cloud Computing Forum "Mobile Cloud Computing at its simplest form 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".

Mobile Cloud Computing centers are accessed via a mobile browser from a remote web server, without the need for installing a client application on the recipient phone. In other words, Mobile Cloud Computing means to run an application for mobile on a remote resource rich server while the mobile device acts like a thin client connecting over to the remote server through a wireless media like 3G, 4G or Wi-Fi. A mobile cloud approach enables developers to build applications designed specifically for mobile users without being restricted by the mobile operating system and the computing power or memory capacity of the smart phone. Some examples of Mobile Cloud Computing are Facebook services, twitter for mobile and mobile weather widgets. With the ever-going usage of Internet, there is a growing trend of disseminating and exchanging information via the Mobile Cloud Computing paradigm.



Concepts and background

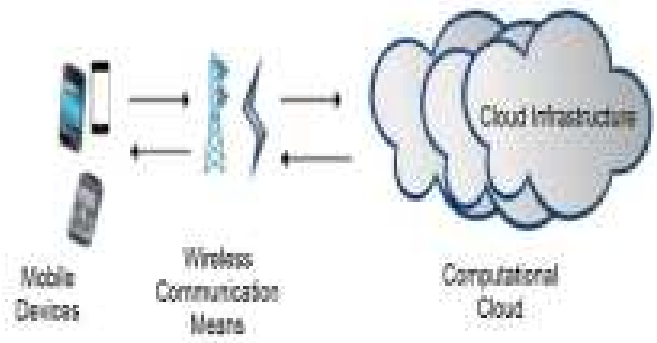
Cloud computing: CC is a new way of providing computing resources and services. It refers to an on-demand infrastructure that allows users to access computing resources anytime from anywhere. CC offers to users and business three main advantages:

1. Enormous computing resources available on demand,
2. Payment for use as needed and on a short-term basis (storage by the day and release them as needed), and
3. Simplified IT management and maintenance capabilities.

CC provides clients with different applications as services via the Internet. As examples of public CC we can list Windows Azure and Amazon Web Services (AWS). Windows Azure is an open and flexible cloud platform which provides several services to develop, deploy and run web applications and services in cloud data centers. AWS, which is considered as an example of a public computing tool, provides users with two models: infrastructure as a service and software as a service. These services allow the user to use virtualized resources in cloud data centers. Computational clouds implement a variety of service models in order to use them in different computing visions.

Mobile cloud computing:MCC can be seen as a bridge that fills the gap between the limited computing resources of SMDs and processing requirements of intensive applications on SMDs.

The Mobile Cloud Computing Forum defines MCC as follows: "Mobile Cloud Computing at its simplest form 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".



MCC has attracted the attention of business people as a beneficial and useful business solution that minimizes the development and execution costs of mobile applications, allowing mobile users to acquire latest technology conveniently on an on-demand basis.

Objective (s) /need of study:

1. To analyze and implement various existing Computation Offloading approaches in Mobile Cloud Computing.
2. To improve Mobile Computation offloading methods to reduce computational overhead.
3. To evaluate the performance of the proposed strategies in terms of efficiency and context awareness parameters like performance enhancement, local resources access and computational intensity.

Need of the study: The aim of this study is to the Computation Offloading is migrating all the process or a part of the application to the Cloud for execution. Mobile Cloud Computing uses different application development models that support computation offloading. Generally there are two environments where the applications can be held––the smartphone and the cloud. Hence, Mobile computing assisted with cloud computing gives us the benefit to transfer, storing of data and its processing is done at the cloud end. To deploy this advantage, the consumer and enterprise markets are increasingly adopting this mobile cloud approach to provide best services to the customers and end users. It will boost their profits by reducing the development cost incurred in developing mobile applications. The infrastructure-based architecture of MCC is taken into consideration in which the computer infrastructure does not change positions and provides services to mobile users, via Wi-Fi or 3G. These models migrates heavy applications to the cloud through a process module and application that is in the cloud and helps to

execute mobile phone's requests. There are two types of Mobile Cloud Applications which are almost similar in nature.

Conclusion: This paper discusses three main concepts: (1) cloud computing, (2) mobile cloud computing, and (3) computation offloading. More specifically, it presents existing frameworks for computation offloading along with the various techniques used to enhance the capabilities of smartphone devices based on the available cloud resources. The paper investigates the different issues in current offloading frameworks and highlights challenges that still obstruct these frameworks in MCC. Moreover, the paper shows the different approaches that are used by the frameworks to achieve offloading. Some of these approaches use static offloading while others employ dynamic offloading. Even though there exist a variety of approaches, all of them target the same objective which is the improvement of the smartphone device capabilities by saving energy, reducing response time, or minimizing the execution cost.

We notice that current offloading frameworks are still facing some challenges and difficulties. For instance, lack of standard architectures. This shortage leads to more complications while developing and managing a proposed framework. Finally, it is important to come up with a lightweight paradigm or model that will help to overcome the difficulties and minimizing efforts while developing, deploying, and managing an offloading framework.

We believe that exploring other alternatives, such as introducing a middleware based architecture using an optimizing offloading algorithm, could help better the available frameworks and provide more efficient and more flexible solutions to the MCC users

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