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A Review on Approaches Involved In MCC Environment For Offloading Computations

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Abstract: Cloud computing is the rising field of information technology in which resources like memory, processing and storage are not physically available at the user's place, but it is available virtually for the user's on the cloud with internet connection. The latest and effective example of the technology is Amazon web services cloud which provides the storage space for the personal data and also provides computation by using Elastic Compute cloud. This concept is also gives an advantage in the mobile computing where the resources like battery life, network bandwidth, storage capacity, and processor performance are limited and leads to slow processing. The problem is solved by the approach computation offloading which sends the complex data to the cloud server and perform effectively. Some issues are also associated with these processes that are solved by the researchers using different approaches and algorithms. From the past development in the field of offloading here we discuss some of those approaches in detail.

Keywords: Elastic Compute cloud, computing, offloading

1. INTRODUCTION

Mobile Computing is developed with a high rate in the last few years which changes the user's preferences for computing. The devices used traditionally are replaced by the mobile devices like PDA, digital camera, and GPS systems. Mobile communication tools are very convenient communication tool which provides effective communication at anytime and anyplace. The human dependency of the mobile devices is increased because it performs most of the daily life task efficiently. Different types of application are supported by the mobile devices like gaming, management, e-learning, healthcare and multimedia features. As the development in mobile communication area is increased requirements of the users are also increased which leads to complicated application. The complex mobile application needs an effective device, as well as computation, become complicated and slow. The tasks like video processing and object recognition need a lot of computation in the device and use the resources of the device [1].

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A. Mobile Cloud Computing

Mobile cloud computing (MCC) is an enhanced technology of the cloud computing which extends the usage of resources effectively. In mobile cloud computing data processing and storage is happened outside the mobile on the cloud. This service of the MCC enhances the performance of the mobile devices. The mobile utilities are acquired past wireless connection and there is no need of powerful hardware and memory to perform the complex tasks [2].

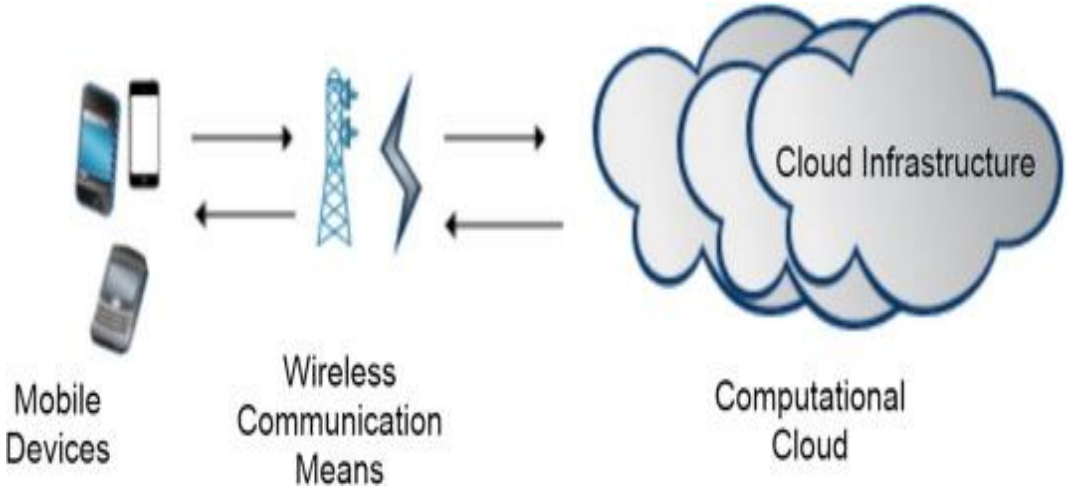

Figure 1.1: Mobile Cloud Computing Environment [1]

B. Computational Offloading

Computational offloading is a process whereheavy loads of the mobile applications are transferred to the powerful cloud servers which improve the capabilities of the mobile services. Computation offloading saves the energy of the mobile devices by performing the complex task on the cloud. A virtualization is an approach which enables the cloud computing services by remote access and explores the feature of computation offloading. In computation offloading process firstly surrogate server or resource is discovered and then resource estimation is done. After the estimation partitioning is done according to the task. The task performs in offloading consumes fewer resources as compared to local mobile resources [2].

Computational Offloading Framework: It is a process in which resource intensive tasks are performed on the cloud to resolve the issue of resource limitation and also reduce the total execution time. Before stating the offloading process we need to anticipate about the section of the application which should be offloaded. The offloading process is divided into modules and called as static and dynamic partitioning.

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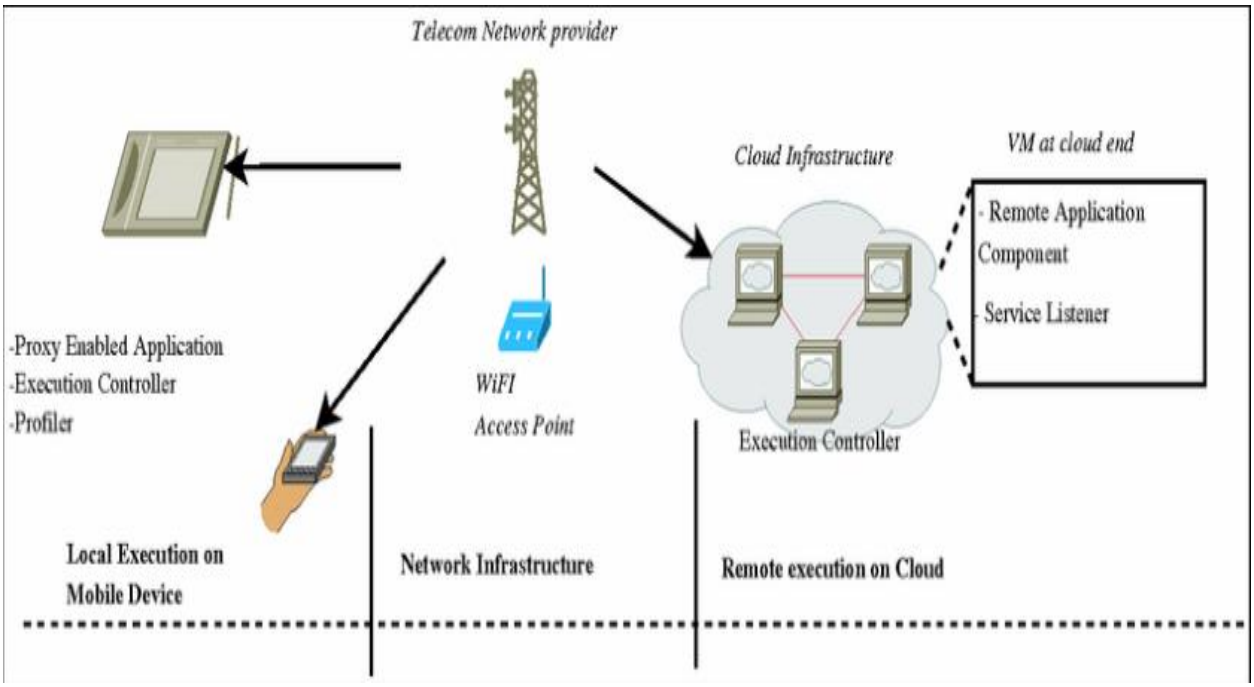

Figure 1.2 Computation Offloading Framework [7]

2. SOME COMPUTATIONAL OFFLOADING FRAMEWORK

In this section we discuss the frameworks that are used for offloading in the existing researches. Some of them are discussed here in brief.

A. HMCC Framework: Frameworkof Hybrid Mobile Cloud Computing mainly enhances the energy efficiency of the offloaded computation. It uses different types of resources having different proximity and scalability to offload the computation from the mobile devices having different quality requirement.

B.Aura: This framework enables the clients to form an improvised cloud by utilizing a system of interrelated computing devices and other processing devices that are close by. When cloud server connectivity is unavailable this framework works proficiently. In this client is able to restart, stop and start the computation when needed. It also supports the migration of computation between the mobile nodes and physical location. Multiple controllers are accountable for the synchronization and scheduling among the IOT devices and clients.

C. Avatar: This framework support the mobile distributed computing in cloud. Automatically spawned programact as amediatoramid archetype and client. The avatar behaves like surrogate on which computation are offloaded. It runs the complete application and components of application. In this framework, the client users are not able to directly connect with avatars.

D. MALMOS: MALMOS is symbolization for Machine Learning Based Mobile-offloading. It serve asmachine-learning based runtime scheduler in an online mechanism which vivaciouslyaccustoms scheduling decision. It mainly focus on decision making for offloading with the assistance of machine learning. Thisarchitecturebehaves as a run-time scheduler to render better user expertise.

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E. MoSeC: It implies for Mobile cloud service composition framework. It involves severalstand-in sites to fulfill the service requests of patron devices. Theresource constraints and mobilityof surrogate sites are the chief concern while selecting the site to offload the computation from the contestant sites. This framework considers the series decision rather than one time decision.

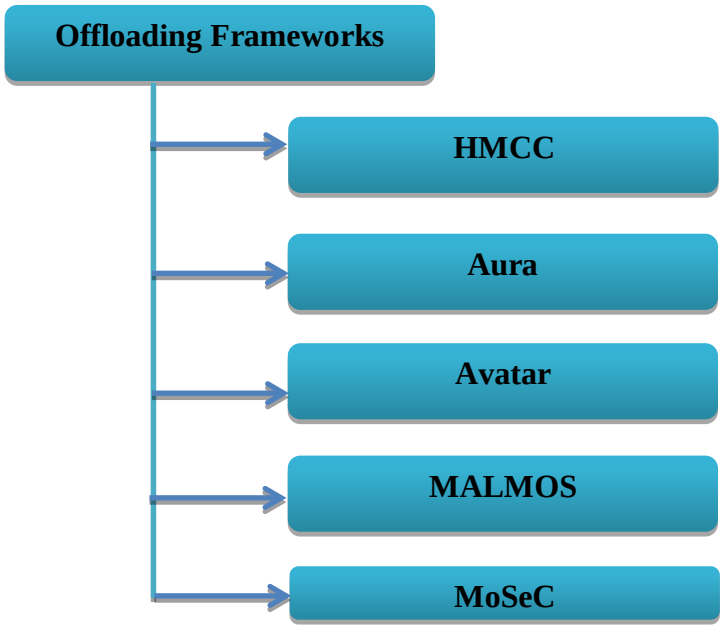

Figure 1.3 Different types of offloading framework

3. VARIOUS APPROACHES USED FOR COMPUTATION OFFLOADING

Mobile cloud computing works on the concept of computation offloading which is normally perform distributed computing at the runtime. Utilization of the lightweight operations for computational offloading in mobile computing environment during runtime has solved the main issue confronted by application processing platform [1]. A genetic algorithm is presented which uncovers the dependency relations among the services and refines the time and cost for making sturdy decisions in offloading. The trade-off fault tolerance and mobility model are utilized for the offloading system. Reduction in the complexity has been achieved with the design and implementation of the genetic algorithm based offloading approach [2].Intensive mobile applications in the mobile computing environment practise frameworks that results into energy efficient computational offloading. These techniques also helps in cutting the cost that imbibes in energy consumption as well as it reduces the size of data while transmission. EEOF approach is energy efficient and provides application layer solutions for computational offloading [3].

Data Binding and Computational offloading are such approaches that are used for providing the capability of resources at low cost by using cloud with mobile. Mobile application can be coupled with cloud resources viacode offloading and task delegation approach. Delegation model involves the utilization of cloud through service oriented approach by mobile handsets. In offloading model, mobile application is divided in parts and then analyze on the basis of code level and check the computation cost according to

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the code and then offload the application to the surrogate cloud [4].Mobile application based on the inference algorithms required a lot or resources to process the request according to use. These types of application enhance the workload on the resources so that they are transferred to the cloud for effective response. In this work three optimization techniques are implementing to empower the application. It provides continuous, accurate and energy efficient mobile applications [5].

Mobile cloud computing supports the different types of computational offloading method. A detailed survey is presented in this work. The computational offloading framework, big data offloading and the issue related to computational offloading is described in this article [6].The architecture is proposed to understand the challenges associated with the computation offloading. In this experiment off loadable class is considered which have offloadable proxies. The profiler monitors the parameter of the application that is memory, bandwidth and CPU utilization [7]. An agent based MCC frame work is produced which enables the offloading in it. The agents make the decision faster in this approach and increase the energy saving with multiple users with effective computation time and bandwidth. The dynamic programming after filtering algorithm is also proposed to transform the 0-1 knapsack problem by filtering process on agent [8]. The concept of tail matching in subsequence is proposed for mobile access prediction. This approach is named as MAGA, it is a method for offloading decision making for distributed MCC. The offloading decisions are based on adaptive genetic algorithm [9]. The scalability problem in MCC is solved by this approach. In this approach IOT, cloud, MEC are integrated for the selective offloading process. This approach makes a green internet of things environment by encapsulating latency requirement in offloading request. This approach is helpful in minimizing the energy consumption of the devices and reduced the signal overhead by self-nominated and self-denied offloading process [10].

Table 1.1 Existing Method of computation offloading

Paper	Objective	Granularity	Scheme	Parameters	Effect
[1]	Analysis of the various offloading approach	Method	Run time	Computation time	Reduced
[2]	Providing effective service offloading in mobile cloud computing	Method	Genetic Algorithm	Complexity	Reduced
[3]	Providing Energy efficient computational offloading	Component	EEOF Approach	EnergyConsumption Size	Reduced Reduced
[4]	Providing the capability of resources at low cost by using cloud with mobile providing the capability of	Component	Delegation Model	Cost	Reduced

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	resources at low cost by using cloud with mobile				
[5]	Implement the optimization techniques to empower the application	Component	Inference algorithm	Energy	Reduced
[6]	Providing the detail information on various offloading approaches	Clones	Different Offloading	Energy Accuracy Size	Reduced Reduced Reduced
[7]	Proposed architecture to understand the challenges associated with the computation offloading.	Class	Offloadable proxies	Memory Bandwidth CPU utilization	Reduced Reduced Reduced
[8]	Enables the offloading in multiuser system	Agent	Filtering algorithm	Bandwidth Knapsack Problem	Not reduced Effectively Solved
[9]	ProvidingComputation Offloading Decision for Distributed MCC	Method	Adaptive Genetic Algorithm	Scalability	Improved
[10]	Integrate the MEC for selective offloading process.	Method	Edge Computing	Energy consumption Signal Overhead	Reduced Reduced
[11]	To achieve efficient offloading	Approach	Game theory	System Size	Increased
[12]	Providing effective cloud computing capabilities in MCC	Method	Game theory	User Size	Increses
[13]	Presenting MAC to enable adaptive extension of android application from mobile to cloud	Agent	Mobile augmentation cloud services	Energy	Reduced

4. CHALLENGES AND ISSUES IN MOBILE CLOUD COMPUTING

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Following are some problems and issues related to the computation offloading that are explained in this section. Here we discuss the important issues in this field that are Security, privacy, infrastructure and granularity [7].

A. Granularity: There are many issues related to the different types of granularity like object identity, state transfer and compatibility. The implementation of optimal granularity level is very difficult.

B. Security and Privacy: This is the most important issue related to the security of confidential information of the user. The data store in cloud service provider is readable by the cloud provider without any knowledge of the user. So, it is a big challenge to maintain the security in mobile cloud computing environment.

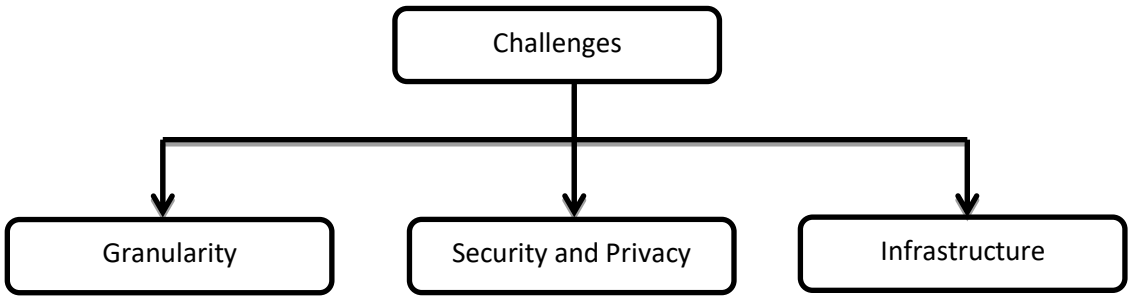

Figure 1.3: Challenges in MCC during Offloading process

C. Infrastructure: In this type the issues like mobility, fault tolerance and inter-operability are considered. The computation capability of the system is different which leads to a big issue in compatibility. The congestion on the same resource or server leads to failure of communication.

5. CONCLUSION

In this paper, a review is presented on the approaches of computation offloading in mobile computing. In this work the virtualization and mobile agents enabling process is discussed. Different types of algorithm and approaches are discussed in this paper in brief to show how they improve the performance in the mobile cloud computing. In these paper different frameworks, algorithms and challenges related to the offloading is discussed in the brief.

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