Survey on Offloading Computation in Mobile Devices

B. Thaarani[1], Mrs. T. Maragatham[2], Dr. S. Karthik[3]
[1]PG Scholar, [2]Assistant Professor, [3]Professor and Dean
Computer Science and Engineering, SNS College of Technology, Coimbatore, India

Abstract- Mobile devices do not have sufficient resources, such as battery life, network bandwidth, storage capacity and processor performance. As Smart phones are becoming more popular, more new mobile applications are emerging and has great attention, these applications needs increasing computational power. So a challenge arises between the mobile applications that requires large amount of resources and mobile devices that does not have sufficient resources .To solve this problem, cloud computing services are used in mobile devices. This paper provides overview on mobile cloud computing and computation offloading techniques.

Keywords: Mobile cloud computing, offloading computation, Nash equilibrium, mob-aware.

I. INTRODUCTION

Cloud computing is an internet based computing and focuses on maximizing the effectiveness of the shared resources. Cloud computing refers to applications and services offered over the internet. Cloud can be classified as public, private and hybrid. Cloud provides service models such as Iaas, Paas, and Saas. Cloud includes three components, client computers, distributed servers and Data centers. Clients are devices where the user interacts with the cloud. Data center includes group of servers where the application is placed. Distributed servers are located at different places, but they appear as working next to each other

The Growth in the use of smart phones, their applications and emerging cloud computing concept, mobile cloud computing is been introduced. Mobile computing is taking a computer and all necessary files and software out into the field. Here data processing and data

storage are done outside of the mobile devices. Mobile computing refers to a variety of devices that allow people to access data and information from where ever they are.

Mobile cloud computing brings benefits to mobile users by the combination of cloud computing and mobile networks, as well as cloud providers. Mobile cloud computing is a combination of cloud computing and mobile environment.

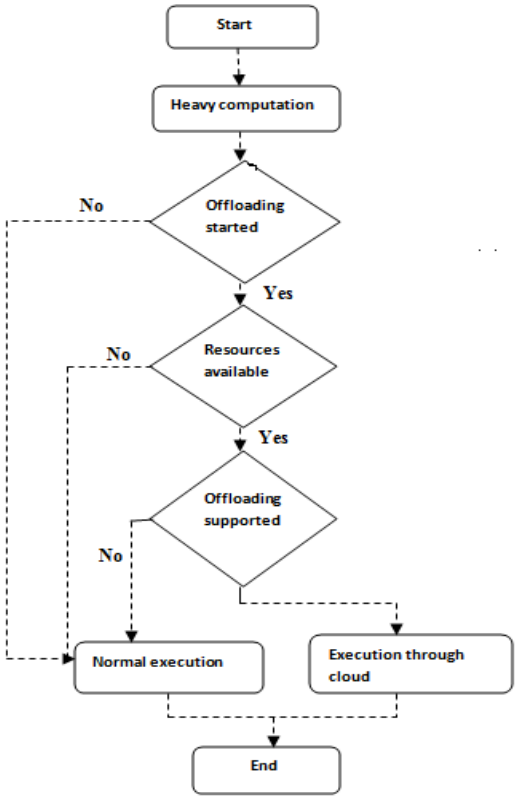

Fig 1. Computation offloading process

The key requirements for mobile cloud computing includes web interface, internet access to remotely store the applications in the cloud. Mobile cloud computing includes two perspectives, Infrastructure based and Ad-hoc mobile cloud. In Infrastructure based, the services are provided to mobile users by hardware infrastructure is static. In Ad-hoc mobile cloud, number of mobile devices act as a cloud.

Large amount of computation is been sent to the servers and result is been gained, which is referred to as computation offloading. Computation offloading moves programs to server which is outside the users computing environment

Offloading helps to save energy and improve performance in mobile devices.

II. LITERATURE SURVEY

Decentralized Computation Offloading:

This technique uses a game theoretic approach in order to achieve efficient computation offloading[1] decision making between the mobile devices, as a decentralized computation offloading game. Game theory is a tool that helps to control the interactions between multiple mobile devices who act in their own interest[1]. In Decentralized computation offloading technique the mobile users take decisions locally, which decreases the controlling and signaling overhead. This technique achieves Nash equilibrium of the offloading game in homogeneous and heterogeneous cases. In homogeneous case, the game includes cloud computing structure and provides the presence of Nash equilibrium, in heterogeneous case the game is a potential game and includes Nash equilibrium. Here one mobile user is allowed to improve its offloading decision at a time, using clock signal for synchronization.

Adaptive Computation Offloading:

This technique includes 2 methods, two competitive timeout and statistically optimal timeout[2].

The two competitive timeout defines break-even time of offloading as minimum execution time for computation. Energy consumption is been considered for performing the computation in client and offloading it to server. For the purpose of offloading the energy consumption considers four parts: energy required to transmit the input data, the energy for getting the result, energy of processor when it is idle during remote computation, energy of network when it is idle during computation. The application that requires short computation runs on client and applications that require large computation runs on server.

Statistically optimal timeout includes the statistical information to find optimal timeout in order to reduce the energy expected by the client[2].

Offloading Computation To Save Energy:

Virtualization distinguishes cloud computing from existing client server model. Cloud vendors executes the programs given by users through virtualization[3] ,where in client server computing ,programs run on server are managed by service provides .The mobile users makes use of the computing cycles provided by cloud vendors to minimize the amount of computation on mobile devices and saves energy.

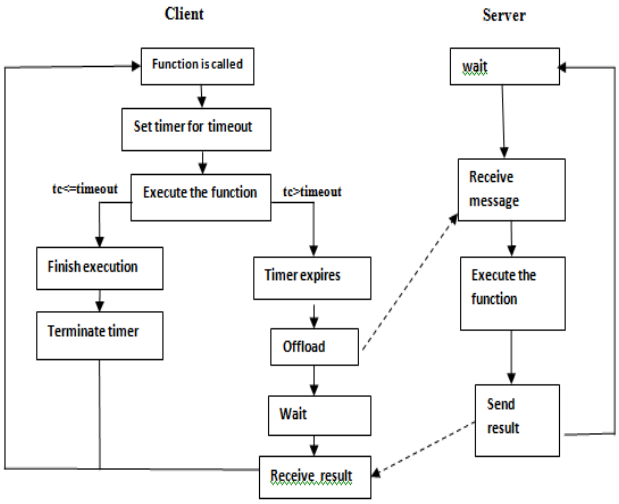

Fig 2. Adaptive computation offloading

Mobility Aware Offloading Decision Making:

The decision of offloading is said to be good when offloaded computation[1] is better than local computation. Mobility aware offloading decision making named as Mob-aware gathers user movements and network changes based on the movements, with the gathered data they build a mobility model. In mobility model, Mob-aware decision maker predicts network condition changes. The user mobility is given by sequence of networks to which users are connected. When the mobile user is connected to wireless access point, the location of that user is specified by the wireless access point ID.Prediction Engine is been used here that gives the expected response time of the computation offloaded and the local computation[4].

Energy-Efficient Multisite Offloading:

Energy-efficient multisite offloading provides multiway partitioning problem as the 0-1 Integer Linear Programming problem. In the computation offloading, the execution of application is divided between the mobile devices, which include the server to perform computation offloading. Graph partition problem describes which part of computation is to be offloaded. In energy-efficient multisite offloading, the program is divided as weight object relation graph. In this graph, the nodes are represented as computation module and

edges are represented as interaction between modules. By using the weight of the edge for communication and weight of node for computation, the cost of partitioning can be calculated. A multiway graph partitioning based algorithm is used to get best trade-off between the communication cost and computation cost.

III. CONCLUSION

This paper provides survey on various offloading computation techniques used in mobile devices. Here cloud computing services are used in mobile devices. Due to unavailability of resources in mobile devices, the applications are offloaded to the cloud server to get the result. Offloading computation can be done either in cloud through virtualization or can be done locally in mobile devices. Offloading computation helps to save energy and improve the performance and energy efficiency in mobile devices[5].

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