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ENERGY EFFICIENT RESOURCE ALLOCATION USING CLOUD LAYERED ARCHITECTURE IN MOBILE CLOUD COMPUTING

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ABSTRACT

Energy efficiency in mobile cloud computing is the main focused area. Resource availability is most important in MCC .Researches have been worked for resource sharing among multiple mobile devices with many algorithms to design energy efficient resource allocation in MCC. This paper proposes a cloud layered architecture. The proposed framework is used to reduce the cost of energy consumption among all users. The main goal of this approach is to share resources efficiently. Thus the resources are managed properly.

Keywords–*Cloudlet, cloud layeredarchitecture,foglet, mobile cloud computing, resource allocation.*

1. INTRODUCTION

Resources Plays an important role in MCC as there availability decides the system performances. High availability of resources means system is efficient. MCC is categorized into two broad architectures i.e.Client-server and cooperation based architecture. In client server architecture, (cloud) provide resource management for mobile devices.Whereas, in the cooperation based cloud computing architecture, mobile devices are considered as a part of the cloud, where overall resources are shared among themselves using the wireless link. Thus, MCC helps in enhancing the performance of mobile applications by divesting data processing from mobile devices to the cloud. As a result, MCC helps in minimizing the computation time required for a mobile application, and hence energy can be drastically reduced [1].The Odessa runtime system is used to reduce resource consumption of mobile devices by using the offloading and parallelism approaches.The objective of the Odessa runtime system is to reduce power consumption on the mobile devices.A game theoretic power management scheme for mobile cloud computing is to minimize power consumption of servers on the cloud and mobile devices [2]. An economic cloud computing model is presented to decide how to manage the computing tasks with a given configuration of the cloud system, i.e., the computing tasks can be migrated between the mobile devices and the cloud servers [3].Cloudlet is consider as a practical platform for accelerating mobile cloud computing. The cloudlet provides wireless LAN(WLAN) connections for mobile devices within its working range, and the distant cloud infrastructure is connected with cloudlets through the high-speed wired network [4].Computing access point has built in computation capability. It can processed received tasks or offload it to cloud.A bandwidth aware admission control policy is developed for cloudlet, where a mobile service is always assigned a fixed amount of system resource without the flexibility of adapting to request traffic and resource availability of the time-varying system [5].

This paper introduces different resource allocation models such as foglet-based resource sharing model, Resource allocation models i.e. (LP, SP, and RO), dynamic cloud domain selection model, cloudlet-based model, ShareCAP model. All these models are better for resource allocation but there are some drawbacks of these models which are overcome by newly proposed cloud layered Architecture. This model efficiently managed resource allocation in cloud system.

2.BACKGROUND

Many studies have been done on resource and task allocation in recent year's .some of these are: Resource sharing using foglets. This foglet-based model acts like resource pool, in which resources are accessed by different users. Thus foglet- based model can improve resource utilization [1].Resource allocation models such as linear programming model (LP), stochastic programming model (SP) and robust optimization model (RO) are proposed. These Models are design for allocating resources to mobile applications from resource pool created by providers [2].Dynamic cloud domain selection model is proposed for managing cloud resources in multiple cloud domains, which is mainly used for balancing computational load among multiple cloud domains [3].cloudlet-based model is proposed for improving computational capabilities of cloud system. As cloudlet are placed at near vicinity to user.A cloudlet is usually set up at the public place, like shopping centre, theatre, office building, and assembly room to enable convenient access for mobile devices [4]. ShareCAP model is proposed for multiple users, CAP and cloud server. This model jointly optimize offloading decisions. SharecCAP model is applicable for multi-user scenario [5].

This paper introduces different resource allocation model i.e. foglet-based resource sharing model, Resource allocation models i.e. (LP, SP, and RO), dynamic cloud domain selection model, cloudlet-based model, ShareCAP model. These are organized as follows:

Section I Introduction. **Section II** discusses Background. **Section III** discusses previous work. **Section IV** discusses existing methodologies. **Section V** discusses analysis and discussion **Section VI** present overview of cloud layered architecture. Its outcome possible results are analyzed in **Section VII**. **Section VIII** concludes this paper. Finally **Section IX** presents future scope.

3. PREVIOUS WORK DONE

Awais Ahmad et al.(2017) [1] has proposed a foglet-based resource sharing model for minimizing the delay in the network based on deploying foglets. The proposed foglet-based system architecture helps in minimizing handover delay, packet loss, average queuing delay, and device lifetime in a network.RakpongKaewpuang et al.(2013) [2] has proposed resource allocation models i.e.linear programming model (LP), stochastic programming model (SP) and Robust optimization model (RO).These proposed models are used to obtain the optimal decisions on allocation of resources (i.e. Radio resource of base stations and computing resources of servers in data centers) from the resource pool to the mobile applications. Above models helps in supporting to maximize the revenue of the service providers while meeting the resource requirements of the mobile applications.

Hongbin Liang et al. (2012) [3] has proposed Dynamic cloud domain selection model.This model works on inter-domain clouds and its main function is load balancing by sharing load with inter-domain cloud. This proposed model can not only improve the cloud system resource utilization but also achieve better QoE for mobile users.

Yanchen Liu et al. (2016) [4] has proposed a cloudlet-based model for resource allocation. Thisproposed multi-resource allocation strategy enhances the quality of mobile cloud service, in terms of the system throughput (the number of admitted mobile applications) and the service latency.MengHsi Cheng et al. (2016) [5] has proposed ShareCAP model and this model helps in reducing the energy and computing task in MCC in multi-user scenario.

4. EXISTING METHODOLOGIES

Various resource allocation strategies have been used in several years. Different algorithms are design and implemented for resource sharing and management i.e. foglet-based resource sharing model, resource allocation models [(LP, SP, RO),].Dynamic cloud domain selection model,cloudlet-based model, ShareCAP model.

4.1. FOGLET-BASED MODEL

In foglet-based model [1] there is use of resource pool. For efficiently allocate various resources, such as memory, processing, accessing and generating the request, sharing data (audio, video, and social data, etc.).Efficient usage of new technology is required to use for MCC. Such technology can be provided with Fog servers and Foglets, which helps in providing a cooperative relay for accessing and share their desired resources. As a result, the resources that are provided by a single cloud computing is not shared among various Foglets and can be used by all devices, when required, and thus, resource utilization can be increased.The proposed scheme

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is composed of system architecture comprises of three function domains, such as Global Cloud Server (GCS), Local ISP Server (LIS),and Gateway Server (GWS).GCS has a main cloud server that is connected with neighboring cloud servers located at the large geographic location. LIS act as a bridge between GCS and GWS, where a network for Fog servers can share their resources with each other. And finally, GWS comprises of gateway server and a network of Foglets.A mobile user in a network form a cluster based on received signal strength (RSSI) and elect clusters that eventually work as virtual machine (VM). All the mobile users and VM at each cluster are connected to their Foglets based on their unique ID that uses the resource of Foglets and generates a request for the desired data.

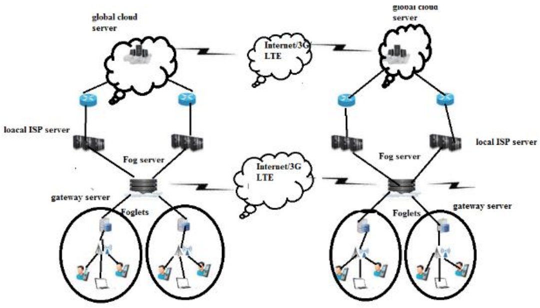

Fig 4.1Foglet- based model

4.2. LP, SP, RO RESOURCE ALLOCATION MODELS

In LP, SP, RO resource allocation models [2] resources are shared from resource pool.

4.2.1 A linear programming (LP) model**:**a linear programming (LP) model can be expressed as:

v(C) = max xa,b,d,p, where,v(C) is the total revenue which can be considered as the value of coalition C.xa,b,d,p is the number of application instances from users in area a using application p connecting to base station b and accessing data center d.

4.2.2 Stochastic programming (SP) model:

In this model allocation of resources from pool is done in two stages i.e.In the first stage, a decision is made on the number of application instances to be offered (i.e., xa, b,d, p) based on the partial information (i.e., probability distribution) of available resources.in the second stage,the coalition determines the number of application instances that it is unable to support (denoted by ya, b, d,p, ˜ω) due to insufficient resources.

4.2.3 Robust optimization (RO) model:

The robust optimization model does not require the probability distributions of random variables Also, the model considers the resource requirement uncertainty of application instances (i.e., required bandwidth and server) for coalition C.

4.3. DYNAMIC CLOUD DOMAIN SELECTION MODEL

In this model consider a mobile cloud system that is composed by multiple service domains. Suppose there are K-VM resource available in one cloud domain, and a service occupies c VMs, where $c \in \{1, 2 \ldots C\}$, $C \leq K$. In each service domain, there are two types of service requests, namely,new service requests initiated in the home cloud domain and inter-domain transfer service request from/to adjacent cloud domains. Now in dynamic cloud domain selection model, when new service request arrives, then system check whether home domain can accommodate it, if yes then it accept and allocate VM to it and if no then transfer the request to adjacent domain, if adjacent domain accept it then select domain that can accommodate more VMs otherwise reject it.

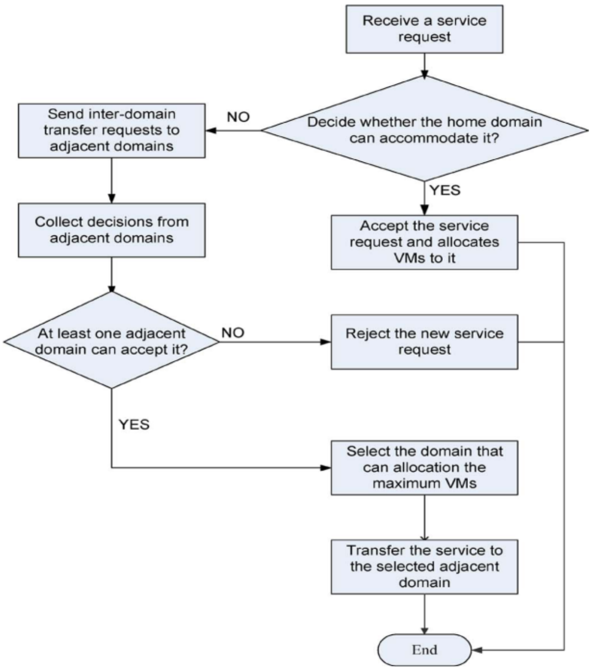

Fig 4.3 dynamic cloud domain selection mode

4.4. CLOUDLET-BASED MODEL

The cloudlet provides wireless LAN (WLAN) connections for mobile devices within its working range, and the distant cloud infrastructure is connected with cloudlets through the high-speed wired network. The mobile device can run mobile applications locally, or offload some workload to the cloudlet or to the distant cloud for faster execution.Upon arrival of a mobile service request, the system decides whether to run it at the mobile device or offload it to the cloudlet according to the offloading decision that hasalready been made based on the network performance and the characteristics of the application. When service request arrives check the availability of wireless bandwidth and cloud VMs, if accepted then allocate wireless bandwidth and cloud VMs, if no then request will be blocked.

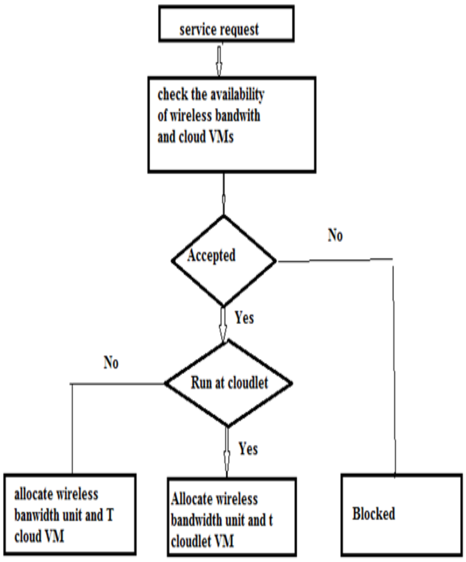

Fig 4.4 Algorithm architecture

4.5 SHARECAP MODEL:

Consider a cloud access network with N mobile users, one CAP, and one remote cloud server as shown in fig.1.the connection between mobile users and CAP are wireless while a wired connection is used between CAP and cloud for the CAP instead of just serving as a relay to always forward received tasks from users to the cloud. Each mobile user has one task to be either processed locally or offload through a two phase procedure. In phase one, each mobile user decides whether to offload its task and in phase two CAP determines whether to process each received task itself or offload it to the cloud for processing.Denote the input and output data sizes by and the application type of each user i's task by Din(i),Dout(out) and App(i) where App(i) refers to the number of processing cycles per unit data in this work. Denote the offloading decisions by:

xli +xai +xci=1, i=1,….N

Where xli,xai,xci E{0,1} indicate whether users task processed locally.

5. ANALYSIS AND DISCUSSION

Foglet-based model shows how system incurs minimum delay with foglets and fog server [1].mobile nodes in a foglet with high mobility decrease the performance of outgoing and incoming data due torapid handovers.LP, SP, RO resource allocation models shows it is more beneficial for the provider to cooperate and share their resources.The providers can gain a higher revenue when they cooperate [2].Since there is bandwidth available to support the mobile application instances.Dynamic cloud domain selection model shows the dropping probability of a new service request depends on the available resources in both the home cloud domain and the neighbouring cloud domains.A higher probability indicates that an adjacent domain has more available computing resources, and it is more likely to accept the transfer requests from the home cloud domain that has insufficient resources [3].Cloudlet based model shows that that the system prefers to assign cloudlet VMs for the new request when the request traffic is low in order to guarantee short service time for mobile applications. (ii) As the request traffic increases, the system allocates less cloudlet VMs for the new service request. When the request traffic becomes heavy enough, the system moves more tasks from cloudlet to the distant cloud in order to reserve more cloudlet resource for the possible coming new request. (iii) More wireless bandwidth resource is assigned to the users when the request traffic is light. On the other hand, less bandwidth resource is assigned to the request when the traffic is heavy [4]. The proposed resource allocation strategy results in much lower blocking probability even with high service request arrival rate.ShareCAP model shows that it is sufficient for shareCAP to provide near optimal performance [5]. This model is also useful for multi user scenario. It is also efficient for allocating resources when there are large number of users

6. PROPOSED METHODOLOGY

CLOUD LAYER MODEL:

This proposed model is composed of three layer i.e. cloud provider, cloud agent and end user. This is a layered cloud architecture. The components of layer model with function is given below:

1. Cloud Provider: It is the first layer, which consists of available system resource such as VMs. Cloud provider provides resources on request by cloud agent.
2. Cloud Agent: Cloud agent is also known as cloud customer. It receives requests from end- user of available resources.
3. End-User: End-user request to cloud agent from resources.

Above model works as follows:

When user send request for service then agent first receives user request before connection with cloud provider. After fulfilling request data is send back to user by one of big client. Agent dispatch the returned data to correct intended user. Cloud provider sends data through multiple paths (m) to multiple clientsthat transfer this data to a agent in the scenario. The agent combines the received data then delivers it to the intended end user.

Algorithm:

```
Input: a    // arrival rate;
b    // service rate;
c   // budget;
SLA(x,z)  // x : response time
              // z : target probability
         q   // budget
Output: m  // min no of VMs required
Float f=a/b
Function:detMinVM(a,b,c,x,z,q)
```

```
if ( f == (int) f ) m = (int) f ;
else m = (int)Math.floor( f ) + 1 ;
end if
while (F(x) <=z && C(s) <=q) m++ ;
end while
return m;
```

where F(x) =distribution function C=cost

In this way the above algorithm improves resource allocation strategy by determining available VMs in cloud.

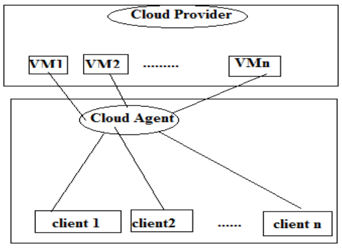

Fig 6.1 Cloud layer model

7. OUTCOME AND POSSIBLE RESULTS

The proposed model cloud layer model improves the resource allocation mechanism. This model efficiently manages resource allocation. It simply divides the model in three layers so that resources are share with reducing load, i.e. load balancing. This method is simpler as compared to other methods so it reduce system overhead. This is a novel network architecture, the expected quality of service requirements can be satisfied. Itcan calculate and select sufficient cloud resources.

8. CONCLUSION

This paper focused on various resources sharing strategies which are used for resource allocation. The proposed model introduced problems present in previous methodologies.To overcome these drawbacks this paper proposed novel and efficient, layered architecture that provides resources in very efficient manner.

9. FUTURE SCOPE

From observation, the scope is planned to be studied in future work, analysis will done for various resource allocation mechanism that is more useful as well as convenient to use and providing security to it.

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