Resource Management Strategy for Mobile Cloud Computing

Juhi Saurabh[1], Joy Shalom Sona [2]

[1]M.Tech. Scholar, Computer Science & Engineering Department,
Rungta College of Engineering and Technology,
Kohka Kurud Road, Bhilai
juhi.saurabh@gmail.com

[2] Assistant Professor, Computer Science & Engineering Department,
Parthivi College of Engineering and Management,
Sirsakala, Bhilai-3
joy.parthivi@gmail.com

Abstract: ***Mobile cloud is internet based data, applications and related services accessed through smartphones, laptops and other portable devices. The combination of cloud computing, wireless communication, portable computing devices is called mobile cloud computing which allows users an online access. Despite increasing usage of mobile computing, exploiting its full potential is difficult due to its inherent problems such as resource scarcity, frequent disconnections, and mobility. Mobile cloud computing can address these problems by executing mobile applications on resource providers external to the mobile device. But the mobile cloud computing have some issues like power consumption, resource poverty and security. In this paper, we are going to present a novel approach to manage resource by using an effective resource management algorithm to overcome above mentioned problems.***

Keywords: MCC, load balancing, entropy, cloud computing, FIFO.

1.Introduction

Mobile devices (e.g., smartphone and tablet PC) are increasingly becoming an essential part of human life as the most effective and convenient communication tools not bounded by time and place. Mobile users accumulate rich experience of various services from mobile applications (e.g., iPhone apps and Google apps), which run on the devices and/or on remote servers via wireless networks. The rapid progress of mobile computing (MC) becomes a powerful trend in the development of IT technology as well as commerce and industry fields. However, the mobile devices are facing many challenges in their resources (e.g., battery life, storage, and bandwidth) and communications (e.g., mobility and security). The limited resources significantly impede the improvement of service qualities [13].
Mobile/cloud computing is the combination of cloud computing and mobile networks to bring benefits for mobile users, network operators, as well as cloud computing providers. The ultimate goal of MCC (mean of MCC is Mobile Cloud Computing) is to enable execution of rich mobile applications on a plethora of mobile devices, with a rich user experience [6]. MCC provides business opportunities for mobile network operators as well as cloud providers. More comprehensively, Mobile Cloud Computing can be defined as "a rich mobile computing technology that leverages unified elastic resources of varied clouds and network technologies toward unrestricted functionality, storage, and mobility to serve a multitude of mobile devices anywhere, anytime through the channel of Ethernet or Internet regardless of heterogeneous environments and platforms based on the pay-as-you-use principle" [7].

Mobile Cloud Computing uses computational augmentation approaches by which resource-constraint mobile devices can utilize computational resources of varied cloud-based resources. In Mobile Cloud Computing, there are four types of cloud-based resources, namely distant immobile clouds, proximate immobile computing entities, proximate mobile computing entities, and hybrid (combination of the other three model) [3]. Giant clouds such as Amazon EC2 are in the distant immobile groups whereas cloudlet or surrogates are member of proximate immobile computing entities. Smartphones, tablets, handheld devices, and wearable computing devices are part of the third group of cloud-based resources which is proximate mobile computing entities. Vodafone, Orange and Verizon have started to offer cloud computing services for companies.

"Cloud computing" is a term, which involves virtualization, distributed computing, networking, software and web services. A cloud consists of several elements such as clients, data centre and distributed servers. It includes fault tolerance, high availability, scalability, flexibility, reduced overhead for users, reduced cost of ownership, on demand services etc [10].
Central to these issues lies the establishment of an effective load balancing algorithm. The load can be CPU load, memory capacity, delay or network load. Load balancing is the process of distributing the load among various nodes of a distributed system to improve both resource utilization and job response time while also avoiding a situation where some of the nodes are heavily loaded while other nodes are idle or doing very little work. Load balancing ensures that all the processor in the system or every node in the network does approximately the equal amount of work at any instant of time. This technique can be sender initiated, receiver initiated or symmetric type (combination of sender initiated and receiver initiated types) [12].

MCC ARCHITECTURE

- Mobile devices are connected to the mobile networks via base stations that establish and control the connections and functional interfaces between the networks and mobile devices.
- Mobile users' requests and information are transmitted to the central processors that are connected to servers providing mobile network services.
- The subscribers' requests are delivered to a cloud through the Internet.
- In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services.

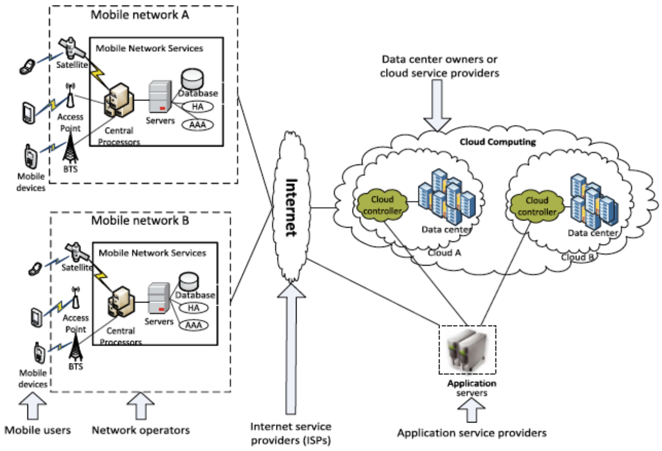

Figure 1: MCC Architecture

CLOUD COMPONENTS

A Cloud system consists of 3 major components such as clients, datacenter, and distributed servers. Each element has a definite purpose and plays a specific role [11].

Clients- End users interact with the clients to manage information related to the cloud. Clients generally fall into three categories:

- **Mobile**: Windows Mobile Smartphone, smartphones, like a Blackberry, or an iPhone.
- **Thin**: They don't do any computation work. They only dispaly the information. Servers do all the works for them. Thin clients don't have any internal memory.
- **Thick**: These use different browsers like IE or mozilla Firefox or Google Chrome to connect to the Internet cloud. Now-a-days thin clients are more popular as compared to other clients because of their low price, security, low consuption of power, less noise, easily replaceble and repairable etc [5].

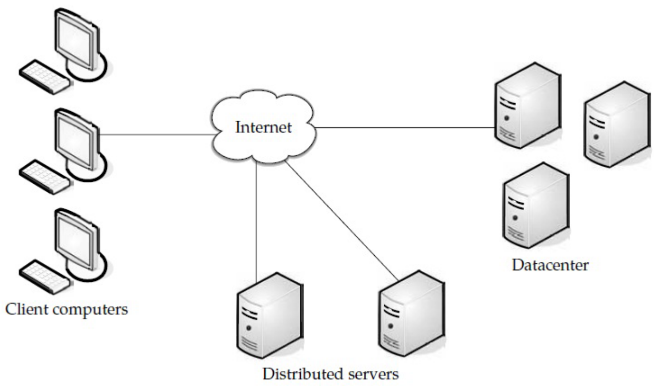

Figure 2: Three components make up a cloud computing solution

Datacenter- Datacenter is nothing but a collection of servers hosting different applications. An end user connects to the datacenter to subscribe different applications. A datacenter may exist at a large distance from the clients. Now-a-days a concept called virtualisation is used to install a software that allow multiple instances of virtual server applications.

Distributed Servers- Distributed servers are the parts of a cloud which are present throughout the Internet hosting different applications. But while using the application from the cloud, the user will feel that he is using this application from its own machine.

2.Related Work

Load balancing algorithms frequently used are divided into two categories [9]. One is static load balancing algorithm,the other is dynamic one [10].Round Robin (RR)& Weighted Round Robin(WRR) are static algorithms commonly used . RR is relatively simple, which does not consider server availability, server load, the distance between clients and servers and other factors.WRR solves the problem of inconsistent servers performance by adding weight, but when requesting service for a long time, it may cause load tilt. Least connection (LC) and weighted least connection (WLC) are dynamic algorithms commonly used. LC does not consider service capability, the distance between clients and servers and other factors. WLC is a relatively good dynamic scheduling algorithm.

In Entropy-Based Grouping Techniques for Resource Management in Mobile Cloud Computing, groups are classified according to the availability and mobility to manage reliable resource. The mobile devices has been grouped by measuring the behaviour of mobile devices and calculating the entropy in order to avoid faults in the mobile cloud computing [3].

An Auction Mechanism for Resource Allocation in Mobile Cloud Computing Systems, first model the resource allocation process of a mobile cloud computing system as an auction mechanism with premium and discount factors. The premium and discount factors indicate complementary and substitutable relations among cloud resources provided by the service provider. Then, the individual rationality and incentive compatibility (truthfulness) properties of the users are analysed in the proposed auction mechanism [2].

3.Methodology

Recently, research on utilizing mobile devices as resources in mobile cloud environments has been gaining attention because of the enhanced computing power of mobile devices, with the advent of quad-core chips. Such research is also motivated by the advance of communication networks as well as the growing population of users of smart phones, tablet PCs, and other mobile devices. This trend has led researchers to investigate the utilization of mobile devices in cloud computing. However, mobile devices have several problems such as characteristics of the mobility, low memory, low battery, and low communication bandwidth. Especially, the mobility of mobile device causes system faults more frequently, and system faults prevent application using mobile devices from being processed reliably. In this method the resources has been allocated to the mobiles based upon the entropy and FIFO. The entropy has been calculated based upon the formula $E(M_i)= -(t/M)\log_2(t/M)$ Where t is the time at which the mobile has sent a request to the cloudlet and M is the total number of mobile devices in a cloudlet.

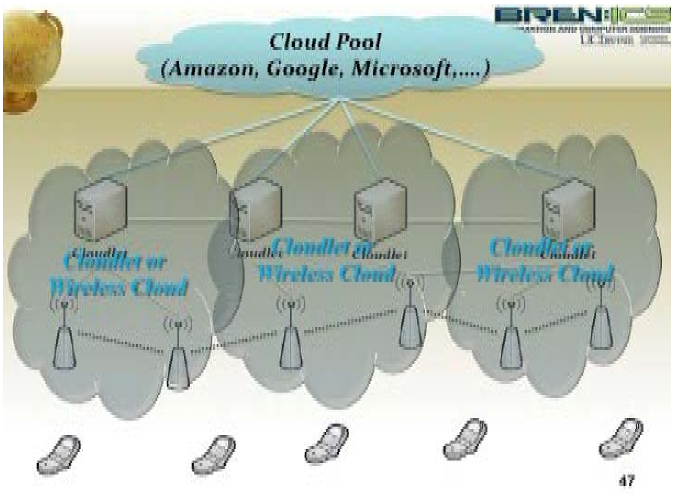

Figure 3: Mobile Network with cloudlets

A cloudlet is a trusted, resource-rich computer or cluster of computers which is well connected to the Internet and available for use by nearby mobile devices. Thus, when mobile devices do not want to offload to the cloud (maybe due to delay and cost), they can find and use a nearby cloudlet. In this way, mobile users may meet the demand for real-time interactive response by low-latency, one-hop, high-bandwidth wireless access to the cloudlet. A threshold value will set. After calculating the entropy for each mobile the threshold value will be checked. If the mobile satisfies the threshold the requested application will be provided otherwise it will be kept in queue. If more than one mobile device satisfies the threshold then based upon the FIFO the application will be served.

4.Expected Outcome

Consider M1,M2…..M10 be ten mobile devices in a cloudlet trying to access three applications A1,A2,A3 from the cloudlet. If too many mobile devices request the same application then there will be resource poverty. To avoid that we calculate the entropy for each mobile device which is requesting the application.

Table 1 Mobile devices with Applications

M	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
A	A1	A2	A3	A2	A1	A2	A3	A3	A1	A2

where M is the mobile devices and A is the applications. The mobile devices M1, M5, M9 are requesting the application A1 .M2, M4, M6, M10 requesting A2 and M3, M7, M8 requesting A3. Assume threshold value as 0.5. Consider the time periods for mobile devices as

Table 2 Mobile devices with Time period

M	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
t	3	2	5	4	6	7	6	9	8	9

where M represents mobile devices and t represents time period. Now for application A1, A2, A3 calculate the entropy values .The values are shown in the table.

Table 3 Applications with Entropy Values and time periods

APPLICATIONS	MOBILE DEVICES	ENTROPY	TIME PERIOD
A1	M1	0.5	3
	M5	0.4	6
	M9	0.3	8
A2	M2	0.5	2
	M4	0.5	4
	M6	0.4	7
	M10	0.1	9
A3	M3	0.5	5
	M7	0.4	6
	M8	0.1	9

For A1, the mobile device M1 is satisfying the threshold value so the application will be allocated to M1 , other devices will be kept in a queue. Similarly for A3, M3 is satisfying the threshold value so A3 will be allocated to the device M3.But for A2, more than one mobile is satisfying the threshold so here we consider FIFO .The device M2 has requested the application first so it will served first and the remaining devices will be served later. So that we can reduce the resource poverty.

5.Conclusions

In this paper, an efficient resource management algorithm is used to allocate resources to the mobile devices to reduce the resource poverty. In future we can also extend this method for storage. The performance of the proposed algorithm can also be increased by varying different entropy levels.

References

[1] Praveena Akki, Y.Mohana Roopa, " Resource Allocation Using Entropy Based Fifo Method In Mobile Cloud Computing", International Journal of Engineering Sciences Research-IJESR, ISSN: 2230-8504; e-ISSN-2230-8512, Vol. 04, Special Issue 01, 2013.

[2] Yang Zhang, Dusit Niyato, Ping Wang ," An Auction Mechanism for Resource Allocation in Mobile Cloud Computing Systems" in Distributed, Parallel, and Cluster Computing (cs.DC); Computer Science and Game Theory (cs.GT)

[3] Ji Su Park, Eun young Lee "Entropy-Based Grouping Techniques for Resource Management in Mobile Cloud Computing" The Journal of Networks, Software Tools and Applications Springer Science Business Media New York 2013.

[4] Rahman "Energy Saving in Mobile Cloud Computing" Cloud Engineering (IC2E), 2013 IEEE International Conference on: 25-27 March 2013.

[5] Xu, Xin ; Yu, Huiqun ; Cong, Xinyu "A QoS-Constrained Resource Allocation Game in Federated Cloud" Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013 Seventh International Conference on 3-5 July 2013.

[6] Abu Sharkh, M., "A resource scheduling model for cloud computing data centres" Wireless Communications and Mobile Computing Conference (IWCMC), 2013 9th International : 1-5 July 2013.

[7] D. Kovachev, D. Renzel, R. Klamma, and Y. Cao, "Mobile Community Cloud Computing: Emerges and Evolves," in Proceedings of the First International Workshop on Mobile Cloud Computing (MCC). Kansas City, MO, USA: IEEE, 2010.

[8] Shahryar Shafique Qureshi, Toufeeq Ahmad, Khalid Rafique, Shuja-ul-Aslam, "Mobile Cloud Computing as Future for Mobile Applications – Implementation Methods and Challenging Issues," in Proceedings of IEEE CCISS 2011.

[9] M. Randles, D. Lamb, and A. Taleb-Bendiab, "A Comparative Study into Distributed Load Balancing Algorithms for Cloud Computing," 2010 IEEE 24th International Conference on Advanced Information Networking and Applications Workshops, 2010, pp. 551–556.

[10] Xiaona Ren, Rongheng Lin,Hua Zou, "A Dynamic Load Balancing Strategy For Cloud Computing Platform Based On Exponential Smoothing Forecast", Proceedings of IEEE CCIS, 2011.

[11] Bu-Sung Lee; Niyato, D. "Optimization of Resource Provisioning Cost in Cloud Computing "Services Computing, IEEE Transactions on April-June 2012 Volume: 5, Issue: 2.

[12] J. Jing, A. S. Helal, and A. Elmagarmid, "Client-server Computing in Mobile Environments," ACM Computing Surveys (CSUR), vol. 31.

[13] Hoang T. Dinh, Chonho Lee, Dusit Niyato and Ping Wang, "A survey of mobile cloud computing: architecture, applications, and approaches", Wiley Online Library, 11 october 2011.

Author Profile

Juhi Saurabh received the B.E. degree in Computer Science & Engineering from Pt.R.S.S.U., Raipur(C.G.) in 2008. She is currently pursuing M.Tech. degree in Computer Science Engineering with specialization in Software Engineering from CSVTU Bhilai (C.G.), India. She has published 2 research papers in reputed national and international journals. Her research areas include Cryptography, Software Engineering, Data Mining, Artificial Intelligence, Computer Network & Pattern Recognition, Image Processing etc.

Joy Shalom Sona received the B.E. degree in Computer Science & Engineering from Pt.R.S.S.U., Raipur(C.G.) in 2008. He is currently working as a Assistant Professor in Computer Science Engineering with specialization in Computer Technology. He has published 4 research papers in reputed national and international journals. His research areas include Computer Technology, Software Engineering, Data Mining, Artificial Intelligence, Computer Network & Web Mining, Cloud Computing etc.