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An Empirical study on Peer-to-Peer sharing of resources in Mobile Cloud Environment

R. K. Nadesh[1], M. Aramudhan[2]
[1]School of Information Technology and Engineering, VIT University, Vellore, India
[2]Department of Information Technology, PKIET, Karaikal, India

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ABSTRACT

The increase usage of mobile users with internet and interoperability among the cloud services intensifies the role of distributed environemtnt in today's real world application. Modern technologies are important for building rich, scalable and interoperable applications. To meet the requirements of client,the cloud service provider should offer adequate infrastructure especially under heavy multi-client load.To provide solution for large scale requirements and to statisfy the mobile client from the critical situation like lacking with bandwidth,connectivity issues,service completion ratio, we present adhoc virtual cloud model for different scenarios that include single and multiple client configurations with various file sizes of various file formats for retrieving files in the mobile cloud environement.We evaluate the strategies with the socket and RMI implemented using java and identify the best model for real world applications. Performance evaluation is done with the results obtained and recommends that when sockets and RMI can be appropriately used in peer-to-peer environment when the mobile user cannot connect directly to the cloud services.

Corresponding Author:

R.K.Nadesh,
School of Information Technology and Engineering,
VIT University,
Vellore, India.
Email: rknadesh@gmail.com

1. INTRODUCTION

With heavy increase of computer system in our regular life, the usage of computer network also increases exponentially. The distributed environment provides the sharing the resource among the peers or execute a set of instruction in the peers [1], [2]. For the end user, it looks the job is completed in the machine itself but originally completed in the another machine and ensure their location, storage, replication, load balancing and functionality is well maintained [3], [4]. The cloud service provider provides anything as a service like Software-as-a-Service, Platform-as-a-Service, Infrastrcture-as-a-Service, Storage-as-a-Service, Database-as-a-Service etc [5]. Today potential mobile user look for mass storage location to store and access their files on the move with large set of applications like business application, healthcare application, gaming, e-learning [6], [7]. These require highest bandwidth and connectivity in the mobile device which is provided by the cellular network service provider in different forms like GSM/CDMA/UMTS/LTE and the device portability is more important [8]. Not all times, the connectivity is stronger on the move, if there is drop in connectivity the idea is to connect to the nearest local server referred as cloudlet and due to high mobility the connection state changes very often [9]. The next direction of the research in mobile cloud computing is to provide mobile cloudlet, a mobile device can act as a cloudlet and serve the need the moving user on demand [10]. Our focus is now identifying the mobile cloudlet and provide services to the user. We propose Peer-to-Peer environment where one mobile user share the resource of the other mobile user.

In addition, we propose mobile cloud network where mobile device form a network and one device is constrained to be the master and identify the volunteering nodes and supports the demand of the moving user.

2. RELATED WORKS

A cloudlet is a server or a collection of servers used to store files that can be accessed, with proper authorization rights, by any number of remote clients in the network [10], [11]. However,the distributed system is accepted worldwide to cater the needs of the end user.

The rapid growth of the mobile user and the smart phones,availability of cloud services in a regional basis made the client user to access any kind of files in a minimum amount of time [12], [13]. When the client device retrieves a file from the cloudlet, the file appears as a normal file on the client machine, and the user is able to work with the file in the same ways as if it were stored locally on the workstation. Later, the file is returned to the central server and the client machine is not utilized to store the file [14].

However the cloudlet is also fixed and the mobility is provided by the Wi-Fi acces point but this has limitation that the mobile device should be within the range of the central server and covered by the access point [15]. The deployment cost for this model is also high and it is very useful when more client users are available [16].

Considering the less number of remote user interms of usage of cloudlet is less but interested in accessing the cloud service one such model designed is Virtual Mobile Cloud [17]. Any mobile device can volunteer the resource to the needed mobile user. The development of volunteering computing leads to the formation of Virtual Cloud using mobile devices [18]. However, to comprise the volunteers to share the resources some pricing schemes and the support is provided by the cloud service provider.

3. PROPOSED MOBILE CLOUD MODEL

The volunteer devices may provide their resources in Peer-to –Peer fashion or redirects to the available device in the nearest place. In P2P sharing of resoruces, only the identification of the device will be shared via Bluetooth and the data transfer can be done using TCP/IP and the connection estabilishment is done viz socket or RMI.

In a distributed environment we implement two way communications for sending different types of files of various sizes from one node to another. Figure 1 show the peer-to-peer mobile environment.

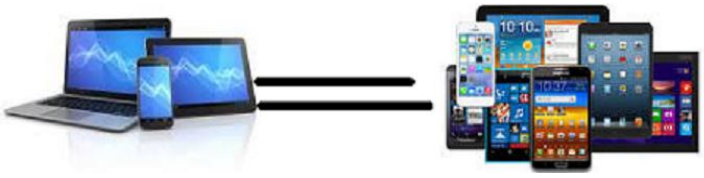

Figure 1. Peer-to-peer mobile environment

Virtual cloud is formed with support of master and slave model where master node has the details about the other nodes. When the end user needs the resoruces it is identified through the master node which is authorized by the concern service provider. Our coverage in this work is limited to a homogenous service provider community. The selection of mobile node is done by pricing schemes and the master node should have the highest resources including the good backup of battery.

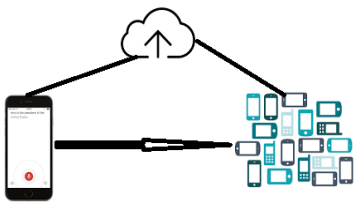

Figure 2. Virtual cloud with mobile devices

In the Figure 2 stated virtual cloud model,the mobile client is initially connected to the cloud services using cellular network and when there is high latency the node is redirected to the nearest virtual cloud. In the virtual cloud, being a first time user request the designated master node to allocate the needed resources and identify to the volunteered nodes.

4. EXPERIMENTAL NETWORK SETUP

For this analysis we proposed three test approaches like peer machine interaction, mobiel nodes within a cloud, mobile nodes between a cloud which uses a common programming aspect. Implementation is done in JAVA and we used various classes supported as java.net and java.rmi. Different loads with different files sizes and format like text, images and video file are used for the study. We use switches to interconnect the mobile nodes.

a. P2P Transfer
   In this peer-to-peer test method file retrieval is done by mobile client and mobile server running in the different location but by giving the ip address of the machine and the port number 5011 for communication.
b. Within a Mobile Cloud
   For this scenario 64 nodes in a single switch is used. At various network traffic the files are retrieved from one mobile node to another using socket and rmi.
c. Inter Mobile Cloud
   We consider multiple nodes in multiple switches in light and heavy traffic loads.

5. RESULT AND DISCUSSIONS

The various file sizes ranging from 21kb to 56.5 mb are taken to study the similarities and differences of the each model in a low to high traffic times.

In the Figure 3, Comparisons are made for file transfer within the same switch with file size 21kb on six different slots and the roundtrip time is measured in milliseconds. Incase of using RMI the time slot is almost the same where as in socket it varies from one point of time to another.

When the comparison is made between virtual cloud of keeping the same file size 21kb. In Figure 4 it is understood that whenever the file is accessed for the first time using RMI the roundtrip time is more as compared to sockets and otherwise both yields the same time in delivery.

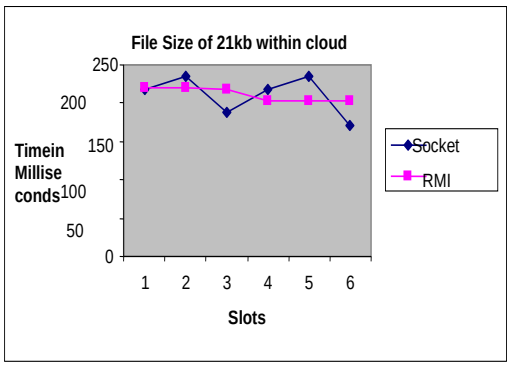

Figure 3. Text file retrieval within a mobile cloud

Figure 4. Text File Retrieval in Inter Cloud Model

In Figure 5 it is clearly shown that using socket gives the best average round trip time when compared with RMI. However the roundtrip time is reduced after the first time access in the registry in RMI.

The file transfer in the text file format the round trip time for all the three test models says both RMI and Socket are best and both can be used which may varies in small deviation in time that too in milliseconds.

In the Figure 6 Image file retrieval within a switch implies that RMI is the best by yielding a minimum 297ms and 328ms for the initial access when compared to socket which gives maximum of 375ms and 312ms at the minimum.

In the Figure 7 Image file retrieval between switches helps to know that whenever the first access is made using RMI it takes more time and repeative access reduces the time for the same ile retrieval but it is clearly know that the socket connection serves better for the single slot of access.

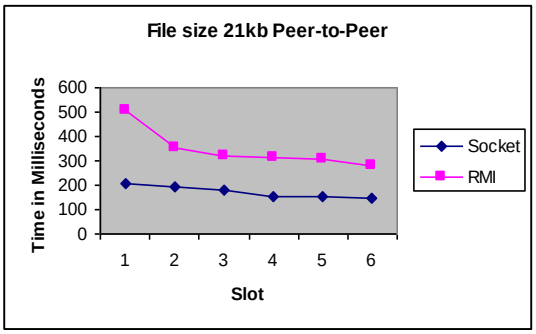

Figure 5. Text file retrieval in peer-to-peer

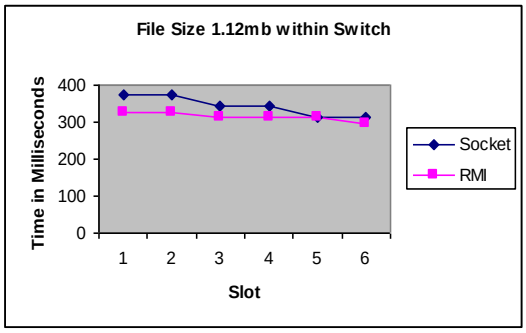

Figure 6. Image file retrieval within a mobile cloud

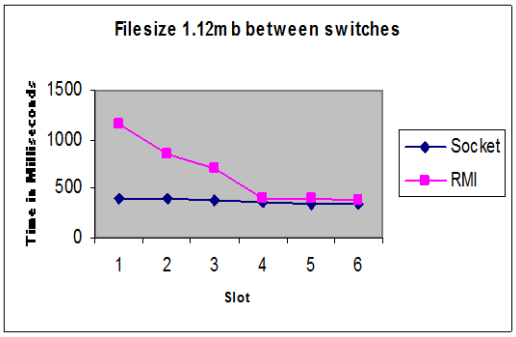

Figure 7. Image File Retrieval between inter mobile cloud

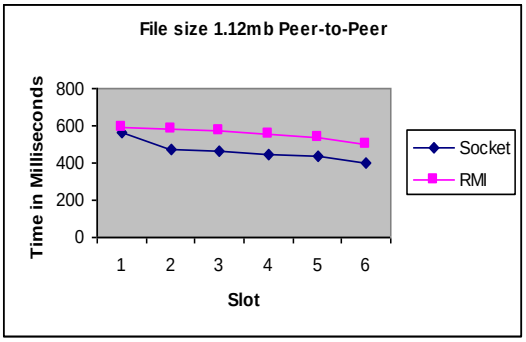

Figure 8. Image file retrieval in peer-to-peer

In the Figure 8 Image file retrieval in Peer-to-Peer Model RMI takes more time than the socket connection. However it may be stated that using socket will be useful. Therefore the image files retrieval in all the three models clearly state that using RMI in Switches and Socket in P2P will be the driving force for the image file transfer.

In the Figure 9 a video file of size 56.6MB has been retrieved within switch implies that socket gives the lesser time value when compared to the RMI value but RMI here is giving a constant value which can be taken as a best case. Because sometimes it is much more required to achieve a constant time rate than to achieve a variable lesser time rate.

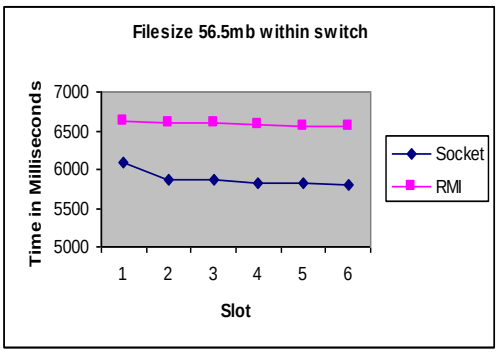

Figure 9. Video File Retrieval within a mobile Cloud

In the Figure 10 when the same image retrieval has been performed between switches it is showing that socket is giving batter performance that RMI. But the difference between both is very small, its of a few millisecond. So keeping RMI's facility in mind it is also can be taken as a preferred one for use in such bed.

In Figure 11 the same operation has been performed in a peer to peer environment which depicts that socket and RMI both are giving similar kind of time value. However it may be stated that using socket will be more useful.

Therefore in case of video file retrieval in all three models socket is favorable within switches and RMI is favorable in P2P system environment.

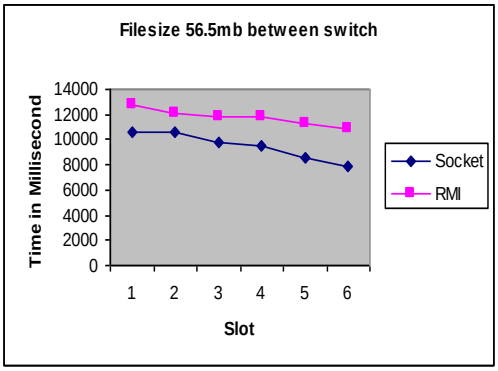

Figure 10. Video File Retrieval between inter mobile cloud

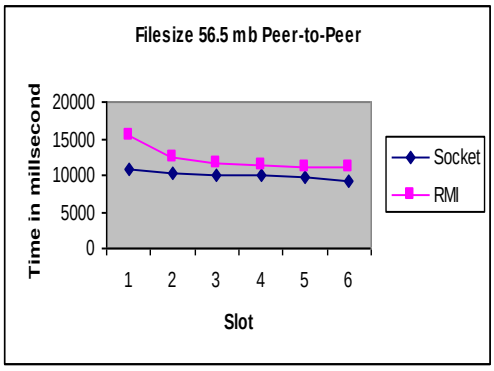

Figure 11. Video File Retrieval Peer-toPeer

6. CONCLUSION

The proposed mobile cloud model is an experimental study to understand the feasibility of forming virtual cloud among mobile devices.This work fully focus on file retrival interms of text, image, video formats and we planning to set up an environment to transfer virtual machine from one mobile device and to another device which will help in many real time applications as extension of this work.

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