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OPTIMIZATION OF MOBILE APPLICATIONS AND FEATURES THROUGH CLOUD COMPUTING

Shashank Jindal[1] Dr. Vineet Richariya[2] Dr. Suneel Phulre[3]

[1]*Computer Science & Engineering, Lakshmi Narain College of Technology, Bhopal, (India)*

[2]*HOD Computer Science & Engineering, Lakshmi Narain College of Technology, Bhopal, (India)*

[3]*Professor, Computer Science & Engineering, Lakshmi Narain College of Technology,Bhopal,(India)*

ABSTRACT

Implementation of cloud computing with mobile applications has become trend of recent years. It combines both mobile as well as cloud computing thereby returns optimum services for mobile users. Before the end of 2016 there will be more than 10 thousand mobile applications that will be executed through cloud computing. That equilibrium will push the income of mobile cloud computing to $5.2 billion. Here in this work, it has been given an outline of distributed computing its definitions, constituting components (that are cloud stage and cloud applications) lastly talked about the difficulties of executing cloud computing in mobile applications. In the last offloading has been implemented for both environments and then comparison has been done. The whole simulation has been done in JAVA to show the results of proposed technique. It has been found out that cloud computing model has better results for applications with respect to mobile users.

Keywords: Cloud computing, Mobile applications, offloading

I. INTRODUCTION

Cloud computing has been suggested to improve mobile phones in various ways, but common area is complexity reduction. The cloud has historically been used as a metaphor for the Internet and is commonly used in network diagrams to represent connections between entities, connected through the Internet [1].

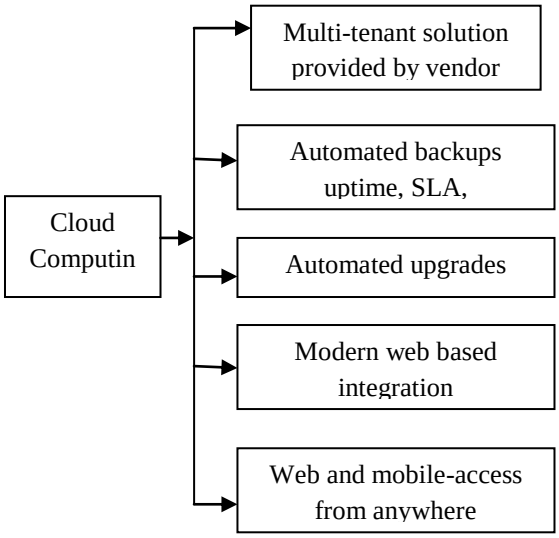

Figure 1: Cloud Computing

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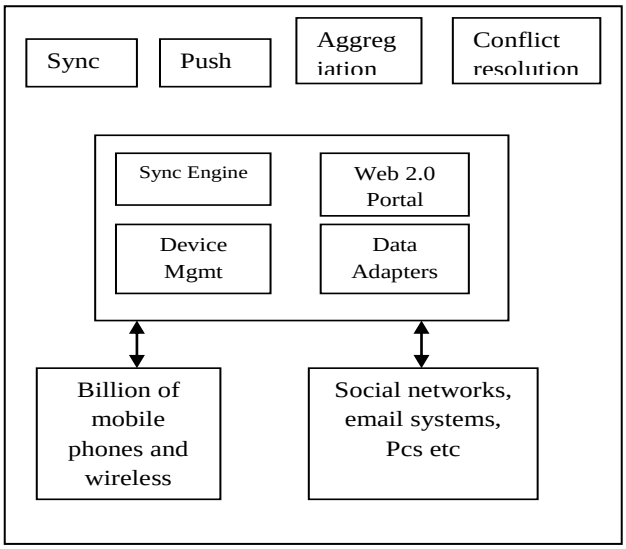
Cloud computing comes into focus only when you think about what IT always needs: a way to increase capacity or capabilities needed without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The name cloud computing was inspired by the cloud symbolthat's often used to represent the Internet in flowcharts and diagrams. Widespread use of the cloud may also encourage open standards for cloud computing that will establish baseline data security features common across different services and providers. Mobile phone is the primary computing platform for many users. The issues of mobile phones are somewhat intertwined; CPU performance is related to energy consumption, size, as well as amount of memory. The increased usage of multimedia through the mobile network creates increased traffic load on the base station, which needs to be handled.



A cloud computing mobile phone application can be downloaded in the same way as a local mobile phone application but would execute on a server instead of on the mobile phone. Mobile phones are set to become the universal interface to online services and cloud computing applications. Developments in mobile hardware and software have enabled users to perform tasks that were once only possible onpersonal computers and other devices like digital cameras and GPS navigation systems. Migrating computing and major data processing tasks to the cloud can fill the gap between resource demand and supply in mobile devices. Definitions of mobile cloud computing can be classified into two categories. The first one denotes carrying out data storage and processing outside mobile devices. Mobile devices tasks are reduced because the storage and computing processes take place in the cloud. The second category refers to mobile cloud computing as an extension of cloud computing in which foundation hardware consists at least partly of mobile devices.The problem of this research paper is to compare the execution pattern and time at jobs both at the cloud and mobile devices.

This paper is divided into five sections. Introduction chapter is defined above following the related work. Simulation work with the working methodology is defined after that. In the fourth section, results and analysis is described with the conclusion.

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II. RELATED WORK

AttaurRehman proposed that hardware level changes alone may not enable smartphones to achieve true unlimited computational power. Therefore, software-level changes are more effective, where computation is performed on remote resources with partial support of a smartphone's hardware.Computation offloading is a procedure that migrates resource-intensive computations from a mobile device to the resource-rich cloud, or server (called nearby infrastructure).Cloud based computation offloading enhances the applications performance, reduces battery power consumption, and execute applications that are unable to execute due to insufficient smartphone resources [2].TayyibaNaeem and SarmadSadiksaid that emphasis is to improve and optimize the performance and fault tolerance characteristics of mobile applications by method of replicating their resources or computation on cloud platform at back end. As a proof of concept, a prototype will be developed. It will be designed for managing and transporting the necessary contents of mobile application from mobile phone/tablets to cloud based platform. This framework or middleware will be responsible for offloading thecomputation intensive code on the cloud resources as well as adaptive or dynamic replication of data on the cloud resources [3].Ibrahim A Elgendy, Mohamed El-kawkagy, ArabiKeshk introduce a novel framework which improves the performance of mobile applications and saves battery consumption of mobile is presented. This framework has dynamic off loader module which decides dynamically atruntime whether the application's methods run locally on mobile device or will be offloaded to the cloud. The framework applied only on Android applications. (Android applications are written in the Java language and can be written using any Development tool)[4].Mostafa A. Elgendy, Ahmed Shawish, and Mahmoud I. Moussa1 saidit would be more efficient to execute the application locally on the Smartphone rather than offloading it on the Cloud. In this paper, we propose a new framework to support offloading heavy applications in low bandwidth network case, where a compression step is proposed for the favor of minimizing the offloading size and time. In this framework, the mobile application is divided into a group of services, where execution-time is calculated for each service apart and under three different scenarios. An offloading decision is then smartly taken based on real-time comparisons between being executed locally, or compressed and then offloaded, or offloaded directly without compression [5].

A.Methodology:

CloudSim Toolkit 3.0 released at Jan 13, 2012. CloudSim provides a generalized and extensible simulation framework that enables modeling, simulation, and experimentation of emerging Cloud computinginfrastructures and application services..It is built at the Cloud Computing and Distributed Systems (CLOUDS) Laboratory.In the Melbourne, University CloudSim is used in the research and academia and become one of the most popular open source cloud simulators which are completely written in Java. Cloud has been extended by independent researchers after developed as a stand-alone simulator. CloudSimconsists of one datacenter, one host and one cloudlet. They all work one certain policies.Datacentre works on VM Allocation Policy. Host works on VM Scheduler Poliy.VM works on Cloudlet Scheduler Policy.CloudSim contains Cloud Information Service (CIS) having some hosts which together form as datacenter and each host contains virtual machines. These Virtual Machines are assigned cloudlets. Broker provide task to datacenter and it is called datacenter broker class. Broker has certain characteristics and tasks which are in CloudSim framework and it is called cloudlet.Datacentre, Broker,CIS are entities.

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1) *CloudSim Feature* :

- Support for modeling and simulation of large scale Cloud computing data centers
- Energy-aware computational resources
- Support for data center network topologies and message-passing applications
- Support for dynamic insertion of simulation elements, stop and resume of simulation
- Support for user-defined policies for allocation of hosts to virtual machines and policies for allocation of host resources to virtual machines

2) *Reasons for Learning CloudSim*

- Cloud resource provisioning
- Energy-efficient management of data center resources
- Optimization of cloud computing
- Research activities
- Limitation: No Graphical User Interface (GUI)

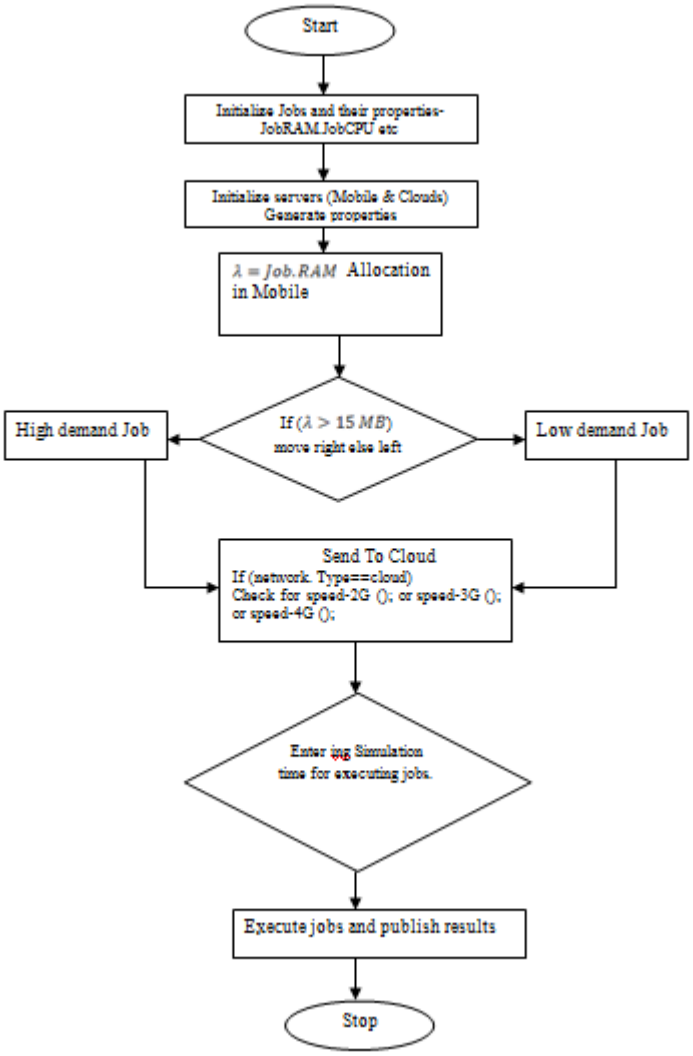

Figure 3: Simulation model

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III. SIMULATION MODEL

The proposed algorithm evaluates jobs at both the cloud and the mobile devices to check how efficient both the platform is in a order to successfully execute the jobs. The cloud network three types of networks namely: 2 G, 3G and 4G and three vary with some speed. The algorithm structure of the entire work is as follows:

1. Start
2. J=Job to be executed

J_P =Job properties

$J_{P.RAM}$ = RAM required executing a job

$J_{P.CPU}$ = CPU required executing a job

$J_{P.time}$ = Minimum time of a job for execution

2.1 CS=Cloud servers or total number of cloud servers present in the network

CS.Speed=Speed which is supported by the cloud network (2G/3G/4G)

Jobc.RAM provided by the cloud server

Jobc.CPU= CPU utilization of the cloud servers

Jobc.time= Time required to execute the job

Once the entire environment has been initialized, it would put all together at XEN cloud which is a supported framework by the CloudSim. The framework details are as follows:

3. Central cloud name=XEN cloud

Central Cloud type=Hybrid

Central Cloud Max RAM=3GB

Maximum supported array value=10,000

4. Divide jobs according to RAM requirement as high demand and low demand jobs

λ = Job.Ram allocation in mobile

End

5. Assign job to cloud and mobile device separately as follows:

a. Put one low demanding job in the mobile

b. One executed (a) , put a high demanding job in the queue of some cloud/mobile device

6. With a given time interval execute job parallel at cloud server as well as at mobile server

7. Publish results.

Formulas:-

Suppose the time required to transfer file from mobile to cloud isT.

T depends on speed of 2G, 3G, 4G networks.

4G>3G>2G

Ratio taken for 2G,3G and 4G Speeds

If 4G takes t seconds to transfer a file.

Then 3G takes 10*t seconds to complete the file transfer process.

Then 2G takes 100*t seconds to complete the file transfer process.

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CS.Speed=Speed which is supported by the cloud network (4G)

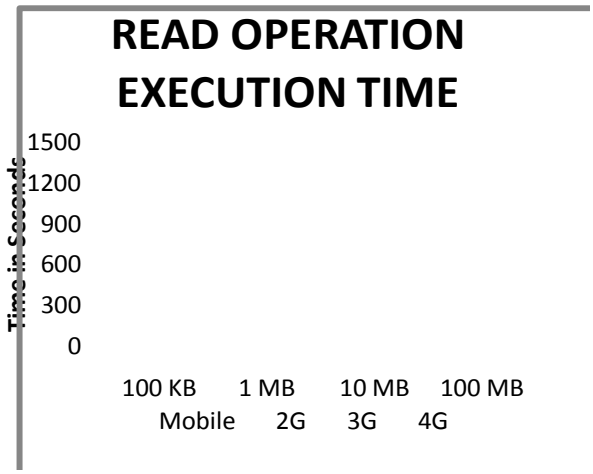
Jobc.Total = Jobc.time+CS.Speed (t/10*t/100*t)

Jobc.Total=total time required to execute the job on cloud.

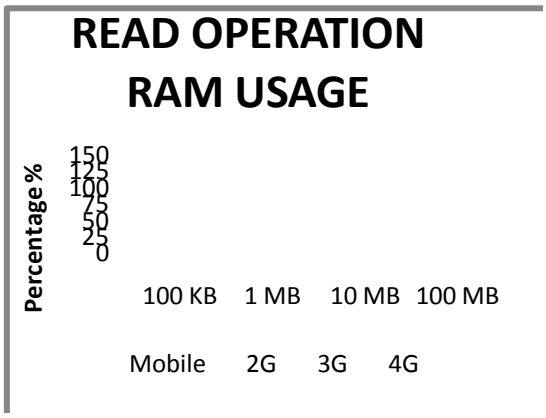
IV.SIMULATION RESULTS

Below are the results for cloud and mobile applications. Three Operations has been considered for cloud and mobile applications. In Cloud operations the operations were considered to perform in 2g, 3g and 4g network.

Round 1- Read Operation



In above figure it has been seen that the execution time of the mobile for reading 100 kb file is less than ofa second .In the cloud execution time depends on two factorsone the time spend in transferring file from mobile to cloud (CS.Speed) and the other one is processing time(Jobc.time). For example at 4G speed for 10 MB file CS.Speed = 10 seconds and Jobc.time=2.2 seconds. Jobc.Total=Jobc.time+CS.Speed=12.2 seconds as compare to mobile it takes 68.2 seconds to complete.



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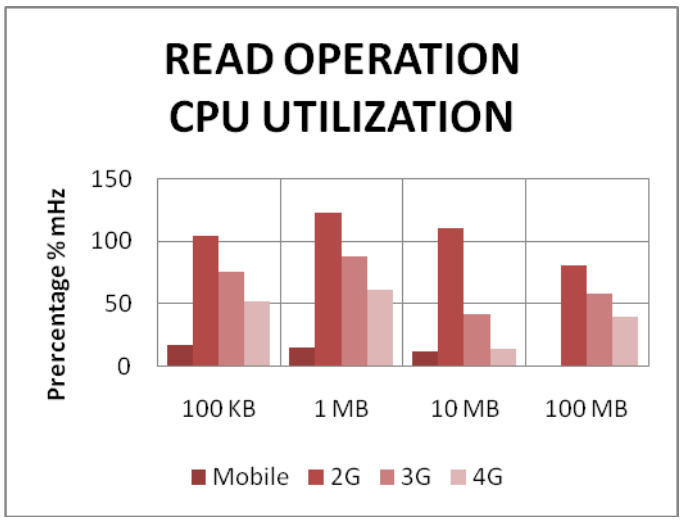
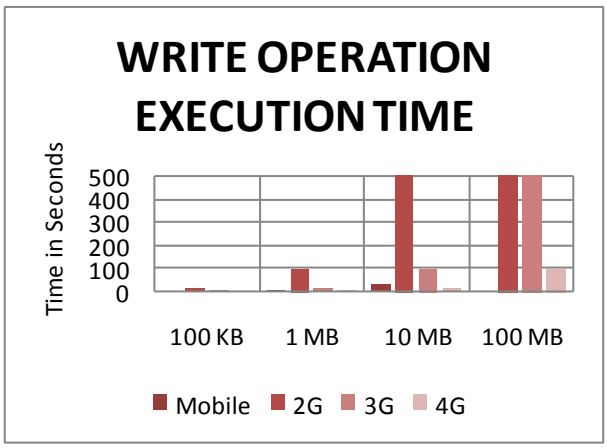
In above figure it has been seen that the ram usage of the mobile has been increased tremendouslyas compare to cloud side. It has been discovered that ram usage at mobile side is about 23 to 100 percent whereas at cloud side it remains 13 to 70 percent.



In above figure it has been seen that the cpu utilization in the mobile is better than cloud due to the limited functionality of mobile. It has been discovered that mobile applications not to deal with multitasking capabilities whereas cloud has to do multiple work together.

Round 2 – Write Operation



In above figure it has been seen that the execution time of the mobile and for cloud at 4G speed reading 100 kb file is less than of a second .In the cloud execution time depends on two factors one the time spend in transferring file from mobile to cloud (CS.Speed) and the other one is processing time(Jobc.time). For example at 4G speed for 10 MB file CS.Speed = 10 seconds and Jobc.time=2.55 seconds. Jobc.Total=Jobc.time+CS.Speed=12.55 seconds as compare to mobile it takes 31.1 seconds to complete where as 2G and 3G takes more time So it shows bandwidth plays important role in performance of a hardware.

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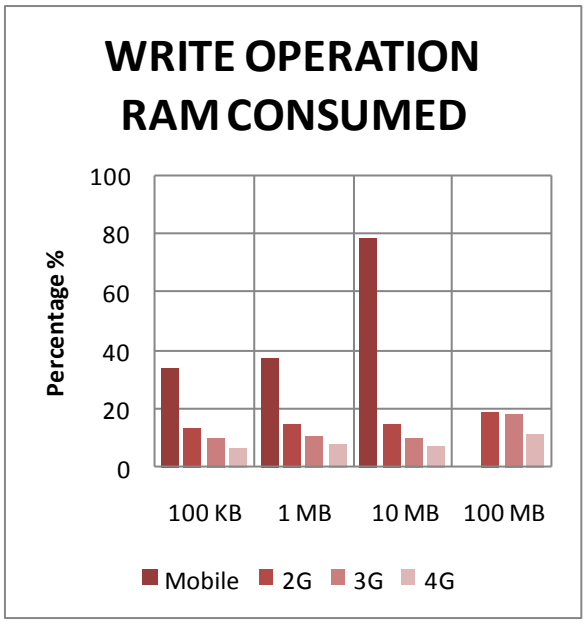
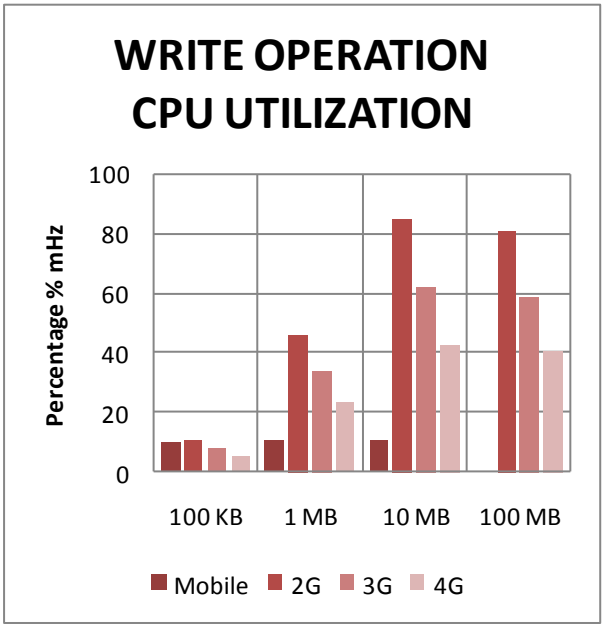


In above figure it has been seen that the ram usage of the mobile has been increased tremendously as compare to cloud side. It has been discovered that ram usage at mobile side is about 33 to 80 percent whereas at cloud side it remains 6 to 20 percent. Here value for mobile at 100 MB file is not shown because mobile not supports more than 15 MB.



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Round 3- Database Operation

a. Insert

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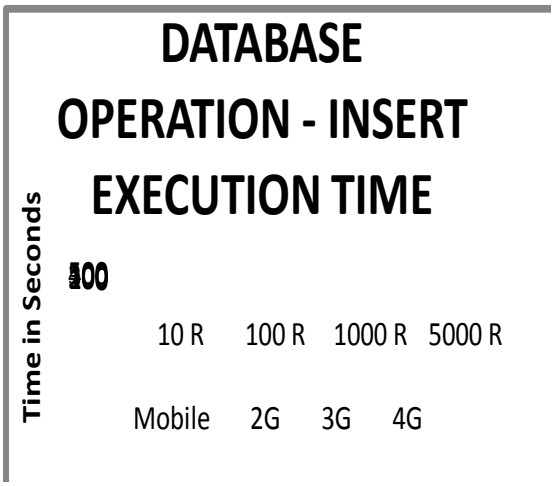
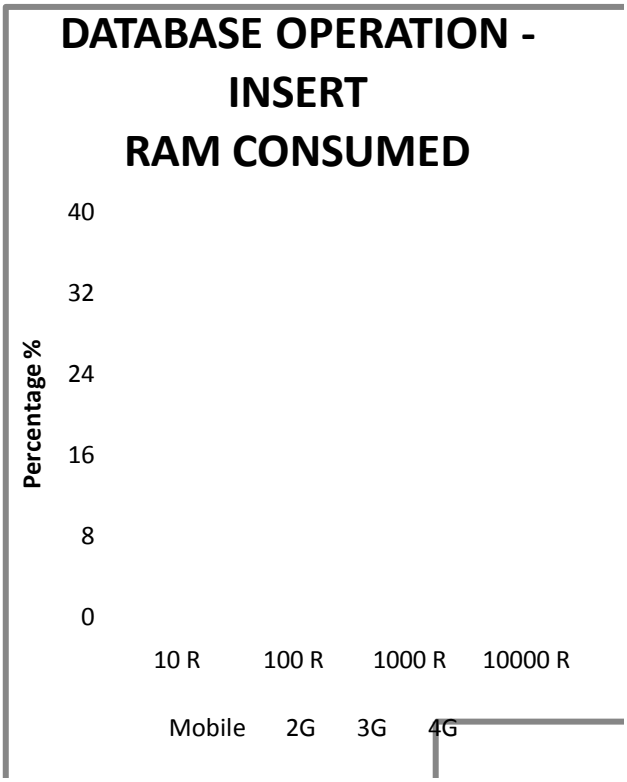


In above figure it has been seen that the insertion of10,100, 1000, and 5000 Records in database and execution time calculated. It has been discovered that 2G and 3G at Cloud side takes more time than 4G at cloud and mobile.



In above figure it has been seen that the insertion of 10,100, 1000, and 5000 Records in database .The ram usage decreased as bandwidth or speed increased at cloud side. The faster the data reaches to cloud lesser the resources used.

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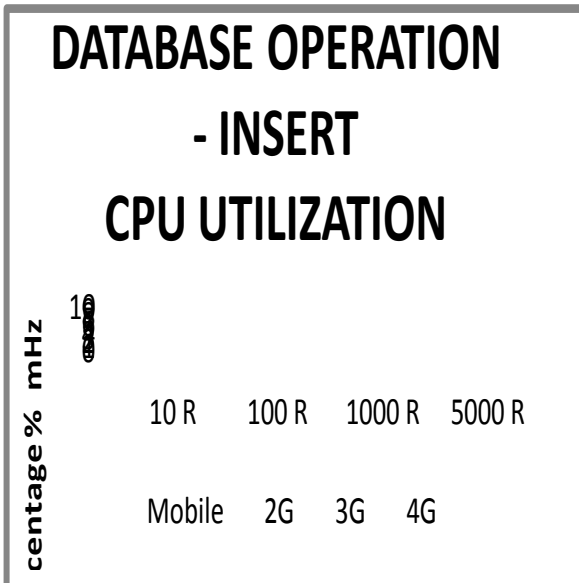
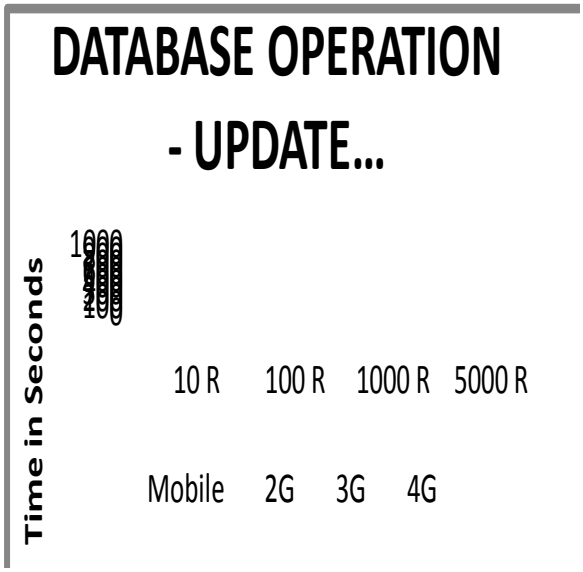


In above figure it has been seen that the CPU utilization in the mobile is very high because of mobile limited configuration than cloud. It has been discovered that mobile applications not deal with complex data task efficientlyas compared to cloud.

Round 3- Database Operation

b. Update



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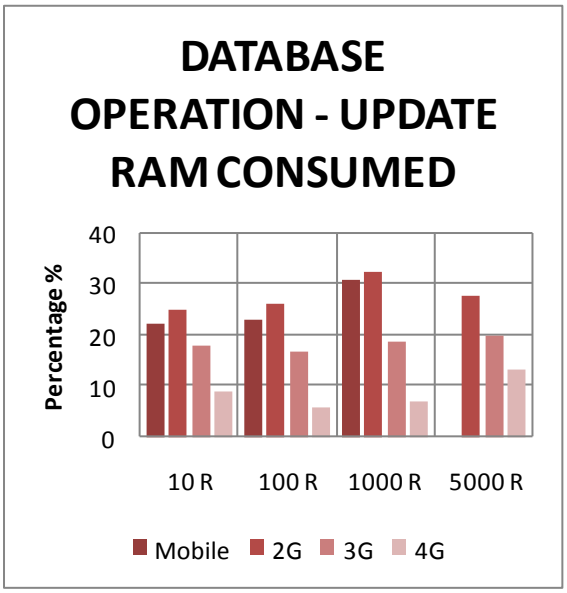

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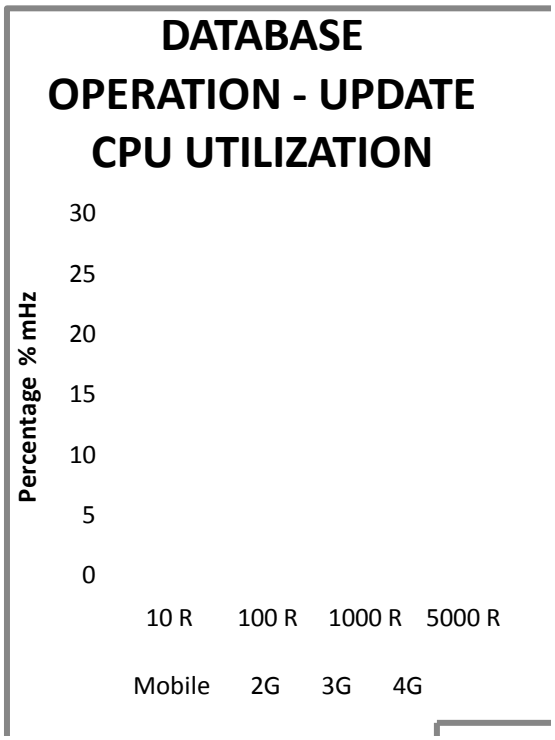

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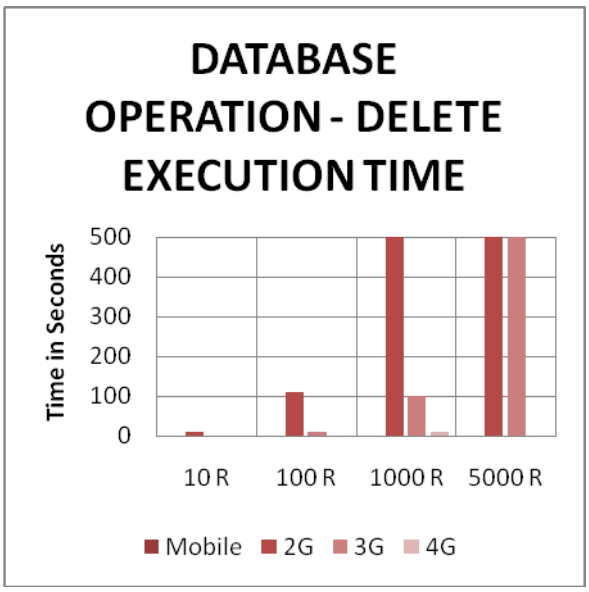
Round 3- Database Operation

c. Delete



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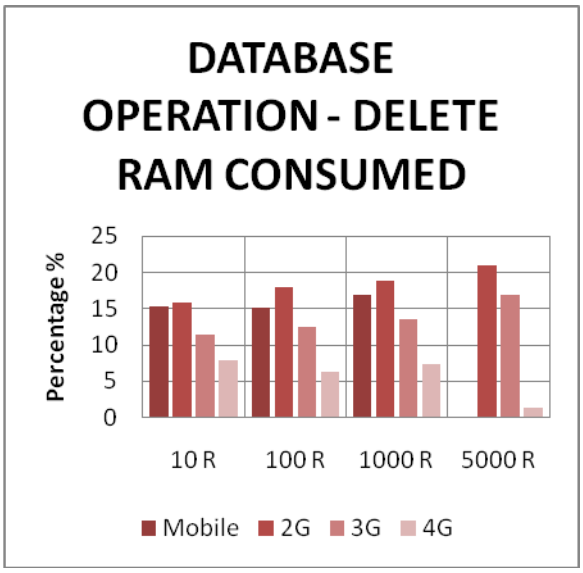

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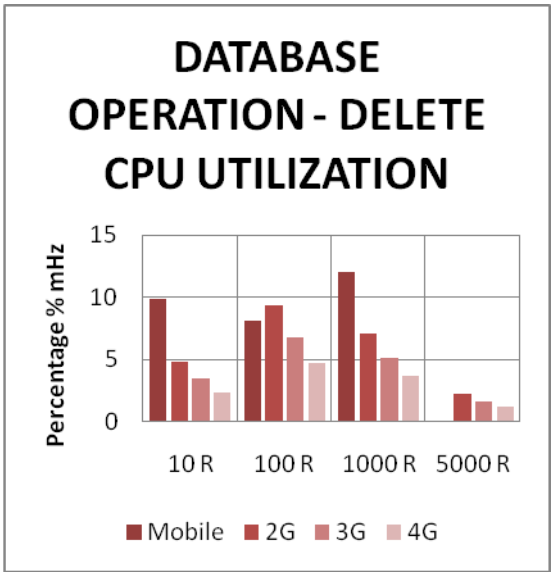

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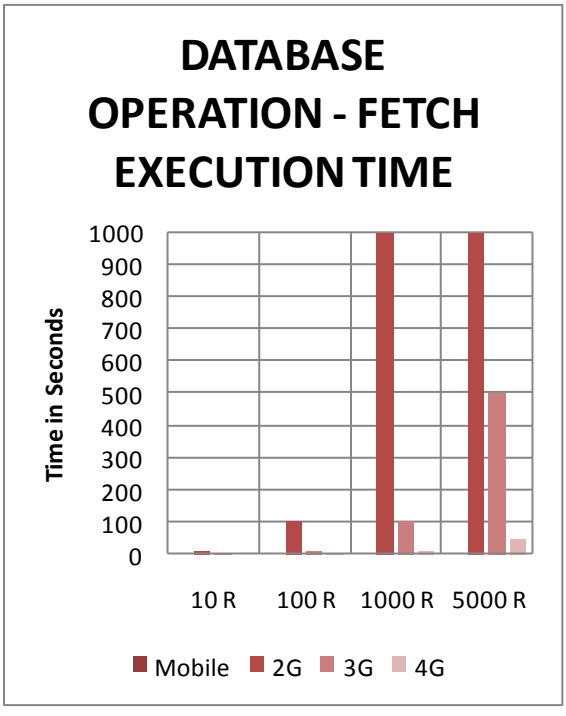
Round 4- Database Operation

d. Fetch



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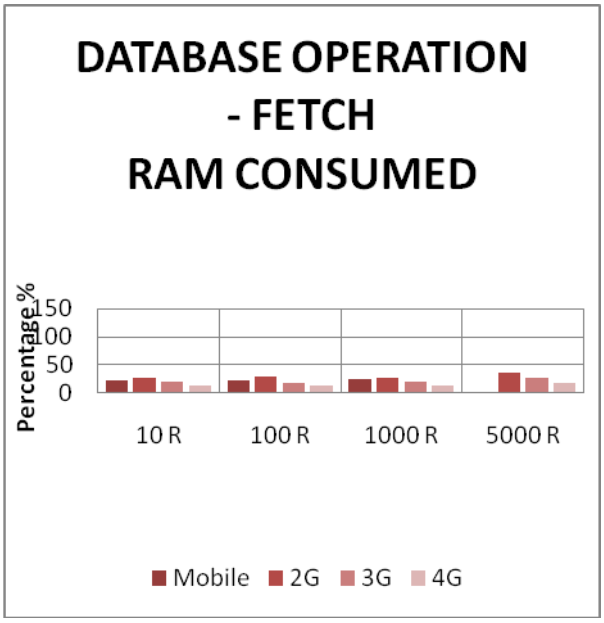

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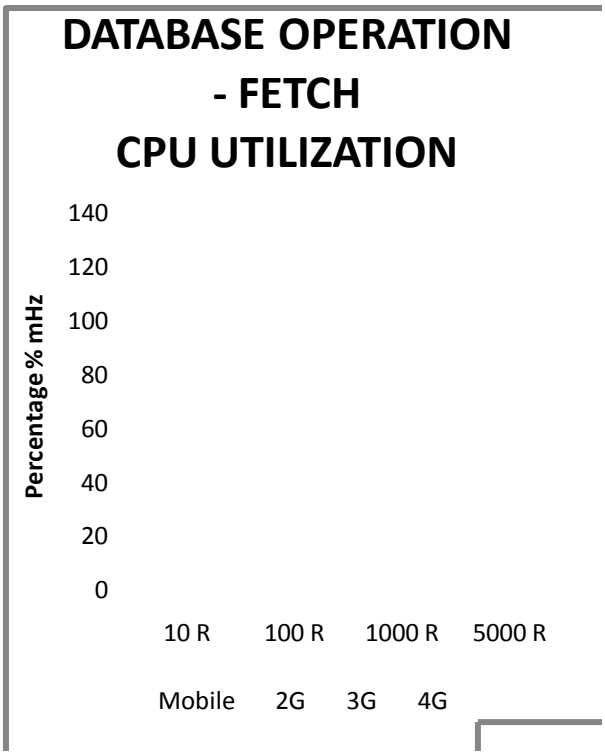

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V. CONCLUSION

In proposed work, the main aim is to create a load balancing algorithm and offloading algorithm based on the availability of RAM, by assigning the jobs to the mobile devices and then to cloud side environment in such a manner that all high demanding job or low demandingjob to balance the system and in the end compare the performance of cloud and mobile devices. So, to implement this, the proposed algorithm evaluates read, write and database applications at both the cloud and the mobile devices to check how efficient both the platform is in order to successfully execute the jobs. The cloud network utilized three type networks i.e. 2 G, 3G and 4G and three vary with some speed. From results it has been concluded that cloud model has good rate of parameter values with respect to mobile model on the basis of three metrics like execution time, cpu utilization and ram usage but cannot denying the factors that at some stages mobile give better performance than cloud due to limited bandwidth availability and security concerns. When it comes cloud side there is a drastic change in performing the operation as data available to cloud comes through the 2g, 3g and 4g channels. The above work also proposed that low end jobs like reading, writing of 100kb, 1 mb files and database operations insert, fetch, delete and update of 10 records to 100 records give better results on mobiles where as high end jobs like reading, writing of 10 mb, 100 mb files and database operations insert, fetch, delete and update of 10 records to 100 records give better results on cloud.

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