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RESEARCH ARTICLE

Optimizing Using the Offloading Technique and Dynamic Computation in the Mobile Cloud Computing

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ABSTRACT

Mobile cloud computing integrates both the mobile computing and cloud computing and tackles the computation offloading. Cloud-based computation offloading optimizes the systems performance, minimizes battery power consumption, and executes the applications that are unable to execute due to insufficient mobile resources. Resources in the mobiles are very less, so offloading is a useful for mobiles. The implementation of the task scheduler minimizes the energy consumption in both the private cloud and public cloud.

Key words: Energy saving, heterogeneity, migration cost, mobile cloud computing, offloading, etc.

INTRODUCTION

Mobile computing is that a user can perform their digital task on mobiles. The best examples for the mobile computing are online delivery system with credit card verification, location-aware mobile services used to telecast the weather and road conditions, social media applications through smartphones, and warble devices to measure and record health conditions. The most frequently used mobile apps are shown in Figure 1.

The main advantages of the mobile computing are the portability, connectivity, interactivity, and adapting a new technology according to the individual users.

How often people are opening the mobile applications

According to the world stat report, people are using their mobiles for communication, food ordering, entertainment, etc. The average number of times the people are using their mobile is shown in graph form in Figure 2. The people saw that their mobile at least 1–10 times per day is 51%.

The primary downside of the mobile computing is the limited resources, low battery lifetime. The loopholes existed in the mobile computing can overcome by mobile cloud computing.

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MOBILE CLOUD COMPUTING

Mobile cloud computing is a technique, in which mobile devices are hosted using cloud computing technique. Mobile cloud computing is accessed through a mobile browser from a remote server without the need of installing a client application on the client smartphone.

Applications that integrate the recent technologies such as machine learning, internet of things, and artificial intelligence require more storage in the mobile internal memory. Cloud computing solves the storage problem. Remote servers provide the necessary storage for functioning the app and do not affect the internal memory of the mobile.

Augmented reality techniques are used mostly in gaming applications and marketing to attract the customers.

Advantages of mobile cloud apps are as follows:

- Mobile cloud apps are available for low cost.
- Small and use of application programming interface.
- There is no need of installation.
- Easy maintenance.
- Easy integration of database.
- Saves time.
- Easy recovery of data.

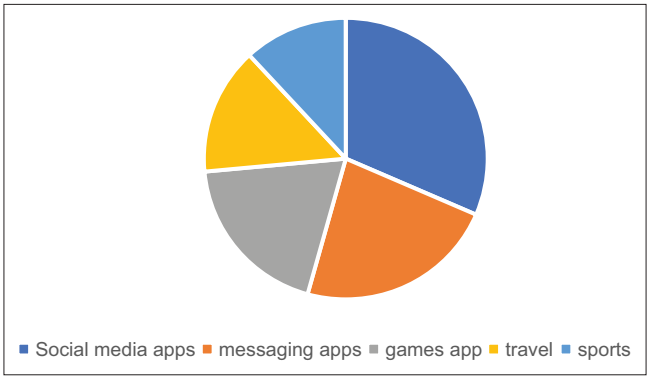

Figure 1: Most frequently used mobile apps

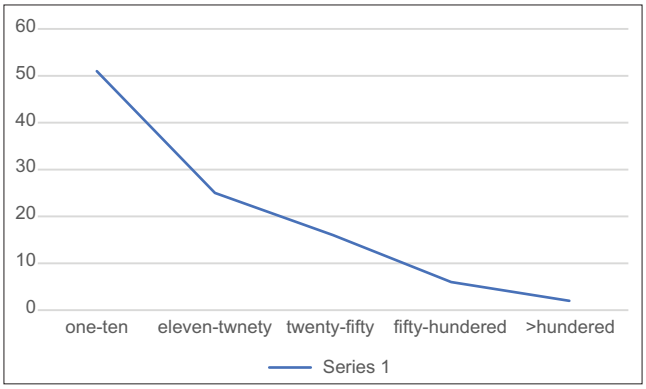

Figure 2: Number of times people opening the mobile phones

- Quick updating and respond according to the market needs.
- Safe storage of data.
- No need to develop separate apps for different platforms.
- Long battery life.
- More storage spaces.
- Opportunity to adopt recent technologies.

Disadvantages of mobile cloud apps are as follows:

- Data security.
- Performance.
- Connectivity.

The usage of mobile cloud computing is going on increasing day by day. The usage of mobile clouds is shown in Figure 3.

The key issues of the mobile cloud computing are given in Table 1.

RELATED WORK

A virtual cloud computing provider for mobile devices[1] solved the issues in the accessibility of the cloud computing resources. The authors proposed a framework to load balance without connecting to the cloud service provides. This framework uses the mobiles as a virtual provider by connecting nearby mobiles.

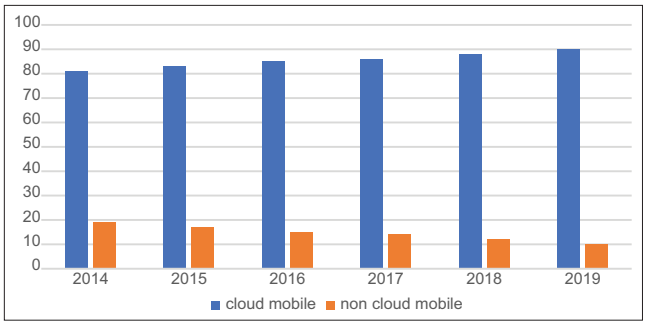

Figure 3: Comparison of cloud versus non-cloud mobile over years

Table 1: The issues of the mobile cloud computing

Issue	Description
Operational level issues	Issues related to the technology such as offloading computation, cost-benefit analysis, mobility management, and connection protocols
End user level issues	Issues related to direct involvement of users such as transactions, participating, cost, and interoperability
Service and application level issues	Issues related to the performance measurements and the quality of the service of the system
Privacy security and trust	Issues related to the offloading computations or data storage
Context awareness	Issues related to the context information to change when reconfigure automatically to adapt the context
Data management	Managing data on the cloud raise many complications regarding to the privacy and security and computations

Clone cloud: Elastic execution between a mobile device and the cloud[2] enhances the speed and minimizes the energy consumption. Using the application partitioning and migration techniques, the cloud enables the mobiles.

Cloud computing through mobile learning[3] reduces the cost for storage and computing for e-learning.

Cloud computing for enhanced mobile health applications[4] proposed a framework for mobile health services.

Mobicloud: Building secure cloud framework for mobile computing and communication[5] proposed a framework for enhancing the security of the services in mobile cloud computing.

MAUI[6] is a framework for offloading process to reduce energy consumption on the mobiles. MAUI measures the device characteristics and keeps monitoring the network characteristics.

Cloudlet[7] proposed a virtual machine-based cloudlet framework that deploys the remote resources on parallel systems. Cloudlets provide scalability, mobility, and elasticity.

Jade[8] minimizes the energy computation offloading and dynamically changes the offloading according to the device status.

Cuckoo[9] enhances the mobile performance and reduces battery consumption. Cuckoo framework takes advantage of offloading and if remote resources are not available, then it uses the local resources.

Phone2cloud[10] proposed that framework enhances the energy efficiency and enhances the performance. It uses the semi-automatic offloading. Task offloading is beneficial when the cost of offloading is less than the cost of executing the task on the mobiles. When offloading, the offloading goals for the mobile users are to save the cost and energy on the mobiles and enhance the execution time. The task scheduler uses the available resources on the mobiles.

PROPOSED APPROACH

The task scheduler minimizes the energy consumption and cost with the help of offloading. Every mobile has multiple tasks and using task offloading, a task is executed locally on mobile or on the cloud independent of mobile. The proposed model optimizes the energy consumption when it evaluated using a private cloud and optimizes the energy and the cost when evaluated in the public clouds. Computation offloading takes advantage of the resource of the cloud to overcome the limitation of the mobiles, the applications are partitioned and migrated to the cloud and the computations are executed on the cloud and the results are sent back to the mobile for further processing.

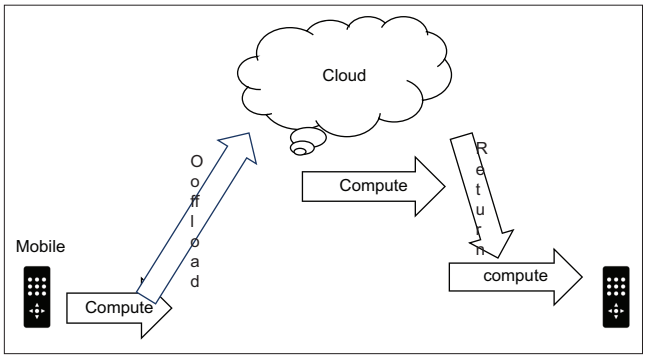

Figure 4: Resource utilization using the offloading technique on the cloud

Figure 5: To upload or download the data in the mobile cloud computing environment

EXPERIMENTAL RESULTS

The upload to the cloud and downloads from the cloud options are shown in Figure 4 when uploading option has chosen then to Figure 5 is shown. We have given the option that multiple files can be uploaded to the cloud at a time. This option is shown in Figure 5. The resource availability and the number of tasks and their corresponding ids are

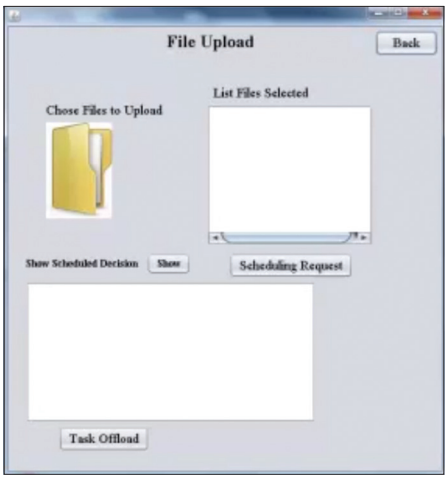

Figure 6: To upload the file in the cloud using the mobile cloud computing environment

Figure 7: Resource availability in the cloud

Figure 8: The specific tasks availability in a specific cloud storage

shown in Figure 6. The total number of resources available at the cloud is also available and is shown in Figure 6. Resource availability in the cloud is shown in Figure 7. The specific tasks availability in specific cloud storage is shown in Figure 8.

CONCLUSION

Computational offloading is a technique, in which resource tasks are executed over the cloud to overcome the resource limitation on mobiles. Mobile computing reduces the computing power and data storage from mobiles. Computation offloading sends computation applications to a remote server. Resource intensive computations executed on a mobile device takes long time, but the same computation executed on cloud takes less time. Offloading improves the usability of mobiles in areas such as healthcare, entertainment, education, and so on.

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