Task Division Algorithm for Mobile Cloud Computing (TDAMCC)

[1]Nachiketa Shrivastava, [2]Ravimohan, [3]Sumit Sharma, [4]Manjul Dhoomketu Shrivastava
[1,2,3,4]EC SRIT

Abstract
Cloud Computing is spreading rapidly around the world and cloud applications are being used extensively for facilitating users for not only storage management but for providing load sharing and easy delivery of the applications. Mobile cloud computing is an area which is also leveraging the advantages of the cloud computing in development, maintenance and high performance of the mobile devices. Since mobile devices are low resources in terms of processing power, memory and screen area therefore it is required that the mobile applications should apply as small work on mobile as possible. This paper presents an algorithm for dividing the loads being carried by mobile devices over the cloud which performs the task of searching on the clouds and provides results to the mobile device which first demands the particular items and then shows the generated results to the mobile user. For achieving the task an application is being developed which shall add all the contact details on the cloud dynamically and will maintain the result. Whenever a user applies the search for contacts another part of the application will send the search to the cloud which will perform the actual search and will send the generated results to the mobile device. The proposed work a framework which can be applied for any data which requires extensive load on CPU and makes the mobile burdened for processing.

Keywords
Cloud Computing, Mobile Cloud Computing, Challenges in Mobile Computing, Task Divison

I. Introduction

A Cloud is a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers.

Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services (Software as a Service - SaaS). The data center hardware and software is what we will call a Cloud. When a Cloud is made available in a pay-as-you-go manner to the public, we call it a Public Cloud; the service being sold is Utility Computing.

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

Cloud computing is internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand. - Wikipedia.

Given that explanation, platforms like YouTube, Video, Flickr, Slideshare and Skype can reasonably be included in a list of cloud applications – platforms that hold your data (images, video, presentations, voice)

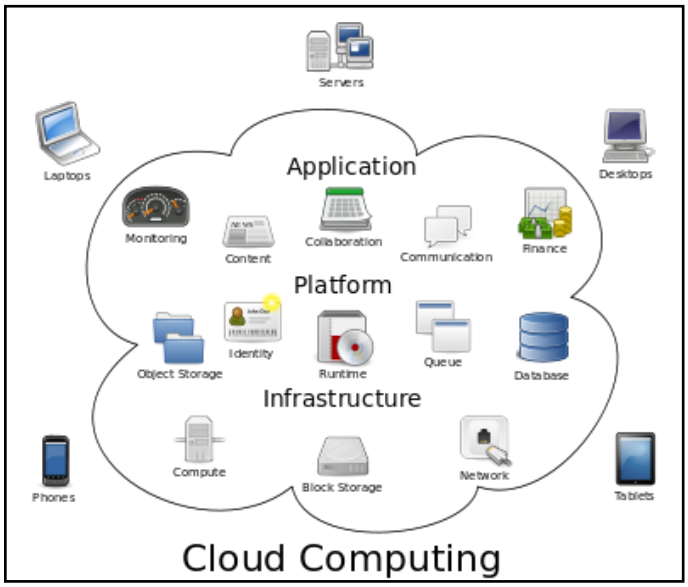

Fig. 1:

and look after it all so you don't have to worry about them.

II. Challenges in Cloud Computing

A. Privacy

The cloud model has been criticized by privacy advocates for the greater ease in which the companies hosting the cloud services control, thus, can monitor at will, lawfully or unlawfully, the communication and data stored between the user and the host company.

B. Compliance

In order to obtain compliance with regulations including FISMA, HIPAA, and SOX in the United States, the Data Protection Directive in the EU and the credit card industry's PCI DSS, users may have to adopt community or hybrid deployment modes that are typically more expensive and may offer restricted benefits. This is how Google is able to "manage and meet additional government policy requirements beyond FISMA" and Rackspace Cloud or Qube Space are able to claim PCI compliance.

C. Legal

As with other changes in the landscape of computing, certain legal issues arise with cloud computing, including trademark infringement, security concerns and sharing of propriety data resources.

D. Open Source

Open-source software has provided the foundation for many cloud computing implementations, prominent examples being the Hadoop framework and VMware's Cloud Foundry.. In November 2007, the Free Software Foundation released the Affero General Public License, a version of GPLv3 intended to close a perceived legal loophole associated with free software designed to be run over a network.

E. Open Standards

Most cloud providers expose APIs that are typically well-documented (often under a Creative Commons license) but also unique to their implementation and thus not interoperable. Some vendors have adopted others' APIs and there are a number of open standards under development, with a view to delivering interoperability and portability. As of November 2012, the Open Standard with broadest industry support is probably Open Stack, founded in 2010 by NASA and Rackspace, and now governed by the Open Stack Foundation. Open Stack supporters include AMD, Intel, Canonical, SUSE Linux, Red Hat, Cisco, Dell, HP, IBM, Linux, Yahoo, and now VMWARE.

F. Security

As cloud computing is achieving increased popularity, concerns are being voiced about the security issues introduced through adoption of this new model. The effectiveness and efficiency of traditional protection mechanisms are being reconsidered as the characteristics of this innovative deployment model can differ widely from those of traditional architectures. An alternative perspective on the topic of cloud security is that this is but another, although quite broad, case of "applied security" and that similar security principles that apply in shared multi-user mainframe security models apply with cloud security.

G. Sustainability

Although cloud computing is often assumed to be a form of "green computing", there is no published study to substantiate this assumption. Citing the servers affects the environmental effects of cloud computing. In areas where climate favors natural cooling and renewable electricity is readily available, the environmental effects will be more moderate.

H. Abuse

As with privately purchased hardware, customers can purchase the services of cloud computing for nefarious purposes. This includes password cracking and launching attacks using the purchased services. In 2009, a banking trojan illegally used the popular Amazon service as a command and control channel that issued software updates and malicious instructions to PCs that were infected by the malware.

I. IT Governance

The introduction of cloud computing requires an appropriate IT governance model to ensure a secured computing environment and to comply with all relevant organizational information technology policies. As such, organizations need a set of capabilities that are essential when effectively implementing and managing cloud services, including demand management, relationship management, data security management, application lifecycle management, risk and compliance management.

III. Challenges in Mobile Cloud Computing

The main objective of mobile cloud computing is to provide a convenient and rapid method for users to access and receive data from the cloud, such convenient and rapid method means accessing cloud computing resources effectively by using mobile devices. The major challenge of mobile cloud computing comes from the characters of mobile devices and wireless networks, as well as their own restriction and limitation, and such challenge makes application designing, programming and deploying on mobile and distributed devices more complicated than on the fixed cloud devices [21].

In mobile cloud computing environment, the limitations of mobile devices, quality of wireless communication, types of application, and support from cloud computing to mobile are all important factors that affect assessing from cloud computing. Table 2 gives an overview of proposed challenges and some solutions about mobile cloud computing.

A. Limitations of Mobile Devices

While discussing mobile devices in cloud the first thing is resource-constrain. Though smart phones have been improved obviously in various aspects such as capability of CPU and memory, storage, size of screen, wireless communication, sensing technology, and operation systems, still have serious limitations such as limited computing capability and energy resource, to deploy complicated applications. By contrast with PCs and Laptops in a given condition, these smartphones like iPhone 4S, Android serials, Windows Mobile serials decrease 3 times in processing capacity, 8 times in memory, 5 to 10 times in storage capacity and 10 times in network bandwidth.

Normally, smartphone needs to be charged everyday as dialing calls, sending messages, surfing the Internet, community accessing, and other internet applications. According to past development trends, the increased mobile computing ability and rapid development of screen technology will lead to more and more complicated applications deployed in smartphones. If the battery technology cannot be improved in a short time, then how to effectively save battery power in smartphone is a major issue we meet today.

The processing capacity, storage, battery time, and communication of those smartphones will be improved consistently with the development of mobile computing. However, such enormous variations will persist as one of major challenges in mobile cloud computing.

B. Quality of Communication

In contrast with wired network uses physical connection to ensure bandwidth consistency, the data transfer rate in mobile cloud computing environment is constantly changing and the connection is discontinuous due to the existing clearance in network overlay. Furthermore, data centre in large enterprise and resource in Internet service provider normally is far away to end users, especially to mobile device users. In wireless network, the network latency delay may 200 ms in 'last mile' but only 50 ms in traditional wired network.

Some other issues such as dynamic changing of application throughput, mobility of users, and even weather will lead to changes in bandwidth and network overlay. Therefore, the handover delay in mobile network is higher than in wired network.

C. Division of Application Services

In mobile cloud computing environment, due to the issue of limited resources, some applications of compute-intensive and data-intensive cannot be deployed in mobile devices, or they may consume massive energy resources. Therefore, we have to divide the applications and use the capacity of cloud computing to achieve those purposes, which is: the core computing task is processed by cloud, and those mobile devices are responsible for some simple tasks only. In this processing, the major issues affecting performance of mobile cloud computing are: data processing in data centre and mobile device, network handover delay, and data delivery time.

For a given standard, providing a quality guaranteed cloud

service should consider the following facts: optimal division of application between cloud and mobile device, interaction between low-latency and code offload, high-bandwidth between cloud and mobile device for high speed data transmission, user-oriented cloud application performance, self-adaptation mechanism of mobile cloud computing, and optimal consumption and overhead of mobile devices and cloud servers. The following strategies can be used to response to the challenges:

1. Upgrade bandwidth for wireless connection, make the web content more suitable for mobile network using regional data centres.
2. Deploy the application processing node at the 'edge' of cloud in order to reduce data delivery time.
3. Duplicate mobile devices to cloud using virtualization and image technologies, to process Data-Intensive Computing (DIC) and Energy-Intensive Computing, such as virus scanning in mobile devices.
4. Dynamically optimize application push in cloud and the division with mobile terminals.

Table 1: Challenge and Soluation of Mobile Cloud Computing

Challenges	Solutions
Limitations of mobile devices	Virtualization and Image, Task migration
Quality of communication	Bandwidth upgrading, Data delivery time reducing
Division of applications services	Elastic application division mechanism

IV. Benefits of Mobile Cloud Computing

Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing apps and mobile computing to not just smartphone users but a much broader range of mobile subscribers. In this section, we enlist the possible benefits of Mobile Cloud Computing.

Mobile Cloud Computing will help to overcome limitations of mobile devices in particular of the processing power and data storage.

It also might help to extend the battery life by moving the execution of commutation-intensive application 'to the cloud'.

Mobile Cloud Computing is also seen as a potential solution for the fragmented market of mobile operating systems with currently eight major operating systems.

V. Existing System

Various researchers have thrown light on the working, benefits and architecture of the Mobile Cloud Computing. Major issues are related with the constraints of the mobile devices and researchers have enlisted these issues as follows:

Although some projects of mobile cloud computing have already been deployed around the world, there is still a long way for business implementation, and some research aspects should be considered in further work [1].

A. Data Delivery

Due to the feature of resource-constrains, mobile devices have potential challenges in cloud accessing, consistent accessing, data transmission, and so on. Such challenges can be solved using: special application (service) and middle-ware (provide a platform for all mobile cloud computing systems).

B. Task division

Researchers divide tasks (applications) from mobile devices into multiple sub-tasks and deliver some of them to run in cloud, which is a good solution to the resource limited mobile devices. However, we do not have an optimal strategy or algorithm on how to divide these tasks, which one should be processed by cloud and which one by devices.

C. Better Service

The original purpose of mobile cloud computing is providing PC-liked services to mobile terminals. However, as the existing different features between mobile devices and PCs, we cannot directly transplant the services from PCs' platform to mobile devices. Therefore, further research should try to identify the method on how to provide suitable and friendly interactive services for mobile devices [1].

The advances in technologies of cloud computing and mobile computing enable the newly emerging mobile cloud computing paradigm. Three approaches have been proposed for mobile cloud applications:

1. Extending the access to cloud services to mobile devices
2. Enabling mobile devices to work collaboratively as cloud resource providers
3. Augmenting the execution of mobile applications on portable devices using cloud resources

In this paper, we focus on the third approach in supporting mobile data stream applications. More specifically, we study the computation partitioning, which aims at optimizing the partition of a data stream application between mobile and cloud such that the application has maximum speed/throughput in processing the streaming data. To the best of our knowledge, it is the first work to study the partitioning problem for mobile data stream applications, where the optimization is placed on achieving high throughput of processing the streaming data rather than minimizing the make span of executions in other applications.

We first propose a framework to provide runtime support for the dynamic partitioning and execution of the application. Different from existing works, the framework not only allows the dynamic partitioning for a single user but also supports the sharing of computation instances among multiple users in the cloud to achieve efficient utilization of the underlying cloud resources.

Meanwhile, the framework has better scalability because it is designed on the elastic cloud fabrics. Based on the framework, we design a genetic algorithm to perform the optimal partition. We have conducted extensive simulations. The results show that our method can achieve more than 2X better performance over the execution without partitioning [2].

VI. Proposed Algorithm

From the challenges as discussed above, the major issue in implementing mobile cloud computing is to divide the application on the mobile device in such a way so that it will require least resources on mobile device and will apply minimum load on network to get the processing done on the cloud and display results to the user.

For this work, search tool in mobile devices is being taken as the service (application) to map on the cloud in following steps:

Step 1:

All the contact details added by the user shall be stored on the cloud using an internal thread. Mobile device will have recently added (within 1 day) or recently searched contacts (within 1 day) on it and rest will be stored on the cloud server.

Step 2:
When the user searches for a contact then, it will be first seen within the local dataset of the mobile device.
Step 3:
If the contact is found locally, then it will be shown to the user.
Step 4:
If the contact is not found locally then it will be sent to the cloud server to process the search and generated list will be displayed to the user.
Step 5:
On cloud there will a database for keeping the contacts of the user and multithreaded software will be created to search the details of the searched contact(s).
Step 6:
There will also be a thread always running to receive the requirements of the user from the mobile to add a new contact, edit a contact details, and delete contact and search as required.
Step 7:
The space requirements, efficiency and bandwidth requirements shall be analysed for the proposed system in comparison with the work done without application of cloud.

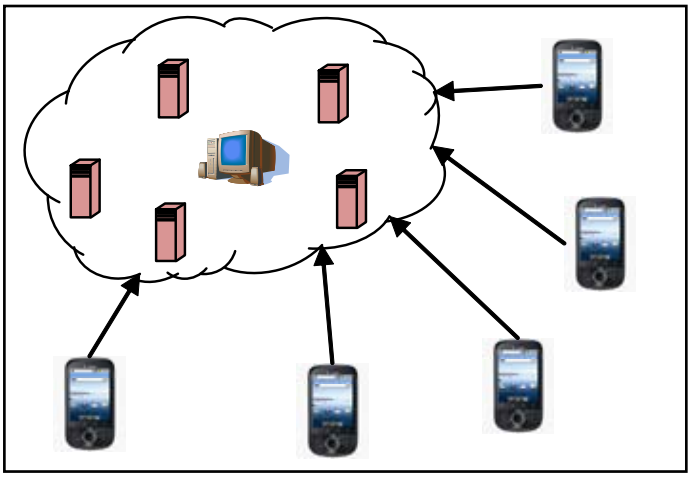

Fig. 2:

showing processing environment for the proposed algorithm

VII. Results & Discussion

The proposed work is oriented on generating a cloud based mobile cloud computing scenario which will provide the high performance and storage management on mobile devices using task division. This paper presented an algorithm for dividing the loads being carried by mobile devices over the cloud which performs the task of searching on the clouds and provides results to the mobile device which first demands the particular items and then shows the generated results to the mobile user. For achieving the task an application is being developed which shall add all the contact details on the cloud dynamically and will maintain the result. Whenever a user applies the search for contacts another part of the application will send the search to the cloud which will perform the actual search and will send the generated results to the mobile device. The proposed work a framework which can be applied for any data which requires extensive load on CPU and makes the mobile burdened for processing.
The work is being implemented using JAVA in which two servers shall be initially implemented to map the cloud and

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Nachiketa Shrivastava, IV SEM ME (EC), Digital Communication S.R.I.T Jabalpur, India