ADAPTIVE OFFLOADING IN MOBILE CLOUD COMPUTING BY AUTOMATIC PARATIONING APPROACH OF TASKS

Samriti Goyal , Bhartii Grover

COMPUTER SCIENCE & ENGINEERING
GURUKUL VIDYAPEETH INSTITUTE OF ENGINEERING & TECHNOLOGY
(PUNJAB TECHNICAL UNIVERSITY)

Abstract- An abstract is a brief summary of a research article, thesis, review, conference proceeding or any in-depth analysis of a particular subject or discipline, and is often used to help the reader quickly ascertain the paper's purpose. This document gives formatting instructions for authors preparing papers for publication. The authors must follow the instructions given in the document for the papers to be published.

Index Terms- About four key words or phrases in alphabetical order, separated by commas. (Mention 4-5 keywords)

I. INTRODUCTION

The term Cloud refers to a Network or Internet. In other words, we can say that Cloud is something, which is present at remote location. Cloud can provide services over public and private networks, i.e., WAN, LAN or VPN. Applications such as e-mail, web conferencing, customer relationship management (CRM) execute on cloud.

Cloud computing, also known as on-demand computing, is a kind of Internet-based computing, where shared resources, data and information are provided to computers and other devices on-demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data center. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort.

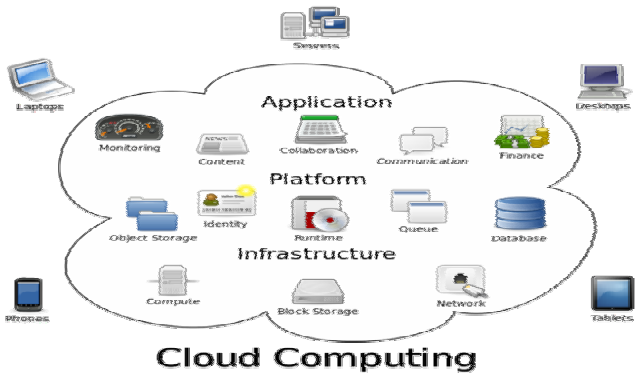
- Cloud Computing provides us means by which we can access the applications as utilities over the internet. It allows us to create, configure, and customize the business applications online.
- Cloud Computing refers to manipulating, configuring, and accessing the hardware and software resources remotely. It offers online data storage, infrastructure, and application. Cloud computing offers platform independency, as the software is not required to be installed locally on the PC. Hence, the Cloud Computing is making our business applications mobile and collaborative.

1.2 Cloud Computing

In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. The cloud is just a metaphor for the Internet. It goes back to the days of flowcharts and presentations that would represent the gigantic

server-farm infrastructure of the Internet as nothing but a puffy, white cumulonimbus cloud, accepting connections and doling out information as it floats.

What cloud computing is *not* about is your hard drive. When you store data on or run programs from the hard drive, that's called local storage and computing. Everything you need is physically close to you, which means accessing your data is fast and easy, for that one computer, or others on the local network.



1) Deployment Models:

Deployment models define the type of access to the cloud, i.e., how the cloud is located? Cloud can have any of the four types of access: Public, Private, Hybrid, and Community.

- **PUBLIC CLOUD:** The public cloud allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness.
- **PRIVATE CLOUD:** The **private cloud** allows systems and services to be accessible within an organization. It is more secured because of its private nature.
- **COMMUNITY CLOUD:** The **community cloud** allows systems and services to be accessible by a group of organizations.
- **HYBRID CLOUD:** The hybrid cloud is a mixture of public and private cloud, in which the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.
- **DISTRIBUTED CLOUD:** A cloud computing platform can be assembled from a distributed set of machines in different locations connected to a single network or hub service. It is possible to distinguish between two types of distributed clouds: public-resource computing and volunteer cloud.
- **MULTI CLOUD**: Multi cloud is the use of multiple cloud computing services in a single heterogeneous architecture to reduce reliance on single vendors, increase flexibility through choice, mitigate against disasters, etc. It differs from hybrid cloud in that it refers to multiple cloud services, rather than multiple deployment modes (public, private, legacy)

Service Models:

Cloud computing is based on service models. These are categorized into three basic service models which are -

- **Infrastructure-as–a-Service (IaaS)**
- **Platform-as-a-Service (PaaS)**
- **Software-as-a-Service (SaaS)**

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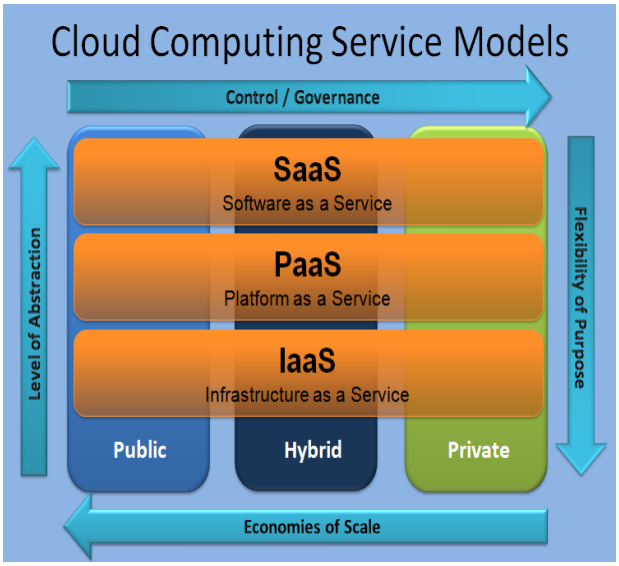
1) INFRASTRUCTURE-AS-A-SERVICE (IAAS) provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.
2) PLATFORM-AS-A-SERVICE (PAAS) provides the runtime environment for applications, development and deployment tools, etc.
3) SOFTWARE-AS-A-SERVICE (SAAS) model allows to use software applications as a service to end-users.



Offloading Techniques

Offloading is a solution to augment these mobile systems' capabilities by migrating computation to more resourceful computers (i.e., servers). This is different from the traditional client-server architecture, where a thin client always migrates computation to a server. Computation offloading is also different from the migration model used in multiprocessor systems and grid computing, where a process may be migrated for load balancing. Offloading May save energy and improve performance on mobile systems.

The common approaches used to make offloading decisions, and classify these approaches based on various factors, including:

• Why to offload (improves performance or save energy)
• When to decide offloading (static vs. dynamic)
• What mobile systems use offloading (laptops, PDAs, robots)
•Types of applications (multimedia, gaming, calculators, text editors, predictors)
• Infrastructures for offloading (grid and cloud computing)

TYPES OF OFFLOADING:

1. PARTIAL/STATIC OFFLOADING
2. COMPLETE/DYNAMIC OFFLOADING

Static Offloading:
In **static offloading** application is partitioned during development. In static environment, parameters such as data size and execution time which acts as deciding factor for offloading are known beforehand. However, it is difficult to know the correct execution time before the actual execution takes place and the inaccurate data can result into inefficient offloading result.

Dynamic Offloading:
Dynamic network environment means changing connection status and bandwidth that affect the process of offloading. By the term dynamic offloading we mean that the modules may be transferred for execution onto cloud when the application is running.

CHAPTER 2

LITERATURE SURVEY

In the last chapter we read a few things about cloud computing like what they are ,what tasks do they perform , motivation behind working on them and about a few commonly known image enhancement techniques.

Roopali, Rajkumari [1] Offloading is defined as a procedure that migrate resource-intensive computations from a mobile device to the resource-rich cloud, or server (called nearby infrastructure). Cloud based computation offloading enhances the application's performance, reduces battery power consumption, and executes applications that are unable to execute due to insufficient smartphone resources. It means that complicated parts of an application run on the remote servers and results are communicated back to the local smartphone device.
Three measures that affect the concept of offloading are as follows:

1) Threshold value
2) Size of Application
3) Critical Section

They used different techniques for Offloading:

- **Static Offloading:**

In static offloading application is partitioned during development. In static environment, parameters such as data size and execution time which acts as deciding factor for offloading are known beforehand. However, it is difficult to know the correct execution time before the actual execution takes place and the inaccurate data can result into inefficient offloading result.

- **3.1.2 Dynamic Offloading:**

Dynamic network environment means changing connection status and bandwidth that affect the process of offloading. By the term dynamic offloading we mean that the modules may be transferred for execution onto cloud when the application is running.

Karthik Kumar·Jibang Liu·Yung-Hsiang Lu· Bharat Bhargava [2] A Survey of Computation Offloading for Mobile Systems Advancements in computing technology have expanded the usage of computers from desktops and main- frames to a wide range of mobile and embedded applications, including surveillance, environmental sensing, GPS navigation, mobile phones, autonomous robots, etc. Many of these applications run on systems with limited resources. For example, mobile phones are battery- powered. Environmental sensors have small physical sizes, slow processors, and small amounts of storage. Most of these applications use wireless networks and their bandwidths are orders-of-magnitude lower than wired networks. Meanwhile, increasingly complex pro-grams are running on these systems—for example, video processing on mobile phones and object recognition on mobile robots. Thus there is an increasing gap between the demand for complex programs and the availability of limited resources. Offloading is a solution to augment these mobile systems' capabilities by migrating computation to more resourceful computers (i.e., servers). This is different from the traditional client-server architecture, where a thin client always migrates computation to a server. Computation offloading is also different from the migration model used in multiprocessor systems and grid computing, where a process may be migrated for load balancing.

Bowen Zhou, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, Satish Narayana Srirama, and Raj Kumar Buyya [3] A Context Sensitive Offloading Scheme for Mobile Cloud Computing Service Mobile cloud computing (MCC) provides services by bringing the abundant resources in cloud computing to the proximity of mobile devices so as to empower the mobile applications performance and conserve the battery life. One of the techniques adopted in mobile cloud computing is code offloading.It identifies the

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computing intensive code of a mobile program and offloads the task to a cloud service via wireless networks. In the concept of code offloading, cloud resources used for offloading have many different types. First and the most common resource is public cloud computing services like Amazon, Google and Microsoft Azure that provide pay-as-you-go services over the Internet. Secondly, a nearby server named cloudlet is considered as cloud resource with fast network connection as well as powerful processors. Cloudlet serves as a middle layer between mobile devices and public cloud services to reduce the network delay and accelerates the computing. Third, a local mobile device ad-hoc network forming a device cloud is another potential cloud resource, especially when there is no access to the Internet.

Pragya Gupta, Sudha Gupta [4] Mobile Cloud Computing: The Future of Cloud Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable resources (e.g. networks, servers, storage, applications and services) that can rapidly be provisioned and released with minimal management effort or service provider interaction."

"It is an information technology service model where computing services (both hardware and software) are delivered on- demand to customers over a network in a self-service fashion, independent of device and location. The resources required to provide the requisite quality-of service levels are shared, dynamically scalable, rapidly provisioned, virtualized and released with minimal service provider interaction. Users pay for the service as an operating expense without incurring any significant initial capital expenditure, with the cloud services employing a metering system that divides the computing resource in appropriate blocks."

Abdullah Gani Han Qi [5] Research on Mobile Cloud Computing: Review, Trend and Perspective smartphones are considered as the representative for the various mobile devices as they have been connected to the Internet with the rapidly growing of wireless network technology. Ubiquity and mobility are two major features in the next generation network which provides a range of personalized network services through numerous network ter- minals and modes of accessing. The core technology of cloud computing is centralizing computing, services, and specific applications as a utility to be sold like water, gas or electricity to users. Thus, the combination of a ubiquities mobile net- work and cloud computing generates a new computing mode, namely Mobile Cloud Computing. As an inheritance and development of cloud computing, resources in mobile cloud computing networks are virtualized and assigned in a group of numerous distributed computers rather than in traditional local computers or servers, and are provided to mobile devices such as smartphones, portable terminal, and so on.

Priyanka Asrani [6] Mobile Cloud Computing the IT industry is ever buzzing with revolutionary inventions since the very first computer came into the picture. The purpose of the computer to perform different tasks and applications has not changed over the last six decades. The only difference is that now these tasks are performed in a cheaper, faster and portable manner. A group of computers or servers are tied together to form a system called as Cloud Computing. Cloud Computing is the new form of application mode in the era of the Internet and it has become the hot topic of research in industrial and scientific communities. It provides the consumers the resources and computing infrastructure as per their requirements. The consumers can use the services and applications available on the cloud through their Internet connection. Cloud computing is not just limited to personal computers; it has a major impact even on the mobile technology. Mobility and ubiquity are the key features of the next generation network. Thus, a combination of Electronic devices like smartphones, PDA"s, tablets, ubiquitous mobile network and cloud computing, resources are

converging together to emerge as a new field of Mobile Cloud Computing.

Ms. Snehal P.Warhekar1, Prof. V.T.Gaikwad [7] Mobile Cloud Computing: Approaches and Issues Mobile devices (e.g., smartphone, tablet pcs, etc.) 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, Google apps, etc.), 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, with mobility come its inherent problems such as resource scarceness, finite energy and low connectivity. Real time applications demand high levels of responsiveness, which in turn, demand intensive computing resources. Some mobile applications, such as location based social networking, process and make use of the phone's various sensor data which is expensive in terms of energy and this limits the mobile phone in providing the user a better service. Furthermore, consider applications that require extensive processing– image processing for video games, speech synthesis, natural language processing, augmented reality, wearable computing—all these demand high computational capacities thus restricting the developers in implementing applications for mobile phones.

Yating Wang and Ing-Ray Chen [8] A Survey of Mobile Cloud Computing Applications: Perspectives and Challenges One design issue for building MCC applications is code/computation offloading to enhance MCC application performance and conserve mobile device energy. The framework of elastic application processing comprises three parts: application partitioning, code offloading, and remote execution. Application partitioning is the process of identifying the units (threads, methods, or classes) that can be processed on the cloud. Static partitioning appeared in which the entry and exit points of a remote method call can be statically identified. Application partitioning is crucial for code offloading. It requires the application be partitioned at the breakpoints correctly and efficiently. If a breakpoint is not set properly, it will largely degrade performance. It also requires a cost model be developed such that the overall cost related to the computation cost, network cost, and energy cost can be minimized.

Qiufen Xia, Weifa Liang and Wenzheng Xu [9] Throughput Maximization for Online Request Admissions in Mobile Cloudlet Many mobile devices such as smart phones and tablets are becoming increasingly popular, people now depend heavily on them to run various applications such as image processing, Facebook, twitter, games, and emails for social and business purposes. However, due to small sizes and being powered by batteries, these portable and lightweight mobile devices have only limited energy to support their operations. To mitigate the severe energy constraint on mobile devices is to make use of the rich resources provided by mobile cloud computing (MCC) platforms. That is to offload data and computation- ally expensive tasks from mobile devices to cloud platforms through wireless networks [4], [6], [10]. In MCC environments, wireless mobile devices access the cloud through wireless communication such as Wi-Fi, 3G/4G, etc. However, it is well known that wireless communication is unreliable and constrained by its bandwidth. The long delay of data transfer between a mobile device and the cloud is unavoidable. Thus, offloading tasks from mobile devices to the cloud are not always a smart choice since the cloud is typically far from mobile users. To overcome the long delay by offloading tasks to the remote clouds, the cloud has to

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be moved closer to the mobile users in the form of the cloudlet, which consists of trusted, resource rich servers in vicinities of mobile users.

R.JeminaPriyadarsini [10] Performance Evaluation of Min-Min and Max-Min Algorithms for Job Scheduling in Federated Cloud Minimum completion time for each task in min-min is computed for all machines. The task with overall minimum completion time is chosen and assigned to corresponding machine. The newly mapped task is removed and the process is repeated till all tasks are mapped. Min-min is a simple and fast algorithm capable of good performance. Even GA "seeds" a population with a min-min chromosome to ensure good performance. Min-min schedules "best case" tasks first generating good schedules. Assigning small task first is it drawback. Thus, smaller tasks are executed first and then few larger tasks are executed while many machines are idling, resulting in poor machine use. Min-min establishes minimum completion time for unscheduled jobs (similar to MCT), and then assigns jobs with minimum completion time (hence min-min) to a processor which offers it. The max-min heuristic is similar to min-min algorithm. The minimum completion times set is calculated for each task and that with overall maximum completion time is selected and assigned to a corresponding machine. This algorithm does better than min-min algorithm where when short tasks outnumber long ones. For e.g. if there is one long task, max- min algorithm executes short tasks concurrently with long task. Max-min [38] is similar to min-min. Again each job's minimum completion time is established, but a job with maximum minimum completion time is assigned a corresponding processor.

References

1] Roopali, Rajkumari Overview of Offloading in Smart Mobile Devices for Mobile Cloud Computing.Vol 5, Number 6, 2014

[2] Karthik Kumar·Jibang Liu·Yung-Hsiang Lu· Bharat Bhargava A Survey of Computation Offloading for Mobile Systems, Published in April 10, 2012.

[3] Bowen Zhou, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, Satish Narayana Srirama, and Raj Kumar Buyya A Context Sensitive Offloading Scheme for Mobile Cloud Computing Service, 2015 IEEE 8th International Conference Paper.

[4] Pragya Gupta, Sudha Gupta [4] Mobile Cloud Computing: The Future of Cloud, Vol. 1, Issue 3, September 2012

[5] Abdullah Gani Han Qi [5] Research on Mobile Cloud Computing: Review, Trend and Perspective, 6 June 2012

[6] Priyanka Asrani, Mobile Cloud Computing, Volume-2, Issue-4, April 2013

[7] Ms. Snehal P.Warhekar1, Prof. V.T.Gaikwad ,Mobile Cloud Computing: Approaches and Issues, International Journal of Scientific & Engineering Research, Volume 6, Issue 12, December-2015

[8] Yating Wang and Ing-Ray Chen, A Survey of Mobile Cloud Computing Applications: Perspectives and Challenges, Volume 80 Issue 4, February 2015.

[9] Qiufen Xia, Weifa Liang and Wenzheng Xu , Throughput Maximization for Online Request Admissions in Mobile Cloudlet, IEEE 2013

[10] R.JeminaPriyadarsini ,Performance Evaluation of Min-Min and Max-Min Algorithms for Job Scheduling in Federated Cloud, Volume 99– No.18, August 2014

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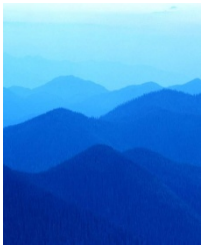

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