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Use of Mapreduce- Based On Mobile Cloud Computing For Mobile Devices

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Abstract

This paper presents the use of MapReduce on mobile cloud computing for mobile devices. Information explosion is a well known phenomenon now and there is a vast amount of research going on into how best to handle and process huge amounts of data. It was designed for and is still used at Google for processing large amounts of raw data to produce various kinds of derived data. The researcher is only required to write specialized map and reduce functions as part of the MapReduce job and the MapReduce framework. To make such services feasible for large amounts of data, researcher use the MapReduce distributed computation model on a cloud. Specifically, Researchers show how the required computational tasks can be factorized and expressed as mobile cloud computing with MapReduce functions. Cloud computing provides massive data for efficient large computation and data analysis. MapReduce is a programming model which designed for improving the performance of large batch jobs on cloud computing systems. The input of the reduced tasks is known only after all the map tasks complete execution and the roles of the reducers are assigned to server between the reduce tasks.

The result shows that a high-performance MapReduce engine can be based on data sets, although analysis indicates that the reasons performance improvements are more slightly than expected. For designed platform for mobile cloud computing on Android a better understanding, its benefits and limitations for a MapReduce.

Keywords: - Cloud computing, Mobile Cloud Computing, MapReduce, Mobile learning.

Introduction

Cloud computing and mobile cloud technology use internet and essential inaccessible host to store information with application. Cloud computing helps consumers implement business applications with storage. They can view their soft files at any computer with internet connectivity. This technology allows for computing centralized storage, memory, processing and bandwidth. Today, mobile devices have developed in such a way that users are able to access network services anywhere, everywhere and anytime. The information technology service architecture is one where computing services are designed to deliver on-demand services to clients over a different network in an independent manner.

Cloud models are suitable for on-demand network access to a mutual collection of configurable resources by allowing users to use infrastructure like networks, servers, storage, applications and other services that can be provided fast and free with low management effort or service source relations. Implementing cloud services in a mobile environment can ask for challenges and problems. Mobile devices cannot handle large complex applications due to their processing capabilities. In order to understand the challenges and provide further scope for design, the work is implemented and executed in a structural way. Cloud computing for mobile, rather, Mobile Cloud Computing (MCC), is a well-accepted concept that aims at using cloud computing techniques for storage and processing of data on mobile devices, thereby reducing their limits [1].

MOBILE CLOUD COMPUTING (MCC)

Mobile Cloud Computing is a model for mobile applications with which most of the processing and data storage applications encourage the mobile device to powerful, centralized computing platforms designed in the Cloud. These central applications are then accessed over mobile Internet, using either a slight inhabitant client or a web browser on the device. However, this model for Mobile Cloud Computing still does not fully influence the powerful communications, context and commercialization capabilities of the mobile network itself. Mobile cloud computing is a powerful combination of mobile computing and cloud computing technology for mobile services. It works on two technologies over many hurdles linked to the performance, flexibility, security, and forceful administration.

Mobile cloud computing is a stage which combines the mobile devices with cloud computing that generates an infrastructure, whereas cloud performs the important work of exciting computing-intensive responsibilities and storing large amounts of information in different datasets. In this architecture, data processing and data storage occur on remote mobile devices.

Mobile cloud computing Model

MCC provides mobile users with data storage and processing services on a cloud computing platforms because MCC is still in its development stage. On cloud computing, one of the most important issues has been how to sweep up data and programs from desktop PCs and install them in the cloud environment. Cloud computing refers to applications delivered as services over internet and also over hardware and software in data centers that provide services of data accessing [2]. Cloud computing in general web based processing [3] for sharing software is a service on demand to computers, and also to smart phones [4] and other devices. Like Mobile, Cloud computing works in computing in which dynamically scalable resources are provided as virtualized services.

Portable devices come under mobile computing, which run stand alone applications and access remote applications through wireless network. In cloud computing, platform resources are used like Amazon EC2, Microsoft Azure, and Google App Engine, which can make for the lack of resources in mobile devices.

Mobile Cloud computing at its simplest refers to infrastructure where both the data storage and the data processing occur inside and outside of the mobile device. Mobile cloud applications works the computing power and data storage away from mobile phones into cloud, bringing applications and mobile computing just smart phone users but a much broader variety of mobile subscribers.

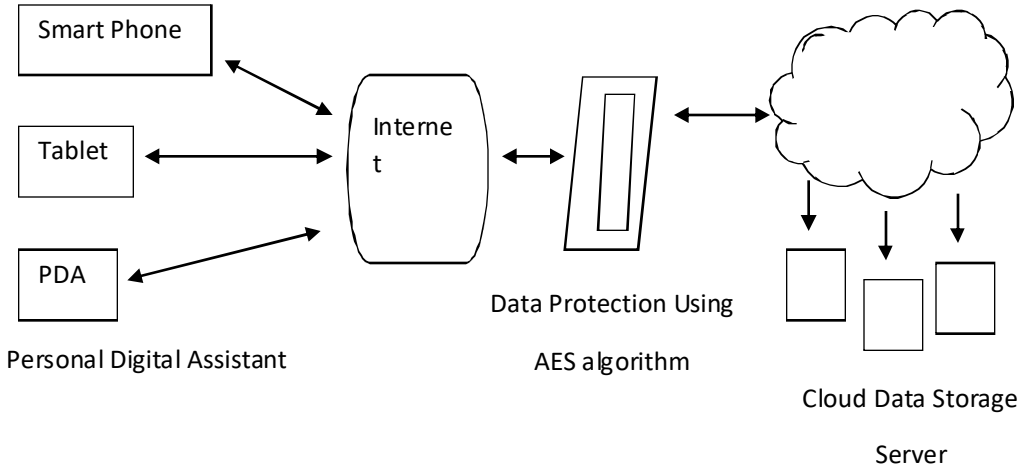

Figure 1.2 The typical architecture of Mobile Cloud Computing
[Source: Compiled by researcher]

In the above Figure 1.2 shows the typical architecture of Mobile Cloud Computing. Mobile devices are related to mobile networks via base stations (e.g., base transceiver station (BTS), access point, or satellite) that found and manage connections (air links) and efficient interfaces between networks and mobile devices. Mobile user's needs and information are transmitted to essential processors that are connected to servers provided that mobile network services. Here, Mobile network operators can supply services to mobile users as AAA [Authentication, Authorization, and Accounting] based on the home agent [HA] and subscriber's data stored in databases. After that, the subscriber's requests are delivered to a cloud through Internet. The cloud controller's process needs to provide mobile users with related cloud services. These services are developed with concepts of utility computing, virtualization, and data service oriented architecture. Mobile devices likes Smart Phones, Tablet, PDA, etc are connected to the Cloud server via internet service providers. Whenever user wants any data, mobile applications etc they send request to cloud service provider, they process the request and send backs the essential information for the users. A gateway is provided to protect data from illegal users between users and cloud service provider.

Mobile Device

A mobile device is dynamic for acquiring environment of signals such as shocks, voices and photo images, but a cloud is not. A mobile device is motorized by batteries with limited facility, but a cloud server is powered by the exciting network. A mobile device has lower computing speed and network speed, but a cloud

has very high computing speed and higher network speed for accessing data for users.

The end mobile device user will ultimately be the Mobile Cloud Computing one. Company users can split set of resources and applications without a high level of spending on hardware and software resources. Nature of cloud applications also is helpful for users since they do not need to have very technical hardware to run applications as these computing operations are run within the cloud. This reduces the value of mobile computing to the end users. The main advantage of cloud computing for researchers is to access users of a wide range of data to mobile subscribers. Smart phones are used in common, almost everywhere. Smart Phones are powerful today. The latest generations of smart phones boast of Quad core 2 GHz processor, 2 GB Random Access Memory (RAM) and 32 gigabytes (GB) of storage. Network connectivity is also fast with faster International Electrical Electronic Engineer (IEEE) 802, wireless fidelity (Wi-Fi) and Fourth generation (4G) cell networks. The powerful resources in smart phones are being equipped with several sensors, Frequency Modulation (FM) receivers, Global Positioning System (GPS), digital compass, cameras, sensors and Microphones. These factors combine to make smart phones a very useful platform for developing cloud applications. It provides environmental data such as, movement images, connectivity and social information from user input, user interaction, contact lists and advance security application. It is generally difficult or expensive for one Smartphone to share data and computing resources with another. Data is shared through centralized services, requiring expensive uploads and downloads wireless data network with Smart phone data and computing allows mobile application to utilize the capabilities of an entire Smartphone cloud while avoiding global network.

Mobile Cloud Computing with Smartphone

Mobile cloud computing refers [5] to infrastructure where both the data storage and data processing occur inside and outside of the mobile device. Mobile cloud applications process computing power and data storage away from mobile phones and into the cloud, bringing applications and MC to not present Smartphone users but a much broader variety of mobile subscribers. The centralized applications used in MCC are then accessed in excess of the wireless link based on a thin client or a web browser on mobile devices. On the other hand, MCC works as a grouping of mobile web [6-7], which is the most accepted device for mobile users to access applications and services on the Internet. Briefly, MCC provides mobile users with the data processing and storage services in clouds. The mobile devices require a controlling configuration (e.g., CPU speed and memory capacity) because all the complex computing modules can be processed in clouds.

Mobile devices like Smartphone, tablet PCs, etc. are suitable and a necessary part of day- to-day life as the most efficient and well-situated communication tools not surrounded by time and place. Mobile users build up rich experience of a variety of services from mobile applications such as iPhone apps, Google apps, etc., which run on the devices with isolated servers via internet. The rapid progress of mobile computing (MC) [8] is due to a powerful trend in development of IT technology as well as commerce and industry fields. However, the mobile devices are facing many challenges in their resources (e.g., battery life, storage, and bandwidth) and communications (e.g., mobility and security) [9]. The limited resources considerably hold up the enhancement of service qualities. Cloud computing (CC) has been widely documented as the next generation's computing infrastructure.

Challenges of Mobile Cloud Computing

Challenges such as the dependence on continuous network connections, data sharing applications and collaboration, security, another key challenge for Mobile Cloud Computing is network accessibility and intermittency. Also Mobile Cloud Computing concepts rely on an always-on connectivity and will require providing a scalable and high quality mobile access.MCC has to face many technical challenges. Following are the four important categories.

(i) Trends and demands

Client may log in remotely and execute their own software on the virtual machines and peculate access to additional mobile device whenever the need. Clients are expecting ease of using companies' websites or application from anyplace and at anytime using mobile devices.

(ii) Improved and increased broadband coverage

3G and 4G along with WiFi, femto-cells, fixed wireless and so on are provided that improved connectivity for computers mobile devices which help faster communication and accessing all data .

(iii) Enabling technologies

HTML5, CSS3, SDK, hypervisor for mobile devices, cloudlets and Web 4.0 will drive implementation of mobile cloud computing and

other programming languages for platform development.

(iv) Security

Along with these features security is desirable at any cost. Cloud brokers put up for sale their cloud storage to public however the cloud storage is required to be very effective and forceful.

MapReduce

MapReduce is a programming model and framework which is simple to write applications that process huge amount of data in corresponding on a large dataset of service hardware in fault-tolerant way. MapReduce combines two components, i.e. map function and reduce function. The map function having a list of key/value pair and the output is a list of intermediate key/value pair. Reduce function takes the intermediate key/value pair and linked with the same key and produce the list of key/value pair. The output is a ultimate output of MapReduce processing. The MapReduce job divides input data set of independent chunks that desires to be processed fully in a parallel way. This framework sorts output of the maps which is the input for reduce tasks. Both the input and output are stored in a files system. The MapReduce framework takes care of development tasking, monitoring them and re-executes in case of failure tasks.

MapReduce Functional Concept

In The MapReduce concept, it is a parallel programming method derived from functional programming concepts for generating large-scale data processing in a distributed computing situation.

- The computation takes a set of input key/value pairs, and produces a set of output key/value pairs. The user of MapReduce library expresses the computation as two functions: Map and Reduce.
- Map, written by user, takes an input pair and produces a set of intermediate key/value pairs. TheMapReduce library groups together all intermediate values related with the same intermediate key and passes them to the Reduce function.
- The Reduce function, written by user, accepts an intermediate key and a set of values for that key. It merges jointly these values to form a probably smaller set of values. Normally, just zero or one output value is produced per Reduce invocation. Counting word occurrences within a large document collection is a typical example used to illustrate the MapReduce technique. The data set is divided into smaller segments and the map function is executed on both of these data segments.

Use of MapReduce

MapReduce is a software framework introduced by Google[10] ,IBM, Yahoo and Face book for supporting computing on large set on data of computers and mobile device. The framework designed in terms of Map and reduces function commonly used in functional programming, although their purpose is MapReduce framework is not same as their original forms. MapReduce libraries are written in C++, C#, Erlang, Java, LabVIEW, OCaml, Perl. Python, PHP, Ruby, F#, R and other programming languages.Map Reduce is a programming model for processing and generating large data sets. A MapReduce computation process is of two phases, map and reduce. The worker which processes map task is called mapper and the worker which processes the reduce task is called reducer. In the logical view, the map and Reduce functions of MapReduce are both defined with respect to data structured in pairs. Map takes one pair of data with a type in one data domain and returns a list of pairs in a different domain. It is important to note here that the MapReduce model simply specifies a very general structure with a focus on how data is put through calculation but not what the different steps of the computation do with the datasets. MapReduce implementation is joined with a distributed file system. MapReduce implementation, the intermediate <key, value> pairs first written to the local files and then accessed by the reduce tasks.

The same architecture is adopted by Apache's MapReduce implementation - Hadoop. It uses a distributed file system called the Hadoop Distributed File System (HDFS) to store data as well as the intermediate results. HDFS maps all the local disks to a single file system hierarchy allowing the data to be isolated at all the data/computing nodes. Hadoop schedules the MapReduce computation tasks depending on the data locality and hence improving the overall I/O bandwidth. This setup is well suitable for an environment where Hadoop is installed in a large cluster of commodity technology.

A user specifies a map function that processes a key value pair in order to generate a set of intermediate key value pairs. It also has a reduce function that merges all intermediates values associated with same intermediate key.

The Map Reduce runtime system splits input data, schedules map and reduce tasks, and transfers input and output data to machines

running the tasks. In MapReduce , an input file is split into asset of smaller information entities, which are allocated to various nodes for parallel processing. The node consists of one master node and multiple slave nodes. The master controls the overall operation of jobs and slave performs the map or reduces tasks. Basically, a MapReduce computation can be described as the following series of steps,

1. Input is read from disk, converted to Key-Value pairs.
2. The Map function processes each pair separately, and outputs the result as any number of Key-Value pairs.
3. For each distinct key, the Reduce function processes all Key-Value pairs with that Key, and similarly to Map - returns any number of Key-Value pairs.
4. Once all input pairs have been processed, the output of the Reduce function is then written to disk as Key-Value pairs.

Conclusion:

Conclusion indicates that MapReduce gives programming framework for mobile platform to process large datasets, MapReduce provides distribution and a cost-effective mechanism for data processing, most of the platform can be integrated with MapReduce for managing and processing their datasets developed on MapReduce. The MapReduce system is utilizes a combination of MapReduce framework and mobile cloud computing as an attractive propositioning for huge data processing. There are many interesting lines of inquiry to pursue in the future, to follow up the work presented here. In this paper, most of application and resources of cloud computing and MapReduce will be available in most efficient manner on mobile devices. The MapReduce programming model has been involved in data processing and data analysis application in the field of Big data analytics, 3G,4G networks. Though Map reduce support of scalability and efficiency.

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