ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology
Volume 1, Issue 3, May 2012

# Cubic Approach to Mobile Cloud Computing

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*Abstract*— Mobile cloud computing provides a solution to meet the increasing functionality demands of end-users, as all application logic is executed on distant servers and only user interface functionalities reside on the mobile device. To handle huge data of user proposed work make use of multidimensional database technology which is a computer software system designed to allow for the efficient and convenient storage and retrieval of large volume of data from different perspective called dimensions. The primary aim of this work is to provide method for improving the accessibility of huge database by using On-Line Analytical Processing (OLAP). It analyzes data stored in cloud using multidimensional structures called OLAP cubes and compare speed in terms of time required for relational database search and multidimensional data search. It can be proven, that the multidimensional database results in shorter response times.

***Index Terms*—Mobile Cloud Computing, OLAP, MDX query ,Android Emulator.**

## I. INTRODUCTION

Cloud computing [1] is one of the emerging technologies that will lead to the next generation of Internet. It provides optimized and efficient computing through enhanced collaboration, agility, scalability, and availability that reduces hardware and software investment cost. The essential cloud characteristics are on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. Computing capabilities, such as server time and network storage, can be unilaterally provisioned or de-provisioned as needed automatically. They are available over the Internet and accessible through heterogeneous client platforms, such as laptops and mobile phones. The computing resources are pooled and dynamically assigned and reassigned to serve multiple consumers. The capabilities appear to be unlimited, as they can be rapidly and elastically provisioned to quickly scale out and rapidly released to quickly scale in.

So Cloud computing is a paradigm in which data, applications or software are accessed over a network. This network of servers is called as "Cloud". A cloud application leverages the cloud in software architecture, often eliminating the need to install and run the application on the customer's own computer, thus alleviating the burden of software maintenance, ongoing operation, and support. Commercial cloud computing has three distinct offerings.

Software as a service (SaaS): SaaS delivers a single application through the browser to thousands of customers using a multitenant architecture. On the customer side, it means no upfront investment in servers or software licensing; on the provider side, with just one application to maintain, costs are low compared to conventional hosting.

Infrastructure as a Service (IaaS): IaaS is the delivery of computer infrastructure (typically a platform virtualization environment) as a service. Raw infrastructure, such as servers and storage, is provided from the vendor premises directly as an on-demand service.

Platform as a service (PaaS): Development platforms and middleware systems hosted by the vendor, allowing developers to simplify code and deploy without directly interacting with underlying infrastructure. That means it is possible to build own applications that run on the provider's infrastructure and are delivered to users via the Internet from the provider's servers.

Mobile Cloud Computing: Advantages

- Lower-Cost Computers for Users
- Improved Performance
- Lower IT Infrastructure Costs
- Fewer Maintenance Issues
- Lower Software Costs
- Instant Software Updates
- Increased Computing Power
- Unlimited Storage Capacity
- Increased Data Safety
- Improved Compatibility Between Operating Systems.
- Improved Document Format Compatibility
- Easier Group Collaboration
- Universal Access to Documents
- Latest Version Availability

## II. MANAGING DATA ON CLOUD

Bassically data management on cloud usually follow layered architecture shown in figure below

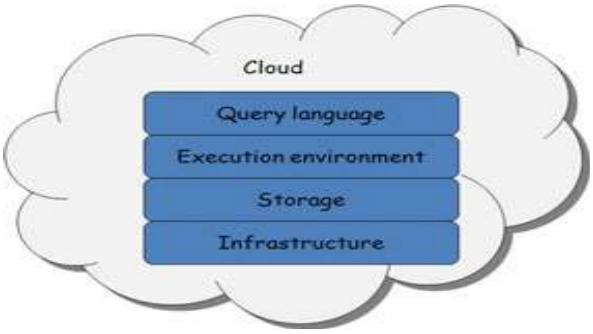


Fig 1. Cloud data management architecture

The first level is the infrastructure tier. Typically, such a tier consists in one or several data centers that are used in order for large data analysis processes to be done . The main behavior of this level is the associated pay-as-you-go model

The second tier is the storage tier. Its main objective is to propose a highly scalable and fault-tolerant system. In clouds, data are stored in files managed by systems. The third tier is the execution environment tier. The most known example of cloud computing execution environment is probably Google MapReduce [2] and its

*Manuscript received May 15, 2012.*

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ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology
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open source version Hadoop.

It gives the advantage to achieve scalable and efficient databases management systems to deal with data volumes that cannot be managed by classical relational or object DBMS (for example Facebook manages more than three hundred millions users, more than two billions pictures uploaded and more than three millions events added per day), Such an execution tier aims at providing elasticity by enabling to adjust resources according to the application.The application server can easily scale out but the data manamgement infrastructure often becomes the bottleneck which sets new requirement for analysis of data . In particular, proposed work apply the concept of multidimensional data(OLAP) to work with large data of cloud.

## III. ONLINE ANALYTICAL PROCESSING(OLAP) TECHNOLOGY

OLAP is a technology that allows users to examine a large database and to get familiar with the information it contains. OLAP storage unit is multidimensional in general term called a cube instead of a table. OLAP implies "digging through tons of data" to uncover patterns and relationships contained within the business activity and history. Data mining can be done with programs that analyze the data automatically. To better support customer behaviour and preferences, businesses are using data mining to pass through the huge amounts of information gathered via the Web [3]. Microsoft SQL server 2008 R2 Analysis Services supports OLAP which let us to design, create, and manage multidimensional structures also called as cubes that contain data obtained from other data sources, such as relational databases

### *A. OLAP Cube*

The cube[4] is the main OLAP structure which is used to view data. It is something similar to a table in the relational database system. The term cube refers to three dimensions in common, but here Analysis Services cube can have 128 dimensions A cube is a multidimensional structure that is defined by a set of dimensions and measures. Dimensions define the structure of the cube, while measures define the numerical values of interest to the user. Each and every cube has a schema which is defined by a set of joined tables in the data warehouse from which the cube gets its source data. The middle table in the schema is the fact table, which is the source of the cube's measures. The other tables are dimension tables, which are the sources of the cube's dimensions. The minor alphanumeric values around the cube are the members of the dimensions. A cube can contain up to 128 dimensions, each with thousands and millions of members, and up to 1,024 measures. A cube with reserved number of dimensions and measures usually serves the requirements of users. Cubes right away follow the database in the object hierarchy. A database is a container for related cubes and the objects they share. We should create a database before we create a cube

### *B. Dimensions*

Dimensions are a structural attributes of the cube; a cube's dimensions are either private to the cube or shared with other cubes in the database. Private dimensions are created when the cube is created. Shared dimensions can be created before or during cube creation. The cube term generally implies three dimensions but here a cube can have up to 128 dimensions .

### *C. Measures*

In a cube, a measure is a set of values that are based on a column in the cube's fact table and are usually numeric. Measures are the central values of a cube. That is, measures are the numeric data of main interest to users browsing a cube. The measures we select depend on the types of information users requests. The measures are created when the cube is created. A cube's measures are not shared with other cubes. A cube can have up to 1,024 measures

### *D. Databases*

A database is a container for related cubes and the objects they share. These objects include data sources, shared dimensions, and database roles. If these objects are to be shared among multiple cubes, the objects and cubes must be within the same database. Databases are immediate objects to the Analysis server in the object hierarchy. Thus, after an Analysis server is installed, databases are the first objects to be created

### *E. Data Sources*

After databases are created, data sources are usually the next objects that are to be created. A cube has a single data source. It can be selected from the data sources in the database or created during cube creation. A cube's dimensions must have the same data source as the cube, but its partitions can have different data sources.

## IV. RELATED WORK

Proposed work proven the speed in terms of time of both relational and multidimensional data structure .It basically depends on three parameters.

1. Database storage
2. Resource (our system)
3. Query response time

### *A. Database storage*

As work make use cube (OLAP) MDX. query require to retrieve data from it that supports the definition and manipulation of multidimensional objects and data.. At the same time SQL query also used to get the data . Major difference in both data structure is traditional database handles data in row and column form and search on basis of primary key, whereas in multidimensional technology we handle it as partitioned database with measure and dimension .So ultimately we get fast access to cube data as compared to relational data .Search takes place on the basis of position.so content of each cell of cube is count i.e number of time that specific combination of values occur in database.

### *B. Resource*

It is same for both data. Query response time depends on system time .It basically time difference between start and end time require to execute the query.

### *C. Query response time*

Depends on response of SQL and MDX query . As length of query and no of joins is more in sql it require more time whereas in mdx retrieve data from cube data structure gives fast results. Graph below show practical results of proposed work. Working environment developed on Visual studio 2010 use Microsoft Azure frame work to create the cloud. Also SQL server 2008 R2 that support BI. Business intelligence systems combine operational data with analytical tools to present complex and competitive information to planners and decision makers. The objective is to improve the timeliness and quality of inputs to the decision process Demand for Business Intelligence (BI) growing day by day in applications. Applying this approach to cloud data will results in better managment of data.

## V. ANDROID EMULATOR FOR TESTING PURPOSE

As mobile cloud computing terms comes we need user interface on mobile device so it uses android emulator for testing data

### A. *Feature of android emulator*

- The Android SDK includes a mobile device emulator -- a virtual mobile device that runs on computer.
- The emulator allow prototype, develop, and test Android applications without using a physical device.
- The Android emulator mimics all of the hardware and software features of a typical mobile device, except that it cannot receive or place actual phone calls.
- It provides a variety of navigation and control keys, which we can "press" using mouse or keyboard to generate events for application.
- It also provides a screen in which application is displayed, together with any other Android applications running.

In proposed work it display the data of cloud and whatever computing takes place in cloud using[5] url string 1.e IP address of respective browsers. Snap shot of testing environment is given below.

## VI. RESULT OF PROPOSED WORK

| Year | No of records | Time for normal data | Time for multidimensional data |
|---|---|---|---|
| 2007 | 3450 | 678 | 15 |
| 2008 | 10000 | 700 | 5 |
| 2009 | 10000 | 656 | 4 |
| 2010 | 2000 | 732 | 69 |
| 2011 | 10000 | 740 | 3 |
| 2012 | 10000 | 351 | 3 |

Fig 3. Comparative results of normal and multidimensional search

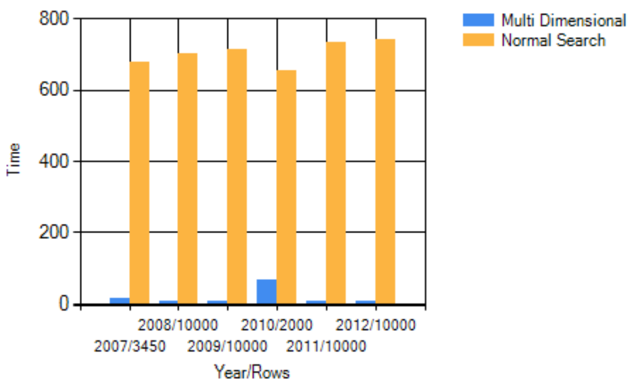


Fig 2. Graph showing time required to search data

## VII. CONCLUSION

Cloud computing means storage for huge data. Applying multidimensional concept to cloud will help to overcome some bottleneck related to data. Android emulator gives better way to test the application. Proposed work can be extended to real time data.

## ACKNOWLEDGMENT

The author would like to gratefully thank to Prof . R. W. Jasutkar for her valuable guidance and technical support.

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