From Conventional to Mobile Database Management System: A Theoretical Review

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Abstract: The wireless and mobile communication is an important technology that improves user's daily life and facilitates the development of some new technology such as electronic commerce and mobile commerce. Commercial relational Database Management Systems (DBMS) are oriented towards efficient support for business data processing applications where large numbers of instances of fixed format records must be stored and accessed. To survive and thrive in today's competitive business environment organisations must have the ability to move business information quickly and securely between the back office and the front lines. There is a general deficiency in the number of literatures that reviews the move from conventional databases to mobile databases and which also addresses new challenges for enterprises created by the growing demand for mobility.

Key words: Database management system, mobile database, mobile computing, ubiquitous computing, conventional database, deficiency

INTRODUCTION

Mobility has come of age; advances in computer and network technology have made mobile computing a reality. In the past, commercial Relational Database Management Systems (RDBMSs) are oriented toward efficient support for business data processing applications where large numbers of instances of fixed format records must be stored and accessed. To survive and thrive in today's competitive business environment; organisations must have the ability to move business information quickly and securely between the back office and the front lines.

This growing demand for mobility creates new challenges for enterprises. To satisfy the needs of users inside and outside of business applications, DBMSs must be expanded to offer mobility services. Information technology departments are tasked with protecting valuable corporate information and assets while also making solutions simple and useful for mobile researchers. Mobile computing are fast-emerging technologies to make an environment conducive for ubiquitous computing.

Since, the evolution of mobile computing, mobile database have started gaining popularity and are likely to do so well into the future as portable devices become more and more popular and common. The study takes a theoretical review of salient issues emanating from the move from traditional database systems to mobile databases.

Literature review
Conventional databases: According to Wikipedia, a database is a structured collection of records or data that is stored in a computer system. The structure is achieved by organizing the data according to a database model. The model in most common use today is the relational model. Other models such as the hierarchical model and the network model use a more explicit representation of relationships Date (1994) also emphasized that a database consists of some collection of persistent data which is used by the application systems of some given enterprises and which is managed by a database management system.

Database management systems: A Database Management System (DBMS) is a collection of programs that enables users to create and maintain a database (Elmasiri and Navathe, 1989). A database management system enables users to look at the data or to update or delete obsolete data in the database. It is the database management system alone that knows where and how the data are stored. A database management system has been used to handle a variety of applications. One system can be used

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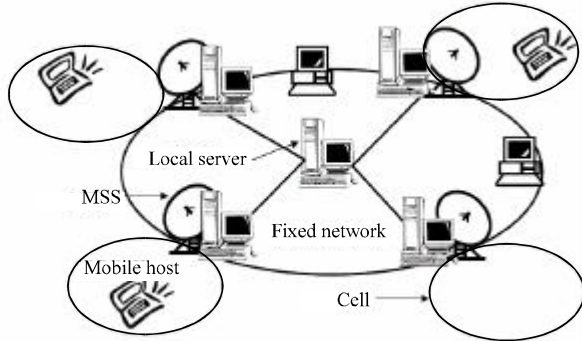Redemption Camp, Mowe, Ogun State, Nigeria

Fig. 1: The model of mobile environment

for research data by an oil company as an abstract retrieving service by a publisher and as a source of background information for reports on newspapers. The traditional transaction management and query facilities for this application area were termed data management and are addressed by relational systems.

Mobile environments: In mobile computing environment, mobile users equipping with compact battery-powered palmtops or laptops need to access the large volume of data stored in the fixed network through Mobile Support Station (MSS) by the wireless communication. In order to realize the data storage in MSS adopting the mobile database technology is essential. Figure 1 shows the model of a mobile environment. A mobile environment consists of 2 distinct sets of entities: mobile hosts and fixed hosts. Some of the fixed hosts called MSS are augmented with wireless interfaces to communicate with mobile hosts which are located within its radio coverage area called a cell. Mobile hosts are connected by wireless connections to the MSS of the cell where they currently exist. A mobile host can move within a cell or between 2 cells while retaining its network connection. Further, every host and cell in the system is assumed to be associated with a unique identifier. The mobile computing environment is a distributed computing platform with the following differences: the mobility and access devices of users, frequent disconnection, limited bandwidth and the mobile resource constrains-limited computational and power sources. As a part of a mobile database system a mobile host acts as a data client and a data server at the same time. A mobile host as a data server is to support basic transaction operations such as read, write, commit and abort. Mobile devices like lap tops, palmtops, cellular phones etc., have become ubiquitous today. These devices cater to a large variety of applications from web browsing to mini database applications. According to Xu *et al.* (2002), portable devices such as cell phones and PDAs in the wireless communication environments can frequently communicate with service providers to obtain a variety of information.

Mobile database: Mobile database provides access to a large amount of data through mobile communication. Mobile database capture data and access data wherever you are. Instantly collect, retrieve and review critical data regardless of your physical location Imielinski *et al.* (1997) stated that mobile users would be in constant need of stock information, traffic directions, local directory, weather information etc. Wireless medium would be used as the first mile of the information highway that would disseminate massive amounts of information across the country. Organizing and accessing data on wireless communication channels are new challenges to the database and telecommunication communities (Alonso and Korth, 1992). Its deployment to companies would help to:

- Streamline and improves work flow and business processes
- Increase productivity
- Automate collections, new business, customer service and financial transactions
- Reduce costs
- Improve customer service
- Provides on the spot decision support wherever you need it

In mobile computing environment users can access information through wireless connections regardless of their physical location. In mobile database systems, new features such as mobility, disconnection, low bandwidth, high bandwidth variability, heterogeneous networks and security risks make traditional database processing schemes no longer well suited.

Features of mobile database: An important feature of these database systems is their ability to allow optimistic replication of data by permitting disconnected mobile devices to perform local updates on replicated data. Replication is one of the key technologies in promoting the performance of mobile database systems. Replication is a general technique to increase the data availability. One key feature of these database systems is their ability to deal with disconnection.

Disconnection refers to the condition when a mobile system is unable to communicate with some or all of its peers.

In such a situation, the mobile no longer has access to shared data. To deal with the disconnection problem, optimistic replication approaches have become exceedingly common.

In such approaches, the mobile unit is allowed to locally replicate shared data and to operate on this data while it is disconnected. The local updates can be propagated to the rest of the system on reconnection. However, since the local updates potentially conflict with

other updates in the system, schemes to detect and resolve such conflicts are required. Some of the characteristics are highlighted below:

Portability: This means information anywhere, data can be accessed anywhere, any time

Effective: Increase performance when the data is condensed as a result of data mining.

Mobility: A mobile computing environment is location dependent, compared with location transparency in a distributed computing environment.

Use of caching: Cache can be used in either the base station or the mobile clients to reduce connection time in wireless communication. Cache used in the base station can minimize the access time of the mobile database avoiding the problem of high-loading of obtaining the information from central server. The frequency of updating the cache increases the database maintenance cost.

Use of indexing: In order to minimize overall response time and consumed power and for the mobile client, the indexing mechanism is employed at the central server and base station. This indexing mechanism improves the efficiency of accessing database. Eliminates restrictions on time and space for users accessing network service.

Characteristics of mobile database services: According to Barbara (1999), the 4 characteristics of mobile database services are:

Asymmetry in the communications: The client user may submit a short request message to the mobile database and then receives a large amount of information as the response.

Frequent disconnections: Mobile clients do not stay connected to the network continuously as fixed hosts do but rather users switch their units on and off regularly. Moreover, mobile clients can roam, disconnecting from a cell to connect to another. This means that the mobility of the client user's device will cause frequent disconnections in 2 way communication.

Power limitations: Some of the portable units are severely limited by the amount of energy they can use before the batteries have to be recharged because the energy of the battery can be consumed quickly if the operations of the device are not in an efficient way.

Screen size: Some of the portable units such as the Personal Digital Assistants have very small screens.

Mobile database application: Mobile database application is an electronic announcement board where authorized users can publish and/or read announcements (Drosatos *et al.*, 2007). There are 2 types of users of the announcement board researchers users and read-only users. The rights of a user are determined by its type: a researchers user has the right to create new announcements and to modify or delete announcements authored by himself. The core of the application is build on mobile database technology. As shown in Fig. 2, the application uses the client-server model. From the user's point of view, there are 2 main application components. An authoring tool for authoring announcements and a viewer to access all announcements. Moreover, if the announcements are intended for public access then read-only access can also be provided through a web interface.

Conventional database and mobile database compared: Traditionally, distributed database is located in a fixed decentralized network. A mobile database can be defined as the union of distributed database, disconnected database ad-hoc database and broadcast disks (Xia and Helal, 2003). The distributed database is treated as the home of mobile database and the others deal with the access of mobile users (Fig. 3). According to Xia and Helal (2003), Traditional database design is static and
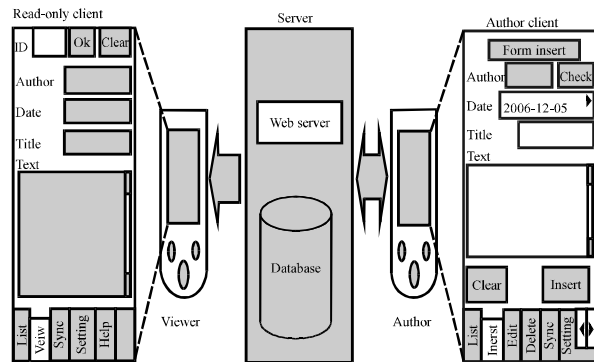
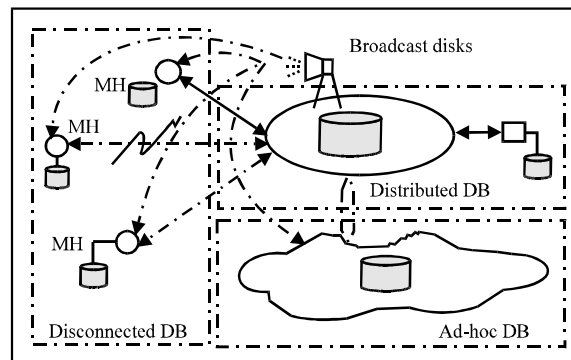

Fig. 2: The mobile database application

Fig. 3: The concept of mobile database

limits the flexibility of database applications while mobility is changing the way we design databases and their DBMS. In mobile database, everything is dynamic, varying from sporadic accesses by individual users to particular data to continuous access of a particular data by a large group of user. This is the case from disconnecteddatabase access to broadcast disks. Mobile hosts have to deal with planned or unexpected disconnections when they mobile; they are likely to have scarce resources such as low battery life, slow processor speed and limited memory; their applications are required to react to frequent changes in the environment such as new location, high variability of network bandwidth; their data interests are changing from time to time and from location to location; even data semantics in mobile hosts are varying according to data access patterns, connection duration and disconnection frequencies etc.

Data partition, location and replication are always dynamic. The client-server paradigm in the wireless environment differs significantly from the traditional approach because of two main reasons: frequent disconnections and low bandwidth. Also in a mobile environment, upstream queries (i.e., from client to server) are more resource-consuming than the downstream queries (i.e., from server to client). So, there is a need to reduce the number of trips made to the server.

CONCLUSION

Database management systems and mobile database have been reviewed in this study. The study has highlighted the previous researchers done on conventional databases and mobile databases and raised some salient issues pertaining to both systems. Future study should provide an elaborate study on both the 2 database systems in terms of redundancy and the security.

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