A Study and Design on the Data Storage Management Methods in Mobile Environment

AN Dezhi[1,2, a *],WU Guangli[1,2], LU Jun[1,2], ZHANG Shengcai[1,2] and LI Yan[1,2]

[1] *School of Information Engineering*
Gansu Institute of Political Science and Law
Lanzhou 730070, China
[2] Key Laboratory of Evidence Science of Gansu Province
Gansu Institute of Political Science and Law
Lanzhou 730070, China
[a]andezhi@yeah.net

***Abstract* — Data storage management methods in a mobile environment is a key technology research area. Mobile environments have multi-source and must be self-reliant to meet environmental characteristics. Data storage management and distribution should concentrate on characteristics and efficient data storage methods. This is needed to provide a safe and speedy operation of storage infrastructure for mobile data applications. Advanced data storage management methods are essential to meet the data needs of an increasingly mobile environment. The provision of efficient and reliable data storage infrastructure is vital to run mobile networks in order to promote the development of China's mobile network technology.**

Keywords-Data Storage Management; Mobile Environment; Mobile Database

I. INTRODUCTION

With the rapid development of mobile Internet technology and mobile number of users continues to grow, a variety of business applications for mobile environment has become increasingly widespread. Accompanied by the information generation mobile data application environment exponential growth, it brings a lot of data to be stored under the mobile environment management of new technology needs, therefore, relevant for the mobile environment data storage management Research has become increasingly important issues [1-2]. People want to be able to achieve the goals unconstrained communication and sharing of resources, which is both flexible and complex distributed computing environment, known as mobile computing. Because mobile computing has the characteristics of mobility, network conditions, and therefore diversity makes mobile computing cannot be effectively supported by traditional distributed database technology. Thus forming a new mobile data storage technology. Data management is the use of computer hardware and software technology for effective data collection, storage, processing and application process. Its purpose is to fully effective functioning of data to achieve the effective management of critical data is data organization.

Existing wired network distributed storage management method is mainly for the bandwidth stable and sustainable service, scalable and high-performance nodes are all relatively stable environments; but it is in the face of heterogeneous mobile environments, distributed high dimensional, dynamic bring mobile data management complexity, and so has obviously not suited, therefore, cannot be directly applied to data storage management in mobile environments [3]. Due to multiple sources, autonomy mobile environment, context-aware and environmental dependence, and data storage for the mobile environment with centralized management and distribution features. In this paper, the key technologies of data storage management method in a mobile environment is studied to meet the data needs of an increasingly mobile environment, can provide efficient and reliable data storage infrastructure for the operation of mobile networks, the promotion of China's mobile Internet technology development of great significance.

II. THE BASIC CONCEPT OF MOBILE DATA STORAGE

In the history of the data storage system, generally based on a study of a wired network and fixed host traditional distributed computing and distributed data storage. These basically using some default assumptions, such as: Host node is fixed, peer communications environment. With the rapid development of communication technology and network technology, coupled with the popularity of mobile devices, many of today's computing nodes need to be free to move the process connected with the fixed network, thus making the above assumptions no longer hold. Traditional distributed data storage technology cannot effectively support this environment [4-5]. Therefore, it must be improved existing traditional distributed data storage technology, or redesign, to fully support the formation of a data storage technology in this environment, that mobile data storage.

Mobile data store contains two meanings: one is that users can access the server data at any time and place in a mobile state; on the other hand a copy of the back-end data storage can be as the user moves. Mobile data storage extends the traditional distributed data storage system, it is also a distributed system, which is fixed by the dynamic client and server nodes connected. Data Mobile data stored in geographically dispersed, but logically centralized, so that the user wants to implement data processing, query and other functions can be connected by means of the mobile terminal device and the node server. Mobile data storage system shown in Figure 1.

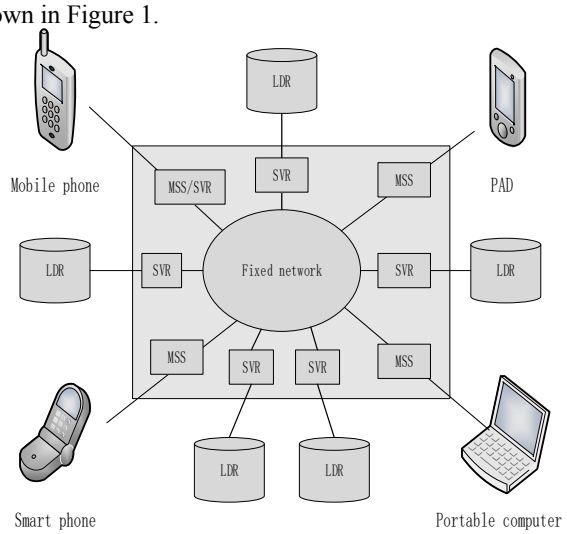

Figure 1.Mobile data storage system structure.

Wherein, MSS fixed network nodes, communicating with the fixed network, an interface with wireless communication, a wireless network using support unit; MC machine including a mobile terminal user PC, PDA, etc., which have mobility, and often break connection to the server. Network bandwidth between the different MC and the server is very different, and relatively low reliability; SVR is generally fixed nodes equipped with data storage and data storage management system, but it is not the function of wireless communication, which constitutes a distributed data storage system. In addition, it can handle online request sent by the client, and the history of online request will be retained.

III. DATA MANAGEMENT STRUCTURE OF THE MOBILE DATA STORAGE

Mobile data storage is one of the latest achievements of computer development, which, in the mobile computing environment, data management is the key to moving the database. Data management needs to consider mobile data storage than traditional distributed data storage system more problems, such as mobility, frequent disconnection, equipment, limited resources, low reliability, synchronized with the server, data queries on other issues [6-8]. Mobile data storage simplifies the functionality of traditional data storage management system to increase the communication module, disconnect support module, buffer management module, consistency maintenance module. The following describes what the function of each module. Data management structure of the mobile data storage shown in Figure 2

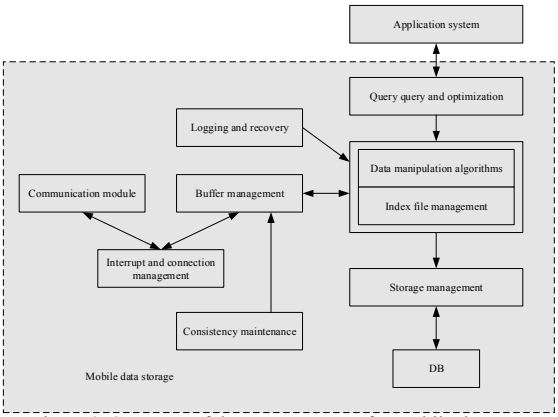

Figure 2. Structure of data management for mobile data storage.

(1)Transaction management module. Transaction Management module include other matters concurrency control, logging and recovery. This module will ensure that mobile data storage local affairs with locally Atomic, consistency, isolation and persistence. When the transaction can be performed locally, transaction management allows local data storage transactions carried out. When the transaction is submitted to the server, the transaction is committed or submitted successfully, or revocation of the transaction. In the latter case, Local transactions can be rolled back, or follow redo logs. Considering the limited resources of mobile smart devices, lock granularity for the table level.

(2) Query processing module. Query processing module main function is to deal with the application of S QL command stream, after compiling, the query optimizer, the query into local queries and needs outside service inquiries, generate a query plan.

(3) Consistency maintenance module. Compliance and consistency maintenance module maintains a local mobile data storage and server-side data storage. User mobile terminal has been submitted in the transaction, but it did not submit to the server side, when after a period of disconnection reconnection is complete, the transaction is required to maintain consistency. The object is to maintain consistency: the data submitted and the local transaction has reached a predetermined time interval has not been updated data.

(4) Disconnect the management module. Access management module manages data storage and off state of the mobile data storage outside. Before disconnected from the network, if the transaction is not completed, it will decide about the information presented to the user, such as the unfinished transaction is immediately executed without breaking operation. Disconnect the management module to the network for a variety of conditions, classification process.

(5) Communication module. Through the establishment of mobile client agent and server-side proxy object with Web Services complete mobile intelligent terminal server access to data.

(6) The storage management module. Including document management, buffer management, memory management module. Due to support disconnected operation, the buffer management module has been redesigned. On the one hand, it can complete the construction and maintenance of mobile data stored: on the other hand complete the query submitted by the user. Just in case of query processing for local queries, direct access to the data locally. Need to query the server for data storage performed into disconnection management module for processing.

IV. MOBILE DATA STORAGE RELATED KEY TECHNOLOGIES

Mobile data storage involving theory and technology covers the latest achievements of today's communication and computer development, where, and how data management in the mobile environment is the key to moving the database. In the mobile database system design, the need to consider many problems in traditional distributed database systems do not need to be considered, such as the client's mobile, clients and frequently broken network access, network conditions, diversity, network communications asymmetric, mobile computing unit power supply capacity is limited, low reliability, high scalability, inconsistencies client and server data, mobile data query and other issues. To solve the problem, on data replication and caching technology, mobile transaction processing, data broadcasting technology, mobile query processing and query optimization, location-related data processing and query technology, mobile information dissemination technology, mobile agent technology research, in the mobile It has special significance database. These technologies are solving a series of problems due to clients moving to bring key technologies [9-10].

Three replication technology (TTR). Copy refers maintained on multiple nodes of data backup, including copying and moving nodes base node (ie servers) saved copy of the database, the former general known as replication, the latter known as caching. The main purpose is to improve the distributed database replication system availability, reliability or access performance. The primary question is how to maintain consistency across multiple nodes on the data replication status.

Data broadcasting technology. A data broadcasting techniques to be the most important issue is how to schedule broadcast data, the broadcast data to optimize the data access time and to achieve the purpose of reducing the tuning time client. MC represents the access time latency to access the broadcast data, and the tuning time reflects the total time for the MC reception specified data maintained answering data broadcast.

Mobile transaction processing and recovery. Mobile transactions are transactions issued by the mobile client. Part of the mobile transaction calculations on mobile clients, and the rest to fixed server computing submit complete. The main objective of mobile transaction management is to achieve a certain degree of consistency at the same time for maximum reliability.

Security technology. In the mobile database security considerations call for effective management of mobile users. Currently, the method generally adopted are: system, each mobile user has a unique mark (ID), a unified system for these ID management, and access control access based on security needs.

SQL Server CE mobile data storage. This will be Microsoft SQL Server Windows CE Edition, for example, discussed in detail at the data management technology mobile database. Microsoft SQL Server Windows CE Edition can be said to function more comprehensive, more stable performance mobile database. Microsoft SQL Server Windows CE Edition (SQL Server CE) Microsoft specifically for mobile application developers a streamlined database products. SQL Server CE is a compact relational database, it only takes about 5 MB of RAM and less than 3 MB of disk space. SQL Server CE is not only able to manage local data, but also provides a subset of the SQL syntax, including inner joins, outer joins and sub-queries, and supports server-side SQL Server database synchronization. Developers use SQL Server CE database functionality provided by mobile developed applications can work effectively in the current mobile computing environment. SQL Server CE programming model with other SQL Server version of the programming model is the same. Figure 3 shows the architecture of SQL Server CE.

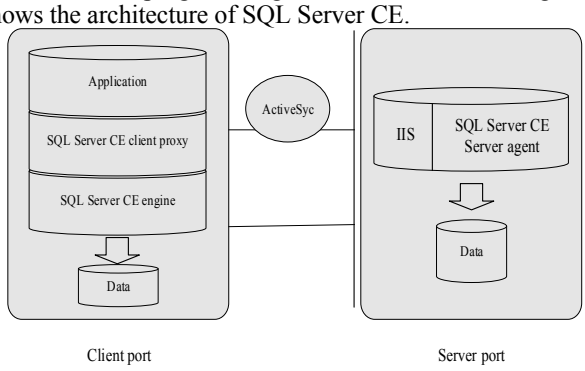

Figure 3. SQL Server CE system structure diagram.

Figure know, SQL Server CE architecture including client and server-side two parts, including the client database engine and client agents that the mobile smart device or PC terminal. The server includes a server-side proxy, and through IIS server and SQL Server Client Agent communications. SQL Server CE Client Agent to SQL Server CE server agent sends an HTTP request, the server-side proxy after receiving the request, will be with the server-side database SQL S ~ to connect, when SQL Server to complete the appropriate action in accordance with the request The server side proxy then HTTP requests to SQL Server CE Client Agent returns the data corresponding result.

V. MOBILE DATA STORAGE MANAGEMENT MODEL FOR APPLICATIONS

In this paper, mobile e-commerce business and its high safety characteristics, design data management model for mobile data storage for a reasonable and shall be implemented in Microsoft SQL Server Windows CE Edition mobile data storage basis. Microsoft SQL Server Windows CE Edition (SQL Server CE) mobile data storage is currently the more comprehensive, more stable performance of removable data storage, SQL Server CE applications in specific features and interface has some inconvenience. Construction of mobile e-commerce, particularly important is the security system, data storage is the foundation for mobile applications, save important business information and customer information, and therefore, data storage auto-recovery function is very important, but not SQL Server CE with local backup and restore functions, we cannot guarantee the security of commercial information. And SQL Server CE does not provide the stored procedure for applications, enabling developers to manipulate data storage is not very convenient. To compensate for the inconvenience of SQL Server CE existence itself, this chapter presents a more reasonable data management model of mobile data storage, as shown in Figure 4. This model is divided into three layers, removable data storage layer, data conversion layer, the application layer. The following will detail the functions of each model.

1. Move the data storage layer. Mobile data storage layer is to use SQL Server CE mobile data storage engine, providing both mobile client local data processing capabilities, but also provides a local SQL Server CE removable data storage function to communicate via a wireless network and remote server-side data storage.

2. The data conversion layer. The function of this layer is to compensate for the inconvenience of SQL Server CE, join a local backup in SQL Server CE removable data storage based on the recovery, and provides the interface functions similar to a stored procedure for upper application, SQL Server CE improve safety and ease of use.

3. The application layer. The application layer is a run on mobile devices, and need to move their applications to provide data storage services. The application layer through the interface functions to access and manipulate data stored in SQL Server CE mobile, data conversion layer corresponds to the application layer and the SQL Server CE removable data storage interface makes the application tier and SQL Server CE mobile data storage is relatively independent.

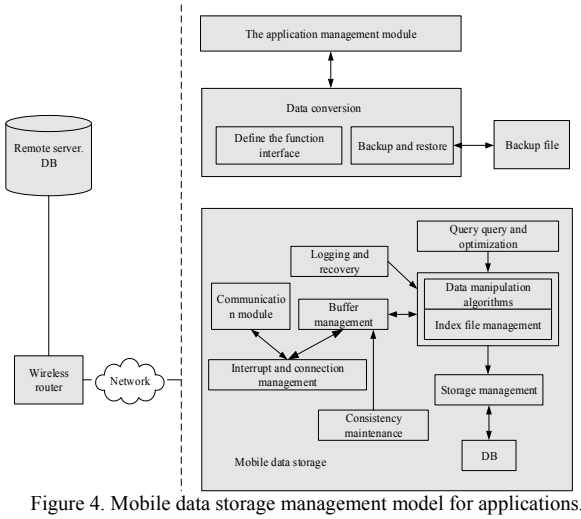

Figure 4. Mobile data storage management model for applications.

In this paper, a data management model for mobile data storage, there are three levels. The bottom layer is a mobile database layer, which is mainly responsible for data management. The middle layer is the data conversion layer, which is to provide the upper application operation of a mobile data-storage interface, but also provides local backup and restore capabilities for SQL Server CE mobile data storage. Top mobile application layer, referring to the application client directly. These three layers form a complete and rational management of mobile data storage data model, not only to improve the mobile data storage SQL Server CE security, and easy for developers to use mobile data storage.

VI. CONCLUSION

Advances in network technology, wireless communication technology, software technology, hardware technology to accelerate the development of mobile phones, handheld computers and other hardware, new products constantly upgrading, have become increasingly indispensable part of daily life. In the mobile computing environment, people need access to information all the time anywhere and expect to get service. Now mobile e-commerce has evolved into virtual reality to give an alternative to traditional e-commerce trends. A variety of intelligent terminal equipment, the rapid development of embedded devices, mobile applications for data management on increasing demands, the place where there are data, a database is needed to help manage the data, so the embedded devices also need to have database support. This is a vital research topic in mobile computing.

Therefore, a focus to all these activities is expected to pave the way to new data storage technology and mobile databases. Mobile data storage technology facilitate the creation of database technology, which in turn is opening up new applications for development. As such, mobile database management technology needs further advanced research and development.

ACKNOWLEDGEMENTS

The national natural science foundation of China, Research of the key technology of large-scale depth calculation group social dimension under the Web environment sensitive (61363024).

REFERENCE

[1] Pitoura E, Samaras G. Data management for mobile computing. Springer Science & Business Media, 2012, pp.856-868.

[2] Danford T E, Batchu S K. Virtual instance architecture for mobile device management systems: U.S. Patent 8, 2012, pp.465-468.

[3] Catthoor F, Danckaert K, Kulkarni K K, et al. Data access and storage management for embedded programmable processors. Springer Science & Business Media, 2013, pp.123-130.

[4] Khan A, Ahirwar K. Mobile cloud computing as a future of mobile multimedia database. International Journal of Computer Science and Communication, 2011, 2, pp.219-221.

[5] Dinh H T, Lee C, Niyato D, et al. A survey of mobile cloud computing: architecture, applications, and approaches. Wireless communications and mobile computing, 2013, 13, pp.1587-1611.

[6] Zhou Z, Huang D. Efficient and secure data storage operations for mobile cloud computing//Proceedings of the 8th International Conference on Network and Service Management. International Federation for Information Processing, New York.2012, pp.37-45.

[7] Balakumar V, Sakthidevi I. An efficient database synchronization algorithm for mobile devices based on Secured Message Digest//Computing, Electronics and Electrical Technologies (ICCEET), 2012 International Conference on. IEEE, London, 2012, pp. 937-942.

[8] Khan A N, Kiah M L M, Ali M, et al. BSS: block-based sharing scheme for secure data storage services in mobile cloud environment. The Journal of Supercomputing, 2014, 70(2), pp.946-976.

[9] Mehmood I, Sajjad M, Baik S W. Mobile-Cloud Assisted Video Summarization Framework for Efficient Management of Remote Sensing Data Generated by Wireless Capsule Sensors. Sensors, 2014, 14(9), pp.17112-17145.

[10] Yang P, Jin P, Yue L. Exploiting the Performance-Energy Tradeoffs for Mobile Database Applications. Journal of Universal Computer Science, 2014, 20(10), pp.1488-1498.