The Processing Technology in Mobile Database Transaction System

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Abstract

Computing technology is combined with the development of wireless communication technology and makes a new computing model a mobile computing has become a reality.In mobile computing mode, also including database technology, the computer research work has brought new challenges.In order to effectively eliminate the mobile computing environment adverse effect brought by the access to information, this article focuses on the mobile transaction processing in mobile database technology and put forward a kind of optimistic two-phase commit transaction processing method (02PC-MT).By introducing a kind of optimistic concurrency control method combined with two locking protocol of mobile transaction processing mechanism, the paper solved the problems of interactive long transactions, and provides the mobile host any mobility and the consistency of database system support.

Keywords: mobile database, transaction processing, optimistic two-stage

1. Introduction

Development and combine computing and wireless communications technology makes a new computing model of a mobile computing model to become a reality. In mobile computing mode, the user interface using a portable computer access to information through wireless communication network, and is not affected by changes in the actual physical location. Development and combine computing and wireless communications technology makes a new computing model of a mobile computing model to become a reality. In mobile computing mode, the user interface using a portable computer access to information through wireless communication network, and is not affected by changes in the actual physical location [1].

Moore's Law tells us that, with the rapid development of semiconductor technology, computer processing power, storage capacity, and other performance indicators are integrated in every 18 months to double the speed increased, while prices continued to fall. Therefore mobile phones, PDAs, handheld computers, PDA, GPS cards and wireless communications cards and other small mobile devices continue to emerge, and applied to all walks of life and in the hands of ordinary people. In recent years, with the analog cellular systems, digital cellular systems, wireless local area network (WLAN), wirelesswide area network (WWAN), infrared technology and to develop satellite technology, making it at any time, any place, to access information they need to become possible, and then with the support of a powerful mobile computer software systems, in order to make these people desire to become a reality, mobile database is one of the important core software systems. Therefore, the mobile database system is a computer

technology and wireless communication technology development to a certain stage, and in promoting the use of demand emerged [2].

Production and development of mobile database systems , in turn, promote the development and application of mobile computing , it not only makes people at any time, any place , access to the information they need to become a reality, and so that people can be the most convenient, fast, the safest , most economical way to access the information they need .

Mobile database technology has a high starting point and involves a number of academic disciplines , stored in the data, such as organization and management to help database technology and tradition , but not identical . The dissemination of the database and also relates to a wireless communication technology and computer network technology. These three aspects of mobile database technology both inherited and present new challenges.

Dataguest 2000 forecast conference held at the Gartner Group, Dataguest Martin Reynolds, vice president pointed out that in the forecast, wireless mobile computing and e-commerce, Internet, genetic engineering, will become the driving force for economic development in the next decade. Since 1999, the United States conducted a series of Battelle Institute 10-year projection, the tiny, wireless, highly mobile, and high-speed and highly personal computers listed in the "10 most strategic of 2020 trends in technology, "the research report fourth. In the next decade, more than 80 percent of business users will require a remote or mobile solutions; worldwide will have hundreds of millions of everyday office environment staff will be non- traditional. There is a big market with. The development of mobile databases will bring people to the use of information models , concepts, methods and approach new changes have a huge impact on all aspects of social , economic, cultural , educational, military , and to enhance the overall level of information technology [3].

In addition, now the computer software industry, although, a good momentum of development of our country. But compared to software powers the United States, India, there are still gaps. Mobile database is a useful new technology, there are more opportunities for us to catch up and exceed them. On existing software, the operating system, database management system, the core software in the hands of others, we have not many independent property rights. From the economic benefits, it goes without saying, the more important is the information security of the state is not guaranteed. In the mobile computing environment, if there is no independent intellectual property core software, information security is more difficult to be guaranteed.

With the mobile computing environment, people do not need to be fixed office, and may be mobile. Chairman of the Board may be convened at the business trip; insurance salesman on the way out you can always contact the business transferred from the headquarters of the latest data and information at any time for a customer, after the completion of the exchange, he will need to enter the latest the immediate feedback policy information to headquarters. This way to get rid of the restrictions place and occasion, improve work efficiency.

Mobile computing environment and the location of the query, when a tourist arrives in a strange city, he can check through mobile devices needed information. If the query with the current position of the nearest inn where? Current position as the most inexpensive hotel in the center of a radius of five kilometers where? Now fewer tourists from the current location of interest is which one? Traditional database query is different, and the result of the query is related to the position, the same problem in a different location, the answer might be different.

At present, China's information industry, from the perspective of the whole industry chain, many in the technology downstream, and have high returns in upstream technology and more in the hands of others. Therefore, from the point of view of the development of information industry, it is imperative to form products with independent property rights in

the upstream technology. Currently, the mobile database technology in mobile computing, generalized computing belonging to the upper reaches of innovative technology, closely combine China's specific national conditions. Due to the application of a broad background, research results can be transformed into a mobile database of high-tech products with independent property rights [4].

2. Related Works

The main purpose is to improve the copy availability, reliability and access performance of database systems. Traditional replication / caching techniques are between the client and the server is typically remaining connected, and based on this premise to maintain consistency. This is not applicable in a mobile computing environment, as a mobile computer is disconnected significant features. Research on the file system replication and caching technologies morein-depth, as are a number of representatives:

1). Coda system is the first to support the disconnection of the file system, Coda system is mainly responsible for determining which objects are cached mobile users , how to keep the cache synchronized with the server . Has a cache manager Venus, Venus using optimistic Coda cache policy on each client, it works in three states: hoarding (collect), simulation (emulation) and re- integration (reintegration). While maintaining the connection, Venus is in collection status, it can access data on the server, and collect data even during the break may be required to be expected; during disconnection, Venus enters the simulation state, then it is a basic proxy server the role and operations on the cached data in the log, the last when the client reconnects, Venus according logging to cache data on the server with the data resynchronization, and a variety of conflict cleanup operations [5].

2). Honey man, who will further connect the mobile computer is divided into four types , namely, connections, weak link , and read-only break even, respectively, for low network bandwidth and reliability of the environment , for each connection status , respectively studied the corresponding cache strategy.

3). Spy Utility is Tait, who developed a semi- automated tool. And Coda is different: Tait want to automatically predict an application (not the user) on the basis of their work on the file perfecting on the working set.

4). Seer Systems is forecast to collect data automatically, is to determine the data to be collected to find users in the past based on semantic relationships between files accessed, how it works is based on the semantic locality of user behavior. File is in accordance with the semantic distance and bundled together. Semantic distance indicates the distance closeness of the relationship between them.

In a traditional database system in order to ensure serialibility of concurrent transactions, the transaction must meet the ACID properties that meet atomicity (Atomicity), consistency (Consistency), isolation (Isolation) and persistent (Durability).

Also moving Affairs also has a location relevance, timeliness, weak autonomy, application-specific, high data availability, weak atomicity, isolation and other weak mobile transactions for these features, many models have been proposed about the mobile transaction, the following describes several typical mobile transaction models [6].

1). MDSTPM mobile transaction processing model

MDSTPM model is a more efficient mobile transaction processing model, in particular, the introduction of the queuing mechanism effectively adapted to the mobile host frequent disconnection characteristics. The disadvantage is presented in a way to move the transaction is not flexible enough to move all operations once the transaction must be submitted to the coordinator, and therefore cannot provide support for interactive mobile transactions, making its application subject to certain restrictions.

2). O2PL-MT mobile transaction processing model [7]

J. Jing *et. al.* proposed a suitable two mobile transaction optimistic locking protocol, in this model, the mobile transaction can be sent in multiple, each time you send a continuous sequence of operations; compared to MDSTPM model, O2PL- MT model provides a more flexible way to send mobile transactions. So it can adapt to mobile computing environments. The disadvantage is the result of the operation sequence returns before moving the computer cannot leave the current network unit; Furthermore, the use of two locking protocol, data may be prolonged blockade, therefore, not well supported disconnection of long transactional. J.Jing , who will be the traditional two -phase locking 2PL is used to improve the mobile transaction processing 02PL-MT, it is fully replicated , complete and partial replication without copying several different situations have shown better performance.

3). Support Services and the Joint Panel report open nested transaction model

P. K. Chrysan this report presents a support Services and the Joint Service Open nested transaction model. A mobile transaction consists of a set of relatively independent member affairs composed of various components of the transaction can be further broken down into other elements affairs , therefore , can support any mobile transaction transactionnesting level . This model adds two types of transactions: Transaction Report (Reporting Transaction) and the Joint ServiceCo-Transaction. A report of the Panel can share some of its results at any time, independently of the main transaction and submit. A joint is also a particular type of transaction reporting services, it was forced to suspend the transaction report, you can continue to execute and submit its results after sending the Reporting Services and the Joint transaction cannot be executed concurrently, but the model is not well supported disconnected operation, there is no better place to consider matters raised during the execution of a mobile distribution of multi-site implementation of the updated price.

3. Proposed Scheme

Mobile database replication technology is an effective way to support disconnected operation, but it is, after all, there are some limitations. Due to the need to save a lot of database copies on a mobile device, when the data size increases the limited resources of mobile devices limit the overall size of the application; addition, replicated mobile database systems require periodic synchronization to ensure the consistency of the database system, so for users to access popular data only occasionally in this way should not be processed.

A transaction is an important database system concept. In a data base system, the user application to the transaction is the basic unit to achieve access to the database. A transaction is composed of a series of read write operations, these operations begin with Begin Transactions to abort or co ~ it ends. In order to improve the efficiency of the database, each transaction can be executed concurrently, to ensure the serializability of transaction scheduling by the concurrency control mechanism of the database. Serializability of transaction scheduling refers to concurrent execution of transaction scheduling equivalent of a particular serial schedule to meet the serializability of transaction scheduling to ensure the consistency of the database. Serializability of transaction scheduling a database system is to determine the correct standard [8].

Traditional database systems transaction processing model can solve the problem of the traditional concurrency control applications *(e.g.* bank transfer systems, aircraft counting system , foreign trade business systems , inventory management systems, *etc..*) transaction , the common feature of these systems is one of the transaction is relatively simple and short duration (usually complete within a few seconds or less). But these transaction models do not effectively support the mobile computing environment. In the mobile database, fixed host and a mobile computer can initiate the transaction, which initiated the transaction mobile computers called mobile transactions. Due to limited

communication bandwidth and frequent disconnection affect the operation of mobile transactions usually fall long transaction; in the process of moving transaction execution, a mobile computer to change the position of the complex will bring handoff problem; addition, the mobile transaction to perform more error-prone, and you want to access more complex data resources. These features make the mobile transaction processing mobile transactions become a challenging area of research in which mobility and long transaction characteristics are mobile transaction model needs to focus on solving problems.

In many cases, direct access to the database server is a more desirable way to access information. This article will focus on the ways in which information access mobile transaction processing technology, and proposes a two-phase commit optimism mobile transaction processing method (02PC-MT). Figure 3.1 is the structure of the mobile transaction processing system.
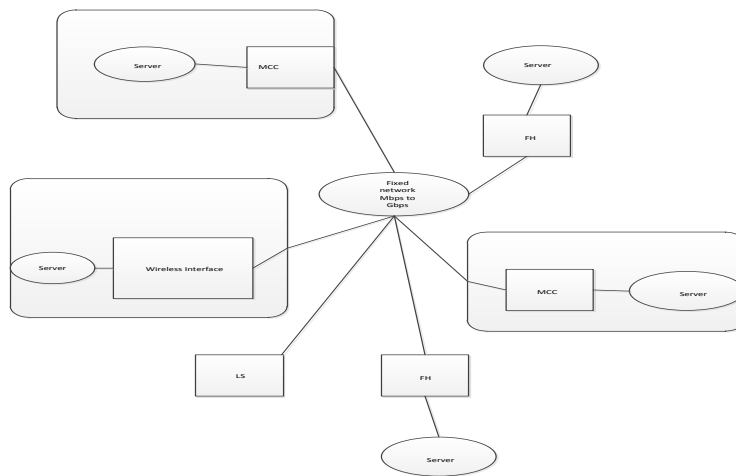

Figure 3.1. The Mobile Transaction Processing System Structure

3.1. O2PL-MT Mobile Transaction Processing Model

Literature [9] proposed a positive thing for mobile two-phase locking protocol (Optimistic Two Phase Looking for Mobile Transactions, referred O2PL-MT). In O2PL-MT model, the mobile database system architecture is expressed as 3.2 shown.
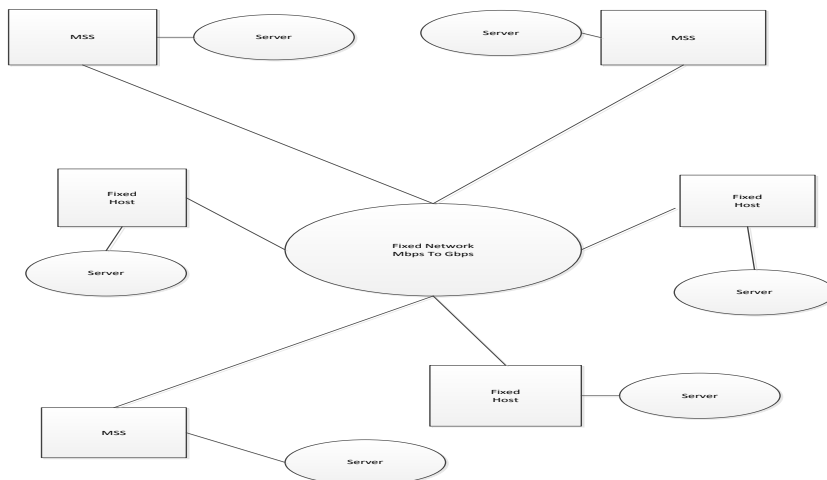

Figure 3.2. Mobile Database System Architecture

Sever: Database server on the fixed network
MSS: Mobile Support Station
MTH: Mobile Transaction Host

In the mobile database system shown in Figure 3.2, each fixed hosts on the fixed network has a database server and manage a local database, the database server supports basic transaction operations such as read, write, ready to submit, submit, mortality, *etc..* ; each MSS has a previous transaction coordinator, which is responsible for accepting transactions from the sequence of operations within the jurisdiction of the mobile host , send them to the fixed network, the corresponding database server to perform , and monitor their implementation.

When the mobile host sends some sequence of operations from one network unit and get the results of the sequence, you can move to another network unit continues to send subsequent operations. Each mobile host at any one time only start a mobile transaction, the transaction is executed only after the completion of the transaction can only initiate the next move. A mobile transaction contains is a series of read and write operations, and were to BEGNI and END as the start and end a transaction.

In 02PL-MT model, the mobile transaction can be divided into several transmission , each transmit a continuous sequence of operations ; the results obtained when operating the mobile computer transmitted sequence can be moved to another network element sending the next operation sequence . Compared to MDSTPM model, 02PL-MT model provides a more flexible way to send mobile transactions, therefore better able to adapt to the mobile computing environment. The disadvantage is the result of the operation sequence returns before moving the computer cannot leave the current network unit; Furthermore, the use of two locking protocol, data may be blocked for a long time, it is not well supported disconnection and long transaction characteristics.

3.2 02PC-MT mobile transaction processing model

In view of the above analysis , this section presents a new transaction model-optimistic two-phase commit mobile transaction processing model (Optimistic Two-phase Commit for Mobile Transactions, denoted O2PC-MT) O2PC-MT model uses optimistic concurrency control and two phase commit a combination of methods to effectively eliminate the influence of long transaction generated on system performance ; addition, this model allows mobile computers of sending multiple affairs , provides support for interactive mobile services; perform operations and affairs of the transaction sent process, the mobile computer can be any cross- moved, so the model provides support for the free mobility[10] .

02PC-MT mobile transaction processing model is shown in Figure 3.3. In 02PC-MT model, MC sent to the MSS mobile transaction consisting of a series of read and write operations, these operations to BEGNI-MT (MTID, TMODE) began to COMMIT or ABOTR end. MC gives it matters when you start moving a mobile transaction identifier (MTID), while the transaction operations sent sequentially numbered from O to N. To simplify the description , it is assumed at any one time only one transaction execution MC , which can have direct access to the mobile computer identifier (MCID) as MTID.

MC sending mobile transactions can be sent in two different ways: 1) Disposable entire transaction will be sent to the MSS, the method is applicable and non- interactive services; 2) send the entire transaction is divided into several, each sending only. Several consecutive operating transactions (called the operation sequence, denoted as OPS), this method is applicable to interactive services" delivery method specified by the transaction TMODE.

No matter what kind of sending the above manner, the mobile transaction may involve receiving multiple MSS. This is because in the process of sending the transaction operations , MC handover may occur "As always MC MSS transmits the transaction operation to the wireless network element is currently located , so the original OPS a

handover occurs when it is divided into two or more OPS, and is the type of the received MSS .
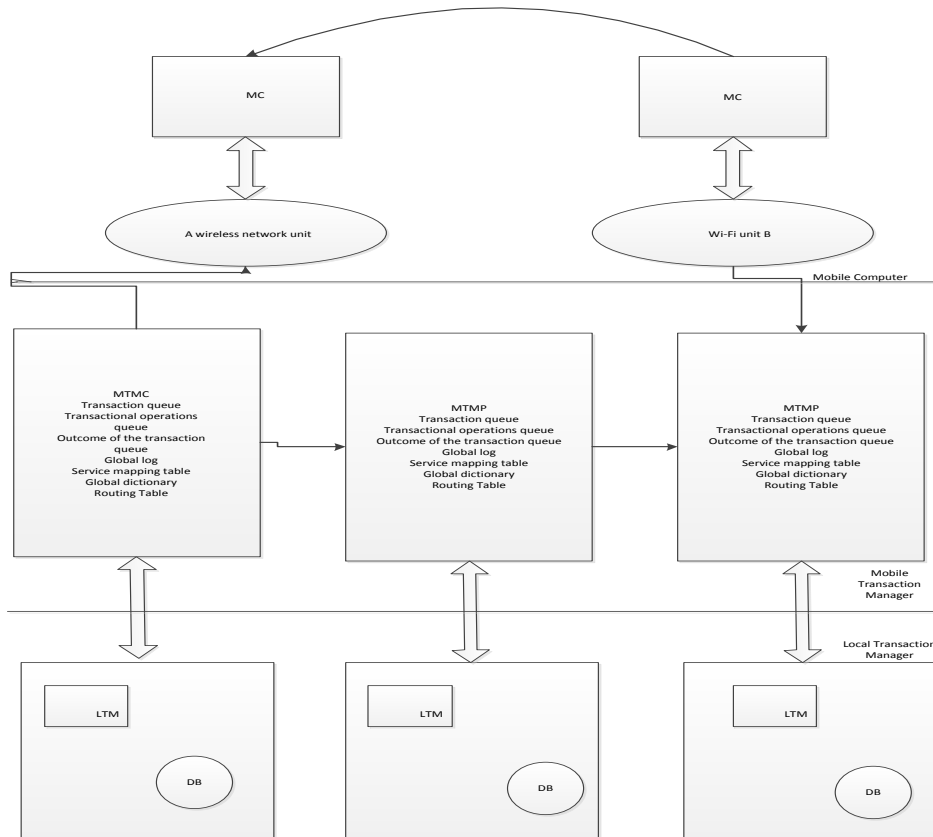

Figure 3.3. O2PC-MT Mobile Transaction Processing Model

3.3 O2PC-MT Two -Phase Commit Algorithm

MT 02PC a two -phase commit algorithm is the first stage of verification. MTMC first round PRE team sent a message to all the RE MTMP, after receiving the message starts each MTMP validate the transaction and verify knot
If sent to MTMC.

Let MT mobile transaction consists of m MTMP work together. Before entering the two-phase commit state, $MTMP_i$ ($1 \leq i \leq m$) optimistic child transaction (denoted as $OT_i = ((OT_i, oa_j, oe_j))_{j=1}^{n}$)) has already been implemented on, However, the corresponding resources (including transaction records in the table and map the applied N Lock) has not been released, but transferred to the two -phase commit process for follow-up treatment. In the authentication phase, the $MTMP_i$ first group corresponding to a transaction starts BT_i , and it contains the same sequence of operations OT_i . In the process of implementation BT_i , $MTMP_i$ using two locking protocol for concurrency control , and the need to detect two types of conflict , a conflict that is set to read and execute conflict.

02PC-MT submitted two algorithms for the second phase of the global commit phase. Within a certain time frame, if all MTMC MTMP collected READY message sent back, it sends all round MTMPGLOBAL-COMMTI broadcast; if the received message contains ABOTR, or exceeding the time limit has not yet received all READY message, then send GLOBAL-ABOTR broadcasts. If MTMP, receive GLOBAL-COMMTI command , then submitted to the MTMC send ACK message ; If you receive GLOBAL-ABOTR

command, after the withdrawal of the above operations, MTMP release N Lock corresponding data elements , delete transaction mapping table the corresponding record , and release of other resources.

For the validation of the transaction is no, MTMC will inform the mobile user, the user determines whether to restart.

4. Experimental Results

We chose two main indicators, moving to undo the transaction and transaction throughput rate, to analyze the 02PC-MT model. Undo the relationship among mobile transaction between rate and MPL Figure 4.1.

As can be seen from Figure 4.1, on the whole, the rate move to undo the transaction with the MPL grows. But before MPL reaches a critical point, withdrawal rate is very small mobile transaction; addition, withdrawal rate of mobile transactions as P_n growth or P_r decline in growth. This is because the possibility 02PC-MT model, the conflict (including conflict set read -conflict) with the increase in the data update rate ζ increases, but before ζ reaches a critical point , the update of less congestion so that these conflicts occur frequently .
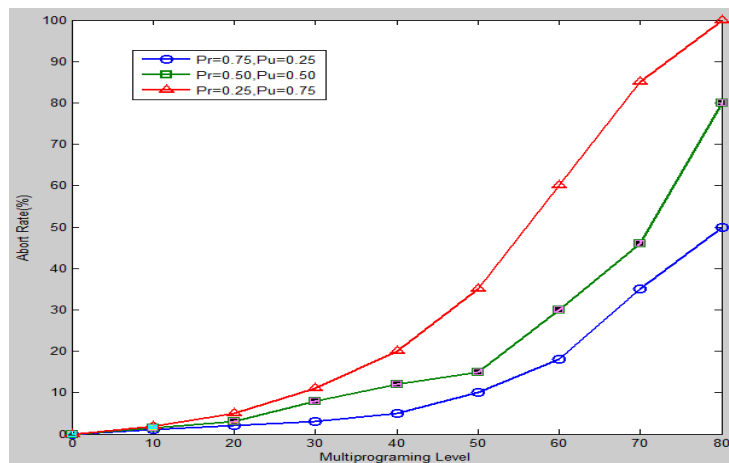

Figure 4.1. Mobile Transaction Cancellation Rates O2PC-MT Model

By the above results , we can get the following conclusions: 1) With the MPL increases , O2PC-MT and transaction throughput rates O2PL-MT model showed for the first rose and then dropped ; 2) Generally speaking , compared to O2PC- MT model , O2PC-MT model to improve the throughput of the system , thus optimizing the performance of the system ; 3) With the increase of $Delay_m$ the performance O2PL-MT decreased rapidly, while the performance is stable O2PC-MT. The above results are caused by the following reason.

Set mobile transaction T_m , for any transaction T_s on the database server, and before you start running T_s , conflict has access to the data of the two. Table 4-1 lists the types of transactions T_m and T_s conflicts that may arise.

Table 4.1. The Possible Conflict Types of T_m and T_s

T_m	T_s	
w	r	1)
w	w	2)
r	w	3)

For 1) 2) class conflict , if T_m used 2PL, T_s will enter the wait state until the T_m commit or revoked ; NSX lock if used T_m , T_s will continue and eventually submitted to , and does not affect the T_m execution and submission , transaction scheduling follow T_s - T_m can serialization. Because T_m is a long transaction, 02PC-MT mobile transaction to avoid long blocking other transactions, thereby increasing transaction throughput of the system.

For the 3) class conflict , if T_m used 2PL, T_s will enter the wait state until the end of the release of the T_m expansion phase in the increase of S locks up ; If T_m using NSX lock, T_s will continue to perform , but T_m due to receive a lock conflict message production and N instant undone. Undo T_m is worth it, because T_m is a long transaction and the database server affairs traffic flow is much larger than the transaction on a mobile device.

5. Conclusions

The above analysis, the data update rate is moderate or low , long transaction characteristics prominent mobile computing environment , 02PC an MT model can provide better overall performance.

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