Issues in Concurrency Control for Different Databases Concurrency Control Methods for Different Databases a Survey of Concurrency Control Protocols

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Abstract: **This paper reviews the coverage of concurrency control in different Databases. Database becomes more popular, the need for improvement in database management systems becomes even more important to maintain reliability. The main challenges are identified as-: (1)Preserving the ACID property atomicity, consistency, isolation and durability property when concurrent transactions perform read and write operation; (2) provides recovery method when distributed data is fail; (3)whatever method that is chosen they must provide feasible solutions with respect to performance.**

Keywords: Centralized Database system, Distributed Database System, object-oriented database System, Distributed Object-Oriented Database System , Mobile Database System, Real-Time Database System ,Multilevel Secure Databases, Replicated Real Time Databases, Concurrency control, Transaction, Locking protocol

I. INTRODUCTION

In today's world of universal dependence on information systems, with the rising need for secure, reliable and accessible information in today's business environment, the need for databases and client/ server applications is also increasing. This paper reviews the concurrency control in dissimilar databases. Database becomes more trendy and to supervise different types of database management systems are required. Many transactions are accessing the databases concurrently. The main challenges are identified for the transactions are -: (1)Preserving the ACID property atomicity, consistency, isolation and durability property when concurrent transactions perform read and write operation; (2) provides recovery method when data is failed; (3)whatever method that is chosen they must provide feasible solutions with respect to performance. One most important mechanism to control the concurrent transactions is concurrent control mechanism. Here we are focusing different types of concurrency control mechanism for different databases. In this paper weaddress lock concept in different databases transactions.

II. CONCURRENCYCONTROL IN CENTRALIZED DATABASESYSTEM

The basic idea of locking is that whenever a transaction accesses a data item, it locks it, and that a transaction which wants to lock a data item which is already locked by another transaction must wait until the other transaction has released the lock (unlock).

Let us see some important terminologies related to this concept:

- *Lock Mode:* Transaction locks the data item in the following modes:
  - *Shared Mode:* Here the transaction wants only to read the data item.
  - *Exclusive Mode:* Here the transaction wants edit the data item.
- *The Well-formed Transactions:*The transactions are always well-formed if it always locks a data item in shared mode before reading it, and it always locks a data item in exclusive mode before writing it
- *Compatibility Rules existing between Lock Modes:*
  - A transaction can lock a data item in shared mode if it is not locked at all or it is locked in shared mode by another transaction
  - A transaction can lock a data item in exclusive mode only if it is not locked at all.
- *Conflicts:* Two transactions are in conflict if they want to want to lock the same data item with two compatible modes; two types of conflicts: Read-Write conflict and Write-Write conflict.
- *Granularity of Locking:* This term relates to the size of objects that are locked with a single lock operation. In general, it is possible to lock at the *record level (*i.e to lock individual tuples)or at the *File level* (to lock at the fragment level).
- *Concurrent transactions are successful if the following rules are followed*:
  - mTransactions are well-formed
  - Compatibility rules are observed

- Each transaction does not request new locks after it has released a lock.

A sophisticated locking mechanism known as *2-Phase locking* which includes the above said principles is normally used. According to this, there are two separate phases:

- *Growing phase*: Each transactions there is a first phase during which new locks are acquired
- *Shrinking Phase***:** A second phase during which locks are only released.

We will simply assume that all transactions are performed according to the following scheme:

(Begin Application)
Begin transaction
Acquire locks before reading or writing
Commit
Release locks
(End application)

In this way the transactions are well formed, 2-Phase locked and isolated.

Deadlock: A deadlock between two transactions arises if each transaction has locked a data item and is waiting to lock a different data item which has already been locked by he other transaction in the conflicting mode. Both transactions will wait forever in this situation, and system intervention is required to unblock the situation. The system must first find out the deadlock situation and force one transaction to release its locks, so that the other one can proceed. i.e one transaction is aborted. This method is called as ***Deadlock detection.***

III. CONCURRENCY CONTROL IN DISTRIBUTED DATABASE SYSTEM

In distributed database systems, database is typically used by many users. These systems usually allow multiple transactions to run concurrently i.e. at the same time. Concurrency control is the activity of coordinating concurrent accesses to a database in a multiuser database management system (DBMS). Concurrency control permits users to access a database in a multi-programmed fashion while preserving the illusion that each user is executing alone on a dedicated system. The main technical difficulty in attaining this goal is to prevent database updates performed by one user from interfering with database retrievals and updates performed by another. When the transactions are updating data concurrently, it may lead to several problems with the consistency of the data.

Distributed Transaction:

A distributed transaction is a transaction that runs in multiple processes. Distributed transaction processing systems are designed to facilitate transactions that span heterogeneous, transaction-aware resource managers in a distributed environment. The execution of a distributed transaction requires coordination between a global transaction management system and all the local resource managers of all the involved systems. The resource manager and transaction processing monitor are the two primary elements of any distributed transactional system. Distributed transactions, like local transactions, must observe the ACID properties. However, maintenance of these properties is very complicated for distributed transactions because a failure can occur in any process. If such a failure occurs, each process must undo any work that has already been done on behalf of the transaction. A distributed transaction processing system maintains the ACID properties in distributed transactions by using two features:

- Recoverable processes: Recoverable processes log their actions and therefore can restore earlier states if a failure occurs.
- A commit protocol: A commit protocol allows multiple processes to coordinate the committing or aborting of a transaction. The most common commit protocol is the two-phase commit protocol.

Distributed Two-Phase Locking (2PL):

In order to ensure serializability of parallel executed transactions states different methods of concurrency control. One of these methods is locking method. There are different forms of locking method. Two phase locking protocol is one of the basic concurrency control protocols in distributed database systems which will ensure serializability. The main approach of this protocol is "read any, write all". Transactions set read locks on items that they read, and they convert their read locks to write locks on items that need to be updated. To read an item, it suffices to set a read lock on any copy of the item, so the local copy is locked; to update anitem, write locks are required on all copies. Write locks are obtained as the transaction executes, with the transaction blocking on a write request until all of the copies of the item to be updated have been successfully locked. All locks are held until the transaction has successfully committed or aborted [3].

The 2PL Protocol oversees locks by determining when transactions can acquire and release locks. The 2PL protocol forces each transaction to make a lock or unlock request in two steps:

- *Growing Phase: A transaction may obtain locks but may not release any locks.*
- *Shrinking Phase: A transaction may release locks but not obtain any new lock.*

The transaction first enters into the Growing Phase, makes requests for required locks, then gets into the Shrinking phase where it releases all locks and cannot make any more requests. Transactions in 2PL Protocol should get all needed

locks before getting into the unlock phase. While the 2PL protocol guarantees serializability, it does not ensure that deadlocks do not happen. So deadlock is a possibility in this algorithm, Local deadlocks are checked for any time a transaction blocks, and are resolved when necessary by restarting the transaction with the most recent initial startup time among those involved in the deadlock cycle. Global deadlock detection is handled by a "Snoop" process, which periodically requests waits-for information from all sites and then checks for and resolves any global deadlocks.

Wound-Wait (WW):

The second algorithm is the distributed wound-wait locking algorithm. It follows the same approach as the 2PL protocol. The difference lies in the fact that it differs from 2PL in its handling of the deadlock problem: unlike 2PL protocol, rather than maintaining waits-for information and then checking for local and global deadlocks, deadlocks are prevented via the use of timestamps in this algorithm. Each transaction is numbered according to its initial startup time, and younger transactions are prevented from making older ones wait. If an older transaction requests a lock, and if the request would lead to the older transaction waiting for a younger transaction, the younger transaction is "wounded" – it is restarted unless it is already in the second phase of its commit protocol. Younger transactions can wait for older transactions so that the possibility of deadlocks is eliminated [3].

Example-: Wound-Wait algorithm

	T1 is allowed to
t(T1) > t(T2) ⟶	Wait
t(T1) < t(T2) ⟶	Abort and rolled back

t(T1) > t(T2) -: If requesting transaction [t(T1)] is younger than the transaction [t(T2)] that has holds lock on requested data item then requesting transaction [t(T1)] has to wait. t(T1) < t(T2) -: If requesting transaction [t(T1)] is older than the transaction [t(T2)] that has holds lock on requested data item then requesting transaction [t(T1)] has to abort or rollback.

IV. CONCURRENCY CONTROL IN OBJECT-ORIENTED DATABASESYSTEM

An object-oriented database management system is defined as acollection of classes and instances of these classes. A class contains the definitions of the variables that will take values in the instances of this class togetherwith the methods used to access these variables. A method execution is considered to be a partial order of sub method calls. It is assumed that the databaseenvironment allows for extensibility, permitting users to dynamically modify the class definitions. As such, we can regard class definitions as objects accessible by the users of the database. Both the class objects and the instance objects(objects derived by instantiating a class object) will be referred to as objectsthus providing uniform treatment for all objects in the database.The objects are assumed to be autonomous entities, internally concurrent, with full control over the methods they are running at any time. They are organized in a hierarchy. Relationships among methodsare described in terms of standard tree terminology (recursive method calls arenot allowed)with a method m2 being a child of a method m1 if m1 invokes m2. The notions of parent and ancestor are defined in the same manner. In this environment the methods of one object can invoke only methods of objects thatare lower the hierarchy and every object inherits the methods of all its ancestors.

As mentioned before, in a OODBMS a transaction (a user program)consists of a series of method invocations on different objects, which in turncan invoke other methods on different objects, this leading to a tree structureof method calls. As in traditional database systems a transaction is representedas a partially ordered set of method calls which are related among them byconflict, commutatively and concurrency conditions specified by the OODBMSdesigner or by the users who extend the database with new objects.

The Basic Protocol

The protocol presented in this paper is an extension of the protocol introducedby Agrawalet all [47].

1. A method t' can execute an atomic operation t on an object o if it canacquire a lock on o.
2. A method execution cannot commit until all its children have terminated. When a method terminates:

- If it is not the top-level, its locks are inherited by its parent.
- If it is not top-level and it aborts, its locks are discarded.
- If it is top-level, its locks are discarded.

3. A lock on an atomic operation o is granted to a method if and only if :

- The current state of the object permits the execution of the requesting method.
- If there exist non-ancestors methods holding inherited locks on o,there are some ancestors of these methods and the requesting methodthat commute.
- Granting locks and scheduling for execution in the same time all other concurrently runnable methods preserves the partial order devised bythe central transaction manager.

The novelty of this protocol consists of forcing parent methods to inherit the locks of terminated children methods, allowing conflicting operations toshare locks if they have commuting ancestors and permitting objects to executemore than one method call at a time, according to the specifications designedby the users and the system designer.

V. CONCURRENCY CONTROL IN DISTRIBUTED OBJECT-ORIENTED DATABASESYSTEM

One scheduler module is availablein thissystem, that is a *black box*, it communicates with the other modules only via a well defined interface. In the distributed version of the simulator, two-phase locking and timestamp ordering schedulers are implemented. The scheduler receives an operation from the transaction manager, and processes it according to its scheduling technique. When the scheduler decides that an operation can be sent to the data manager, the data manager is called. When the operation has completed, the scheduler will be notified by a call from the data manager. The following distributed schedulers are implemented:

- Strict Two-Phase Locking Scheduler:
  Anice feature with non-replicated distributed databases is that each local scheduler can schedule the data accesses as if it was a centralized scheduler. But of course there are also some problems that are more difficult to solve in the distributed context than for a centralized scheduler. For the 2PL scheduler the main problem which has to be solved is deadlock.
- Strict Timestamp Ordering Scheduler:
  We have implemented a strict TO scheduler. Although deadlocks are no problem here, we have another "global problem". Assigning monotonous increasing unique timestamps to transactions. In a real implementationthiscould be done by concatenating a local timestamp counter with the node number. Keeping the clocks synchronized is not trivial, but one solution to this problem is discussed by Lomet in [4].

In a distributed database, it is common that more than one scheduler participate in executing a transaction. Because of this, a distributed commit protocol has to be used, to make sure that all participating schedulers reach the same result. Either all perform the commit, or all have to abort. Two well-known protocols are two-phase commit (2PC) and three-phase commit [5]. We have employed 2PC, which the protocol is used by most commercially availabledistributed database systems.

VI. CONCURRENCY CONTROL IN MOBILE DATABASESYSTEM

Most of concurrency control strategies are based on three mechanisms viz., locking, timestamps and optimistic concurrency control. Though these schemes are well suited for traditional database applications, they don't work efficiently in mobile environments. Due to various constraints in the mobile environment and nature of different online applications, traditional concurrency control mechanism may not work effectively.

Concurrency control deals with the issues involved in allowing Simultaneous accesses to shared data items. Atomicity, consistency, and isolation of transactions are achieved in the database through concurrency control mechanisms. In particular, mobile applications have to facedisconnections. It is expected that the transaction continues when the mobile host is disconnected. Hence there is a need of optimistic replication techniques.

In optimistic replication, shared data is replicated on mobile hosts and users are allowed to continue their work while disconnected. After successful completion of local operations at mobile host, the results are later propagated to fixed hosts. In the earlier approaches whenever a concurrency violation occurs i.e. data items are updated at fixed host the conflicting transaction using the similar data items was aborted. In this approach the conflicting transaction is notaborted but it is restated with new state of the data items.

VII. CONCURRENCY CONTROL IN REAL-TIMEDATABASE SYSTEM

The data access scheduling policies are commonly referred as concurrency controlprotocols. These protocols have the responsibility to ensure that although transactions are executed concurrently with interleaving operations, the committed or certified transactions canbe ordered or given a certification time stamp ordering so that the net effect on the database isequivalent to the execution of these transactions in a serialized order one at a time. The generalapproach for scheduling transactions in soft RTDBS is to use existing techniques in CPUscheduling, buffer management, I/O scheduling, and concurrency control, and by applying time criticalscheduling methods to observe the timing requirements of transactions. A lot of researchhas been conducted in this regard (Agrawal et al, 1992; Son et al, 1995, Abbott and Garcia-Molina, 1989 & 1992; Lin and Son, 1990, Huang et al, 1992 and Idoudi et al, 2009), which have developed and analyzed many paradigms that ensure timing constraints while schedulingtransactions.

In this paper CC protocols are for time criticaltransaction (e.g. with deadline) and specialized CCP for RTDBS. Conventional CCPsincludes: Pessimistic Concurrency Control (modification of 2PL being used in conventionalDBMS) (PCC), Optimistic Concurrency Control (OCC), Timestamp Ordering (TO) andMultiversion

Concurrency Control (MCC). Whereas the specialized one's which we going tosurvey here includes: Speculative Concurrency Control, Hybrid Algorithms and Real-TimeIndex Concurrency Control (RICC).

2.1 Pessimistic Concurrency Control (PCC) Protocols

Two Phase locking (2PL) is the most common pessimistic concurrency control protocolin conventional database systems. In 2PL if there is a lock conflict, the requesting transaction isblocked and put into a wait state. Most locking protocols proposed for RTDBS are based on one of the following two approaches: priority abort and priority inheritance. The priority abortapproach aborts low priority transactions when priority inversion occurs (Abbott and Garcia-Molina, 1989). On the other hand, the priority inheritance approach allows a low prioritytransaction to execute at the highest priority of all the higher priority transactions it blocks. Studies have shown better results of priority inheritance than those based of priority abort.

Priority Abort PCC

This algorithm incorporates a conflict resolution scheme that ensures that high prioritytransactions are not delayed by the low priority transactions. In particular when a transaction T(high priority one) requests a lock on an object held by one or more lower priority transactions in a conflicting mode, the lock-holding transactions are restarted and T is granted the lock. If T'spriority is lower than that of any of the lock holders, it awaits for the object to be released (as in standard 2PL). The drawback of this protocol is that transactions may be restarted by higherpriority transactions, which are discarded later and these wasted restarts results in performance degradation.

Priority Inheritance PCC

The priority inheritance resolves the priority problem by considering only the actualConflict transactions (Sha et al, 1987). Whenever a requester blocks behind a lower priority lockholder, the lock holder inherits the priority of the lock requester, until it terminates and releasesthe lock. Because of the increase in priority the lock-holding transaction may finish sooner,resulting in reduced blocking time for the high priority transaction. Since a high prioritytransaction requests a lock on an object by a lower priority transaction in conflicting mode. Thebiggest drawback of this protocol is that the blocking time of high priority transactions isUnpredictable in their duration.

VIII. CONCURRENCYCONTROL IN MULTIMEDIA DATABASE

MMDBMS is that it provides simultaneousaccess to information for many clients via TCP/IP network. The problems thatshould be handled refers to process multiple requests and access the same set ofdata in a concurrentenvironment. The system must include a synchronization algorithm to ensure that the information doesn't get corrupted when multiple clients' requests access concurrentlythe same set of data. However, in most of the cases the information is frequentlyread and only occasionally written. It is far more efficient to allow all reading re-quests to be executed simultaneously and only write requests to be executed in anexclusive manner.

The locking mechanism that was chosen for the system is based on L. Lamport'sbakery algorithm. This algorithm was chosen because it offers a good balance between performances and implementation complexity.There are two types of locks used: shared locks used for reading (e.g.: SELECT)and exclusive locks used for writing (e.g.: INSERT). These types of locks are usedonly at the table level of granularity. There are not defined row-level locks or otherslocks at a higher level of granularity.

If a SELECT command is retrieved (that implies reading from database), aread-lock will be enabled on the tables (files) involved in the operation. This lockwill be active until the tables (files) will no longer be used. It is a non-exclusive lock,meaning that all other reading requests will be permitted, each of them activatingtheir own read-lock.

If an INSERT command or other command that involves writing into databasewill be received meanwhile, it cannot be executed. No writes are permitted whileany read-lock is active. Instead it will be put in a waiting queue for a random periodof time. The write operation can be executed only when no other lock is active. Afterall locks are inactivated for a specific table, the write-lock can be activated. Thistype of lock is an exclusive one. No other request (read or write) can be acceptedwhile this is active.

When an operation activates a lock, it can include one or several tables. If thereis no foreign key defined on the requested table, only one table will be locked. If thetable includes foreign keys, all the connected tables will be locked using the sametype of lock for all of them.

In order to override the critical section when locks are activated or upgraded,it is used the Lamport's bakery synchronization algorithm. This way it is notpossible for two different users to lock accidentally the same resources.When a lock is no longer needed, it will be deactivated directly without usingany synchronization algorithm.

The basic idea for the Lamport's bakery algorithm is quite simple. Each user'srequest receives a serving number when a lock is needed. The holder of the lowestnumber is the next one that gets access to resources.

The implementation of the algorithm is presented in pseudocode:

```
Algorithm 1. The Bakery Algorithm
waiting[i] <- true;
number[i] <-  max(number[0],number[1],
              ...,number[n-1]) + 1;
waiting[i] <-  false;
for j <-  0 ... n-1 do {
     while waiting[j] do nothing;
     while (number[j] != 0) and
           (number[j] < number[i])
                 do nothing;
   }
*ENTER critical section:
       number[i] <- 0;
       * Activate requested lock
```

To implement this algorithm, two lists are used. There is one entry in each listfor every lock request. The first array stores the priority number. The other list contains a Boolean value for each request specifying if that request is in line toreceive a number. Each entry uniquely identifies the requesting client and lockedresources by three values: the user name, the running thread id, and the table namewhere the lock is needed. The thread id is needed to avoid some deadlocks whenan user locks a resource an then suddenly disconnects. The resource's lock will beautomatically released because the thread will no longer exist. Even if the clientconnects again, it will be allocated on a different thread and he will need anotherlock.

When a new lock request arrives and needs to be enabled, first it sets its Booleanvalue to true. Then it is assigned the next number available for waiting its turn.After it receives a number, it's no longer waiting so it sets its waiting value to false.Next, the lock request goes through the first list and if there is a request with alower number, or a request that's waiting for a number, it waits until that requestis finished or assigned a higher number. After the lock manager traverses the list itsearches for the request with the lowest number in order to be served and activatethe lock.After the operation ends, the system automatically calls a "release lock" command. This command will also include information about: user, thread id, and table.

IX. CONCURRENCY CONTROL IN MULTILEVEL SECUREDATABASES (MLS/DB)

Concurrency control is important for MLS/DBs becausea covert channel can be easily created through collaboration of multilevel secure transactions in most traditionalconcurrency control protocols. In a MLS/DB, the concurrency control protocol must ensure that there are nocovert channels between the transactions at different security levels. Traditional concurrency control protocolssuch as 2PL and Timestamp Ordering protocols are not suitable for MLS/DBs, because when those concurrencycontrol mechanisms are applied to multilevel secure trans-actions, problems such as covert channel, too much delayor repeated aborts of high security level transactions, andretrieval anomaly [27] can occur. Consequently, concurrency control algorithms for MLS/DB must address theproblems originated by the security and availability issuesof the MLS/DB. Several protocols have been proposed forconcurrency control in MLS/DBMS. Due to the influx ofthese protocols, we have classified the protocols into fol-lowing five categories:

Secure Locking Protocol

In the locking-based approaches, in order to prevent timing channels, the executions of transactions at lower security level are never delayed by the actions of a transactionat a higher security level. This can be accomplished byproviding a high priority to a low transaction whenever adata conflict occurs between a high transaction and a lowtransaction.

In [35], Keefe, Tsai and Srivastava examined the security issues and present a formal framework for secureconcurrency control in multilevel databases. In this, theyhave characterized several level of assurance in secure system and show how a scheduler can affect the security in this framework.

A secure locking-based protocol called S2PL was proposed by Jajodia and McCollum [32], which modified thestrict two phases locking protocol to covert channel freeprotocol. In this protocol, a high security level transactionmust release its lock on a data item when a low securitylevel transaction requests a write lock on the same dataitem. When a read lock by a high security level transaction is broken, high security level transaction is to beaborted. Since a low security level transaction is neverblocked or restarted by a high security level transaction,this protocol satisfies the secrecy (covert channel free) andintegrity requirement, but a malicious low security leveltransaction may cause a high security level transaction tobe aborted repeatedly, resulting in starvation.

McDermott and Jajodia [37] provide a way to reducethe amount of starvation. According to their approach,whenever a high security level transaction prematurelyreleases its read lock on a low security level data itemdue to security reasons, it does not abort and roll-backentirely, but holds its write locks on high security leveldata items, marks the low security level data item in itsprivate workspace as unread and retries reading this dataitem by entering into a queue. This queue maintains thelist of all high security level

transactions waiting for retrialto read that particular data item and enables the first transaction in the queue to be serviced first. The modifiedapproach, however, does not always produce serializableschedules [33].

Another secure two-phase locking-based protocol(S2PL), is based on a completely different approach wasproposed by Son and David [38]. The basic principlebehind this S2PL is to try to simulate the execution ofconventional 2PL without blocking the actions of low security level transactions by high security level transactions. This is accomplished by providing a new lock typecalled virtual lock, which is used by low security leveltransactions that develop conflicts with high security level transactions. The actions corresponding to setting of virtual locks are implemented on private versions of the dataitem. When the conflicting high security level transactioncommits and releases the data item, the virtual lock of thelow security level transaction is upgraded to a real lockand the operation is performed on the original data item.To complete this scheme, an additional lock type calleddependent virtual lock is required apart from maintaining, for each executing transaction Ti, lists of the activetransactions that precede or follow Ti in the serializationorder.

Another solution that has been proposed is to allowusers to read and write information at multiple classification levels by decomposing the original transaction intomultiple sub-transactions, each of which is assigned a single classification level, and all actions performed by sub transactions obey the Bell-LaPadula properties. However, even in such a scenario, it is impossible to simultaneously guarantee both transaction atomicity and absenceof covert channels [30, 36, 39].

Jajodia et al. [33] proposed two secure locking protocolthat attempts to detect all cycles in the serialization graphby painting certain transactions and data items accessedby the high security level transactions whose low securitylevel locks are broken and by detecting a cycle at the moment. The first protocol produces pair-wise serializable histories while the second protocol produces serializable histories if the security levels form a total order.

E. Bertino et al. [37] presented an approach to secureconcurrency control for transactions in a multilevel secureenvironment. This approach, which uses singleversiondata items, is based on the use of nested transactions,application-level recovery, and notification-based locking protocols. The notification protocol is based on the useof signal locks. A signal lock is acquired by a transactionwhenever it needs to read lower security level data; such alock does not delay a write lock request by a low securitylevel transaction on the same data item. Hence, timingcovert channels arising from synchronization are eliminated. When a data item on which a write lock is acquiredby a transaction is modified, all high security level transactions holding signal locks on that data are notified bythe trusted lock manager, and thus may perform recoveryactions. To better support recovery activity, transactionsare organized according to the nested transaction modelextended with specific primitives for supporting the notification protocol. The proposed approach satisfies most ofthe properties pointed out in Atluri et al. [36], as basic requirements for a secure concurrency control mechanism ina multilevel environment: it avoids starvation and timing channels, and guarantees serializability.

X. CONCURRENCY CONTROLPROTOCOL FOR REPLICATED REAL TIME DATABASES

Even thoughS2PL**(Static Two Phase Locking)** [41] is a deadlock free mechanism but it slows down the concurrent processing of multitransactions. This is due to locking of all the data till the end of the commit phase. Also if a higher transactionarrives at a site than executing one then current transaction is aborted and lock is made available to higher priorityone. This makes the wastage resources. Hence we propose here a new mechanism with augmentation of S2PL.

We will use here a term Healthy Point(HP) with Block(B)/Donot Abort(DA) which means if a cohort reachesits Healthy Point(HP) than it will not be aborted against a higher priority transaction at that site. It means DA isused here. And if a lower priority transaction demands a lock then it will be blocked against a higher priorityexecuting one. It means B is used here.

The proposed mechanism is:

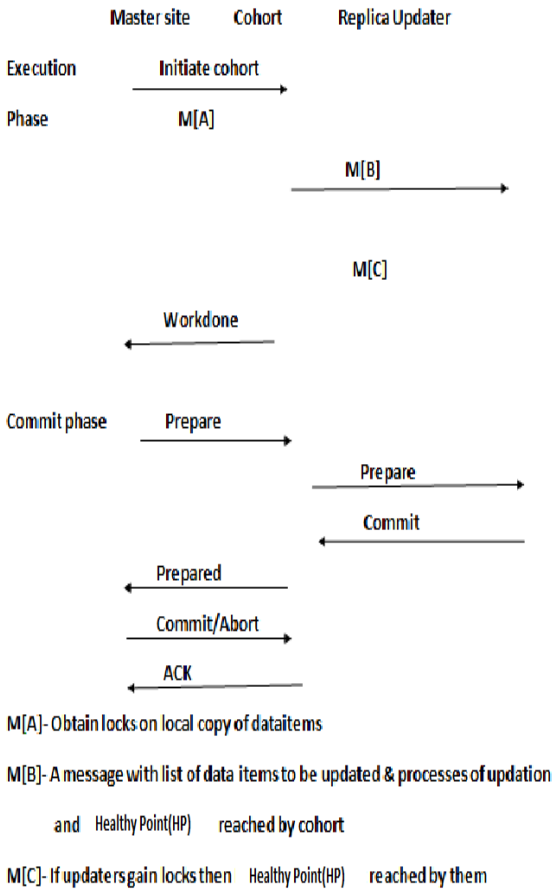
HP of a cohort:
A cohort reaches its HP after sending a PREPARE message to its replica updaters in its execution phase i.e. infirst phase of 2PC.

HP of a replica updater:
A replica updater reaches HP after gaining locks on needed data items.

By this mechanism some significant improvements can be noted in S2PL.Since after HP a cohort has a lessprobability of abortion hence a blocked transaction can borrow data from executing one. It means waiting andexecuting time of blocked transaction will get reduced which is very needed in a firm RTDBMS. Also by sendingPREPARE message to its replica updaters as shown in Figure 3 the waiting time of a cohort between sendingPREPARE message to its updaters and receiving COMMIT message from them will get reduced. Hence over alltime of execution of transaction will get reduced.

Algorithm:
For a cohort:

HP=false;
EXfinish (execution finished) =false;
If (message=INITIATE COHORT) {
Start execution of cohort;
EXfinish=true;
}
If (EXfinish=true) {
Send PREPARE message to its replica updaters;
HP=true;
Send WORKDONE message to its coordinator;
}
For a replica updater:
If (message=PREPARE&&lock obtained=true) {
HP=true;
After execution send COMMIT message to its cohort;
}



Here we present CIRS (Concurrency control In Replicated real-time Systems) a state conscious
Concurrency control protocol in replicated distributed environment which is specially for firm real-timedatabase system. CIRS mechanism uses S2PL (Static Two Phase Locking) for deadlock free environment. It also includes veto power given to a cohort after receiving PREPARE message from its coordinator.

XI. CONCLUSIONS

This paper is an attempt to summarize available literaturepertaining to work in the direction of developing concurrency control protocols for different database systems.In distributed database system that is considered to be more reliable than centralized database system. It is really important for database to have the ACID properties to perform. Indistributed object-oriented databaseOnescheduler module is available, that is a *black box*, it communicates with the other modules throughinterface. In the distributed version of the simulator, two-phase locking and timestamp ordering schedulers are implemented. The scheduler receives an operation from the transaction manager, and processes it according to its scheduling technique. When the scheduler decides that an operation can be sent to the data manager, the data manager is called. When the operation has completed, the scheduler will be notified by a call from the data manager.

In a distributed database, it is common that more than one scheduler participate in executing a transaction. Because of this, a distributed commit protocol has to be used, to make sure that all participating schedulers reach the same result. Either all perform the commit, or all have to abort. Two well-known protocols are two-phase commit (2PC) and three-phase commit [5]. We have employed 2PC, which the protocol is used by most commercially availabledistributed database systems.In Real Time Data Base each transaction is associated with a priority, high priority transaction has earlier deadline. Higher priority transaction obtains the lock first. Lower priority transaction has to sacrifice the lock. If transaction confronts the same priority transaction, then lock is obtained by timestamp ordering.

Concurrency control in Mobile Databases has thesame behaviors with those in multidatabase systems in manyaspects. Many approaches in multidatabase systems can beextended to mobile multidatabase environment. Thedifferences in Mobile Databases are that transactions inMobile Databases have mobility and long-lived nature.

In this paper we present CIRS (Concurrency control In Replicated realtime Systems) a state consciousconcurrency control protocol in replicated distributed environment which is specially for firm realtimedatabase system. CIRS mechanism uses S2PL (Static Two Phase Locking) for deadlock free environment.It also includes veto power given to a cohort after receiving PREPARE message from its coordinator.Also with some more assumptions like sending an extra message in execution phase but after completionof execution at local copy which is described later in this paper the proposed mechanism has a significantincreased performance over O2PL and MIRROR in decreasing execution time of the currenttransaction and it also decreases the waiting time of transactions in wait queue.

In Multi-level secure database systems (MLS/DBSs) areshared by concurrent transactions with different clearancelevels and manage data objects with different classification levels. We proposed andevaluated a new secure multiversion concurrency controlprotocol. It was observed that our protocol has betterresponse than SMVCC. In addition to this, results showthat our protocol achieve fair performance than SMVCCacross different security levels. Here we implemented a new lock that is virtual lock.

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