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   HYPOTHESES

   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

   RECOMMENDATIONS/SUGGESTIONS

   CONCLUSIONS

   SCOPE FOR FURTHER RESEARCH

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CONCURRENCY CONTROL MECHANISM IN DBMS

GEETIKA
ASST. PROFESSOR
DEPARTMENT OF COMPUTER SCIENCE
GOVERNMENT COLLEGE
GURGAON

ABSTRACT

In computer science Concurrency is adopted in all fields like computer programming, operating systems, multiprocessors, and databases so that valuable recourses may be utilized efficiently. But the activities which opt concurrency are full of is challenges. Many problems like dirty read, lost update problem, security, deadlock, livelock are faced here. In this paper I have discussed the why concurrency is required in DBMS and how it can be controlled. Here, the locking technique is taken into account to control concurrency of DBMS. In multi user system ACID is very important. During concurrency it should be taken in to account. We cann't say that locking is perfect technique. It depends upon situation to situation which will be the best. Pessimistic lockings are easy to implement and guarantees that your changes to the database are made consistently and safely. But the drawback is that this approach isn't scalable. Therefore this limits the practical number of simultaneous users that your system can support. Optimistic locking let the user decide what to do. The problem of deadlock may occur here. To avoid this time stamping may be used.

KEYWORDS
Distribution, Optimistic locking, Pessimistic locking, Recoverability.

INTRODUCTION
In information technology and computer science, especially in the fields of computer programming, operating systems, multiprocessors, and databases, concurrency control ensures that correct results for concurrent operations are generated, while getting those results as quickly as possible. Computer systems, both software and hardware, consist of modules, or components. Each component is designed to operate correctly, i.e., to obey to or meet certain consistency rules. When components that operate concurrently interact by messaging or by sharing accessed data (in memory or storage), a certain component's consistency may be violated by another component. The general area of concurrency control provides rules, methods, design methodologies, and theories to maintain the consistency of components operating concurrently while interacting, and thus the consistency and correctness of the whole system. Introducing concurrency control into a system means applying operation constraints which typically result in some performance reduction. Operation consistency and correctness should be achieved with as good as possible efficiency, without reducing performance below reasonable.In this paper I have discussed concurrency issues in DBMS.Concurrency control in database management systems (DBMS) ensures that database transactions are performed concurrently without the concurrency violating the data integrity of a database. Executed transactions should follow the ACID rules. The DBMS must guarantee that only serializable (unless Serializability is intentionally relaxed), recoverable schedules are generated. It also guarantees that no effect of committed transactions is lost, and no effect of aborted (rolled back) transactions remains in the related database.

MAJOR GOALS OF CONCURRENCY CONTROL MECHANISM
Concurrency control mechanisms firstly need to operate correctly, i.e., to maintain each transaction's integrity rules (as related to concurrency; application-specific integrity rule are out of the scope here) while transactions are running concurrently, and thus the integrity of the entire transactional system. Correctness needs to be achieved with as good performance as possible. In addition, increasingly a need exists to operate effectively while transactions are distributed over processes, computers, and computer networks. Other subjects that may affect concurrency control are recovery and replication.

CORRECTNESS
For correctness, a common major goal of most concurrency control mechanisms is generating schedules with the *Serializability* property. Without serializability undesirable phenomena may occur, e.g., money may disappear from accounts, or be generated from nowhere. Serializability of a schedule means equivalence (in the resulting database values) to some *serial* schedule with the same transactions (i.e., in which transactions are sequential with no overlap in time, and thus completely isolated from each other: No concurrent access by any two transactions to the same data is possible). Serializability is considered the highest level of isolation among database transactions, and the major correctness criterion for concurrent transactions. In some cases compromised, relaxed forms of serializability are allowed for better performance or to meet availability requirements in highly distributed systems, but only if application's correctness is not violated by the relaxation Almost all implemented concurrency control mechanisms achieve serializability by providing *Conflict serializablity*, a broad special case of serializability (i.e., it covers, enables most serializable schedules, and does not impose significant additional delay-causing constraints) which can be implemented efficiently.

RECOVERABILITY
Concurrency control typically also ensures the *Recoverability* property of schedules for maintaining correctness in cases of aborted transactions (which can always happen for many reasons). Recoverability (from abort) means that no committed transaction in a schedule has read data written by an aborted transaction. Such data disappear from the database (upon the abort) and are parts of an incorrect database state. Reading such data violates the consistency rule of ACID. Unlike Serializability, Recoverability cannot be compromised, relaxed at any case, since any relaxation results in quick database integrity violation upon aborts. The major methods listed above provide serializability mechanisms. None of them in its general form automatically provides recoverability, and special considerations and mechanism enhancements are needed to support recoverability. A commonly utilized special case of recoverability is *Strictness*, which allows efficient database recovery from failure (but excludes optimistic implementations; e.g., Strict CO (SCO) cannot have an optimistic implementation, but has semi-optimistic ones).

DISTRIBUTION
With the fast technological development of computing the difference between local and distributed computing over low latency networks or buses is blurring. Thus the quite effective utilization of local techniques in such distributed environments is common, e.g., in computer clusters and multi-core processors. However the local techniques have their limitations and use multi-processes (or threads) supported by multi-processors (or multi-cores) to scale. This often turns transactions into distributed ones, if they themselves need to span multi-processes. In these cases most local concurrency control techniques do not scale well.

LOCKING

To provide concurrency control and prevent uncontrolled data access, the database manager places locks on buffer pools, tables, table blocks, or table rows. A *lock* associates a database manager resource with an application, called the *lock owner*, to control how other applications access the same resource.Main locking techniques are:

PESSIMISTIC LOCKING

Pessimistic locking is an approach where an entity is locked in the database for the entire time that it is in application memory (often in the form of an object). A lock either limits or prevents other users from working with the entity in the database. A write lock indicates that the holder of the lock intends to update the entity and disallows anyone from reading, updating, or deleting the entity. A read lock indicates that the holder of the lock does not want the entity to change while the hold the lock, allowing others to read the entity but not update or delete it. The scope of a lock might be the entire database, a table, a collection of rows, or a single row. These types of locks are called database locks, table locks, page locks, and row locks respectively. The advantages of pessimistic locking are that it is easy to implement and guarantees that your changes to the database are made consistently and safely. The primary disadvantage is that this approach isn't scalable. When a system has many users, or when the transactions involve a greater number of entities, or when transactions are long lived, then the chance of having to wait for a lock to be released increases. Therefore this limits the practical number of simultaneous users that your system can support.

OPTIMISTIC LOCKING

With multi-user systems it is quite common to be in a situation where collisions are infrequent. Although the two persons are working with customer objects, one is working with the A object while other is working with the B object and therefore they won't collide. But when both work on same object the situation changes, there may be collision. When this is the case optimistic locking becomes a viable concurrency control strategy. The idea is that you accept the fact that collisions occur infrequently, and instead of trying to prevent them you simply choose to detect them and then resolve the collision when it does occur.
There are two basic strategies for determining if a collision has occurred:

1. Mark the source with a unique identifier. The source data row is marked with a unique value each time it is updated. At the point of update, the mark is checked, and if there is a different value than what you originally read in, then you know that there has been an update to the source. There are different types of concurrency marks:
   - Datetime stamps (the database server should assign this value because you can't count on the time clocks of all machines to be in sync).
   - Incremental counters.
   - User IDs (this only works if everyone has a unique ID and you're logged into only one machine and the applications ensure that only one copy of an object exists in memory).
   - Values generated by a globally unique surrogate key generator.
2. Retain a copy of the original. The source data is retrieved at the point of updating and compared with the values that were originally retrieved. If the values have changed, then a collision has occurred. This strategy may be your only option if you are unable to add sufficient columns to your database schema to maintain the concurrency marks.

We have five basic strategies that you can apply to resolve collisions: Give up., Display the problem and let the user decide, Merge the changes, Log the problem so someone can decide later, ignore the collision and overwrite.

OVERLY OPTIMISTIC LOCKING

With the strategy we neither try to avoid nor detect collisions, assuming that they will never occur. This strategy is appropriate for single user systems, systems where the system of record is guaranteed to be accessed by only one user or system process at a time, or read-only tables. These situations do occur. It is important to recognize that this strategy is completely inappropriate for multi-user systems.

- Semi-optimistic - Block operations in some situations, if they may cause violation of some rules, and do not block in other situations while delaying rules checking (if needed) to transaction's end, as done with optimistic.

Different categories provide different performance, i.e., different average transaction completion rates (*throughput*), depending on transaction types mix, computing level of parallelism, and other factors. If selection and knowledge about trade-offs are available, then category and method should be chosen to provide the highest performance.
The mutual blocking between two transactions (where each one blocks the other) or more results in a deadlock, where the transactions involved are stalled and cannot reach completion. Most non-optimistic mechanisms (with blocking) are prone to deadlocks which are resolved by an intentional abort of a stalled transaction (which releases the other transactions in that deadlock), and its immediate restart and re-execution. The likelihood of a deadlock is typically low.Both blocking, deadlocks, and aborts result in performance reduction, and hence the trade-offs between the categories.

CONCLUSION

The locking mechanism is not perfect as when dealing with locks two problems can arise, the first of which being deadlock (where two or more processes are each waiting for another to release a resource, or more than two processes are waiting for resources in a circular chain. Deadlock is a common problem in multiprocessing where many processes share a specific type of mutually exclusive resource)and another is livelock(A livelock is similar to a deadlock, except that the states of the processes involved constantly change with regard to one another wile never progressing.). So to avoid this time stamping can be used.

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