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To Study the Concurrency Mechanism and its control in DBMS

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ABSTRACT: A transaction is the group of tasks. A single task of program is the minimum processing unit. Transaction is the execution of a program or task that retrieves or modify into the contents of a database. A chronological step of execution sequence of a transaction called a schedule. A schedule can have one or more transactions in it, each compressed of a number of instructions or tasks. In transaction, the most important element for the proper functioning of a system where two or multiple database transactions that require access to the same data, are executed parallel. Concurrency control or parallel is the ability of a database to allow one or more multiple users without affecting parallel transactions at a time. Concurrency control used to address such conflicts, which mostly occur with a many user system.Concurrency control can be managing the simultaneous or parallel execution of transactions in a shared database thus ensuring the serialization of transactions. In multiprogramming environment where multiple transactions can execute parallel, it is highly important to control the concurrency of transaction s. This paper gives details to manage the transaction we have concurrency control mechanism and protocols to ensure ACID Properties, and serializable of concurrent transactions. This helps to make sure that database transactions performed concurrently without violating or conflicting the data integrity of respective databases.

KEYWORDS: ACID Properties, scheduled, conflict, concurrency control protocol, concurrency control mechanism.

I. INTRODUCTION

The multiple user system we know that multiple transactions run in parallel or concurrently, so trying to access the same data and if one transaction already has the access to the same data item and now another transaction tries to modify the data. There are problems with the concurrent or parallel execution of transactions such as conflicting operation where in simultaneously both transactions may be try to access the same data item, which leads to the problems in database.

Therefore, the possible solution to this to control the concurrency execution. Control on transactions achieved by a mechanism called concurrency control mechanism

II. LITERATURE SURVEY

A set of logically related operations known as transaction. Ant transaction may have a mix of reading and write operations and hence the concurrency is a challenge. A transaction is the execution of a task those accesses or changes the contents of a database. It is a logical unit of work (LUW) on the database that either completed in its entirety (COMMIT) or not done at all. In the latter case, the transaction has to clean its own mess or transactions know as ROLLBACK or recovery. A transaction may be an entire program, a portion of a program or it can be a single command. The main operations of a transaction are

1. **Read-** operations Read (A) or R (A) reads the value of a form the database and stores it in a buffer in main memory.
2. **Write-** operation Write (A) or W (A) writes the value back to the database
3. **Commit-** all instructions of a transaction are successfully executed the changes made by transaction are made permanent and stored into the database.
4. **Rollback-** If a transaction is not able to execute all operations successfully; all the changes or modifications made by transaction are undone.

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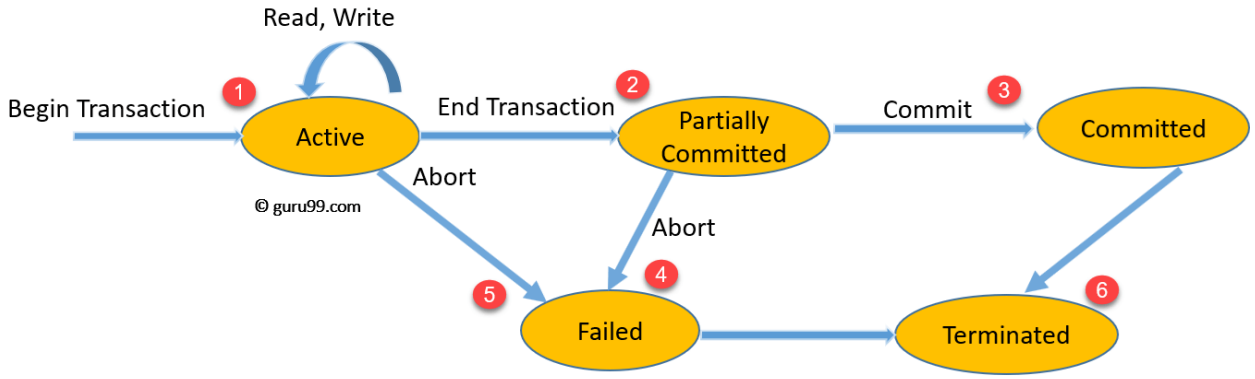
III. SYSTEM DESIGN

Transaction state or Properties of transaction

The concept of an atomic transaction and concepts related to transaction processing in database systems are atomicity, consistency, isolation and durability called as ACID properties that are considered desirable in good transactions are presented which one maintain or to ensure accuracy, completeness, and data integrity.



Atomicity- As a transaction is set of logically related operations, so the operations either all of them should be executed or none at all.

Consistency- If the operations of debit and credit transactions on same account executed concurrently, it may be leave database in an inconsistent state.

Isolation- Result of a transaction should not be visible to others before transaction when it is committed.

Durable- Once database has committed a transaction; the changes made by the transaction should be permanent

Concurrency control-Concurrency control mechanism can simply defined as the process of managing the concurrent execution of transactions in a shared database thus ensuring the serialization of transactions. Concurrency controls aims towards isolation that means transactions do not interfere with each other to preserve the database consistency and to resolve the conflicting operations such as read-write and write-write conflict operation.

Schedule-It is a process of one by one the transactions and executing them serially. There is multiple transaction in concurrent manner and the order of operation needed to be set so that the operations do not interleaved each other. Scheduling is always orderly and the transactions timed accordingly. There are type of Scheduling where the operations of multiple transactions are interleaved. This sort of schedule Serializable and Non-Serializable Schedule.

Serial Schedule-When one transaction completely executes before starting another transaction the schedule called serial schedule. A serial schedule is always consistent. E.g. If a schedule S has follows transaction T1 and follow transaction T2, possible serial schedules are T1 followed by T2 (T1->T2) or T2 followed by T1 (T1->T2). A serial schedule has low throughput and less resource utilization. A schedule is a series of operations from one or more transactions execute serially.

Non-Serial Schedule- In this type of Scheduling the operations of multiple transactions are interleaved. The transactions executed in a non-serial manner Keeping the result correct and same as the serial schedule. Unlike the serial schedule

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Non-serial schedule

T1	T2
Read(A)	
Write(A)	
	Read(A)
	Write(A)
Read(B)	
Write(B)	
	Read(B)
	Write(B)

Schedule S1

Serial Schedule

T1	T2
Read(A)	
Write(A)	
Read(B)	
Write(B)	
	Read(A)
	Write(A)
	Read(B)
	Write(B)

Schedule S2

Concurrent Schedule- When operations of a transaction are interleaved operations without conflicting or conflicting with each another. Schedule of S1 transaction shown in figure is concurrent or Non-serial schedule in nature. However, concurrency can lead to inconsistency in the database due to interleaved operation of read and write so the above example of a concurrent schedule is inconsistent. Therefore, concurrency control is a most important mechanism for the proper functioning of a system where two or multiple database transactions that require retrieve to the same data executed simultaneously.

Serializable-This is used to maintain the consistency of the database. It used in the Non-Serial scheduling to verify whether the scheduling will lead to any inconsistency or not. On the other hand, a serial schedule does not need the serializability because it follows a transaction only when the previous transaction is complete. The non-serial schedule to be in a serializable schedule only when it is equivalent to the serial schedules for a number of transactions. A serializable schedule helps in improving both resource utilization and CPU throughput.

Non-Serializable: The non-serializable schedule divided into two types, Recoverable and Non-recoverable Schedule. The concept of schedules of executing transactions and characterizing the recoverability of schedules is introduce with a detailed discussion of the concept of serializable of concurrent transaction executions, which can be used to define correct execution sequences of concurrent transactions. We will also focus on recovery from transaction fail.

IV. EXISTING SYSTEM APPROACH

Recoverable Schedule: Schedules in which transactions commit only after all transactions whose changes they read commit called recoverable schedules. If some transaction T_1 is reading value updated or written by some other transaction T_2, then the commit of T_1 must occur after the commit of T_2.

Cascading Schedule: When there is a failure in one transaction and this leads to the rolling back or aborting other dependent transactions, then such scheduling is referred to as Cascading rollback or cascading abort.

Cascadeless Schedule: Schedules in which transactions read values only after all transactions whose changes they are going to read commit called cascade less schedules. This Avoids a single transaction abort leads to a series of transaction rollbacks. A strategy to prevent cascading aborts not allows a transaction from reading uncommitted changes from another transaction in the same schedule. In other case, if some transaction T_1 wants to read value updated or written by some other transaction T_1, then the commit of T1 must read it after the commit of T_1.

Concurrency Control Protocols: In a multiprogramming where multiple transactions can execute parallel, it is highly important to control the concurrency of transactions. We have concurrency control mechanism to ensure atomicity, isolation, and serializable of concurrent transactions. Different concurrency control mechanism offer different benefits between the amount of concurrency they allow and the amount of overheads.

1. Lock-Based Protocols
2. Two Phase
3. Timestamp-Based Protocols

Lock-based Protocols: Database systems apply lock-based protocols use a mechanism that any transaction cannot read or write data until it acquires an appropriate lock on it. A lock is a data variable, which is associated with a data item. This lock signifies that operations that can be performed on the data item. Locks help synchronize to the database items by concurrent transactions. Locks are of two kinds

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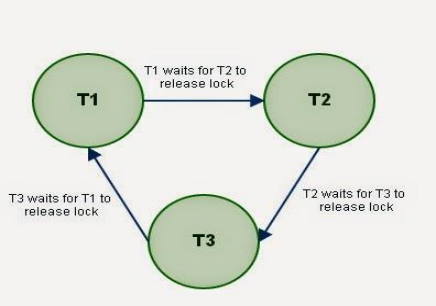
1. Shared Lock (S)-A shared lock also called a Read-only lock. Data item can be read or shared transactions. This is because will never have permission to change data on the data item its read only that is why it is called shared Lock.
2. Exclusive Lock (X)-the Exclusive Lock, a data item can read as well as written. This is exclusive not be held concurrently on the same data item. X-lock is requested using lock-x instruction. Transactions may unlock the data item after finishing the 'write' operation.

V. PROPOSED SYSTEM APPROACH

Starvation-It is the situation when a transaction needs to wait for a period to acquire a lock. The reasons for Starvation are as follows

1. When waiting time scheme for locked data items is not properly managed
2. In the case of resource are not available or leak
3. The same transaction selected as a victim again or repeatedly.

Deadlock refers to a specific situation where two or more transactions are waiting for each other to release a resource or more than two transactions are waiting for the resource in a circular chain.



Two Phase Locking (2PL) Protocol-Two-Phase locking protocol also known as a 2PL protocol or 2PL. In this type of locking protocol. This, locking protocol divides the execution phase of a transaction into three different Phase.

1. In the 1st phase when the transaction begins to execute, it requires permission for the resources locks it needs.
2. The 2nd phase is the transaction obtains all the resources locks. When a transaction releases its first lock then the third phase starts.
3. In this 3rd phase, the transaction cannot demand any new locks. Instead, it only releases the acquired locks.

The Two-Phase Locking protocol allows each transaction to make a lock or unlock request in two steps:

1. **Growing Phase**: In this phase, transaction may obtain locks but release any locks of resources.
2. **Shrinking Phase**: In this phase, a transaction only releases locks but not get or obtain any new lock for the resources. Thus, it is true that the 2PL

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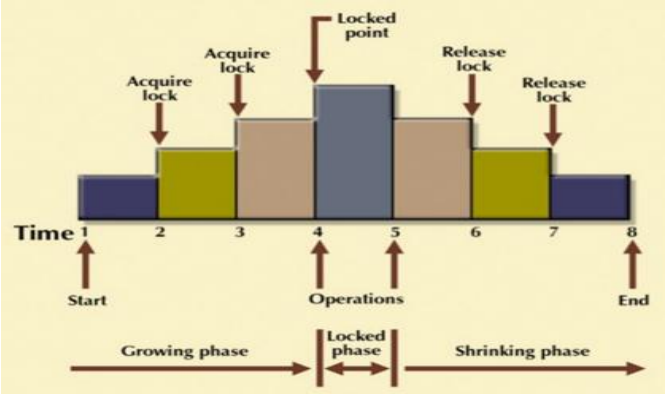

However, it does not gives ensure about that deadlock will happened or not.

The given figure, local and global deadlock detectors searching for deadlocks and solve them with resuming transactions to their initial states.

VI. METHODOLOGY USED

1. Timestamp Ordering Protocol: The most commonly used concurrency protocol is the timestamp-based protocol. This protocol uses system time or logical counter as a timestamp. Lock-based protocols manage the order between the conflicting pairs among transactions at the time of execution, whereas timestamp based protocols start working when a transaction is start or initiated. Every transaction has a timestamp associated with it, and the ordering is determined by the age of the transaction. In addition, when every data item is gives latest read and write-timestamp. The timestamp-ordering protocol ensures serializability. The responsibility of the timestamp system that the conflicting pair of tasks executed according to the timestamp values of the transactions.

1. The timestamp of transaction T_1 denoted as TS (T_1).
2. Read time-stamp of data-item X denoted by R-timestamp(X).
3. Write time-stamp of data-item X denoted by W-timestamp(X).

Timestamp ordering protocol works as follows −

1. **If a transaction T1 issues a read(X) operation** −
   1.1. If TS (T1) < W-timestamp(X) then Operation rejected.
   1.2. If TS (T1) >= W-timestamp(X) then Operation executed.

2. **If a transaction Ti1issues a write(X) operation** −
   2.1. If TS (T1) < R-timestamp(X) then Operation rejected.
   2.2. If TS (T1) < W-timestamp(X) Then Operation rejected and T1 rolled back.
   2.3. Otherwise, the operation executed.

2. Thomas' Write Rule: This rule states if TS (T1) < W-timestamp(X), then the operation is rejected and T_1 is rolled back. Time-stamp ordering rules can modified to make the schedule view serializable. Instead of making T_1 rolled back, the 'write' operation itself ignored. The timestamp-based algorithm uses a timestamp to serialize the execution of concurrent transactions. This protocol ensures that every conflicting read and writes operations executed in timestamp order.

3. The protocol uses the **System Time or Logical Count as** a Timestamp. The older transaction always given priority in this method. It uses system time to determine the time stamp of the transaction. This is the most commonly used concurrency protocol mechanism.

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VII. CONCLUSION

1. Concurrency control is the procedure in DBMS for managing concurrent operations without conflicting with each another.
2. Lock-Based, Two-Phase, Timestamp-Based are types of Concurrency mechanism protocols
3. The lock could be Shared (S) or Exclusive (X)
4. Two-Phase locking protocol, which also known as a 2PL protocol has 2 phases growing and shrinking.
5. The timestamp-based algorithm uses a timestamp to serialize the execution of concurrent transactions. The protocol uses the System Time or Logical Count as a Timestamp.

FUTURE WORK

1. Future research will be extended for enforce some constraints on the data item of atomic actions of transactions.
2. Its storage mechanisms and computational methods should be modest to minimize overhead

ACKNOWLEDGMENT

This Paper allows studying the parallel execution of transactions to achieve high concurrency

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