05-mvcc1

- Compare-and-Swap
  - Atomic instruction that compares contents of a memory location M to a given value V . If the values are equal, installs new given value V'in M. Otherwise, operation fails.
  - Can be done with an ***intrinsic*** function call; a function that a compiler knows to convert to an instruc- tion without having to write the machine code.
- Isolation Levels
  - Serializability is useful because it allows programmers to ignore concurrency issues but enforcing it may allow too little parallelism and limit performance.
  - We may want to use a weaker level of consistency to improve scalability.
  - Isolation levels control the extent that a transaction is exposed to the actions of other concurrent transactions.
  - Anomalies
    - Dirty Read
      - Reading uncommitted data
    - Unrepeatable Reads
      - Redoing a read results in a different result.
    - Phantom Reads
      - Insertion or deletions result in different results for the same range scan queries.
  - Isolation levels (strongest to weakest)
    - 1. SERIALIZABLE
      - No Phantoms, all reads repeatable, and no dirty reads.
    - 2. REPEATABLE READS
      - Phantoms may happen
    - 3. READ-COMMITTED
      - Phantoms and unrepeatable reads may happen
    - 4. READ-UNCOMMITTED
      - All anomalies may happen
    - The isolation levels defined as part of SQL-92 standard only focused on anomalies that can occur in a 2PL-based DBMS
      - H. Berenson, P. Bernstein, J. Gray, M. Jim, E. O'Neil, and P. O'Neil. A critique of ansi sql isolation lev- els. In SIGMOD '95 Proceedings of the 1995 ACM SIGMOD international conference on Management of data, pages 1-10. URL https://dl.acm.org/citation.cfm?id=223785.
    - REAL-WORLD ISOLATION LEVELS
      - **Cursor stability:**
        locks any row being accessed during a transaction while the cursor is positioned on that row
        Snapshot isolation:
        In databases, and transaction processing (transaction management), snapshot isolation is a guarantee that all reads made in a transaction will see a consistent snapshot of the database (in practice it reads the last committed valu
      - CURSOR STABILITY (CS)
        - The DBMS's internal cursor maintains a lock on a item in the database until it moves on to the next item.
        - CS is a stronger isolation level in between ***REPEATABLE READS*** and ***READ COMMITTED*** that can (sometimes) prevent the ***Lost Update Anomaly***.
        - Lost Update Anomaly
      - SNAPSHOT ISOLATION (SI)
        - Guarantees that all reads made in a txn see a consistent snapshot of the database that existed at the time the txn started.
          - A txn will commit under SI only if its writes do not conflict with any concurrent updates made since that snapshot
        - SI is susceptible to the ***Write Skew Anomaly***
          - Txn1 Txn2 Txn3 Txn4 Txn5 Txn6 Txn7 Txn8 Txn9 Txn10 Txn11 Txn12 Txn13 Txn14 Txn15 Txn16 Txn17 Txn18 Txn19 Txn20 Txn21 Txn22 Txn23 Txn24 Txn25 Txn26 Txn27 Txn28 Txn29 Txn30 Txn31 Txn32 Txn33 Txn34 Txn35 Txn36 Txn37 Txn38 Txn39 Txn40