20. Spanner & new SQL database

google spanner

- How to shard(P8)
- Problems faced by large-scale company(P10)
  - Question: is a replication factor of 2 ok(P11)
- **Replication within a DC is insufficient（P13）**
  - Spanner further replicates the data across datacenters(P14)
- Big picture of Spanner(P18)
  - **Solution: Paxos for single-copy consistency（P16）**
  - **2-phase commit + 2-phase locking（P17）**
- **Execution flow of read-write transaction(TX)（P19-30）**
- **Read-write TX: put it together**
  - **Spanner’s read-write TX gives a strong abstraction to the user（P31）**
  - **what are the costs?性能（P32）**
- **Snapshot is not suitable for Spanner: non-serializable（P37）**
- **Idea: use 2PL for read-write TX, MVCC for read-only TX（P38）**
  - **MV-2PL: read-write TX (w/o 2PC & Paxos for simplicity)（P39）**
  - **MV-2PL: read-only TX（P40）**
  - **Challenge: missing the update（P41）**
- **Achieves the atomicity w/ waiting for the lock（P42）**
  - **Example revisit（P44）**
  - **Question remains: how do we assign the time to TXs?（P45）**

google spanner’s TimeStamp

- **Global time is inefficient for Spanner’s use case(P47)**
- **Cache the time locally to avoid querying the global counter(P48)**
  - **Cache global counter to avoid frequently reads(P49)**
  - **Drawbacks of cached time(P51-52)**
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- **Time Measuring(P55)**
- **Challenge: clock synchronization(P56)**
  - **Sync clock with NTP(P57)**
  - **Sync clock with NTP: Estimating Network Latency(P58-59)**
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- **Power of TrueTime API (return [L,U])(P62-63)**
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SQL

- **OldSQL = Relational Model + SQL + ACID(P78)**
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  - Specific (Simplified from SQL) Data Model(P86)
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