

Question:

Imagine Spanner allowed a read-write transaction to skip the commit-wait step. Construct a scenario involving two transactions, T1 and T2 where skipping the commit-wait would break external consistency, and explain how TrueTime's uncertainty bound ϵ interacts with this failure. **[2 marks]**

Answer:

If T1 commits at timestamp s_1 without waiting for $TT.after(s_1)$ to be true, T2, starting shortly after T1's commit, could incur a scenario where T2's start time overlap with T1's commit time in absolute terms due to ϵ . The overlap is possible since s_2 can lie within $s_1 + \epsilon$ in real time ordering. This overlap could lead to an apparent reversal of real-time order, where T2 seems to start before T1 committed. This breaks external consistency, which requires T2 to observe T1's effects only if T1's commit is guaranteed to have occurred before T2 started. The commit-wait ensures that T1's commit is fully in the past, resolving this conflict and preserving the serialization order aligned with real time.