Transaction Processing is easy if you're God

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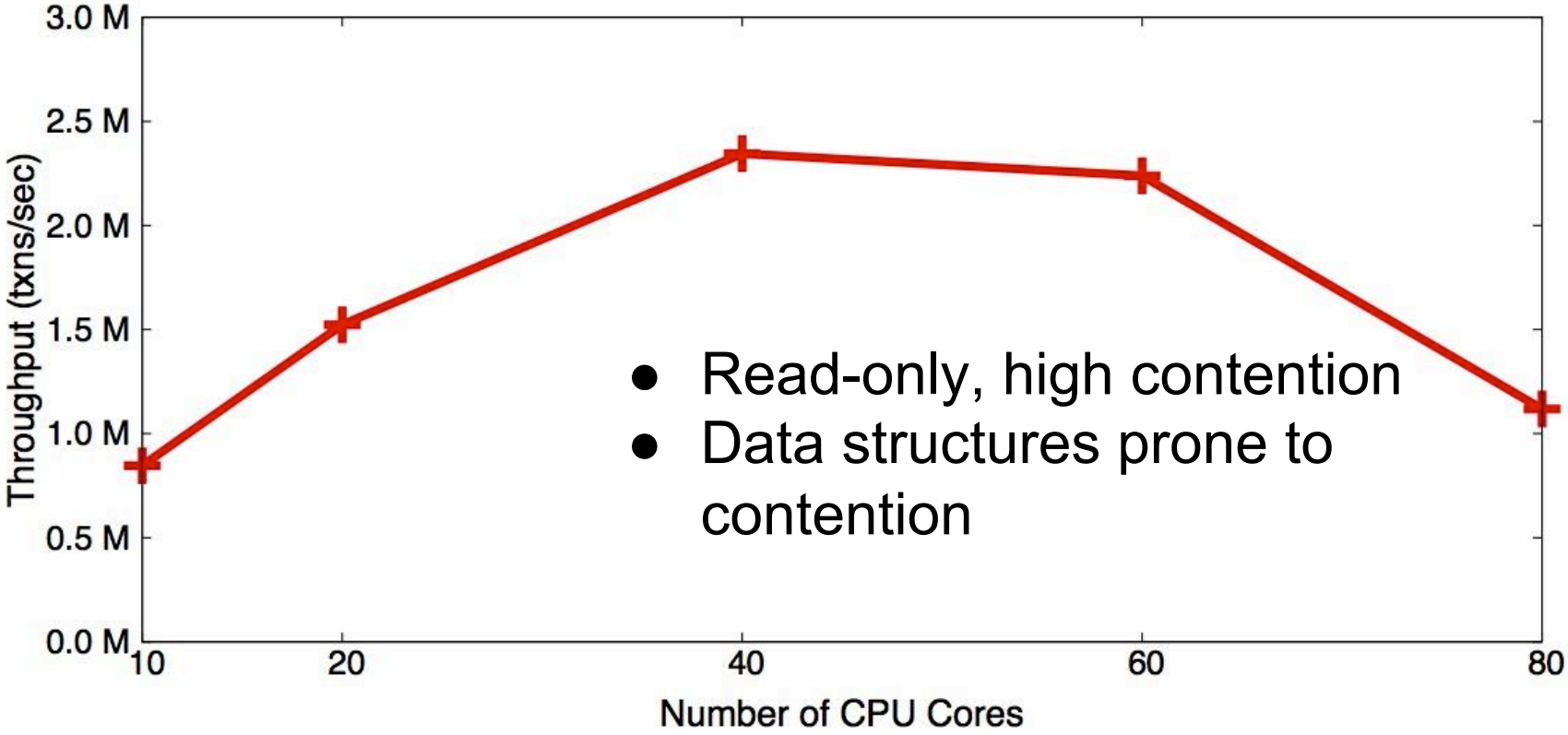
The Problem: Concurrency Control

- Don’t expect linear scalability under contention
  - Real conflicts among txns
  - Limited concurrency among conflicting txns

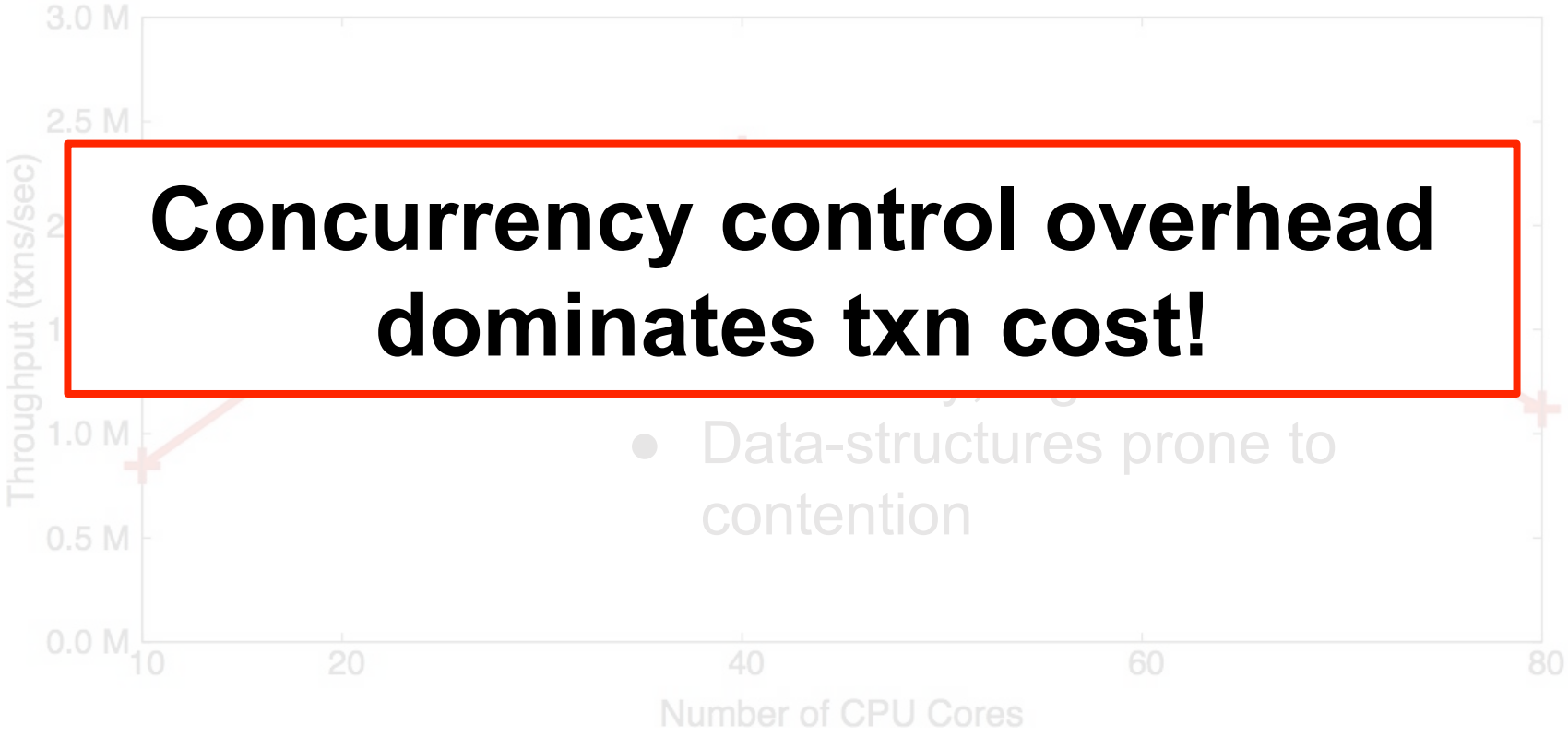
- But concurrency control exacerbates the problem
  - Data-structures prone to contention; e.g. latches, lock lists
  - Scheduling overhead

The Problem: Concurrency Control



- Read-only, high contention
- Data structures prone to contention

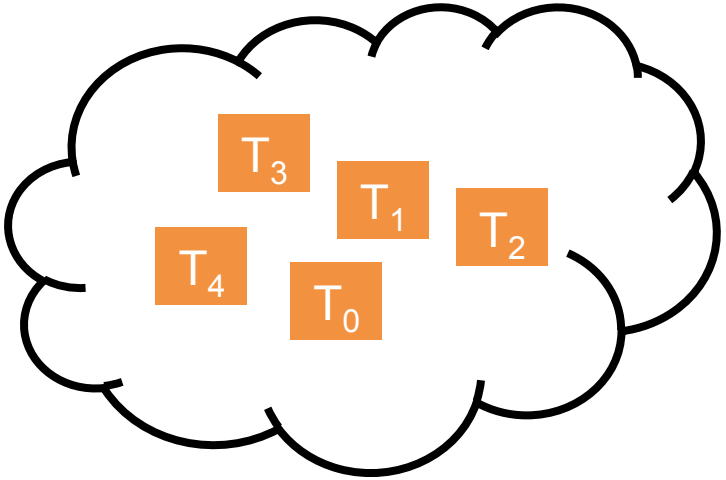
The Problem: Concurrency Control



Concurrency control overhead dominates txn cost!

- Data-structures prone to contention

What would God do?



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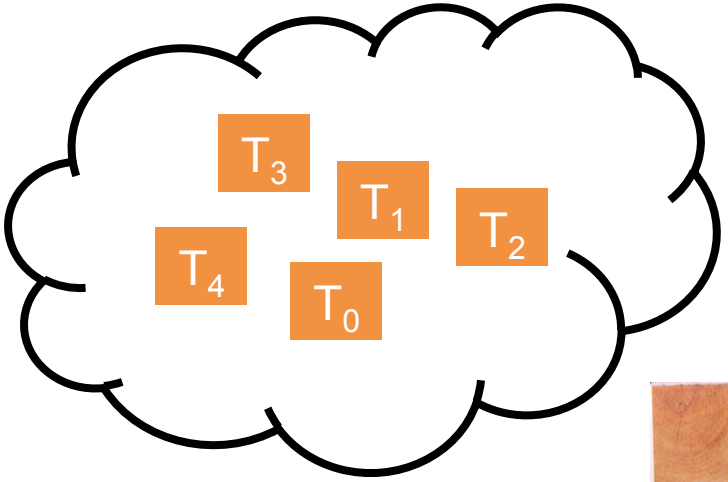
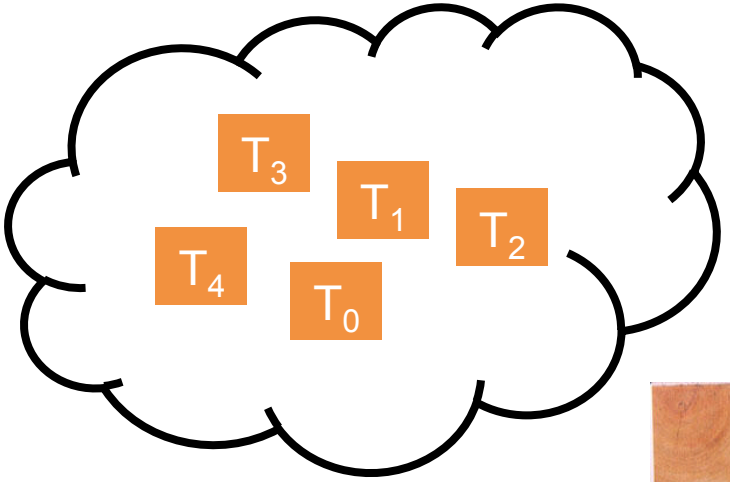
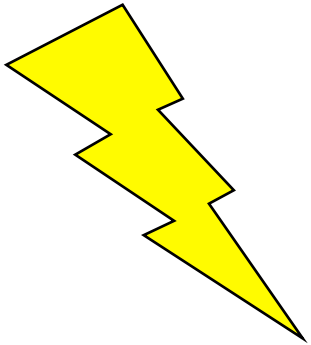
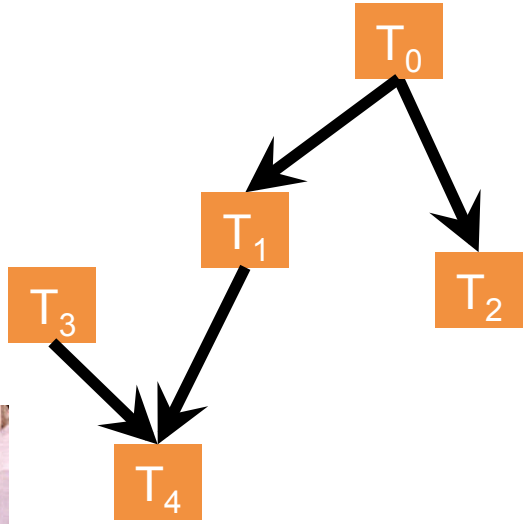


Let there be (a serializable) order!

What would God do?







Let there be
(a serializable)
order!

God's Concurrency Control Algorithm

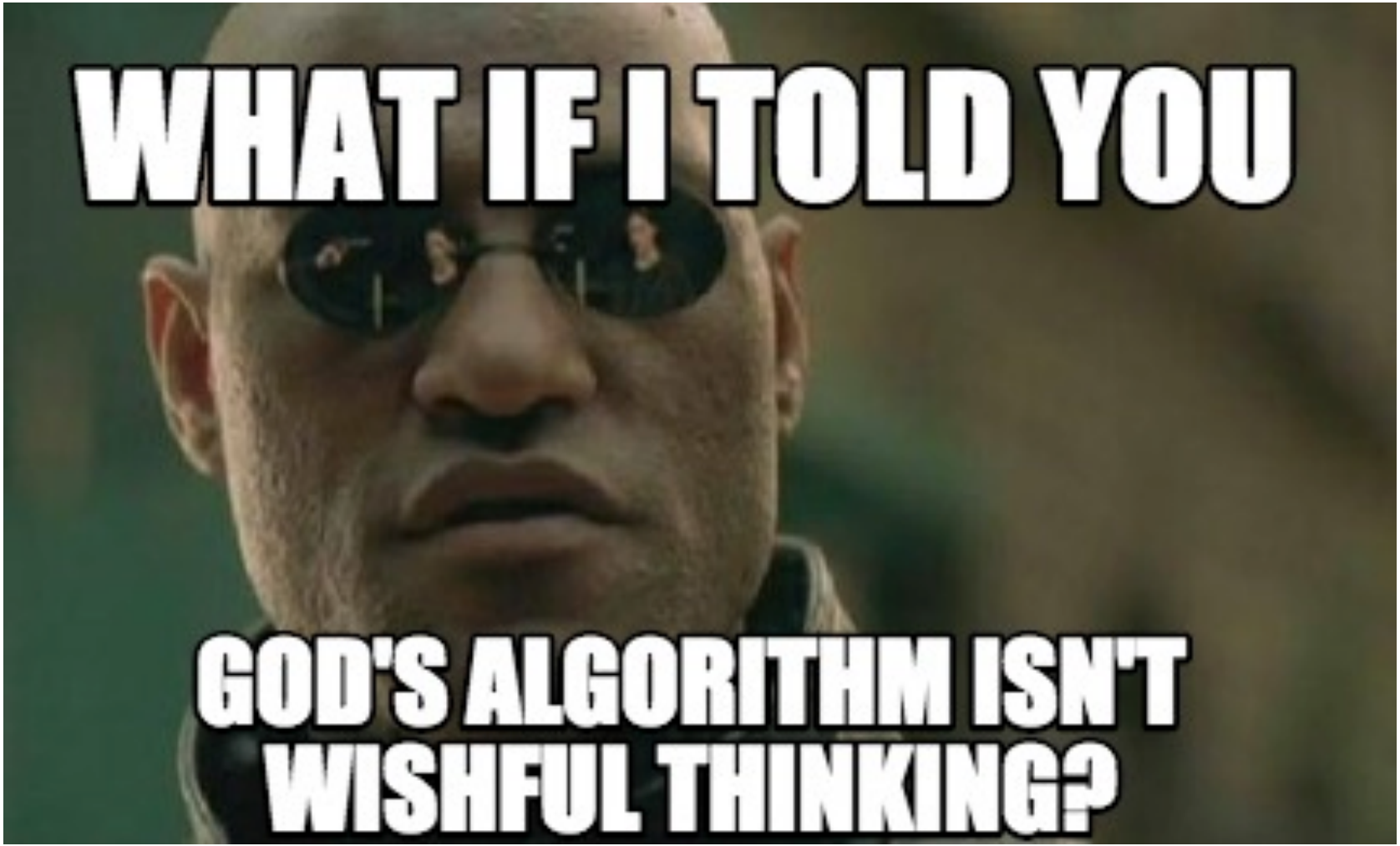
- Use omniscience to pull serializable order from thin air
- DB executes txns based on serializable order

God's Concurrency Control Algorithm

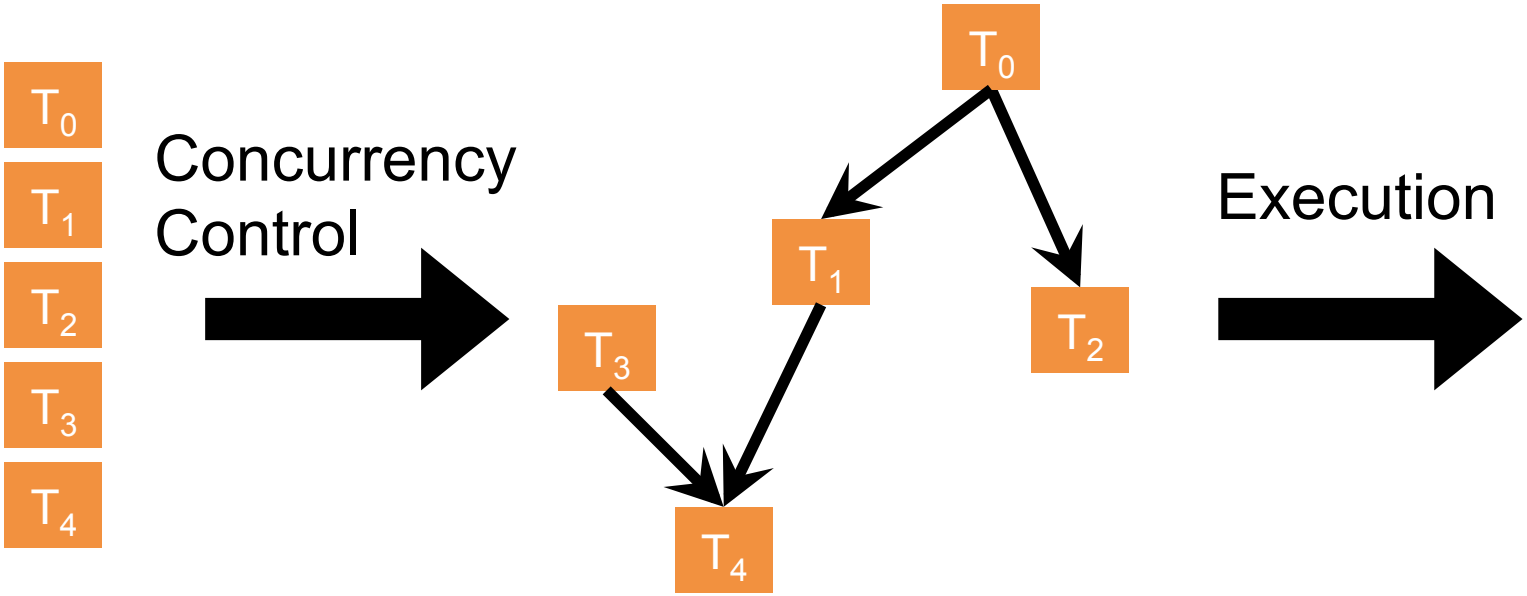
Serializable (*not* serial!) order given up front

vs

Obtain serializable order at execution time

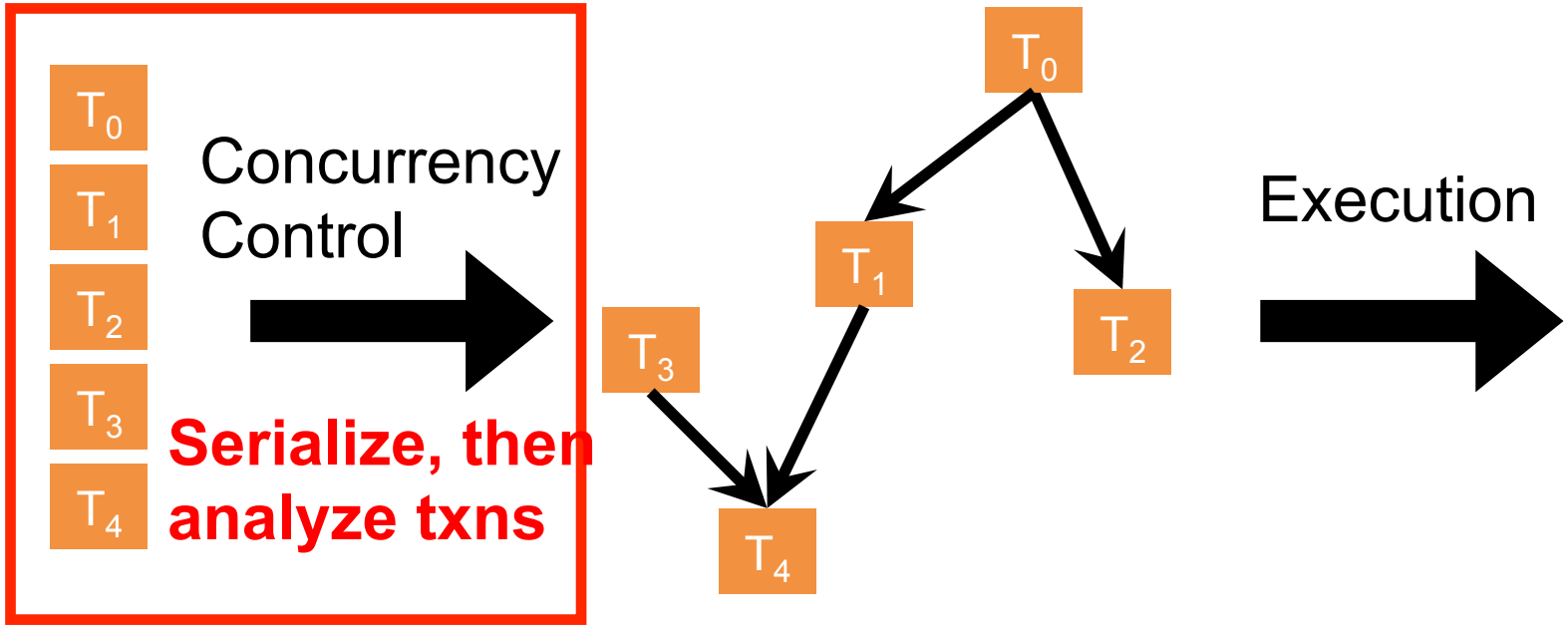

WHAT IF I TOLD YOU
GOD'S ALGORITHM ISN'T WISHFUL THINKING?

Example: Bohm



[Faleiro and Abadi, VLDB'15]

Example: Bohm



[Faleiro and Abadi, VLDB'15]

Divine Design

- Determine serializable order prior to execution
  - No concurrency control overhead during execution
- Minimal scheduling overhead
  - Efficiency of optimism/speculation
  - Contention resilience of pessimism
- Tradeoffs
  - Latency for throughput
  - Benefits applicable to workloads amenable to analysis