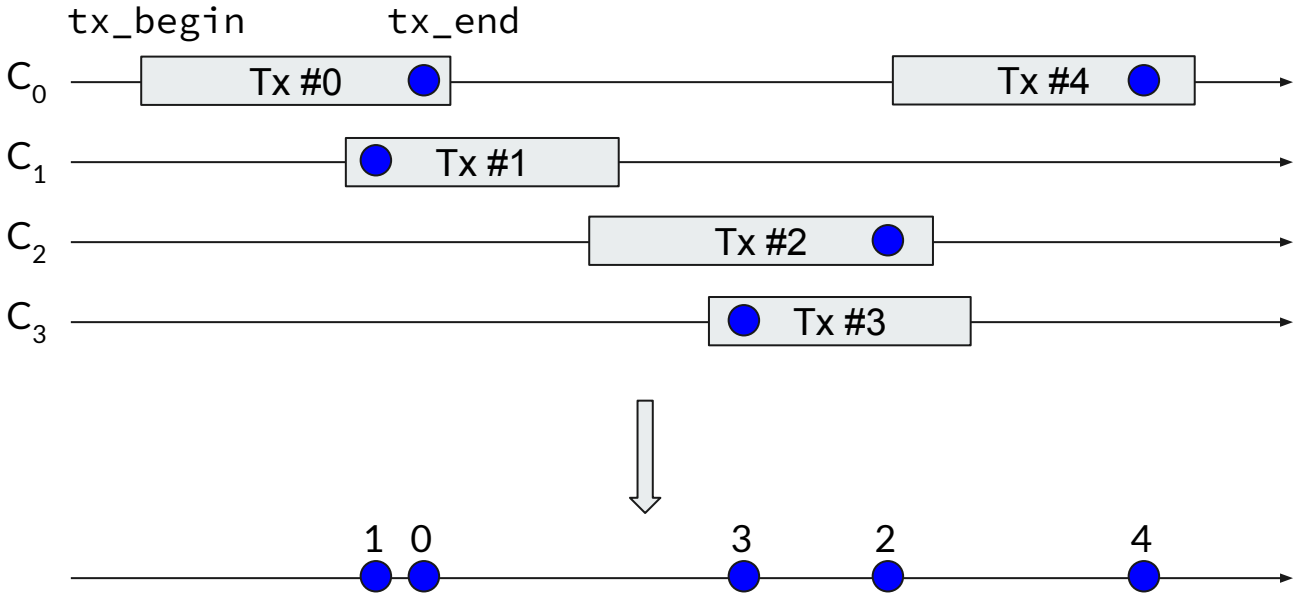
CS-453 - Project
STM Implementations

Distributed Computing Laboratory

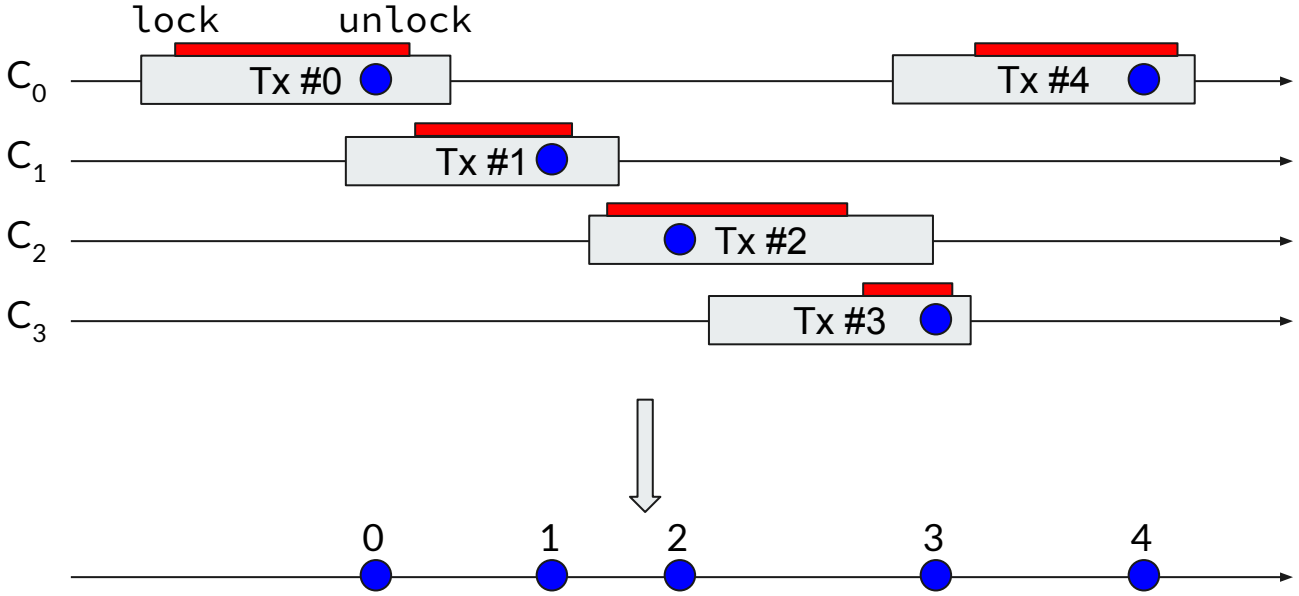
September 16, 2025

STM: Serializing transactions



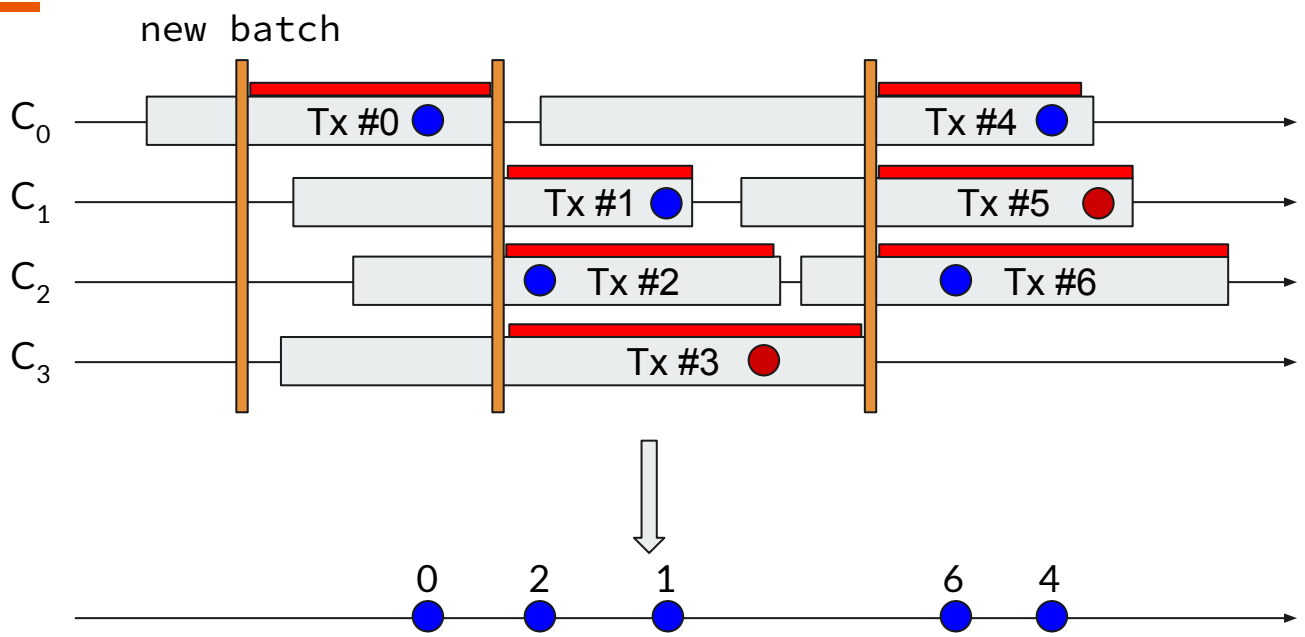
- The execution on multiple cores is equivalent to a *serial* execution on a single core.
- The (atomic) execution points are between the start and the end of each transaction: *strict serialization*.

STM: With a coarse-grained lock



- Works, but only one transaction executes at a time.
- Transactions never fail.

STM: Batch & detect conflicts

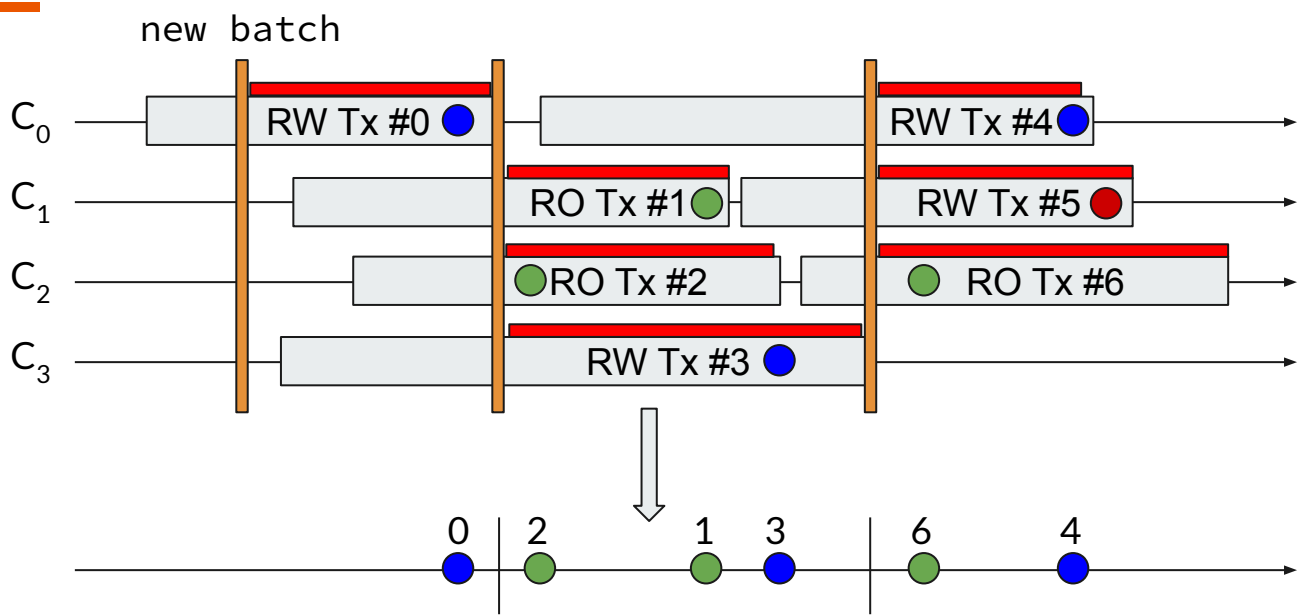


- A tad slow because of the batching, but allows concurrent executions.
- Transactions can fail if they conflict.

STM: Dual-versioning, briefly

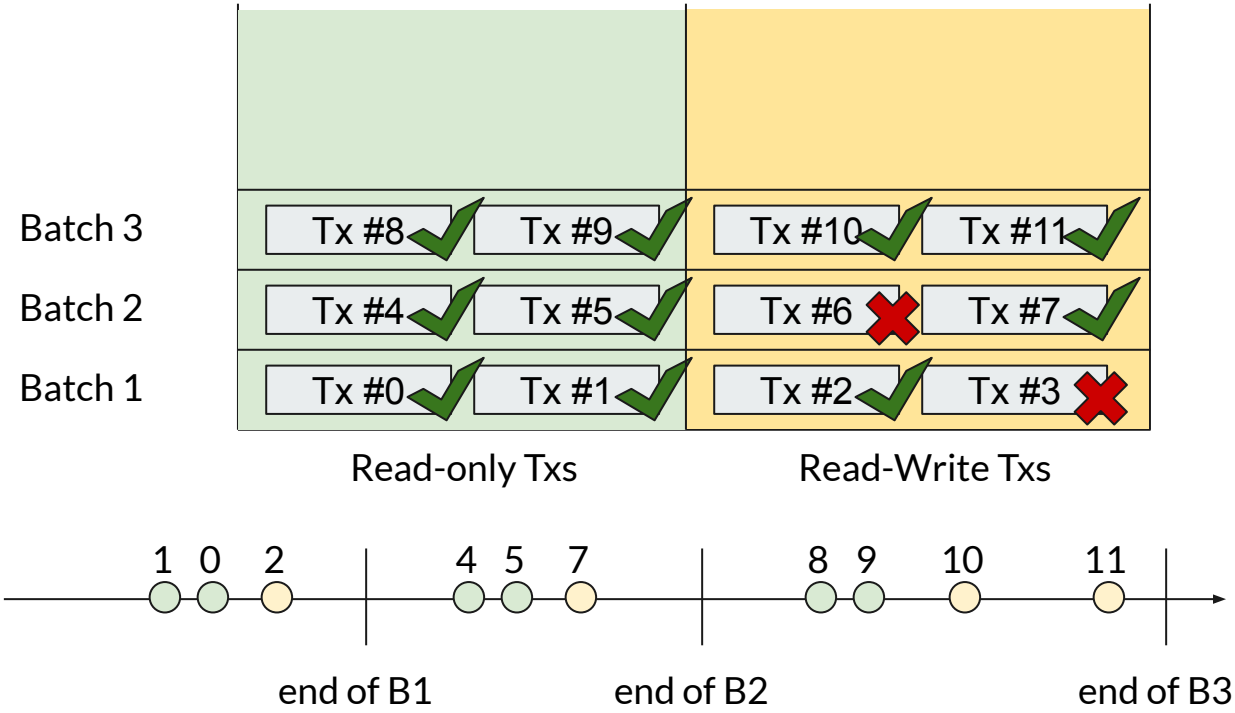
- **Observation**: If all Txs were read-only (RO), no need to check conflicts! ⚡⚡⚡
- **Problem:** We also need to run read-write (RW) Txs :(
- **Solution:** Run RO Txs and RW Txs on two different copies of memory
  1. Batch Txs for a little while,
  2. Run all RO Txs on the RO copy.
  3. In parallel, synchronize all RW Txs on the RW copy.
  4. Once every Tx (tentatively) executed, update the RO copy to match the RW.
- **Notes**:
  - RW Txs do not affect concurrent RO Txs.
  - RO Txs never fail and are *serialized before* RW Txs.
  - RW Txs can fail if they conflict.

STM: Dual-versioning visualized



- RO Txs never fail and are *serialized* before RW Txs of the same batch.
- The RO memory copy is updated at the end of a batch.
- Will get you a good grade, but you need to play some tricks to get a 6.

Dual-versioning batching visualized



- All Txs in a batch run in parallel.
- RO Txs never fail and are *serialized* before RW Txs of the same batch.
- RW Txs can fail.
- RW Txs write to their own copy of memory (not to disturb RO Txs).
- The RO memory copy is updated at the end of a batch.
- Will get you a good grade, but you need to play some tricks to get a 6.

Referencing memory in a dual-versioned STM?

- Usually, **pointers** contain (***virtual) memory addresses***.
- But every piece of memory exists in 2 versions.
- ***What should my STM pointers contain?***
- Good news:
  - The pointers are ***created by your STM*** (i.e., when allocating memory).
  - The pointers are only ever ***used by your STM*** (via `tm_read`/`tm_write`/etc.).
  - They ***don't*** need to ***hold*** *valid (virtual)* ***addresses*** (we never dereference them).
  - You just need ***your STM*** to understand them.