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Scaling Concurrent Log-Structured Data Stores

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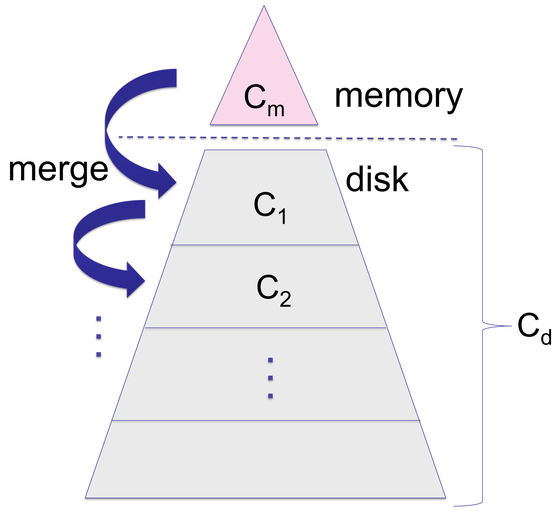
Log-Structured-Merge (LSM) Data Stores

LSM DSs
- absorb writes in memory
- merge to disk in batches

☺ Sequential I/O increases throughput

☹ Concurrent in-memory operations become a bottleneck



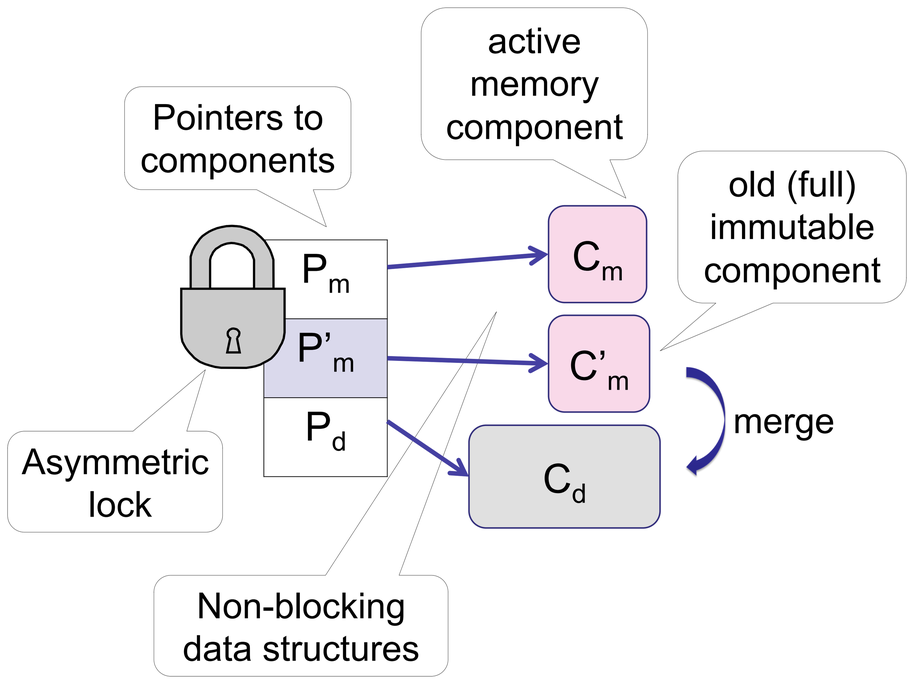
Goal Dramatically speedup in-memory operations

How Non-blocking (lock-free) synchronization

Challenges Support rich API:
Atomic R/W, Snapshot Scan, RMW

Impl Extend popular open-source LevelDB

cLSM - Scalable Concurrent LSM



Merge update pointers before & after merge
lock exclusive mode (block writes)

Write ***lock shared*** mode
update C_m

Read ***no locking***
read C_m, then C'_m, then C_d
may read same data twice

Scan ***lock shared*** mode to get a timestamp
iterate over C_m, C'_m, and C_d
track active operations
beware of races

RMW ***lock shared*** mode
read C_m, then C'_m, then C_d
update C_m

Evaluation RocsDB bLSM LevelDB HyperLeveDB cLSM