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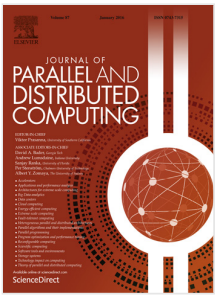

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Grasping the Gap between Blocking and Non-blocking Transactional Memories

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Abstract

Transactional memory (TM) is an inherently optimistic abstraction: it allows concurrent processes to execute sequences of shared-data accesses (transactions) speculatively, with an option of aborting them in the future. Early TM designs avoided using locks and relied on non-blocking synchronization to ensure *obstruction-freedom*: a transaction that encounters no step contention is not allowed to abort. However, it was later observed that obstruction-free TMs perform poorly and, as a result, state-of-the-art TM implementations are nowadays *blocking*, allowing aborts because of data *conflicts* rather than step contention.

In this paper, we explain this shift in the TM practice theoretically, via complexity bounds. We prove a few important lower bounds on obstruction-free TMs. Then we present a *lock-based* TM implementation that beats all of these lower bounds. In sum, our results exhibit a considerable complexity gap between non-blocking and blocking TM implementations.

Keywords: Transactional memory, Obstruction-freedom, Memory stalls, Expensive synchronization, Lower bounds, Invisible reads, Disjoint-access parallelism, Perturbability, Blocking, Non-blocking