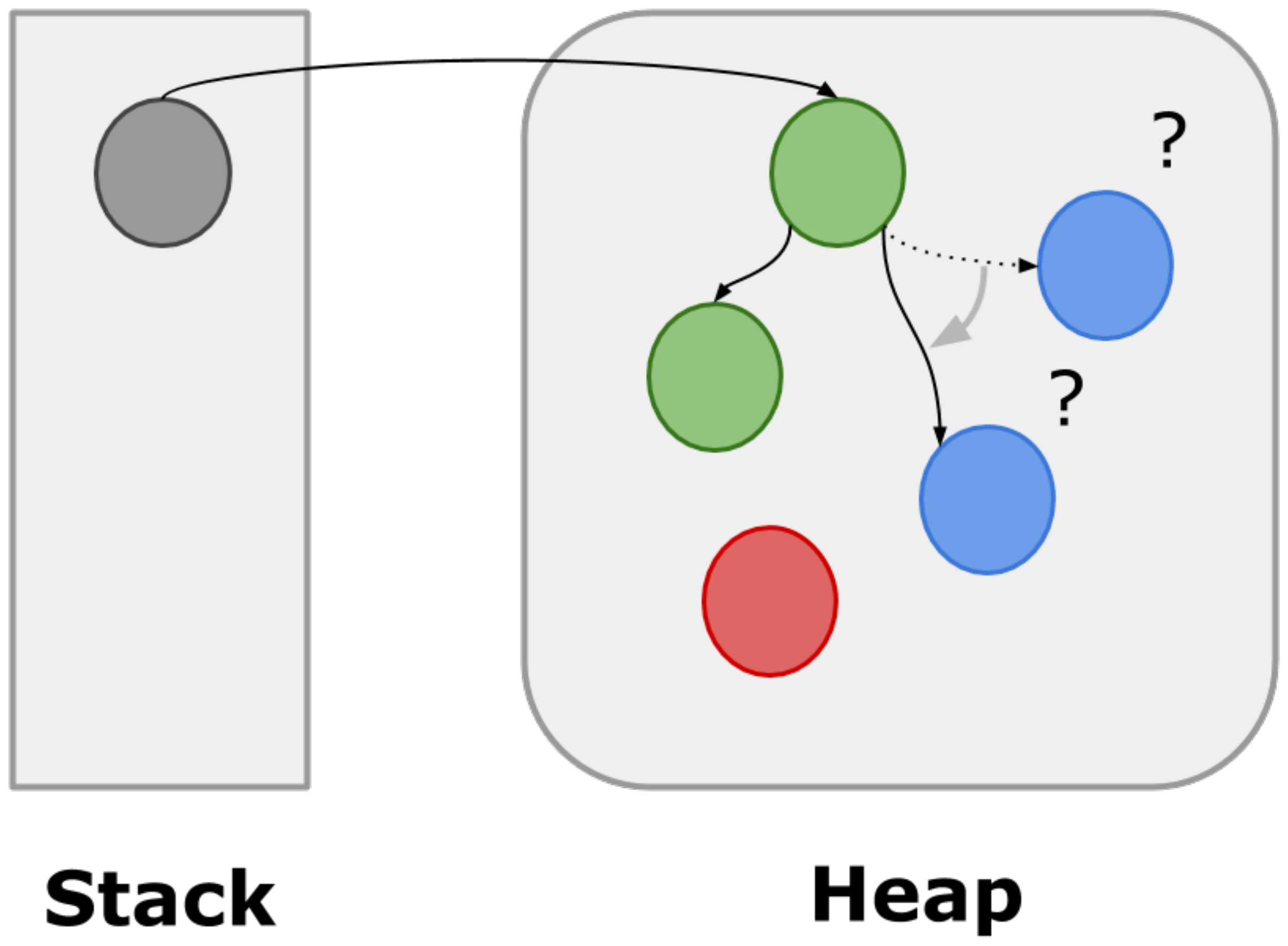
Assessing the Suitability of Transactional Memory Synchronization in Concurrent GC

Aaron Tabor, Gerhard Dueck, Kenneth B. Kent
University of New Brunswick, IBM Canada
Faculty of Computer Science
Aaron.tabor@unb.ca, gdueck@unb.ca, ken@unb.ca

Concurrent Garbage Collection

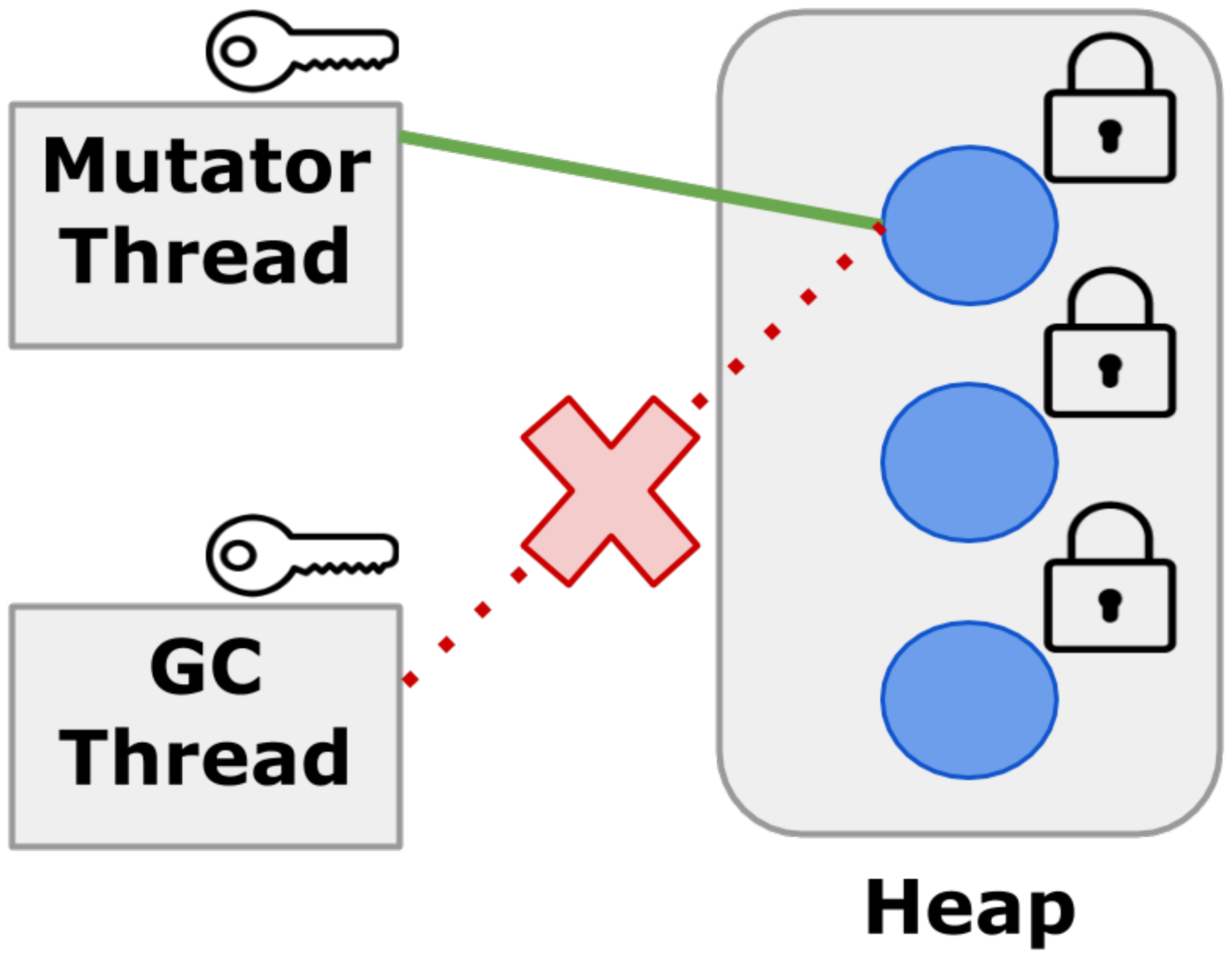
A concurrent garbage collection policy runs alongside, or concurrently, with the software application. However, problems can arise if synchronization between the application and the collector is not maintained.



Concurrent updates during a collection can cause ambiguity. Should the blue objects be considered dead (red), or alive (green)?

Traditional Locking (a "pessimistic" approach)

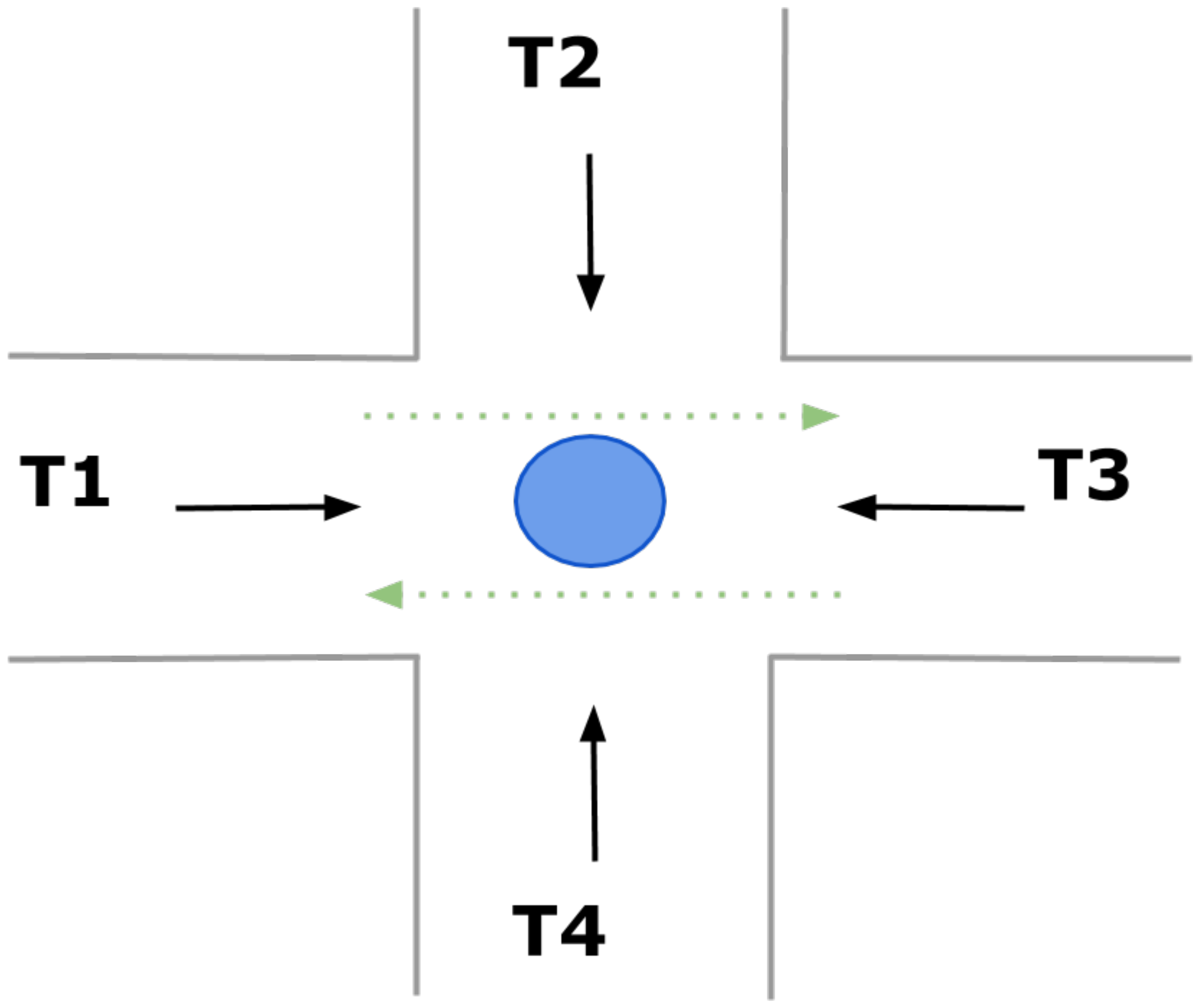
Traditionally, this problem is solved using lock-based synchronization. A thread can only update an object if it is in possession of the object's associated lock. This prevents concurrent updates.



While traditional locking ensures program correctness, it decreases the overall parallelism of the application. Lock based synchronization is considered pessimistic because it assumes that *if a conflict **can** occur, it **will** occur*.

Transactional Memory (an "optimistic" approach)

An alternative approach, which has just recently become supported in hardware, is called Transactional Memory (TM). Concurrent updates in a TM system can be thought of as automobiles approaching an intersection. Even though a given object may be affected by more than one update, it may still be possible multiple updates to proceed simultaneously.



Transactional Memory is considered optimistic because potentially conflicting threads are allowed to proceed concurrently. Corrective action is only applied when/if a conflict occurs.

Proposed Research

Transactional Memory is well suited for situations where the ***possibility*** of conflict exists, but the ***probability*** of it occurring is low.

Our research involves developing tools for profiling lock-based concurrent applications to identify key areas within the application where TM synchronization will be most beneficial. These tools will be used to profile the IBM J9 virtual machine to determine where its existing GC policies can be improved through TM synchronization.

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