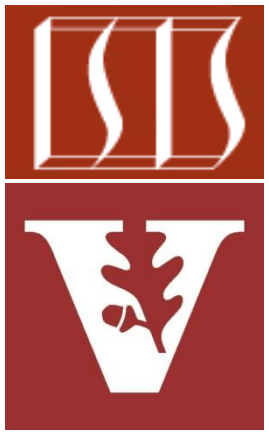
Java Readers-Writer Locks: Evaluating Pros & Cons



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Learning Objectives in this Part of the Lesson

- Recognize the intent of readers-writer locks
- Note a human known use of readers-writer locks
- Appreciate the pros & cons of readers-writer locks in general

Pros & Cons of Readers-Writer Locks

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Pros

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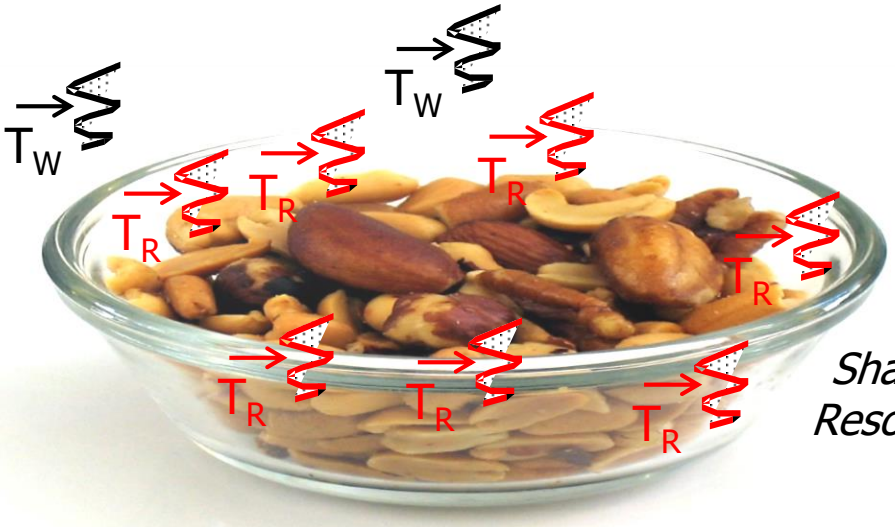
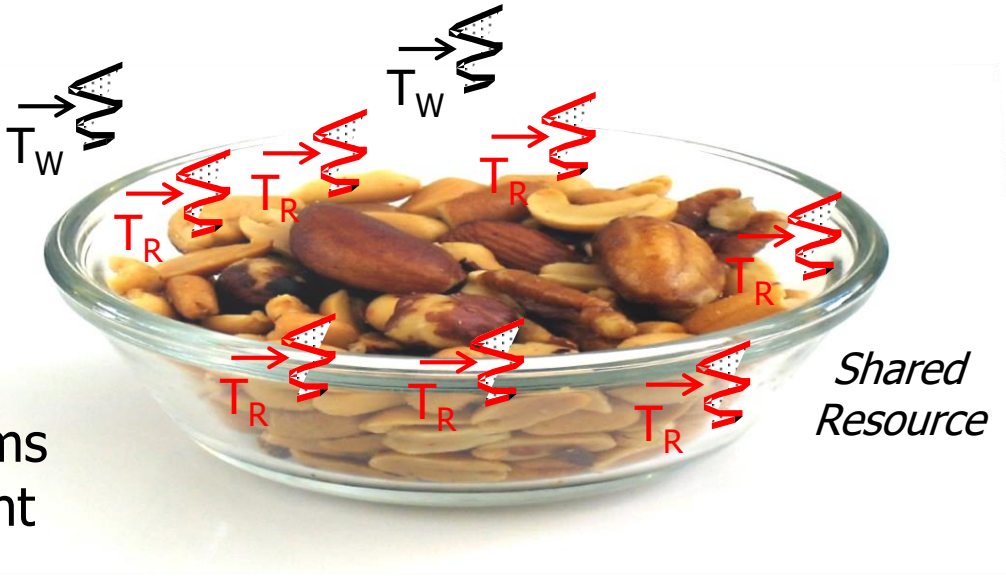
  - e.g., when resources are *read* from much more often than they are *written to*



Pros & Cons of Readers-Writer Locks

Pros

- Readers-writer locks *may* help improve performance
  - e.g., when resources are *read* from much more often than they are *written to*
    - Especially on multi-core platforms that have a high level of inherent parallelism



See docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/ReadWriteLock.html

Pros & Cons of Readers-Writer Locks

Cons

- Readers-writer locks can be problematic in practice

Pros & Cons of Readers-Writer Locks

Cons

- Readers-writer locks can be problematic in practice, e.g.
  - Can lead to starvation
    - Giving preference to either readers or writers can yield problems due to unfairness

See www.javaspecialists.eu/archive/Issue165.html

Pros & Cons of Readers-Writer Locks

Cons

- Readers-writer locks can be problematic in practice, e.g.
  - Can lead to starvation
  - Can be hard to program
    - Due to features like lock upgrading & downgrading

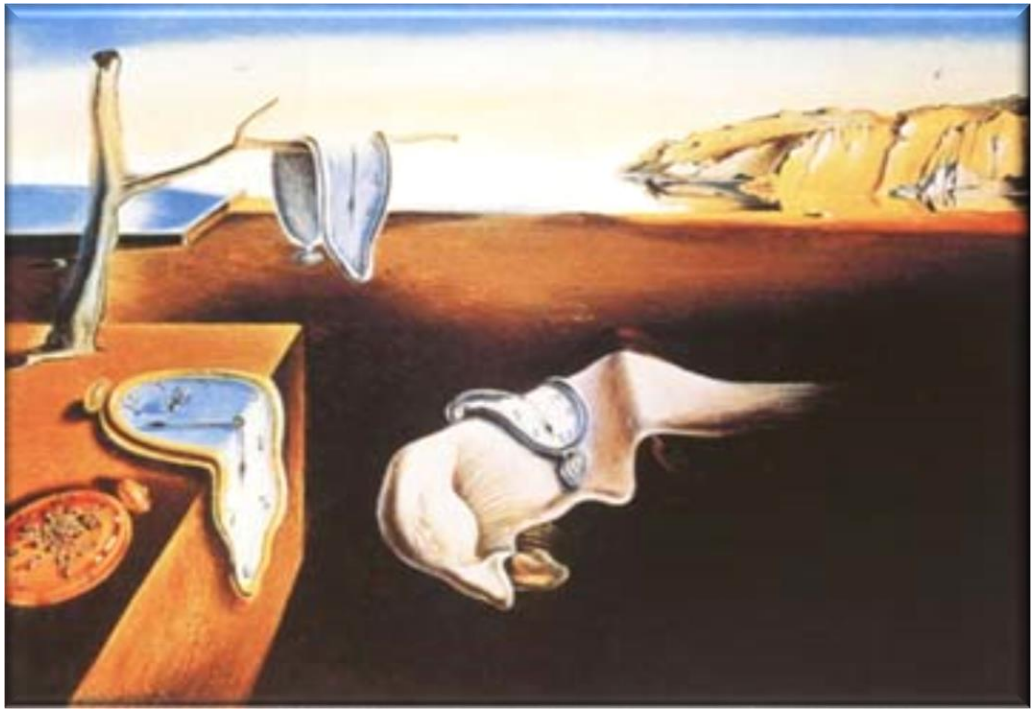
```
public class SimpleAtomicLong {
  ...
  public long incrementAndGet() {
    long value = 0;
    Lock lock = mRWLock.writeLock();
    lock.lock();
    try {
      mValue++;
      final Lock readLock =
        mRWLock.readLock();
      readLock.lock(); // Downgrade
      try {
        lock.unlock();
        value = mValue;
      } finally { lock = readLock; }
    } finally {
      lock.unlock();
    }
    return value;
  }
```

See word-bits.flurg.com/safely-downgrading-a-write-lock-with-readwritelock

Pros & Cons of Readers-Writer Locks

Cons

- Readers-writer locks can be problematic in practice, e.g.
  - Can lead to starvation
  - Can be hard to program
  - May be significantly slower than other synchronizers
    - Due to complexities of implementing the readers-writer protocol in software



See www.takipiblog.com/java-8-stampedlocks-vs-readwritelocks-and-synchronized

Pros & Cons of Readers-Writer Locks

- Upcoming lessons evaluate the pros & cons of Java StampedLock & ReentrantReadWriteLock in more detail

Class ReentrantReadWriteLock

java.lang.Object
    java.util.concurrent.locks.ReentrantReadWriteLock

All Implemented Interfaces:

Serializable, ReadWriteLock


```
public class ReentrantReadWriteLock
extends Object
implements ReadWriteLock, Serializable
```

An implementation of `ReadWriteLock` supporting similar semantics to `ReentrantLock`.

This class has the following properties:

- **Acquisition order**

  This class does not impose a reader or writer preference ordering for lock access. However, it does support an optional *fairness* policy.

Class StampedLock

java.lang.Object
    java.util.concurrent.locks.StampedLock

All Implemented Interfaces:

`Serializable`

```
public class StampedLock
extends Object
implements Serializable
```

A capability-based lock with three modes for controlling read/write access. The state of a StampedLock consists of a version and mode. Lock acquisition methods return a stamp that represents and controls access with respect to a lock state; "try" versions of these methods may instead return the special value zero to represent failure to acquire access. Lock release and conversion methods require stamps as arguments, and fail if they do not match the state of the lock. The three modes are:

- **Writing.** Method `writeLock()` possibly blocks waiting for exclusive access, returning a stamp that can be used in method `unlockWrite(long)` to release the lock. Untimed and timed versions of `tryWriteLock` are also provided. When the lock is held in write mode, no read locks may be obtained, and all optimistic read validations will fail.
- **Reading.** Method `readLock()` possibly blocks waiting for non-exclusive access, returning a stamp that can be used in method `unlockRead(long)` to release the lock. Untimed and timed versions of `tryReadLock` are also provided.
- **Optimistic Reading.** Method `tryOptimisticRead()` returns a non-zero stamp only if the lock is not currently held in write mode. Method `validate(long)` returns true if the lock has not been acquired in write mode since obtaining a given stamp. This mode can be thought of as an extremely weak version of a read-lock, that can be broken by a writer at any time. The use of optimistic mode for short read-only code segments often

End of Java Readers-Writer Locks: Evaluating Pros & Cons