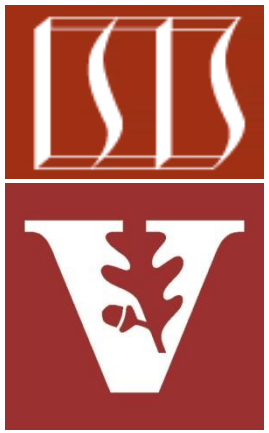
Java Semaphore: Key Methods



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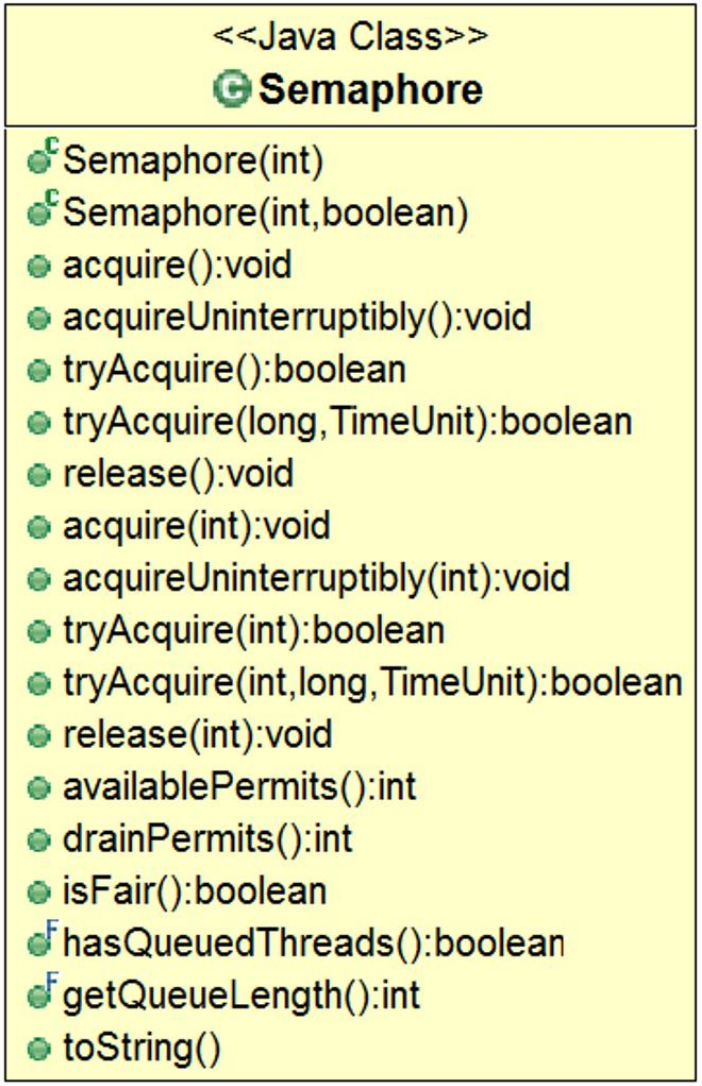
Learning Objectives in this Part of the Lesson

- Understand the concept of semaphores
- Be aware of the two types of semaphores
- Note a human known use of semaphores
- Recognize the structure & functionality of Java Semaphore
- Know the key methods defined by the Java Semaphore class



Overview of Key Java Semaphore Methods

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- Its key methods acquire & release the semaphore

```
public class Semaphore
             implements ... {
  ...
  public void acquire() { ... }

  public void
    acquireUninterruptibly()
  { ... }

  public boolean tryAcquire
          (long timeout,
           TimeUnit unit)
  { ... }

  public void release() { ... }
  ...
```

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

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  public boolean tryAcquire
         (long timeout,
          TimeUnit unit)
  { ... }

  public void release() { ... }
  ...
```

These methods forward to their implementor methods, which are largely inherited from the AbstractQueuedSynchronizer framework

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

Overview of Key Java Semaphore Methods

- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore

```
public class Semaphore
             implements ... {
  ...
  public void acquire() {
    sync.
    acquireSharedInterruptibly(1);
  }
  ...
```

Overview of Key Java Semaphore Methods

- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore
    - Can be interrupted

```
public class Semaphore
             implements ... {
  ...
  public void acquire() {
    sync.
    acquireSharedInterruptibly(1);
  }
  ...
```

See docs.oracle.com/javase/tutorial/essential/concurrency/interrupt.html

Overview of Key Java Semaphore Methods

- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore
  - acquireUninterruptibly() also obtains a permit from the semaphore
    - Cannot be interrupted

```
public class Semaphore
             implements ... {
  ...
  public void
    acquireUninterruptibly() {
    sync.acquireShared(1)
  }
  ...
```

Overview of Key Java Semaphore Methods

- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore
  - acquireUninterruptibly() also obtains a permit from the semaphore
  - tryAcquire() obtains a permit if it's available at invocation time

```
public class Semaphore
             implements ... {
  ...
  public boolean tryAcquire()
                                  ... {
    sync.
      nonfairTryAcquireShared(1)
      >= 0;
  }
  ...
```

Overview of Key Java Semaphore Methods

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  - acquire() atomically obtains a permit from the semaphore
  - acquireUninterruptibly() also obtains a permit from the semaphore
  - tryAcquire() obtains a permit if it's available at invocation time

```
public class Semaphore
             implements ... {
  ...
  public boolean tryAcquire()
                                  ... {
    sync.
      nonfairTryAcquireShared(1)
      >= 0;
  }
  ...
```

Untimed tryAcquire() methods will "barge", i.e., they don't honor the fairness setting & take any permits available

Overview of Key Java Semaphore Methods

- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore
  - acquireUninterruptibly() also obtains a permit from the semaphore
  - tryAcquire() obtains a permit if it's available at invocation time
  - release() atomically increments the permit count by 1

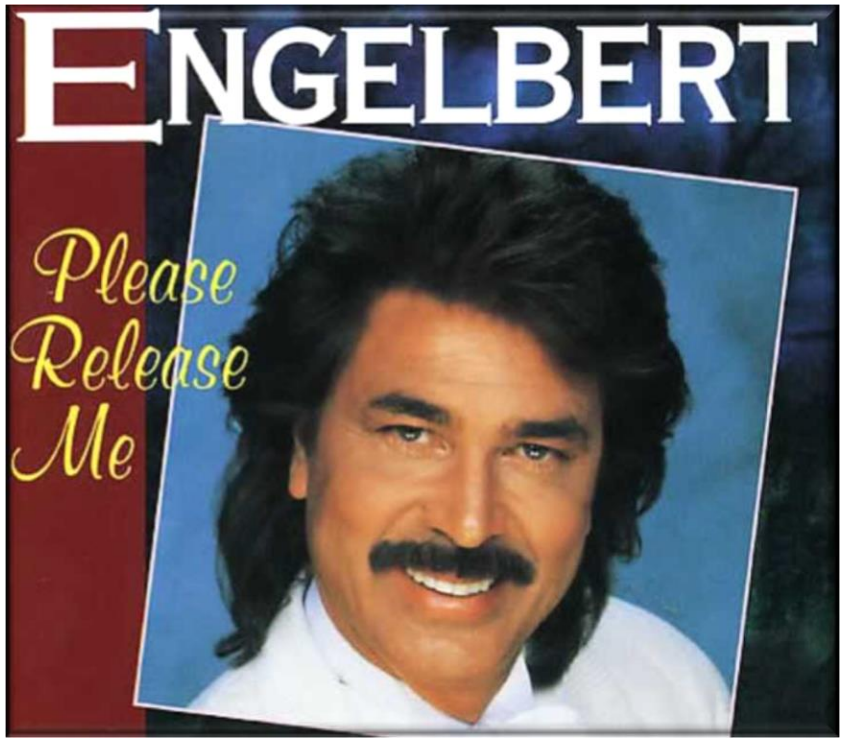
```
public class Semaphore
             implements ... {
  ...
  public void release() {
    sync.releaseShared(1);
  }
  ...
```

Recall it's valid for the permit count to exceed the initial permit count!!

Overview of Key Java Semaphore Methods

- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore
  - acquireUninterruptibly() also obtains a permit from the semaphore
  - tryAcquire() obtains a permit if it's available at invocation time
  - release() atomically increments the permit count by 1
    - If the permit count is now > - a thread waiting to acquire the semaphore can then proceed

```
public class Semaphore
             implements ... {
  ...
  public void release() {
    sync.releaseShared(1);
  }
  ...
```



Overview of Other Java Semaphore Methods

Overview of Other Java Semaphore Methods

- There are many other Semaphore methods

void	acquire(int permits) – Acquires # of permits from semaphore, blocking until all are available, or thread interrupted
void	acquireUninterruptibly(int permits) – Acquires # of permits from semaphore, blocking until all available
boolean	tryAcquire(int permits) – Acquires given # of permits from semaphore, only if all are available at the time of invocation
void	release(int permits) – Releases # of permits, returning them to semaphore
boolean	tryAcquire(long timeout, TimeUnit unit) – Acquires a permit from semaphore, if one is available within given waiting time & thread has not been interrupted
boolean	tryAcquire(int permits, long timeout, TimeUnit unit) – Acquires given # of permits from semaphore, if all available within given waiting time & current thread has not been interrupted

Overview of Other Java Semaphore Methods

- There are many other Semaphore methods
  - Some methods can acquire or release multiple permits at a time

void	acquire(int permits) – Acquires # of permits from semaphore, blocking until all are available, or thread interrupted
void	acquireUninterruptibly(int permits) – Acquires # of permits from semaphore, blocking until all available
boolean	tryAcquire(int permits) – Acquires given # of permits from semaphore, only if all are available at the time of invocation
void	release(int permits) – Releases # of permits, returning them to semaphore
boolean	tryAcquire(long timeout, TimeUnit unit) – Acquires a permit from semaphore, if one is available within given waiting time & thread has not been interrupted
boolean	tryAcquire(int permits, long timeout, TimeUnit unit) – Acquires given # of permits from semaphore, if all available within given waiting time & current thread has not been interrupted

Overview of Other Java Semaphore Methods

- There are many other Semaphore methods
  - Some methods can acquire or release multiple permits at a time
  - Likewise, some of these methods use timeouts

void	acquire(int permits) – Acquires # of permits from semaphore, blocking until all are available, or thread interrupted
void	acquireUninterruptibly(int permits) – Acquires # of permits from semaphore, blocking until all available
boolean	tryAcquire(int permits) – Acquires given # of permits from semaphore, only if all are available at the time of invocation
void	release(int permits) – Releases # of permits, returning them to semaphore
boolean	tryAcquire(long timeout, TimeUnit unit) – Acquires a permit from semaphore, if one is available within given waiting time & thread has not been interrupted
boolean	tryAcquire(int permits, long timeout, TimeUnit unit) – Acquires given # of permits from semaphore, if all available within given waiting time & current thread has not been interrupted

Ironically, the timed tryAcquire() methods *do* honor the fairness setting, so they don't "barge"

End of Java Semaphore: Key Methods