Key Methods in Java Semaphore

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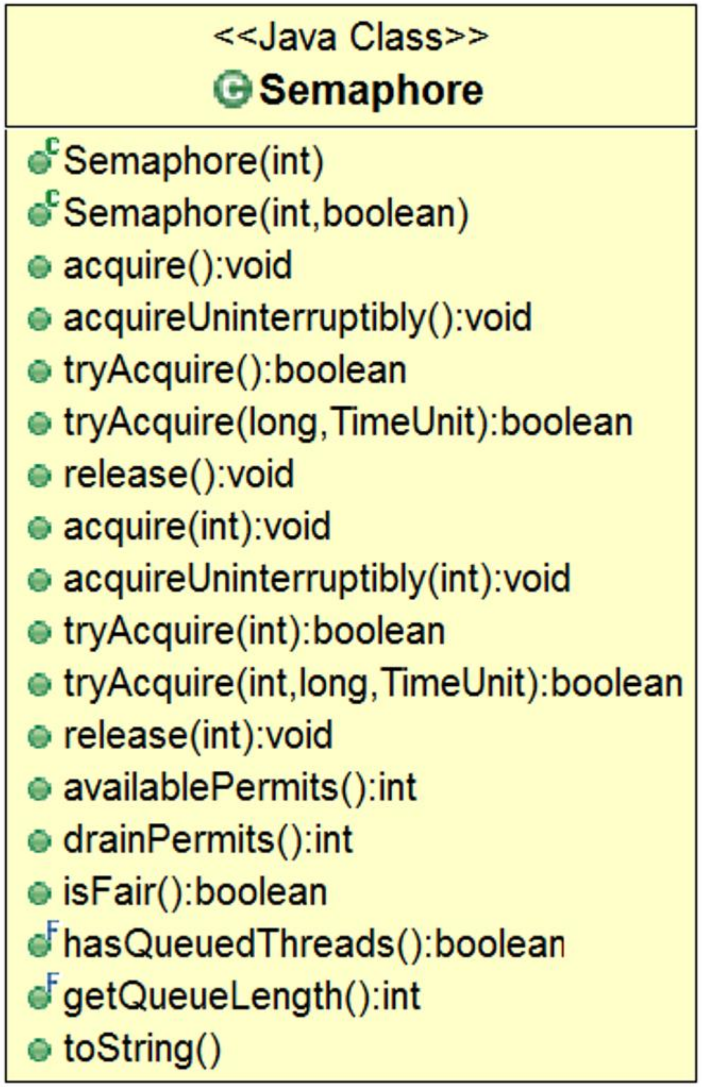
Learning Objectives in this Part of the Lesson

- 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 ... {
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  public void acquire() {
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  }
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```

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;
  }
  ...
```

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```
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

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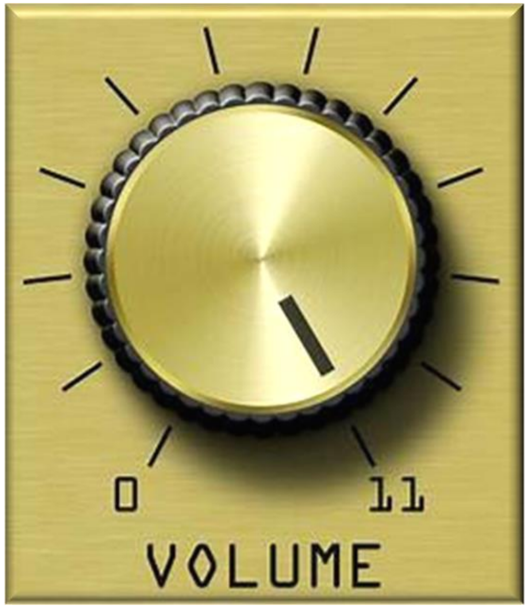
  - tryAcquire() obtains a permit if it's available at invocation time
  - release() atomically increments the permit count by 1

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



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

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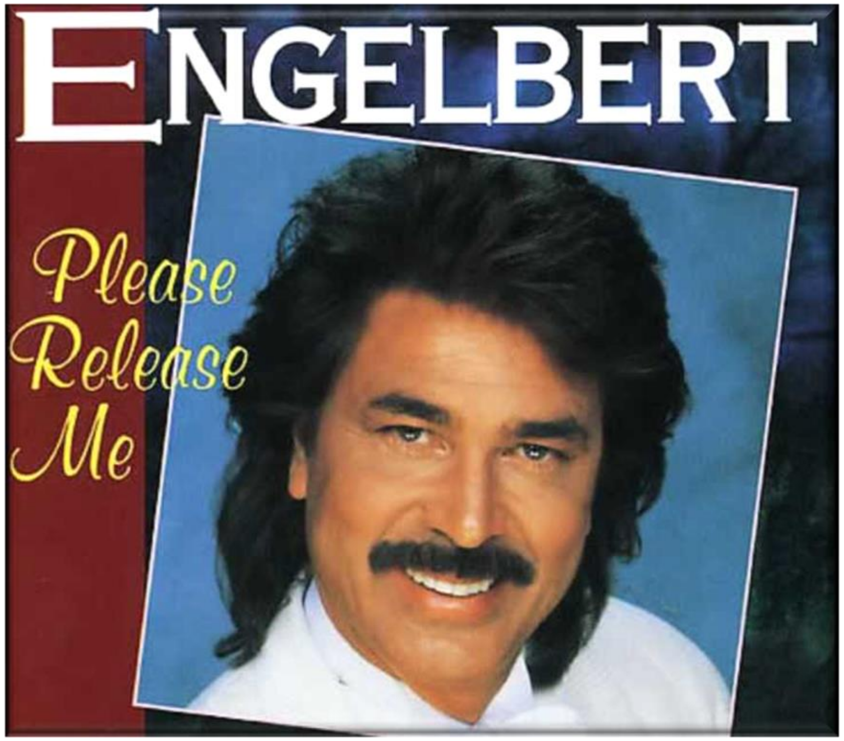
  - tryAcquire() obtains a permit if it's available at invocation time
  - release() atomically increments the permit count by 1
    - If the permit count is now > 0 a thread waiting to acquire the semaphore can then proceed

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



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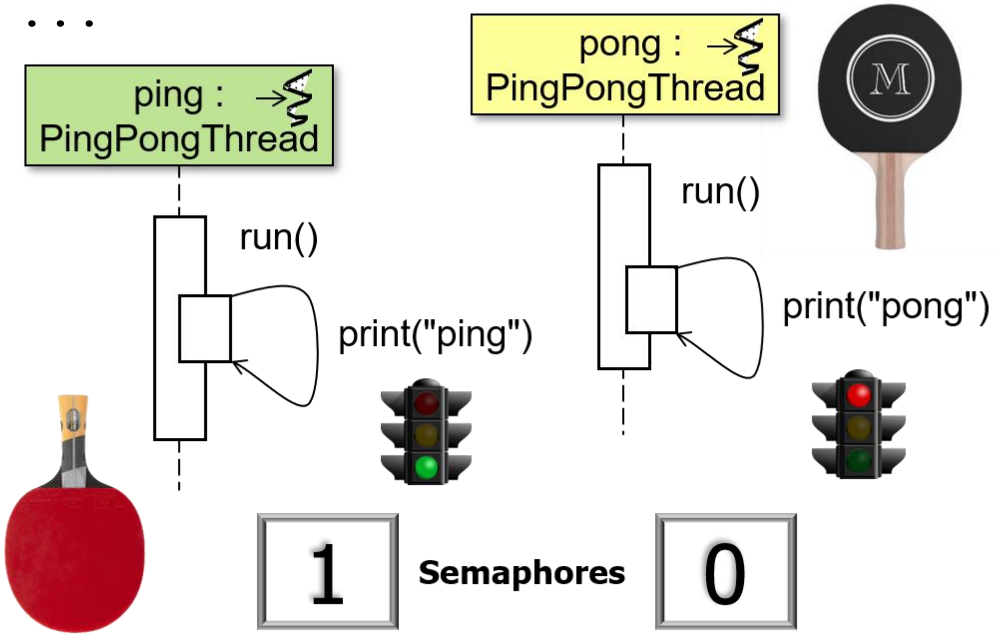
- Its key methods acquire & release the semaphore
  - acquire() atomically obtains a permit from the semaphore
  - acquireUninterruptibly() also obtains a permit from the semaphore
  - tryAcquire() obtains a permit if it's available at invocation time
  - release() atomically increments the permit count by 1
    - If the permit count is now > 0 a thread waiting to acquire the semaphore can then proceed
    - The thread calling release() needn't be the one calling acquired()

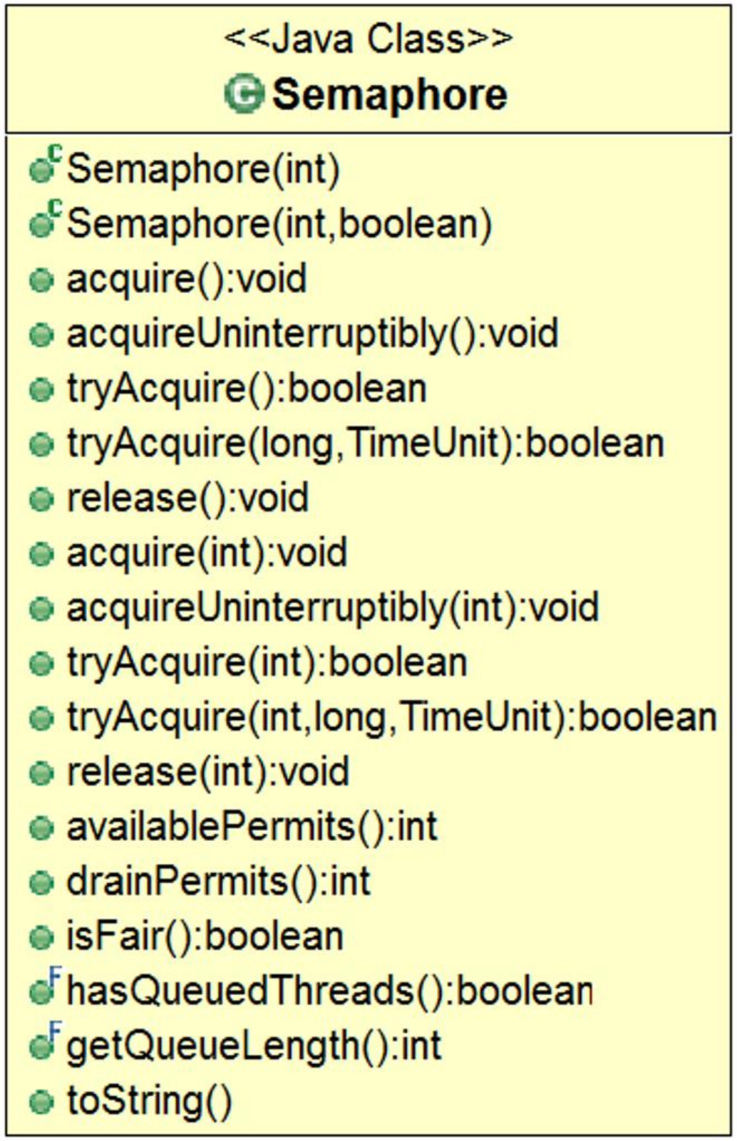
```
public class Semaphore
             implements ... {
  ...
  public void release() {
    sync.releaseShared(1);
  }
  ...
```



Overview of Other Java Semaphore Methods

Overview of Other Java Semaphore Methods

- There are many other Semaphore methods

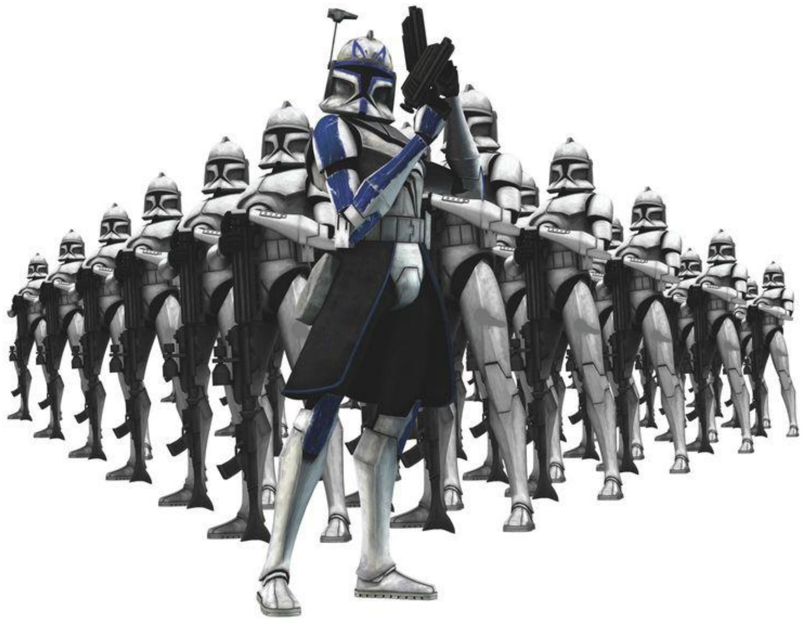


<<Java Class>>
Semaphore

Semaphore(int)
Semaphore(int,boolean)
acquire():void
acquireUninterruptibly():void
tryAcquire():boolean
tryAcquire(long,TimeUnit):boolean
release():void
acquire(int):void
acquireUninterruptibly(int):void
tryAcquire(int):boolean
tryAcquire(int,long,TimeUnit):boolean
release(int):void
availablePermits():int
drainPermits():int
isFair():boolean
hasQueuedThreads():boolean
getQueueLength():int
toString()

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

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

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"

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
  - Yet another methods provide information about the current state of the semaphore

int	availablePermits() – Returns the current number of permits available in this semaphore.
int	getQueueLength() – Returns an estimate of the number of threads waiting to acquire.
boolean	hasQueuedThreads() – Queries whether any threads are waiting to acquire.

Naturally, these values are always an “estimate” in concurrent programs!

End of Key Methods in Java Semaphore