Key Methods in Java

ConditionObject

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Learning Objectives in this Part of the Lesson

- Understand what condition variables are
- Note a human known use of condition variables
- Know what pattern they implement
- Recognize common use cases where condition variables are applied
- Recognize the structure & functionality of Java ConditionObject
- Know the key methods defined by the Java ConditionObject class
Key Methods of Java
ConditionObject
Key Methods of Java `ConditionObject`

- Its key methods allow threads to wait & notify each other

```java
public class ConditionObject
    implements Condition,
    java.io.Serializable {

    ...

    /** Implement interruptible condition wait. */
    public final void await()
        throws InterruptedException
    { ... }

    /** Wakeup the longest waiting thread. */
    public final void signal()
    { ... }

    /** Wakeup all waiting threads. */
    public final void signalAll()
    { ... }

    ...
```
Key Methods of Java ConditionObject

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}
```

Method names are similar to Java’s built-in monitor object methods, but these Java Object final methods can’t be overridden

See lessons on “Java Built-in Monitor Objects”
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Methods are implemented via the AbstractQueued Synchronizer framework

See gee.cs.oswego.edu/dl/papers/aqs.pdf
Key Methods of Java ConditionObject

- Its key methods allow threads to wait & notify each other
- `await()` suspends the calling thread until it’s signaled (or interrupted)

```java
public class ConditionObject
    implements Condition,
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    ...

    /** Implement interruptible condition wait. */
    public final void await() {
        ...
    }

    ...

    See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/AbstractQueuedSynchronizer.ConditionObject.html#await](https://docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/AbstractQueuedSynchronizer.ConditionObject.html#await)
Key Methods of Java ConditionObject

• Its key methods allow threads to wait & notify each other
• `await()` suspends the calling thread until it’s signaled (or interrupted)
• The thread is “parked” on the condition object’s queue

```java
public class ConditionObject implements Condition, java.io.Serializable {
  ...
  /** Implement interruptible condition wait. */
  public final void await() {
    ...
  }
  ...
}
```

See [www.docjar.com/docs/api/sun/misc/Unsafe.html#park(boolean, long)](http://www.docjar.com/docs/api/sun/misc/Unsafe.html#park(boolean, long))
Key Methods of Java ConditionObject

- Its key methods allow threads to wait & notify each other
  - `await()` suspends the calling thread until it’s signaled (or interrupted)
- The thread is “parked” on the condition object’s queue
- If the associated lock is not held when `await()` is called an `IllegalMonitorStateException` is called

```java
class ConditionObject implements Condition, java.io.Serializable {

    /** Implement interruptible condition wait. */
    public final void await() {
        /* ... */
    }

    public final void await() {
        /* ... */
    }

    /* ... */
}
```

See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/Condition.html#await](https://docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/Condition.html#await)
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- Its key methods allow threads to wait & notify each other
  - await() suspends the calling thread until it’s signaled (or interrupted)
  - signal() moves the longest waiting thread from the queue for this condition object to the queue for the owning lock

```java
public class ConditionObject implements Condition, java.io.Serializable {
    ... 
    /** Wakeup longest waiting thread. */
    public final void signal() {
        ... }
    ...
}
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See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/AbstractQueuedSynchronizer.ConditionObject.html#signal](docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/AbstractQueuedSynchronizer.ConditionObject.html#signal)
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  - signalAll() moves all threads from the condition object’s queue to owning lock’s queue

public class ConditionObject implements Condition, java.io.Serializable {
    ...
    /** Wakeup all waiting threads. */
    public final void signalAll()
    {
        ...
    }
    ...

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/locks/AbstractQueuedSynchronizer.ConditionObject.html#signalAll
Key Methods of Java ConditionObject

- Its key methods allow threads to wait & notify each other
  - `await()` suspends the calling thread until it’s signaled (or interrupted)
  - `signal()` moves the longest waiting thread from the queue for this condition object to the queue for the owning lock
  - `signalAll()` moves all threads from the condition object’s queue to owning lock’s queue
  - `signalAll()` may cause the “thundering herd” problem, so use it sparingly!!

```java
public class ConditionObject implements Condition, java.io.Serializable {
    ...
    /** Wakeup all waiting threads. */
    public final void signalAll() {
        ...}
    ...
}
```

See [en.wikipedia.org/wiki/Thundering_herd_problem](en.wikipedia.org/wiki/Thundering_herd_problem)
Other Methods of Java ConditionObject
Other Methods of Java `ConditionObject`

- `ConditionObject` has several `await()` methods

<table>
<thead>
<tr>
<th>Return Type</th>
<th>Method Signature</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>void</code></td>
<td><code>await()</code></td>
<td>Causes the current thread to wait until it is signalled or interrupted</td>
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<tr>
<td><code>boolean</code></td>
<td><code>await(long time, TimeUnit unit)</code></td>
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<td><code>awaitNanos(long nanosTimeout)</code></td>
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<td><code>awaitUninterruptibly()</code></td>
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<td><code>boolean</code></td>
<td><code>awaitUntil(Date deadline)</code></td>
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### Other Methods of Java ConditionObject

- ConditionObject has several `await()` methods
  - e.g., interruptible, non-interruptible, & timed operations

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Unlike Java’s built-in monitor object timed `wait()` calls, these timed `await*()` calls gives a sensible return value.

See [stackoverflow.com/questions/3397722/how-to-differentiate-when-waitlong-timeout-exit-for-notify-or-timeout](https://stackoverflow.com/questions/3397722/how-to-differentiate-when-waitlong-timeout-exit-for-notify-or-timeout)
End of Key Methods in Java ConditionObject