Structure & Functionality of Java CyclicBarrier

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Learning Objectives in this Part of the Lesson

- Understand the structure & functionality of Java CyclicBarrier

Class CyclicBarrier

```java
java.lang.Object
java.util.concurrent.CyclicBarrier
```

```java
public class CyclicBarrier extends Object
```

A synchronization aid that allows a set of threads to all wait for each other to reach a common barrier point. CyclicBarriers are useful in programs involving a fixed sized party of threads that must occasionally wait for each other. The barrier is called cyclic because it can be re-used after the waiting threads are released.

A CyclicBarrier supports an optional Runnable command that is run once per barrier point, after the last thread in the party arrives, but before any threads are released. This barrier action is useful for updating shared-state before any of the parties continue.

**Sample usage:** Here is an example of using a barrier in a parallel decomposition design:
Overview of Java CyclicBarrier
Overview of Java CyclicBarrier

- Implements another Java barrier synchronizer

```java
public class CyclicBarrier {
...
```

---

### Class CyclicBarrier

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See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/CyclicBarrier.html](docs.oracle.com/javase/8/docs/api/java/util/concurrent/CyclicBarrier.html)
Overview of Java CyclicBarrier

- Implements another Java barrier synchronizer
- Allows a set of threads to wait for each other to reach a common barrier point
- Threads are referred to as “parties”

Class CyclicBarrier

class CyclicBarrier extends Object

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One human known use is an assembly line where fixed-sized groups of workers coordinate to build various parts of cars moving by in phases.
Overview of Java CyclicBarrier

• Implements another Java barrier synchronizer
  
  • Allows a set of threads to wait for each other to reach a common barrier point
  
  • Well-suited for fixed-size “cyclic”, “entry”, and/or “exit” barriers

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Overview of Java CyclicBarrier

- Implements another Java barrier synchronizer
- Allows a set of threads to wait for each other to reach a common barrier point
- Well-suited for fixed-size “cyclic”, “entry”, and/or “exit” barriers
- Enables barrier to be reset manually at any point

In contrast, Java CountDownLatch does not enable the barrier to be reset!
Overview of Java CyclicBarrier

• Implements another Java barrier synchronizer
• Allows a set of threads to wait for each other to reach a common barrier point
• Well-suited for fixed-size “cyclic”, “entry”, and/or “exit” barriers
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Overview of Java CyclicBarrier

- Does not apply the *Bridge* pattern

```java
public class CyclicBarrier {
    ...
}
```
Overview of Java CyclicBarrier

- Does not apply the *Bridge* pattern
- Nor does it use the Abstract QueuedSynchronizer framework

Unlike the Java ReentrantLock, ReentrantReadWriteLock, Semaphore, ConditionObject, & CountDownLatch classes
Overview of Java CyclicBarrier

• Instead, it defines a # of fields that implement a cyclic barrier

```java
public class CyclicBarrier {
    private final ReentrantLock lock = new ReentrantLock();

    private final Condition trip = lock.newCondition();

    private final int parties;

    private int count;

    private final Runnable barrierCommand;

    ...
}
```

See src/share/classes/java/util/concurrent/CyclicBarrier.java
### Overview of Java CyclicBarrier

- Instead, it defines a # of fields that implement a cyclic barrier
- Lock that protects critical sections

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public class CyclicBarrier {
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Overview of Java CyclicBarrier

• Instead, it defines a # of fields that implement a cyclic barrier
  • Lock that protects critical sections
  • Condition to wait on until tripped

public class CyclicBarrier {
  private final ReentrantLock lock = new ReentrantLock();

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Overview of Java CyclicBarrier

- Instead, it defines a # of fields that implement a cyclic barrier
  - Lock that protects critical sections
  - Condition to wait on until tripped
  - The total # of parties
    - This value is initially set by the CyclicBarrier constructor

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public class CyclicBarrier {
    private final ReentrantLock lock = new ReentrantLock();
    private final Condition trip = lock.newCondition();
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    ...}
```
Overview of Java CyclicBarrier

- Instead, it defines a # of fields that implement a cyclic barrier
  - Lock that protects critical sections
  - Condition to wait on until tripped
  - The total # of parties
  - # of parties that haven’t called await() yet
    - Initially set to total # of parties & then decremented each time await() is called

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- Instead, it defines a # of fields that implement a cyclic barrier
  - Lock that protects critical sections
  - Condition to wait on until tripped
  - The total # of parties
  - # of parties that haven’t called await() yet
  - Barrier action (optional)
    - Called when barrier is “tripped” after all parties arrive

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Overview of Java CyclicBarrier

• Instead, it defines a # of fields that implement a cyclic barrier
  • Lock that protects critical sections
  • Condition to wait on until tripped
  • The total # of parties
  • # of parties that haven’t called await() yet
• Barrier action (optional)
  • Called when barrier is “tripped” after all parties arrive
    • An action is typically used to (re)initialize data structures for the next cycle

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  private final ReentrantLock lock = new ReentrantLock();
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End of Structure & Functionality of Java CyclicBarrier