Visualizing Java Futures in Action

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Learning Objectives in this Part of the Lesson

- Motivate the need for Java futures by understanding the pros & cons of synchrony & asynchrony
- Know how Java futures provide the foundation for completable futures in Java
- Understand a human known use of Java futures
- Recognize the methods in the Future interface
- Visualize Java futures in action
Visualizing Java Futures in Action
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- An Java async call immediately returns a future & continues to run the computation in a background thread.
Visualizing Java Futures in Action

- `ExecutorService.submit()` can initiate an async call in Java

See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#submit](https://docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#submit)
Visualizing Java Futures in Action

- ExecutorService.submit() can initiate an async call in Java
- Create a thread pool
  - e.g., fixed- or variable-sized

```java
ExecutorService executorService = Executors.newFixedThreadPool(sMAX_THREADS);
```

See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/Executors.html#newFixedThreadPool](docs.oracle.com/javase/8/docs/api/java/util/concurrent/Executors.html#newFixedThreadPool)
Visualizing Java Futures in Action

- ExecutorService.submit() can initiate an async call in Java
  - Create a thread pool
  - Submit a task
    - e.g., a callable

Callable<BigFraction> task = () -> {
    BigFraction bf1 = new BigFraction(f1);
    BigFraction bf2 = new BigFraction(f2);
    return bf1.multiply(bf2);
};

Future<BigFraction> future = executorService.submit(task);

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#submit
Visualizing Java Futures in Action

- ExecutorService.submit() can initiate an async call in Java
- Create a thread pool
- Submit a task
- Return a future
  - e.g., implemented as a FutureTask

Callable<BigFraction> task = () -> {
    BigFraction bf1 = new BigFraction(f1);
    BigFraction bf2 = new BigFraction(f2);
    return bf1.multiply(bf2);
};

Future<BigFraction> future = executorService.submit(task);

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/FutureTask.html
Visualization of Java Futures in Action

- **ExecutorService.submit()** can initiate an async call in Java
  - Create a thread pool
  - Submit a task
  - Return a future
  - Run computation asynchronously
    - e.g., in a thread pool

```java
Callable<BigFraction> task = () -> {
    BigFraction bf1 = new BigFraction(f1);
    BigFraction bf2 = new BigFraction(f2);
    return bf1.multiply(bf2);
};

Future<BigFraction> future = executorService.submit(task);
```
When the async call completes the future is triggered & the result is available.

See [www.nurkiewicz.com/2013/02/javautilconcurrentfuture-basics.html](http://www.nurkiewicz.com/2013/02/javautilconcurrentfuture-basics.html)
Visualizing Java Futures in Action

- When the async call completes the future is triggered & the result is available
- `get()` can block

```java
BigFraction result = future.get();
```

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/Future.html#get
Visualizing Java Futures in Action

- When the async call completes the future is triggered & the result is available
- `get()` can block
- `get()` can also be timed/pollled

BigFraction result = future.get (n, SECONDS);

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/Future.html#get
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- When the async call completes the future is triggered & the result is available
  - get() can block
  - get() can also be timed/pollled

**OUT OF ORDER**

Computations can complete in a different order than the async calls were made
End of Visualizing Java Futures in Action