Visualizing Java Futures in Action

Douglas C. Schmidt
d.schmidt@vanderbilt.edu
www.dre.vanderbilt.edu/~schmidt

Professor of Computer Science
Institute for Software Integrated Systems
Vanderbilt University
Nashville, Tennessee, USA
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

1. submit (task)
2. Return future
3. offer()
4. take()
5. run()
6. get()
Visualizing Java Futures in Action
An Java async call immediately returns a future & continues to run the computation in a background thread.

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

See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#submit](docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#submit)
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- 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](https://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](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
  - Submit a task
  - Return a future
    - e.g., implemented as a FutureTask

```java
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](docs.oracle.com/javase/8/docs/api/java/util/concurrent/FutureTask.html)
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- `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

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

Future\(<\text{BigFraction}\>\) future = executorService.submit(task);
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• 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)
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- 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](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

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

See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/Future.html#get](https://docs.oracle.com/javase/8/docs/api/java/util/concurrent/Future.html#get)
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