Future Interface

The `Future` interface is used to represent the result of an asynchronous computation. The interface also provides methods to check the status of a submitted task and also allows the task to be cancelled if possible. Without further ado, let's dive into an example and see how callable and future objects work in tandem. We'll continue with our sumTask example from the previous lesson.

```
import java.util.concurrent.Callable;
import java.util.concurrent.ExecutionException;
import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;
import java.util.concurrent.Future;

class Demonstration {

    // Create and initialize a threadpool
    static ExecutorService threadPool = Executors.newFixedThreadPool(2);

    public static void main( String args[] ) throws Exception {
        System.out.println( "sum :" + findSum(10));
        threadPool.shutdown();
    }

    static int findSum(final int n) throws ExecutionException, InterruptedException {

        Callable<Integer> sumTask = new Callable<Integer>() {

            public Integer call() throws Exception {
                int sum = 0;
                for (int i = 1; i <= n; i++)
                    sum += i;
                return sum;
            }
        };

```

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Using Future and Callable Together

Thread pools implementing the `ExecutorService` return a future for their task submission methods. In the above code on **line 29** we get back a future when submitting our task. We retrieve the result of the task by invoking the `get` method on the future. The get method will return the result or throw an instance of `ExecutionException`. Let's see an example of that now.

```
import java.util.concurrent.Callable;
import java.util.concurrent.ExecutionException;
import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;
import java.util.concurrent.Future;


class Demonstration {

    static ExecutorService threadPool = Executors.newFixedThreadPool(2);

    public static void main( String args[] ) throws Exception {
        System.out.println( " sum: " + findSumWithException(10));
        threadPool.shutdown();
    }

    static int findSumWithException(final int n) throws ExecutionException, InterruptedException {

        int result = -1;

        Callable<Integer> sumTask = new Callable<Integer>() {

            public Integer call() throws Exception {
                throw new RuntimeException("something bad happened.");
            }
        };

        Future<Integer> f = threadPool.submit(sumTask);
```

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Callable throwing Exception

On **line 31** of the above code, we make a `get` method call. The method throws an execution exception, which we catch. The reason for the exception can be determined by using the `getCause` method of the execution exception. If you run the above snippet, you'll see it prints the runtime exception that we throw on **line 24**.

The `get` method is a blocking call. It'll block till the task completes. We can also write a polling version, where we poll periodically to check if the task is complete or not. Future also allows us to cancel tasks. If a task has been submitted but not yet executed, then it'll be cancelled. However, if a task is currently running, then it may or may not be cancellable. We'll discuss cancelling tasks in detail in future lessons.

Below is an example where we create two tasks. We poll to check if the task has completed. Also, we cancel the second submitted task.

```
import java.util.concurrent.Callable;
import java.util.concurrent.ExecutionException;
import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;
import java.util.concurrent.Future;

class Demonstration {

    static ExecutorService threadPool = Executors.newSingleThreadExecutor();

    public static void main( String args[] ) throws Exception {
        System.out.println(pollingStatusAndCancelTask(10));
        threadPool.shutdown();
    }

    static int pollingStatusAndCancelTask(final int n) throws Exception {

        int result = -1;

        Callable<Integer> sumTask1 = new Callable<Integer>() {

            public Integer call() throws Exception {

                // wait for 10 milliseconds
                Thread.sleep(10);

                int sum = 0;
                for (int i = 1; i <= n; i++)
```

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Note the following about the above code

- On **lines 44 and 45** we submit two tasks for execution.
- **line 45** the second task submitted doesn't return any value so the future is parametrized with `Void`.
- On **line 52**, we cancel the second task. Since our thread pool consists of a single thread and the first task sleeps for a bit before it starts executing, we can assume that the second task will not have started executing and can be cancelled. This is verified by checking for and printing the value of the `isCancelled` method later in the program.
- On **lines 56 - 58**, we repeatedly poll for the status of the first task.

The final output of the program shows messages from polling and the status of the second task cancellation request.

FutureTask

Java also provides an implementation of the future interface called the `FutureTask`. It can wrap a callable or runnable object and in turn be submitted to an executor. Though, the class may not be very useful if you don't intend to create customized tasks but we mention it for the sake of completeness.

```
import java.util.concurrent.Callable;
import java.util.concurrent.ExecutorCompletionService;
import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;
import java.util.concurrent.Future;
import java.util.concurrent.FutureTask;

class Demonstration {

    @SuppressWarnings("unchecked")
    public static void main( String args[] ) throws Exception{

        FutureTask<Integer> futureTask = new FutureTask(new Callable() {

            public Object call() throws Exception {
                try{
                    Thread.sleep(1);
                }
                catch(InterruptedException ie){
                    // swallow exception
                }
                return 5;
            }
        });

        ExecutorService threadPool = Executors.newSingleThreadExecutor();
        Future duplicateFuture = threadPool.submit(futureTask);
```

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