Key Methods in the Java ExecutorService (Part 1)

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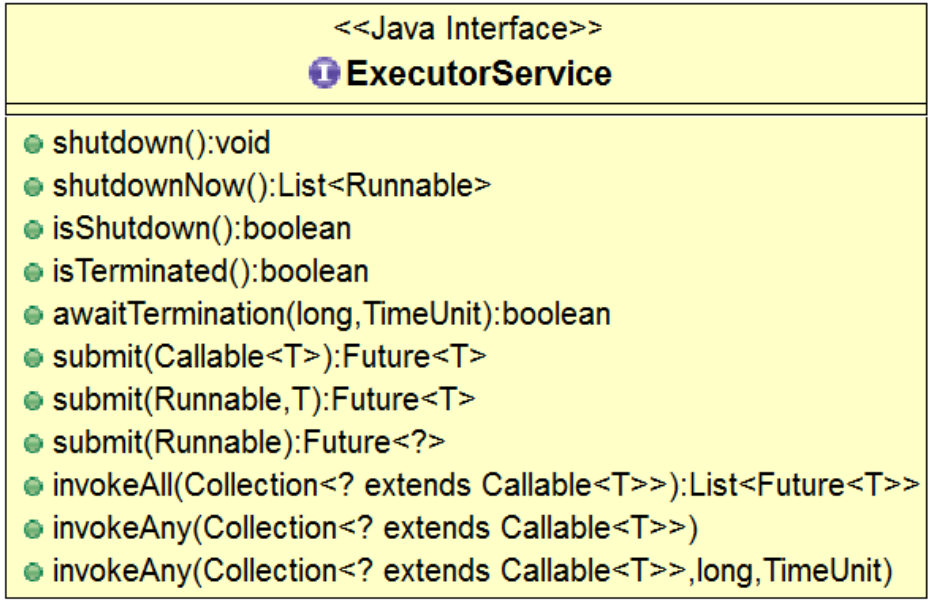
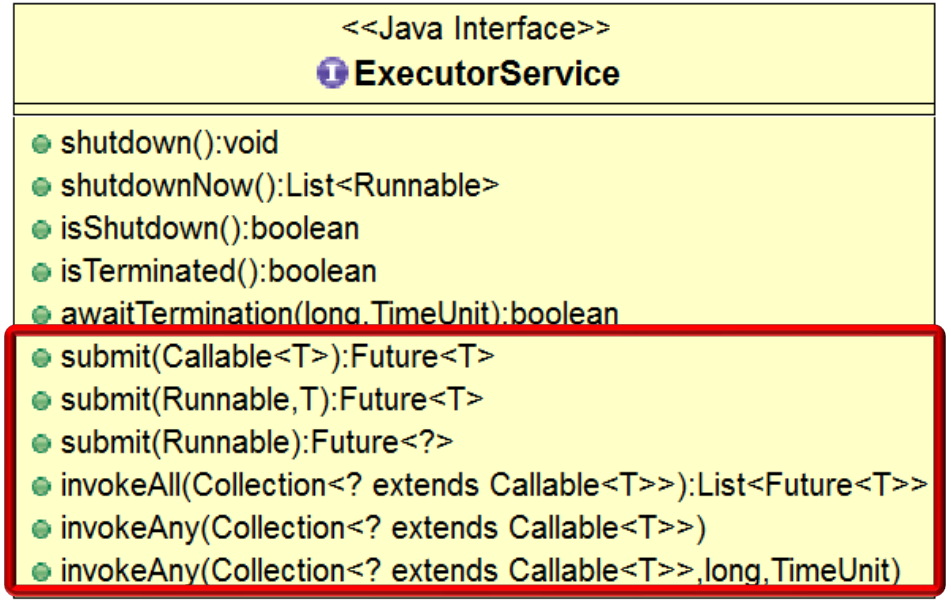
Learning Objectives in this Part of the Lesson

- Recognize the powerful features defined in the Java ExecutorService interface
- Understand other interfaces related to ExecutorService
- Know the key methods provided by ExecutorService



Learning Objectives in this Part of the Lesson

- Recognize the powerful features defined in the Java ExecutorService interface
- Understand other interfaces related to ExecutorService
- Know the key methods provided by ExecutorService
  - These methods submit 1+ tasks for asynchronous execution



Key Methods in the ExecutorService Interface: Task Execution

Key Methods in the ExecutorService Interface

- ExecutorService executes tasks

```
public interface ExecutorService
                    extends Executor {
  // Inherited from Executor
  void execute(Runnable command);

  <T> Future<T> submit
          (Callable<T> task);
  ...
```

Key Methods in the ExecutorService Interface

- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void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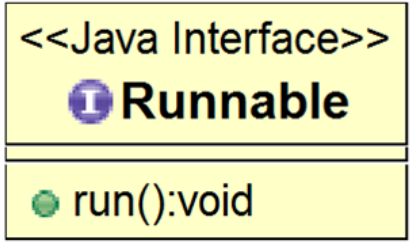

However, this method isn't very useful/common in practice

Key Methods in the ExecutorService Interface

- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void
  - submit() runs two-way async tasks whose call() hook method returns a value


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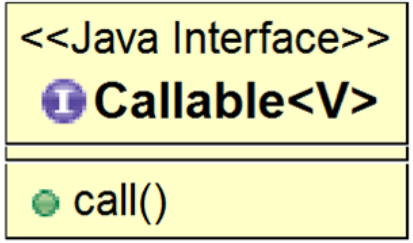

This method is the most useful/common in practice

Key Methods in the ExecutorService Interface

- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void
  - submit() runs two-way async tasks whose call() hook method returns a value
    - This value can be obtained via a future

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public interface ExecutorService
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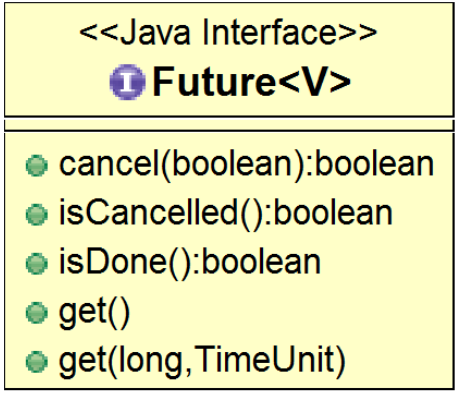

Key Methods in the ExecutorService Interface

- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void
  - submit() runs two-way async tasks whose call() hook method returns a value
    - This value can be obtained via a future
      - Supports the "synchronous future" processing model

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- ExecutorService executes tasks
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    - This value can be obtained via a future
    - Future.get() can block until task completes successfully

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public interface ExecutorService
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- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void
  - submit() runs two-way async tasks whose call() hook method returns a value
    - This value can be obtained via a future
    - Future.get() can block until task completes successfully
      - After which point get() returns the task's result

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public interface ExecutorService
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Key Methods in the ExecutorService Interface

- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void
  - submit() runs two-way async tasks whose call() hook method returns a value
  - submit() can also run one-way async tasks that return no value

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public interface ExecutorService
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  void execute(Runnable command);

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  ...
```

Key Methods in the ExecutorService Interface

- ExecutorService executes tasks
  - execute() runs one-way tasks whose run() hook method returns void
  - submit() runs two-way async tasks whose call() hook method returns a value
  - submit() can also run one-way async tasks that return no value
    - It is possible to cancel this computation, however

```
public interface ExecutorService
                    extends Executor {
  // Inherited from Executor
  void execute(Runnable command);

  <T> Future<T> submit
          (Callable<T> task);

  <T> Future<T> submit
          (Runnable task);
  ...
```

Key Methods in the ExecutorService Interface

- ExecutorService can also execute groups of tasks

```
public interface ExecutorService
                    extends Executor {
    ...
    <T> List<Future<T>> invokeAll
        (Collection<? extends
         Callable<T>> tasks) ...;

    <T> T invokeAny
        (Collection<? extends
         Callable<T>> tasks) ...;
    ...
```

Key Methods in the ExecutorService Interface

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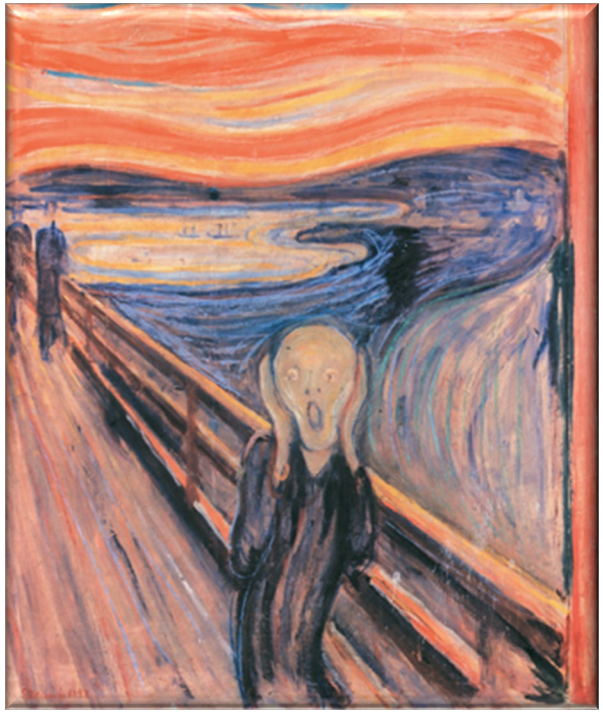
```

Groups of tasks can be passed to these methods as collection parameters

Key Methods in the ExecutorService Interface

- ExecutorService can also execute groups of tasks



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  <T> List<Future<T>> invokeAll
      (Collection<? extends
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       Callable<T>> tasks) ...;
  ...
```

Don’t modify collection param while invokeAll() or invokeAny() are running!!!

Key Methods in the ExecutorService Interface

- ExecutorService can also execute groups of tasks
  - Returns a list of futures when all tasks complete

```
public interface ExecutorService
                 extends Executor {
  ...
 <T> List<Future<T>> invokeAll
     (Collection<? extends
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```

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#invokeAll

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```

All futures returned in this list are "done"!

Futures are used to indicate whether task terminate normally or exceptionally

Key Methods in the ExecutorService Interface

- ExecutorService can also execute groups of tasks
  - Returns a list of futures when all tasks complete
  - Return the result of *one* successful completion


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public interface ExecutorService
                    extends Executor {
  ...
  <T> List<Future<T>> invokeAll
      (Collection<? extends
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  <T> T invokeAny
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  ...
```

Useful for concurrent algorithms that just want the result that completes first

Key Methods in the ExecutorService Interface

- ExecutorService can also execute groups of tasks
  - Returns a list of futures when all tasks complete
  - Return the result of *one* successful completion
    - Cancel uncompleted tasks


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public interface ExecutorService
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Key Methods in the ExecutorService Interface

- ExecutorService can also execute groups of tasks
  - Returns a list of futures when all tasks complete
  - Return the result of *one* successful completion
    - Cancel uncompleted tasks
    - Ignore other completed task results


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  <T> List<Future<T>> invokeAll
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These methods block the calling thread until they are finished, which may be non-intuitive..

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- ExecutorService can also execute groups of tasks
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  - Return the result of *one* successful completion

```
public interface ExecutorService
                    extends Executor {
  ...
  <T> List<Future<T>> invokeAll
      (Collection<? extends
       Callable<T>> tasks,
       long timeout, TimeUnit unit)
       ...;

  <T> T invokeAny(Collection<?
       extends Callable<T>> tasks,
       long timeout, TimeUnit unit)
       ...;
  ...
```

These overloaded methods block for up to a given amount of time

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If method didn't time out, each task completed, whereas if it did time out, some tasks will not have completed.

Task that have not completed are cancelled if timeout occurs.

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TimeoutException is thrown if timeout elapses

End of Key Methods in the Java ExecutorService (Part 1)