Introduction to the Java ScheduledExecutorService

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Learning Objectives in this Part of the Lesson

- Recognize the key methods provided by the Java ScheduledExecutorService interface & its related interfaces/classes

<table>
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<th>Interface ScheduledExecutorService</th>
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<td><strong>All Superinterfaces:</strong></td>
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<td>Executor, ExecutorService</td>
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<td><strong>All Known Implementing Classes:</strong></td>
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<td>ScheduledThreadPoolExecutor</td>
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```java
public interface ScheduledExecutorService
extends ExecutorService

An ExecutorService that can schedule commands to run after a given delay, or to execute periodically.

The schedule methods create tasks with various delays and return a task object that can be used to cancel or check execution. The scheduleAtFixedRate and scheduleWithFixedDelay methods create and execute tasks that run periodically until cancelled.

Commands submitted using the Executor.execute(Runnable) and ExecutorService.submit methods are scheduled with a requested delay of zero. Zero and negative delays (but not periods) are also allowed in schedule methods, and are treated as requests for immediate execution.
```
Overview of the Scheduled ExecutorService Interface
Overview of the ScheduledExecutorService Interface

- Extends ExecutorService to schedule commands to run after a given delay and/or to execute periodically.

```
<Java Interface>
ScheduledExecutorService

- schedule(Runnable, long, TimeUnit)
- schedule(Callable<V>, long, TimeUnit)
- scheduleAtFixedRate(Runnable, long, long, TimeUnit)
- scheduleWithFixedDelay(Runnable, long, long, TimeUnit)
```

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ScheduledExecutorService.html
Overview of the ScheduledExecutorService Interface

- Key methods in the interface

```java
interface ScheduledExecutorService
    extends ExecutorService {
    public <V> ScheduledFuture<V> schedule(Callable<V> callable,
        long delay, TimeUnit unit);

    public ScheduledFuture<?> schedule(Runnable command,
        long delay, TimeUnit unit);

    ...

```
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
- Schedule execution of a one-shot task that runs at a given delay

```java
interface ScheduledExecutorService extends ExecutorService {
    public <V> ScheduledFuture<V> schedule(Callable<V> callable,
                                            long delay, TimeUnit unit);

    public ScheduledFuture<?> schedule(Runnable command,
                                         long delay, TimeUnit unit);
...
```
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
  - Schedule execution of a one-shot task that runs at a given delay

```java
interface ScheduledExecutorService
    extends ExecutorService {
    public <V> ScheduledFuture<V>
      schedule(Callable<V> callable,
                long delay, TimeUnit unit);

    public ScheduledFuture<?>
      schedule(Runnable command,
                long delay, TimeUnit unit);

    ...
```

*Schedules two-way (callable) tasks*
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
- Schedule execution of a one-shot task that runs at a given delay

```java
interface ScheduledExecutorService extends ExecutorService {
    public <V> ScheduledFuture<V> schedule(Callable<V> callable, 
                                            long delay, TimeUnit unit);

    public ScheduledFuture<?> schedule(
                                            Runnable command, 
                                            long delay, TimeUnit unit);

    ...
```

*Schedules one-way (runnable) tasks*
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
- Schedule execution of a one-shot task that runs at a given delay

```java
interface ScheduledExecutorService extends ExecutorService {
    public <V> ScheduledFuture<V> schedule(Callable<V> callable,
                                              long delay, TimeUnit unit);
    public ScheduledFuture<?> schedule(Runnable command,
                                        long delay, TimeUnit unit);
    ...
}
```

*The time from now to delay the execution*

delay is specified in relative time, not absolute time a la the Java Timer class
Overview of the ScheduledExecutorService Interface

• Key methods in the interface

• Schedule execution of a one-shot task that runs at a given delay

```
interface ScheduledExecutorService extends ExecutorService {
    public <V> ScheduledFuture<V> schedule(Callable<V> callable, long delay, TimeUnit unit);
    public ScheduledFuture<?> schedule(Runnable command, long delay, TimeUnit unit);
    ...
```

*Returns an object that can cancel or check execution status*
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
  - Schedule execution of a one-shot task that runs at a given delay

```java
interface ScheduledExecutorService extends ExecutorService {
    public <V> ScheduledFuture<V> schedule(Callable<V> callable,
                                             long delay, TimeUnit unit);

    public ScheduledFuture<?>
        schedule(Runnable command,
                 long delay, TimeUnit unit);
    ...
```

Future.get() always returns null when called on a ScheduledFuture that’s returned for a runnable!

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ScheduledFuture.html
Overview of the ScheduledExecutorService Interface

• Key methods in the interface
• Schedule execution of a one-shot task that runs at a given delay
• Schedule execution of periodic tasks that run after the initial delay (or are cancelled)

```java
interface ScheduledExecutorService
    extends ExecutorService {

    public ScheduledFuture<?>
        scheduleAtFixedRate(Runnable command,
                            long initialDelay,
                            long period, TimeUnit unit);

    public ScheduledFuture<?>
        scheduleWithFixedDelay(Runnable command,
                                long initialDelay,
                                long delay, TimeUnit unit);

    ...
```
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
  - Schedule execution of a one-shot task that runs at a given delay
  - Schedule execution of periodic tasks that run after the initial delay (or are cancelled)

Tasks must be one-way (Runnable)

```java
interface ScheduledExecutorService
  extends ExecutorService {
...

  public ScheduledFuture<?> scheduleAtFixedRate(Runnable command,
  long initialDelay, long period, TimeUnit unit);

  public ScheduledFuture<?> scheduleWithFixedDelay(Runnable command,
  long initialDelay, long delay, TimeUnit unit);
...
```
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
  - Schedule execution of a one-shot task that runs at a given delay
  - Schedule execution of periodic tasks that run after the initial delay (or are cancelled)

```
interface ScheduledExecutorService
    extends ExecutorService {
        ...
        public ScheduledFuture<?> scheduleAtFixedRate(Runnable command,
                                                     long initialDelay,
                                                     long period, TimeUnit unit);
        public ScheduledFuture<?> scheduleWithFixedDelay(Runnable command,
                                                       long initialDelay,
                                                       long delay, TimeUnit unit);
        ...
    }
```

The time to delay the first execution

The delay is specified as a relative time, not absolute times or dates.
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
  - Schedule execution of a one-shot task that runs at a given delay
  - Schedule execution of periodic tasks that run after the initial delay (or are cancelled)

interface ScheduledExecutorService
extends ExecutorService {

  ...
  public ScheduledFuture<?> scheduleAtFixedRate(Runnable command,
                                              long initialDelay,
                                              long period, TimeUnit unit);

  public ScheduledFuture<?> scheduleWithFixedDelay(Runnable command,
                                                  long initialDelay,
                                                  long delay, TimeUnit unit);
  ...

The time between successive executions

Next execution starts immediately if last one runs too long
Overview of the ScheduledExecutorService Interface

- Key methods in the interface
  - Schedule execution of a one-shot task that runs at a given delay
  - Schedule execution of periodic tasks that run after the initial delay (or are cancelled)

```java
interface ScheduledExecutorService
    extends ExecutorService {

    public ScheduledFuture<?>
scheduleAtFixedRate(Runnable command,
                      long initialDelay,
                      long period, TimeUnit unit);

    public ScheduledFuture<?>
scheduleWithFixedDelay(Runnable command,
                          long initialDelay,
                          long delay, TimeUnit unit);

    ...

```

*Time between termination of one execution & commencement of next*
Overview of the ScheduledExecutorService Interface

- Key methods in the interface

  - Schedule execution of a one-shot task that runs at a given delay

  - Schedule execution of periodic tasks that run after the initial delay (or are cancelled)

interface ScheduledExecutorService extends ExecutorService {

  ...

  public ScheduledFuture<?>
scheduleAtFixedRate(Runnable command,
                  long initialDelay,
                  long period, TimeUnit unit);

  ...

  public ScheduledFuture<?>
scheduleWithFixedDelay(Runnable command,
                         long initialDelay,
                         long delay, TimeUnit unit);

  ...

Returns an object that can be used to cancel or check execution status
End of Introduction to the Java ScheduledExecutorService