Java ExecutorCompletionService: Key Methods

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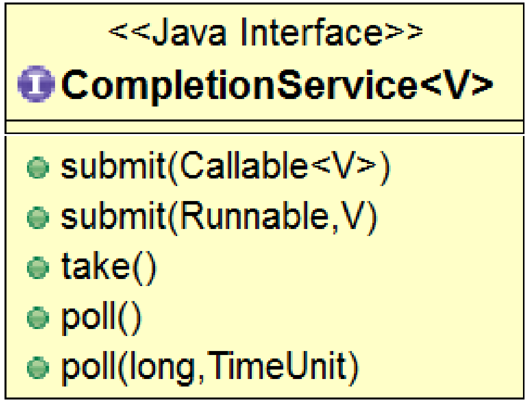
Learning Objectives in this Part of the Lesson

- Understand how the Java CompletionService interface defines a framework for handling the completion of asynchronous tasks
- Know how to instantiate the Java ExecutorCompletionService
- Recognize the key methods in the Java CompletionService interface



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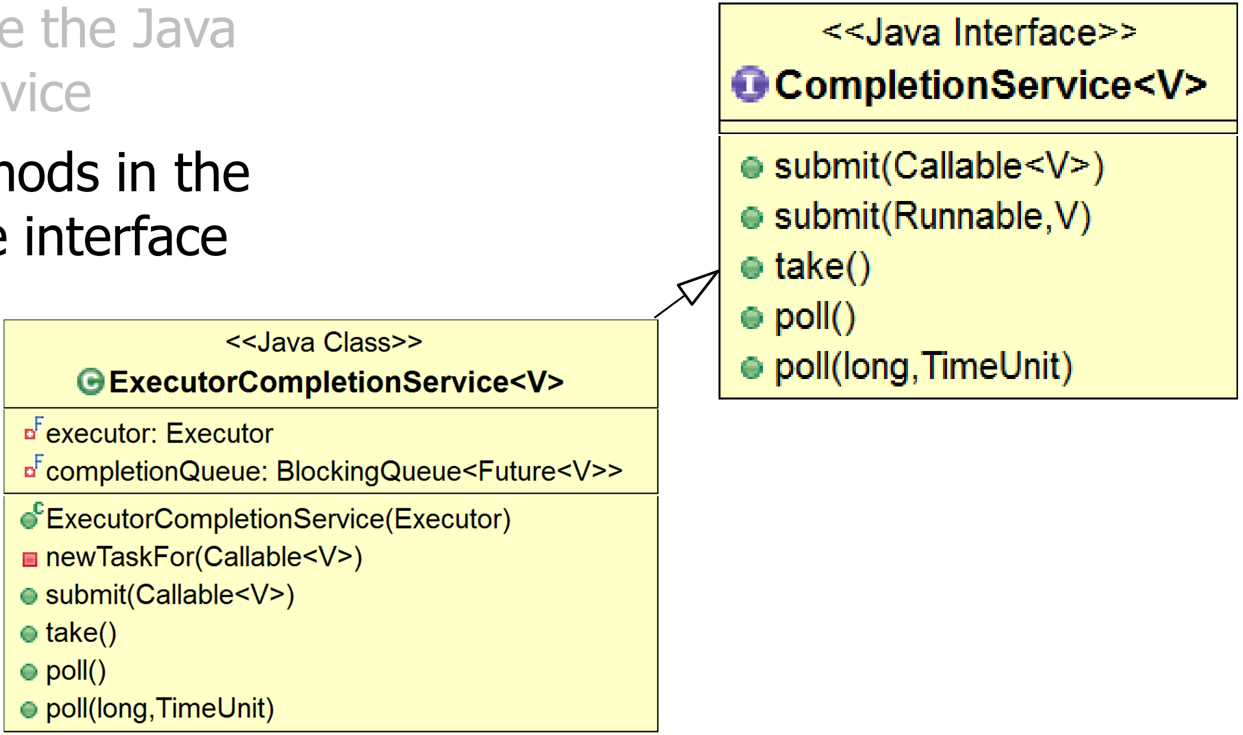
- Know how to instantiate the Java ExecutorCompletionService
- Recognize the key methods in the Java CompletionService interface
    - These methods are implemented by the ExecutorCompletion Service class



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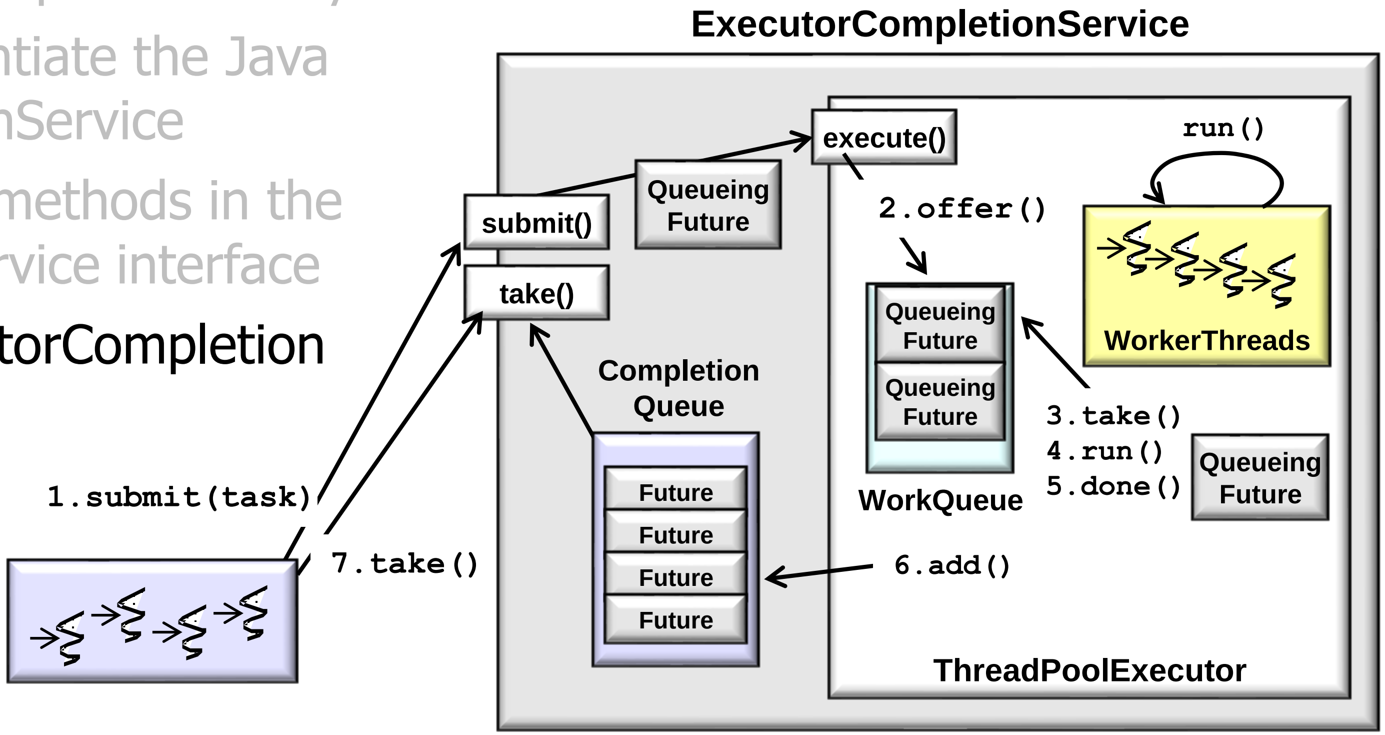
- Visualize the ExecutorCompletion Service in action



Key Methods in the CompletionService Interface

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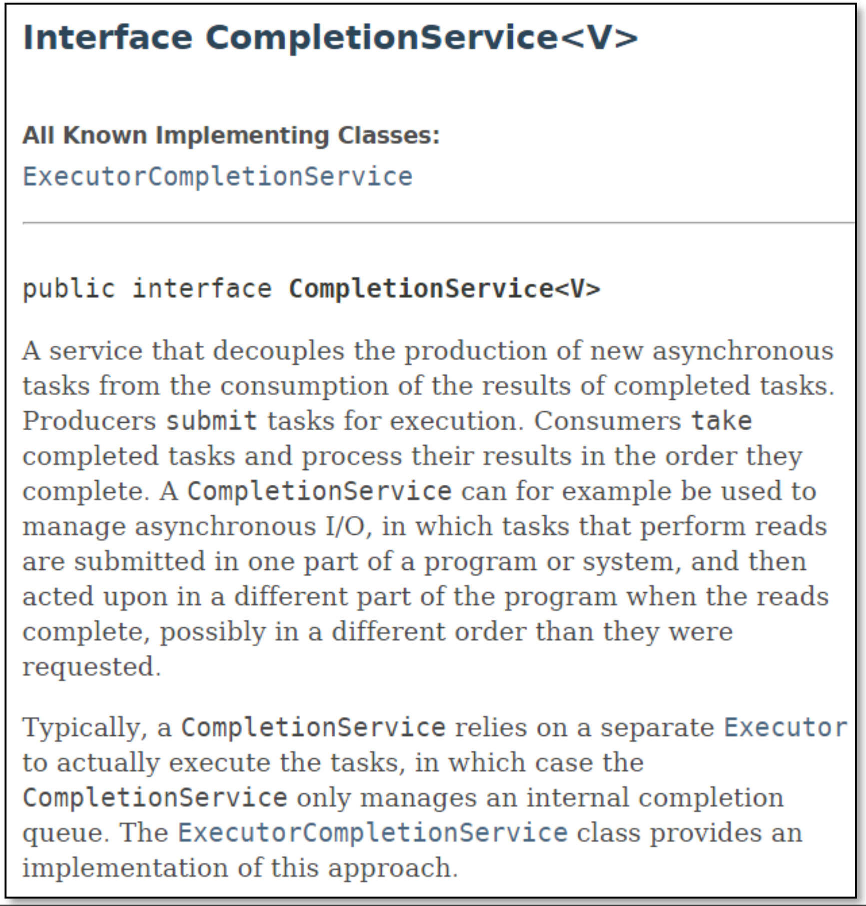

Interface CompletionService<V>

All Known Implementing Classes:

ExecutorCompletionService

```
public interface CompletionService<V>
```

A service that decouples the production of new asynchronous tasks from the consumption of the results of completed tasks. Producers `submit` tasks for execution. Consumers `take` completed tasks and process their results in the order they complete. A `CompletionService` can for example be used to manage asynchronous I/O, in which tasks that perform reads are submitted in one part of a program or system, and then acted upon in a different part of the program when the reads complete, possibly in a different order than they were requested.

Typically, a `CompletionService` relies on a separate `Executor` to actually execute the tasks, in which case the `CompletionService` only manages an internal completion queue. The `ExecutorCompletionService` class provides an implementation of this approach.

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/CompletionService.html

Key Methods in the CompletionService Interface

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  - Submit a task for execution

```
class ExecutorCompletionService<V>
  implements CompletionService<V> {
  ...
  public Future<V>
    submit(Callable<V> task) {
    ...
  }


  public Future<V>
    submit(Runnable task,
             V result) {
    ...
  }
  ...
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Return values of submit() are typically ignored

Key Methods in the CompletionService Interface

- The CompletionService interface only defines a few methods, e.g.
  - Submit a task for execution
    - Submit a value-returning two-way task

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                  V result) {
    ...
  }
  ...
```

```
public interface Callable<V> {
  V call() throws Exception;
}
```

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/Callable.html

Key Methods in the CompletionService Interface

- The CompletionService interface only defines a few methods, e.g.
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    - Submit a value-returning two-way task
      - Provides an "asynchronous future" processing model

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i.e., no need to block on the future

Key Methods in the CompletionService Interface

- The CompletionService interface only defines a few methods, e.g.
  - Submit a task for execution
    - Submit a value-returning two-way task
      - Provides an "asynchronous future" processing model
    - The main reason to access this future is to cancel the async computation

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- The CompletionService interface only defines a few methods, e.g.
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    - Submit a value-returning two-way task
    - Submit a one-way task that returns nothing

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Not as widely used as the two-way callable task

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```
public interface Runnable {
  void run();
}
```

See docs.oracle.com/javase/8/docs/api/java/lang/Runnable.html

Key Methods in the CompletionService Interface

- The CompletionService interface only defines a few methods, e.g.
  - Submit a task for execution
  - Retrieve results

```
class ExecutorCompletionService<V>
  implements CompletionService<V> {
  ...
   public Future<V> take() ... {
      ...
   }

   public Future<V> poll() {
      ...
   }

   public Future<V> poll(long
     timeout, TimeUnit unit) ... {
      ...
   } ...
```

These methods access an internal blocking queue containing Queueing Futures whose tasks have completed

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/BlockingQueue.html

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get() never blocks on a future removed from the internal queue!

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  - Submit a task for execution
  - Retrieve results
    - Block until a future for next completed task is available & then retrieve/remove it
    - Retrieve/remove a future for the next completed task or null if none are available
    - Block up to the specified wait time if future isn't available

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Visualizing the Java ExecutorCompletionService

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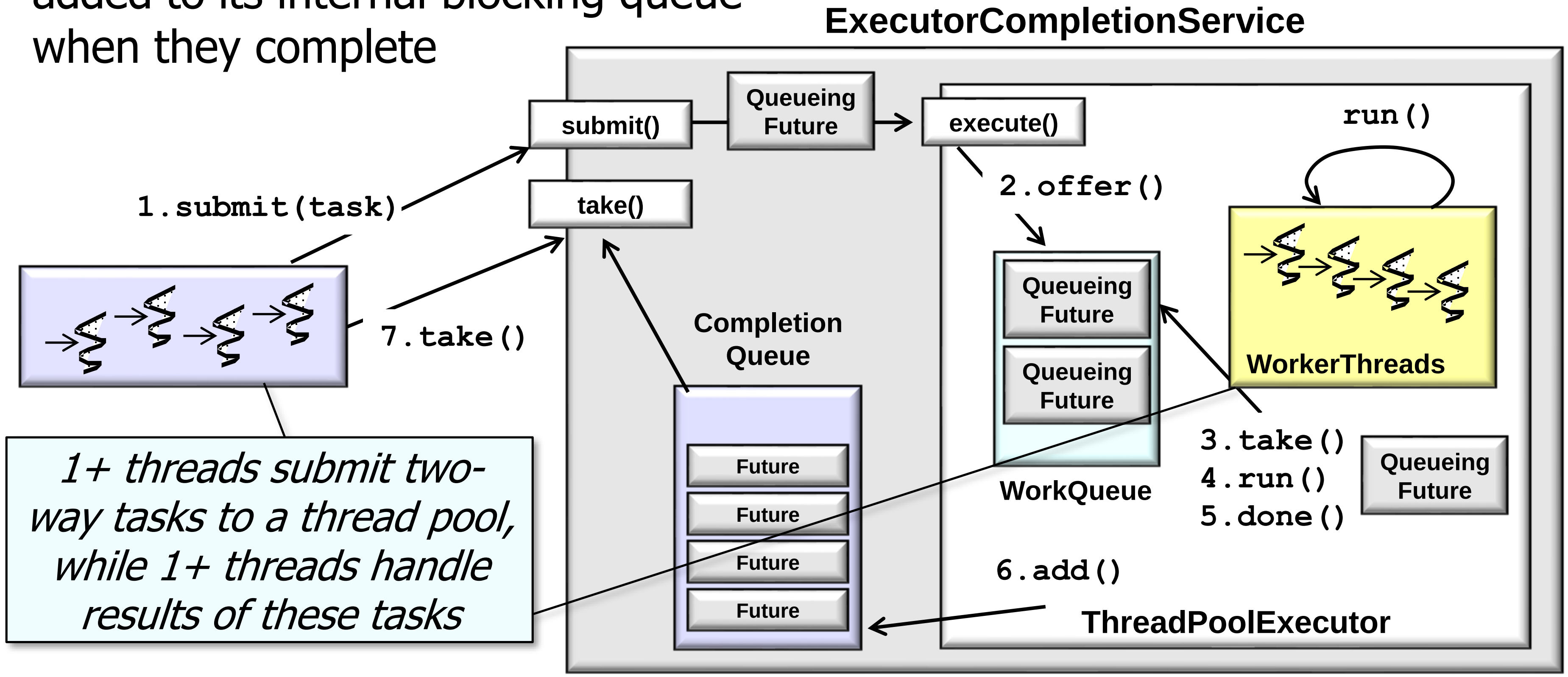
- ExecutorCompletionService uses an Executor to run tasks, which are then added to its internal blocking queue when they complete



Visualizing the Java ExecutorCompletionService

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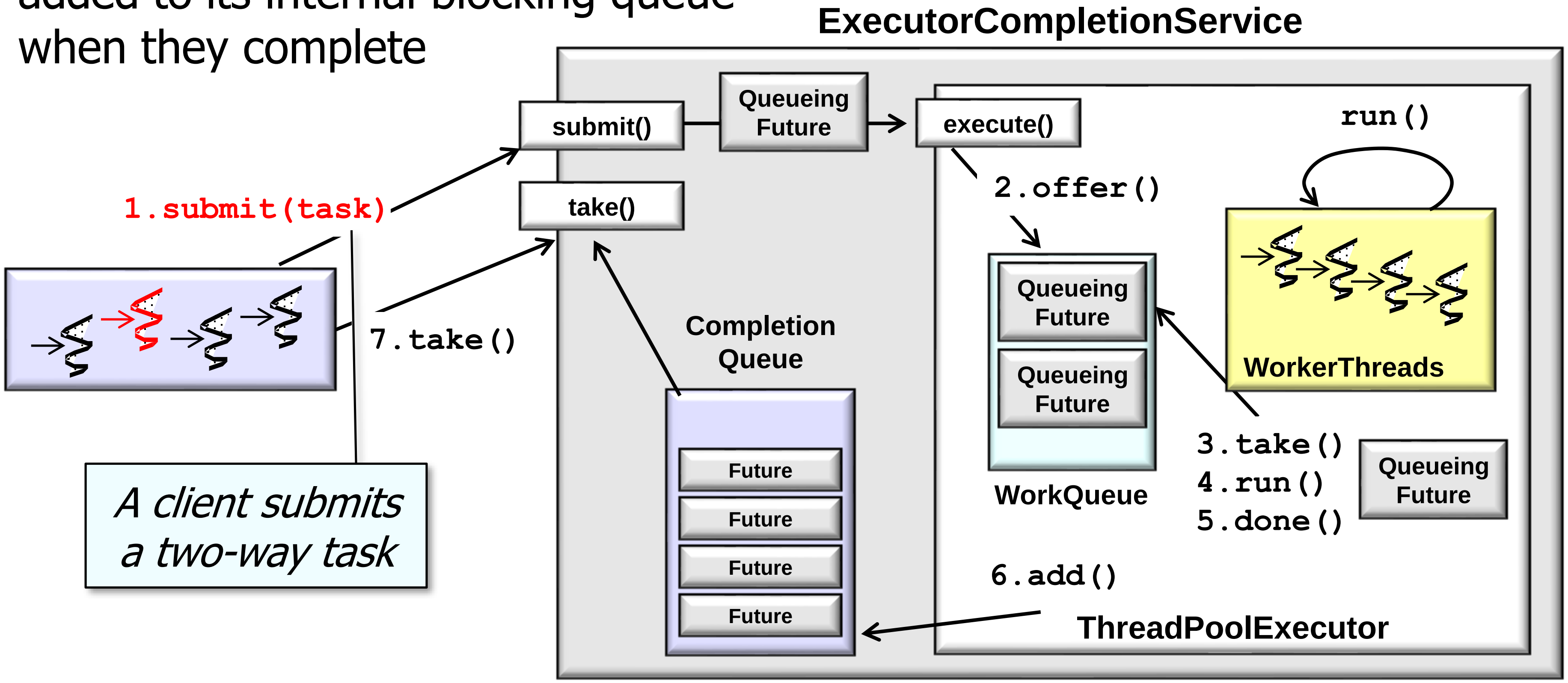

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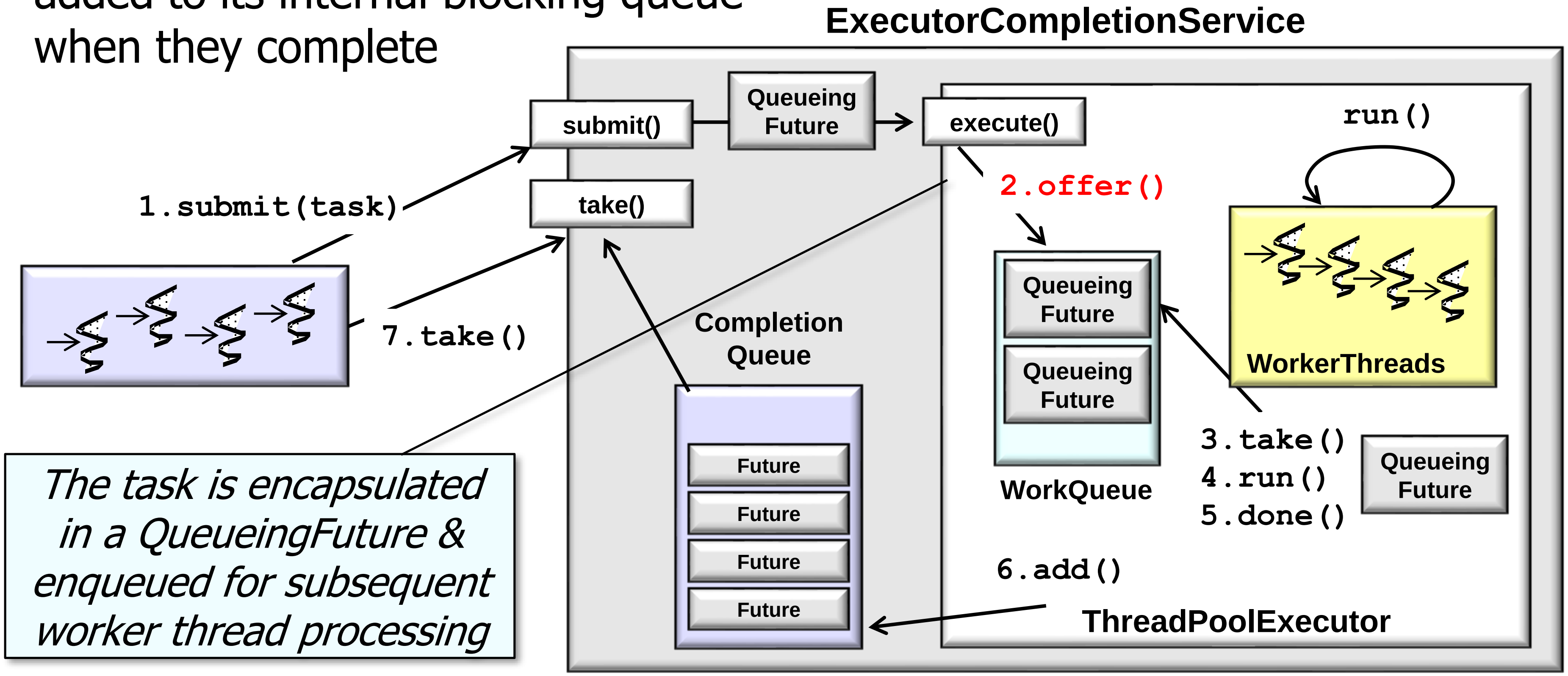

The task is encapsulated in a QueueingFuture & enqueued for subsequent worker thread processing

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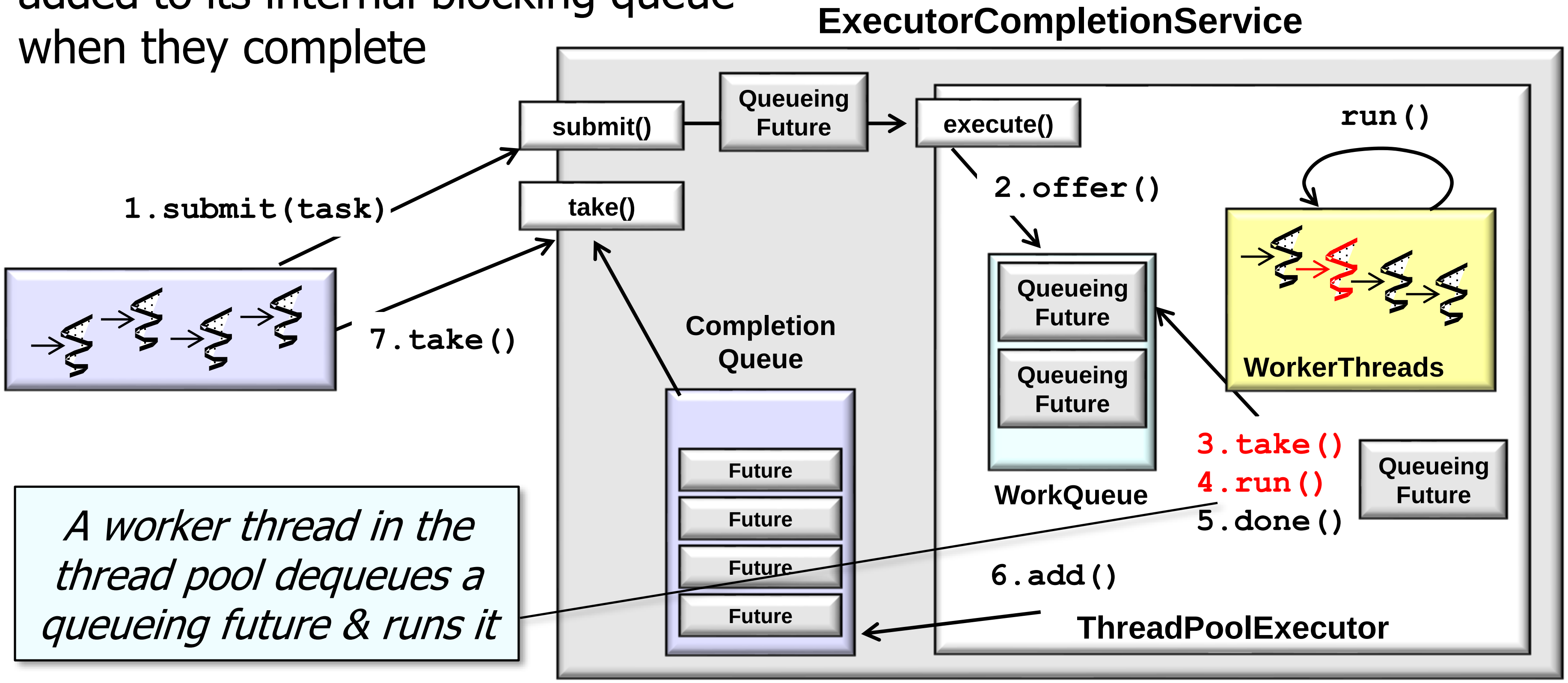

A worker thread in the thread pool dequeues a queueing future & runs it

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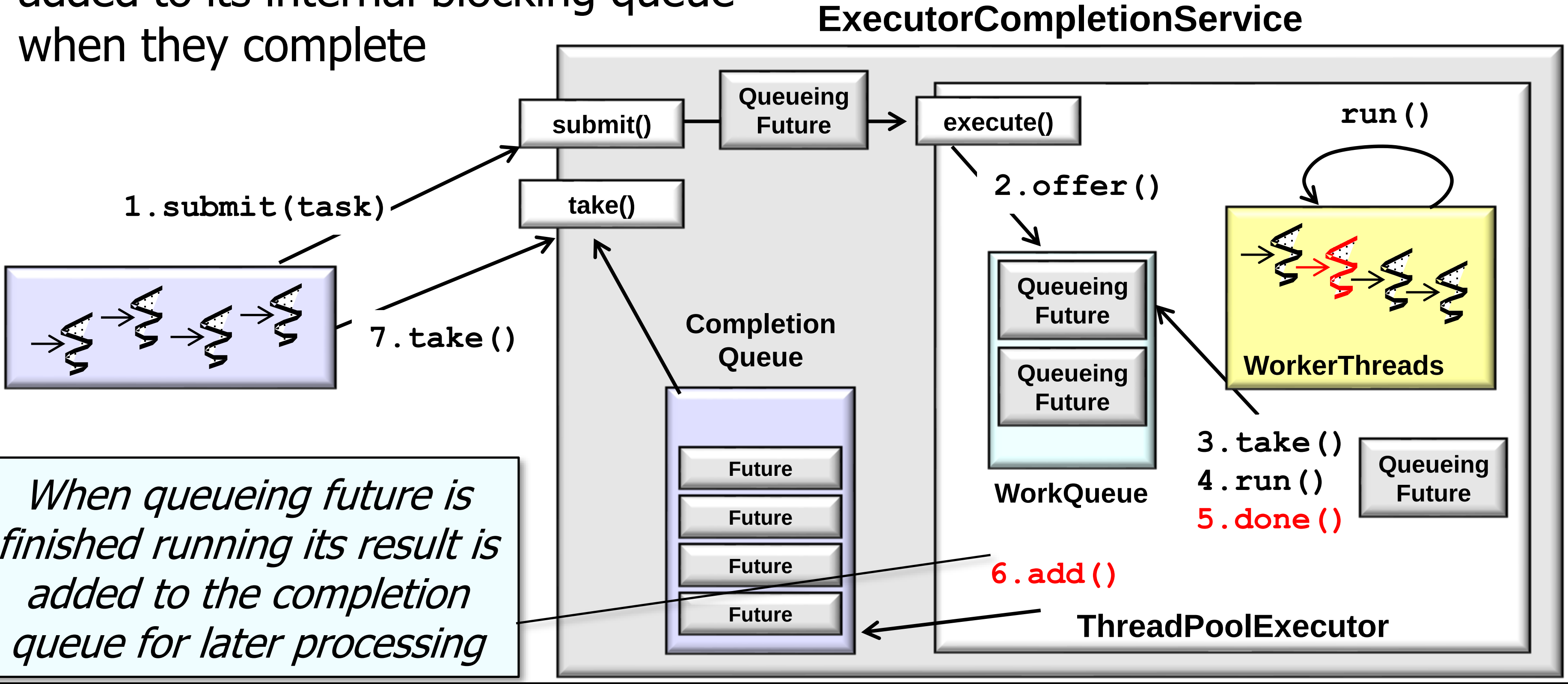

When queueing future is finished running its result is added to the completion queue for later processing

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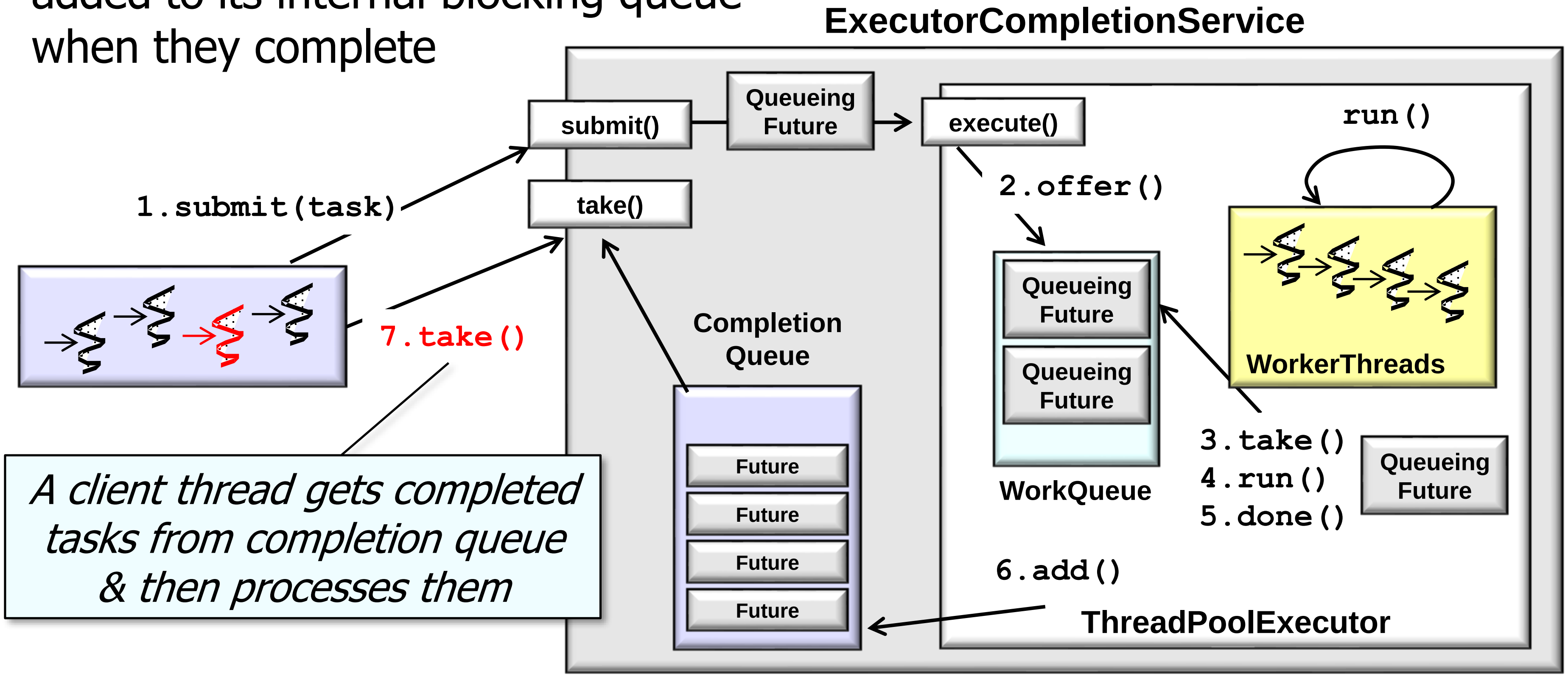

A client thread gets completed tasks from completion queue & then processes them

End of Java Executor CompletionService: Key Methods