

# How Java Completable Futures Overcome Limitations of Java Futures

**Douglas C. Schmidt**

**[d.schmidt@vanderbilt.edu](mailto:d.schmidt@vanderbilt.edu)**

**[www.dre.vanderbilt.edu/~schmidt](http://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

- Recognize how Java completable futures overcome limitations with Java futures & helps fight complexity



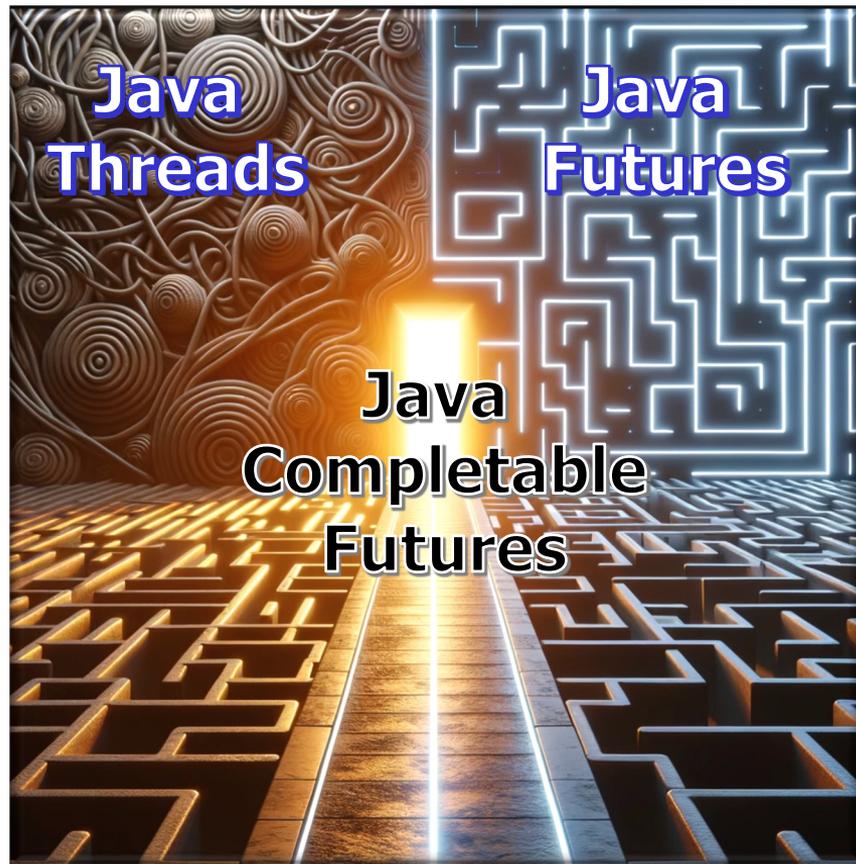
See earlier lesson on “*Overview of the Java Completable Futures Framework*”

---

# Overcoming Limitations with Java Futures

# Overcoming Limitations with Java Futures

- The completable futures framework overcomes Java future limitations



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

# Overcoming Limitations with Java Futures

- The completable futures framework overcomes Java future limitations
  - *Can* be completed explicitly



you complete me

```
CompletableFuture<...> future =  
    new CompletableFuture<>();
```

```
new Thread (() -> {  
    ...  
    future.complete(...);  
}).start();
```

*After complete() is done  
calls to join() will unblock*

```
...  
System.out.println(future.join());
```

# Overcoming Limitations with Java Futures

- The completable futures framework overcomes Java future limitations
  - *Can* be completed explicitly
  - *Can* be chained fluently to handle async results efficiently & cleanly

`CompletableFuture`

```
.supplyAsync(reduceFraction)
  .thenApply(BigFraction
             ::toMixedString)
  .thenAccept(System.out::println);
```

*The action of each "completion stage" is triggered when the previous stage's future completes asynchronously*

# Overcoming Limitations with Java Futures

---

- The completable futures framework overcomes Java future limitations
  - *Can* be completed explicitly
  - *Can* be chained fluently to handle async results efficiently & cleanly
  - Async programming thus looks more like sync programming!

## CompletableFuture

```
.supplyAsync (reduceFraction)  
.thenApply (BigFraction  
            :: toMixedString)  
.thenAccept (System.out :: println) ;
```



# Overcoming Limitations with Java Futures

- The completable futures framework overcomes Java future limitations

- *Can* be completed explicitly
- *Can* be chained fluently to handle async results efficiently & cleanly
- *Can* be triggered reactively & efficiently as a *collection* of futures w/out undue overhead



```
CompletableFuture<List  
<BigFraction>> futureToList =  
Stream  
    .generate(generator)  
    .limit(sMAX_FRACTIONS)  
    .map(reduceFractions)  
    .collect(FuturesCollector  
            .toFuture());  
  
futureToList  
    .thenAccept(printList);
```

*Create a single future that will be triggered when a group of other futures all complete*

# Overcoming Limitations with Java Futures

- The completable futures framework overcomes Java future limitations

- *Can* be completed explicitly
- *Can* be chained fluently to handle async results efficiently & cleanly
- *Can* be triggered reactively & efficiently as a *collection* of futures w/out undue overhead



```
CompletableFuture<List  
<BigFraction>> futureToList =  
Stream  
    .generate(generator)  
    .limit(sMAX_FRACTIONS)  
    .map(reduceFractions)  
    .collect(FuturesCollector  
            .toFuture());
```

```
futureToList  
    .thenAccept(printList);
```

*Print out the results after all async fraction reductions have completed*

# Overcoming Limitations with Java Futures

- The completable futures framework overcomes Java future limitations

- *Can* be completed explicitly
- *Can* be chained fluently to handle async results efficiently & cleanly
- *Can* be triggered reactively & efficiently as a *collection* of futures w/out undue overhead



```
CompletableFuture<List  
<BigFraction>> futureToList =  
Stream  
    .generate(generator)  
    .limit(sMAX_FRACTIONS)  
    .map(reduceFractions)  
    .collect(FuturesCollector  
            .toFuture());
```

```
futureToList  
    .thenAccept(printList);
```

*Java completable futures can also be combined with Java sequential streams*

---

# End of How Java Completable Futures Overcome Limitations of Java Futures