Key Action Operators in the Flux Class (Part 2)

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Learning Objectives in this Part of the Lesson

- Recognize key Flux operators
  - Concurrency operators
  - Scheduler operators
  - Factory method operators
  - Action operators
    - These operators don't modify a Flux, but instead use it for side effects
      - i.e., doFinally() & doOnComplete()

Key Action Operators in the Flux Class

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason

```
Flux<T> doFinally
  (Consumer<SignalType> onFinally)
```

See projectreactor.io/docs/core/release/api/reactor/core/publisher/Flux.html#doFinally

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
    - The param is called when the Flux signals onError() or onComplete() or is disposed by the downstream

```
Flux<T> doFinally
  (Consumer<SignalType> onFinally)
```

Interface Consumer<T>

Type Parameters:

T - the type of the input to the operation

All Known Subinterfaces:

Stream.Builder<T>

Functional Interface:

This is a functional interface and can therefore be used as the assignment target for a lambda expression or method reference.

See docs.oracle.com/javase/8/docs/api/java/util/function/Consumer.html

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
    - The param is called when the Flux signals onError() or onComplete() or is disposed by the downstream
      - It is a "callback" that only has side-effects

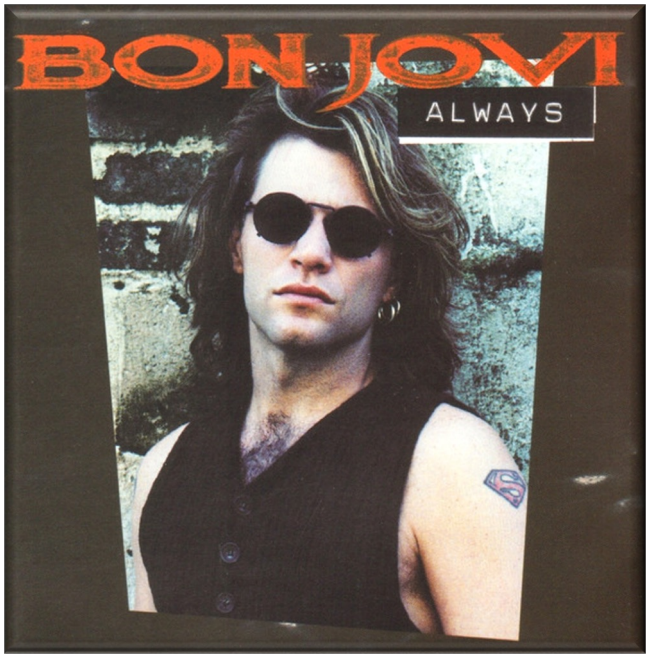
```
Flux<T> doFinally
  (Consumer<SignalType> onFinally)
```

See en.wikipedia.org/wiki/Callback_(computer_programming)

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
    - The param is called when the Flux signals onError() or onComplete() or is disposed by the downstream
      - It is a "callback" that only has side-effects
    - Action is always called regardless of successful or error completion
      - Similar to a C++ destructor

```
Flux<T> doFinally
  (Consumer<SignalType> onFinally)
```



Contrast this doFinally() behavior with the doOnComplete() behavior

Key Action Operators in the Flux Class

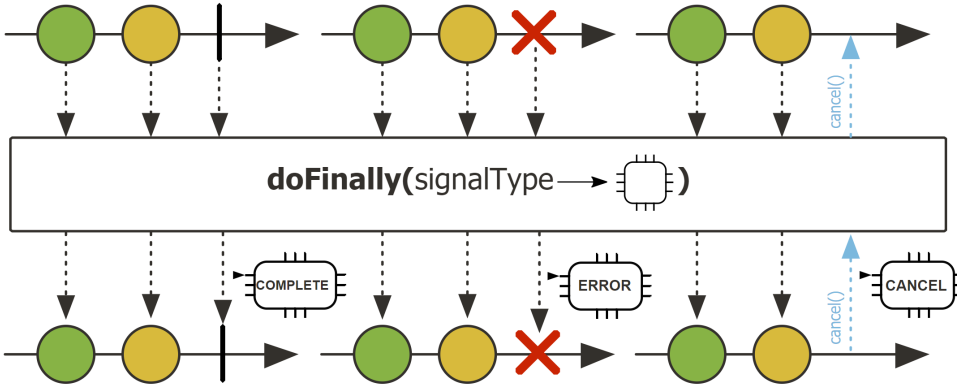
- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
    - The param is called when the Flux signals onError() or onComplete() or is disposed by the downstream
  - Returns the new unchanged Flux instance

```
Flux<T> doFinally
  (Consumer<SignalType> onFinally)
```

The type or the value of elements that is processed is unchanged

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
  - Does not operate by default on a particular Scheduler
    - i.e., it uses the current scheduler



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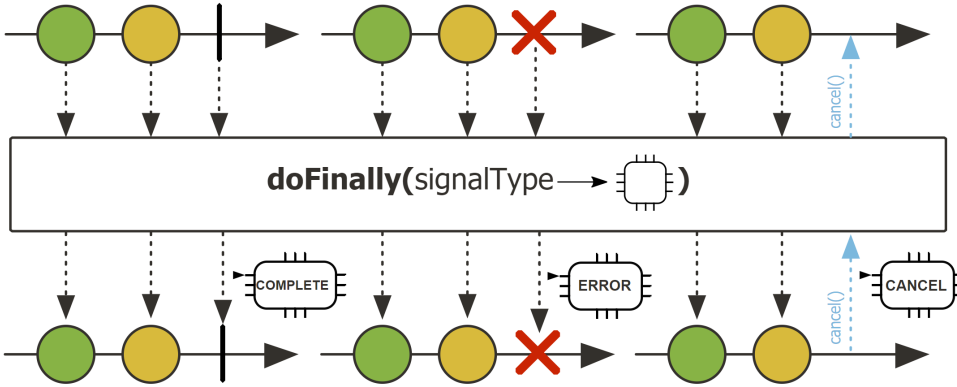


```
Scheduler subscriber = Schedulers.newParallel("subscriber", 1);
return Flux
   .create(makeAsyncFluxSink())
   ...
   .publishOn(subscriber)
   ...
   .doFinally(___ -> subscriber.dispose()) ...
```

This operator is called after the Flux completes

See Reactive/flux/ex2/src/main/java/FluxEx.java

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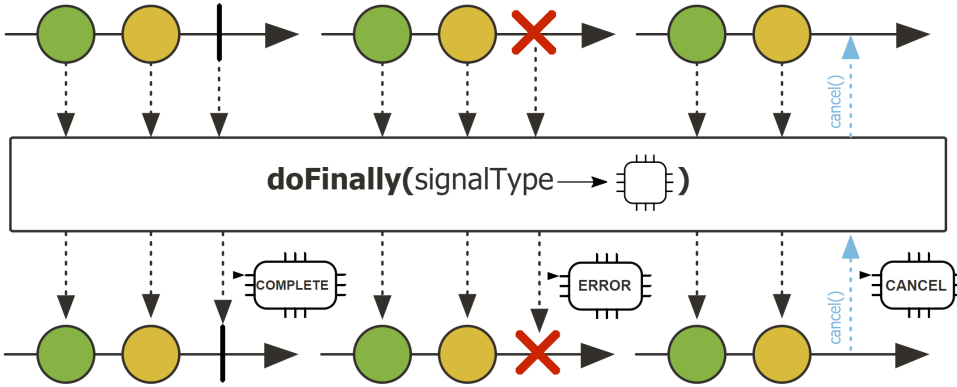
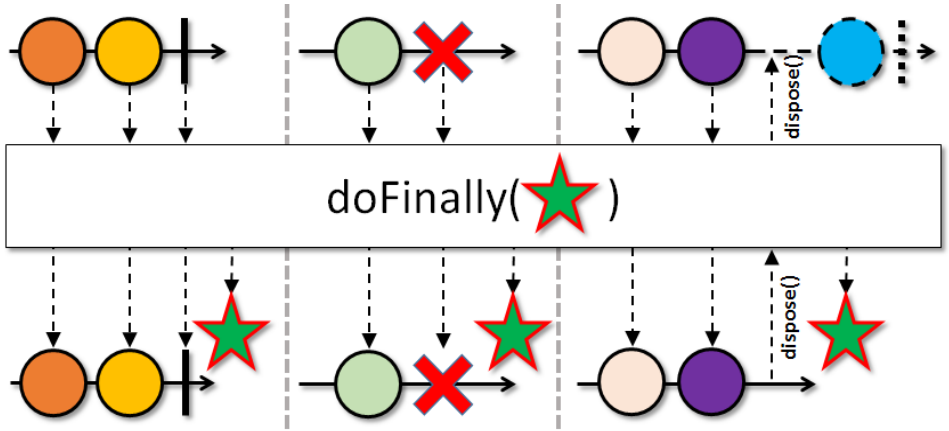



```
Scheduler subscriber = Schedulers.newParallel("subscriber", 1);
return Flux
   .create(makeAsyncFluxSink())
   ...
   .publishOn(subscriber)
   ...
   .doFinally(___ -> subscriber.dispose()) ...
```

This callback disposes the subscriber thread

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
  - Does not operate by default on a particular Scheduler
  - RxJava's operator Observable .doFinally() works the same



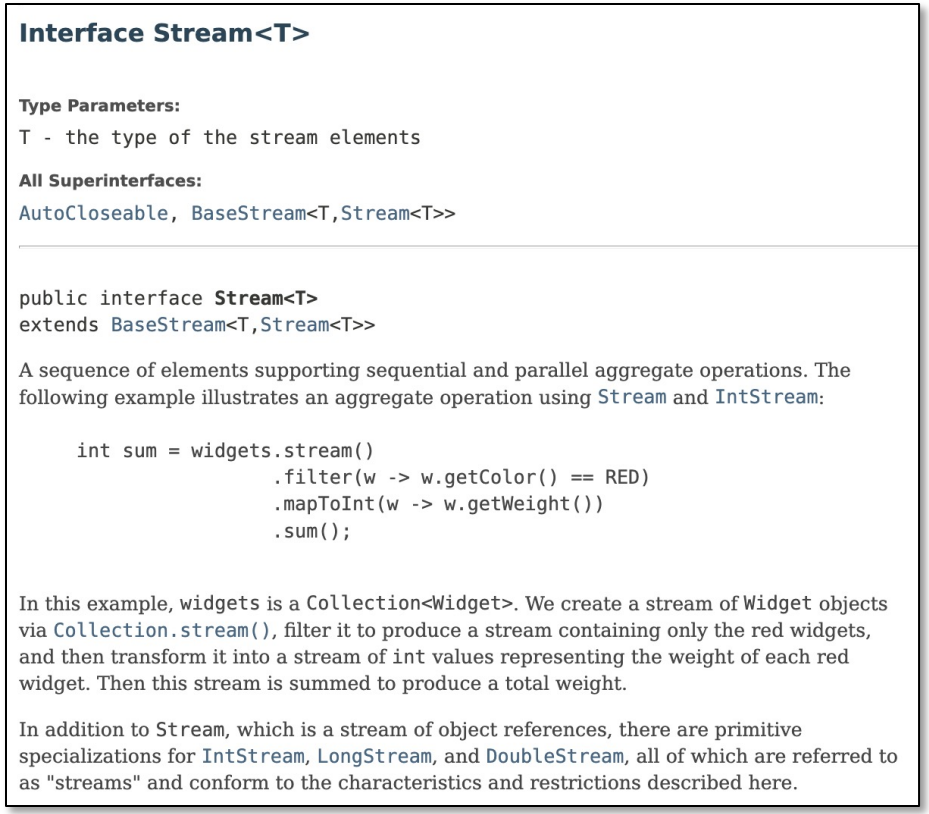

```
Observable
    .create(ObservableEx::emitAsync)
    .observeOn(Schedulers.newThread()) ...
    .doFinally(() -> BigFractionUtils.display(sb.toString()))
```

Print BigIntegers to aid debugging

See reactivex.io/RxJava/3.x/javadoc/io/reactivex/rxjava3/core/Observable.html#doFinally

Key Action Operators in the Flux Class

- The doFinally() operator
  - Add a behavior triggered after the Flux terminates for any reason
  - Does not operate by default on a particular Scheduler
  - RxJava's operator Observable .doFinally() works the same
- The Java Streams framework has no operations like doFinally()
  - Any cleanup can be done after the stream's terminal operation completes synchronously



Interface Stream<T>

Type Parameters:

`T` - the type of the stream elements

All Superinterfaces:

`AutoCloseable`, `BaseStream<T,Stream<T>>`

```
public interface Stream<T>
extends BaseStream<T,Stream<T>>
```

A sequence of elements supporting sequential and parallel aggregate operations. The following example illustrates an aggregate operation using `Stream` and `IntStream`:

```
int sum = widgets.stream()
                 .filter(w -> w.getColor() == RED)
                 .mapToInt(w -> w.getWeight())
                 .sum();
```

In this example, `widgets` is a `Collection<Widget>`. We create a stream of `Widget` objects via `Collection.stream()`, filter it to produce a stream containing only the red widgets, and then transform it into a stream of `int` values representing the weight of each red widget. Then this stream is summed to produce a total weight.

In addition to `Stream`, which is a stream of object references, there are primitive specializations for `IntStream`, `LongStream`, and `DoubleStream`, all of which are referred to as "streams" and conform to the characteristics and restrictions described here.

See docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html

Key Action Operators in the Flux Class

- The doOnComplete() operator
  - Add behavior triggered when the Flux completes successfully

```
Flux<T> doOnComplete
            (Runnable onComplete)
```

See projectreactor.io/docs/core/release/api/reactor/core/publisher/Flux.html#doOnComplete

Key Action Operators in the Flux Class

- The doOnComplete() operator
  - Add behavior triggered when the Flux completes successfully
    - The parameter is called when the Flux signals onComplete()
      - Runnable is a functional interface

```
Flux<T> doOnComplete
        (Runnable onComplete)
```

Interface Runnable

All Known Subinterfaces:

RunnableFuture<V>, RunnableScheduledFuture<V>

All Known Implementing Classes:

AsyncBoxView.ChildState, ForkJoinWorkerThread, FutureTask, RenderableImageProducer, SwingWorker, Thread, TimerTask

Functional Interface:

This is a functional interface and can therefore be used as the assignment target for a lambda expression or method reference.

```
@FunctionalInterface
public interface Runnable
```

The Runnable interface should be implemented by any class whose instances are intended to be executed by a thread. The class must define a method of no arguments called run.

This interface is designed to provide a common protocol for objects that wish to execute code while they are active. For example, Runnable is implemented by class Thread. Being active simply means that a thread has been started and has not yet been stopped.

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

Key Action Operators in the Flux Class

- The doOnComplete() operator
  - Add behavior triggered when the Flux completes successfully
    - The parameter is called when the Flux signals onComplete()
      - Runnable is a functional interface
        - i.e., it's a callback that only has side-effects

```
Flux<T> doOnComplete
        (Runnable onComplete)
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See en.wikipedia.org/wiki/Callback_(computer_programming)

Key Action Operators in the Flux Class

- The doOnComplete() operator
  - Add behavior triggered when the Flux completes successfully
    - The parameter is called when the Flux signals onComplete()
      - Runnable is a functional interface
    - onComplete() is only called on successful completion, but not when errors occur

```
Flux<T> doOnComplete
        (Runnable onComplete)
```

Contrast this doOnComplete() behavior with the doFinally() behavior

Key Action Operators in the Flux Class

- The doOnComplete() operator
  - Add behavior triggered when the Flux completes successfully
    - The parameter is called when the Flux signals onComplete()
    - Returns the new Flux instance

```
Flux<T> doOnComplete
        (Runnable onComplete)
```

Can't change the type or the value of elements it processes

Key Action Operators in the Flux Class

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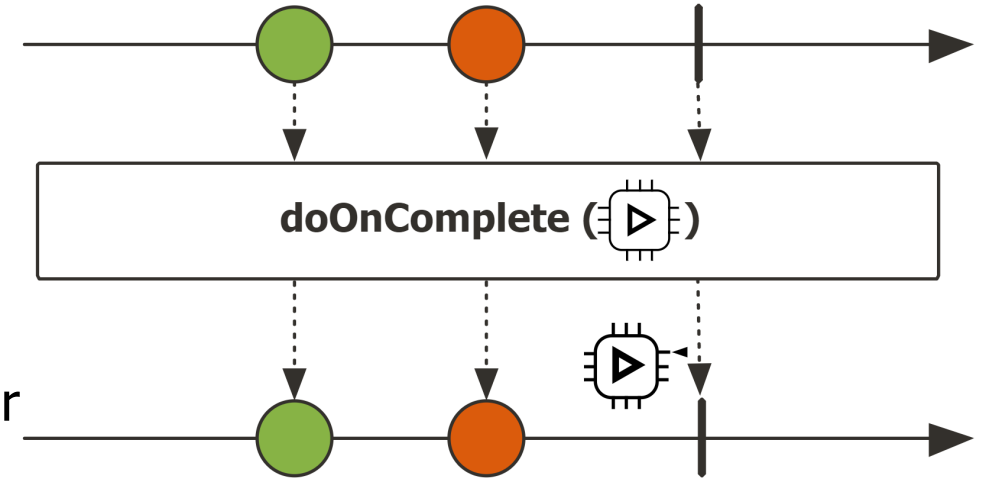

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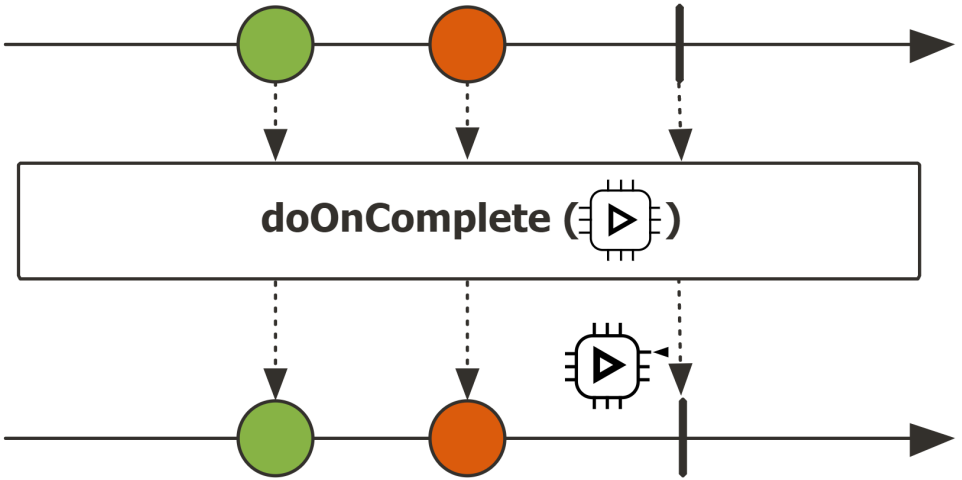


```
Flux
   .create(makeAsyncFluxSink())
   ...
   .map(bigInt -> FluxEx.checkIfPrime(bigInt, sb))
   .doOnComplete(() -> BigFractionUtils.display(sb.toString()))
   ...
```

Print BigIntegers when Flux stream completes successfully

See Reactive/flux/ex2/src/main/java/FluxEx.java

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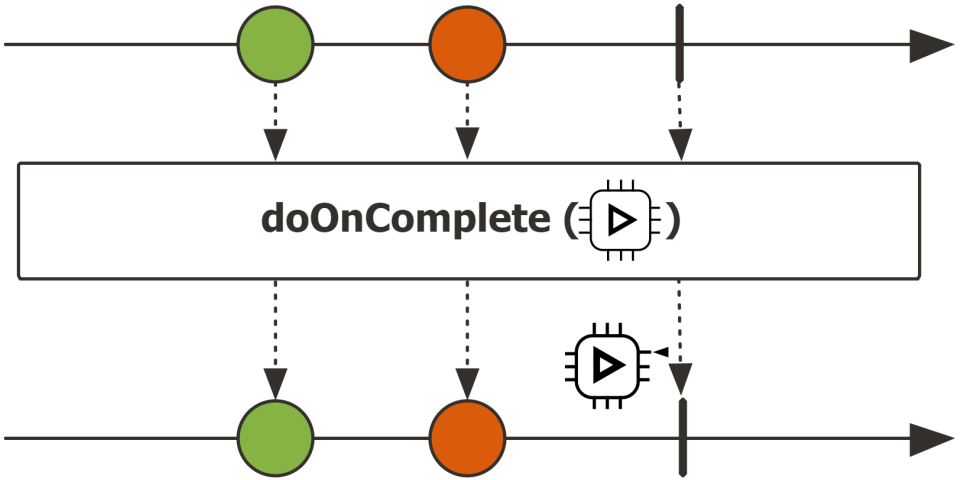


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```

Only a "side-effect"

See Reactive/flux/ex2/src/main/java/FluxEx.java

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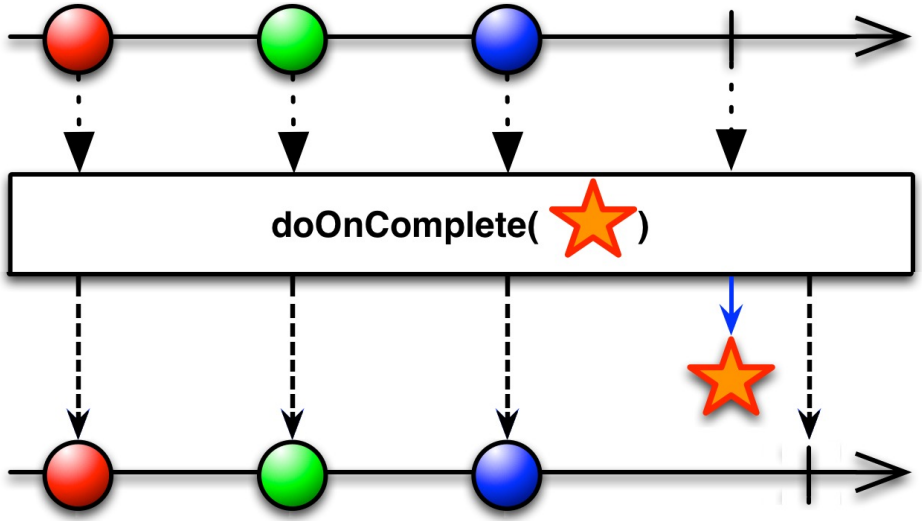


```
Observable
   .create(ObservableEx::emitInterval)
   .map(bigInt -> ObservableEx.checkIfPrime(bigInt, sb))
   .doOnComplete(() -> BigFractionUtils.display(sb.toString()))
   ...
```

Print BigIntegers when Observable stream completes successfully

See reactivex.io/RxJava/3.x/javadoc/io/reactivex/rxjava3/core/Observable.html#doOnComplete

End of Key Action Operators in the Flux Class (Part 2)