Key Transforming Operators in the Flux Class (Part 1)

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Learning Objectives in this Part of the Lesson

- Recognize key Flux operators
  - Factory method operators
  - Transforming operators
    - Transform the values and/or types emitted by a Flux
      - e.g., map() & mapNotNull()

Key Transforming Operators in the Flux Class

Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux

```
<V> Flux<V> map
   (Function<? super T, ? extends V>
    mapper)
```

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

Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item

```
<V> Flux<V> map
  (Function<? super T, ? extends V>
   mapper)
```

Interface Function<T,R>

Type Parameters:

T - the type of the input to the function

R - the type of the result of the function

All Known Subinterfaces:

UnaryOperator<T>

Functional Interface:

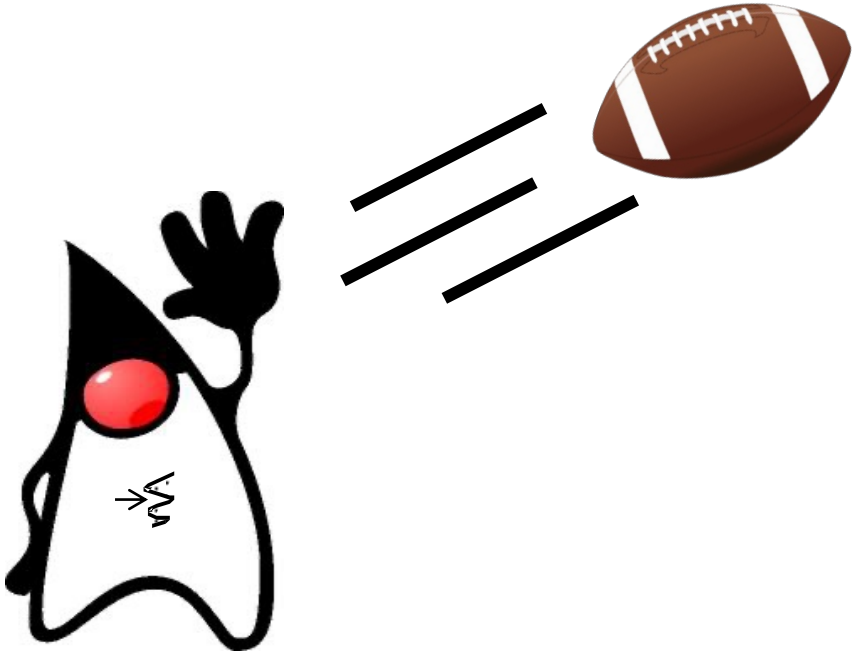
This is a functional interface and can therefore be used as the assignment target for a lambda expression or method reference.

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

Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
      - map() can terminate if mapper throws an exception

```
<V> Flux<V> map
  (Function<? super T, ? extends V>
   mapper)
```



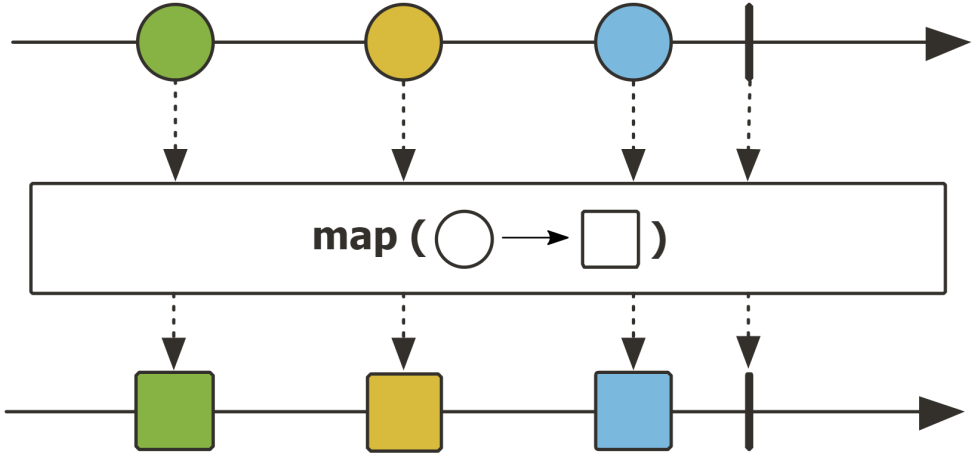
Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
    - Returns a transformed Flux

```
<V> Flux<V> map
   (Function<? super T, ? extends V>
    mapper)
```

Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items must match the # of input items



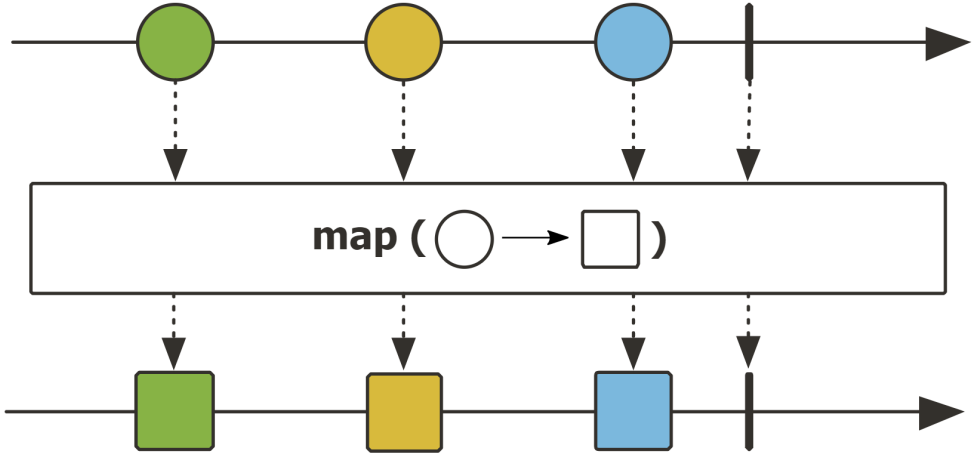

```
Flux
   .fromIterable
     (bigFractionList)
   ...
   .map(fraction -> fraction
        .multiply(sBigReducedFrac))
   ...
```

Multiply each element in the Flux stream by a constant

See Reactive/flux/ex1/src/main/java/FluxEx.java

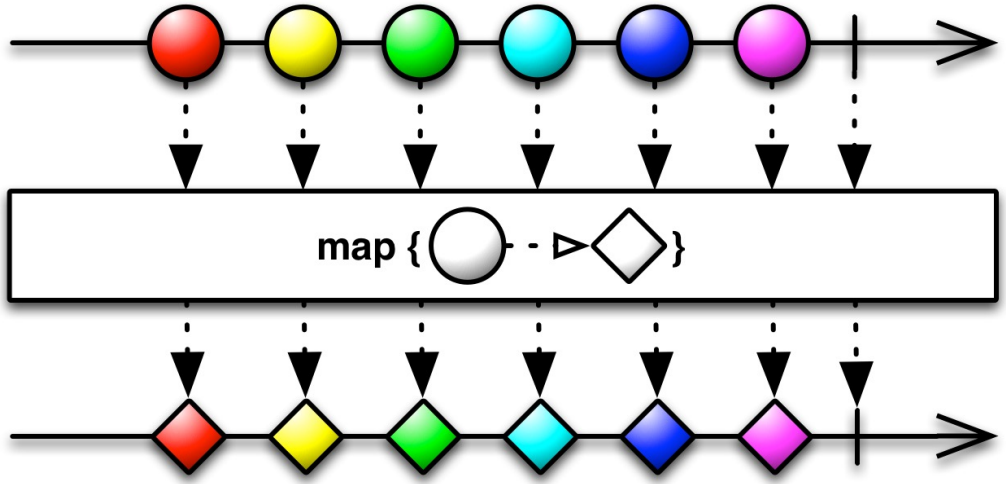
Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items must match the # of input items
    - map() can transform the type and/or value of elements it processes



Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items must match the # of input items
  - RxJava's Observable.map() operator works the same




```
Observable
   .fromIterable(bigFractionList)
   ...
   .map(fraction -> fraction
         .multiply(sBigReducedFrac))
   ...
```

Multiply each element in the Observable stream by a constant

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

Key Transforming Operators in the Flux Class

- The map() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items must match the # of input items
  - RxJava's Observable.map() operator works the same
  - Similar to Stream.map() in Java Streams

map

```
<R> Stream<R> map(Function<? super T,? extends R> mapper)
```

Returns a stream consisting of the results of applying the given function to the elements of this stream.

This is an intermediate operation.

Type Parameters:

`R` - The element type of the new stream

Parameters:

`mapper` - a non-interfering, stateless function to apply to each element

```
List<String> collect = List
   .of("a", "b", "c").stream()
   .map(String::toUpperCase).toList();
```

Uppercase strings & collect into a List

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

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux

```
<V> Flux<V> mapNotNull
   (Function<? super T, ? extends V>
    mapper)
```

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

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item

```
<V> Flux<V> mapNotNull
  (Function<? super T, ? extends V>
   mapper)
```

Interface Function<T,R>

Type Parameters:

T - the type of the input to the function

R - the type of the result of the function

All Known Subinterfaces:

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Functional Interface:

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

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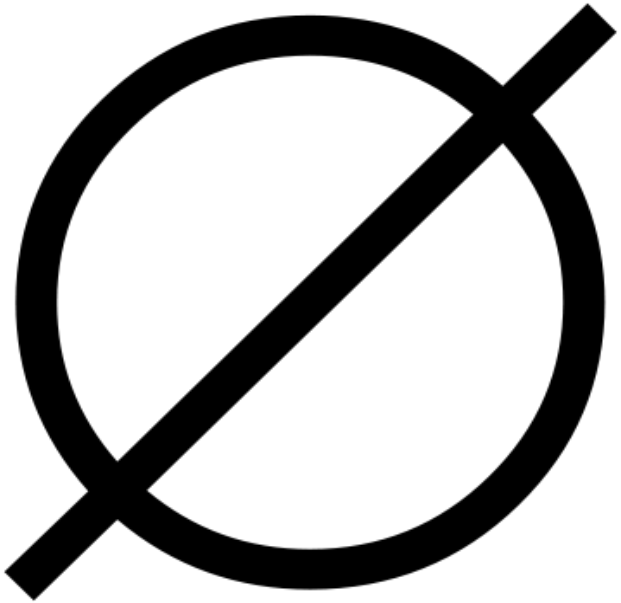
Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
      - It's possible for a mapper function to produce null values

```
<V> Flux<V> mapNotNull
  (Function<? super T, ? extends V>
   mapper)
```



Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
      - It's possible for a mapper function to produce null values
        - However, these null values are not emitted

```
<V> Flux<V> mapNotNull
    (Function<? super T, ? extends V>
     mapper)
```

Key Transforming Operators in the Flux Class

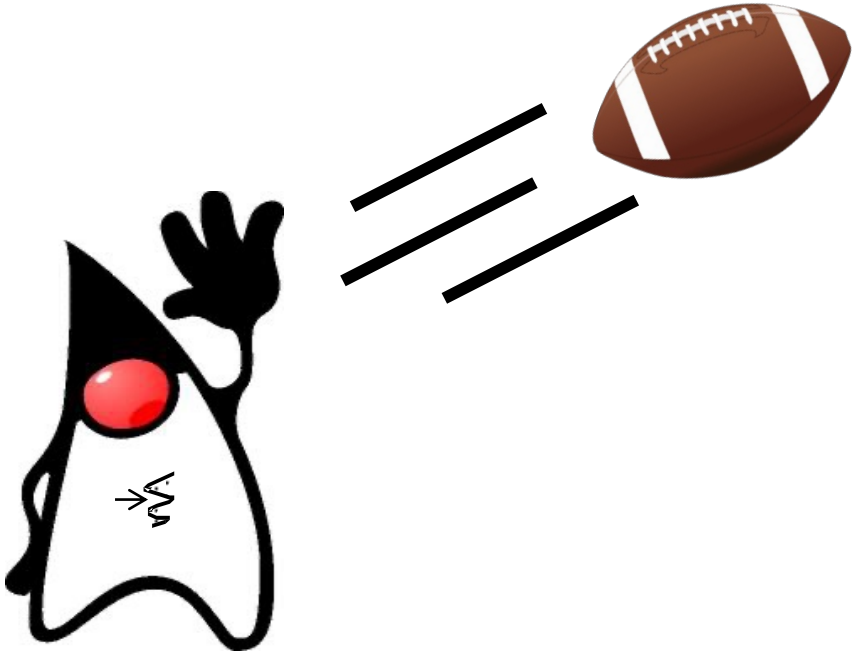
- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
      - It's possible for a mapper function to produce null values
        - These null values are not emitted
      - Behaves like map(Function) followed by filter(Predicate)
        - However, null is not a supported value, so it can't be filtered out

```
<V> Flux<V> mapNotNull
  (Function<? super T, ? extends V>
   mapper)
```

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
      - It's possible for a mapper function to produce null values
      - mapNotNull() can terminate if mapper throws an exception

```
<V> Flux<V> mapNotNull
  (Function<? super T, ? extends V>
   mapper)
```



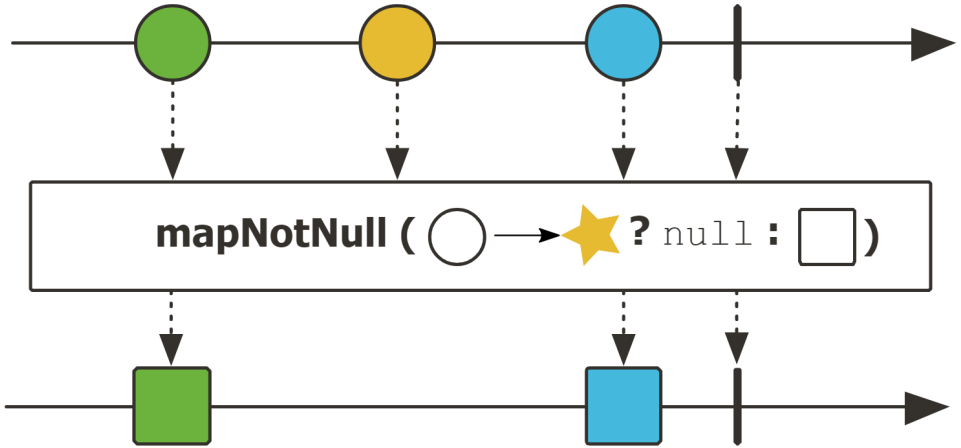
Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
    - Applies a synchronous function to transform each item
    - Returns a transformed Flux that emits no nulls

```
<V> Flux<V> mapNotNull
    (Function<? super T, ? extends V>
     mapper)
```

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items may *not* match the # of input items



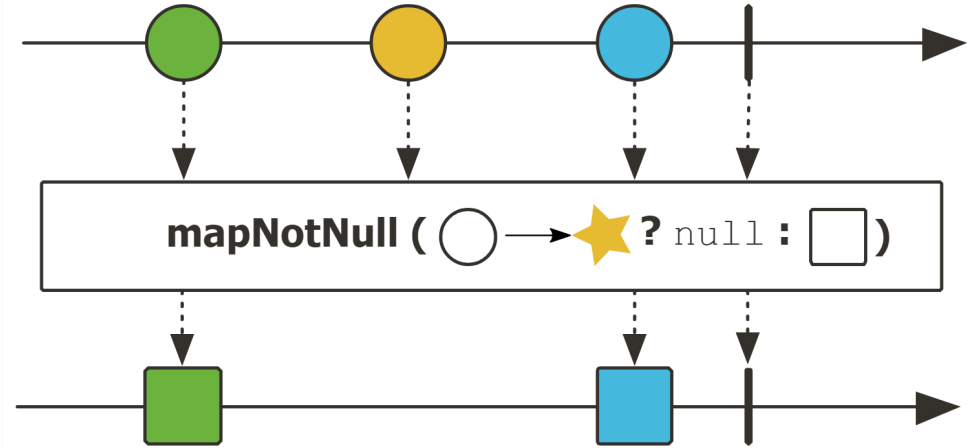

```
Flux
   .just(BigFraction
            .valueOf(100, 3),
         BigFraction
            .valueOf(100, 10))
   .mapNotNull(bf -> bf
      .equals(BigFraction.TEN)
      ? null : bf)
   ...
```

Return null if bf equals 10, which is then ignored

See Reactive/flux/ex1/src/main/java/FluxEx.java

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items may *not* match the # of input items
    - mapNotNull() can transform the type and/or value of elements it processes



Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items may *not* match the # of input items
  - RxJava's Observable lacks a mapNotNull() operator

See github.com/ReactiveX/RxJava/issues/4644

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items may *not* match the # of input items
  - RxJava's Observable lacks a mapNotNull() operator
    - Java Optional can be used in this case

```
return Observable
   .fromCallable(() -> url)

   .subscribeOn(Schedulers.io())

   .map(__ -> Optional
        .ofNullable(download(url)))

   .filter(Optional::isPresent)

   .map(Optional::get);
```

See joshfein.medium.com/handling-null-in-rxjava-2-0-10abd72afa0b

Key Transforming Operators in the Flux Class

- The mapNotNull() operator
  - Transform the item(s) emitted by this Flux
  - The # of output items may *not* match the # of input items
  - RxJava's Observable lacks a mapNotNull() operator
    - Java Optional can be used in this case
    - RxJava transformers can also be used

```
static <T, R>
ObservableTransformer<T, R>
mapNotNull(Function<? super T,
                    ? extends R>
           mapper) {
  return upstream -> upstream
    .flatMap(it -> {
      R result = mapper.apply(it);
      if (result == null)
        return Observable.empty();
      else
        return Observable
          .just(result);
    });
}
```

See reactivex.io/RxJava/3.x/javadoc/io/reactivex/rxjava3/core/ObservableTransformer.html

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  - RxJava's Observable lacks a mapNotNull() operator
    - Java Optional can be used in this case
    - RxJava transformers can also be used

```
Observable<Image> downloadImage
    (URL url) {
  return Observable
    .fromCallable(() -> url)

    .subscribeOn(Schedulers.io())

    .compose(mapNotNull
                (this::download));
}
```

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

End of Key Transforming Operators in the Flux Class (Part 1)