Key Factory Method Operators in the Flowable Class (Part 1)

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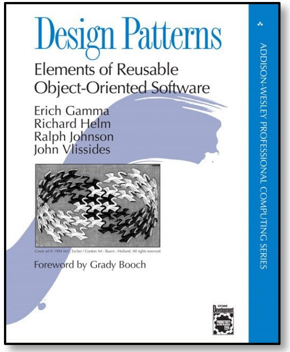
Learning Objectives in this Part of the Lesson

- Recognize key operators defined in—or used with—Flowable
  - Factory method operators
    - These operators create Flowable streams in various ways
      - e.g., create()



Design Patterns

Elements of Reusable Object-Oriented Software

Erich Gamma
Richard Helm
Ralph Johnson
John Vlissides

Foreword by Grady Booch

ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES

See en.wikipedia.org/wiki/Factory_method_pattern

Key Factory Method Operators in the Flowable Class

Key Factory Method Operators in the Flowable Class

- The create() operator
  - Bridges the reactive world with the callback-style, non-back-pressure-aware world

```
static <T> Flowable<T> create
   (FlowableOnSubscribe<T> source,
    BackpressureStrategy mode)
```

See reactivex.io/RxJava/3.x/javadoc/io/reactivex/rxjava3/core/Flowable.html#create

Key Factory Method Operators in the Flowable Class

- The create() operator
  - Bridges the reactive world with the callback-style, non-back-pressure-aware world
    - The FlowableOnSubscribe() subscribe() method receives an FlowableEmitter instance

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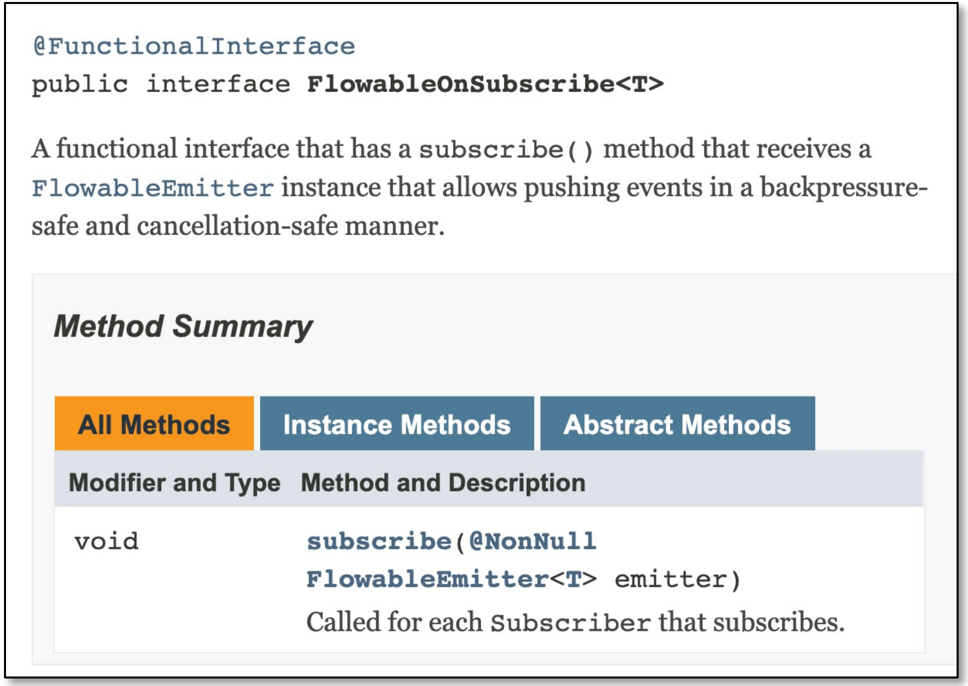

```
@FunctionalInterface
public interface FlowableOnSubscribe<T>
```

A functional interface that has a `subscribe()` method that receives a `FlowableEmitter` instance that allows pushing events in a backpressure-safe and cancellation-safe manner.

Method Summary

Modifier and Type	Method and Description
`void`	`subscribe(@NonNull FlowableEmitter<T> emitter)` Called for each `Subscriber` that subscribes.

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

Key Factory Method Operators in the Flowable Class

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    - The FlowableOnSubscribe() subscribe() method receives an FlowableEmitter instance
      - FlowableEmitter can emit events via onNext(), onError(), & onComplete()

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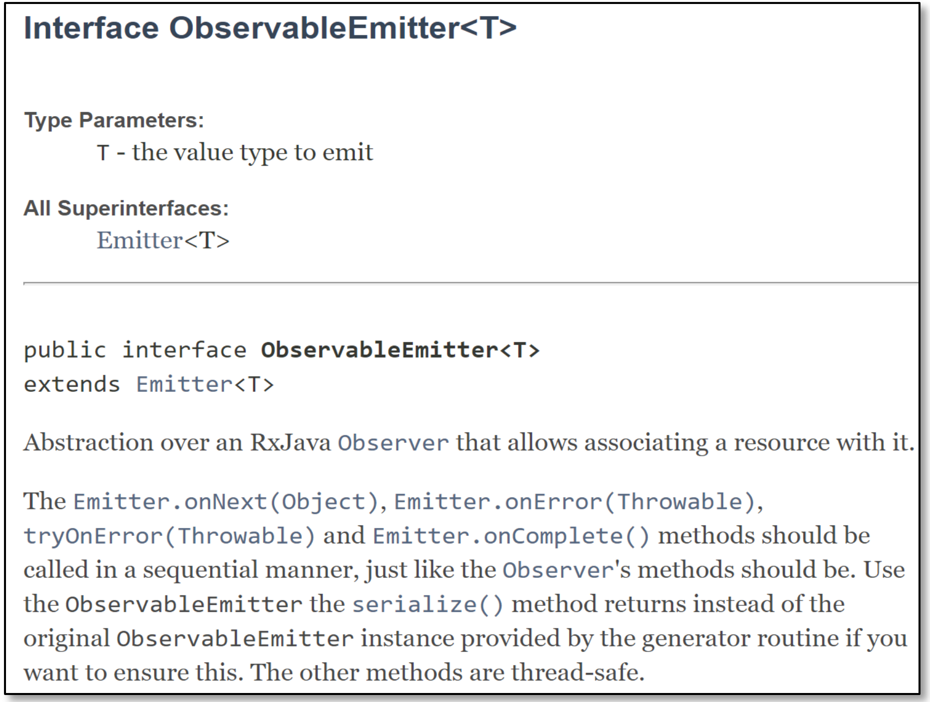

Interface ObservableEmitter<T>

Type Parameters:
T - the value type to emit

All Superinterfaces:
Emitter<T>

```
public interface ObservableEmitter<T>
extends Emitter<T>
```

Abstraction over an RxJava `Observer` that allows associating a resource with it.

The `Emitter.onNext(Object)`, `Emitter.onError(Throwable)`, `tryOnError(Throwable)` and `Emitter.onComplete()` methods should be called in a sequential manner, just like the `Observer`'s methods should be. Use the `ObservableEmitter` the `serialize()` method returns instead of the original `ObservableEmitter` instance provided by the generator routine if you want to ensure this. The other methods are thread-safe.

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

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    - The FlowableOnSubscribe() subscribe() method receives an FlowableEmitter instance
      - FlowableEmitter can emit events via onNext(), onError(), & onComplete()
      - Supports more dynamic use cases than the Flowable & Observable just() & fromIterable() operators

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static <T> Flowable<T> create
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```

See earlier lesson on "*Key Factory Method Operators in the Observable Class (Part 1)*"

Key Factory Method Operators in the Flowable Class

- The create() operator
  - Bridges the reactive world with the callback-style, non-back-pressure-aware world
    - The FlowableOnSubscribe() subscribe() method receives an FlowableEmitter instance
    - Defines the backpressure mode
      - Applied if the downstream Subscriber doesn't request (fast) enough

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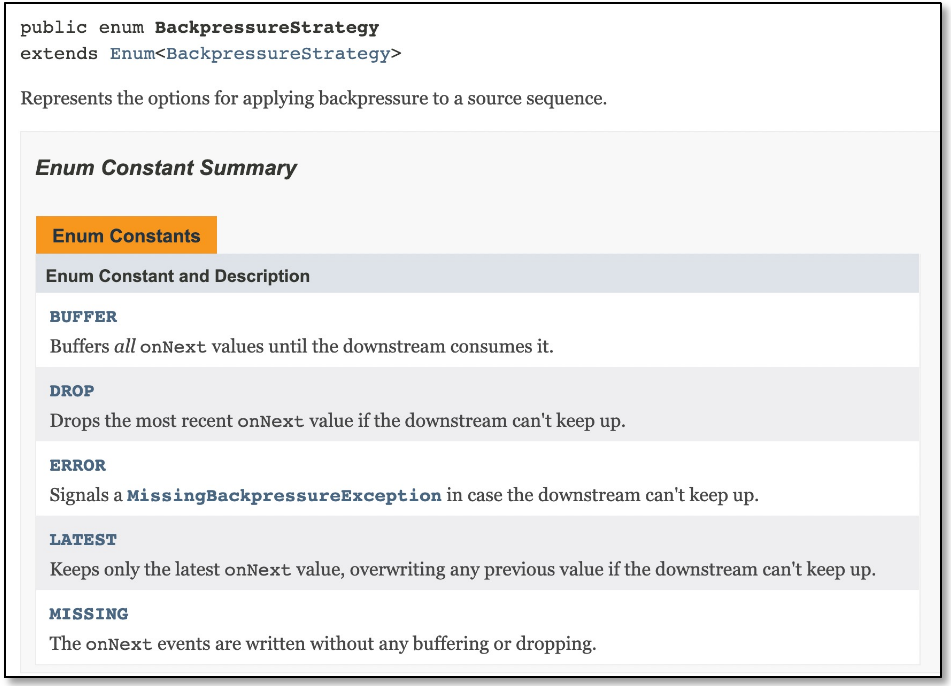

```
public enum BackpressureStrategy
extends Enum<BackpressureStrategy>
```

Represents the options for applying backpressure to a source sequence.

Enum Constant Summary

Enum Constants

Enum Constant and Description
BUFFER Buffers *all* onNext values until the downstream consumes it.
DROP Drops the most recent onNext value if the downstream can't keep up.
ERROR Signals a **MissingBackpressureException** in case the downstream can't keep up.
LATEST Keeps only the latest onNext value, overwriting any previous value if the downstream can't keep up.
MISSING The onNext events are written without any buffering or dropping.

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

Key Factory Method Operators in the Flowable Class

- The create() operator
  - Bridges the reactive world with the callback-style, non-back-pressure-aware world
    - The FlowableOnSubscribe() subscribe() method receives an FlowableEmitter instance
    - Defines the backpressure mode
    - Returns a 'cold' Flowable that emits elements from Flowable Emitter upon subscription

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See medium.com/tompee/rxjava-ninja-hot-and-cold-observables-19b30d6cc2fa

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    - The FlowableOnSubscribe() subscribe() method receives an FlowableEmitter instance
    - Defines the backpressure mode
    - Returns a 'cold' Flowable that emits elements from Flowable Emitter upon subscription
      - Subject to the BackpressureStrategy mode

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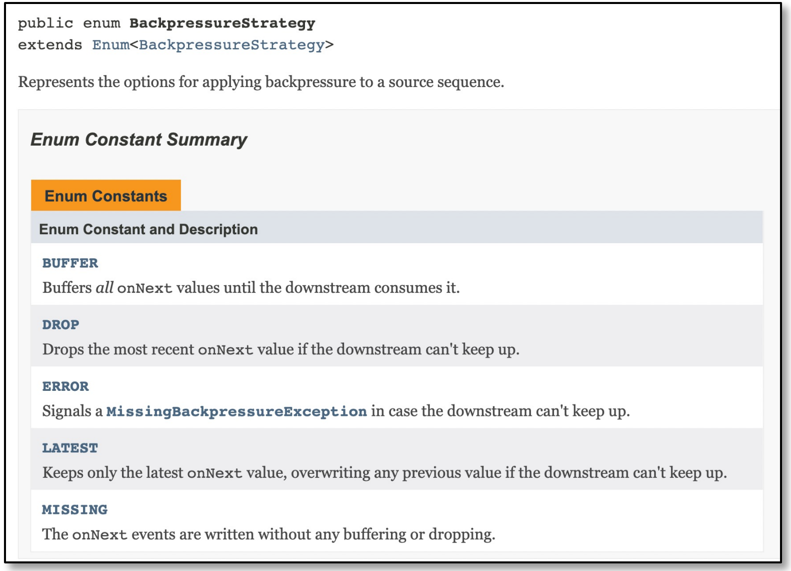

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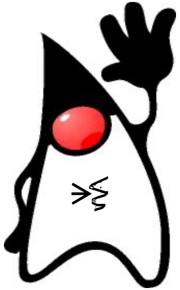
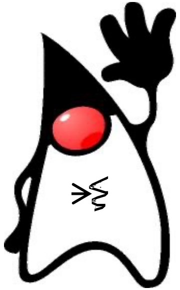
Key Factory Method Operators in the Flowable Class

- The create() operator
  - Bridges the reactive world with the callback-style, non-back-pressure-aware world
  - Elements can be emitted from one or more threads

```
return Flowable
  .create(emitter -> { Flowable
    .range(1, count)
    .subscribe(___ ->
        emitter.onNext(random
             .nextInt(maxValue)),
        emitter::onError,
        emitter::onComplete);
   }))
  ...
  .subscribeOn(scheduler);
```





See github.com/douglascraigschmidt/LiveLessons/tree/master/Reactive/Flowable/ex1

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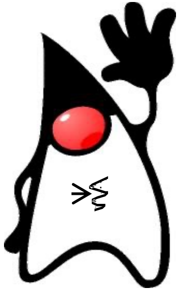
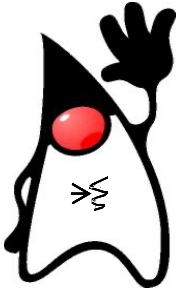
Rapidly generate 'count' events





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```
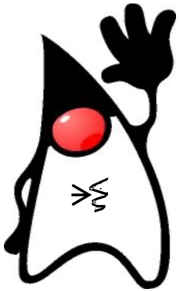
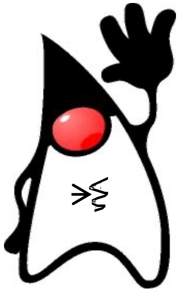

This emitter uses a background thread





Key Factory Method Operators in the Flowable Class

- The create() operator
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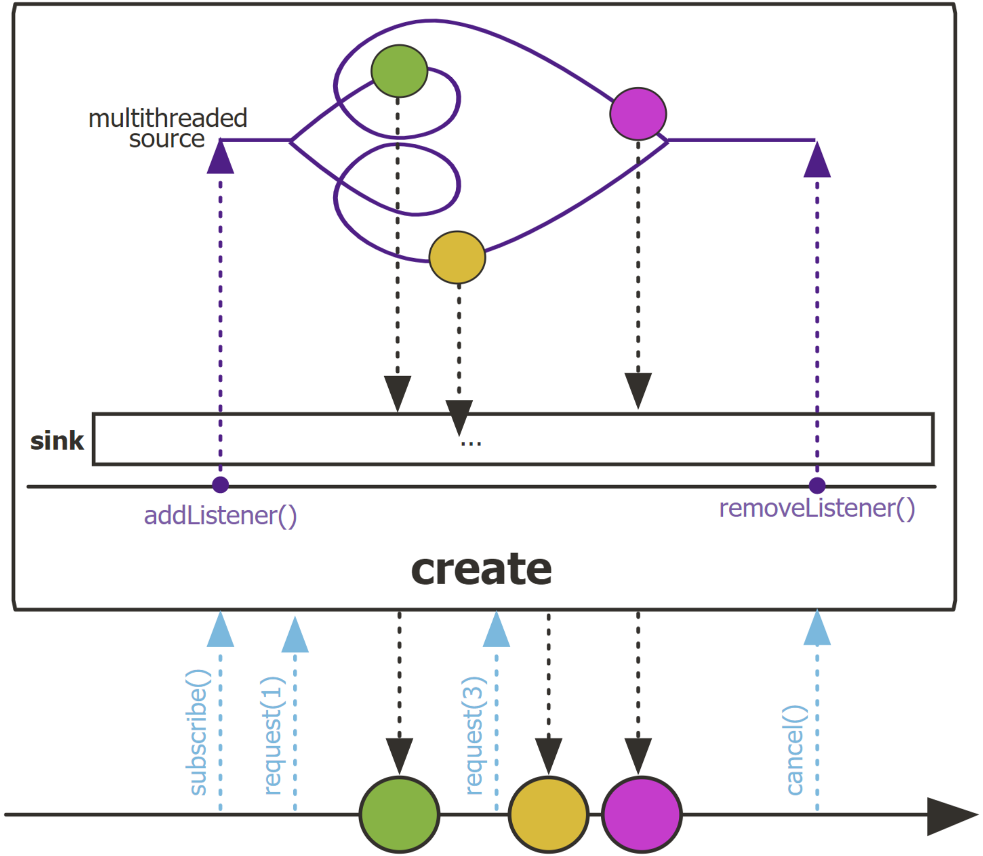
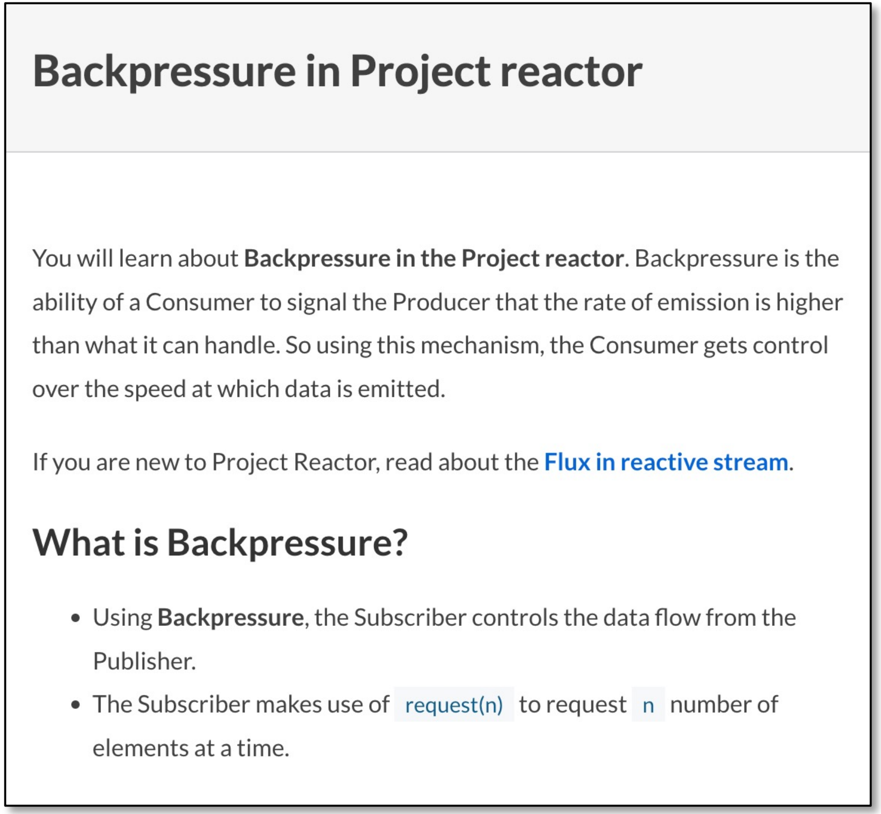
  - Elements can be emitted from one or more threads
  - Project Reactor's Flux.create() operator works in a similar way



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

Key Factory Method Operators in the Flowable Class

- The create() operator
  - Bridges the reactive world with the callback-style, non-back-pressure-aware world
  - Elements can be emitted from one or more threads
  - Project Reactor's Flux.create() operator works in a similar way
    - However, it supports backpressure-aware Publisher(s) & Subscriber(s), as well as backpressure strategies



Backpressure in Project reactor

You will learn about **Backpressure in the Project reactor**. Backpressure is the ability of a Consumer to signal the Producer that the rate of emission is higher than what it can handle. So using this mechanism, the Consumer gets control over the speed at which data is emitted.

If you are new to Project Reactor, read about the **Flux in reactive stream**.

What is Backpressure?

- Using **Backpressure**, the Subscriber controls the data flow from the Publisher.
- The Subscriber makes use of `request(n)` to request `n` number of elements at a time.

See jstobigdata.com/java/backpressure-in-project-reactor

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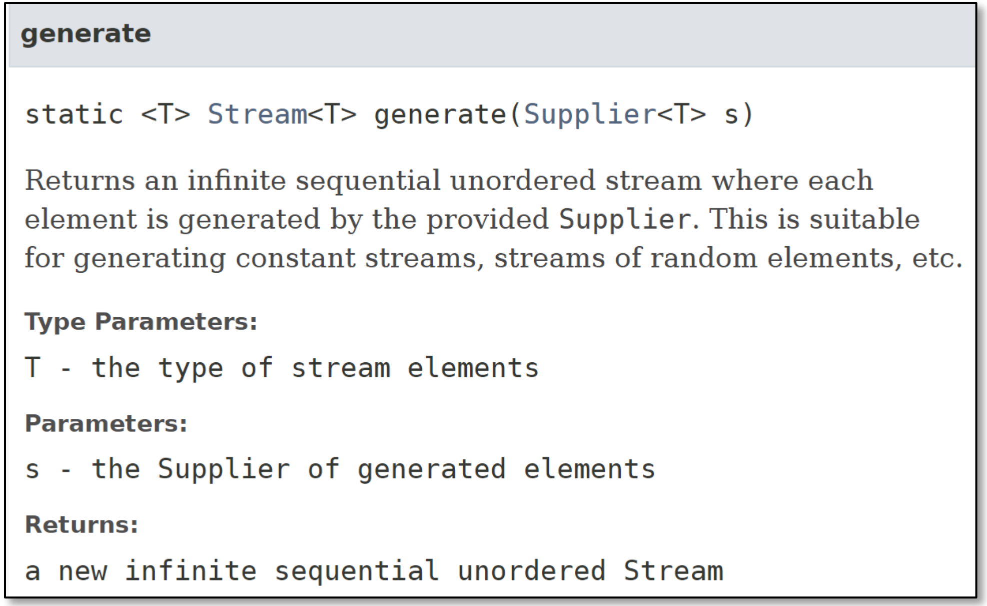
  - Project Reactor's Flux.create() operator works in a similar way
  - Java Streams generate() method doesn't support backpressure



generate

```
static <T> Stream<T> generate(Supplier<T> s)
```

Returns an infinite sequential unordered stream where each element is generated by the provided `Supplier`. This is suitable for generating constant streams, streams of random elements, etc.

Type Parameters:

`T - the type of stream elements`

Parameters:

`s - the Supplier of generated elements`

Returns:

`a new infinite sequential unordered Stream`

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

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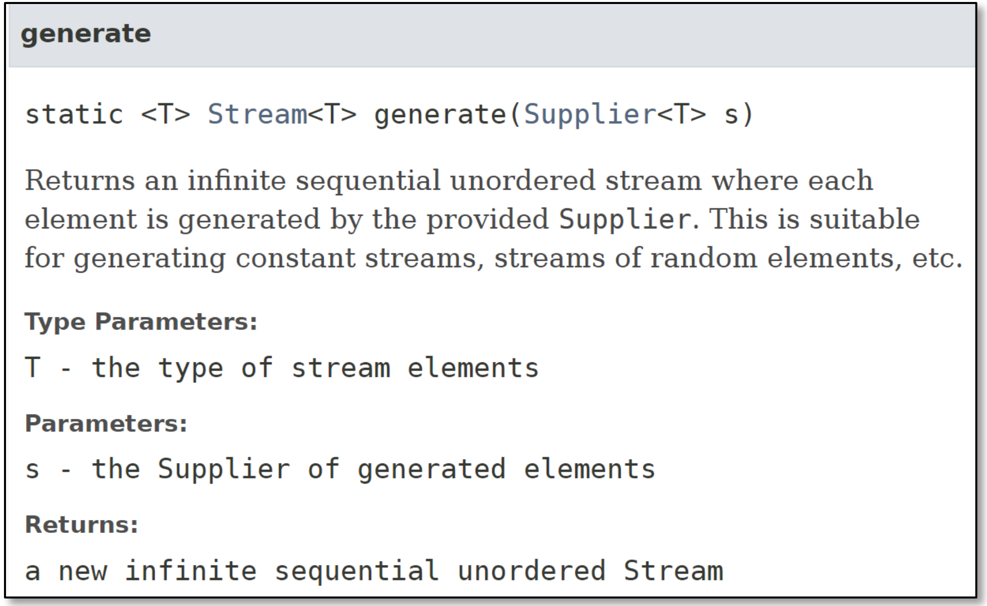
  - Elements can be emitted from one or more threads
  - Project Reactor's Flux.create() operator works in a similar way
  - Java Streams generate() method doesn't support backpressure
    - However, it is "pull-based" model rather than "push-based" pub/sub model, so backpressure support is not necessary



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End of Key Factory Method Operators in the Flowable Class (Part 1)