Java Streams: Implementing Non-Concurrent Collectors

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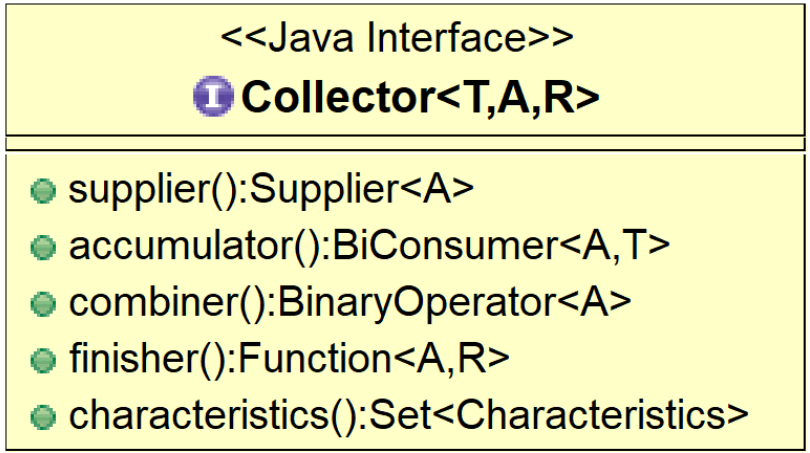
Learning Objectives in this Part of the Lesson

- Understand the structure & functionality of non-concurrent collectors for sequential streams
- Know how to implement a non-concurrent collector for sequential streams



Implementing a Non-Concurrent Collector

Implementing a Non-Concurrent Collector

- The Collector interface defines three generic types

<<Java Interface>>

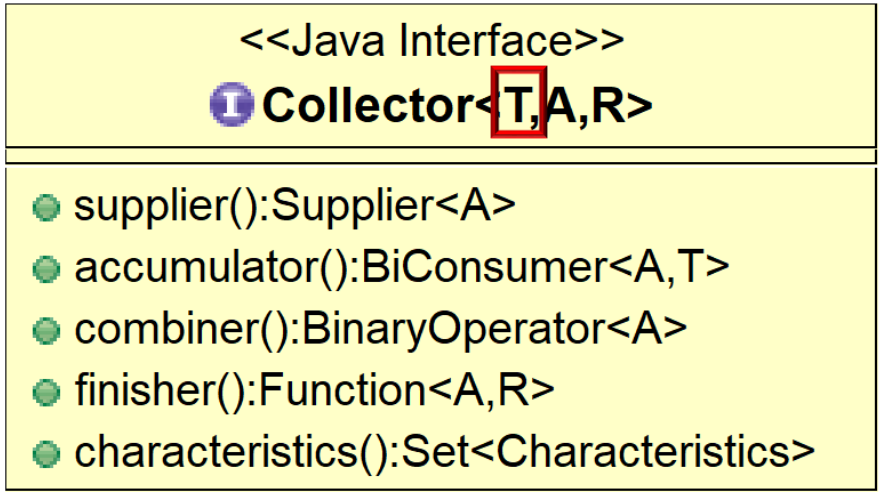
Collector<T,A,R>

- supplier():Supplier<A>
- accumulator():BiConsumer<A,T>
- combiner():BinaryOperator<A>
- finisher():Function<A,R>
- characteristics():Set<Characteristics>

See www.baeldung.com/java-8-collectors

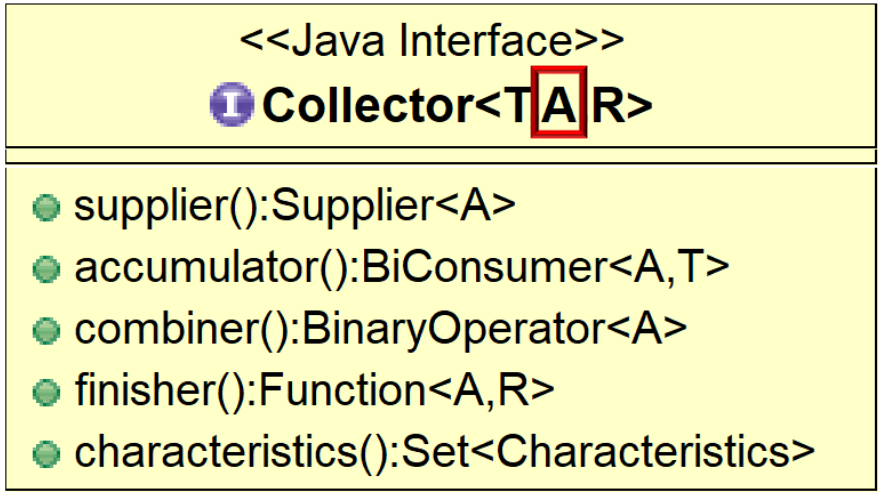
Implementing a Non-Concurrent Collector

- The Collector interface defines three generic types
  - **T** - The type of elements available in the stream
    - e.g., Long, String, SearchResults, etc.



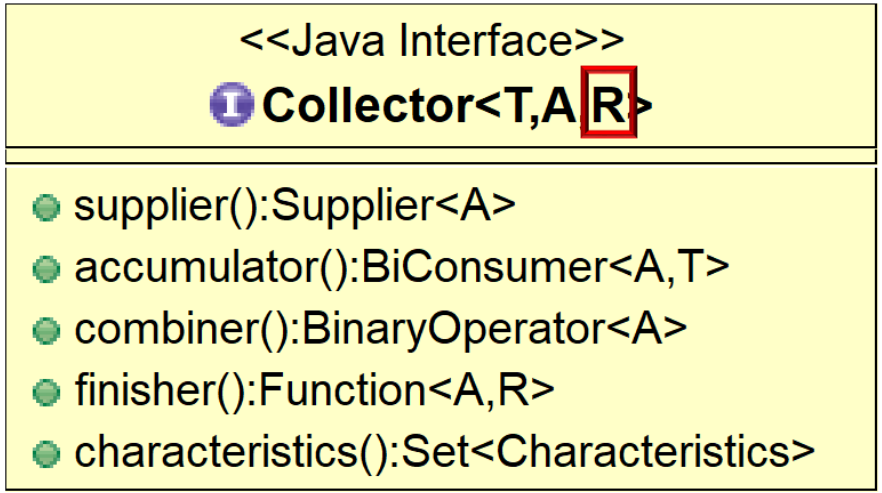
Implementing a Non-Concurrent Collector

- The Collector interface defines three generic types
  - T
  - **A** – The type of mutable accumulator object to use for collecting elements
    - e.g., List of T (implemented via ArrayList, LinkedList, etc.)



Implementing a Non-Concurrent Collector

- The Collector interface defines three generic types
  - T
  - A
  - **R** – The type of the final result
    - e.g., List of T



Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface

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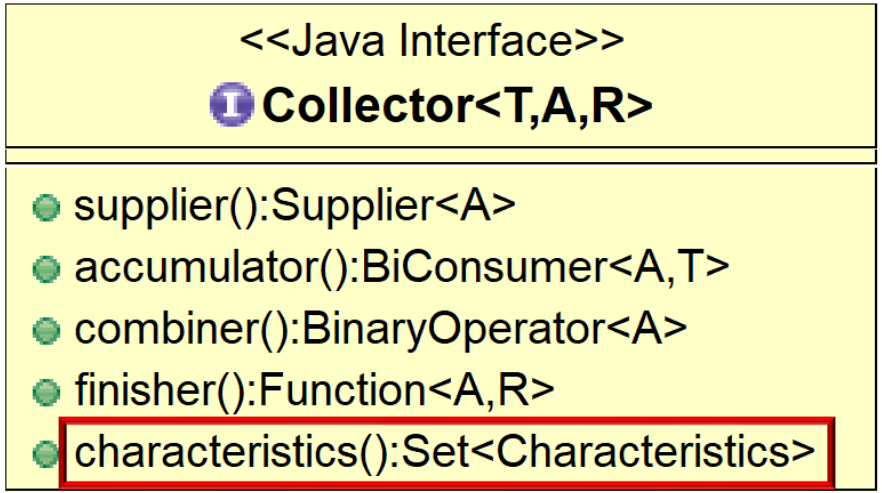
Again, this discussion assumes we're implementing a *non-concurrent* collector

Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface
  - **characteristics()** – provides a stream with additional information used for internal optimizations



Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface
  - **characteristics()** – provides a stream with additional information used for internal optimizations, e.g.
    - UNORDERED
      - The collector need not preserve the encounter order

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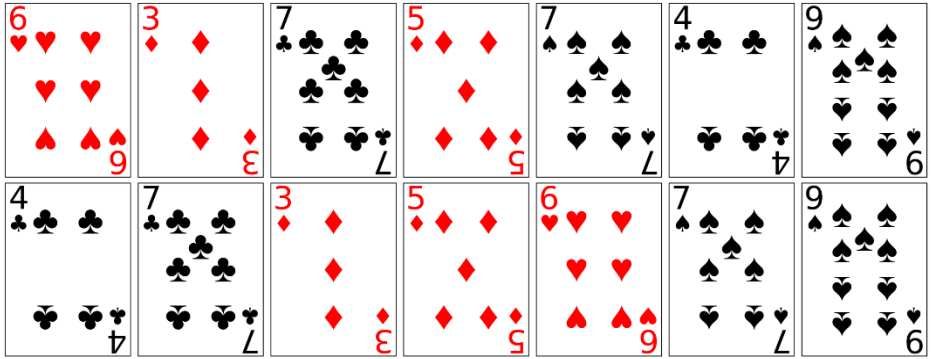

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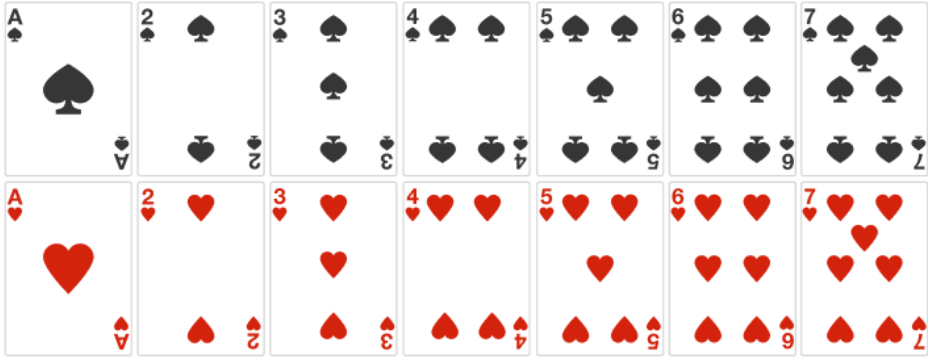

A collector may preserve encounter order if it incurs no additional overhead

Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface
  - **characteristics()** – provides a stream with additional information used for internal optimizations, e.g.
    - UNORDERED
    - IDENTITY_FINISH
      - The finisher() is the identity function so it can be a no-op
        - e.g., finisher() just returns null

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- Five factory methods are defined in the Collector interface
  - **characteristics()** – provides a stream with additional information used for internal optimizations, e.g.
    - UNORDERED
    - IDENTITY_FINISH
    - CONCURRENT
      - The accumulator() method is called concurrently on the result container

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The mutable result container must be synchronized!!

Implementing a Non-Concurrent Collector

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    - UNORDERED
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We're focusing on a non-concurrent collector, which doesn't enable CONCURRENT

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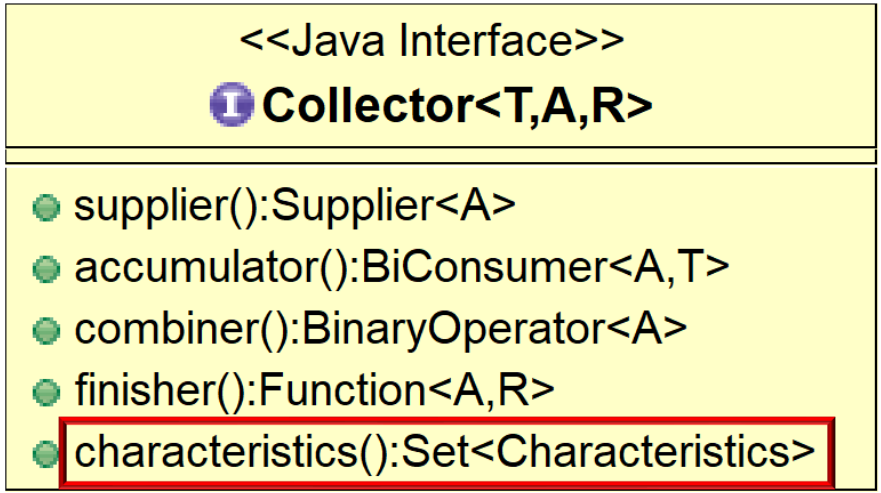


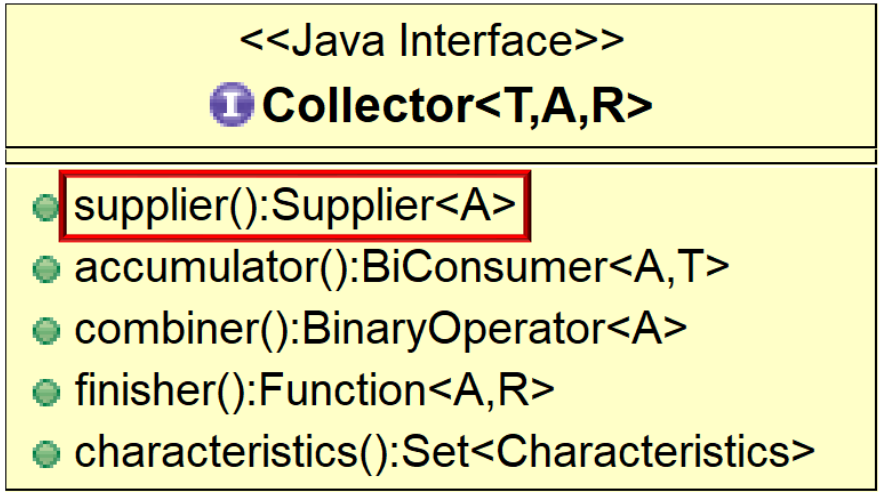
Any/all characteristics can be set using EnumSet.of()

```
Set characteristics() {
  return Collections.unmodifiableSet
    (EnumSet.of(Collector.Characteristics.CONCURRENT,
                Collector.Characteristics.UNORDERED,
                Collector.Characteristics.IDENTITY_FINISH));
}
```

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

Implementing a Non-Concurrent Collector

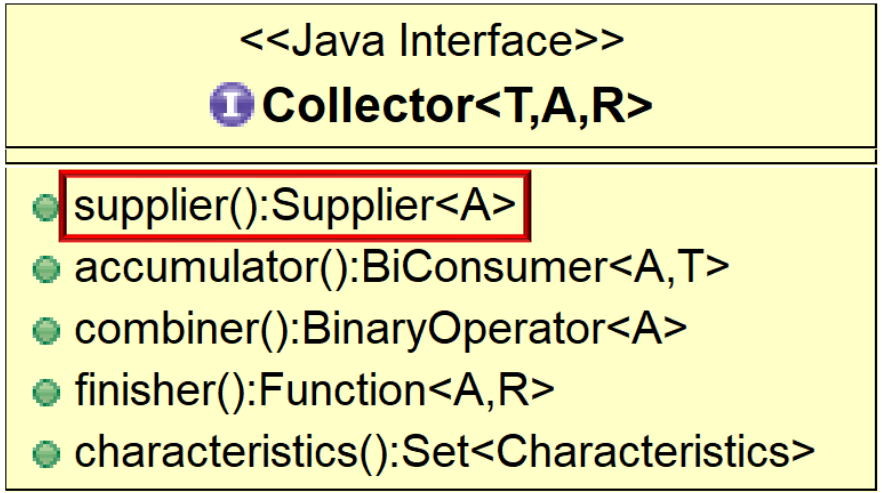
- Five factory methods are defined in the Collector interface
  - characteristics()
  - **supplier()** – returns a supplier that acts as a factory to generate an empty result container



Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface
  - characteristics()
  - **supplier()** – returns a supplier that acts as a factory to generate an empty result container, e.g.

```
Supplier<List> supplier() {
  return ArrayList::new;
}
```



Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface
  - characteristics()
  - supplier()
  - **accumulator()** – returns a bi-consumer that adds a new element to an existing result container, e.g.

```
BiConsumer<List, Integer> accumulator() {
  return List::add;
}
```

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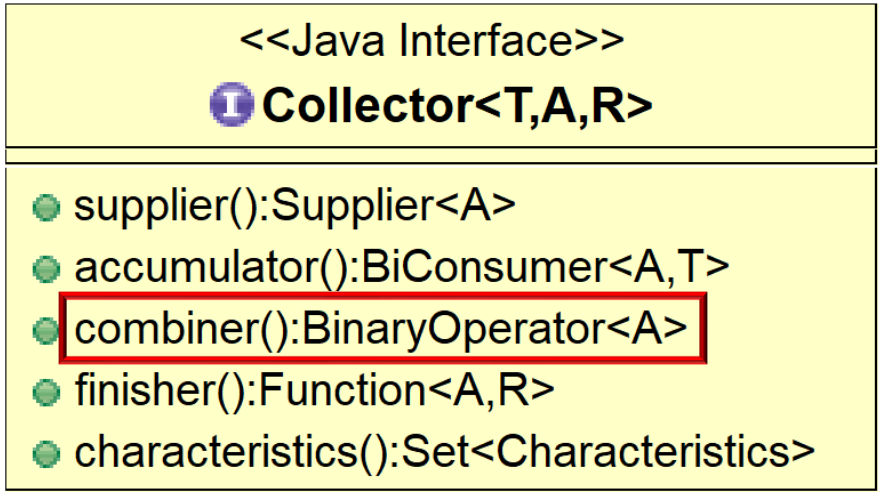
A non-concurrent collector needs no synchronization

Implementing a Non-Concurrent Collector

- Five factory methods are defined in the Collector interface
  - characteristics()
  - supplier()
  - accumulator()
  - **combiner()** – returns a binary operator that merges two result containers together, e.g.




```
BinaryOperator<List> combiner() {
  return (one, another) -> {
          one.addAll(another);
          return one;
  }};
```

This combiner() will not be called for a sequential stream..

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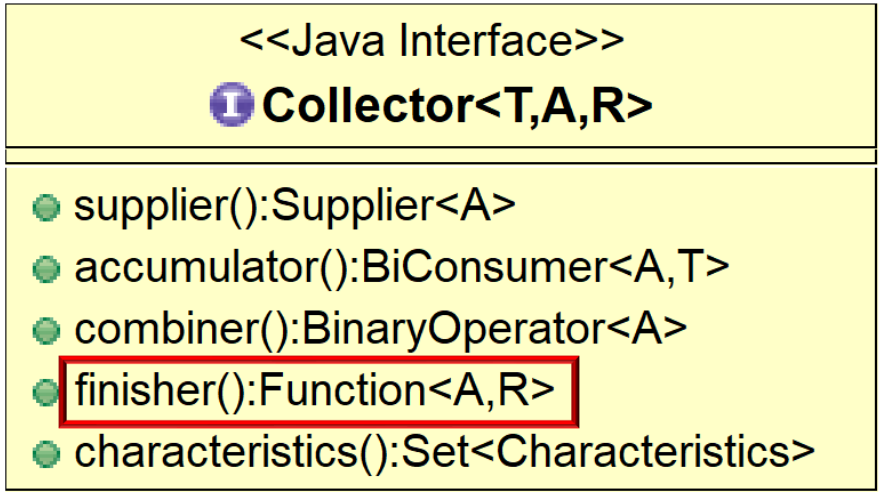
  - **supplier()**
  - **accumulator()**
  - **combiner()**
  - **finisher()** – returns a function that converts the result container to final result type, e.g.
    - `return Function.identity()`



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    - `return Function.identity()`
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Should be a no-op if IDENTITY_FINISH characteristic is set

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  - supplier()
  - accumulator()
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    - `return Function.identity()`
    - `return null;`

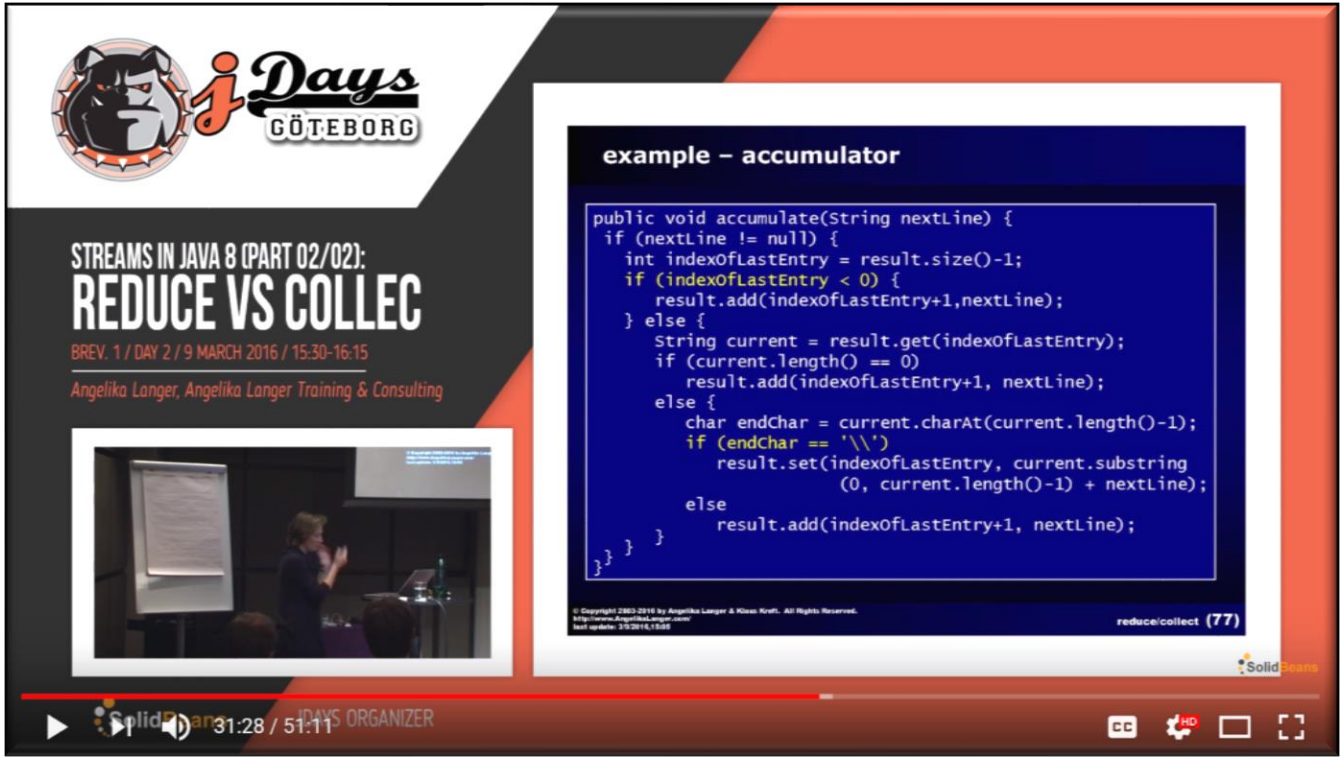
```
Stream
   .generate(() ->
      makeBigFraction
         (new Random(), false))
   .limit(sMAX_FRACTIONS)

   .map(reduceAndMultiplyFraction)
   .collect(FuturesCollector
            .toFuture())

   .thenAccept
      (this::sortAndPrintList);
```

finisher() can also be much more interesting!

See Java8/ex19/src/main/java/utils/FuturesCollector.java

Applying Non-Concurrent Collectors

- More information on implementing custom collectors is available online



See www.youtube.com/watch?v=H7VbRz9aj7c

End of Java Streams: Implementing Non-Concurrent Collectors