Understand Java Streams 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

Interface Collector<T,A,R>

Type Parameters:

`T` - the type of input elements to the reduction operation

`A` - the mutable accumulation type of the reduction operation (often hidden as an implementation detail)

`R` - the result type of the reduction operation

`public interface Collector<T,A,R>`

A mutable reduction operation that accumulates input elements into a mutable result container, optionally transforming the accumulated result into a final representation after all input elements have been processed. Reduction operations can be performed either sequentially or in parallel.

Examples of mutable reduction operations include: accumulating elements into a `Collection`; concatenating strings using a `StringBuilder`; computing summary information about elements such as sum, min, max, or average; computing "pivot table" summaries such as "maximum valued transaction by seller", etc. The class `Collectors` provides implementations of many common mutable reductions.

A `Collector` is specified by four functions that work together to accumulate entries into a mutable result container, and optionally perform a final transform on the result. They are:

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

Overview of Non-Concurrent Collectors

Overview of Non-Concurrent Collectors

- The collect() terminal operation uses a collector to accumulate stream elements into a mutable result container

```
void runCollectToList() {
  List<String> characters = Arrays
   .asList("horatio", "laertes",
           "Hamlet, ...);

  List<String> results =
    characters
      .stream()
      .filter(s ->
        toLowerCase(…) =='h')
      .map(this::capitalize)
      .sorted()
      .collect(toList()); ...
```

Collect the results into a ArrayList

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

Overview of Non-Concurrent Collectors

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  - Collector is defined by a generic interface

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  - Collector is defined by a generic interface
    - T – stream elements type
    - A – accumulator type
    - R – result type

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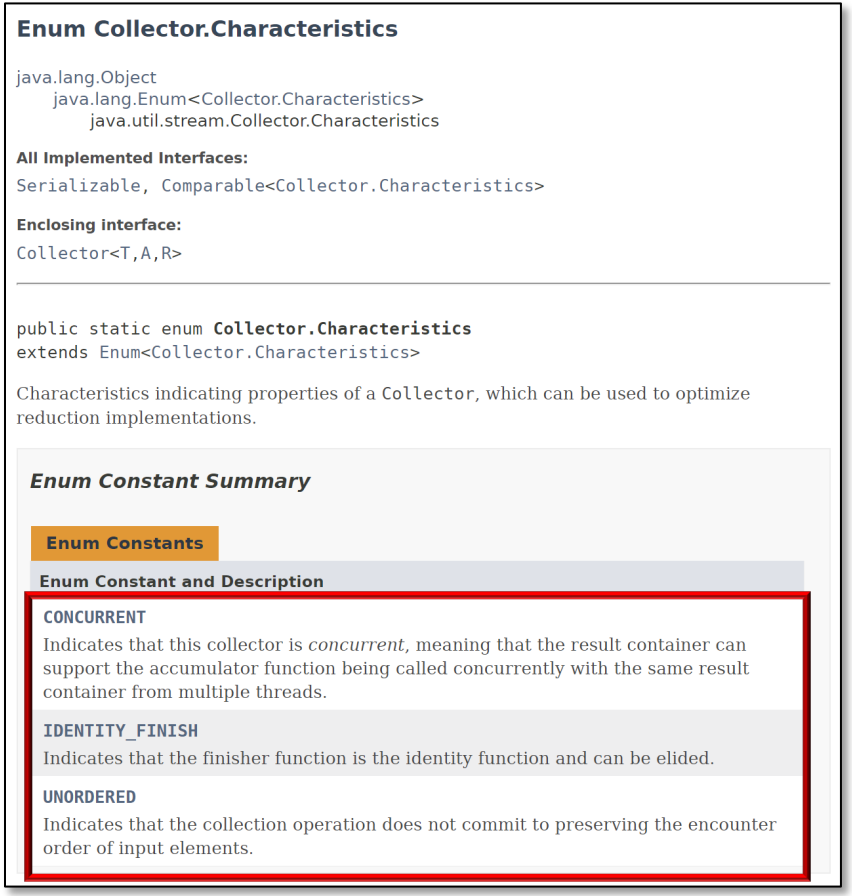

Enum Collector.Characteristics

java.lang.Object
    java.lang.Enum<Collector.Characteristics>
        java.util.stream.Collector.Characteristics

All Implemented Interfaces:

`Serializable, Comparable<Collector.Characteristics>`

Enclosing interface:

`Collector<T,A,R>`

```
public static enum Collector.Characteristics
extends Enum<Collector.Characteristics>
```

Characteristics indicating properties of a `Collector`, which can be used to optimize reduction implementations.

Enum Constant Summary

Enum Constants

Enum Constant and Description
`CONCURRENT` Indicates that this collector is *concurrent*, meaning that the result container can support the accumulator function being called concurrently with the same result container from multiple threads.
`IDENTITY_FINISH` Indicates that the finisher function is the identity function and can be elided.
`UNORDERED` Indicates that the collection operation does not commit to preserving the encounter order of input elements.

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

Overview of Non-Concurrent Collectors

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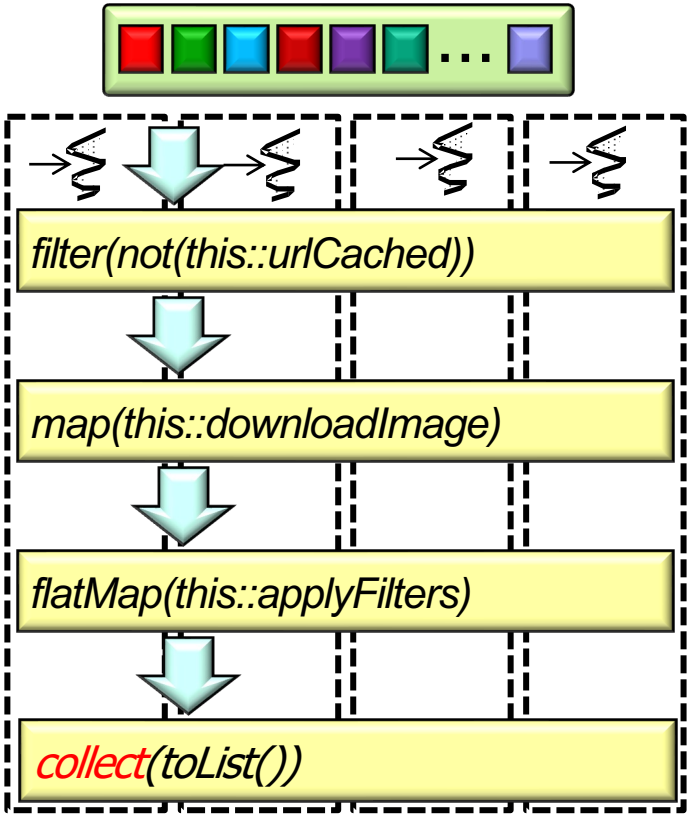
  - This distinction is only relevant for *parallel* streams



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    - **Non-concurrent collectors**
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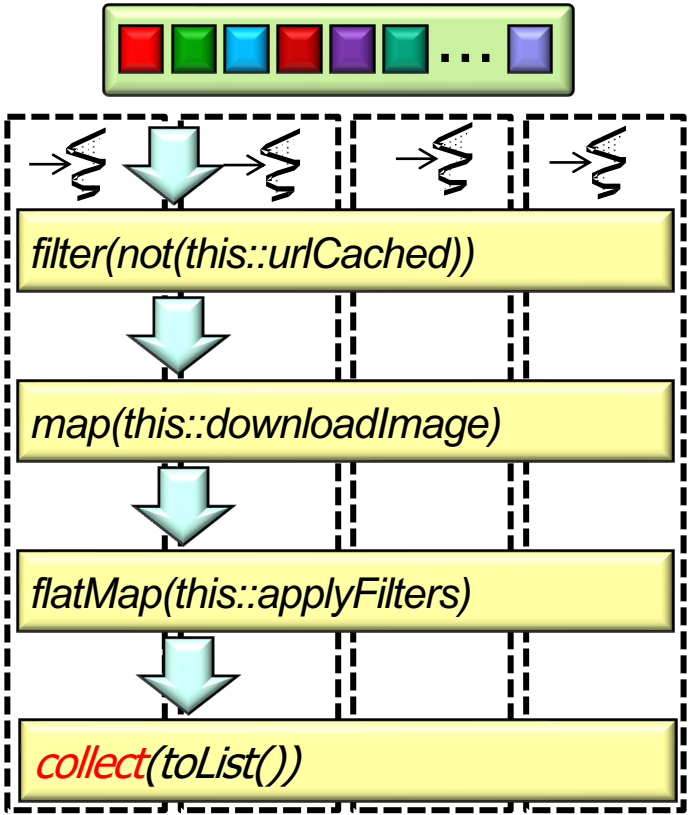

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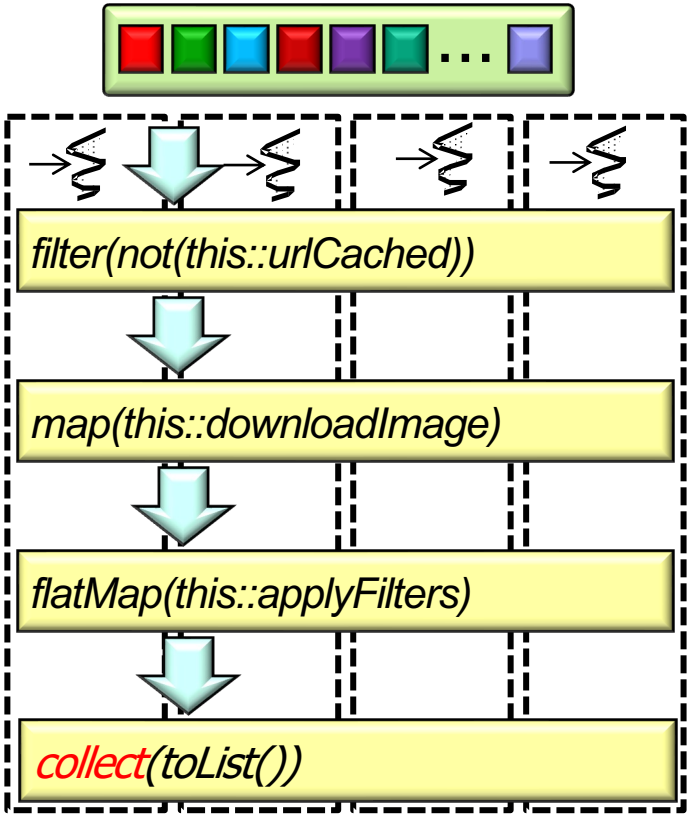
  - This distinction is only relevant for *parallel* streams, e.g.
    - **Non-concurrent collectors**
      - Run in a sequential or parallel stream but do not support concurrent accumulation
        - Each thread accumulates results in its own container & merge in a single-threaded manner at the end



There's no need to synchronize non-concurrent collectors

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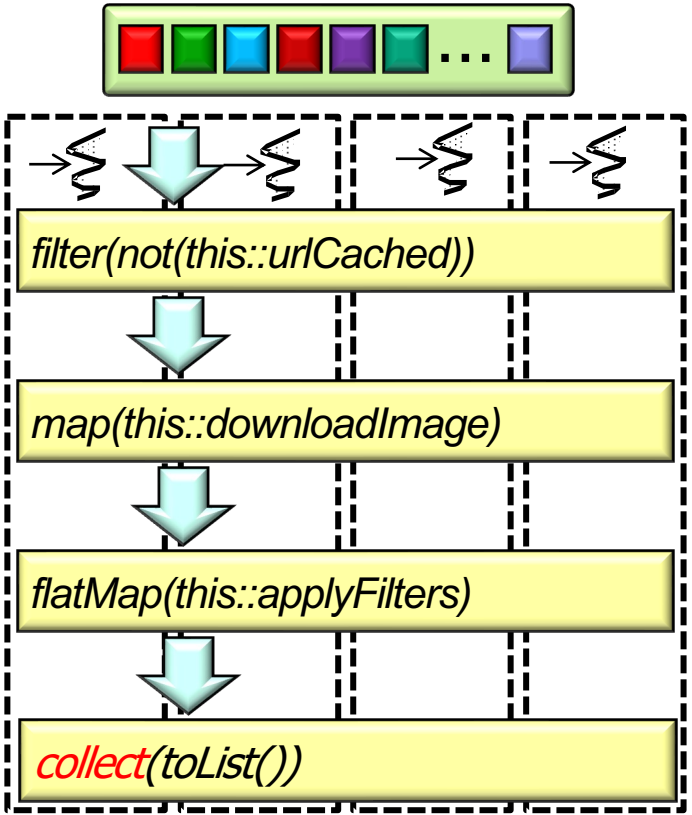
    - Non-concurrent collectors
    - **Concurrent collectors**
      - Support parallel accumulation directly
        - Multiple threads concurrently accumulate results into a single shared container



Concurrent collector accumulator methods must be synchronized!

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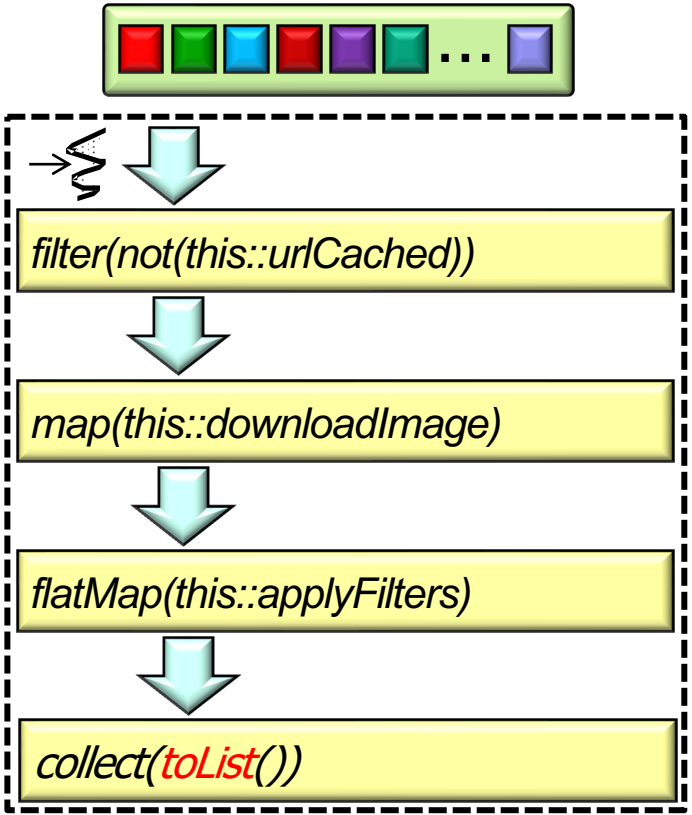

Non-concurrent & concurrent collectors for parallel streams are covered later

Overview of Non-Concurrent Collectors

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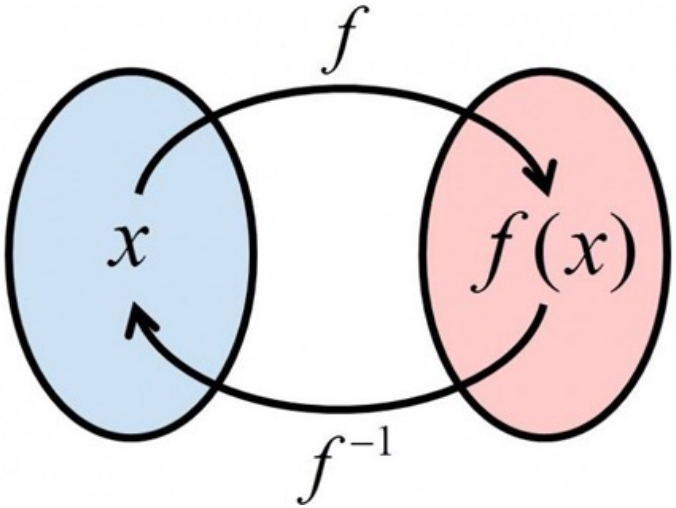
  - This distinction is only relevant for *parallel* streams
  - Our focus here is on non-concurrent collectors for sequential streams
    - Using concurrent collectors for sequential streams is overkill & pointless!!

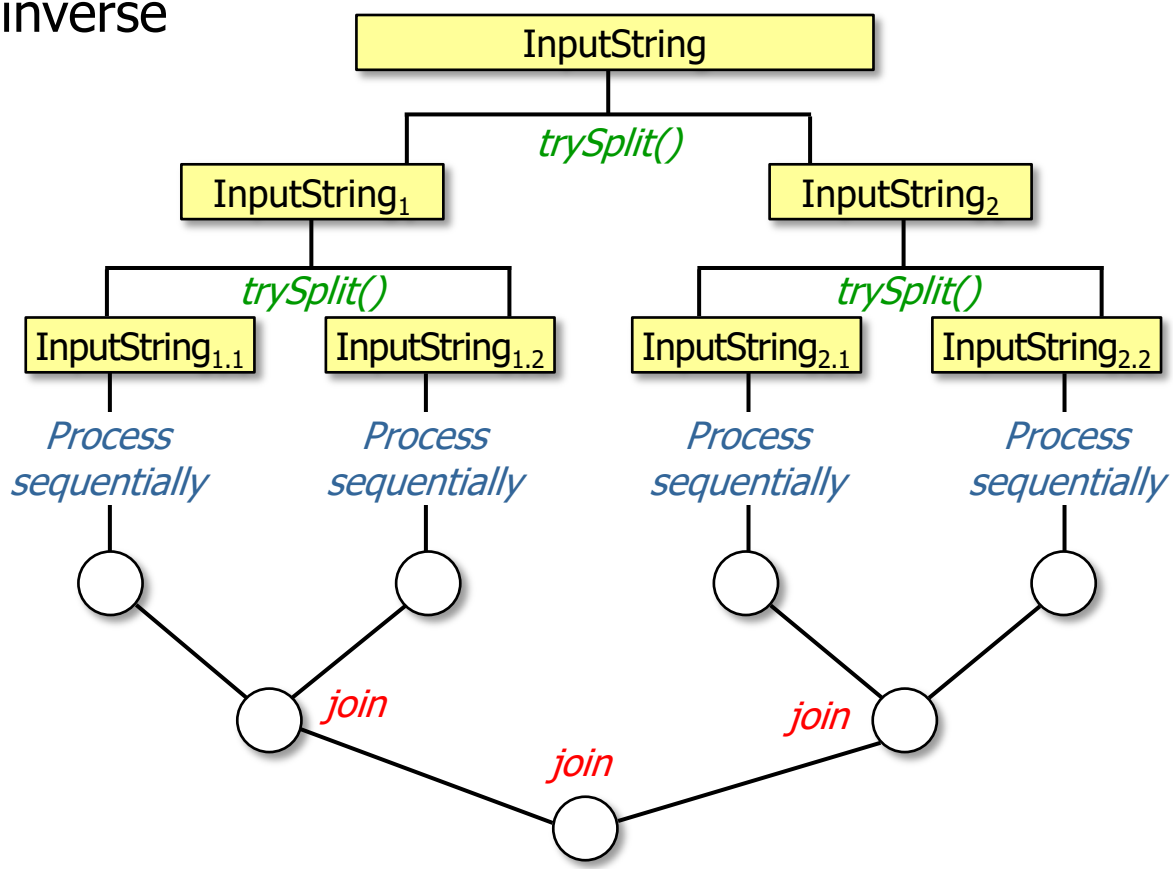
Overview of Non-Concurrent Collectors

- A non-concurrent collector for a sequential stream simply accumulates elements into a mutable result container

Overview of Non-Concurrent Collectors

- A collector is essentially the inverse of a spliterator

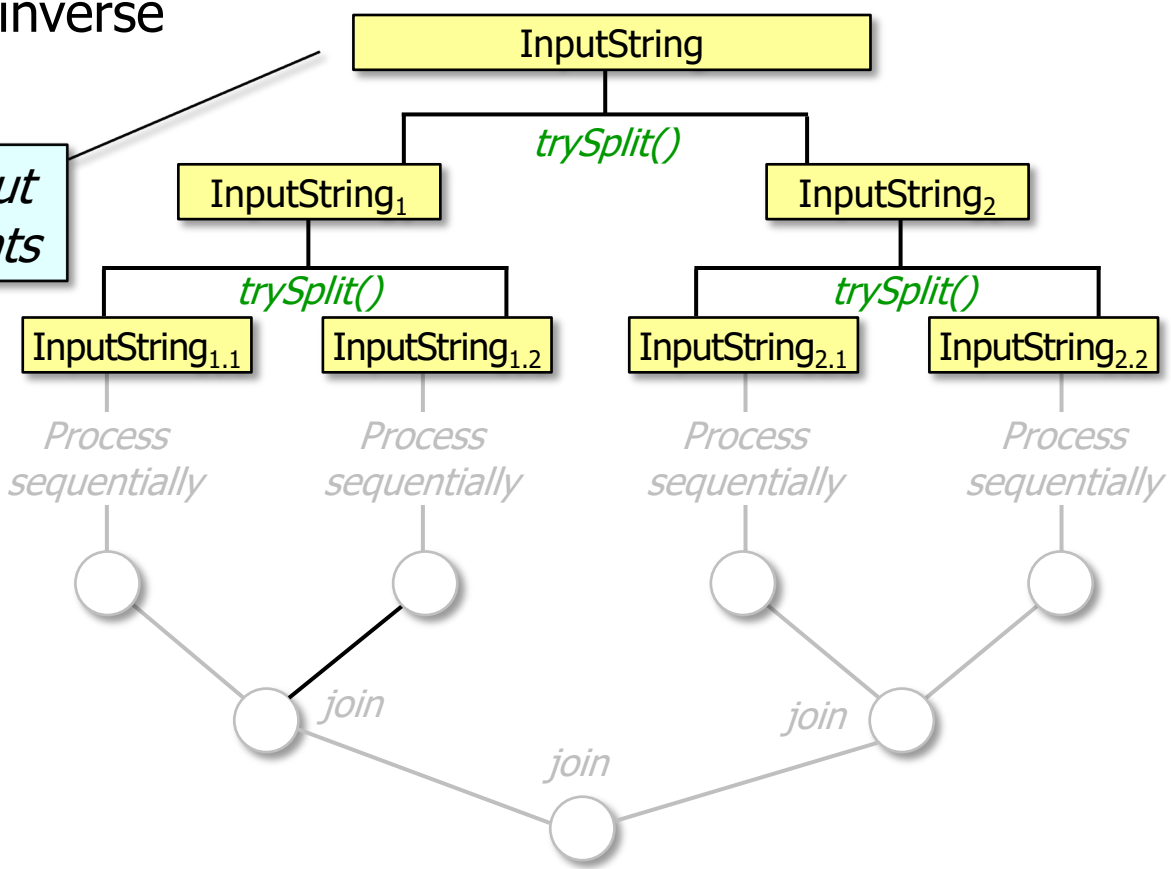




Overview of Non-Concurrent Collectors

- A collector is essentially the inverse of a spliterator

A spliterator partitions one input source into a stream of elements



Overview of Non-Concurrent Collectors

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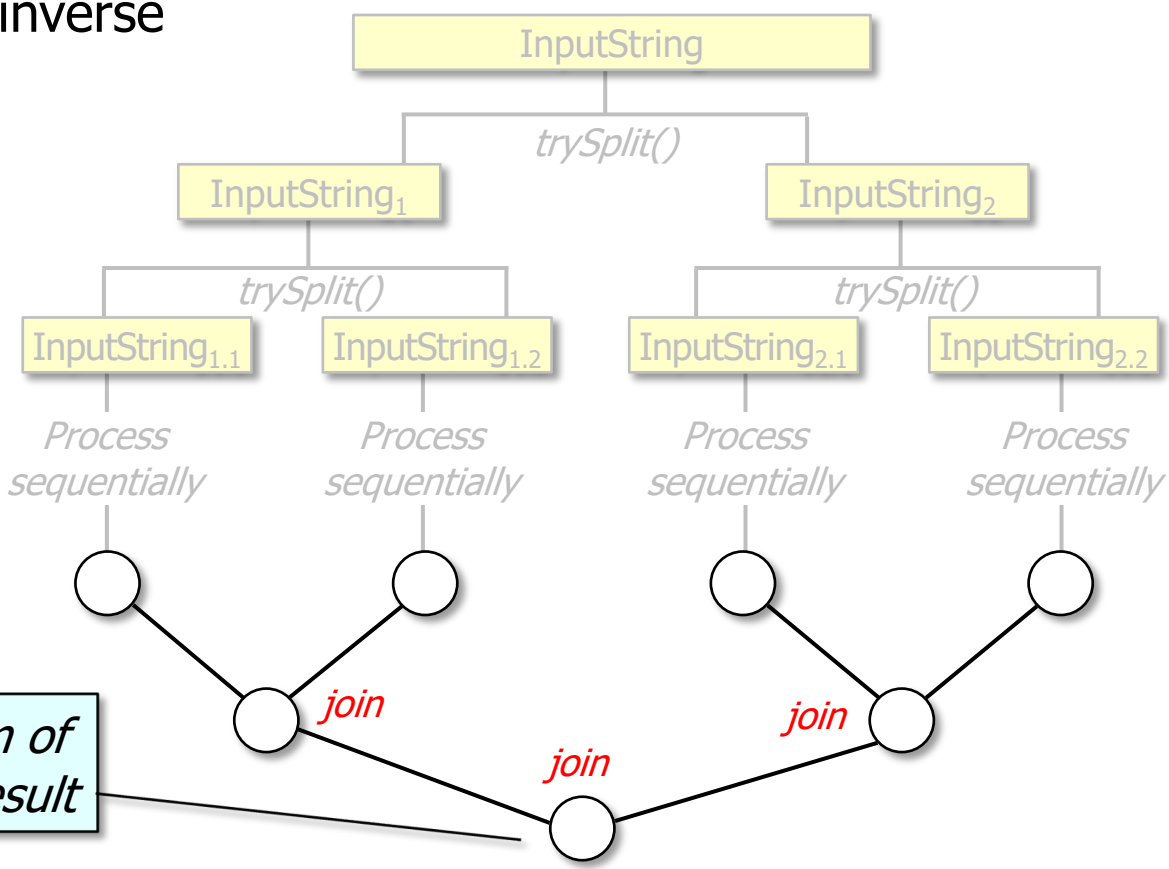

A collector combines a stream of elements back into a single result

End of Understand Java Streams Non-Concurrent Collectors