Overview of Java Parallel Streams: Phases

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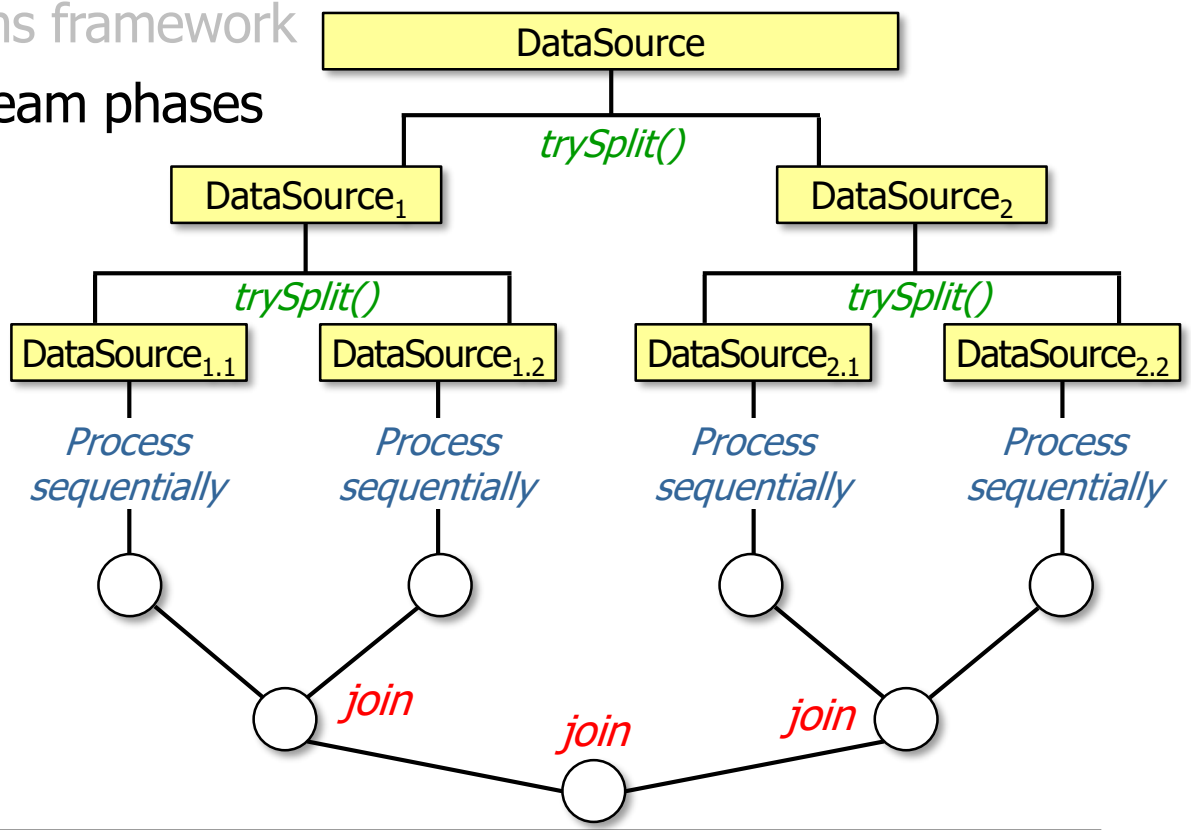
Learning Objectives in this Part of the Lesson

- Know how aggregate operations & functional programming features are applied in the parallel streams framework
- Be aware of how parallel stream phases work "under the hood"



See www.ibm.com/developerworks/library/j-java-streams-3-brian-goetz

Overview of How a Parallel Stream Works

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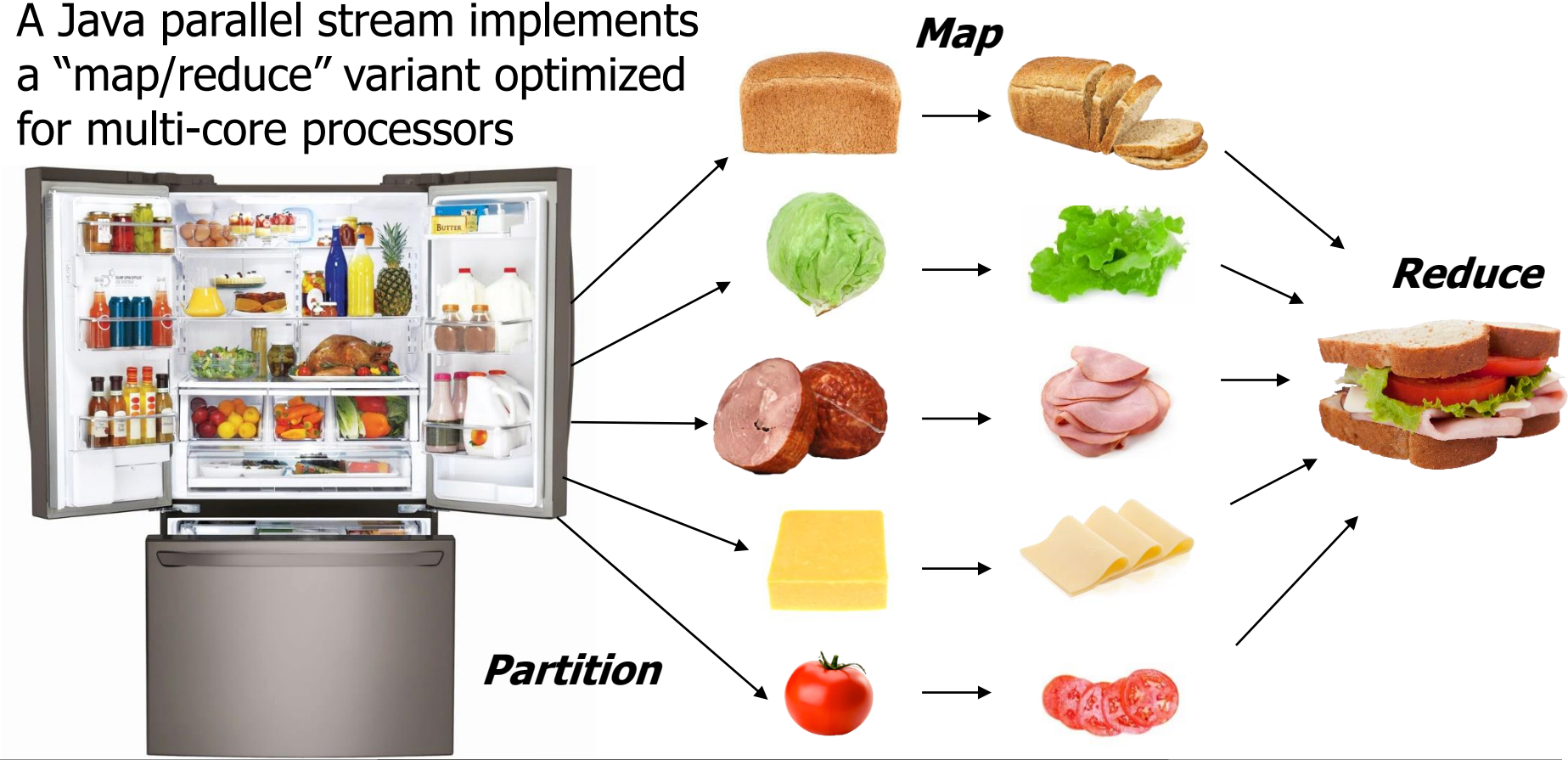
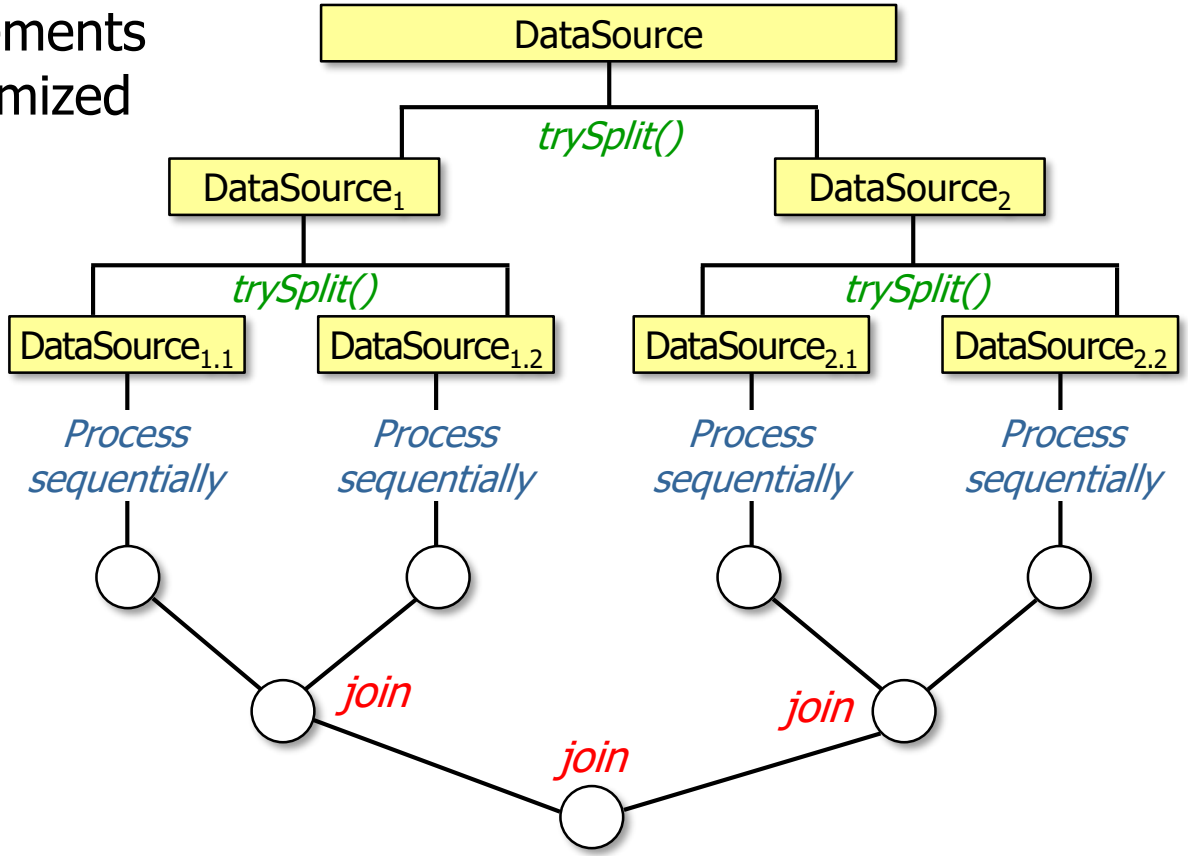
- A Java parallel stream implements a "map/reduce" variant optimized for multi-core processors



See en.wikipedia.org/wiki/MapReduce

Overview of How a Parallel Stream Works

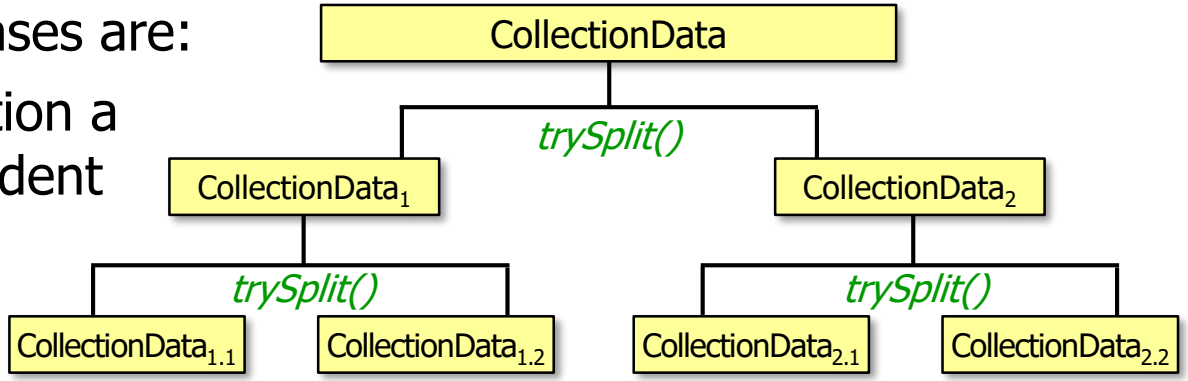
- A Java parallel stream implements a "map/reduce" variant optimized for multi-core processors
  - It's actually a three phase "split-apply-combine" data processing strategy



See www.jstatsoft.org/article/view/v040i01

Overview of How a Parallel Stream Works

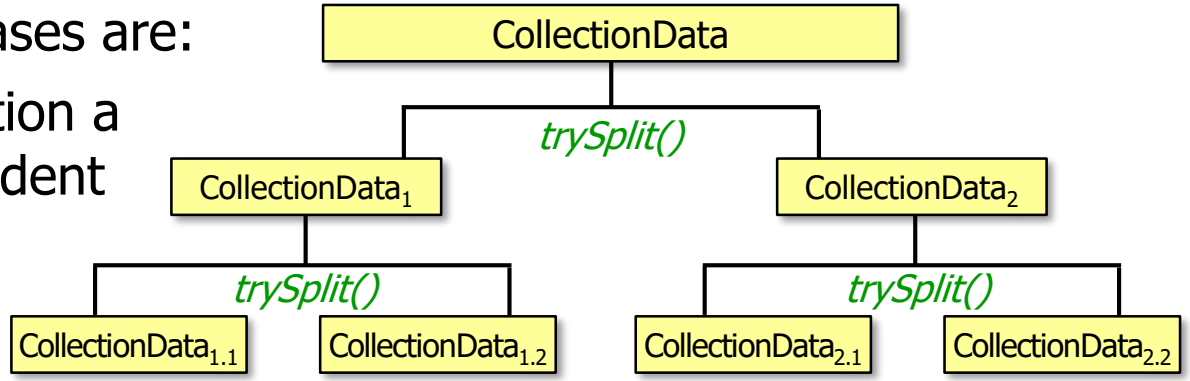
- The split-apply-combine phases are:
  1. **Split** – Recursively partition a data source into independent "chunks"



See en.wikipedia.org/wiki/Divide_and_conquer_algorithm

Overview of How a Parallel Stream Works

- The split-apply-combine phases are:
  1. **Split** – Recursively partition a data source into independent "chunks"
     - Spliterators are defined to partition collections in Java




```
public interface Spliterator<T> {
  boolean tryAdvance(Consumer<? Super T> action);

  Spliterator<T> trySplit();

  long estimateSize();

  int characteristics();
}
```

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

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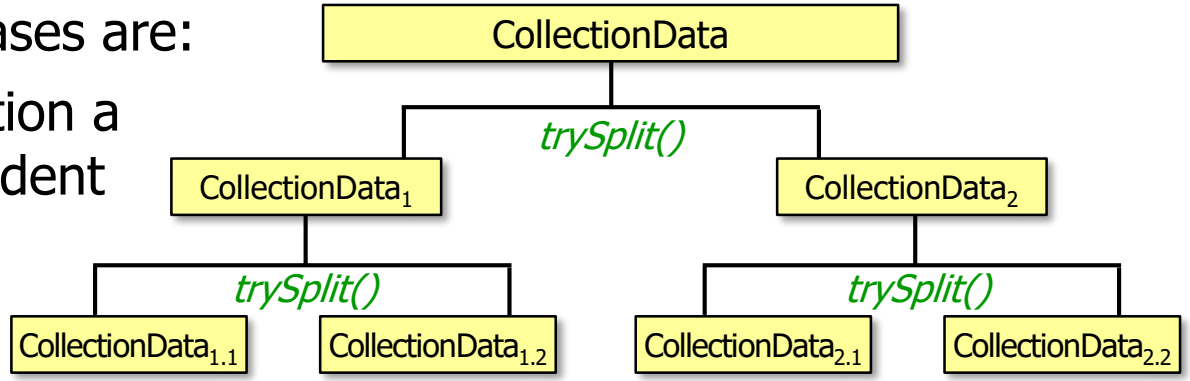

Used for sequential (& parallel) streams

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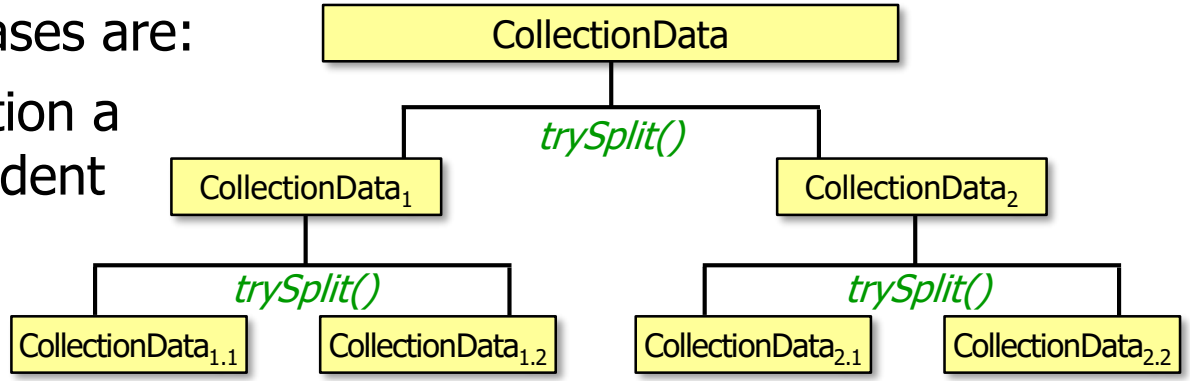

Used only for parallel streams

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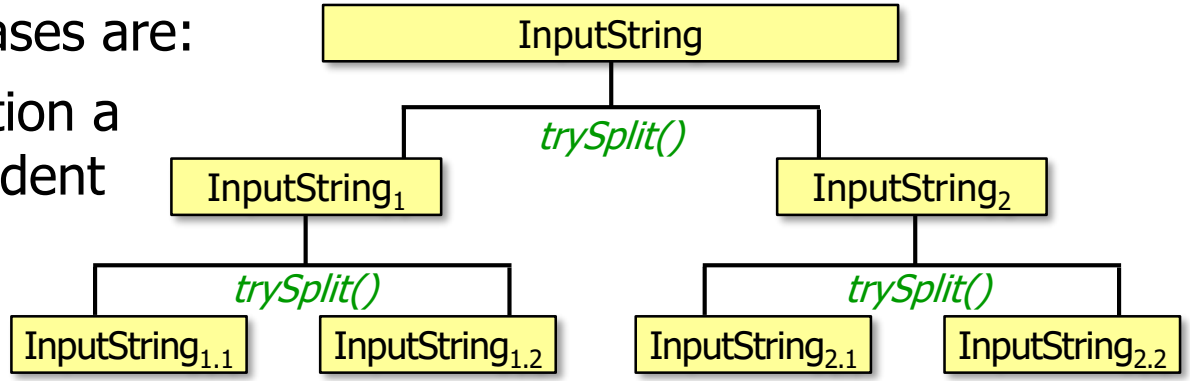
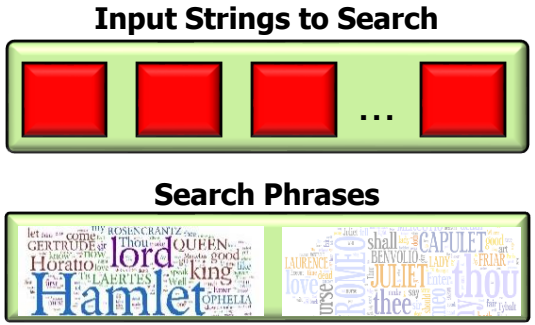
     - You can also define custom spliterators

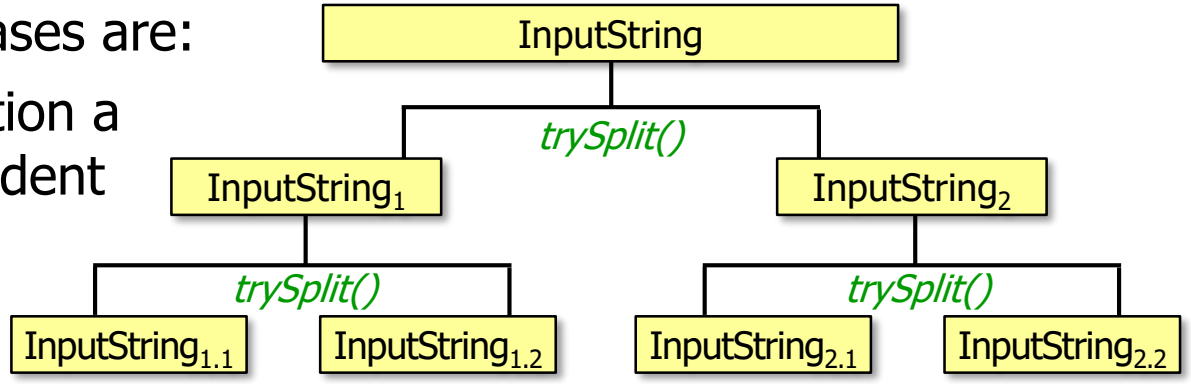




See github.com/douglascraigschmidt/LiveLessons/tree/master/SearchStreamSpliterator

Overview of How a Parallel Stream Works

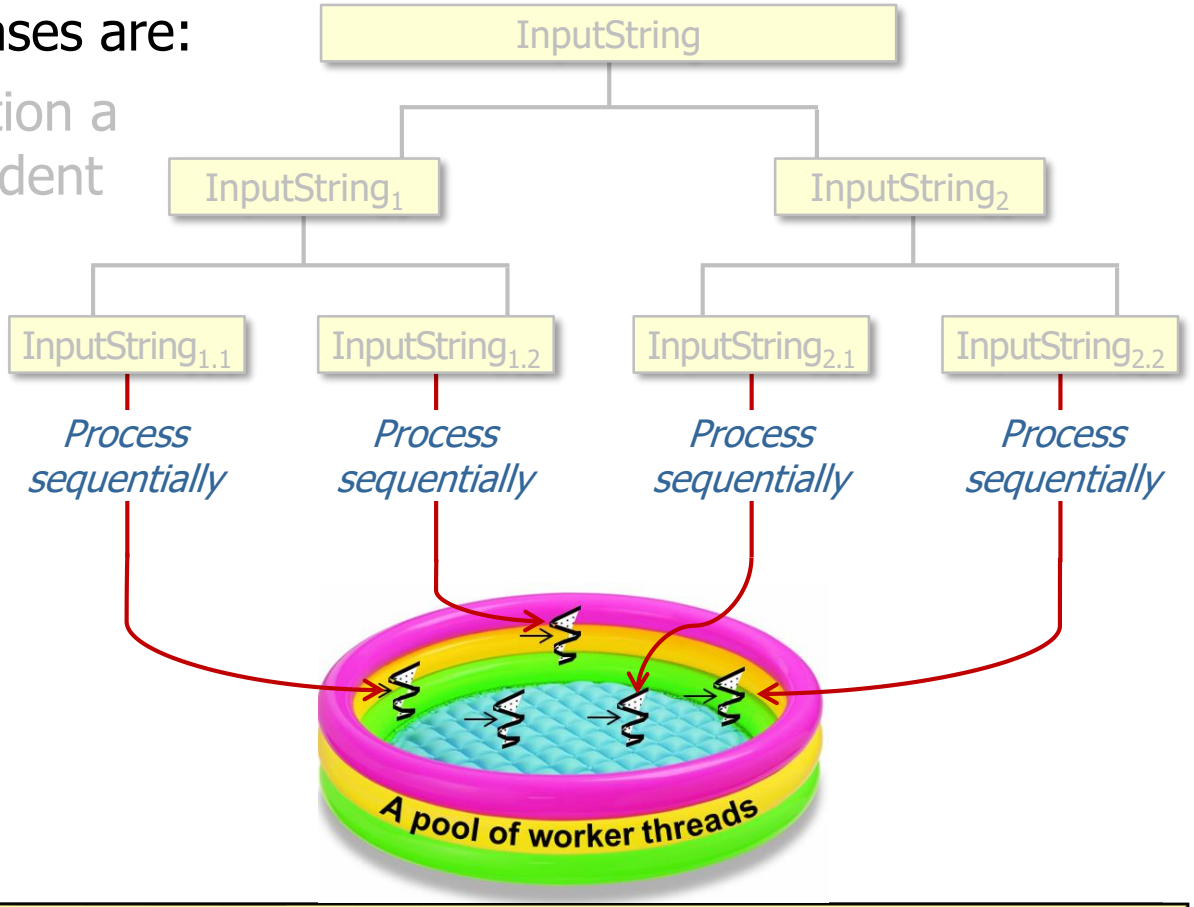
- The split-apply-combine phases are:
  1. **Split** – Recursively partition a data source into independent "chunks"
     - Spliterators are defined to partition collections in Java
     - You can also define custom spliterators
     - Parallel streams perform better on data sources that can be split efficiently & evenly



See www.airpair.com/java/posts/parallel-processing-of-io-based-data-with-java-streams

Overview of How a Parallel Stream Works

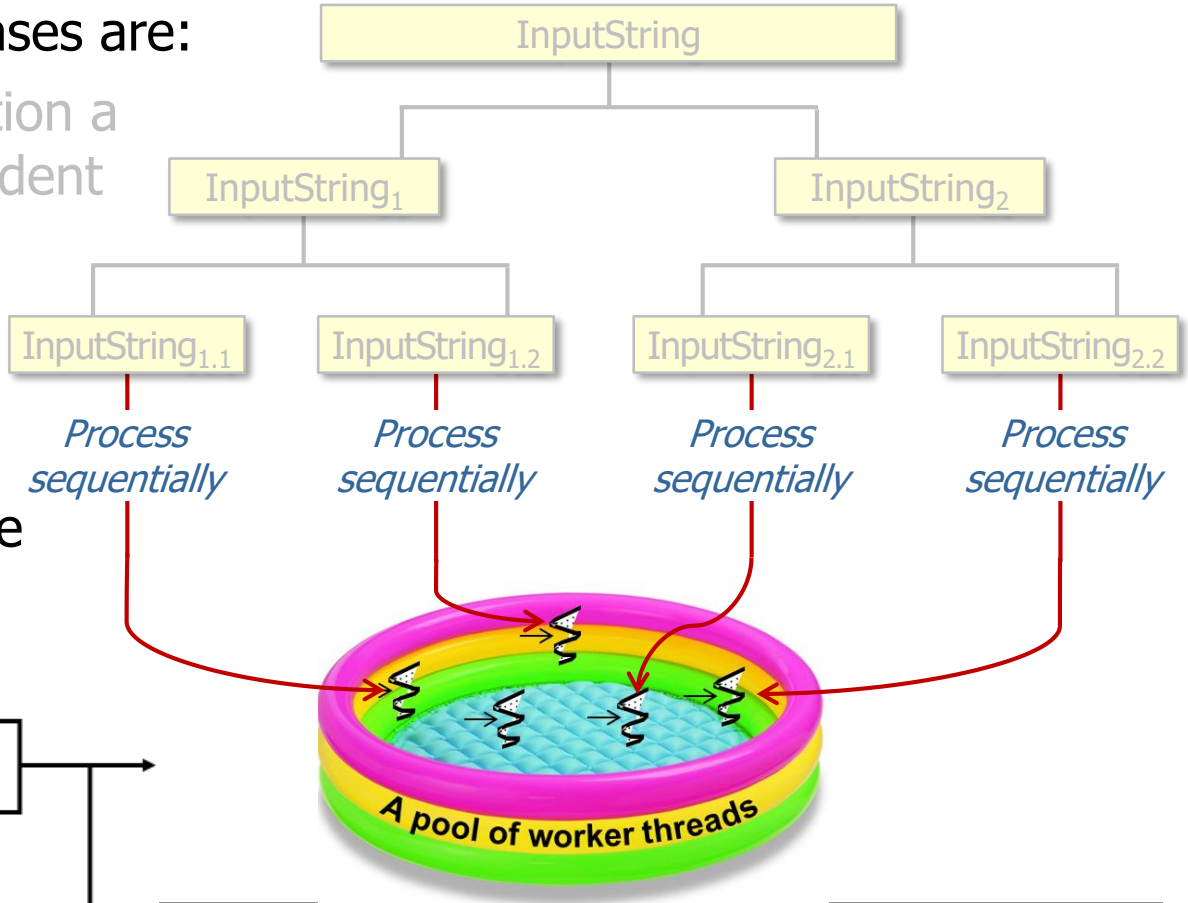
- The split-apply-combine phases are:
  1. **Split** – Recursively partition a data source into independent "chunks"
  2. **Apply** – Process chunks independently in one (common) thread pool

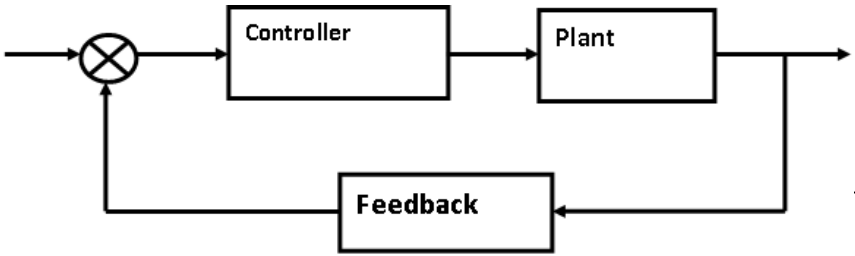


Splitting & applying run simultaneously (after certain limit met), not sequentially

Overview of How a Parallel Stream Works

- The split-apply-combine phases are:
  1. **Split** – Recursively partition a data source into independent "chunks"
  2. **Apply** – Process chunks independently in one (common) thread pool
     - Programmers have some control over how many threads are in the pool





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  1. **Split** – Recursively partition a data source into independent "chunks"
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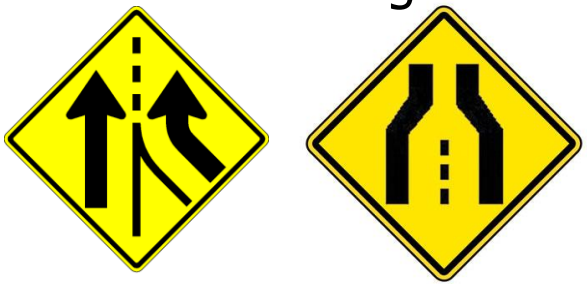
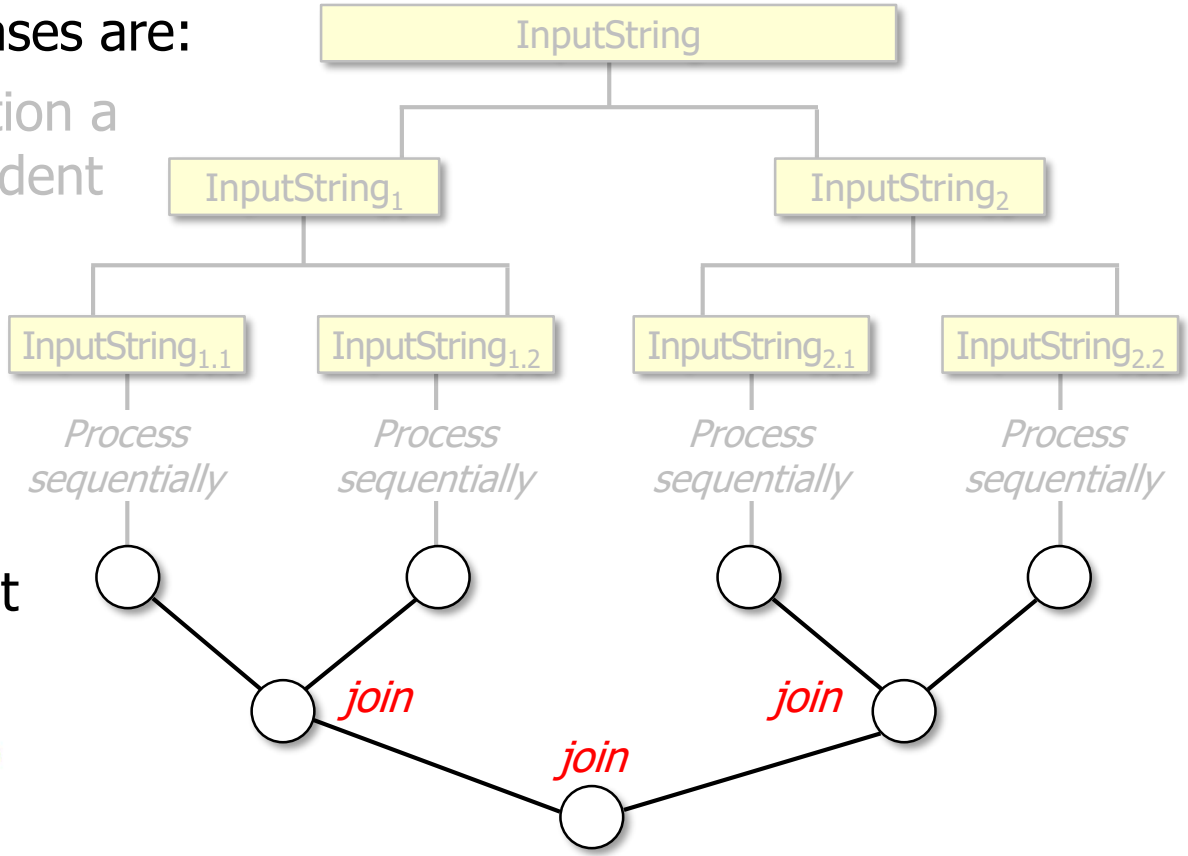
  3. **Combine** – Join partial results into a single result





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  1. **Split** – Recursively partition a data source into independent "chunks"
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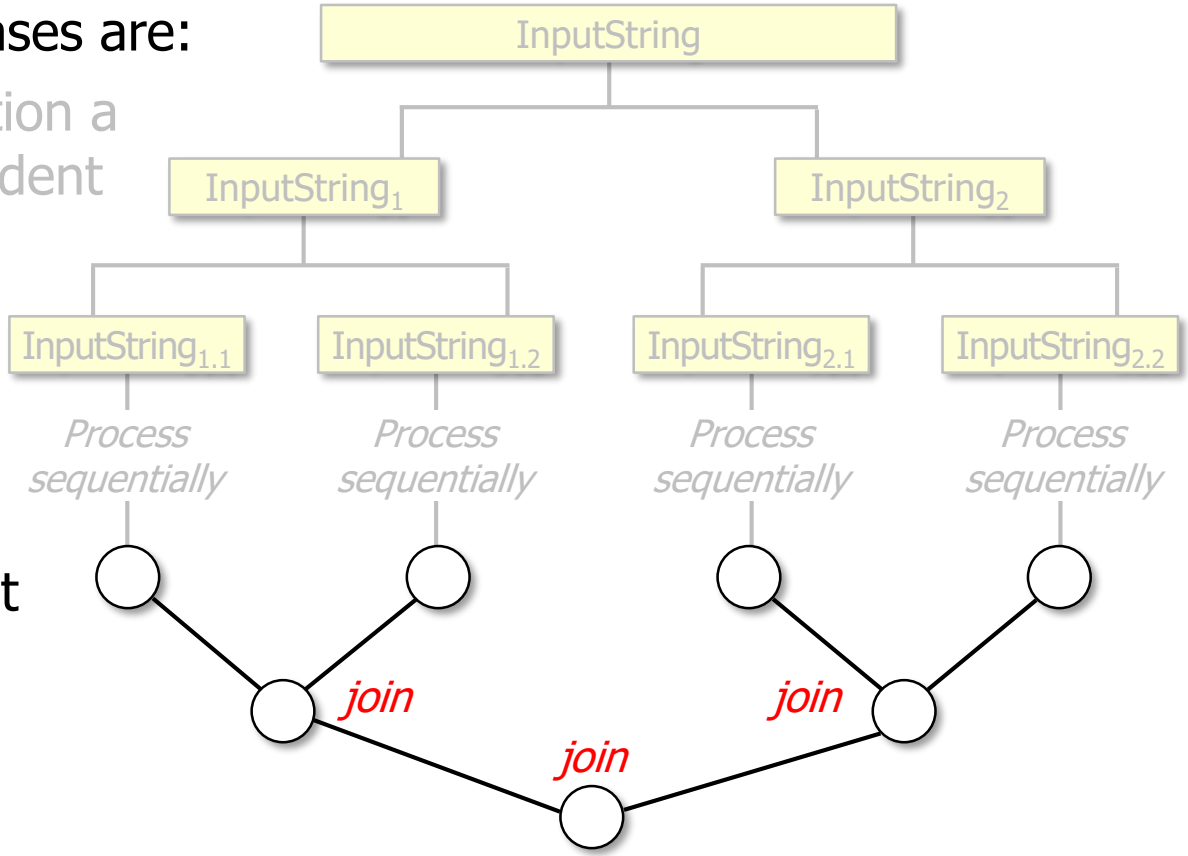
     - Performed by terminal operations like collect() & reduce()



See www.codejava.net/java-core/collections/java-8-stream-terminal-operations-examples

End of Overview of Java Parallel Streams: Phases