Java Parallel Streams Internals: Splitting, Combining, & Pooling

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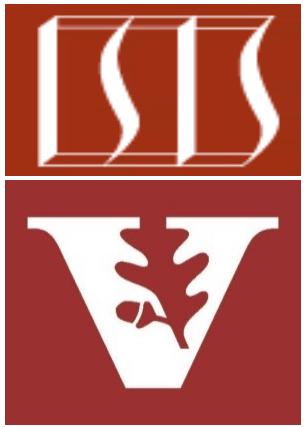

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Learning Objectives in this Part of the Lesson

- Understand parallel stream internals, e.g.
  - Know what can change & what can't
    - Splitting, combining, & pooling mechanisms

```
final class Collectors {
  ...
  public static <T> Collector<T, ?, List<T>>
    toList() { ... }

  public static <T> Collector<T, ?, Set<T>>
    toSet() { ... }
  ...
}
```

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

  Spliterator<T> trySplit();

  long estimateSize();

  int characteristics();
}
```

```
public interface ManagedBlocker {
  boolean block()
    throws InterruptedException;

  boolean isReleasable();
}
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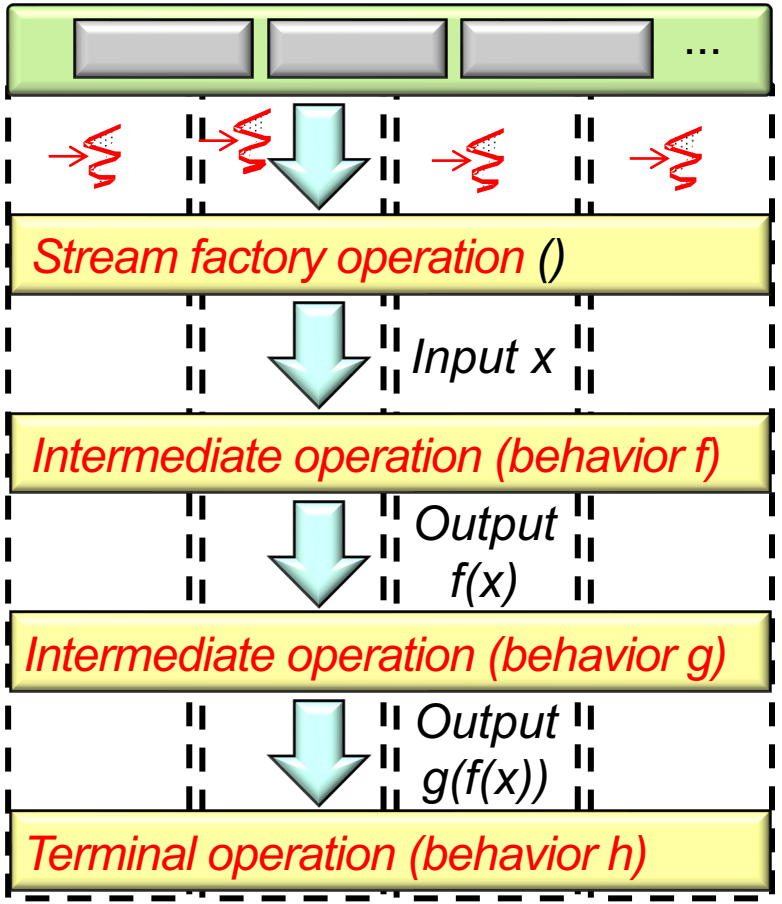
Parallel Stream Splitting, Combining, & Pooling Mechanisms

Parallel Stream Splitting, Combining, & Pooling Mechanisms

- A parallel stream's splitting, combining, & pooling mechanisms are often invisible

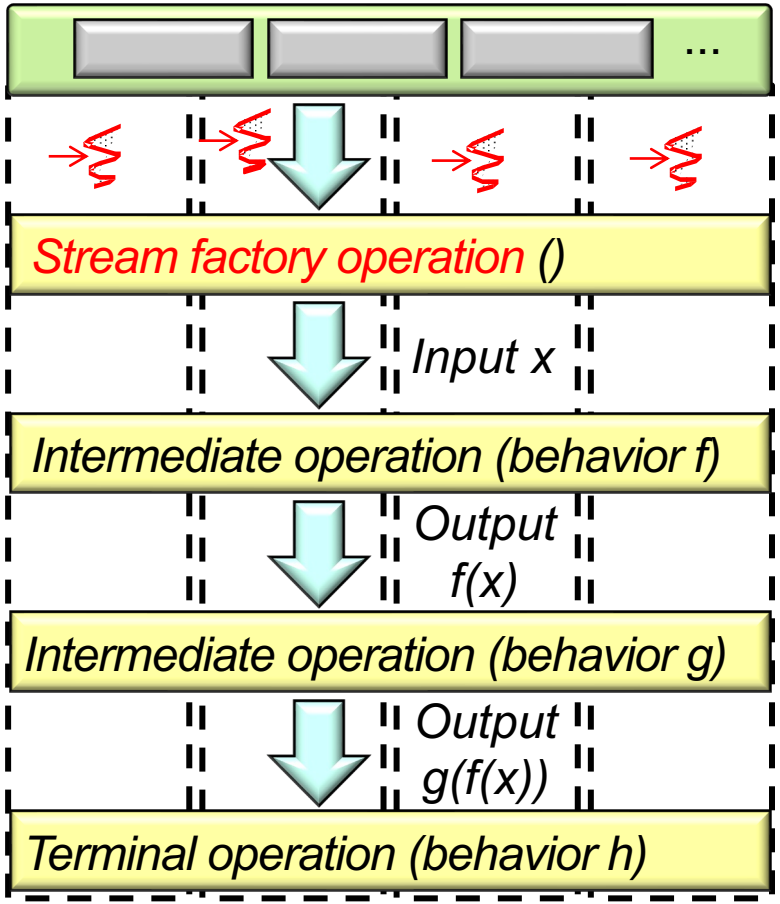


Parallel Stream Splitting, Combining, & Pooling Mechanisms

- A parallel stream's splitting, combining, & pooling mechanisms are often invisible
  - All Java collections have predefined spliterators that create parallel streams

```
interface Collection<E> {
  ...
  default Spliterator<E> spliterator() {
    return Spliterators
      .spliterator(this, 0);
  }

  default Stream<E> parallelStream() {
    return StreamSupport
      .stream(spliterator(), true);
  }
 ...
}
```



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

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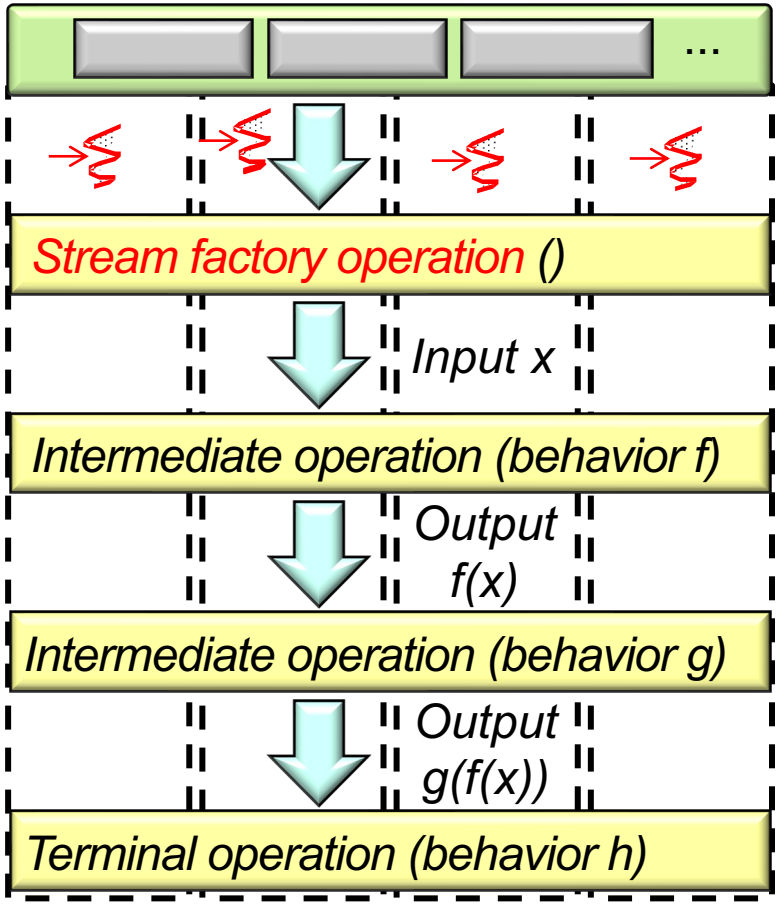

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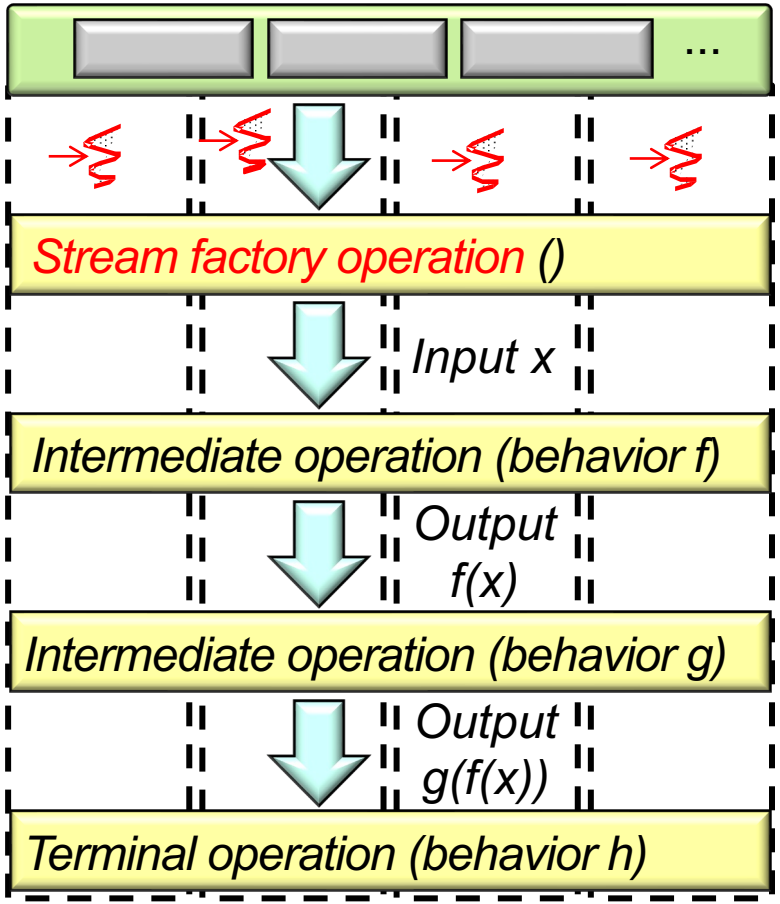

See blog.logentries.com/2015/10/java-8-introduction-to-parallelism-and-spliterator

Parallel Stream Splitting, Combining, & Pooling Mechanisms

- A parallel stream's splitting, combining, & pooling mechanisms are often invisible
  - All Java collections have predefined spliterators that create parallel streams
  - Java also predefines collector factory methods in the Collectors utility class

```
final class Collectors {
  ...
  public static <T> Collector<T, ?, List<T>>
    toList() { ... }

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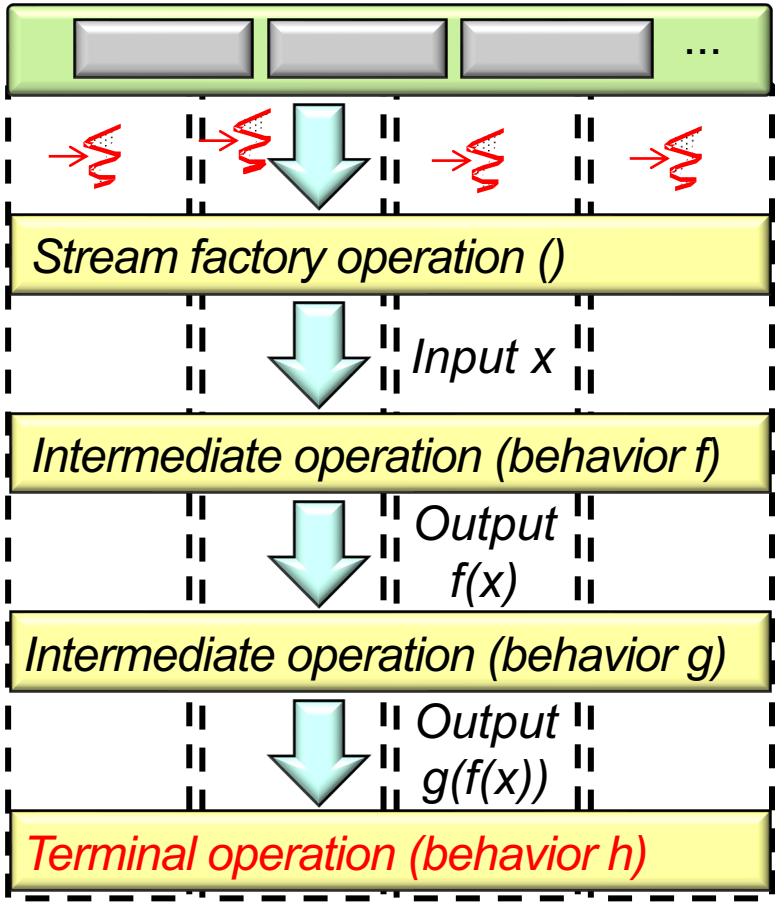

See docs.oracle.com/javase/8/docs/api/java/util/stream/Collectors.html

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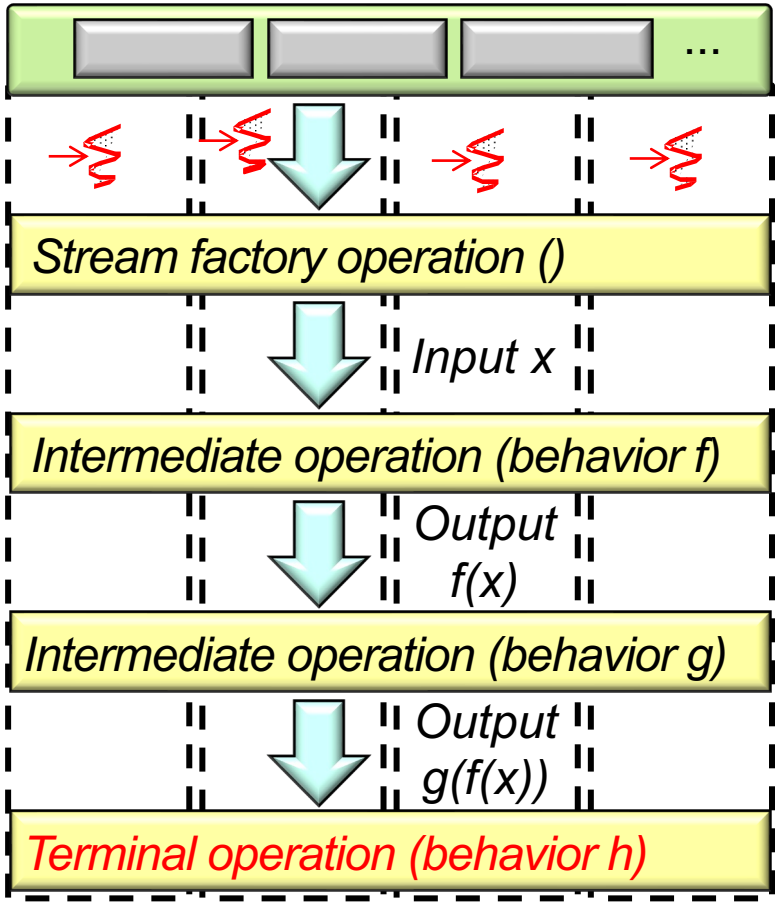
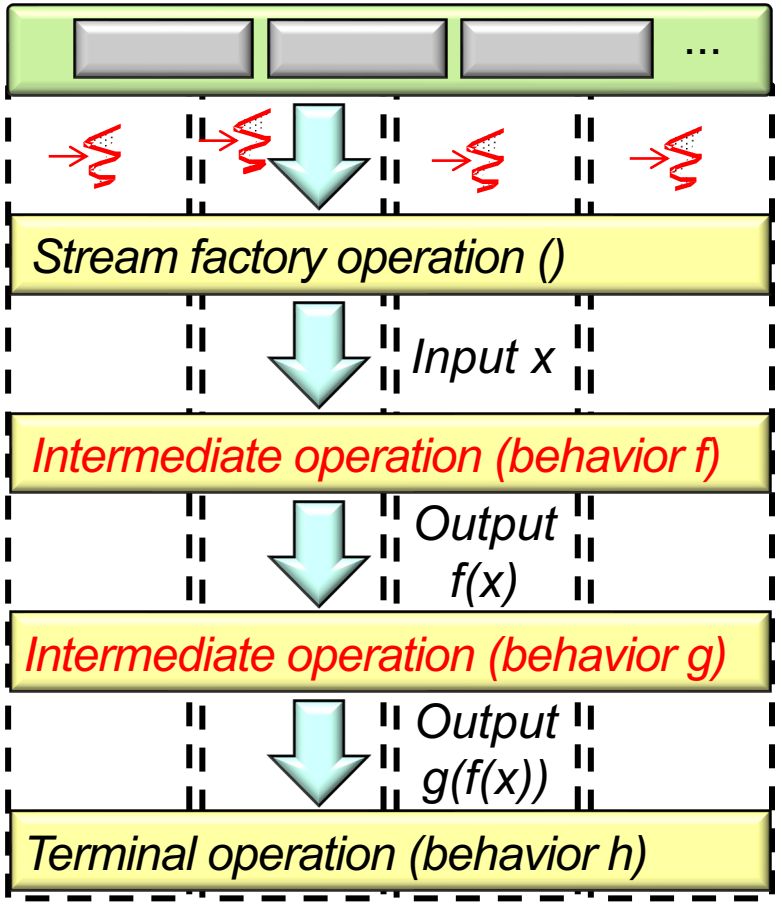


These non-concurrent collectors can work seamlessly with parallel streams

Parallel Stream Splitting, Combining, & Pooling Mechanisms

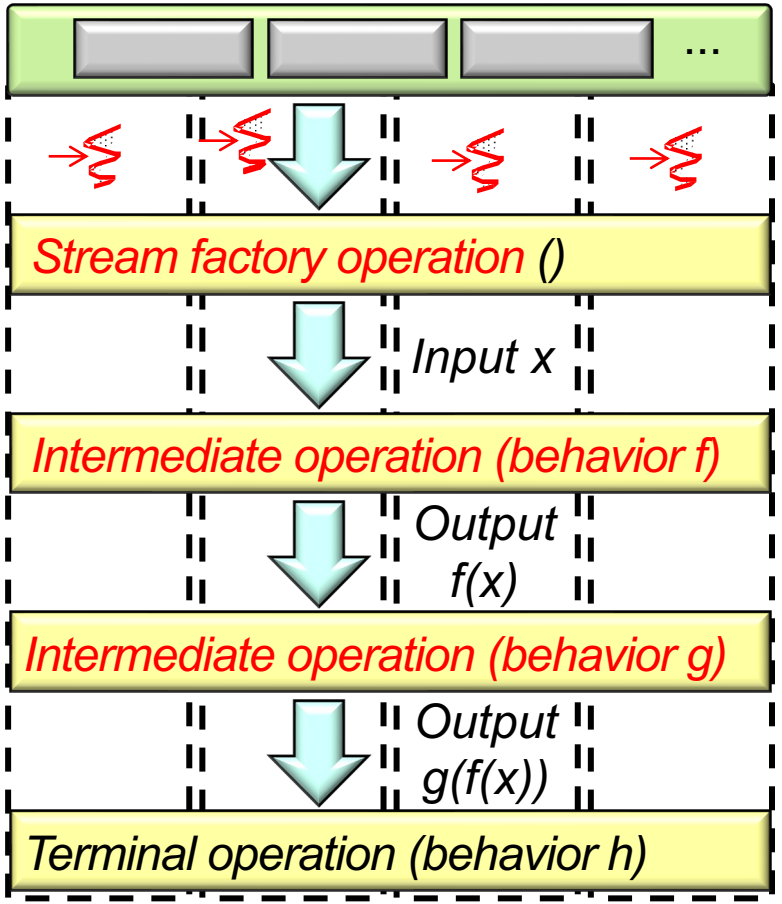
- A parallel stream's splitting, combining, & pooling mechanisms are often invisible
  - All Java collections have predefined spliterators that create parallel streams
  - Java also predefines collector factory methods in the Collectors utility class
  - The common fork-join pool is used to run intermediate operations on chunks of data



See www.baeldung.com/java-fork-join

Parallel Stream Splitting, Combining, & Pooling Mechanisms

- However, parallel streams programmers can also customize these mechanisms



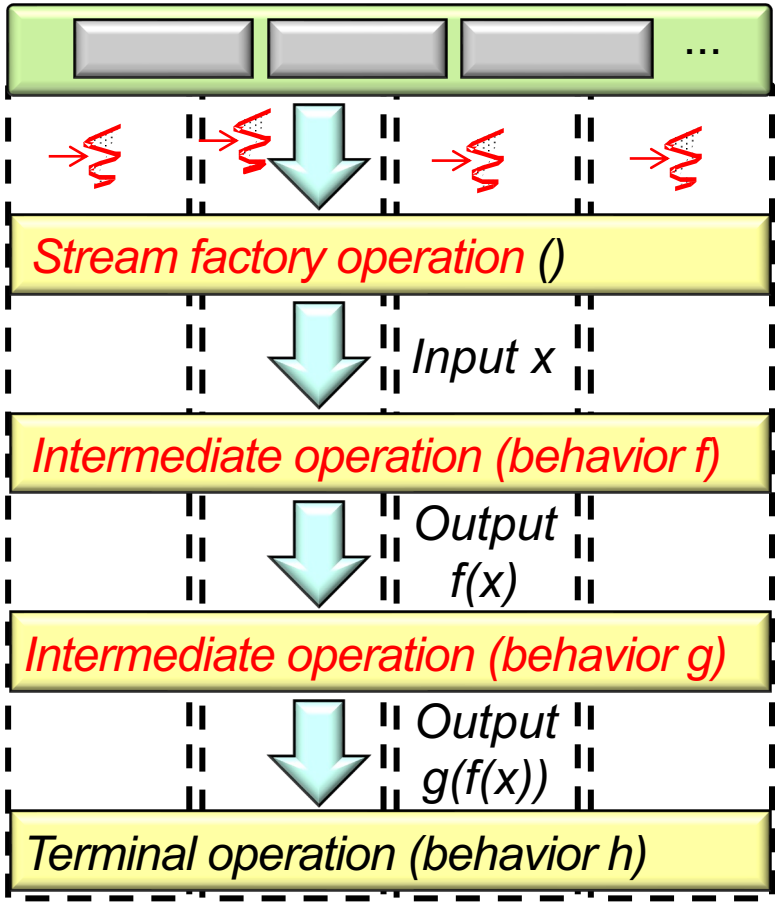
See upcoming lessons on *"Java Parallel Stream Internals"*

Parallel Stream Splitting, Combining, & Pooling Mechanisms

- However, parallel streams programmers can also customize these mechanisms

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

  Spliterator<T> trySplit();

  void forEachRemaining
    (Consumer<? Super T> action);

  long estimateSize();

  int characteristics();

}
```

An interface used to traverse & partition elements of a source.



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

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  boolean tryAdvance
    (Consumer<? Super T> action);

  Spliterator<T> trySplit();

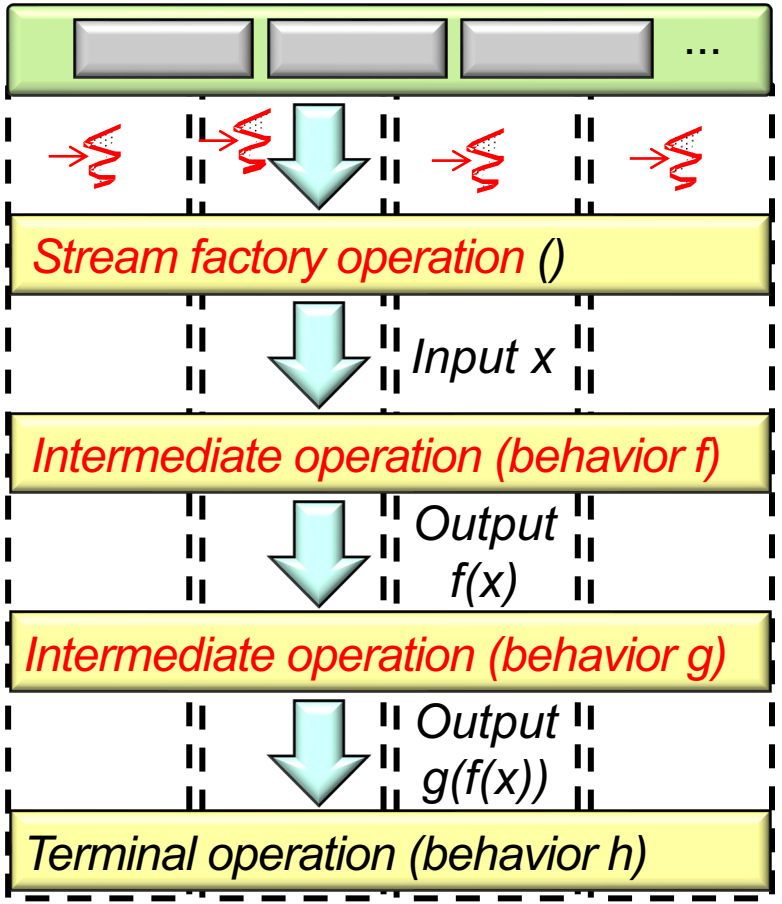
  void forEachRemaining
    (Consumer<? Super T> action);

  long estimateSize();

  int characteristics();

}
```

The streams framework uses this method to process elements in sequential and parallel streams.



See earlier lesson on "*Java Streams: Applying Spliterators*"

Parallel Stream Splitting, Combining, & Pooling Mechanisms

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    (Consumer<? Super T> action);

  Spliterator<T> trySplit();

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    (Consumer<? Super T> action);

  long estimateSize();

  int characteristics();

}
```
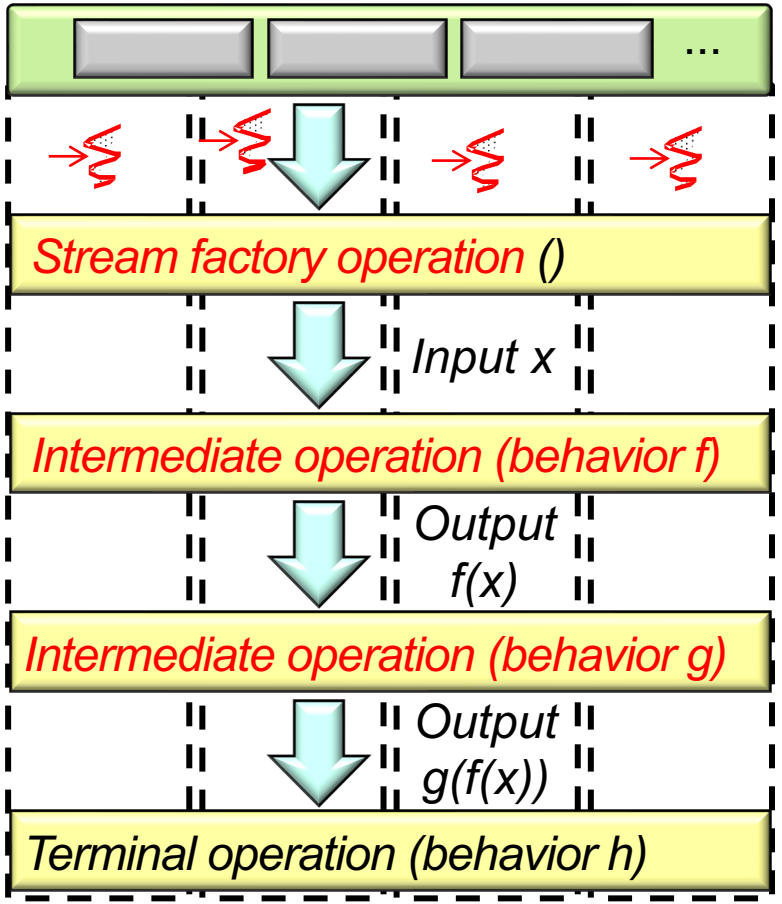

The streams framework uses this method to partition elements in a parallel stream.



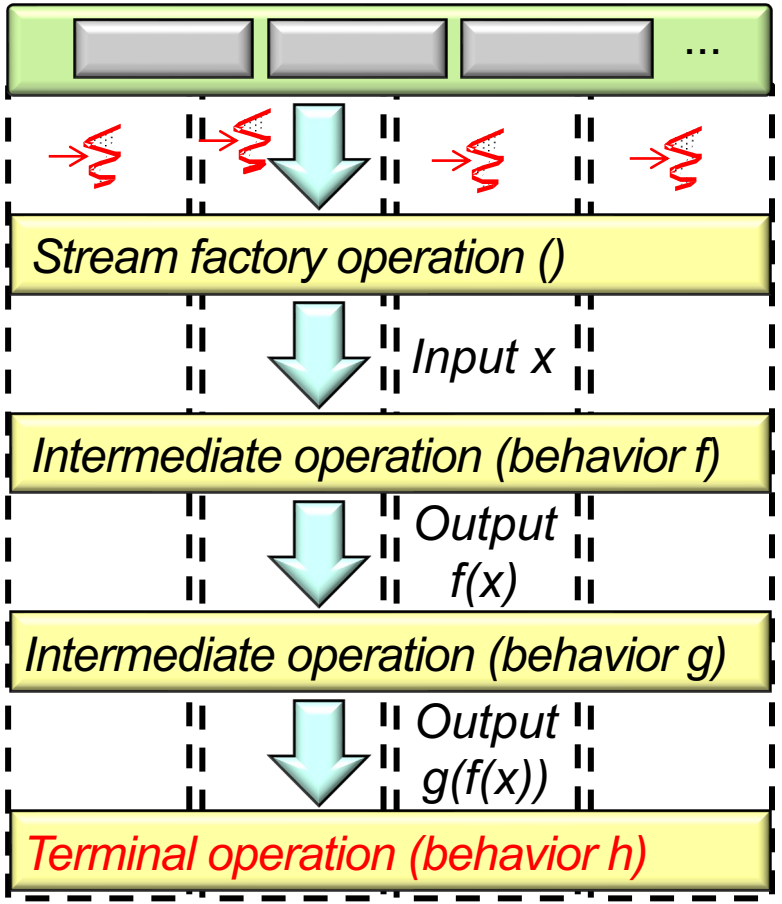
See upcoming lesson on "*Java Parallel Streams Internals: Partitioning*"

Parallel Stream Splitting, Combining, & Pooling Mechanisms

- However, parallel streams programmers can also customize these mechanisms

```
interface Collector<T,A,R> {
  Supplier<A> supplier();
  BiConsumer<A, T> accumulator();
  BinaryOperator<A> combiner();
  Function<A, R> finisher();
  Set<Collector.Characteristics>
    characteristics()
  ...
}
```

A framework that accumulates input elements into a concurrent and/or non-concurrent mutable result containers.



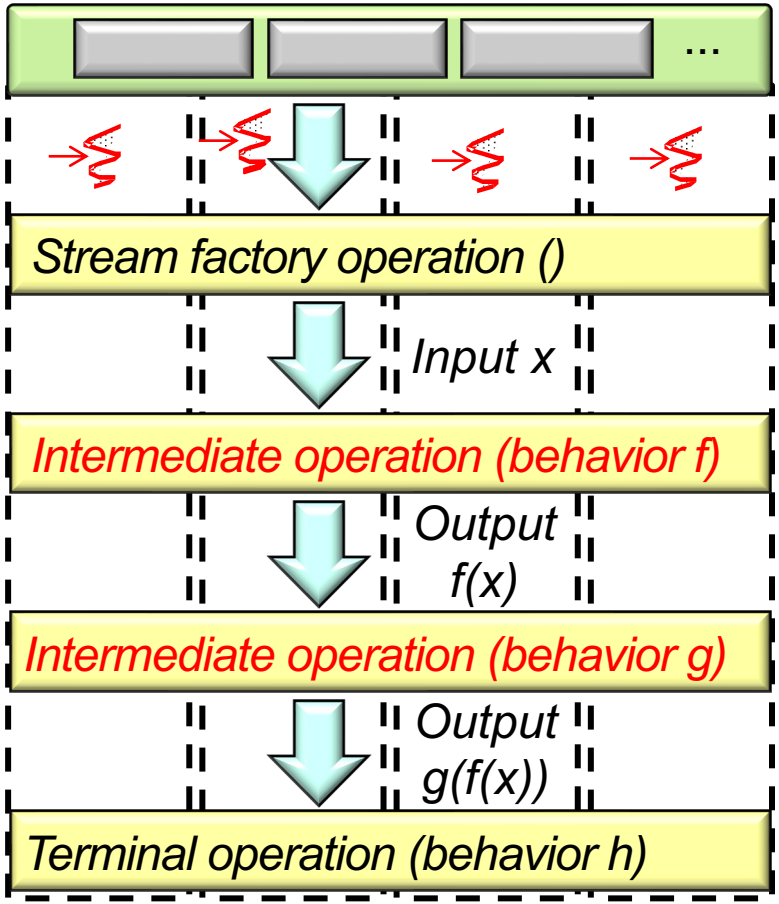
See docs.oracle.com/javase/8/docs/api/java/util/stream/Collector.html

Parallel Stream Splitting, Combining, & Pooling Mechanisms

- However, parallel streams programmers can also customize these mechanisms

```
public interface ManagedBlocker {
  boolean block()
    throws InterruptedException;

  boolean isReleasable();
}
```

This interface provides managed parallelism for tasks running in the common fork-join pool.



See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ForkJoinPool.ManagedBlocker.html

End of Java Parallel Stream Internals: Splitting, Combining, & Pooling