Java Stream Internals: Execution

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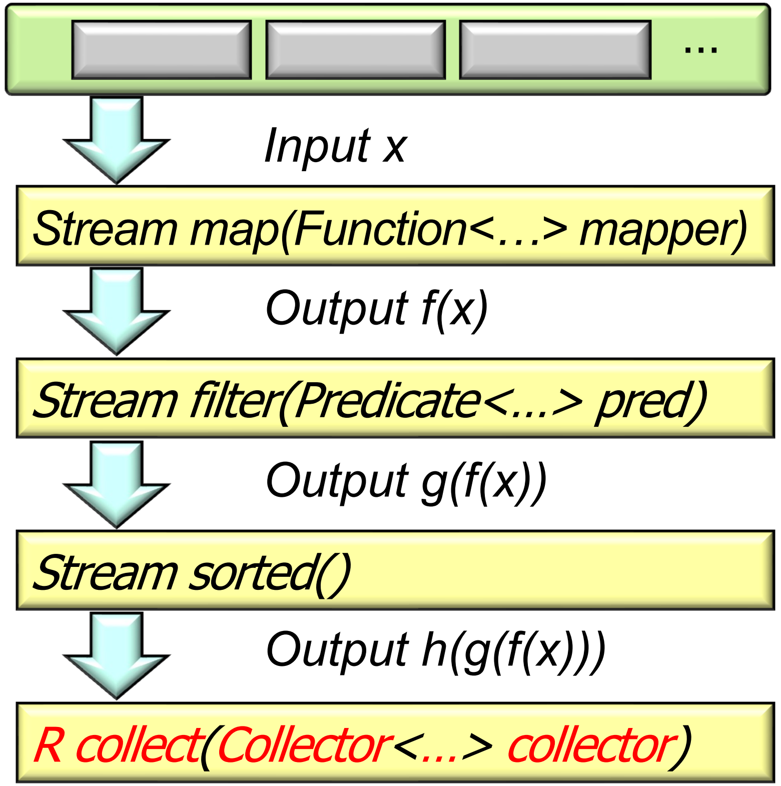
Learning Objectives in this Part of the Lesson

- Understand stream internals, e.g.
  - Know what can change & what can't
  - Recognize how a Java stream is constructed
  - Be aware of how a Java stream is executed
    - e.g., how stateless & stateful intermediate operations & run-to-completion & short-circuiting terminal operations are run

Java Stream Execution

Java Stream Execution

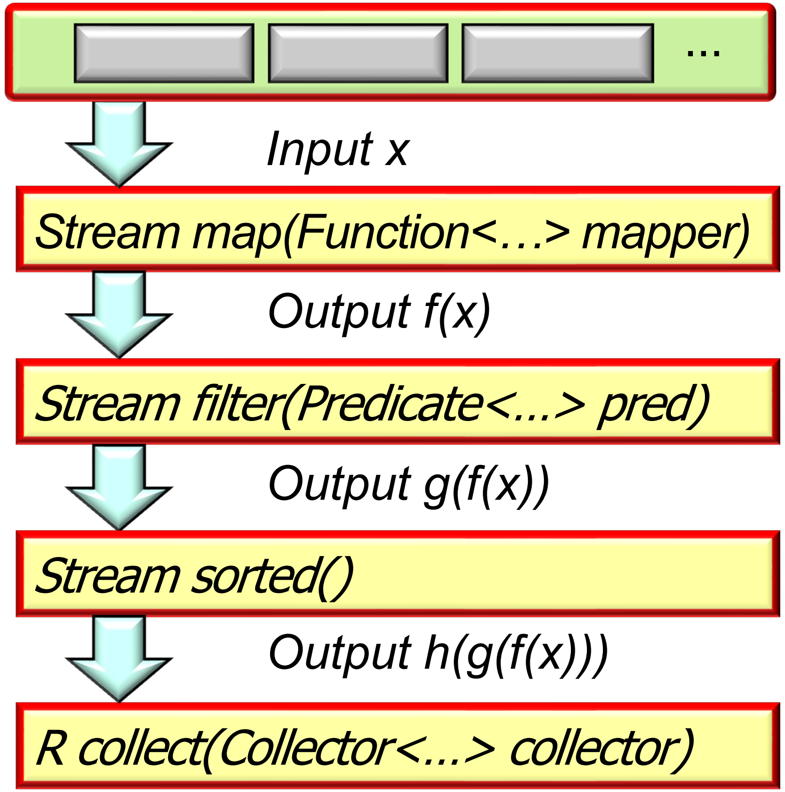
- When terminal operation runs the streams framework picks an execution plan


...
Input x
Stream map(Function<...> mapper)
Output f(x)
Stream filter(Predicate<...> pred)
Output g(f(x))
Stream sorted()
Output h(g(f(x)))
R collect(Collector<...> collector)

See developer.ibm.com/technologies/java/articles/j-java-streams-3-brian-goetz/#executing-a-stream-pipeline

Java Stream Execution

- When terminal operation runs the streams framework picks an execution plan
  - The plan is based on properties of the source & aggregate operations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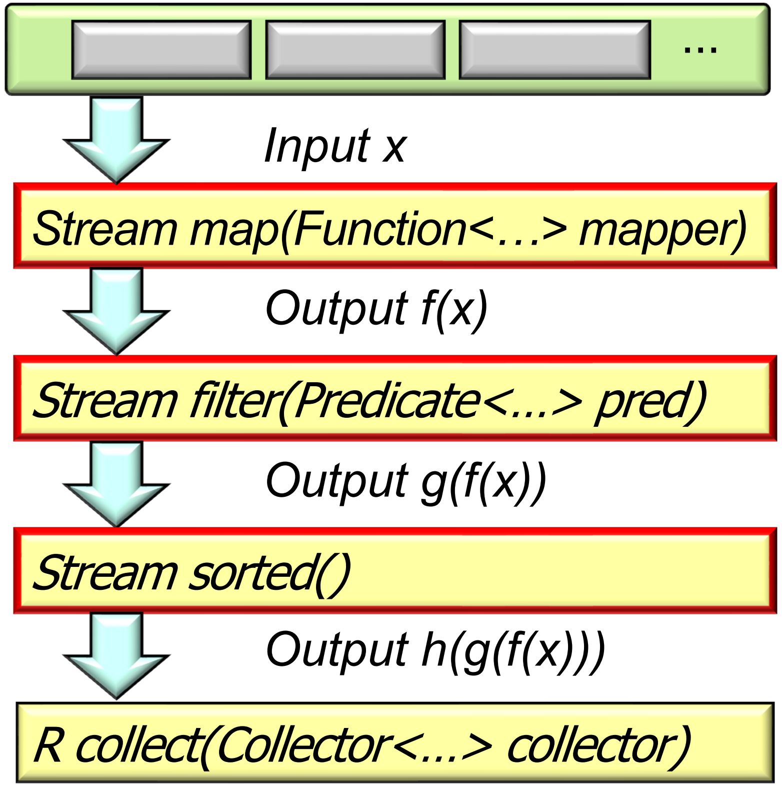
Java Stream Execution

- When terminal operation runs the streams framework picks an execution plan
  - The plan is based on properties of the source & aggregate operations
  - Intermediate operations are divided into two categories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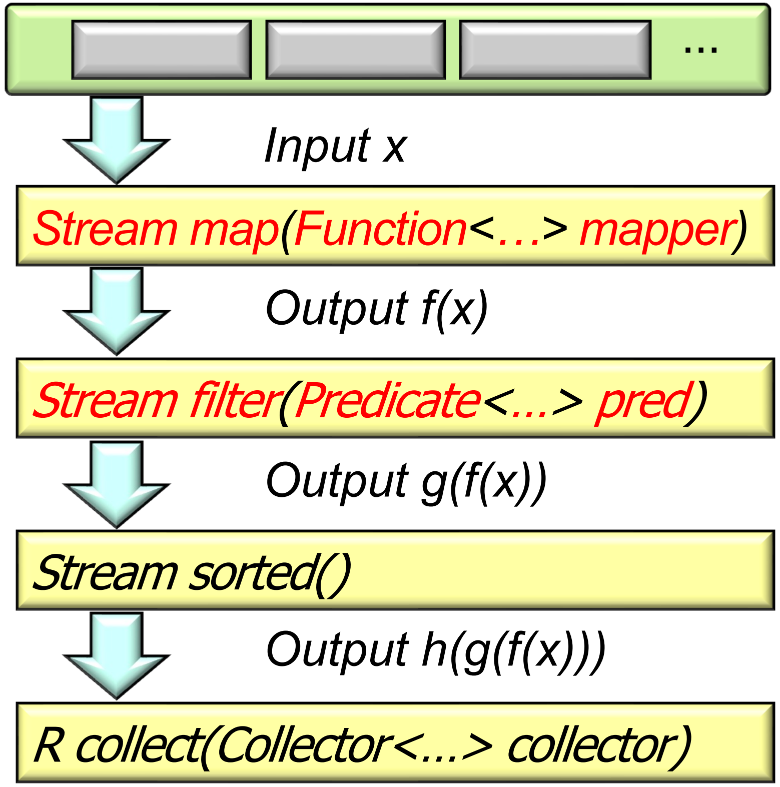
Java Stream Execution

- When terminal operation runs the streams framework picks an execution plan
  - The plan is based on properties of the source & aggregate operations
  - Intermediate operations are divided into two categories:
    - Stateless
      - e.g., filter(), map(), flatMap(), mapMulti(), etc.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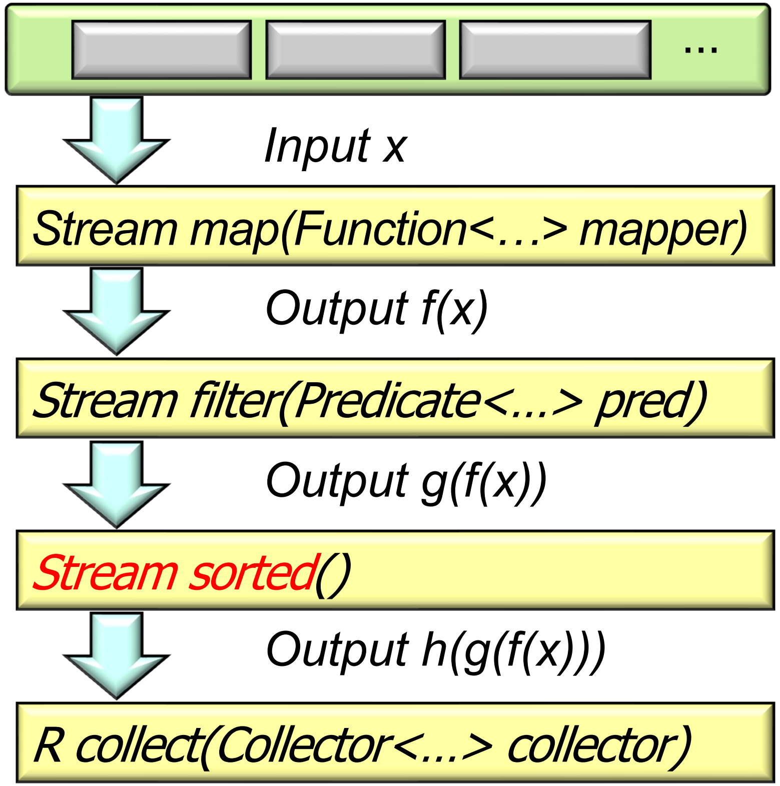
A pipeline with only stateless operations runs in one pass (even if it's parallel)

Java Stream Execution

- When terminal operation runs the streams framework picks an execution plan
  - The plan is based on properties of the source & aggregate operations
  - Intermediate operations are divided into two categories:
    - Stateless
    - Stateful
      - e.g., sorted(), limit(), distinct(), dropWhile(), takeWhile(), etc.



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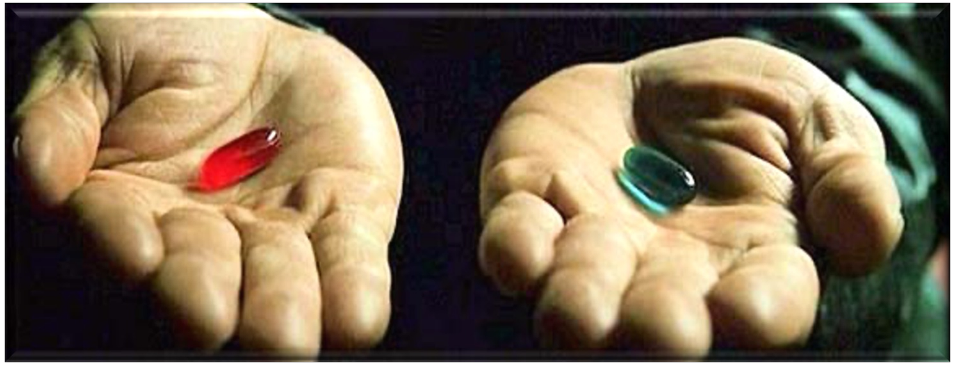
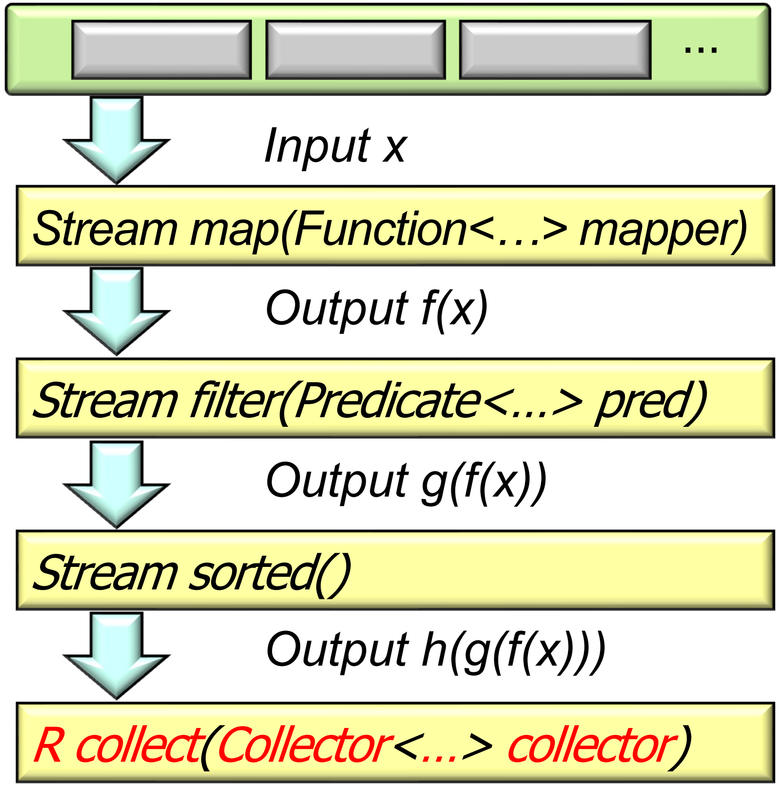
A pipeline with stateful operations is divided into sections & runs in multiple passes

Java Stream Execution

- When terminal operation runs the streams framework picks an execution plan
  - The plan is based on properties of the source & aggregate operations
  - Intermediate operations are divided into two categories
  - Terminal operations are also divided into two categories





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Java Stream Execution

- When terminal operation runs the streams framework picks an execution plan
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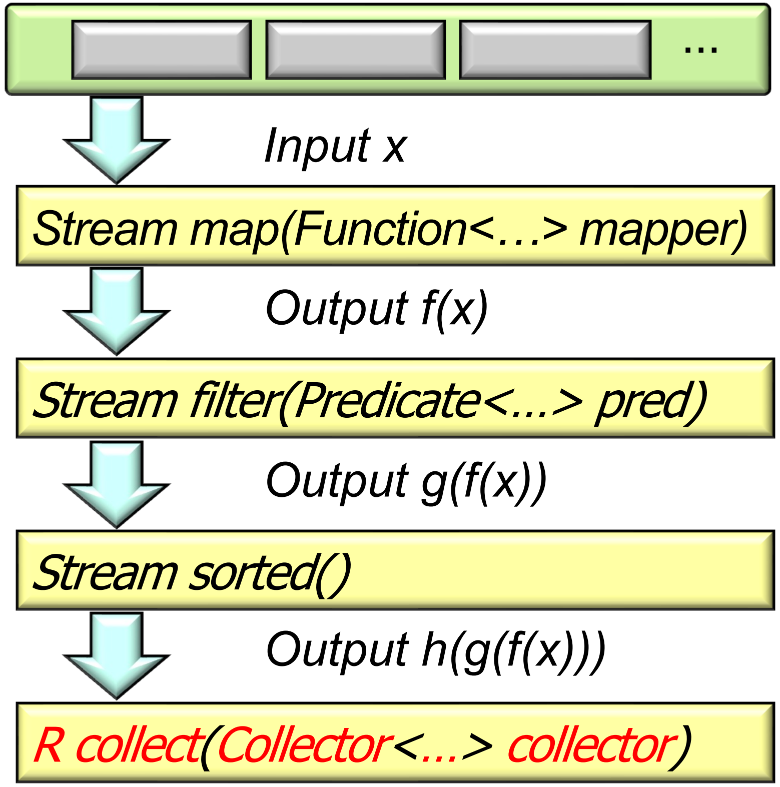
  - Intermediate operations are divided into two categories
  - Terminal operations are also divided into two categories
    - Run-to-completion
      - e.g., reduce(), collect(), forEach(), etc.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These terminal operation process data in bulk using Spliterator.forEachRemaining()

Java Stream Execution

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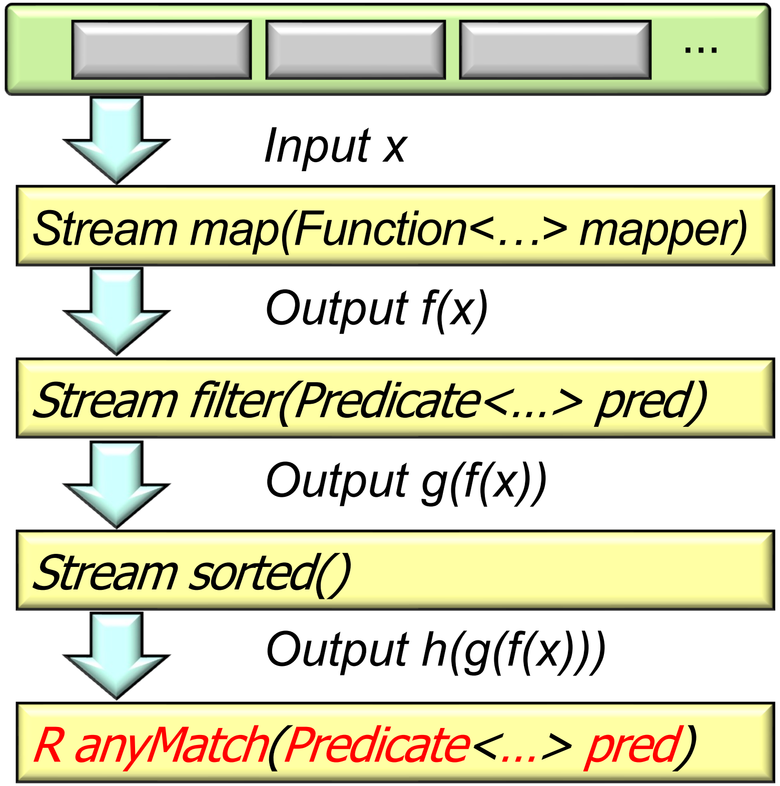
  - The plan is based on properties of the source & aggregate operations
  - Intermediate operations are divided into two categories
  - Terminal operations are also divided into two categories
    - Run-to-completion
    - Short-circuiting
      - e.g., anyMatch(), findFirst(), etc.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R anyMatch(Predicate<…> pred)

These terminal operation process data one element at a time using tryAdvance().

End of Java Stream Internals: Execution