When to Use Java Parallel Streams

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Learning Objectives in this Part of the Lesson

- Learn when to use parallel streams
  - e.g., when behaviors are independent, computationally expensive, applied to many elements of data sources, as well as when multiple cores are available

Parallelism is Not a Panacea

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- A parallel program *always* does more work than a non-parallel program

"Work" in this context means "extra steps"

Parallelism is Not a Panacea

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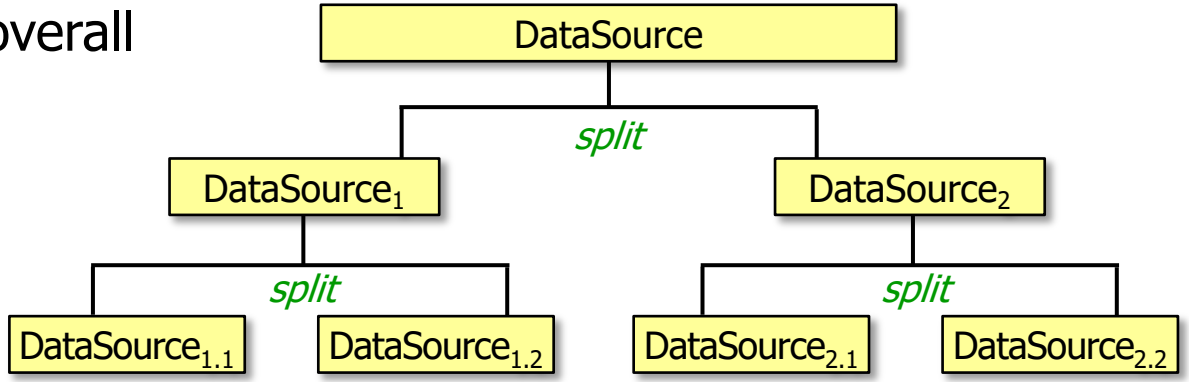
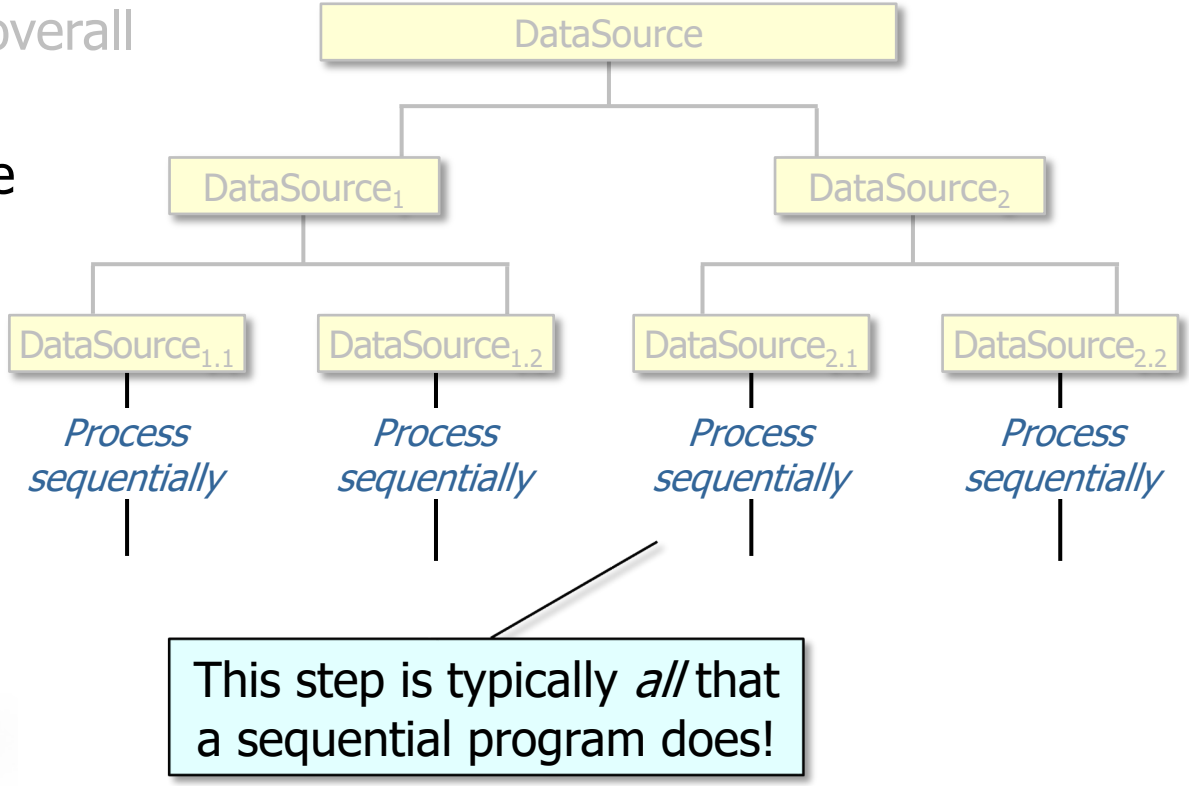
  1. It needs to partition the overall task into sub-tasks



Parallelism is Not a Panacea

- A parallel program *always* does more work than a non-parallel program, e.g.
  1. It needs to partition the overall task into sub-tasks
  2. It needs to process all the sub-tasks



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- A parallel program *always* does more work than a non-parallel program, e.g.
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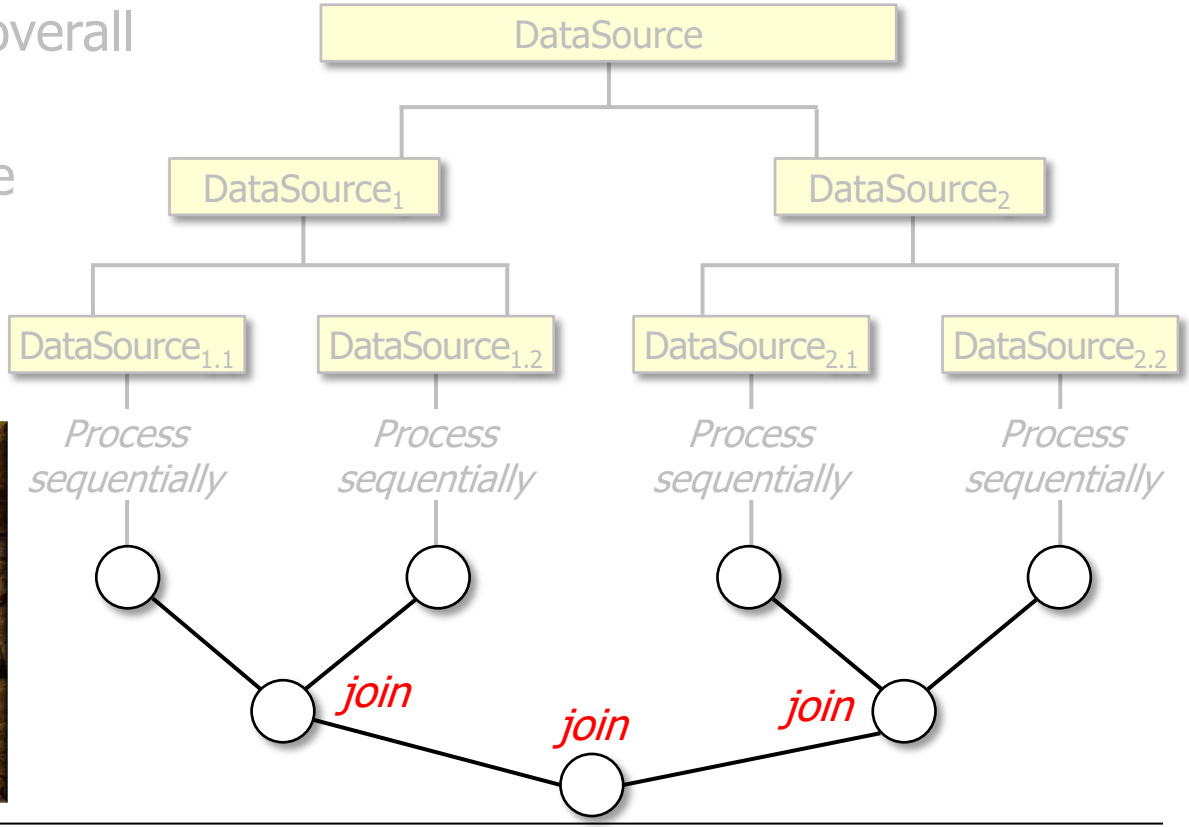
  3. It needs to combine the sub-task results



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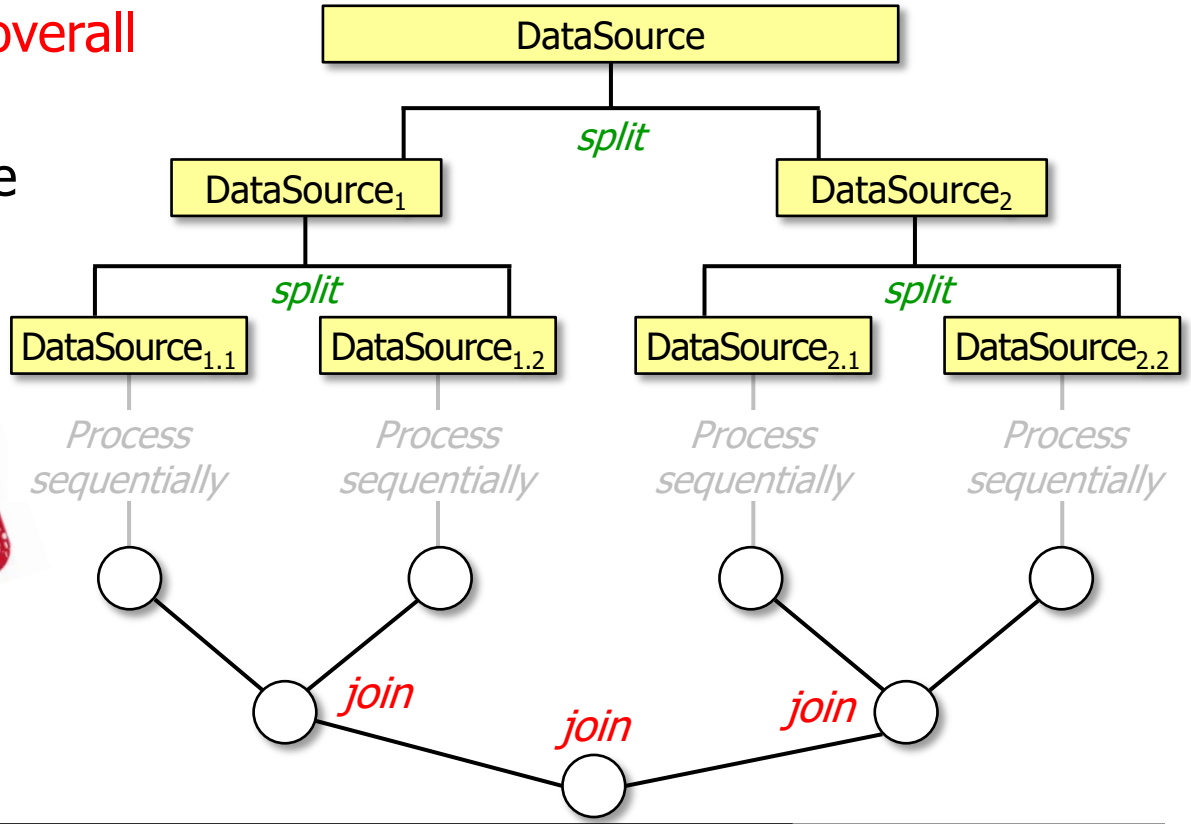

A sequential program needn't do steps 1 & 3..

Parallelism is Not a Panacea

- Java parallel streams are thus useful in some (but not all) conditions

See gee.cs.oswego.edu/dl/html/StreamParallelGuidance.html

When to Use Java Parallel Streams

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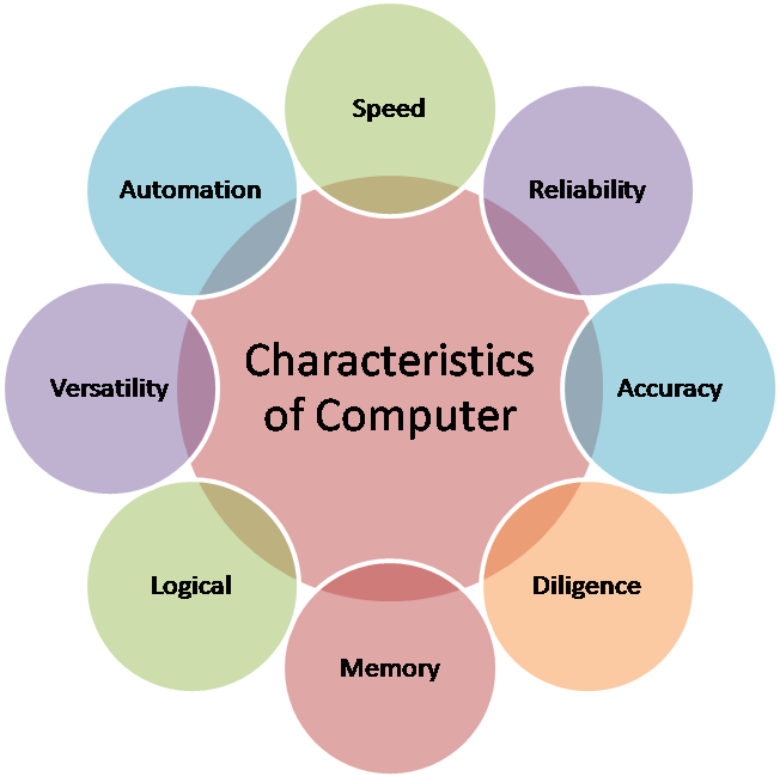
- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics



When to Use Java Parallel Streams

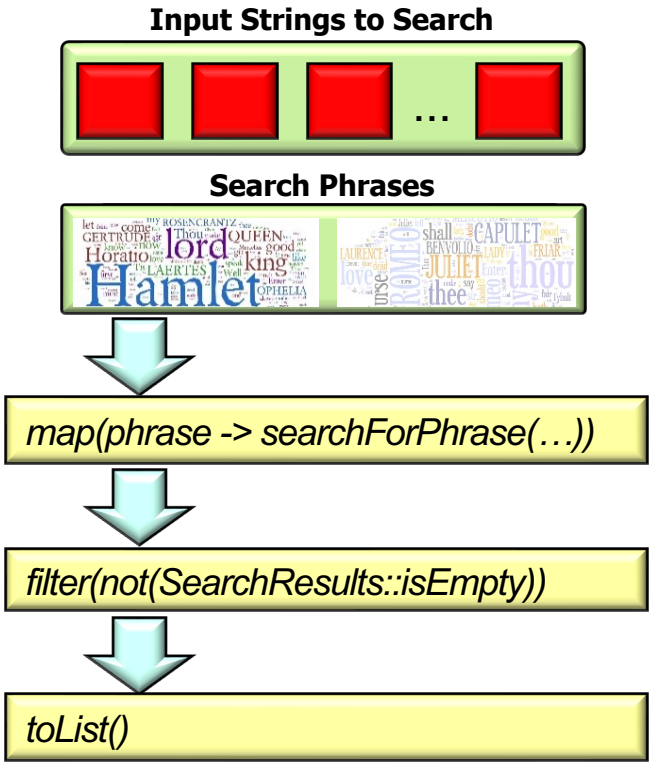
- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
    - Independent

"Embarrassingly parallel" tasks have little/no dependency or need for communication between tasks or for sharing results between them

See en.wikipedia.org/wiki/Embarrassingly_parallel

When to Use Java Parallel Streams

- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
    - Independent
      - e.g., searching for phrases in a list of input strings



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

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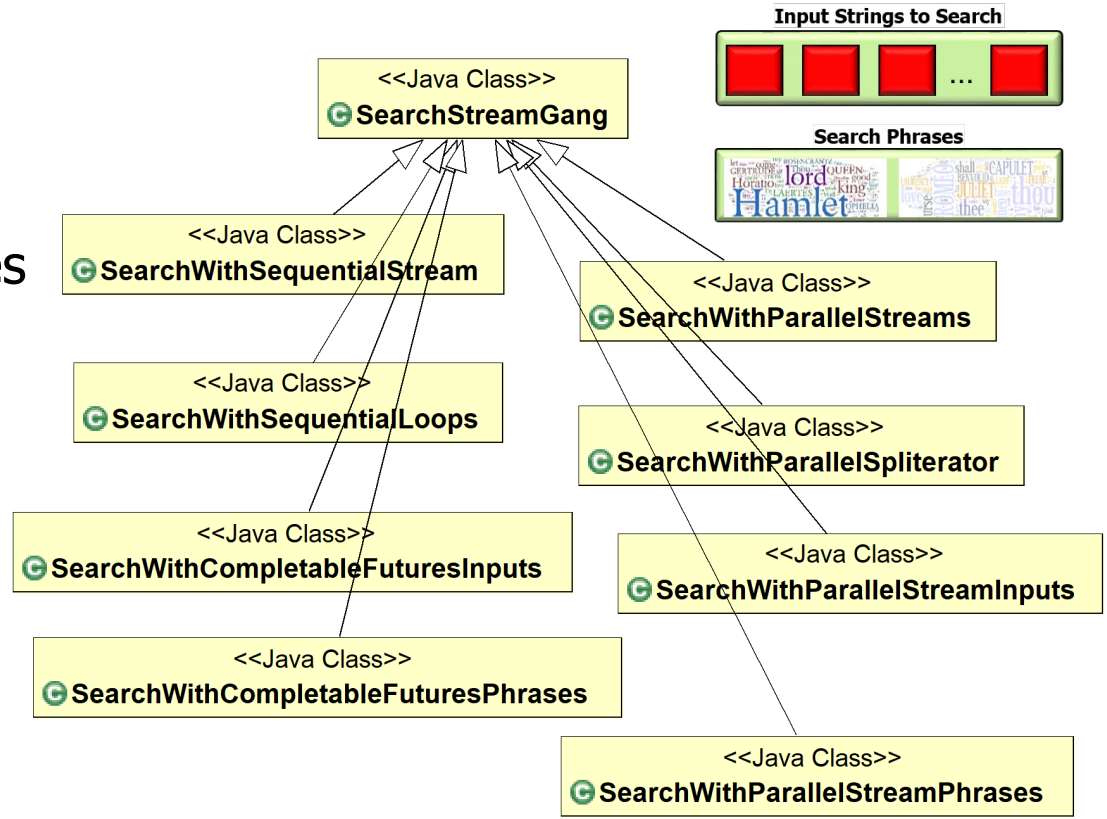

See SearchStreamGang/src/main/java/livelessons/streamgangs

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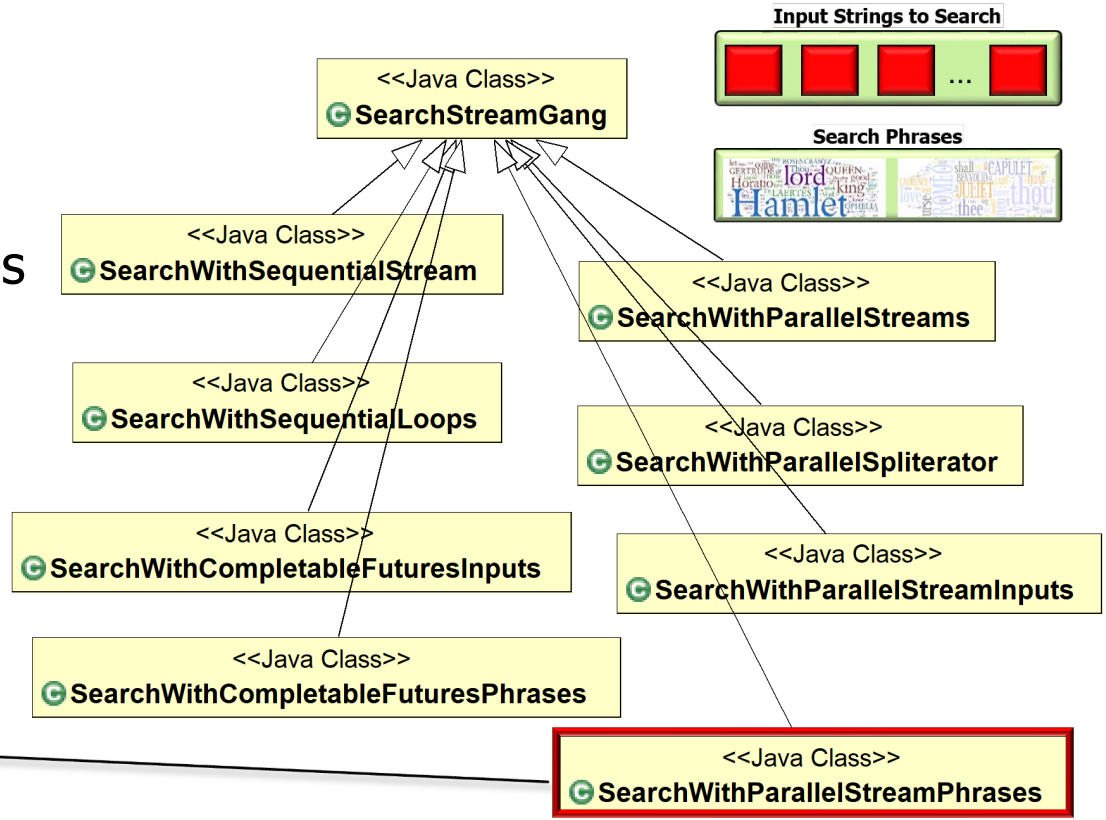

Parallel streams can:

- *search each phrase in parallel*
- *search each input string in parallel*
- *search chunks of each input string in parallel*

See SearchStreamGang/src/main/java/livelessons/streamgangs/SearchWithParallelStreamPhrases.java

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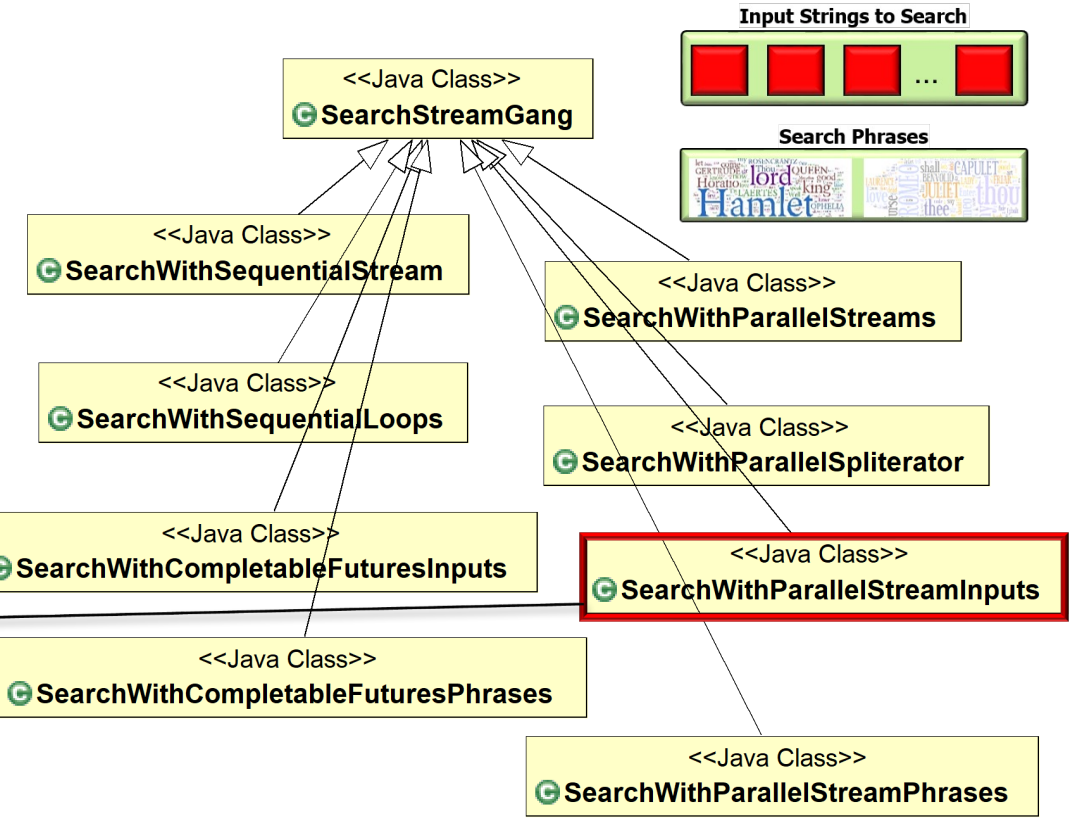

Parallel streams can:

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See SearchStreamGang/src/main/java/livelessons/streamgangs/SearchWithParallelStreamInputs.java

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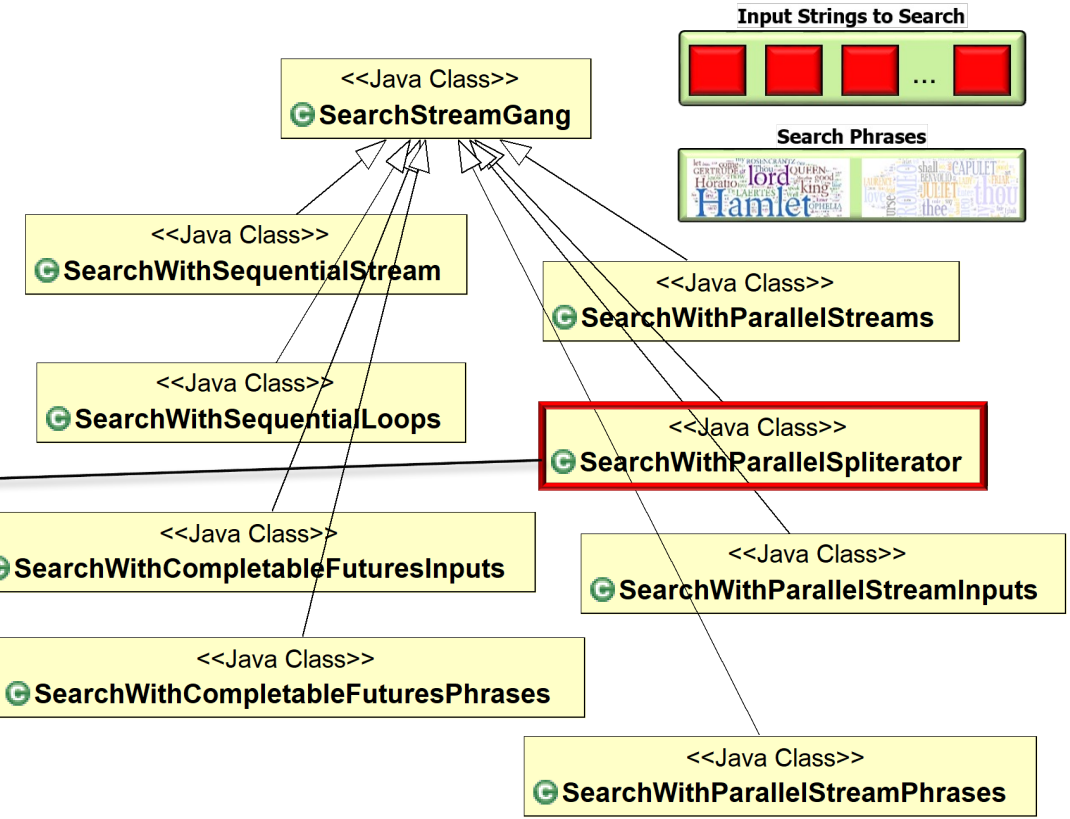


Parallel streams can:

- *search each phrase in parallel*
- *search each input string in parallel*
- *search chunks of each input string in parallel*

See SearchStreamGang/src/main/java/livelessons/streamgangs/SearchWithParallelSpliterator.java

When to Use Java Parallel Streams

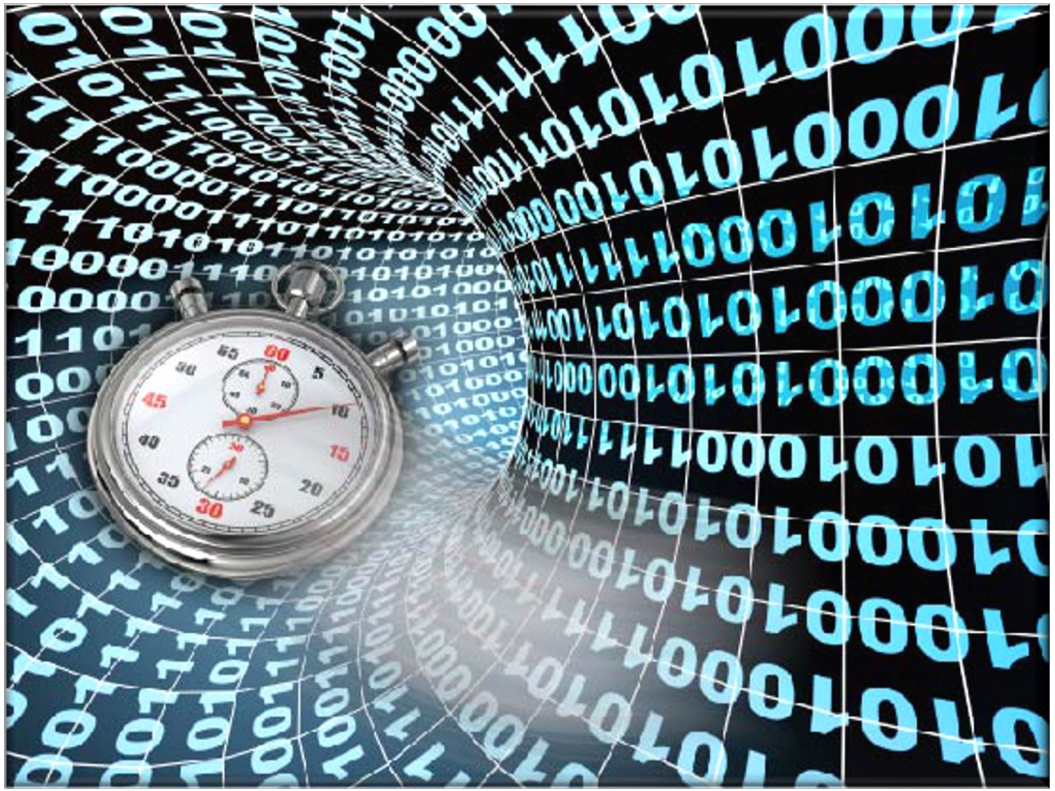
- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
    - Independent
      - e.g., searching for phrases in a list of input strings

Parallel streams can:
- *search chunks of phrases in parallel*
- *search chunks of input in parallel*
- *search chunks of each input string in parallel*

SearchWithParallelSpliterator is the most aggressive parallelism strategy!

When to Use Java Parallel Streams

- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
    - Independent
    - Computationally expensive
      - e.g., when behavior(s) applied to each element take a "long-time" to run



See developer.ibm.com/articles/j-java-streams-5-brian-goetz

When to Use Java Parallel Streams

- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
    - Independent
    - Computationally expensive
    - Applied to many elements of data sources

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When to Use Java Parallel Streams

- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
    - Independent
    - Computationally expensive
    - Applied to many elements of data sources
      - Where these sources can be split efficiently/evenly

When to Use Java Parallel Streams

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    - Independent
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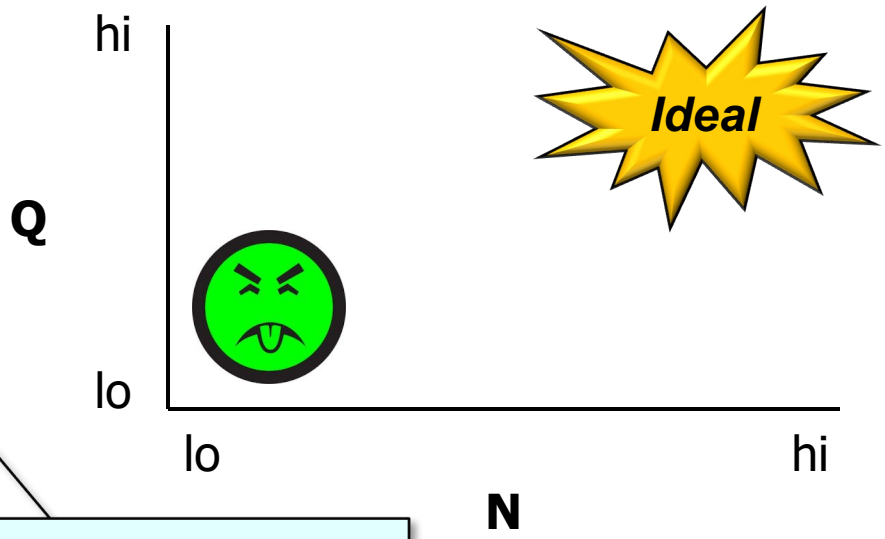
    - Applied to many elements of data sources



The "NQ" model:

- *N is the # of data elements to process per thread*
- *Q quantifies how CPU-intensive the processing is*

See on-sw-integration.epischel.de/2016/08/05/parallel-stream-processing-with-java-8-stream-api

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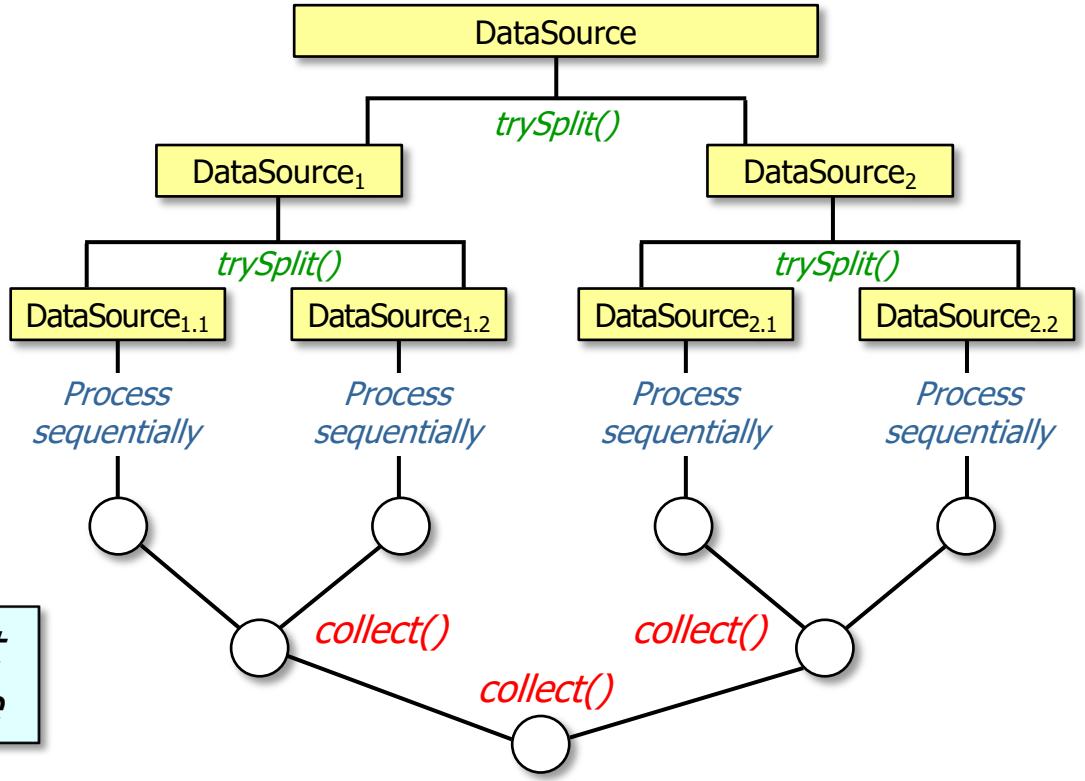
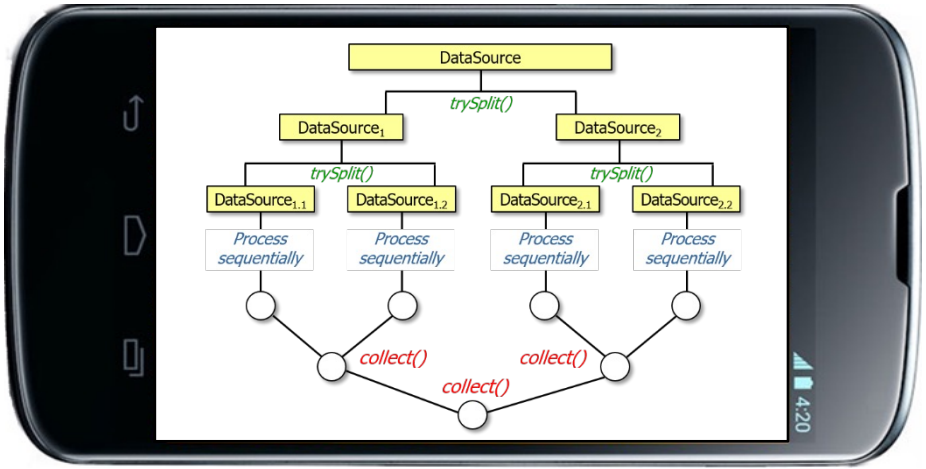


e.g., searching for phrases that match in works of Shakespeare

See github.com/douglascraigschmidt/LiveLessons/blob/master/SearchStreamGang

When to Use Java Parallel Streams

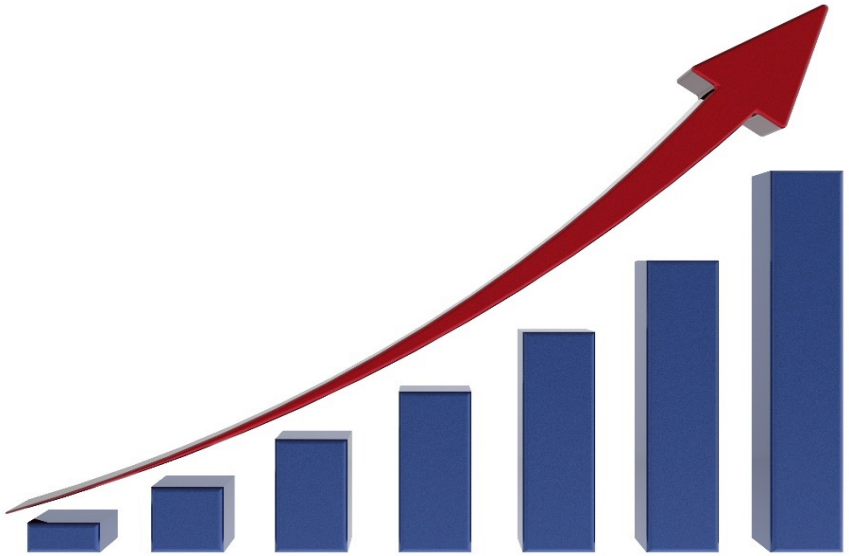
- Java parallel streams are most useful under certain conditions, e.g.
  - When behaviors have certain characteristics
  - If there are multiple cores

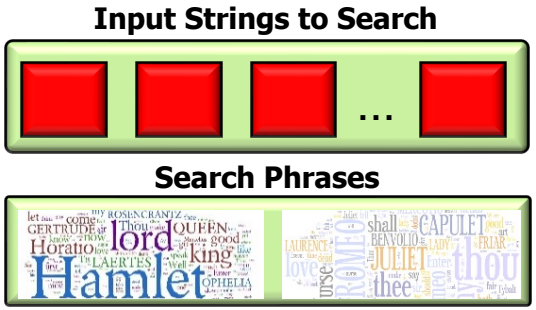


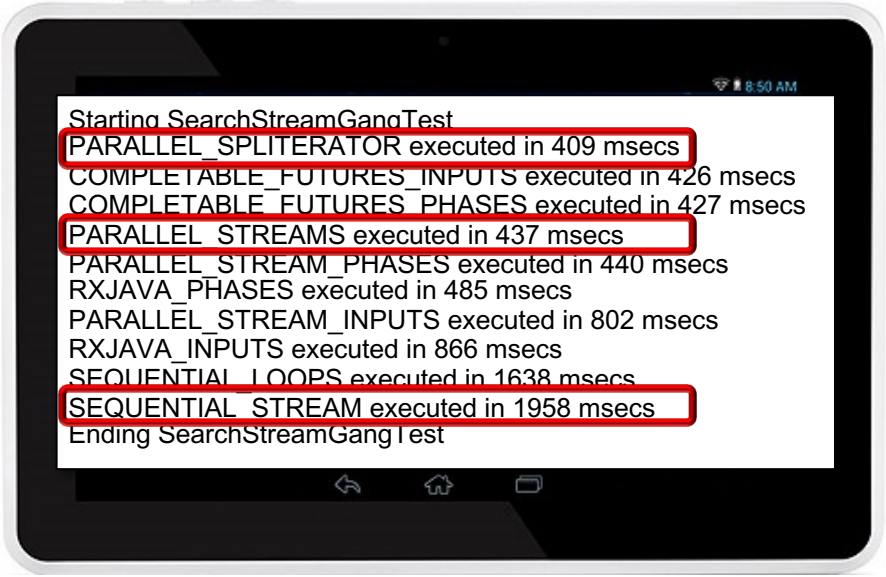
See blog.oio.de/2016/01/22/parallel-stream-processing-in-java-8-performance-of-sequential-vs-parallel-stream-processing

When to Use Java Parallel Streams

- Under the right conditions Java parallel streams can scale up nicely on multi-core & many-core processors







See www.infoq.com/presentations/parallel-java-se-8

End of When to Use Java Parallel Streams