Understand the Java Sequential SearchStreamGang Case Study

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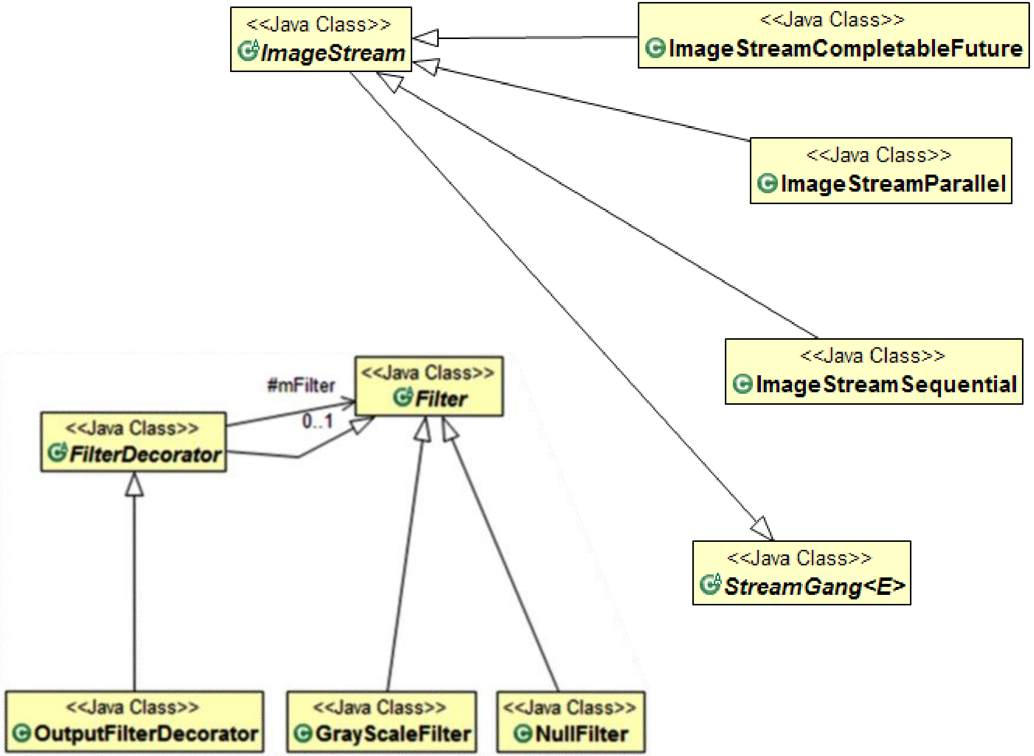
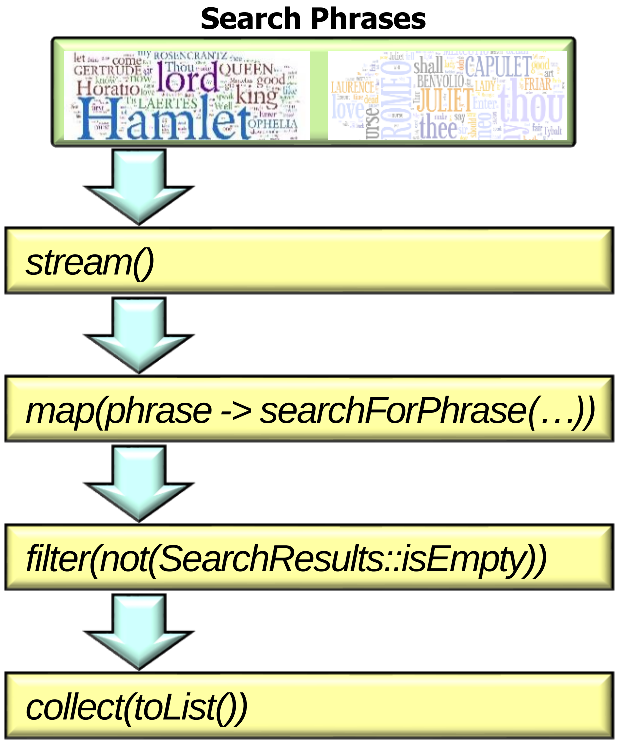
Learning Objectives in this Part of the Lesson

- Understand the design of the SearchStreamGang program





stream()

map(phrase -> searchForPhrase(…))

filter(not(SearchResults::isEmpty))

collect(toList())

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

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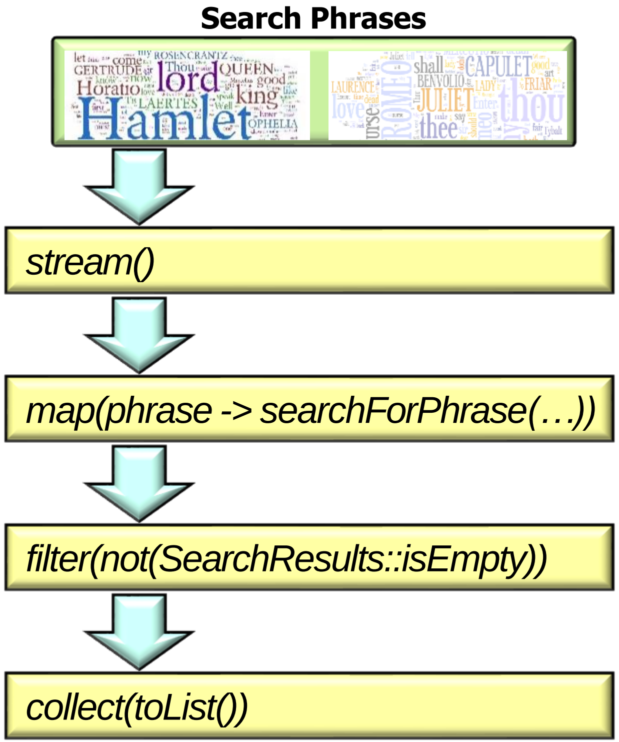
Search Phrases

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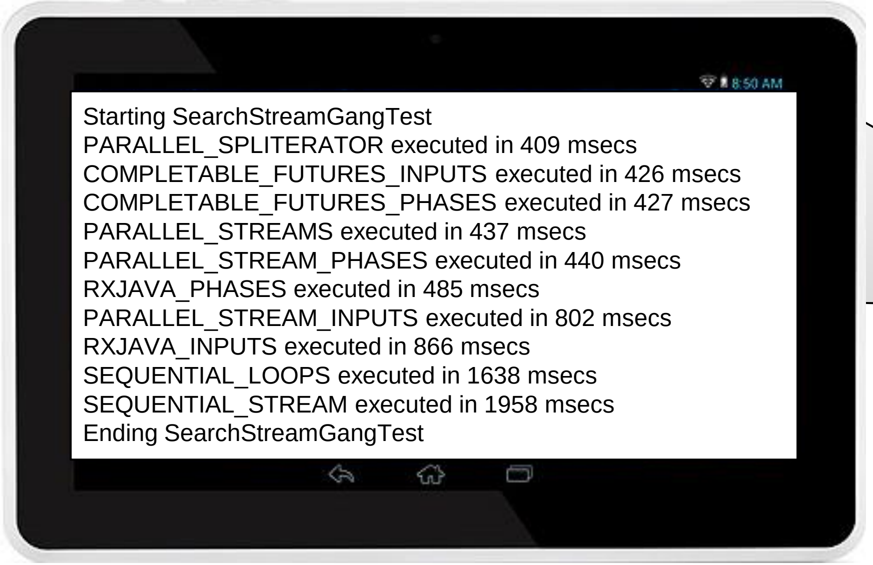
This example is more interesting than the SimpleSearchStream program

Learning Objectives in this Part of the Lesson

- Understand the design of the SearchStreamGang program
  - Later we'll cover the performance of different implementation strategies



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PARALLEL_SPLITERATOR executed in 409 msecs
COMPLETABLE_FUTURES_INPUTS executed in 426 msecs
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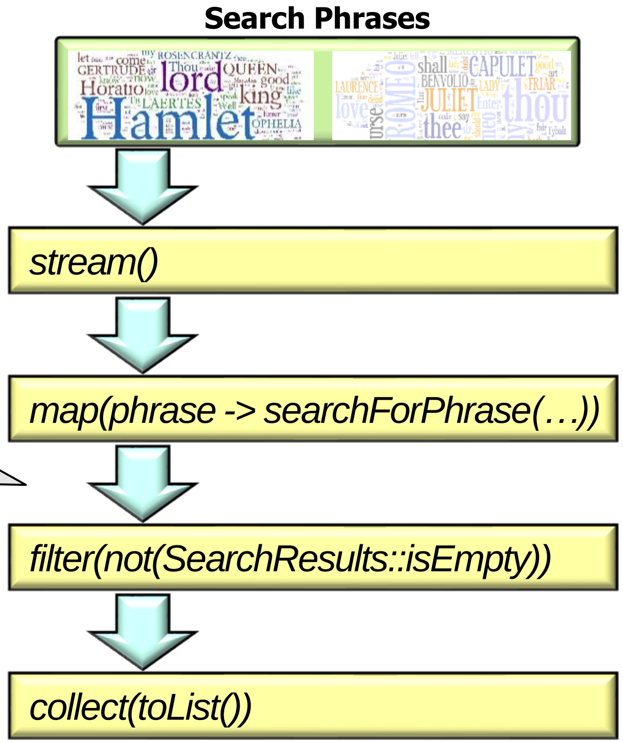

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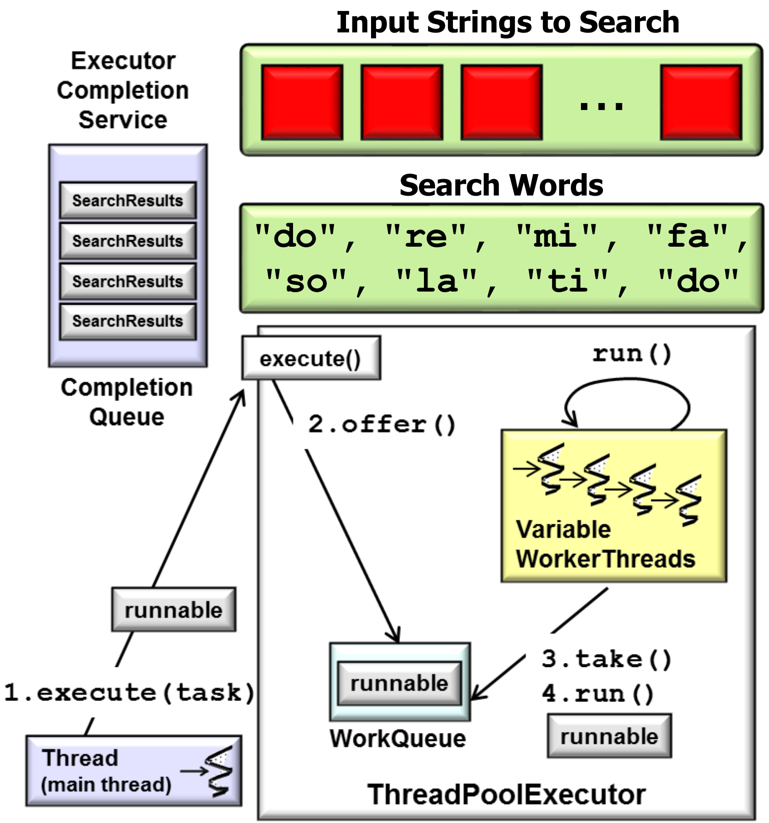
Overview of SearchStreamGang

Overview of SearchStreamGang

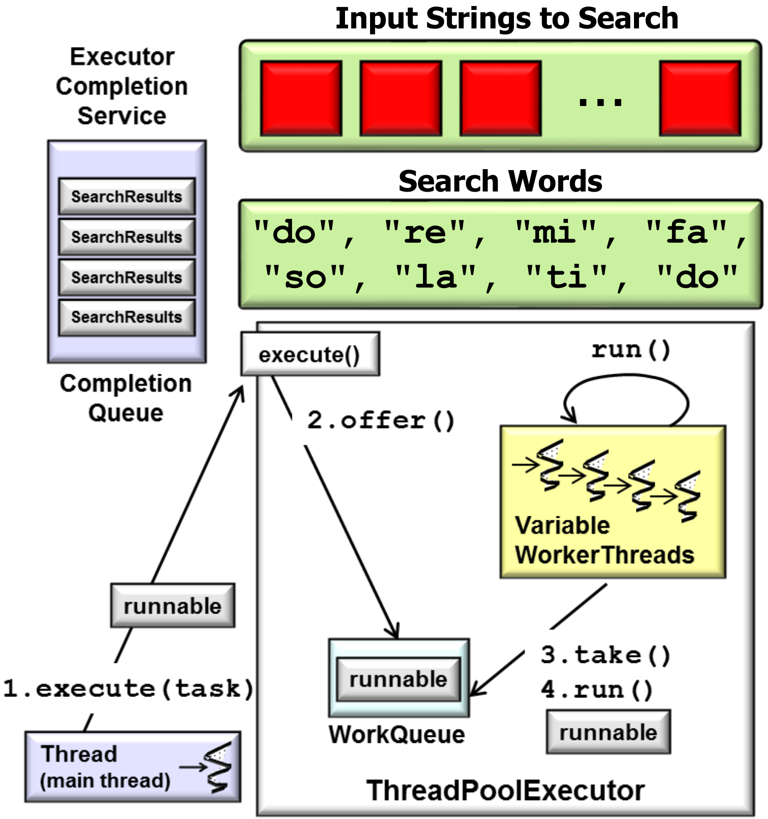
- SearchStreamGang revises SearchTaskGang to use functional programming & streams instead of OO programming



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

Overview of SearchStreamGang

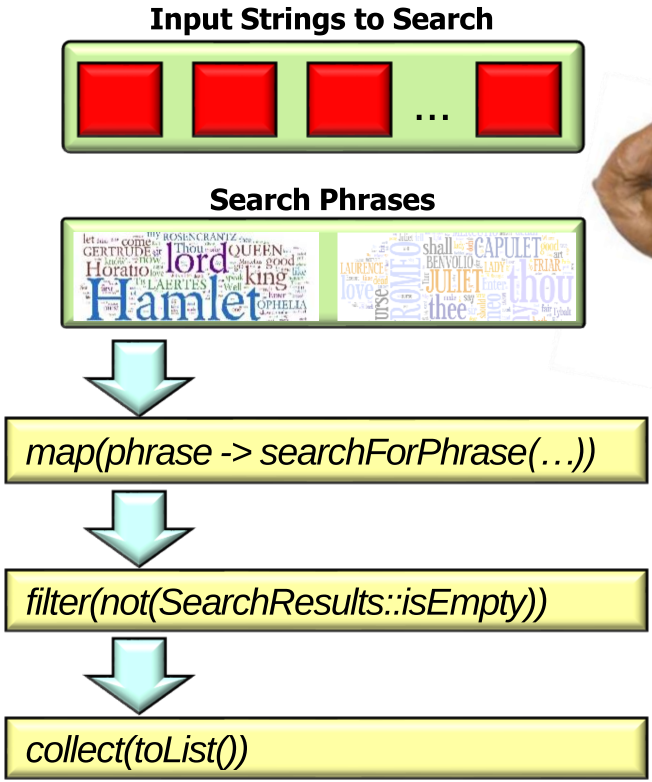
- SearchStreamGang revises SearchTaskGang to use functional programming & streams instead of OO programming
    - SearchTaskGang showcases the Java executor framework for tasks that are "embarrassingly parallel"

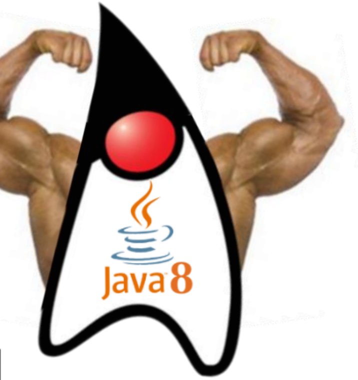


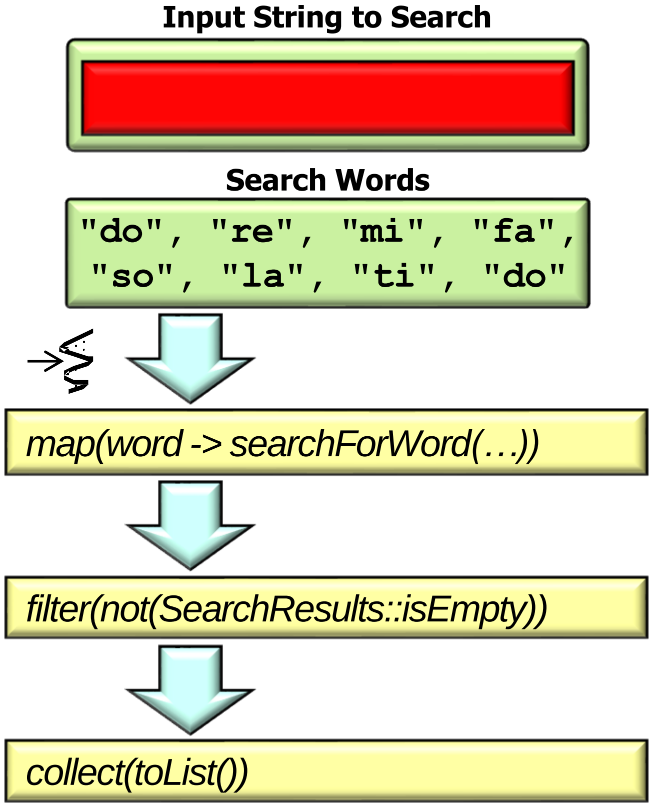
e.g., Executor, ExecutorService, ExecutorCompletionService

Overview of SearchStreamGang

- SearchStreamGang is also a more powerful revision of SimpleSearchStream







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

Overview of SearchStreamGang

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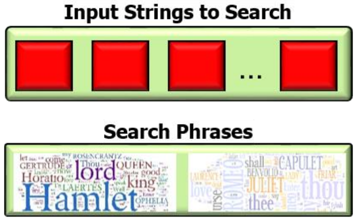
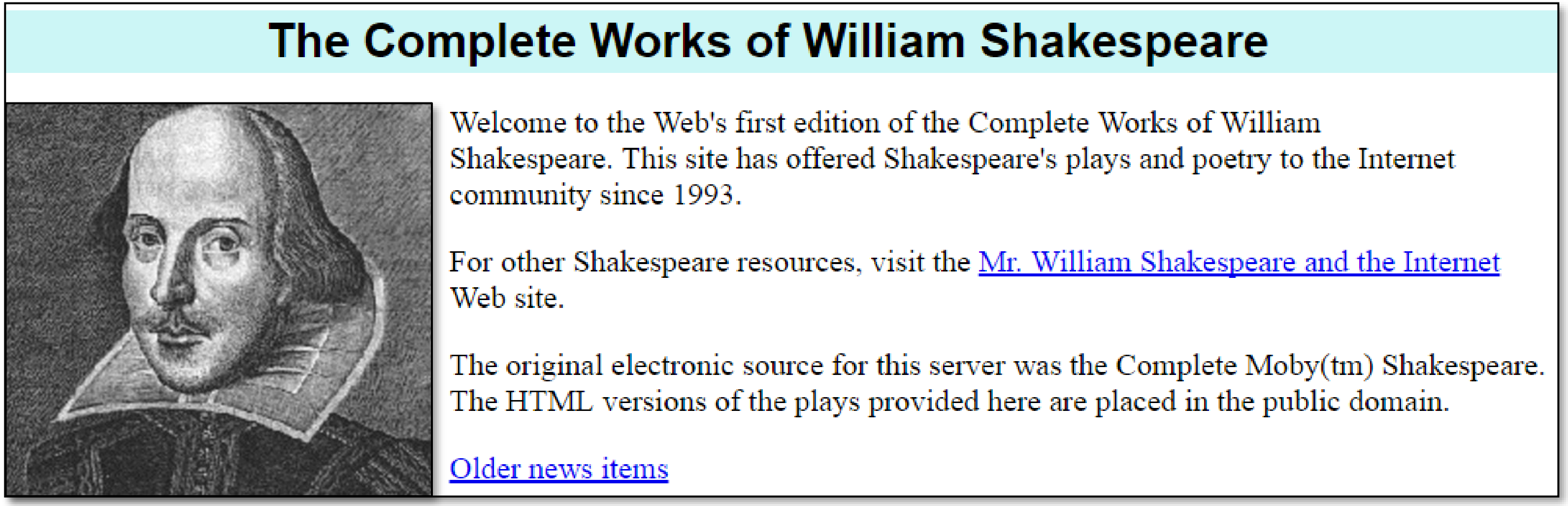
  - It uses regular expressions to find phrases in works of Shakespeare





The Complete Works of William Shakespeare

Welcome to the Web's first edition of the Complete Works of William Shakespeare. This site has offered Shakespeare's plays and poetry to the Internet community since 1993.

For other Shakespeare resources, visit the Mr. William Shakespeare and the Internet Web site.

The original electronic source for this server was the Complete Moby(tm) Shakespeare. The HTML versions of the plays provided here are placed in the public domain.

Older news items

See shakespeare.mit.edu

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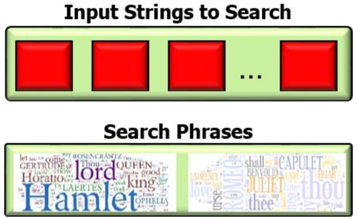

"…
My liege, and madam, to expostulate
What majesty should be, what duty is,
Why day is day, night is night, and time is time.
Were nothing but to waste night, day, and time.
Therefore, since brevity is the soul of wit,
And tediousness the limbs and outward flourishes,
I will be brief. …"

"Brevity is the soul of wit"

A phrase can match anywhere within a line

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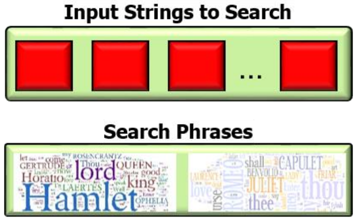

"…
What's in a name? That which we call a rose
By any other name would smell as sweet.
So Romeo would, were he not Romeo call'd,
Retain that dear perfection which he owes
Without that title. …"

"What's in a name? That which we call a rose
By any other name would smell as sweet."

The phrases can also match across multiple lines

Overview of SearchStreamGang

- SearchStreamGang is also a more powerful revision of SimpleSearchStream, e.g.
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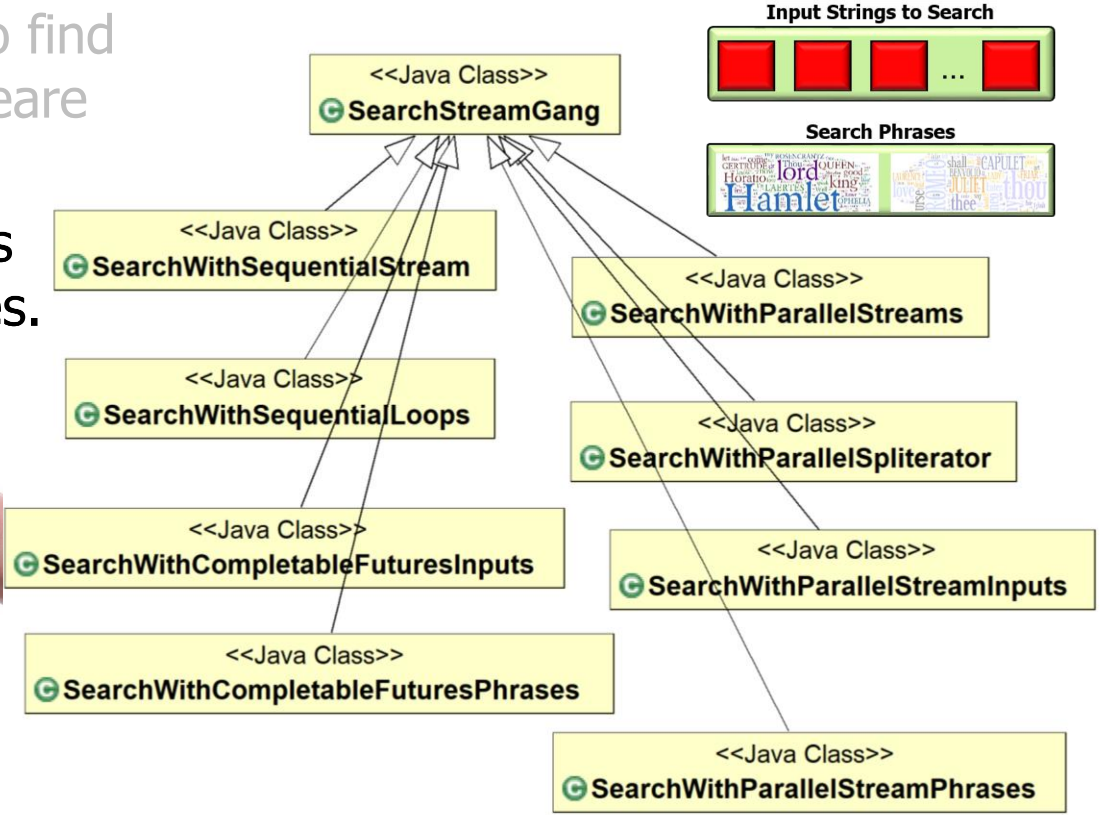
  - It defines a framework for apples-to-apples comparisons of Java's parallelism strategies.



Input Strings to Search

...

Search Phrases

<<Java Class>>
SearchStreamGang

<<Java Class>>
SearchWithSequentialStream

<<Java Class>>
SearchWithSequentialLoops

<<Java Class>>
SearchWithCompletableFuturesInputs

<<Java Class>>
SearchWithCompletableFuturesPhrases

<<Java Class>>
SearchWithParallelStreams

<<Java Class>>
SearchWithParallelSpliterator

<<Java Class>>
SearchWithParallelStreamInputs

<<Java Class>>
SearchWithParallelStreamPhrases

e.g., parallel streams, parallel spliterator, fork-join pool, & completable futures

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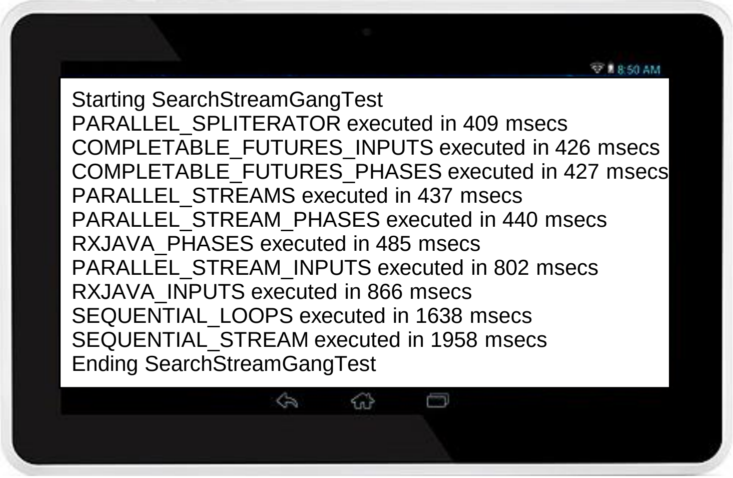

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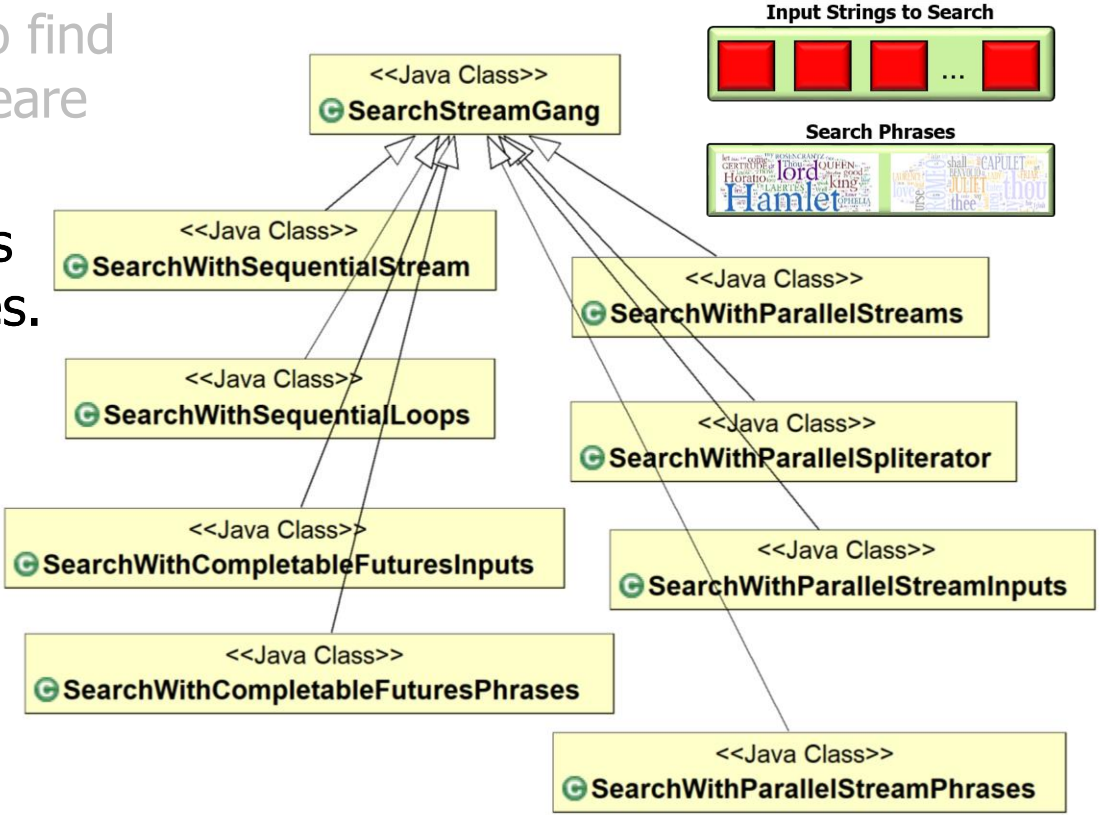

The differences in performance is quite informative!

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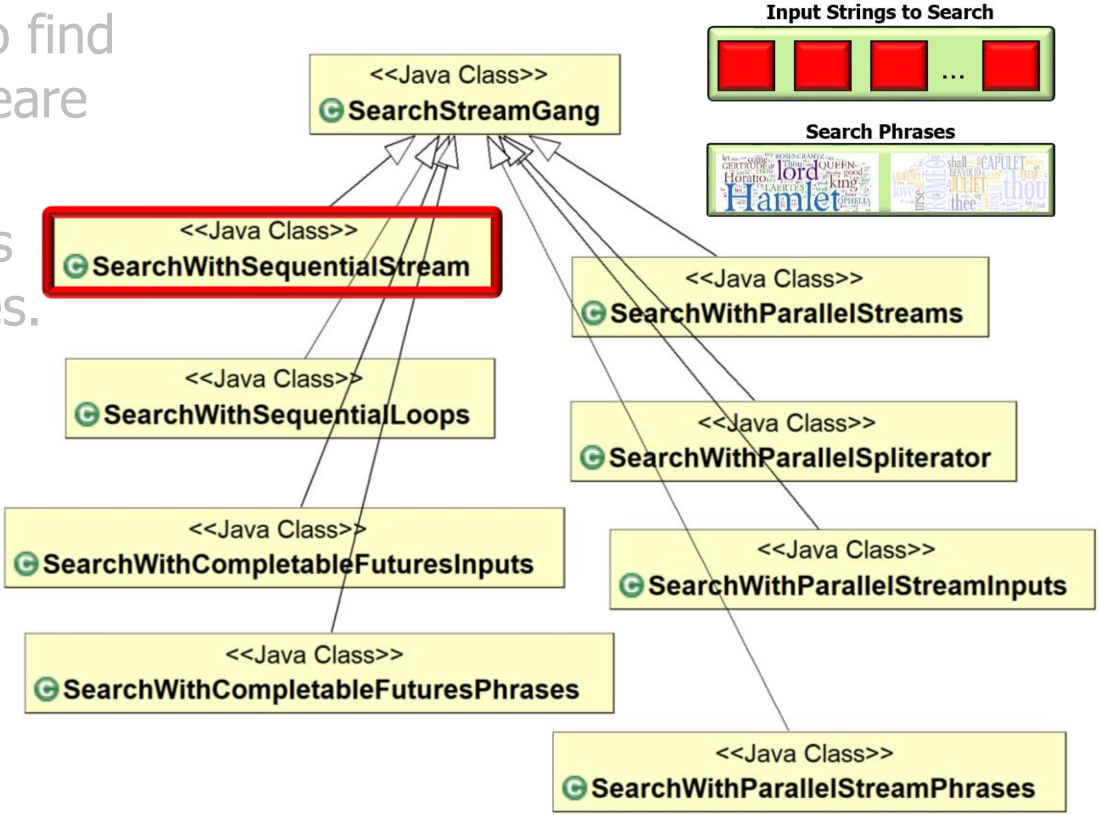
  - We'll cover the Java parallel strategies after first covering sequential streams.



Input Strings to Search
...
Search Phrases
Hamlet
lord
king
Horatio
thou
thee
<<Java Class>>
SearchStreamGang
<<Java Class>>
SearchWithSequentialStream
<<Java Class>>
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<<Java Class>>
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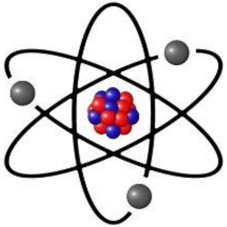

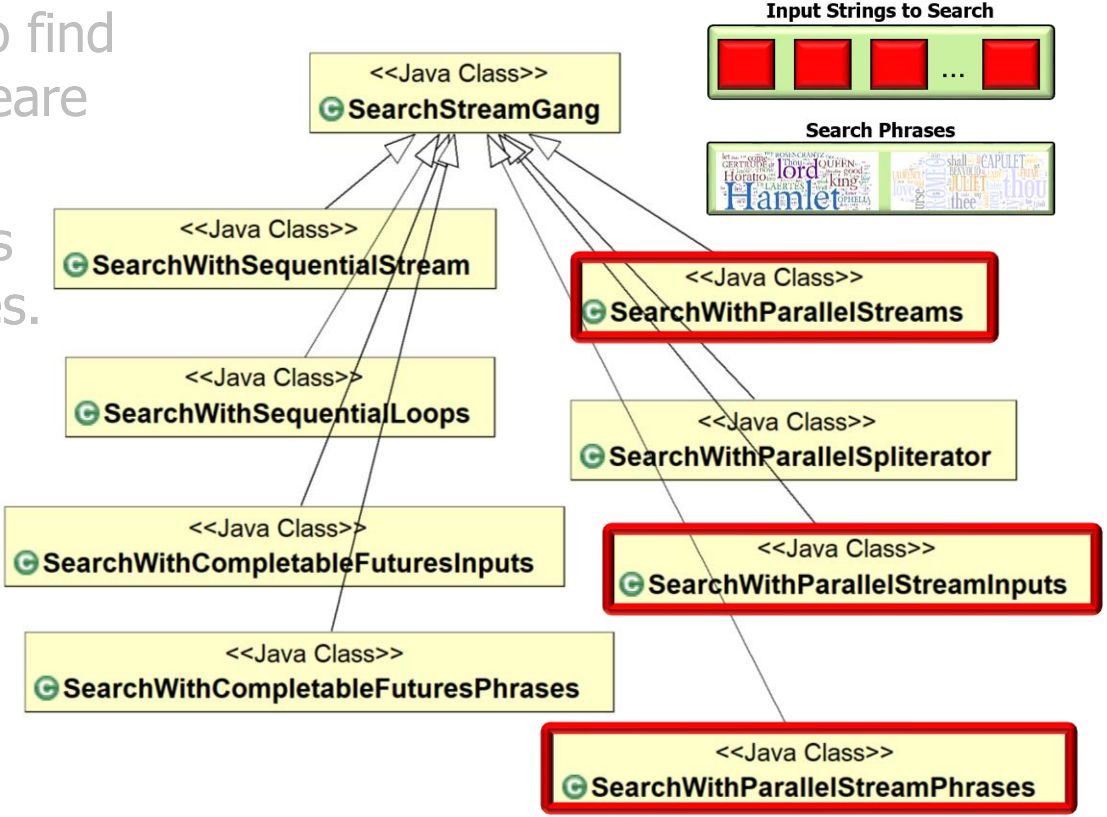
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Minuscule changes are needed to transition from sequential to parallel streams!

Applying Sequential Streams to SearchStreamGang

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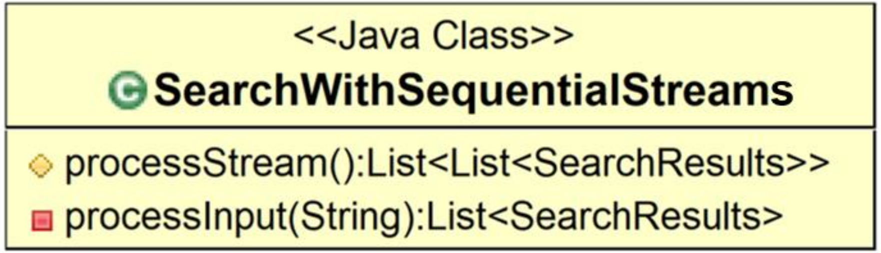
- We show aggregate operations in the SearchStreamGang’s processStream() & processInput() methods



<<Java Class>>

SearchWithSequentialStreams

processStream():List<List<SearchResults>>

processInput(String):List<SearchResults>

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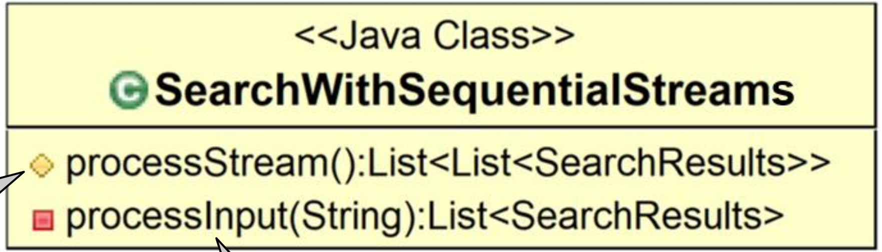

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SearchWithSequentialStreams

◇ processStream():List<List<SearchResults>>

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```
getInput()
  .stream()
  .map(this::processInput)
  .collect(toList());
```

```
return mPhrasesToFind
  .stream()
  .map(phrase -> searchForPhrase(phrase, input, title, false))
  .filter(not(SearchResults::isEmpty))
  .collect(toList());
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See livelessons/streamgangs/SearchWithSequentialStreams.java

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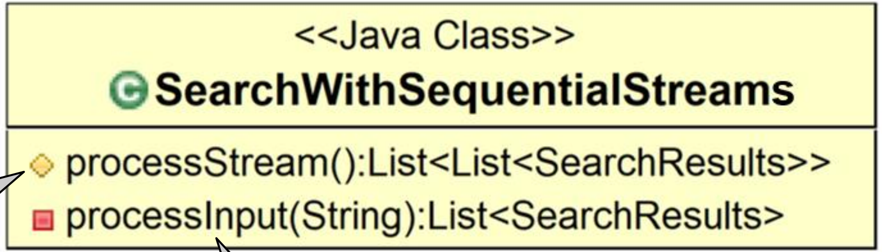

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i.e., the map(), filter(), & collect() aggregate operations

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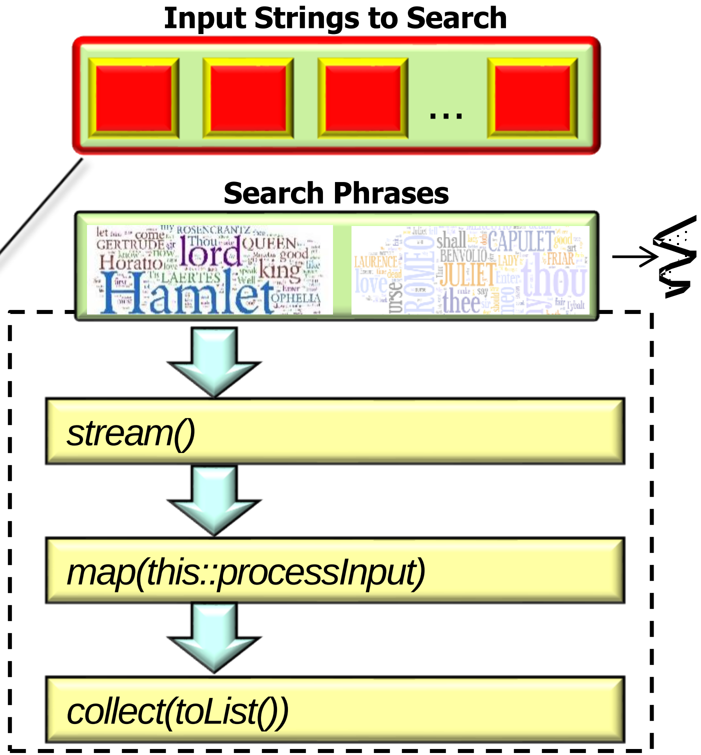
- We show aggregate operations in the SearchStreamGang's processStream() & processInput() methods
  - **processStream()**
    - Uses a sequential stream to search a list of input strings in one thread

Each input string contains a work of Shakespeare (e.g., Hamlet, MacBeth, etc.)



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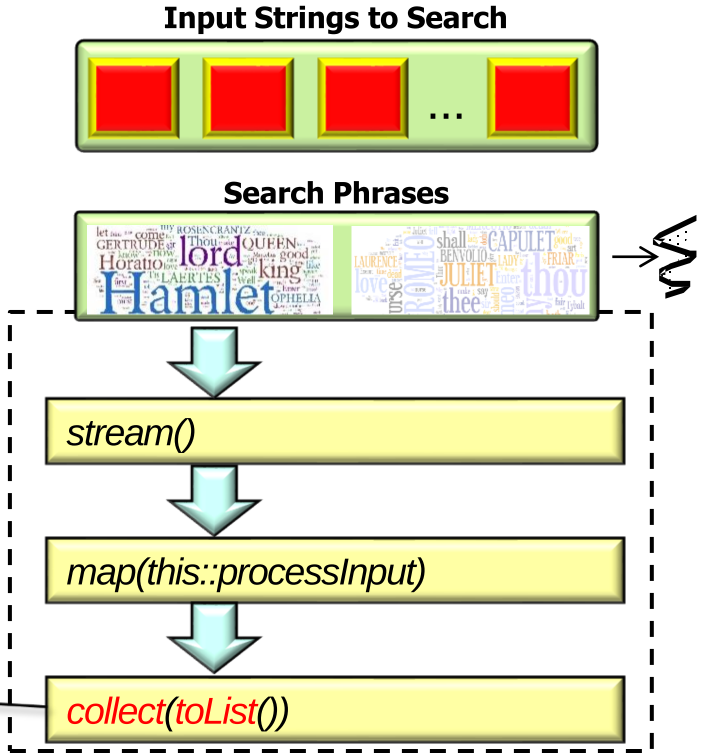

Returns a list of lists of SearchResults

Applying Sequential Streams to SearchStreamGang

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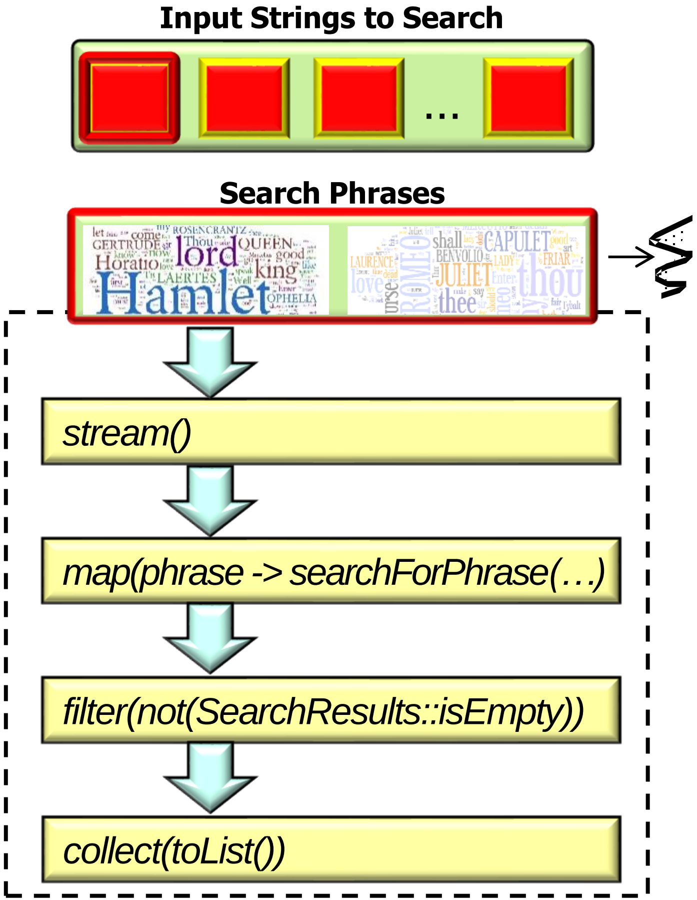
  - processStream()
  - **processInput()**
    - Uses a sequential stream to search a given input string & locate all the occurrences of phases in one thread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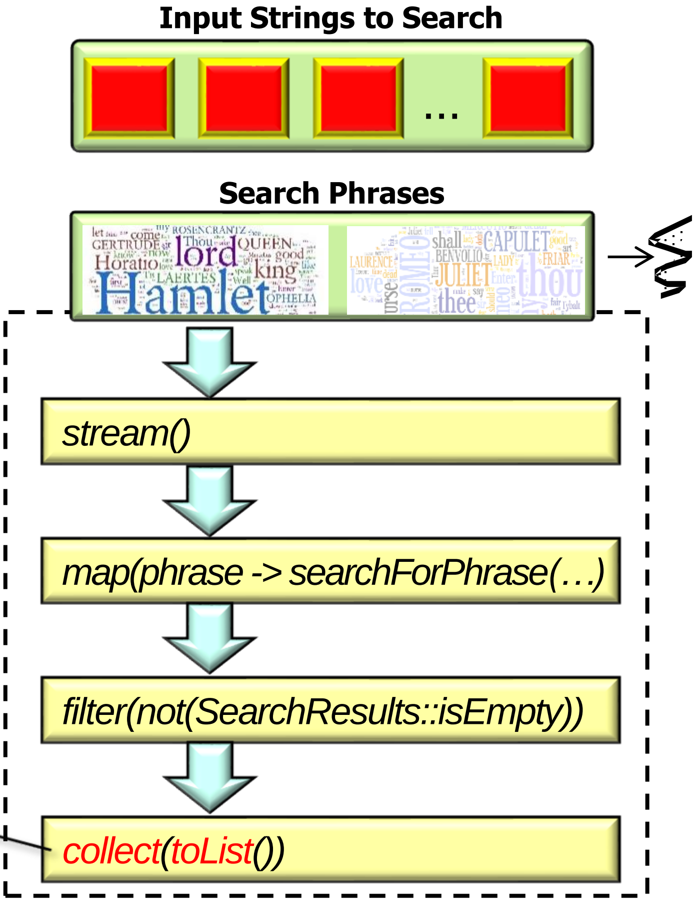
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End of Understand the Java Sequential SearchStreamGang Case Study