# Evaluating the Java Parallel ImageStreamGang Case Study

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# Learning Objectives in this Part of the Lesson

- Understand purpose of the ImageStreamGang app
- Recognize patterns applied in the ImageStreamGang app
- Know how the structure of the ImageStreamGang app
- Visualize how Java parallel streams are applied to the ImageStreamGang app
- Learn how the parallel stream behaviors of ImageStreamGang are implemented
- Be aware of the pros & cons of the parallel streams solution

See [github.com/douglascraigschmidt/LiveLessons/blob/master/ImageStreamGang](https://github.com/douglascraigschmidt/LiveLessons/blob/master/ImageStreamGang)

# Pros of the Java Parallel Streams Solution

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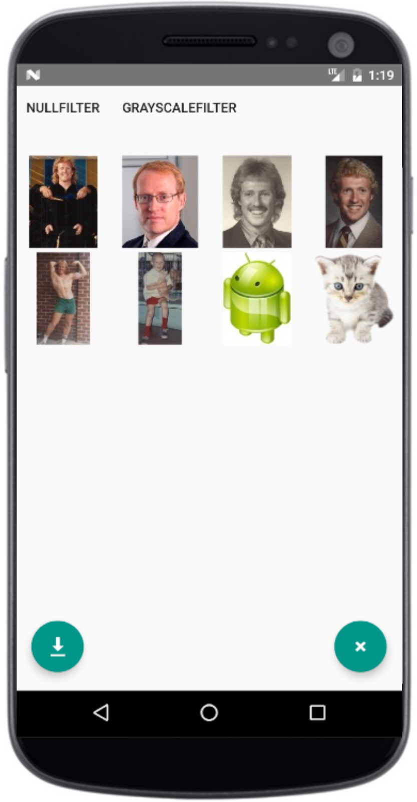
- The parallel stream version is faster than the sequential streams version

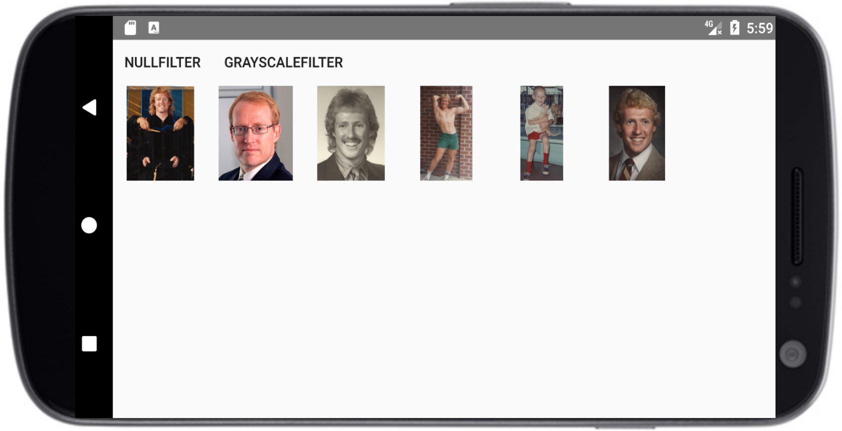
```
Starting ImageStreamGangTest
Printing 4 results for input file 1 from fastest to slowest
COMPLETABLE_FUTURES_2 executed in 153 msecs
COMPLETABLE_FUTURES_1 executed in 251 msecs
PARALLEL_STREAM executed in 300 msecs
SEQUENTIAL_STREAM executed in 1026 msecs

Printing 4 results for input file 2 from fastest to slowest
PARALLEL_STREAM executed in 62 msecs
COMPLETABLE_FUTURES_1 executed in 68 msecs
COMPLETABLE_FUTURES_2 executed in 70 msecs
SEQUENTIAL_STREAM executed in 261 msecs
Ending ImageStreamGangTest
```

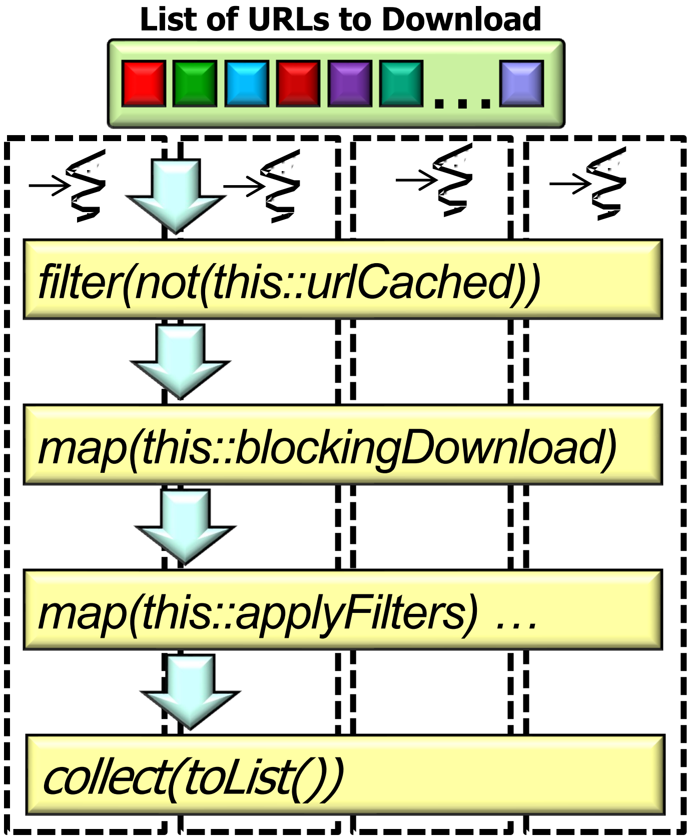


Tests conducted on a 2.4 GHz eight-core Lenovo P1 with 128 Gbytes of RAM

# Pros of the Java Parallel Streams Solution

- The parallel stream version is faster than the sequential streams version
  - e.g., images are downloaded & processed in parallel on multiple cores




List of URLs to Download

filter(not(this::urlCached))

map(this::blockingDownload)

map(this::applyFilters) …

collect(toList())

# Pros of the Java Parallel Streams Solution

- The solution is relatively straight forward to understand

```
void processStream() {
  List<Image> filteredImages =
  getInput()
    .parallelStream()
    .filter(not(this::urlCached))
    .map(this::blockingDownload)
    .map(this::applyFilters)
    .reduce(Stream::concat)
    .orElse(Stream.empty())
    .collect(toList());

  System.out.println(TAG
        + "Image(s) filtered = "
        + filteredImages.size());
}
```

# Pros of the Java Parallel Streams Solution

- The solution is relatively straight forward to understand, e.g.
  - The behaviors map cleanly onto the domain intent

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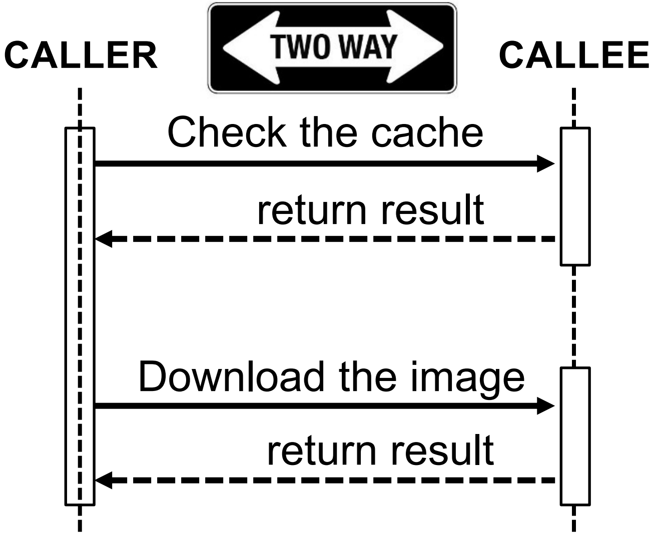
- The solution is relatively straight forward to understand, e.g.
  - The behaviors map cleanly onto the domain intent
  - Behaviors are all synchronous



```java
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See www.iro.umontreal.ca/~keller/Layla/remote.pdf

# Pros of the Java Parallel Streams Solution

- The solution is relatively straight forward to understand, e.g.
  - The behaviors map cleanly onto the domain intent
  - Behaviors are all synchronous
  - The flow of control can be read "linearly"
    - Parallel programming thus closely resembles sequential programming

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# Cons of the Java Parallel Streams Solution

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- Completable futures are sometimes faster than parallel streams

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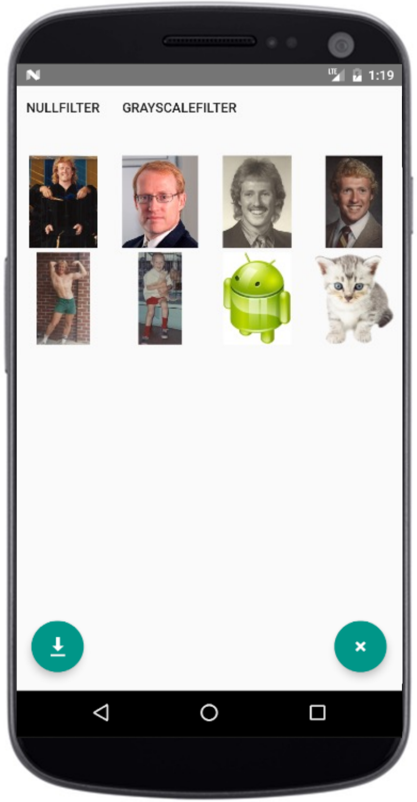

# Cons of the Java Parallel Streams Solution

- In general, there's a tradeoff between computing performance & programmer productivity when choosing amongst Java parallelism frameworks
  - i.e., completable futures are often more efficient & scalable than parallel streams, but are somewhat harder to program

Productivity
Performance

# End of Evaluating the Java Parallel ImageStreamGang Case Study