Java Parallel ImageStreamGang Example: Implementing Behaviors

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Learning Objectives in this Part of the Lesson

- Recognize the structure/functionality of the ImageStreamGang app
- Know how Java parallel streams are applied to the ImageStreamGang app
- Understand the parallel streams implementation of ImageStreamGang

```
void processStream() {
  List<URL> urls = getInput();

  List<Image> filteredImages =
  urls
    .parallelStream()
    .filter(not(this::urlCached))
    .map(this::blockingDownload)
    .flatMap(this::applyFilters)
    .collect(toList());

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

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

Implementing a Parallel Stream in ImageStreamGang

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- We focus on processStream() in ImageStreamParallel.java

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See imagestreamgang/streams/ImageStreamParallel.java

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Get a list of URLs

getInput() is defined by the underlying StreamGang framework

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Convert a collection into a parallel stream

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```

Return an output stream consisting of the URLs in the input stream that are not already cached

See docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html#filter

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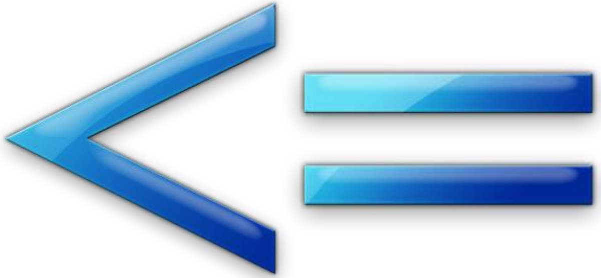

# of output stream elements will be <= # of input stream elements

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```

```
boolean urlCached(URL url) {
  return mFilters
    .stream()
    .filter(filter ->
       urlCached(url,
          filter.getName()))
    .count() > 0;
}
```

Determine whether this url has been downloaded to an image & had filters applied to it yet

See [imagestreamgang/streams/ImageStreamGang.java]()

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```
boolean urlCached(URL url,
         String filterName) {
  File file =
    new File(getPath(),
             filterName);

  File imageFile =
    new File(file,
         getNameForUrl(url));

  return imageFile.exists();
}
```

Check if a file with this name already exists

See imagestreamgang/streams/ImageStreamGang.java

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There are clearly better ways of implementing an image cache!

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Return an output stream consisting of the images that were downloaded from the URLs in the input stream

See docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html#map

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# of output stream elements must match the # of input stream elements

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```

```
Image blockingDownload
                 (URL url) {
  return BlockingTask
   .callInManagedBlocker
     (() ->
       downloadImage(url));
}
```

Downloads content from a url & converts it into an image

See imagestreamgang/streams/ImageStreamParallel.java

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Uses a "managed blocker" to ensure sufficient threads are in the common fork-join pool

See lesson on "*The Java Fork-Join Pool: Applying the ManagedBlocker Interface*"

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I/O-bound tasks on an N-core CPU typically run best with N(1+WT/ST) threads (WT = wait time & ST = service time)*

See www.ibm.com/developerworks/library/j-jtp0730

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```

Return an output stream containing the results of applying a list of filters to each image in the input stream & storing the results in the file system

See docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html#flatMap

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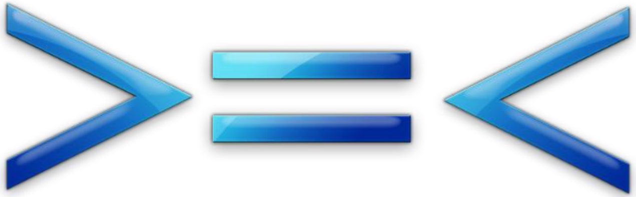

# of output stream elements may differ from the # of input stream elements

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  System.out.println(TAG
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}
```

```
Stream<Image> applyFilters
                (Image image) {
  return mFilters
    .parallelStream()
    .map(filter ->
          makeFilterWithImage
           (filter,
            image).run())
}
```

Apply all filters to an image in parallel & store on the device

See imagestreamgang/streams/ImageStreamParallel.java

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collect() is a "reduction" operation that combines elements into one result

See docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html#collect

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Trigger all intermediate operations

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Create a list containing all the filtered & stored images

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```

Logs the # of images that were downloaded, filtered, & stored

End of Java Parallel ImageStreamGang Example: Implementing Behaviors