Example: Applying Arbitrary-Arity Methods

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Learning Objectives in this Part of the Lesson

- Understand the design of the Java completable future version of ImageStreamGang
- Know how to apply completable futures to ImageStreamGang, e.g.
  - Factory methods
  - Completion stage methods
  - Arbitrary-arity methods
Applying Arbitrary-Arity Methods in ImageStreamGang
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- collect() returns a future to a stream of futures to images being processed asynchronously.

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

    CompletableFuture<Stream<Image>> resultsFuture = urls
        .stream()
        .map(this::checkUrlCachedAsync)
        .map(this::downloadImageAsync)
        .flatMap(this::applyFiltersAsync)
        .collect(toFuture())
        .thenApply(stream ->
            log(stream.flatMap(Optional::stream),
                urls.size())
        .join();
```

flatMap() outputs a stream of futures associated with processing that’s running asynchronously.
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            log(stream.flatMap(Optional::stream),
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```

Provides a single means to await completion of a list of futures before continuing with the program.
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}
```

collect() also triggers processing of all the intermediate operations
Applying Arbitrary-Arity Methods in ImageStreamGang

- `collect()` returns a future to a stream of futures to images being processed asynchronously
- Images are displayed after async processing completes
- `StreamOfFuturesCollector` wraps “arbitrary-arity” `allOf()` method

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        .thenApply(stream ->
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        .join();
}
```

Return a future that completes when all futures in the stream complete

See AndroidGUI/app/src/main/java/livelessons/utils/StreamOfFuturesCollector.java
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```

Log the results after the final future completes
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    .thenApply(stream ->
        log(stream.flatMap(Optional::stream), urls.size()))
    .join();
}
```

Remove empty optional values from the stream in Java 9+

See docs.oracle.com/javase/9/docs/api/java/util/Optional.html#flatMap
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            .flatMap(this::applyFiltersAsync)
            .collect(toFuture())
            .thenApply(stream -> log(stream
                .filter(Optional::isPresent)
                .map(Optional::get),
                urls.size()
            ))
        .join();
}
```

*Remove empty optional values from the stream in Java 8*
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See blog.codefx.org/java/java-9optional
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- `collect()` returns a future to a stream of futures to images being processed asynchronously.
- Images are displayed after async processing completes.
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            log(stream.flatMap(Optional::stream), urls.size()))
        .join();
}
```

Wait until all the async processing is completed.

See [docs.oracle.com/javase/8/docs/api/java/util/concurrent/CompletableFuture.html#join](http://docs.oracle.com/javase/8/docs/api/java/util/concurrent/CompletableFuture.html#join)
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This is the one & only call to `join()` in this async stream pipeline!
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            log(stream.flatMap(Optional::stream),
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        .join();
}
```

Images are displayed after all the async processing completes.
End of Applying Arbitrary-Arity Methods in Image StreamGang