The Java CompletableFuture ImageStream Gang Case Study: Applying Factory Methods

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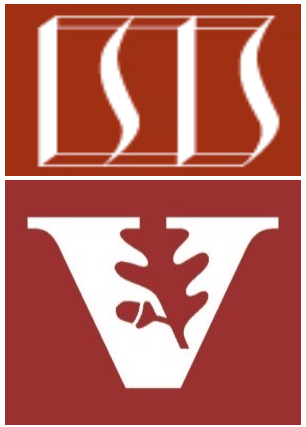

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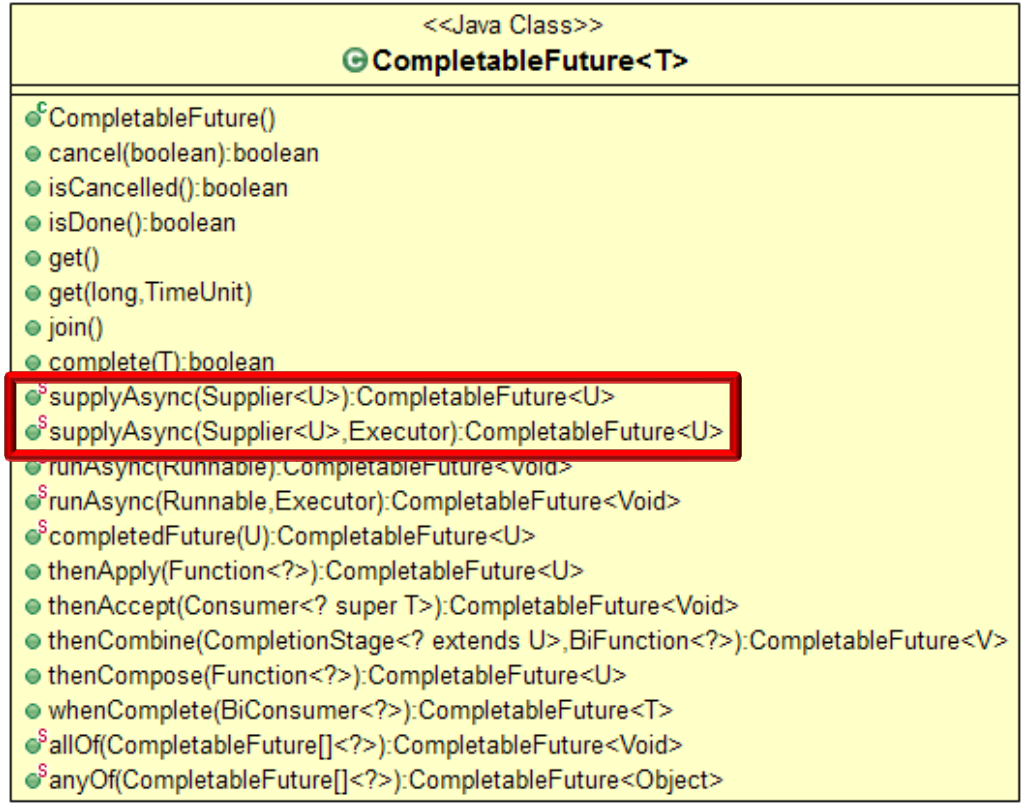
Learning Objectives in this Part of the Lesson

- Understand the design of the Java completable future version of ImageStreamGang
- Know how to apply completable futures to ImageStreamGang, e.g.
  - Factory methods
    - supplyAsync()
      - & Java Streams map()



Applying Factory Methods in ImageStreamGang

Applying Factory Methods in ImageStreamGang

- Initiate an async check to see if images are cached locally

map() calls the behavior checkUrlCachedAsync()

```
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();
```

Applying Factory Methods in ImageStreamGang

- Initiate an async check to see if images are cached locally

Asynchronously check if a URL is already downloaded

```
void processStream() {
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  CompletableFuture<Stream<Image>>
    resultsFuture = urls
    .stream()
    .map(this::checkUrlCachedAsync)
    .map(this::downloadImageAsync)
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    .collect(toFuture())
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                 log(stream.flatMap
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- Initiate an async check to see if images are cached locally

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void processStream() {
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  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();
```

Returns a stream of completable futures to optional URLs, which have a value if the URL is not cached or are empty if it is cached

Later behaviors simply ignore "empty" optional URL values

Applying Factory Methods in ImageStreamGang

- checkUrlCachedAsync() uses the supplyAsync() factory method internally

```
CompletableFuture<Optional<URL>> checkUrlCachedAsync(URL url) {
  return CompletableFuture
    .supplyAsync(() ->
                 Optional.ofNullable(urlCached(url)
                   ? null
                   : url),
                 getExecutor());
}
```

See imagestreamgang/streams/ImageStreamCompletableFutureBase.java

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   return CompletableFuture
      .supplyAsync(() ->
                   Optional.ofNullable(urlCached(url)
                     ? null
                     : url),
                   getExecutor());
}
```

This factory method registers an action that runs asynchronously

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/CompletableFuture.html#supplyAsync

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  return CompletableFuture
    .supplyAsync(() ->
                 Optional.ofNullable(urlCached(url)
                   ? null
                   : url),
                 getExecutor());
}
```

supplyAsync() runs action in a worker thread from the common fork-join pool


```
void initiateStream() {
  // Set the executor to the common fork-join pool.
  setExecutor(ForkJoinPool.commonPool());
  ...
}
```

See dzone.com/articles/common-fork-join-pool-and-streams

Applying Factory Methods in ImageStreamGang

- checkUrlCachedAsync() uses the supplyAsync() factory method internally

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CompletableFuture<Optional<URL>> checkUrlCachedAsync(URL url) {
  return CompletableFuture
    .supplyAsync(() ->
                 Optional.ofNullable(urlCached(url)
                   ? null
                   : url),
                 getExecutor());
}
```

ofNullable() is a factory method that returns an optional URL, which has a value if the URL is not cached or is empty if it is already cached

See docs.oracle.com/javase/8/docs/api/java/util/Optional.html#ofNullable

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- checkUrlCachedAsync() uses the supplyAsync() factory method internally

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CompletableFuture<Optional<URL>> checkUrlCachedAsync(URL url) {
  return CompletableFuture
    .supplyAsync(() ->
                 Optional.ofNullable(urlCached(url)
                   ? null
                   : url),
                 getExecutor());
}
```

Returns true if the image has already been filtered before

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

See imagestreamgang/streams/ImageStreamGang.java

Applying Factory Methods in ImageStreamGang

- checkUrlCachedAsync() uses the supplyAsync() factory method internally

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CompletableFuture<Optional<URL>> checkUrlCachedAsync(URL url) {
  return CompletableFuture
    .supplyAsync(() ->
                 Optional.ofNullable(urlCached(url)
                   ? null
                   : url),
                 getExecutor());
}
```

Returns true if image file already exists

```
boolean urlCached(URL url, String filterName) {
  File file = new File(getPath(), filterName);
  File imageFile = new File(file, getNameForUrl(url));
  return !imageFile.createNewFile();
}
```

See imagestreamgang/streams/ImageStreamGang.java

Applying Factory Methods in ImageStreamGang

- checkUrlCachedAsync() uses the supplyAsync() factory method internally

```
CompletableFuture<Optional<URL>> checkUrlCachedAsync(URL url) {
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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.createNewFile();
}
```

There are clearly better ways of implementing an image cache!

End of the Java Completable Future ImageStreamGang Case Study: Applying Factory Methods