Java Completable Futures ImageStreamGang

Example: Applying Factory Methods

Douglas C. Schmidt
d.schmidt@vanderbilt.edu
www.dre.vanderbilt.edu/~schmidt

Professor of Computer Science
Institute for Software Integrated Systems
Vanderbilt University
Nashville, Tennessee, USA
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()
Applying Factory Methods in ImageStreamGang
Apply Factory Methods in ImageStreamGang

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

```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();
```

*map() calls the behavior checkUrlCachedAsync()*
• Initiate an async check to see if images are cached locally

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    List<URL> urls = getInput();

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

Asynchronously check if a URL is already downloaded
Applying Factory Methods in ImageStreamGang

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

```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();
```

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

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

See [imagestreamgang/streams/ImageStreamCompletableFutureBase.java](imagestreamgang/streams/ImageStreamCompletableFutureBase.java)
Applying Factory Methods in ImageStreamGang

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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
Applying Factory Methods in ImageStreamGang

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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

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

See [dzone.com/articles/common-fork-join-pool-and-streams](dzone.com/articles/common-fork-join-pool-and-streams)
Applying Factory Methods in ImageStreamGang

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

```java
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
Applying Factory Methods in ImageStreamGang

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

```java
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

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

See `imagestreamgang/streams/ImageStreamGang.java`
Applying Factory Methods in ImageStreamGang

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

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

**Returns true if image file already exists**

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

See [imagestreamgangstreams/ImageStreamGang.java](imagestreamgangstreams/ImageStreamGang.java)
Applying Factory Methods in ImageStreamGang

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

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

```java
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 Java Completeable Futures ImageStreamGang Example: Applying Factory Methods