Evaluating Java Programming Paradigms

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Learning Objectives in this Part of the Lesson

• Understand the key benefits & principles underlying the reactive programming paradigm
• Know the Java reactive streams API & popular implementations of this API
• Learn how Java reactive streams maps to key reactive programming principles
• Recognize how reactive programming compares with other Java paradigms
Learning Objectives in this Part of the Lesson

• Understand the key benefits & principles underlying reactive programming
• Know the Java reactive streams API & popular implementations of this API
• Learn how Java reactive streams maps to key reactive programming principles
• Recognize how reactive programming compares with other Java paradigms
• Be aware of the pros & cons of reactive streams platforms
Comparing Reactive Programming with Other Paradigms
Comparing Reactive Programming with Other Paradigms

- Reactive programming is one of several Java programming paradigms

<table>
<thead>
<tr>
<th>Single value</th>
<th>Multiple values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>Reactive Streams (Streams + CompletableFutures)</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>Completable Futures</td>
</tr>
</tbody>
</table>

Objects

Streams
Comparing Reactive Programming with Other Paradigms

- Reactive programming is one of several Java programming paradigms

```java
byte[] downloadContent(URL url) {
    byte[] buf = new byte[BUFSIZ];
    ByteArrayOutputStream os = new ByteArrayOutputStream();
    InputStream is = url.openStream();

    for (int bytes;
         (bytes = is.read(buf)) > 0;)
        os.write(buf, 0, bytes);
    ...}
```
Comparing Reactive Programming with Other Paradigms

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```java
List<Image> imgs = getInput()
    .parallelStream()
    .filter(not(this::urlCached))
    .map(this::downloadImage)
    .flatMap(this::applyFilters)
    .collect(toList());
```
Comparing Reactive Programming with Other Paradigms

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```java
CompletableFuture
  .supplyAsync(reduce)
  .thenApply
    (BigFraction::toMixedString)
  .thenAccept
    (System.out::println);
```
Comparing Reactive Programming with Other Paradigms

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```
List<Image> imgs = getInput()
    .stream()
    .map(checkUrlCachedAsync)
    .map(downloadImageAsync)
    .flatMap(applyFiltersAsync)
    .collect(toFuture())
    .thenApply(logResults)
    .join(); ...
```
Comparing Reactive Programming with Other Paradigms

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```
List<Image> imgs = Flux
    .fromIterable(Options.
        instance().getUrlList())
    .parallel(parallelism)
    .runOn(scheduler)
    .map(downloadAndStoreImage)
    .sequential()
    .collectList()
    .block();
```
Pros & Cons of Java Reactive Streams Platforms
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- Java reactive streams platforms implement reactive programming principles to achieve several benefits

- Responsive
- Resilient
- Elastic
- Message-driven
Pros & Cons of Java Reactive Streams Platforms

- Java reactive streams platforms implement reactive programming principles to achieve several benefits
- Support concurrency with a minimal number of threads

![Diagram showing a pool of worker threads with Deque and Sub-Tasks](image-url)
Pros & Cons of Java Reactive Streams Platforms

Java reactive streams platforms implement reactive programming principles to achieve several benefits:

- Support concurrency with a minimal number of threads
- Scale up performance with fewer hardware resources

See dzone.com/articles/spring-boot-20-webflux-reactive-performance-test
Pros & Cons of Java Reactive Streams Platforms

- However, reactive programming is not appropriate for all situations..

See [www.youtube.com/watch?v=z0a0N9OgaAA](http://www.youtube.com/watch?v=z0a0N9OgaAA)
End of Evaluating Java Programming Paradigms