Java 8 CompletableFutures ImageStreamGang Example (Part 3)

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

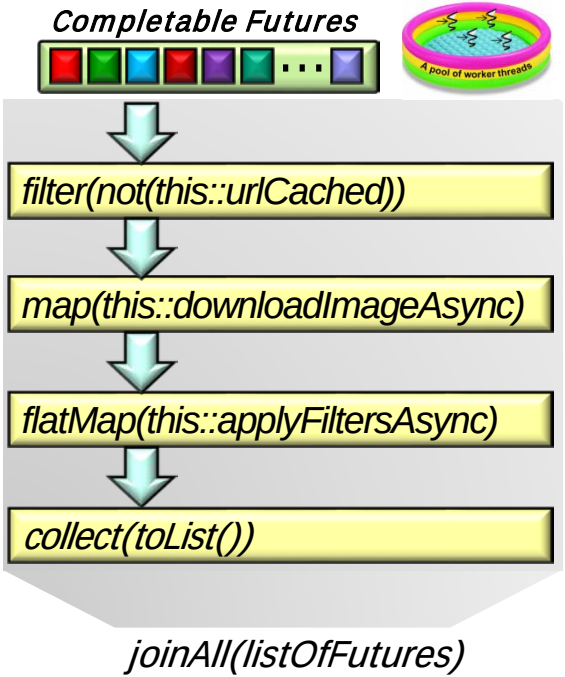
Learning Objectives in this Part of the Lesson

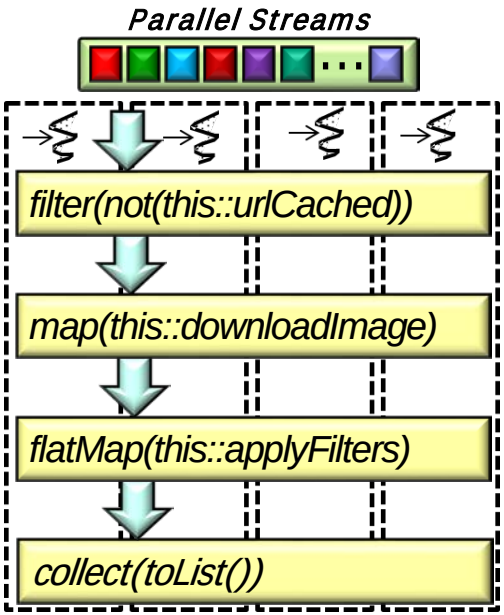
- Understand the design of the Java 8 completable future version of the ImageStreamGang app
- Know how the Java 8 completable future framework is applied to the ImageStreamGang app
- Be aware of the pros & cons of using the completable futures framework

Evaluating the Completable Futures ImageStreamGang

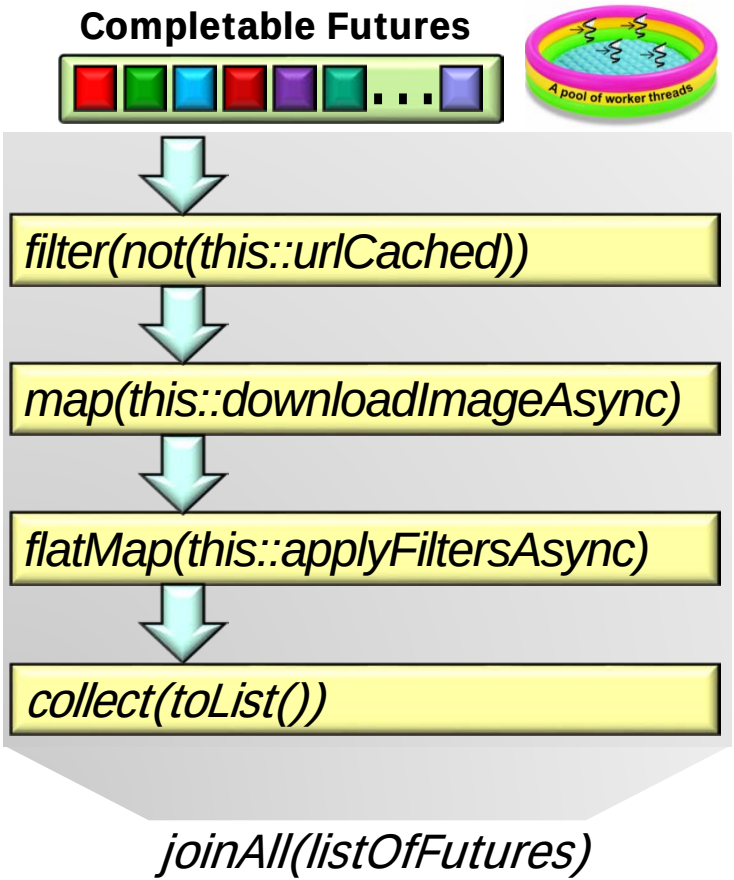
Evaluating the Completable Futures ImageStreamGang

- We'll evaluate the Java 8 completable futures framework compared with the parallel streams framework



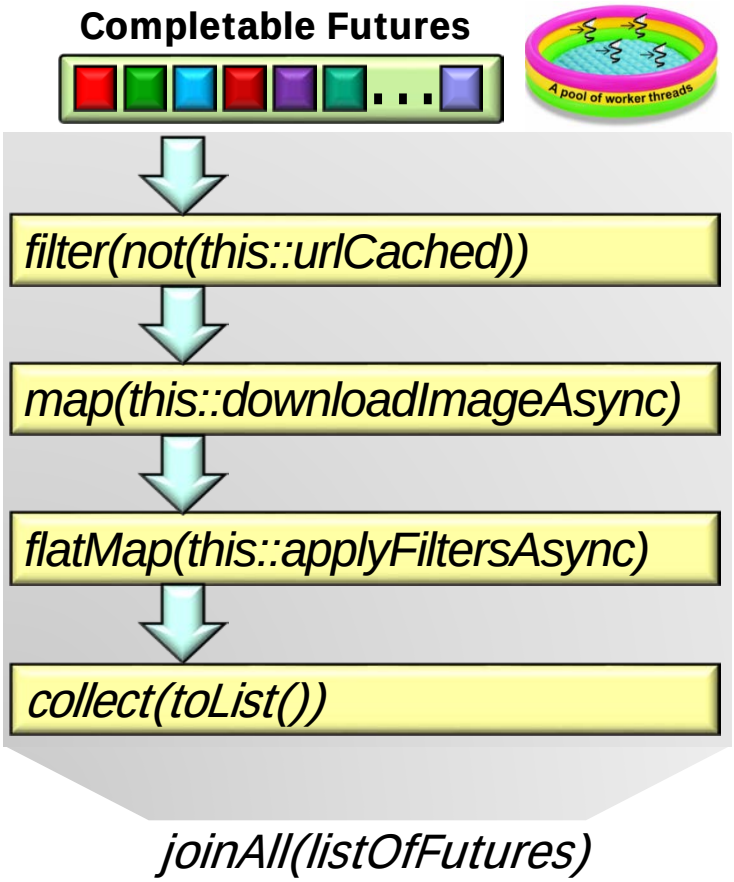


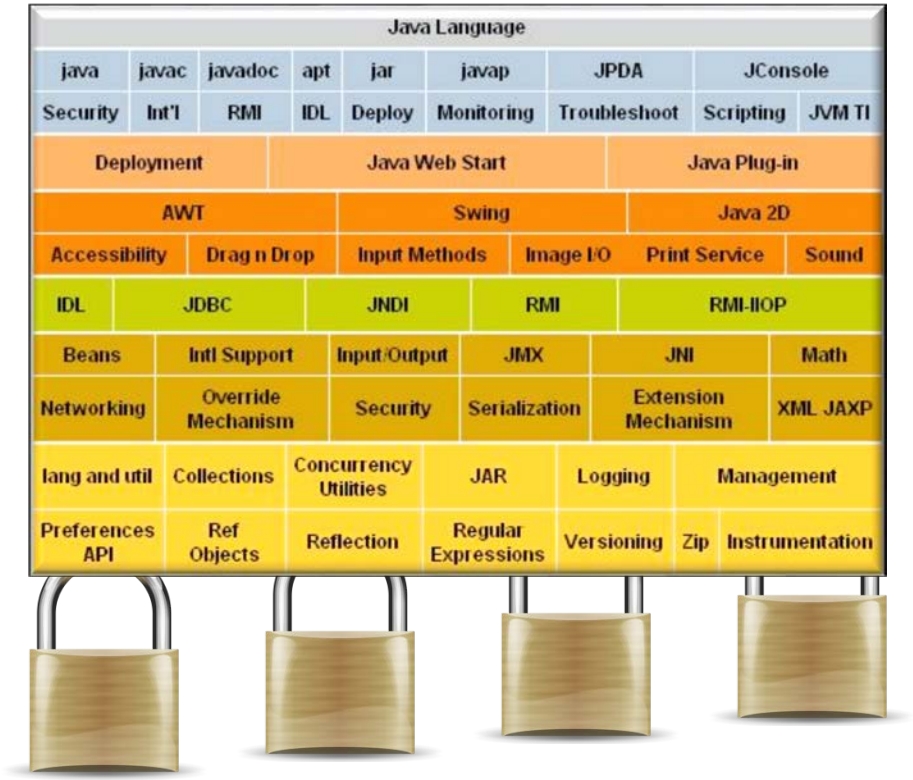
Evaluating the Completable Futures ImageStreamGang



No explicit synchronization is required in this implementation

Evaluating the Completable Futures ImageStreamGang





Java libraries handle any locking needed to read/write to files & connections

Evaluating the Completable Futures ImageStreamGang

- Java 8 completable futures framework is much more complex to program

```
List<CompletableFuture<List<Image>>>
  listOfFutures = getInput()
    .stream()
    .filter(not(this::urlCached))
    .map(this::downloadImageAsync)
    .flatMap(this::applyFiltersAsync)
    .collect(toList());

  CompletableFuture<List<List<Image>>>
  allImagesDone = StreamsUtils.joinAll(listOfFutures);

  int imagesProcessed = allImagesDone.join().stream()
                                .collect(summingInt(List::size));
```

Evaluating the Completable Futures ImageStreamGang

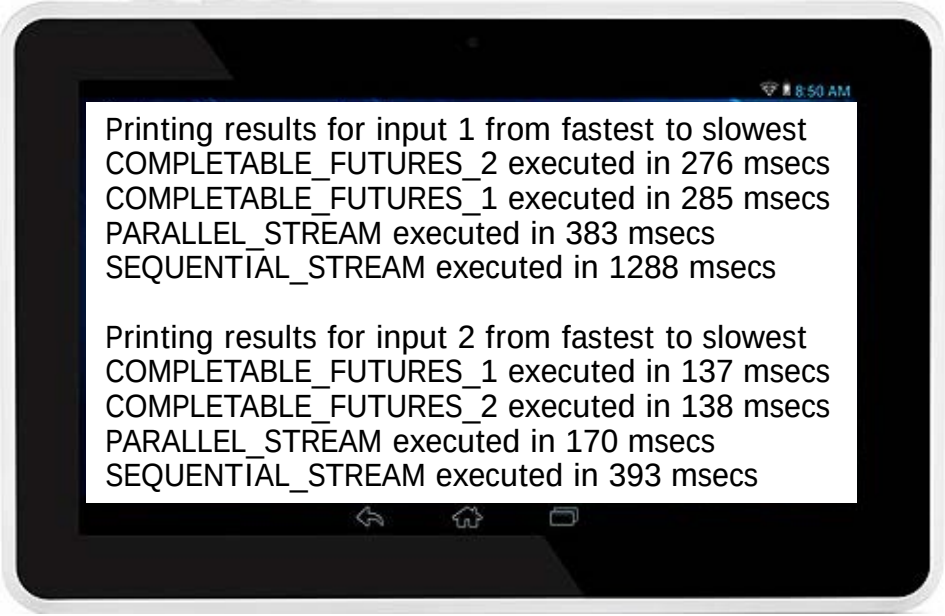
- Java 8 completable futures framework is much more complex to program

```
List<CompletableFuture<List<Image>>>
  listOfFutures = getInput()
    .stream()
    .filter(not(this::urlCached))
    .map(this::downloadImageAsync)
    .flatMap(this::applyFiltersAsync)
    .collect(toList());

  CompletableFuture<List<List<Image>>>
  allImagesDone = StreamsUtils.joinAll(listOfFutures);

  int imagesProcessed = allImagesDone.join().stream()
                                .collect(summingInt(List::size));
```

In general, asynchrony patterns aren’t as well understood by many developers

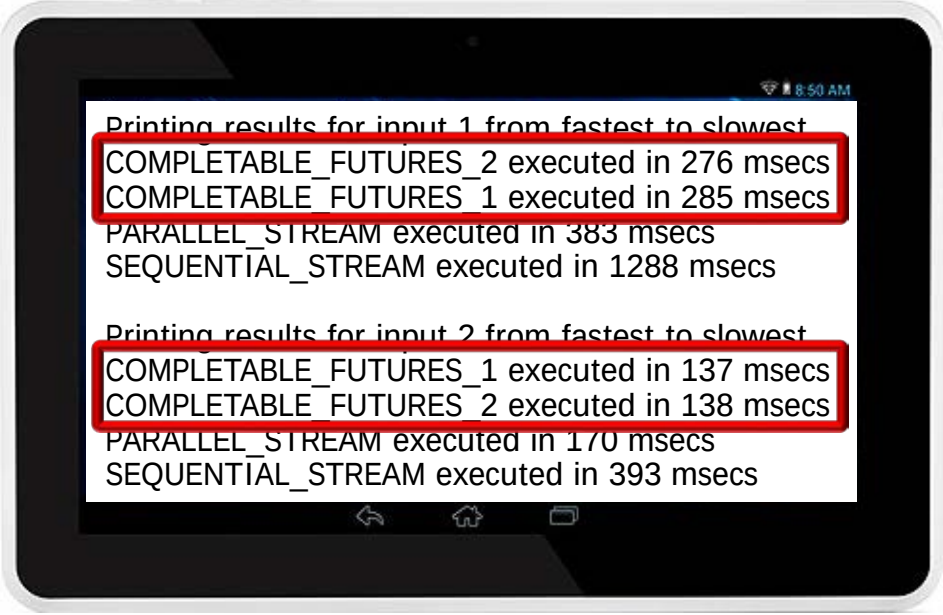
Evaluating the Completable Futures ImageStreamGang

- There's a tradeoff between computing performance & programmer productivity when choosing amongst these frameworks



Evaluating the Completable Futures ImageStreamGang

- There's a tradeoff between computing performance & programmer productivity when choosing amongst these frameworks, e.g.
  - Completable futures are more efficient & scalable, but are harder to program



Evaluating the Completable Futures ImageStreamGang

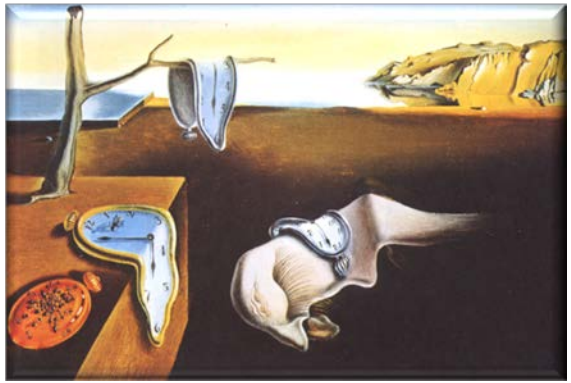
- There's a tradeoff between computing performance & programmer productivity when choosing amongst these frameworks, e.g.
  - Completable futures are more efficient & scalable, but are harder to program
  - Parallel streams are often easier to program, but are less efficient & scalable

Evaluating the Completable Futures ImageStreamGang

- There's a tradeoff between computing performance & programmer productivity when choosing amongst these frameworks, e.g.
  - Completable futures are more efficient & scalable, but are harder to program
  - Parallel streams are often easier to program, but are less efficient & scalable

Evaluating the Completable Futures ImageStreamGang

- Java 9 fixes some completable future limitations



```
CompletableFuture
   .supplyAsync(
      () -> findBestPrice("LDN - NYC"),
                          executorService)
 .thenCombine(CompletableFuture
              .supplyAsync
                  (() -> queryExchangeRateFor("GBP")),
                            this::convert)
 .orTimeout(1, TimeUnit.SECONDS)
 .whenComplete((amount, error) -> {
    if (error == null) { System.out.println("The price is: "
                          + amount + "GBP"); }
    else { System.out.println("Sorry, no result"); } });
```

See iteratrlearning.com/java9/2016/09/13/java9-timeouts-completablefutures.html

End of Java 8 Completable Futures ImageStreamGang Example (Part 3)