Overview of Parallelism in Java

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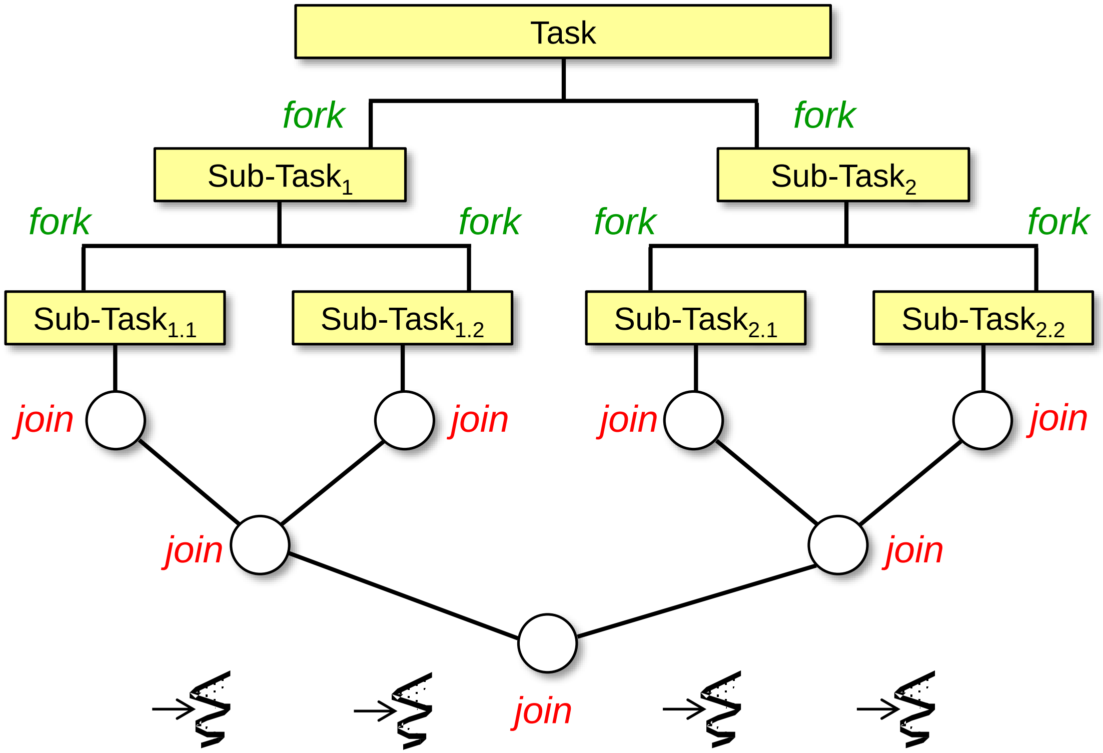
Learning Objectives in this Part of the Lesson

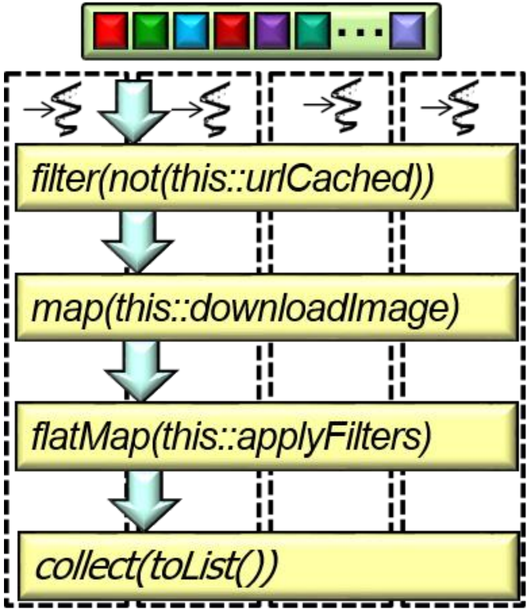
- Understand the meaning of key parallelism concepts



Learning Objectives in this Part of the Lesson

- Understand the meaning of key parallelism concepts
- Recognize how these concepts are supported in Java

Parallel Streams



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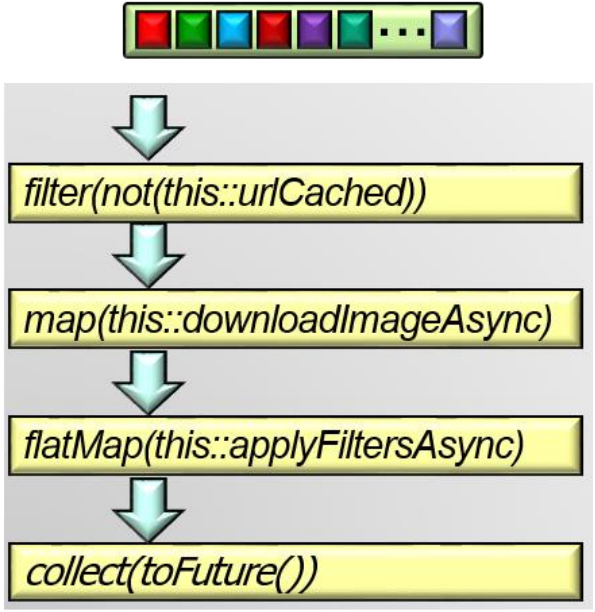
flatMap(this::applyFilters)

collect(toList())

ForkJoinPool

Completable Futures



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An Overview of Parallelism

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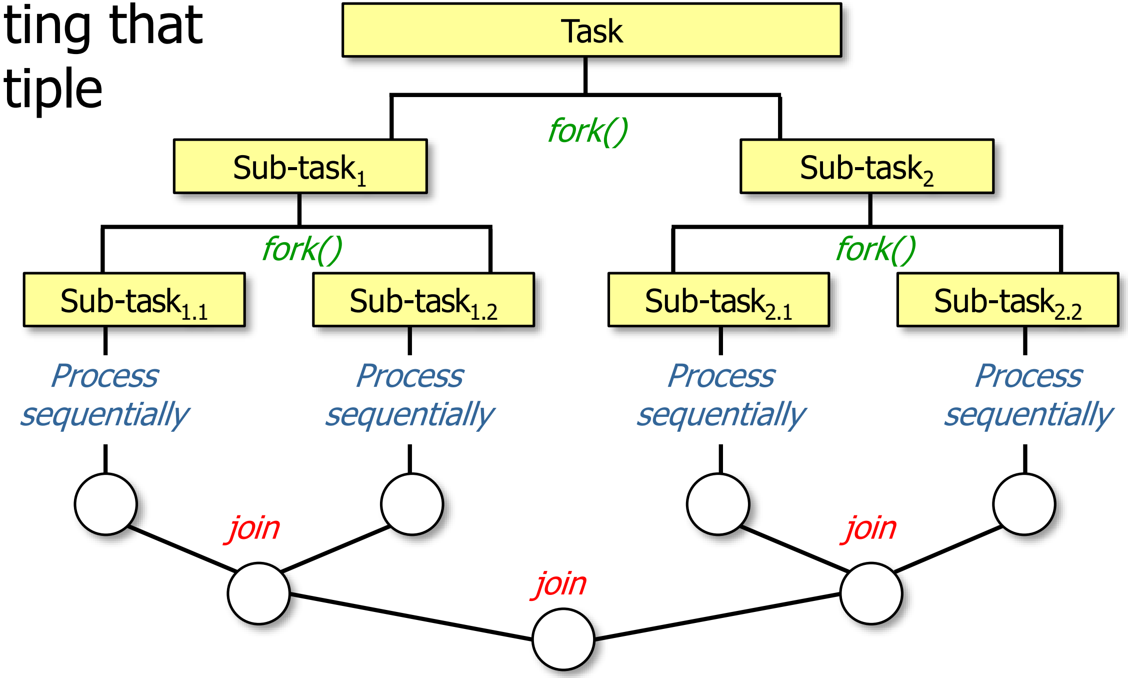
- Parallelism is a form of computing that performs several steps on multiple processor cores



See en.wikipedia.org/wiki/Parallel_computing

An Overview of Parallelism

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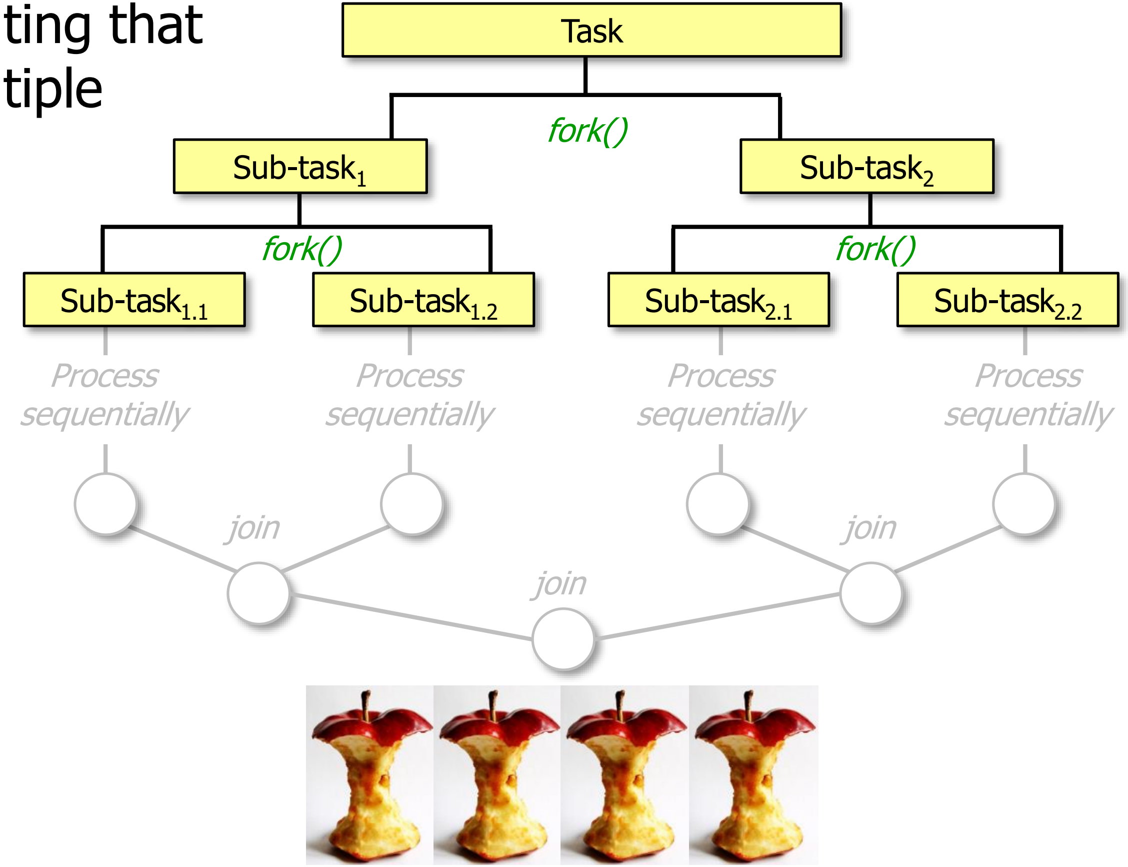
  - Split – partition a task into sub-tasks



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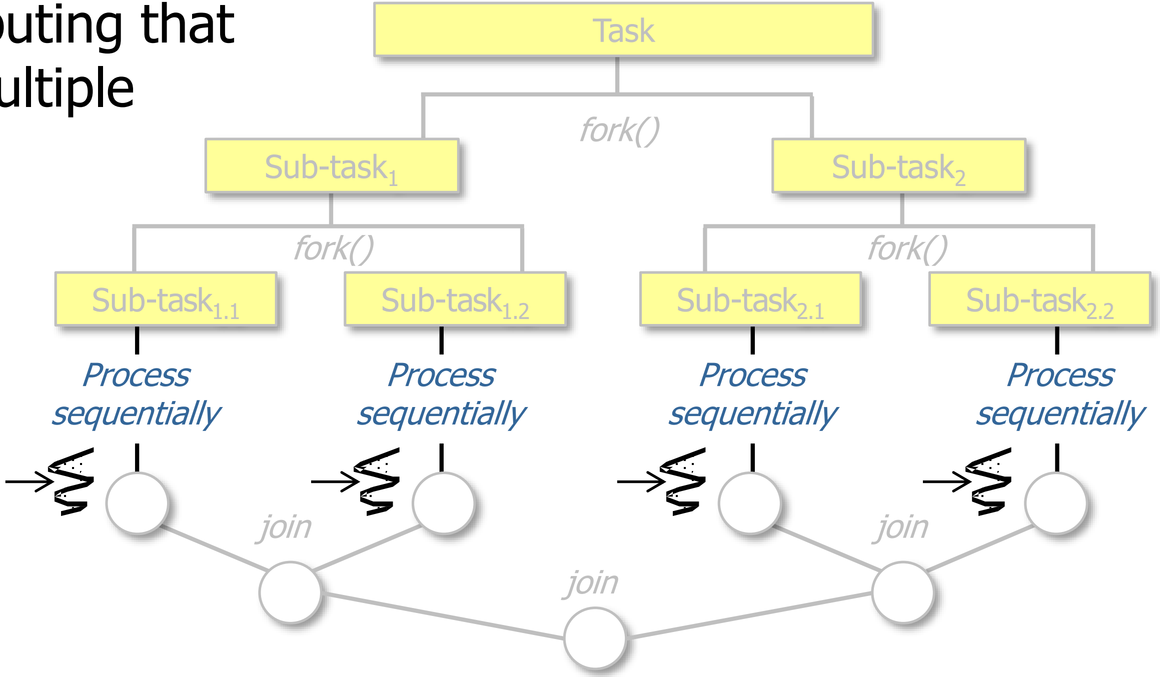
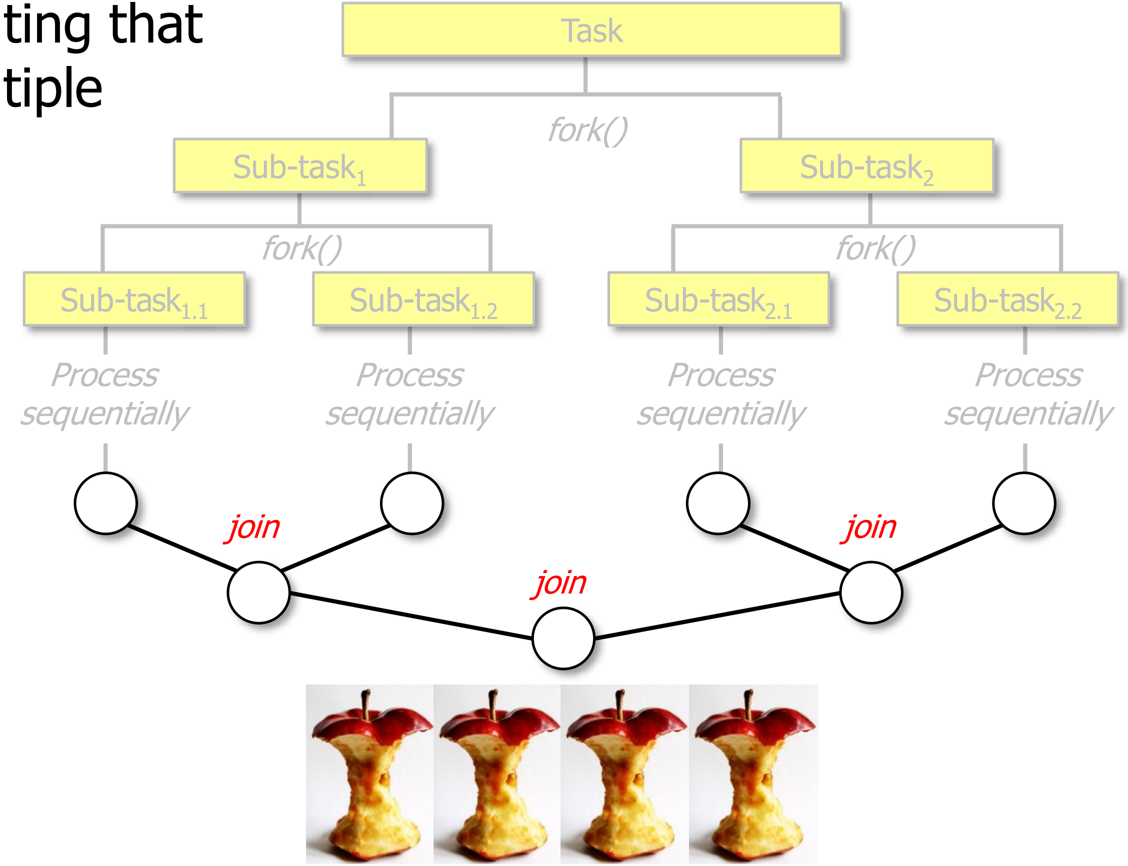


An Overview of Parallelism

- Parallelism is a form of computing that performs several steps on multiple processor cores, i.e.
  - Split – partition a task into sub-tasks
  - Apply – Run independent sub-tasks in parallel
  - Combine – Merge the sub-results from sub-tasks into one final result



An Overview of Parallelism

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  - Parallelism thus focuses on optimizing performance
    - e.g., throughput, scalability, & latency

See www.ibm.com/developerworks/library/j-java-streams-4-brian-goetz

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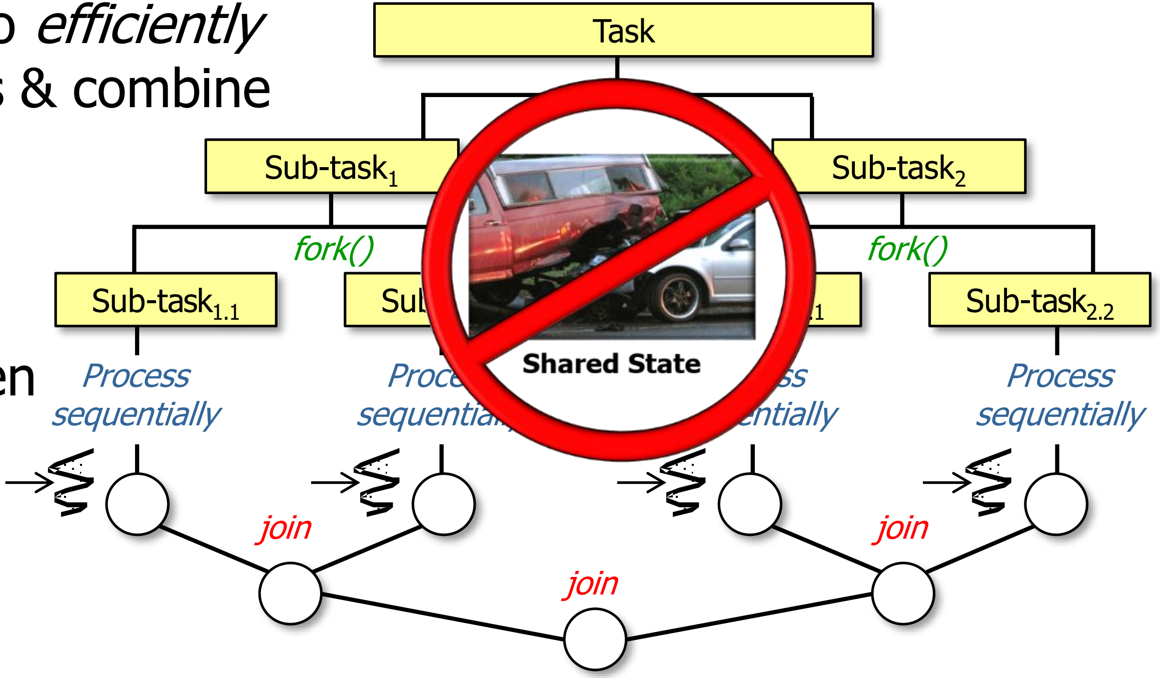

See henrikeichenhardt.blogspot.com/2013/06/why-shared-mutable-state-is-root-of-all.html

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- A key goal of parallelism is to *efficiently* partition tasks into sub-tasks & combine results
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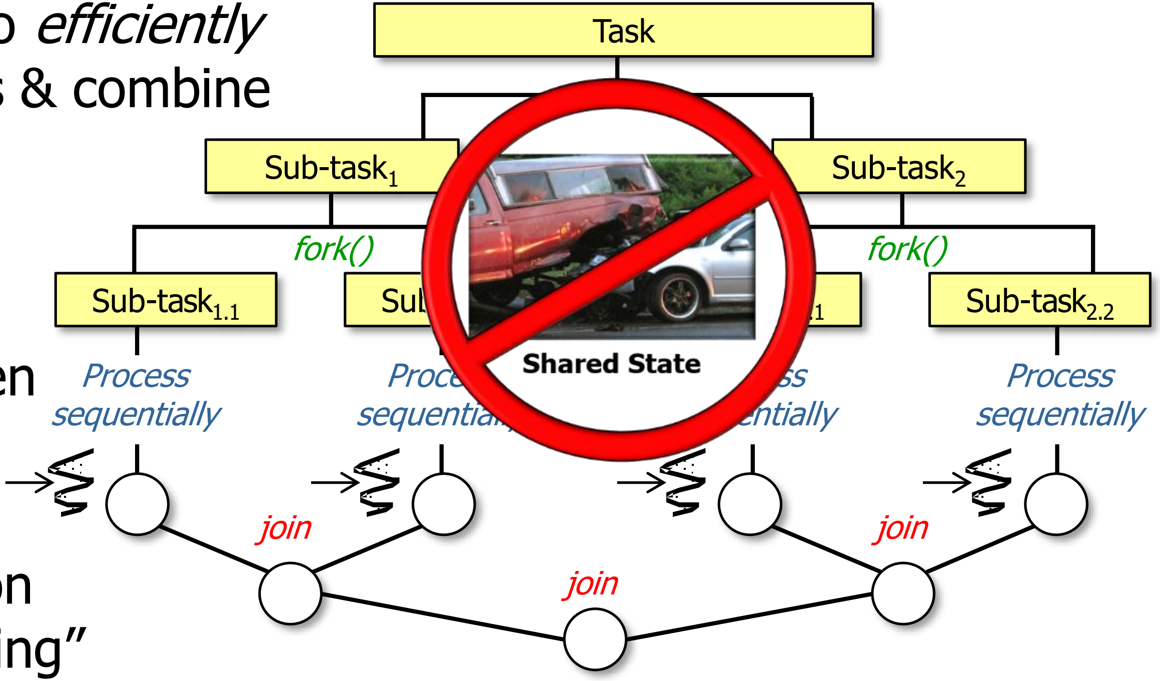
    - Hence Java's emphasis on "fork-join" & "work-stealing"



See en.wikipedia.org/wiki/Fork-join_model & en.wikipedia.org/wiki/Work_stealing

An Overview of Parallelism in Java

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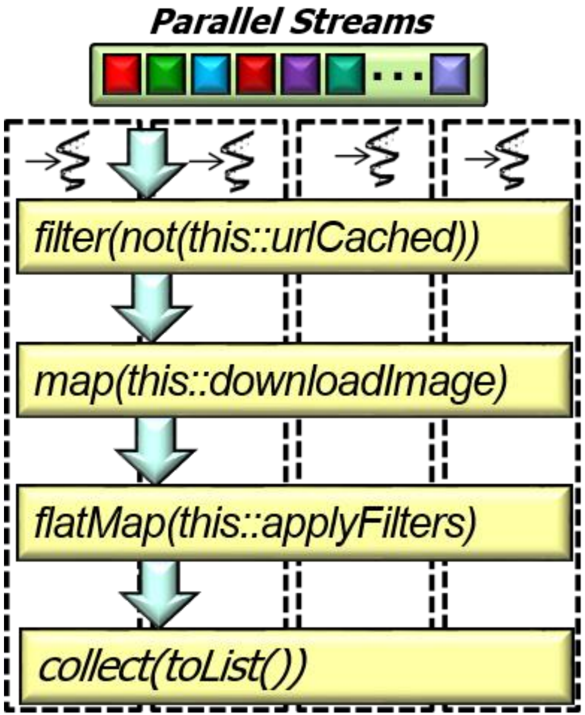
- Java supports parallelism via three primary frameworks



Parallel Streams

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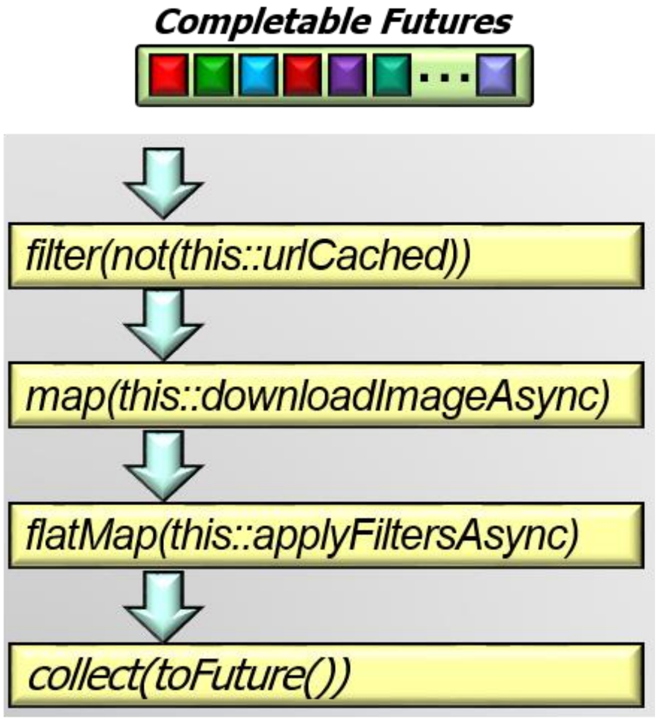
ForkJoinPool



Completable Futures

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See docs.oracle.com/javase/tutorial/collections/streams/parallelism.html

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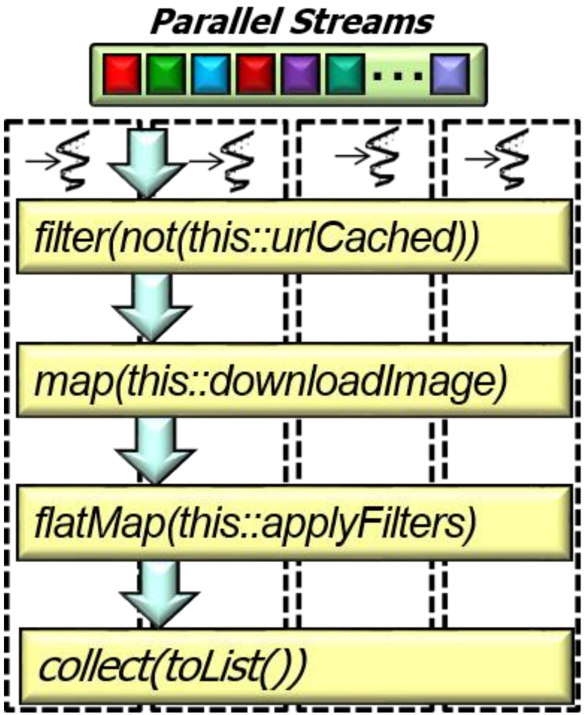

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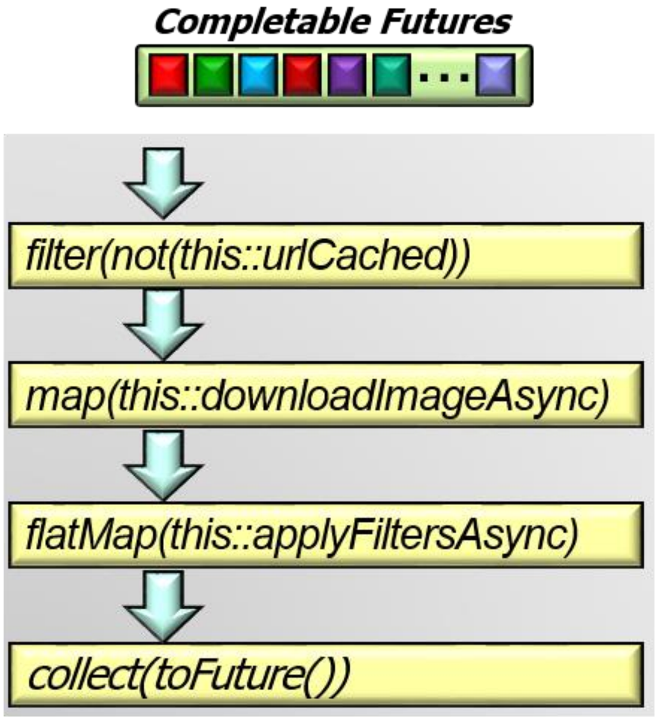

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This is an object-oriented framework

See www.dre.vanderbilt.edu/~schmidt/frameworks.html

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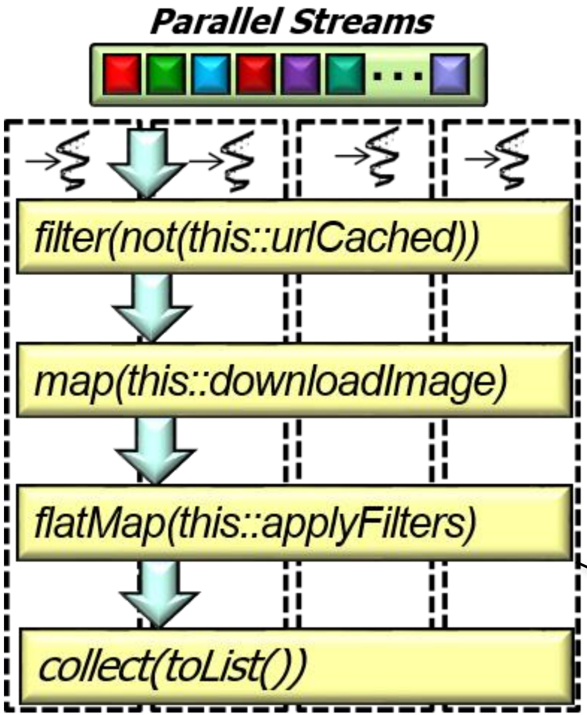

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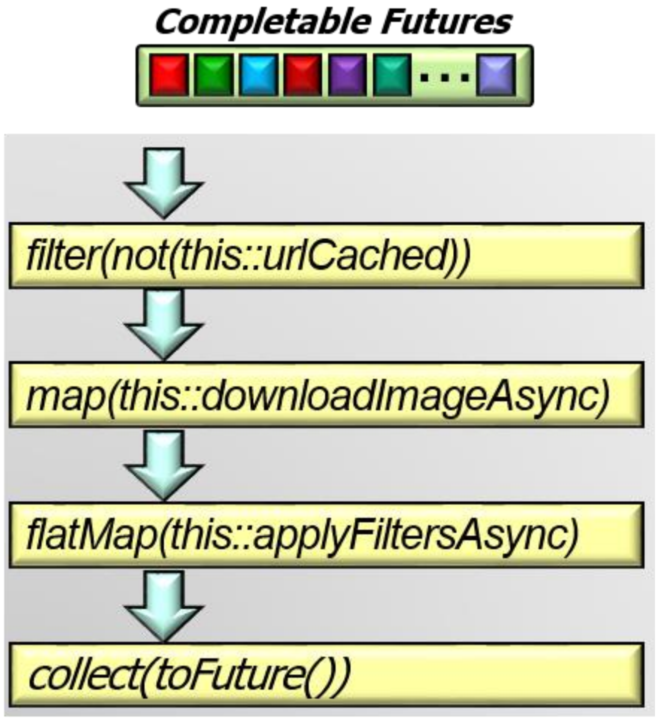

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This is a functional framework

See www.baeldung.com/java-8-streams

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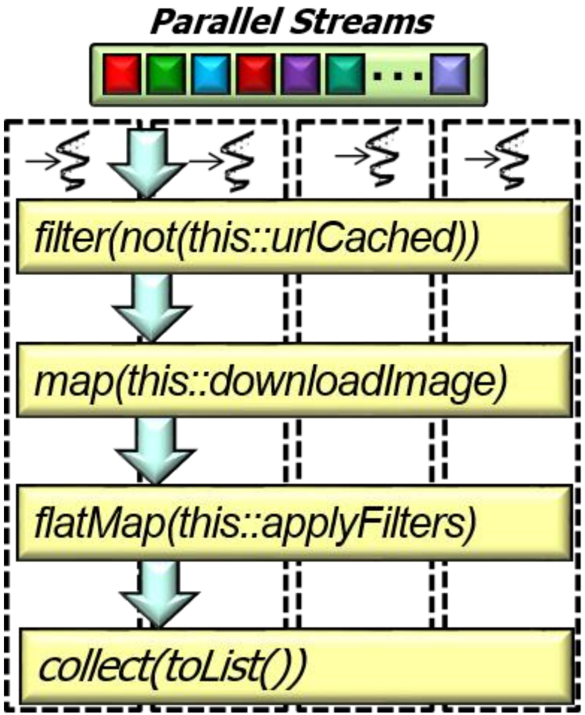

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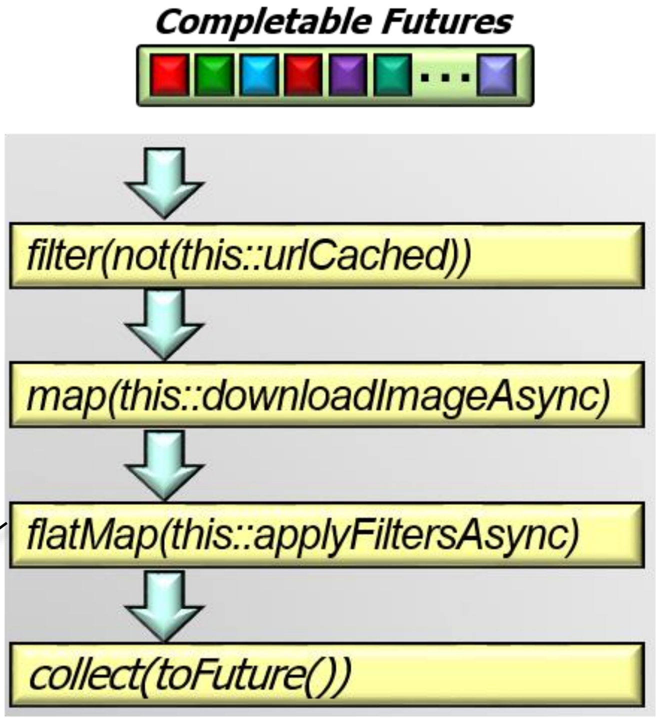

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This is a reactive asynchronous framework

See www.nurkiewicz.com/2013/05/java-8-definitive-guide-to.html

An Overview of Parallelism in Java

- Brian Goetz has an excellent talk about the evolution of Java from concurrent to parallel computing

From Concurrent to Parallel

Jfokus

See www.youtube.com/watch?v=NsDE7E8sIdQ

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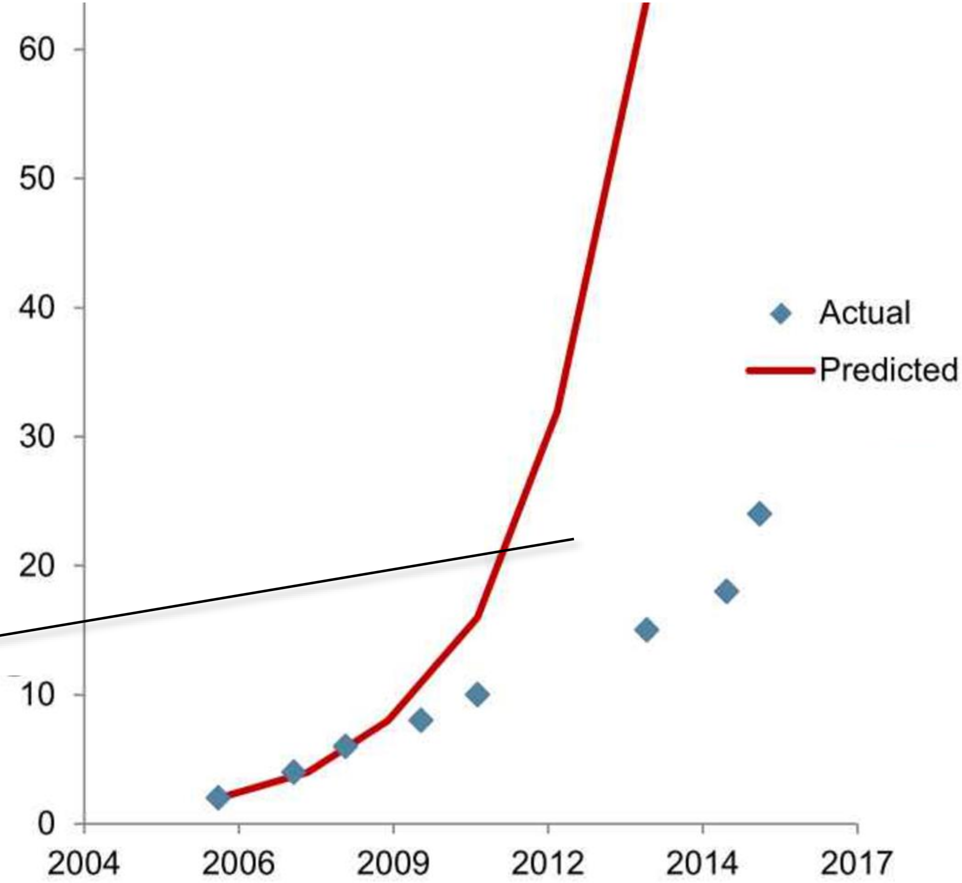

His talk emphasizes that Java 8 combines functional programming with fine-grained data parallelism to leverage many-core processors

See www.infoq.com/presentations/parallel-java-se-8

End of Overview of Parallelism in Java