Java Parallel Stream Internals:
Combining Results (Part 1)

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Learning Objectives in this Part of the Lesson

- Understand parallel stream internals, e.g.
  - Know what can change & what can’t
  - Partition a data source into “chunks”
  - Process chunks in parallel via the common fork-join pool
  - Configure the Java parallel stream common fork-join pool
- Perform a reduction to combine partial results into a single result

Combining Results in a Parallel Stream
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- After the common fork-join pool finishes processing chunks their partial results are combined into a final result.

This discussion assumes a non-concurrent collector (other discussions follow).
Combining Results in a Parallel Stream

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- `join()` occurs in a single thread at each level.
- i.e., the “parent”
Combining Results in a Parallel Stream

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- `join()` occurs in a single thread at each level
  - i.e., the “parent”

As a result, there’s typically no need for synchronizers during the joining
Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways

Understanding these differences is particularly important for parallel streams
Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways, e.g.
- `reduce()` creates a new immutable value

See [docs.oracle.com/javase/tutorial/essential/concurrency/immutable.html](docs.oracle.com/javase/tutorial/essential/concurrency/immutable.html)
Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways, e.g.
  - `reduce()` creates a new immutable value

```java
long factorial(long n) {
    return LongStream
        .rangeClosed(1, n)
        .parallel()
        .reduce(1, (a, b) -> a * b,
                (a, b) -> a * b);
}
```

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}
```

- `reduce()` combines two immutable values (e.g., `long`) & produces a new one

![Diagram showing the process of combining results in a parallel stream](image-url)
Combining Results in a Parallel Stream

• Different terminal operations combine partial results in different ways, e.g.
  • `reduce()` creates a new immutable value
  • `collect()` mutates an existing value

See greenteapress.com/thinkapjava/html/thinkjava011.html
Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways, e.g.
  - `reduce()` creates a new immutable value
  - `collect()` mutates an existing value

```java
Set<CharSequence> uniqueWords =
    getInput(sSHAKESPEARE, "\s+")
    .parallelStream()
    ...
    .collect(toCollection(TreeSet::new));
```

Combining Results in a Parallel Stream

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Set<CharSequence> uniqueWords =
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    parallelStream()
    ...
    .collect(toCollection(TreeSet::new));
```

- `collect()` mutates a container to accumulate the result it’s producing
Combining Results in a Parallel Stream

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Set<CharSequence>

\[
\text{uniqueWords = getInputStream(sSHAKESPEARE), } \\
\text{"\\s+"), parallelStream(), } \\
\text{... .collect(ConcurrentHashSetCollector.toSet()));}
\]

Concurrent collectors (covered later) are different than non-concurrent collectors
End of Java Parallel Stream Internals: Combining Results (Part 1)