

Java Parallel Streams Internals: Combining Results (Part 1)

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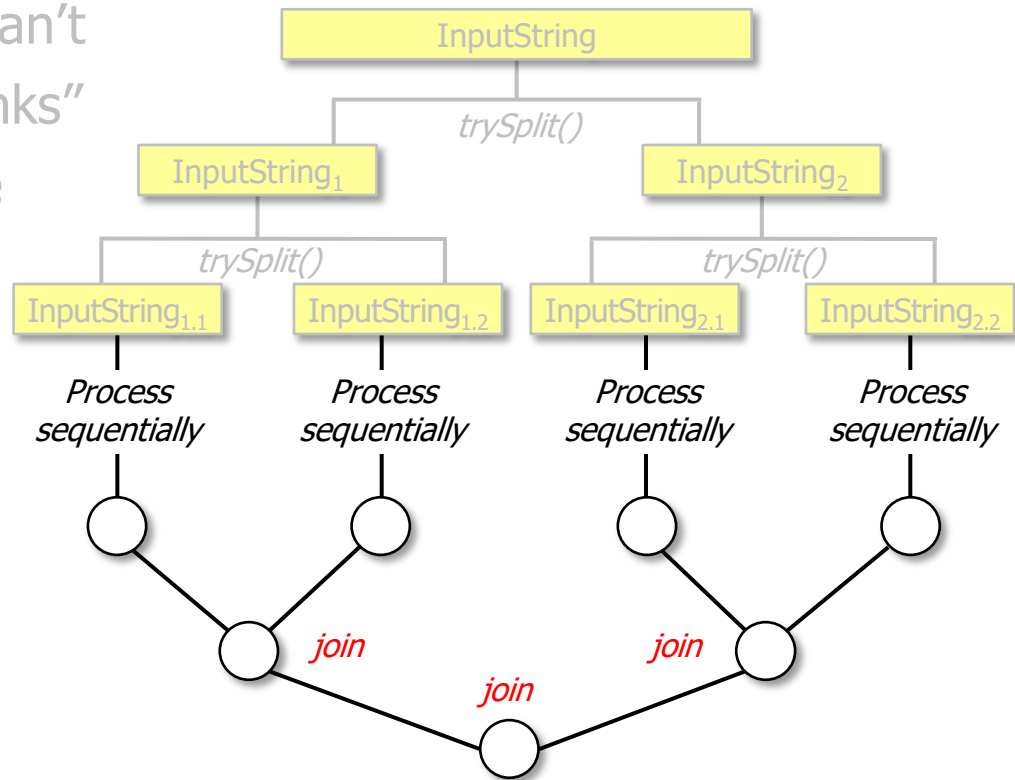
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Nashville, Tennessee, USA**



Learning Objectives in this Part of the Lesson

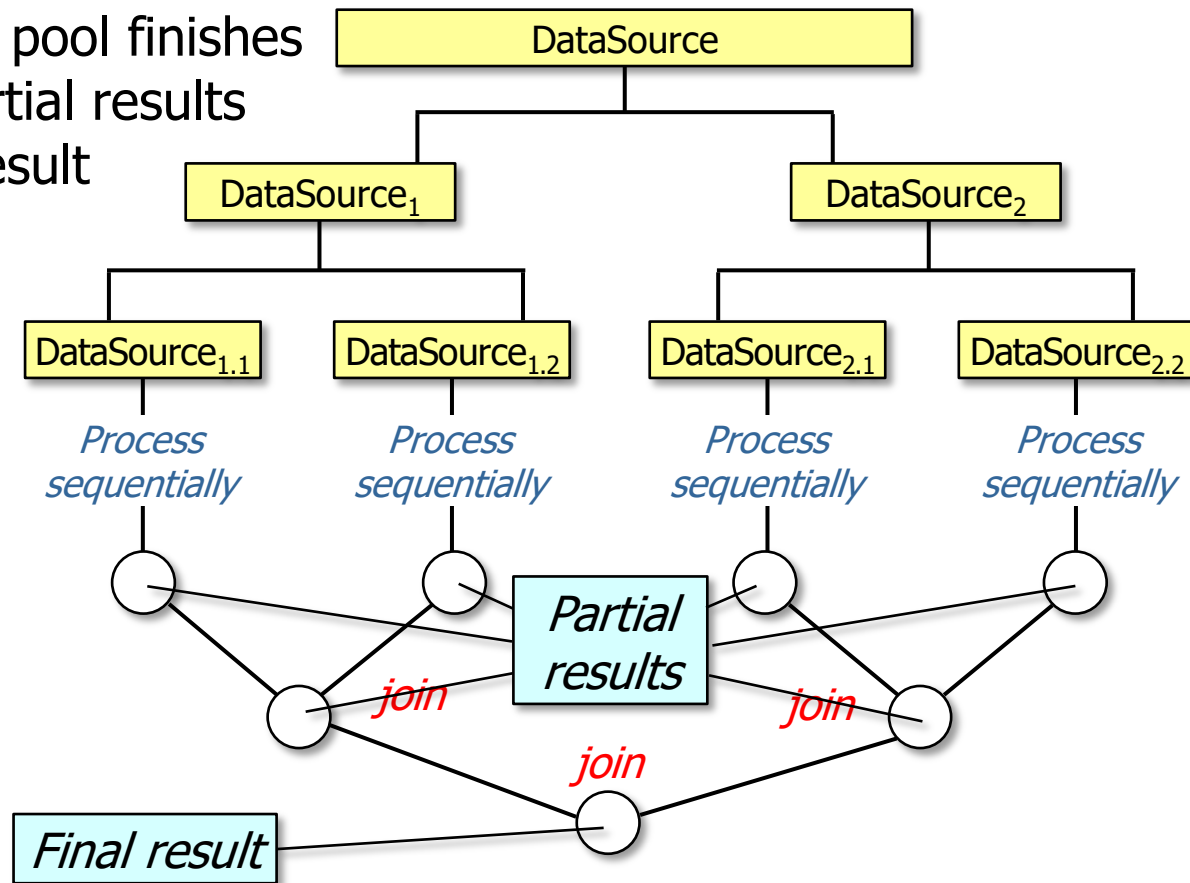
- Understand parallel stream internals, e.g.
 - Know what can change & what can't
 - Partition a data source into "chunks"
 - Process chunks in parallel via the common fork-join pool
 - Configure the Java parallel stream common fork-join pool
- Perform a reduction to combine partial results into a single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



Combining Results in a Parallel Stream

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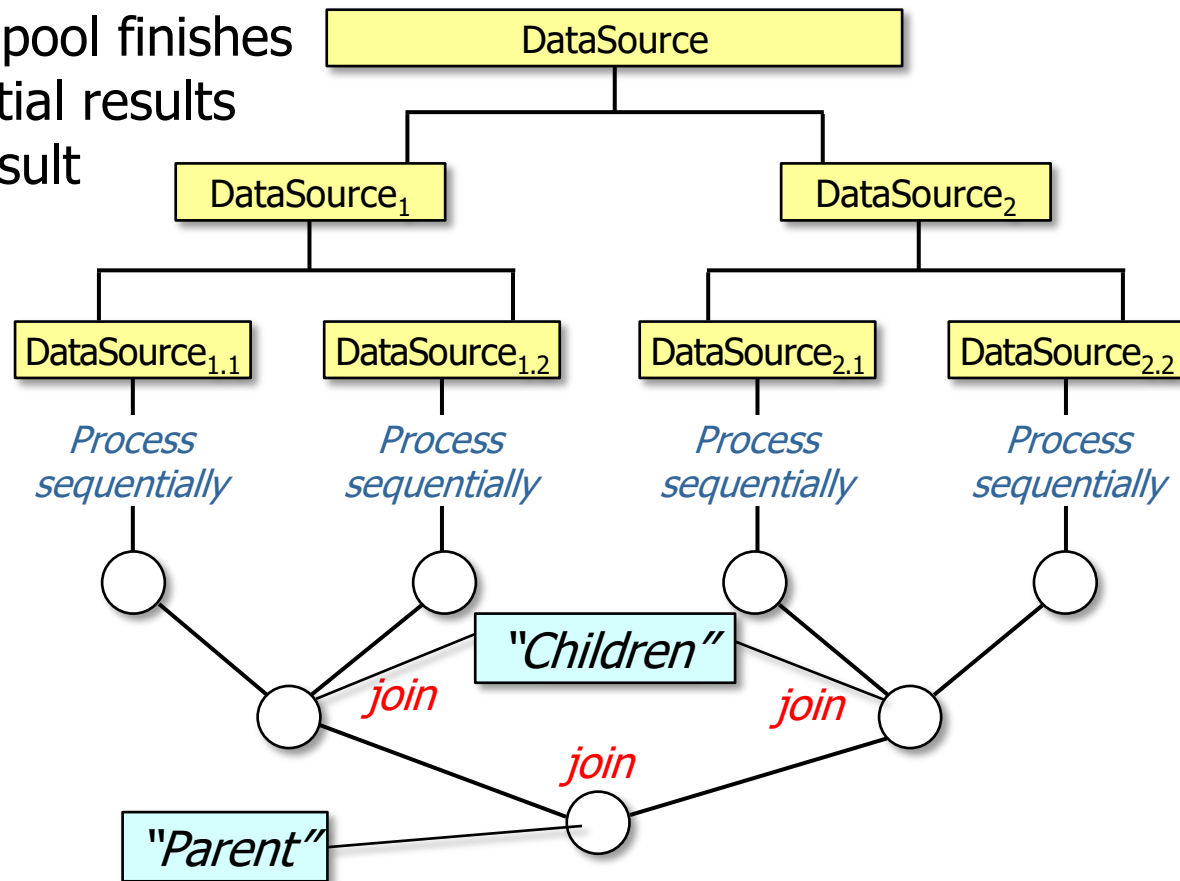
- After the common fork-join pool finishes processing chunks their partial results are combined into a final result



This discussion assumes a non-concurrent collector (other discussions follow)

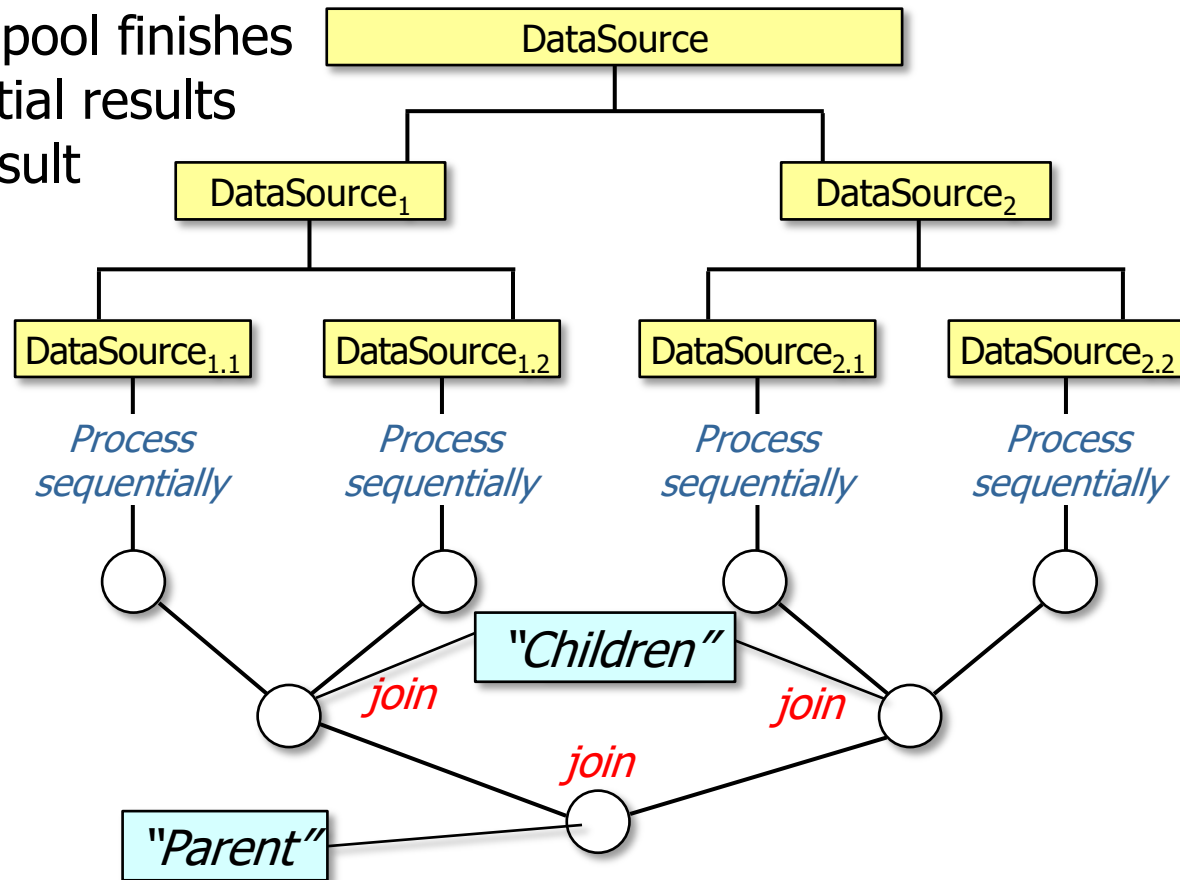
Combining Results in a Parallel Stream

- After the common fork-join pool finishes processing chunks their partial results are combined into a final result
 - `join()` occurs in a single thread at each level
 - i.e., the “parent”



Combining Results in a Parallel Stream

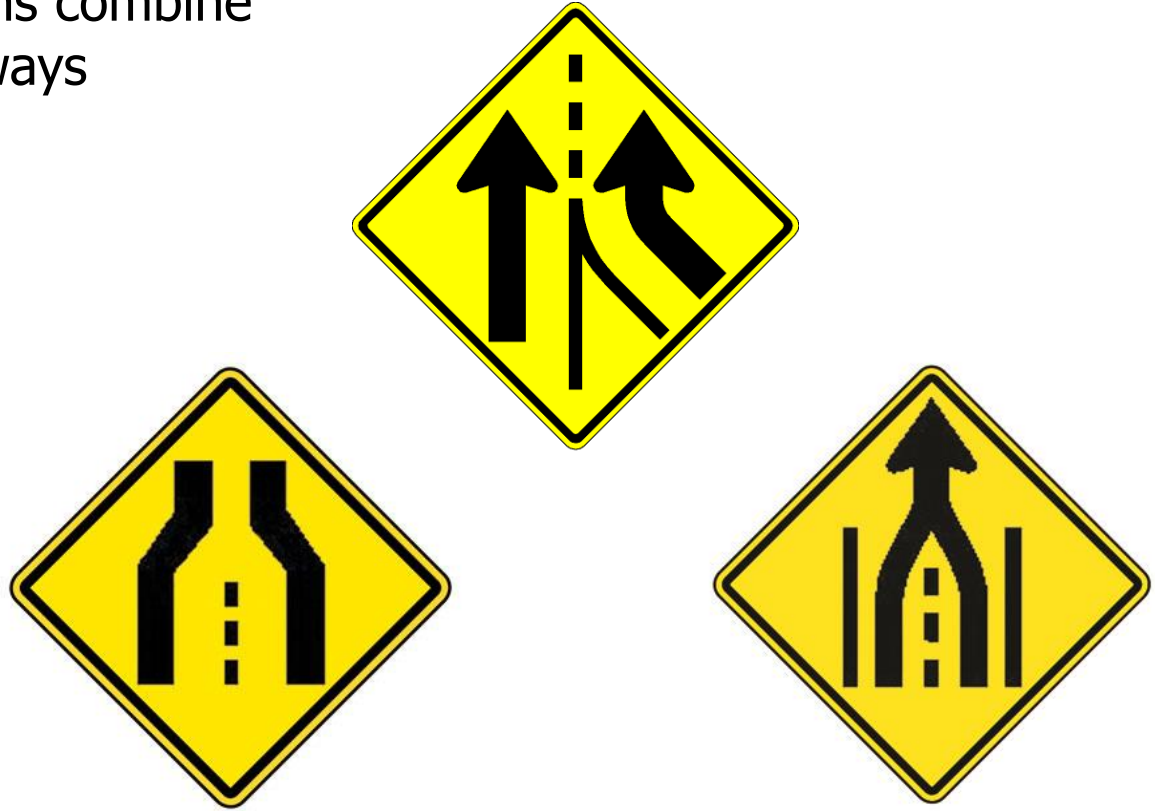
- After the common fork-join pool finishes processing chunks their partial results are combined into a final result
 - `join()` occurs in a single thread at each level
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As a result, there's typically no need for synchronizers during the joining

Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways



Understanding these differences is particularly important for parallel streams

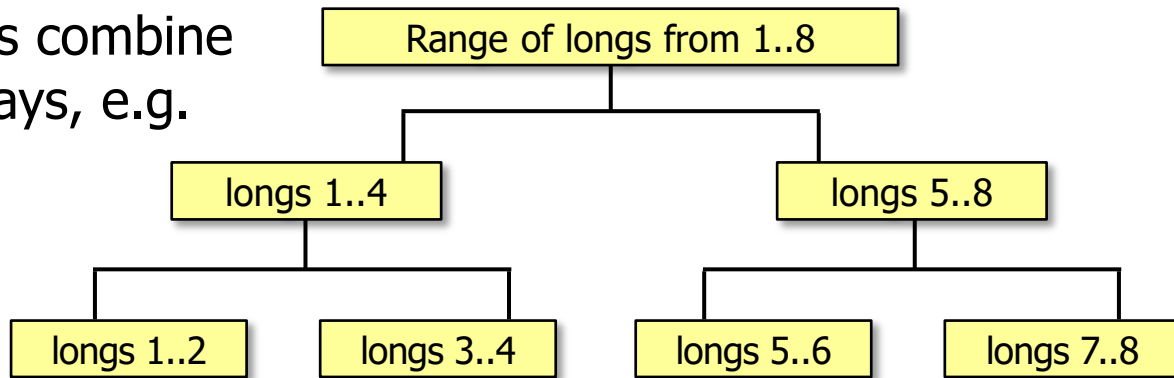
Combining Results in a Parallel Stream

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 - `reduce()` creates a new immutable value



Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways, e.g.
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```
long factorial(long n) {  
    return LongStream  
        .rangeClosed(1, n)  
        .parallel()  
        .reduce(1, (a, b) -> a * b,  
                (a, b) -> a * b);  
}
```

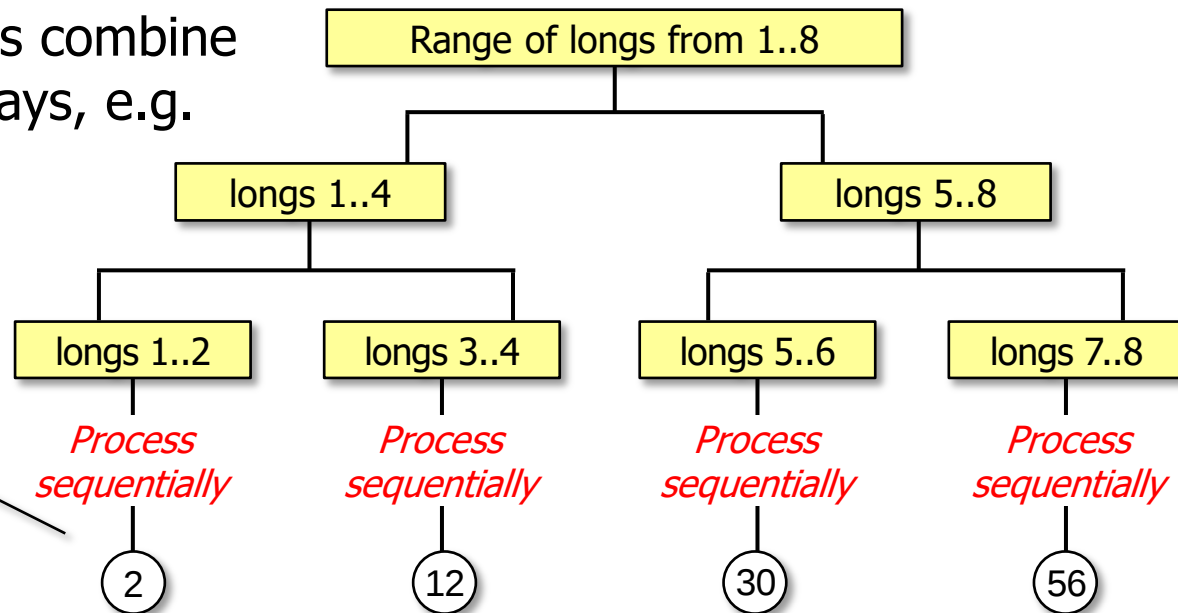
*Generate a range of longs
from 1..8 in parallel*

Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways, e.g.
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Multiply pair-wise values

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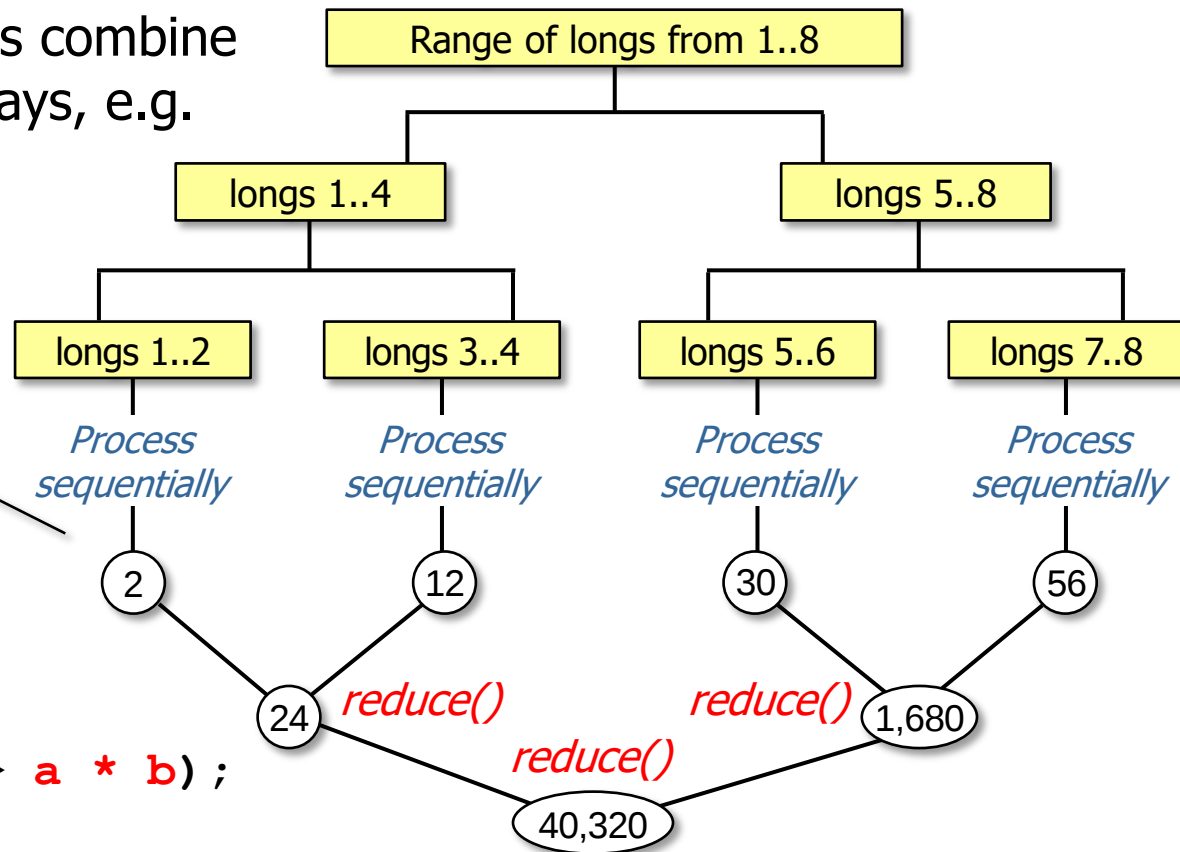


Combining Results in a Parallel Stream

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```



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

Combining Results in a Parallel Stream

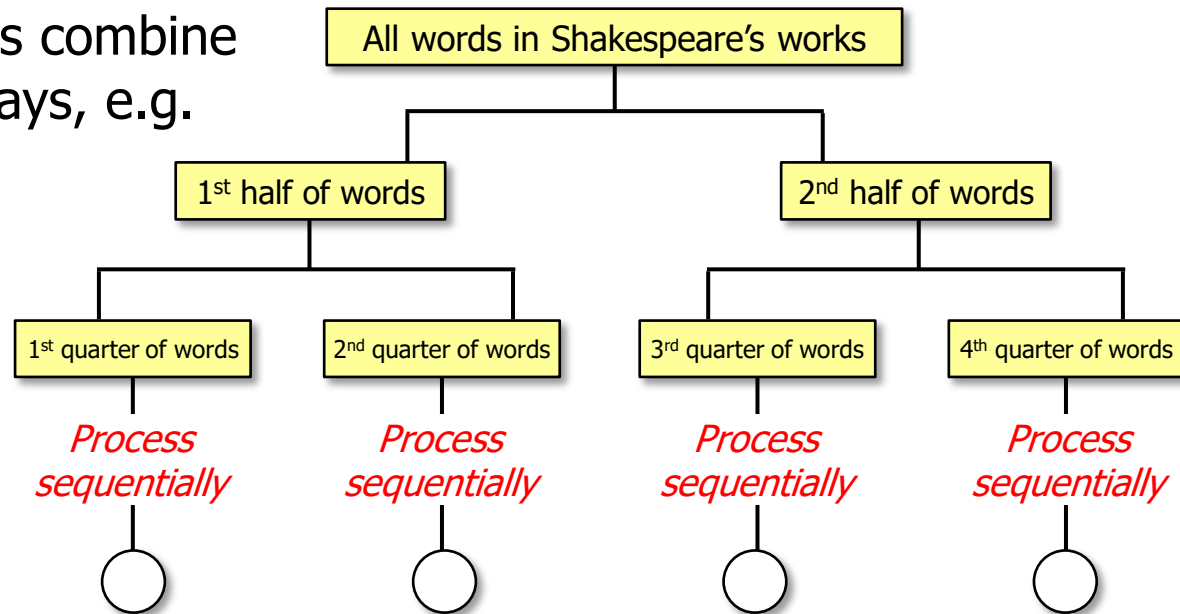
- Different terminal operations combine partial results in different ways, e.g.
 - `reduce()` creates a new immutable value
 - `collect()` mutates an existing value



Combining Results in a Parallel Stream

- Different terminal operations combine partial results in different ways, e.g.

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

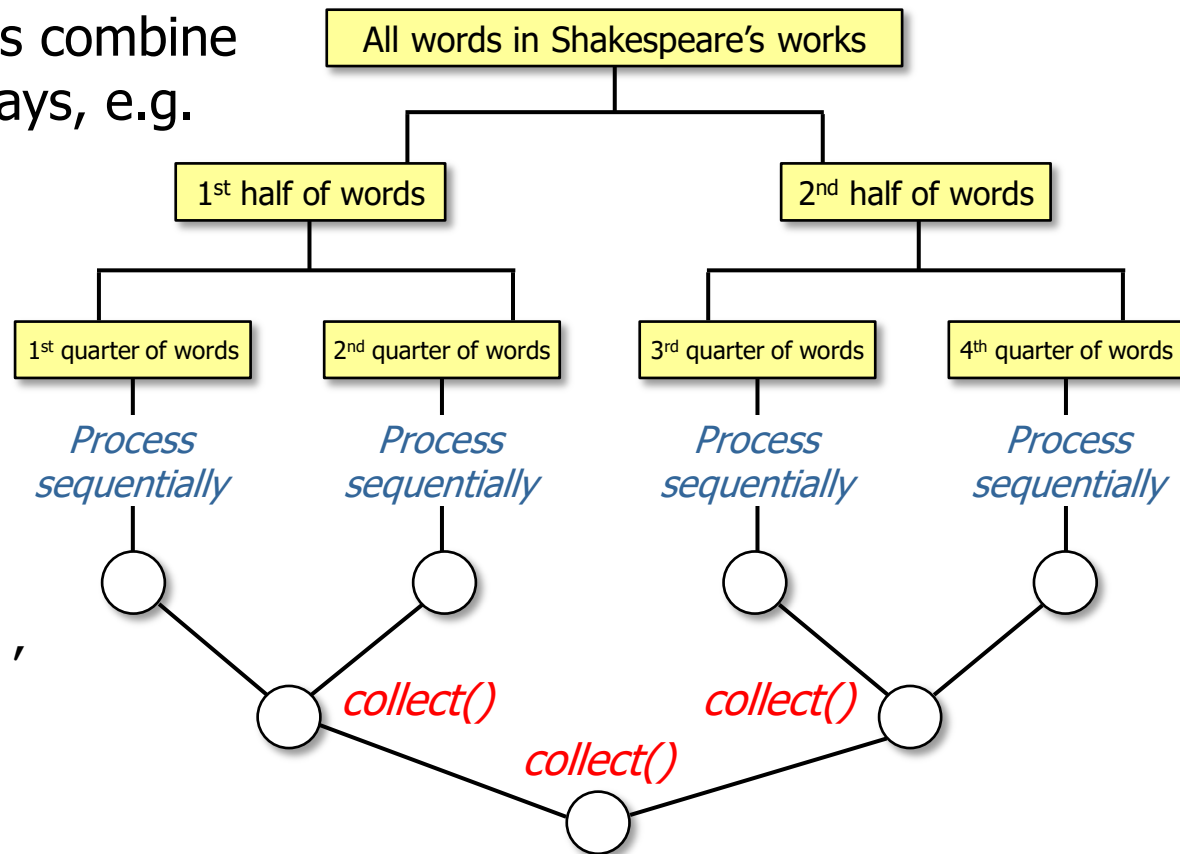
See github.com/douglasraigschmidt/LiveLessons/tree/master/Java8/ex14

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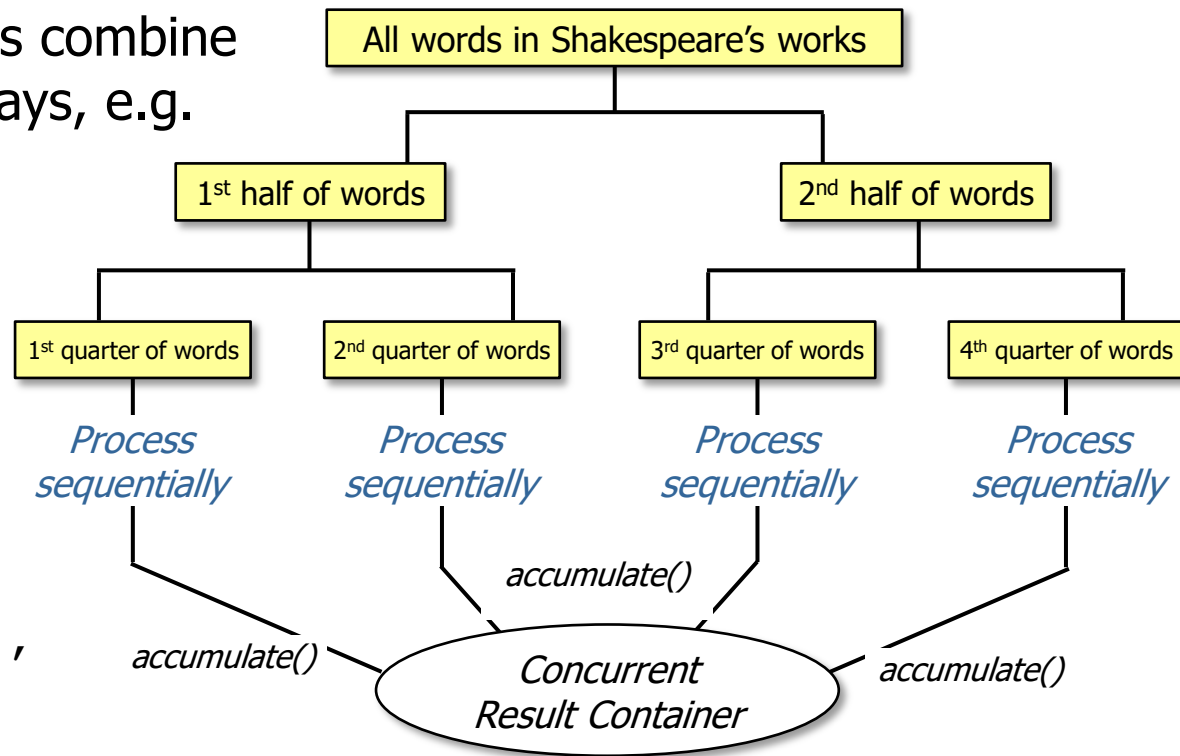
`collect()` mutates a container to accumulate the result it's producing

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```
Set<CharSequence>  
    uniqueWords =  
    getInput(sSHAKESPEARE) ,  
        "\\s+")  
    .parallelStream()  
    ...  
    .collect(ConcurrentHashSetCollector.toSet());
```



Concurrent collectors (covered later) are different than non-concurrent collectors

End of Java Parallel Streams Internals: Combining Results (Part 1)