The Java Fork-Join Pool: Evaluating the Example Applications

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Learning Objectives in this Part of the Lesson

- Apply the fork-join framework in practice
- Examine the applyAllIter() method
- Examine the applyAllSplit() method
- Examine the applyAllSplitIndex() method
- Evaluate the example applications of the Fork-Join Pool framework

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  - Iterative fork()/join() is simple to program/understand

```
<T> List<T> applyAllIter
                  (List<T> list,
                   Function<T, T> op,
                   ForkJoinPool fjPool) {
  ...
  for (T t : list)
    forks.add
      (new RecursiveTask<T>() {
        protected T compute()
        { return op.apply(t); }
      }.fork());

  for (ForkJoinTask<T> task : forks)
    results.add(task.join());
  ...
```

Evaluating the Example Applications

- Each Java fork-join programming model has pros & cons, e.g.
  - Iterative fork()/join() is simple to program/understand
    - but it incurs more work-stealing

```
Starting ForkJoinTest
applyAllIter() steal count = 31
applyAllSplitIndex() steal count = 16
applyAllSplit() steal count = 21
applyAllSplitIndexEx() steal count = 21
[1] Printing 4 results from fastest to slowest
testApplyAllSplitIndexEx() executed in 4575 ms
testApplyAllSplitIndex() executed in 5145 ms
testApplyAllSplit() executed in 5172 ms
testApplyAllIter() executed in 5599 ms
[1] Finishing ForkJoinTest
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Evaluating the Example Applications

- Each Java fork-join programming model has pros & cons, e.g.
  - Iterative fork()/join() is simple to program/understand
    - but it incurs more work-stealing
      - which lowers performance

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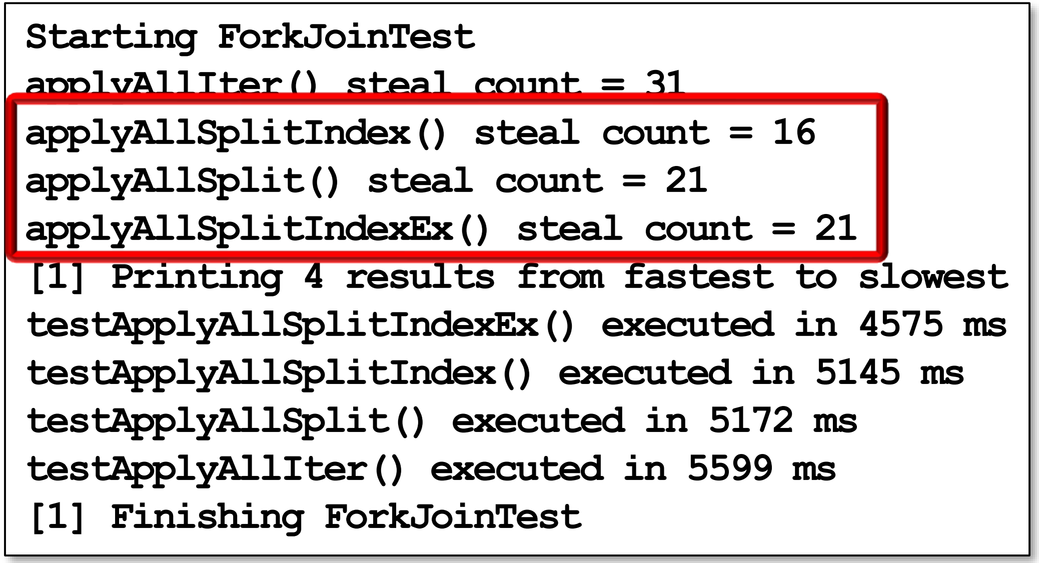
Evaluating the Example Applications

- Each Java fork-join programming model has pros & cons, e.g.
  - Iterative fork()/join() is simple to program/understand
  - Recursive decomposition incurs fewer "steals"



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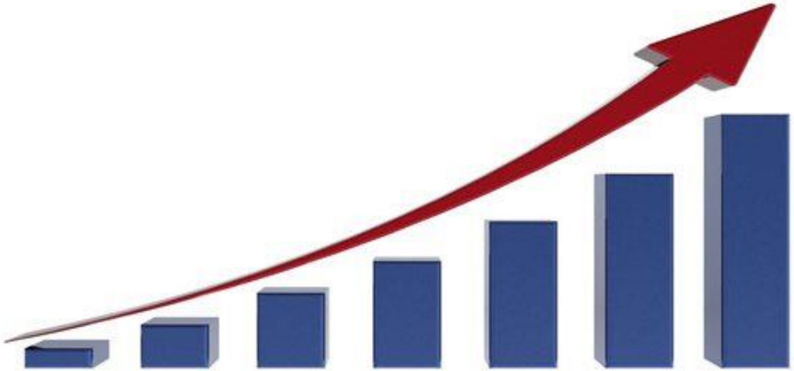

There are also other factors (e.g., less data copying) that improve performance

Evaluating the Example Applications

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  - Iterative fork()/join() is simple to program/understand
  - Recursive decomposition incurs fewer "steals"
    - which improves performance
    - but is more complicated to program

```
class SplitterTask extends
      RecursiveTask<List<T>> {
  protected List<T> compute() {
    ...
    int mid = mList.size() / 2;
    ForkJoinTask<List<T>> lt =
      new SplitterTask(mList.subList
                        (0, mid)).fork();
    mList = mList
      .subList(mid, mList.size());
    List<T> rightResult = compute();
    List<T> leftResult = lt.join();
    leftResult.addAll(rightResult);
    return leftResult;
  } ...
```

Evaluating the Example Applications

- Each Java fork-join programming model has pros & cons, e.g.
  - Iterative fork()/join() is simple to program/understand
  - Recursive decomposition incurs fewer "steals"
    - which improves performance
    - but is more complicated to program
    - & also does more "work" wrt method calls, etc.

Evaluating the Example Applications

- Each Java fork-join programming model has pros & cons, e.g.
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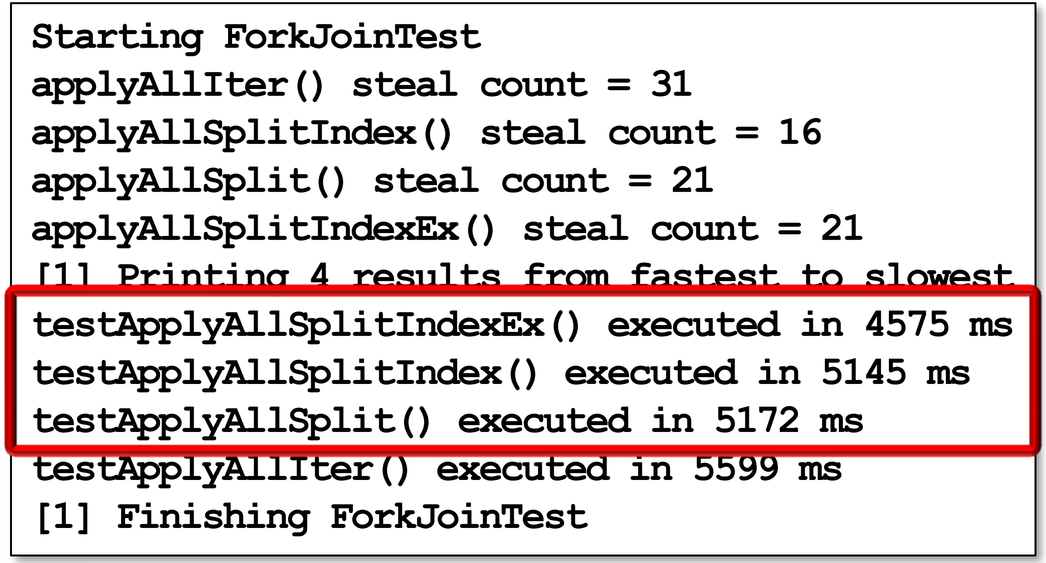
  - Recursive decomposition incurs fewer "steals"
  - RecursiveAction's overhead is lower than RecursiveTask's



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  - RecursiveAction's overhead is lower than RecursiveTask's
    - But RecursiveAction is also more idiosyncratic

```
<T> List<T> applyAllSplitIndex
                (List<T> list,
                 Function<T, T> op,
                 ForkJoinPool fjPool) {
  T[] results = (T[]) Array
    .newInstance
      (list.get(0).getClass(),
       list.size());
  ...
```

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      - Especially for generics

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  - Recursive decomposition incurs fewer "steals"
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    - But RecursiveAction is also more idiosyncratic
      - Especially for generics
      - Changing the API can help!

```
<T> List<T> applyAllSplitIndexEx
                 (List<T> list,
                  Function<T, T> op,
                  ForkJoinPool fjPool,
                  T[] results) {
 ...
```

End of the Java Fork-Join Pool: Evaluating the Example Applications