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Java8
Advanced Stream Techniques

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Stream Design

Stream design

I like to look at this as having chosen a design center that recognizes that sequential is a degenerate case of parallel, rather than treating parallel as the "weird bonus mode". I realize that this choice was controversial and definitely caused some compromises, but eventually people will have to start to unlearn their sequential biases, and there's no time like the present.

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http://mail.openjdk.java.net/pipermail/lambda-dev/2014-February/011870.html

Ordered/Unodered

forEach

```
collection.forEach(Consumer<T> action);
```

VS

```
stream.forEach(Consumer<T> action);
```


forEach

```
iterable.forEach(Consumer<T> action);
```

VS

```
stream.forEach(Consumer<T> action);
```


Iterable.forEach

```
/**
  * ...  Unless otherwise specified by the implementing
  * class, actions are performed in the order of
  * iteration (if an iteration order is specified).
  * ...
  */
       iterable.forEach(Consumer<T> action);
```


Stream.forEach

```
/** ...
  * The behavior of this operation is explicitly
  * nondeterministic. For parallel stream pipelines,
  * this operation does not guarantee to respect the
  * encounter order of the stream, as doing so would
  * sacrifice the benefit of parallelism.
  * If the action accesses shared state, it is
  * responsible for providing the required
  * synchronization.
  * ...
  */
      stream.forEach(Consumer<T> action);
```


Stream.forEachOrdered

```
/** ...
  * This operation processes the elements one at
  * a time, in encounter order if one exists.
  * Performing the action for one element happens-before
  * performing the action for subsequent elements,
  * but for any given element, the action may be
  * performed in whatever thread the library chooses.
  * ...
  */
      stream.forEachOrdered(Consumer<T> action);
```


Demo0

Demo0

```
List<Long> list;

public List<Long> oldSchool() {
    List<Long> l = new ArrayList<>();
    for (Long v : list) {
        if ((v & 0xff) == 0) {
            l.add(v);
        }
    }
    return l;
}
```


Demo0

Sequential/Ordered

```
list.stream()
    .filter(x -> (x & 0xff) == 0)
    .collect(Collectors.toList());
```


Demo0

Sequential/Unordered

```
list.stream()
    .unordered()
    .filter(x -> (x & 0xff) == 0)
    .collect(Collectors.toList());
```


Demo0

Parallel/Ordered

```
list.parallelStream()
    .filter(x -> (x & 0xff) == 0)
    .collect(Collectors.toList());
```


Demo0

Parallel/Unordered

```
list.parallelStream()
    .unordered()
    .filter(x -> (x & 0xff) == 0)
    .collect(Collectors.toList());
```


Results

list == range from 0 to 10000000;

oldSchool	13
Sequential/Ordered	10
Sequential/Unordered	10
Parallel/Ordered	20
Parallel/Unordered	26

throughput, ops/sec

Spliterator или что у Stream'а под капотом

Spliterator

```
interface Spliterator<T> {
    ...

    long  estimateSize(); // Long.MAX_VALUE if unknown

    boolean tryAdvance(Consumer<T> action);

    Spliterator<T>  trySplit();

    int characteristics();

    ...
}
```


Характеристки Stream'a (Spliterator'a)

ORDERED
DISTINCT
SORTED
SIZED
SUBSIZED
NONNULL
IMMUTABLE
CONCURRENT

Demo1

Demo1

Как получить сумму четных чисел Фибоначчи не превышающих 4000000 [1] ?

[1] http://projecteuler.net

Demo1

Как получить сумму четных чисел Фибоначчи не превышающих N?

Demo1 prequel

- Получить Фибоначчи Stream
- Сложить первые 4096 элементов

Demo1 prequel results

sum of limit(4096)

	'no load'	
OldSchool	849	
Generator/Sequential	804	
Iterator/Sequential	760	
Iterate/Sequential	662	
Iterator/Parallel	219	
Iterate/Parallel	223	

throughput, ops/sec

Demo1 prequel results

sum of limit(4096)

	'no load'	'heavy load'
OldSchool	849	55
Generator/Sequential	804	53
Iterator/Sequential	760	53
Iterate/Sequential	662	54
Iterator/Parallel	219	105
Iterate/Parallel	223	106

throughput, ops/sec

Demo1 results

$$N = 4 * 10^{2048}$$

	'no load'	
OldSchool	239	
Iterator/Sequential	225	
Iterate/Sequential	216	
Iterator/Parallel	208	
Iterate/Parallel	209	
throughput, ops/sec		

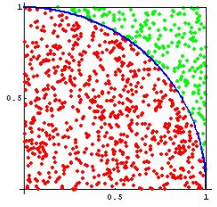
Demo1 results

$$N = 4 * 10^{2048}$$

	'no load'	'heavy load'
OldSchool	239	56
Iterator/Sequential	225	55
Iterate/Sequential	216	54
Iterator/Parallel	208	72
Iterate/Parallel	209	72
throughput, ops/sec		

Demo2

MonteCarlo



$$\pi = 4 \times \frac{M}{N}$$

N - брошено

M - попало

MonteCarlo results

OldSchool	14
ZipBoxed/Sequential	126
ZipDouble/Sequential	23
ZipDouble/Parallel	20
ZipUnsafe/Sequential	24
ZipUnsafe/Parallel	9
ZipPaired/Sequential	22
ZipPaired/Parallel	8
time, secs/op	

Leibniz

$$\frac{\pi}{4} = \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1}$$

Leibniz results

OldSchool	1175
Stream/Sequential	1507
Stream/Parallel	600
time, ms/op	

Thank you!

Q & A ?

