



Why I  streams
and you should
too!

by Patryk Drabiński, 24.05.2020

Who am I?

- Java Developer (3 years of exp)
- Learned streams API on a job
- Fell in  with streams

Agenda

1. Presentation (what and why)
2. Practical Training
3. Wrap-up

Presentation

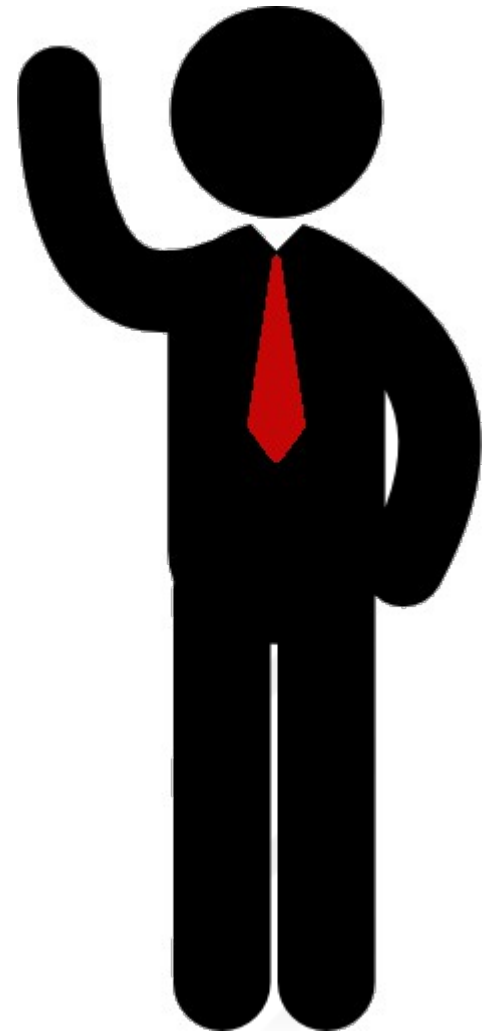
Streams look scary

```
people.stream()  
  .map(person -> person.getName())  
  .filter(name -> name.startsWith("A"))  
  .collect(Collectors.toList())
```

But they are not!

Story time

- Find all female employees



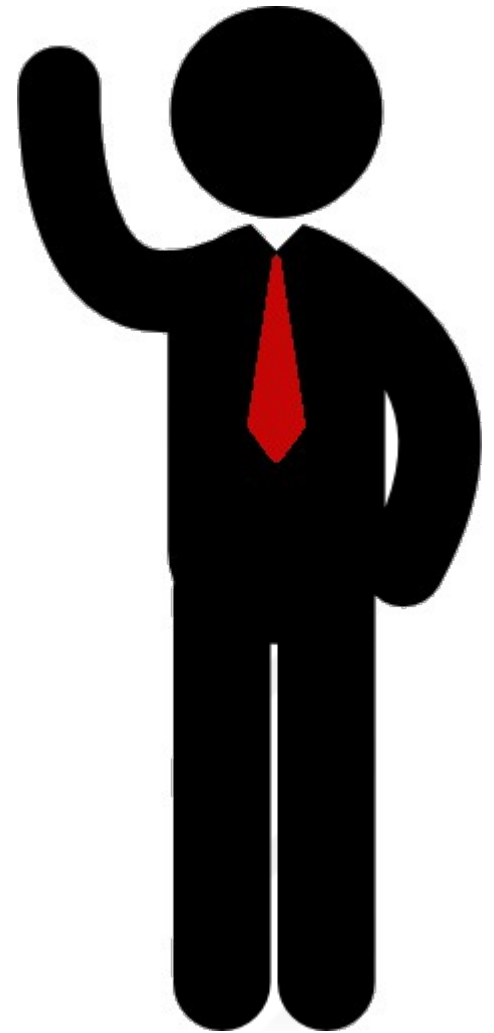
Story time

Function:

```
result = new ArrayList<>();  
for (Person person: people) {  
    if (person.isFemale()) {  
        result.add(person)  
    }  
}  
  
return result;
```

Story time

- Find all female employees
- Find all employees over 50



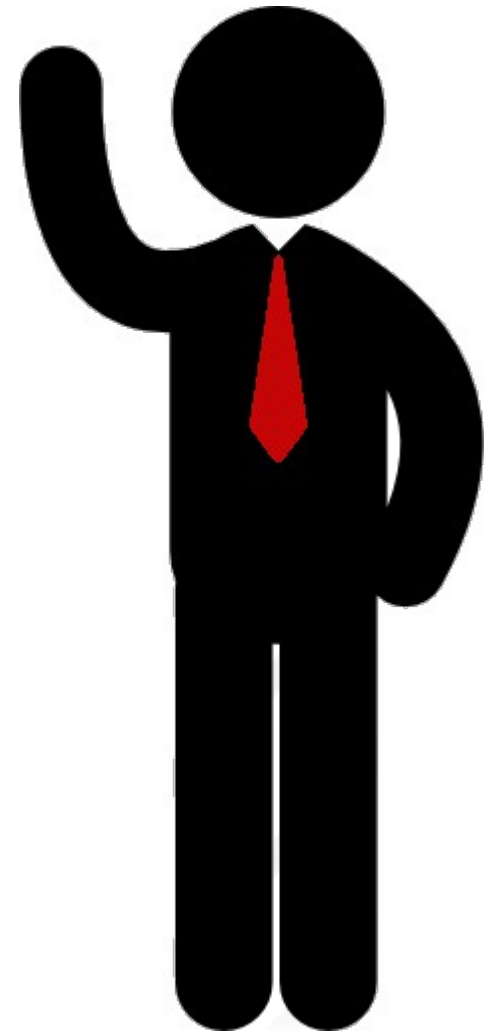
Story time

Another function:

```
result = new ArrayList<>();  
for (Person person: people) {  
    if (person.getAge() > 50) {  
        result.add(person)  
    }  
}  
  
return result;
```

Story time

- Find all female employees
- Find all employees over 50
- Find all employees with salary over 70 000



Story time

Another function:

```
result = new ArrayList<>();  
for (Person person: people) {  
    if (person.getSalary() > 70000) {  
        result.add(person)  
    }  
}  
  
return result;
```

Story time – the final straw

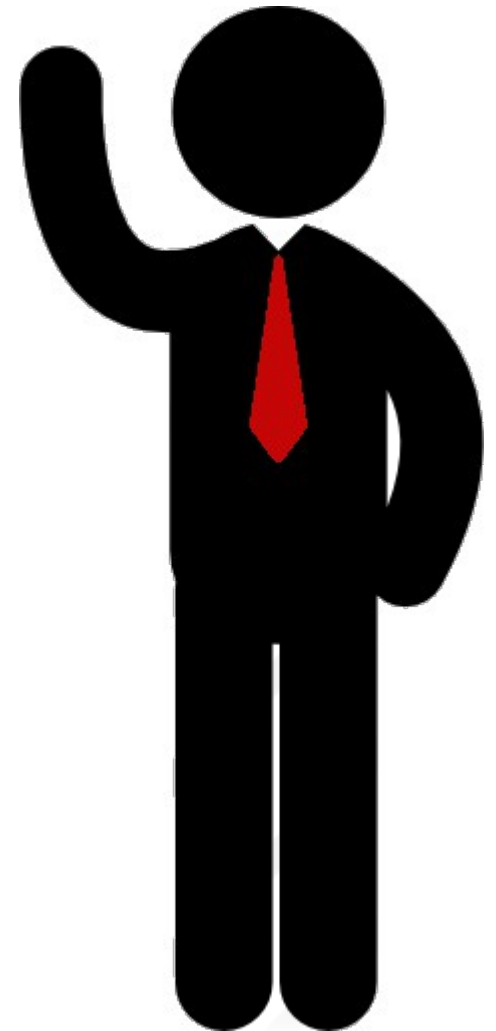
- Find all female employees

AND

- over 50

AND

- with salary over 70 000



Existential crisis

- I would like to pass function as argument but I can't because Java
- All day working with collections, why is it so complex?
- Why couldn't it be like SQL?

Why Streams?

- Introducing function paradigm to Java
- Makes passing function as argument possible
- Working with collections almost like SQL
- Makes coding easier

Java 8 Streams API

- Java 8: March 2014
- Streams API
- Sequential operations on elements
- Declarative approach
- Functional paradigm (function as arg)

Stream structure

- data source (collection)

people.stream()

.map(person -> person.getName())

.filter(name -> name.startsWith("A"))

.collect(Collectors.toList())

Stream structure

- `stream()` - transform to stream object

`people.stream()`

`.map(person -> person.getName())`

`.filter(name -> name.startsWith("A"))`

`.collect(Collectors.toList())`

Stream structure

- intermediate operations – zero or more

```
people.stream()
```

```
    .map(person -> person.getName())
```

```
    .filter(name -> name.startsWith("A"))
```

```
    .collect(Collectors.toList())
```

Stream structure

- terminal operation – one at the end

```
people.stream()
```

```
    .map(person -> person.getName())
```

```
    .filter(name -> name.startsWith("A"))
```

```
    .collect(Collectors.toList())
```

Path to lambda

- What is lambda? (args -> logic)

```
people.stream()  
    .map(person -> person.getName())  
    .collect(Collectors.toList())
```

Path to lambda

- Functional interface

”A functional interface is an interface that contains only one abstract method.”

Path to lambda

- Code: PathToLambdaTest

Path to lambda

- Implementing interface
- Problem: works but requires extra class
- Solution: anonymous class

Path to lambda

- Anonymous class
- Problem: works but makes code dirty
- Solution: predicate requires only one method to be implemented -> it is functional interface -> it can be written using lambda expression

Path to lambda

- Lambda can be inlined
- Usually logic using lambda won't be reused (write once and forget)

Lambda vs anonymous class

- Arguments

```
Predicate<Person>() {  
    @Override  
    public boolean test(Person person)  
        { return person.getAge() > 70; }  
};
```

```
(Person person) ->  
    { return person.getAge() > 70; }
```

Lambda vs anonymous class

- Body

```
Predicate<Person>() {  
    @Override  
    public boolean test(Person person)  
        { return person.getAge() > 70; }  
};
```

```
(Person person) ->  
    { return person.getAge() > 70; }
```

Lambda vs anonymous class

- Note: When dealing with lambdas we no longer speak about classes but instead we call it "a function that takes ... parameters and returns ..."

Simplifying lambda

- Skip argument type
- If one argument we can skip brackets ()
- If one instruction in body we can skip brackets {}, return and semicolon ;
- Short version makes it easier to inline lambda

Simplifying lambda

- Before:

(Person person) ->

{ return person.getAge() > 70; }

- After:

person -> person.getAge() > 70

Method reference

- Method reference:
people.stream()
 .map(**Person::getAge**)
 .collect(Collectors.toList())
- Simplifies lambda even further
- Only in specific cases

Method reference






Cases:

- Static methods
- Instance methods of particular objects
- Instance methods of an arbitrary object of a particular type
- Constructor

Method reference

- You don't have to remember that
- IntelliJ helps (Alt + Enter), both ways

```
List<Integer> ages = people.stream()  
    .map(person -> person.getAge())  
    .collect(Collector
```

-  Replace lambda with method reference ▶
-  Go to super method Ctrl+U
-  Expand lambda body to {...} ▶
-  Replace Stream API chain with loop ▶
-  Split into declaration and assignment ▶

Properties of streams

- Lazy
- Closes after execution
- Elements are processed vertically
`people.stream()`
 `.map(person -> person.getName())`
 `.filter(name -> name.startsWith("A"))`
 `.collect(Collectors.toList())`

Properties of streams

- No recursion allowed
- No stream splitting allowed
- Objects from outside must be final (or effective final)

```
String prefix = "Mr. ";  
prefix = "Mrs. ";  
List<String> peopleWithPrefixes = people.stream()  
    .map(person -> prefix + person.getName())  
    .collect(Collectors.toList());
```

Variable used in lambda expression should be final or effectively final

Function types

- Predicate – returns true/false
(Person person) -> person.isFemale()
- Supplier -> zero arguments,
returns something
() -> new ArrayList<Person>()

Function types

- Consumer - some arguments, returns nothing
(Person person) ->
 System.out.println(person)
- BiFunction -> take two arguments, returns something
(Person p1, Person p2) ->
 p1.getAge() > p2.getAge()
- And many more.....

Practical Training

Practical training

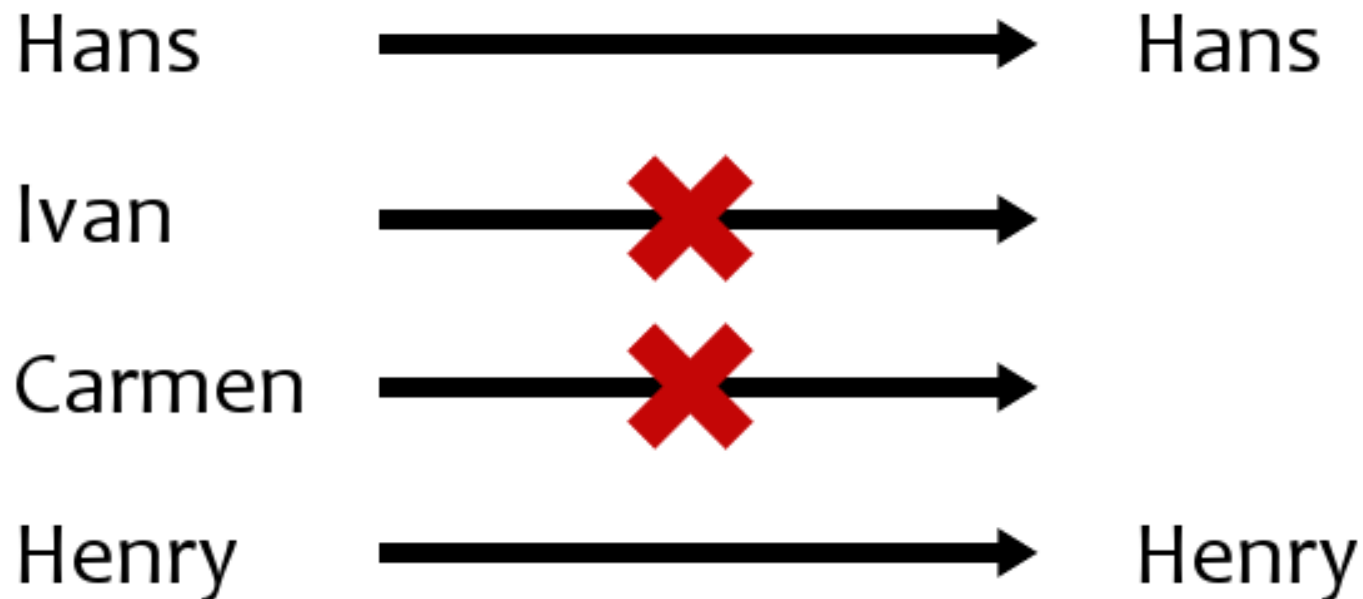
- Basics (solves 80% of problems)
- Advanced I
- Advanced II
- Bonus: Streams with Optional
- Coffee breaks on demand

Basics

- `forEach`
- `collectors(toList, toSet, toMap)`
- streams on map data structure
- `filter`
- `map`
- `flatMap`
- debug & code style
- vertical processing
- lazy

filter

- `filter(name -> name.startsWith("H"))`



- May change number of elements but keeps the type

map

- `map(name -> name.length())`



- Keeps the number of elements but may change the type

flatMap

- flatMap(nation -> nation.getPeople().stream())

```
[  
  Germans: [ "Hans", "Heinrich" ],  
  Russians: [ "Ivan", "Vladmir" ]  
]
```



```
["Hans", "Heinrich", "Ivan", "Vladmir"]
```

flatMap

- Flattens list of lists to list
- Instead of processing current element open new stream on element

Advanced I

- streams with arrays
- joining, groupingBy, partitionBy
- skip, limit, distinct
- allMatch, noneMatch, anyMatch, findFirst
- sorted

Advanced II

- IntStream
- count, sum
- reduce
- custom collector
- parallel

Streams advantages

- Type faster, type nicer
- More expressive, higher readability
- **Required during job interviews**
- Common style for developers

Streams advantages

- Synergy with optionals
- Works similarly in other languages (arrow functions in JavaScript)
- Easy parallel processing

Streams disadvantages

- Slower than standard loops
- No strong typing
- Tricky debugging

Recruitment questions

- What will be the results of this stream?
- What is functional interface? Give me examples (Runnable, EventListener, Comparable)
- What kind of operations exist in streams?
What are terminal and non-terminal operations?
- What does it mean that streams are lazy?

Sources

1. <http://tutorials.jenkov.com/java-functionalprogramming/streams.html>
2. <https://www.samouczekprogramisty.pl/strumienie-w-jezyku-java/> (Polish)
3. <https://www.baeldung.com/java-8-streams-introduction>
4. <https://winterbe.com/posts/2014/07/31/java8-stream-tutorial-examples/>



That's All Folks!



**KEEP
CALM**

AND



STREAMS

Contact info

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<https://github.com/t4upl>



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