Stream API

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Introduction

- **Imperative programming**
  - Say how to do
    - C, C++, Java...
- **Declarative programming**
  - Say what to do
    - HTML, SQL...
- **Processing on a data stream**
  - Collection, array, I/O, String...

Imperative code

```
List<Animal> herd = …
int animalAgeSummed = 0;
int numSickAnimal = 0;
for (Animal animal : herd) {
    if (animal.getTemperature() > FeverThreshold) {
        ++numSickAnimal;
        animalAgeSummed += animal.getAge();
    }
}
double meanSickAnimalAge = animalAgeSummed / numSickAnimal;
```

Declarative code

```
List<Animal> herd = …

double meanSickAnimalAge = herd.stream()
    .filter(a -> a.getTemperature() > FeverThreshold)
    .mapToInt(a -> a.getAge())
    .average()    // Optional result
    .getAsDouble();
```

Advantages

- **Better intent communication**
  - Less boiler plate code
  - Less cluttered by technical detail (iteration)
- **Easy to parallelize code execution**
- **Laziness**
  - Wait until last time to acquire data
- **Short-circuiting**
  - Able to break stream execution on some operation

Functional style

- **Input - Process - Output**

- **No side effect**
  - Input data are not modified
  - New data are generated on each transformation (use of map)

Stream usage schema

- **Stream definition**
  - Data source on demand (may be infinite)
  - maCollection.stream() (99%)
- **Operations**
  - Define by functional interface (lambdas, method reference)
  - Intermediate operations => stream
    - Filtering
    - Mapping
    - Reduce
    - ...
  - Ending operation => result
    - Count, reduce, collector

- ***Stream automatically produce a pipeline of operation where data are processed on the fly (no storage)***

JDK Stream API

- **Stream<T>**
  - Stream of T elements
    - IntStream, LongStream, DoubleStream
    - https://www.jmdoudoux.fr/java/dej/chap-streams.htm#streams-1-5

- **Collector<T, A, R>**
  - Reduce and accumulate results in a container
  - Parameter for collect method
  - Mainly used
    - toList(), toSet()

Main stream operations