Stream API & Lambda Expression in Java

Problems faced before implementing Stream API

- Can process data in a declarative way similar to SQL statements.

SELECT max(salary), employee_id, employee_name FROM Employee

The above SQL expression automatically returns the maximum salaried employee's details, without doing any computation on the developer's end. Using collections framework in Java, a developer has to use loops and make repeated checks. Why can’t we do something similar with collections?

- **Efficiency**

As multi-core processors are available at ease, a Java developer has to write parallel code processing that can be pretty error-prone

Stream API – Java 8

- New abstraction called Stream that lets you process data in a declarative way.
- streams can leverage multi-core architectures without you having to write a single line of multithread code.

Stream API Implementation compared with Java 7

Java 7

```
List<Transaction> groceryTransactions = new Arraylist<>();
for(Transaction t: transactions){
  if(t.getType() == Transaction.GROCERY){
    groceryTransactions.add(t);
  }
}
Collections.sort(groceryTransactions, new Comparator(){
  public int compare(Transaction t1, Transaction t2){
    return t2.getValue().compareTo(t1.getValue());
  }
});


List<Integer> transactionIds = new ArrayList<>();
for(Transaction t: groceryTransactions){
  transactionsIds.add(t.getId());
}
```

Java 8

```
List<Integer> transactionsIds =
    transactions.stream()
                .filter(t -> t.getType() == Transaction.GROCERY)
                .sorted(comparing(Transaction::getValue).reversed())
                .map(Transaction::getId)
                .collect(toList());
```

What is Stream API?

- A sequence of elements from a source that supports aggregate operations.

Sequence of elements − A stream provides an interface to a sequenced set of values of a specific element type. However, streams don’t actually store elements; they are computed on demand.

Source − Streams consume from a data-providing source such as collections, arrays, or I/O resources.

Aggregate operations − Stream supports aggregate operations like filter, map, limit, reduce, find, match, and so on.

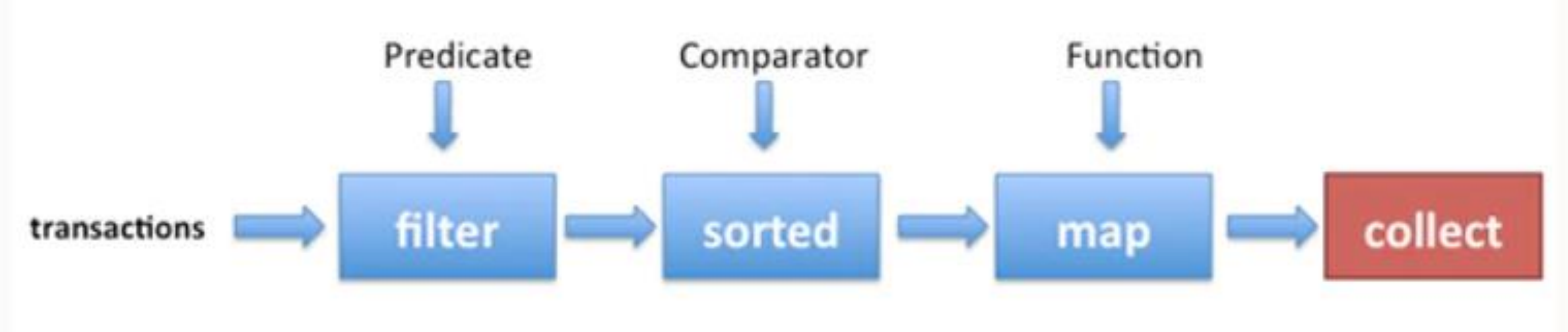
- **Pipelining**

Many stream operations return a stream themselves. This allows operations to be chained to form a larger pipeline. This enables certain optimizations, such as laziness and short-circuiting, which we explore later.

- **Internal iteration**

In contrast to collections, which are iterated explicitly (*external iteration*), stream operations do the iteration behind the scenes for you.

Implementation of Stream API



```
List<Integer> transactionsIds =
    transactions.parallelStream()
                .filter(t -> t.getType() == Transaction.GROCERY)
                .sorted(comparing(Transaction::getValue).reversed())
                .map(Transaction::getId)
                .collect(toList());
```

Intermediate Operations	**Terminal Operations**
Stream operations that can be connected are called intermediate operations.	Operations that close a stream pipeline are called terminal operations.
filter() - takes a predicate as an argument and returns a stream including all elements that match the given predicate	collect()
map()	collect()
flatMap()	forEachOrdered()
distinct() - Returns a stream with unique elements	toArray()
sorted()	findFirst()
peek()	forEach()
limit(n) - Returns a stream that is no longer than the given siz	min()
skip(n) - Returns a stream with the first n number of elements discarded	max()

Collection vs Stream

Collections	Stream
About data	About computations
In-memory data structure, which holds all the values that the data structure currently has—every element in the collection has to be computed before it can be added to the collection	A stream is a conceptually fixed data structure in which elements are computed on demand

External iteration
List<String> transactionIds = new ArrayList<>();
for(Transaction t: transactions){
    transactionIds.add(t.getId());
}
	Internal iteration
	List<Integer> transactionIds =
	transactions.stream().map(Transaction::getId)
	.collect(toList());

Lambda Expression

- Provides a clear and concise way to represent one method interface using an expression
- Helps to iterate, filter and extract data from collection
- Don't need to define the method again for providing the implementation. Here, we just write the implementation code.
- Java lambda expression is treated as a function, so compiler does not create .Class file.

Why we need lambda expression?

- To provide the implementation of Functional interface.

- Less coding.

How to implement lambda expression?

- (argument-list) -> {body}

Argument-list: It can be empty or non-empty as well.

Arrow-token: It is used to link arguments-list and body of expression.

Body: It contains expressions and statements for lambda expression.

Without Lamda

```
interface Drawable{
    public void draw();
}
public class LambdaExpressionExample {
    public static void main(String[] args) {
        int width=10;


        //without lambda, Drawable implementation using anonymous class


        Drawable d=new Drawable(){
            public void draw(){System.out.println("Drawing "+width);}
        };
        d.draw();
    }
}
```

With Lamda

```
@FunctionalInterface  //It is optional
interface Drawable{
    public void draw();
}

public class LambdaExpressionExample2 {
    public static void main(String[] args) {
        int width=10;

        //with lambda
        Drawable d2=()->{
            System.out.println("Drawing "+width);
        };
        d2.draw();
    }
}
```

Lambda expression with multiple parameters

```
interface Addable{
    int add(int a,int b);
}


public class LambdaExpressionExample5{
    public static void main(String[] args) {


        // Multiple parameters in lambda expression
        Addable ad1=(a,b)->(a+b);
        System.out.println(ad1.add(10,20));


        // Multiple parameters with data type in lambda expression
        Addable ad2=(int a,int b)->(a+b);
        System.out.println(ad2.add(100,200));
    }
}
```

Lamda expression : for each loop

```
import java.util.*;
public class LambdaExpressionExample7{
   public static void main(String[] args) {

      List<String> list=new ArrayList<String>();
      list.add("ankit");
      list.add("mayank");
      list.add("irfan");
      list.add("jai");

      list.forEach(
         (n)->System.out.println(n)
      );
   }
}
```

Thank you