Java 8 Stream API Guide

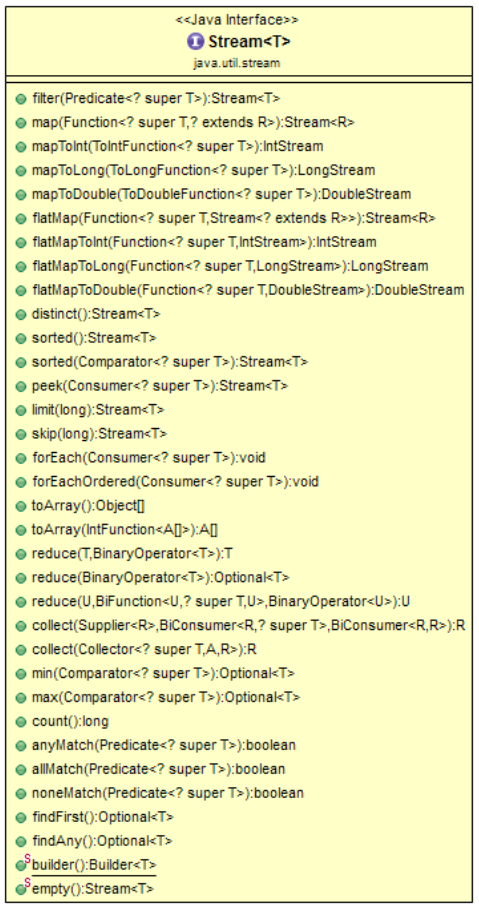
1. Overview

Java provides a new additional package in Java 8 called `java.util.stream`. This package consists of classes, interfaces, and an enum to allows functional-style operations on the elements. You can use stream by importing `java.util.stream` package in your programs.

1.1 The Stream provides the following features:

- `Stream` does not store elements. It simply conveys elements from a source such as a data structure, an array, or an I/O channel, through a pipeline of computational operations.
- `Stream` is functional in nature. Operations performed on a stream does not modify its source. For example, filtering a Stream obtained from a collection produces a new Stream without the filtered elements, rather than removing elements from the source collection.
- `Stream` is lazy and evaluates code only when required.
- The elements of a stream are only visited once during the life of a stream. Like an Iterator, a new stream must be generated to revisit the same elements of the source.

You can use Stream to `filter, collect, print,` and convert from one data structure to other etc.



2. `Stream` API's with Examples

Let's explore Stream API's with examples

2.1 Java Example: Filtering Collection without using `Stream`

In the following example, we are filtering data without using a stream. This approach we are used before the stream package was released.
First create a `Product` class, which is used in below examples :

```
public class Product {
     private int id;
     private String name;
     private float price;
     public Product(int id, String name, float price) {
          this.id = id;
          this.name = name;
          this.price = price;
     }
     public int getId() {
          return id;
     }
     public void setId(int id) {
          this.id = id;
     }
```

```
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public float getPrice() {
        return price;
    }
    public void setPrice(float price) {
        this.price = price;
    }
}
```

Let's first discuss without using *Stream API's* examples then we will create the same examples using *Stream API's*.

```
import java.util.ArrayList;
import java.util.List;
import java.util.stream.Collectors;

public class JavaWithoutStreamExample {
    private static List < Product > productsList = new ArrayList < Product > ();

    public static void main(String[] args) {

        // Adding Products
        productsList.add(new Product(1, "HP Laptop", 25000 f));
        productsList.add(new Product(2, "Dell Laptop", 30000 f));
        productsList.add(new Product(3, "Lenevo Laptop", 28000 f));
        productsList.add(new Product(4, "Sony Laptop", 28000 f));
        productsList.add(new Product(5, "Apple Laptop", 90000 f));
        // Without Java 8 Stream API'S
        withoutStreamAPI();
    }

    private static void withoutStreamAPI() {
        // without Stream API's
        List < Float > productPriceList = new ArrayList < Float > ();
        // filtering data of list
        for (Product product: productsList) {
            if (product.getPrice() > 25000) {
                // adding price to a productPriceList
                productPriceList.add(product.getPrice());
            }
        }

        // displaying data
        for (Float price: productPriceList) {
            System.out.println(price);
        }
    }

}
```

2.2 Java *Stream* Example: filtering Collection by using *Stream*

Here, we are filtering data by using stream. You can see that code is optimized and maintained. The stream provides fast execution.

```
import java.util.ArrayList;
import java.util.List;
```

```
import java.util.stream.Collectors;

public class JavaStreamExample {
 private static List<Product> productsList = new ArrayList<Product>();

 public static void main(String[] args) {

  // Adding Products
  productsList.add(new Product(1, "HP Laptop", 25000f));
  productsList.add(new Product(2, "Dell Laptop", 30000f));
  productsList.add(new Product(3, "Lenevo Laptop", 28000f));
  productsList.add(new Product(4, "Sony Laptop", 28000f));
  productsList.add(new Product(5, "Apple Laptop", 90000f));
  // With Java 8 Stream API'S
  withStreamAPI();
 }

 private static void withStreamAPI() {
  // filtering data of list
  List<Float> productPriceList = productsList.stream()
   .filter((product) -> product.getPrice() > 25000)
   .map((product) -> product.getPrice()).collect(Collectors.toList());
  // displaying data
  productPriceList.forEach((price) -> System.out.println(price));
 }
}
```

2.3 Java *Stream* Example: Filtering and Iterating *Collection*

In the following example, we are using filter() method. Here, you can see the code is optimized and very concise.

```
public class FilteringAndIteratingCollection {
 public static void main(String[] args) {
  List<Product> productsList = new ArrayList<Product>();
  // Adding Products
  productsList.add(new Product(1, "HP Laptop", 25000f));
  productsList.add(new Product(2, "Dell Laptop", 30000f));
  productsList.add(new Product(3, "Lenevo Laptop", 28000f));
  productsList.add(new Product(4, "Sony Laptop", 28000f));
  productsList.add(new Product(5, "Apple Laptop", 90000f));
  // This is more compact approach for filtering data
  productsList.stream().filter(product -> product.getPrice() == 30000)
    .forEach(product -> System.out.println(product.getPrice()));
 }
}
```

2.4 Java *Stream* Example: Sum by using *Collectors* Methods

We can also use collectors to compute a sum of numeric values. In the following example, we are using *Collectors* class and it?s specified methods to compute a sum of all the product prices.

```
public class SumByUsingCollectorsMethods {
 public static void main(String[] args) {
        List<Product> productsList = new ArrayList<Product>();
        //Adding Products
        productsList.add(new Product(1,"HP Laptop",25000f));
        productsList.add(new Product(2,"Dell Laptop",30000f));
        productsList.add(new Product(3,"Lenevo Laptop",28000f));
        productsList.add(new Product(4,"Sony Laptop",28000f));
        productsList.add(new Product(5,"Apple Laptop",90000f));
```

```
        // Using Collectors's method to sum the prices.
        double totalPrice3 = productsList.stream()
                          .collect(Collectors.summingDouble(product->product.getPrice()));
        System.out.println(totalPrice3);

    }
}
```

2.5 Java *Stream* Example: Find Max and Min Product Price

Following example finds min and max product price by using stream. It provides a convenient way to find values without using the imperative approach.

```
public class FindMaxAndMinMethods {
 public static void main(String[] args) {
  List<Product> productsList = new ArrayList<Product>();
  // Adding Products
  productsList.add(new Product(1, "HP Laptop", 25000f));
  productsList.add(new Product(2, "Dell Laptop", 30000f));
  productsList.add(new Product(3, "Lenevo Laptop", 28000f));
  productsList.add(new Product(4, "Sony Laptop", 28000f));
  productsList.add(new Product(5, "Apple Laptop", 90000f));
  // max() method to get max Product price
  Product productA = productsList
   .stream().max((product1,
   product2) -> product1.getPrice() > product2.getPrice() ? 1 : -1)
   .get();

  System.out.println(productA.getPrice());
  // min() method to get min Product price
  Product productB = productsList
   .stream().max((product1,
   product2) -> product1.getPrice() < product2.getPrice() ? 1 : -1)
   .get();
  System.out.println(productB.getPrice());
 }
}
```

2.6 Java *Stream* Example: Convert *List* into *Set*

```
public class ConvertListToSet {
 public static void main(String[] args) {
  List<Product> productsList = new ArrayList<Product>();

  // Adding Products
  productsList.add(new Product(1, "HP Laptop", 25000f));
  productsList.add(new Product(2, "Dell Laptop", 30000f));
  productsList.add(new Product(3, "Lenevo Laptop", 28000f));
  productsList.add(new Product(4, "Sony Laptop", 28000f));
  productsList.add(new Product(5, "Apple Laptop", 90000f));

  // Converting product List into Set
  Set<Float> productPriceList = productsList.stream()
    .filter(product -> product.getPrice() < 30000)
    .map(product -> product.getPrice())
                                  .collect(Collectors.toSet());
  System.out.println(productPriceList);
 }
```

```
}
```

2.7 Java *Stream* Example: Convert *List* into *Map*

```
public class ConvertListToMap {
 public static void main(String[] args) {
  List<Product> productsList = new ArrayList<Product>();

  // Adding Products
  productsList.add(new Product(1, "HP Laptop", 25000f));
  productsList.add(new Product(2, "Dell Laptop", 30000f));
  productsList.add(new Product(3, "Lenevo Laptop", 28000f));
  productsList.add(new Product(4, "Sony Laptop", 28000f));
  productsList.add(new Product(5, "Apple Laptop", 90000f));

  // Converting Product List into a Map
  Map<Integer, String> productPriceMap = productsList.stream()
    .collect(Collectors.toMap(p -> p.getId(), p -> p.getName()));
  System.out.println(productPriceMap);
 }
}
```

2.8 Using Method References in *Stream* Examples

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

  List<Product> productsList = new ArrayList<Product>();

  // Adding Products
  productsList.add(new Product(1, "HP Laptop", 25000f));
  productsList.add(new Product(2, "Dell Laptop", 30000f));
  productsList.add(new Product(3, "Lenevo Laptop", 28000f));
  productsList.add(new Product(4, "Sony Laptop", 28000f));
  productsList.add(new Product(5, "Apple Laptop", 90000f));

  List<Float> productPriceList = productsList.stream()
  .filter(p -> p.getPrice() > 30000)// filtering data
  .map(Product::getPrice) // fetching price by referring getPrice method
  .collect(Collectors.toList()); // collecting as list
  System.out.println(productPriceList);
 }
}
```

3. Reference

- Java 8 Stream API JavaDoc

4. Online Article of this Guide

- http://www.javaguides.net/2018/07/java-8-stream-api.html

5. Java 8 Tutorial

- Top Java 8 Tutorial