Core Java 8 and Development Tools

Lesson 22 : Stream API

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Lesson Objectives

After completing this lesson, participants will be able to

- Understand concept stream API
- Use stream API with collections
- Perform different stream opeations

22.1: Introduction to Streams API
Why Stream API?

Group of Employees (Collections)

How to find the most senior employee?

What is the count of employees joined this year?

Send meeting Invite to only Java Programmers

Manager

22.1: Introduction to Streams API
Why Stream API?

Stream API allows developers process data in a declarative way.

Streams can leverage multicore architectures without writing a single line of multithread code

Enhances the usability of Java Collection types, making it easy to iterate and perform tasks against each element in the collection

Supports sequential and parallel aggregate operations

Stream API

22.1: Introduction to Streams API
Stream API

Characteristics of Stream API

- Not a data structure
- Designed for lambdas
- Do not support indexed access
- Can easily be output as arrays or Lists
- Lazy
- Parallelizable
- Can be unbounded

22.1: Introduction to Streams API
Stream Operations

Stream defines many operations, which can be grouped in two categories

- Intermediate operations
- Terminal Operations

Stream operations that can be connected are called intermediate operations. They can be connected together because their return type is a Stream.

Operations that close a stream pipeline are called terminal operations.

Intermediate operations are “lazy”

Intermediate operations

Terminal operation

22.2: Working with Stream
Working with Stream: Step - 1

To perform a computation, first we need to define source of stream

To create a stream source from values, use “of ” method

```
Stream<Integer> stream = Stream.of(10,20,30);
```

A stream can be obtained from sources like arrays or collections using “stream” method

To obtain steam from array, use java.util.Arrays class

- stream()

```
Integer[] values = new Integer[] {10,20,30};
Stream<Integer> stream = Arrays.stream(values);
```

To obtain stream from collections, use java.util.Collection interface

- stream()
- parallelStream()

22.2: Working with Stream
Working with Stream: Step - 2

A stream pipeline consist of source, zero or more intermediate operations and a terminal operation

A stream pipeline can be viewed as a query on the stream source

Operations on stream are categories as:

- Filter
- Map
- Reduce
- Search
- Sort

22.2: Working with Stream
Stream Interface

The Stream API consists of the types in the java.util.stream package

The “Stream” interface is the most frequently used stream type

A Stream can be used to transfer any type of objects

Few important method of Stream Interface are:

Concat	**Count**
Collect	**Filter**
forEach	**Limit**
Map	**Max**
Min	**Of**
Reduce	**Sorted**

Intermediate
Terminal

22.2: Working with Stream Demo

Execute the :

- BasicStream

22.3: Stream Operations
Mapping

The Stream interface's map method maps each element of stream with the result of passing the element to a function.

Map() takes a function (java.util.function.Function) as an argument to project the elements of a stream into another form.

The function is applied to each element, “mapping” it into a new element.

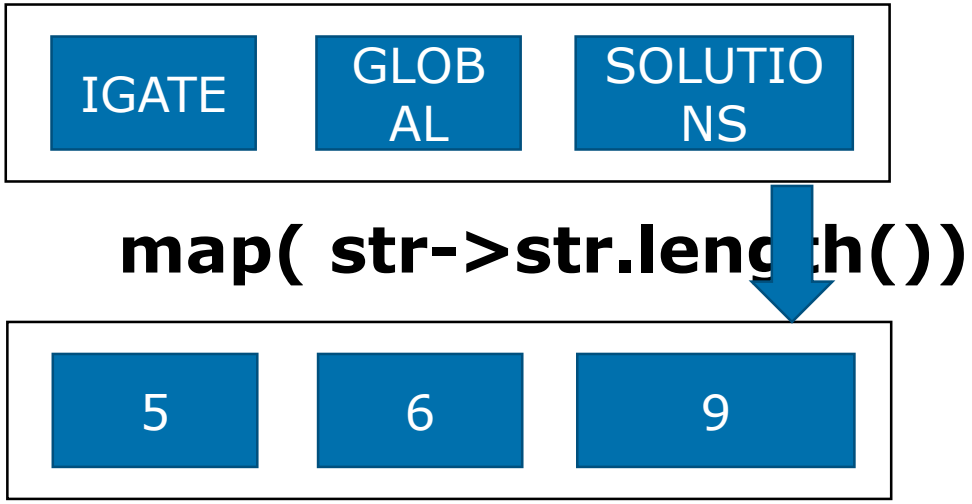
Syntax:

```
<R> Stream<R> map(java.util.function.Function<? super T, ? extends R> mapper)
```

The map method returns a new Stream of elements whose type may be different from the type of the elements of the current stream.

22.3: Stream Operations
Mapping Example

```
List<String> words = Arrays.asList("IGATE","GLOBAL","SOLUTIONS");
words.stream().map(str->str.length()).forEach(System.out : : println);
```



22.3: Stream Operations
Filtering

There are several operations that can be used to filter elements from a stream:

Operation	What ?
filter(Predicate)	Takes a predicate (java.util.function.Predicate) as an argument and returns a stream including all elements that match the given predicate
distinct	Returns a stream with unique elements (according to the implementation of equals for a stream element)
limit(n)	Returns a stream that is no longer than the given size n
skip(n)	Returns a stream with the first n number of elements discarded

22.3: Stream Operations
Filtering Examples

filter(predicate)

```
List<Integer>  listInt = Arrays.asList(11,3,44,5,66,33,44);
listInt.stream().filter(num -> num > 10).forEach(num->System.out.println(num));
```

11 44 66 33 44

distinct()

```
List<Integer>  listInt = Arrays.asList(11,3,44,5,66,33,44);
listInt.stream().distinct().forEach(System.out : : println);
```

11 3 44 5 66 33

limit(size)

```
List<Integer>  listInt = Arrays.asList(11,3,44,5,66,33,44);
listInt.stream().limit(4).forEach(System.out : : println);
```

11 3 44 5

22.3: Stream Operations
Reducing

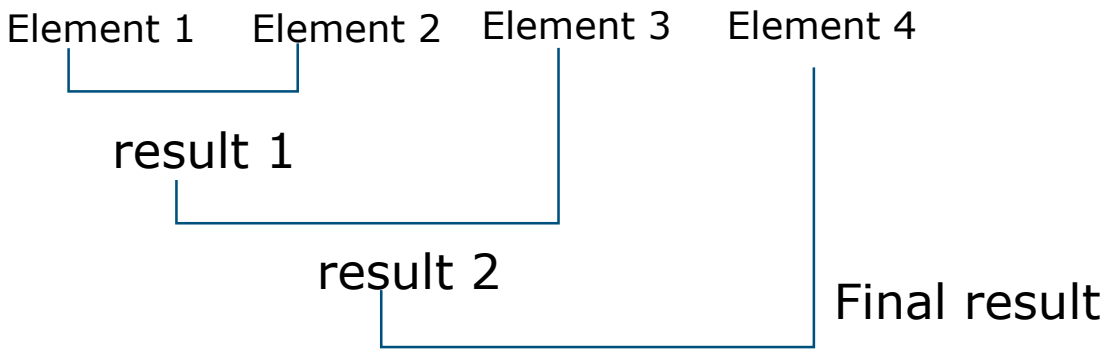
The reduce operation on streams, which repeatedly applies an operation on each element until a result is produced.

It's often called a fold operation in functional programming

Syntax:

```
java.util.Optional<T> reduce(java.util.function.BinaryOperator<T> accumulator))
```

The reduce() method takes a BinaryOperator as argument and returns an Optional instance

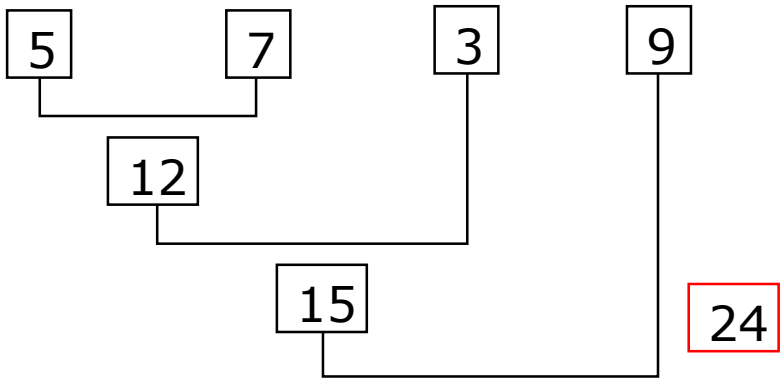


22.3: Stream Operations
Reducing Example

```
List<Integer> intList = Arrays.asList(5,7,3,9);
Optional<Integer> result = intList.stream().reduce((a,b)->a+b);
if(result.isPresent()) {
        System.out.println("Result:"+result.get());
}
```

Reduction of elements by adding them

Result: 24



22.3: Stream Operations Demo

Execute the :

- StreamMap
- StreamFiter
- StreamReduce

22.5: Stream API
Lab

Lab 10: Lambda Expressions and Stream API

Summary

In this lesson, you have learnt:

- Working with Stream API
- Using Stream Operations on Collections

Review Question

Question 1 : Which of the following stream reduce call is valid to find max of given stream?

- Option 1 : stream.reduce((a,b)->a>b?a:b)
- Option 2 : stream.max()
- Option 3 : stream.map((a,b)->a>b)

Question 2 : _____ is a pipe for transferring data.

Question 3 : Resource-intensive tasks can be done efficiently by using parallel stream.

- True/False