# Theory: Collectors

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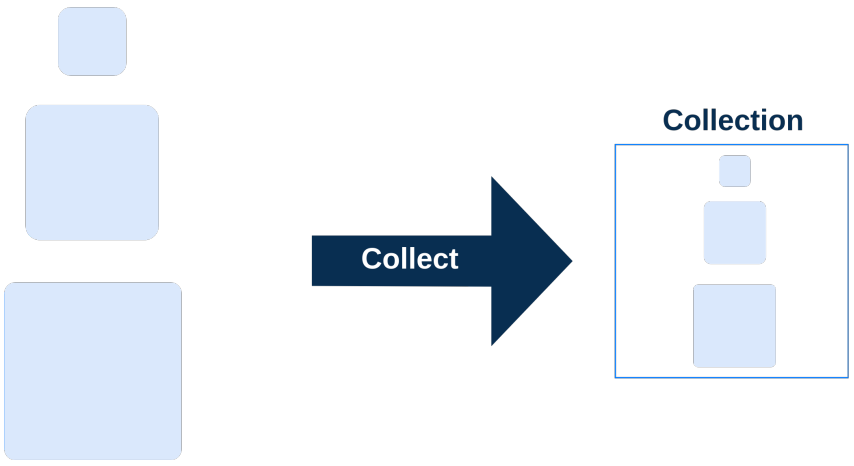
So far we know how to produce a single value from a stream of elements by using `reduce` operation. However, collecting stream elements into a collection such as a `List` or a `Set` is a much more popular scenario than reducing them to a single value. For that, Java Stream API provides a terminal operation called `collect`. In a combination with a utility `stream.Collectors` class that contains a lot of useful reduction operations, `collect` allows us to easily produce collections from streams as well as single values like the `reduce` operations do.

## §1. Producing collections

The `collect` is a terminal reduction operation that can accept an object of the `Collector` type. But instead of focusing on the `Collector`, let's consider the `Collectors` class more closely. It is important that the `Collectors` class contains static methods that return the `Collector` and implement functionality for accumulating stream elements into a collection, summarizing them, repacking to a single string, etc.




Note that the `collect` is a terminal operation, which means that it begins all evaluations with the stream and produces a final result.

To be more concrete, let's consider an example where the `Account` class is given:

```
public class Account {
    private long balance;
    private String number;

    // getters and setters
}
```

We want to produce a list of accounts from the stream of accounts `Stream<Account> accountStream`. To do so, we can accumulate stream elements to the list using `Collectors.toList` method:

```
List<Account> accounts = accountStream.collect(Collectors.toList());
```

As you can see, the `Collectors.toList` method did all the work for us. Similarly to producing a `List` from a stream, we can produce a `Set`. Again, we can delegate that responsibility to the `Collectors` class and use `Collectors.toSet` method:

```
Set<Account> accounts = accountStream.collect(Collectors.toSet());
```

If you need more control over producing collections and want to accumulate stream elements to the particular collection that is not a `List` or a `Set`, than `Collectors.toCollection` method may come in handy:

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Reduction methods

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```
LinkedList<Account> accounts = accountStream.collect(Collectors.toCollection(LinkedList::new));
```

The `Collections.toCollection` method accepts a function that generates a new collection of a specified type. In the example above, we've accumulated a stream of account numbers to the `LinkedList<Account>` by providing a reference to its default constructor.

## §2. Producing values

Similarly to the `reduce` operation, `collect` is able to accumulate stream elements into a single value. Here you can see some `Collectors` methods that produce a single value:

- `summingInt`, `summingLong`, `summingDouble`;
- `averagingInt`, `averagingLong`, `averagingDouble`;
- `maxBy`, `minBy`;
- `counting`.

The names of the methods are quite self-explanatory regarding their purpose. We'll employ one in the example below.

> Note that you can make your code shorter and more clear by using static import of necessary collectors such as `import static java.util.stream.Collectors.averagingLong;`

Now let's summarize balances on the accounts. We can use `summingLong` method for that:

```
long summary = accounts.stream()
        .collect(summingLong(Account::getBalance));
```

Also, we can calculate the mean value:

```
double average = accounts.stream()
        .collect(averagingLong(Account::getBalance));
```

> Note that all averaging collectors (`averagingLong`, `averagingInt`, `averagingDouble`) return a `double` value.

If you need to perform more specific calculations, you can use `Collectors.reducing` method. Similarly to the `reduce` operation, `Collectors.reducing` method implementations can accept an accumulator function or the identity value together with an accumulator. However, there is one additional implementation that accepts identity, *mapper*, and an accumulation function.

> It is notable that the mapper is a mapping function that is applied to stream elements, while the reducing accumulator function reduces the mapped values of a stream.

Let's consider an example:

```
String meganumber = accountStream.collect(Collectors.reducing("",
          account -> account.getNumber(),
          (numbers, number) -> numbers.concat(number)
  ));
```

The code above maps each account to its number and concatenates all account numbers into one single number using a reducing collector.

## §3. Conclusion

The `collect` is a terminal operation that allows us to accumulate stream

elements to a collection or a single value. The `collect` method accepts the object of the `Collector` type. Instead of implementing the `Collector`, we can use the `Collectors` class that contains useful methods that return a `Collector` with already implemented logic. By using `Collectors` we can accumulate stream elements into a `List` or a `Set` by using `toList` and `toSet` methods respectively. If we need to produce some other collection we can use the method called `toCollection`. Besides producing collections, the `collect` operation can be used for calculating such values as the average, summarized, maximum, minimum, etc.

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