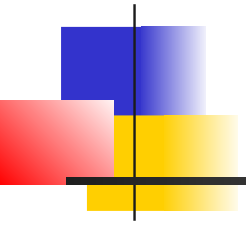


Java 8 New Features

A few of the more significant changes and additions.

James Brucker

Interfaces

- Default methods
  - instance methods can have method code!
  - class "inherits" the default implementation

- Static methods with code

  Interfaces can have static methods, which must have an implementation.

Default Method in Interfaces

Add a getCurrency method to Valuable with default implementation.

```
public interface Valuable {
    /** value of this item. This is abstract. */
    public double getValue();

    /** Get the currency. Default is "Baht". */
    default public String getCurrency() {
        return "Baht";
    }

    // ILLEGAL: Cannot override an existing method
//  default String toString() { return "error!": }
}
```

Static Method in Interface

A static **`create()`** method for creating instances.

Implementation must be included in interface.

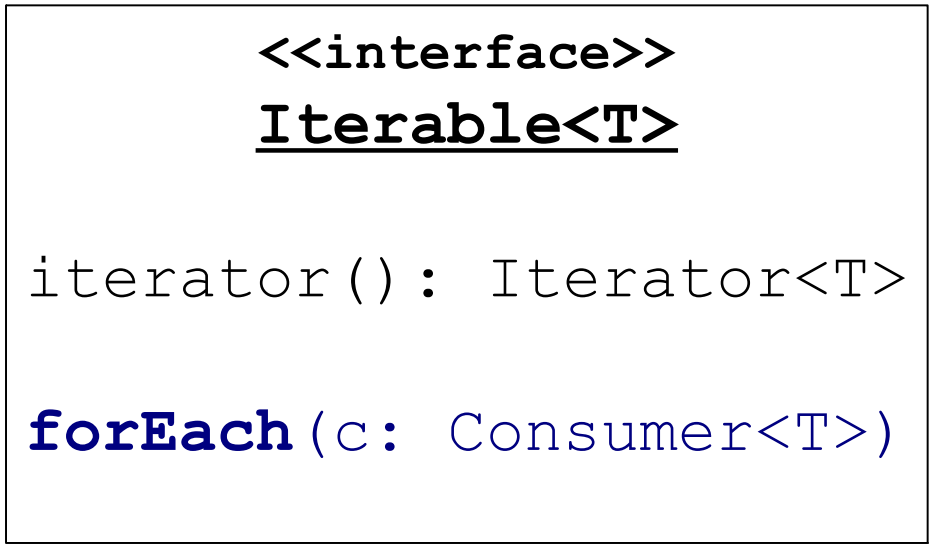
```
public interface Valuable {
    /** value of this item. This is abstract. */
    public double getValue();

    /** Create money (static). public by default */
    static Valuable create(double value) {
        return MoneyFactory.getInstance()
                           .createMoney(value);
    }
}
```

Why add default methods?

Java added new methods to existing interfaces.
How to do that without breaking existing applications?

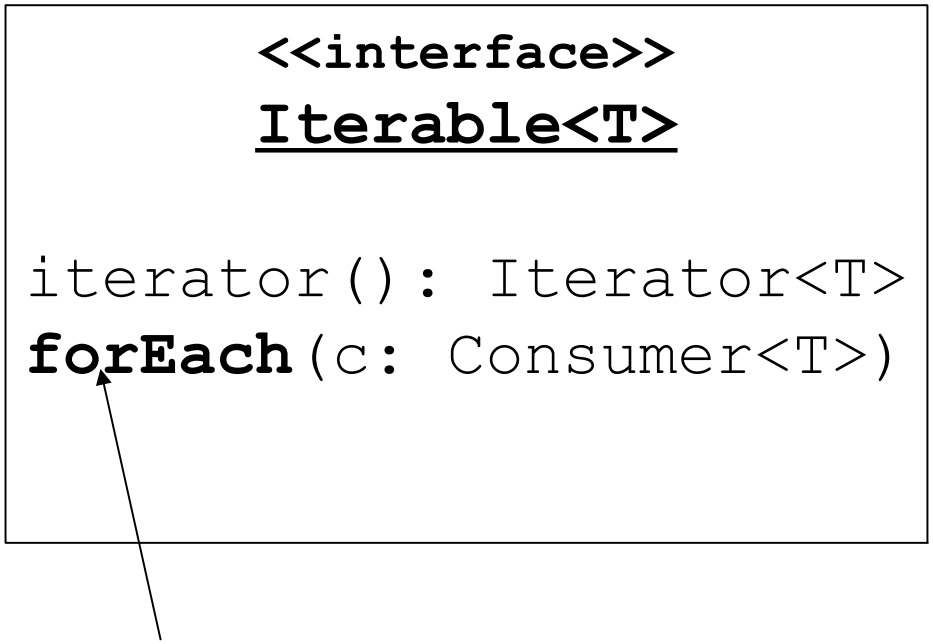
Example: `Iterable` has a new "`forEach`" method:

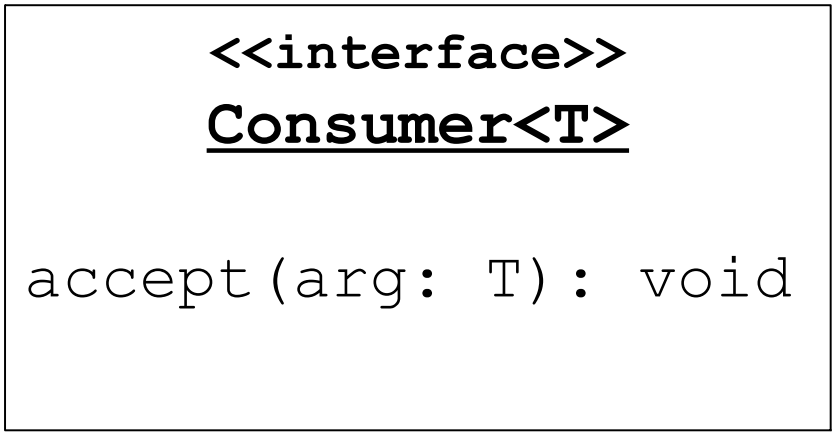


← New method

Iterable has a forEach() method

The Iterable interface has a default forEach() method that invokes a Consumer object with each element of the Iterable.





Print a List of Students using loop

The old way:

```
List<Student> classlist =
        Registrar.getStudents("01219113");

// print each student using for-each loop
for( Student s: classlist ) {
    System.out.println(s);
}
```

Using forEach with a List

New way: use `forEach` and a `Consumer`

```
List<Student> classlist =
                Registrar.getStudents("01219113");
// print each student
classlist.forEach(
           // Consumer as Anonymous Class
           new Consumer<Student>() {
                public void accept(Student s) {
                    System.out.println(s);
                }
           } );
```

Let's make the code shorter using a Lambda expression...

Using forEach with Lambda

Lambdas (anonymous functions) are another new Java 8 feature

```
List<Student> classlist =
                Registrar.getStudents("01219113");
// print each student
              /* Consumer as Lambda Expression */
classlist.forEach(
                (s) -> System.out.println(s) );
```

Let's make this code even shorter using a Method Reference.

Method Reference for Lambda

The Lambda just calls System.out.println(s) with the same parameter (s), so we can refer to "println" directly.

"ClassName::methodName" is a *method reference*.

```
List<Student> classlist =
                Registrar.getStudents("01219113");
// print each student
                /* Consumer as Method Reference */
classlist.forEach(  System.out::println );
```

Lambda Expressions

Lambdas are "anonymous functions".

A Lambda implements an interface with one abstract method.

```
// Runnable as anonymous class
Runnable mytask = new Runnable() {
    public void run( ) {
        System.out.println("I'm running");
    }
};
```

```
// Runnable as Lambda
Runnable mytask = () -> {
        System.out.println("I'm running");
    };
```

How to Invoke a Lambda?

Exactly the same as object defined using anonymous class.

```
// Runnable mytask as Lambda
Runnable mytask = () ->
        System.out.println("I'm running");

// Invoke the method:
mytask.run();
```

Lambda Shortcuts

If the method has only one statement, you may omit { }.

```
// Runnable as Lambda
Runnable mytask = () -> {
        System.out.println("I'm running");
    };
```

```
// Lambda shortcut notation
Runnable mytask = () ->
        System.out.println("I'm running");
```

Swing ActionListener

An ActionListener that reads a text field.

```
private JTextField inputField;

ActionListener inputListener =
    new ActionListener( ) {
        public void actionPerformed(ActionEvent e){
            String input = inputField.getText();
            inputField.setText("");
            processInput( input );
        }
    }
};
inputField.addActionListener(inputListener);
```

ActionListener using Lambda

Java can infer the parameter type (ActionEvent)

```
private JTextField inputField;

ActionListener inputListener =
    (event) -> {
            String input = inputField.getText();
            inputField.setText("");
            processInput( input );
        };

inputField.addActionListener(inputListener);
```

Lambda that returns a value

A Comparator object to compare strings by length

```
Comparator<String> compByLength =
  // this is an anonymous class
  new Comparator<String>() {
      public int compare(String a, String b) {
          return
             Integer.compare(a.length(), b.length());
      }
  };
```

Integer.compare(int a, int b) is same as:

if (a < b) return -1;

else if (a > b) return 1;

else return 0;

Lambda that returns a value

Compare strings by length

```
Comparator<String> compByLength =
  // Lambda express returning a value
  (a,b) -> Integer.compare(a.length(), b.length());
```

Java can *infer* from "Comparator<String>" that a and b are type `String`.

So, we don't have to write it.

Streams

All collections now support use of *streams*.
New classes and interfaces are in package:

`java.util.stream`

Several new "functional interfaces" that are needed for streams:

`java.util.function`

Simple Stream Examples

Create a stream from a list:

```
List<String> fruit = Arrays.asList("grape","orange",
   "banana", "apple", "durian", "pear", "guava");

fruit.stream()
  // creates a stream of elements in fruit
  // what can you do with a Stream?
```

A stream is like a pipeline.

Each element of the stream is passed from one stream processor to the next.

Stream methods

void forEach(Consumer)	*Consumes* each element of the stream.
Stream filter(Predicate)	filter elements in the stream using a boolean test, called a *Predicate*
Stream sorted( ) Stream sorted(Comparator)	sort elements in the Stream. This requires significant memory.
Stream<R> map(Function<T,R> mapper)	Apply a function to map elements from one type (T) to another (R).
T[ ] toArray( )	return elements as an array

Filter the fruit

Write a test that returns true if string contains "a".

```
Predicate<String> hasLetterA =
    new Predicate<String>() {
         public boolean test(String s) {
             return s.contains("a");
         }
    };
```

<<interface>>

Predicate<T>

```
test(arg: T): boolean
```

Filter the fruit

Write a Predicate that returns true if string contains "a".

```
Predicate<String> hasLetterA = s -> s.contains("a");

fruit.stream().filter(hasLetterA).forEach( print );
```

<<interface>>

Predicate<T>

```
test(arg: T): boolean
```

References

The Java Tutorial:
https://docs.oracle.com/javase/tutorial

Java 8 Features with Examples

http://www.journaldev.com/2389/java-8-features-with-examples

Has short examples of several features