Interfaces in Java

An **Interface in Java** programming language is defined as an abstract type used to specify the behavior of a class. An interface in Java is a blueprint of a behavior. A Java interface contains static constants and abstract methods.

What are Interfaces in Java?

The interface in Java is *a* mechanism to achieve abstraction. Traditionally, an interface could only have abstract methods (methods without a body) and public, static, and final variables by default. It is used to achieve abstraction and multiple inheritances in Java. In other words, interfaces primarily define methods that other classes must implement. Java Interface also represents the IS-A relationship. In Java, the abstract keyword applies only to classes and methods, indicating that they cannot be instantiated directly and must be implemented.
When we decide on a type of entity by its behavior and not via attribute we should define it as an interface.

Syntax for Java Interfaces

```
interface
{
                        // declare constant fields
                       // declare methods that abstract
                        // by default.
}
```

To declare an interface, use the interface keyword. It is used to provide total abstraction. That means all the methods in an interface are declared with an empty body and are public and all fields are public, static, and final by default. A class that implements an interface must implement all the methods declared in the interface. To implement the interface, use the implements keyword.

Uses of Interfaces in Java

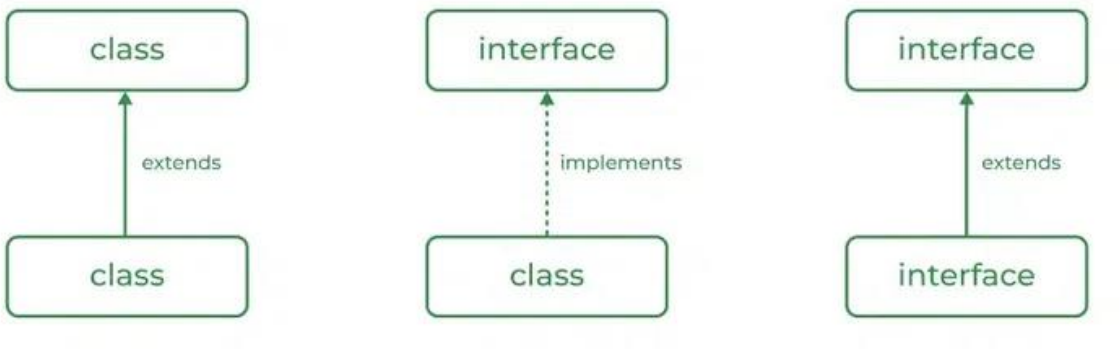
- *It is used to achieve total abstraction.*
- *Since java does not support multiple inheritances in the case of class, by using an interface it can achieve multiple inheritances.*
- *Any class can extend only one class, but can implement multiple interfaces.*
- *It is also used to achieve loose coupling.*
- *Interfaces are used to implement abstraction.*

So, the question arises why use interfaces when we have abstract classes?
The reason is, abstract classes may contain non-final variables, whereas variables in the interface are final, public, and static.

```
// A simple interface
interface Player
{
        final int id = 10;
        int move();
}
```

Relationship Between Class and Interface

A class can extend another class, and similarly, an interface can extend another interface. However, only a class can implement an interface, and the reverse (an interface implementing a class) is not allowed.



Difference Between Class and Interface

Although Class and Interface seem the same there have certain differences between Classes and Interface. The major differences between a class and an interface are mentioned below:

Class	Interface
In class, you can instantiate variables and create an object.	In an interface, you must initialize variables as they are final but you can't create an object.
A class can contain concrete (with implementation) methods	The interface cannot contain concrete (with implementation) methods.
The access specifiers used with classes are private, protected, and public.	In Interface only one specifier is used- Public.

Implementation: *To implement an interface, we use the keyword* ***implements***

```
// Java program to demonstrate working of
// interface

import java.io.*;

// A simple interface
interface In1
{
   // public, static and final
   final int a = 10;

   // public and abstract
   void display();
}

// A class that implements the interface.
class TestClass implements In1
{
   // Implementing the capabilities of
   // interface.
   public void display()
   {
     System.out.println("YMIM");
   }

   // Driver Code
   public static void main(String[] args)
   {
      TestClass t = new TestClass();
      t.display();
      System.out.println(t.a);
   }
}
```

Output

```
YMIM

10
```

Java Interfaces Examples

Let's consider the example of vehicles like bicycles, cars, bikes, etc they have common functionalities. So we make an interface and put all these common functionalities. And lets Bicycle, Bike, car, etc implement all these functionalities in their own class in their own way.

Below is the implementation of the above topic:

```
// Java program to demonstrate the
// real-world example of Interfaces

import java.io.*;

interface Vehicle
{
   // all are the abstract methods.
   void changeGear(int a);
   void speedUp(int a);
   void applyBrakes(int a);
}

class Bicycle implements Vehicle
{
   int speed;
   int gear;


   // to change gear
   @Override
   public void changeGear(int newGear)
  {
      gear = newGear;
   }


   // to increase speed
   @Override
   public void speedUp(int increment)
  {
      speed = speed + increment;
   }
```

```
    // to decrease speed
    @Override
    public void applyBrakes(int decrement)
    {
        speed = speed - decrement;
    }

    public void printStates()
    {
        System.out.println("speed: " + speed + " gear: " + gear);
    }
}

class Bike implements Vehicle
{
    int speed;
    int gear;

    // to change gear
    @Override
    public void changeGear(int newGear)
    {
        gear = newGear;
    }

    // to increase speed
    @Override
    public void speedUp(int increment)
    {
        speed = speed + increment;
    }

    // to decrease speed
    @Override
    public void applyBrakes(int decrement)
    {
        speed = speed - decrement;
    }

    public void printStates()
    {
        System.out.println("speed: " + speed + " gear: " + gear);
    }
}
```

```
class  Transports
{
   public static void main (String[] args)
  {
      // creating an instance of Bicycle
      // doing some operations
      Bicycle bicycle = new Bicycle();
      bicycle.changeGear(2);
      bicycle.speedUp(3);
      bicycle.applyBrakes(1);

      System.out.println("Bicycle present state :");
      bicycle.printStates();

      // creating instance of the bike.
      Bike bike = new Bike();
      bike.changeGear(1);
      bike.speedUp(4);
      bike.applyBrakes(3);

      System.out.println("Bike present state :");
      bike.printStates();
   }
}
```

Output

```
Bicycle present state :
speed: 2 gear: 2
Bike present state :
speed: 1 gear: 1
```

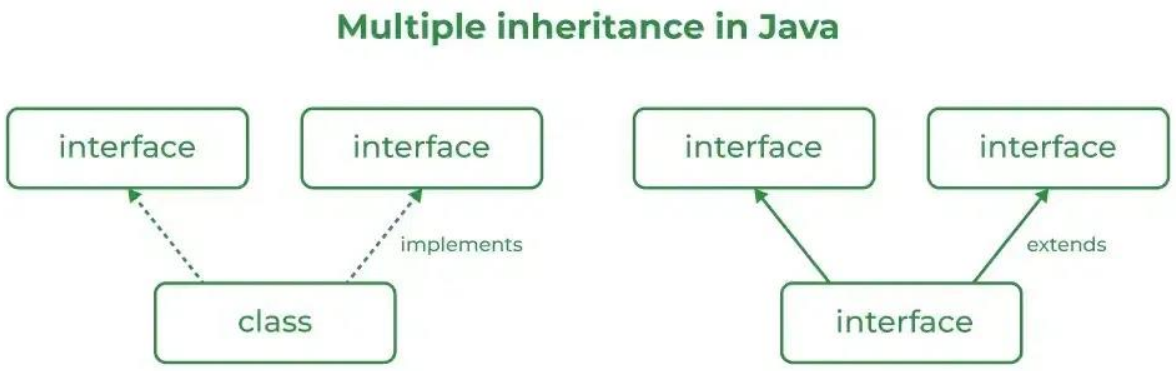
Advantages of Interfaces in Java

The advantages of using interfaces in Java are as follows:

- Without bothering about the implementation part, we can achieve the security of the implementation.
- In Java, multiple inheritances are not allowed, however, you can use an interface to make use of it as you can implement more than one interface.

Multiple Inheritance in Java Using Interface

Multiple Inheritance is an OOPs concept that can't be implemented in Java using classes. But we can use multiple inheritances in Java using Interface. let us check this with an example.



Example:

```
// Java program to demonstrate How Diamond Problem
// Is Handled in case of Default Methods

// Interface 1
interface API
{
   // Default method
   default void show()
   {

      // Print statement
      System.out.println("Default API");
   }
}

// Interface 2
// Extending the above interface
interface Interface1 extends API
{
   // Abstract method
   void display();
}

// Interface 3
// Extending the above interface
interface Interface2 extends API
{
   // Abstract method
   void print();
}

// Main class
// Implementation class code
class TestClass implements Interface1, Interface2
{
   // Overriding the abstract method from Interface1
   public void display()
   {
      System.out.println("Display from Interface1");
   }
   // Overriding the abstract method from Interface2
   public void print()
   {
      System.out.println("Print from Interface2");
   }
```

```
  // Main driver method
  public static void main(String args[])
  {
    // Creating object of this class
    // in main() method
    TestClass d = new TestClass();

    // Now calling the methods from both the interfaces
    d.show(); // Default method from API
    d.display(); // Overridden method from Interface1
    d.print(); // Overridden method from Interface2
  }
}
```

Output

```
Default API
Display from Interface1
Print from Interface2
```

New Features Added in Interfaces in JDK 8

There are certain features added to Interfaces in JDK 8 update mentioned below:
1. *Prior to JDK 8, the interface could not define the implementation. We can now add default implementation for interface methods. This default implementation has a special use and does not affect the intention behind interfaces.*
Suppose we need to add a new function to an existing interface. Obviously, the old code will not work as the classes have not implemented those new functions. So with the help of default implementation, we will give a default body for the newly added functions. Then the old codes will still work.
Below is the implementation of the above point:

```
// Java program to show that interfaces can
// have methods from JDK 1.8 onwards

interface In1
{
   final int a = 10;
   default void display()
   {
      System.out.println("hello");
   }
}

// A class that implements the interface.
class TestClass implements In1
{
   // Driver Code
   public static void main (String[] args)
   {
      TestClass t = new TestClass();
      t.display();
   }
}
```

Output

```
hello
```

2. *Another feature that was added in JDK 8 is that we can now define static methods in interfaces that can be called independently without an object.*
Note: these methods are not inherited.
Java

```
// Java Program to show that interfaces can
// have methods from JDK 1.8 onwards

interface In1
{
   final int a = 10;
   static void display()
   {
      System.out.println("hello");
   }
}

// A class that implements the interface.
class TestClass implements In1
{
   // Driver Code
   public static void main (String[] args)
   {
      In1.display();
   }
}
```

Output

```
hello
```

Extending Interfaces

One interface can inherit another by the use of keyword extends. When a class implements an interface that inherits another interface, it must provide an implementation for all methods required by the interface inheritance chain.

Program 1:

```
interface A
{
   void method1();
   void method2();
}

// B now includes method1 and method2
interface B extends A
{
   void method3();
}

// the class must implement all method of A and B.

class Calc implements B
{
   public void method1()
   {
      System.out.println("Method 1");
   }
   public void method2()
   {
      System.out.println("Method 2");
   }
   public void method3()
   {
      System.out.println("Method 3");
   }
}
```

Program 2:

```
interface Student
{
   public void data();

}

class avi implements Student
{
   public void data ()
   {
      String name="avinash";
      int rollno=68;
      System.out.println(name);
      System.out.println(rollno);
   }
}

public class inter_face
{
   public static void main (String args [])
   {
      avi h= new avi();
      h.data();
   }
}
```

Output

```
avinash

68
```

In a Simple way, the interface contains multiple abstract methods, so write the implementation in implementation classes. If the implementation is unable to provide an implementation of all abstract methods, then declare the implementation class with an abstract modifier, and complete the remaining method implementation in the next created child classes. It is possible to declare multiple child classes but at final we have completed the implementation of all abstract methods.

In general, the development process is step by step:

***Level 1** – interfaces: It contains the service details.*

***Level 2** – abstract classes: It contains partial implementation.*

***Level 3** – implementation classes: It contains all implementations.*

***Level 4** – Final Code / Main Method: It have access of all interfaces data.*

Example:

```
// Java Program for
// implementation Level wise
import java.io.*;
import java.lang.*;
import java.util.*;

// Level 1
interface Bank
{
   void deposit();
   void withdraw();
   void loan();
   void account();
}

// Level 2
abstract class Dev1 implements Bank
{
   public void deposit()
   {
      System.out.println("Your deposit Amount :" + 100);
   }
}

abstract class Dev2 extends Dev1
{
   public void withdraw()
   {
      System.out.println("Your withdraw Amount :" + 50);
   }
}

// Level 3
class Dev3 extends Dev2
{
   public void loan() {}
   public void account() {}
}
```

```
// Level 4
class Finance_Sector
{
   public static void main(String[] args)
   {
      Dev3 d = new Dev3();
      d.account();
      d.loan();
      d.deposit();
      d.withdraw();
   }
}
```

Output

```
Your deposit Amount :100

Your withdraw Amount :50
```

New Features Added in Interfaces in JDK 9

From Java 9 onwards, interfaces can contain the following also:

1. Static methods
2. Private methods
3. Private Static methods

Important Points in Java Interfaces

In the article, we learn certain important points about interfaces as mentioned below:

- We can't create an instance (interface can't be instantiated) of the interface but we can make the reference of it that refers to the Object of its implementing class.
- A class can implement more than one interface.
- An interface can extend to another interface or interface (more than one interface).
- A class that implements the interface must implement all the methods in the interface.
- All the methods are public and abstract. And all the fields are public, static, and final.
- It is used to achieve multiple inheritances.
- It is used to achieve loose coupling.
- Inside the Interface not possible to declare instance variables because by default variables are **public static final.**
- Inside the Interface, constructors are not allowed.
- Inside the interface main method is not allowed.
- Inside the interface, static, final, and private methods declaration are not possible.