Abstract Classes Interfaces

CSCI 201
Principles of Software Development

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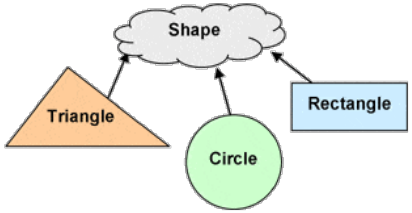
Outline

- Abstract Classes
- Interfaces

Abstract Classes

- An abstract class is a way for parent classes to guarantee that child classes provide an implementation for a specific method
  - Consider the `Shape` example. Even though a `Shape` does not know how to find the area of a `Triangle` or `Rectangle`, it could require that both of those classes implement a `getArea()` method
- Abstract methods only contain declarations but no implementations
  - Any class that contains an abstract method must be declared `abstract`
- Abstract classes cannot be instantiated since not all of the methods have implementations
- Any class that inherits from an abstract class **must** implement all of the abstract methods or declare itself abstract
  - When a class implements an abstract method, it is said to override that method



Abstract Class Example

```
1  abstract class Parent {
2    public abstract int meth1();
3    public int meth2() {
4      return 10;
5    }
6  }
7
8  class Child extends Parent {
9    public int meth1() {
10     return 20;
11   }
12 }
13 public class Test {
14   public static void main(String [] args) {
15     Child c = new Child();
16     System.out.println(c.meth1());
17     System.out.println(c.meth2());
18     Parent p = new Parent();
19     System.out.println(p.meth1());
20     System.out.println(p.meth2());
21   }
22 }
```

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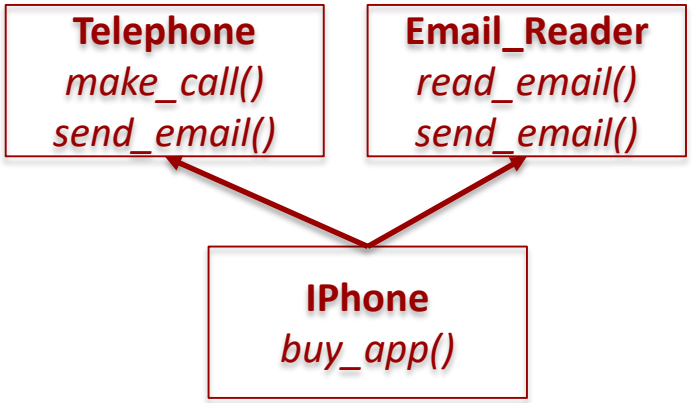
Interfaces

- An interface is similar to a class, but there are no method implementations in it (not even inherited)
- When a class implements an interface, it must implement all of the methods in the interface
  - If it doesn't implement all of the methods, it has then inherited an abstract method, so the class must be declared abstract
- A class can implement as many interfaces as it wants
  - This is how Java deals with supporting something similar to multiple inheritance
  - This is different than multiple inheritance though. How?
    - If the same method is inherited from more than one interface, there is no implementation, so there is no confusion
- If interfaces inherit from other interfaces, they will extend them

Multiple Inheritance and Interfaces

- In C++, we had a problem with multiple inheritance when the same function was implemented in two different branches of the hierarchy



Which `send_email()` function gets called when you call it on an instance of `IPhone`?

```
IPhone ip;
ip.send_email();
```

It doesn't matter which one gets called if the `Telephone` and `Email_Reader` classes only contained function definitions and the only implementation was in `IPhone`

Interface Example

```
1  interface Parent {
2    public abstract int meth1();
3    public int meth2();
4  }
5
6  abstract class Child implements Parent {
7    public int meth1() {
8     return 20;
9   }
10 }
11
12 class GrandChild extends Child {
13   public int meth2() {
14     return 30;
15   }
16 }
17
```

```
18 public class Test {
19   public static void main(String [] args) {
20     GrandChild gc = new GrandChild();
21     System.out.println(gc.meth1());
22     System.out.println(gc.meth2());
23     Child c = new Child();
24     System.out.println(c.meth1());
25     System.out.println(c.meth2());
26   }
27 }
```

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