Accelerating Information Technology Innovation

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Lecture 10: Interfaces

AITI Nigeria Summer 2012

University of Lagos.

MISTI

Interfaces

- An interface in Java is special type
- A class with only method signatures
  - Methods have no body
  - Can never create an instance of an interface
- Classes can *implement* the interface
  - A contract: the class will implement all the methods of an interface definition

Example:
A General Sorting Method

- Create a general sorting method that works on Arrays of any class
  - Each class implements the *MyComparable* interface
- The interface allows two objects to be compared
- obj1.compareTo(obj2)
  - return 1 if obj1 > obj2
  - 0 if obj1 == obj2
  - -1 if obj1 < obj2

Example: MyComparable

```
public interface MyComparable {
    public int compareTo(Object obj);
}
```

General SelectionSort

```
public static void sort(MyComparable[] array) {
      for (int i = array.length; i >= 1; i--) {
        // find the maximum index in the array [0..i-1]
        int maxIndex = i - 1;
    for (int j = 0; j < i; j++) {
      if (array[j].compareTo(array[maxIndex]) == 1) {
        maxIndex = j;
       }

    }
    // Replace last element with maximum value indexed at maxIndex
        MyComparable temporary = array[i - 1];
        array[i - 1] = array[maxIndex];
        array[maxIndex] = temporary;
     }
}
```

Example: Bank Account

- Compare bank accounts based on balance
- Bank account with greater balance is greater

```
public class BankAccount implements MyComparable {
    private double balance;
    …
```

Example: Bank Account

```
public class BankAccount implements MyComparable

    public int compareTo(Object obj) {
     if (obj instanceof BankAccount) {
            BankAccount ba = (BankAccount)obj;
            if (this.balance > ba.balance)
                return 1;
            else if (this.balance < ba.balance)
                return -1;
            else return 0;
      } else
            //error
    }
}
```

Interfaces

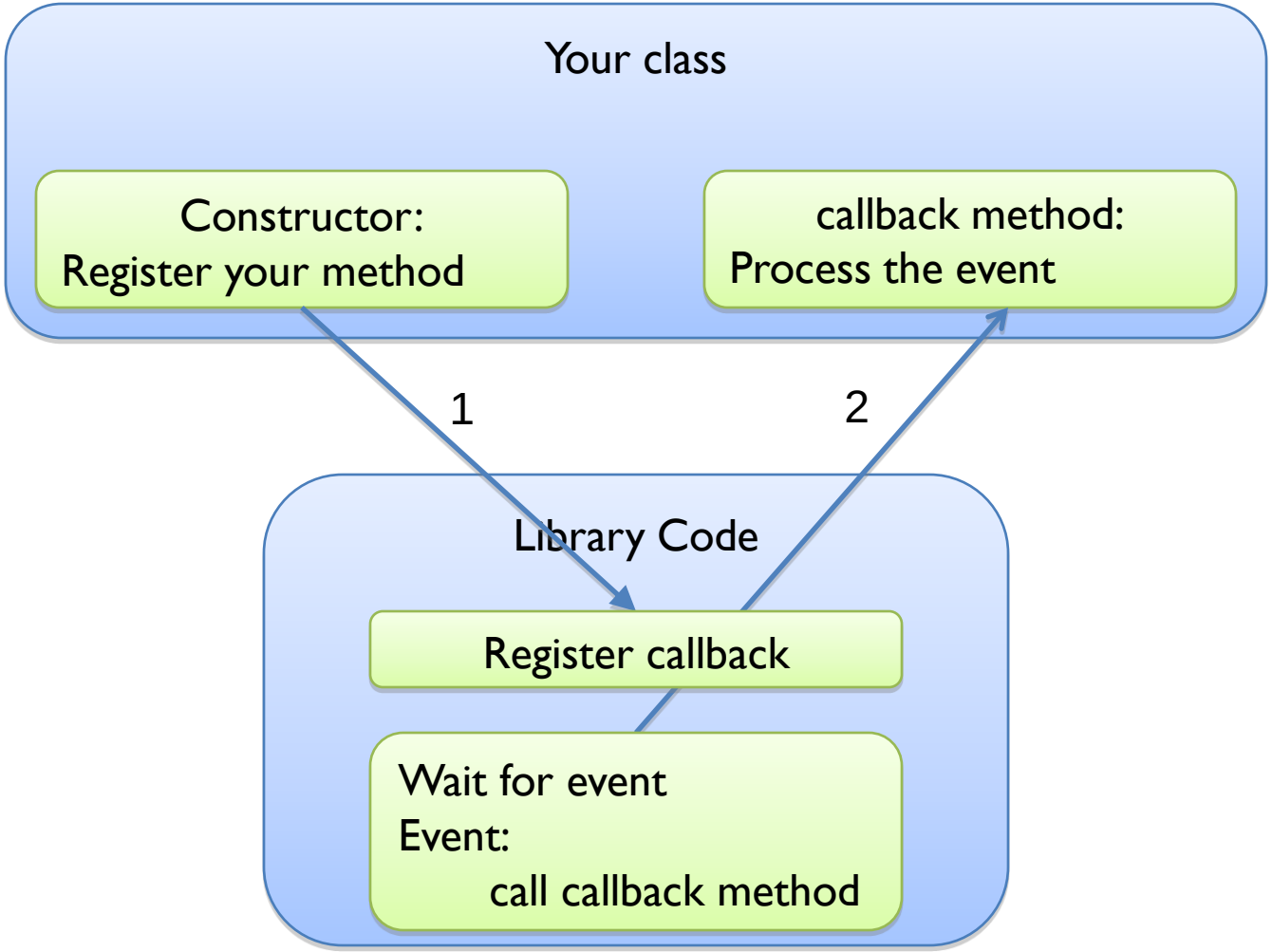
- An interface type can be used just like any other type
  - return type of method
  - argument type of method
  - array of interface type
- One cannot create an object of an interface:

  ~~new Comparable();~~
- All methods of an interface are public

Callbacks

- Executable code passed as argument to another class
- The class calls the code when an event happens
- Examples:
  - Call a method when an SMS message is received
  - Call a method when a user presses a button on a phone (J2ME, Android)

Callbacks


Your class
Constructor:
Register your method
callback method:
Process the event
1
2
Library Code
Register callback
Wait for event
Event:
call callback method

Interfaces and Callback

- Interface defines the method that will be called when the event happens
  - Defines the arguments you are passed
- You create a class that implements the method
  - The code you want to execute when the event happens
- Must register the callback first

Callback Example

- A class is implemented that receives an SMS message and calls a callback
  - Class Name: Gateway.java
  - Register callback:

```
void setInboundNotification(IInboundMessageNotificiation);
```

- Interface:

```
public Interface IInboundMesssageNotification {
    public void process(String message);
}
```

Your class: ProcessMessage

```
public class ProcessMessage
                    implements IInboundNotification {
    public ProcessMessage() {
     Gateway = new Gateway();
     gateway.setInboundNotification(this);
    }

    public void process(String message) {
     System.out.println(message);
    }
}
```

Differences from Inheritance

- The interface does not define any default behavior to inherit
  - Empty definitions in the interface
- The methods must be completed by the implementing class
- A class can implement multiple interfaces

Inheritance or Interface?

- Inheritance:
  - When you want to promote code reuse
  - A subclass is a refinement of superclass
  - A class can only have one superclass

- Interface
  - More general contracts than inheritance
    - Comparable, Writeable, process message, process button-press
  - When you want to define a method contract
  - When you cannot find any reuse in the methods

Relationships

- has-a: A class has reference to another class
  - Ex: ContactList **has a** list of Contact
- is-a: A class inherits from another class
  - Ex: Person **is a** Contact
- implements: A class defines the methods of an Interface
  - BankAccount **implements** Comparable