Decorator Design Pattern

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Decorator DP

Decorator pattern allows a user to add new functionality to an existing object without altering its structure. This type of design pattern comes under structural pattern as this pattern acts as a wrapper to existing class.

This pattern creates a decorator class which wraps the original class and provides additional functionality keeping class methods signature intact.

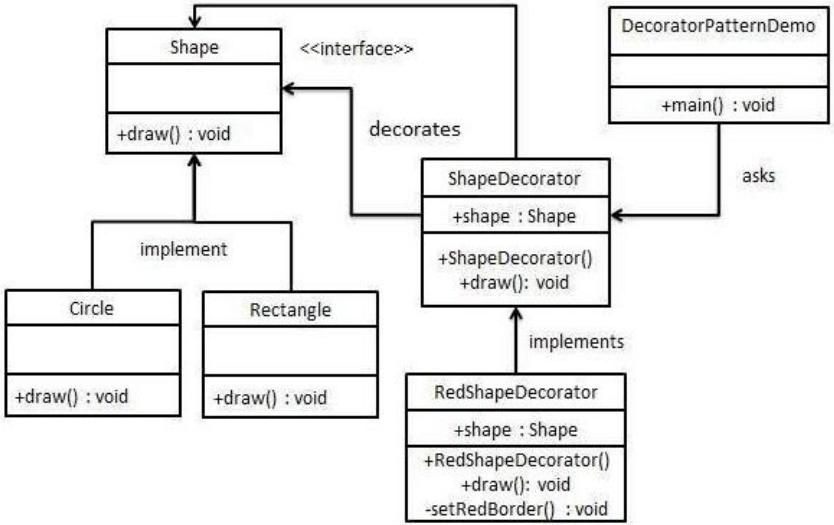
Implementation (working on the example)

We're going to create a *Shape* interface and concrete classes implementing the *Shape* interface. We will then create an abstract decorator class *ShapeDecorator* implementing the *Shape* interface and having *Shape* object as its instance variable.

RedShapeDecorator is concrete class implementing *ShapeDecorator*.

DecoratorPatternDemo, our demo class will use *RedShapeDecorator* to decorate *Shape* objects.

Diagram


Shape
<<interface>>
+draw() : void
DecoratorPatternDemo
+main() : void
decorates
asks
ShapeDecorator
+shape : Shape
+ShapeDecorator()
+draw(): void
implement
Circle
+draw() : void
Rectangle
+draw() : void
implements
RedShapeDecorator
+shape : Shape
+RedShapeDecorator()
+draw(): void
-setRedBorder() : void

Implementation

Create an interface:

Shape.java

```
public interface Shape {

  void draw();

}
```

Create concrete classes implementing the same interface:

Rectangle.java

```
public class Rectangle implements Shape {

  @Override

  public void draw() {  System.out.println("Shape: Rectangle"); }

}
```

Circle.java

```
public class Circle implements Shape {

  @Override

  public void draw() { System.out.println("Shape: Circle"); }

}
```

Implementation

Create abstract decorator class implementing the *Shape* interface.

ShapeDecorator.java

```
public abstract class ShapeDecorator implements Shape {

   protected Shape decoratedShape;



   public ShapeDecorator(Shape decoratedShape){  this.decoratedShape = decoratedShape; }

   public void draw(){ decoratedShape.draw();  }

}
```

Implementation

Create concrete decorator class extending the *ShapeDecorator* class.

RedShapeDecorator.java

```
public class RedShapeDecorator extends ShapeDecorator {

  public RedShapeDecorator(Shape decoratedShape) { super(decoratedShape); }

  @Override

  public void draw() {

    decoratedShape.draw();

    setRedBorder(decoratedShape);

  }

private void setRedBorder(Shape decoratedShape){

    System.out.println("Border Color: Red");

  }

}
```

Implementation

Use the *RedShapeDecorator* to decorate *Shape* objects.

DecoratorPatternDemo.java

```
public class DecoratorPatternDemo {

   public static void main(String[] args) {

      Shape circle = new Circle();

      Shape redCircle = new RedShapeDecorator(new Circle());

      Shape redRectangle = new RedShapeDecorator(new Rectangle());

      System.out.println("Circle with normal border");

      circle.draw();

      System.out.println("\nCircle of red border");

      redCircle.draw();

      System.out.println("\nRectangle of red border");

      redRectangle.draw();

   }

}
```

Result

```
Circle with normal border

Shape: Circle
```

```
Rectangle of red border

Shape: Rectangle

 Border Color: Red
```

```
Circle of red border

Shape: Circle

Border Color: Red
```

Advantages

More flexible than inheritance because inheritance adds responsability at compile time whereas decorator adds at run time.
We can have any number of decorators in any order.
It extends functionality of an object without affecting any other object.
Keeps root classes simple -- Dynamic addition/removal of decorators.

Disadvantages

The main disadvantage of decorator design pattern is code maintainability because this pattern creates lots of similar decorators which can be hard to maintain and distinguish.

Proliferation of run-time instances