

Konzepte objektorientierter Programmierung

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Software Component Technology

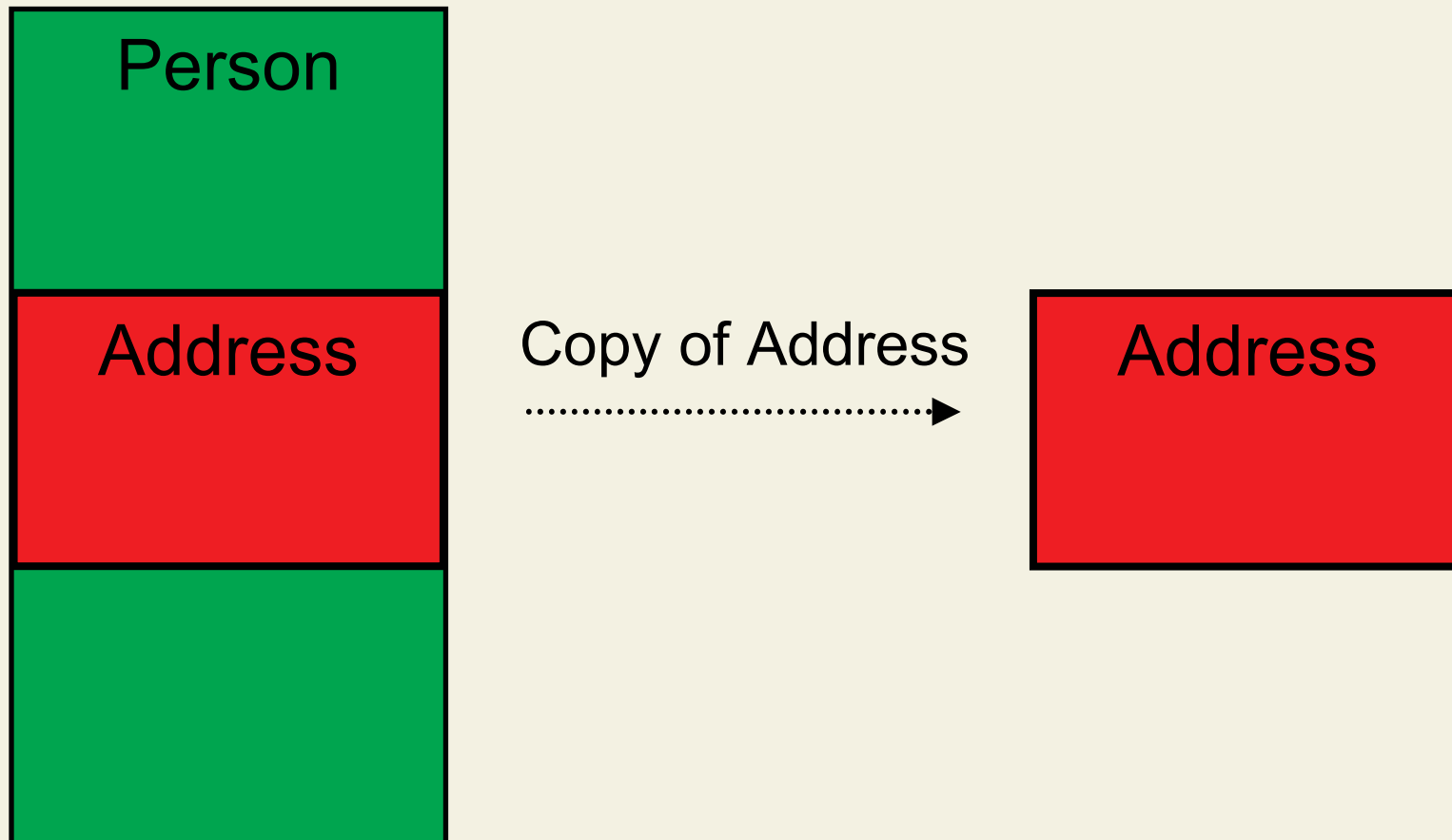
Exercises 5: Frameworks

Wintersemester 03/04

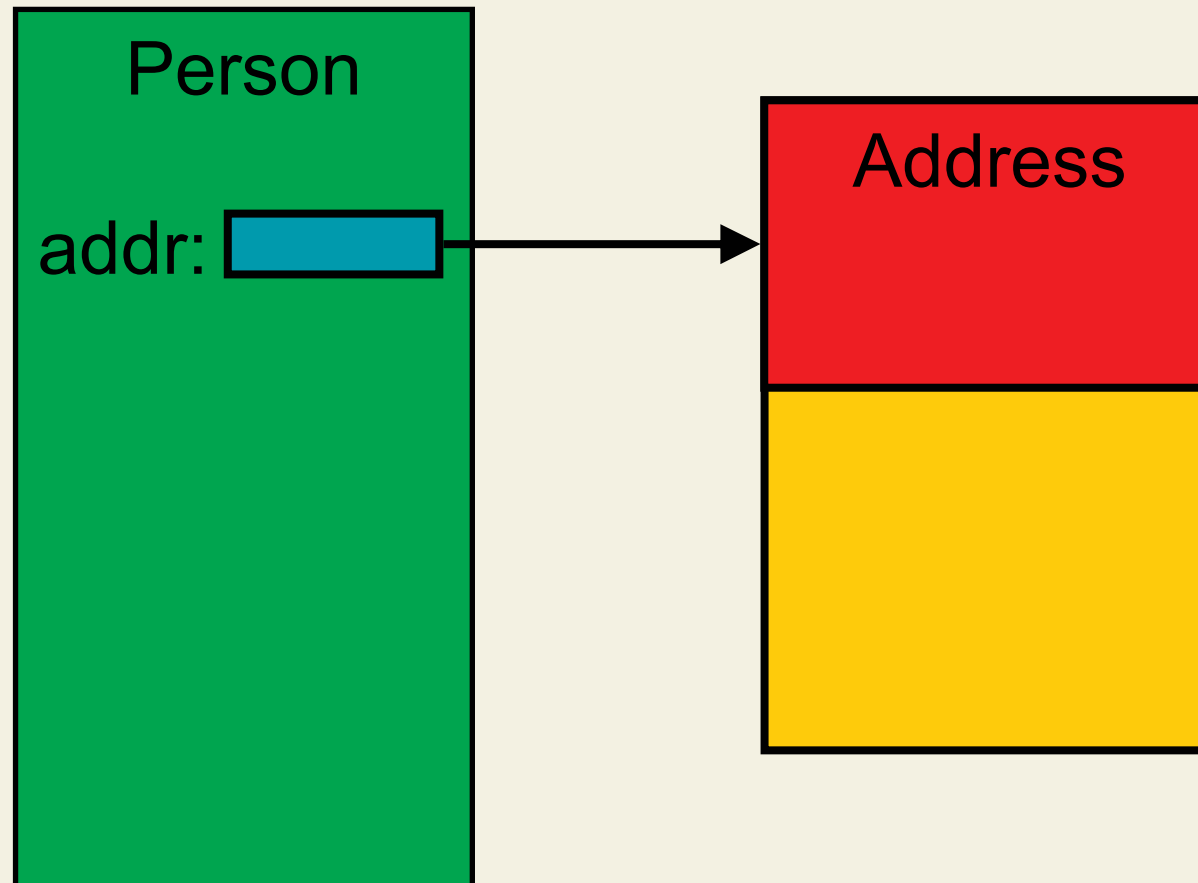
ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Part-of Aggregation



Has-a Aggregation

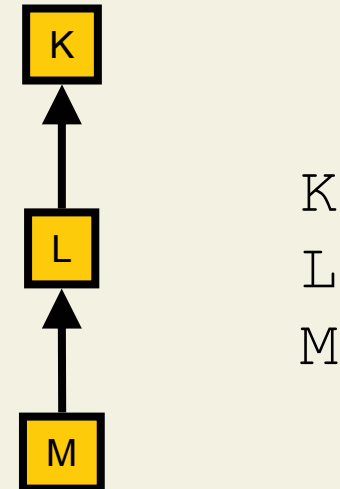


What's this programs output?

```
class K {  
    K() { System.out.println("K"); }  
  
    public static void main(String[] args) { new M(3); }  
}
```

```
class L extends K {  
    L() { System.out.println("L"); }  
}
```

```
class M extends L {  
    M(int p) { System.out.println("M"); }  
}
```



What's this programs output?

```
class K {  
    K(int p) { System.out.println("K"); }  
  
    public static void main(String[] args) { new M(3); }  
}
```

```
class L extends K {  
    L(int p) { System.out.println("L"); }  
}
```

```
class M extends L {  
    M(int p) { System.out.println("M"); }  
}
```

Compilation Error!

Dynamic Type Information

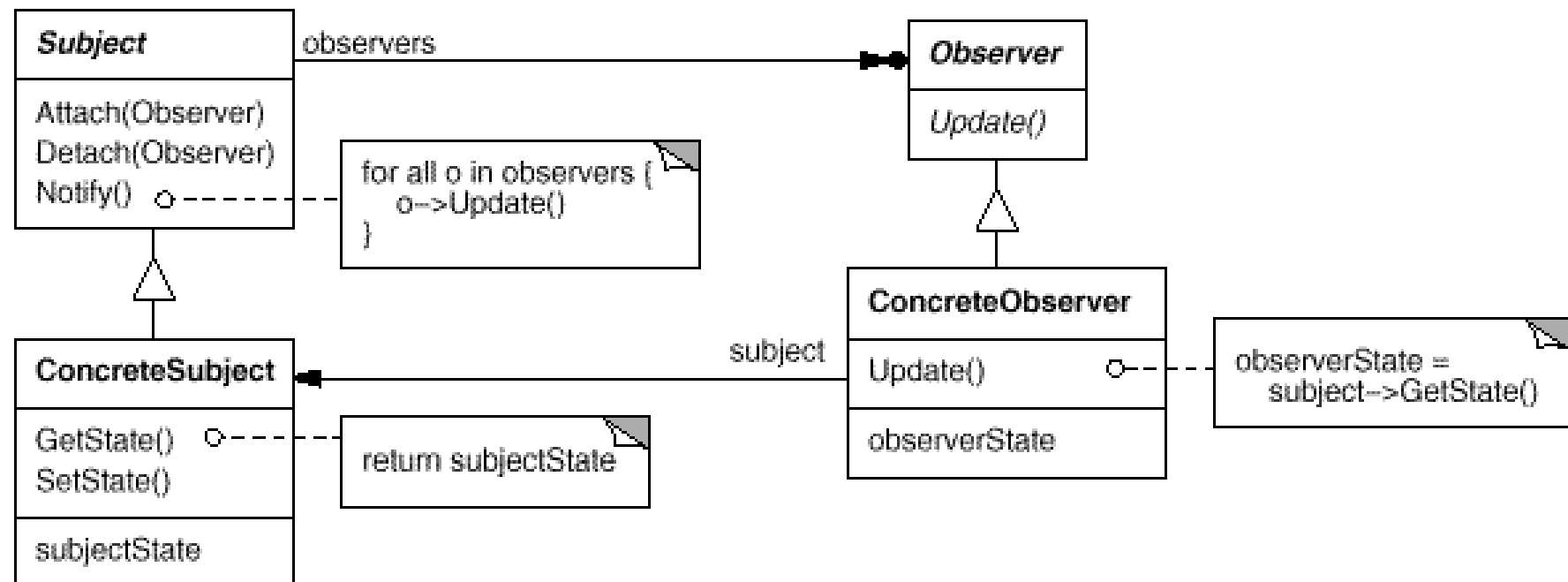
```
class A {  
    void m() {  
        if( this instanceof A )  
            System.out.println("I'm an A!");  
        if( this instanceof B )  
            System.out.println("I'm a B!");  
    }  
}  
  
class B extends A {  
    public static void main(String[] args) {  
        A a = new B();  
        a.m();  
    }  
}
```

I'm an A!
I'm a B!

Object Comparison

```
class D {  
    private int x;  
    public D( int p ) { x = p; }  
  
    public boolean equals( Object o ) {  
        if( o instanceof D ) {  
            return ((D)o).x == this.x;  
        } else {  
            return false;  
        }  
    }  
}
```

Homework – Observer Pattern



From: Gamma, Helm, Johnson, Vlissides: "Design Patterns"

Java support for the Observer Pattern

- **Subject** → `java.util.Observable`
 - `void addObserver(Observer o)`
 - `void setChanged()`
 - `void notifyObservers(Object arg)`
- **Observer** → `java.util.Observer`
 - `void update(Observable o, Object arg)`
- **Events** → `java.util.EventObject`
 - `EventObject(Object source)`
 - `Object getSource()`

Events

```
abstract public class ChangeEvent
    extends java.util.EventObject {

    public ChangeEvent( Object source,
                      int v, int c ) {
        super(source); value = v; change = c; }

    public int getValue() { return value; }

    public int getChange() { return change; }

    private int value;
    private int change;
}
```

Specialized Events

```
public class IncreaseEvent
    extends ChangeEvent {
    public IncreaseEvent(Object s,int v,int c) {
        super(s, v, c);
    }
}
```

```
public class DecreaseEvent
    extends ChangeEvent {
    public DecreaseEvent(Object s,int v,int c) {
        super(s, v, c);
    }
}
```

ActiveValue – Setup

```
public class ActiveValue
    extends java.util.Observable {

    private int myval;

    public void run() {
        int change;
        Random crnd = new Random();

        myval = 0;

        while( true ) { ... }
    }
}
```

ActiveValue – Main Loop

```
while ( true ) {  
    change = crnd.nextInt( 11 ) - 5;  
  
    myval += change;  
  
    sendEvent( change );  
  
    Thread.sleep( 1000 );  
}
```

ActiveValue – Event Notification

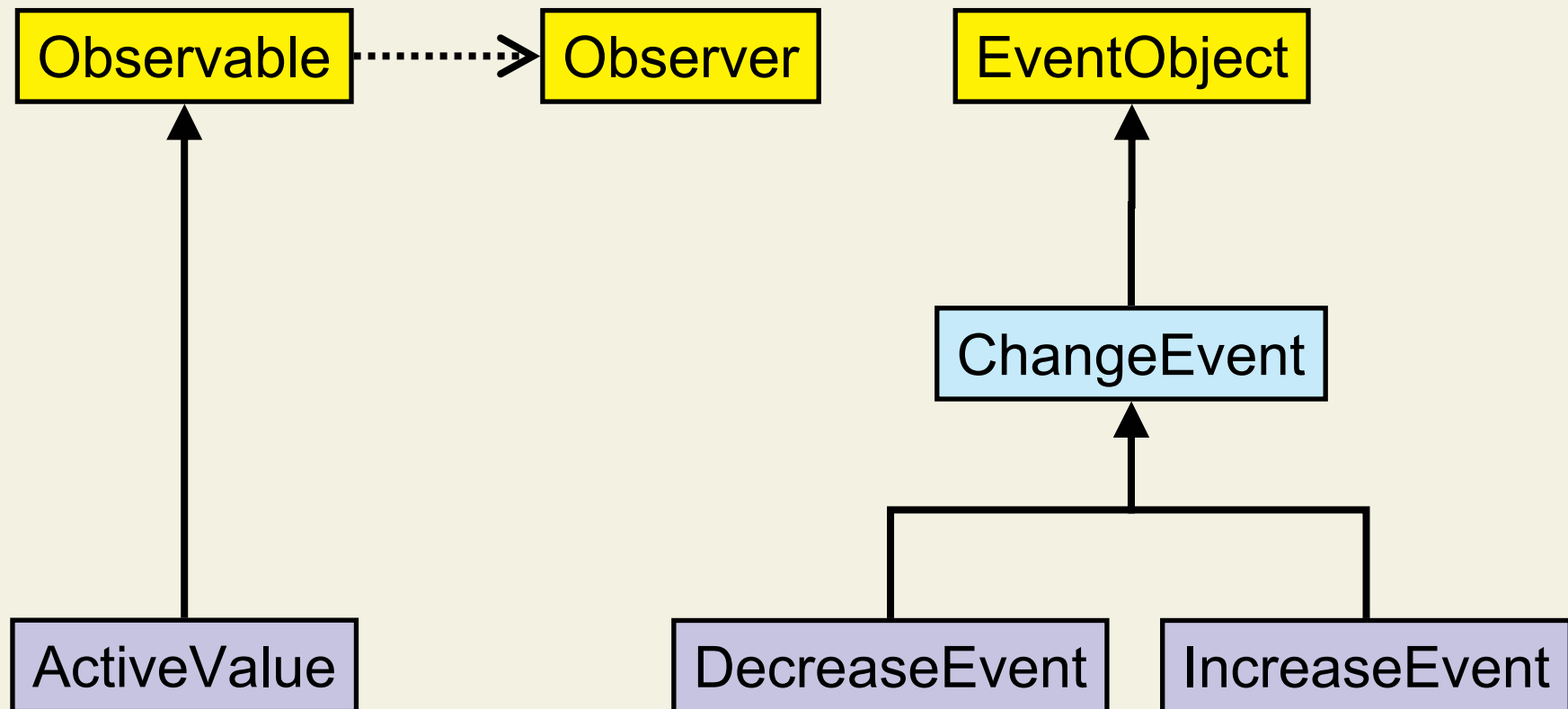
```
public void sendEvent( int change ) {  
    java.util.EventObject e;  
  
    if( change >= 0 ) {  
        e = new IncreaseEvent( this, myval, change );  
    } else {  
        e = new DecreaseEvent( this, myval, change );  
    }  
  
    setChanged();  
    notifyObservers( e );  
}
```

ActiveValue – Changing the Value

```
public void reset() {  
    setValue( 0 );  
}
```

```
public void setValue( int value ) {  
    int change;  
  
    change = value - myval;  
    myval = value;  
  
    sendEvent( change );  
}
```

Class Hierarchy so far



SignChangeObserver

```
public class SignChangeObserver
    implements java.util.Observer {

    public void update( java.util.Observable s,
                        Object e ) {

        if( !(e instanceof ChangeEvent)) return;
        ChangeEvent ce = (ChangeEvent) e;

        if( ce instanceof IncreaseEvent ) {
            System.out.println("+");
        } else {
            System.out.println("-");
        }
    }
}
```

TextChangeObserver

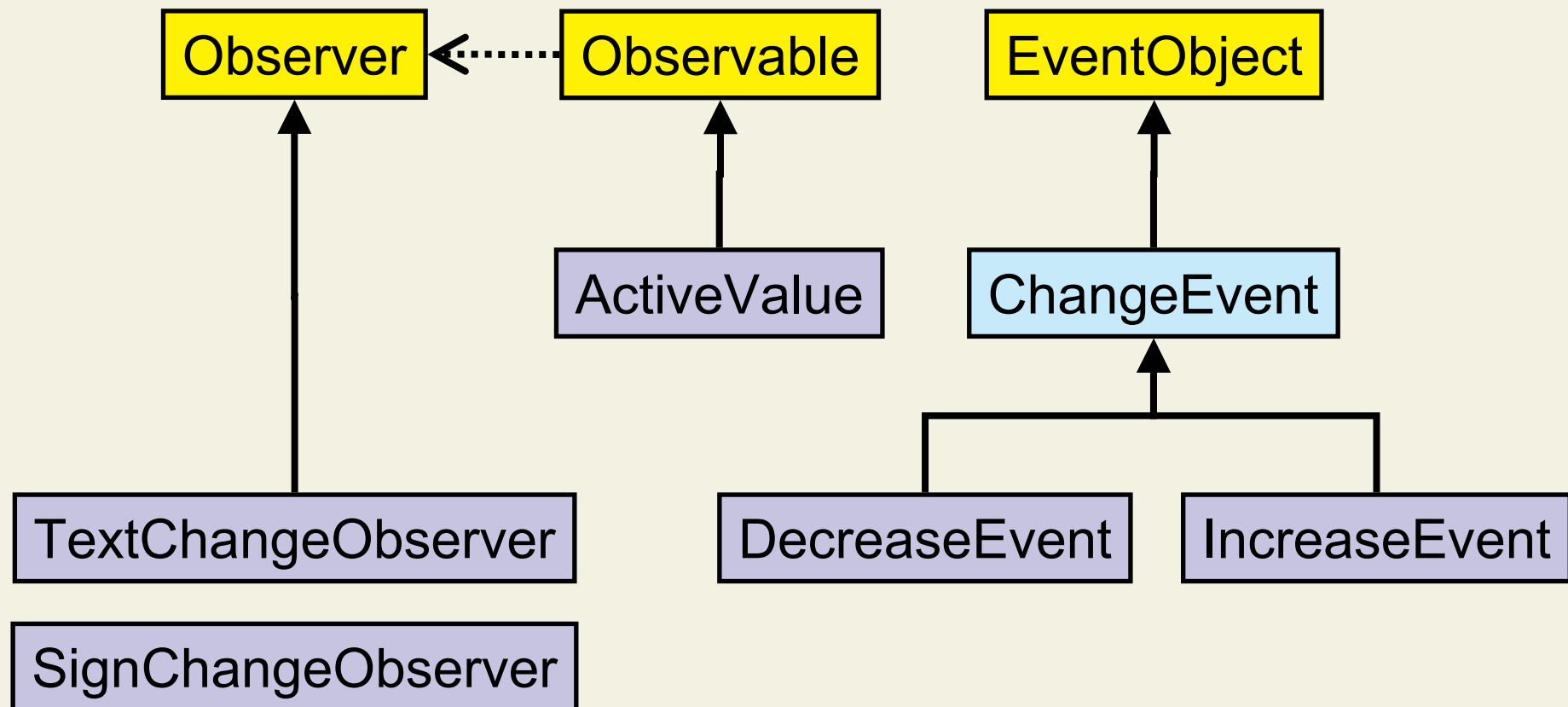
```
public class TextChangeObserver
    implements java.util.Observer {

    public void update(Observable s, Object e) {
        if( !(e instanceof ChangeEvent)) return;
        ChangeEvent ce = (ChangeEvent) e;
        if( ce instanceof IncreaseEvent ) {
            System.out.print("++++ ");
        } else {
            System.out.print("---- ");
        }
        System.out.println("New Value: "+ce.getValue() +
            " Change: " + ce.getChange() );
    }
}
```

TextMain

```
public class TextMain {  
    public static void main( String[] args ) {  
        ActiveValue v = new ActiveValue();  
  
        Observer o1 = new TextChangeObserver();  
        Observer o2 = new SignChangeObserver();  
  
        v.addObserver( o1 );  
        v.addObserver( o2 );  
  
        v.run();  
    }  
}
```

Class Hierarchy



GuiMain – Adding a Graphical UI

```
public class GuiMain {  
    public static void main( String[] args ) {  
  
        ActiveValue v = new ActiveValue();  
  
        Observer o1 = new GuiChangeObserver();  
        Observer o2 = new GuiSignChangeObserver();  
  
        v.addObserver( o1 );  
        v.addObserver( o2 );  
  
        v.run();  
    }  
}
```

GuiChangeObserver – Update

```
public class GuiChangeObserver implements java.util.Observer {

    public void update( Observable s, Event e ) {
        if( ! (e instanceof ChangeEvent) ) return;
        ChangeEvent ce = (ChangeEvent) e;

        if( ce instanceof IncreaseEvent ) {
            sign.setForeground( Color.RED );
            sign.setText("++++");
        } else { ... }

        value.setText("New Value: " + ce.getValue());
        change.setText("Change: " + ce.getChange());
    }
    ...
}
```

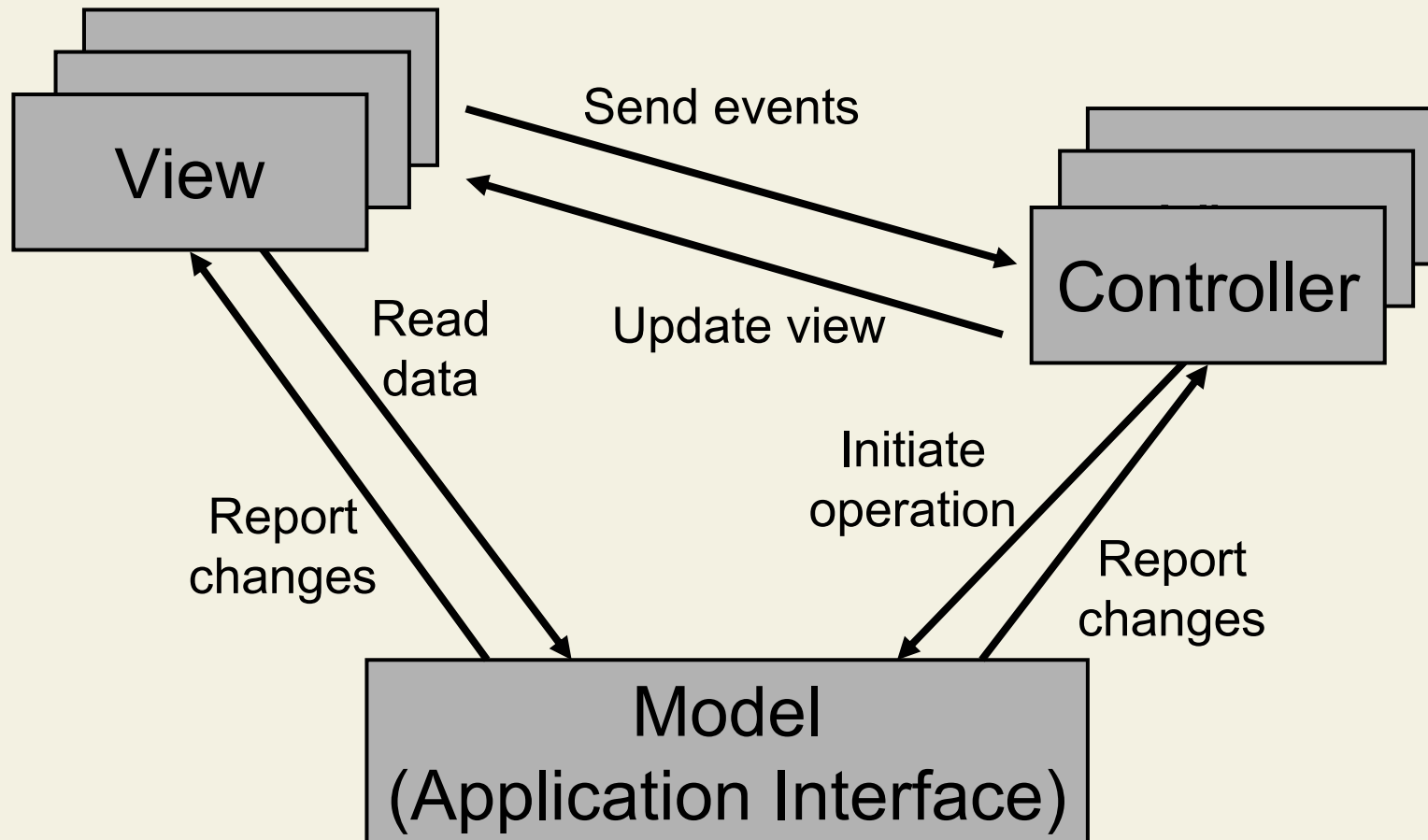
Adding Components

```
public Component createComponents() {  
    JPanel pane = new JPanel();  
    pane.setBorder(  
        BorderFactory.createEmptyBorder(  
            30, 30, // top, left  
            30, 30) // bottom, right  
    );  
    pane.setLayout(new GridLayout(0, 3));  
    pane.add(sign);  
    pane.add(value);  
    pane.add(change);  
    return pane;  
}
```

Screenshot & Demo



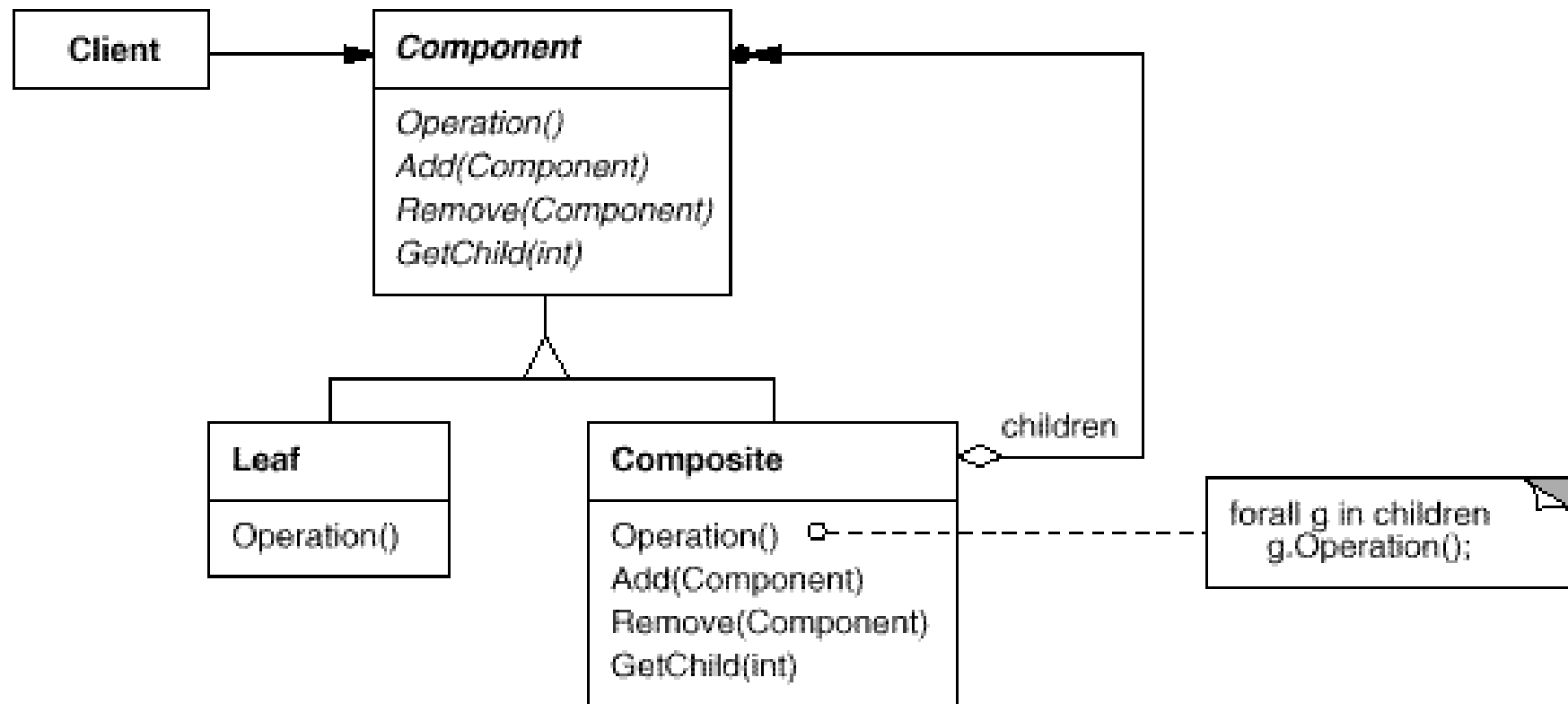
Model-View-Controller Architecture



Adding a Simple Reset Controller

```
button = new JButton();  
button.addActionListener(  
    new ActionListener() {  
        public void actionPerformed(  
                               (ActionEvent e) {  
                                    theValue.reset();  
                                }  
        }  
    ) ;  
  
pane.add(button, BorderLayout.CENTER);
```

Composite Pattern



From: Gamma, Helm, Johnson, Vlissides: "Design Patterns"

Composite Pattern in Swing

- Used many times
- Composite is called Container

```
java.lang.Object
└─ java.awt.Component ◀·····
    └─ java.awt.Container ····
        └─ javax.swing.JComponent
            └─ javax.swing.JPanel
```