SoPra 2011

University of Zurich[UZH]

Today SoPra 2011

- FAQs
- Java RMI
- Java Swing
- Design Patterns
- JUnit Testing

FAQs SoPra 2011

- Libraries/Frameworks?
- Code of SoPra 200X?
- GUI Builder?

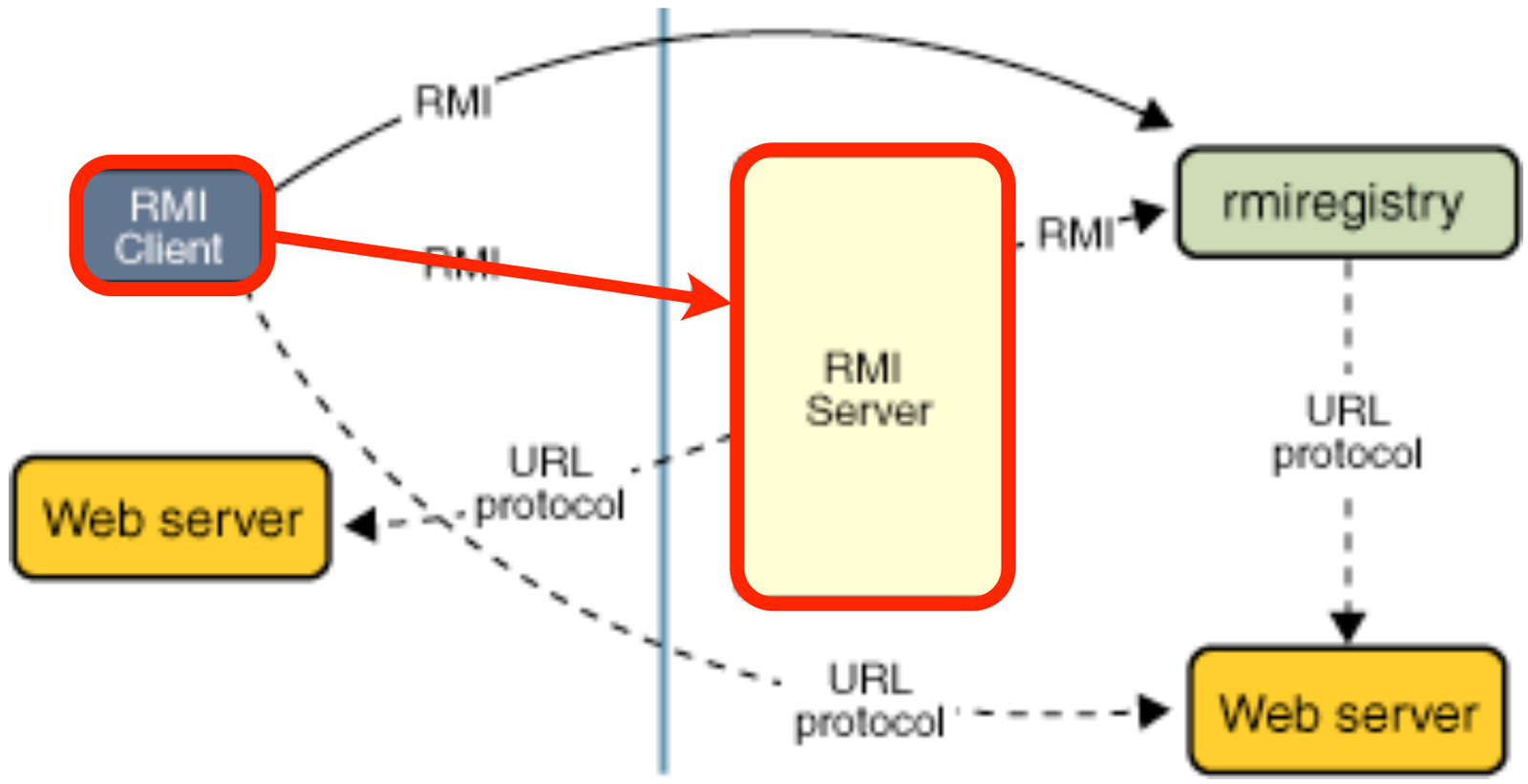
Java RMI SoPra 2011

Java **R**emote **M**ethod **I**nvocation

The Java Remote Method Invocation (RMI) system allows an object running in one Java virtual machine (JVM) to invoke methods on an object running in another JVM.

These JVMs may run on different computers!

Java RMI SoPra 2011



Remote Objects Java RMI

...implement a **Remote Interface**:

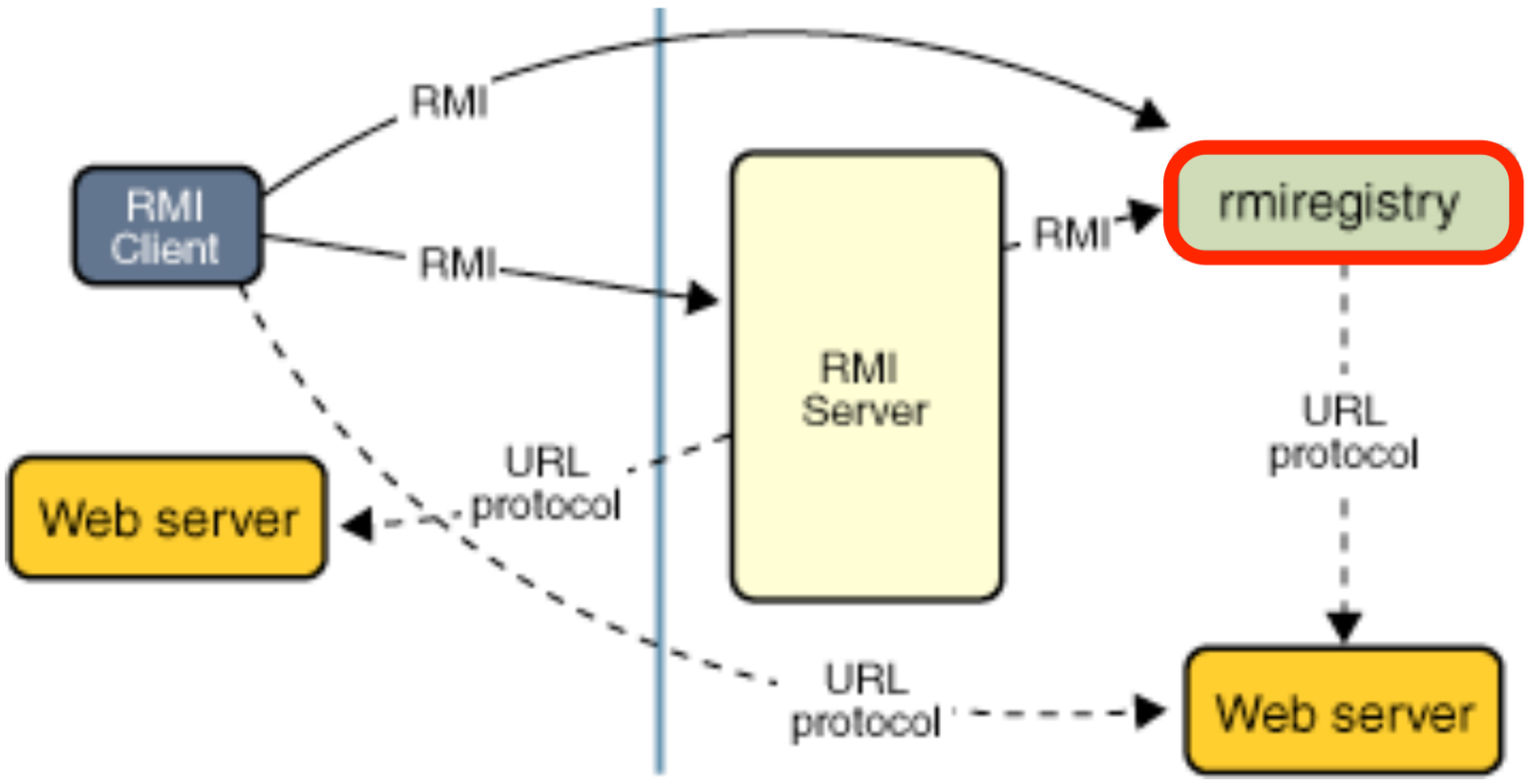
- extends **java.rmi.Remote**
- throws **java.rmi.RemoteException**

Example Java RMI

```
public interface Compute extends Remote {
    public Task execute(Task task) throws RemoteException;
}
```

```
public class ComputeEngine implements Compute {

    public ComputeEngine() {
        super();
    }

    public Task execute(Task task) {
        return task.execute();
    }
}
```

RMI Registry Java RMI



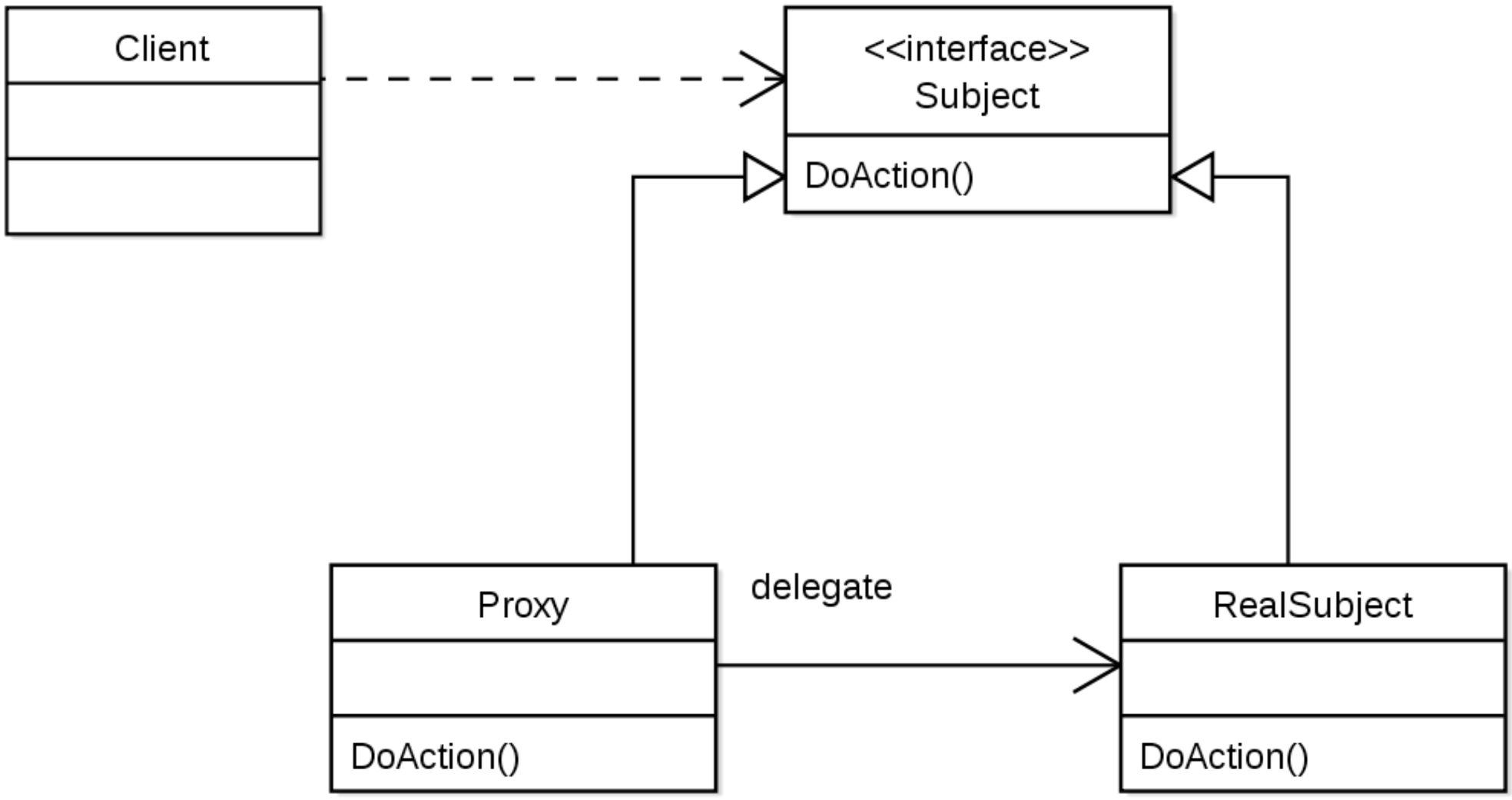
Example Java RMI

```
// Server
public static void main(String[] args) {
    try {
        String name = "Compute";
        Compute engine = new ComputeEngine();
        Compute proxy = (Compute)UnicastRemoteObject.exportObject(engine);
        Registry registry = LocateRegistry.getRegistry();
        registry.rebind(name, proxy);
        System.out.println("ComputeEngine bound");
    } catch (Excepti
        System.err.p
        e.printStack
    }
}
```

```
// Client
public static void main(String args[]) {
    try {
        String name = "Compute";
        Registry registry = LocateRegistry.getRegistry();
        Compute comp = (Compute)registry.lookup(name);
        /* ... */
    } catch (Exception e) {
        System.err.println("Compute exception:");
        e.printStackTrace();
    }
}
```

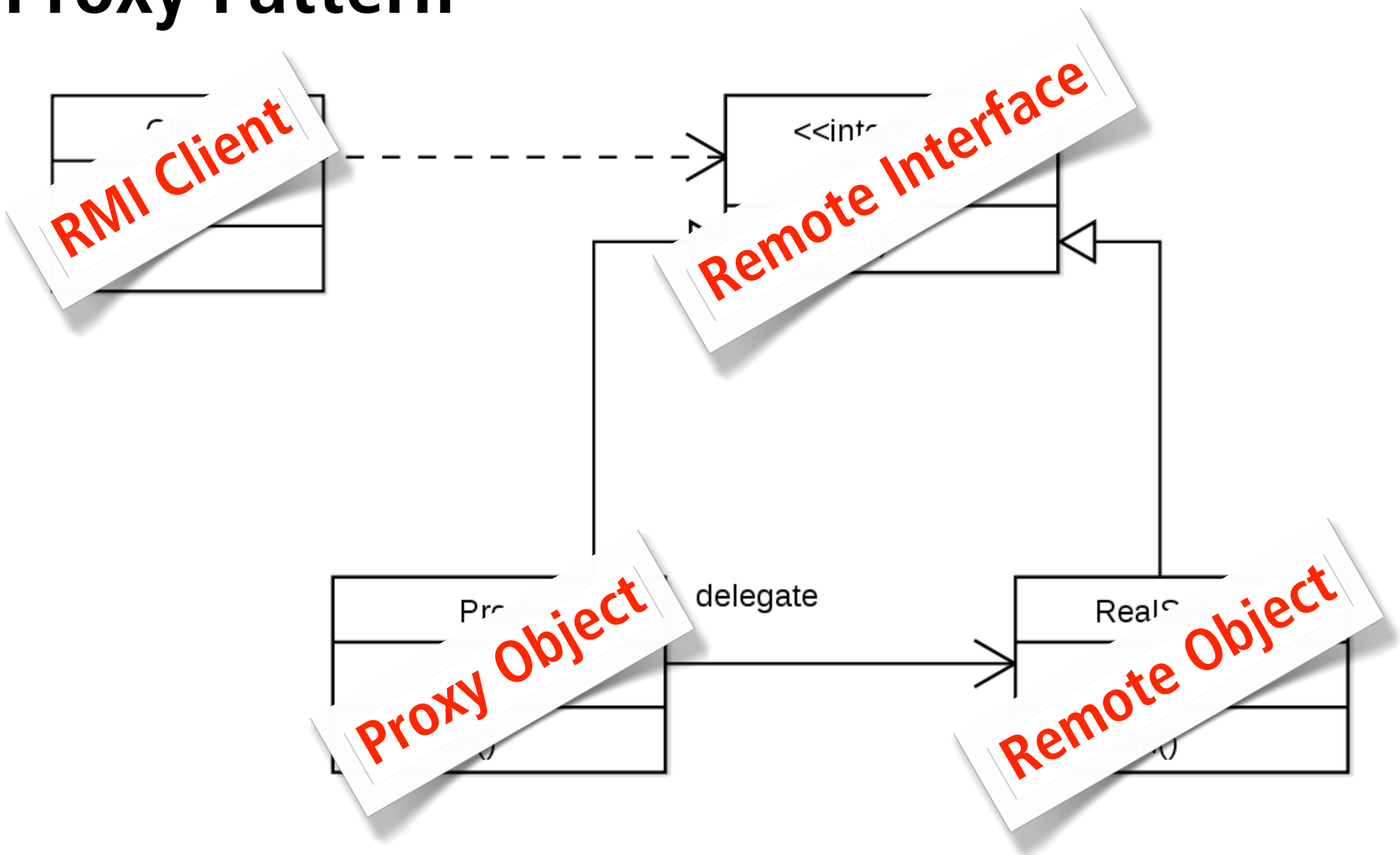
How does it work? Java RMI

Proxy Pattern



How does it work? Java RMI

Proxy Pattern



Java RMI SoPra 2011

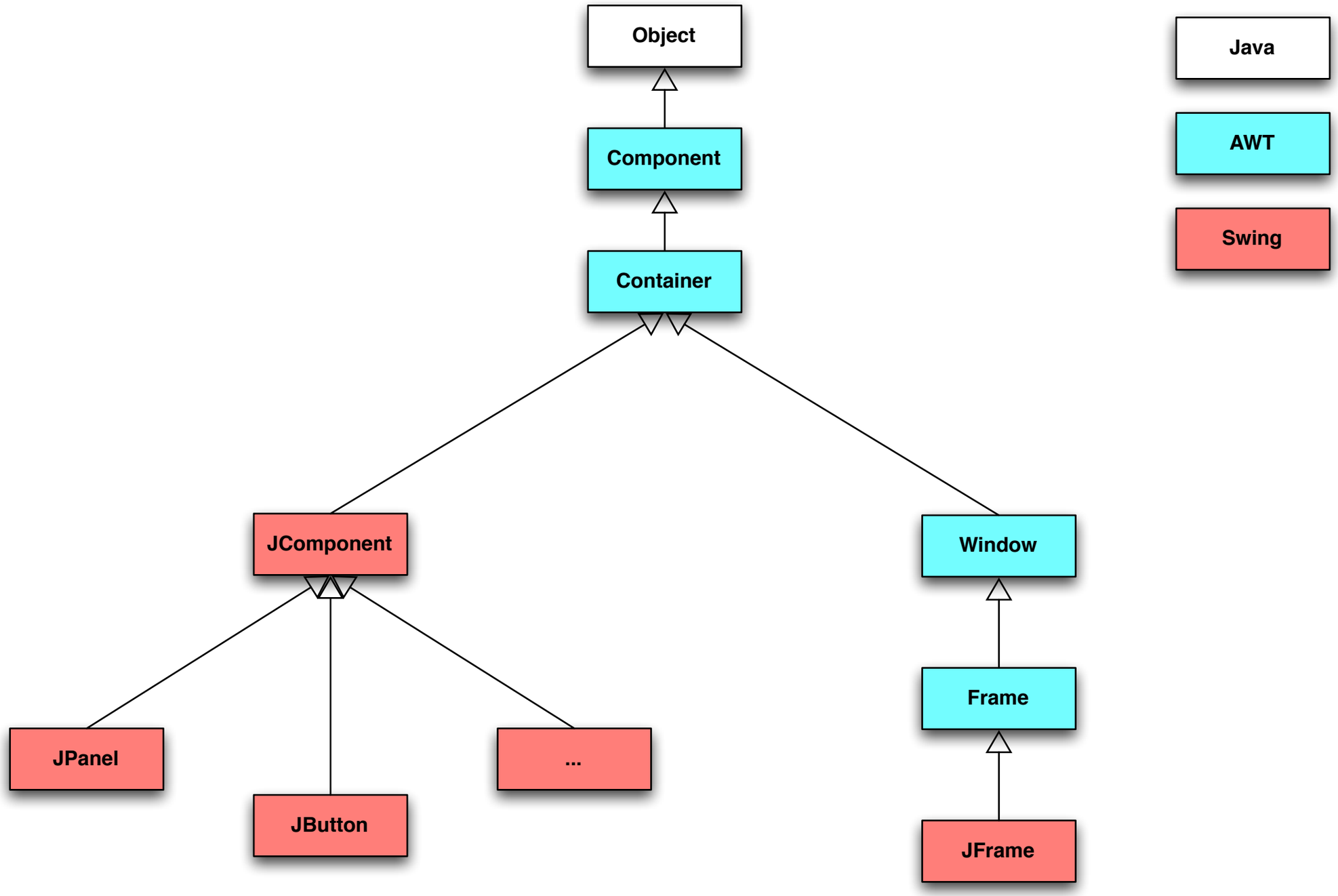
Sun RMI Tutorial

http://seal.ifi.uzh.ch/sopra ➠ Links

Java Swing SoPra 2011

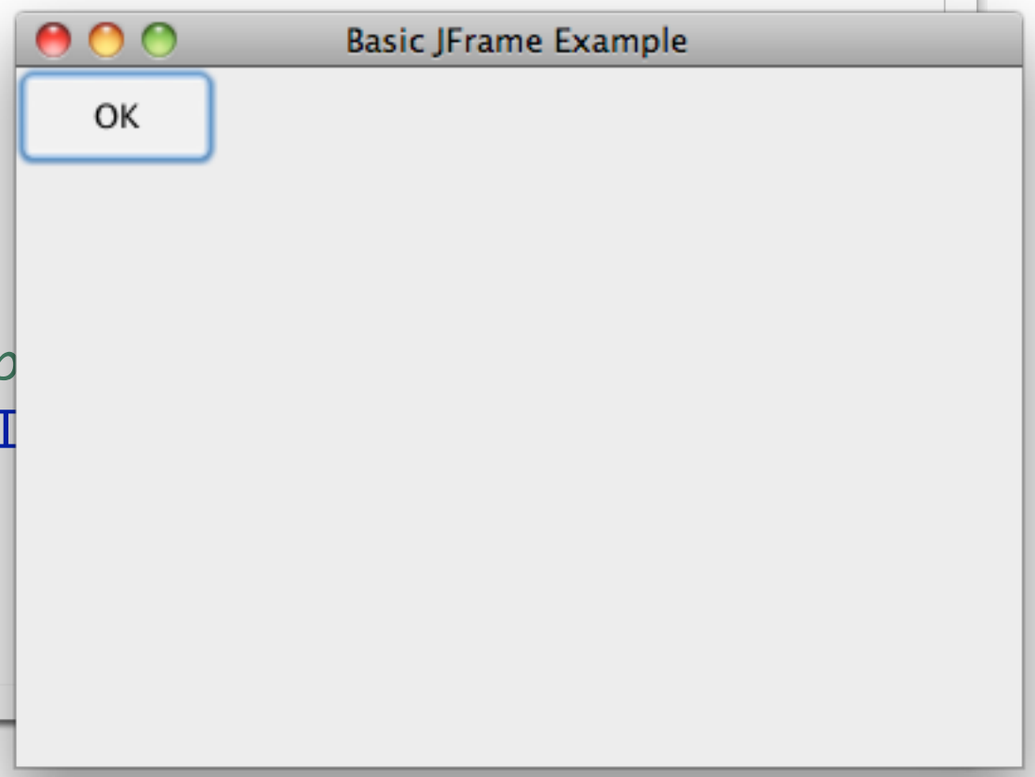
- extension of the Abstract Window Toolkit (AWT)
- platform-independent GUI framework for Java
- set of GUI components
- extensible (e.g. SwingLabs SwingX)
- customizable
- configurable

Java Swing SoPra 2011



JFrame Java Swing

```
// create new JFrame object with title "Basic JFrame Example"
JFrame frame = new JFrame("Basic JFrame Example");
// create a new JButton object
JButton button = new JButton();
// text on JButton
button.setText("OK");
// set size of JButton
button.setSize(80, 40);
// disable layout manager
frame.setLayout(null);
// add JButton to JFrame
frame.add(button);
// size of JFrame
frame.setSize(400, 300);
// closing the JFrame closes the Java app
frame.setDefaultCloseOperation(JFrame.EXI
// display JFrame
frame.setVisible(true);
```

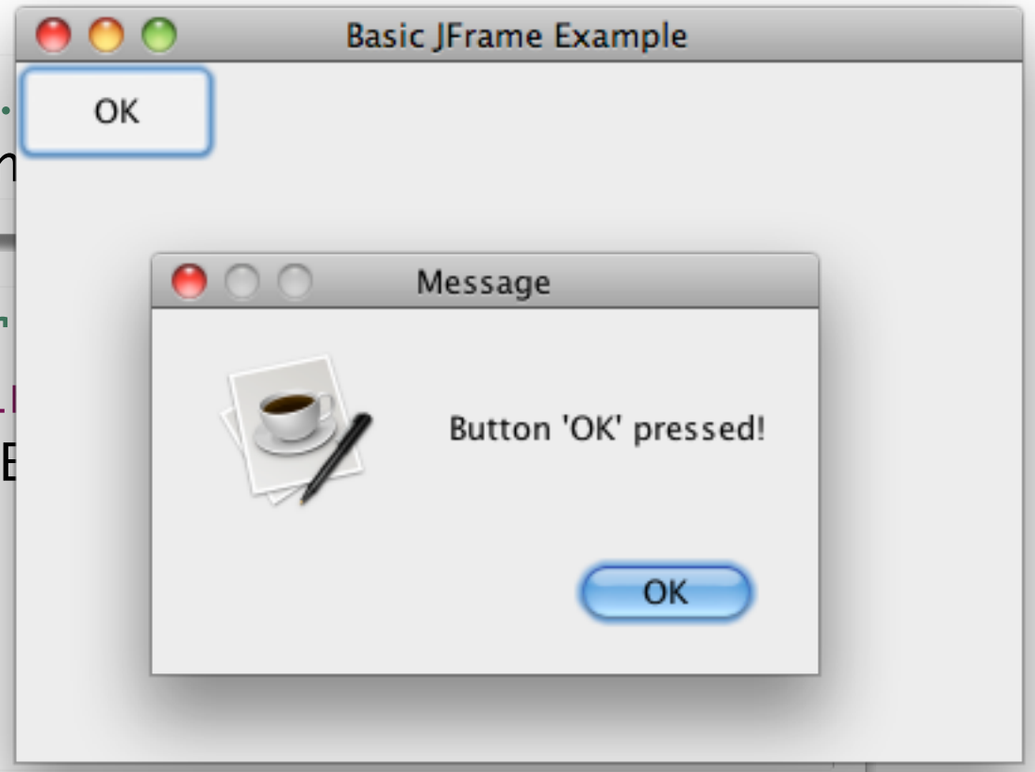


Event Handling Java Swing

```
        // add action listener as anonymous inner class
    button.addActionListener(new ActionListener() {
        public void actionPerformed(ActionEvent e) {
            System.out.println("Button 'OK' pressed!");
            /* ... */
        }
    });
```

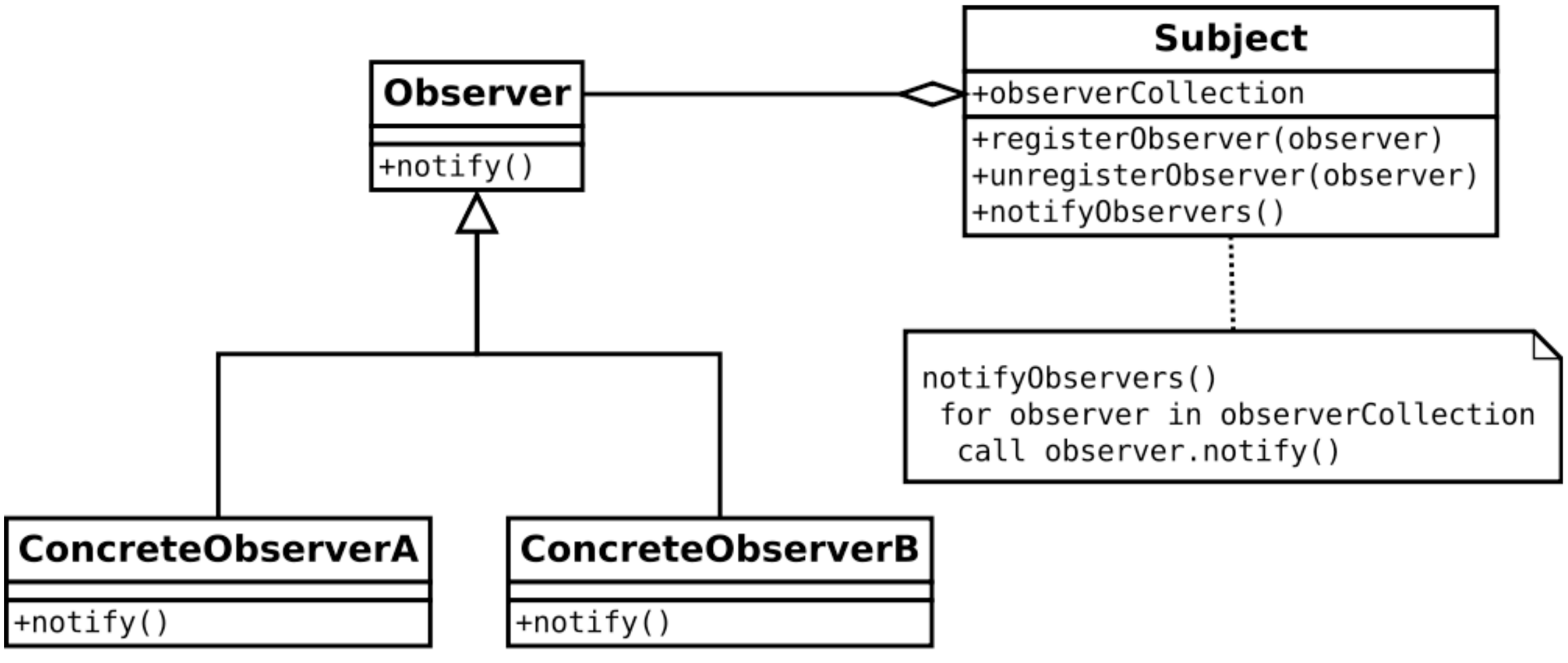
```
    // add action listener as ‘normal’ class...
    button.addActionListener(new OkButtonAction
```

```
    // ...implementing the ActionListener
    public class OkButtonActionListener i
        public void actionPerformed(ActionE
            System.out.println("Button 'OK'
            /* ... */
        }
    }
```



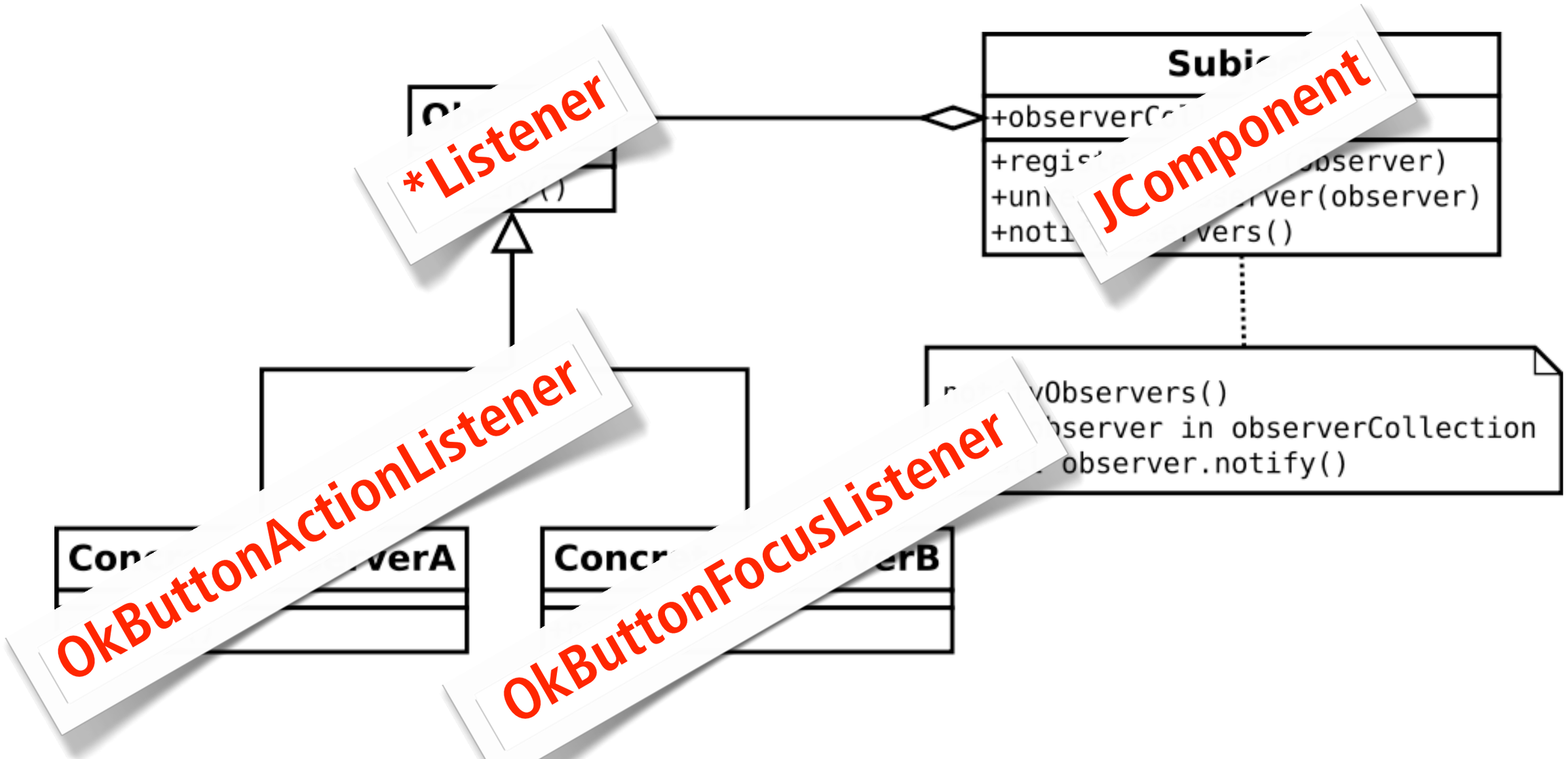
How does it work? Event Handling

Observer Pattern



How does it work? Event Handling

Observer Pattern



SwingLabs SwingX Java Swing

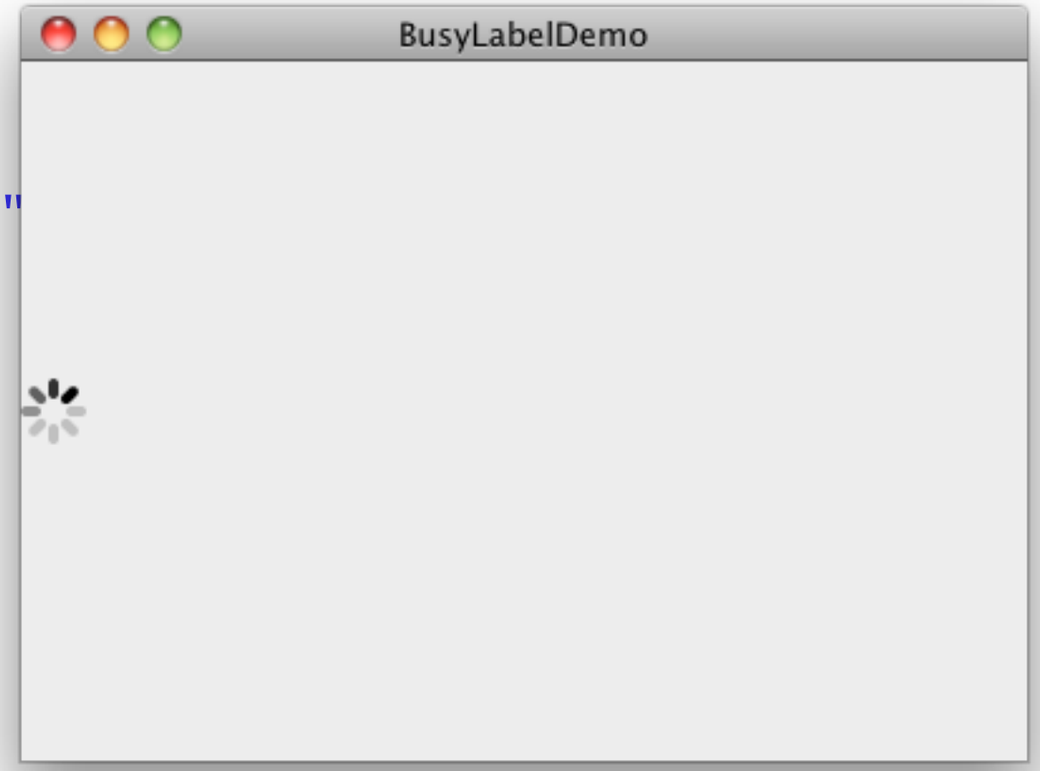
Example I: JXPanel + ImagePainter

```
// ...
JFrame frame = new JFrame("ImagePanelDemo

JXPanel imagePanel = new JXPanel();
ImagePainter painter = new ImagePainter(I
imagePanel.setBackgroundPainter(painter)

frame.add(imagePanel);
// ...
```

SwingLabs SwingX Java Swing

Example II: JXBusyLabel

```
JFrame frame = new JFrame("BusyLabelDemo"

JXBusyLabel label = new JXBusyLabel();

frame.add(label);
label.setBusy(true);
// ...
```



Java Swing SoPra 2011

- **Java Swing Tutorial**
- **SwingLabs SwingX**

  http://seal.ifi.uzh.ch/sopra ➠ Links

Design Patterns SoPra 2011

A **design pattern** is a general reusable solution to a commonly occurring problem in software design.

A design pattern is not a finished design that can be transformed directly into code. It is a description or template for how to solve a problem that can be used in many different situations.

Design Patterns SoPra 2011

- **State Pattern**
- Observer Pattern
- Singleton Pattern
- Command Pattern
- Decorater Pattern
- Composite Pattern
- Proxy Pattern
- ...

State Pattern
Design Patterns

- Etliche Zustände eines Objektes
- Zustandsübergänge verbunden mit komplizierten Bedingungen
- Spielzustände !
- Spielregeln bestimmen Zustandsübergänge
- Naiver Ansatz: Grosses Switch-Case Statement, tief verschachteltes if-else-if-else-if-... Konstrukt
- Beispiele: Parser und Scanner Klassen aus Eclipse

State Pattern Design Patterns

```
5109    case 30 : if (DEBUG) { System.out.println("Type ::= PrimitiveType"); }  //$NON-NLS-1$
5110          consumePrimitiveType();
5111          break;
5112
5113    case 44 : if (DEBUG) { System.out.println("ReferenceType ::= ClassOrInterfaceType"); }  //$NON-NLS-1$
5114          consumeReferenceType();
5115          break;
5116
5117    case 48 : if (DEBUG) { System.out.println("ClassOrInterface ::= Name"); }  //$NON-NLS-1$
5118          consumeClassOrInterfaceName();
5119          break;
5120
5121    case 49 : if (DEBUG) { System.out.println("ClassOrInterface ::= GenericType DOT Name"); }  //$NON-NLS-1$
5122          consumeClassOrInterface();
5123          break;
5124
5125    case 50 : if (DEBUG) { System.out.println("GenericType ::= ClassOrInterface TypeArguments"); }  //$NON-NLS-1$
5126          consumeGenericType();
5127          break;
5128
5129    case 51 : if (DEBUG) { System.out.println("ArrayTypeWithTypeArgumentsName ::= GenericType DOT Name"); }  //$NON-NLS-1$
5130          consumeArrayTypeWithTypeArgumentsName();
5131          break;
5132
5133    case 52 : if (DEBUG) { System.out.println("ArrayType ::= PrimitiveType Dims"); }  //$NON-NLS-1$
5134          consumePrimitiveArrayType();
5135          break;
5136
5137    case 53 : if (DEBUG) { System.out.println("ArrayType ::= Name Dims"); }  //$NON-NLS-1$
5138          consumeNameArrayType();
5139          break;
5140
5141    case 54 : if (DEBUG) { System.out.println("ArrayType ::= ArrayTypeWithTypeArgumentsName Dims"); }  //$NON-NLS-1$
5142          consumeGenericTypeNameArrayType();
5143          break;
5144
```

State Pattern Design Patterns

```
6105            break;
6106
6107    case 456 : if (DEBUG) { System.out.println("AssignmentOperator ::= UNSIGNED_RIGHT_SHIFT_EQUAL"); }  //$NON-NLS-1$
6108            consumeAssignmentOperator(UNSIGNED_RIGHT_SHIFT);
6109            break;
6110
6111    case 457 : if (DEBUG) { System.out.println("AssignmentOperator ::= AND_EQUAL"); }  //$NON-NLS-1$
6112            consumeAssignmentOperator(AND);
6113            break;
6114
6115    case 458 : if (DEBUG) { System.out.println("AssignmentOperator ::= XOR_EQUAL"); }  //$NON-NLS-1$
6116            consumeAssignmentOperator(XOR);
6117            break;
6118
6119    case 459 : if (DEBUG) { System.out.println("AssignmentOperator ::= OR_EQUAL"); }  //$NON-NLS-1$
6120            consumeAssignmentOperator(OR);
6121            break;
6122
6123    case 463 : if (DEBUG) { System.out.println("Expressionopt ::="); }  //$NON-NLS-1$
6124            consumeEmptyExpression();
6125            break;
6126
6127    case 468 : if (DEBUG) { System.out.println("ClassBodyDeclarationsopt ::="); }  //$NON-NLS-1$
6128            consumeEmptyClassBodyDeclarationsopt();
6129            break;
6130
6131    case 469 : if (DEBUG) { System.out.println("ClassBodyDeclarationsopt ::= NestedType..."); }  //$NON-NLS-1$
6132            consumeClassBodyDeclarationsopt();
6133            break;
6134
6135     case 470 : if (DEBUG) { System.out.println("Modifiersopt ::="); }  //$NON-NLS-1$
6136            consumeDefaultModifiers();
6137            break;
6138
6139    case 471 : if (DEBUG) { System.out.println("Modifiersopt ::= Modifiers"); }  //$NON-NLS-1$
6140            consumeModifiers();
6141            break;
6142
6143    case 472 : if (DEBUG) { System.out.println("BlockStatementsopt ::="); }  //$NON-NLS-1$
6144            consumeEmptyBlockStatementsopt();
6145            break;
6146
6147     case 474 : if (DEBUG) { System.out.println("Dimsopt ::="); }  //$NON-NLS-1$
6148            consumeEmptyDimsopt();
6149            break;
```

State Pattern Design Patterns

```
6750
6751    case 694 : if (DEBUG) { System.out.println("MarkerAnnotation ::= AnnotationName"); }  //$NON-NLS-1$
6752          consumeMarkerAnnotation() ;
6753          break;
6754
6755    case 695 : if (DEBUG) { System.out.println("SingleMemberAnnotationMemberValue ::= MemberValue"); }  //$NON-NLS-1$
6756          consumeSingleMemberAnnotationMemberValue() ;
6757          break;
6758
6759    case 696 : if (DEBUG) { System.out.println("SingleMemberAnnotation ::= AnnotationName LPAREN..."); }  //$NON-NLS-1$
6760          consumeSingleMemberAnnotation() ;
6761          break;
6762
6763    case 697 : if (DEBUG) { System.out.println("RecoveryMethodHeaderName ::= Modifiersopt TypeParameters"); }  //$NON-NLS-1$
6764          consumeRecoveryMethodHeaderNameWithTypeParameters();
6765          break;
6766
6767    case 698 : if (DEBUG) { System.out.println("RecoveryMethodHeaderName ::= Modifiersopt Type..."); }  //$NON-NLS-1$
6768          consumeRecoveryMethodHeaderName();
6769          break;
6770
6771    case 699 : if (DEBUG) { System.out.println("RecoveryMethodHeader ::= RecoveryMethodHeaderName..."); }  //$NON-NLS-1$
6772          consumeMethodHeader();
6773          break;
6774
6775    case 700 : if (DEBUG) { System.out.println("RecoveryMethodHeader ::= RecoveryMethodHeaderName..."); }  //$NON-NLS-1$
6776          consumeMethodHeader();
6777          break;
6778
```

State Pattern Design Patterns

```
case 'e' : //else extends
   switch (length) {
      case 4 :
         if ((data[++index] == 'l') && (data[++index] == 's') && (data[++index] == 'e'))
            return TokenNameelse;
         else if ((data[index] == 'n')
            && (data[++index] == 'u')
            && (data[++index] == 'm')) {
               if (this.sourceLevel >= ClassFileConstants.JDK1_5) {
                  return TokenNameenum;
               } else {
                  this.useEnumAsAnIndentifier = true;
                  return TokenNameIdentifier;
               }
            } else {
               return TokenNameIdentifier;
            }
      case 7 :
         if ((data[++index] == 'x')
            && (data[++index] == 't')
            && (data[++index] == 'e')
            && (data[++index] == 'n')
            && (data[++index] == 'd')
            && (data[++index] == 's'))
            return TokenNameextends;
         else
            return TokenNameIdentifier;
      default :
         return TokenNameIdentifier;
   }

case 'f' : //final finally float for false
   switch (length) {
      case 3 :
         if ((data[++index] == 'o') && (data[++index] == 'r'))
            return TokenNamefor;
         else
            return TokenNameIdentifier;
```

State Pattern Design Patterns

```
if ((c1 = ScannerHelper.getNumericValue(this.source[this.currentPosition++])) > 15
        || c1 < 0
        || (c2 = ScannerHelper.getNumericValue(this.source[this.currentPosition++])) > 15
        || c2 < 0
        || (c3 = ScannerHelper.getNumericValue(this.source[this.currentPosition++])) > 15
        || c3 < 0
        || (c4 = ScannerHelper.getNumericValue(this.source[this.currentPosition++])) > 15
        || c4 < 0){
    throw new InvalidInputException(INVALID_UNICODE_ESCAPE);
}
```

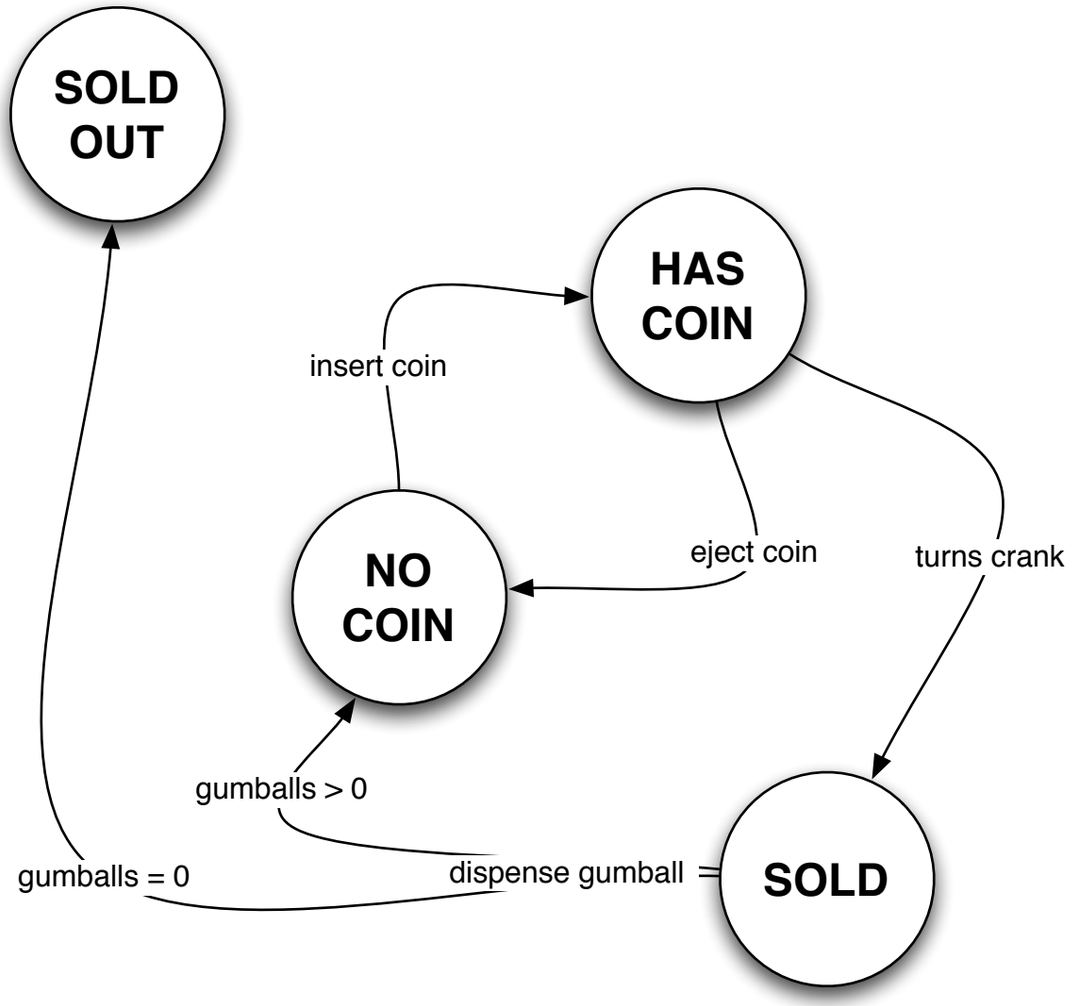
State Pattern Design Patterns

```
if (getNextChar('d', 'D') >= 0) {
    return TokenNameDoubleLiteral;
} else { //make the distinction between octal and float ....
    boolean isInteger = true;
    if (getNextChar('.')) {
        isInteger = false;
        while (getNextCharAsDigit()){/*empty*/}
    }
    if (getNextChar('e', 'E') >= 0) { // consume next character
        isInteger = false;
        this.unicodeAsBackSlash = false;
        if (((this.currentCharacter = this.source[this.currentPosition++]) == '\\')
            && (this.source[this.currentPosition] == 'u')) {
            getNextUnicodeChar();
        } else {
            if (this.withoutUnicodePtr != 0) {
                unicodeStore();
            }
        }

        if ((this.currentCharacter == '-')
            || (this.currentCharacter == '+')) { // consume next character
            this.unicodeAsBackSlash = false;
            if (((this.currentCharacter = this.source[this.currentPosition++]) == '\\')
                && (this.source[this.currentPosition] == 'u')) {
                getNextUnicodeChar();
            } else {
                if (this.withoutUnicodePtr != 0) {
                    unicodeStore();
                }
            }
        }
        if (!ScannerHelper.isDigit(this.currentCharacter))
            throw new InvalidInputException(INVALID_FLOAT);
        while (getNextCharAsDigit()){/*empty*/}
    }
    if (getNextChar('f', 'F') >= 0)
        return TokenNameFloatingPointLiteral;
    if (getNextChar('d', 'D') >= 0 || !isInteger)
        return TokenNameDoubleLiteral;
    return TokenNameIntegerLiteral;
}
```

State Pattern
Design Patterns

- Zustand und damit verbundenes Verhalten wird in eigenen Klassen modelliert
- Für jeden Zustand eine Klasse, die Verhalten in diesem Zustand definiert
- Regeln werden werden ebenfalls in diesen Zustandsklassen gekapselt
- → Ein Zustand kennt seinen Nachfolger

Example State Pattern



Example State Pattern

```
public class GumballMachine {

    final static int SOLD_OUT = 0;
    final static int NO_COIN = 1;
    final static int HAS_COIN = 2;
    final static int SOLD = 3;

    int state
    int coun

    public G
        this.
        if (c
            st
        }
    }
```

```
public void insertCoin() {
    if (state == HAS_COIN) {
        System.out.println("You can't insert another coin");
    } else if (state == NO_COIN) {
        state = HAS_COIN;
        System.out.println("You inserted a coin");
    } else if (state == SOLD_OUT) {
        System.out.println("You can't insert a coin, the machine is so
    } else if (state == SOLD) {
        System.out.println("Please wait, we're already giving you a gu
    }
}
```

Example State Pattern

```
public void ejectCoin() {
    if (state == HAS_COIN) {
        System.out.println("Coin returned");
        st
```

```
publi
    if
    }
    }
    }
    }
}
```

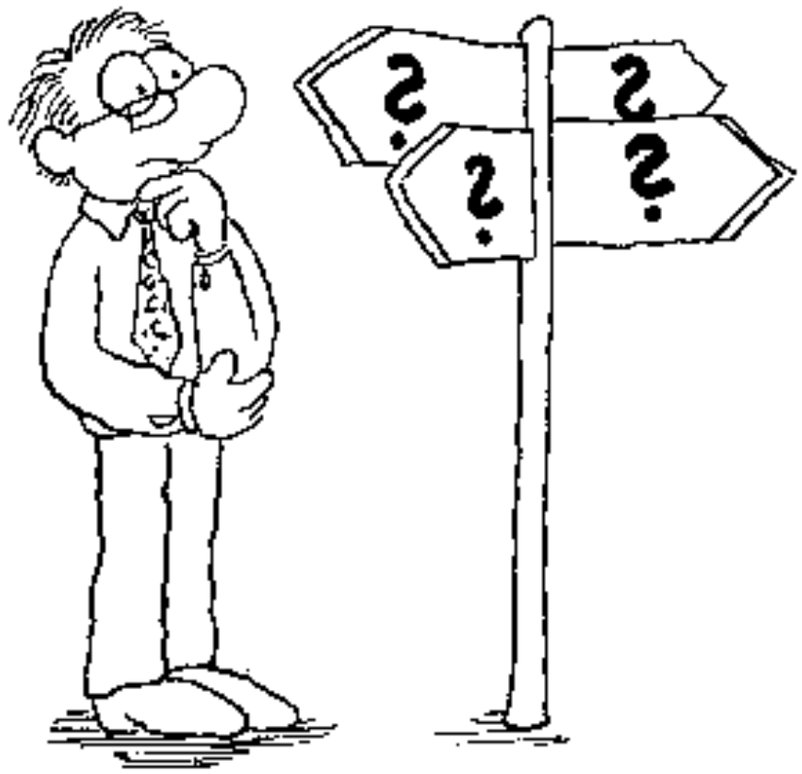
```
public void dispense() {
    if (state == SOLD) {
        System.out.println("A gumball comes rolling out the slot");
        count = count - 1;
        if (count == 0) {
            System.out.println("Oops, out of gumballs!");
            state = SOLD_OUT;
        } else {
            state = NO_COIN;
        }
    } else if (state == NO_COIN) {
        System.out.println("You need to pay first");
    } else if (state == SOLD_OUT) {
        System.out.println("No gumball dispensed");
    } else if (state == HAS_COIN) {
        System.out.println("No gumball dispensed");
    }
}
```

Example State Pattern

Change Request:

One in Ten get a FREE GUMBALL!

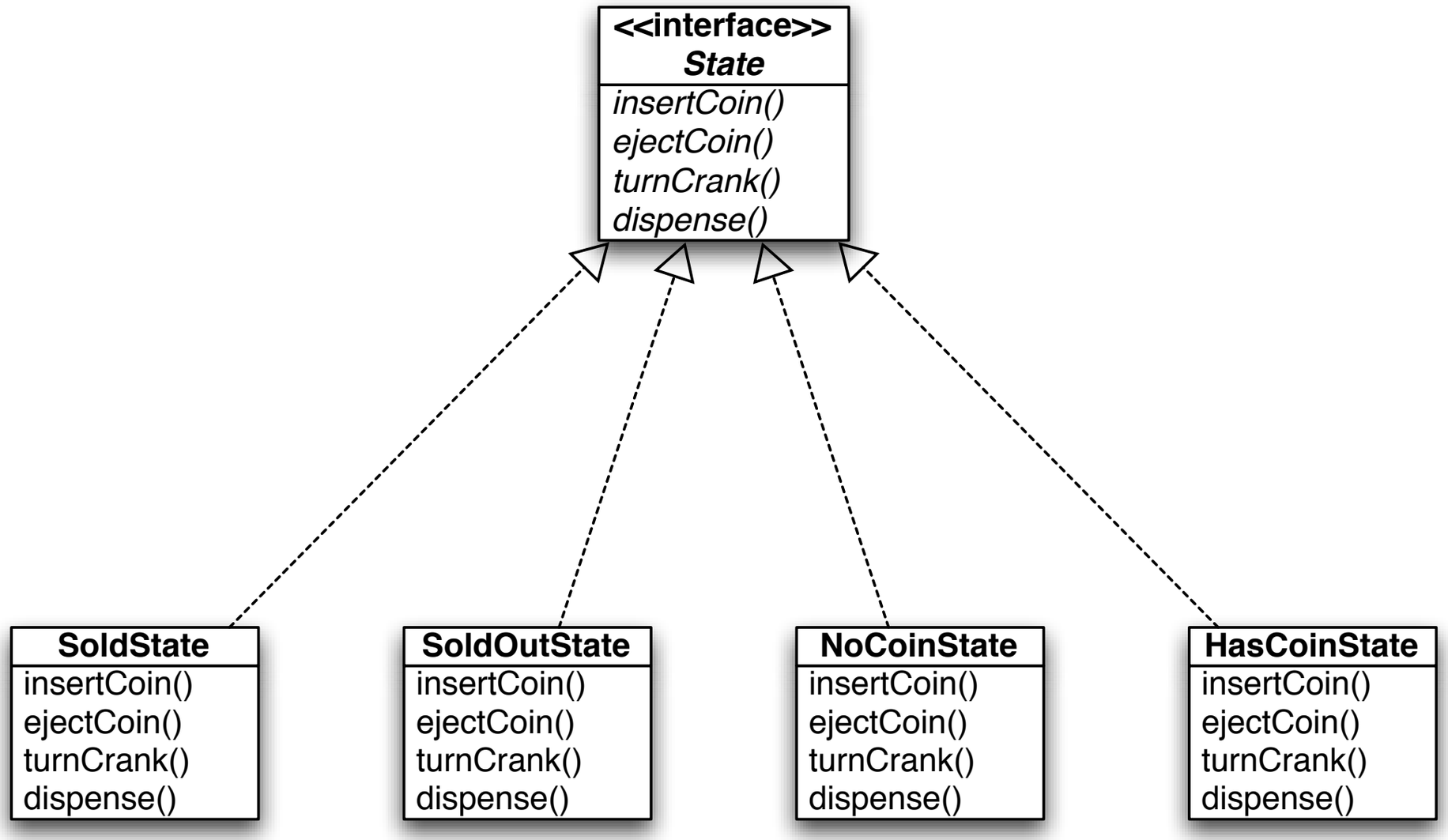
Example State Pattern



```
public class GumballMachine {

    final static int SOLD_OUT = 0;
    final static int NO_QUARTER = 1;
    final static int HAS_QUARTER = 2;
    final static int SOLD = 3;
     // CHANGE NEEDED

    int state = SOLD_OUT;
    int count = 0;

    public GumballMachine(int count) {
    }

    public void insertQuarter() {
        // CHANGE NEEDED
    }

    public void ejectQuarter() {
        // CHANGE NEEDED
    }

    public void turnCrank() {
        // CHANGE NEEDED
    }

    public void dispense() {
         // CHANGE NEEDED
    }
}
```

Example State Pattern

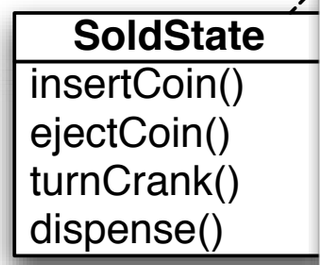
New Design: **State Pattern**



Example State Pattern

New Desig

```
public class NoCoinState implements State {
    GumballMachine gumballMachine;

    public NoCoinState(GumballMachine gumballMachine) {
        this.gumballMachine = gumballMachine;
    }

   public void insertCoin() {
       System.out.println("You inserted a quarter");
       gumballMachine.setState(gumballMachine.getHasCoinState());
   }

   public void ejectCoin() {
       System.out.println("You haven't inserted a coin");
   }

   public void turnCrank() {
       System.out.println("You turned, but there's no coin");
    }

   public void dispense() {
       System.out.println("You need to pay first");
   }
}
```



Example State Pattern

```
public class GumballMachine {

    State soldOutState;
    State noCoinState;
    State hasCoinState;
    State soldState;

    State state = soldOutState;
    int count = 0;

    public GumballMachine(int numberGumballs
        soldOutState = new SoldOutState(this)
        noCoinState = new NoQuarterState(this
        hasCoinState = new HasCoinState(this)
        soldState = new SoldState(this);

        this.count = numberGumballs;
        if (numberGumballs > 0) {
            state = noCoinState;
        }
    }
```

```
void setState(State state) {
    this.state = state;
}

public State getState() {
    return state;
}

public State getSoldOutState() {
    return soldOutState;
}

public State getNoCoinState() {
    return noCoinState;
}

public State getHasCoinState() {
    return hasCoinState;
}

public State getSoldState() {
    return soldState;
}
```

Example State Pattern

Change Request:

One in Ten get a FREE GUMBALL!

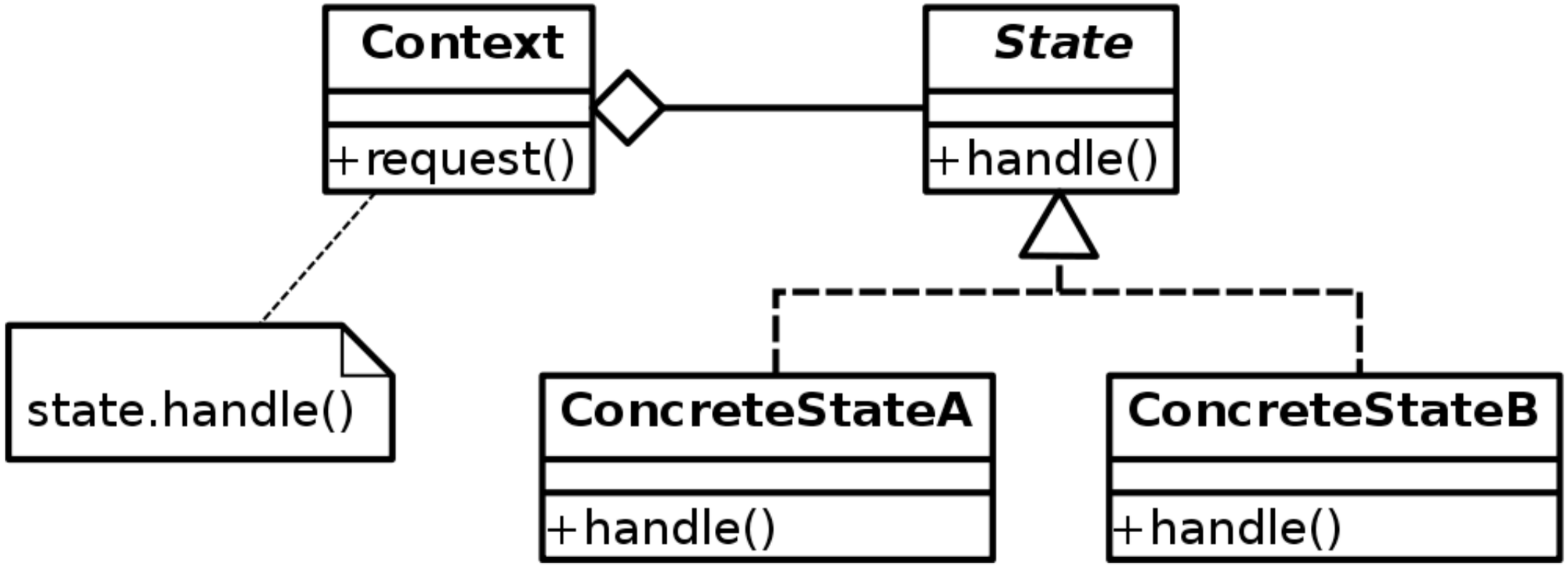
```
public cl
    /* ...
}
```

```
public
    /* .
    Stat
    /* .
}
```

```
public class HasQuarterState implements State {
    Random randomWinner = new Random(System.currentTimeMillis());
    /* ... */
    public void turnCrank() {
        System.out.println("You turned...");
        int winner = randomWinner.nextInt(10);
        if ((winner == 0) && (gumballMachine.getCount() > 1)) {
            gumballMachine.setState(gumballMachine.getWinnerState());
        } else {
            gumballMachine.setState(gumballMachine.getSoldState());
        }
    }
    /* ... */
}
```

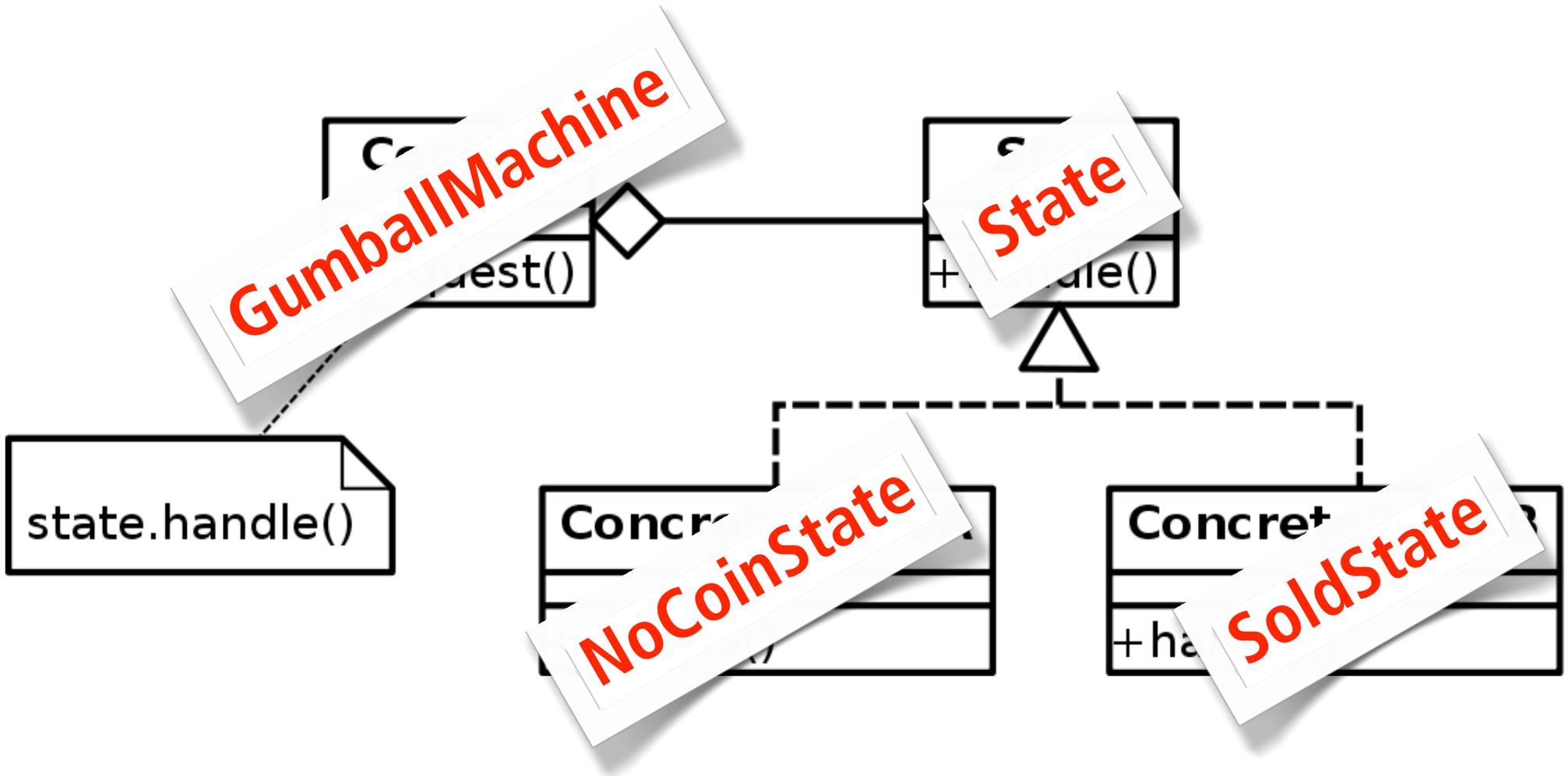
State Pattern Design Patterns

The **State Pattern** allows an object to alter its behavior when its internal state changes. The object will appear to change its class.



State Pattern
Design Patterns

The **State Pattern** allows an object to alter its behavior when its internal state changes. The object will appear to change its class.



Design Patterns SoPra 2011

Head First Design Patterns by Eric T. Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra

Design Patterns - Elements of Reusable Object-Oriented Software by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides

JUnit Testing SoPra 2011

- **test units in isolation:** concentrate on possible bugs within smallest possible units
- **regression tests:** develop a set of tests that can be run after each modification of the code
- **JUnit 4**
- later: **integration tests** with JUnit

Example JUnit Testing

```
public class PriceCalculator {
   private Map<Integer, Double> taxTable = initTaxTable();

   public double calculatePriceWithTax(double input, int year) {
      return input * taxTable.get(year);
   }

   private Map<Integer, Double> initTaxTable() {
      /* init tax table */
   }
}
```

```
public class PriceCalculatorTest {

   @Test
   public void calculatePriceWithTax() {
      PriceCalculator calculator = new PriceCalculator();
      double priceWithTax = calculator.calculatePriceWithTax(100.0, 2011);
      assertEquals(108.00, priceWithTax, 0.0);
   }
}
```

Assert
JUnit Testing

- assertArrayEquals
- assertEquals
- assertFalse
- assertNotNull
- assertNotSame
- assertNull
- assertSame
- assertThat
- assertTrue

http://junit.sourceforge.net/javadoc/org/junit/Assert.html

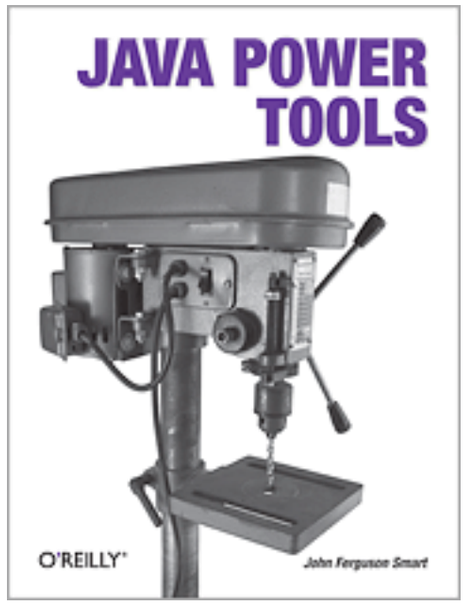
```java
@RunWith(Parameterized.class)
public class PriceCalculatorTest {

    @Parameters
    public static Collection data() {
        return Arrays.asList(new Object[][] {
                /* Price  Year  PriceWithTax */
                {  100.0, 2010,        108.0 },
                {    0.0, 2010,          0.0 },
                /*   ...,  ...,          ... */
        });
    }

    private double price;
    private int year;
    private double expectedPriceWithTax;

    public PriceCalculatorTest(double price, int year, double expectedPriceWithTax) {
        this.price = price;
        this.year = year;
        this.expectedPriceWithTax = expectedPriceWithTax;
    }

    @Test
    public void calculatePriceWithTax() {
        PriceCalculator calculator = new PriceCalculator();
        double priceWithTax = calculator.calculatePriceWithTax(price, year);
        assertEquals(expectedPriceWithTax, priceWithTax, 0.0);
    }
}
```

JUnit 4 JUnit Testing

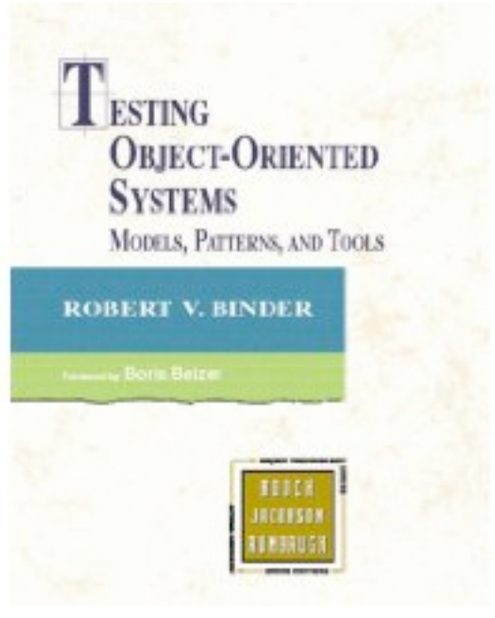
- **@BeforeClass**: called once before any test
- **@AfterClass**: called once after all tests
- **@Before**: called before each test
- **@After**: called after each test
- **@Test**: define a method as a test
- **@Parameters**: define test data

JUnit 4 JUnit Testing

Java Power Tools by John Ferguson Smart



Testing Object-Oriented Systems: Models, Patterns, and Tools by Rober Binder



Hint! SoPra 2011

- **Simple RMI Example with State Pattern**
- **RMI Example with State Pattern and Notification (Observer Pattern)**

http://seal.ifi.uzh.ch/sopra ➠ RMI State Pattern Examples

Next Review 11.03.11

- **Origo Account** wurde erstellt
- **Kommunikation** ist organisiert
- Alle **Use Cases** wurden erstellt
- Alle Elemente des Spiels wurden in einem **Domain Model** umgesetzt
- **RMI** Tutorial wurde durchgearbeitet
- Merkblatt zur Projektorganisation durchgelesen