CS 635 Advanced Object-Oriented Design & Programming
Spring Semester, 2010
Doc 13 Proxy & State
Apr 5, 2011

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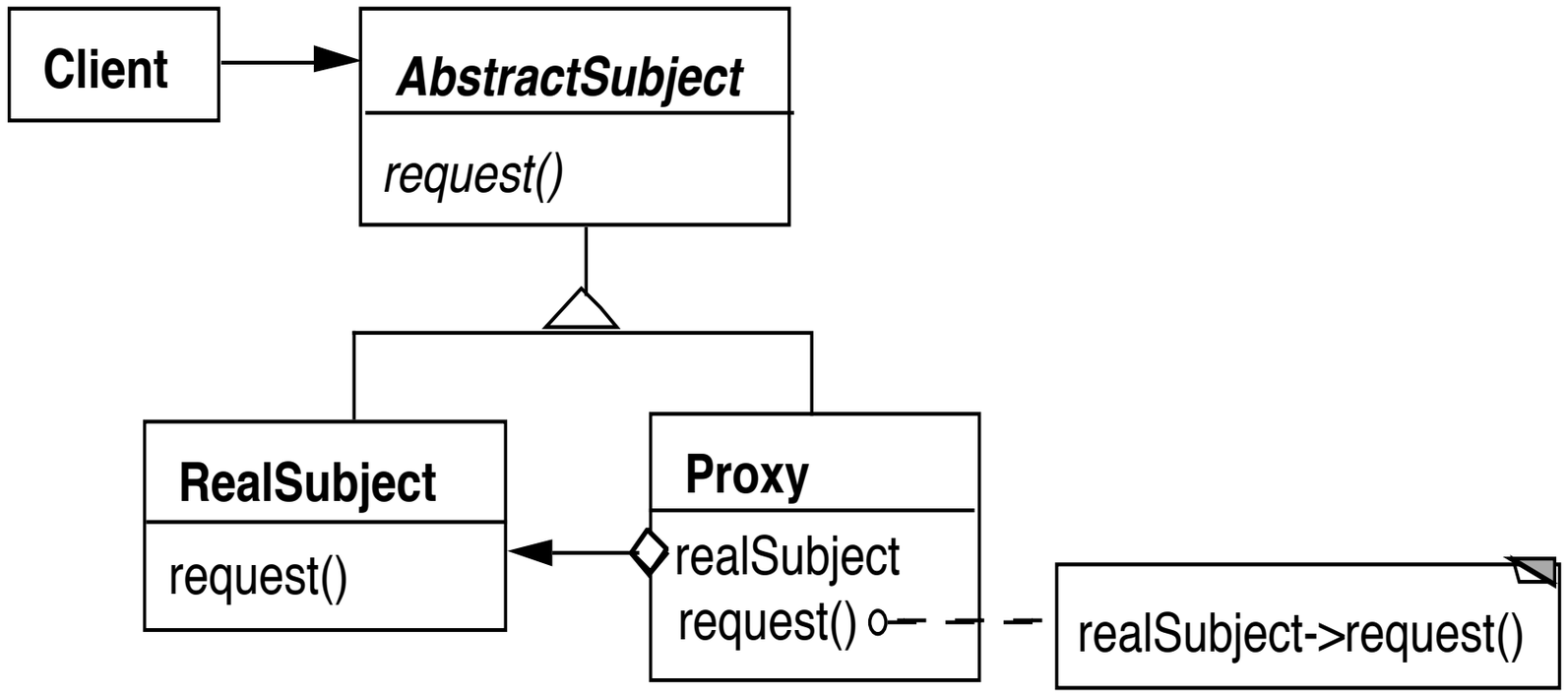
References

Design Patterns: Elements of Resuable Object-Oriented Software,
Gamma, Helm, Johnson, Vlissides, Addison-Wesley, 1995, pp. 207-218, 305-314

Proxy (Surrogate)

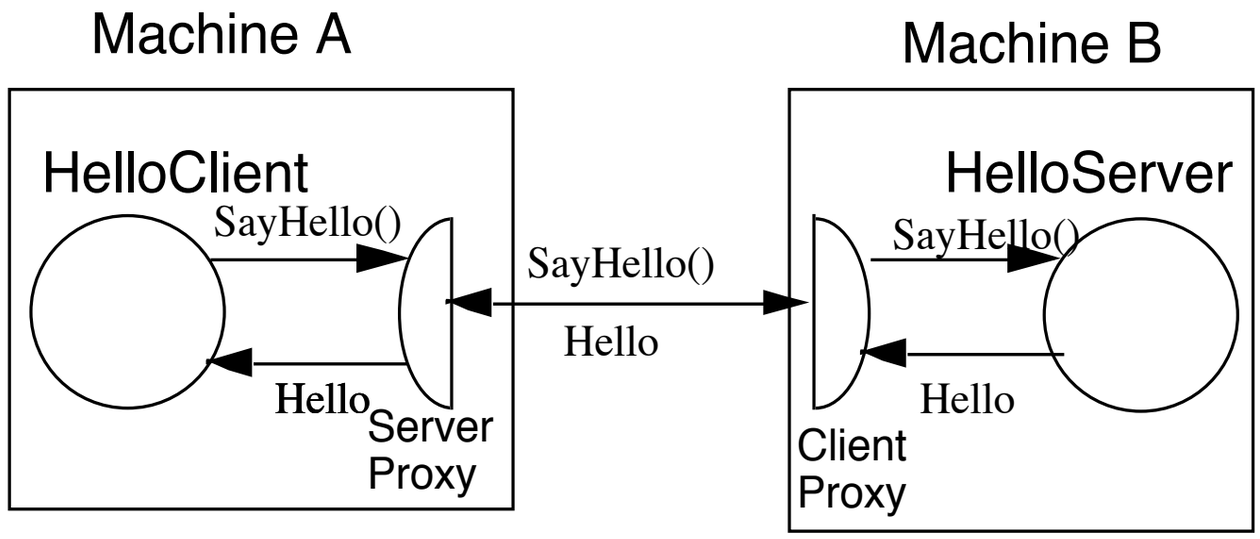
a person authorized to act on behalf of another




```
class Proxy {
    AbstractSubject realSubject;

public Foo service(Bar x ) {
     return realSubject(x);
}
```

Why do it?

Remote Proxy




```
String server = getHelloHostAddress( args);
Hello proxy = (Hello) Naming.lookup( server );
String message = proxy.sayHello();
System.out.println( message );
```

More General Proxy

```
class Proxy {
        AbstractSubject realSubject;

        public Foo service(Bar x ) {
                some preprocessing
                result = realSubject(x);
                some postprocessing
        }
```

Virtual Proxy

Creates/accesses expensive objects on demand

O-R Mapping Layers

Java's Synchronized List

```
ArrayList notSafe = new ArrayList();
List threadSafe = Collections.synchronizedList(notSafe);
```

```
static class SynchronizedList {
        List list;
        public Object get(int index) {
            synchronized(mutex) {return list.get(index);}
        }
}
```

Java's Unmodifiable List

```
ArrayList notSafe = new ArrayList();
List noChange = Collections.unmodifiableList(notSafe);
```

```
static class UnmodifiableList {
        List list;
        public Object get(int index) { return list.get(index);}

        public Object set(int index, Object element) {
            throw new UnsupportedOperationException();
         }
```

Proxy or Decorator?

```
ArrayList notSafe = new ArrayList();
List noChange = Collections.unmodifiableList(notSafe);
List threadSafe = Collections.synchronizedList(noChange);
```

Proxy verses Decorator

"Decorators can have similar implementations as proxies"

Proxy controls access to an object

Decorator adds one or more responsibilities to an object

Smalltalk Proxy Trick

```
Object subclass: #Proxy
        instanceVariableNames: 'target '
        classVariableNames: ''
        poolDictionaries: ''
        category: 'Whitney-Examples'
```

Class Method

```
on: anObject
        ^super new target: anObject
```

Instance Methods

```
doesNotUnderstand: aMessage
        ^target
                perform: aMessage selector
                withArguments: aMessage arguments

target: anObject
        target := anObject
```

```
| wrapper |
wrapper := Proxy on: Transcript.
wrapper open.
wrapper show: 'Hi mom'.
```

```
| wrapper |
wrapper := Proxy on: 3.
wrapper + 5.
```

```
| wrapper |
wrapper := Proxy on: 'Hi '.
wrapper , ' mom'.
```

Java Proxy Trick

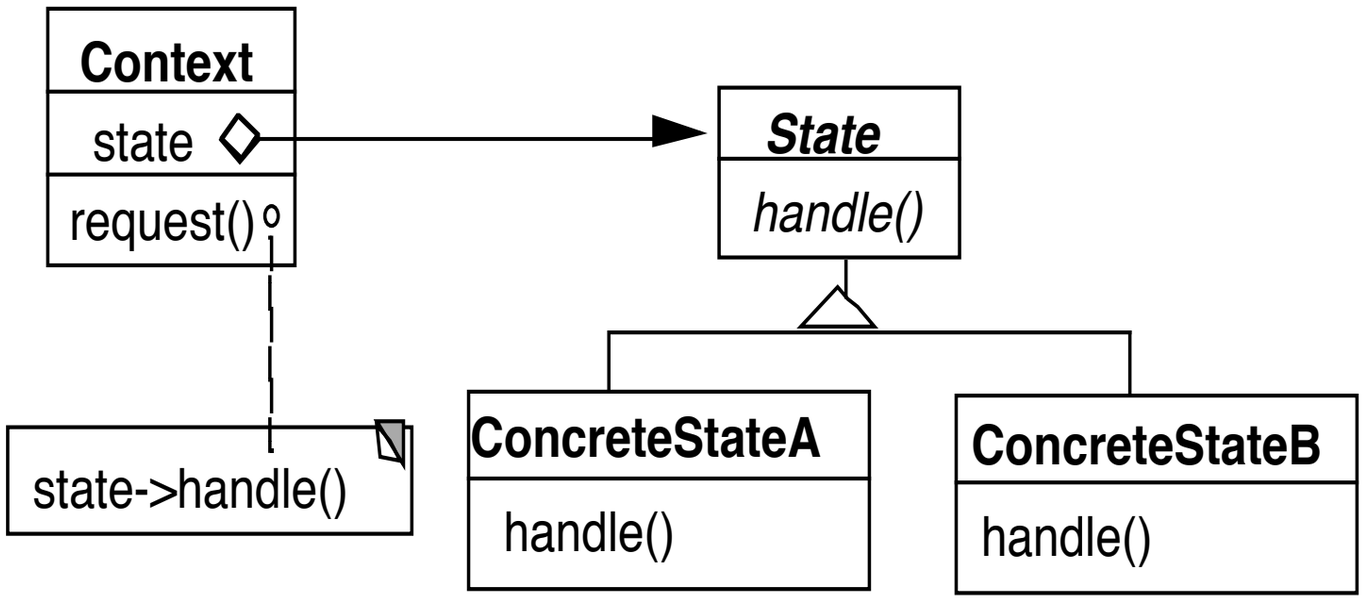
```
Foo proxy = (Foo) Proxy.newProxyInstance(Foo.class.getClassLoader(),
                                         new Class[] { Foo.class },
                                         handler);

proxy instanceof Foo
```

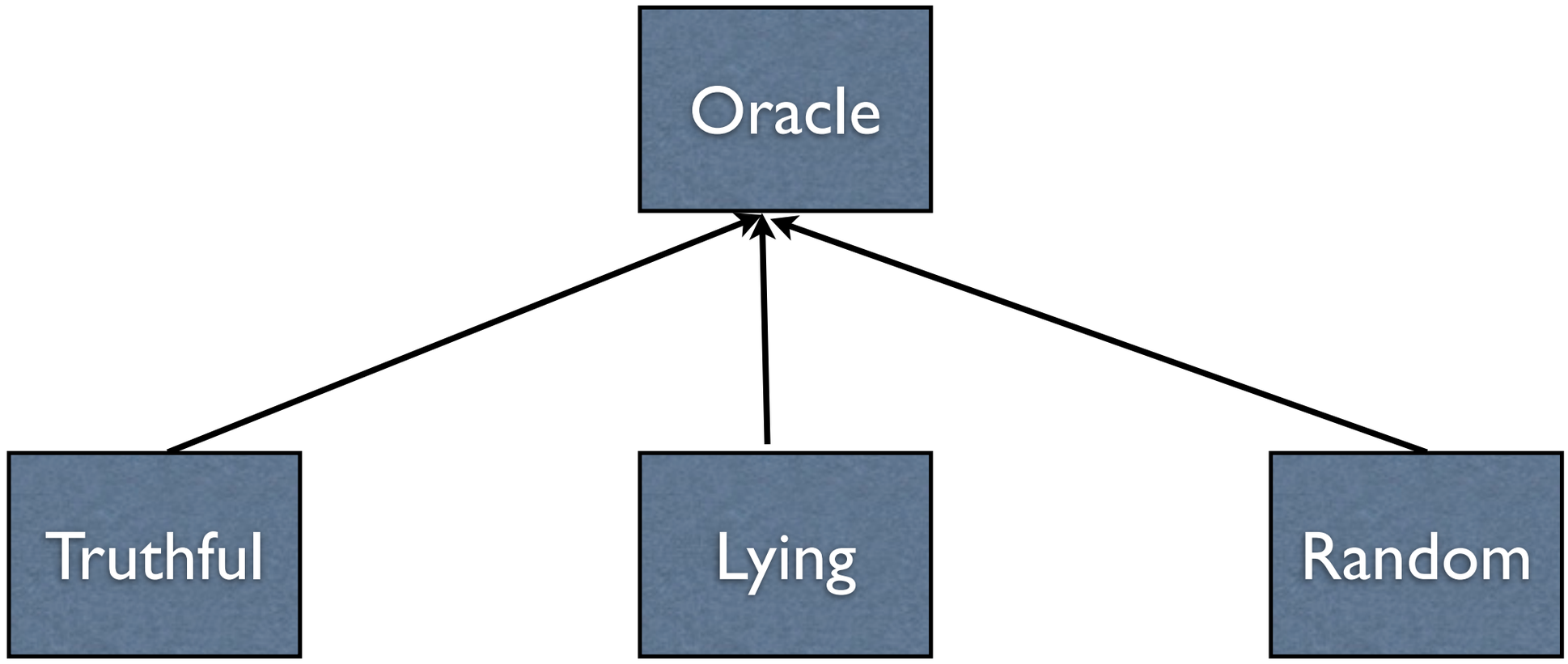
State Pattern

Allow an object to alter its behavior when its internal state changes

The object will appear to change it class

Structure

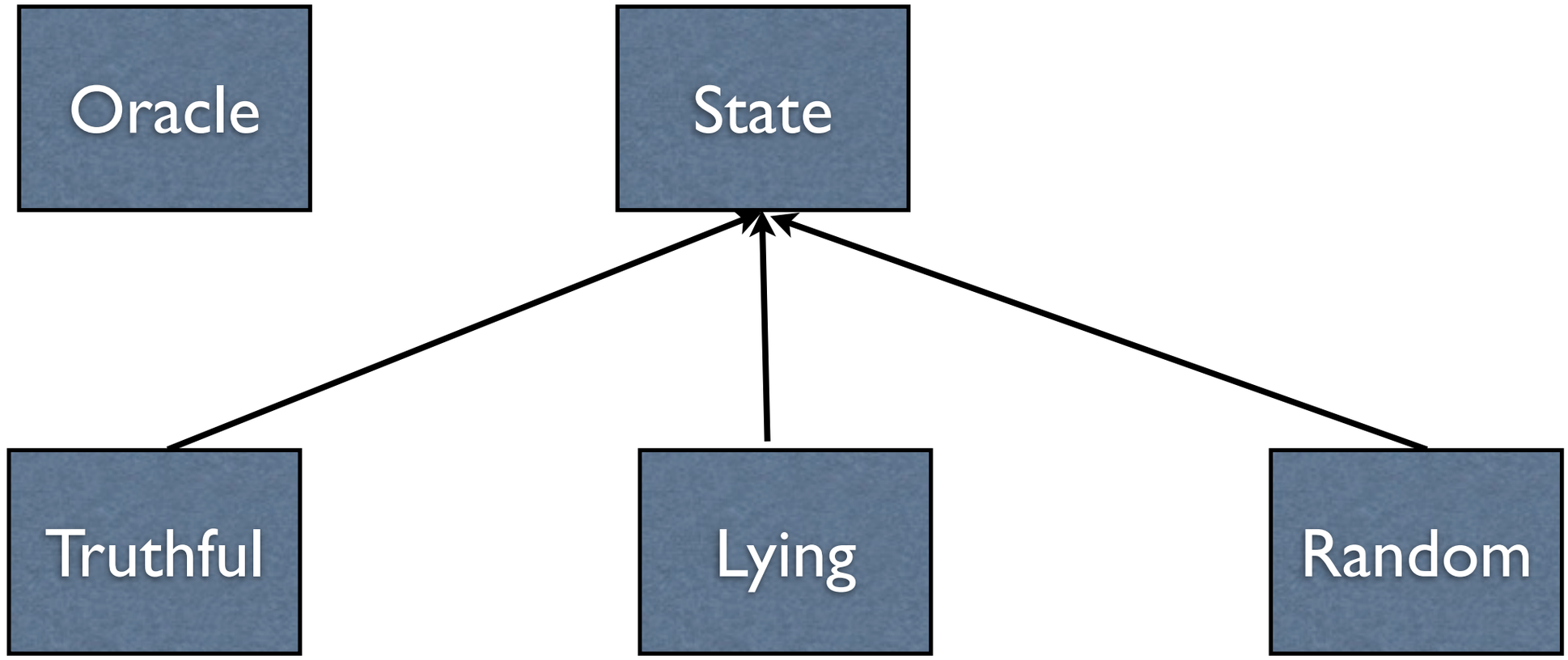

Context
state
request()
State
handle()
state->handle()
ConcreteStateA
handle()
ConcreteStateB
handle()




```
Oracle seer = new Truthful();
seer.willThereBeAFeeIncreaseNextYear();
seer = new Lying();
seer.willThereBeAFeeIncreaseNextYear();
```

Oracle

```
public class Oracle {
    private final TRUTH = "truth";
    private final LIE = "lie";
    private final RANDOM = "random";

    String state = TRUTH;

    public boolean willThereBeAFeeIncreaseNextYear() {
        if (state == TRUTH)
            blah
        else if (state == LIE)
            more blah
        else if (state == RANDOM)
            random blah
    }
```



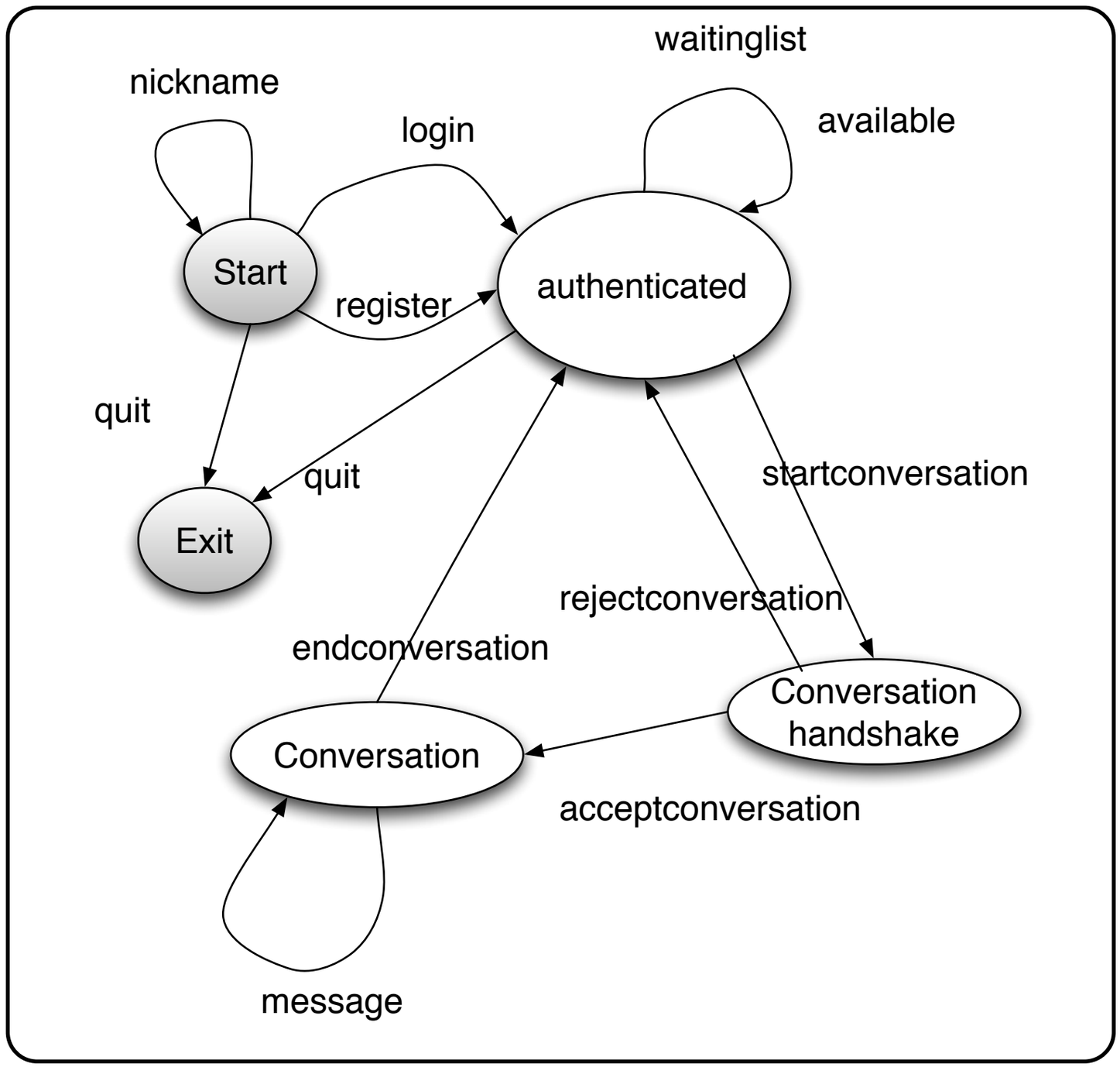

```
class Oracle {
        private State mode = set mode;

        public boolean willThereBeAFeeIncreaseNextYear() {
                return mode. willThereBeAFeeIncreaseNextYear():
        }
}
```

Example: SDChat Server

Commands

"available"
"login"
"register"
"nickname"
"startconversation"
"quit"
"waitinglist"
"acceptconversation"
"message"
"rejectconnection"
"endconversation"

Server States



Without States

```
public class SDChatServer {

    String handleNickname(String data) {
        if (state != START)
            return someErrorMessage();
        handle the main case
    }

    String handleLogin(String data) {
        if (state != START)
            return someErrorMessage();
        handle main case
    }

    String handleWaitinglist(String data) {
        if (state != AUTHENTICATED)
            return someErrorMessage();
        handle main case
    }
```

Who defines state Transitions - Context

```
class Context {
        private AbstractState state = new StartState();

        public Bar foo(int x) {
                int result = state.foo(x);
                if (someConditionHolds() )
                        state = nextState();
        return result;
        }
```

Who defines state Transitions - States

```
class Context {
        private AbstractState state = new StartState();

        public void foo(int x) {
                state = state.foo(x);
                }
```

What if foo returns a value?

Who defines state Transitions - States

```
class Context {
        private AbstractState state = new StartState();

        public int foo(int x) {
                return state.foo(x, this);
                }

        protected void setState(AbstractState newState) {
                state = newState;
        }
```

Sharing State Objects

Stateless state

- State objects without fields
- Can be shared by multiple contexts

Can store date in context and pass as arguments

Large number of state transitions can be expensive

Only create state once & reuse same object

Changing Class - No Need for Context

Language Dependent Feature

Smalltalk & Lisp

```
class Truthful extends Oracle {

    public boolean foo(int x) {
        int result = state.foo(x);
        this.changeClassTo(Random);
        return result;
    }
```

State Verses Strategy

Rate of Change

Strategy

Context usually contains just one strategy object

State

Context often changes state objects

State Verses Strategy

Exposure of Change

Strategy

Strategies all do the same thing

Client do not see change in behavior of Context

State

States act differently

Client see the change in behavior