OO Design Patterns

Coding Cleverly

Why design pattern

Design patterns make code :

- **Reusable**
- **Common** building blocks most programmers know
- Add **functionality** in the simplest way

See Repository for code examples!

Types of Design patterns

Creational

Create objects but hide details of **constructors**

Structural

Concern **composition**, **aggregation**, **inheritance**

Behavioral

Concerning **interfaces** between objects

Today’s Agenda

Patterns we will cover

Observer

Strategy

Factory

Decorator

Adapter

Singleton

Proxy

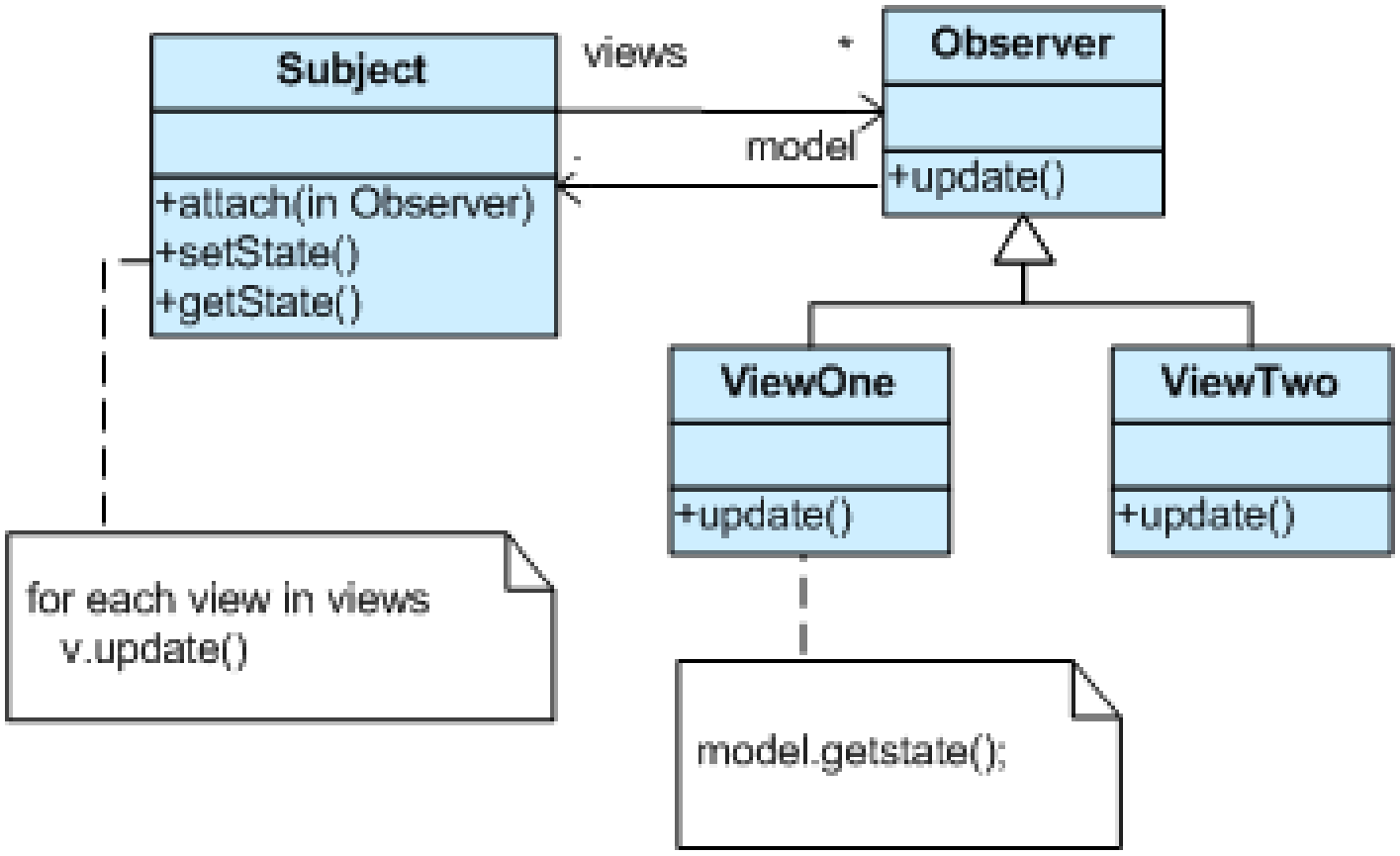
Observer

Problem:

There is a **one to many** relationship where the many need to know information from the one. Is it **scalable** for many to be polling the one?

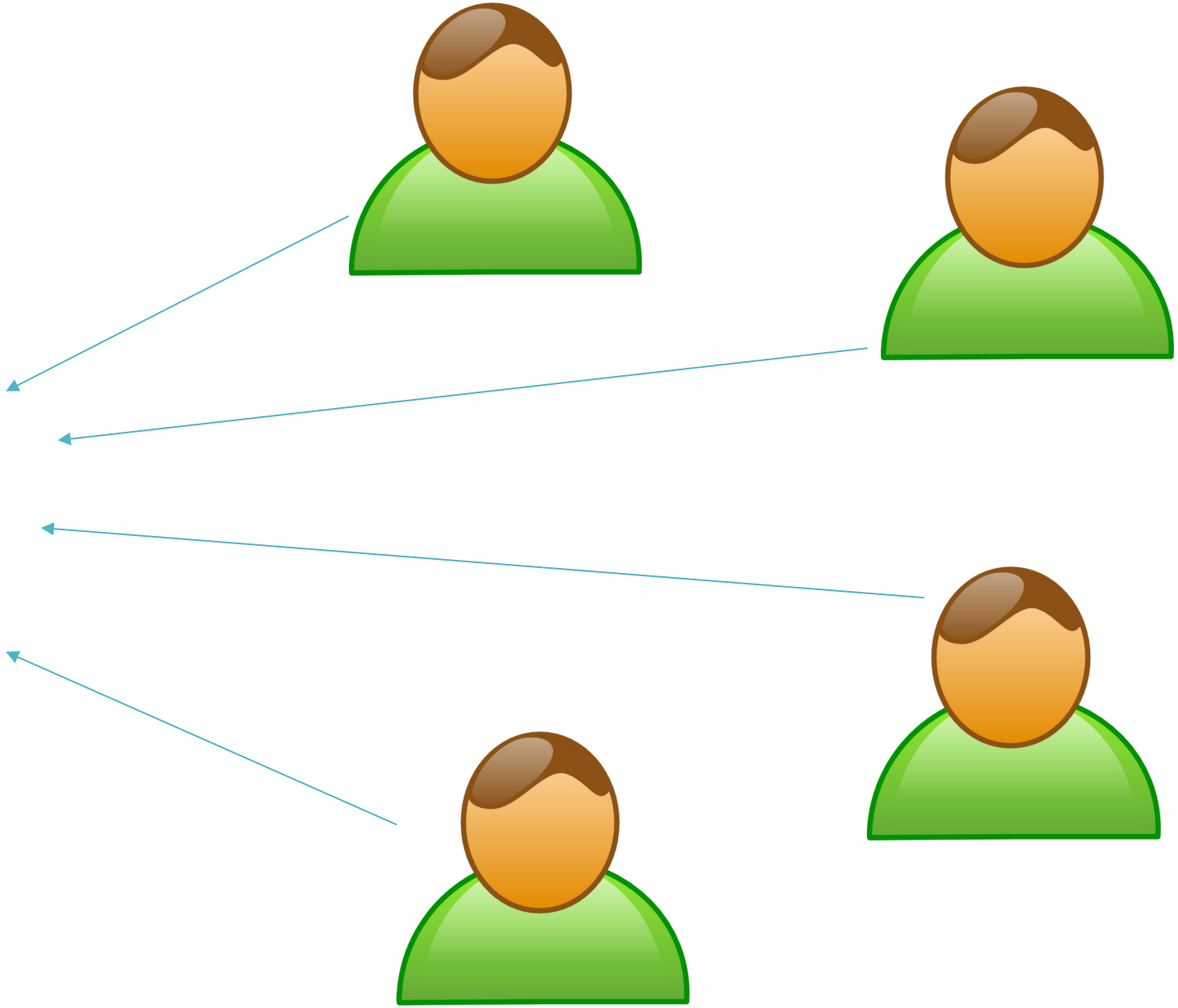
Example: Think of designing **push notifications** on mobile phones

Observer

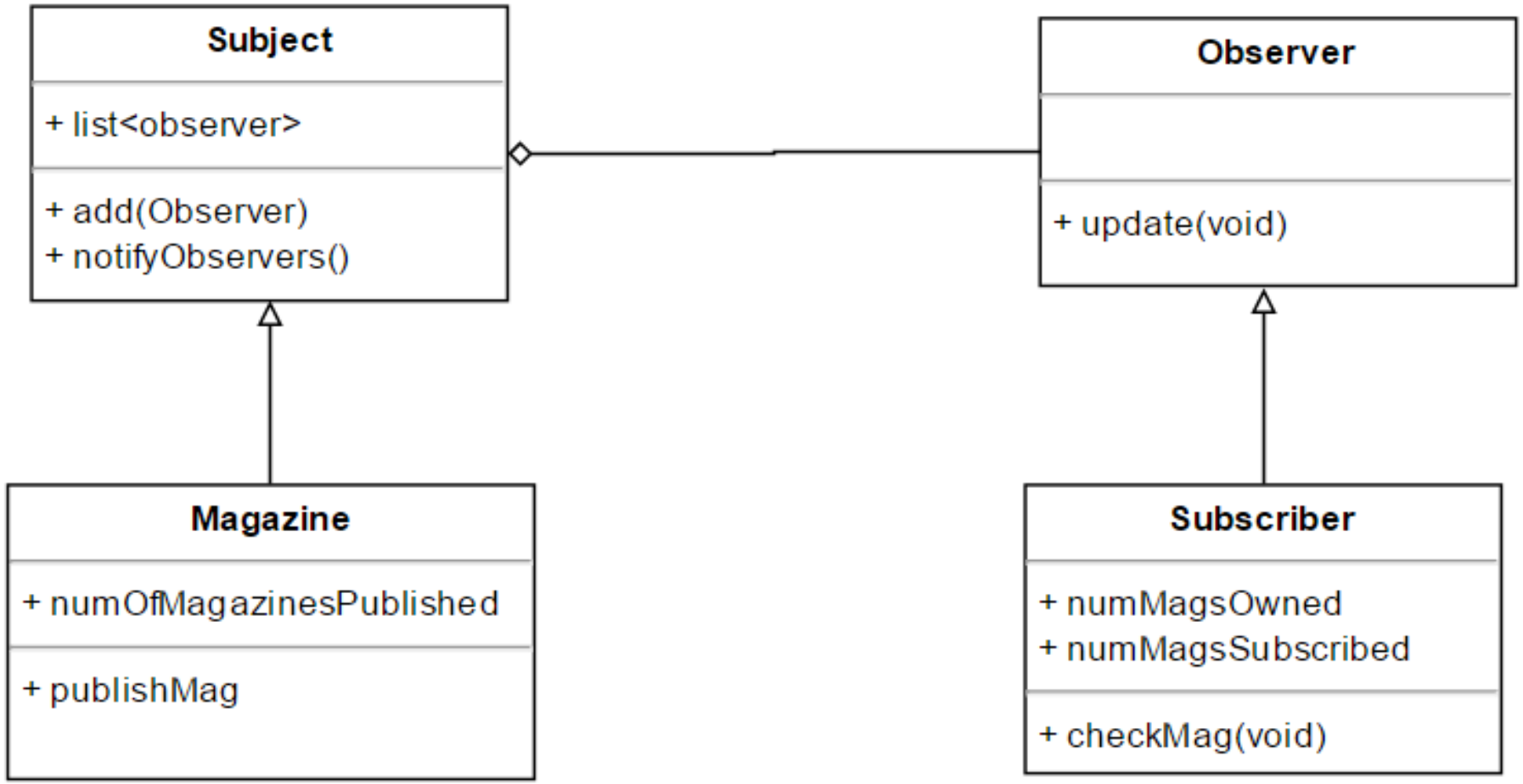

Subject
views
*
Observer
model
+attach(in Observer)
+setState()
+getState()
+update()
ViewOne
+update()
ViewTwo
+update()
for each view in views
v.update()
model.getstate();

Observer

Billboard
DON'T MISS! MUSIC & ADVERTISING CONFERENCE
DEVO REINVENTS THE COMEBACK
APPLE, THE CLOUD AND THE CALM BEFORE THE STORM
MACY GRAY 40 AND FEARLESS
ARTISTS SPLIT ON BOYCOTT OF ISRAEL
EXCLUSIVE!
M.I.A.
On Her New Album, Trufflegate And The Art Of Controversy
CHART BEAT
JACK JOHNSON
KATY PERRY
INDIA
LUDACRIS



Observer

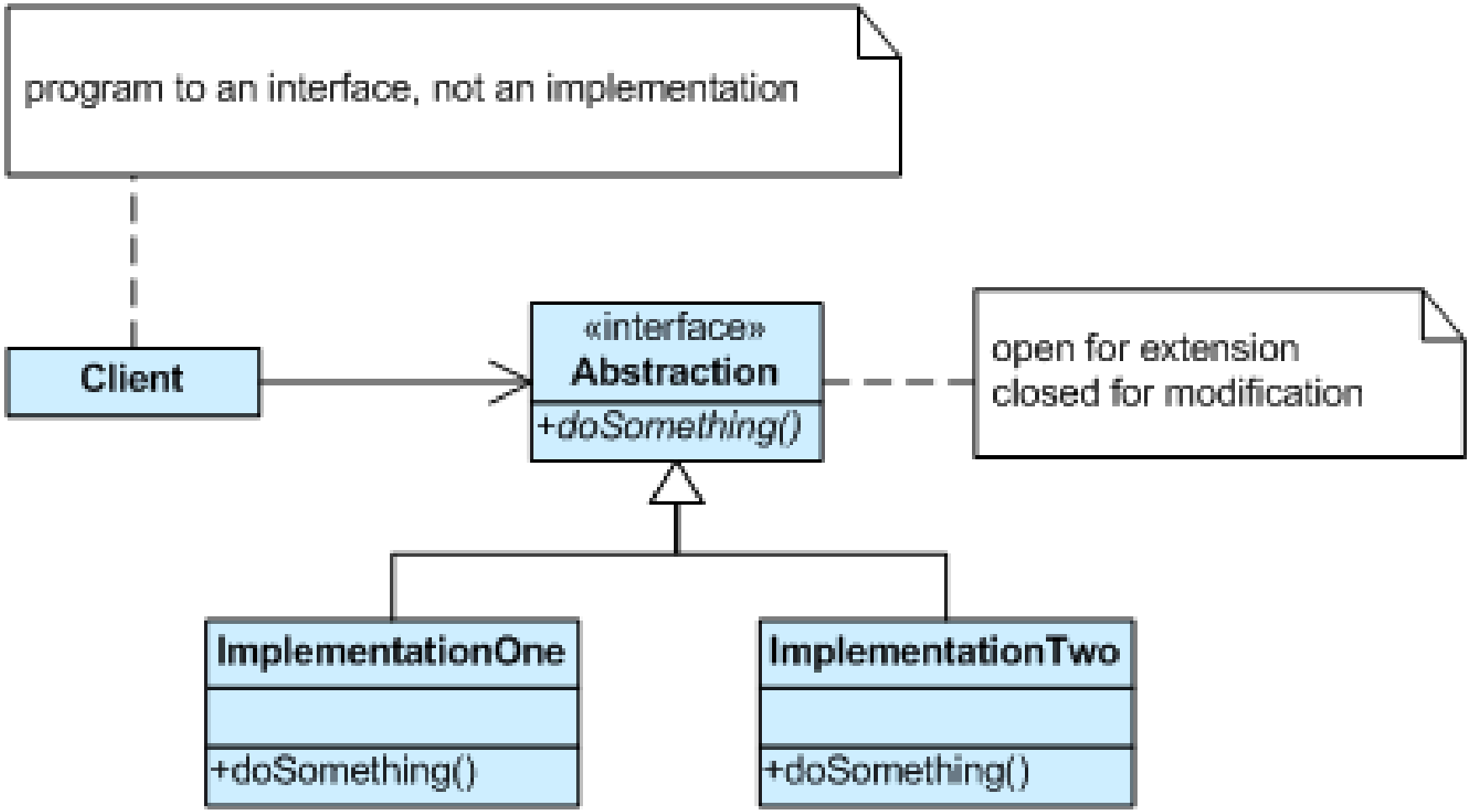

Subject
+ list<observer>
+ add(Observer)
+ notifyObservers()
Observer
+ update(void)
Magazine
+ numOfMagazinesPublished
+ publishMag
Subscriber
+ numMagsOwned
+ numMagsSubscribed
+ checkMag(void)

Strategy

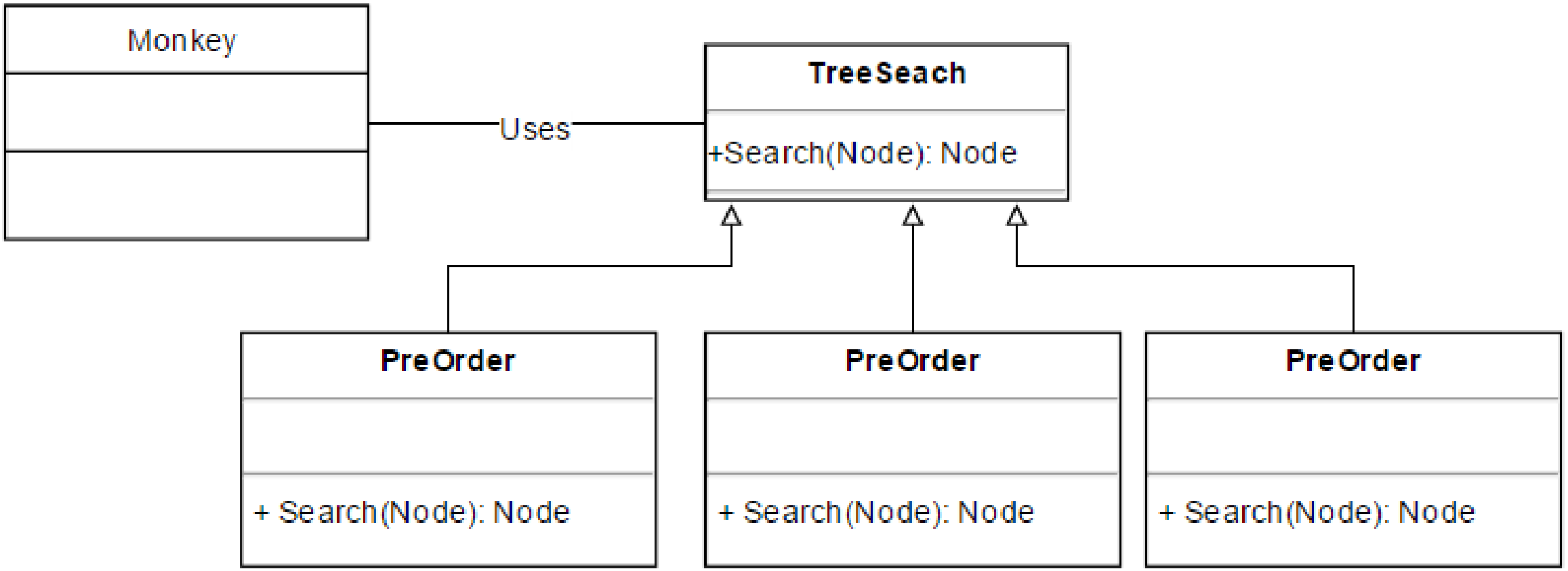
Problem:

The **same object** needs to have **different behaviours** at different times when running the program

Strategy


program to an interface, not an implementation
Client
«interface»
Abstraction
+doSomething()
open for extension
closed for modification
ImplementationOne
+doSomething()
ImplementationTwo
+doSomething()

Strategy

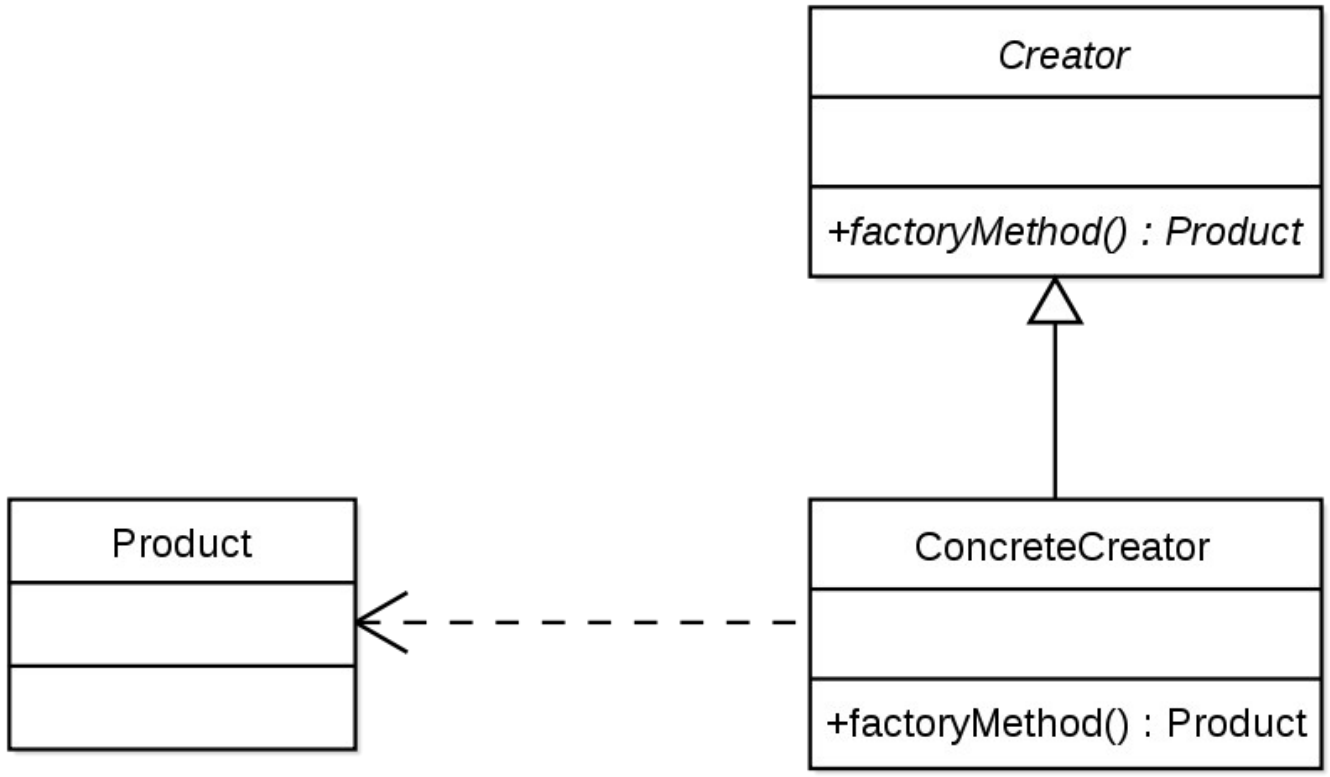

Monkey
Uses
TreeSeach
+Search(Node): Node
PreOrder
+ Search(Node): Node
PreOrder
+ Search(Node): Node
PreOrder
+ Search(Node): Node

Factory

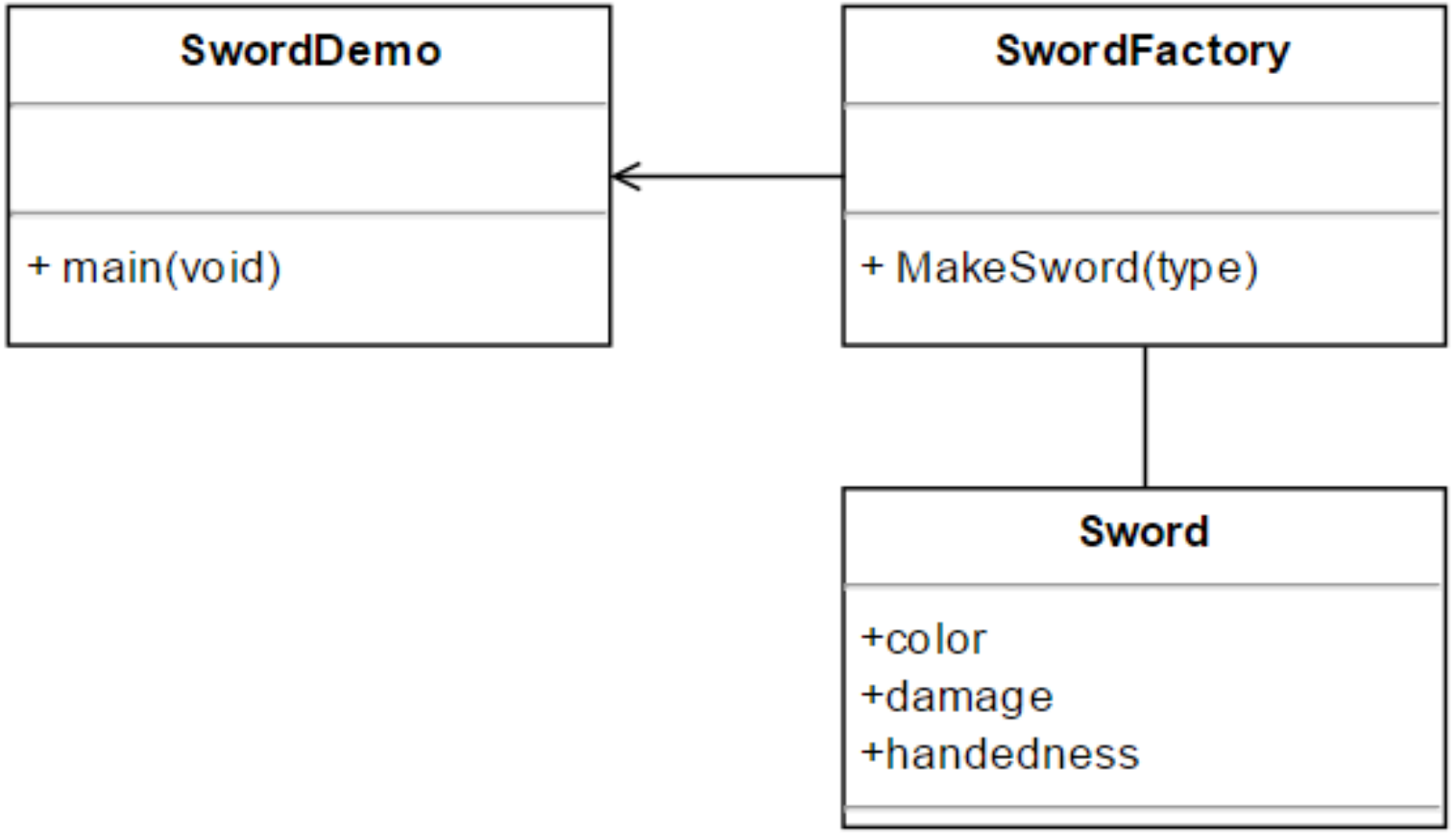
Problem:

How can we **create objects at runtime** without cluttering code with many if else statements

Factory


Creator
+factoryMethod() : Product
Product
ConcreteCreator
+factoryMethod() : Product

Factory


SwordDemo
+ main(void)
SwordFactory
+ MakeSword(type)
Sword
+color
+damage
+handedness

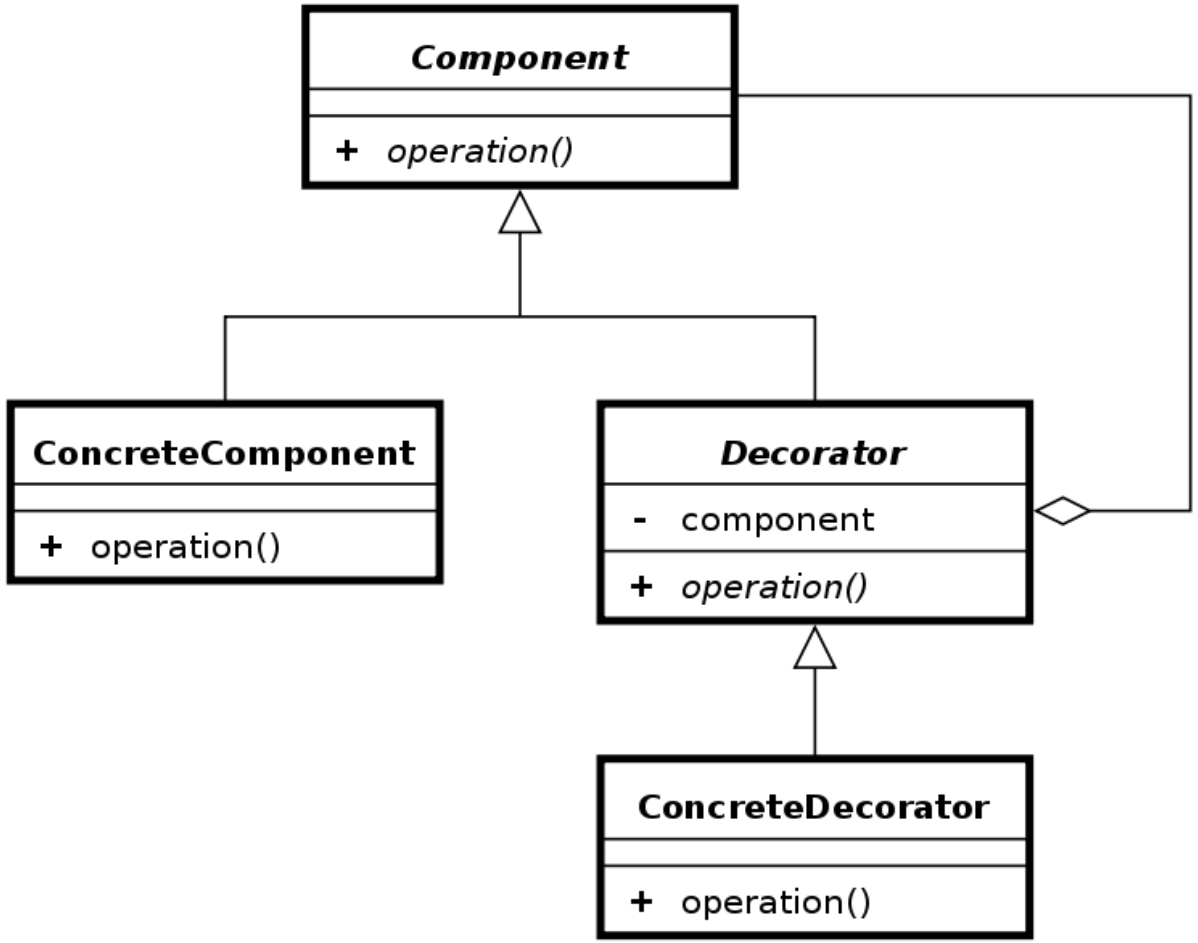
Decorator Pattern

Problem:

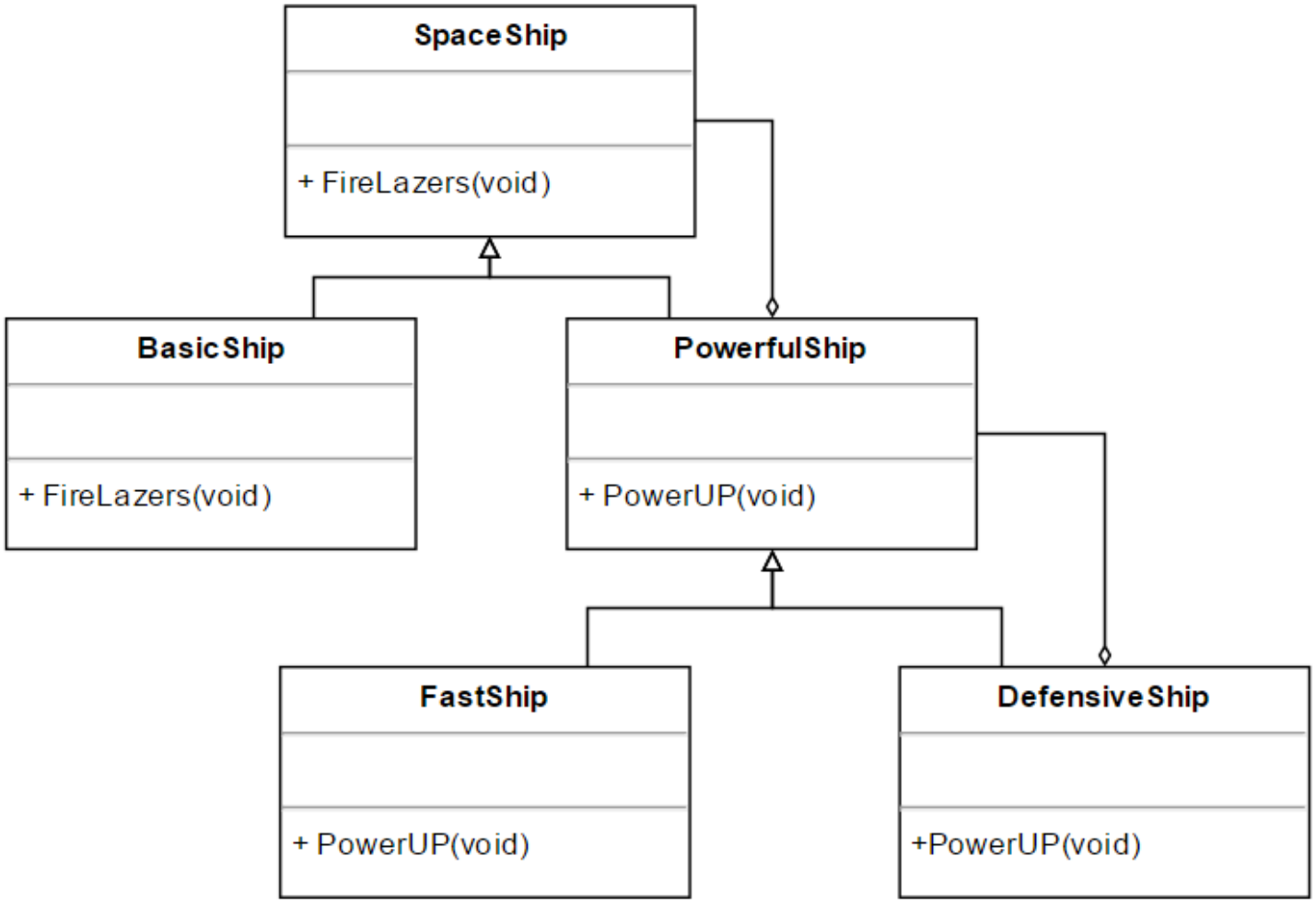
How can we add **functionality** to a class at **runtime** instead of using inheritance at compiletime?

Example: See Java inputstream

Decorator Pattern



Decorator Pattern

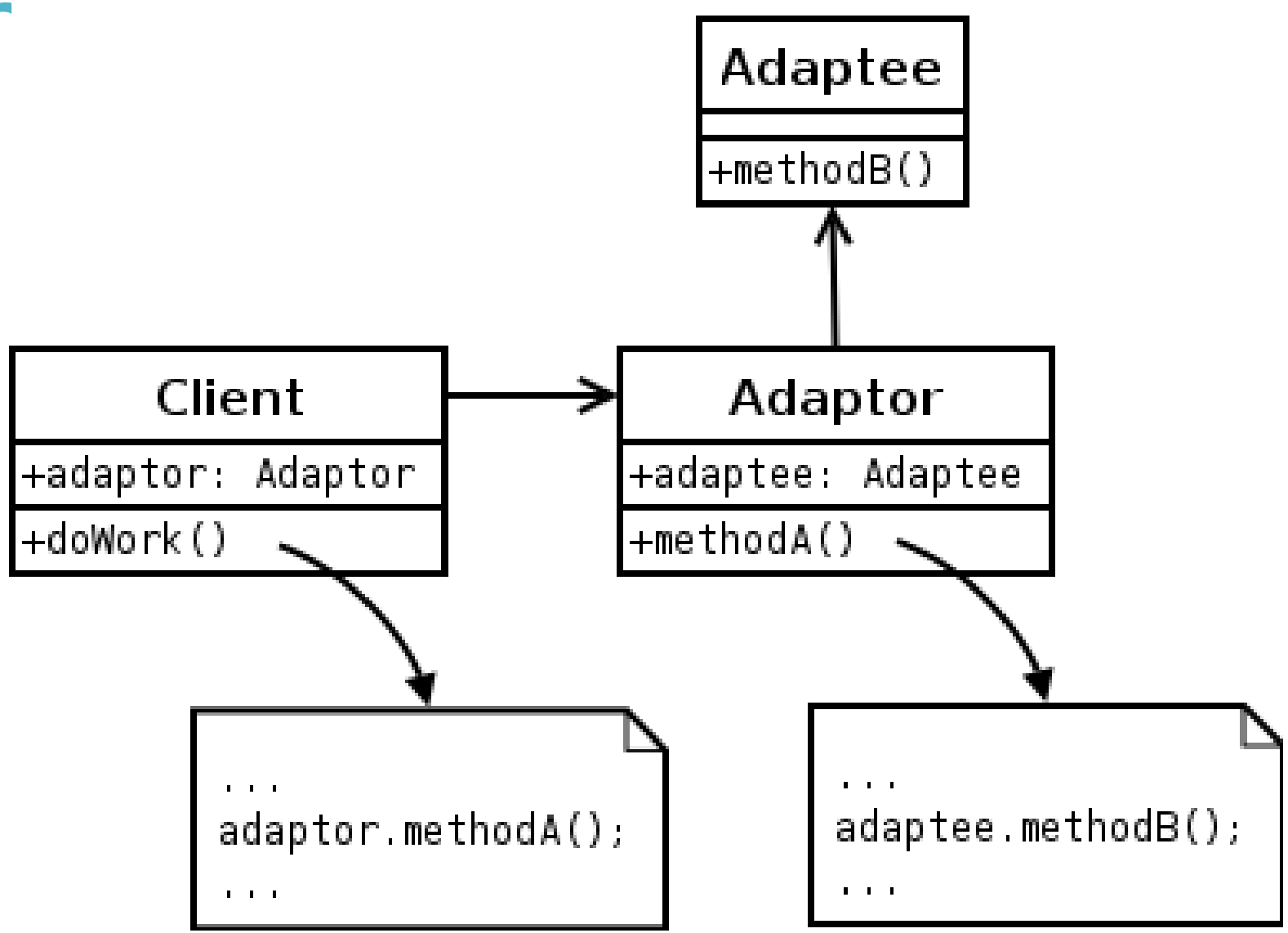


Adapter

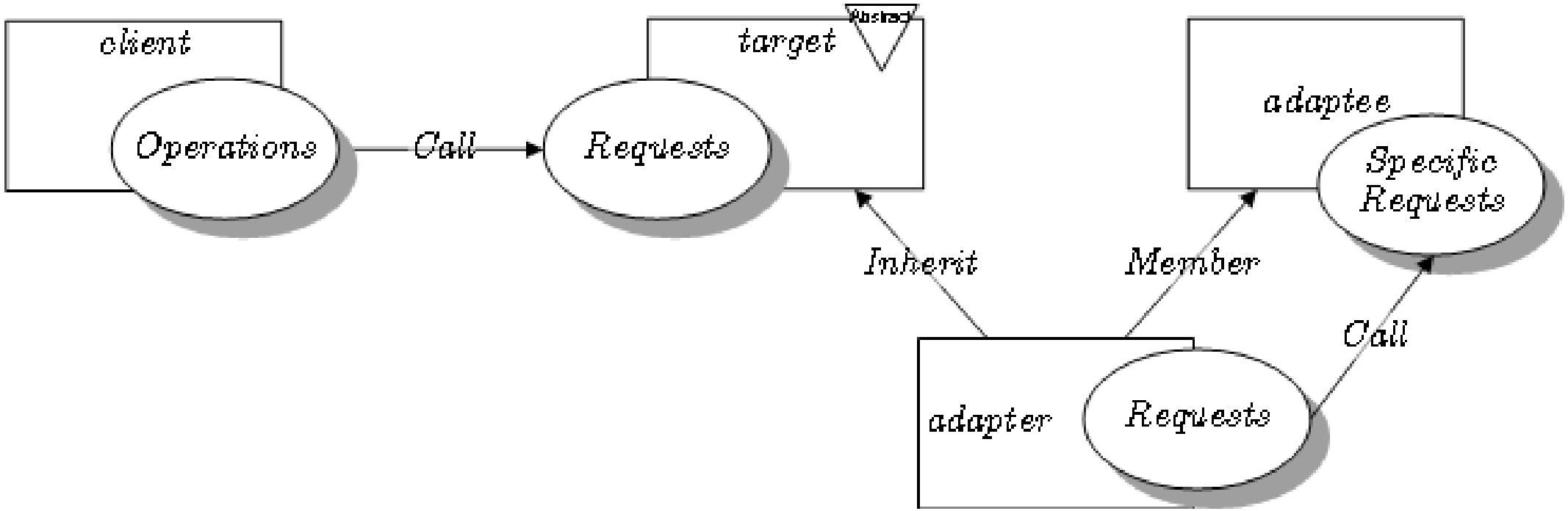
Problem:

How can we make an **old piece of code** (eg. code taken from the internet) function with our **current project**?

Adapter


Adaptee
+methodB()
Client
+adaptor: Adaptor
+doWork()
Adaptor
+adaptee: Adaptee
+methodA()
...
adaptor.methodA();
...
...
adaptee.methodB();
...

Adapter


client
Operations
Call
target
Abstract
Requests
adaptee
Specific
Requests
Inherit
Member
Call
adapter
Requests

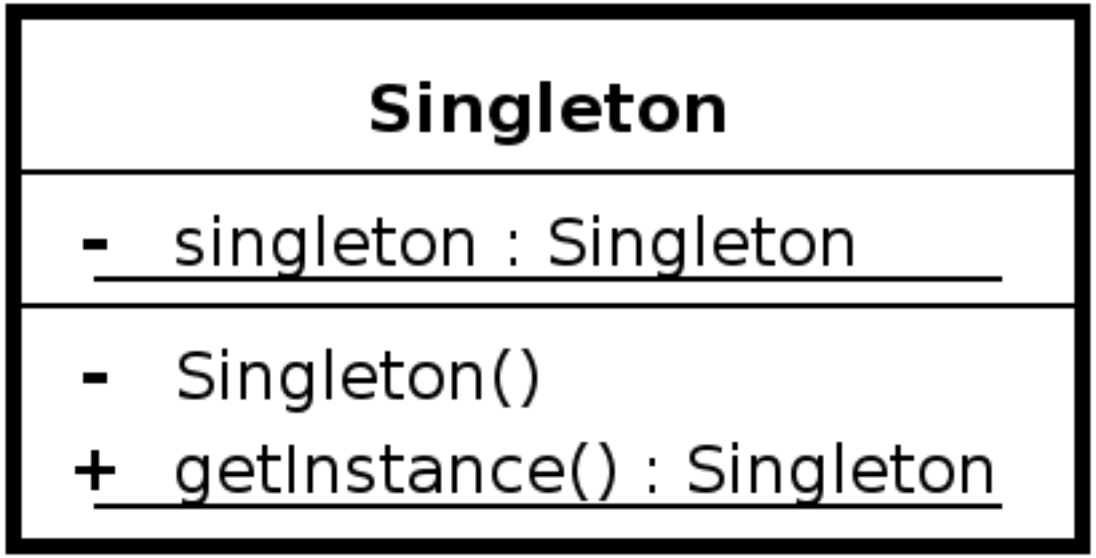
Singleton

Problem:

How can we make sure an object gets **created once** only during the program.

Bonus: if its created once only, can all other classes know and use this object?

Singleton


Singleton
- singleton : Singleton
- Singleton()
+ getInstance() : Singleton

Singleton

Steps:

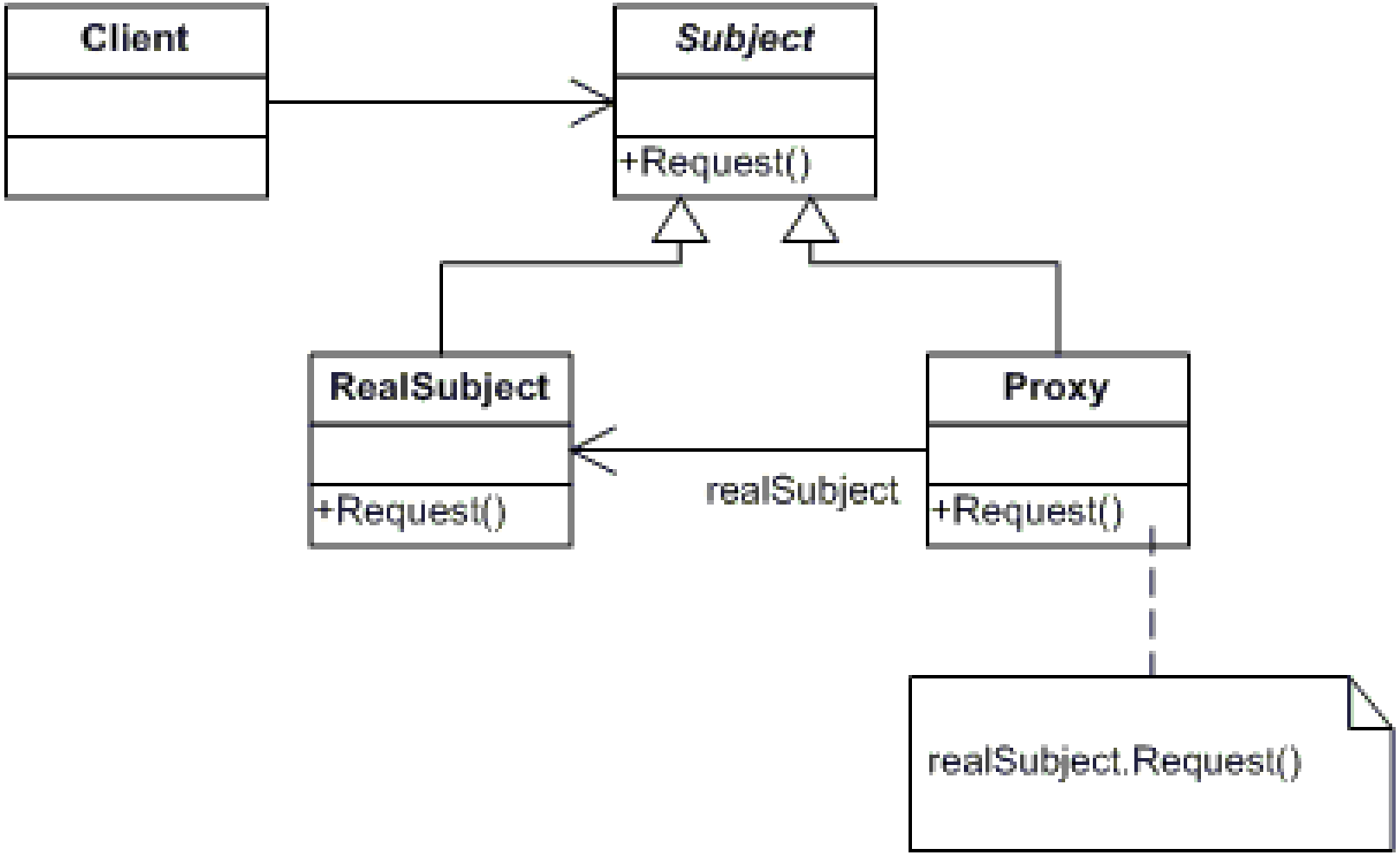
1. Add a static instance of the class
2. Make constructor Private
3. Make a static getter method for the instance

Proxy

Problem:

How can we hide complexity of a class?

Proxy


Client
Subject
+Request()
RealSubject
+Request()
realSubject
Proxy
+Request()
realSubject.Request()

Proxy

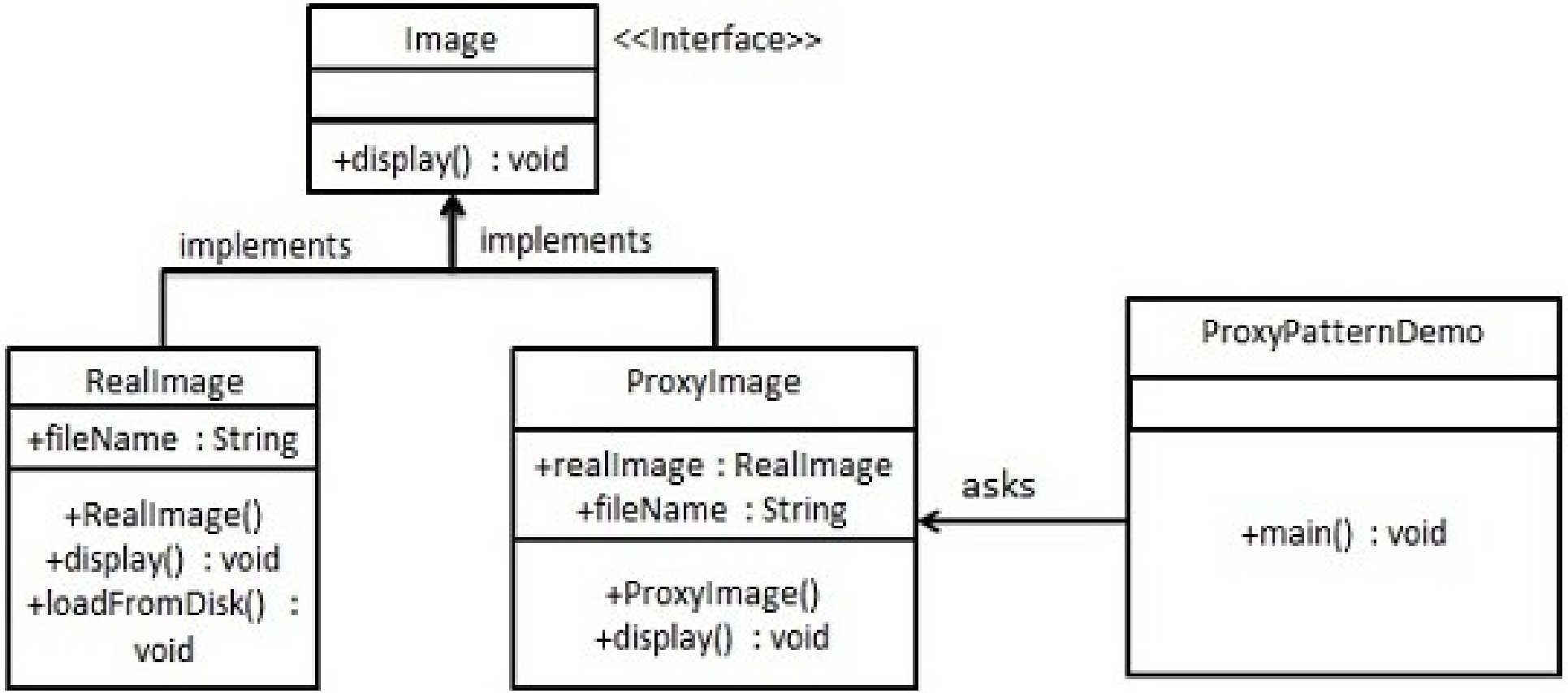


Image
<<Interface>>
+display() : void
implements
implements
RealImage
+fileName : String
+RealImage()
+display() : void
+loadFromDisk() : void
ProxyImage
+realImage : RealImage
+fileName : String
+ProxyImage()
+display() : void
asks
ProxyPatternDemo
+main() : void

References

1. http://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm
2. Factory: https://www.youtube.com/watch?v=ub0DXaeV6hA