Ingegneria del Software

Corso di Laurea in Informatica per il Management

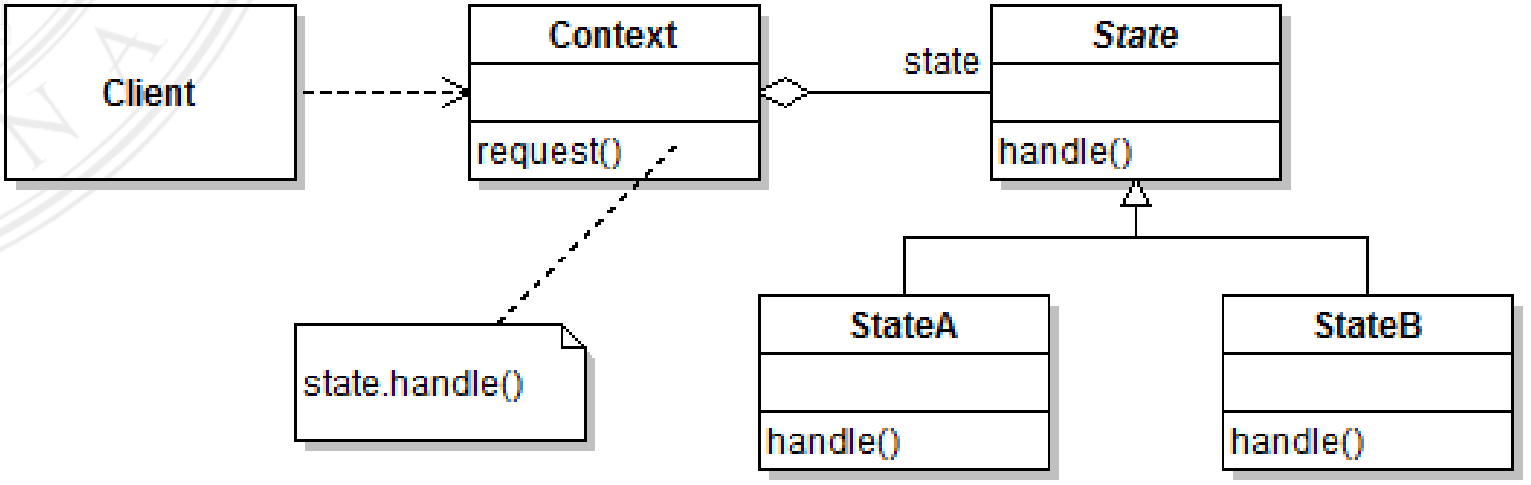
Design Patterns
part 2

Davide Rossi
Dipartimento di Informatica
Università di Bologna

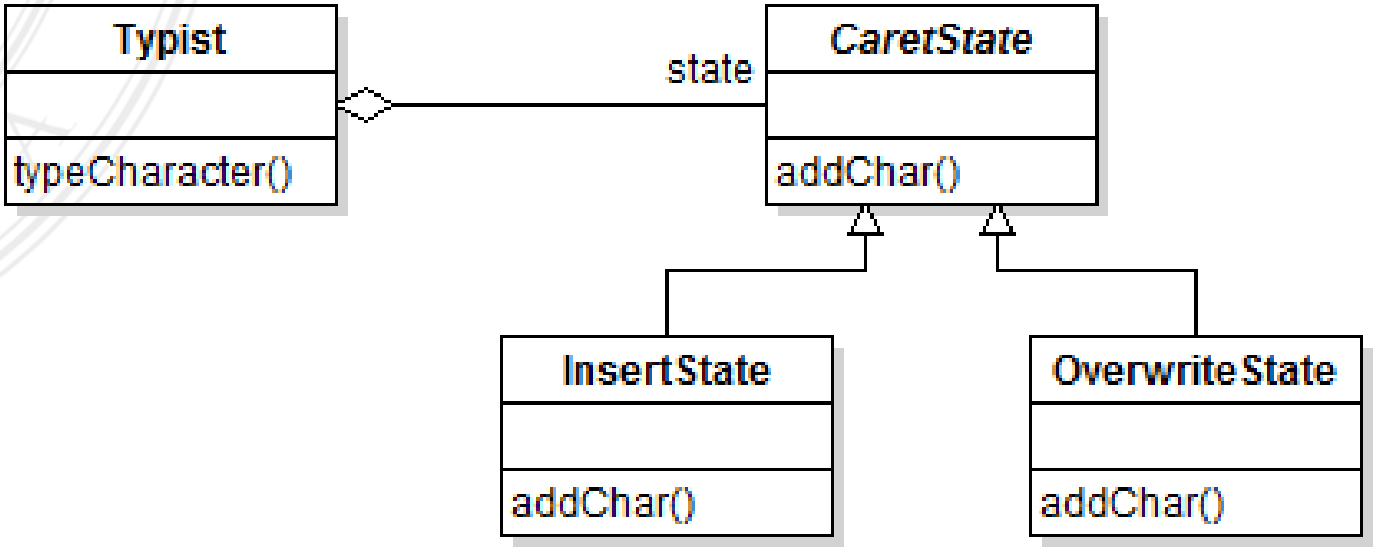
GoF: State

- Problem: how can I change the behavior of an object depending on its state with a high-quality solution?
- State: allow an object to alter its behavior when its internal state changes.
- The object will appear to change its class.

GoF: State


Client
Context
request()
state
State
handle()
state.handle()
StateA
handle()
StateB
handle()

State example

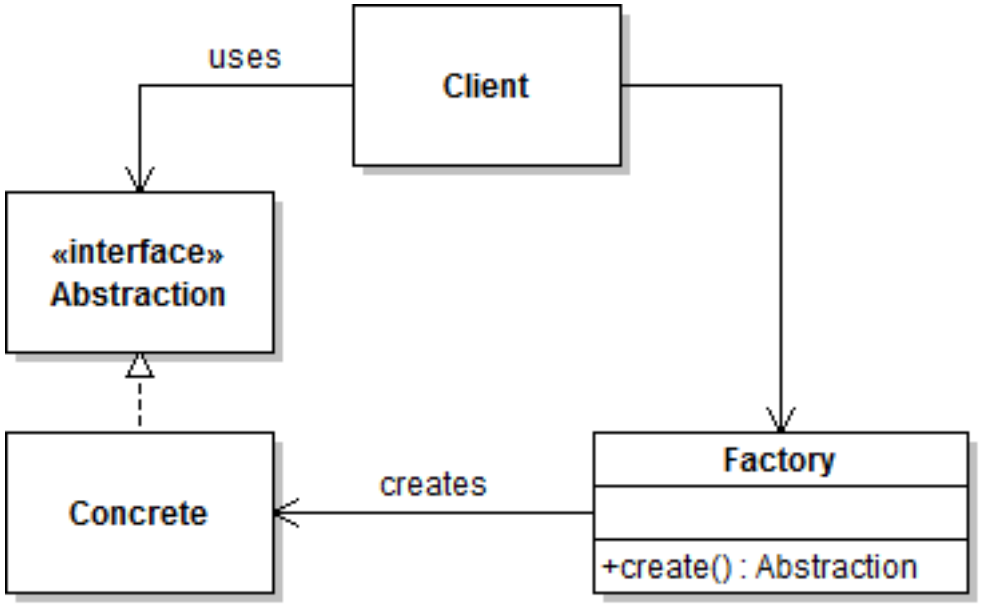


New considered armful

- Allocates memory each time a client needs a reference
- No control on instances lifecycle
- Changes in the constructor of the concrete class breaks clients (violates OCP)
- Creates a dependency between the user and the concrete class implemented by the reference (**violates DIP**)

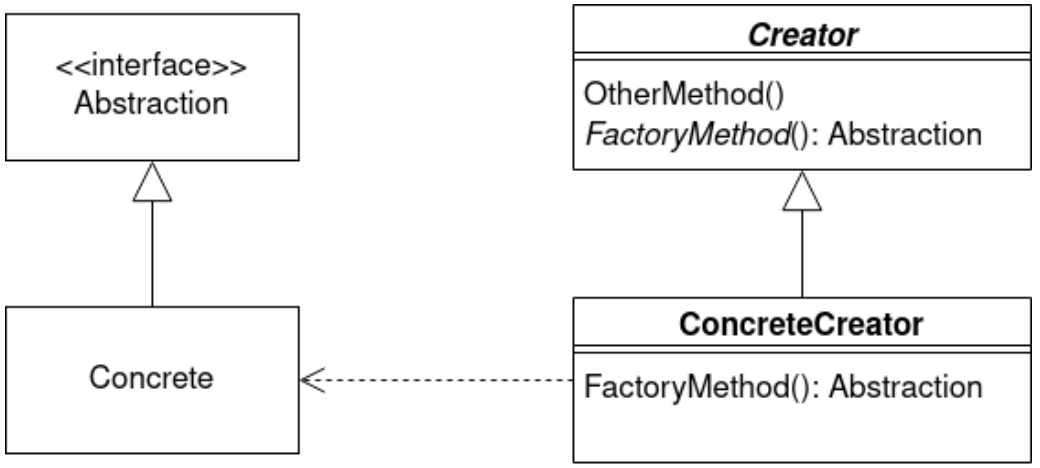
Factory

- Decouples client from instantiation process
- Refers to the newly created object through a common interface



GoF: Factory method

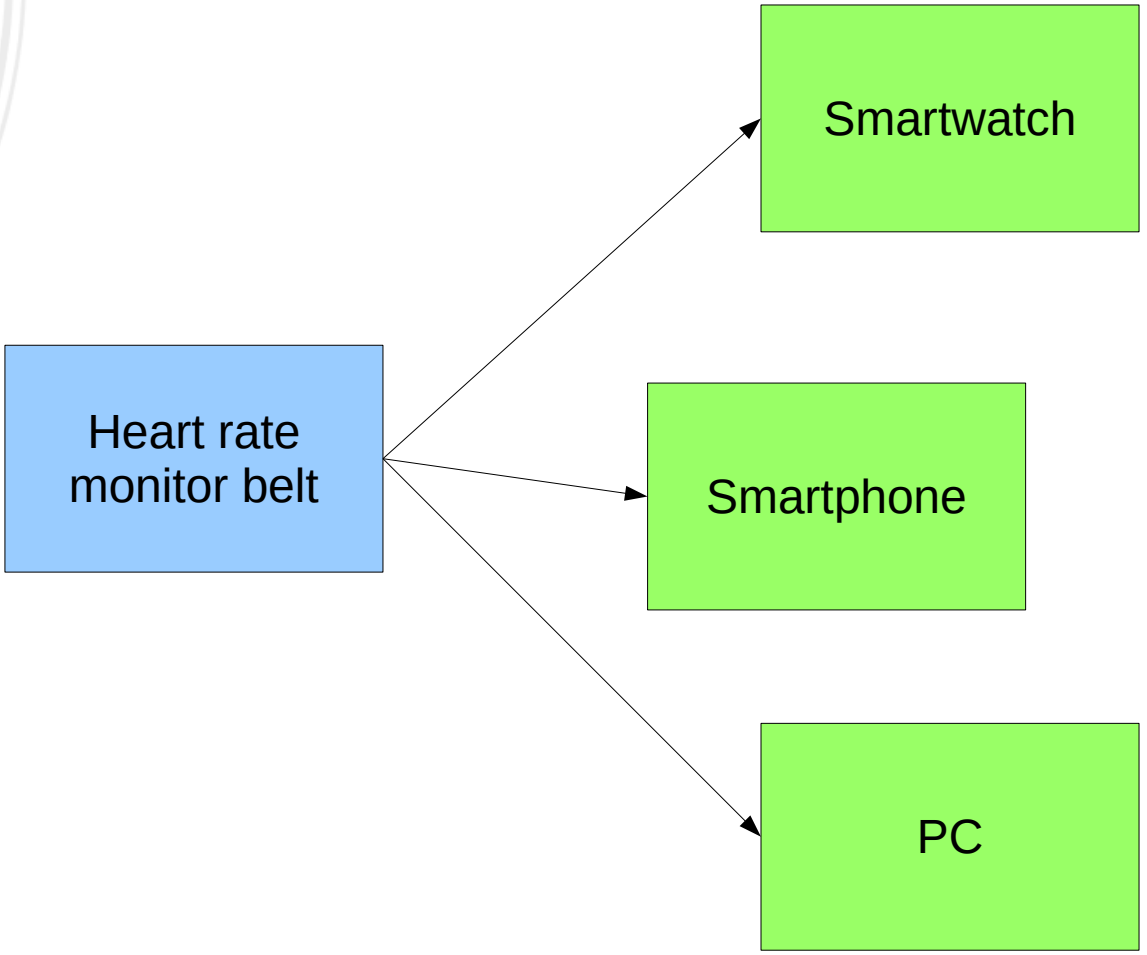
- Define an interface for creating an object, but let subclasses decide which class to instantiate
- Factory Method lets a class defer instantiation to subclasses



Factory Method

- A popular variation collapses the abstraction and the creator putting the factoryMethod inside the abstraction (that becomes an abstract class)
- Java API examples:
  - `java.util.Calendar#getInstance()`
  - `java.text.NumberFormat#getInstance()`
  - `java.nio.charset.Charset#forName()`

The notification problem

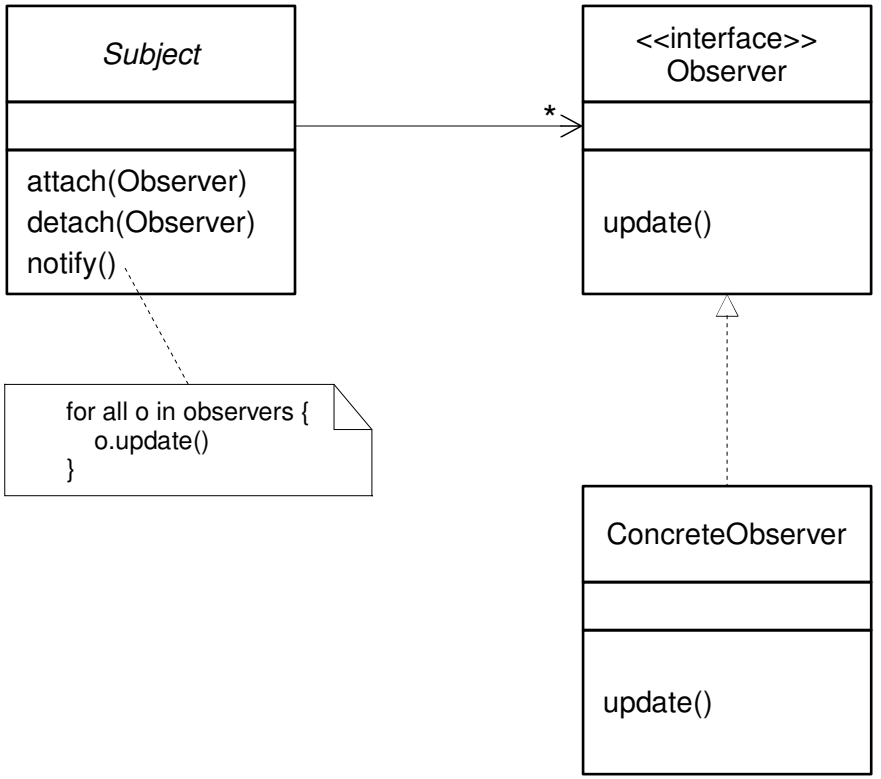


The notification problem

- New observers can appear at a later time
- New types of observers can appear at a later time
- When a class “notifies” another it is exposed to its interface (thus it depends on that interface)
- ISP: The dependency of one class to another one should depend on the smallest possible interface
- DIP: Depend upon Abstractions
- PV: Identify points of predicted variation or instability; assign responsibilities to create a stable interface around them.

GoF: Observer

- Define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically.

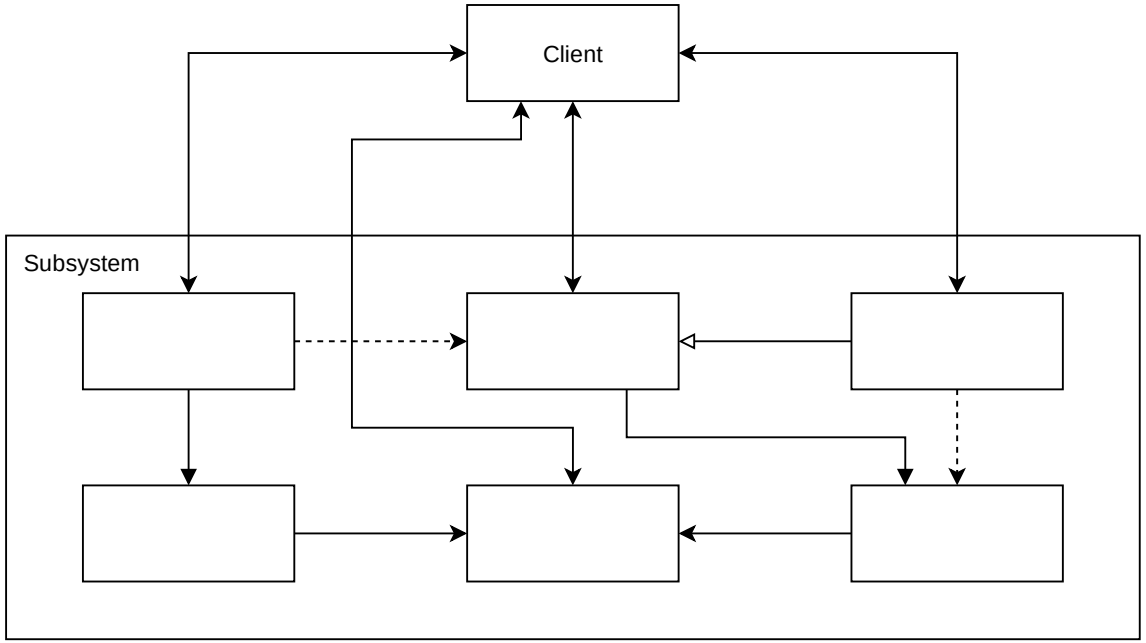


Observer in Java

```
java.util.Observer
   public interface Observer {
        void update(Observable o, Object arg)
   }
java.util.Observable
   public class Observable {
        public void addObserver(Observer o);
        public void deleteObserver(Observer o);
        public void notifyObservers();
        protected void setChanged();
        …
   }
```

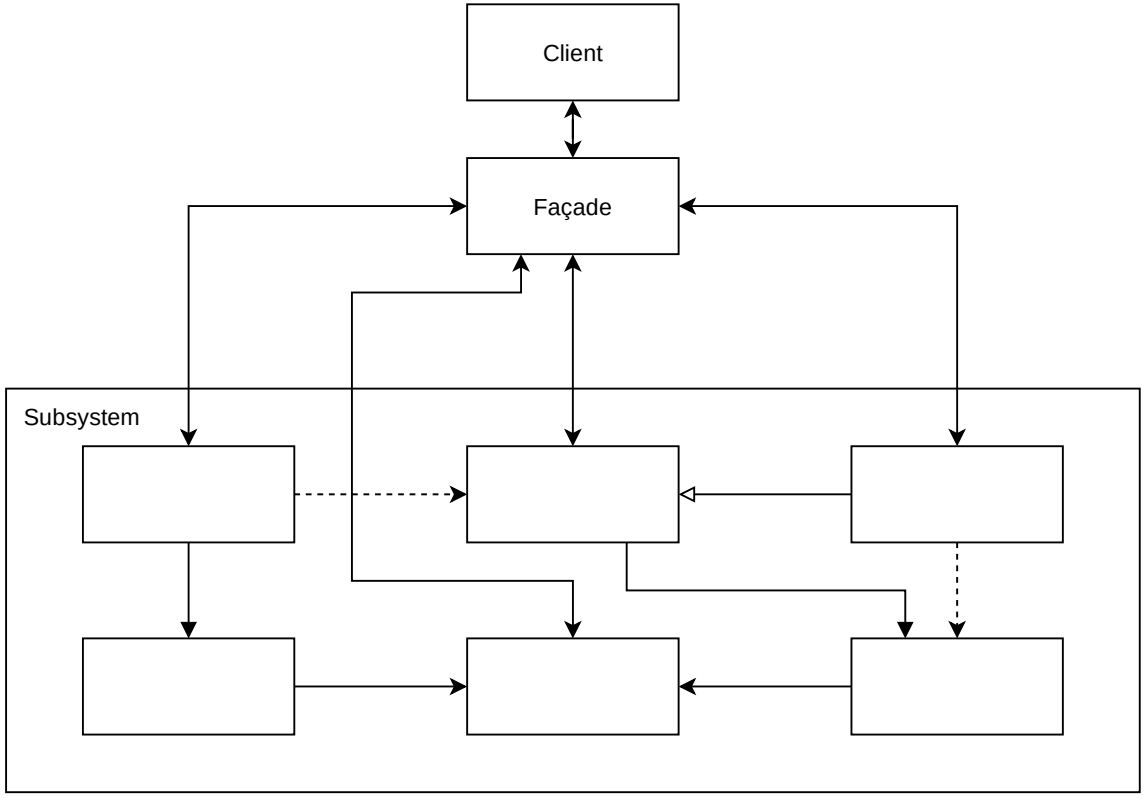
GoF: Façade

- Problem: how can I isolate a client from the internal complexity of a subsystem?



GoF: Façade

- Façade: provide a unified interface to a set of interfaces in a subsystem.
- Facade defines a higher-level interface that makes the subsystem easier to use.



Resources

Books

- Eric Freeman & Elisabeth Robson, **Head First Design Patterns: Building Extensible and Maintainable Object-Oriented Software** (2nd Edition), O'Reilly

Online:

- http://www.vincehuston.org/dp/
- http://www.oodesign.com/
- https://refactoring.guru/design-patterns/
- http://www.informit.com/articles/article.aspx?p=1404056