

Design Pattern

(OOProg chapter 3)

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S O L I D

- **S** Single Responsibility -> High cohesion for classes
- **O** Open / Closed -> open for extensions
- **L** Liskov Substitution
-> Subclasses 'same' behaviour e.g. pre- and post conditions
- **I** Interface Segregation -> Separate interfaces (minimize)
- **D** Dependency Injection/Inversion -> parameter, methods, objects

Design Pattern - Description

Name – common term – a technical term/concepts among programmers

Problem – description of the problem

Solution – Only! A Design solution (UML diagrams)

Design Pattern – GRASP (General Responsibility Assignment Software Patterns)

- Information Expert
- Creator Pattern
- Controller
- Low Coupling
- High Cohesion

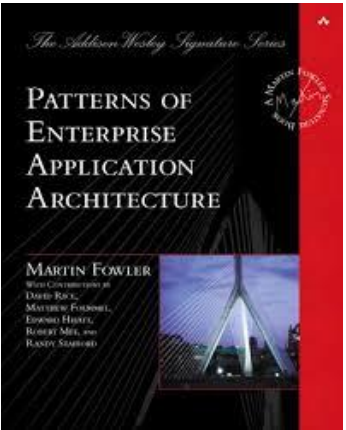
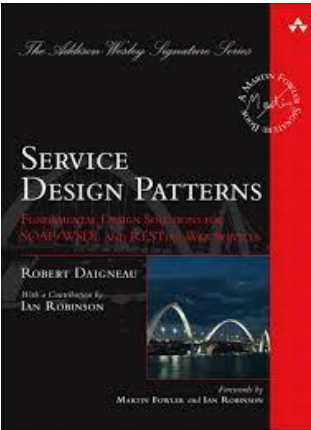
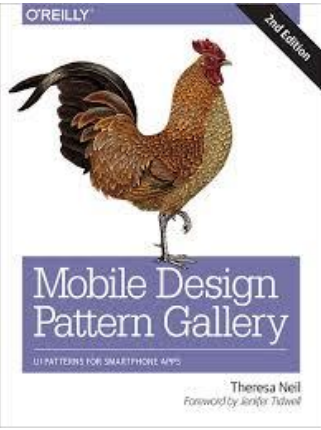
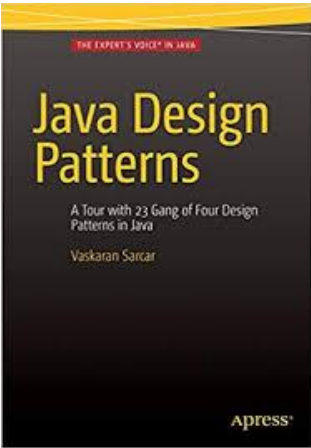
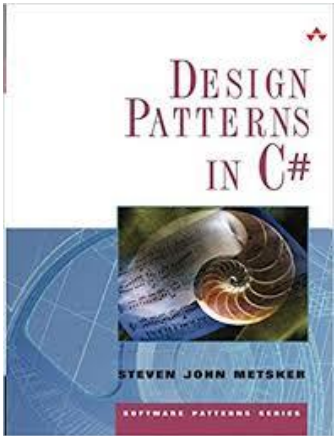
Design Pattern – other patterns from 1st year

- Singleton - only one object
- Controller - PageModel

Patterns from this course

- Template - reuse og code
- State - different behaviour depending on states

Books of Design Patterns

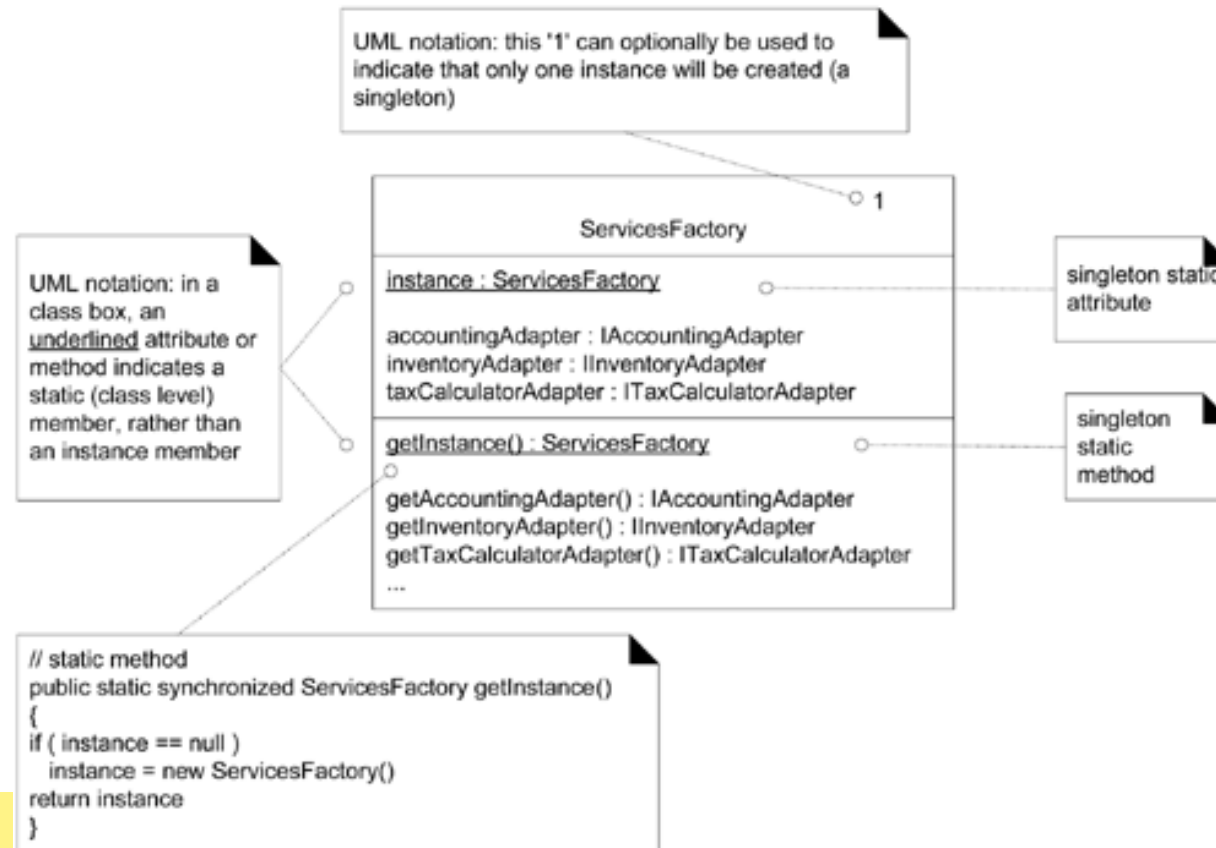


Design Pattern – Categories

- **Creational Patterns**
 - Factory, Abstract Factory, Singleton ...
- **Structural Patterns**
 - Adaptor, Proxy, Facade, Decorator ...
- **Behavioral Patterns**
 - Observer, Template, Strategy, State ...
- **Concurrency patterns**
 - Monitor, Lock, Thread Pool

Design Pattern – Creational Patterns

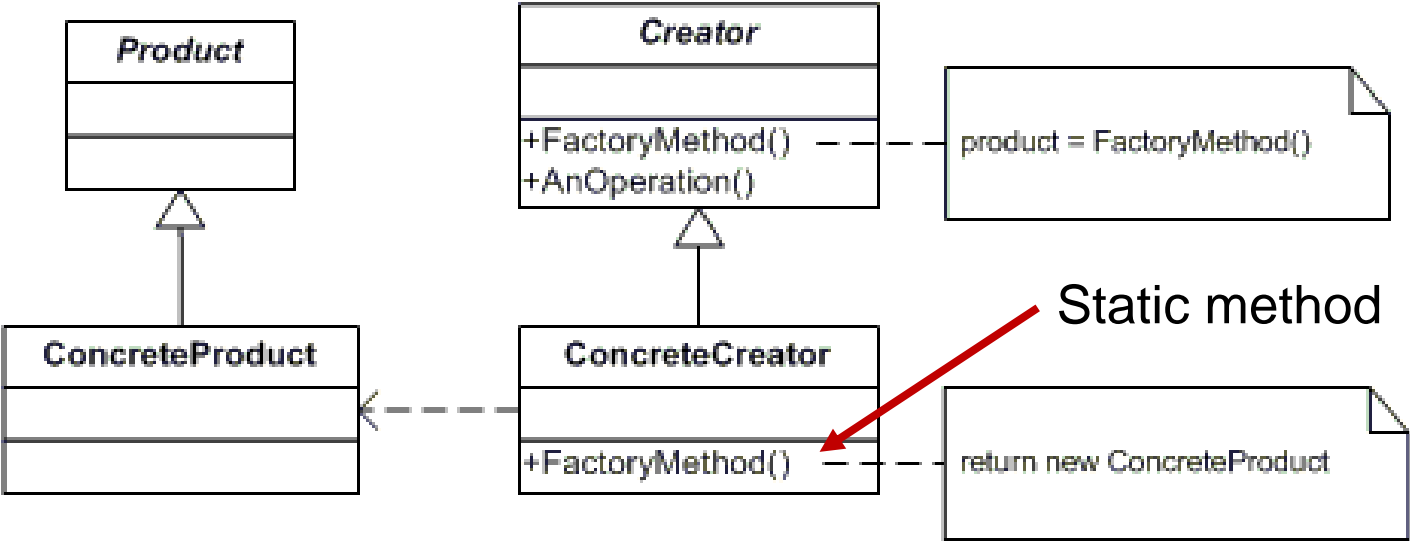
- **Singleton**
 - Problem: Exactly one instance of a class is allowed.
 - Solution:



Design Pattern – Creational Patterns

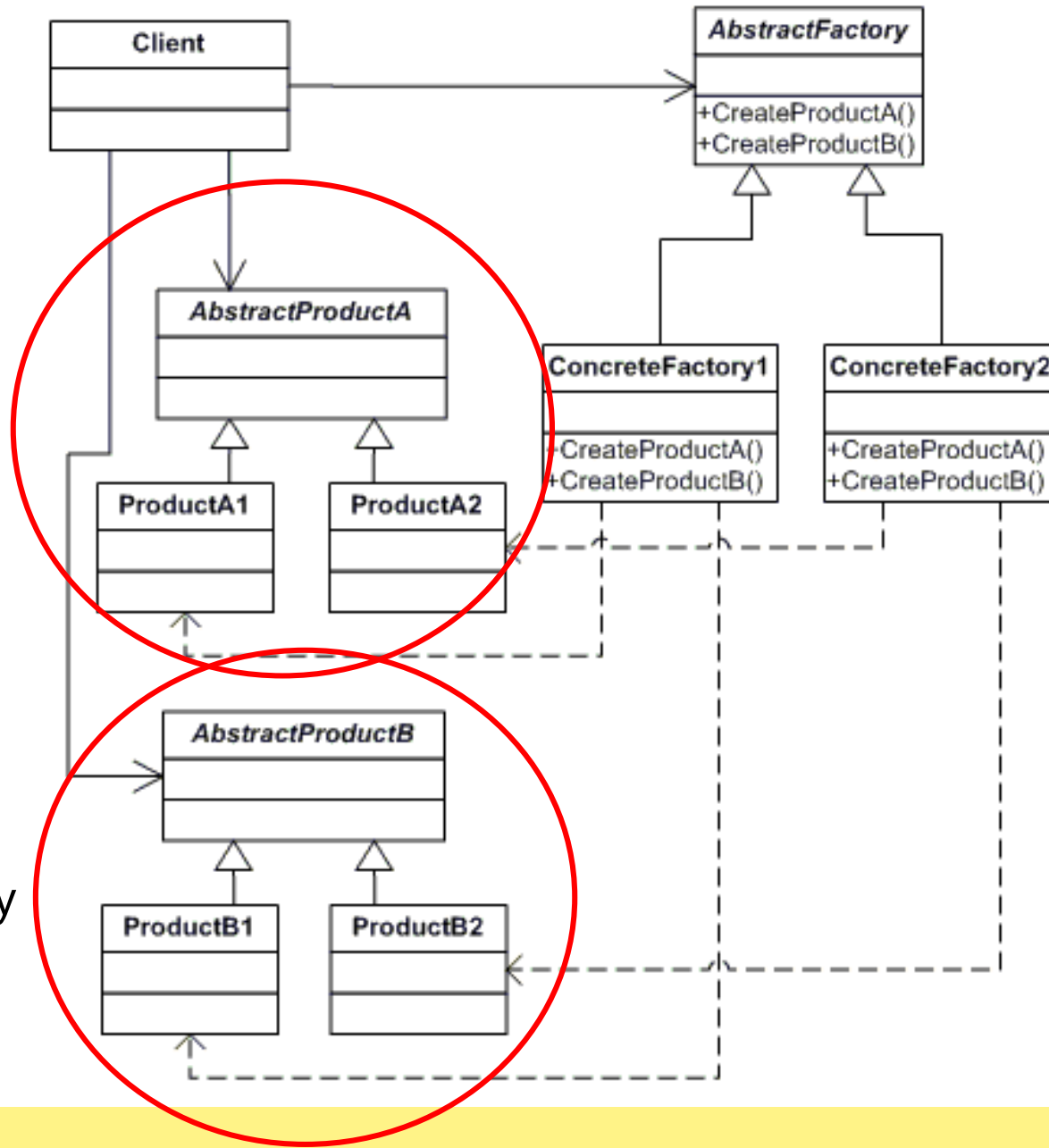
- **Factory**

- **Problem:** Who should be responsible for creating objects when there are special considerations, such as complex creation logic, a desire to separate the creation responsibilities for better cohesion, and so forth?
- **Solution:**



Abstract Factory

One set of factory



Another set of factory

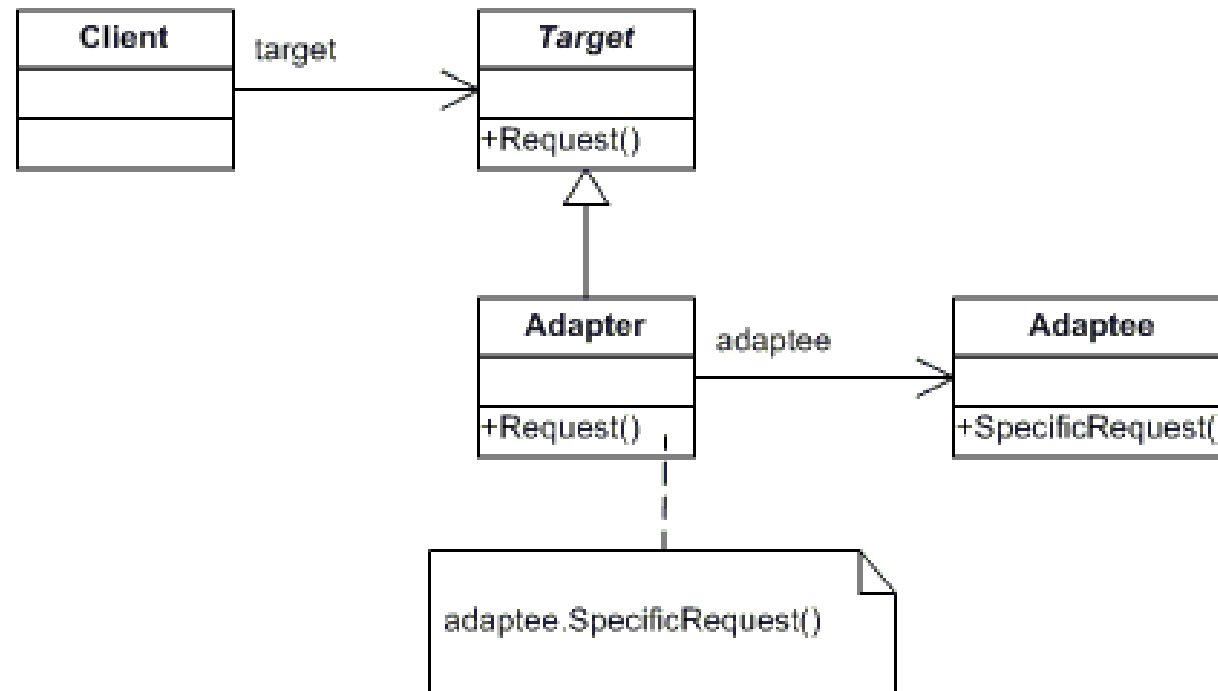
Demo

- Demo af Factory, Singleton og Abstract Factory

Design Pattern – Structural Patterns

- **Adaptor**
 - Problem: How to resolve incompatible interfaces, or provide a stable interface to similar components with different interfaces?

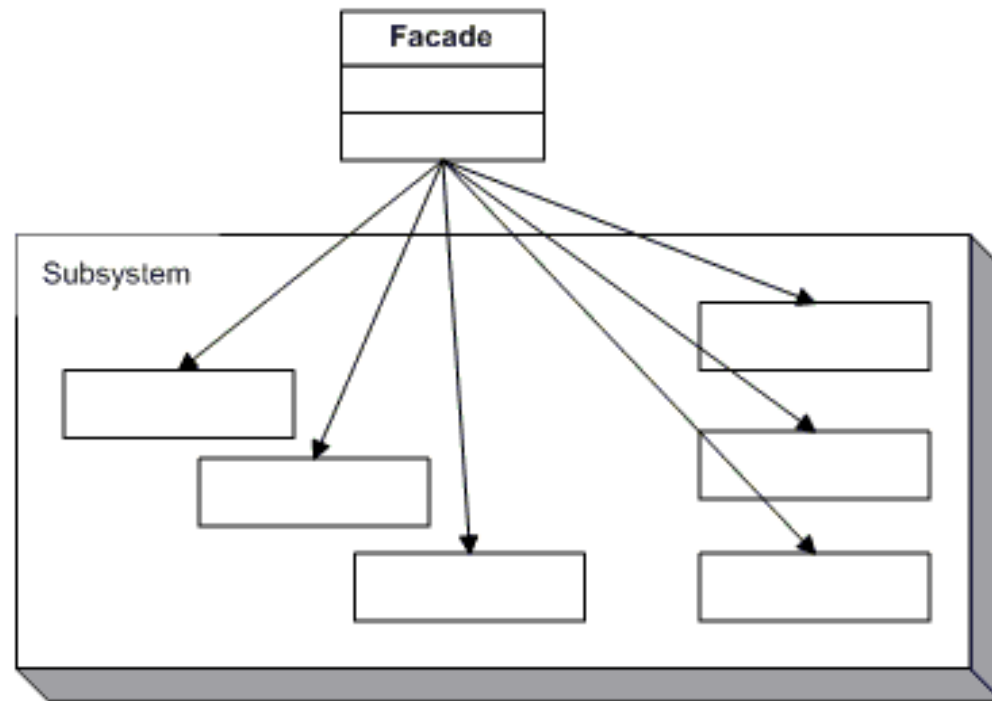
- Solution:



Design Pattern – Structural Patterns

- **Facade**

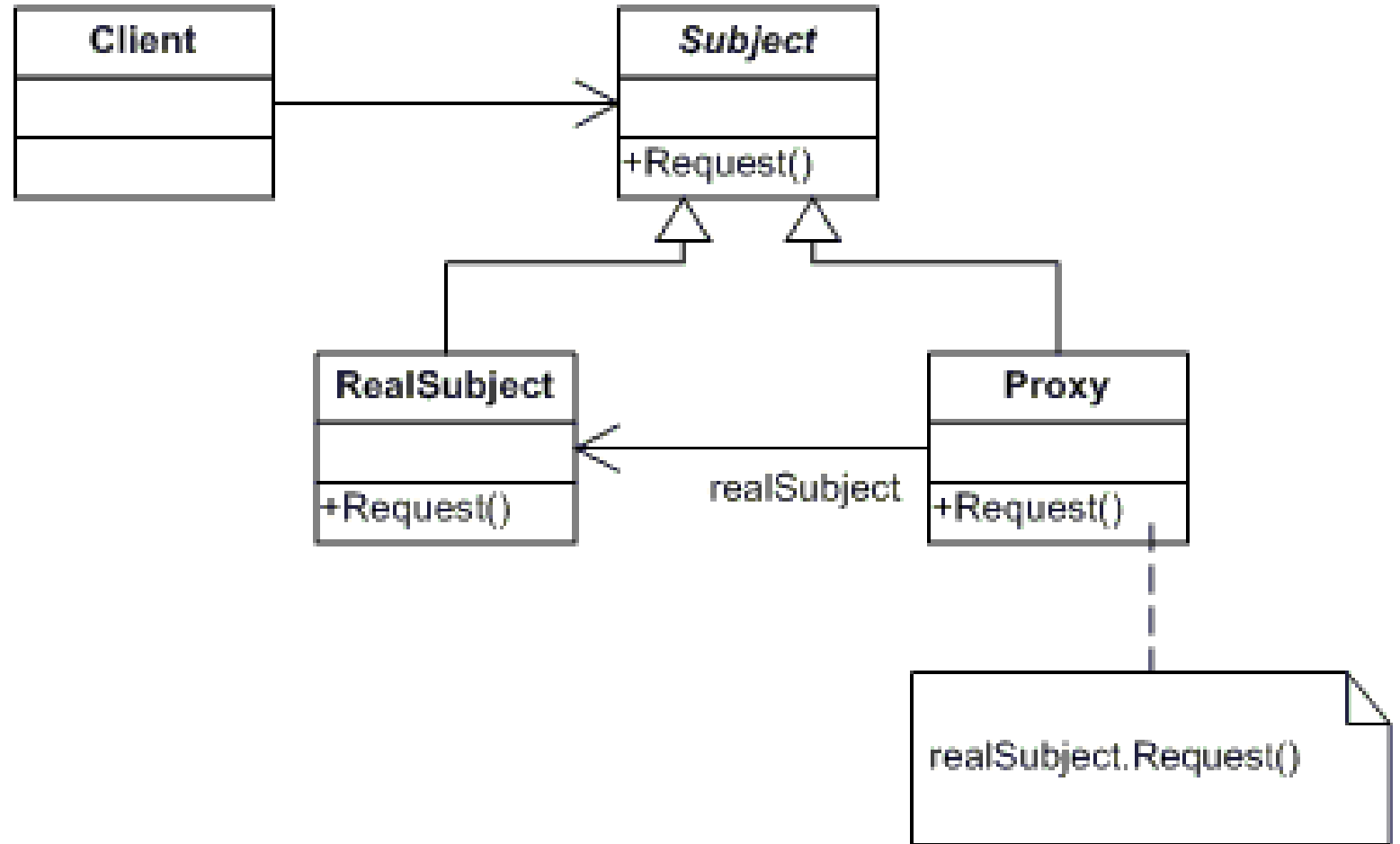
- Problem: A common, unified interface to a disparate set of implementations or Interfaces such as within a subsystem is required.
- Solution:



Design Pattern – Structural Patterns

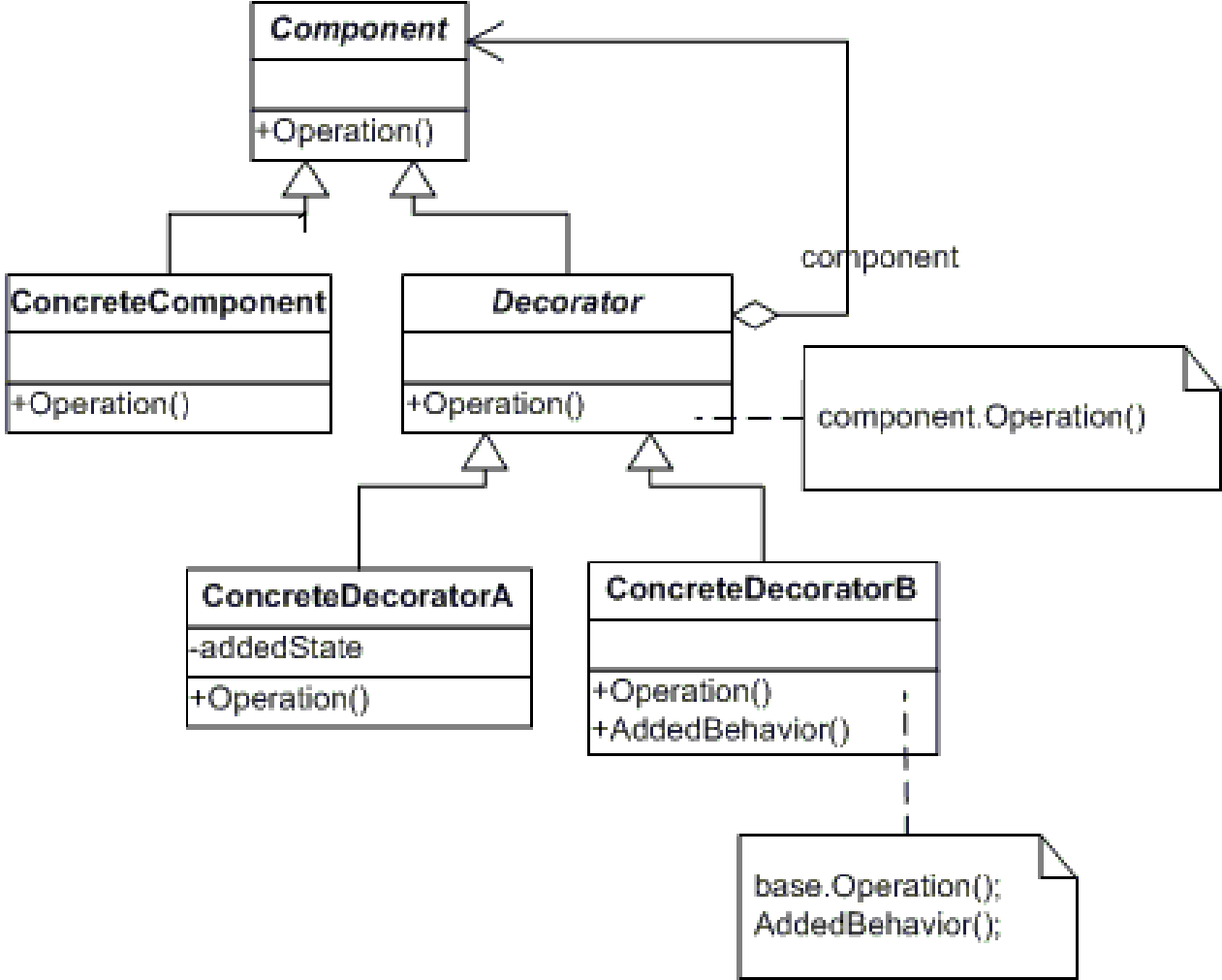
- **Proxy**

- Problem: How to provide a placeholder for another object to control access to it.
- Solution:



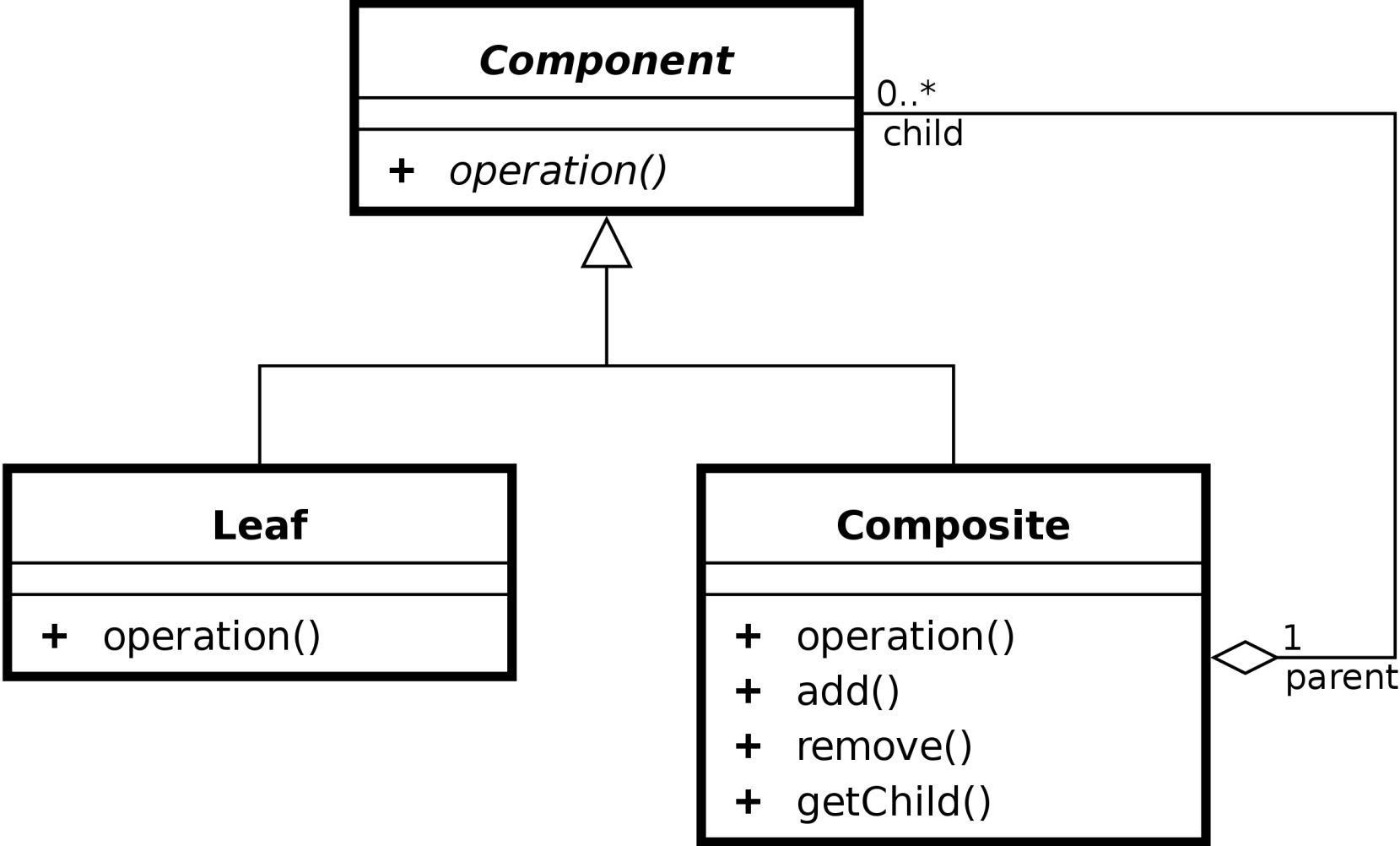
Design Pattern – Structural Patterns

- **Decorator**
 - Problem: How to Attach additional responsibilities to an object dynamically
 - Solution:



Design Pattern – Structural Patterns

- **Composite**
 - Problem: How to represented a part-whole hierarchy so that clients can treat part and whole objects uniformly.
 - Solution:



Demo

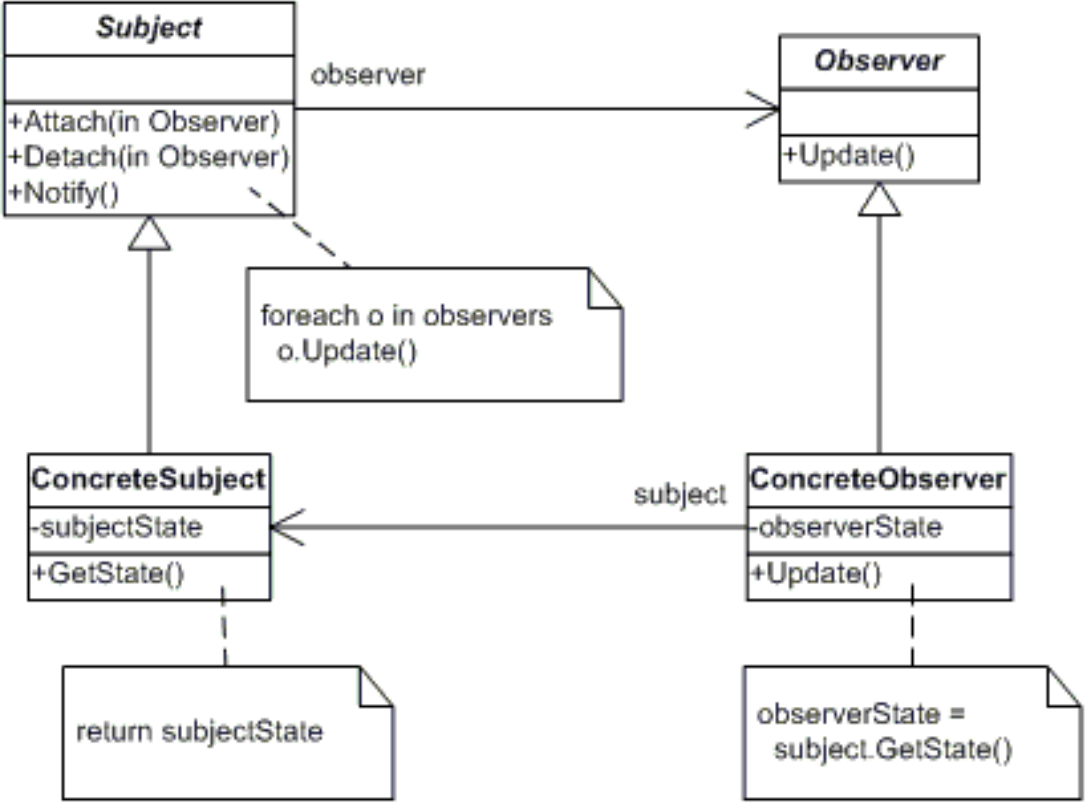
- Adaptor, Proxy, Facade, Decorator, Composite
- Training: Exercises 3.1 (Factory), 3.2(Abstract Factory), 3.3 (Adaptor)
- Mandatory Assignment

Design Pattern – Behavioural Patterns

- **Observer**

Problem: How to handle different kinds of subscriber objects are interested in the state changes or events of a publisher object

- **Solution:**



Design Pattern – Behavioural Patterns

- **Observer** - the C# way of doing it

The one that Observe

```
...
XX x = new XX();

// Register as observer
x.PropertyChanged += Update;

....
protected void Update(object sender,
                    PropertyChangedEventArgs arg)
{
    ...
}
```

To be Observed

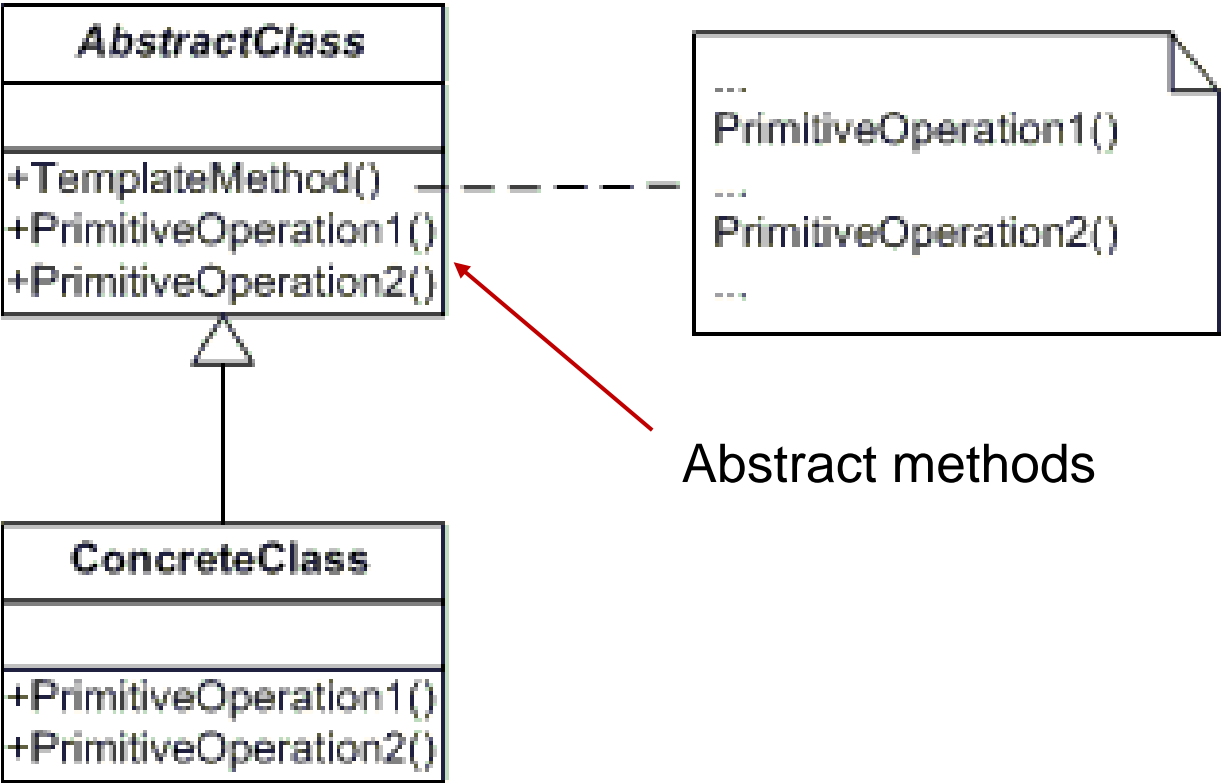
```
Class XX : INotifyPropertyChanged
{
    ...
    // Attach, Deattach
    public event PropertyChangedEventHandler PropertyChanged;

    // notify
    protected virtual void OnPropertyChanged(string propertyName)
    {
        PropertyChanged?.Invoke(this,
                                new PropertyChangedEventArgs(propertyName));
    }
}
```

Design Pattern – Behavioural Patterns

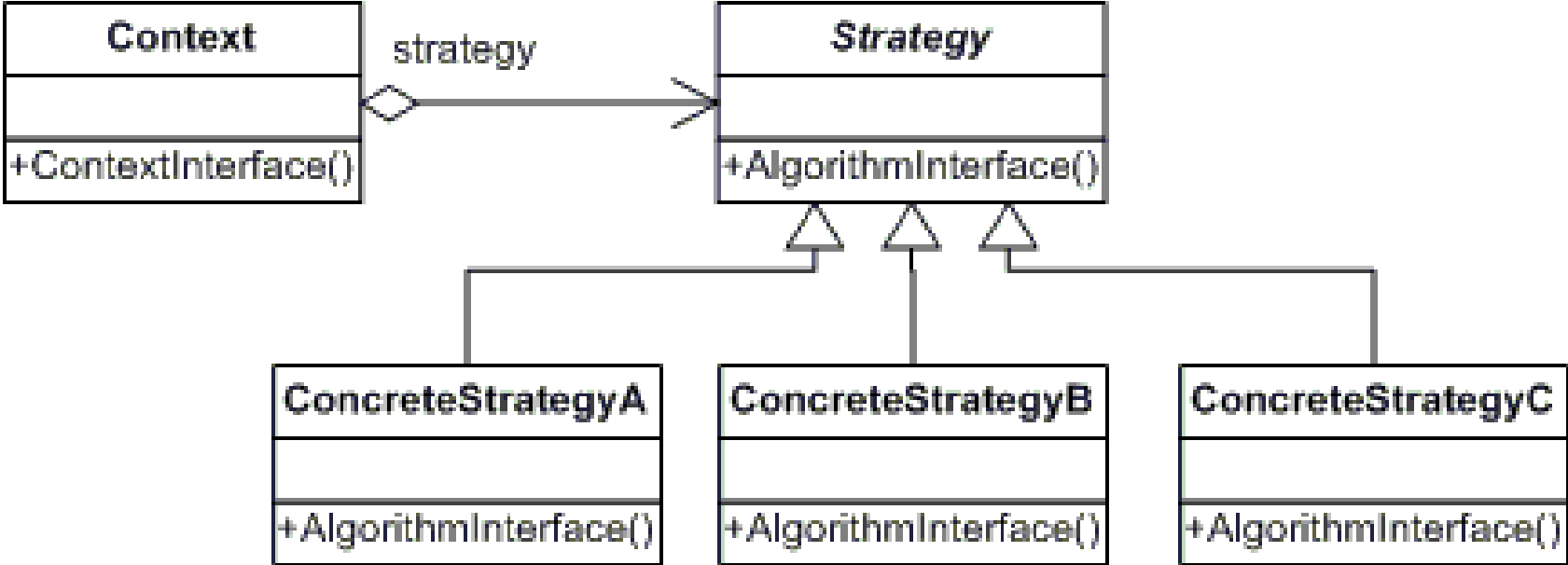
- **Template** (seen at the TCP server generalisation)
Problem: How to reuse a skeleton of an algorithm in an operation

• Solution:



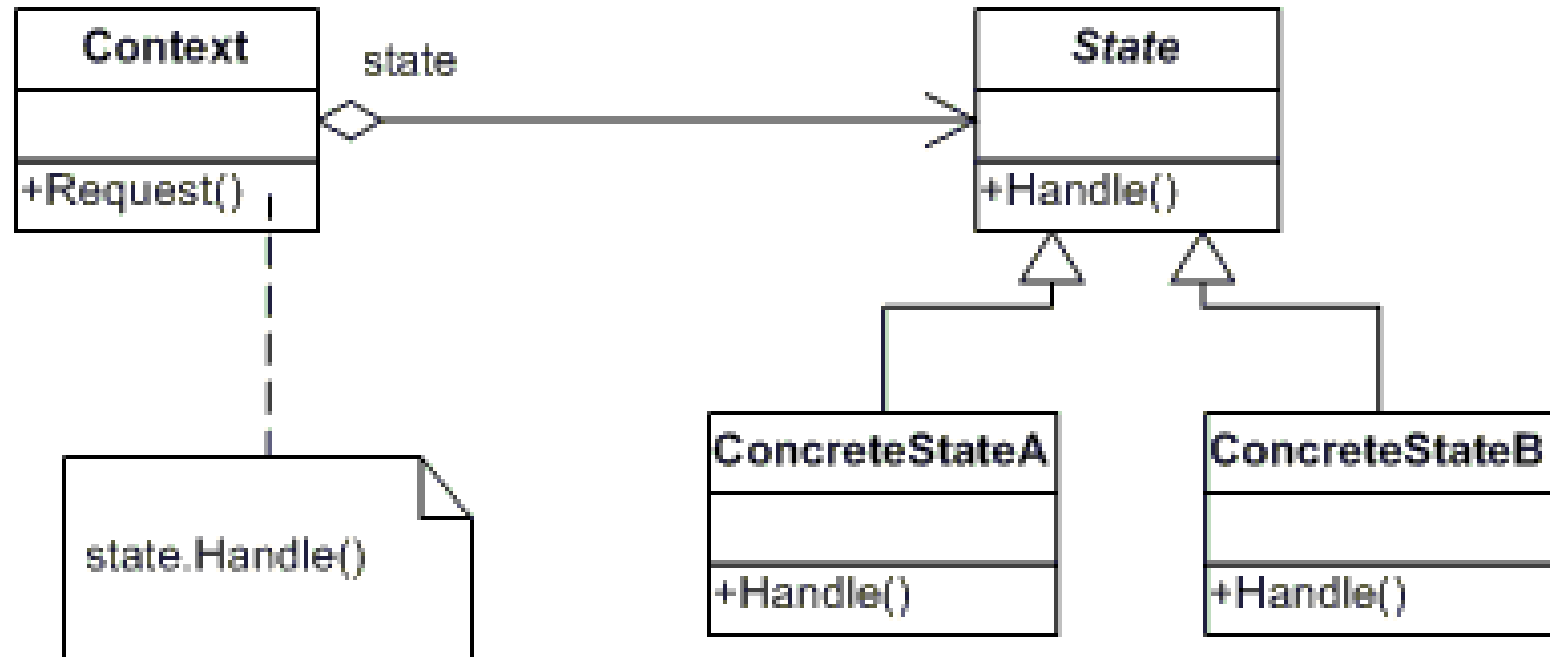
Design Pattern – Behavioural Patterns

- **Strategy**
Problem: How to interchange part of algorithm dynamically
- Solution:



Design Pattern – Behavioural Patterns

- **State** (seen at the snake game)
Problem: How to Allow an object to alter its behaviour when its internal state changes
- Solution:



Demo

- Demo of Observer, Template og Strategy
- Training: Exercises: 3.7 (Composite), 3.9 (Strategy)
- ***And of course the Mandatory Assignment***