COURSE NAME

OBJECT ORIENTED ANALYSIS AND DESIGN

CSC 2210

(UNDERGRADUATE)

CHAPTER 10
DESIGN PATTERN

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WHAT IS DESIGN PATTERN?

- A design pattern describes a problem that occurs over and over in software engineering
- And then describes the solution in a sufficiently generic manner as to be applicable in a wide variety of contexts.

TYPICAL PATTERN FORMAT

- **The pattern name**
- **The problem**
  - Specification of the problem
  - Explanation why it is important
  - Applications
  - Examples of known uses

SOFTWARE MEASUREMENT

- **The solution**
  - A description of classes possibly with a structure diagram
  - A language independent implementation, with language-specific issues as appropriate
  - Sample code

- **Consequences**
  - Results
  - Trade-offs of using the pattern
  - A discussion of related patterns

SINGLETON

- The Singleton pattern ensures you have at most one instance of a class in your application (One of a Kind Objects)
- For example, in a system there should be only one window manager (or only a file system or only a print spooler)
- If more than one instantiated: Incorrect program behavior, overuse of resources, inconsistent results

THE LITTLE SINGLETON

How would you create a single object?	`new MyObject ( );`
And what if another object wanted to create a `MyObject`? Could it call new on `MyObject` again?	Yes.
Can we always instantiate a class one or more times?	Yes. Caveat: Only if it is public class
And if not?	Only classes in the same package can instantiate it - but they can instantiate it more than once.

Is this possible?
`public class MyClass {`
`  private MyClass ( ) { }`
`}`
	Yes. It is a legal definition

What does it mean?	A class that can't be instantiated because it has a private constructor

THE CLASSIC SINGLETON PATTERN

```
public class Singleton {
    private static Singleton uniqueInstance;
    // other useful instance variables

    private Singleton ( ) { }
    public static Singleton getInstance ( ) {
        if (uniqueInstance == null) {
            uniqueInstance = new Singleton ( );
        }
        return uniqueInstance;
    }

    // other useful methods
}
```

Constructor is declared private; only singleton can instantiate this class!

We have a static variable to hold our one instance of the class Singleton.

The getInstance ( ) method gives us a way to instantiate the class and also return an instance of it.

Of course, Singleton is a regular class so it has other useful instances and methods.

ADAPTER

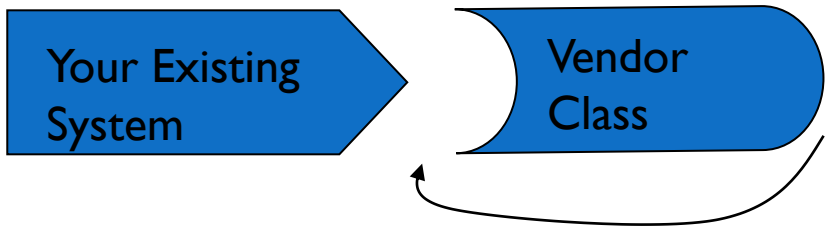
- An adapter is used when you need to use an existing class, but its interface is not the one you need
- An adapter changes an interface into one that a client expects.

"Putting a Square Plug in a Round Socket"

- Implementing an adapter may require little work or a great deal of work depending on the size and complexity of the target interface.
- An adapter wraps an object to change its interface, a decorator wraps an object to add new behaviors and responsibilities.

ADAPTER

- **Scenario:** you have an existing software system that you need to work a new vendor library into it, but the new vendor designed their interfaces differently than the last vendor
- What to do?



Their interface doesn't match the one you've written your code against. Not going to work!

- Write a class that adapts the new vendor interface into the one you're expecting

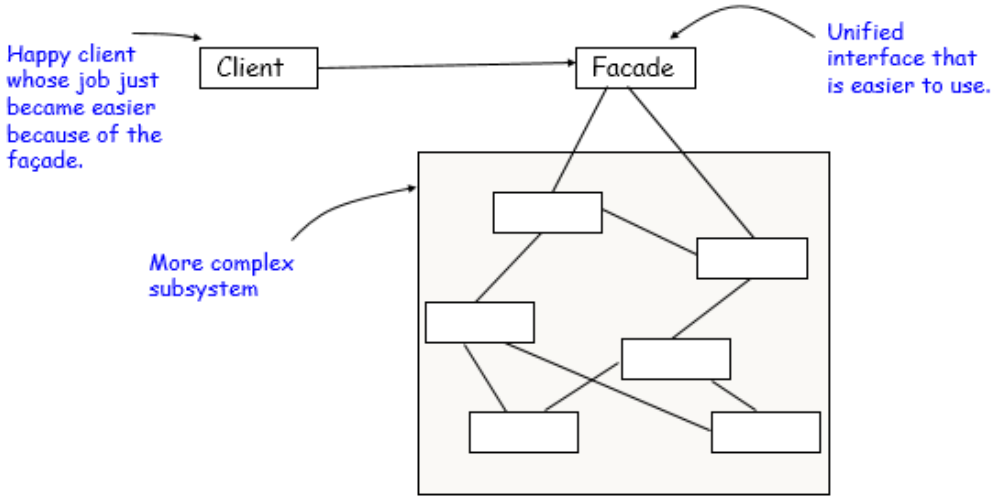
No code changes

New code

No code changes

FAÇADE

- A façade is used when you need to simplify and unify a large interface or a complex set of interfaces
- The **Façade Pattern** provides a unified interface to a set of interfaces in a subsystem. Façade defines a higher-level interface that makes the subsystem easier to use
- A façade decouples the client from a complex subsystem
- Implementing a façade requires that we compose the façade with its subsystem and use delegation to perform the work of the façade
- A façade "wraps" a set of objects to simplify
- This pattern hides all the complexity behind



OBSERVER

- Observer pattern is used when there is one-to-many relationship between objects such as if one object is modified, its dependent objects are to be notified automatically
- Example: when you subscribe to your local newspaper agent, every time there is a new edition, it gets delivered to you
- It is mainly used to implement distributed event handling systems

STRATEGY

- Strategy pattern allows selection of one of several algorithms dynamically
- In Strategy pattern, a class behavior or its algorithm can be changed at run time.
- Strategies don't hide everything -- client code is typically aware that there are a number of strategies and has some criteria to choose among them -- shifts the algorithm decision to the client.
- In Strategy pattern, we create objects which represent various strategies and a context object whose behavior varies as per its strategy object. The strategy object changes the executing algorithm of the context object.

FACTORY

- When a method returns one of several possible classes that share a common super class
- Class is chosen at run time
- Factory pattern allows to create objects without specifying the exact class of object that will be created

REFERENCES

- R.S. Pressman & Associates, Inc (2010). *Software Engineering: A Practitioner's Approach.*