CS 635 Advanced Object-Oriented Design & Programming
Spring Semester, 2004
Doc 14 Flyweight, Facade
Contents

References

Design Patterns: Elements of Reusable Object-Oriented Software, Gamma, Helm, Johnson, Vlissides, Addison-Wesley, 1995, pp. 185-206

The Design Patterns Smalltalk Companion, Alpert, Brown, Woolf, 1998, pp. 179-211

Sharable & Flyweight Nation Example

Each country, like India or China, has a lot of information

A Nation object for one country may have a lot of data

A program may only have a few references to an India object

Having all references share the same object

- Saves space
- Saves time creating/copying the object
- Keeps all references consistent

Symbol & Interned Strings

Smalltalk

Only one instance a symbol with a give character sequence in an image

```
| a b |

a := #cat.
b := (‘ca’ , ‘t’) asSymbol.
a = b  “True”
a == b   “True – a & b point to same location”
```

Symbols

- Save space
- Make comparing symbols fast
- Make hashing symbols fast

Java

Compiler tries to use only one instance of a string with a given character sequence

String>>intern() returns a reference to a unique instance of a string

Text Example

Use objects to represent individual characters of the alphabet

Using objects allows the program to treat characters like any other part of the document - as an object

A character, like “G”, may require a fair amount of information:

- The character type - G not h or y
- Its font
- Its width, height, ascenders, descenders, etc.
- How to display/print the character
- Where it is in the document

Most of this information is the same for all instances of the same letter

So

- Have one G object and
- Have all places that need a G reference the same object

What if there is state information that is different between references?

Intrinsic State

- Information that is independent from the objects context
- The information that can be shared among many objects

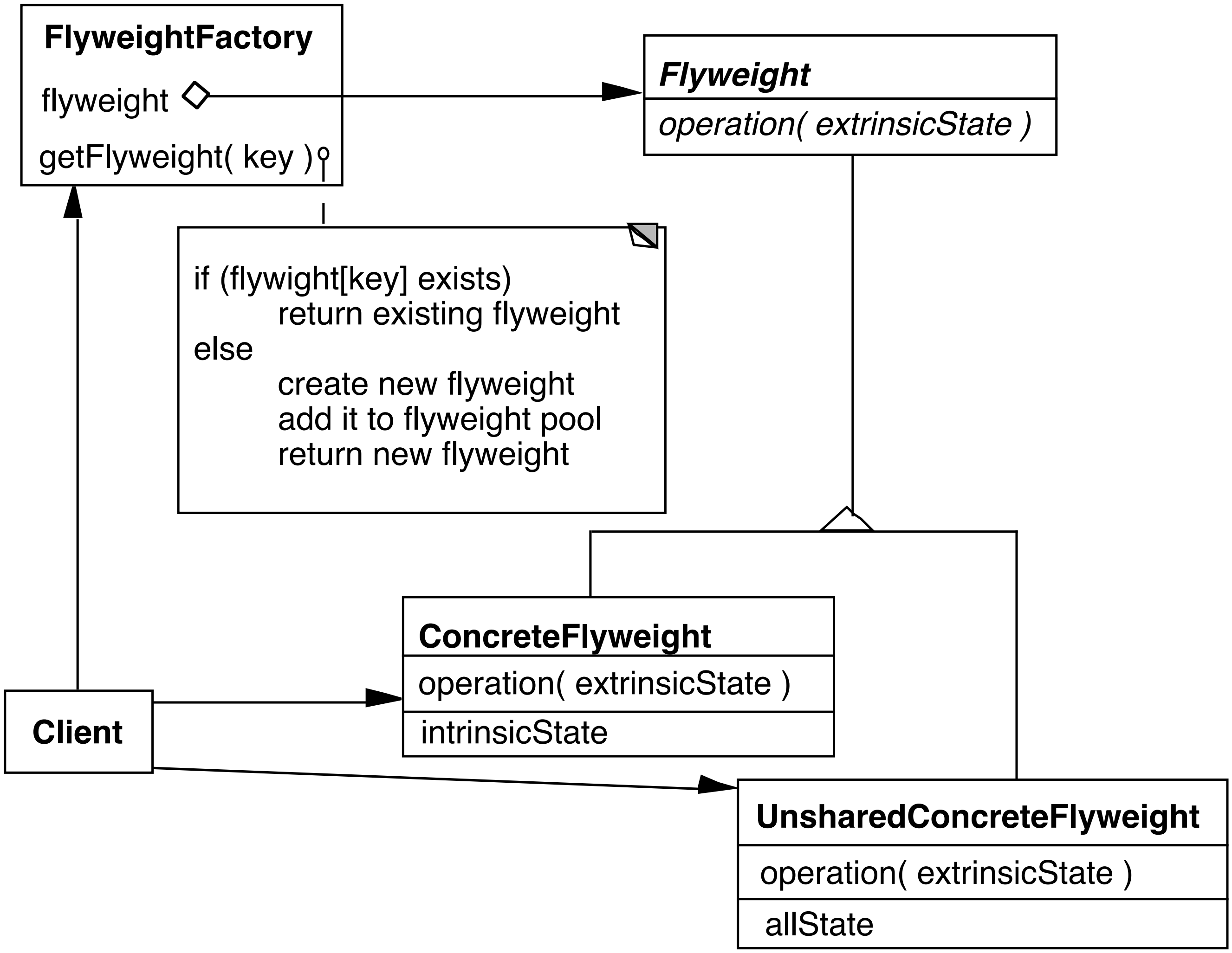
Extrinsic State

- Information that is dependent on the objects context
- The information that can not be shared among objects

So create one instance of the object and use the same object wherever you need an instance

The one object can store the intrinsic state, but someone else needs to store the extrinsic state for each context of the object

Structure



FlyweightFactory

flyweight

getFlyweight(key)

Flyweight

operation(extrinsicState)

```
if (flywight[key] exists)
        return existing flyweight
else
        create new flyweight
        add it to flyweight pool
        return new flyweight
```

ConcreteFlyweight

operation(extrinsicState)

intrinsicState

Client

UnsharedConcreteFlyweight

operation(extrinsicState)

allState

Applicability

The pattern can be used when all the following are true

- The program uses a large number of objects
- Storage cost are high due to the sheer quantity of objects
- The program does not use object identity

```
MyClass* objectPtrA;
MyClass* objectPtrB;

if ( objectPtrA == objectPtrB ) //testing object identity
```

- Most object state can be made **extrinsic**
  - Extrinsic state is data that is stored outside the object
  - The extrinsic state is passed to the object as an argument in each method
- Many objects can be replaced by a relatively few shared objects, once the extrinsic state is removed

Implementation

Separating state from the flyweight

This is the hard part

Must remove the extrinsic state from the object

Store the extrinsic state elsewhere

- This needs to take up less space for the pattern to work

Each time you use the flyweight you must give it the proper extrinsic state

Managing Flyweights

Cannot use object identity on flyweights

Need factory to create flyweights, cannot create directly

How do we know when we are done with a flyweight?

Façade

Compiler Example

The VisualWorks Smalltalk compiler system has 75 classes

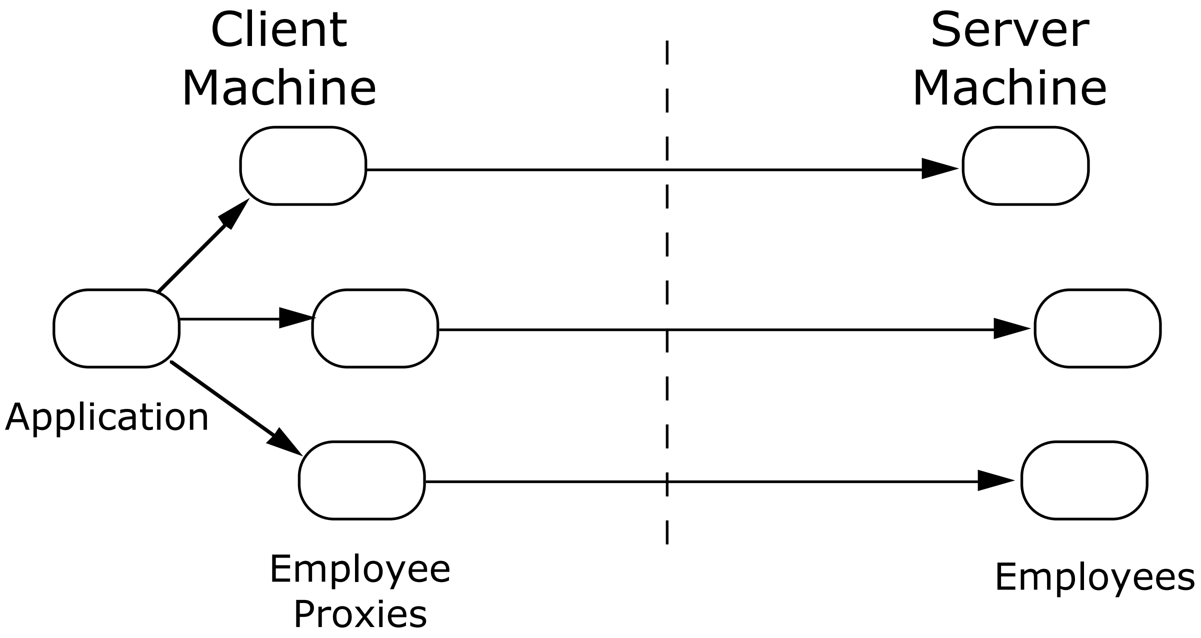
Programmers only use Compiler, which uses the other classes

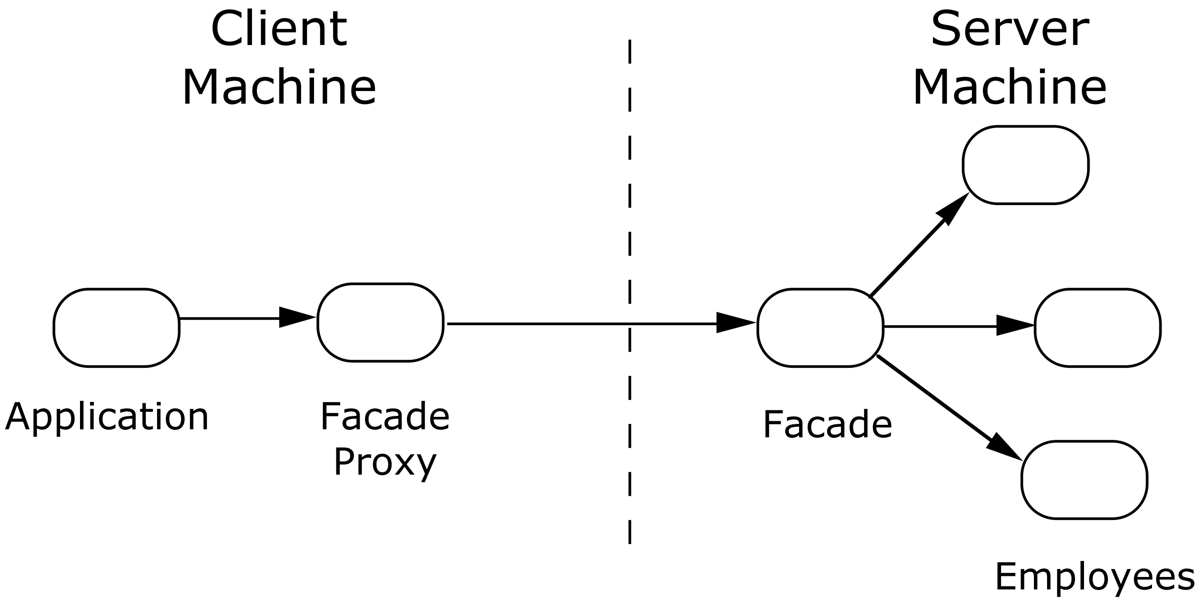
```
Compiler evaluate: '100 factorial'
```

```
| method compiler |
method := 'reset
   "Resets the counter to zero"
   count := 0.'.

compiler := Compiler new.
compiler
   parse:method
   in: Counter
   notifying: nil
```

Distributed Object Systems





Subsystems

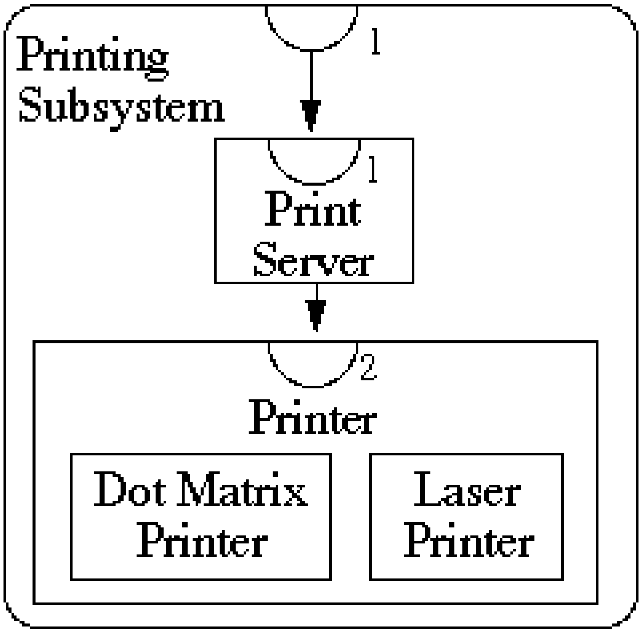
Subsystems are groups of classes, or groups of classes and other subsystems, that collaborate among themselves to support a set of contracts

There is no conceptual difference between the responsibilities of a class and a subsystem of classes

The difference between a class and subsystem of classes is a matter of scale

A subsystem should be a good abstraction

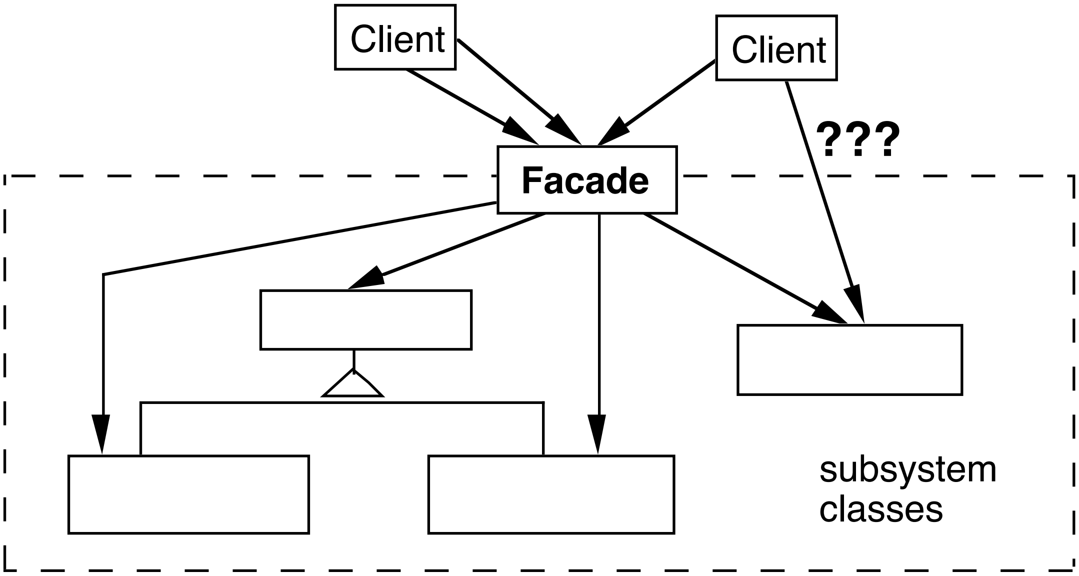
There should be as little communication between different subsystems as possible



The Facade Pattern - Basic Idea

Create a class that is the interface to the subsystem

Clients interface with the Facade class to deal with the subsystem



Consequences of Facade Pattern

It hides the implementation of the subsystem from clients

It promotes weak coupling between the subsystems and its clients

It does not prevent clients from using subsystem classes directly, should it?

Facade does not add new functionality to the subsystem