CS 635 Advanced Object-Oriented Design & Programming
Spring Semester, 2014
Doc 8 Dilbert, Strategy, Decorator, Pipes
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Principles of OO Design, or Everything I Know About Programming, I Learned from Dilbert

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THE KEY TO CAREER SUCCESS IS FINDING YOUR SPECIAL GIFT.
MY SPECIAL GIFT IS GETTING PAID FOR DOING NOTHING BUT BABBLING JARGON.
MAYBE I SHOULD LEAD BY EXAMPLE.
MAYBE YOU ALREADY DID.
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1-21-14

1. Never do any work that you can get someone else to do for you

Example 1 Total of bills that have been paid this quarter for a factory

```
total = 0;
Vector billings = aFactory.billings();
 for (Bill billing : billings)
    if ((billing.status() == "paid") && (billing.date() > startDate))
        total = total + billing.amount();
```

versus

```
total = aFactory.totalBillingsPaidSince(startDate).
```

1. Never do any work that you can get someone else to do for you

Excuse me Smithers. I need to know the total bills that have been paid so far this quarter. No, don't trouble yourself. If you'll just lend me the key to your filing cabinet I'll go through the records myself. I'm not that familiar with your filing system, but how complicated can it be? I'll try not to make too much of a mess.

Verses

SMITHERS! I need the total bills that have been paid since the beginning of the quarter. No, I'm not interested in the petty details of your filing system. I want that total, and I'll expect it on my desk within the next half millisecond.

1. Never do any work that you can get someone else to do for you

somebody.clients().add(new Client());

Less work

somebody just returns collection

verses

somebody.addClient(new Client());

Needs

addClient:
removeClient:
more?

1. Never do any work that you can get someone else to do for you

somebody.clients().add(new Client());

Information Leakage

All code using class needs to know you have a collection of clients

verses

somebody.addClient(new Client());

Information hiding

Encapsulation & Responsibility

Encapsulation is about responsibility

Who does the work

Who should do the work

2. Avoid Responsibility

If you must accept a responsibility, keep it as vague as possible.

For any responsibility you accept, try to pass the real work off to somebody else.

Strategy Pattern

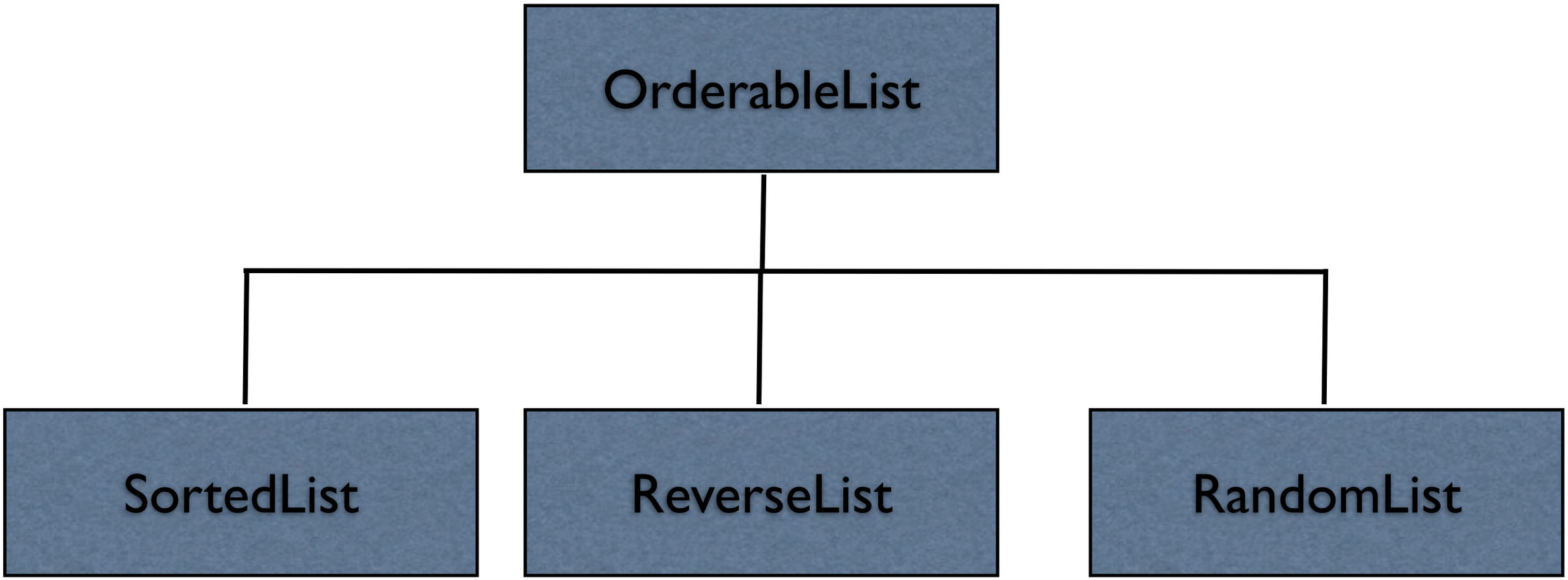
Favor
Composition
over
Inheritance

Orderable List

Sorted

Reverse Sorted

Random


OrderableList
SortedList
ReverseList
RandomList

One size does not fit all

Issue 1 - Orthogonal Features

Order

Sorted

Reverse Sorted

Random

Threads

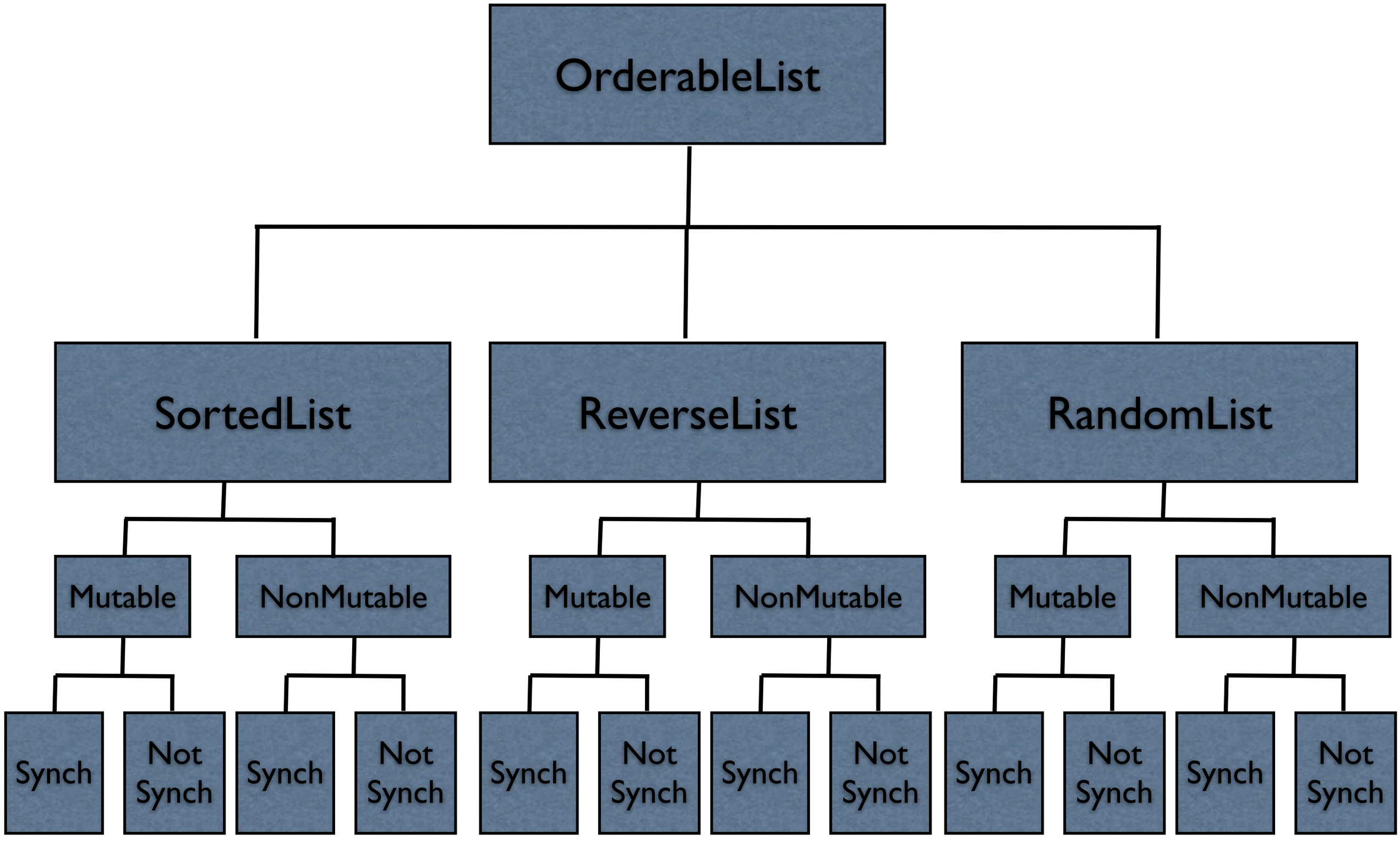
Synchronized

Unsynchronized

Mutability

Mutable

Non-mutable


OrderableList
SortedList
ReverseList
RandomList
Mutable
NonMutable
Mutable
NonMutable
Mutable
NonMutable
Synch
Not Synch
Synch
Not Synch
Synch
Not Synch
Synch
Not Synch
Synch
Not Synch
Synch
Not Synch

Issue 2 - Flexibility

Change behavior at runtime

```
OrderableList x = new OrderableList();
x.makeSorted();
x.add(foo);
x.add(bar):
x.makeRandom();
```

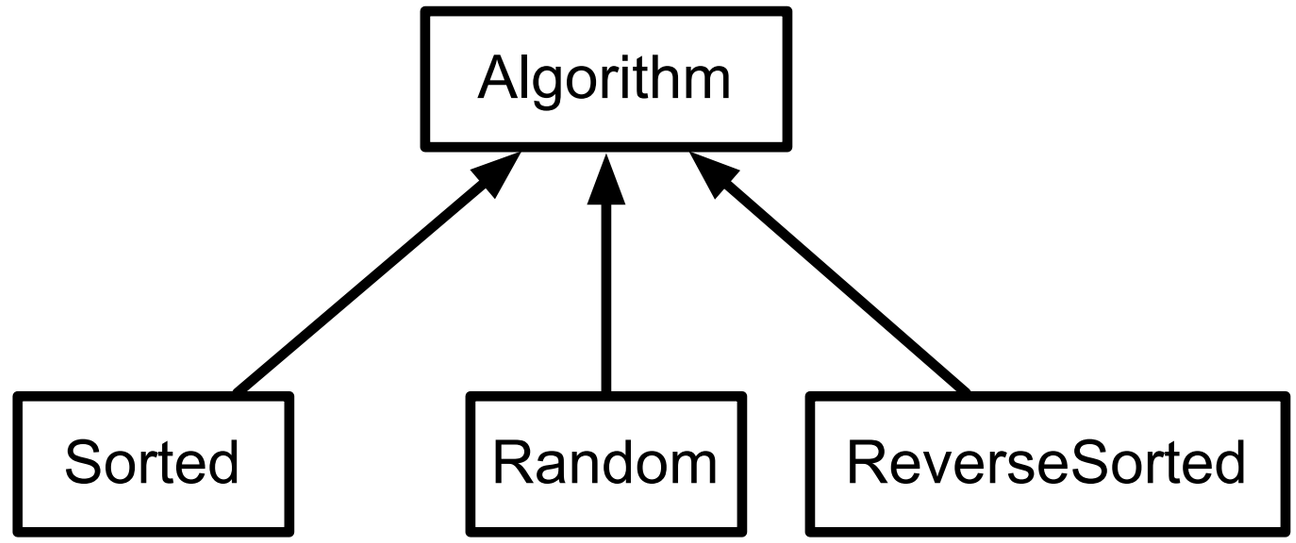
Configure objects behavior at runtime

Strategy Pattern

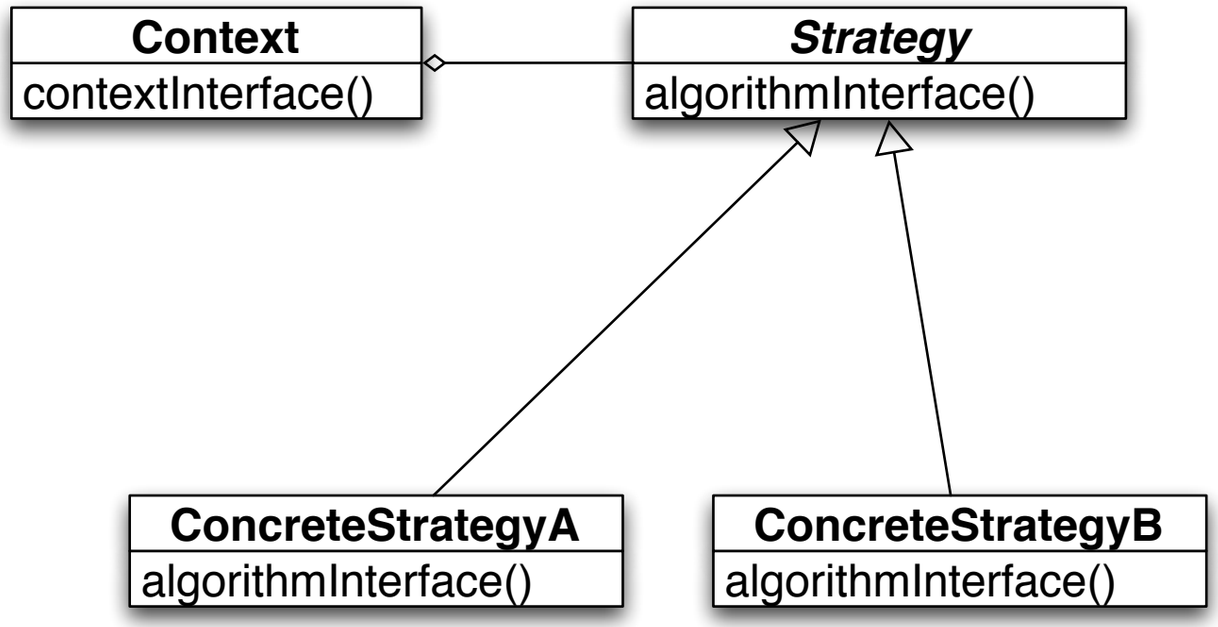
```
class OrderableList {
        private Object[ ] elements;
        private Algorithm orderer;

        public OrderableList(Algorithm x) {
                orderer = x;
        }

    public void add(Object element) {
       elements = ordered.add(elements,element);
    }
```



Structure


Context
contextInterface()
Strategy
algorithmInterface()
ConcreteStrategyA
algorithmInterface()
ConcreteStrategyB
algorithmInterface()

The algorithm is the operation

Context contains the data

How does this work?

Prime Directive

Data + Operations

How does Strategy Get the Data?

Pass needed data as parameters in strategy method

Give strategy object reference to context
Strategy extracts needed data from context

Example - Java Layout Manager

```
import java.awt.*;
class  FlowExample  extends Frame  {

      public FlowExample( int  width, int height ) {
            setTitle( "Flow Example" );
            setSize( width, height );
            setLayout( new FlowLayout( FlowLayout.LEFT) );

            for ( int label = 1; label < 10; label++ )
                  add( new Button( String.valueOf( label ) ) );
            show();
      }

      public  static  void  main( String  args[] ) {
            new  FlowExample( 175, 100 );
            new  FlowExample( 175, 100 );
      }
}
```

Example - Smalltalk Sort blocks

```
| list |
list := #( 1 6 2 3 9 5 ) asSortedCollection.
Transcript
        print: list;
        cr.
list sortBlock: [:x :y | x > y].
Transcript
        print: list;
        cr;
        flush.
```

Costs

Clients must be aware of different Strategies

Communication overhead between Strategy and Context

Increase number of objects

Benefits

Alternative to subclassing of Context

Eliminates conditional statements

Replace in Context code like:

```
switch  ( flag ) {
        case A: doA(); break;
        case B: doB(); break;
        case C: doC(); break;
}
```

With code like:

```
strategy.do();
```

Gives a choice of implementations

Refactoring: Replace Conditional Logic with Strategy

Conditional logic in a method controls which of several variants of a calculation are executed

so

Create a Strategy for each variant and make the method delegate the calculation to a Strategy instance

Replace Conditional Logic with Strategy

```
class Foo {
    public void bar() {
        switch  ( flag ) {
            case A: doA(); break;
            case B: doB(); break;
            case C: doC(); break;
        }
    }
}
```

```
class Foo {
    private strategy;
    public void bar() {
        strategy.do(data);
    }
}
```

Decorator

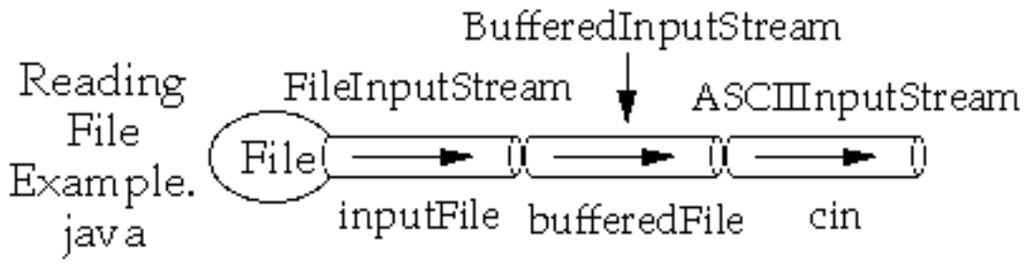
Prime Directive

Data + Operations

Decorator Pattern

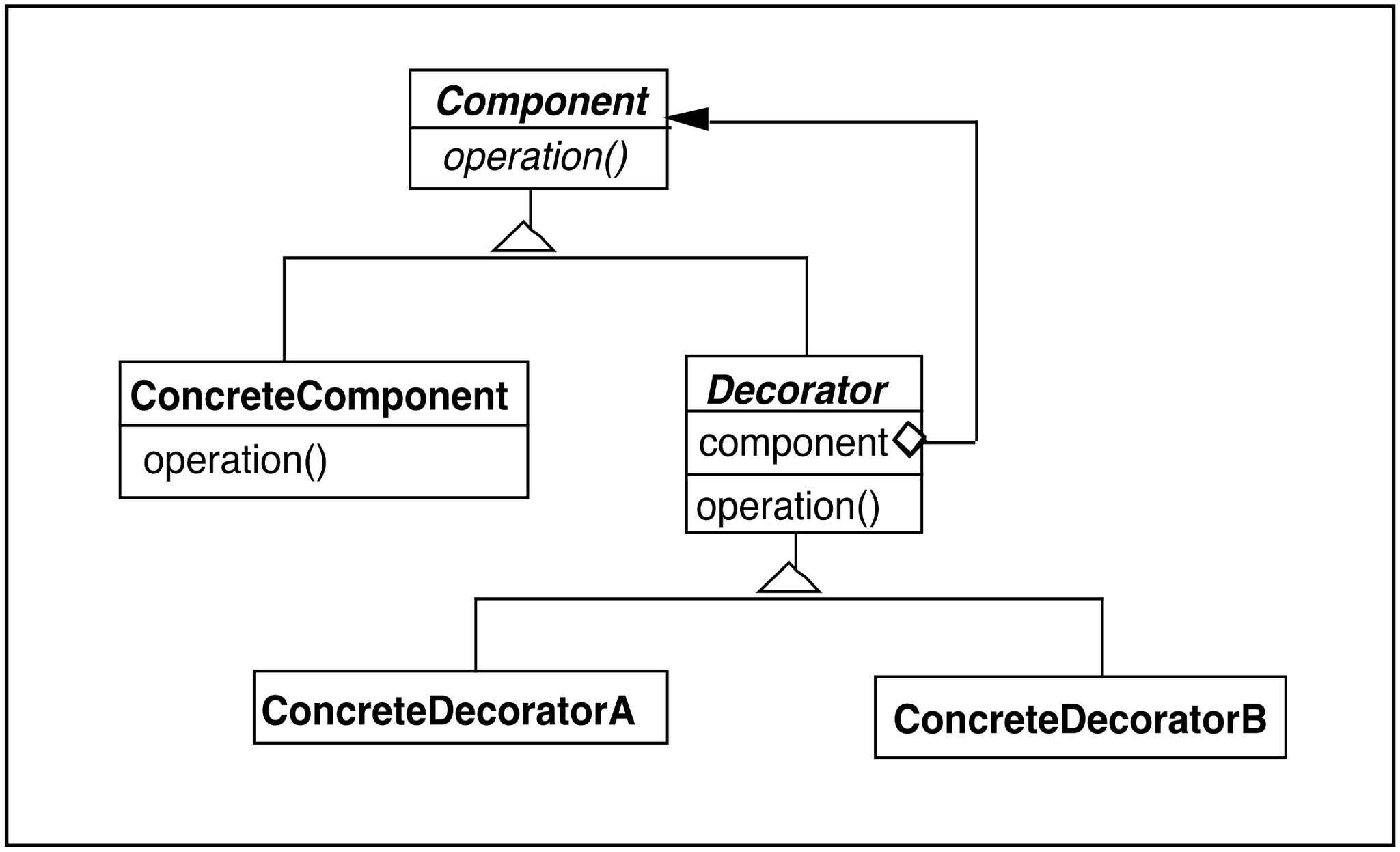
Adds responsibilities to individual objects

Dynamically
Transparently



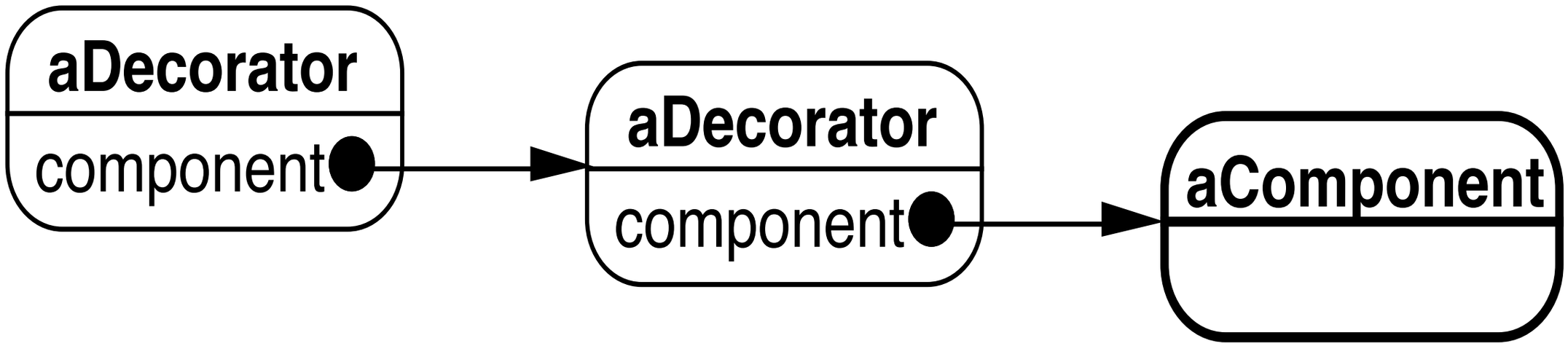

```
import java.io.*;
import sdsu.io.*;
class  ReadingFileExample
      {
      public  static  void  main( String  args[]  ) throws Exception
            {
            FileInputStream inputFile;
            BufferedInputStream bufferedFile;
            ASCIIInputStream  cin;

            inputFile = new FileInputStream( "ReadingFileExample.java" );
            bufferedFile = new BufferedInputStream( inputFile );
            cin = new ASCIIInputStream( bufferedFile );
```


Component
operation()
ConcreteComponent
operation()
Decorator
component
operation()
ConcreteDecoratorA
ConcreteDecoratorB


POLICE LINE DO NOT CROSS

Decorator forwards all component operations



Favor Composition over Inheritance

Refactoring: Move Embellishment to Decorator

Benefits & Liabilities

Benefits

Simplifies a class

Distinguishes a classes core responsibilities from embellishments

Liabilities

Changes the object identity of a decorated object

Code harder to understand and debug

Combinations of decorators may not work correctly together

Pipes and Filters

Pipes & Filters

ls | grep -i b | wc -l

Context

Processing data streams

Problem

Building a system that processes or transforms a stream of data

Forces

Small processing steps are easier to reuse than large components

Non-adjacent processing steps do not share information

System changes should be possible by exchanging or recombining processing steps, even by users

Final results should be presented or stored in different ways

Solution

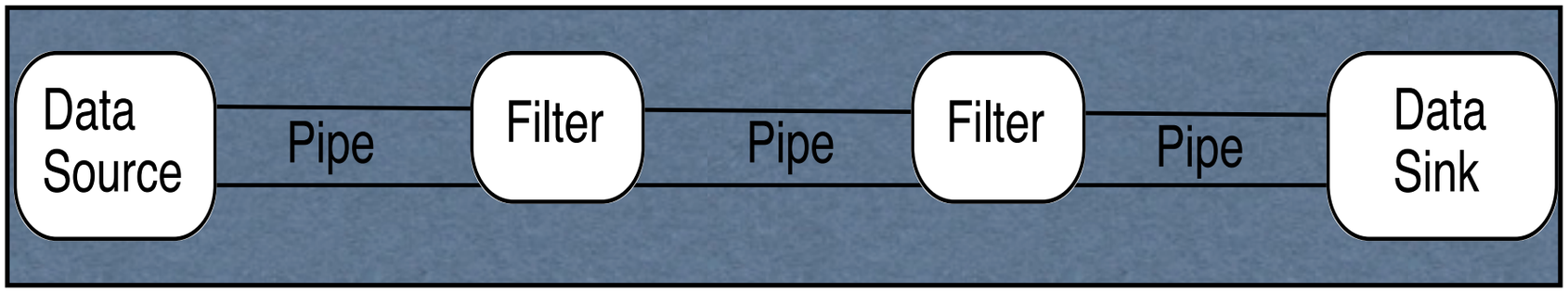
Divide task into multiple sequential processing steps or filter components

Output of one filter is the input of the next filter

Filters process data incrementally

- Filter does not wait to get all the data before processing

Solution Continued



Data source – input to the system

Data sink – output of the system

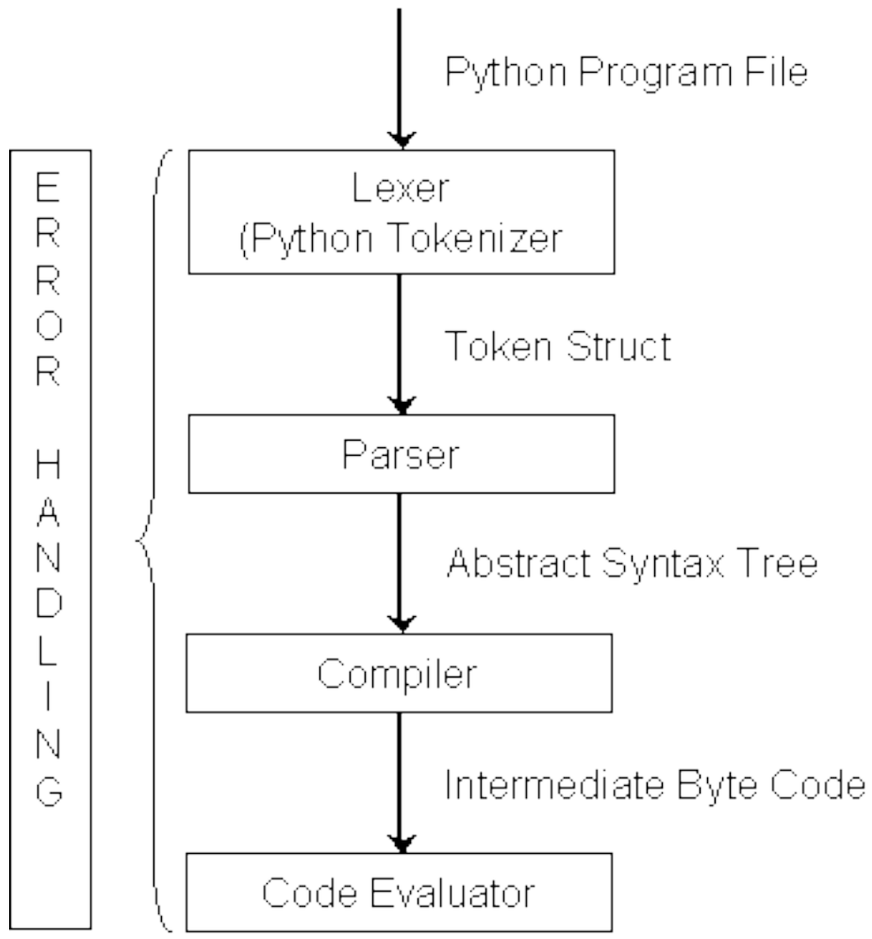
Pipes - connect the data source, filters and data sink

Pipe implements the data flow between adjacent processes steps

Processing pipeline – sequence of filters and pipes

Pipeline can process batches of data

Python Interpreter



http://wiki.cs.uiuc.edu/cs427/Python+-+Batch+Sequential

Intercepting Filter - Problem

Preprocessing and post-processing of a client Web request and response

A Web request often must pass several tests prior to the main processing

- Has the client been authenticated?
- Does the client have a valid session?
- Is the client's IP address from a trusted network?
- Does the request path violate any constraints?
- What encoding does the client use to send the data?
- Do we support the browser type of the client?

Nested if statements lead to fragile code

Intercepting Filter - Forces

Common processing, such as checking the data-encoding scheme or logging information about each request, completes per request.

Centralization of common logic is desired.

Services should be easy to add or remove unobtrusively without affecting existing components, so that they can be used in a variety of combinations, such as

Logging and authentication

Debugging and transformation of output for a specific client

Uncompressing and converting encoding scheme of input