CS 635 Advanced Object-Oriented Design & Programming
Spring Semester, 2011
Doc 8 Decorator & Command
Feb 22, 2011

References

Design Patterns: Elements of Resuable Object-Oriented Software,
Gamma, Helm, Johnson, Vlissides, Addison-Wesley, 1995, pp. 175-184, 233-242

Pattern-Oriented Software Architecture: A System of Patterns, Buschman, Meunier, Rohnert, Sommerlad, Stal, 1996, pp. 277-290, Command Processor

Command Processor, Sommerlad in Pattern Languages of Program Design 2, Eds. Vlissides, Coplien, Kerth, Addison-Wesley, 1996, pp. 63-74

Decorator

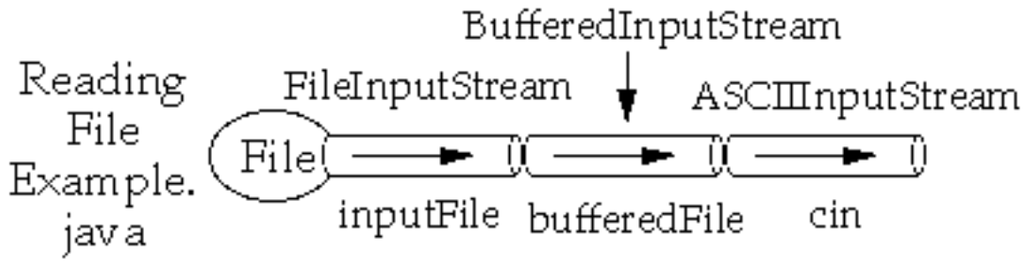
Prime Directive

Data + Operations

Decorator Pattern

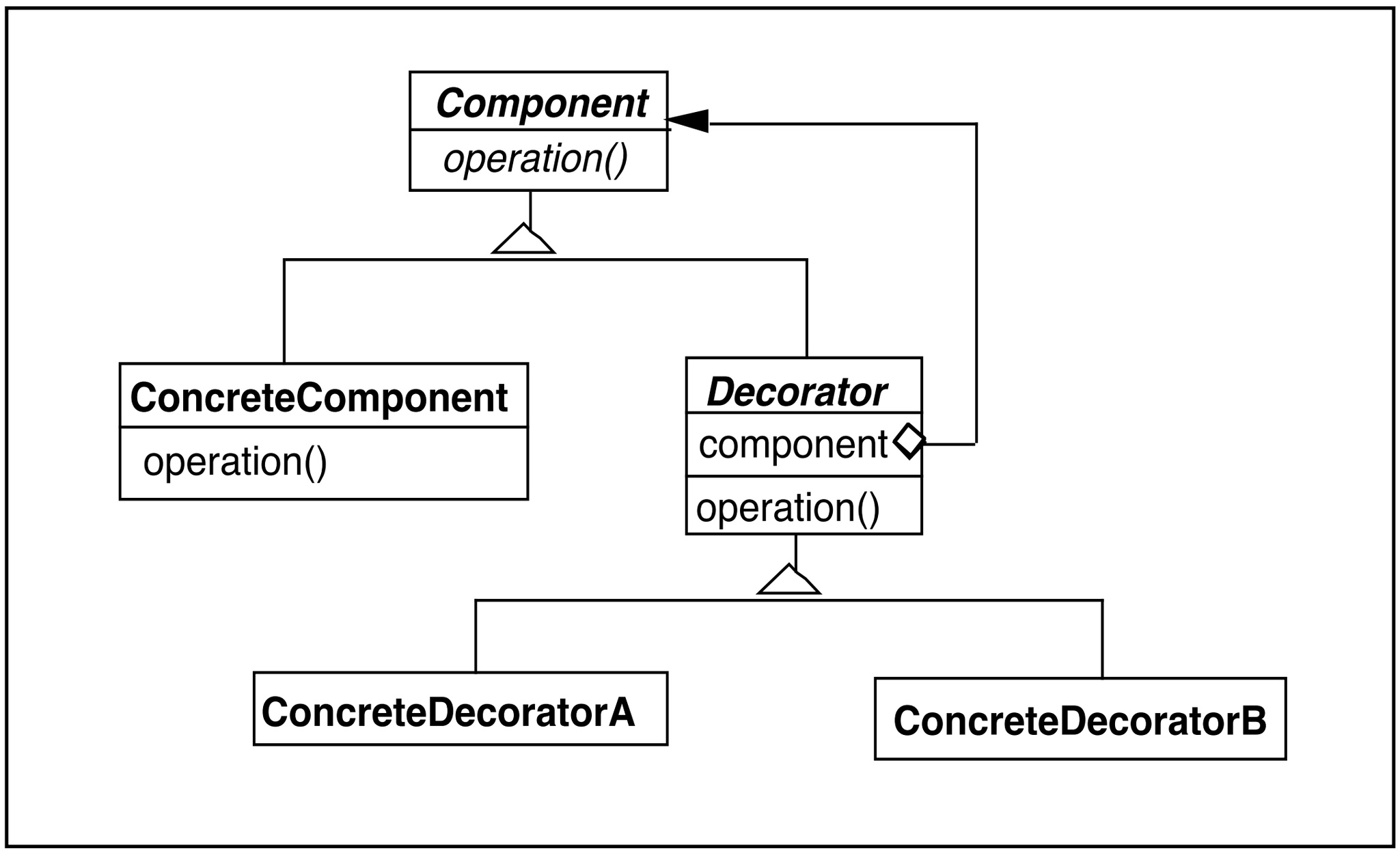
Adds responsibilities to individual objects

Dynamically
Transparently



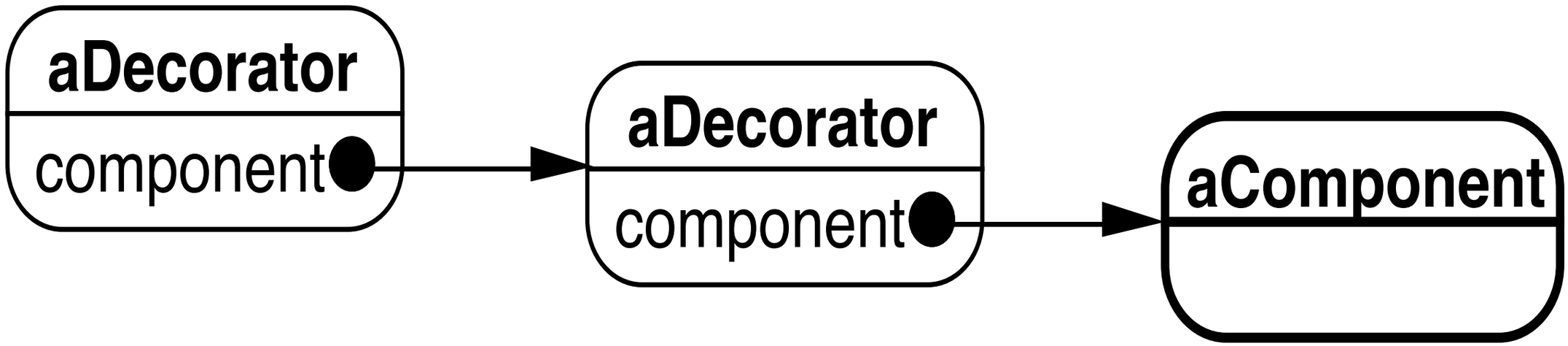

```
import java.io.*;
import sdsu.io.*;
class  ReadingFileExample
      {
      public  static  void  main( String  args[]  ) throws Exception
            {
            FileInputStream inputFile;
            BufferedInputStream bufferedFile;
            ASCIIInputStream  cin;

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


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

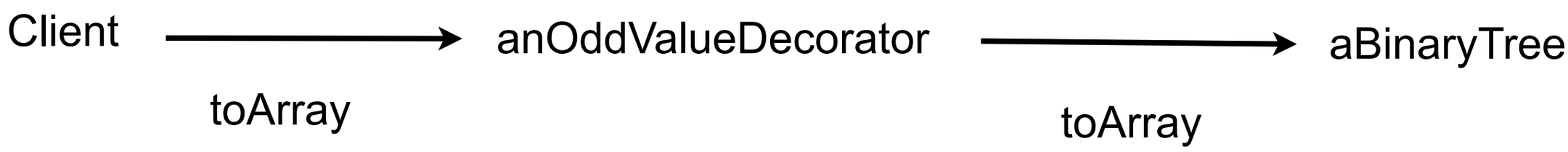

POLICE LINE DO NOT CROSS

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

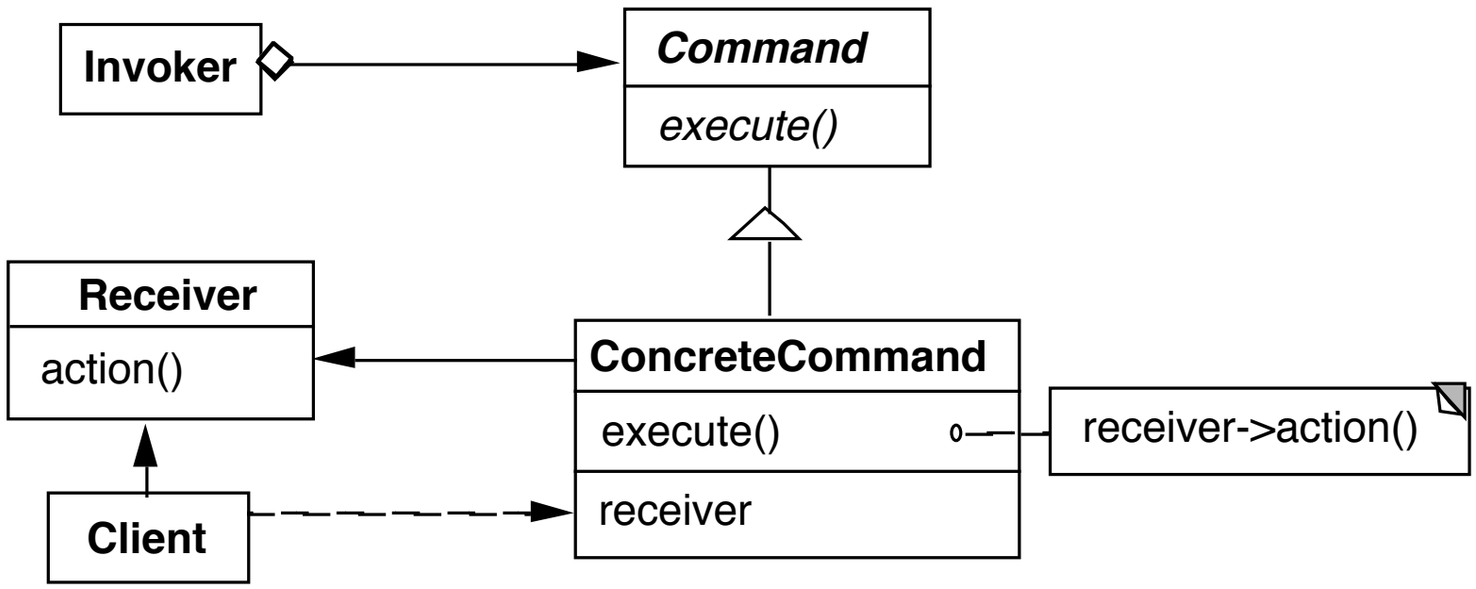
Code harder to understand and debug

Combinations of decorators may not work correctly together

Command

Command

Encapsulates a request as an object



Example

Invoker be a menu

Client be a word processing program

Receiver a document

Action be save

When to Use the Command Pattern

Need action as a parameter (replaces callback functions)

Specify, queue, and execute requests at different times

Undo

Logging changes

High-level operations built on primitive operations

A transaction encapsulates a set of changes to data

Systems that use transaction often can use the command pattern

Macro language

Callback Function vs Command

Command contains reference to object that it acts on

Consequences

Command decouples the object that invokes the operation from the one that knows how to perform it

It is easy to add new commands, because you do not have to change existing classes

You can assemble commands into a composite object

Refactoring: Replace Conditional Dispatcher with Command

```
public class SDSUChatServer {
    public void processClientRequest(String request) {
        blah
        if (command.equals("quit"))
            quit();
        else if  (command.equals("register"))
            registerNewUser(commandData);
        else if  (command.equals("login"))
            login(commandData);
        else if  (command.equals("nickname"))
            checkNickname(commandData);
        blah
    }
```

```
action = actions.get(command);
action.execute(commandData);
```


Refactoring to Patterns, Kerievsky, pp 191-201

Sample Command

```
public class RegisterCommand extends Command {
    private SDSUChatServer target;

    public RegisterCommand(SDSUChatServer aServer) {
        target = aServer;
    }
                                        bad example do not use

    public void execute(String commandData) {
        target.registerNewUser(commandData);
    }
}
```

The actions table

```
public class SDSUChatServer {
    private HashMap<String, Command> actions;

    private populateActions() {
        actions = new HashMap<String, Command>();
        actions.put("quit", new QuitCommand(this));
        actions.put("register", new RegisterCommand(this));
        actions.put("login", new LoginCommand(this));
        actions.put("nickname", new NicknameCommand(this));
    }
```

When to do this?

Need runtime flexibility

Conditional Dispatcher is bloated

Pluggable Commands

Can create one general Command using reflection

Don’t hard code the method called in the command

Pass the method to call an argument

Java Example of Pluggable Command

```
import java.util.*;
import java.lang.reflect.*;

public class Command
        {
        private Object receiver;
        private Method command;
        private Object[] arguments;

        public Command(Object receiver, Method command,
                                                Object[] arguments )
        {
        this.receiver = receiver;
        this.command = command;
        this.arguments = arguments;
        }

    public void execute() throws InvocationTargetException,
                                                IllegalAccessException
        {
        command.invoke( receiver, arguments );
        }
}
```

Using the Pluggable Command

```
public class Test {
        public static void main(String[] args) throws Exception
                {
                Vector sample = new Vector();
                Class[] argumentTypes = { Object.class };
                Method add =
                        Vector.class.getMethod( "addElement", argumentTypes);
                Object[] arguments = { "cat" };

                Command test = new Command(sample, add, arguments );
                test.execute();
                System.out.println( sample.elementAt( 0));
                }
}
```

Output

```
cat
```

Command Processor Pattern

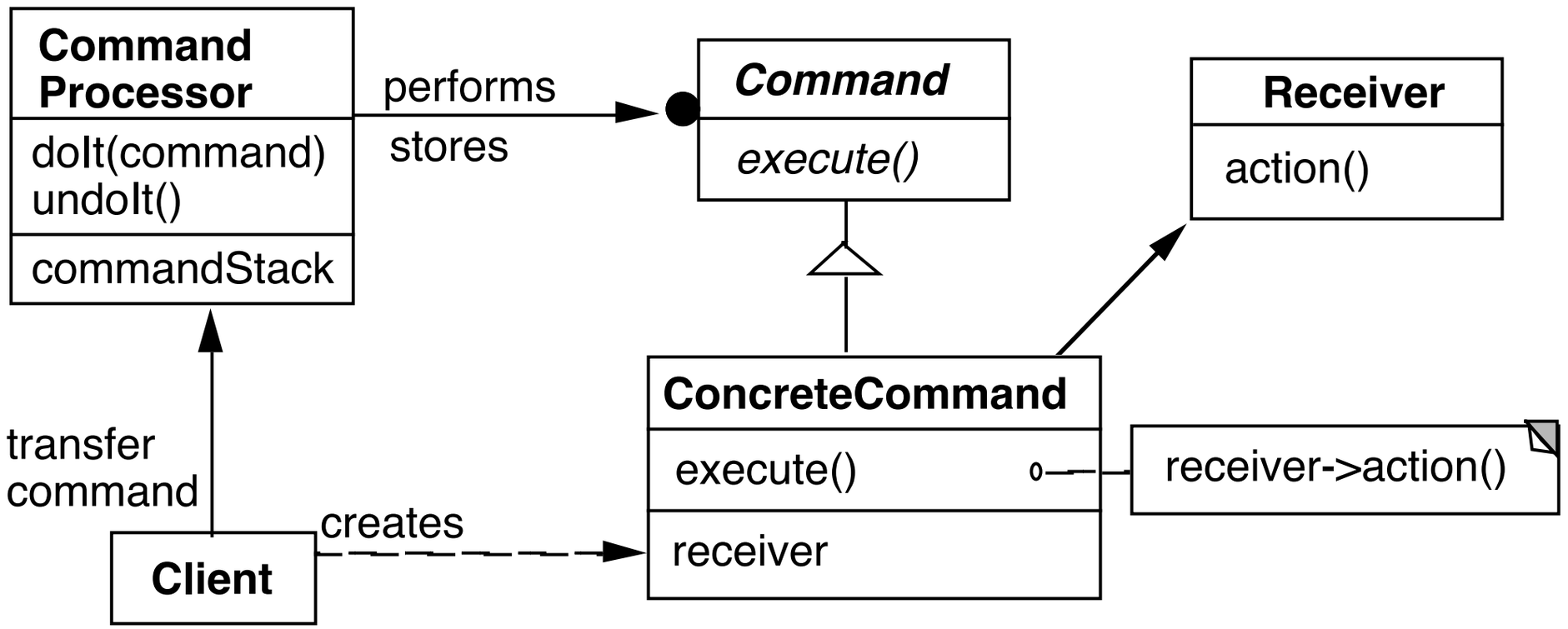
Command Processor Pattern

Command Processor manages the command objects

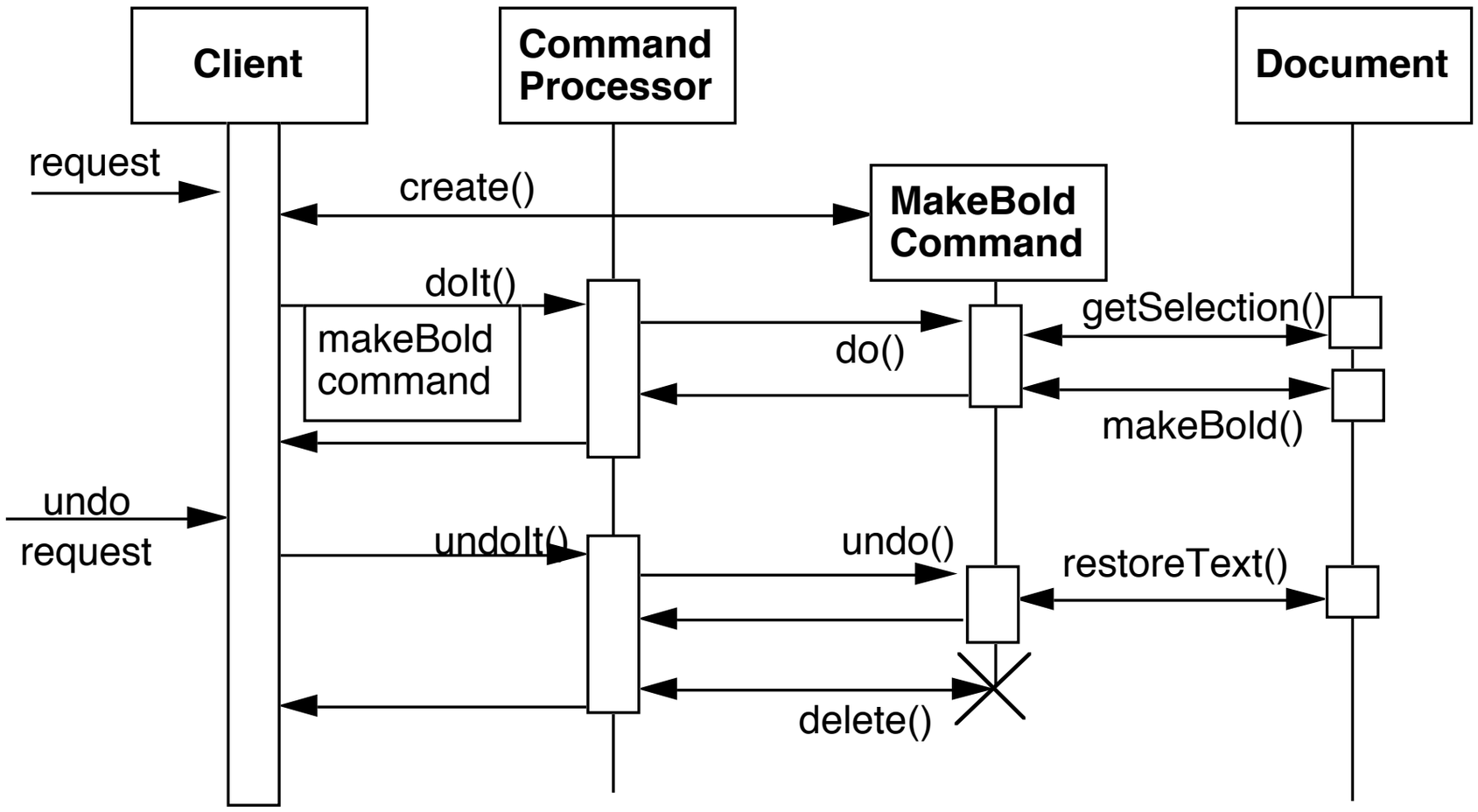
The command processor:

- Contains all command objects
- Schedules the execution of commands
- May store the commands for later unto
- May log the sequence of commands for testing purposes
- Uses singleton to insure only one instance

Structure


Command Processor
doIt(command)
undoIt()
commandStack
performs
stores
Command
execute()
Receiver
action()
transfer command
ConcreteCommand
execute()
receiver
receiver->action()
creates
Client

Dynamics


Client
Command Processor
Document
request
create()
MakeBold Command
doIt()
makeBold command
do()
getSelection()
makeBold()
undo request
undoIt()
undo()
restoreText()
delete()

Benefits

Flexibility in the way requests are activated

- Different user interface elements can generate the same kind of command object
- Allows the user to configure commands performed by a user interface element

Flexibility in the number and functionality of requests

- Adding new commands and providing for a macro language comes easy

Programming execution-related services

- Commands can be stored for later replay
- Commands can be logged
- Commands can be rolled back

Testability at application level

Concurrency

- Allows for the execution of commands in separate threads

Liabilities

Efficiency loss

Potential for an excessive number of command classes

Try reducing the number of command classes by:

Grouping commands around abstractions

Unifying simple commands classes by passing the receiver object as a parameter

Complexity

How do commands get additional parameters they need?