Command

Turning method call into an object

Command

In my word processor system I would like the user to configure what the F1 button does freely

- Like ‘save’ or ‘open new file’ or ?
- Or perhaps record a macro of key strokes in F1
  - F1 => insert text ‘iskagefabrik’ at the cursor position

But how to code this?

```
public void F1Press() {
  editor.showFileDialogAndOpen();
or
  editor.save();
or
  some other behavior?
}
```

A parametric solution?

No. Can only handle those case I have imagined in advance ☹

③ *Encapsulate what varies.* I need to handle behavior as objects that can be assigned to keys or buttons, that can be put into macro lists, etc. The obvious responsibility of such a "request object" is to be executable. The next logical step is to require that it can "un-execute" itself in order to support undo.

① *Program to an interface.* The request objects must have a common interface to allow them to be exchanged across those user interface elements that must enact them. This interface is the **Command** role that encapsulate the responsibility "execute" (and potentially "undo").

② *Object composition.* Instead of buttons, menu items, key strokes hard coding behavior, they delegate to their assigned command objects.

```
editor.save();
```

becomes something like

```
Command saveCommand = new SaveCommand(editor);
saveCommand.execute();
```

```
D:\proj\Book\src\chapter\command>java C
Exception in thread "main" java.lang.No

D:\proj\Book\src\chapter\command>java C
======= Demonstration of Command ======
======= First - using method calls ====
Chapter: The command pattern.
Section 1: Problem
Command is a pattern that makes behavio

---> Erasing last entered line
Chapter: The command pattern.
Section 1: Problem

======= Next - command objects assigned
Chapter: The command pattern.
Section 1: Problem
Command is a pattern that makes behavio

======= F2 reassigned and pressed =====
Chapter: The command pattern.
Section 1: Problem
Command is a pattern that makes behavio
A wrong line

======= Undo of last insert =======
Chapter: The command pattern.
Section 1: Problem
Command is a pattern that makes behavio
```

```
public static void main(String[] args) {
  System.out.println( "======= Demonstration of Command =======");
  Document doc = new Document();

  String line1 = "Chapter: The command pattern.";
  String line2 = "Section 1: Problem";
  String line3 = "Command is a pattern that makes behavior an object.";

  System.out.println( "======= First - using method calls =======" );
  doc.write(line1);
  doc.write(line2);
  doc.write(line3);
  System.out.println( doc );

  System.out.println( "---> Erasing last entered line" );
  doc.erase(line3);
  System.out.println( doc );


  System.out.println( "======= Next - command objects assigned to F1..F3 =======" );
  doc = new Document();
  // Create the commands
  Command write1, write2, write3;
  write1 = new WriteCommand(doc, line1);
  write2 = new WriteCommand(doc, line2);
  write3 = new WriteCommand(doc, line3);
  // Note - nothing has happened to the document yet!

  // assign bindings to the F1 keys
  FKey F1 = new FKey(), F2 = new FKey(), F3 = new FKey();
  // assign write commands to the keys
  F1.assign(write1);
  F2.assign(write2);
  F3.assign(write3);

  // next press F1 to F3 and see the result in the document
  F1.press(); F2.press(); F3.press();
  System.out.println( doc );

  // reassigning F2
  System.out.println( "======= F2 reassigned and pressed =======" );
  Command write4 = new WriteCommand(doc,"A wrong line");
  F2.assign(write4);
  F2.press();
  System.out.println( doc );

  // undoing the last operation
  System.out.println( "======= Undo of last insert =======" );
  write4.undo();
  System.out.println( doc );
}
```

Demo

```
/** A concrete command to write text to the document */
class WriteCommand implements Command {
  private Document doc;
  private String line;
  public WriteCommand(Document doc, String line) {
    this.doc = doc; this.line = line;
  }
  public void execute() {
    doc.write(line);
  }
  public void undo() {
    doc.erase(line);
  }
}

/** A class representing a function key on keyboard */
class FKey {
  private Command command;
  /** assign a command to the key */
  public void assign(Command command) {
    this.command = command;
  }
  /** "press the key" */
  public void press() {
    command.execute();
  }
}
```

Command

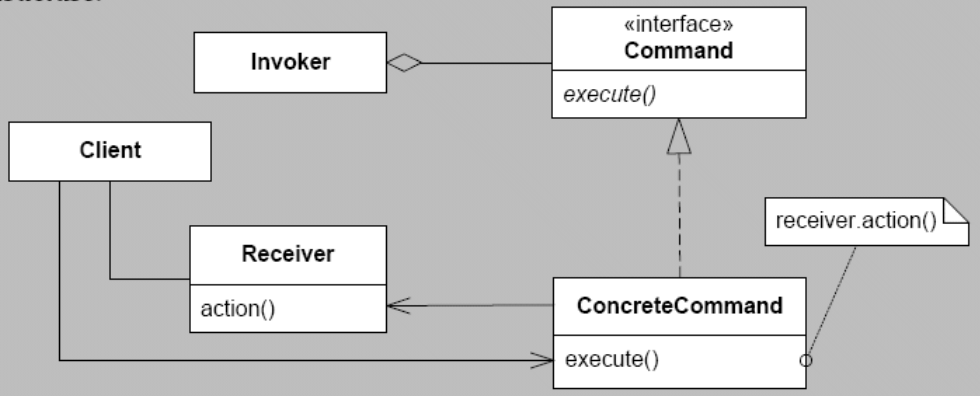
[23.1] Design Pattern: Command

Intent Encapsulate a request as an object, thereby letting you parameterize clients with different requests, queue or log requests, and support undoable operations.

Problem You want to configure objects with behavior/actions at run-time and/or support undo.

Solution Instead of defining operations in terms of methods, define them in terms of objects implementing an interface with an execute method. This way requests can be associated to objects dynamically, stored and replayed, etc.

Structure:



Roles **Invoker** is an object, typically user interface related, that may execute a **Command**, that defines the responsibility of being an executable operation. **ConcreteCommand** defines the concrete operations that involves the object, **Receiver**, that the operation is intended to manipulate. The **Client** creates concrete commands and sets their receivers.

Cost - Benefit Objects that invoke operations are decoupled from those that know how to perform it. *Commands are first-class objects*, and can be manipulated like all other objects. You can assemble commands into *composite commands* (macros). It is *easy to add new commands.*

Consequences

Benefits

- Decouples clients from set of commands
- Command set can be extended at run-time
- Easy to support multiple ways to execute command (menu, pop up, shortcut key, tool bar, …)
- Commands are first-class objects
  - Log them, store them
- Assembling macros is easy (composite of commands)
- Undo can be supported
  - Add an ‘unexecute()’ method, and stack the set of executed commands.

Liability: Cumbersome code for calling a method