Design Patterns

MSc in Communications Software

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Undo / Redo Challenges

Issues

- How do we know if command is ‘undoable’ or not?
- How to manage the redo stack?
- Does our solution in fact work at all? (as currently implemented)

How do we know if command is ‘undoable’?

```
public boolean dispatchCommand(String commandName, Object [] parameters)
{
  boolean dispatched = false;
  Command command = commands.get(commandName);

  if (command != null)
  {
    dispatched = true;
    command.doCommand(parameters);
    undoBuffer.push(command);
  }
  return dispatched;
}
```

- Eg. if command is ‘lu’ what happens when next command is ‘undo’?

One Solution

- Only push commands onto undo stack that make sense
- Is this solution feasible?

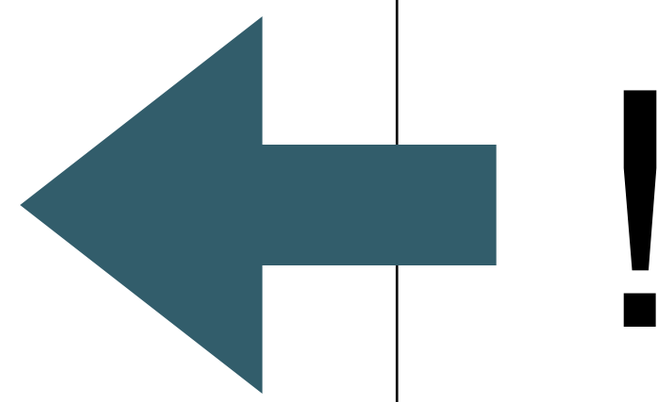
```
public boolean dispatchCommand(String commandName, Object [] parameters)
{
  boolean dispatched = false;
  Command command = commands.get(commandName);

  if (command != null)
  {
    dispatched = true;
    command.doCommand(parameters);
    if ((command instanceof CreateUserCommand)
     || (command instanceof DeleteUserCommand))
    {
      undoBuffer.push(command);
    }
  }
  return dispatched;
}
```

One Solution

```
public boolean dispatchCommand(String commandName, Object [] parameters)
{
  boolean dispatched = false;
  Command command = commands.get(commandName);

  if (command != null)
  {
    dispatched = true;
    command.doCommand(parameters);
    if ((command instanceof CreateUserCommand)
     || (command instanceof DeleteUserCommand)
     || (command instanceof UpdateUserCommand)
     || (command instanceof AddLocationCommand)
     || (command instanceof StoreCommand)
     || (command instanceof LoadCommand)
     || (command instanceof ChangeFormatCommand))
    {
      undoBuffer.push(command);
    }
  }
  return dispatched;
}
```



!

How to manage the redo stack?

- Summary:
  - command 1 - cu a a a a
  - command 2 - cu b b b b
  - undo - (cu b b b b)
  - command 3 - (cu v v v v)
  - redo - (cu b b b b)?

```
Welcome to pacemaker-console - ?help for instructions
pm> cu a a a a
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  1 |         a |        a |     a |        a |
+----+-----------+----------+-------+----------+
pm> cu b b b b
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  2 |         b |        b |     b |        b |
+----+-----------+----------+-------+----------+
pm> undo
pm> cu v v v v
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  3 |         v |        v |     v |        v |
+----+-----------+----------+-------+----------+
pm> lu
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  1 |         a |        a |     a |        a |
|  3 |         v |        v |     v |        v |
+----+-----------+----------+-------+----------+
pm> redo
pm> lu
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  1 |         a |        a |     a |        a |
|  3 |         v |        v |     v |        v |
|  4 |         b |        b |     b |        b |
+----+-----------+----------+-------+----------+
pm>
```

Clear the redo Stack?

- Redo stack should have been cleared.
- When?
  - When performing a command other than redo/undo

```
public boolean dispatchCommand(String commandName, Object [] parameters)
{
  boolean dispatched = false;
  Command command = commands.get(commandName);

  if (command != null)
  {
    dispatched = true;
    command.doCommand(parameters);
        clear redo stack ?
  }
  return dispatched;
}
```

Does our solution in fact work at all?

- add user a
- add user b
- add user c
- 1st undo - should remove user c
- 2nd undo - should remove user b
- Error?

```
Welcome to pacemaker-console - ?help for instructions
pm> cu a a a a
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  1 |         a |        a |     a |        a |
+----+-----------+----------+-------+----------+

pm> cu b b b b
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  2 |         b |        b |     b |        b |
+----+-----------+----------+-------+----------+

pm> cu c c c c
+----+-----------+----------+-------+----------+
| ID | FIRSTNAME | LASTNAME | EMAIL | PASSWORD |
+----+-----------+----------+-------+----------+
|  3 |         c |        c |     c |        c |
+----+-----------+----------+-------+----------+

pm> undo
pm> undo
Error executing command
pm>
```

Debug

this	CommandDispatcher (id=25)
commands	HashMap<K,V> (id=42)
redoBuffer	Stack<E> (id=46)
undoBuffer	Stack<E> (id=49)
capacityIncrement	0
elementCount	3
elementData	Object[10] (id=75)
[0]	CreateUserCommand (id=31)
[1]	CreateUserCommand (id=31)
[2]	CreateUserCommand (id=31)
modCount	3

- Breakpoint and inspect of undo stack after the third add command.
- Notice anything unusual?

Diagnosis

- Each contact in the AddCommand stored on the stack is in fact the same object.

undoBuffer	Stack<E> (id=49)
capacityIncrement	0
elementCount	3
elementData	Object[10] (id=75)
[0]	CreateUserCommand (id=31)
pacemaker	PacemakerAPI (id=36)
parser	AsciiParser (id=38)
user	User (id=76)
activities	HashMap<K,V> (id=77)
email	"c" (id=78)
firstname	"c" (id=79)
id	Long (id=80)
lastname	"c" (id=83)
password	"c" (id=84)
[1]	CreateUserCommand (id=31)
pacemaker	PacemakerAPI (id=36)
parser	AsciiParser (id=38)
user	User (id=76)
activities	HashMap<K,V> (id=77)
email	"c" (id=78)
firstname	"c" (id=79)
id	Long (id=80)
lastname	"c" (id=83)
password	"c" (id=84)
[2]	CreateUserCommand (id=31)
pacemaker	PacemakerAPI (id=36)
parser	AsciiParser (id=38)
user	User (id=76)
activities	HashMap<K,V> (id=77)
email	"c" (id=78)
firstname	"c" (id=79)
id	Long (id=80)
lastname	"c" (id=83)
password	"c" (id=84)
modCount	3

Resolution

- We should in fact take a copy of the Command object push the copy onto the undo stack.
- The original will be reused in subsequent command dispatches.
- How do we copy an object at runtime?

```
public boolean dispatchCommand(String commandName, Object [] p
{
  boolean dispatched = false;
  Command command = commands.get(commandName);

  if (command != null)
  {
    dispatched = true;
    command.doCommand(parameters);
    if ((command instanceof CreateUserCommand)
     || (command instanceof DeleteUserCommand)
     || (command instanceof UpdateUserCommand)
     || (command instanceof AddLocationCommand)
     || (command instanceof StoreCommand)
     || (command instanceof LoadCommand)
     || (command instanceof ChangeFormatCommand))
    {
      undoBuffer.push(command);
    }
  }
  return dispatched;
}
```

Copy a Command?

- use instanceof to determine type
- construct and push appropriate object.

```
...
    {
      if (command instanceof CreateUserCommmand)
      {
        Command newcommand = new new CreateUserCommand(paceApi, parser, command.user))
        undoBuffer.push(newcommand);
      }
      else if (command instanceof DeleteUserCommand)
      {
        Command newcommand = new new DeleteUserCommand(paceApi, parser, command.user))
        undoBuffer.push(newcommand);
      }
      else if (command instanceof AddLocationCommand)
      {
        Command newcommand = new new AddLocationCommand(paceApi, parser, command.user))
        undoBuffer.push(newcommand);
      }

      else ....
      ....
    }
...
```

Rethink

```
public PacemakerShell()
{
  Parser parser = new AsciiParser();
  paceApi    = new PacemakerAPI();
  dispatcher = new CommandDispatcher();
  dispatcher.addCommand("list-users",  new ListUsersCommand(paceApi,  parser));
  dispatcher.addCommand("create-user", new CreateUserCommand(paceApi, parser));
  dispatcher.addCommand("delete-user", new DeleteUserCommand(paceApi, parser));
}
```

- Core design needs a rethink.
- Command objects are created in CommandDispatcher
- Consider these to be “Prototypes” of Command objects.
- We generate new commands from these prototypes in some manner.

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