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Pattern: Command

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Behavioral Patterns

- Concerned with algorithms and the assignment of responsibility between objects. They describe not only the objects or classes but also the pattern of communication between them
- Characterize complex control flow that is difficult to follow at run-time.

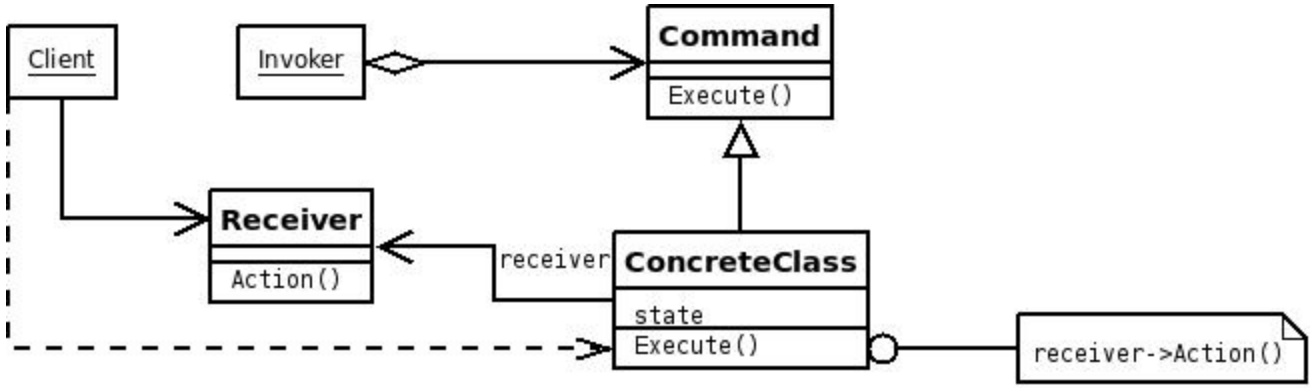
Command Pattern: Intent

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

Command Pattern: Motivation/Applications

- Motivation:
  - Used when it is necessary to issue requests to objects without knowing anything about the operation being requested or the receiver of the request.
- Applications:
  - Object oriented replacement for “Call-back” functions
  - specify,queue, and execute requests at different times
  - Support “undo”
  - Log changes to be replayed upon system crash
  - Implement “transactional” systems

Command Pattern: Structure



- Command: declares an interface for executing a operation
- ConcreteClass:
  - Defines a binding between a Receiver and an Action()
  - Implements Execute by invoking the Action() from Receiver
- Client: creates a ConcreteCommand and sets the Receiver
- Invoker: asks the command to carry out the request
- Receiver: knows how to perform an Action()
  - Any class can act as a Receiver

Command Pattern: Consequences

- Decouples invoker from the object that performs the operation
- Can assemble multiple Commands into composite commands, like Macros/ Transactions
- Easily change Commands without changing existing classes.
- If you are going to support “undo” you will need to possibly store extra state information in the ConcreteCommand object to ensure no loss or alteration of behavior

Command Pattern: Sample Code

```
class Command{
  public:
   virtual void execute(void) =0;
   virtual ~Command(void){};
};

class Task : public Command {
  public:
   Task(string day, string task ){
       _task = task;
       _day = day;
   }
   void execute(void){
       cout << _day << "\t" << _task << endl;
   }
  private:
   string _task;
   string _day;
};

class TaskList{
  public:
   void add(Command *c) {
       commands.push_back(c);
   }
   void printTasks(void){
       for(vector<Command*>::size_type x=0;x<commands.size();x++){
           commands[x]->execute();
       }
   }
   void undo(void){
       if(commands.size() > 0) {
           commands.pop_back();
       }
       else {
           cout << "Can't undo" << endl;
       }
   }
  private:
   vector<Command*> commands;
};
```

Command Pattern: Sample Code – Main

```
int main(void) {
    TaskList todos;

    //Create each task
    Task first("Monday", "OO class");
    Task second("Tuesday", "Car appointment");
    Task third("Wednesday","VHD meeting");
    Task fourth("Friday", "leave early");

    //Add tasks to TaskList
    cout << endl << "TODO List:" << endl;
    todos.add(&first);
    todos.add(&second);
    todos.add(&third);
    todos.printTasks();

    //Show an undo operation
    todos.undo();
    cout << endl << "TODO List:" << endl;
    todos.add(&fourth);
    todos.printTasks();
    return 0;
}
```