Proxy Design Pattern

Overview

- the proxy design pattern provides a surrogate or placeholder for another object to control access to it
  - used when we want to provide controlled access of a functionality

- the formal definition of a proxy is a person authorized to act for another person
  - an agent or substitute
  - the authority to act for another

- there are situations in which a client does not or can not reference an object directly, but wants to still interact with the object
  - introduces a level of indirection when accessing an object

- a proxy object can act as the intermediary between the client and the target object

- another common use case is to provide a wrapper implementation for better performance

examples

- a check or a credit card is a proxy for what is in a bank account
  - can be used in place of cash
    - provides a means of accessing that cash when required
  - exactly what a proxy does, it controls and manage access to the object they are protecting

- in a classroom, when one student is absent, during roll call, his best friend may try to mimic the student’s voice to try to keep his friend from being marked as absent

- lets say we have a class that can run some command on a system
  - if we are using it, it works fine
  - if we want to give this program to a client application
    - can have severe issues because client program can issue commands to delete some system files or change some settings that you do not want to
  - a proxy class can be created to provide controlled access of the program

- a proxy is used in the java API remote method invocation package (java.rmi.*)

examples (cont'd)

- one reason for controlling access to an object is to defer the full cost of its creation and initialization until we actually need to use it

- for example, a document editor that can embed graphical objects in a document
  - large raster images can be expensive to create
  - however, opening a document should be fast
    - we should avoid creating all the expensive objects at once when the document is opened

- these constraints would suggest creating each expensive object on demand
  - occurs when an image becomes visible

- the solution is to use another object
  - an image proxy that acts as a stand-in for the real image
  - the proxy acts just like the image and takes care of instantiating it when it is required

types of proxies

- remote proxy
  - manages interaction between a client and a remote object
  - provides a reference to an object located in a different address space on the same or different machine

- virtual proxy
  - controls access to an object that is expensive to instantiate
  - allows for the creation of a memory intensive object on demand
    - object will not be created until it is really needed

- Copy-On-Write proxy
  - defers copying (cloning) a target object until required by client actions
  - a form of a virtual proxy

- protection (Access) proxy
  - provides different clients with different levels of access to a target object

types of proxies (cont'd)

- cache proxy
  - provides temporary storage of the results of expensive target operations so that multiple clients can share the results

- firewall proxy
  - protects targets from bad clients (or vice versa)

- synchronization proxy
  - provides multiple accesses to a target object

- smart reference proxy
  - provides additional actions whenever a target object is referenced such as counting the number of references to the object

Summary

- the proxy pattern provides a representative for another object in order to control the client's access to it

- security is a big advantage
  - remote proxies ensures a more secure application by installing the local code proxy (stub) in the client machine and then accessing the server with help of the remote code

- avoids duplication of objects which might be huge in size and memory intensive
  - increases the performance of the application

- proxy is structurally similar to decorator, but the two differ in their purpose
  - decorator pattern adds behavior to an object
  - proxy controls access

- proxies will increase the number of classes and objects in your designs