The Proxy Pattern

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Proxy Pattern: Motivation

There are situations in which a client does not or can not reference an Object directly, but wants to still interact with the object.

A proxy object can act as the intermediary between the client and the target object.

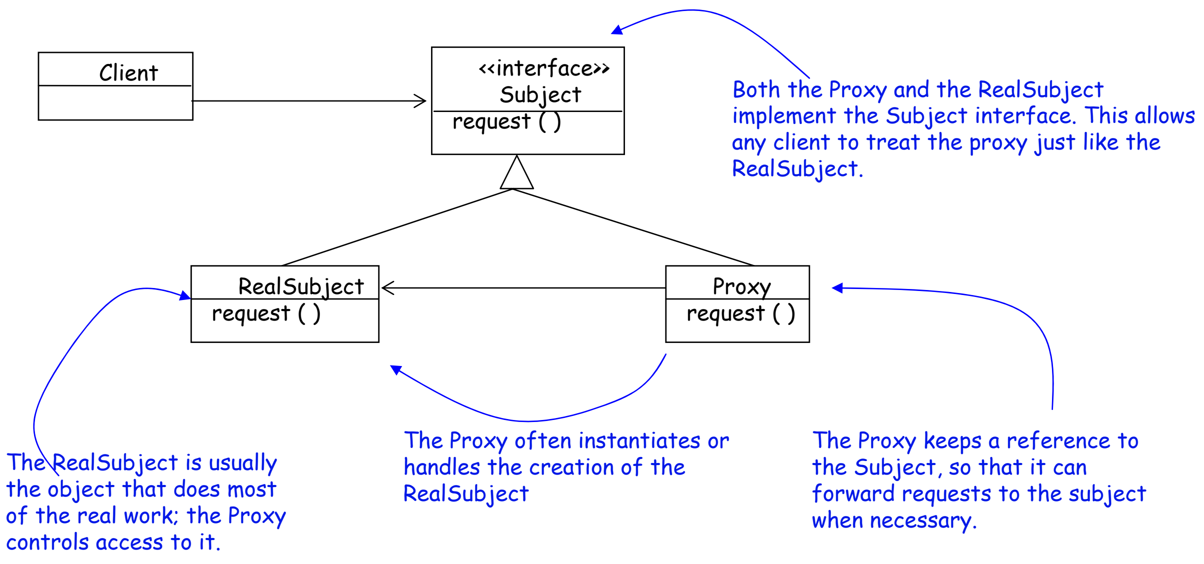
The proxy object has the same interface as the target object.

The proxy holds a reference to the target object and can forward requests to the target as required.

Proxies are useful wherever there is a need for a more sophisticated reference to an object than a simple pointer or simple reference can provide.

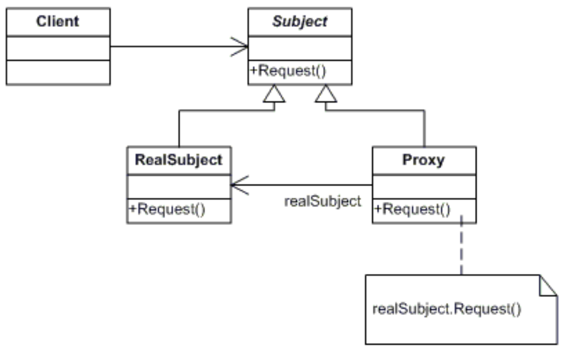
The Proxy Pattern Defined

The **Proxy Pattern** provides a surrogate or placeholder for another object to control access to it.



Client
<<interface>>
Subject
request ( )
RealSubject
request ( )
Proxy
request ( )
Both the Proxy and the RealSubject implement the Subject interface. This allows any client to treat the proxy just like the RealSubject.
The RealSubject is usually the object that does most of the real work; the Proxy controls access to it.
The Proxy often instantiates or handles the creation of the RealSubject
The Proxy keeps a reference to the Subject, so that it can forward requests to the subject when necessary.

Participants



Proxy:

- maintains a reference that lets the proxy access the real subject. Proxy may refer to a Subject if the RealSubject and Subject interfaces are the same.
- provides an interface identical to Subject's so that a proxy can be substituted for for the real subject.
- controls access to the real subject and may be responsible for creating and deleting it.

Subject: defines the common interface for RealSubject and Proxy so that a Proxy can be used anywhere a RealSubject is expected.

RealSubject: defines the real object that the proxy represents.

Different ways proxies control access

Proxy Pattern control and manage access.

The Proxy pattern can manifest itself in many different ways:

- A *Virtual Proxy* allows the creation of a memory intensive object on demand. The object will not be created until it is really needed.
- A *Protection Proxy* (firewall) controls access to a resource based on access rights.
- *Remote Proxy* controls access to a remote object - As we have seen in the case of RMI,

Proxy Pattern: Structural Code

```
/**
 * Test driver for the pattern.
 */
public class Test {
            public static void main( String arg[] ) {
                 Subject real = new RealSubject();
                 Proxy proxy = new Proxy();
                 proxy.setRealSubject( real );
                 proxy.request();
                 }
}

/**
 * Defines the common interface for RealSubject and Proxy so that
 * a Proxy can be used anywhere a RealSubject is expected.
 */
public interface Subject {
            void request();
}

/**
 * Defines the real object that the proxy represents.
 */
public class RealSubject implements Subject {
            public void request() {
                        // Do something based on the interface.
            }
}
```

```
/**
 * Maintains a reference that lets the proxy access the real subject. Proxy may refer to a Subject
 * if the RealSubject and Subject interfaces are the same. Provides an interface identical to
 * Subject's so that a proxy can by substituted for the real subject.
 */
public class Proxy implements Subject {
            private Subject realSubject;
            public void setRealSubject( Subject subject ) {
                        realSubject = subject;
            }
            public Subject getRealSubject() {
                        // This may not be possible if the
                        // proxy is communicating over a network.
                        return realSubject;
            }
            public void request() {
                        // This is very simplified.
                        //
                        // This could actually be a call to a different
                        // run-time environment locally, a machine over a
                        // TCP socket, or something completely different.
                        realSubject.request();
            }
}
```

Virtual Proxy: Example

```
import java.util.*;

interface Image {
   public void displayImage();
}

class RealImage implements Image {
   private String filename;
   public RealImage(String filename) {
       this.filename = filename;
       System.out.println("Loading   "+filename);
   }
   public void displayImage() { System.out.println("Displaying "+filename); }
}
```

```
class ProxyImage implements Image {
   private String filename;
   private RealImage image;
   public ProxyImage(String filename) { this.filename = filename; }
   public void displayImage() {
       if (image == null) {
           image = new RealImage(filename); // load only on demand
       }
       image.displayImage();
   }
}

class ProxyExample {
   public static void main(String[] args) {
       ArrayList<Image> images = new ArrayList<Image>();
       images.add( new ProxyImage("HiRes_10MB_Photo1") );
       images.add( new ProxyImage("HiRes_10MB_Photo2") );
       images.add( new ProxyImage("HiRes_10MB_Photo3") );
       images.get(0).displayImage(); // loading necessary
       images.get(1).displayImage(); // loading necessary
       images.get(0).displayImage(); // no loading necessary; already done
       // the third image will never be loaded - time saved!
   }
}
```

Protection Proxy: Example

The real client stores an Account Number. Only the users who know the valid password can access this Account Number. Real client is protected by a proxy who knows the password. If a user wants to get an Account Number, first the proxy asks him/her to authenticate itself. If the user entered a correct password the proxy will call the real client and pass the Account Number to the user.

```
/// C# example
using System;
namespace ConsoleApplicationTest.FundamentalPatterns.ProtectionProxyPattern {
   public interface IClient{
       string GetAccountNo();
   }
   public class RealClient : IClient{
       private string accountNo="AB-111111";
       public RealClient(){
           Console.WriteLine("RealClient: Initialized");
       }
       public string GetAccountNo(){
           Console.WriteLine("RealClient's AccountNo: " + accountNo);
           return accountNo;
      }
   }
public class ProtectionProxy : IClient {
       private string password=null;  //password to get secret
       RealClient client=null;
       public ProtectionProxy(string pwd) {
           Console.WriteLine("ProtectionProxy: Initialized");
           password=pwd;
           client=new RealClient();
       }
       public String GetAccountNo() {
           Console.WriteLine("Password: ");
           string tmpPwd= Console.ReadLine();
           if(tmpPwd == password) {
               return client.GetAccountNo(); }
           else {
               Console.WriteLine("ProtectionProxy: Illegal password!");
               return "";
           }
       }
   }
class ProtectionProxyExample {
       public static void Main(string[] args){
           IClient client = new ProtectionProxy("thePassword");
           Console.WriteLine("main received: "+client.GetAccountNo());
           Console.WriteLine("main received: "+client.GetAccountNo());
           Console.Read();
       }
   }
}
```

Proxy vs Decorator

- Proxy is structurally similar to Decorator, but the two differ in their purpose.
- The Decorator Pattern adds behavior to an object, while a proxy controls access to it.
- Like any wrapper, proxies will increase the number of classes and objects in your design.