CS 417-505
Design Patterns

Proxy

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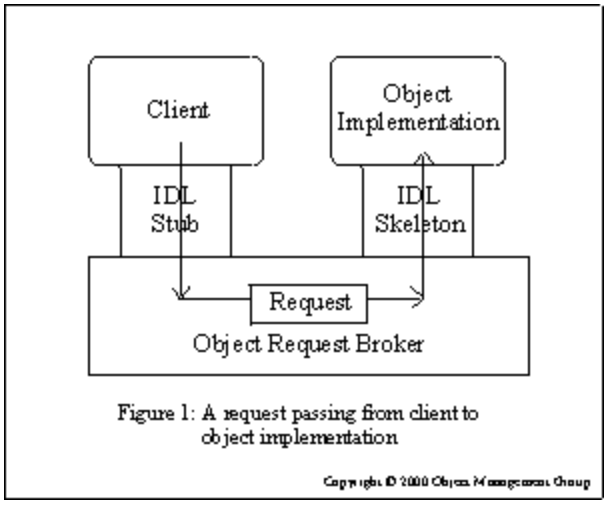
Design pattern: Proxy

- **Category**: Structural design pattern
- **Intent**:
  - Provide surrogate or placeholder for another object to control access to it.
- **Motivation**
  - Control access to actual object
    - Actual object may be remote
    - Cost of actual operation is expensive so defer until needed
    - Monitor object access

Applicability

- Applicable wherever need for more versatile or sophisticated reference to an object
  - Remote proxy
    - Actual object is located in different address space, Proxy acts as ambassador for remote object. Ex. remote EJBs, Common Object Request Broker Architecture (CORBA)



Ex. CORBA interaction

Applicability cont.

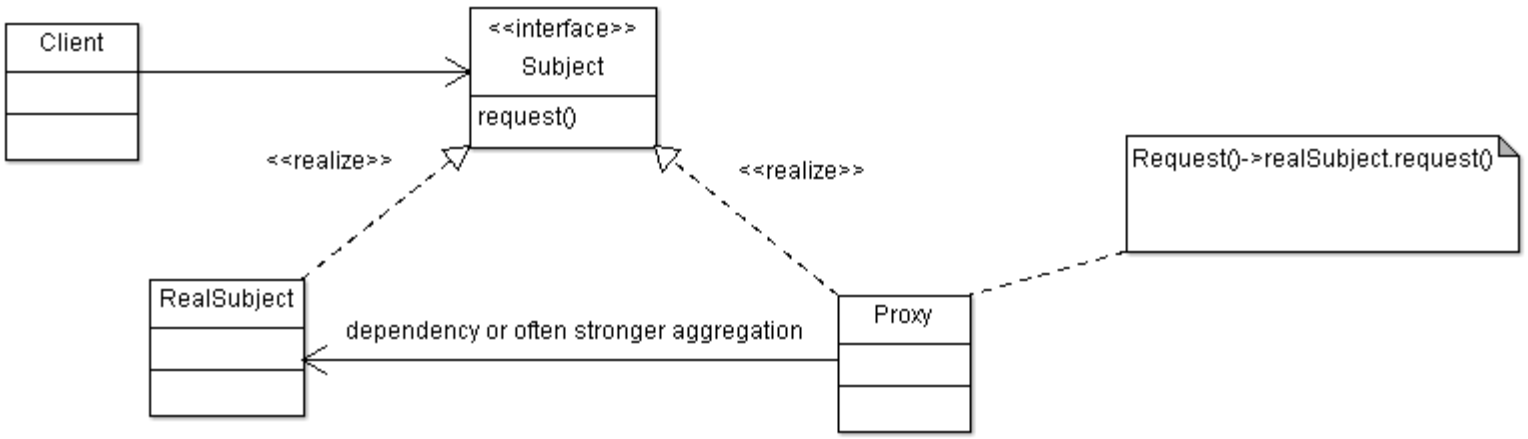
- Applicable wherever need for more versatile or sophisticated reference to an object
  - Virtual proxy
    - Create expensive objects on demand rather than up front (example to follow)
  - Protection proxy
    - Used to enforce when objects should have different access rights. Verify access before actual object called
  - Smart reference
    - Ex. Track number of references held or have multiple point to same object in memory until modification is made then split to new actual instance reference.

Participants

- Proxy
  - Maintains a reference that lets the proxy access the real subject – may refer to Subject or RealSubject
  - Provides interface identical to Subject's
  - Controls access to RealSubject may be responsible for creating/destroying
  - Others
    - *Remote proxy* – responsible for encoding request sent to RealSubject in different address space
    - *Virtual proxy* – optimizations such as on-demand
    - *Protection proxy* and *smart reference* – additional house cleaning

Participants cont.

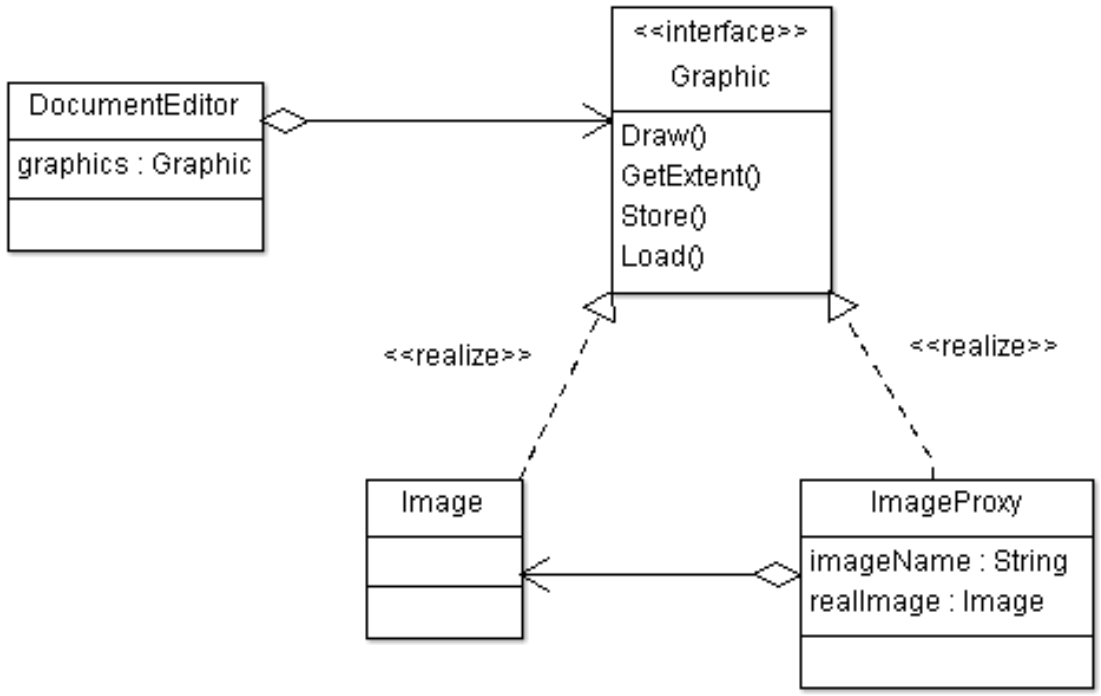
- Subject
  - Defines common interface for RealSubject and Proxy so Proxy can be used interchangeably
- RealSubject
  - Real object proxy represents



Motivation cont. – virtual proxy

- Motivation – Multi-page Word document with lots of embedded pictures
  - If load all when document opened very expensive
    - Time consuming
    - Resource consuming
  - Instead defer actual loading until page is visible
    - Load on demand

Proxy UML


<<interface>>
Graphic
Draw()
GetExtent()
Store()
Load()
DocumentEditor
graphics : Graphic
<<realize>>
<<realize>>
Image
ImageProxy
imageName : String
realImage : Image

More proxy examples

- Remote proxy
  - Ex. remote EJBs, Common Object Request Broker Architecture (CORBA)
- Protection proxy
  - Security protection
- Smart reference
  - All refer to same until modification made combining with flyweight pattern

- Decorator vs Proxy
  - Both provide identical interface
    - Decorator – goal add additional responsibilities or functionality dynamically without subclassing can recurse multiple decorators
    - Proxy – intent is to stand in when inconvenient or undesirable to access class directly – tied to single class not recursive

In class examples

- Identify two concrete example where different forms of Proxy would make sense
  - Remote proxy
  - Virtual proxy
  - Protection proxy
  - Smart reference

Design pattern: Memento

- **Category**: Behavioral design pattern
- **Intent**:
  - Without violating encapsulation, capture and externalize an object's state so it can be restored later
- **Motivation**
  - Record checkpoint or undo mechanism
  - Serialize object state

Applicability

- A snapshot of an object's state must be saved so it can be restored later, ***and***
- A direct interface to obtaining the state would expose implementation details and break the object's encapsulation

Participants

- Memento
  - Stores internal state of the Originator object
    - Can be full state or partial state
  - Protects against access by objects other than originator
    - Caretaker sees a *narrow* interface
    - Originator sees a *wide* interface
  - Originator
    - Creates a memento containing snapshot of relevant state info
    - Uses memento to restore internal state
  - Caretaker
    - Is responsible for the memento's safekeeping
    - Never operates on or examines the contents of the memento