Laboratorio di Progettazione di Sistemi Software
Design Pattern Strutturali

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Indice degli argomenti

- Catalogo di Design Patterns strutturali:
  - Composite
  - Decorator
  - Adapter

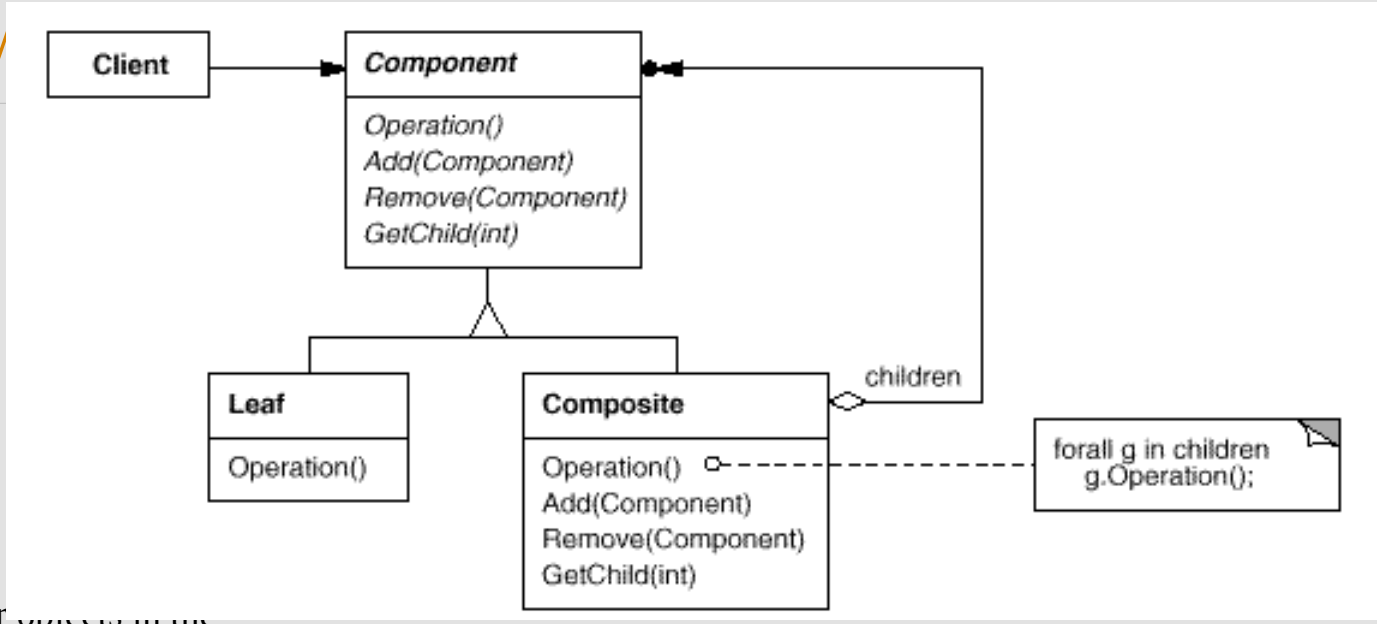
Composite

- Intent
  - Compose objects into tree structures to represent part-whole hierarchies.

  Composite lets clients treat individual objects and compositions of objects uniformly
- Applicability
  - you want to represent part-whole hierarchies of objects.
  - you want clients to be able to ignore the difference between compositions of objects and individual objects. Clients will treat all objects in the composite structure uniformly

Composite /

- Structure



Participants

Component

declares the interface for objects in the composition.
implements default behavior for the interface common to all classes.
declares an interface for accessing and managing its child components.
(optional) defines an interface for accessing a component's parent in the recursive structure, and implements it if that's appropriate.

Leaf

represents leaf objects in the composition.
defines behavior for primitive objects

Composite

defines behavior for components having children.
stores child components.
Implements child-related operations in the Component interface.

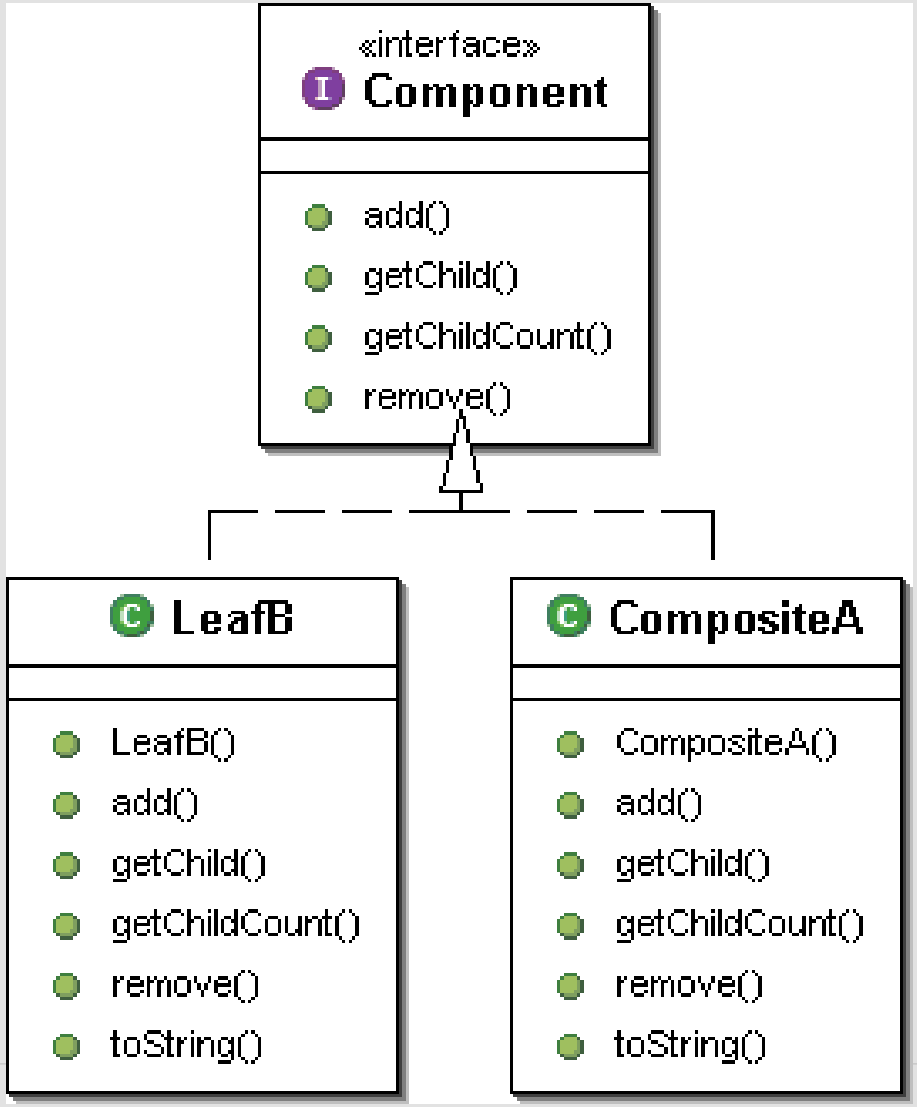
Client

manipulates objects in the composition through the Component interface.

Composite /3

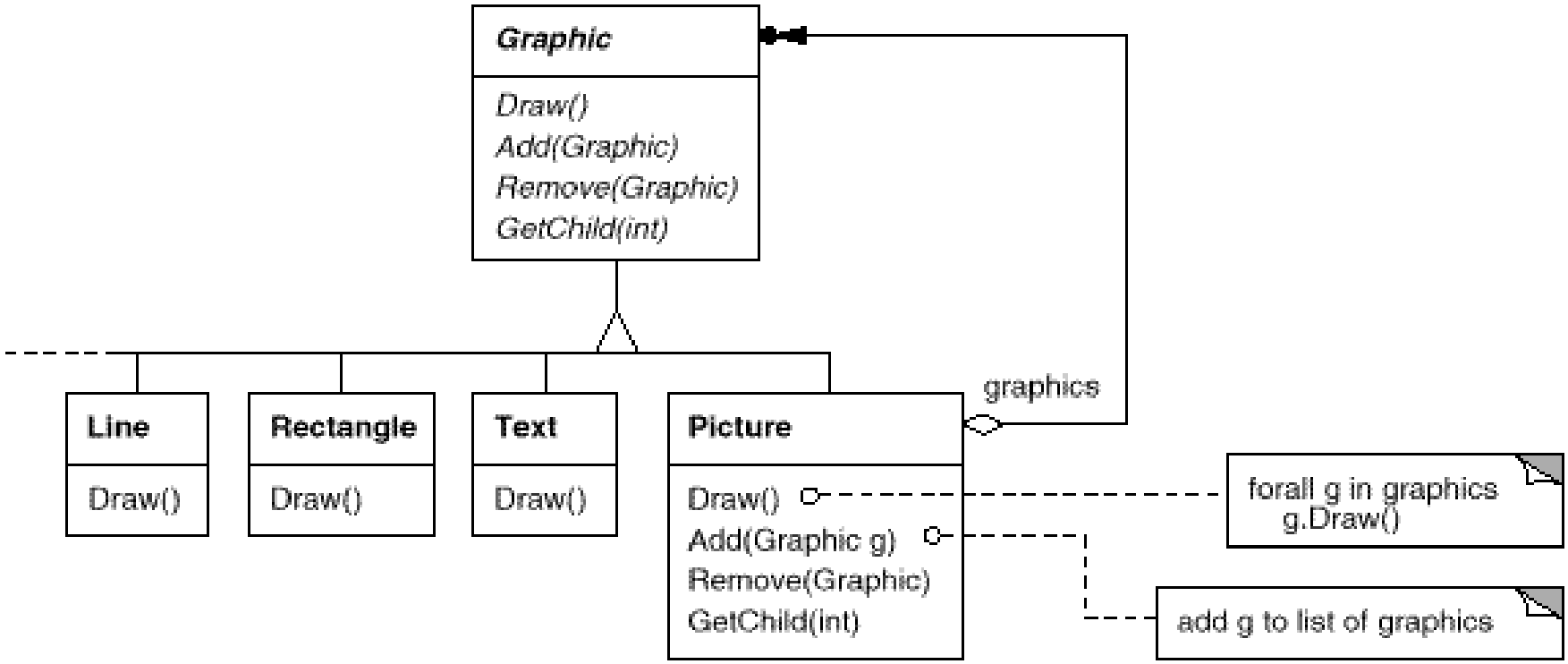
- Collaborations
  - Clients use the Component class interface to interact with objects in the composite structure. If the recipient is a Leaf, then the request is handled directly. If the recipient is a Composite, then it usually forwards requests to its child components, possibly performing additional operations before and/or after forwarding.
- Consequences
  - defines class hierarchies consisting of primitive objects and composite objects
  - makes the client simple
  - makes it easier to add new kinds of components
  - can make your design overly general

Composite example 1



Composite example 2

- Graphics applications like drawing editors and schematic capture systems let users build complex diagrams out of simple components



Composite Questions

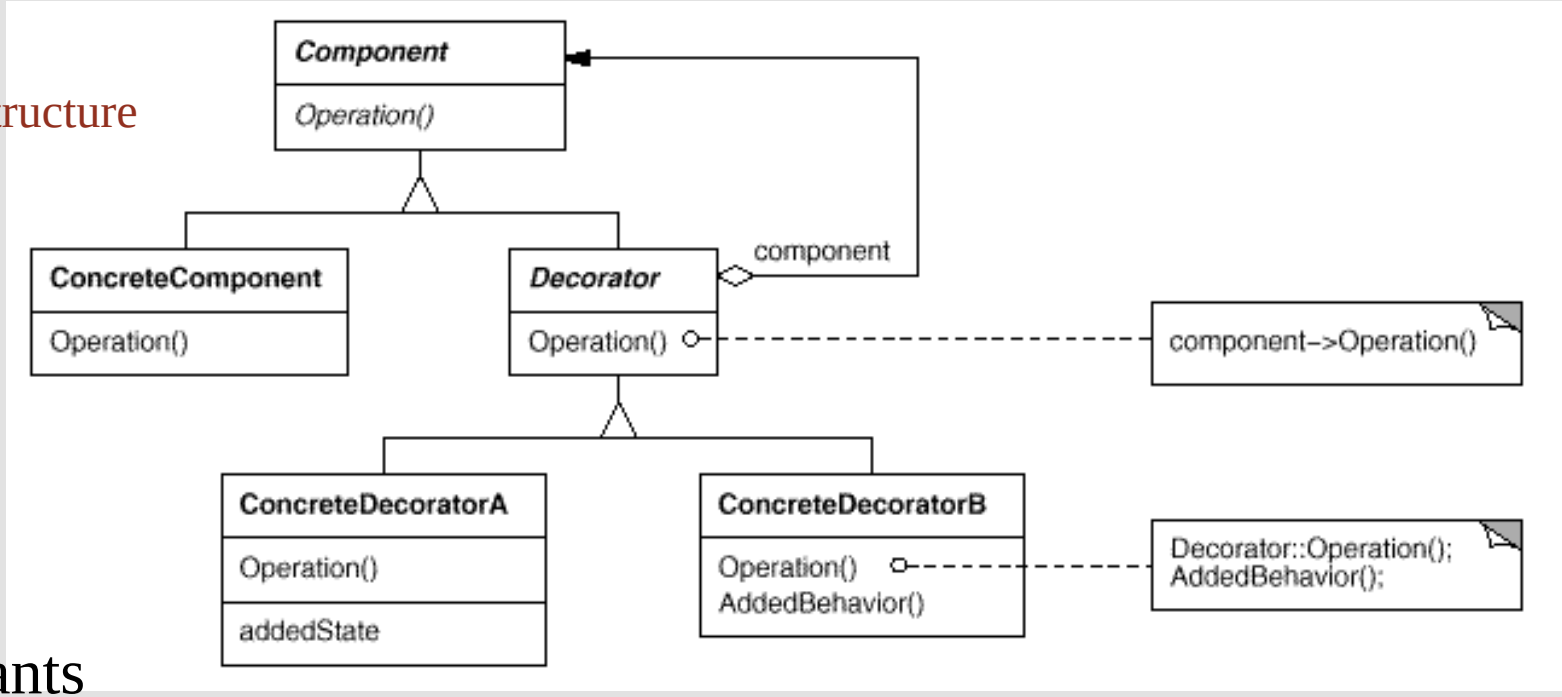
- Part 1: How does the Composite pattern help to consolidate system-wide conditional logic?
- Part 2: Would you use the composite pattern if you did not have a part-whole hierarchy? In other words, if only a few objects have children and almost everything else in your collection is a leaf (a leaf can have no children), would you still use the composite pattern to model these objects?

Decorator or Wrapper

- Intent
  - Attach additional responsibilities to an object dynamically. Decorators provide a flexible alternative to subclassing for extending functionality.
- Applicability
  - to add responsibilities to *individual* objects *dynamically* and *transparently*, that is, without affecting other objects.
  - for responsibilities that can be withdrawn.
  - when extension by subclassing is impractical or not allowed

Decorator /2

- Structure



Participants

Component

defines the interface for objects that can have responsibilities added to them dynamically

ConcreteComponent

defines an object to which additional responsibilities can be attached

Decorator

maintains a reference to a Component object and defines an interface that conforms to Component's interface

ConcreteDecorator

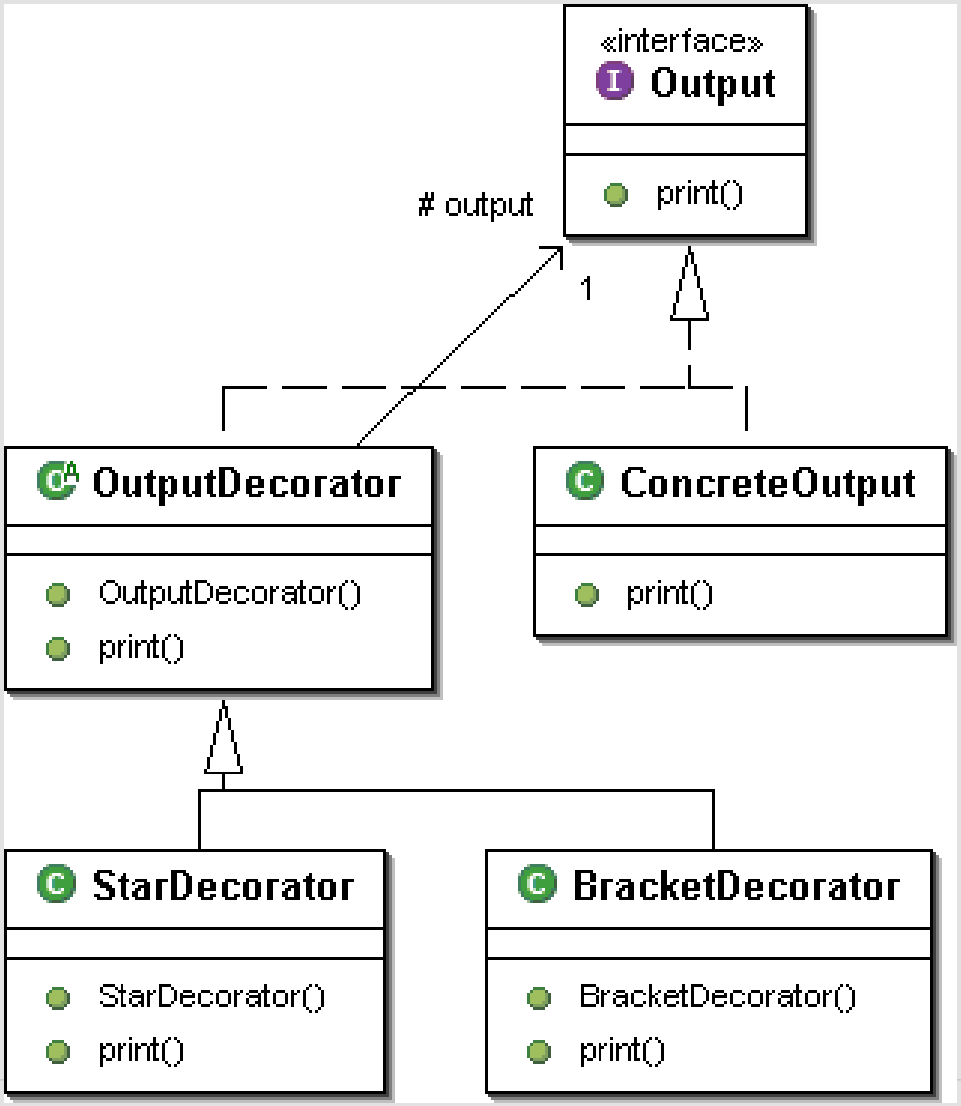
adds responsibilities to the component

Decorator /3

- Collaborations
  - Decorator forwards requests to its Component object. It may optionally perform additional operations before and after forwarding the request
- Consequences
  - More flexibility than static inheritance.
  - Avoids feature-laden classes high up in the hierarchy.
  - A decorator and its component aren’t identical.
  - Lots of little objects.
- Implementation
  - Keeping Component classes lightweight.
  - Changing the skin of an object versus changing its guts.

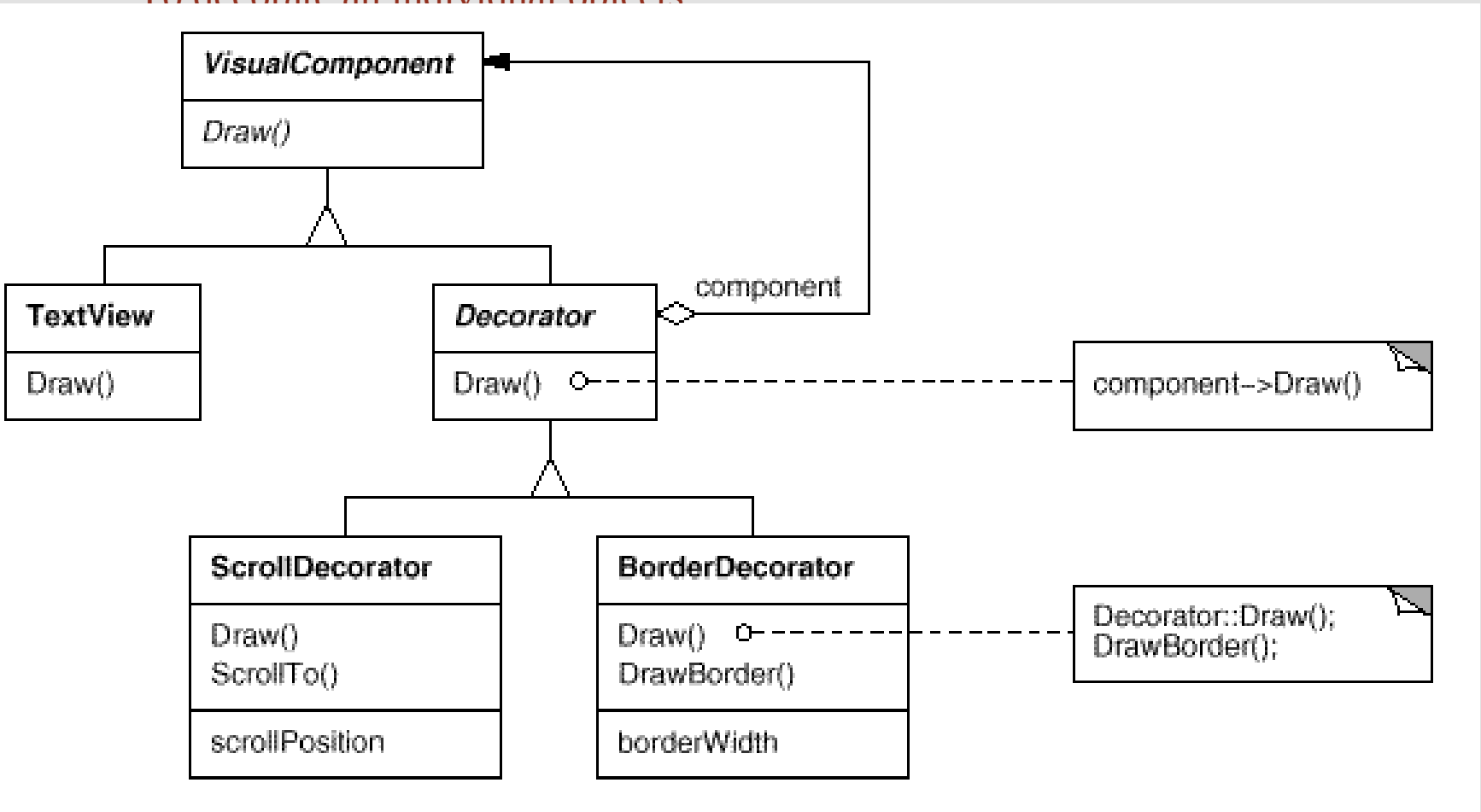
Decorator example 1

- String Decorator



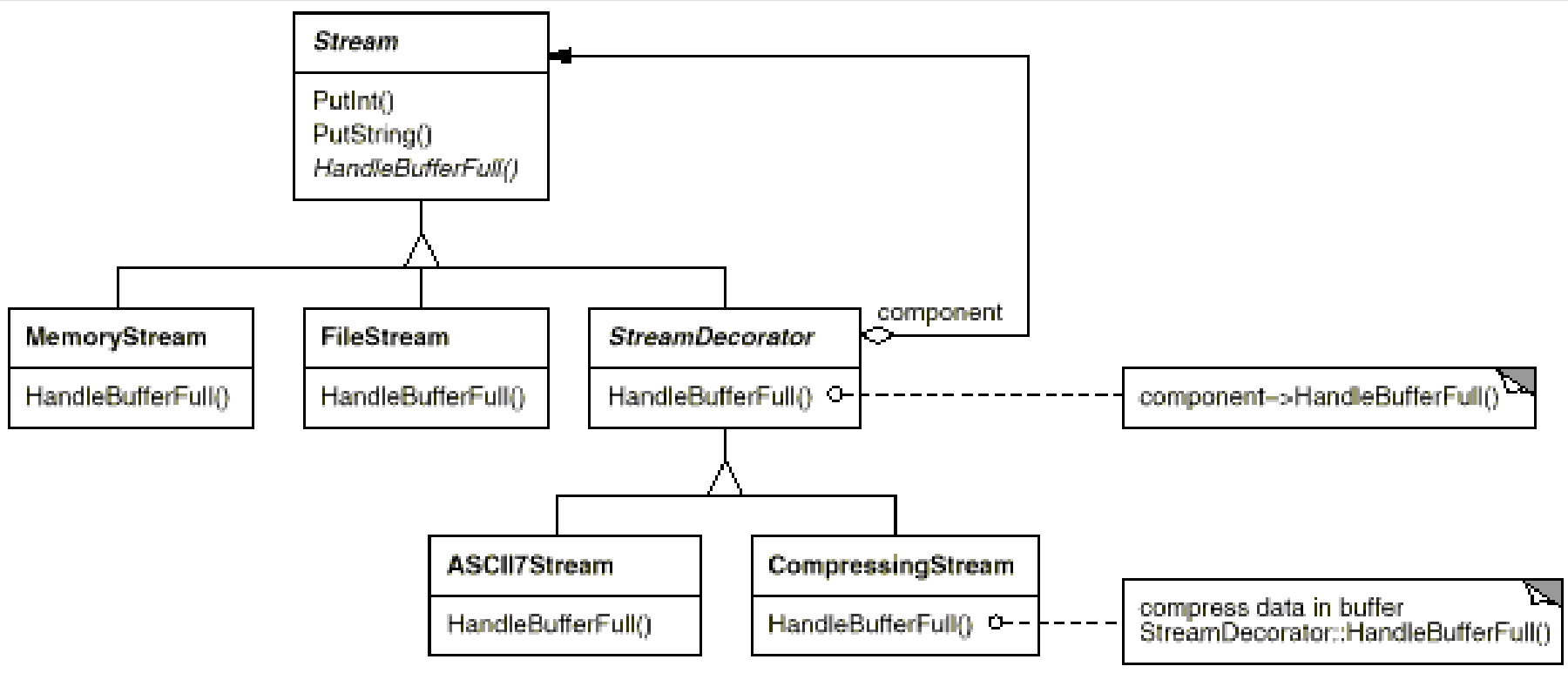
Decorator example 2

- To decorate an individual objects



Decorator example 3

- Adding responsibilities to streams



Decorator questions

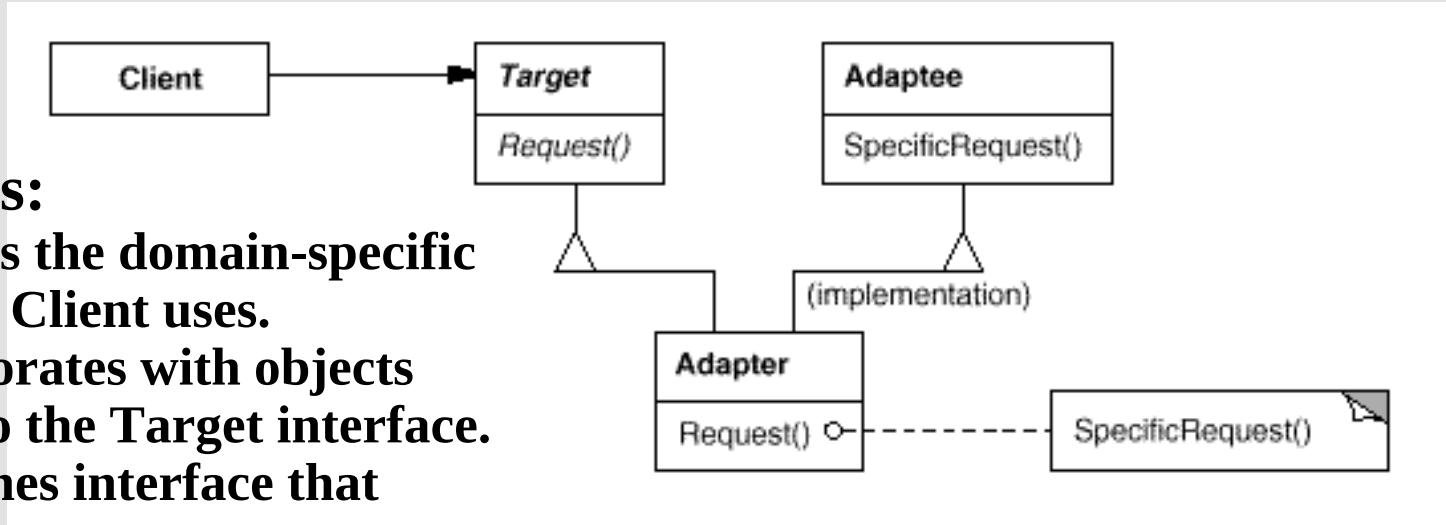
- Now consider an object A, that is decorated with an object B. Since object B "decorates" object A, object B shares an interface with object A. If some client is then passed an instance of this decorated object, and that method attempts to call a method in B that is not part of A's interface, does this mean that the object is no longer a Decorator, in the strict sense of the pattern? Furthermore, why is it important that a decorator object's interface conforms to the interface of the component it decorates?

Adapter

- Intent
  - Convert the interface of a class into another interface clients expect. Adapter lets classes work together that couldn't otherwise because of incompatible interfaces.
- Applicability
  - you want to use an existing class, and its interface does not match the one you need.
  - you want to create a reusable class that cooperates with unrelated or unforeseen classes, that is, classes that don't necessarily have compatible interfaces.
  - *(object adapter only)* you need to use several existing subclasses, but it's impractical to adapt their interface by subclassing every one. An object adapter can adapt the interface of its parent class.

Adapter/2

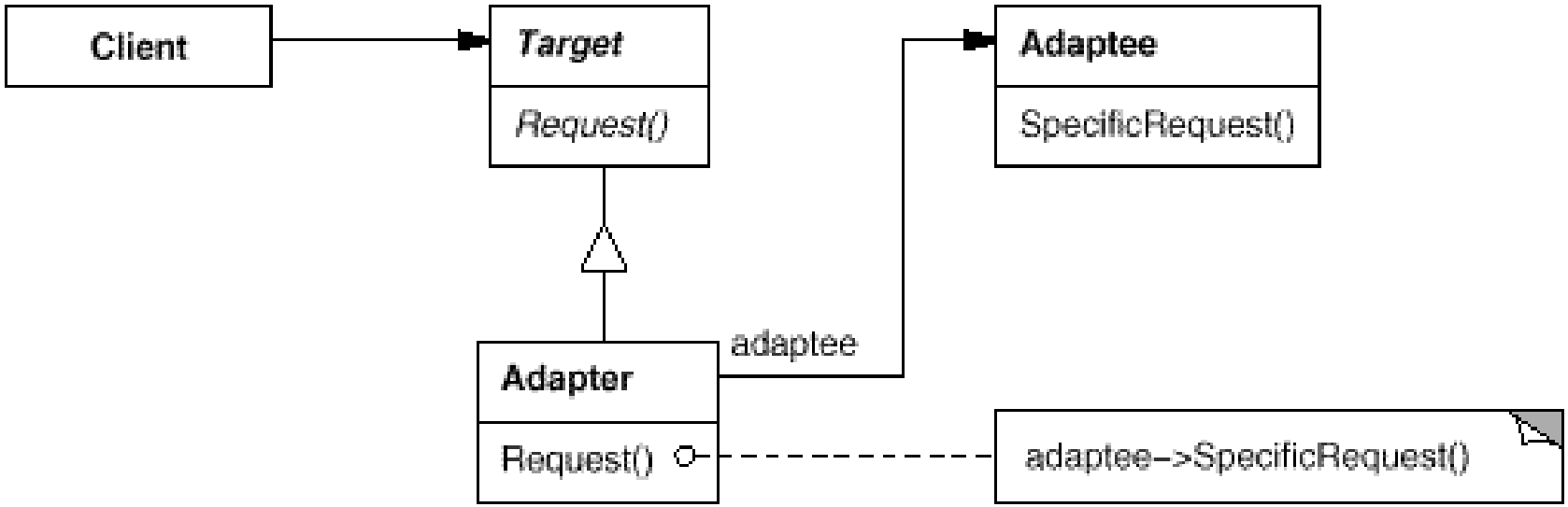
- Structure
- A class adapter uses multiple inheritance to adapt one interface to another:



Participants:
Target**: defines the domain-specific interface that Client uses.**
Client**: collaborates with objects conforming to the Target interface.**
Adaptee**: defines interface that needs adapting.**
Adapter**: adapts the interface of Adaptee to the Target interface.**

Adapter/2

- Structure
- An object adapter relies on object composition:



Adapter/4

- Consequences
- **Class and object adapters have different trade-offs.**
- A class adapter
- **adapts Adaptee to Target by committing to a concrete Adapter class. A class adapter won't work when we want to adapt a class *and* all its subclasses.**
- **lets Adapter override some of Adaptee's behavior, since Adapter is a subclass of Adaptee.**
- **introduces only one object, and no additional pointer indirection is needed to get to the adaptee.**
- An object adapter
- **lets a single Adapter work with many Adaptees, that is, the Adaptee itself and all of its subclasses (if any). The Adapter can also add functionality to all Adaptees at once.**
- **makes it harder to override Adaptee behavior. It will require subclassing Adaptee and making Adapter refer to the subclass rather than the Adaptee itself.**

Adapter/5

- Example
  - Sometimes a toolkit class that's designed for reuse isn't reusable only because its interface doesn't match the domain-specific interface an application requires.Consider for example a drawing editor that lets users draw and arrange graphical elements (lines, polygons, text, etc.) into pictures and diagrams. An user interface toolkit might already provide a sophisticated TextView class for displaying and editing text.