Decorator Pattern – Structural

- Intent
  - » **Attach additional responsibilities to an object dynamically**
  - » **Provide a flexible alternative to sub-classing for extending functionality**
- Also known as
  - » **Wrapper**

Motivation

- Need to add responsibility to individual objects not to entire classes

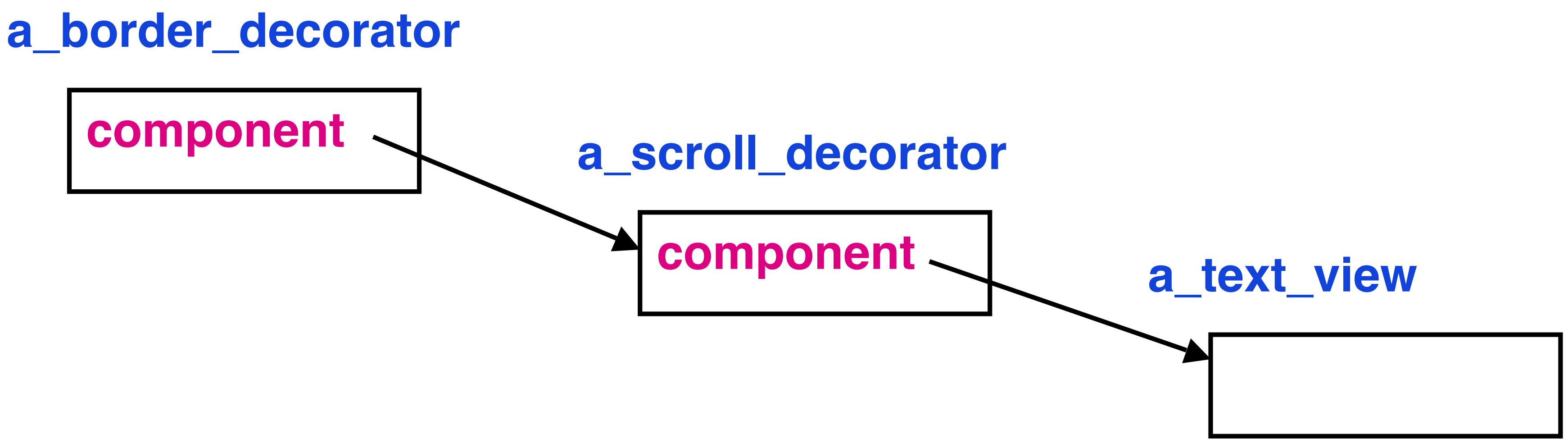
  Add properties like border, scrolling, etc. to any user interface component as needed

- Enclose object within a decorator object for flexibility

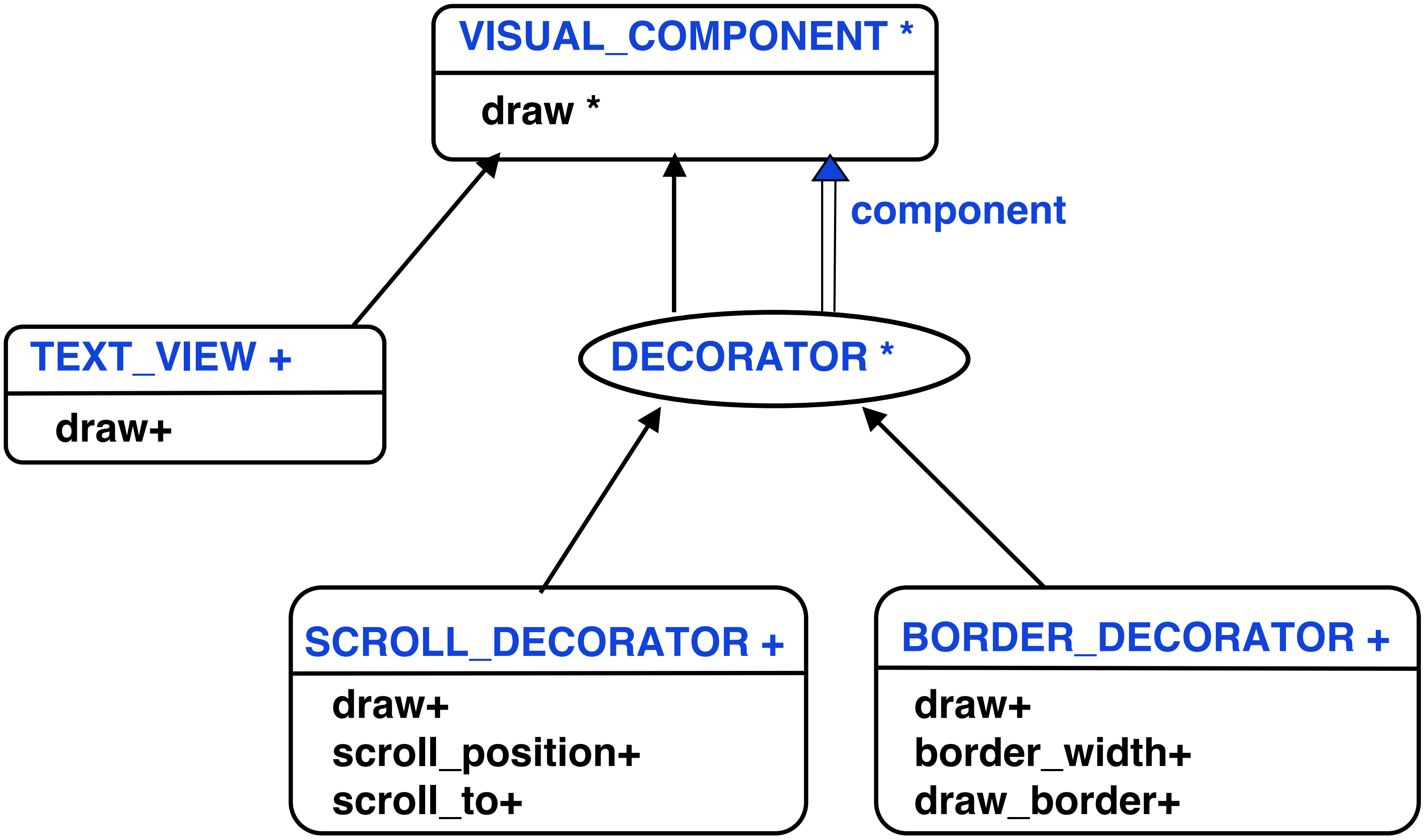
  Nest recursively for unlimited customization

Example Text Decoration

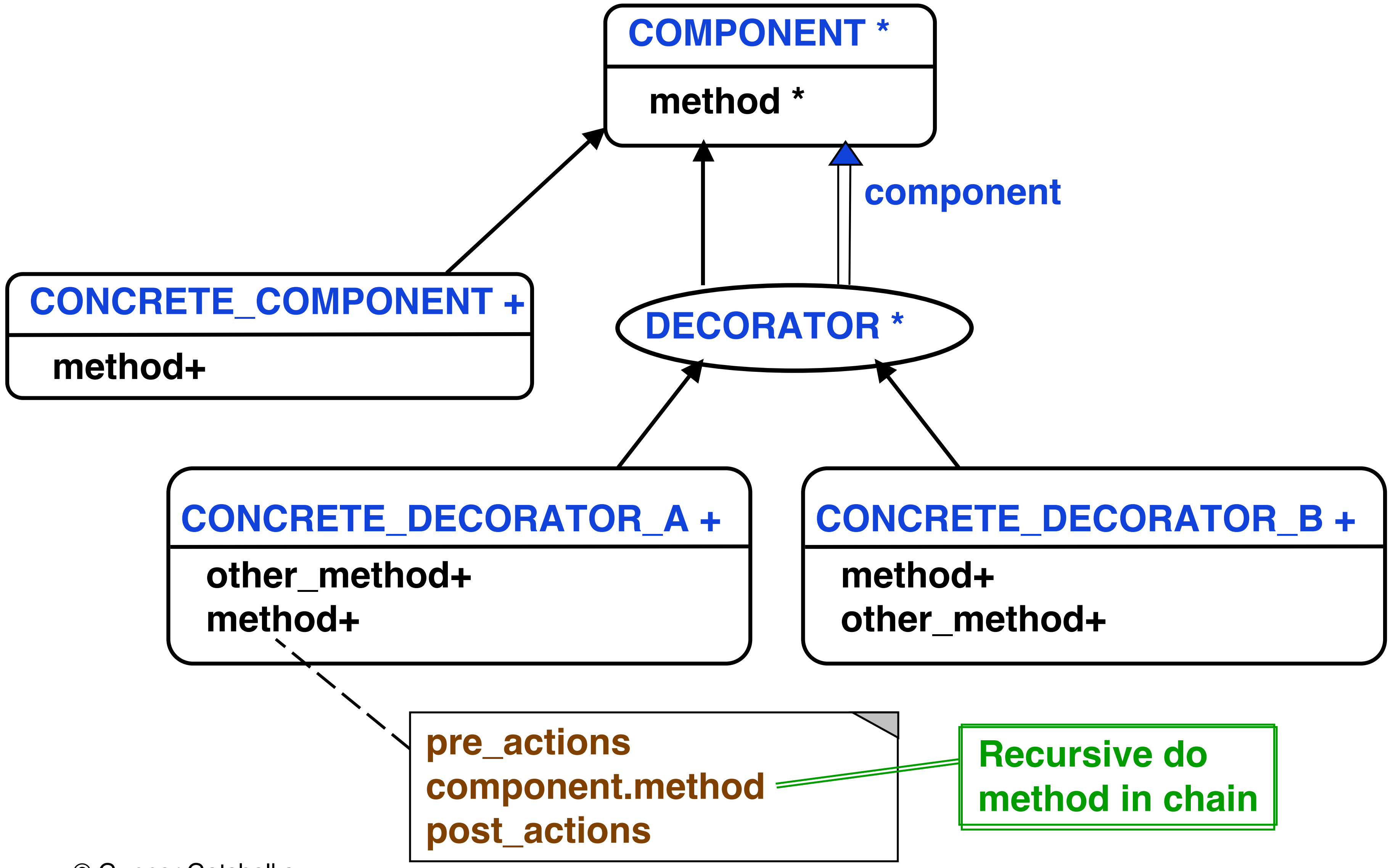
- Compose a border decorator with a scroll decorator for text view.



Text Example Architecture



Abstract Architecture



Participants

- Component

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

- Concrete component

  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

- Concrete decorator

  Add responsibilities to the component

Applicability

- Add responsibilities to individual objects dynamically and transparently

  Without affecting other objects

- For responsibilities that can be withdrawn

- When subclass extension is impractical

  Sometimes a large number of independent extensions are possible

    Avoid combinatorial explosion

  Class definition may be hidden or otherwise unavailable for subclassing

Benefits

- More flexible than static inheritance
  - » **Can add and remove responsibilities dynamically**
  - » **Can handle combinatorial explosion of possibilities**

- Avoids feature laden classes high up in the hierarchy
  - » **Pay as you go when adding responsibilities**
  - » **Can support unforeseen features**
  - » **Decorators are independent of the classes they decorate**
  - » **Functionality is composed in simple pieces**

Liabilities

- From object identity point of view, a decorated component is not identical
  - » **Decorator acts as a transparent enclosure**
  - » **Cannot rely on object identity when using decorators**
- Lots of little objects
  - » **Often result in systems composed of many look alike objects**
  - » **Differ in the way they are interconnected, not in class or value of variables**
  - » **Can be difficult to learn and debug**

Why not use a collection class?

- A design using an array or linked list of the decorator class objects provides the same functionality
  - » **Client interface for the base object becomes more complex**
  - » **Client becomes more specialized for the problem**
    - > **Has to know the Decorator classes to be able to program the method operation with appropriate pre- and post-actions**

Related Patterns

- Adapter changes interface to an object, while Decorator changes an object’s responsibilities

- Decorator is a degenerate Composite – only one component
  - » **But Decorator is not meant for object aggregation, only for added responsibility**
    - > **Similar to the Chain of Responsibility pattern**

- Strategy lets you change the internals of an object, while Decorator changes the exterior

Decorator in Java API

- Used in input classes
  - » At base is an InputStream object such as System.in.
  - » InputStreamReader decorates InputStream
  - » BufferedReader in turn decorates InputStreamReader

```
inputObject =
   BufferedReader ( InputStreamReader ( System.in ) )
```