CS 417
Design Patterns

Composition and Decorator

Dr. Chad Williams
Central Connecticut State University

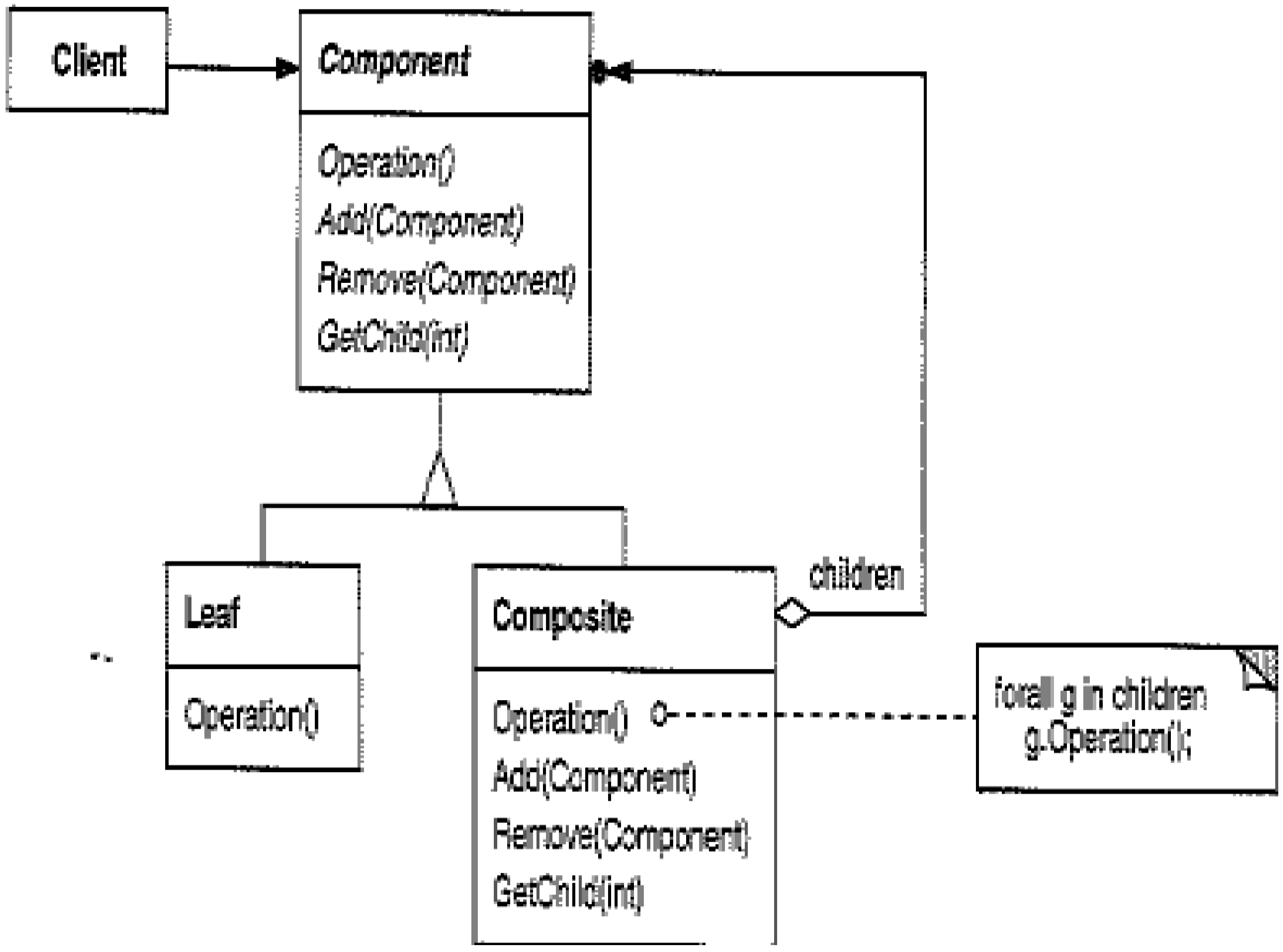
Design pattern: Composite

- Structural pattern
- Motivation:
  - Group smaller components together and treat as a single large component. Referred to as part-whole heirarchies of objects.
  - Client able to ignore whether interacting with single object or group of objects
- Example:

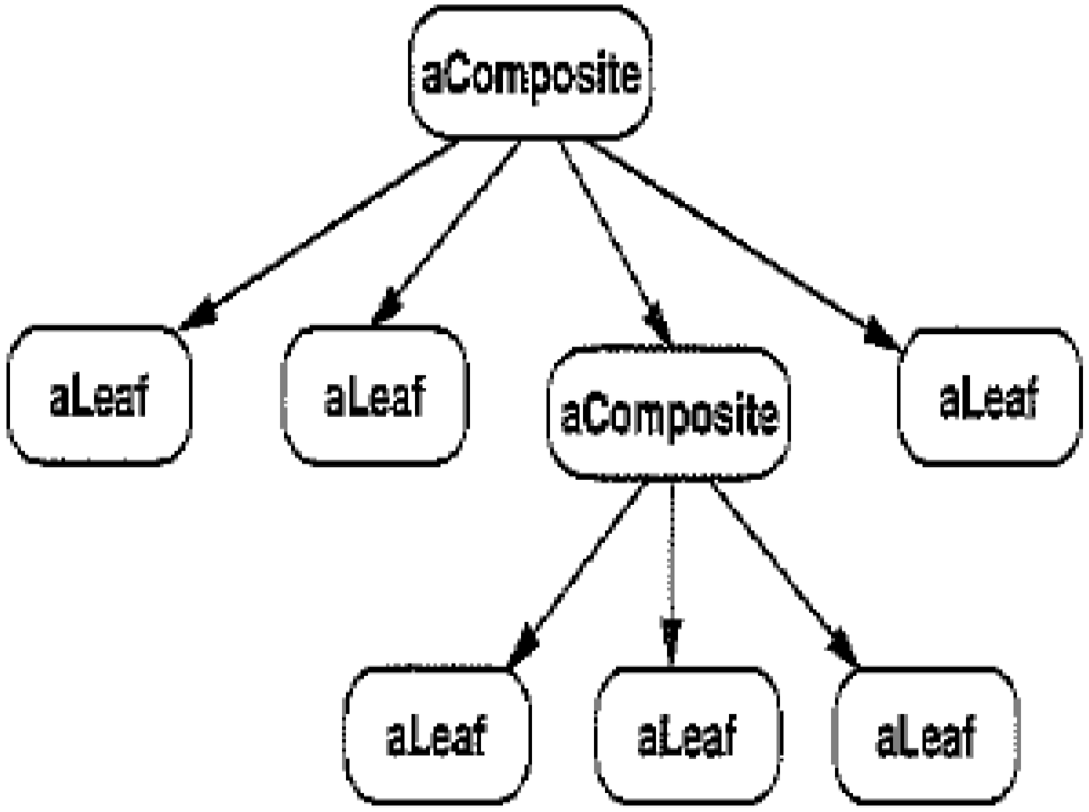
Application window – tell application to draw graphics

- Menu bar
  - File menu, Home, Insert,…
    - File->Save, Save as, Open,…
- Toolbar
  - Set of options bold, underline, some are menus

Composite UML



Sample instance structure



Considerations

- Parents?
- Want to treat all components the same without loss of functionality
  - What about how to deal with children?
    - Wait! We talked about how shouldn't inherit from a class if didn't implement all functionality
      - Trade-off of safety and transparency – different approaches depending on application
    - Option 1: Try to make meaningful
    - Option 2: Composite method
    - Option 3: Defined exception

Relevant patterns

- Sorting of children common – example GUI where consider which element is in front of another
- Iterator over children – usually immediate children, but could have scenario where you would want deep iteration
- Frequently combined with Decorator pattern
- Visitor – localizes operations and behaviors (may get to this later)

Design pattern: Decorator

- Structural pattern
- Motivation:
  - Attach additional responsibilities dynamically
  - Additional flexibility compared to extensive subclassing
- Example:

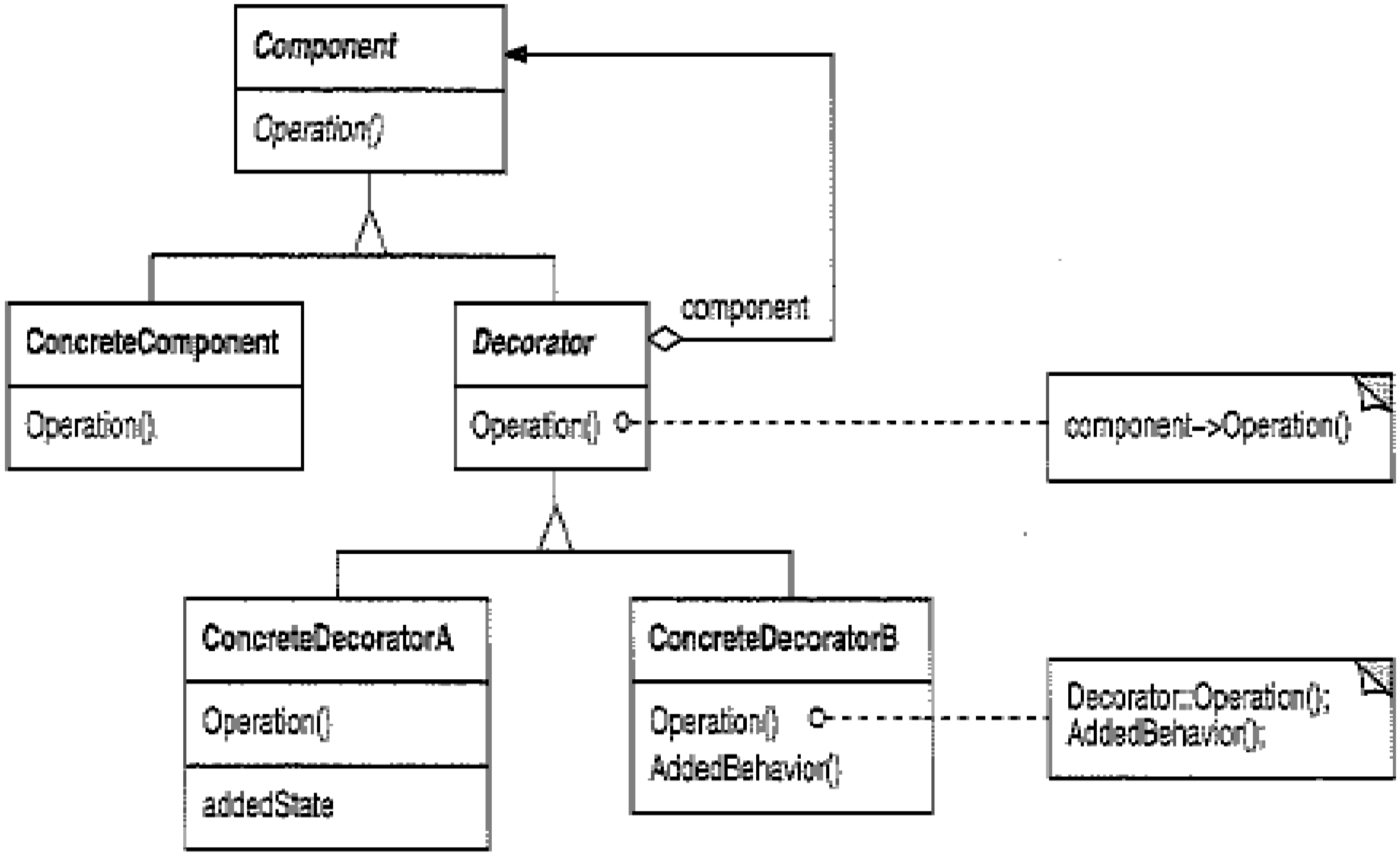
PDF viewer

  - View document
  - Add scroll bar
- Add border

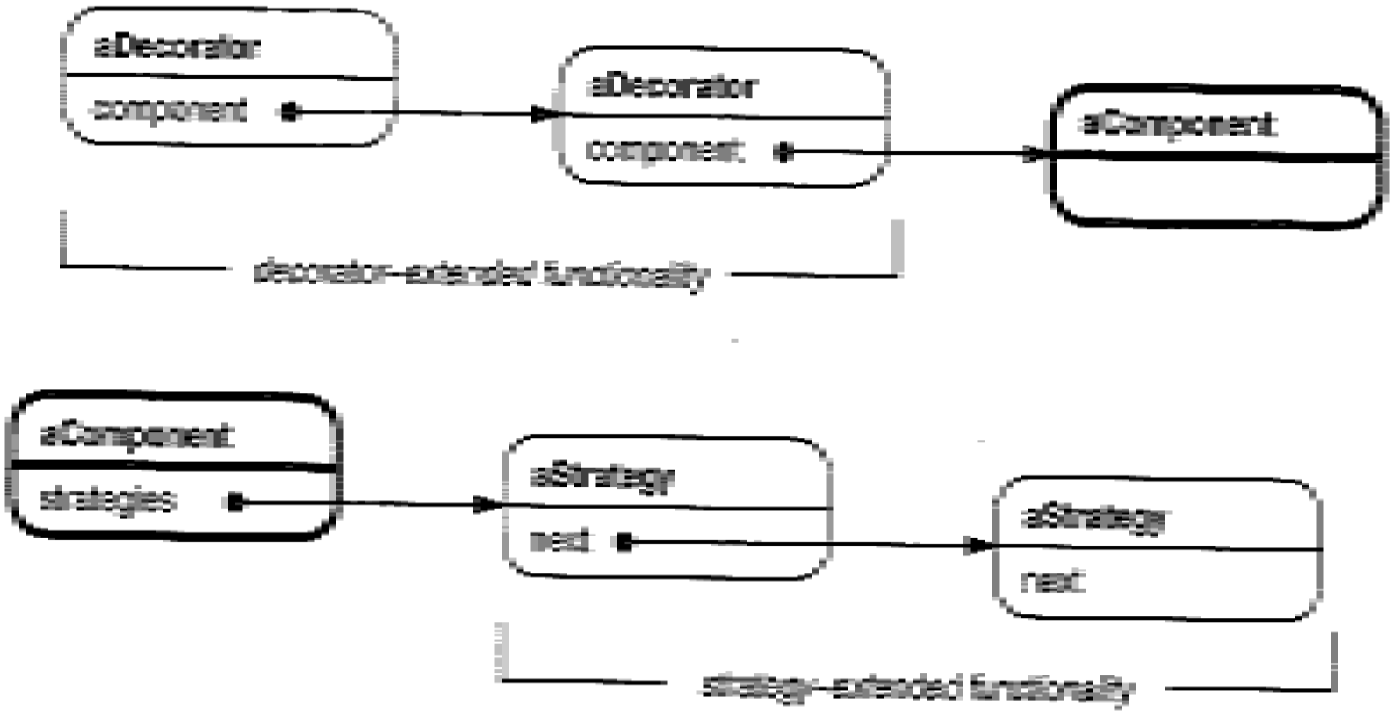
Car

  - Base model
  - Add leather seats option
- Add sports package (upgraded wheels, shocks, etc)

Decorator UML



Sample instance structure


aDecorator
component
aDecorator
component
aComponent
decorator-extended functionality
aComponent
strategies
aStrategy
next
aStrategy
next
strategy-extended functionality