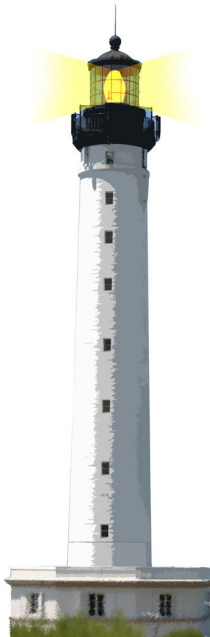
Composite

A nice and common design pattern

S. Ducasse



Pharo

http://www.pharo.org

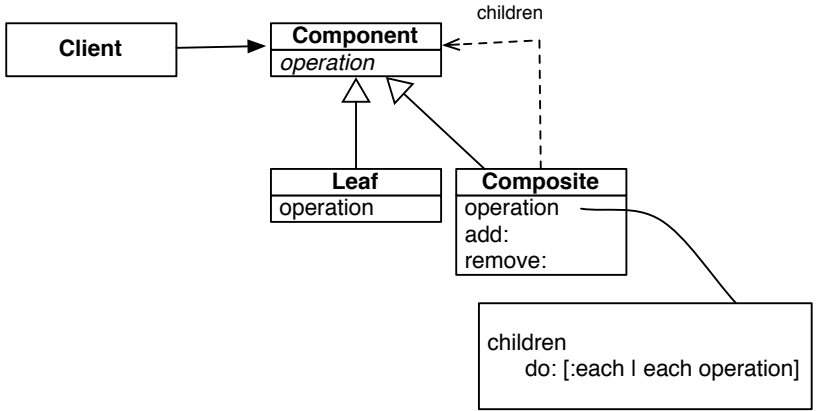
Outline

- Composite Design Pattern
- Composite discussions

Composite: Intent

- Compose objects into tree structures to represent **part-whole** hierarchies
- Composite lets clients treat individual objects and compositions of objects **uniformly**

Composite design essence



Composite motivation

A tree is a

- leave
- a node with trees as children

Examples

A book is composed of

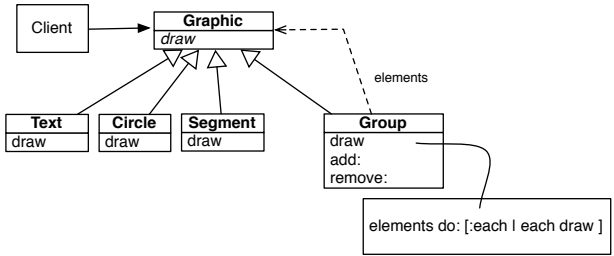
- title
- table of contents
- chapters

A chaper is composed of

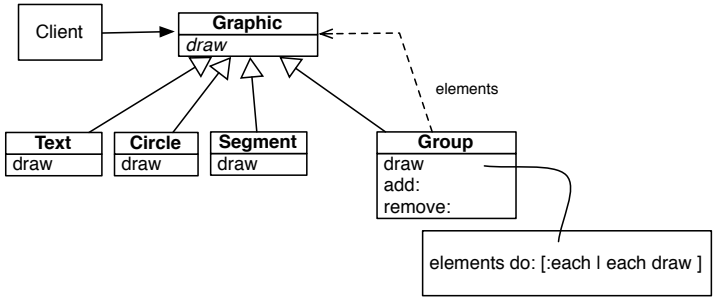
- sections
- paragraph
- lists

Composite motivation

- A diagram is composed of elements
- An element can be
  - a circle
  - a segment
  - a text
  - a group of elements

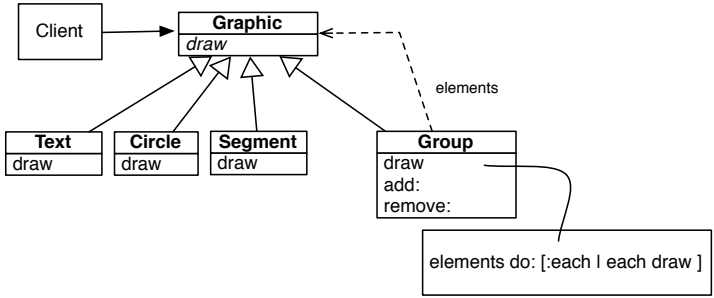


Composite participants: Client



Client manipulates objects in the composition through the **Component** interface

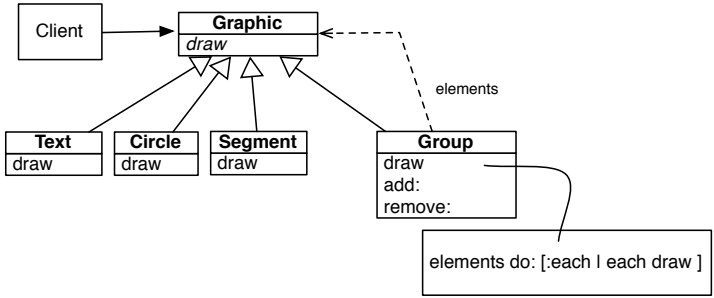
Composite participants: Component



Component (here Graphic)

- declares the interface for objects in the composition
- may implement default behavior for common interfaces
- may declare an interface for accessing and managing its child components

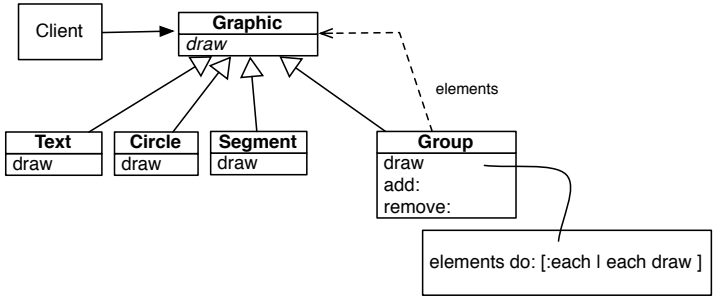
Composite participants: Leaf



Leaf (Circle, Segment, Text, ...)

- represents leaf objects in the composition.
- has usually no children
- defines behavior for primitive objects in the composition

Composite participants: Composite



Composite (Group)

- defines behaviour for components having children
- stores child components
- implements child-related operations (add/remove...)

Collaborations

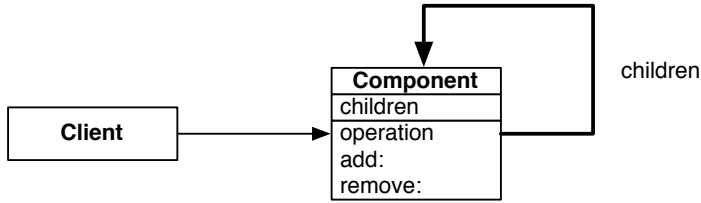
- Clients use the Component class interface to interact with objects in the composite structure
- Leaves handle requests directly
- Composites 'forward' requests to its child components
  - they can implement different semantics

Composite consequences

- Defines class hierarchies consisting of primitive and composite objects
- Makes the client simple. Composite and leaves objects are treated uniformly
- Eases the creation of new kinds of components
- Can make your design general

Alternate extreme implementation

- Remember a Design Pattern is a name + intent
- It can have multiple implementations



- Now the gain treating a leave as a container with a single element is unclear

In a dynamically-typed language

- add:, remove: do not need to be declared into Component but only on Composite
  - Avoid to have to define dummy behavior for children in superclass (Component)

Open questions

- Can Composite contain any type of child? (domain issues)
- Is the Composites number of children limited?
- Forward/Delegation
  - *Simple forward*. Send the message to all the children and merge the results without performing any other behavior
  - *Selective forward*. Conditionally forward to some children
  - *Extended forward*. Extra behavior
  - *Override*. Instead of delegating

Working well with

Composite and Visitors: Visitors walk on structured recursive objects: composites
Composite and Factories Factories can create composite elements

Conclusion

- Composite is a natural way of composing structural relationships
- Composite provide uniform API
- Basis for complex treatment expressed as Visitor

A course by

S. Ducasse, L. Fabresse, G. Polito, and Pablo Tesone