Composite Pattern Tutorial

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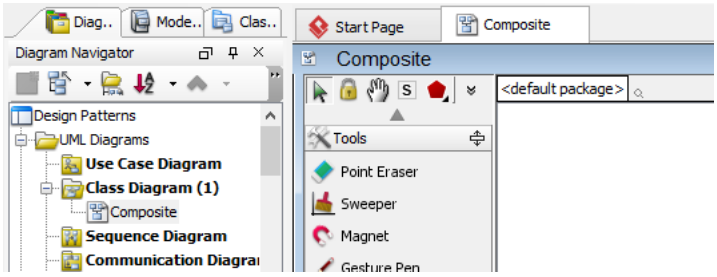
This tutorial is aimed to guide the definition and application of Gang of Four (GoF) composite design pattern. By reading this tutorial, you will know how to develop a model for the composite pattern, and how to apply it in practice.

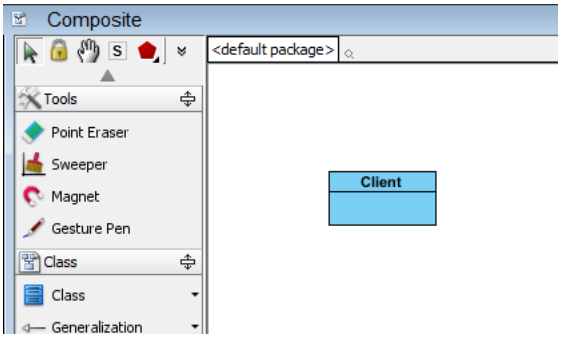
Modeling Design Pattern with Class Diagram

1. Create a new project *Design Patterns*.

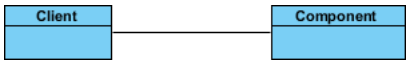
2. Create a class diagram *Composite*.



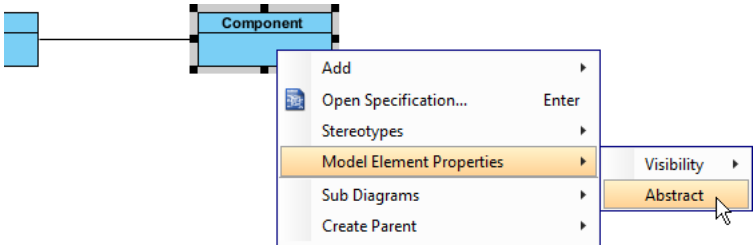
3. Select **Class** from diagram toolbar. Click on the diagram to create a class. Name it as *Client*.



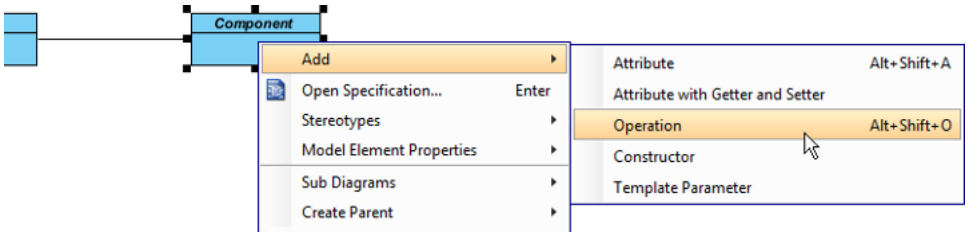
4. Move the mouse cursor over the *Client* class, and drag out **Association** > **Class** to create an associated class *Component*.



5. Right click on *Component*, and select **Model Element Properties** > **Abstract** to set it as abstract.

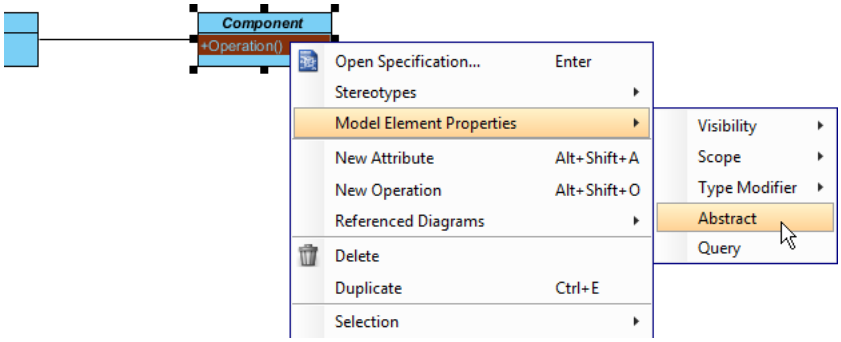


6. Right click on the *Component* class, and select **Add** > **Operation** from the popup menu.

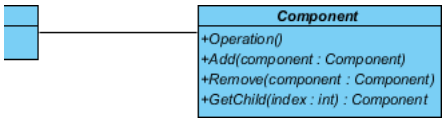


7. Name the operation *Operation()*.

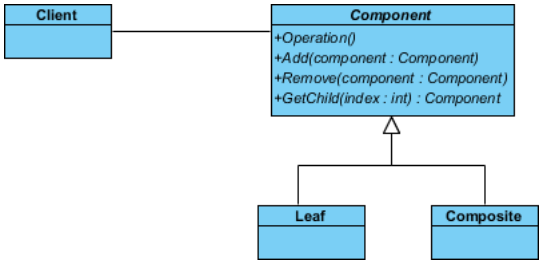
8. Right click on *Operation*, and select **Model Element Properties** > **Abstract** to set it as abstract.



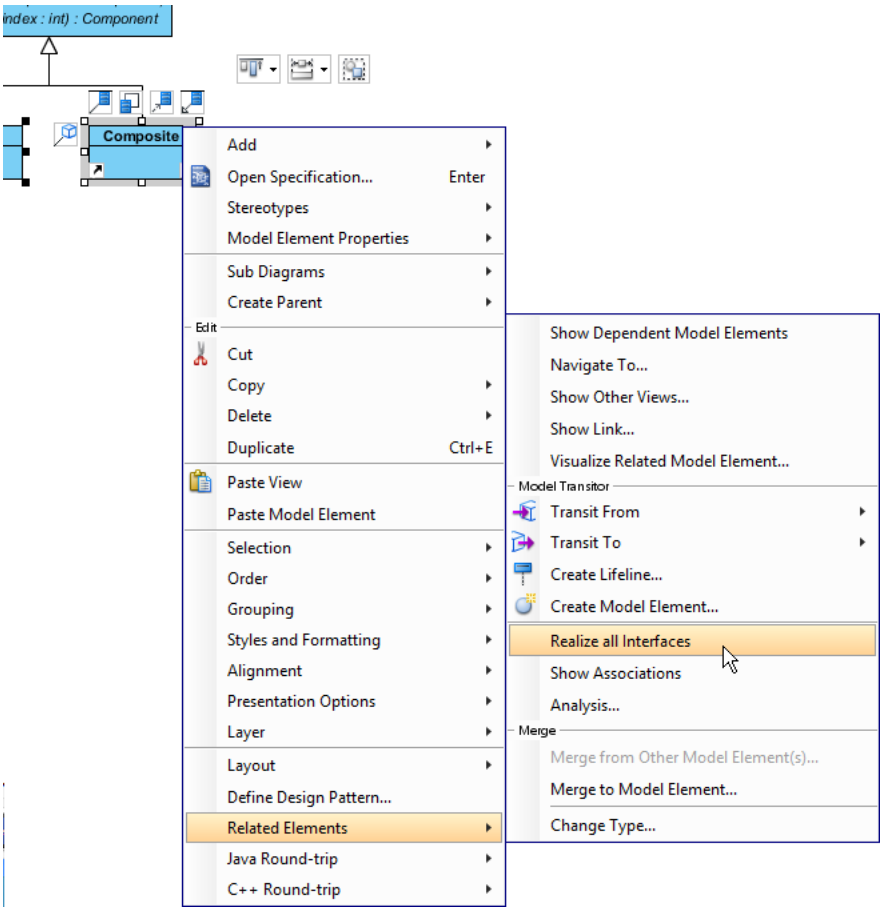
9. Repeat steps 6 to 8 to create operations *Add(component : Component)*, *Remove(component : Component)*, *GetChild(index : int) : Component*.



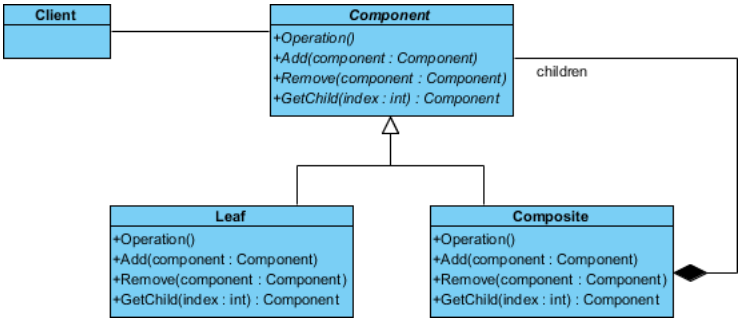
10. Move the mouse cursor over the *Component* class, and drag out **Generalization** > **Class** to create a subclass *Leaf*. Repeat this step to create another subclass *Composite*, from *Component*.



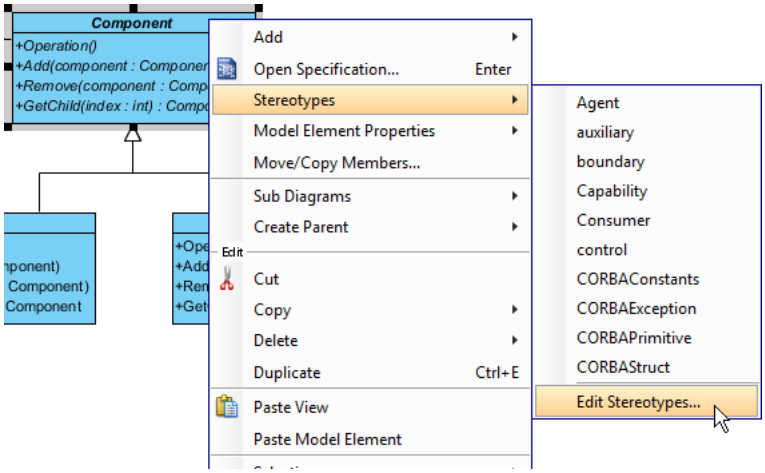
11. *Leaf* and *Composite* will inherit the operations from *Component*. Select *Leaf* and *Component*, right click on them and select **Related Elements** > **Realize all Interfaces** from the popup menu.



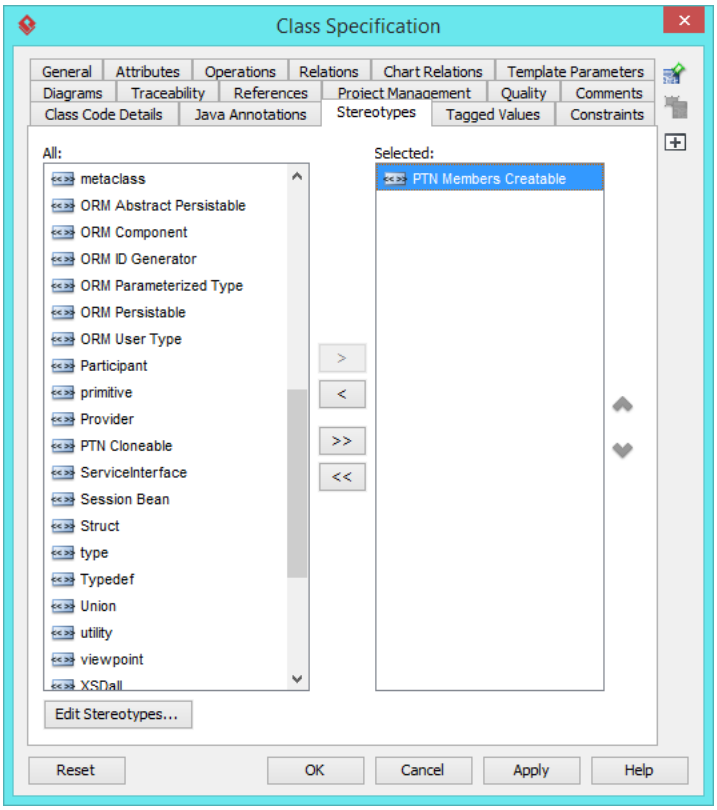
12. Move the mouse cursor over the *Component* class, and drag out **Composition** > **Class** to *Component*. Name the Component's role as *children*.



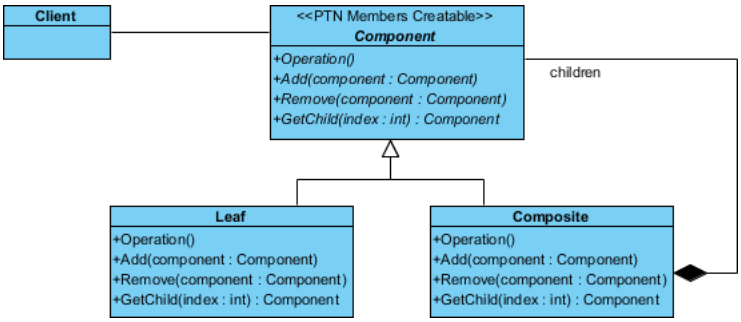
13. In practice, there may be multiple operations in *Component*. To represent this, stereotype the class *Component* as **PTN Members Creatable**. Right click on *Component* and select **Stereotypes** > **Stereotypes...** from the popup menu.



14. In the **Stereotypes** tab of the **Class Specification** dialog box, select **PTN Members Creatable** and click > to assign it to *Component* class. Click **OK** to confirm.

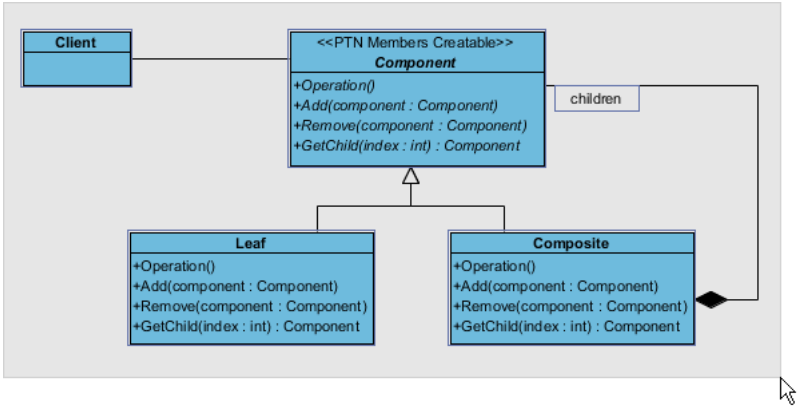


Up to now, the diagram should look like this:

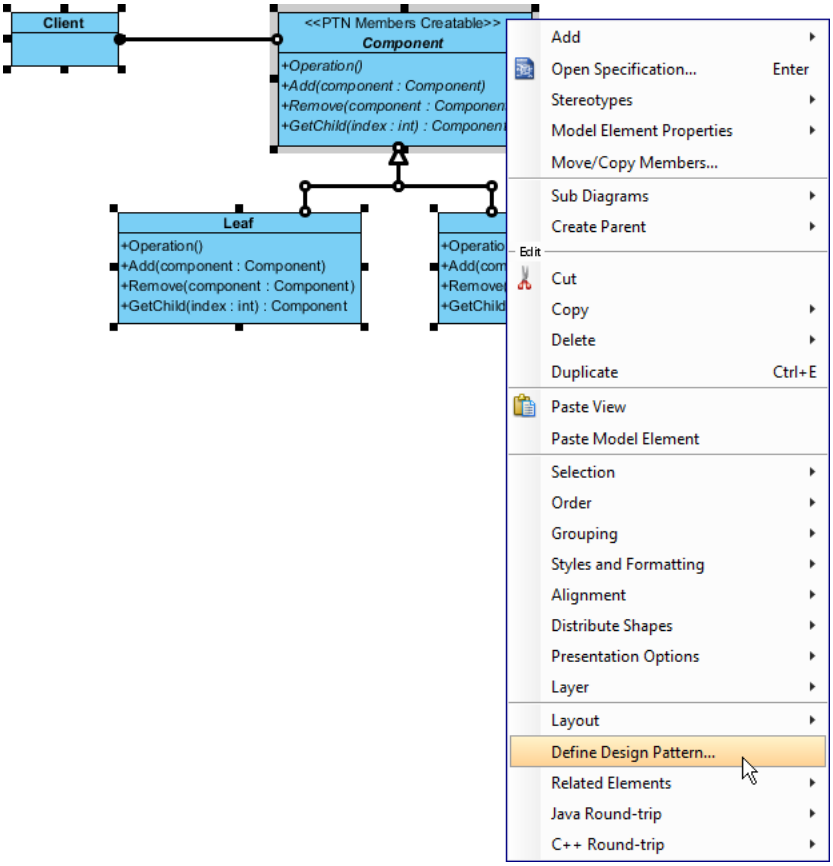


Defining Pattern

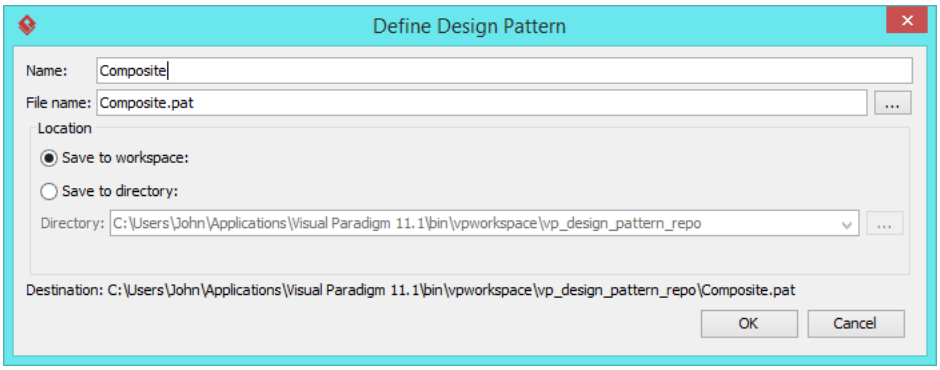
1. Select all classes on the class diagram.



2. Right click on the selection and select **Define Design Pattern...** from the popup menu.



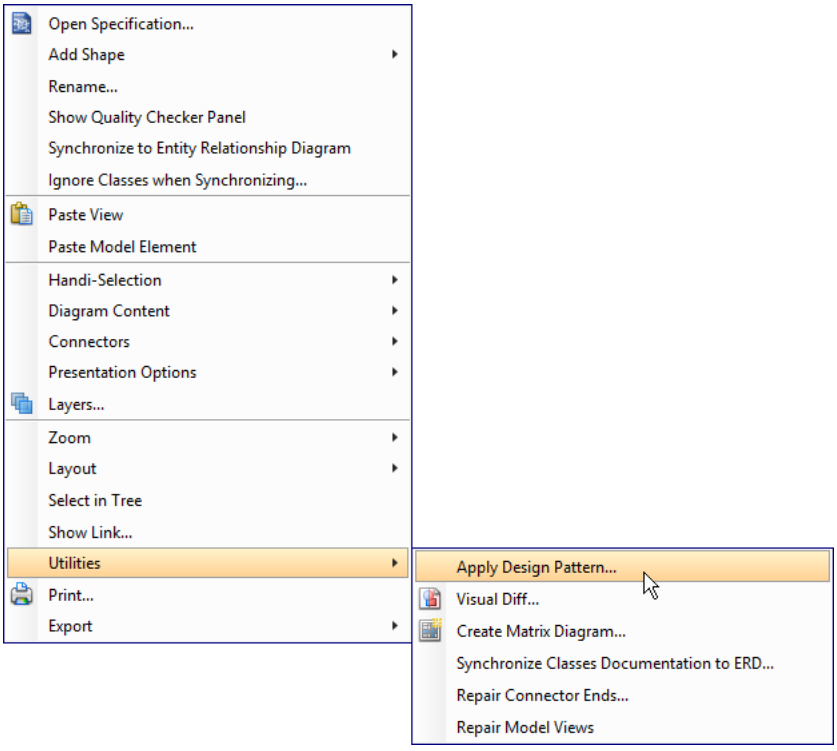
3. In the **Define Design Pattern** dialog box, specify the pattern name *Composite*. Keep the file name as is. Click **OK** to proceed.



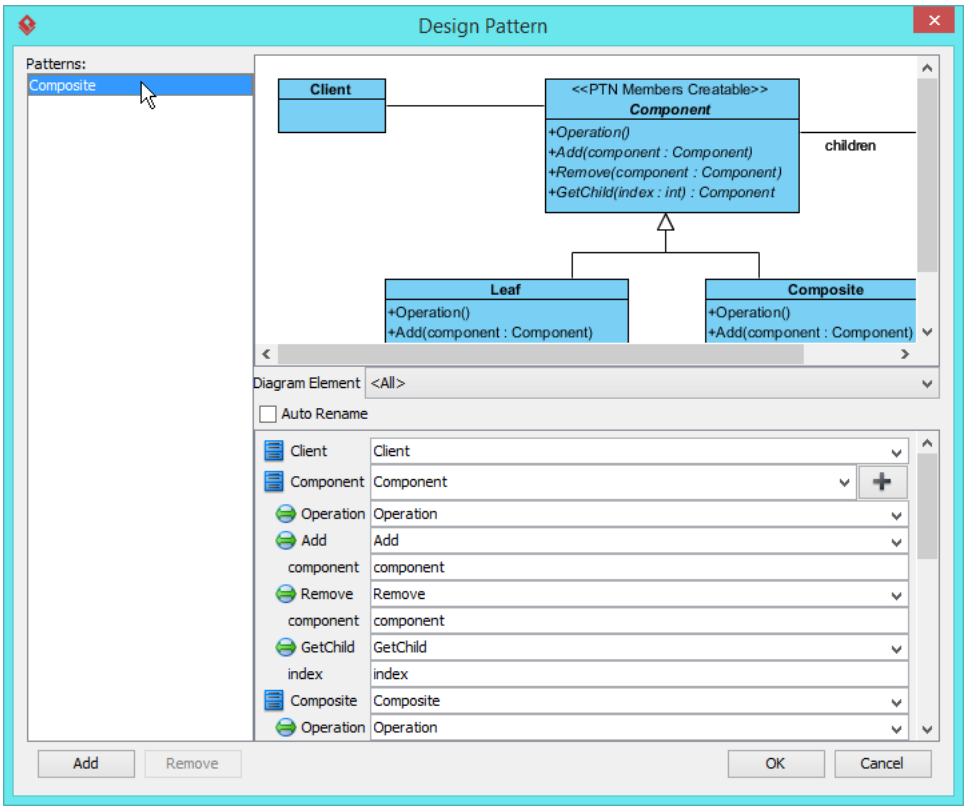
Applying Design Pattern on Class Diagram

In this section, we are going to apply the composite pattern to model a furniture shop's furniture catalog.

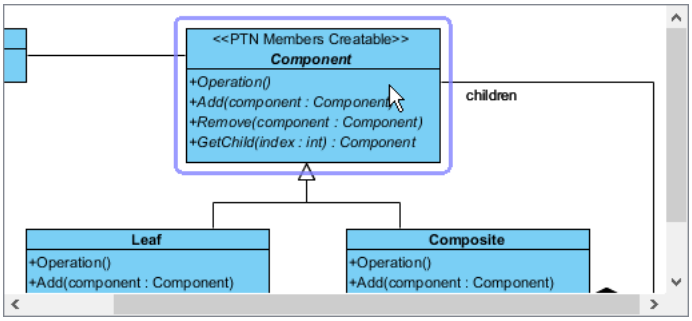
1. Create a new project *Furniture Shop*.
2. Create a class diagram *Domain Model*.
3. Right click on the class diagram and select **Utilities** > **Apply Design Pattern...** from the popup menu.



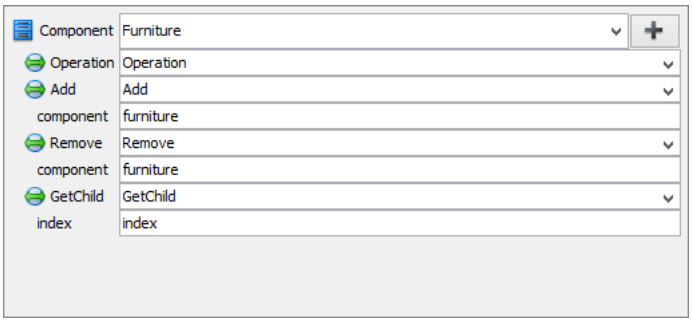
4. In the **Design Pattern** dialog box, select *Composite* from the list of patterns.



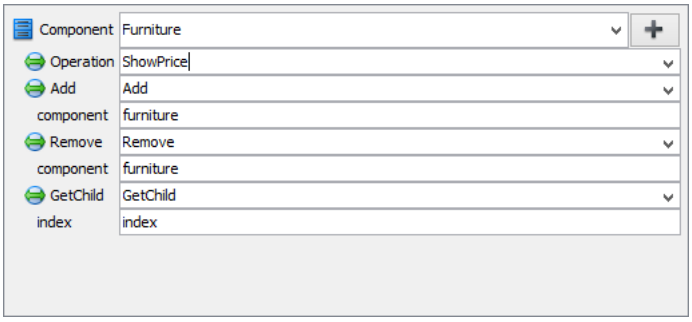
5. Click on *Component* in the overview.



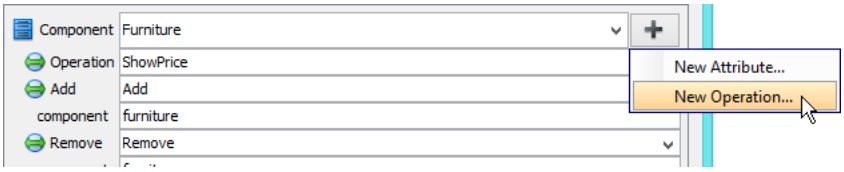
6. Rename *Component* to *Furniture*, and the parameters *component* in various operations to *furniture* at the bottom pane.



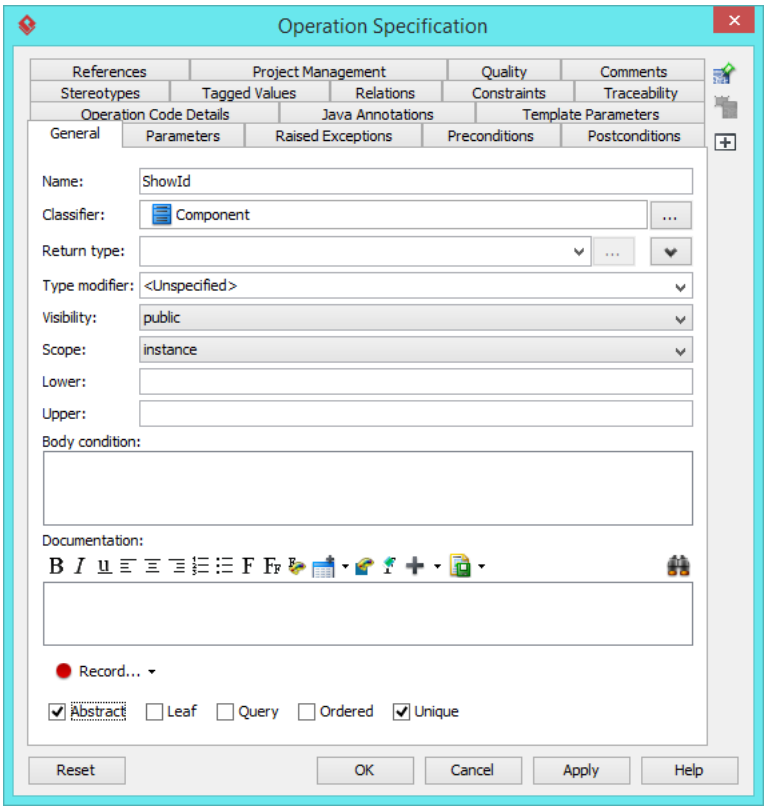
7. Rename *Operation* to *ShowPrice*.



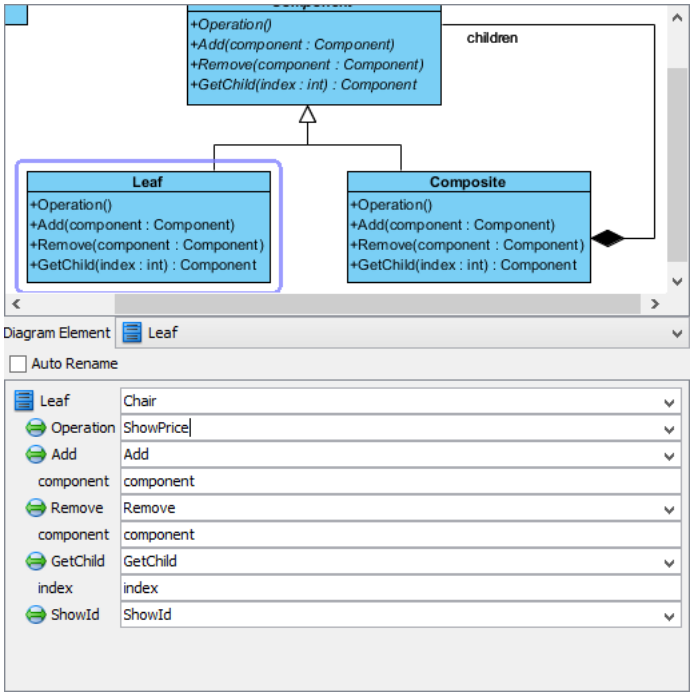
8. Besides the operation *ShowPrice*, we also need one more operation for *ShowId*. Keep *Component* selected, click on the + button at the bottom pane, and select **New Operation...** from the popup menu.



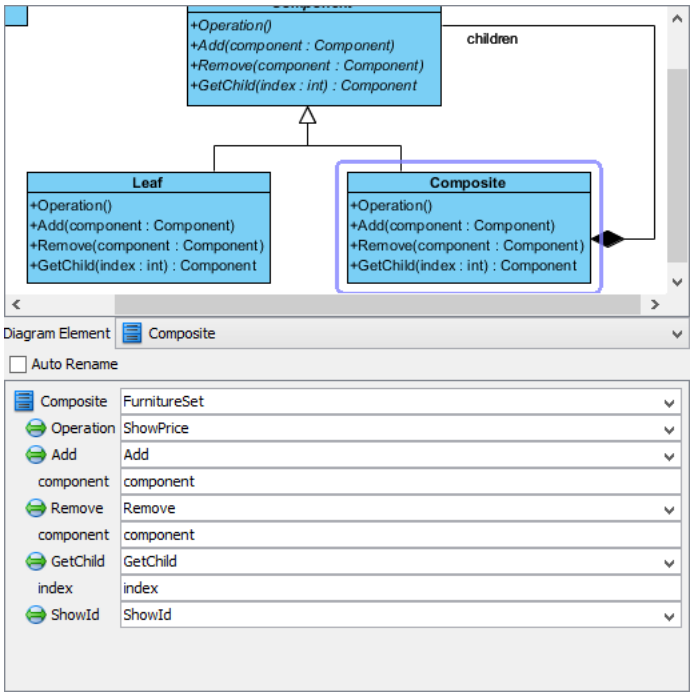
9. In the **Operation Specification** dialog box, name the operation *ShowId*. Check **Abstract** at the bottom of dialog box.



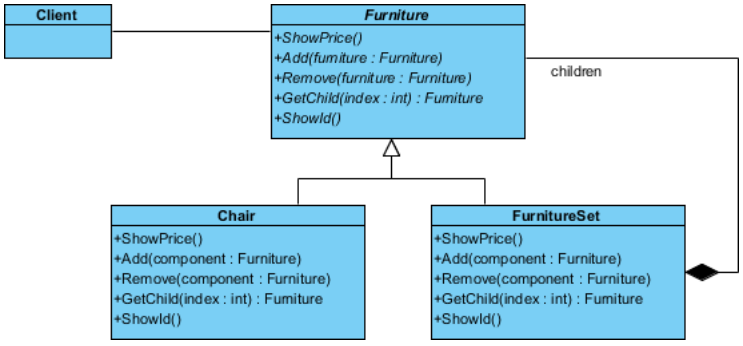
10. Select *Leaf* in overview, and rename it as *Chair* at the bottom pane. Rename also the operation *Operation* to *ShowPrice*. Note that if the option **Auto Rename** is on, rename of operation is not needed as this will be done automatically.



11. Select *Composite* in overview, and rename it as *FurnitureSet* at the bottom pane. Rename also *Operation* to *ShowPrice*. Click **OK** to apply the pattern to diagram.



This is the result:



Resources

1. Composite.pat
2. Design Patterns.vpp

Related Links

- Full set of UML tools and UML diagrams

Visual Paradigm home page
(https://www.visual-paradigm.com/)

Visual Paradigm tutorials
(https://www.visual-paradigm.com/tutorials/)