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

**Modeling Design Pattern with Class Diagram**

1. Create a new project *Design Pattern*.
2. Create a class diagram *Prototype*.

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

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[Image of a class diagram showing a class named 'Client']
4. Right-click on the Client class, and select **Add > Operation** from the popup menu.

5. Name the operation *Operation*. 

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

7. Right-click on *Prototype*, and select **Model Element Properties > Abstract** to set it as abstract.

8. Add an operation *Clone()* to *Prototype*. Make it return *Prototype*. 

9. Right-click on *Clone()* , and select **Model Element Properties > Abstract** to set it as abstract.
10. Move the mouse cursor over the *Prototype* class, and drag out **Generalization > Class** to create a subclass *ConcretePrototype*.

11. Make *ConcretePrototype* inherit the abstract operations provided from *Prototype* by right clicking on *ConcretePrototype*, and selecting **Related Elements > Realize all Interfaces** from the popup menu.
12. In practice, there may be multiple `ConcretePrototype` classes. To represent this, stereotype the `ConcretePrototype` class as **PTN Cloneable**. Right-click on `ConcretePrototype` class and select **Stereotypes > Stereotypes...** from the popup menu.
13. In the Stereotypes tab of class specification, select **PTN Cloneable** and click > to assign it to the class. Click **OK** to confirm.

![Image of Class Specification](https://www.visual-paradigm.com/tutorials/prototypepattern.jsp)

The diagram should look like this:

```
Client
  +operation()

Prototype
  +Clone() : Prototype

<<PTN Cloneable>>
ConcreatePrototype
  +Clone() : Prototype
```

**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 *Prototype*. Keep the file name as it. Click **OK** to proceed.

**Applying Design Pattern on Class Diagram**

In this section, we will try to make use of the prototype pattern to model a part of diagram editor.

1. Create a new project *My Diagram Tool*.
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 *Prototype* from the list of patterns.

5. Click on **Client** in the overview.
6. Rename it to **EditTool** at the bottom pane.

7. Rename **Operation** to **Duplicate**.

8. Select **Prototype** in overview.

9. Rename **Prototype** to **Shape** at the bottom pane, and rename the operation **Clone** to **Duplicate**.

10. Select **ConcretePrototype** in overview.
11. Rename `ConcretePrototype` to `OvalShape` at the bottom pane, and rename the operation `Clone` to `duplicate`.

![Diagram showing the change in prototype classes]

12. We need to have two more concrete prototype classes for square and triangle. Keep `ConcretePrototype` selecting, click the + button, and select `Clone...` from the popup menu.

![Diagram showing the addition of new classes]

13. Enter 2 to be the number of classes to clone.
14. Rename `ConcretePrototype2` and `ConcretePrototype3` to `Square` and `Triangle` respectively. Rename the two `Clone` operations to duplicate.

15. Click **OK** to confirm editing and apply the pattern to diagram.

16. Tidy up the diagram. It should become:

Resources
1. **Design Patterns.vpp**
2. **Prototype.pat**

Related Links
- **Full set of UML tools and UML diagrams**