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Object Oriented Programming JAVA

Dr. Prafulla Kalapatapu
Computer Science Engineering
Mahindra Ecole Centrale
prafulla.kalapatapu@mechyd.ac.in

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GUI Programming

GUI Programming

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- A program which has got graphical environment to interact with that.

- Advantages of GUI programming:

1. It is user friendly.
2. It adds attraction and beauty to any application by adding pictures, colors, menus, animation etc.
3. GUI helps to create graphical components like push buttons, radio buttons, check boxes etc and use them effectively in our programs.

How can we write GUI programming in java

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- How can we write GUI programming in java?

  Using awt package.

- what is awt?

  Abstract Window Toolkit (AWT) represents a class library(collection of classes) to develop applications using GUI.

- What awt package contains?

  It has got classes and interfaces to develop GUI programs.

Important classes of java.awt

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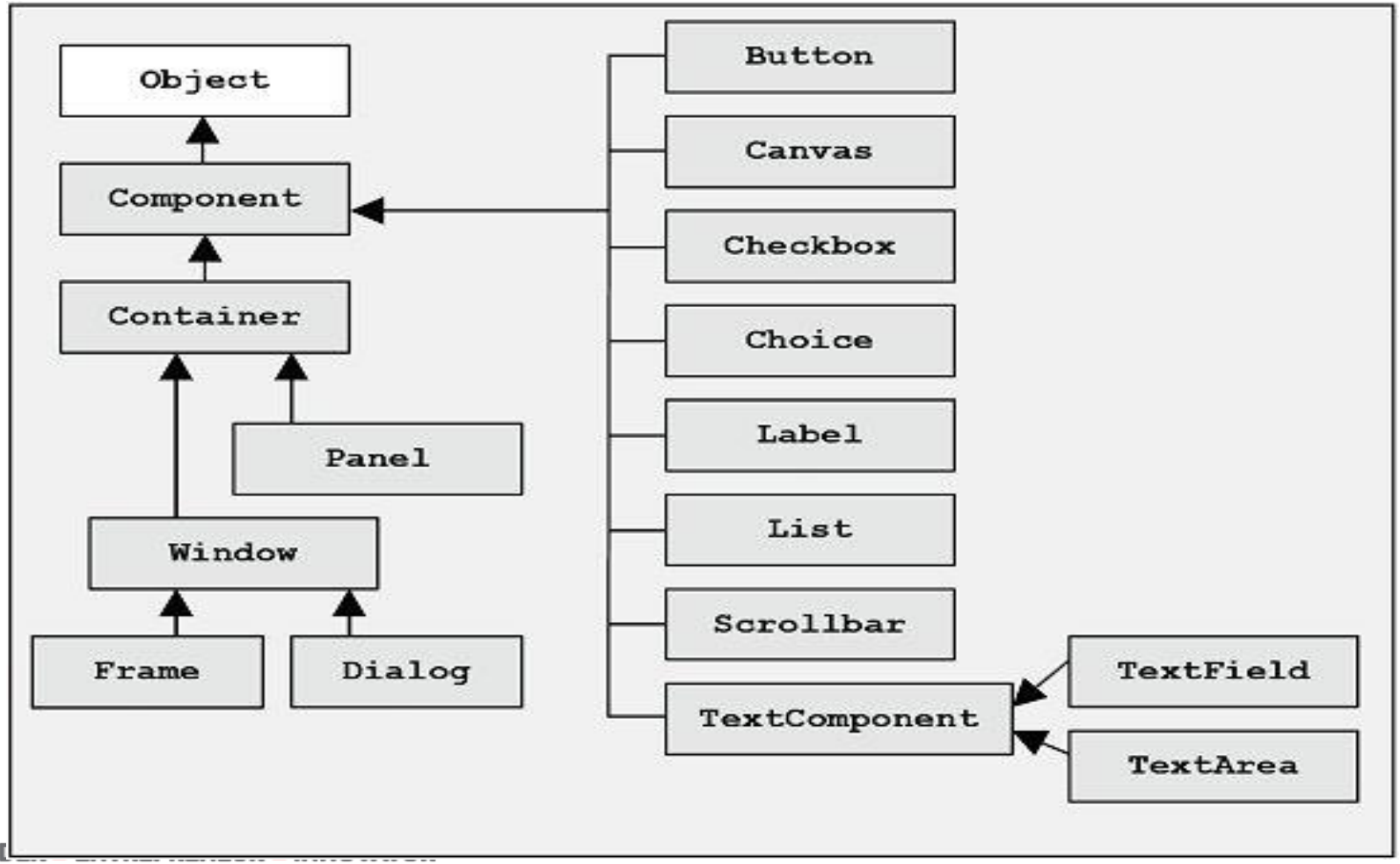
- Diagram:



Component

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- What is component?

  A component represents an object which is displayed pictorially on the screen.

- Component is a graphical representation of an object.

  Label, Button, Checkbox, Choice, List, Scrollbar, radio buttons, TextField, TextArea, Panel, Frame and Window all are components.

Window and Frame

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- What is Window?

  A Window represents any imaginary rectangular area on the screen without borders or title bar.

- What is Frame?

  A Frame represents a window on the screen with title and borders.

Creating a Frame

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- A frame becomes the basic component in AWT.
- The frame has to be created before any other component.
- The reason is that all other components can be displayed in a frame

Three Ways to create a Frame:

1)Create a Frame class object

```
Frame f= new Frame();
```

2) Create a Frame class object and pass its title also

```
Frame  f= new Frame("My Frame");
```

3) The third way is to create a subclass MyFrame to the Frame class and create an object to the subclass

```
class MyFrame   extends  Frame {  }
MyFrame  f= new MyFrame()
```

Note: in all cases ,a frame with initial size of 0 pixels width and 0 pixels of height will be created ,which is not visible on the screen.

setSize() and setVisible()

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- setSize(int,int):

This method is used to increase the size of the width and height .

Ex: f.setSize(400,350);

Width=400,height=350 in pixels.

- setVisible(boolean):

This method is used to display the frame on the screen

Ex: f.setVisible(true); //visibility argument value should be true .

Program 1:

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- Write a program to create a frame by creating an object to Frame class.

```
import java.awt.*;
class MyFrame{
public static void main(String ...args){
//create a frame
Frame f=new Frame("My First Frame");
//set the size of the frame
f.setSize(300,250);
//display the frame
f.setVisible(true);
}
}
```

Program 2:

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- Write a program to create a frame by creating an object to the subclass of Frame class.

```
import java.awt.*;
class MyFrame extends  Frame{
//call super class constructor to store title
MyFrame(String s){ super(s);}
public static void main(String ...args){
//create a frame
MyFrame f=new MyFrame("My First Frame");
//set the size of the frame
f.setSize(300,250);
//display the frame
f.setVisible(true);
}
}
```

- Note: after executing above programs, Frame will be created. This frame can be minimized ,maximized and resized ,but cannot be closed.

- Even if we click on close button of the frame ,it will not perform any closing action.

How can we close the frame?

Closing a frame means attaching action to the component.

→To attach actions to the components ,we need "event delegation model".

Event Delegation Model

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- Steps involved in even delegation model:

1. We should attach an appropriate listener to a component.
   this is done using addxxxListener() method.

similarly, to remove listener from a component ,we can use removexxxListener()

2. Implement the methods of the listener, especially the method which handles the event.

3. When an event is generated on the component, then the method in step2 will be executed and the event is handled.

Event Delegation Model

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- Advantages of event delegation model:

In this model, the component part is separated from the action part.

So there are 2 advantages:

1) The component and the action parts can be developed in two separate environments.

For example: we can create the component in java and the action logic can developed in Visual Basic.

2) We can modify the code for creating the component without modifying the code for action part of the component . Similarly we can modify the action part without modifying the code for the component.

Thus ,we can modify one part without effecting any modification to other part.

This makes debugging and maintenance of code very easy.

Closing a frame

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1. We should attach a listener to the frame component .
   → Remember ,all listeners are available in java.awt.event package .
   → The most suitable listener to the frame is "WindowListener".
   → It can be attached using addWindowListener() method as :

```
addWindowListener(WindowListener obj);
```

→ Please note that the addWindowListener() method has a parameter that is expecting object of WindowListener interface.
→ Since it is not possible to create an object to an interface ,we should create an object to the implementation class of the interface and pass it to the method.

Closing a frame

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2. Implement all methods of the WindowListener interface. The following methods are found in WindowListener interface:

```
public void windowActivated(WindowEvent e)
public void windowClosed(WindowEvent e)
public void windowClosing(WindowEvent e)
public void windowDeactivated(WindowEvent e)
public void windowDeiconified(WindowEvent e)
public void windowIconified(WindowEvent e)
public void windowOpened(WindowEvent e)
```

Note: In all the preceding methods , WindowListener interface calls the public void windowClosing(WindowEvent e) method when the frame is being closed.

So implementing this method alone is enough,as:

```
void windowClosing(WindowEvent e){ System.exit(0);}
```

For the remaining methods ,we can provide empty body.

Program to Close a frame

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Program 1:Write a program which first creates a frame and then closes it on clicking the close button.

```
import java.awt.*;
import java.awt.event.*;
class MyFrame extends Frame{
public static void main(String[] args){
MyFrame f= new MyFrame();
f.setTitle("My AWT Frame");
f.setSize(300,250);
f.setVisible(true);
f.addWindowListener(new MyClass());
}
}
```

Program to Close a frame

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```
class MyClass implements WindowListener{
public  void   windowActivated(WindowEvent e){}
public   void   windowClosed(WindowEvent e){}
public   void   windowClosing(WindowEvent e){
System.exit(0);
}
public   void   windowDeactivated(WindowEvent e){}
public   void   windowDeiconified(WindowEvent e){}
public   void   windowIconified(WindowEvent e){}
public   void    windowOpened(WindowEvent e){}
}
```

Program to Close a frame

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Program 2: Write a program to close frame using WindowAdapter class.

```
import java.awt.*;
import java.awt.event.*;
class MyFrame extends Frame{
public static void main(String[] args){
MyFrame f= new MyFrame();
f.setTitle("My AWT Frame");
f.setSize(300,250);
f.setVisible(true);
f.addWindowListener(new MyClass());
}
}
```

Program to Close a frame

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```
class MyClass extends WindowAdapter{
public  void  windowClosing(WindowEvent e){
System.exit(0);
}
}
```

→What is an adapter class?

An adapter class is an implementation class of a listener interface which contains all methods with empty body.

For example: WindowAdapter is an adapter class of WindowListener interface.

→ What is the advantage of adapter class?

Adapter classes reduce overhead on programming while working with listener interfaces.

Program to Close a frame

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3rd way to close a Frame using anonymous inner class:

→In this, even the code of MyClass can be copied directly into addWindowListener() method as:

```
f.addWindowListener(new WindowAdapter(){
  public void windowClosing(WindowEvent e){
    System.exit(0);
}
});
```

This looks a bit confusing, but it is correct.

→we copy the code of MyClass into the method of MyFrame class.

What is anonymous inner class?

→Anonymous inner class is an inner class whose name is not mentioned ,and for which only one object is created.

```
import java.awt.*;
import java.awt.event.*;
class MyFrame extends Frame{
public static void main(String[] args){
MyFrame f= new MyFrame();
f.setSize(300,250);
f.setVisible(true);
f.addWindowListener(new WindowAdapter(){
        public void  windowClosing(WindowEvent e){
          System.exit(0);
}});
}}
```

Three ways to close the frame

1. By implementing all the methods of WindowListener interface.

2. By using WindowAdapter class and by implementing only the required method.

3. By directly copying the code of an anonymous inner class.