Creating a GUI with JFC/Swing

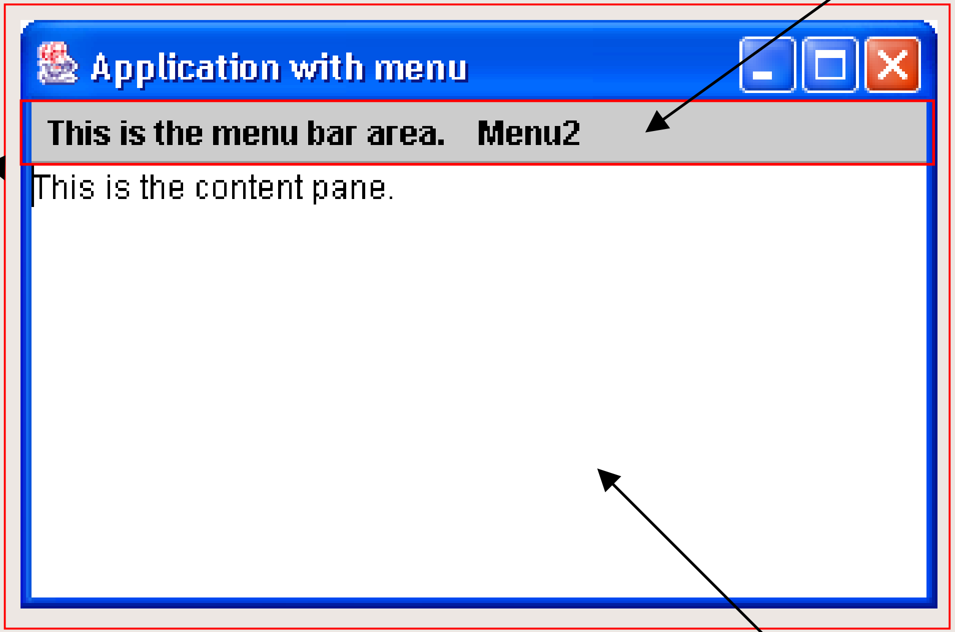
What are the JFC and Swing?

- JFC
  - Java Foundation Classes
  - a group of features to help people build graphical user interfaces (GUIs)
- Swing
  - Components for GUIs
  - to use Swing, you have to import javax.swing package.

What are the objects in an application?

Frame – the top-level container class

Menu Bar -- optional



Content Pane – contains the visible components in the top-level container's GUI

How to make frames (main windows)?

- A frame, an instance of the JFrame, is a window that typically has decorations such as a border, a title, and a buttons for closing and iconifying the window.
- Every GUI components must be put into a container.
- Each GUI components can be contained only once.
- A frame has a content pane that contains the visible components
- An optional menu bar can be added to a top-level container

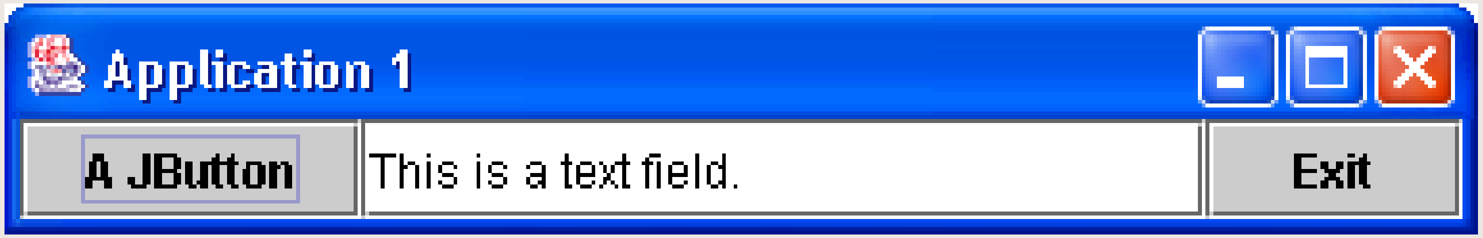
```
import java.awt.*;
import javax.swing.*;

public class App1 {

   public static void main(String[] args) {

      // 1. Optional: Specify who draws the window
      //    decorations. (default: native window system)
      JFrame.setDefaultLookAndFeelDecorated(true);

      // 2. Create a top-level frame
      JFrame frame = new JFrame("Application 1");

      // 3. Optional: What happens when the frame closes?
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      // 4. Optional: How the components are put in the
      //    frame?
      Container cp = frame.getContentPane();
      cp.setLayout(new FlowLayout());
```

```
        // 5. Create GUI/Swing components
        JButton button1 = new JButton("A JButton");
        JButton exitButton = new JButton("  Exit  ");
        JTextField text =
           new JTextField("This is a text field.", 20);

        // 6. Put the components in the frame
        cp.add(button1, BorderLayout.WEST);
        cp.add(text, BorderLayout.CENTER);
        cp.add(exitButton, BorderLayout.EAST);

        // 7. Set frame size
        //    frame.setSize(int width, int hieght);
        frame.pack();

        // 8. Show it
        frame.setVisible(true);
    }
}
```

frame.pack();

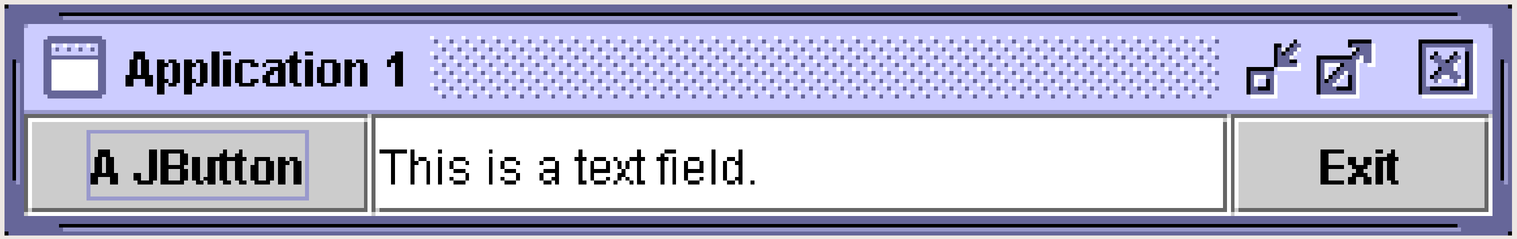
- without

```
JFrame.setDefaultLookAndFeelDecorated(true);
```

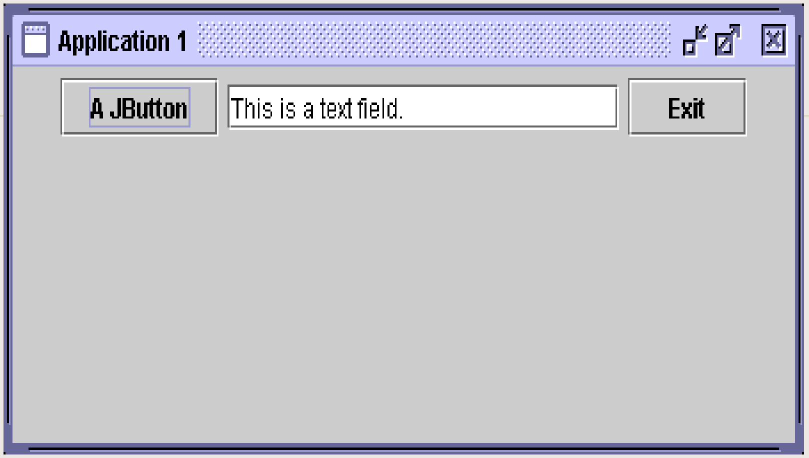


- with

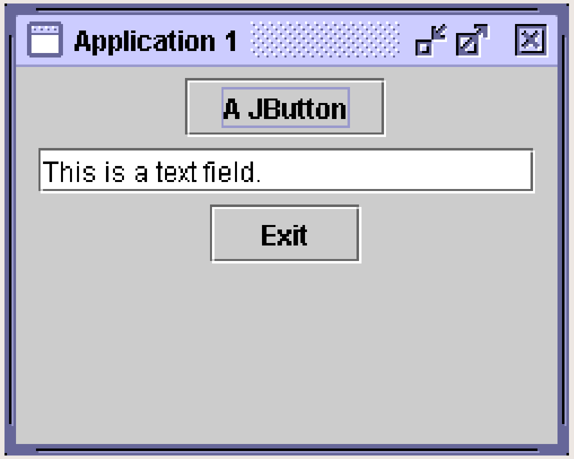
```
JFrame.setDefaultLookAndFeelDecorated(true);
```



```
frame.setSize(450, 200);
```



```
frame.setSize(250, 200);
```



Run the application

- When you click on a button, or type in a text field and press enter, an event is generated.
- Nothing happen, why?
- To make the program response to an action, you need to create a listener object that waits for a particular event to handle and modified the correspondence method.

Example of actions

Act that results in the event	**Listener Type**
User clicks a button, presses Return while typing in a text field, or chooses a menu item	ActionListener
User closes a frame (main window)	WindowListener
User presses a mouse button while the cursor is over a component	MouseListener
User moves the mouse over a component	MouseMotionListener

How to implement an event handler ?

- Define a new class that either implements a listener interface or extends a class that implements a listener interface (adapter class)

```
public class MyListener implements ActionListener {
    .
    .
    .
}
```

How to implement an event handler ?

- Register an instance of the event handler class as a listener upon one or more components

```
someComponent.addActionListener(anInstanceOfMyListener);
```

How to implement an event handler ?

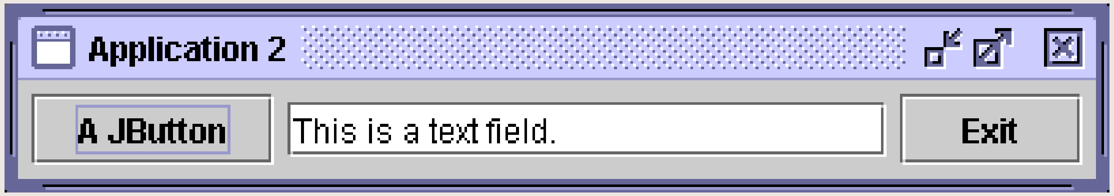
- Implement all methods in the listener interface.

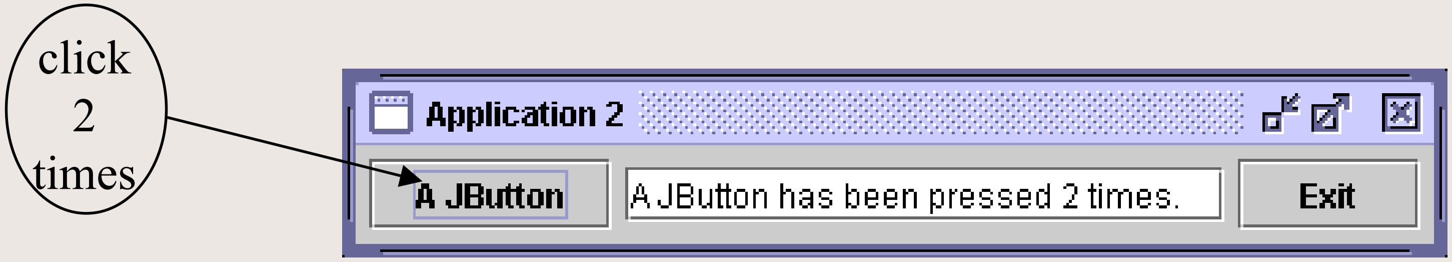
```
public void actionPerformed(ActionEvent e) {
    // code that reacts to the action
    . . .
 }
```

Example

```
// Program App3 with event handling

public class App3 {

   public static JTextField text;

   public static void main(String[] args) {
      . . .
      // 6.1. Register an event handler
      exitButton.addActionListener(
         new  MyExitButtonListener());
      button1.addActionListener(new MyButtonListener());
      . . .
   }
}
```

```
// New classes that implement ActionListener

class MyExitButtonListener implements ActionListener {
   public void actionPerformed(ActionEvent e) {
      System.exit(0);
   }
}

class MyButtonListener implements ActionListener {
   static int count = 0;
   public void actionPerformed(ActionEvent e) {
      App2.text.setText("A JButton has been pressed " +
         ++count + " times.");
   }
}
```





Using inner class

- A class defined inside any class.
- Advantages:
  - Be able to access instance variables from the enclosing class.
  - Keep the event-handling code close to where event occurs.
  - Your event-handling class can inherit from other class.
- Disadvantages:
  - lengthy class
  - longer loading time
  - increase memory requirements

```
// Example
// Program App4 with event handling using inner class

public class App4 {
   public static void main(String[] args) {
      . . .
      class MyExitButtonListener implements ActionListener {
         public void actionPerformed(ActionEvent e) {
            System.exit(0);
      }

      class MyButtonListener implements ActionListener {
         // code for event handling
      }

      // 6.1. Register an event handler
      exitButton.addActionListener(
         new  MyExitButtonListener());
      button1.addActionListener(new MyButtonListener());
      . . .
   }
}
```

```
// Example
// Program App5 with event handling using
//   anonymous inner class

public class App5 {
   public static void main(String[] args) {
      . . .

      // 6.1. Register an event handler
      exitButton.addActionListener(new ActionListener() {
         public void actionPerformed(ActionEvent e) {
            System.exit(0);
         });
      button1.addActionListener(new ActionListener() {
         public void actionPerformed(ActionEvent e) {
            // code for event handling
         });
      . . .
   }
}
```

Writing Event Listeners

- The event-listener methods should execute quickly. Because all event-handling and drawing methods are executed in the same thread.
- If the action that need to be performed will take a long time, initialize as required and perform the rest in a new thread (will cover later).

Getting Event Info.: Event Objects

- EventObject – the root class of all event state objects
- Useful methods:

getSource

`public Object getSource()`

Returns:

The object on which the Event initially occurred.

toString

`public String toString()`

Overrides:

toString in class Object

Returns:

A a String representation of this EventObject.

Listeners supported by Swing

- Component listener – changes in the component's size, position, or visibility.
- Focus listener – whether the component gained or list the ability to receive keyboard input.
- Key listener – keypresses; key events are fired only by the component that has the current keyboard focus.
- Mouse events – mouse clicks and movement into or out of the component's drawing area.
- Mouse-motion events – changes in the cursor's position over the component

Common Event-Handling Problem

- A component does not generate the events it should.
  - Did you register the right kind of listener to detect the events?
  - Did you register the listener to the right object?
  - Did you implement the event handler correctly?

Exercise

- Create a calculator application that has buttons for 0 – 9, +, ?, and = signs. It should have a display are that shows the result.
- Modify the program from (1) to have more functions such as, *, /, %, or handle real number.