JAV
Spring 2014

Lecture 8

GUI programming (2)

Intermediate issues

Lecture outline

- Basic components
- GUI containers
- Content container
- Menu (container)
- More display components

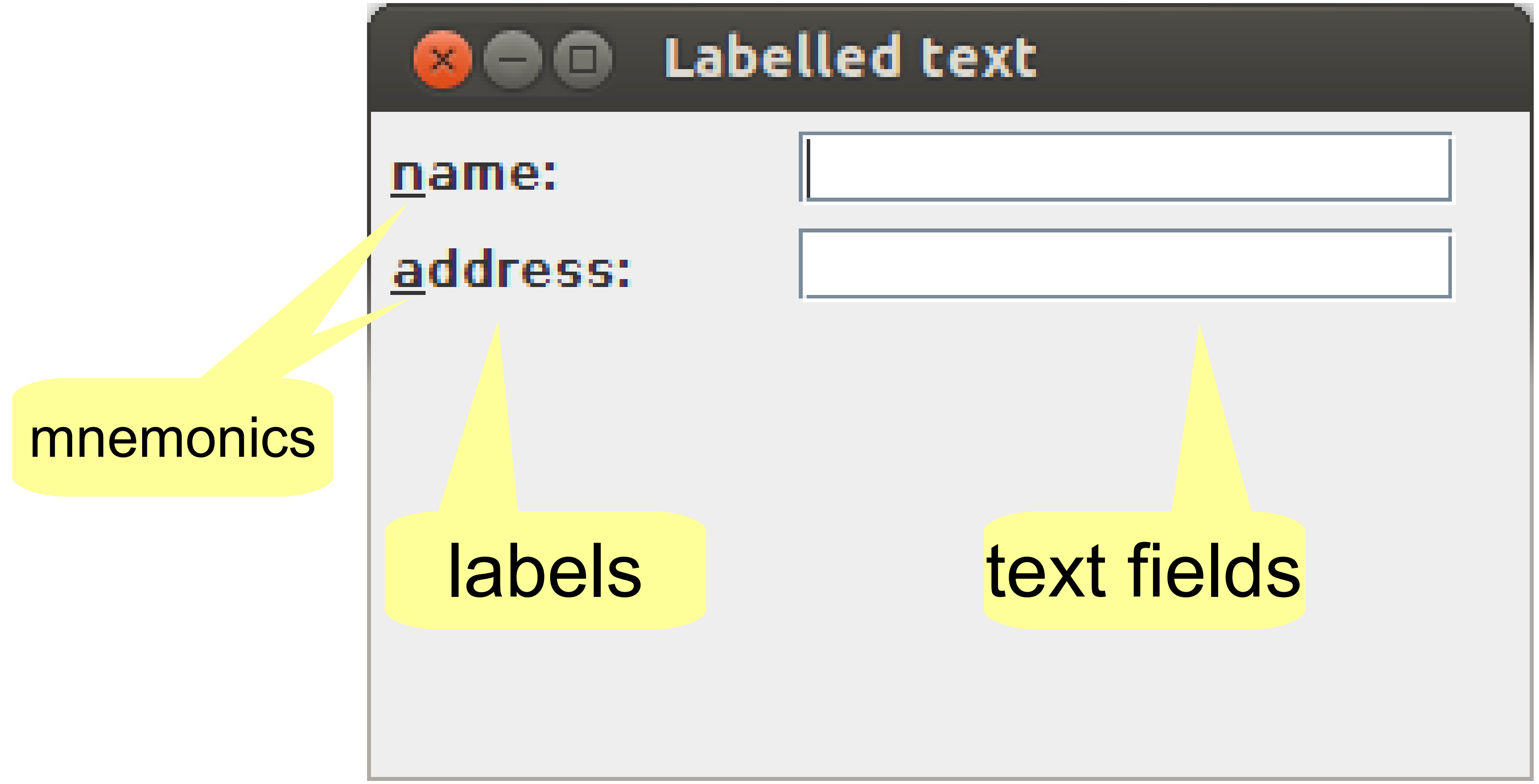
Basic display components

- Label
- Text field

DEMO

Labelled text field

`gui.text.LabelledTextFieldDemo`



Label

- Class: `JLabel`
- Displays a single line text
- Example:

```
JLabel label = new JLabel("name:");
```

Text field (1)

- Class: `JTextField`
- Captures a single line text input
- Can contain any number of characters, but only a limited number will be visible
- Number of visible characters (the visible area) can be set

Text field (2)

- Create a text field:

```
JTextField tf = new JTextField();
```

- with a fixed visible area:

```
JTextField tf = new JTextField(30);
```

- Change text:

```
tf.setText("some name");
```

- Get text:

```
String t = tf.getText();
```

Bounding a label to a text field

- A label can be bound to a text field:

```
label.setLabelFor(tf);
```

- Activate the bounded text field through the label:

```
label.setDisplayMnemonic('n');
```

a character of the label

- To retrieve the bounded text field:

```
Component comp = label.getLabelFor();
JTextField tf = (JTextField) comp;
```

DEMO

Code

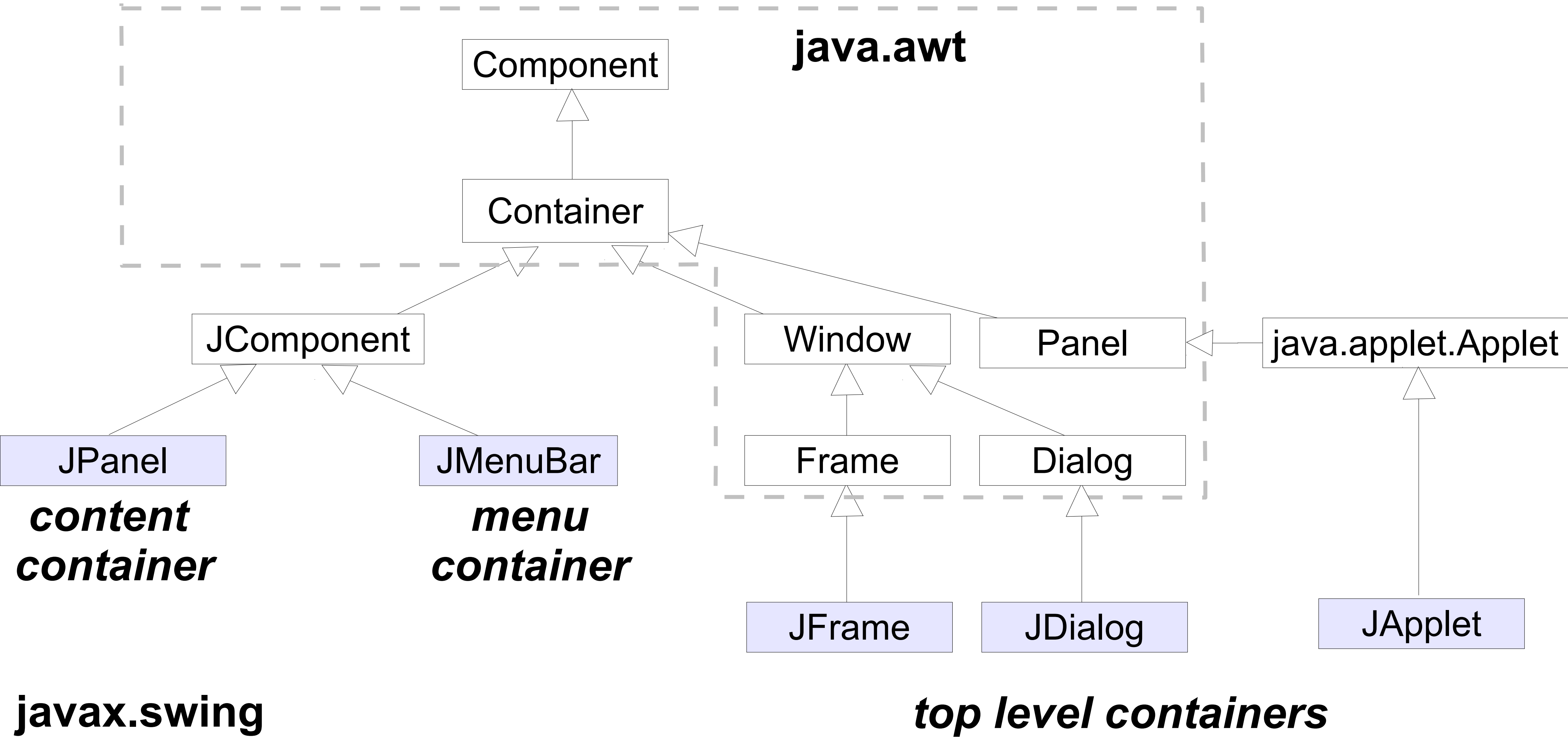
```
gui.text.LabelledTextFieldDemo
```

2

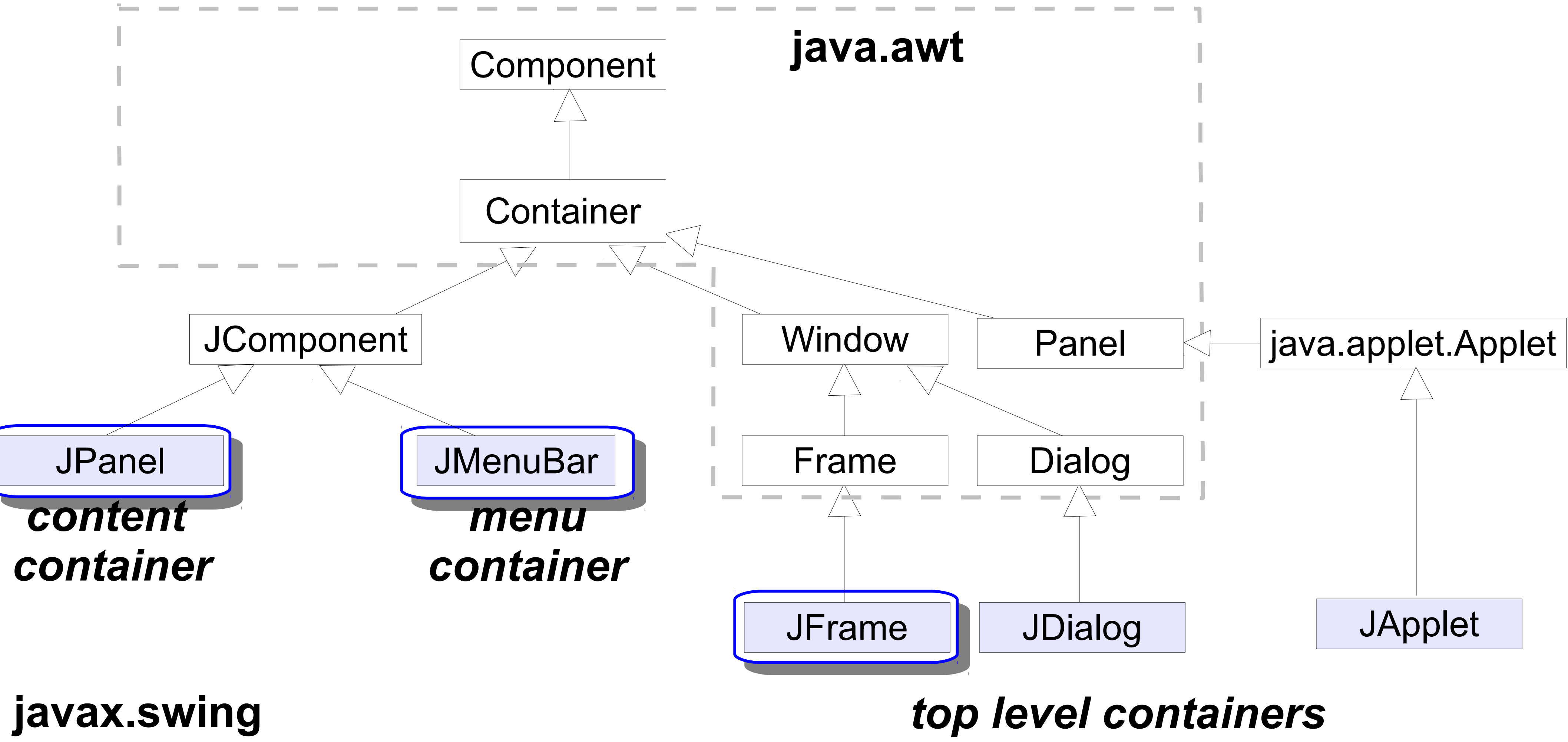
GUI containers

- All **Swing** components are sub classes of `Container`: can contain other components
- GUI components are arranged in a nested structure called ***containment hierarchy*** (CH)
- Container-specific components:
  - ***top level*** container: contains components & other containers
  - ***content*** container: contains non-menu components
  - **menu** container: contains *menu* components
- Display-specific components: label, text field, etc.

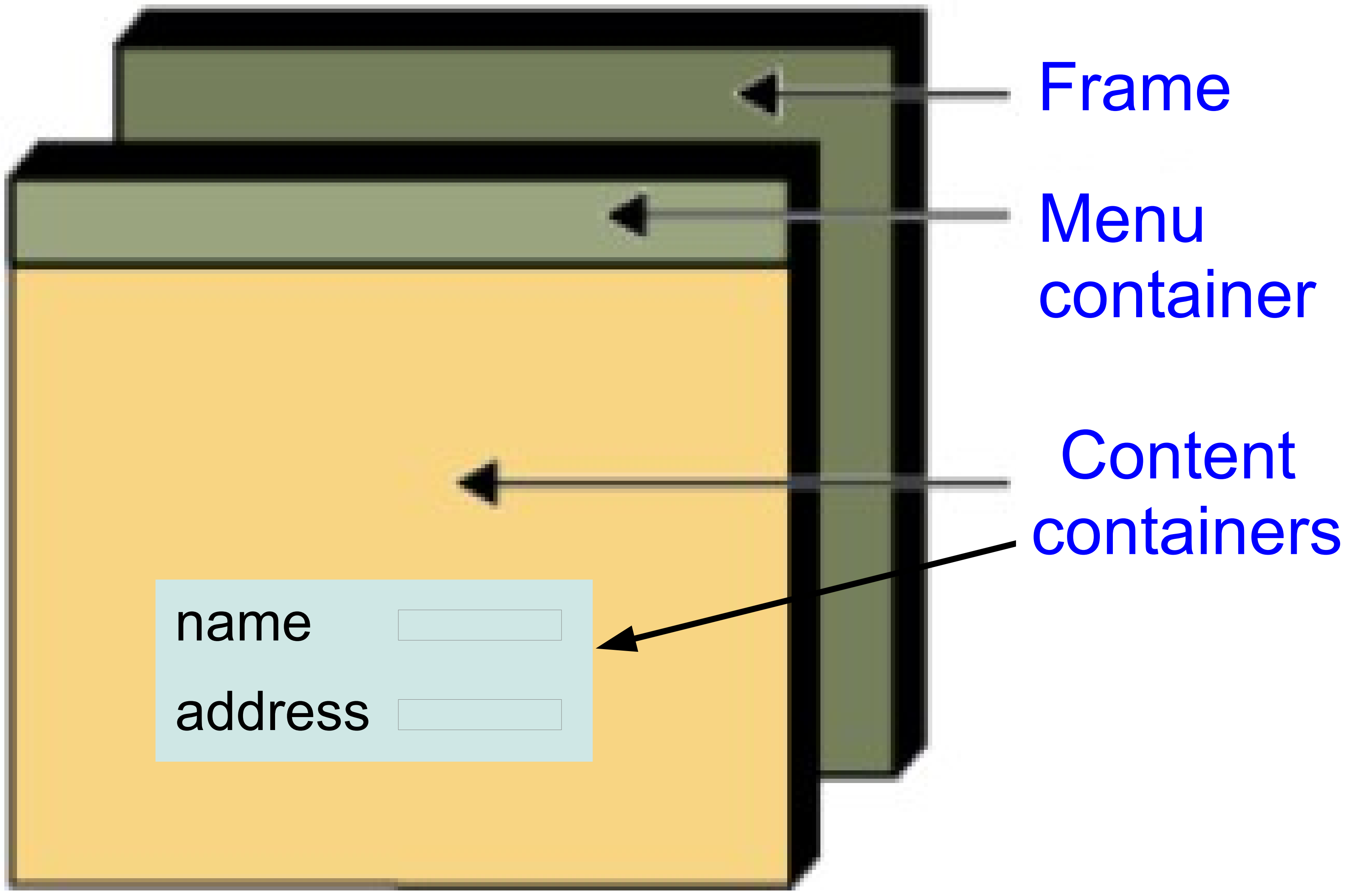
Swing CH diagram



Our application scope



Containers



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Content container

- Types of content container
- Content pane
- Panel
- Layout manager
- Working with the container's components

Types of content container

- The **content pane** of a window:
  - the top-level content container
- A **panel** of components:
  - to group the related display components together
- A content pane may contain one or more panels

Content pane

- Every Swing window (`JWindow` or `JFrame`) has a content pane
- All non-menu, displayable components are added to the content pane by default
- To access the content pane:

```
Container c = w.getContentPane();
```

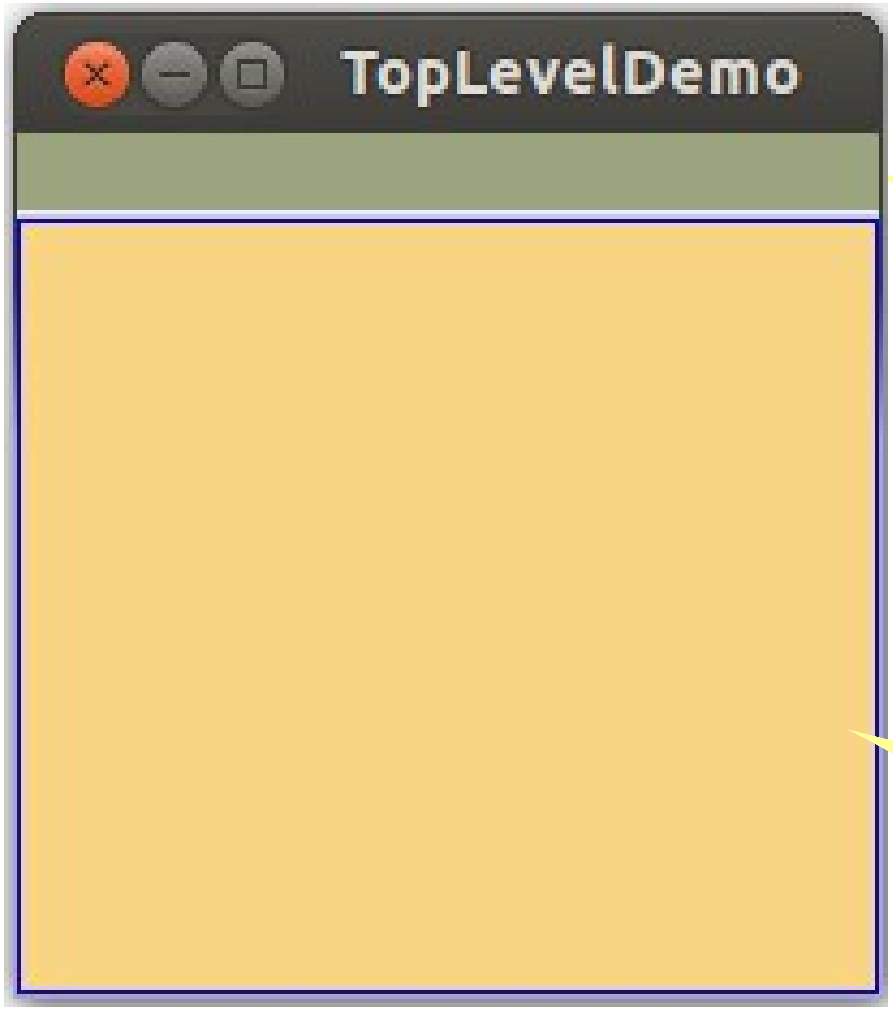
- To change a content pane:

```
Container c = new JPanel();
w.setContentPane(c);
```

DEMO

Window and containers

- `gui.window.TopLevelDemo`



menu bar

content pane with a yellowish label

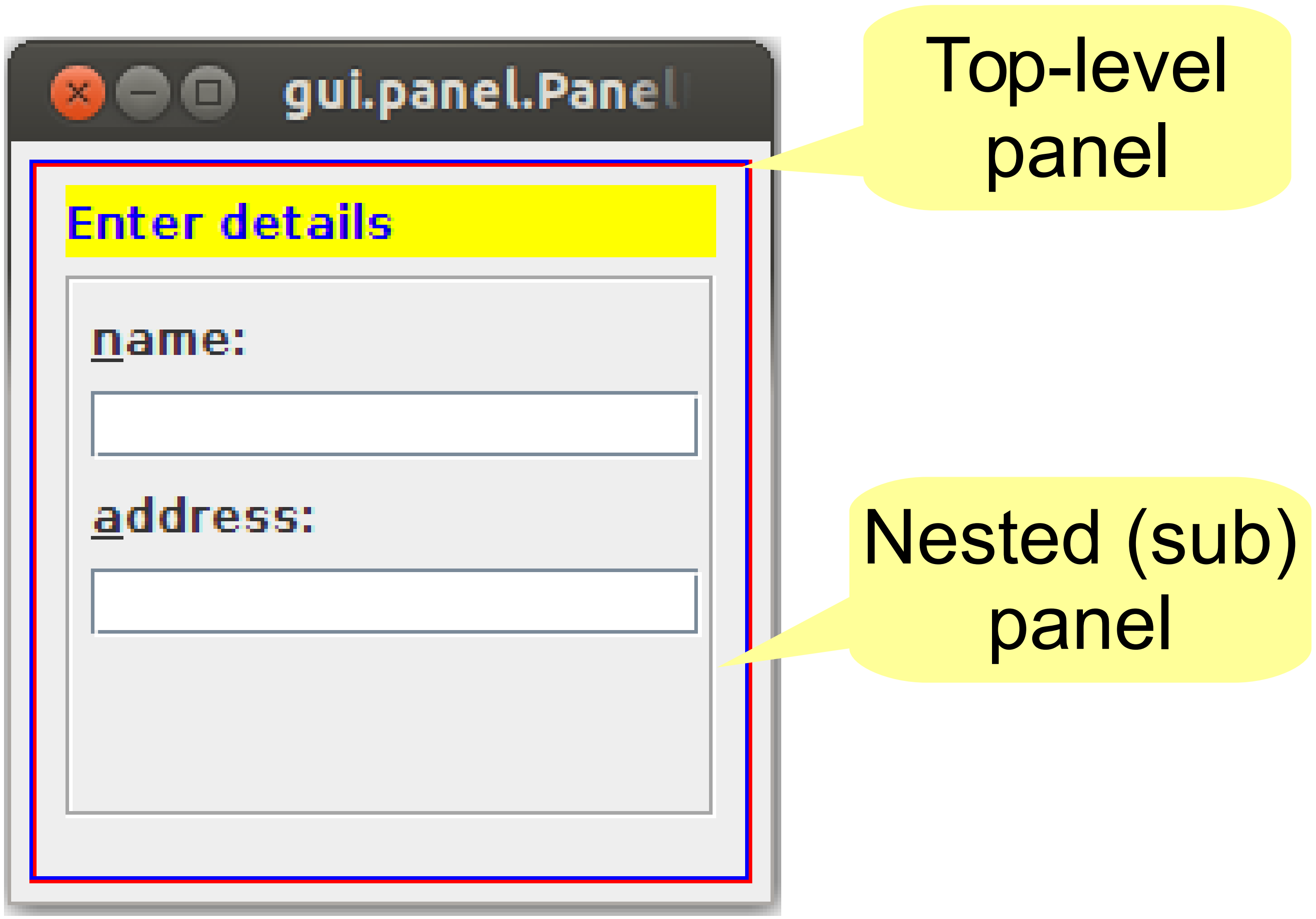
Panel

- A sub-container to organise related display components
- A panel can be nested inside another panel
- Components in a panel are arranged using *layouts*

DEMO

Panel

`gui.panel.PanelDemo`



Enter details

name:

address:

Working with panels (1)

- Class: `JPanel`
- Create a panel (with a default layout):

```
JPanel p = new JPanel();
```

- Add components to a panel:

```
p.add(label);
p.add(tf);
```

- Create a nested panel:

```
JPanel subPanel = new JPanel();
p.add(subPanel);
```

Working with panels (2)

- Add a panel to a `JFrame` (its content pane):

```
JFrame w = new JFrame("My GUI");
w.add(p);
// or w.getContentPane().add(p)
```

Layout manager

- Defines the *layout* of the components in a container:
  - specifies the relative positions of the components
- Implement interface `java.awt.LayoutManager` and/or `LayoutManager2`
- Pre-defined layout managers:
  - Flow layout
  - Border layout
  - Grid layout

Layout manager (2)

- Change the layout manager of a container:

```
LayoutManager lm = new FlowLayout();
w.setLayout(lm);
```

- Obtain the layout manager of a container:

```
LayoutManager lm = w.getLayout();
```

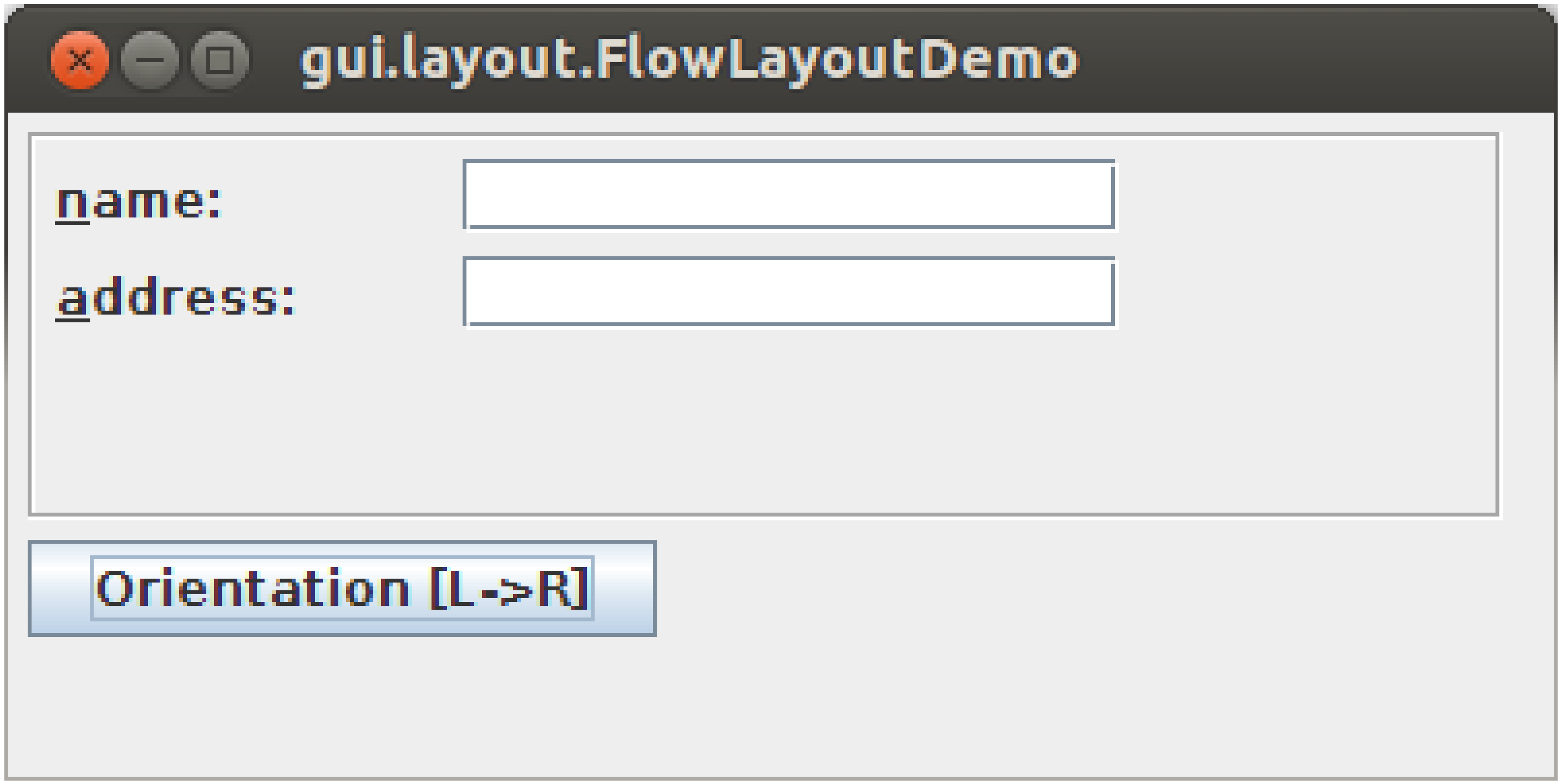
Flow layout

- Class: `java.awt.FlowLayout`
- Default layout for panels
- Arranges components in rows:
  - direction depends on container's orientation
  - number of rows are determined by container's size
- Components alignment: left, right, center, leading, trailing
  - default: center
- Respect the components size

DEMO

Flow layout

`gui.layout.FlowLayoutDemo`



Refresh a container's GUI

- Required when a container's layout or composition has been changed:
  - components are added/removed
  - layout information changed
- Method: `Container.validate()`

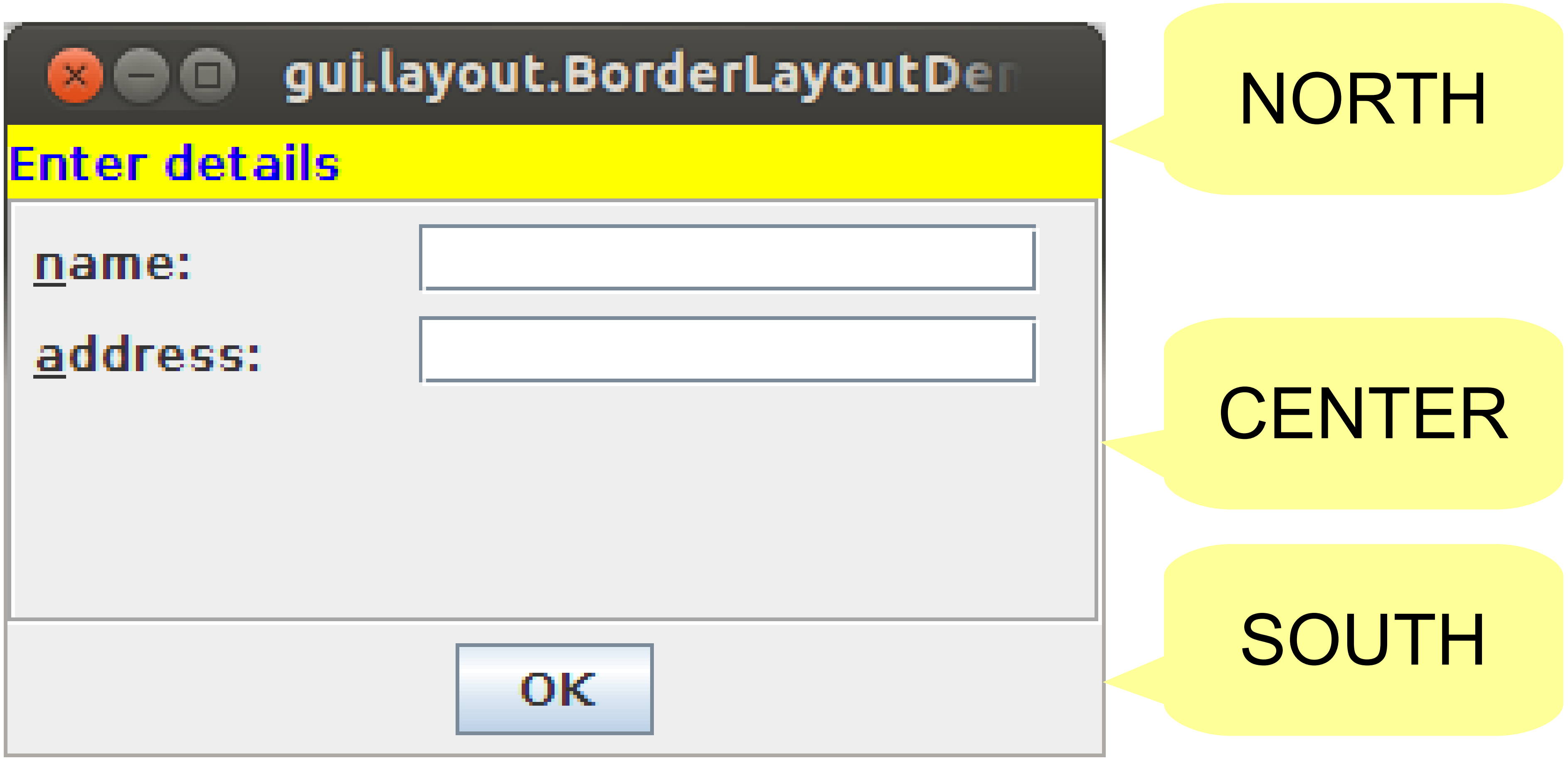
Border layout

- Class: `java.awt.BorderLayout`
- Default layout for windows (e.g. `JFrame`)
- Arranges components in five regions: NORTH, SOUTH, EAST, WEST, CENTER
  - defined as constants of `BorderLayout`
- Each region can only contain one component:
  - use a panel if multiple components are needed
- Spaces are allocated in the above order:
  - CENTER region fills up the remaining space

DEMO

Border layout

```
gui.layout.BorderLayoutDemo
```



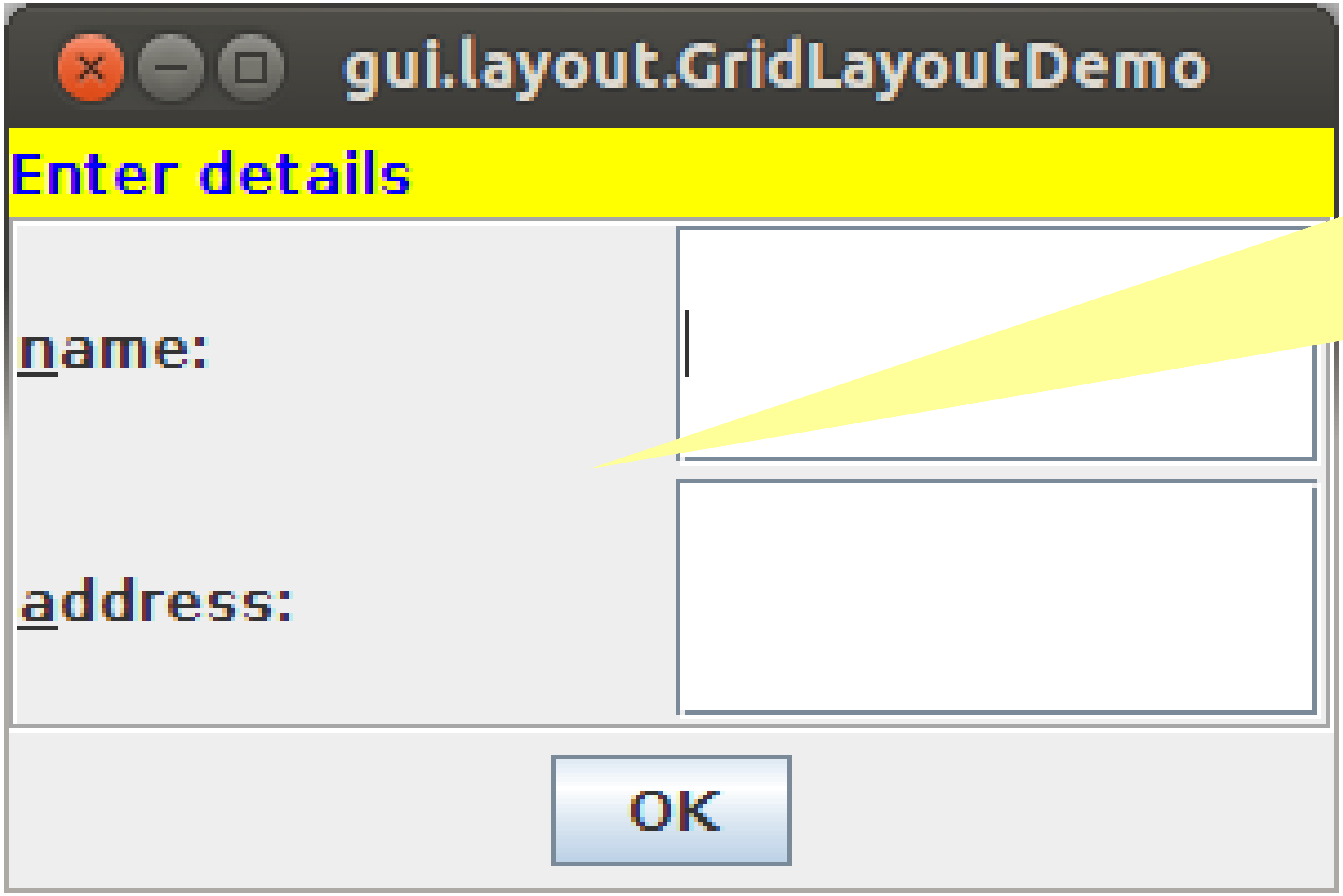
Grid layout

- Class: `java.awt.GridLayout`
- Arranges components in a table *N*x*M*
    - *N*: number of rows
    - *M*: number of columns
    - all cells have equal size
- Components are added sequentially: from left to right, one row at a time
- Does not respect the components size:
    - components are stretched to fill up their cells

DEMO

Grid layout

gui.layout.GridLayoutDemo



Grid layout (2,2) components are stretched

Working with a container's components

- Get all the display components (of a container):

```
Container c = w.getContentPane();
Component[] comps = c.getComponents();
```

- Get a display component at a given position:

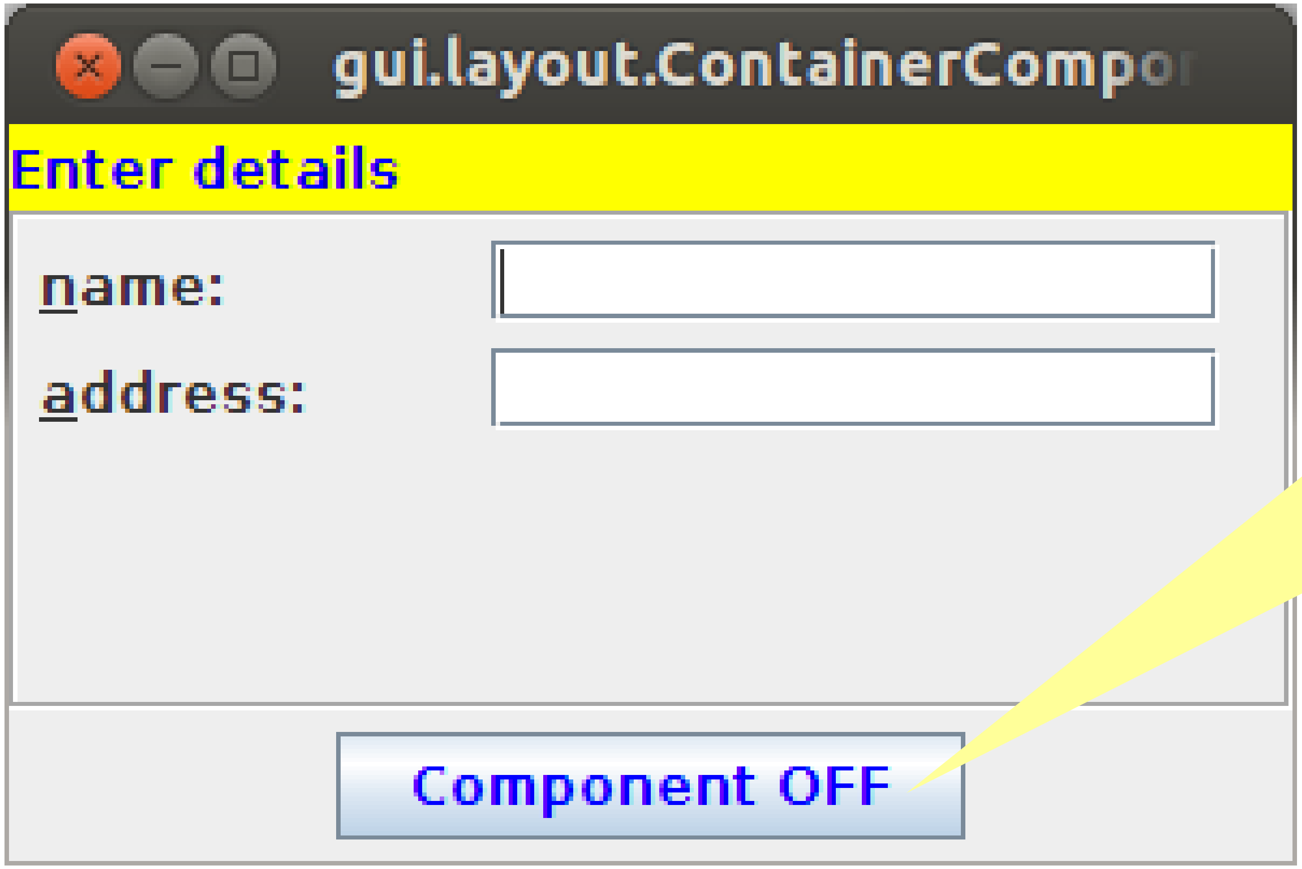
```
Component co = c.getComponent(i);
```

- Search for a component:
    - loop over the component array

DEMO

Container components

`gui.layout.ContainerComponentDemo`



To turn ON/OFF each component of the middle panel

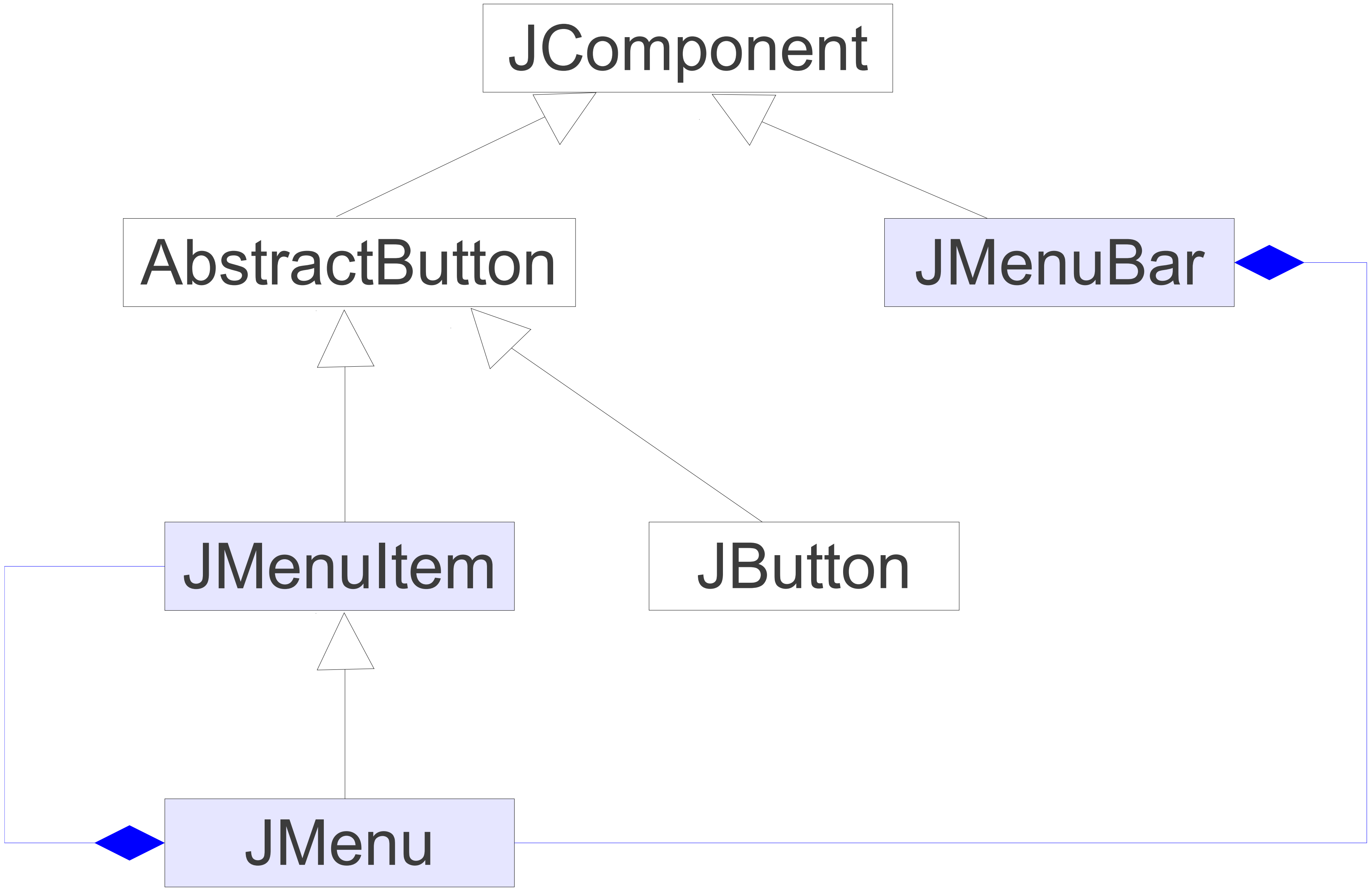
Menu (container)

- Menu bar, menu, menu item
- Menu component hierarchy
- Working with menus

Menu bar, menu, menu item

- Every `JFrame` has a menu bar displayed above the content pane
- A **menu bar** contains zero or more menus
- A **menu** contains zero or more menu items
- A **menu item** is a user action (same as that on a button)
- Swing classes:
  - `JMenuBar`
  - `JMenu`
  - `JMenuItem`

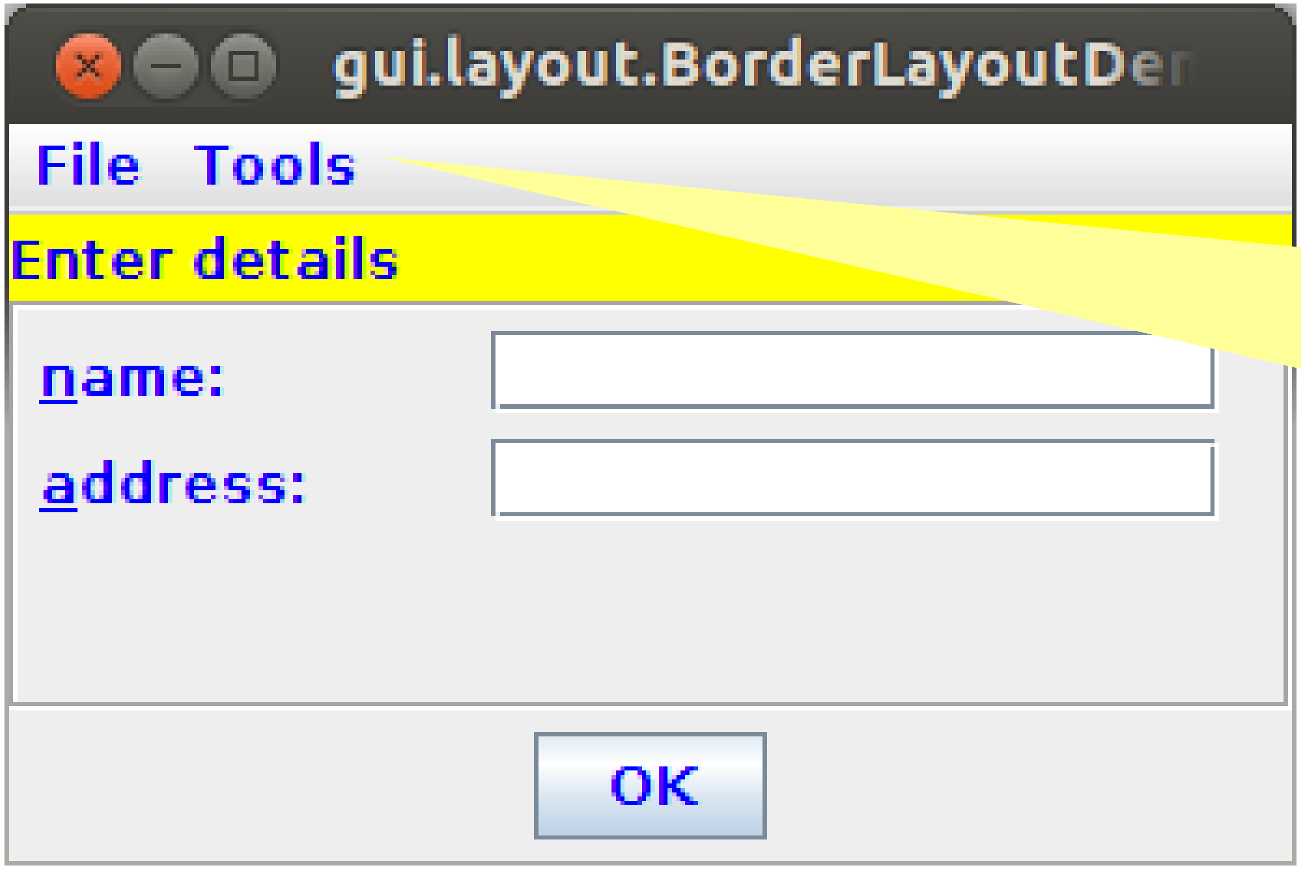
Menu component/container hierarchy



DEMO

Menu

`gui.menus.MenuDemo`



Menu bar/
Options :
to change
text colours

Working with menus (1)

- Create a menu bar:

```
JMenuBar menuBar = new JMenuBar();
```

- Create one or more menus:

```
JMenu fileMenu = new JMenu("File");
```

- Create one or more menu items under a menu:

```
JMenuItem exit = new JMenuItem("Exit");
```

- Set up action handler for menu items:

```
exit.addActionListener(...);
```

Working with menus (2)

- Add menu items to a menu:

```
fileMenu.add(exit);
```

- Add menus to a menu bar:

```
menuBar.add(fileMenu);
menuBar.add(toolsMenu);
```

- Set menu bar on the `JFrame`:

```
w.setJMenuBar(menuBar);
```

Create a nested menu

- Add a menu to another menu:

```
JMenu saveMenu = new JMenu("Save");
JMenuItem toFile = new
  JMenuItem("to file");
JMenuItem toDB = new
  JMenuItem("to database");
saveMenu.add(toFile);
saveMenu.add(toDB);
fileMenu.add(saveMenu);
```

Obtain menu components

- Use `getMenuComponents()`:

```
Component[] menuItems =
          fileMenu.getMenuComponents();
```

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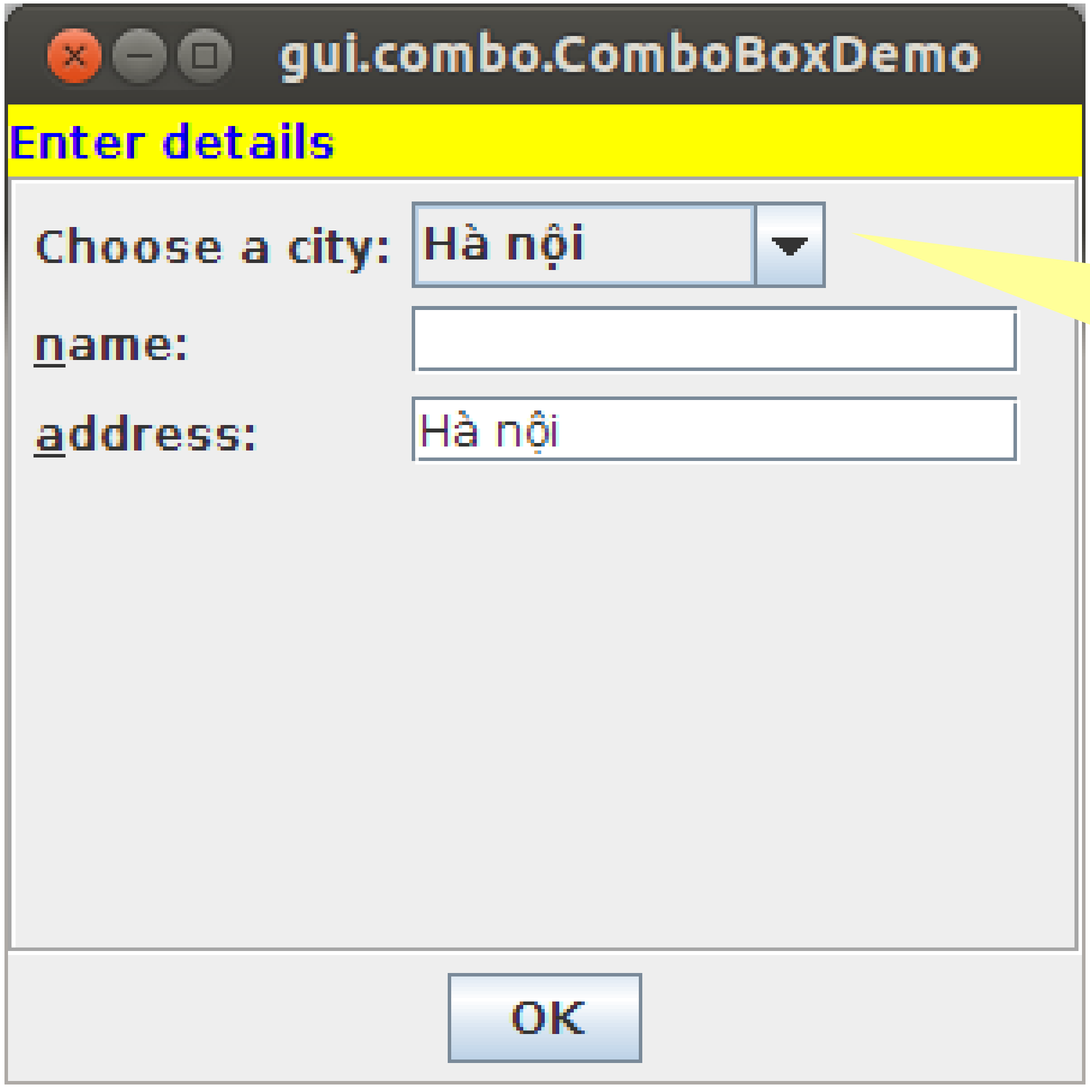
More display components

- Combo box

DEMO

Combo box

gui.combo.ComboBoxDemo



Choose a city to update address field

Combo box (1)

- Class: `JComboBox`
- Displays a drop-down list of objects:
  - typically strings
- Read only (by default), but can be made editable

Combo box (2)

- Create a combo box:

```
String[] strings = { "", "Hà nội" };
JComboBox combo = new JComboBox(strings);
```

- Get the selected object:

```
String s = (String) combo.getSelectedItem();
```

- Change the selected object:

```
combo.setSelectedIndex(1);
combo.setSelectedItem("Hà nội");
```

Handle combo box events

- Create event handler for combo box
- Create an event handler object
- Register event handler object to the combo box
    - invoke an add*X*Listener() method

Create event handler for combo box

- Event: `ActionEvent` or `ItemEvent`
- Listener: `ActionListener` or `ItemListener`
- Create a handler as **`ActionListener`**:
  - implements `ActionListener`
  - in `actionPerformed()`:
    - get combo box object from source
    - invoke `getSelectedItem` to retrieve current item
    - process item

[!0] Additional components & issues

- Technical guide for Swing components:
  - Java tutorial > Creating a GUI With JFC/Swing > Using Swing Components
- Handle text field events:
  - Java tutorial > ... > How to Use Text Fields

Summary

- Display components are organised on a GUI using containers
- All containers are sub-class of Container class
- All Swing components are containers
- Layout managers are used to layout components in a container
- Top level containers are JFrame, JDialog and JApplet
- JFrame uses a content pane to organise components and an (optional) menu bar

References

Savitch W., Absolute Java, 4th, Addision-Wesley, 2009

- Chapter 17

Oracle, The Java Tutorial, Oracle, 2011, http://docs.oracle.com/javase/tutorial

- Lesson: Creating a GUI With JFC/Swing, Using Swing Components