

GUI I: Swing Layouts and Widgets

JFrame, panels, layout managers, JTable, and building the LMS window

Lecture + Lab 5

Branch: week8-gui-layouts

Learning outcome 4

What you will be able to do after today

- Open a window with `JFrame` and fill it with components.
- Use **BorderLayout**, **FlowLayout** and **GridLayout** and nest panels to build a real screen.
- Show a list of LMS items in a `JTable`.
- Start Swing correctly on the Event Dispatch Thread.

1. From console to window

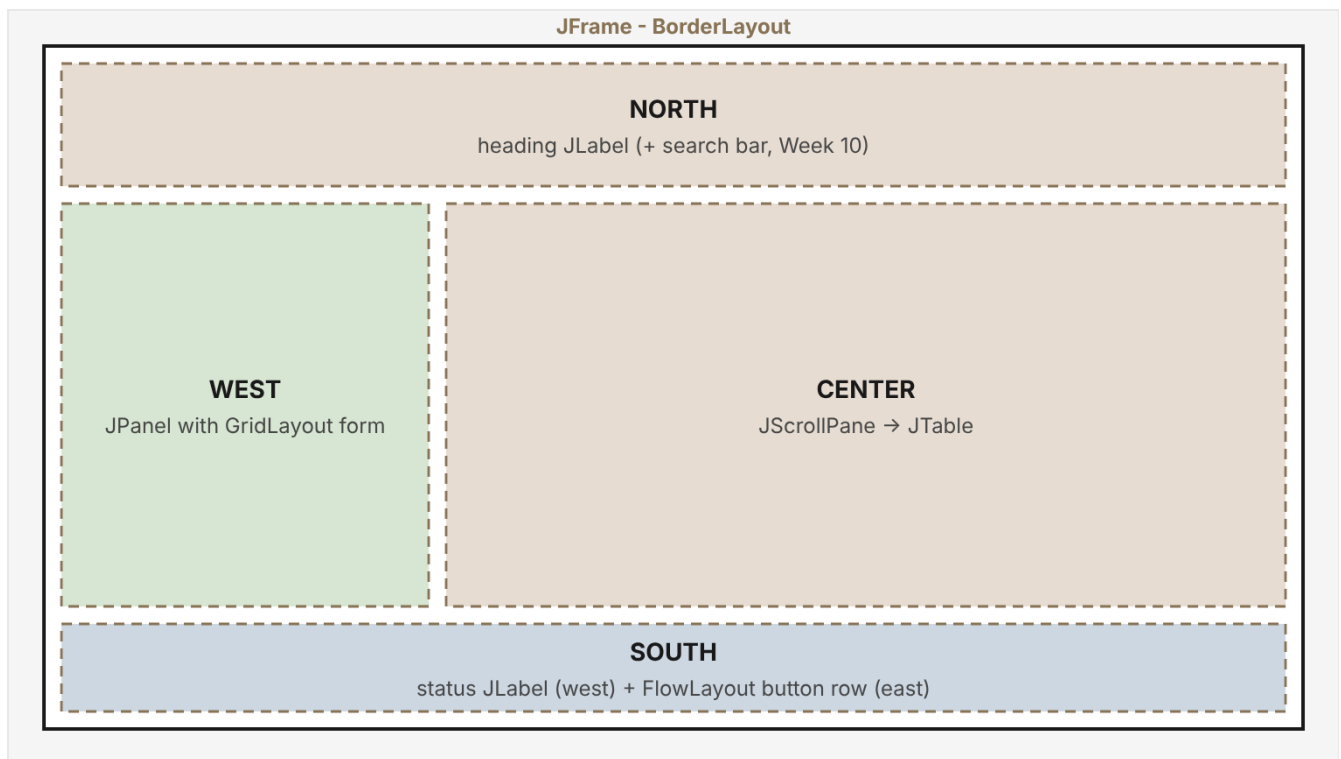
Everything so far printed text. A GUI has the same classes, plus **widgets** that show and collect information. Swing ships with Java, so there is nothing to install.

Widget	Purpose
<code>JFrame</code>	The window
<code>JPanel</code>	An invisible container used to group other widgets
<code>JLabel</code>	Text (or icon)
<code>TextField</code>	One line of input
<code>JComboBox<String></code>	Drop-down list
<code>JButton</code>	Clickable button
<code>JTable</code> + <code>DefaultTableModel</code>	Rows and columns
<code>JScrollPane</code>	Adds scrollbars around another widget

2. Layout managers: let Java do the arithmetic

You almost never position widgets by pixel. You choose a **layout manager** that arranges the container's children.

Layout	Arranges	Use for
<code>BorderLayout</code>	NORTH, SOUTH, EAST, WEST, CENTER	The overall window
<code>FlowLayout</code>	Left to right, wrapping	A row of buttons
<code>GridLayout(rows, cols)</code>	Equal-sized grid cells	A form: label, field, label, field



The trick: nest panels. The form on the left is a `JPanel` with a `GridLayout`, placed in the `WEST` region of the frame's `BorderLayout`.

```
JPanel form = new JPanel(new GridLayout(0, 2, 6, 8)); // any number of rows, 2 columns
form.setBorder(BorderFactory.createTitledBorder("New item"));
form.add(new JLabel("Type:")); form.add(typeBox);
form.add(new JLabel("ID:")); form.add(idField);
form.add(new JLabel("Title:")); form.add(titleField);
```

3. The frame

```
public class MainFrame extends JFrame {
    public MainFrame(Library library) {
        super("Library Management System"); // window title
        setLayout(new BorderLayout());
        add(heading, BorderLayout.NORTH);
        add(west, BorderLayout.WEST);
        add(new JScrollPane(table), BorderLayout.CENTER);
        add(south, BorderLayout.SOUTH);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE); // closing the window ends the program
        setSize(820, 460);
        setLocationRelativeTo(null); // centre on screen
    }
}
```

`MainFrame` **extends** `JFrame`: inheritance again, this time reusing a huge library class.

4. A table from your objects

`JTable` shows what a `DefaultTableModel` holds. Copy your items into rows:

```
private void refreshTable() {
    tableModel.setRowCount(0); // clear
    for (LibraryItem item : library.getItems()) {
        tableModel.addRow(new Object[]{
            item.getId(), item.getTitle(), item.getClass().getSimpleName(),
            detailOf(item), item.isBorrowed() ? "On loan" : "Available"});
    }
}
```

5. Starting Swing correctly

Swing is **not thread-safe**: all GUI work must happen on one special thread, the **Event Dispatch Thread (EDT)**. Always start the window like this:

```
public static void main(String[] args) {
    Library library = new Library();
    // ... add sample items and members ...
    SwingUtilities.invokeLater(() -> new MainFrame(library).setVisible(true));
}
```

(We return to the EDT in Week 12.)

6. What the Week 8 window looks like

Library Management System

New item

Type: Book

ID:

Title:

Detail:

Add Item

ID	Title	Type	Detail	Status
B001	Clean Code	Book	Robert C. Martin	Available
B002	Refactoring	Book	Martin Fowler	Available
D001	Introduction to ...	DVD	120 min	Available
G001	Software Weekly	Magazine	Issue 42	Available

Ready

Borrow
Return

Buttons do nothing yet. That is deliberate: **layout first, behaviour next week.**

7. Common problems

Symptom	Likely cause
Window is tiny or empty	Forgot <code>setSize(...)</code> or <code>setVisible(true)</code>
Form fields stretch across the whole side	Added the grid panel straight to <code>WEST</code> ; wrap it in a panel and put it in <code>NORTH</code>
Table has no headers	Forgot <code>JScrollPane</code> around the <code>JTable</code>
Program does not exit when window closes	Forgot <code>setDefaultCloseOperation</code>
Widgets overlap or vanish	Added to the wrong container

8. Lab 5 preview (Week 8)

Create `lms.ui.MainFrame` with the five regions above, a table filled from the `Library`, the form and the three buttons. Sketch the layout on paper first and add it to `docs/`. Branch `week8-gui-layouts`.

9. Self-check

1. Which layout would you pick for a row of three buttons, and why?
2. Why do we wrap the form in another panel before adding it to `WEST` ?
3. Why does `MainFrame` use `extends JFrame` ?
4. What goes wrong if Swing code runs off the EDT?