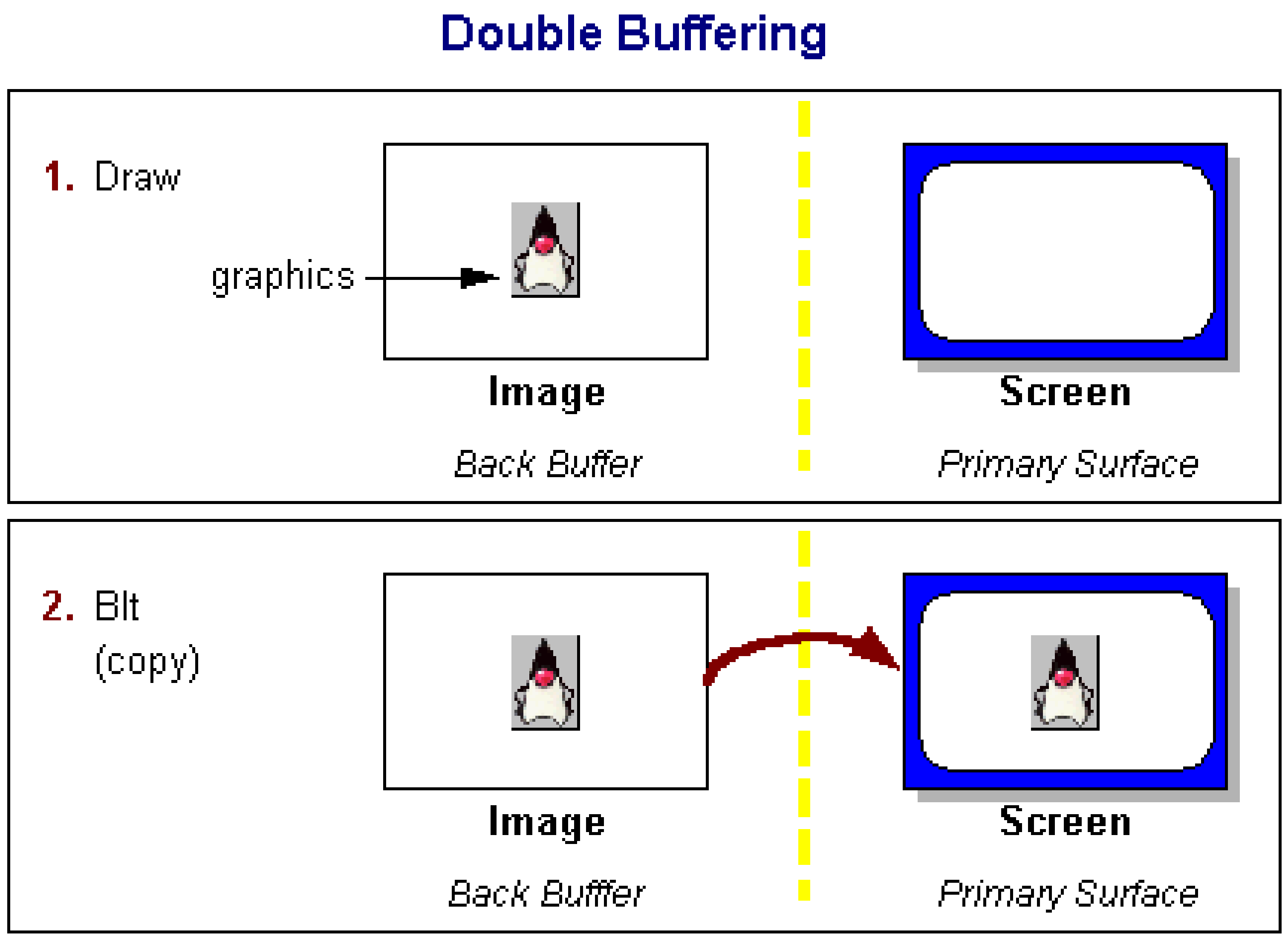
Graphical User Interface (GUI), Part 2

- Double Buffering

- Various components
  - Menu Bar, Menu, and Menu Items
  - Combo Box
  - Table

- Java Beans
  - For visual programming

Double Buffering



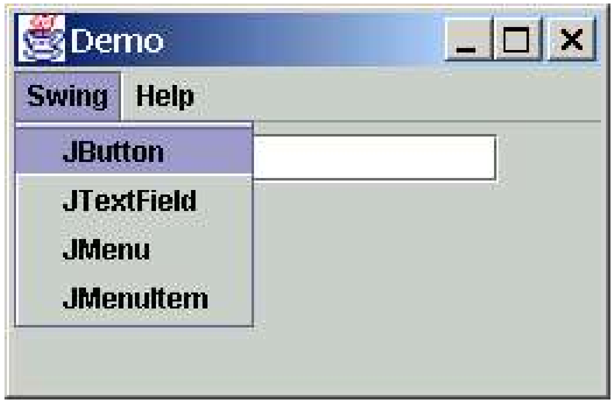
[Source: java.sun.com]

Double Buffering, cont.

- Double buffering is used to eliminate visual draws.
- Used extensively in Swing use the method **`setDoubleBuffered`** in **`javax.swing.JComponent`**.

- An alternative technique is called *page flipping*.
- Page flipping is used to avoid tearing, a splitting effect that occurs when drawing to the screen happens faster than the monitor's refresh rate.

Menu and Menu Items



- The class **`JMenuBar`**, **`JMenu,`** and **`JMenuItem`** are used for this purpose.

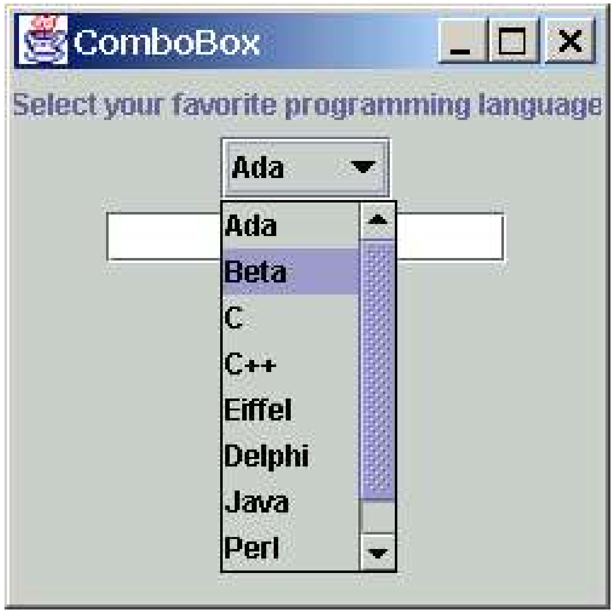
Menu and Menu Items, cont.

```
public class DemoApplet extends JApplet {
  JTextField t = new JtextField(15);
  Container cp;
  // use anonymous inner class
  ActionListener al = new ActionListener() {
    public void actionPerformed(ActionEvent e){
      t.setText(((JMenuItem)e.getSource()).getText());
    }
  };


  JMenu[] menus = { new JMenu("Swing"),
                    new JMenu("Help")};

  JMenuItem[] swingItems = { new JMenuItem("JButton"),
                             new JMenuItem("JTextField"),
                             new JMenuItem("JMenu"),
                             new JMenuItem("JMenuItem")};

  JMenuItem[] helpItems = { new JMenuItem("Topics"),
                            new JMenuItem("About") };
```

Menu and Menu Items, cont.

```
public void init() {
    // the swing menu
    for(int i = 0; i < swingItems.length; i++) {
      swingItems[i].addActionListener(al);
      menus[0].add(swingItems[i]);
    }
    // the help menu
    for(int i = 0; i < helpItems.length; i++) {
      helpItems[i].addActionListener(a2);
      menus[1].add(helpItems[i]);
    }

    // create the menu bar
    JMenuBar mb = new JMenuBar();
    for(int i = 0; i < menus.length; i++) {
      mb.add(menus[i]);
    }
    // set up the menu bar
    setJMenuBar(mb);
    cp = getContentPane();
    cp.setLayout(new FlowLayout());
    cp.add(t);
```

Combo Box



- The class **`JComboBox`** is used for this purpose.
- One and only one element from the list can be selected.

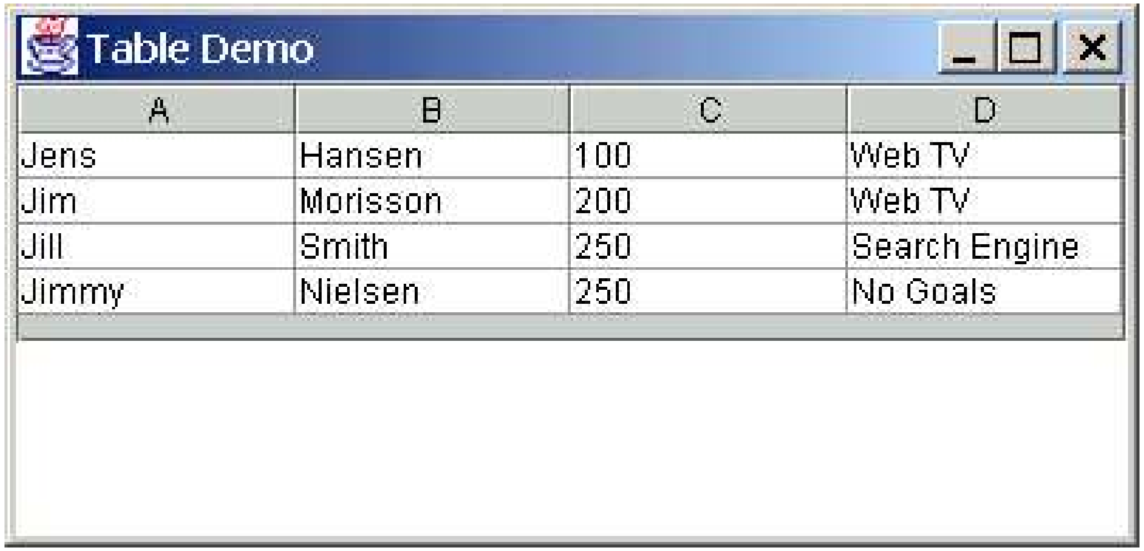
Combo Box, cont.

```
public class ComboBox extends JApplet {
  JTextField t = new JTextField(15);
  JLabel     l =
    new JLabel ("Select your favorite programming language");
  Container cp;

  ActionListener al = new ActionListener() {
    public void actionPerformed(ActionEvent e){
      t.setText(
       (String)((JComboBox)e.getSource()).getSelectedItem());
    }
  };

  String[] languages = { "Ada", "Beta", "C", "C++",
                         "Eiffel", "Delphi", "Java",
                         "Perl", "Python"};
  JComboBox cb = new JComboBox();
```

Combo Box, cont.

```
public void init() {
 // populate the combo box
 for(int i = 0; i < languages.length; i++) {
    cb.addItem(languages[i]);
  }
  // connect the action listener
  cb.addActionListener (al);
  cp = getContentPane();
  cp.setLayout(new FlowLayout());
  cp.add(l);
  cp.add(cb);
  cp.add(t);
}
public static void main(String[] args) {
  ComboBox applet = new ComboBox();
  JFrame frame = new JFrame("ComboBox");
  frame.setDefaultCloseOperation (JFrame.EXIT_ON_CLOSE);
  frame.getContentPane().add(applet);
  frame.setSize(250,250);
  applet.init();
  applet.start();
  frame.setVisible(true);
```

Tables



A	B	C	D
Jens	Hansen	100	Web TV
Jim	Morisson	200	Web TV
Jill	Smith	250	Search Engine
Jimmy	Nielsen	250	No Goals

- The classes **`JTable`** and **`AbstractTableModel`** are used.
  - The latter controls the data

Tables, cont.

```
public class Table extends JApplet {
  JTextArea text = new JTextArea(4, 24);

  // AbstractTableModel controls all data
  class TModel extends AbstractTableModel {
    Object[][] table_data = {
      {"Jens",  "Hansen",   "100", "Web TV"},
      {"Jim",   "Morisson", "200", "Web TV"},
      {"Jill",  "Smith",    "250", "Search Engine"},
      {"Jimmy", "Nielsen",  "250", "No Goals"}};

    // reprint table data when changes
    class TMList implements TableModelListener {
      public void tableChanged(TableModelEvent e){
        text.setText(""); // clear screen
        for(int i = 0; i < table_data.length; i++) {
          for(int j = 0; j < table_data[i].length; j++){
            text.append(table_data[i][j] + "  ");
          }
          text.append("\n");
        }
      }
```

Tables, cont.

```
    public TModel() {
       addTableModelListener(new TMList());
    }
    public int getColumnCount() {
       return table_data[0].length;
    }
    public int getRowCount() {
       return table_data.length;
    }

    public Object getValueAt(int row, int col) {
       return table_data[row][col];
    }
 }
 public void init() {
    Container cp = getContentPane();
    JTable the_table = new JTable(new TModel());
    cp.add(the_table);
    cp.add(BorderLayout.CENTER, text);
 }
```

Java Beans

- Component programming model
- Core JDK1.1 capability
- Must be able to instantiate, query and configure objects at design time
- Java *reflection* provides method and field information on a "live" object.
  - Methods, arguments, return values
- Beans specifies a naming convention.
  - Identifies design-time fields, event handlers
- For information see http://java.sun.com/products/javabeans/

Java Beans, cont.

- Simply a Java class (or classes)

- Supports three concepts
  - Properties
  - Events
  - Methods

- Follows naming convention to identify the concepts.

Java Beans Properties

- For a property named weight create two methods
  - getWeight( ) and
  - setWeight( ). (First letter automatically to lowercase).
- For boolean property possible to use “is” instead of “get.”
- "Ordinary" methods are public.

- Events use the same “Listeners” with add- and remove- methods.
  - You can create your own events.

A Simple Java Bean

```
import java.awt.*; // [Source: java.sun.com]
import java.io.Serializable;
public class SimpleBean extends Canvas
                                  implements Serializable{
  private Color color = Color.green;

  //property getter method public
  Color getColor(){ return color; }

  //property setter method. Sets color and repaints.
  public void setColor(Color newColor){
    color = newColor; repaint();
  }
  public void paint(Graphics g){
   g.setColor(color); g.fillRect(20, 5, 20, 30);
  }
  //Constructor sets inherited properties
  public SimpleBean(){
    setSize(60,40);
  setBackground(Color.red);
  }
}
```

Summary

- This should get you started programming GUIs

- Listener event model and Beans are huge steps forward.
- Swing is a good UI library.
- All Swing components are Java Beans.
- Numerous application builders use Java Beans.
- Java Beans enable RAD environments.

- Java UI library has gone through a lot of design changes.
- Use a GUI builder for your project.