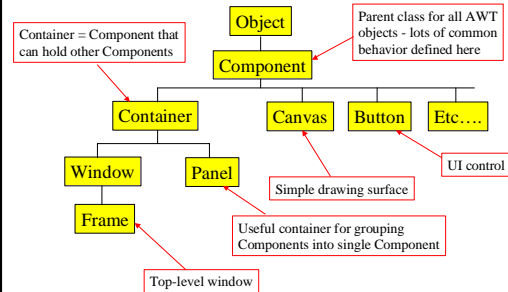


Java AWT Notes

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AWT Class Hierarchy (partial)



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One Java Application Structure

```
import java.awt.*;
// free-standing application w/Window
public class App extends Frame {
    public void paint(Graphics g) {
        // redraw screen when requested by window manager
    }

    // other function declarations

    // main program -- create window etc.
    public static void main(String args[]){
        App a = new App( );
        // set up App window a
        a.show( );
        // continue processing
    }
}
```

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Java Application Notes

- `paint()` is called by the window manager as needed, i.e., asynchronously.
- Component can request redrawing by calling `repaint()`
- Window manager doesn't call `paint()` directly - it calls `update()`. The default implementation inherited from component is (roughly)

```
public void update(Graphics g){
    set window to background color
    paint(g);
}
```
- Override `update()` if desired (ex. less flicker)

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Event Handling

- User interface components generate *events*
- Objects (often other components) can register themselves to receive events of interest
- When an event happens, an appropriate method is called in all *listeners* (all interested objects)
- A listener object must implement the interface corresponding to the events, which means implementing an expected set of methods
- Need to `import java.awt.event.*`; to do this

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Example: Track Mouse

```
public class TrackMouse
    extends Frame
    implements MouseMotionListener {
    // instance variables
    int locX = 100; // last mouse
    int locY = 100; // location

    // constructor - register this
    // object to receive mouse move
    public TrackMouse( ) {
        addMouseMotionListener(this);
    }
    ...
}
```

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Example: Track Mouse (cont)

```
// MotionEventListener methods
public void MouseMoved( ) { }

public void MouseDragged
    (MouseEvent e){
    locX = e.getX();
    locY = e.getY();
    repaint();
}

// repaint screen
public void paint(Graphics g)
{g.drawString("Here!",locX,locY);}
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```

Example: Button

- Most user-interface components need to be allocated, added to an appropriate container, and interested objects need to register to receive events.

```
Public class WatchButton
    extends Frame
    implements ActionListener {
    // instance variables
    Button belly; // the button
    ...
}
```

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Example: Button (cont)

```
// constructor - create button,
// add to this Frame
// and register as a listener
public WatchButton( ) {
    belly = new Button("press me");
    add(belly);
    belly.addActionListener(this);
}
...
```

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Example: Button (concl)

```
// react to button press
public ActionPerformed
    (ActionEvent e) {
    if (e.getSource() == belly) {
        respond to button press
    }
}
...
```

- The test isn't strictly necessary if we know that `belly` is the only button that could generate the event.
- Many other UI components (text boxes, dials, ...) generate similar events. The `ActionEvent` contains details of the event (source, kind, data values, locations, ...).

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Layout Managers

- A Layout Manager is associated with every **Container**. The layout manager is responsible for positioning components in the container when the container is redrawn.
- Basic layout manager classes
 - **FlowLayout** - arranges components from left to right, top to bottom. Nothing Fancy
 - **GridLayout** - regularly spaced rows and columns
 - **BorderLayout** - Components can be placed in the Center, North, South, East, or West. Useful trick: to place several controls in one of these places, create a **Panel** containing the controls, then place the **Panel** in one of the 5 **BorderLayout** locations.
 - **GridBagLayout** - General constraint layout. Can create almost any effect, but can take some work to do it. If you're comfortable with complex HTML tables, you'll feel at home.

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Layout Manager Example

- In the constructor for a Container

```
public SomeContainer( ) {
    ...
    button c = new Button("cold");
    button w = new Button("warm");
    setLayout(new BorderLayout( ));
    add(c, "North");
    add(w, "South");
    ...
}
```

- Also need to add listeners for the buttons, etc.

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