Java Programming

Fall 2016 - Week 6

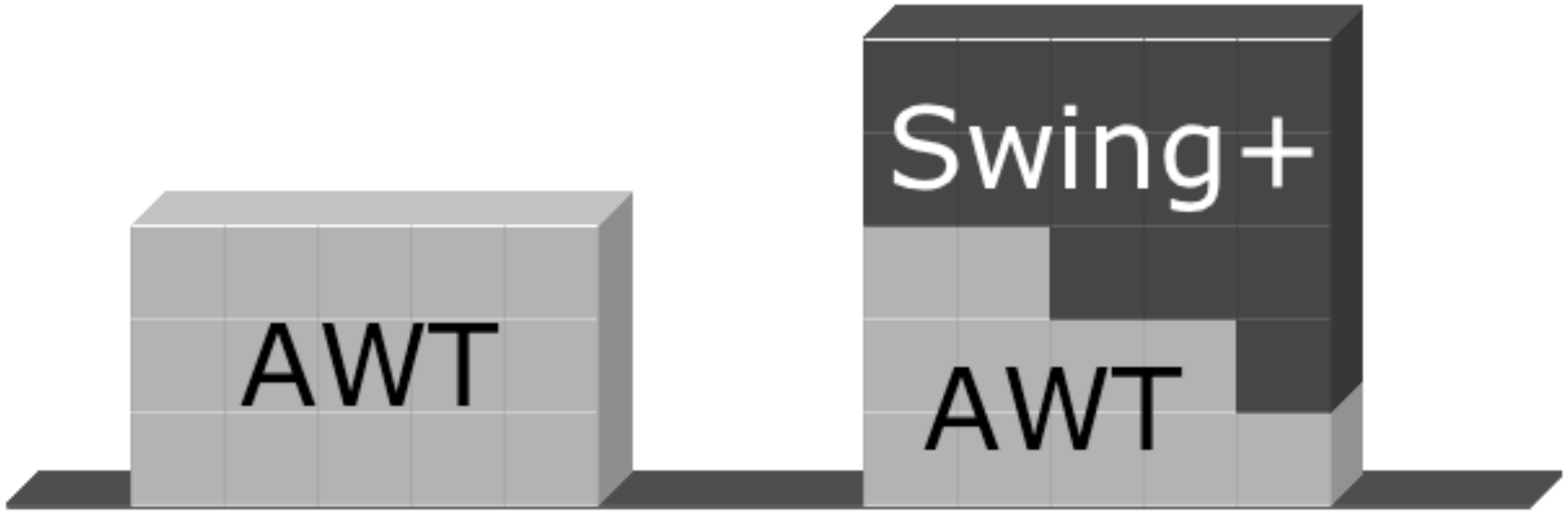
GUI

Weng Kai

http://fm.zju.edu.cn

A Little Story

AWT and Swing



About the JFC and Swing

- JFC is short for Java Foundation Classes, which encompass a group of features for building graphical user interfaces (GUIs) and adding rich graphics functionality and interactivity to Java applications.

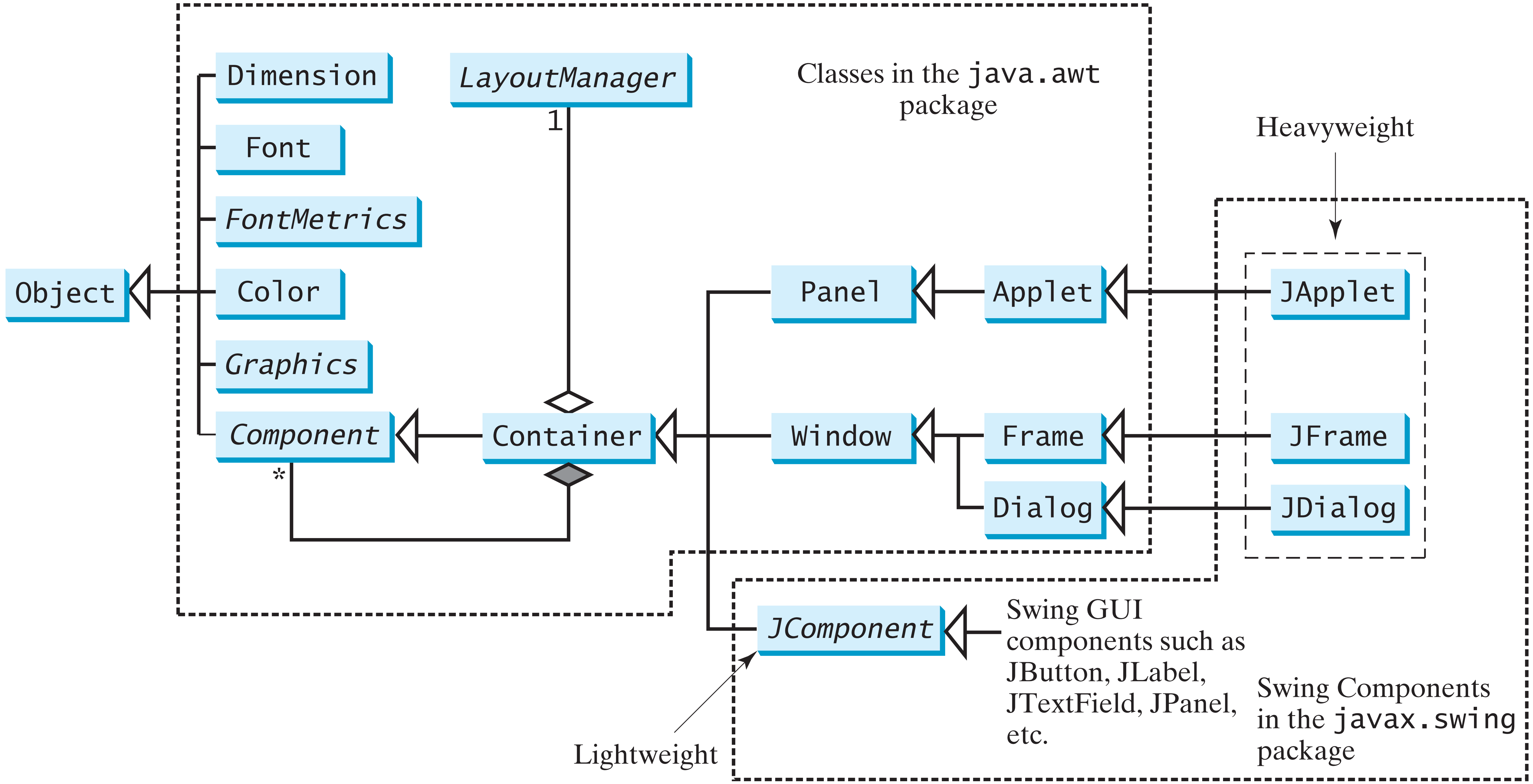
Features of the Java Foundation Classes

- Swing GUI Components
- Pluggable Look-and-Feel Support
- Accessibility API
- Java 2D API
- Internationalization

Swing Features

GUI Principles

- Components: GUI building blocks.
  - Buttons, menus, sliders, etc.
- Layout: arranging components to form a usable GUI.
  - Using layout *managers*.
- Events: reacting to user input.
  - Button presses, menu selections, etc.


Classes in the java.awt package
Dimension
LayoutManager
1
Font
FontMetrics
Object
Color
Graphics
Component
*
Container
Panel
Applet
Window
Frame
Dialog
Heavyweight
JApplet
JFrame
JDialog
JComponent
Swing GUI components such as JButton, JLabel, JTextField, JPanel, etc.
Lightweight
Swing Components in the javax.swing package

Classes

`java.awt.Container`

`javax.swing.JFrame`

`javax.swing.JPanel`

`javax.swing.JApplet`

`javax.swing.JDialog`

`java.awt.Graphics`

`java.awt.Color`

`java.awt.Font`

`java.awt.FontMetrics`

`java.awt.Dimension`

`java.awt.LayoutManager`

JFrame

- A Frame is a top-level window with a title and a border.
- A frame, implemented as an instance of the JFrame class, is a window that typically has decorations such as a border, a title, and buttons for closing and iconifying the window. Applications with a GUI typically use at least one frame.

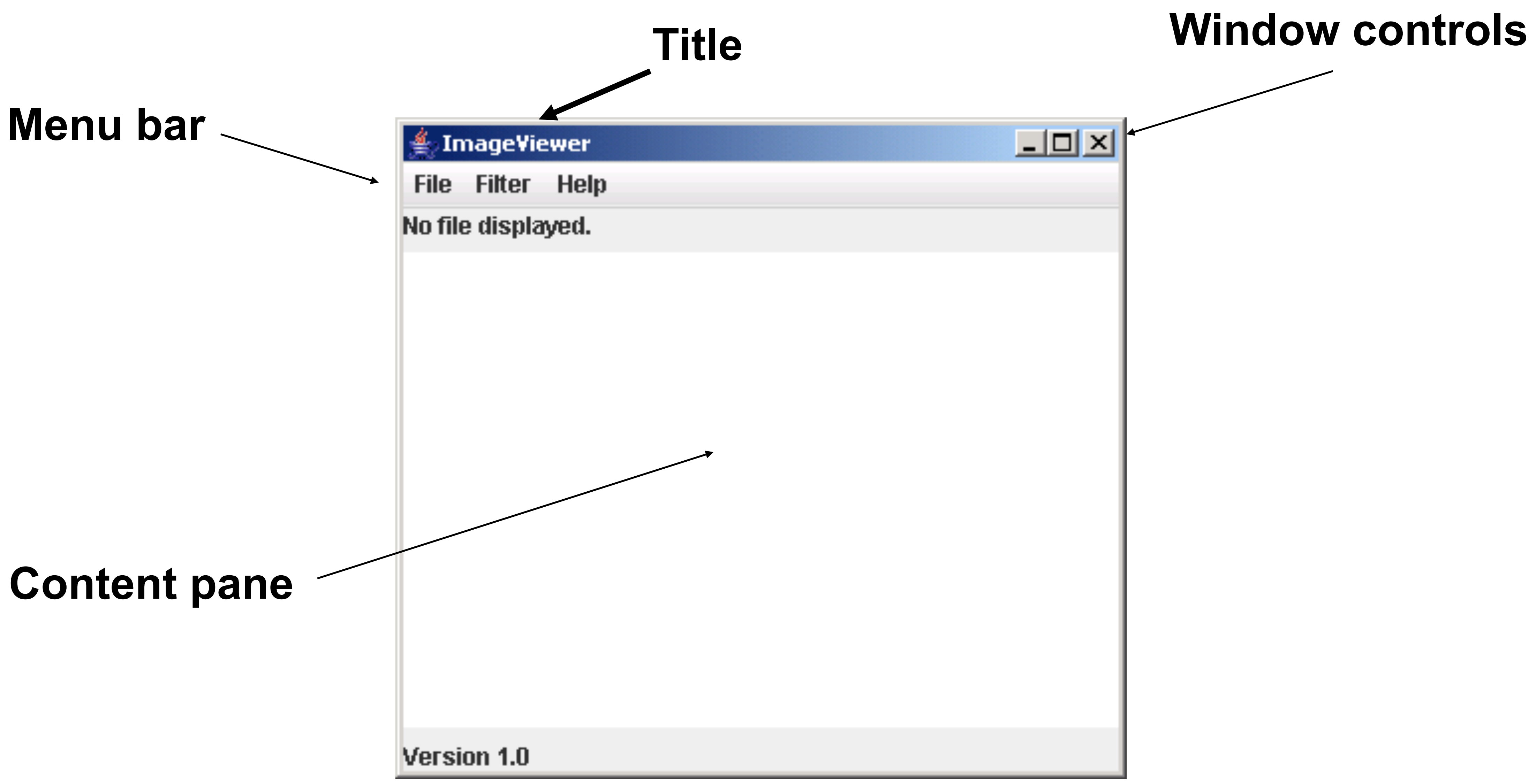
Creating a frame

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

public class ImageViewer
{
     private JFrame frame;

     /**
      * Create an ImageViewer show it on screen.
      */
     public ImageViewer()
     {
             makeFrame();
     }

     // rest of class omitted.
}
```

code for JFrame

```
JFrame frame = new ScoreBoard();
frame.pack();
frame.setVisible(true);
```

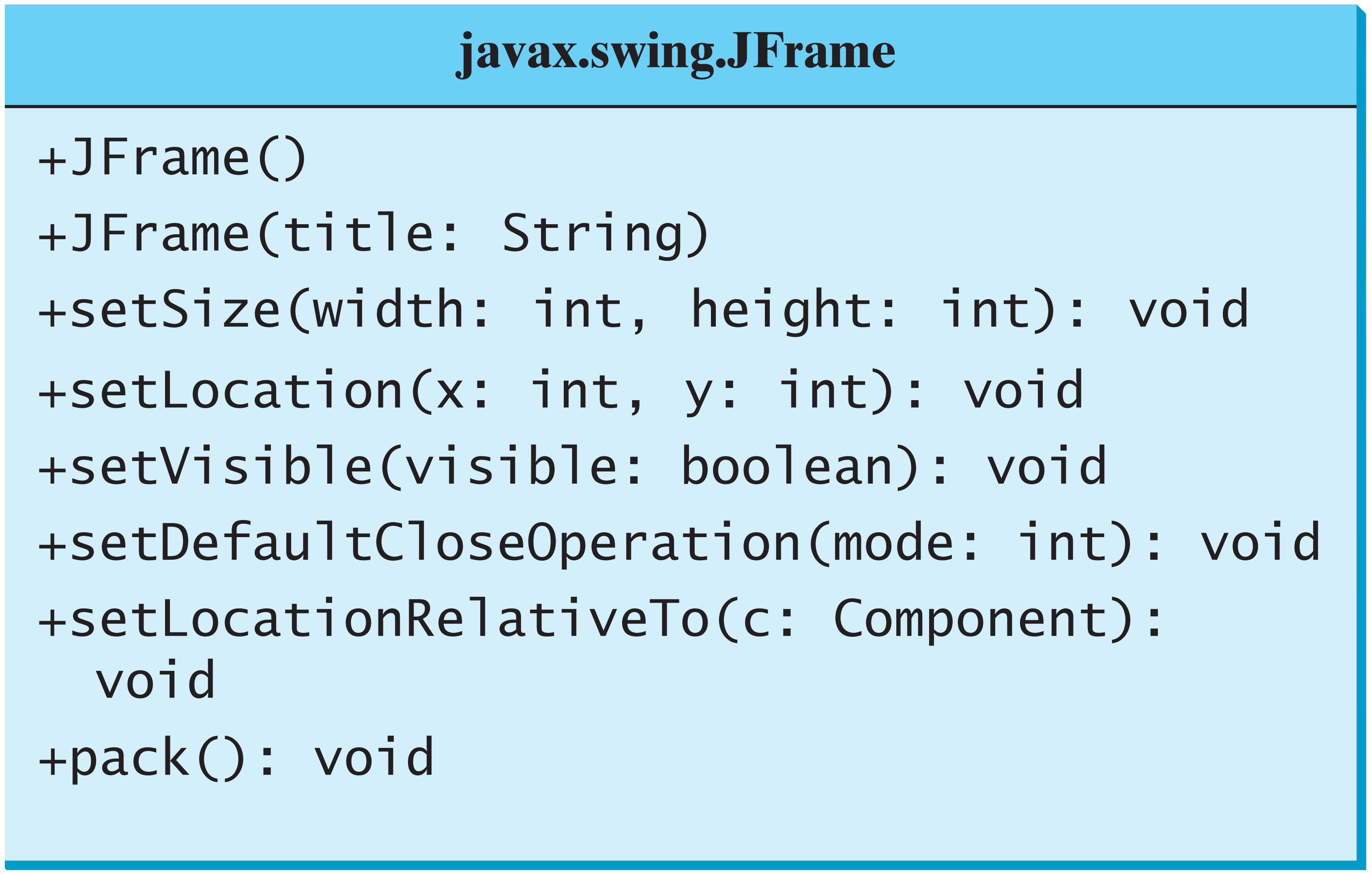
Elements of a frame



No file displayed.

Version 1.0

JFrame



javax.swing.JFrame

```
+JFrame()
+JFrame(title: String)
+setSize(width: int, height: int): void
+setLocation(x: int, y: int): void
+setVisible(visible: boolean): void
+setDefaultCloseOperation(mode: int): void
+setLocationRelativeTo(c: Component):
  void
+pack(): void
```

- JFrame is a top-level container to hold GUI components.

MyFrame.java

Graphics

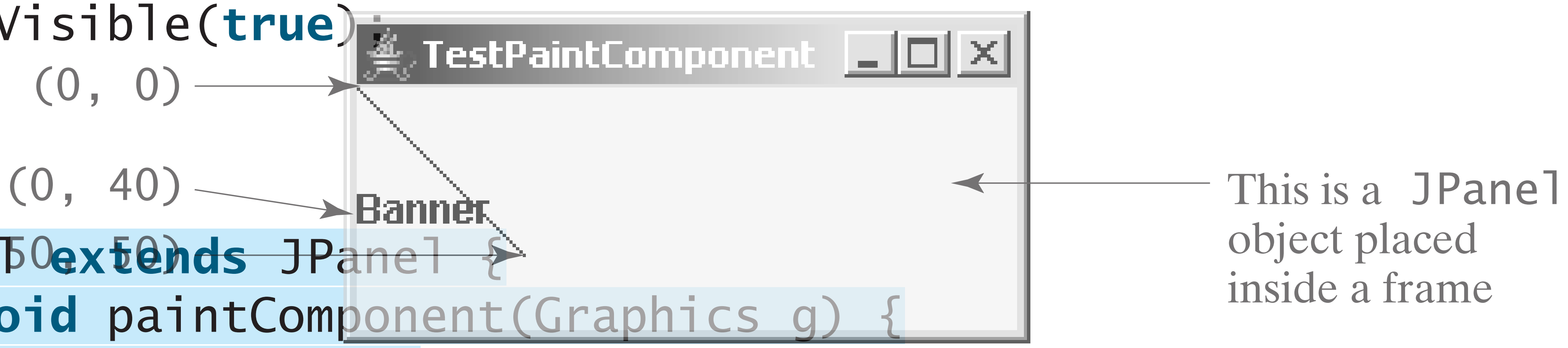
Directly Render

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

public class TestPaintComponent extends JFrame {
  public TestPaintComponent() {
    add(new NewPanel());
  }

  public static void main(String[] args) {
    TestPaintComponent frame = new TestPaintComponent();
    frame.setTitle("TestPaintComponent");
    frame.setSize(200, 100);
    frame.setLocationRelativeTo(null); // Center the frame
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setVisible(true);
  }
}

class NewPanel extends JPanel {
  protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    g.drawLine(0, 0, 50, 50);
    g.drawString("Banner", 0, 40);
  }
}
```

TestPaintComponent.java

Directly Render

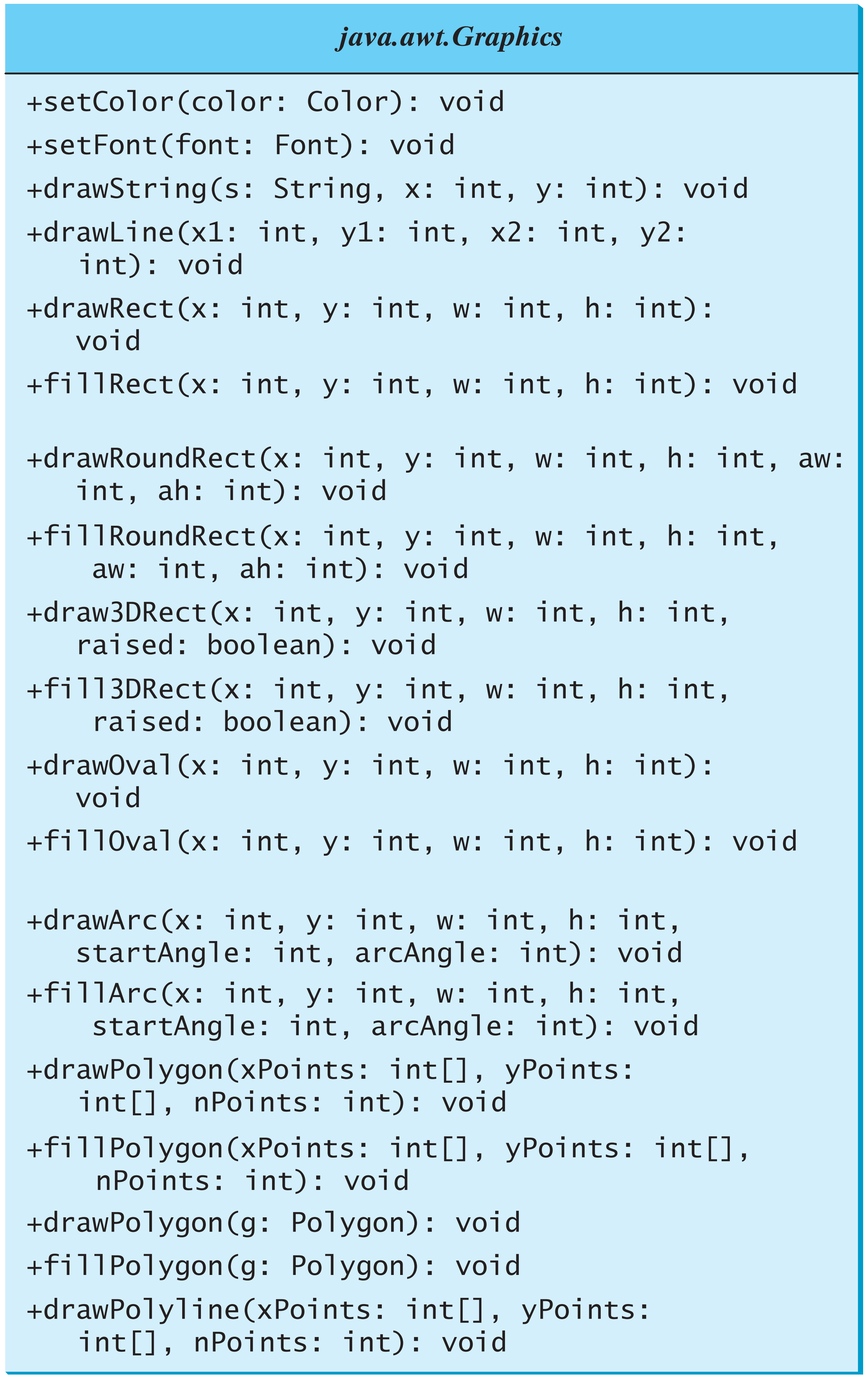
```java
import javax.swing.*;
import java.awt.Graphics;

public class TestPaintComponent extends JFrame {
  public TestPaintComponent() {
    add(new NewPanel());
  }

  public static void main(String[] args) {
    TestPaintComponent frame = new TestPaintComponent();
    frame.setTitle("TestPaintComponent");
    frame.setSize(200, 100);
    frame.setLocationRelativeTo(null); // Center the frame
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setVisible(true);
  }
}

class NewPanel extends JPanel {
  protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    g.drawLine(0, 0, 50, 50);
    g.drawString("Banner", 0, 40);
  }
}
```



TestPaintComponent.java

The Graphics

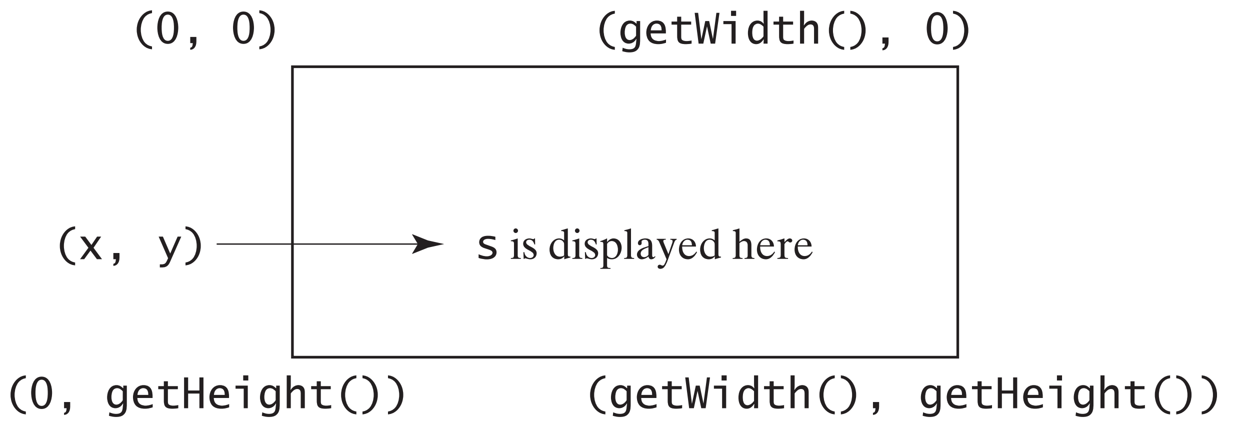
- The Graphics class contains the methods for drawing strings and shapes.



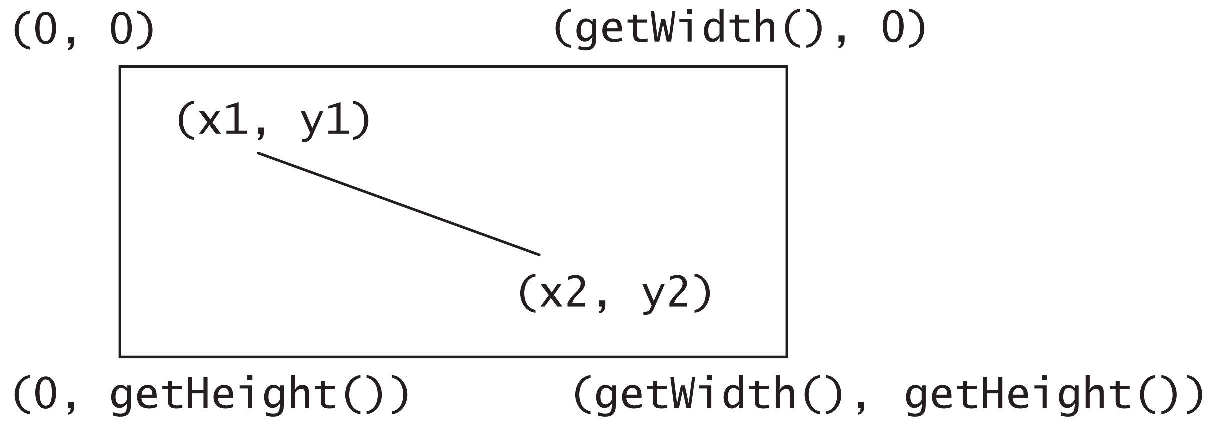
java.awt.Graphics

```
+setColor(color: Color): void
+setFont(font: Font): void
+drawString(s: String, x: int, y: int): void
+drawLine(x1: int, y1: int, x2: int, y2:
   int): void
+drawRect(x: int, y: int, w: int, h: int):
   void
+fillRect(x: int, y: int, w: int, h: int): void

+drawRoundRect(x: int, y: int, w: int, h: int, aw:
   int, ah: int): void
+fillRoundRect(x: int, y: int, w: int, h: int,
    aw: int, ah: int): void
+draw3DRect(x: int, y: int, w: int, h: int,
   raised: boolean): void
+fill3DRect(x: int, y: int, w: int, h: int,
    raised: boolean): void
+drawOval(x: int, y: int, w: int, h: int):
   void
+fillOval(x: int, y: int, w: int, h: int): void

+drawArc(x: int, y: int, w: int, h: int,
   startAngle: int, arcAngle: int): void
+fillArc(x: int, y: int, w: int, h: int,
    startAngle: int, arcAngle: int): void
+drawPolygon(xPoints: int[], yPoints:
   int[], nPoints: int): void
+fillPolygon(xPoints: int[], yPoints: int[],
    nPoints: int): void
+drawPolygon(g: Polygon): void
+fillPolygon(g: Polygon): void
+drawPolyline(xPoints: int[], yPoints:
   int[], nPoints: int): void
```

String and Line



(a) **drawString**



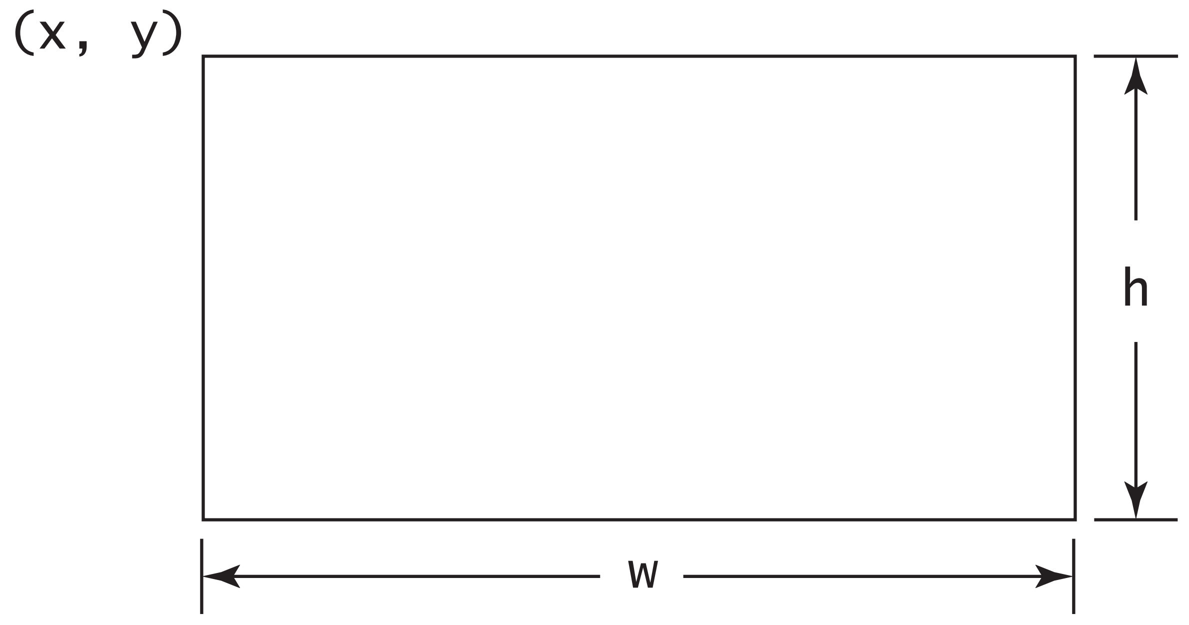
(b) **drawLine**

- drawString(s, x, y)
- drawLine(x1, y1, x2, y2)

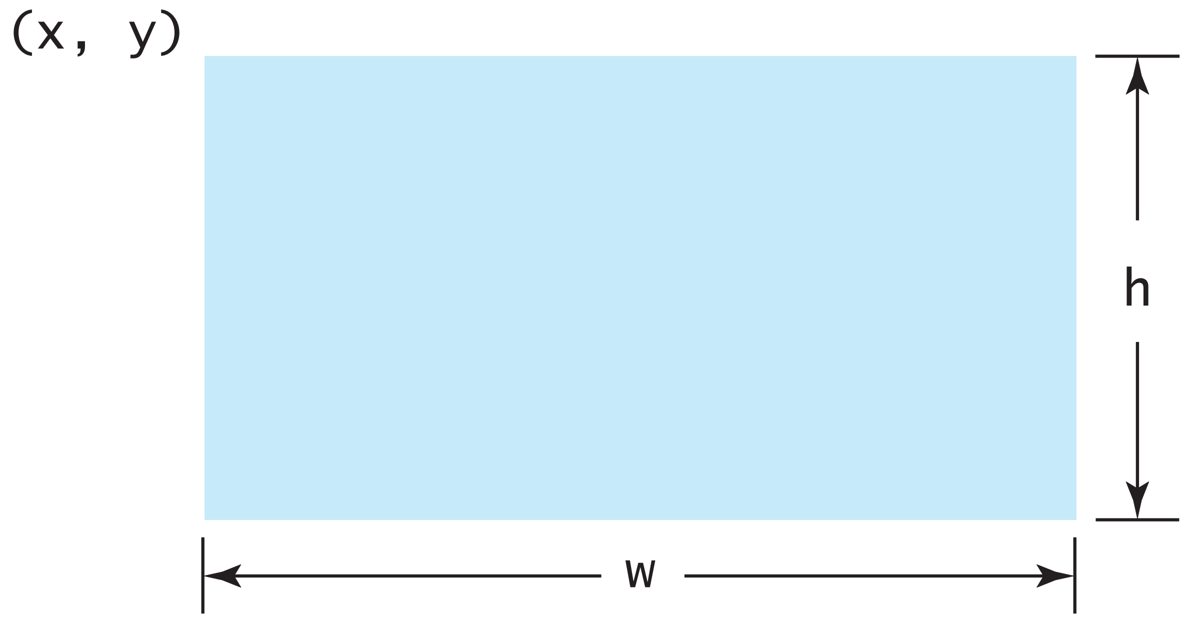
Color

- public Color(int r, int g, int b);
- setColor(Color color);
- JButton jbtOK = new JButton("OK");
  jbtOK.setBackground(color);
  jbtOK.setForeground(new Color(100, 1, 1));
- jbtOK.setForeground(Color.RED);

Draw and Fill Rectangle



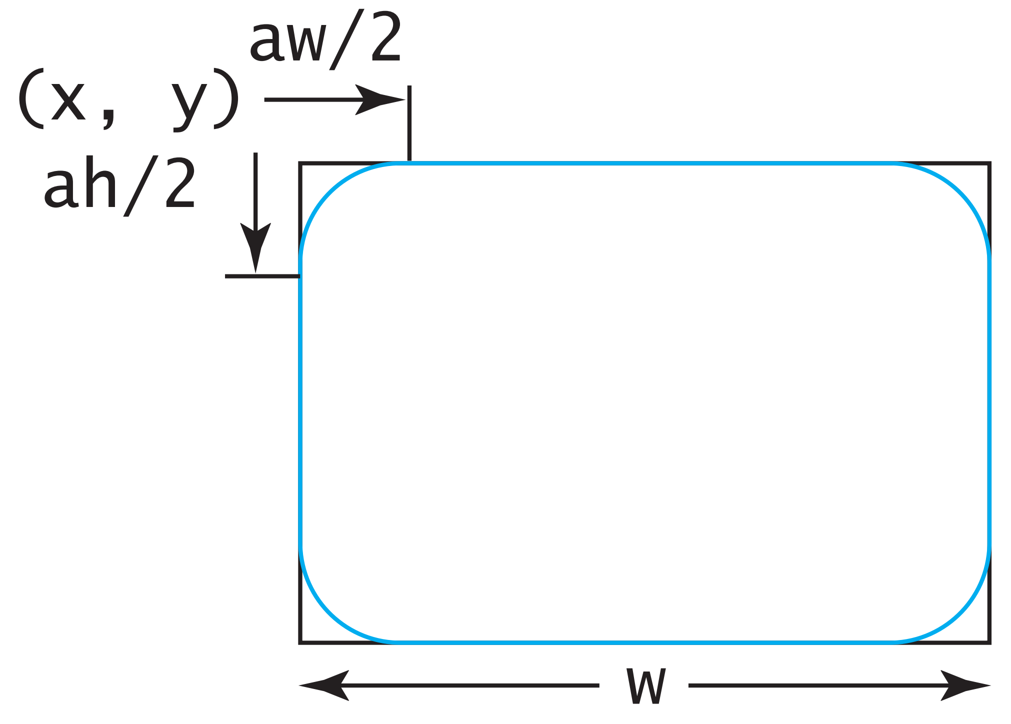
(a) Plain rectangle



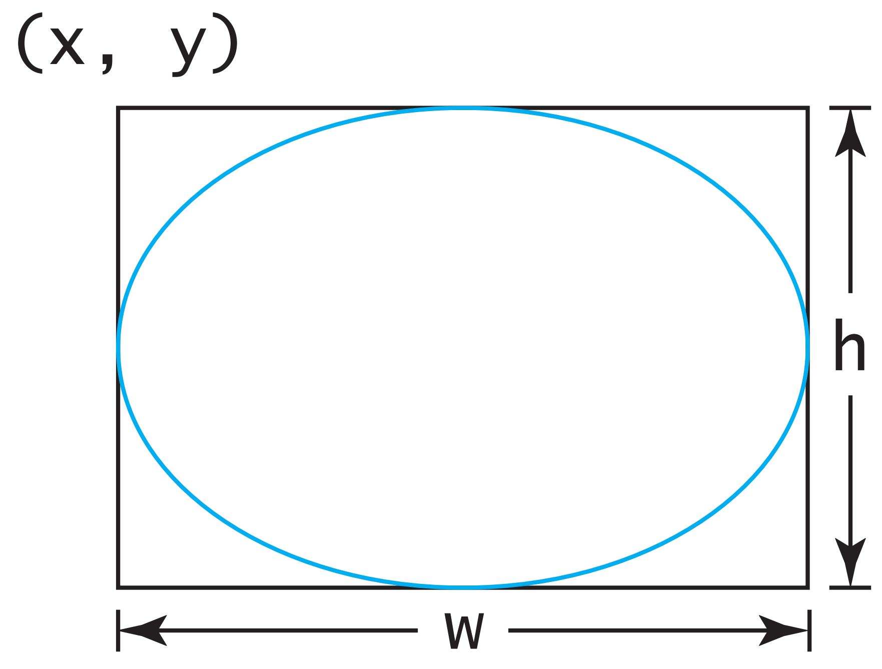
(b) Filled rectangle

- drawRect(x, y, w, h)
- fillRect(x, y, w, h)

RoundRect and Oval



(a) **drawRoundRect**



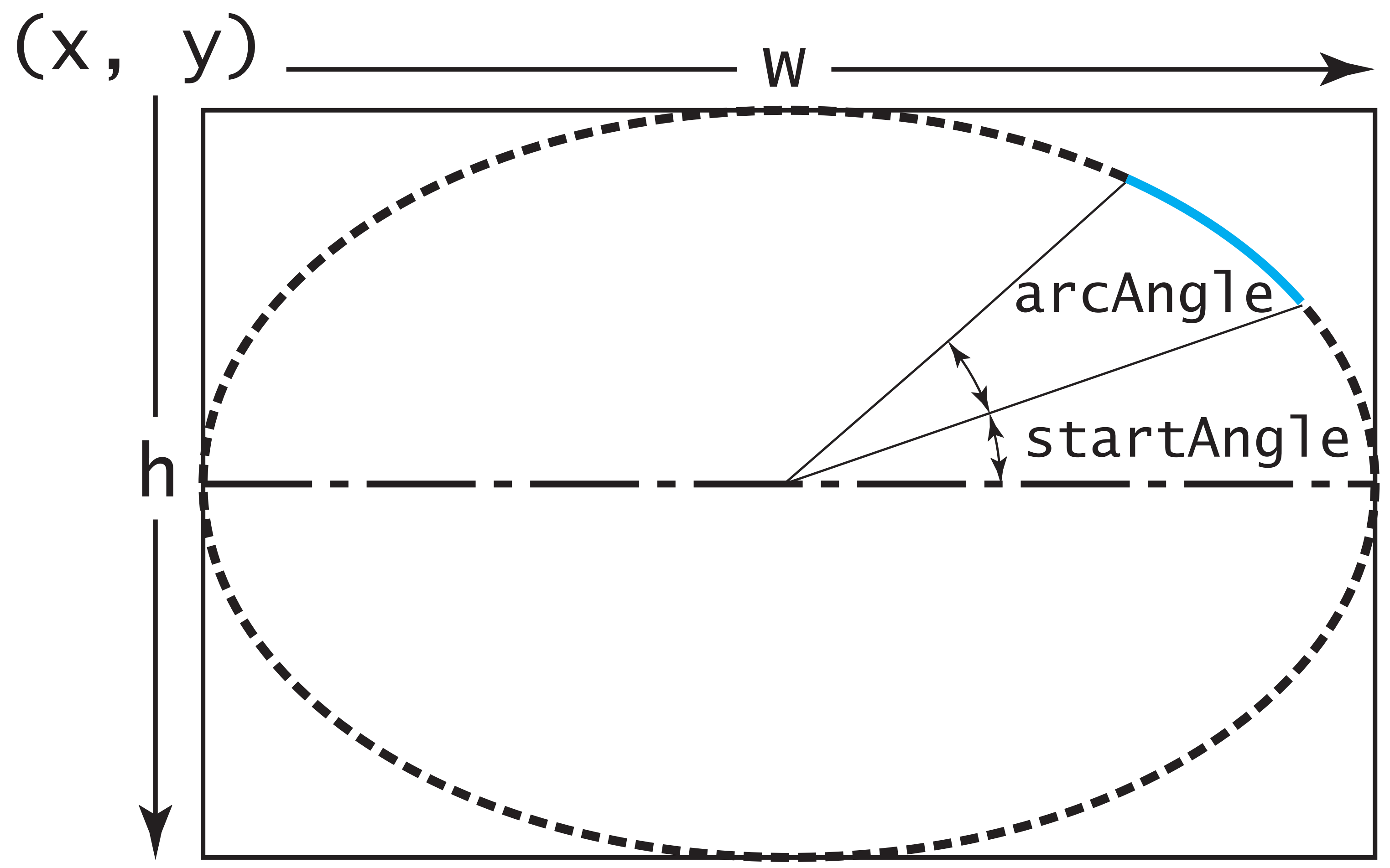
(b) **drawOval**

- drawRoundRect(x, y, w, h, aw, ah)
- drawOval(x, y, w, h)

FigurePanel.java

TestFigurePanel.java

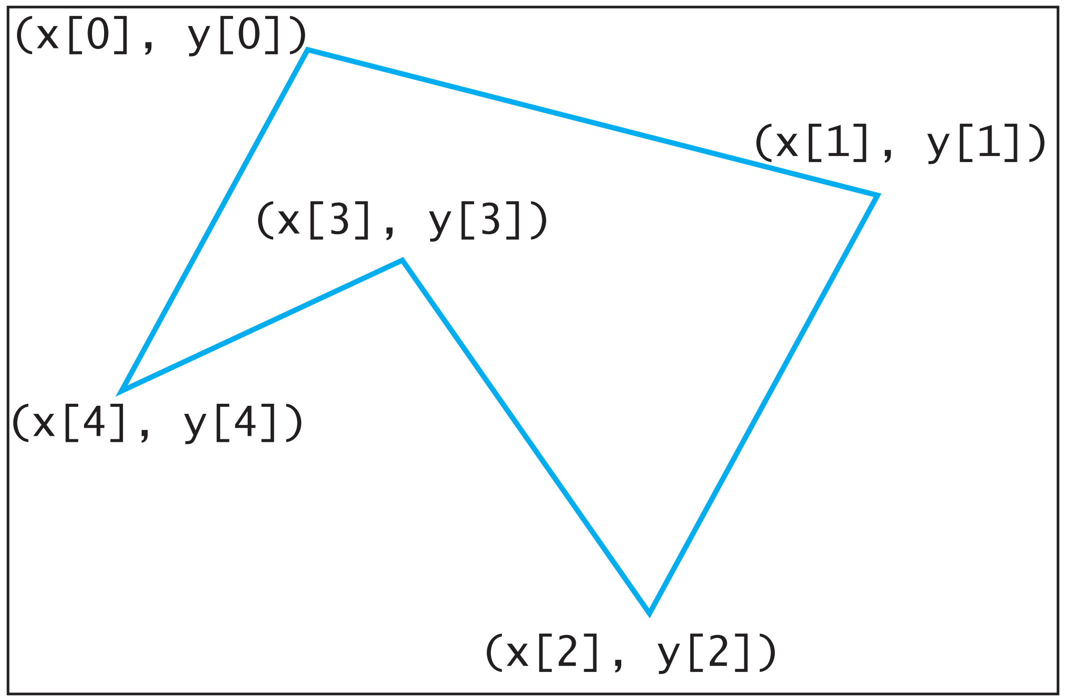
Arcs



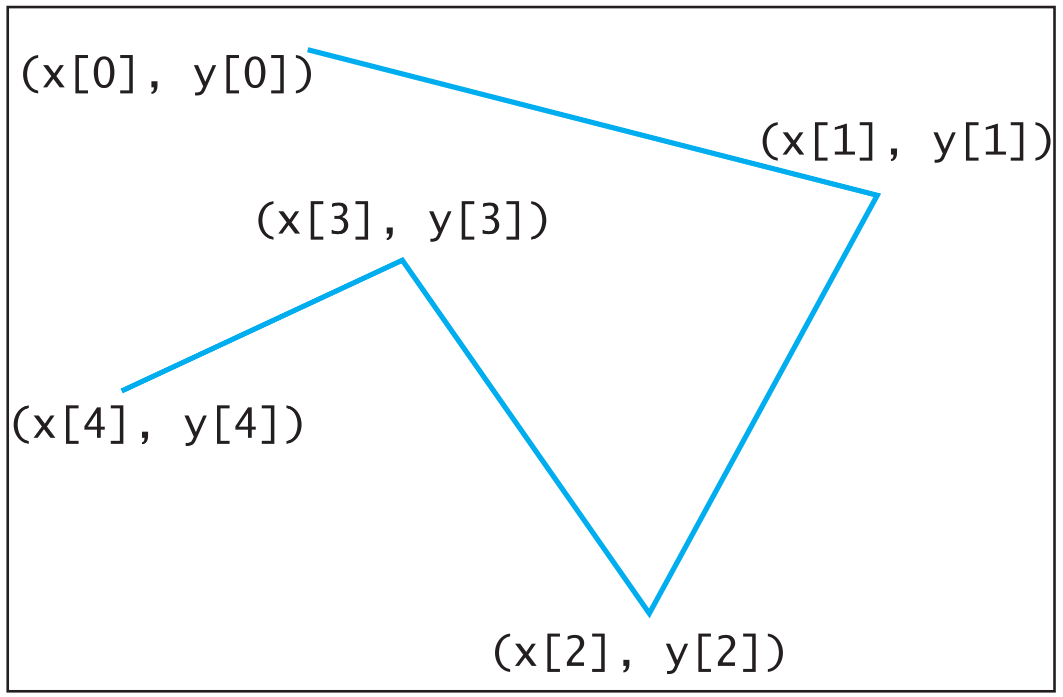
- drawArc(int x, int y, int w, int h, int startAngle, int arcAngle);
- fillArc(int x, int y, int w, int h, int startAngle, int arcAngle);

DrawArcs.java

Polygon and Polyline



(a) Polygon



(b) Polyline

- Polygon polygon = new Polygon();
  polygon.addPoint(40, 20);
- drawPolygon(Polygon polygon);
  fillPolygon(Polygon polygon);

Another way polygon

```
int x[] = {40, 70, 60, 45, 20};
int y[] = {20, 40, 80, 45, 60};
g.drawPolygon(x, y, x.length);
g.drawPolyline(x, y, x.length);
```

DrawPolygon.java

Font

- public Font(String name, int style, int size);
- You can choose a font name from SansSerif, Serif, Monospaced, Dialog, or DialogInput,
- choose a style from Font.PLAIN (0), Font.BOLD (1), Font.ITALIC (2), and Font.BOLD + Font.ITALIC (3),
- and specify a font size of any positive integer.

英文字体从单字上分两种，一种有衬线（serif），一种无衬线（sanserif）。从26个字母比较上又分两种，一种自然宽度，一种等宽（monospace）。衬线字体笔画有粗细变化，且首尾带装饰线，无衬线字体笔画粗细均匀无变化，也没有装饰线。自然宽度字体 m 最 宽，i 最窄，等宽字体26个字母全部一样宽。

style from Font.PLAIN (0), Font.BOLD (1), Font.ITALIC (2), and Font.BOLD + Font.ITALIC (3),

- and specify a font size of any positive integer.

Font

英文字体从单字上分两种，一种有衬线（serif），一种无衬线（sansserif）。从26个字母比较上又分两种，一种自然宽度，一种等宽（monospace）。衬线字体笔画有粗细变化，且首尾带装饰线，无衬线字体笔画粗细均匀无变化，也没有装饰线。自然宽度字体 m 最宽，i 最窄，等宽字体26个字母全部一样宽。

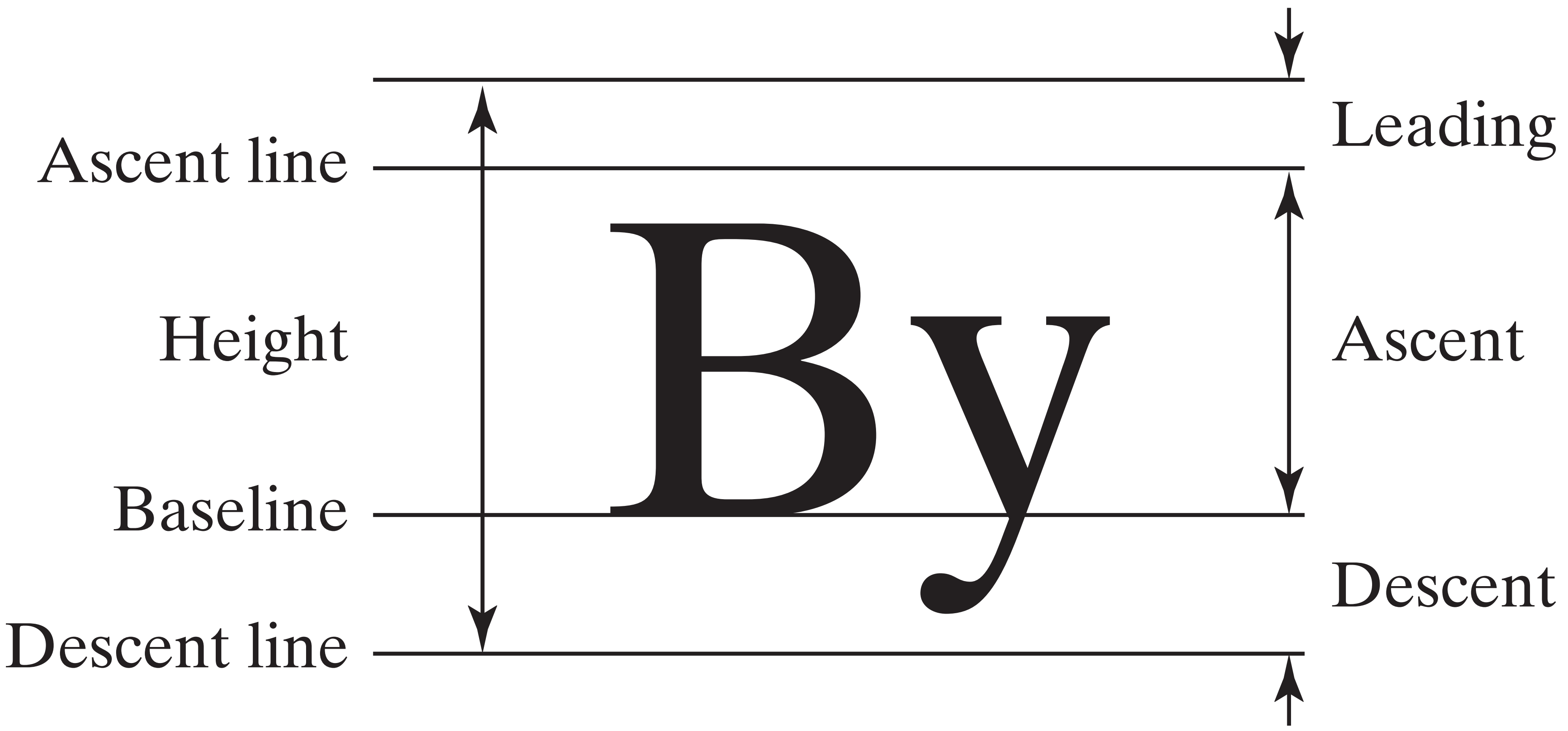
- public Font(String name, int style, int size);
- You can choose a font name from SansSerif, Serif, Monospaced, Dialog, or DialogInput,
- choose a style from Font.PLAIN (0), Font.BOLD (1), Font.ITALIC (2), and Font.BOLD + Font.ITALIC (3),
- and specify a font size of any positive integer.

- Font font1 = new Font("SansSerif", Font.BOLD, 16);
  Font font2 = new Font("Serif", Font.BOLD + Font.ITALIC, 12);
- JButton jbtOK = new JButton("OK");
  jbtOK.setFont(font1);

Enum Fonts

```
GraphicsEnvironment e =
GraphicsEnvironment.getLocalGraphicsEnvironment();

String[] fontnames = e.getAvailableFontFamilyNames();

for (int i = 0; i < fontnames.length; i++)

    System.out.println(fontnames[i]);
```

FontMetrics



- In Graphics:
    - FontMetrics getFontMetrics(Font font)
    - FontMetrics getFontMetrics()

TestCenterMessage.java

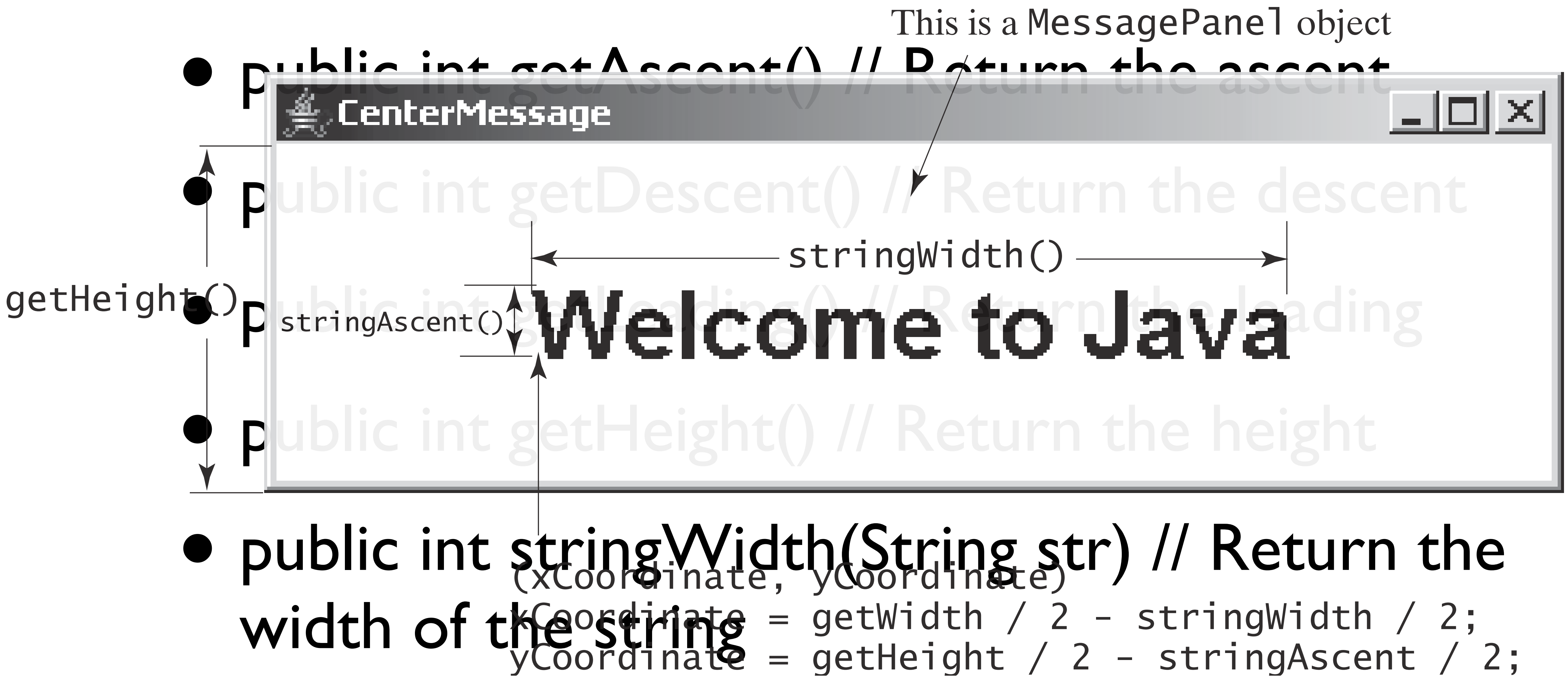
FontMetrics

- public int getAscent() // Return the ascent
- public int getDescent() // Return the descent
- public int getLeading() // Return the leading
- public int getHeight() // Return the height
- public int stringWidth(String str) // Return the width of the string

MessagePanel.java
TestMessagePanel.java

FontMetrics

- public int getAscent() // Return the ascent
- public int getDescent() // Return the descent
- public int getLeading() // Return the leading
- public int getHeight() // Return the height
- public int stringWidth(String str) // Return the width of the string



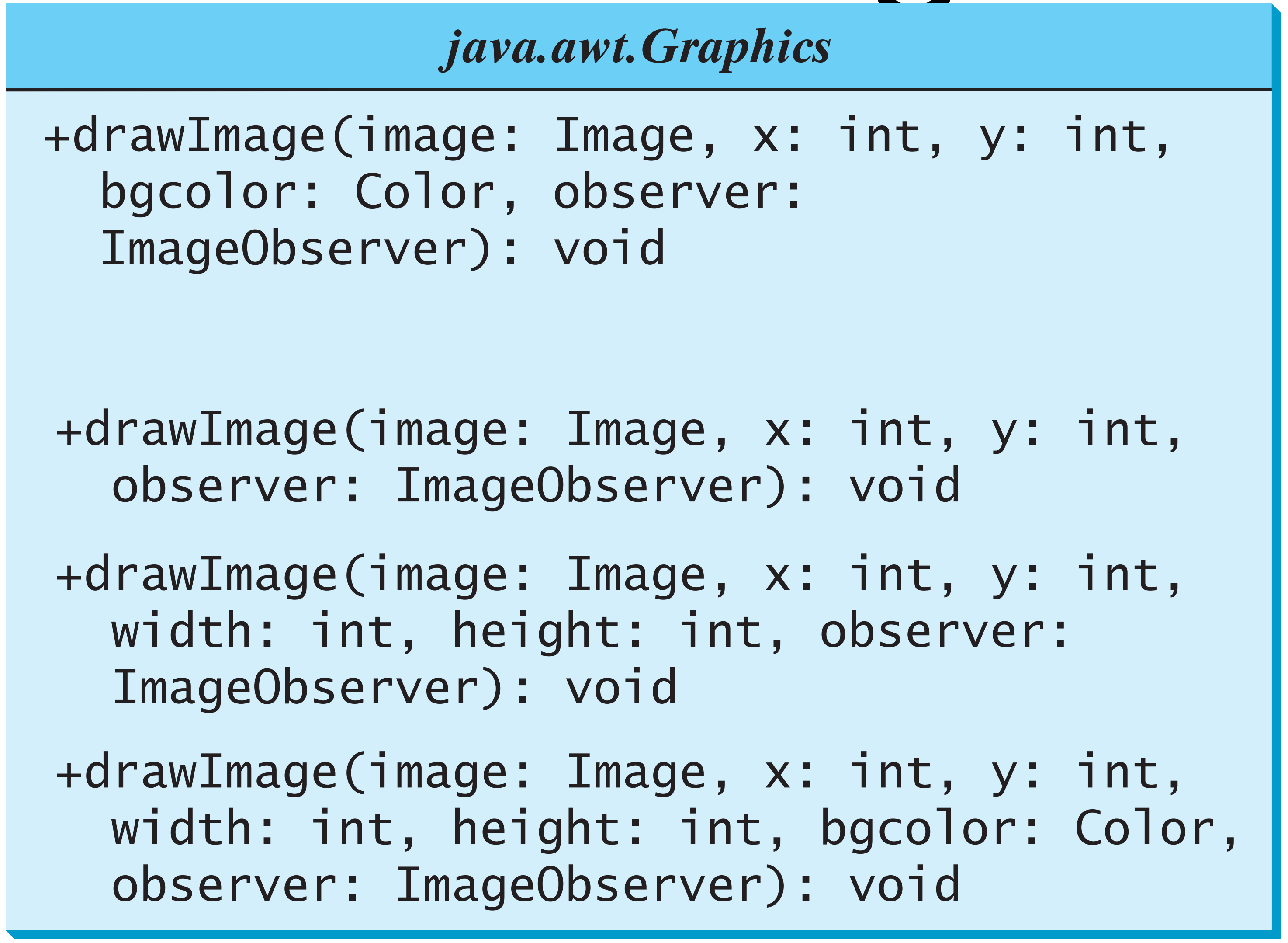
```
xCoordinate = getWidth / 2 - stringWidth / 2;
yCoordinate = getHeight / 2 - stringAscent / 2;
```

MessagePanel.java
TestMessagePanel.java

Images as Icons

- ImageIcon icon = new ImageIcon("image/us.gif"); JLabel jlblImage = new JLabel(imageIcon);
- Image image = imageIcon.getImage();
- g.drawImage(image, 0, 0, getWidth(), getHeight(), this);

drawImage



java.awt.Graphics

```
+drawImage(image: Image, x: int, y: int,
  bgcolor: Color, observer:
  ImageObserver): void


+drawImage(image: Image, x: int, y: int,
  observer: ImageObserver): void

+drawImage(image: Image, x: int, y: int,
  width: int, height: int, observer:
  ImageObserver): void

+drawImage(image: Image, x: int, y: int,
  width: int, height: int, bgcolor: Color,
  observer: ImageObserver): void
```

- JPanel is a kind of ImageObserver

DisplayImage.java