Java Applets

Lecture Objectives

- Learn about Java applets.
- Know the differences between Java applets and applications.
- Designing and using Java applets
- Running Java applets.
- Security issues with Java applets.

Introduction

- Java programs are divided into two main categories, *applets* and *applications.*
- An application is an ordinary Java program.
- An applet is a kind of Java program that can be run across the Internet.

Programming Applets

- **The word *applet* is meant to suggest a small *application.***

- **Applets were intended to be small programs run over the Internet:**
  - However, there are no size constraints on applets.
  - Applets can be viewed over the Internet, or without any connection to the internet.

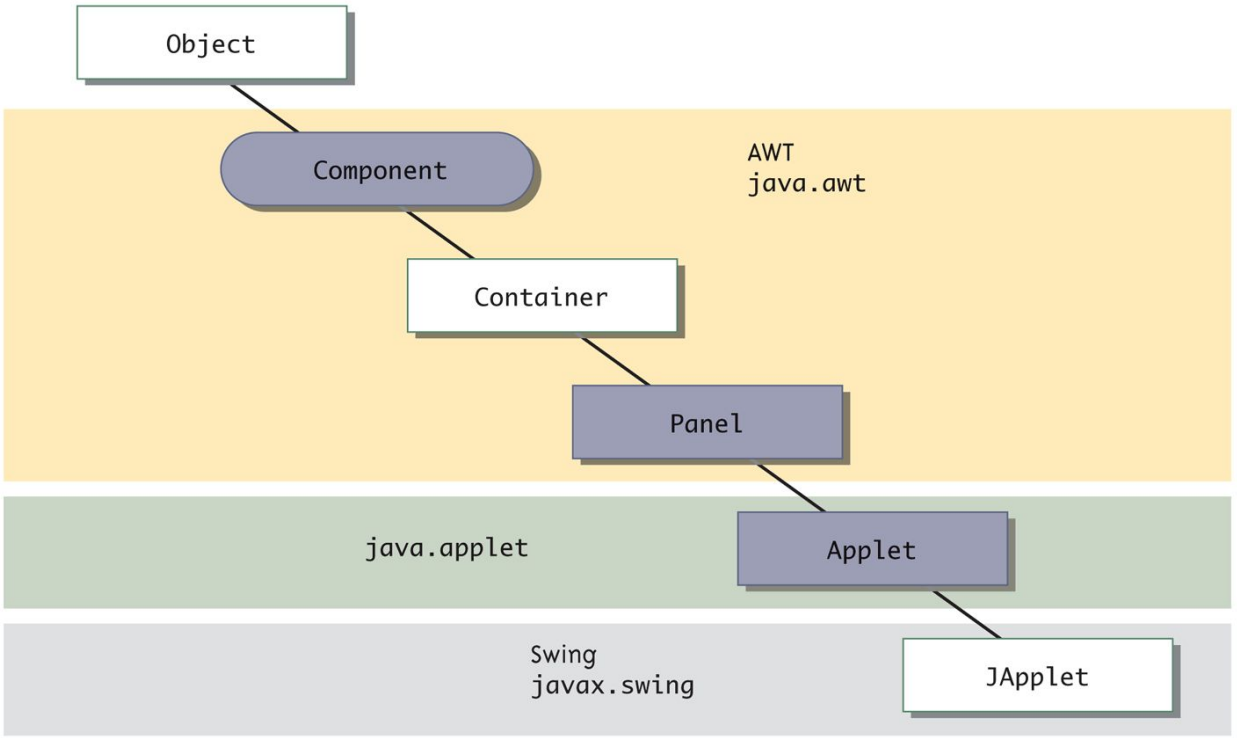
- **An applet is similar to a Swing GUI:**
  - In fact, almost all of the Swing techniques can be used in applets.

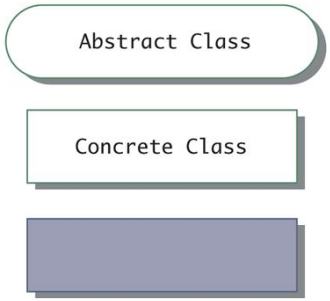
Defining an Applet

- **An applet class is normally defined as a derived class of the class `Japplet`.**
  - The class **`JApplet`** is in the package **`javax.swing`**.
- **There is also an older class, `Applet`, which has been superseded by the `JApplet` class.**

Applets in the Class Hierarchy

Display 18.6 Applets in the Class Hierarchy





A line between two boxes means the lower class is derived from (`extends`) the higher one.

This blue color indicates a class that is not used in this text but is included here for reference. If you have not heard of any of these classes, you can safely ignore them.

Designing an Applet

- **An applet class can be designed as a derived class of `JApplet` in much the same way that regular Swing GUIs are defined as derived classes of `Jframe`.**

- **However, an applet normally defines no constructors.**

  - The method `init` performs the initializations that would be performed in a constructor for a regular Swing GUI

Designing an Applet (Cont'd)

- **Components can be added to an applet in the same way that a component is added to a `JFrame`**
  - The method **`add`** is used to add components to an applet in the same way that components are added to a **`JFrame`**

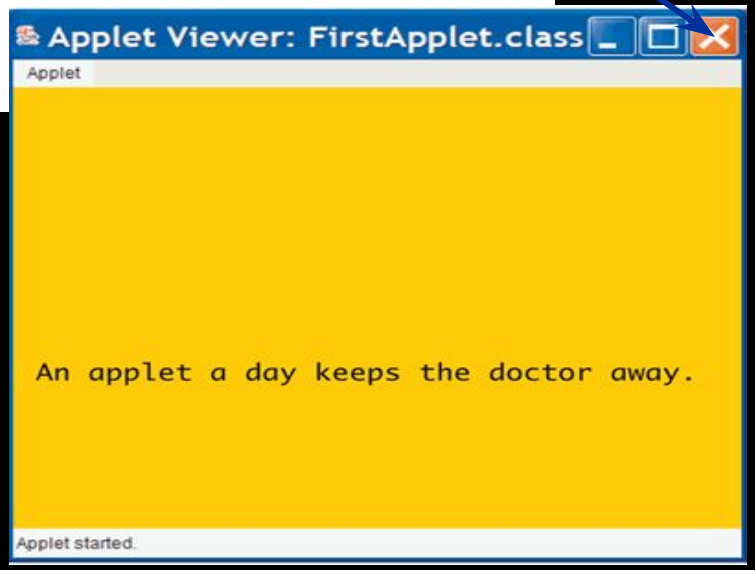
Java Applets: An Example

Display 18.7 An Applet

```
1  import javax.swing.JApplet;
2  import javax.swing.JLabel;
3  import java.awt.BorderLayout;
4  import java.awt.Color;
5
6  public class FirstApplet extends JApplet
7  {
8      public void init()
9      {
10         getContentPane().setBackground(Color.ORANGE);
11         setLayout(new BorderLayout());
12         JLabel aLabel =
13             new JLabel("An applet a day keeps the doctor away.");
14         add(aLabel, BorderLayout.CENTER);
15     }
16 }
```

The `init()` method is used instead of a constructor.

This close-window button and the other two buttons are part of the applet viewer, not part of the applet.



Output using an applet viewer

How Applets Differ from Swing GUIs?

- **Some of the items included in a Swing GUI are not included in an applet**

- **Applets do not contain a `main` or `setVisible` method**
  - Applets are displayed automatically by a Web page or an applet viewer

- **Applets do not have titles**
  - Therefore, they do not use the `setTitle` method
  - They are normally embedded in an HTML document, and the HTML document can add any desired title

How Applets Differ from Swing GUIs? (Cont'd)

- **Applets do not use the `setSize` method**
  - The HTML document takes care of sizing the applet
- **Applets do not have a close-window button**
  - Therefore, they do not have a `setDefaultCloseOperation` method
  - When the HTML document containing the applet is closed, then the applet is automatically closed

Running an Applet

- **An applet class is compiled in the same way as any other Java class**
  - However, an applet is run differently from other Java programs
- **The normal way to run an applet is to embed it in an HTML document**
  - The applet is then run and viewed through a Web browser

Running an Applet (Cont'd)

- **An applet can also be viewed using an *applet viewer***
  - An applet viewer is a program designed to run an applet as a stand-alone program

- **The Java `appletviewer` can be used to run an applet:**

```
appletviewer FirstApplet.html
```

- **It may be necessary, however, to create the HTML document, and place the applet in it**

Menus in a `JApplet`

- **Menus are constructed and added to a `JApplet` as they are for a `Jframe`**
  - **`JApplet`** has a method named **`setJMenuBar`** that behaves the same as the **`setJMenuBar`** method of a **`JFrame`**
  - **`JApplet`** can also have menu bars added to a **`JApplet`** or to a panel that is part of the **`JApplet`** using the **`add`** method

Tip: Converting a Swing Application to an Applet

- **The fastest and easiest way to explain how to define an applet, is to explain how to modify a Swing GUI to transform it into an applet**

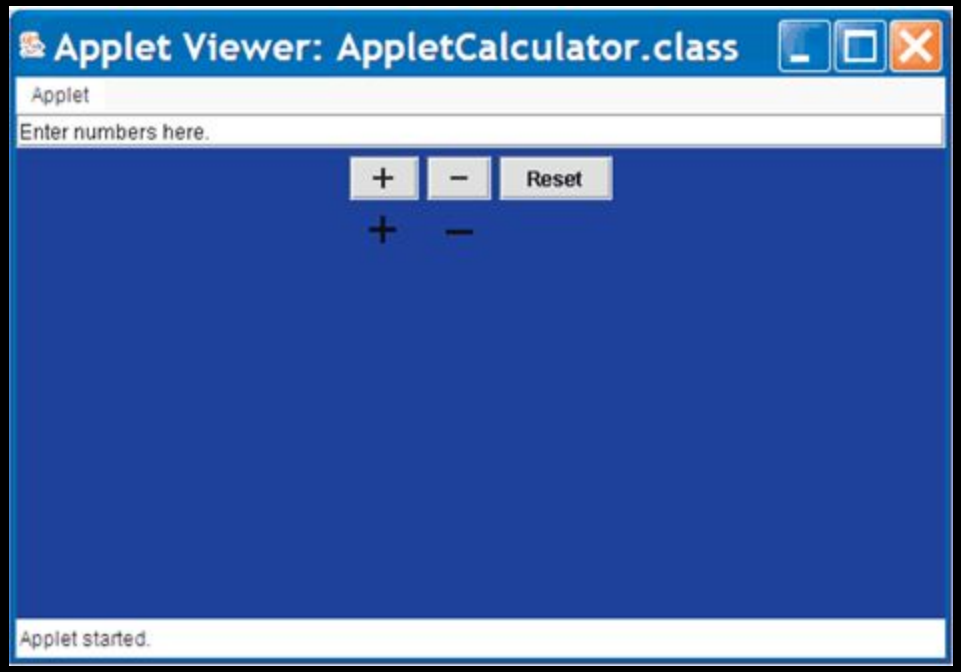
1. Derive the class from the class `JApplet` instead of from the class `Jframe`
2. Remove the `main` method
3. Replace the constructor with a no-parameter method named `init`
   - The body of the `init` method can be the same as the body of the deleted constructor, but with some items removed

Tip: Converting a Swing Application to an Applet (2)

4. Delete any invocation of `super`
5. Delete any method invocations that program the close-window button of a windowing GUI
6. Delete any invocation of `setTitle`
7. Delete any invocation of `setSize`

- **The following applet was generated in this way.**

The Applet Calculator



Icons: Reminder

- **An icon is a picture**
  - It is typically, but not always, a small picture
- **An icon can be stored in a file of many different standard formats**
  - Such as .`gif`, .`tiff`, or .`jpg`
- **The class `ImageIcon` is used to convert a picture file to a Swing icon**
  - Then it can be added as a component to any `Container` class, such as `JApplet`
  - The class `ImageIcon` is in the `javax.swing` package

```
ImageIcon NameOfImageIcon = new ImageIcon("PictureFileName");
```

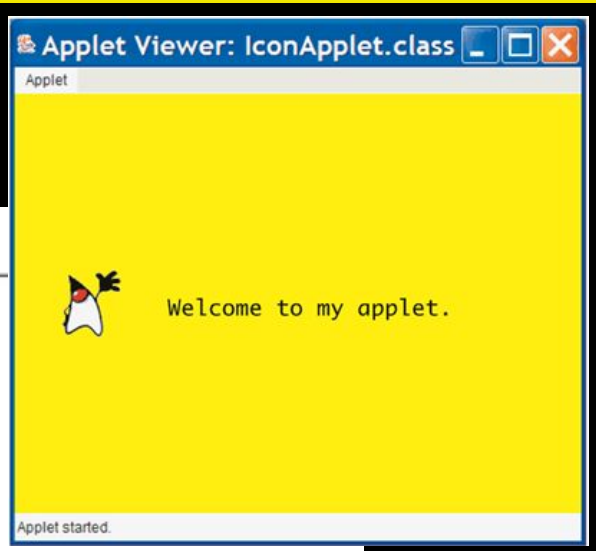
Adding Icons to an Applet

- The easiest way to display an icon in an applet is to place it in a `JLabel`
- The following three lines create a label, create an icon, and then add the icon to the label:

```
JLabel aLabel=new JLabel("Welcome to my applet.");
ImageIcon dukeIcon = new
                     ImageIcon("duke_waving.gif");
aLabel.setIcon(dukeIcon);
```

An Applet with an Icon

Output using an applet viewer



Display 18.9 An Applet with an Icon

```
1  import javax.swing.JApplet;
2  import javax.swing.JLabel;
3  import javax.swing.ImageIcon;
4  import java.awt.BorderLayout;
5  import java.awt.Color;

6  public class IconApplet extends JApplet
7  {
8      public void init()
9      {
10         getContentPane().setBackground(Color.YELLOW);
11         setLayout(new BorderLayout());

12         JLabel shift = new JLabel("                ");
13         JLabel aLabel = new JLabel("Welcome to my applet.");
14         ImageIcon dukeIcon = new ImageIcon("duke_waving.gif");
15         aLabel.setIcon(dukeIcon);
16         add(shift, BorderLayout.WEST);
17         add(aLabel, BorderLayout.CENTER);
18     }
19 }
```

Inserting an Applet in an HTML Document

- **An applet can be placed in an HTML document with an *applet tag:***

```
<applet code="PathToApplet"
            width=Number1 height=Number2>
</applet>
```

- **If given a `.class` file name only, then the HTML file and the applet file must be in the same directory**
  - The ***`PathToApplet`*** can be a full or relative path name

Inserting an Applet in an HTML Document (Cont'd)

- **Note that the name of the `.class` file, not the `.java` file, is given**

- **Note also that the width and height of the applet is given in this command, and not within the applet class definition**
  - The width and height are in pixels

- **The following code, when placed in an HTML document, will display the calculator applet in a browser as shown**

```
<applet code="AppletCalculator.class"
                              width=400 height=300>
</applet>
```

An Applet in an HTML Document

```
<html>
<head>
<title>
Vampire Control
</title>
</head>
. . .

   <applet code="AppletCalculator.class" width=400
     height=300>
   </applet>

 . . .
</html>
```

The Browser View of Applets

Pitfall: Using an Old Web Browser

- **An old browser may not be able to run applets from an HTML document:**
  - Even if a java application runs correctly on the same system.
- **Web browsers do not use the same Java Virtual Machine used to run regular Java applications.**
  - An old browser will have an old Java Virtual Machine, or perhaps, no Java Virtual Machine.
- **However, an applet viewer will work, as long as a recent version of Java is installed.**

Applets and Security

- **An applet can be a program, written by someone else, that runs on your computer.**

- **Whenever someone else's program runs on your computer, there are security questions you should ask:**
  - Will it read information from your files?
  - Will it corrupt your operating system?

Applets are designed so that they cannot do any of these things (at least easily).