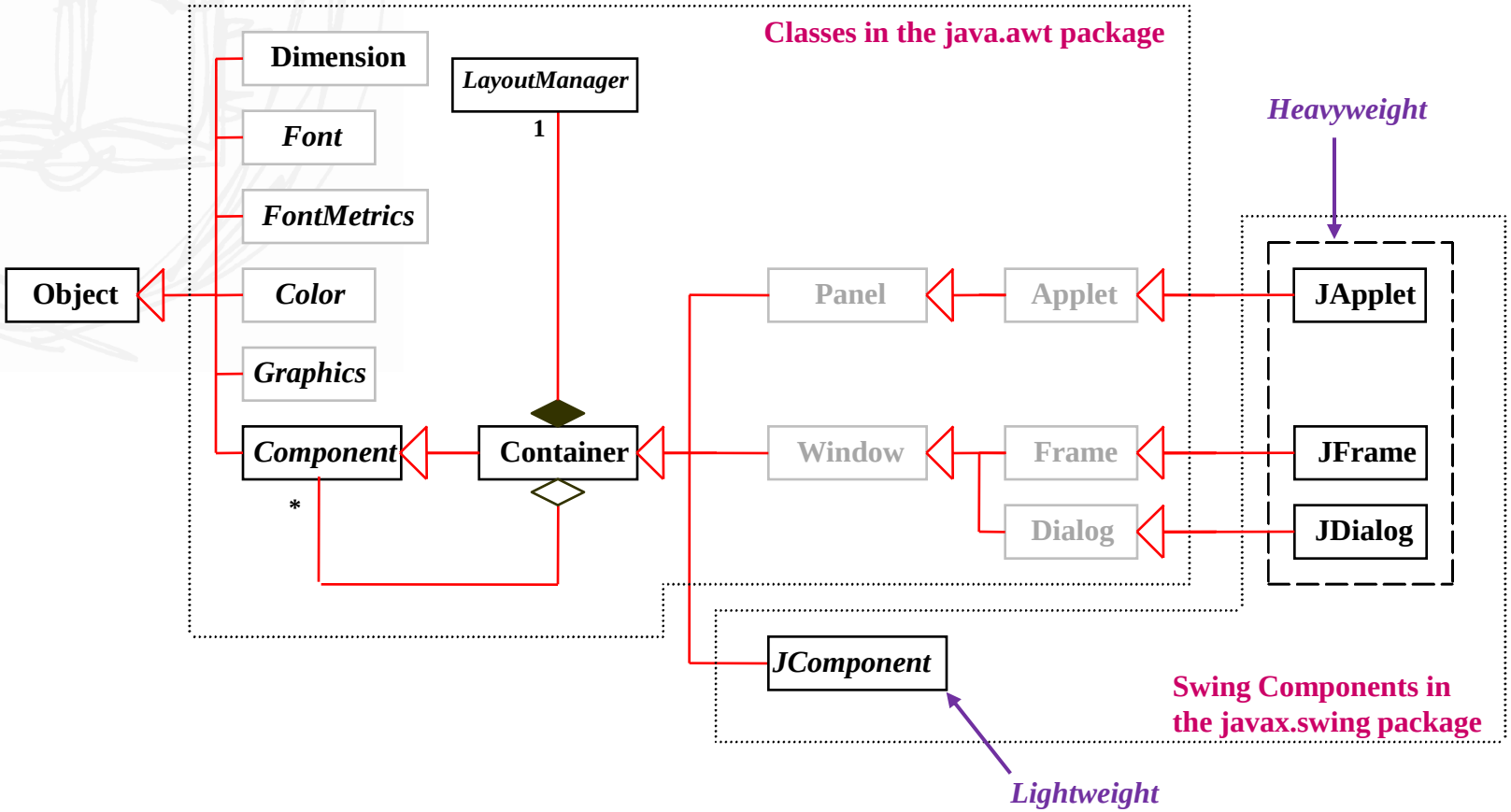
Applets

Applets

- Applets are Java programs that
  - are embedded in an HTML page
  - run in a Web browser using a JVM
    - on many platforms, except mobile browsers on Apple iOS and Android
    - with very little extra code, applets can run as applications – offline mode without the need for any web browser
- Applets normally delivered to users from a web server
  - suitable for computationally intensive visualization
  - provide interactions that cannot be provided by HTML
  - parameters can be passed to applets from HTML

Java Class Hierarchy

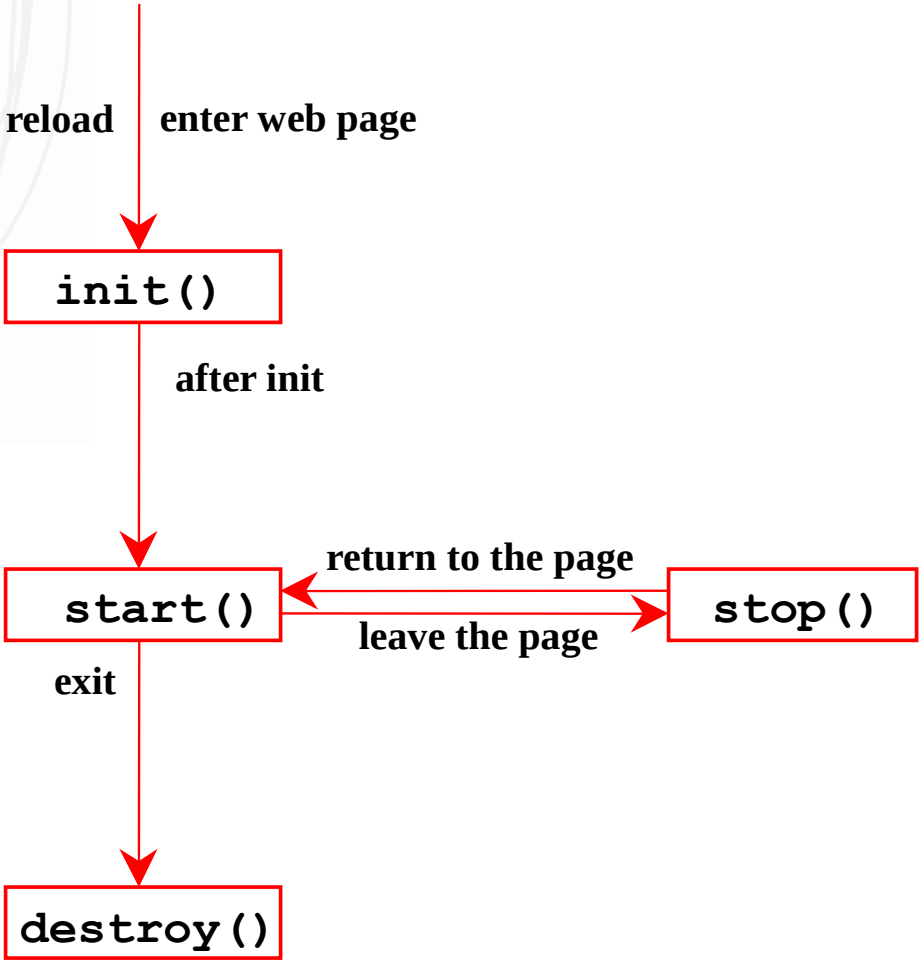


The Applet Class

```
public class MyApplet extends JApplet {
    // This method is mandatory, but can be empty
    public void init() {
        ...
    }
    public void start() {
        ...
    }
    public void stop() {
        ...
    }
    public void destroy() {
      ...
    }

    //your other methods
}
```

Applet Life Cycle



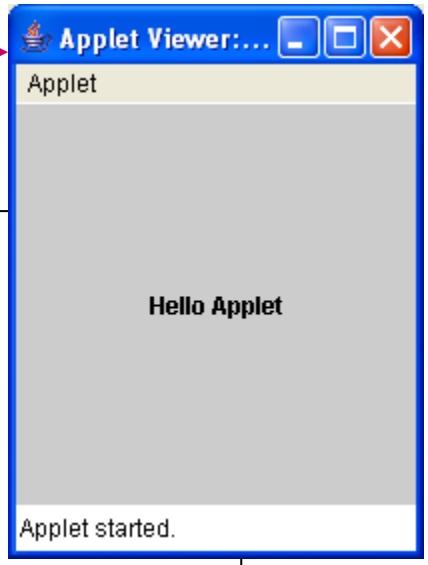
Developing Applet

- Always extends the **`JApplet`** class, which is a subclass of **`Applet`** for Swing components.
- Override **`init()`**, **`start()`**, **`stop()`**, and **`destroy()`** if necessary.
- Add your own methods and data if necessary.
- Applets are always embedded in an HTML page.
  - Applets can be viewed using a Web browser or Applet Viewer utility in JDK

Example: HelloApplet

Viewing in the applet viewer

```
appletviewer HelloApplet.html
```




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

public class HelloApplet extends JApplet {
    public void init() {
        JLabel label = new JLabel("Hello Applet",
            SwingConstants.CENTER);
        add(label);
    }
}
```

HelloApplet.html

```
<applet code="HelloApplet.class" width="200" height="200">
</applet>
```

Example: HTML with the Applet

```
<html>
    <head>
        <title>Hello Applet</title>
    </head>
    <body>
        <applet code="HelloApplet.class"
                width="100"
                height="100">
        </applet>
    </body>
</html>
```

The <applet> HTML Tag

```
<applet
    [codebase=applet_url]
    code=classfilename.class
    width=applet_viewing_width_in_pixels
    height=applet_viewing_height_in_pixels
    [archive=archivefile]
    [codebase=applet_url]
    [vspace=vertical_margin]
    [hspace=horizontal_margin]
    [align=applet_alignment]
    [alt=alternative_text]
    <param name=param_name1 value=param_value1>
    <param name=param_name2 value=param_value2>
    ...
</applet>
```

Passing Parameters to Applets

- Applets can use parameters that are embedded in the HTML file
- This is done by the HTML tag called **`param`** along with attributes that you define
- In HTML file:

```
<applet … >
  ...
  <param name=parametername  value=stringvalue />
</applet>
```

- In the applet class:

```
getParameter(parametername);
```

Example: HTML with the Applet Parameters

```
<html>
    <head>
        <title>Hello Applet</title>
    </head>
    <body>
        <applet code="HelloApplet.class"
                width="100"
                height="100">
                <param name="message" value="Hello HTML">
                <param name="x" value="10">
                <param name="y" value="30">
        </applet>
    </body>
</html>
```

Example: Hello HTML Applet

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

public class HelloApplet extends JApplet {
    public void init() {
        // get parameter values from the HTML file
        String message = getParameter("message");
        int x = Integer.parseInt(getParameter("x"));
        int y = Integer.parseInt(getParameter("y"));
        JLabel label = new JLabel(message);
        label.setXCooedinate(x);
        label.setXCooedinate(y);
        add(label);
    }
}
```

Loading Image and Audio Files

- Images
  - Supported formats: GIF, PNG, JPG

```
Image img = getImage(getCodeBase(), "myImage.jpg");
```

URL of the applet's codebase directory

- Audio
  - Supported formats: AU, AIFF, WAV, MIDI
  - Loading audio

```
AudioClip audioClip = getAudioClip(getCodeBase(), "myAudio.au");
```

  - Playing audio

```
audioClip.play();
```

or

```
play(getCodeBase(), "myAudio.au");  //play directly once
```

The Applet Context

- An applet can ask the browser to do things
  - Display a string in the status line

```
showStatus("message");
```

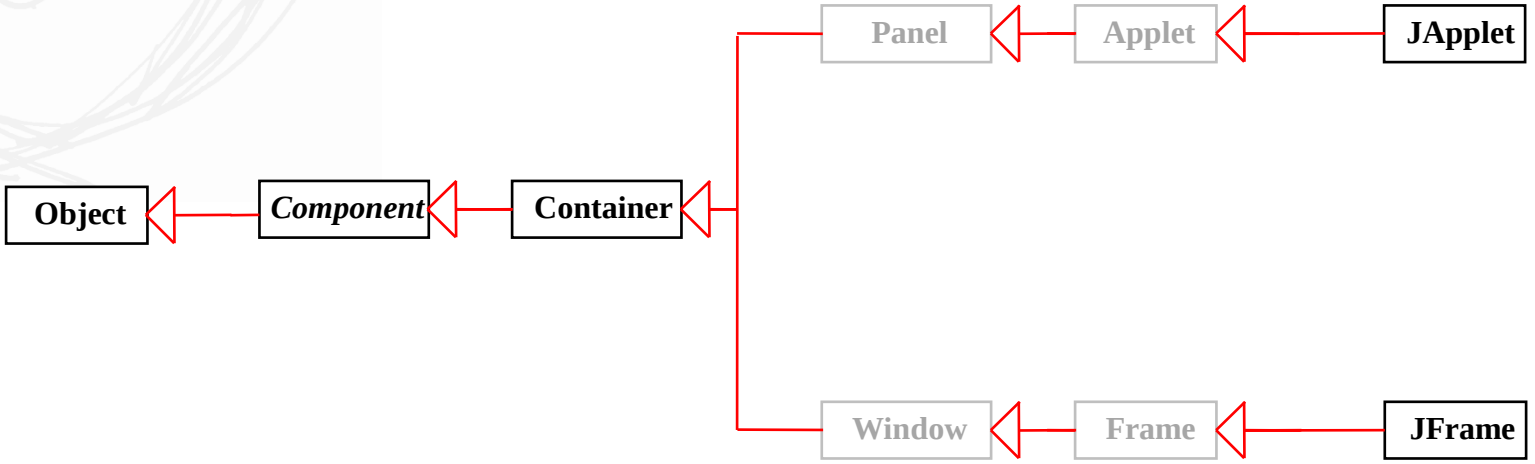
  - Tell the browser to show a different web page

```
getAppletContext().showDocument(pageURL);
```

Applications vs. Applets

- Similarities
  - Since they both are subclasses of the **`Container`** class, all the user interface components, layout managers, and event-handling features are the same for both classes.
- Differences
  - Applications are invoked by the Java interpreter, and applets are invoked by the Web browser.
  - Applets have security restrictions
  - Web browser creates graphical environment for applets, GUI applications are placed in a frame.

JApplet vs JFrame



Conversions Between Applications and Applets

- Possible to write a Java program that is both an applet and an application
  - You can load the program with the applet viewer or a browser
  - You can run the program as a standalone program
- You can always convert an applet into an application
  - Add a **`main`**() method in the applet
- You can convert an application to an applet as long as security restrictions are not violated
  - Put any initialization code from the frame window constructor into the **`init`**() method of the applet

Applets as Applications

```
public static void main(String[] args) {
  // create a frame
  JFrame frame = new JFrame("Applet in the frame");

  // create an instance of the applet. e.g. HelloApplet
  HelloApplet applet = new HelloApplet();

  // add the applet to the frame
  frame.add(applet, BorderLayout.CENTER);

  // invoke init() and start()
  applet.init();
  applet.start();

  // display the frame
  frame.setSize(FRAME_WIDTH, FRAME_HEIGHT);
  frame.setVisible(true);
}
```

Security Restrictions on Applets

- ***Sandbox*** - Restricted execution environment
  - *Untrusted* (unsigned) Applets are not allowed to read from, or write to, the file system of the computer viewing the applets
  - Applets are not allowed to run any programs on the browser's computer
  - Applets are not allowed to establish connections between the user's computer and another computer except with the server where the applets are stored
  - Applet are not allowed to find out any information abut the local computer
    - except for the Java version used, the name and version of the operating system, and the characters used to separate files, paths and lines
    - in particular, applets cannot find out the user's name, email address, and so on
  - All windows that an applet pops up carry a warning message

Additional rights can be given by using signed applets

Notes on Applets

- Applets are interpreted by the JVM and not directly executed by the CPU on the user's machine with "security manager" objects. The interpreter checks all critical instructions
- The applet security manager throws a **`SecurityException`** whenever an applet attempts to violate one of the access rules
- **`JApplet`** is a part of Swing
  - Thread issues
  - **`init`**() is not executed by the Event Dispatching Thread
    - do not build the **`JApplet`** GUI interface
    - instead build it by **`invokeLater`**() in the EDT

Applets are no longer used much; WebStart is recommended as an alternative