Creating Dynamic Charts With JFreeChart

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Overview

JFreeChart is an open source charting package implemented in Java. The focus of this presentation is on using JFreeChart to embed charts within web pages. After this presentation, you will be able to answer the following questions about this exciting technology:
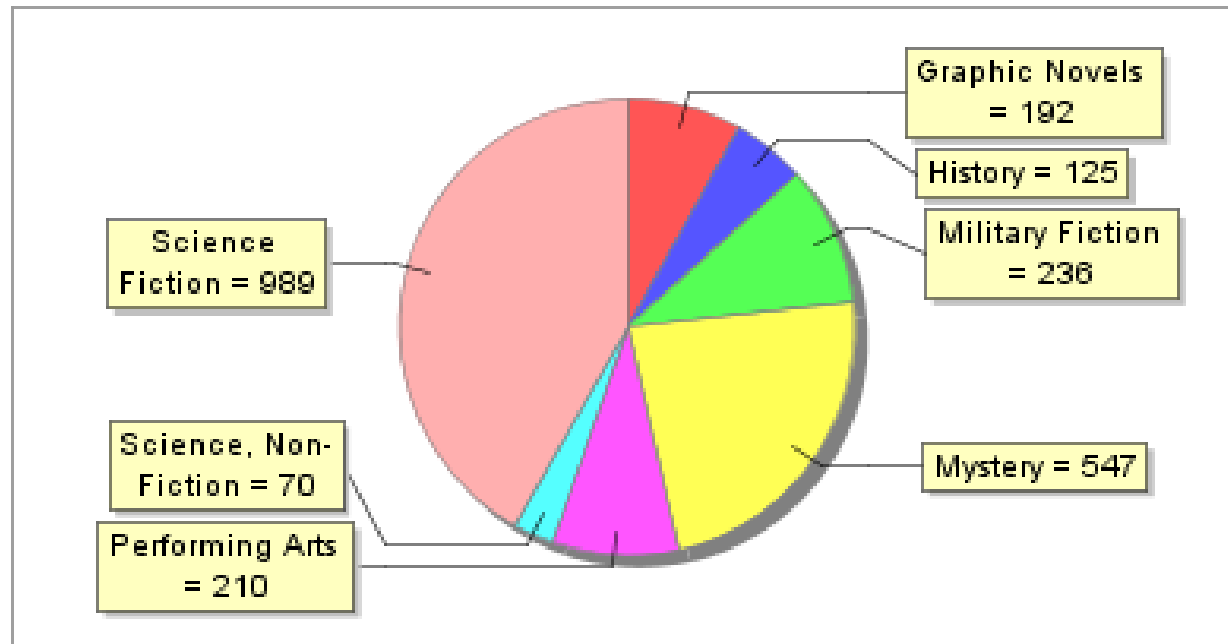
- What is JFreeChart?
- Why would you want to use it?
- What do you need to use it?
- Where do you get it?
- How can charts be embedded in Java-based web pages?
- What if your web site isn't Java-based?

What Is JFreeChart?

- Open source Java charting class library
- Easy to use; with well-documented API
- Supports dozens of chart types
- Real-time chart generation
- Extensive customization of charts
- Can output charts in numerous formats
- Mature technology – supported and enhanced since 2000

A Typical Chart

Books by Type

Graphic Novels = 192
History = 125
Military Fiction = 236
Mystery = 547
Science Fiction = 989
Science, Non-Fiction = 70
Performing Arts = 210

- Graphic Novels = 192 History = 125 Military Fiction = 236
- Mystery = 547 Performing Arts = 210 Science, Non-Fiction = 70
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Supported Chart Types

- Pie Charts
- Exploded Pie Charts
- Area Charts
- Stacked Area Charts
- Candlestick Charts
- Time Series Charts
- Gantt Charts
- Dual Axis Charts
- Histograms
- Time Series Charts

- Line Charts
- Bar Charts
- Layered Bar Charts
- Stacked Bar Charts
- Statistical Bar Charts
- Waterfall Charts
- Meter Charts
- Ring Charts
- Scatter Plots
- Etc.

Prerequisites for Use

- Java 2 Platform (JDK 1.3 or later)
- JFreeChart 1.0.4 (as of February 9, 2007)
- (Optional) Web Container, e.g. – Tomcat, WebLogic, etc.

Where Do You Get It?

JFreeChart Home Page

- http://www.jfree.org/jfreechart/

JFreeChart Documentation

- Free Installation Manual (PDF)

- Generated API Documentation

  - http://www.jfree.org/jfreechart/api/gjdoc/index.html

- Developer Manual (PDF)

  - Costs $48.75 for PDF download (well worth it!)

Ways to Produce Charts

JFreeChart is flexible enough to support a variety of ways to generate charts:

- Servlet

- Application

- Applet

For embedding charts within web sites, <u>servlets</u> are generally used.

Servlet Review

To create a servlet, perform these steps:

- Create a class that extends the <u>HttpServlet</u> class

- Provide an implementation for either the doGet() or doPost() methods

- This method will produce the output that will be sent back to the requester

The Basic Servlet

```java
import java.io.IOException;              // Required Servlet Imports
import java.io.OutputStream;
import javax.servlet.*;
import javax.servlet.http.*;

import java.awt.Color;                   // Imports related to chart production
import org.jfree.chart.ChartFactory;
import org.jfree.chart.ChartUtilities;
import org.jfree.chart.JFreeChart;
import org.jfree.data.general.DefaultPieDataset;

public class ChartServlet extends HttpServlet {

    public void doGet(HttpServletRequest request,
                      HttpServletResponse response)
        throws IOException, ServletException {
        doTestPieChart(request, response);        // Will produce chart
    } // End Method

} // End Class
```

Steps to Produce a Chart

- Determine type of chart to be produced
- Get the raw data for the chart
- Store data in JFreeChart <u>Dataset</u> object
- Create a <u>Chart</u> object – Of desired chart type and passing in the Dataset object
- Customize Chart object as needed
- Output generated chart in desired format

Creating a Chart

```java
protected void doTestPieChart(HttpServletRequest request,
  HttpServletResponse response) throws IOException, ServletException  {
    OutputStream out = response.getOutputStream();

    try  {
        DefaultPieDataset dataset = new DefaultPieDataset();

        dataset.setValue("Graphic Novels", 192);
        . . .

        JFreeChart chart = ChartFactory.createPieChart("Books by Type",
            dataset, true, false, false);
        chart.setBackgroundPaint(Color.white);      // Customize chart

        response.setContentType("image/png");
        ChartUtilities.writeChartAsPNG(out, chart, 400, 300);
    }
    catch (Exception e)  {
        System.out.println(e.toString());
    }
    finally  {
        out.close();
    }
} // End Method
```

Key Code Elements

```
dataset.setValue("Graphic Novels", 192);
. . .

JFreeChart chart = ChartFactory.createPieChart("Books by Type",
    dataset, true, false, false);
```

- Sets chart data items in a Dataset object (only one data line is shown)

- Creates a chart with a title, a dataset and flags

- Flags are: Yes for a legend, no for URLs and Tool Tips

Key Code Elements 2

```
OutputStream out = response.getOutputStream();

. . .

response.setContentType("image/png");
ChartUtilities.writeChartAsPNG(out, chart, 400, 300);
```

- Gets output stream from Response
- Sets mime type to "image/png"
- Uses ChartUtilities class to write the chart out as a PNG
- Writes the chart to the stream
- Chart is never stored as a file

Using the Servlet

- References servlet with URL like this:

  http://www.site.com/servlet/ChartServlet

- Servlet shows chart as an image

- Not embedded within a web page…

- How do you embed it within a web page?

Embedding a Chart

```
<html>
<head>
    <title>Test Chart</title>
</head>
<body>

<div align=center>
<img src="/servlet/ChartServlet" width=400 height=300 border=0>
</div>

</body>
</html>
```

- Uses a standard HTML IMG tag
- The Tag references the chart servlet
- Page loads; slight delay until chart shows

Referencing the Servlet

- Servlet can be referenced from anywhere
- Nothing in embedding technique requires Java except the servlet itself
- Non-Java sites can reference the servlet
- Servlet can function as sort of a "poor man's web service"
- May need security for servlet to control where/how servlet is referenced

Other Ways to Use JFreeChart

- ChartUtilities class allows charts to be output in many formats, written to files, written to streams, etc.

- Charts can easily be incorporated into servlets (as just shown), or applets or applications

Summary

The benefits of JFreeChart are:

- Dynamic generation of very nice charts
- Easy integration into web sites
- Light-weight, with few dependencies
- Flexible usage; easily customizable
- Numerous chart types
- Numerous ways to output charts