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Controlling the Structure of Generated Servlets: The JSP page Directive

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Agenda

- Understanding the purpose of the page directive
- Designating which classes are imported
- Specifying the MIME type of the page
- Generating Excel spreadsheets
- Participating in sessions
- Setting the size and behavior of the output buffer
- Designating pages to handle JSP errors
- Controlling threading behavior

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Purpose of the page Directive

- Give high-level information about the servlet that will result from the JSP page
- Can control
 - Which classes are imported
 - What class the servlet extends
 - What MIME type is generated
 - How multithreading is handled
 - If the servlet participates in sessions
 - The size and behavior of the output buffer
 - What page handles unexpected errors

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The import Attribute

- Format
 - `<%@ page import="package.class" %>`
 - `<%@ page import="package.class1, ..., package.classN" %>`
- Purpose
 - Generate import statements at top of servlet definition
- Notes
 - Although JSP pages can be almost anywhere on server, classes used by JSP pages must be in normal servlet dirs
 - E.g.:
 - .../WEB-INF/classes or
 - .../WEB-INF/classes/*directory*MatchingPackage
 - *Always use packages for utilities that will be used by JSP!*

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The Importance of Using Packages

- What package will the system think that SomeHelperClass and SomeUtilityClass are in?

```

...
public class SomeClass {
  public String someMethod(...) {
    SomeHelperClass test = new SomeHelperClass(...);
    String someString =
      SomeUtilityClass.someStaticMethod(...);
    ...
  }
}
  
```

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The Importance of Using Packages (Continued)

- What package will the system think that SomeHelperClass and SomeUtilityClass are in?

```

...
<%
  SomeHelperClass test = new SomeHelperClass(...);
  String someString =
    SomeUtilityClass.someStaticMethod(...);
%>
  
```

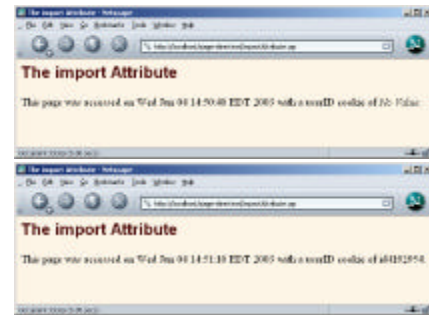
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The import Attribute: Example (Code)

```

...<H2>The import Attribute</H2>
<%@ page import="java.util.*,coreservlets.*" %>
<%!
private String randomID() {
    int num = (int)(Math.random()*10000000.0);
    return("id" + num);
}
private final String NO_VALUE = "<I>No Value</I>";
%>
<%
String oldID =
    CookieUtilities.getCookieValue(request, "userID",
        NO_VALUE);
if (oldID.equals(NO_VALUE)) {
    String newID = randomID();
    Cookie cookie = new LongLivedCookie("userID", newID);
    response.addCookie(cookie);
}
%>
This page was accessed on <%= new Date() %> with a userID
cookie of <%= oldID %>.
</BODY></HTML>
    
```

The import Attribute: Example (Results)



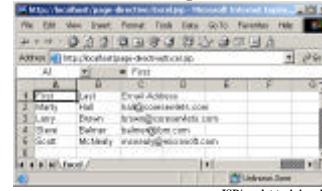
The contentType and pageEncoding Attributes

- **Format**
 - <%@ page contentType="MIME-Type" %>
 - <%@ page contentType="MIME-Type; charset=Character-Set" %>
 - <%@ page pageEncoding="Character-Set" %>
- **Purpose**
 - Specify the MIME type of the page generated by the servlet that results from the JSP page
- **Notes**
 - Attribute value cannot be computed at request time
 - See section on response headers for table of the most common MIME types

Generating Excel Spreadsheets

```

First    Last    Email Address
Marty   Hall    hall@coreservlets.com
Larry   Brown   brown@coreservlets.com
Steve   Balmer   balmer@microsoft.com
Scott   McNealy mcnealy@microsoft.com
<%@ page contentType="application/vnd.ms-excel" %>
<!-- There are tabs, not spaces, between cols. -->
    
```



Conditionally Generating Excel Spreadsheets

- You cannot use the contentType attribute for this task, since you cannot make contentType be conditional.
 - The following *always* results in the Excel MIME type

```

<% boolean usingExcel = checkUserRequest(request); %>
<% if (usingExcel) { %>
<%@ page contentType="application/vnd.ms-excel" %>
<% } %>
    
```

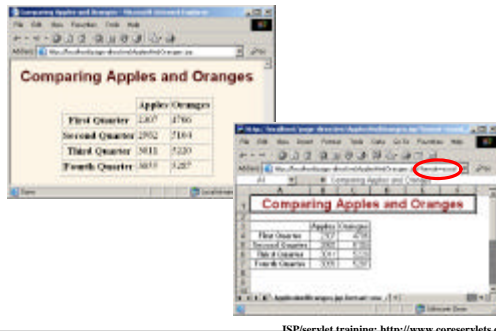
- **Solution:** use a regular JSP scriptlet with response.setContentType

Conditionally Generating Excel Spreadsheets (Code)

```

...
<BODY>
<CENTER>
<H2>Comparing Apples and Oranges</H2>
<%
String format = request.getParameter("format");
if ((format != null) && (format.equals("excel"))) {
    response.setContentType("application/vnd.ms-excel");
}
%>
<TABLE BORDER=1>
<TR><TH></TH>                <TH>Apples<TH>Oranges
<TR><TH>First Quarter <TD>2307 <TD>4706
<TR><TH>Second Quarter<TD>2982 <TD>5104
<TR><TH>Third Quarter <TD>3011 <TD>5220
<TR><TH>Fourth Quarter<TD>3055 <TD>5287
</TABLE>
</CENTER></BODY></HTML>
    
```

Conditionally Generating Excel Spreadsheets (Results)



The session Attribute

- **Format**
 - `<%@ page session="true" %>` `<%-- Default --%>`
 - `<%@ page session="false" %>`
- **Purpose**
 - To designate that page not be part of a session
- **Notes**
 - By default, it is part of a session
 - Saves memory on server if you have a high-traffic site
 - *All* related pages have to do this for it to be useful

The isELIgnored Attribute

- **Format**
 - `<%@ page isELIgnored="false" %>`
 - `<%@ page isELIgnored="true" %>`
- **Purpose**
 - To control whether the JSP 2.0 Expression Language (EL) is ignored (true) or evaluated normally (false).
- **Notes**
 - If your web.xml specifies servlets 2.3 (corresponding to JSP 1.2) or earlier, the default is true
 - But it is still legal to change the default—you are permitted to use this attribute in a JSP-2.0-compliant server regardless of the web.xml version.
 - If your web.xml specifies servlets 2.4 (corresponding to JSP 2.0), the default is false

The buffer Attribute

- **Format**
 - `<%@ page buffer="sizekb" %>`
 - `<%@ page buffer="none" %>`
- **Purpose**
 - To give the size of the buffer used by the out variable
- **Notes**
 - Buffering lets you set HTTP headers even after some page content has been generated (as long as buffer has not filled up or been explicitly flushed)
 - Servers are allowed to use a larger size than you ask for, but not a smaller size
 - Default is system-specific, but must be at least 8kb

The errorPage Attribute

- **Format**
 - `<%@ page errorPage="Relative URL" %>`
- **Purpose**
 - Specifies a JSP page that should process any exceptions thrown but not caught in the current page
- **Notes**
 - The exception thrown will be automatically available to the designated error page by means of the "exception" variable
 - The web.xml file lets you specify *application-wide* error pages that apply whenever certain exceptions or certain HTTP status codes result.
 - The errorPage attribute is for *page-specific* error pages

The isErrorPage Attribute

- **Format**
 - `<%@ page isErrorPage="true" %>`
 - `<%@ page isErrorPage="false" %>` `<%-- Default --%>`
- **Purpose**
 - Indicates whether or not the current page can act as the error page for another JSP page
- **Notes**
 - A new predefined variable called exception is created and accessible from error pages
 - Use this for emergency backup only; explicitly handle as many exceptions as possible
 - Don't forget to always check query data for missing or malformed values

Error Pages: Example

```
...<BODY>
<%@ page errorPage="/WEB-INF/SpeedErrors.jsp" %>
<TABLE BORDER=5 ALIGN="CENTER">
<TR><TH CLASS="TITLE">Computing Speed</TABLE>
<%!
private double toDouble(String value) {
    return(Double.parseDouble(value));
}
%>
<%
double furlongs = toDouble(request.getParameter("furlongs"));
double fortnights =
    toDouble(request.getParameter("fortnights"));
double speed = furlongs/fortnights;
%>
<UL>
<LI>Distance: <%= furlongs %> furlongs.
<LI>Time: <%= fortnights %> fortnights.
<LI>Speed: <%= speed %> furlongs per fortnight.
</UL>
</BODY></HTML>
```

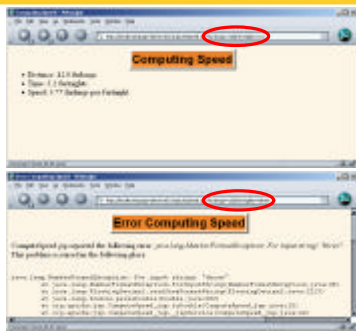
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Error Pages: Example (Continued)

```
...<BODY>
<%@ page isErrorPage="true" %>
<TABLE BORDER=5 ALIGN="CENTER">
<TR><TH CLASS="TITLE">
    Error Computing Speed</TABLE>
<P>
ComputeSpeed.jsp reported the following error:
<I><%= exception %></I>. This problem occurred in the
following place:
<PRE>
<%@ page import="java.io.*" %>
<% exception.printStackTrace(new PrintWriter(out)); %>
</PRE>
</BODY></HTML>
```

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Error Pages: Results



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The isThreadSafe Attribute

- **Format**
 - <%@ page isThreadSafe="true" %> <!-- Default -->
 - <%@ page isThreadSafe="false" %>
- **Purpose**
 - To tell the system when your code is not threadsafe, so that the system can prevent concurrent access
 - Normally tells the servlet to implement SingleThreadModel
- **Notes**
 - Avoid this like the plague
 - Causes degraded performance in some situations
 - Causes incorrect results in others

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Example of Non-Threadsafe Code (IDs Must Be Unique)

- **What's wrong with this code?**

```
<%! private int idNum = 0; %>
<%
String userID = "userID" + idNum;
out.println("Your ID is " + userID + ".");
idNum = idNum + 1;
%>
```

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isThreadSafe Needed Here?

- **No!**

```
<%! private int idNum = 0; %>
<%
synchronized(this) {
    String userID = "userID" + idNum;
    out.println("Your ID is " + userID + ".");
    idNum = idNum + 1;
}
%>
```
- **Better performance in high-traffic environments**
- **isThreadSafe="false" will totally fail if server uses pool-of-instances approach**

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The extends Attribute

- **Format**
 - `<%@ page extends="package.class" %>`
- **Purpose**
 - To specify parent class of servlet that will result from JSP page
- **Notes**
 - Use with extreme caution
 - Can prevent system from using high-performance custom superclasses
 - Typical purpose is to let you extend classes *that come from the server vendor* (e.g., to support personalization features), not to extend your own classes.

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Summary

- **The import attribute**
 - Changes the packages imported by the servlet that results from the JSP page
 - *Always* use packages for utility classes!
- **The contentType attribute**
 - Specifies MIME type of result
 - Cannot be used conditionally
 - Use `<% response.setContentType(...); %>` for conditional
- **The errorPage and isErrorPage attributes**
 - Specifies "emergency" error handling pages
- **The isThreadSafe attribute**
 - Turns off concurrent access
 - Always use explicit synchronization instead

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