

Core Servlets and JavaServer Pages / 2e
Volume 1: Core Technologies
Marty Hall • Larry Brown

**Controlling the Structure
of Generated Servlets:
The JSP `page` Directive**

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**

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

The import Attribute

- **By default, the servlet imports:**
 - `java.lang.*` `javax.servlet.*`
 - `javax.servlet.jsp.*` `javax.servlet.http.*`
- **Format**
 - `<%@ page import="package.class" %>`
 - `<%@ page import="package.class1,...,package.classN" %>`
- **Purpose**
 - Generate import statements at top of servlet definition
- **Notes**
 - Only page directive that can appear multiple times within one document
 - 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/directoryMatchingPackage`
 - *Always use packages for utilities that will be used by JSP!*

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(...);  
        ...  
    }  
}
```

The Importance of Using Packages

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

<%

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

%>

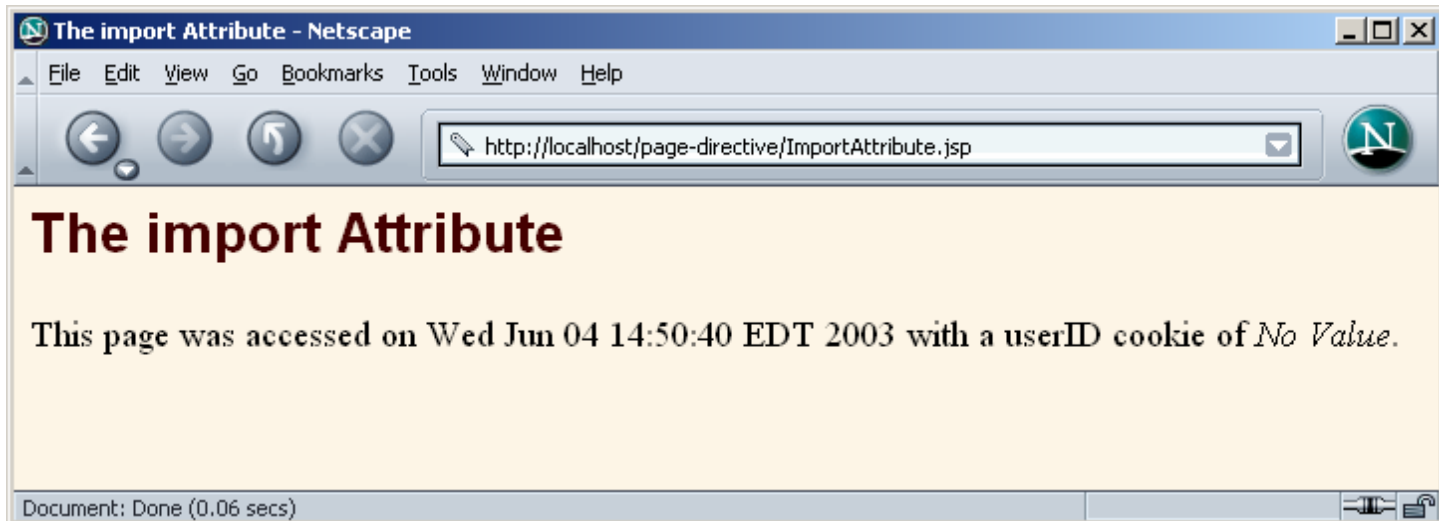
- If they are in imported packages, there is no ambiguity
- If they are not in packages or if the package to which they belong is not explicitly imported, then the system will assume they are in the same package as the autogenerated servlet
 - This package is not known, different servers use different approaches

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**

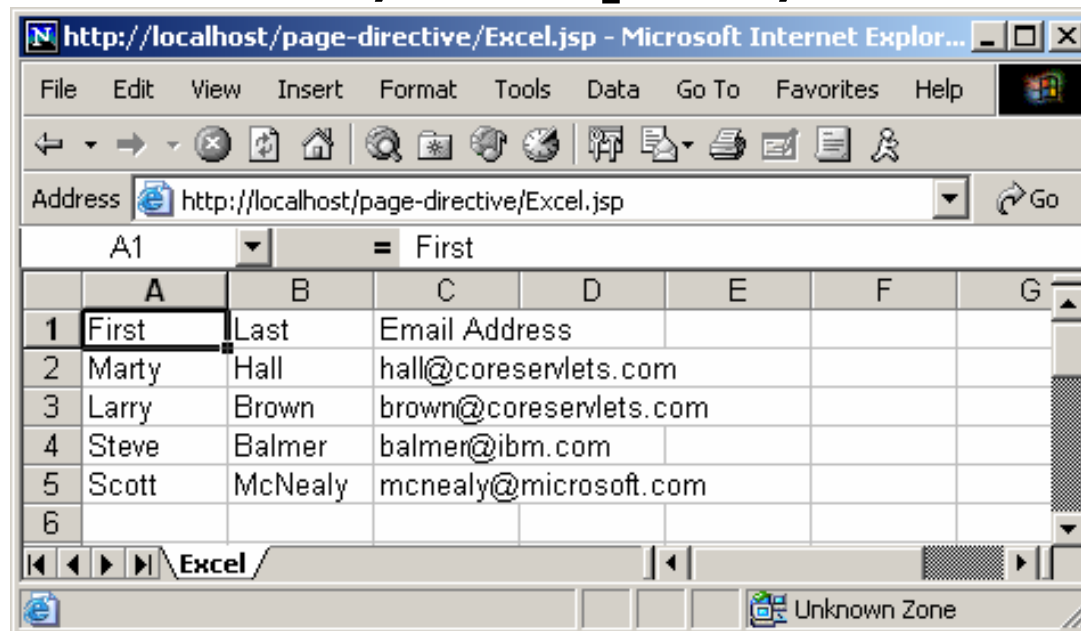
- Attribute value cannot be computed at request time
- See section on response headers for table of the most common MIME types
- `<%@ page contentType="application/vnd.ms-excel" %>` is equivalent to `<%response.setContentType("application/vnd.ms-excel"); %>`

Generating Excel Spreadsheets

First	Last	Email Address
Marty	Hall	hall@coreservlets.com
Larry	Brown	brown@coreservlets.com
Steve	Balmer	balmer@ibm.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
 - Attribute values can not be computed at runtime
 - Page directives can not be conditionally inserted as template text

```
<% 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)

Comparing Apples and Oranges - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://localhost/page-directive/ApplesAndOranges.jsp> Go

Comparing Apples and Oranges

	Apples	Oranges
First Quarter	2307	4706
Second Quarter	2982	5104
Third Quarter	3011	5220
Fourth Quarter	3055	5287

Done Local intranet

<http://localhost/page-directive/ApplesAndOranges.jsp?format=excel...>

File Edit View Insert Format Tools Data Go To Favorites Help

Address <http://localhost/page-directive/ApplesAndOranges.jsp?format=excel> Go

A1 = Comparing Apples and Oranges

	A	B	C	D	E	F
1	Comparing Apples and Oranges					
2						
3		Apples	Oranges			
4	First Quarter	2307	4706			
5	Second Quarter	2982	5104			
6	Third Quarter	3011	5220			
7	Fourth Quarter	3055	5287			
8						
9						
10						

ApplesAndOranges.jsp format=exc / Unknown Zone

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
 - A value of true signifies that the predefined variable `session` (of type `HttpSession`) should be bound to the existing session if one exists; otherwise a new session should be created and bound to `session`
- A value of false saves memory on the server side if you have a high-traffic site
 - It does not disable session tracking; it prevents the JSP page from creating *new* sessions for users who don't already have them
 - To truly save memory, *all* related pages have to set session to false

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) or earlier, 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

ComputeSpeed.jsp

```
...<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>
```

Error Pages: Example (Continued)

SpeedErrors.jsp

...<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>

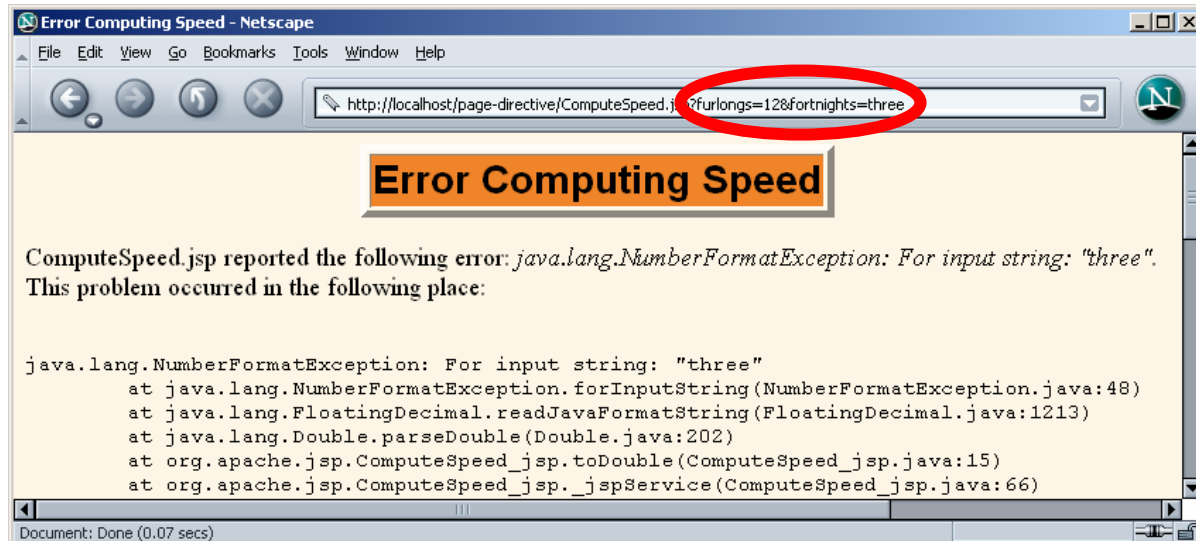
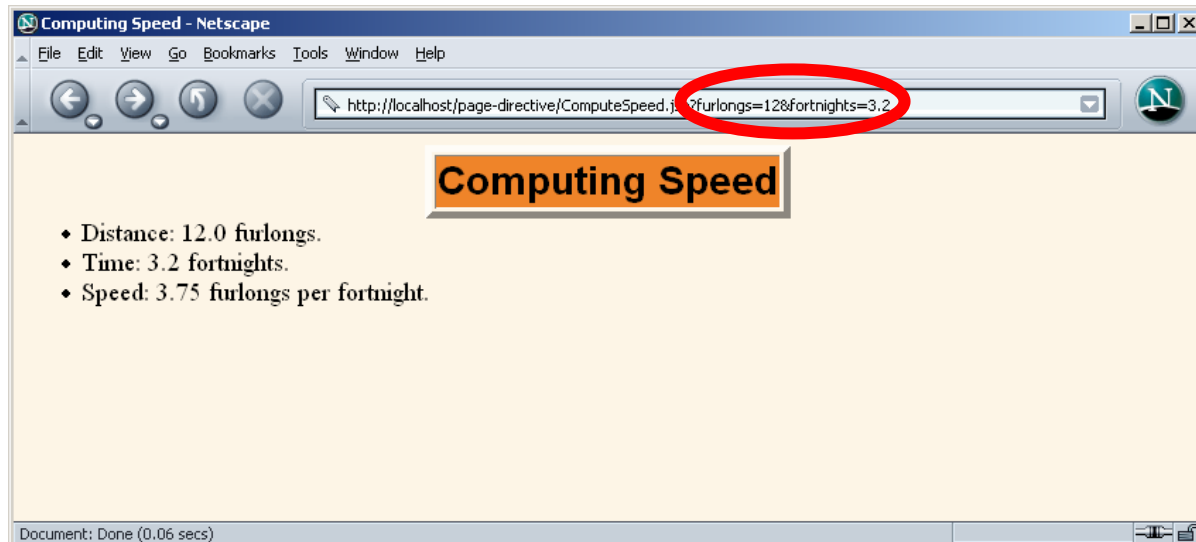
<%@ page import="java.io.*" %>

<% exception.printStackTrace(new PrintWriter(out)); %>

</PRE>

</BODY></HTML>

Error Pages: Results



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
- **Use explicit synchronization**

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

- **What's wrong with this code?**
 - A thread could be pre-empted after reading idNum but before updating it yielding two users with the same user ID

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

Explicit synchronization

```
<%! 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

The extends Attribute

- **Format**

- `<%@ page extends="package.class" %>`

- **Purpose**

- To specify superclass of the 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.

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

Putting it together

CreateCookie.JSP

```
<HTML>
<HEAD><TITLE>Creating cookies</TITLE></HEAD>
<BODY>
Use the following form to set cookies.<br><br>
<form action=CreateCookie.jsp method=post>
  Cookie Name:<input type=text name=cookieName><br>
  Cookie Value: <input type=text name=cookieValue><br>
  Set maxAge (in seconds): <input type=text name=cookieAge size=10>
  <br><br>
  <input type=submit value="Submit">
</form>
<%
String cookieName = request.getParameter("cookieName");
String cookieValue = request.getParameter("cookieValue");
if ( cookieName !=null && cookieName.length() !=0)
{
  Cookie cookie = new Cookie(cookieName,cookieValue);
  int maxAge = 24*60*60;
  try{
    maxAge = Integer.parseInt(request.getParameter("cookieAge"));
    cookie.setMaxAge(maxAge);
  }
  catch(Exception e) {}
  response.addCookie(cookie);
}
%>
<a href="ListCookie.jsp">List cookies</a><br>
<a href="RemoveCookie.jsp">Delete cookies</a>
</BODY>
</HTML>
```

Putting it together

ListCookie.JSP

```
<HTML>
<HEAD><TITLE>Listing cookies</TITLE></HEAD>
<BODY>
  <table border=1>
    <tr><th colspan=2 align=center>Cookie List</th></tr>
    <tr><th align=center>Cookie Name</th>
      <th align=center>Cookie Value</th>
    </tr>
  <%
Cookie[] cookies = request.getCookies();
for (int i=0; i<cookies.length; i++){
%>
  <tr><td align =center><%=cookies[i].getName() %>
    <td align =center><%=cookies[i].getValue() %>
  </tr>
  <% } %>

</table><br>
<a href="CreateCookie.jsp">Create cookies</a><br>
<a href="RemoveCookie.jsp">Delete cookies</a>
</BODY>
</HTML>
```

Putting it together

RemoveCookie.JSP

```
<HTML>
<HEAD><TITLE>Deleting cookies</TITLE></HEAD>
<BODY>
<%
    String cookienametoremove =
        request.getParameter("removecookie");
    Cookie[] cookies = request.getCookies();
    if (cookienametoremove != null)
    {
        for (int i=0; i<cookies.length; i++)
        {
            if (cookies[i].getName().equals(cookienametoremove))
            {
                cookies[i].setMaxAge(0);
                response.addCookie(cookies[i]);
                response.sendRedirect("RemoveCookie.jsp");
                break;
            }
        }
    }
%>
```

Putting it together

RemoveCookie.JSP

```
<table border=1>
  <tr><th colspan=3 align=center>Cookie List</th></tr>
  <tr><th align=center>Cookie Name</th>
    <th align=center>Cookie Value</th>
    <th> Remove?</th>
  </tr>
<%
  for(int i=0; i<cookies.length; i++){
%>
  <tr><td align=center><%= cookies[i].getName() %></td>
    <td align=center><%= cookies[i].getValue() %></td>
    <td> <a href="RemoveCookie.jsp?removecookie=<%=
      cookies[i].getName() %>">
      Remove?</a>
    </td>
  </tr>
<% } %>
</table>
<a href="CreateCookie.jsp">Create cookies</a><br>
<a href="ListCookie.jsp">List cookies</a>
</BODY>
</HTML>
```