Java Server Pages

Outline

- Introducing JavaServer Pages^{TM} (JSP^{TM})
- JSP scripting elements
- The JSP page Directive: Structuring Generated Servlets^{TM}
- Including Files in JSP Documents
- Using JavaBeans™ components with JSP
- Creating custom JSP tag libraries
- Integrating servlets and JSP with the *Model View Controller* (MVC) or *Model 2* architecture

The Need for JSP

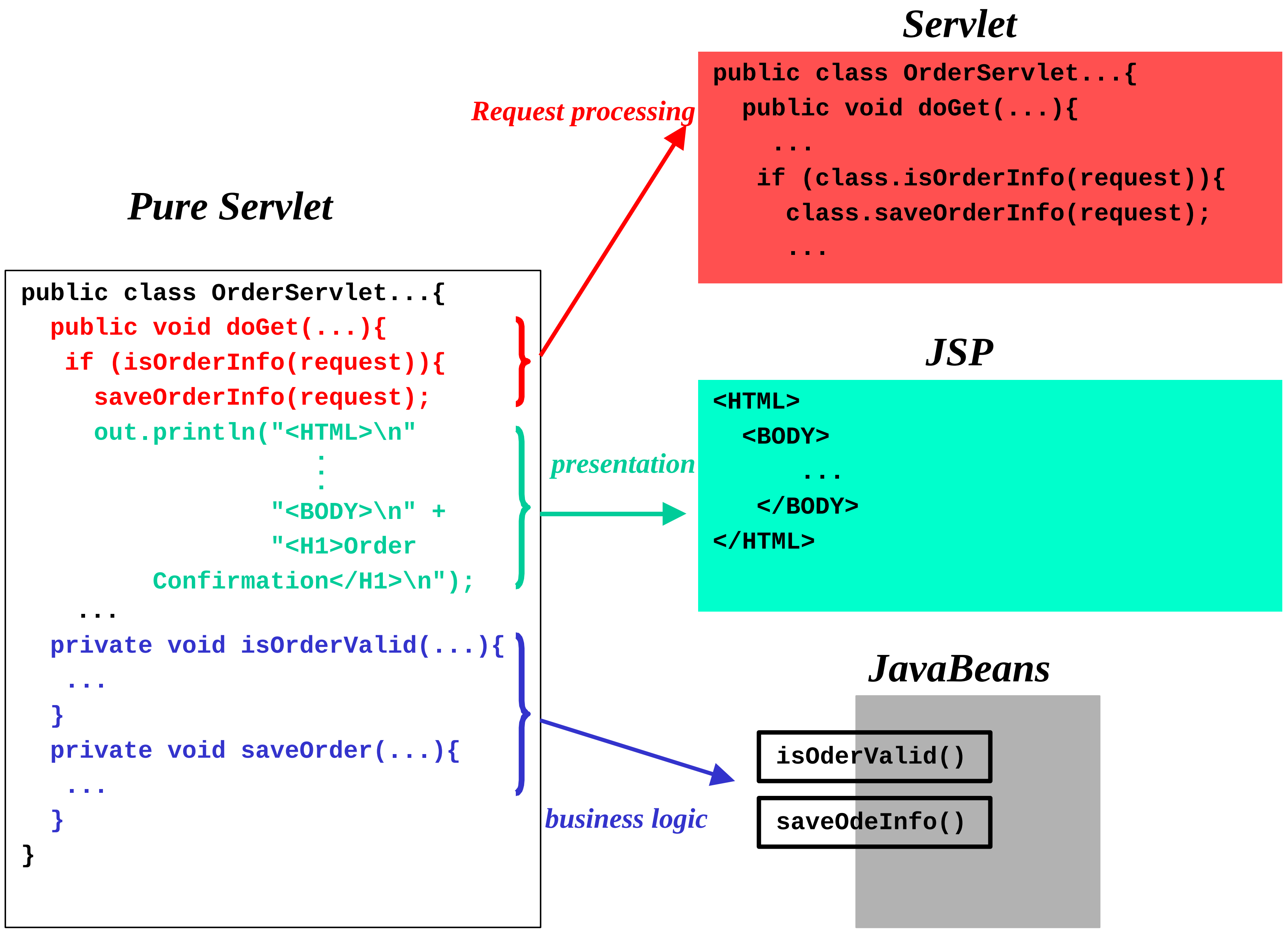
- With servlets, it is easy to
  - Read form data
  - Read HTTP request headers
  - Set HTTP status codes and response headers
  - Use cookies and session tracking
  - Share data among servlets
  - Remember data between requests
- But, it is tedious
  - Use those println statements to generate HTML
  - Maintain that HTML

Problem with Servlets

Java servlet-based applications, processing the request and generating the response are both handled by a single servlet class.

Example

```
public class OrderServlet extends HttpServlet {
  public void doGet(HttpServletRequest request,
                    HttpServletResponse response)
      throws ServletException, IOException {
    response.setContentType("text/html");
    PrintWriter out = response.getWriter();
    if (isOrderInfo(request))
    {
     saveOrderInfo(request);
     out.println("<HTML>\n" +
                "<HEAD><TITLE>Order Confirmation</TITLE></HEAD>\n" +
                "<BODY>\n" +
                "<H1>Order Confirmation</H1>\n");
     renderOrderInfo(request)
     out.println("</BODY></HTML>");
     }
  }
}
```



```
public class OrderServlet...{
  public void doGet(...){
   if (isOrderInfo(request)){
     saveOrderInfo(request);
     out.println("<HTML>\n"
                           :
                           :
                 "<BODY>\n" +
                 "<H1>Order
         Confirmation</H1>\n");
    ...
  private void isOrderValid(...){
   ...
  }
  private void saveOrder(...){
   ...
  }
}
```

```
public class OrderServlet...{
  public void doGet(...){
    ...
   if (class.isOrderInfo(request)){
     class.saveOrderInfo(request);
     ...
```

```
<HTML>
  <BODY>
      ...
   </BODY>
</HTML>
```

```
isOderValid()
saveOdeInfo()
```

The JSP Framework

- Idea:
  - Use regular HTML for most of page
  - Mark servlet code with special tags
  - Entire JSP page gets translated into a servlet (once), and servlet is what actually gets invoked (for each request)

The JSP Framework

- Example:
  - JSP
    - Address:
      <I><%= request.getParameter(“address") %></I>
  - URL
    - http://host/Information.jsp?title=One+Main+Street
  - Result
    - Address: One Main Street

Benefits of JSP

- Although JSP technically can't do anything servlets can't do, JSP makes it easier to:
  - Write HTML
  - Read and maintain the HTML
- JSP makes it possible to:
  - Use standard HTML tools
  - Have different members of your team do the HTML layout and the programming
- JSP encourages you to
  - Separate the (Java) code that creates the content from the (HTML) code that presents it

Setting Up Your Environment

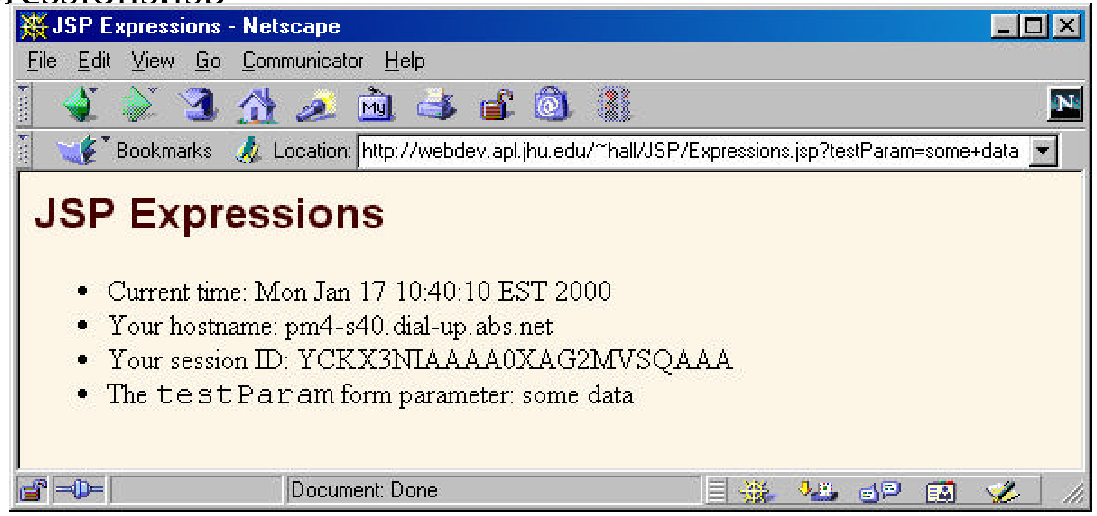
- Set your CLASSPATH. Not.
- Compile your code. Not.
- Use packages to avoid name conflicts. Not.
- Put JSP page in special directory. Not.
  - tomcat_install_dir/webapps/ROOT
  - jrun_install_dir/servers/default/default-app
- Use special URL to invoke JSP page. Not.
- Caveats
  - Previous rules about CLASSPATH, install dirs, etc., still apply to regular classes used *by* JSP

Example

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0
   Transitional//EN">
</HEAD>
<BODY>
<H2>JSP Expressions</H2>
<UL>
  <LI>Current time: <%= new java.util.Date() %>
  <LI>Your hostname: <%= request.getRemoteHost()
  %>
  <LI>Your session ID: <%= session.getId() %>
  <LI>The <CODE>testParam</CODE> form parameter:
      <%= request.getParameter("testParam") %>
</UL>
</BODY>
</HTML>
```

Example Result

- With default setup, if location was
  - C:\jakarta-tomcat\webapps\ROOT\Expressions.jsp
  - C:\Program Files\Allaire\JRun\servers\default\default-app\Expressions.jsp
- URL would be
  - http://localhost/Expressions.jsp


JSP Expressions - Netscape
File Edit View Go Communicator Help
Bookmarks
Location:
Document: Done

http://webdev.apl.jhu.edu/~hall/JSP/Expressions.jsp?testParam=some+data

JSP Expressions

- Current time: Mon Jan 17 10:40:10 EST 2000
- Your hostname: pm4-s40.dial-up.abs.net
- Your session ID: YCKX3NIAAAA0XAG2MVSQAAA
- The `testParam` form parameter: some data

Most Common isunderstanding: Forgetting JSP is Server-Side Technology

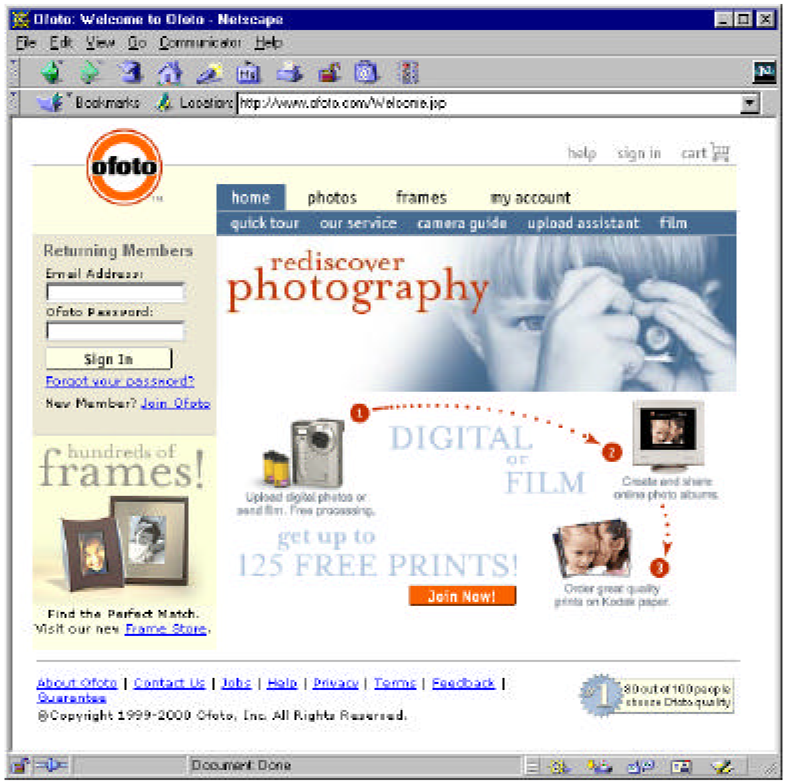
- Very common question
  - I can’t do such and such with HTML.
    Will JSP let me do it?
- Why doesn't this question make sense?
  - JSP runs entirely on server
  - It doesn’t change content the browser can handle
- Similar questions
  - How do I put an applet in a JSP page?
    Answer: send an <APPLET…> tag to the client
  - How do I put an image in a JSP page?
    Answer: send an <IMG …> tag to the client
  - How do I use JavaScript/Acrobat/Shockwave/Etc?
    Answer: send the appropriate HTML tags

2nd Most Common Misunderstanding: Translation/Request Time Confusion

- What happens at page translation time?
  - JSP constructs get translated into servlet code
- What happens at request time?
  - Servlet code gets executed. No interpretation of JSP occurs at request time. The original JSP page is ignored at request time; only the servlet that resulted from it is used
- When does page translation occur?
  - Typically, the first time JSP page is accessed after it is modified. This should never happen to real user (developers should test all JSP pages they install).
  - Page translation does not occur for each request

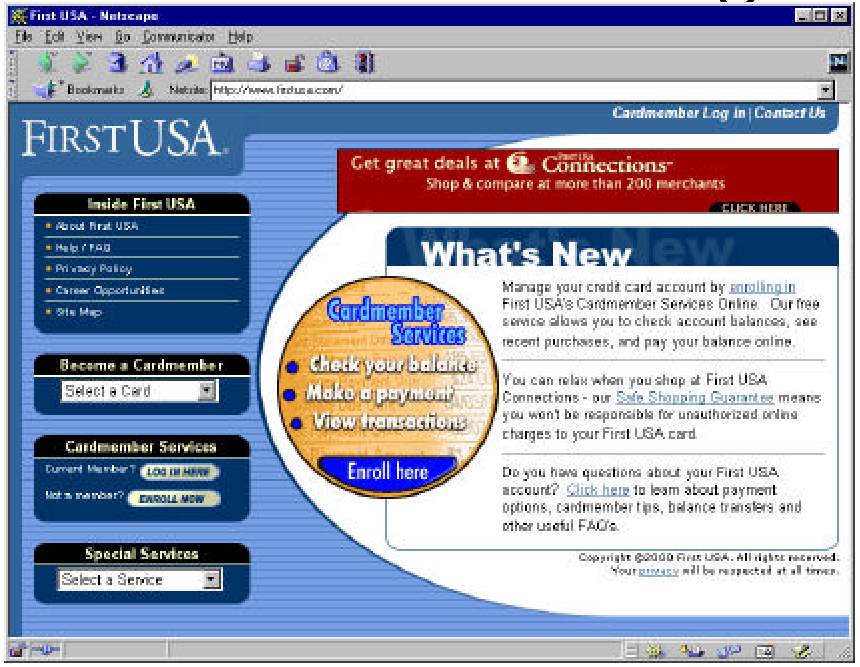
JSP/Servlets in the Real World

- ofoto.com: print and manage digital and conventional photos.


Ofoto: Welcome to Ofoto - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://www.ofoto.com/Welcome.jsp
ofoto
help sign in cart
home photos frames my account
quick tour our service camera guide upload assistant film
Returning Members
Email Address:
Ofoto Password:
Sign In
Forgot your password?
New Member? Join Ofoto
rediscover photography
hundreds of frames!
Find the Perfect Match.
Visit our new Frame Store.
DIGITAL or FILM
Upload digital photos or send film. Free processing.
Create and share online photo albums.
get up to 125 FREE PRINTS!
Join Now!
Order great quality prints on Kodak paper.
About Ofoto | Contact Us | Jobs | Help | Privacy | Terms | Feedback | Guarantee
©Copyright 1999-2000 Ofoto, Inc. All Rights Reserved.
80 out of 100 people choose Ofoto quality
Document: Done

JSP/Servlets in the Real World

- First USA Bank: largest credit card issuer in the world; most on-line banking customers



Manage your credit card account by enrolling in First USA's Cardmember Services Online. Our free service allows you to check account balances, see recent purchases, and pay your balance online.

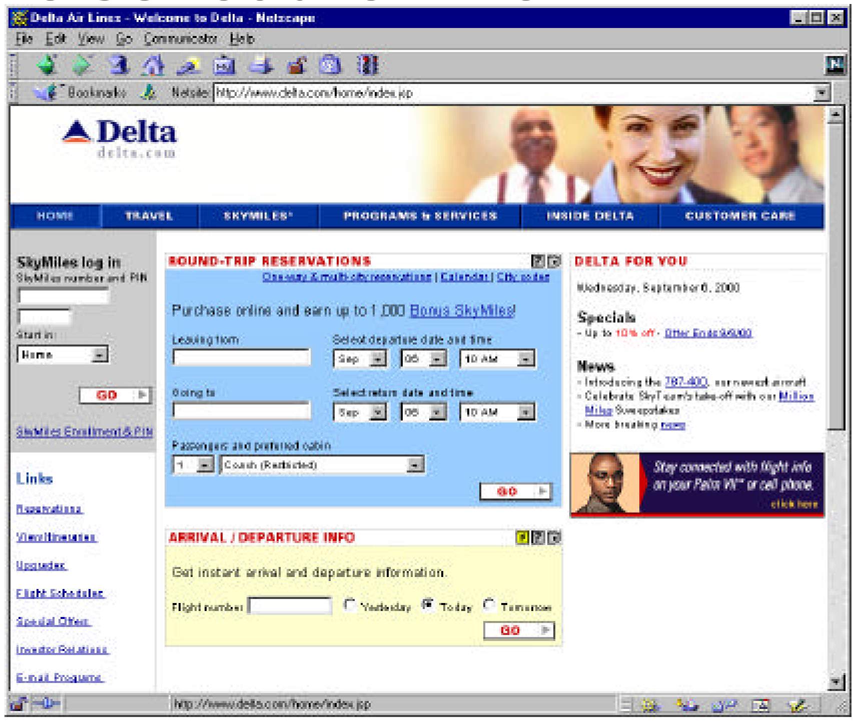
You can relax when you shop at First USA Connections - our Safe Shopping Guarantee means you won't be responsible for unauthorized online charges to your First USA card.

Do you have questions about your First USA account? Click here to learn about payment options, cardmember tips, balance transfers and other useful FAQ's.

Copyright ©2000 First USA. All rights reserved.
Your privacy will be respected at all times.

JSP/Servlets in the Real World

- Delta Airlines: entire Web site, including real-time schedule info


Delta Air Lines - Welcome to Delta - Netscape
File Edit View Go Communicator Help
Bookmarks
Netsite: http://www.delta.com/home/index.jsp
Delta
delta.com
HOME
TRAVEL
SKYMILES®
PROGRAMS & SERVICES
INSIDE DELTA
CUSTOMER CARE
GO
Stay connected with flight info on your Palm VII™ or cell phone.
click here

SkyMiles log in
SkyMiles number and PIN
Start in: Home
SkyMiles Enrollment & PIN

Links
Reservations
View Itineraries
Upgrades
Flight Schedules
Special Offers
Investor Relations
E-mail Programs

ROUND-TRIP RESERVATIONS
One-way & multi-city reservations | Calendar | City codes
Purchase online and earn up to 1,000 Bonus SkyMiles!
Leaving from
Select departure date and time: Sep 06 10 AM
Going to
Select return date and time: Sep 06 10 AM
Passengers and preferred cabin: 1 Coach (Restricted)

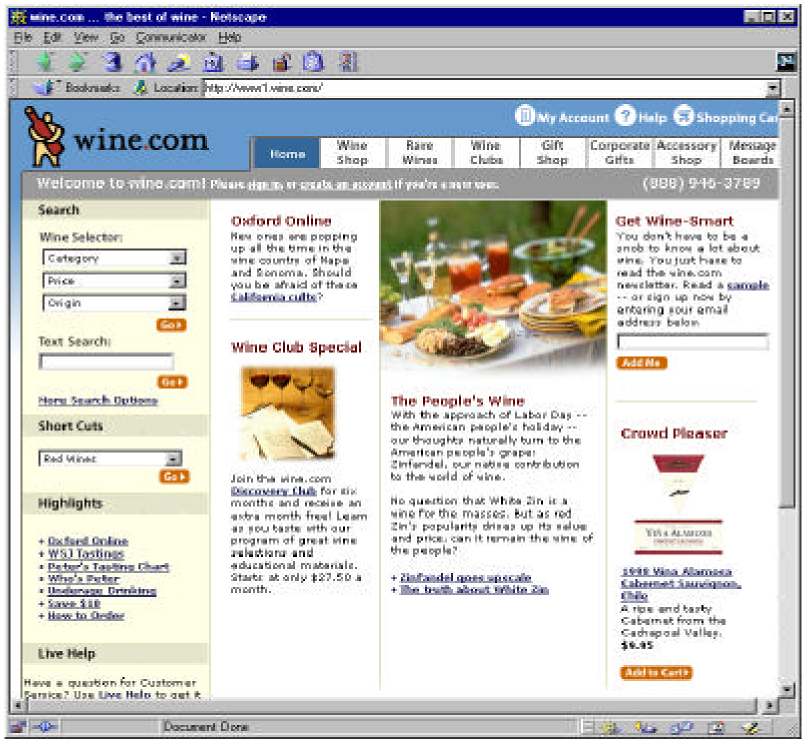
ARRIVAL / DEPARTURE INFO
Get instant arrival and departure information.
Flight number: Yesterday [✓ Today] Tomorrow

DELTA FOR YOU
Wednesday, September 6, 2000
Specials
- Up to 10% off - Offer Ends 9/9/00
News
- Introducing the 767-400, our newest aircraft
- Celebrate SkyTeam's take-off with our Million Miles Sweepstakes
- More breaking news

http://www.delta.com/home/index.jsp

JSP/Servlets in the Real World

- wine.com: the Internet's leading wine retailer



wine.com ... the best of wine - Netscape

File Edit View Go Communicator Help

Bookmarks Location: http://www1.wine.com/

My Account Help Shopping Cart

Home | Wine Shop | Rare Wines | Wine Clubs | Gift Shop | Corporate Gifts | Accessory Shop | Message Boards

Welcome to wine.com! Please sign in, or create an account if you're a new user. (888) 946-3789

Search

Wine Selector: Category, Price, Origin — Go

Text Search: Go

More Search Options

Short Cuts

Red Wines — Go

Highlights

- Oxford Online
- WSJ Tastings
- Peter's Tasting Chart
- Who's Peter
- Underage Drinking
- Save $10
- How to Order

Live Help

Have a question for Customer Service? Use Live Help to get it

Oxford Online

New ones are popping up all the time in the wine country of Napa and Sonoma. Should you be afraid of these California cults?

Wine Club Special

Join the wine.com Discovery Club for six months and receive an extra month free! Learn as you taste with our program of great wine selections and educational materials. Starts at only $27.50 a month.

The People's Wine

With the approach of Labor Day -- the American people's holiday -- our thoughts naturally turn to the American people's grape: Zinfandel, our native contribution to the world of wine.

No question that White Zin is a wine for the masses. But as red Zin's popularity drives up its value and price, can it remain the wine of the people?

- Zinfandel goes upscale
- The truth about White Zin

Get Wine-Smart

You don't have to be a snob to know a lot about wine. You just have to read the wine.com newsletter. Read a sample -- or sign up now by entering your email address below.

Add Me

Crowd Pleaser

1998 Viña Alamosa Cabernet Sauvignon, Chile

A ripe and tasty Cabernet from the Cachapoal Valley.

$9.95

Add to Cart

Document: Done

JSP/Servlets in the Real World

- American Century Investments: more than 70 mutual funds, $90 billion under management, two million investors

09-06-2000

Welcome to American Century®

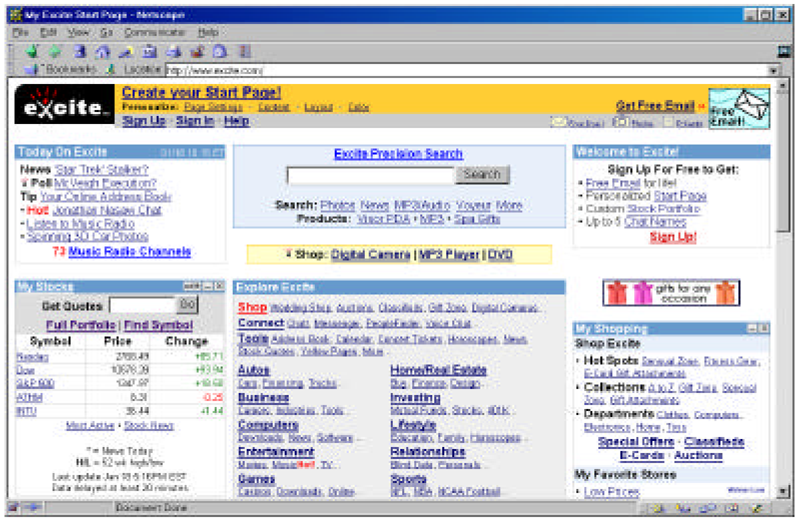
What kind of investor are you?

Highlights

- Target Maturities Trust 2000 to close this year. Learn more.
- Changing jobs or thinking about retirement? Enjoy expert guidance for your 401(k) needs with the American Century Personalized Rollover Service.
- Saving for your child's education soon will be easier thanks to the new LearningQuest.
- Hot Topics: Get insights on how to manage your investments with short features and answers to investor questions.

JSP/Servlets in the Real World

- Excite: one of the top five Internet portals; one of the ten busiest sites on the Web
  - AltaVista also uses servlets/JSP on part of their site



JSP Scripting Elements

Uses of JSP Constructs

Simple Application

↓

Complex Application

- Scripting elements calling servlet code directly
- Scripting elements calling servlet code indirectly (by means of utility classes)
- Beans
- Custom tags
- Servlet/JSP combo (MVC architecture)

Types of Scripting Elements

- Expressions
  - Format: <%= expression %>
  - Evaluated and inserted into the servlet's output, i.e., results in something like out.println(expression)
- Scriptlets
  - Format: <% code %>
  - Inserted verbatim into the servlet's _jspService method (called by service)
- Declarations
  - Format: <%! code %>
  - Inserted verbatim into the body of the servlet class, outside of any existing methods

JSP Expressions

- Format
  - <%= Java Expression %>
- Result
  - Expression evaluated, converted to String, and placed into HTML page at the place it occurred in JSP page
  - That is, expression placed in _jspService inside out.print
- Examples
  - Current time: <%= new java.util.Date() %>
  - Your hostname: <%= request.getRemoteHost() %>
- XML-compatible syntax
  - <jsp:expression>Java Expression</jsp:expression>
  - XML version not supported by Tomcat 3. Until JSP 1.2, servers are not required to support it.

JSP/Servlet Correspondence

- Original JSP

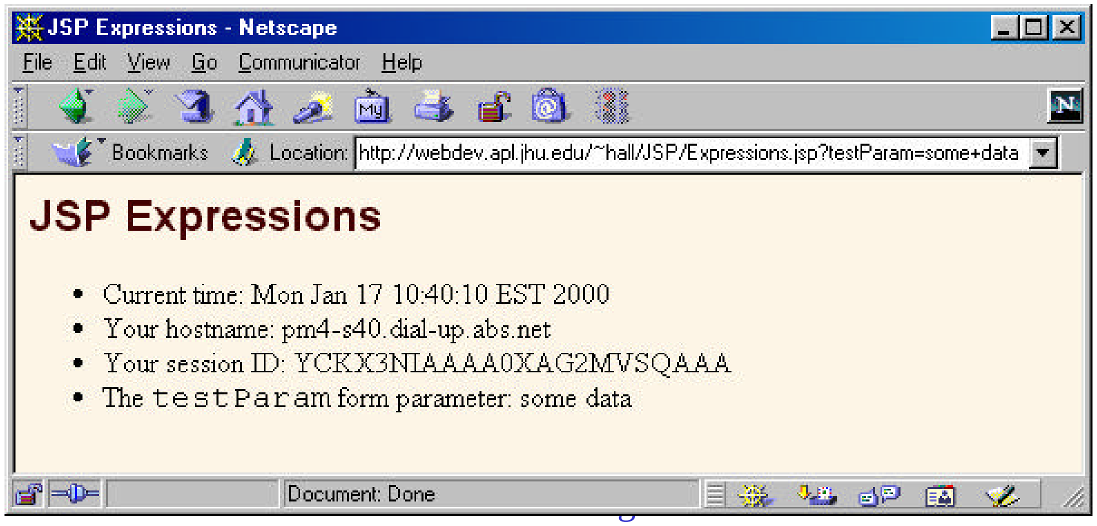
```
<H1>A Random Number</H1>
<%= Math.random() %>
```

- Possible resulting servlet code

```
public void _jspService(HttpServletRequest request,
                        HttpServletResponse response)
    throws ServletException, IOException {
  request.setContentType("text/html");
  HttpSession session = request.getSession(true);
  JspWriter out = response.getWriter();
  out.println("<H1>A Random Number</H1>");
  out.println(Math.random());
  ...
}
```

Example Using JSP Expressions

```
<BODY>
<H2>JSP Expressions</H2>
<UL>
  <LI>Current time: <%= new java.util.Date() %>
  <LI>Your hostname: <%= request.getRemoteHost() %>
  <LI>Your session ID: <%= session.getId() %>
  <LI>The <CODE>testParam</CODE> form parameter:
      <%= request.getParameter("testParam") %>
</UL>
</BODY>
```


JSP Expressions - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://webdev.apl.jhu.edu/~hall/JSP/Expressions.jsp?testParam=some+data
Document: Done

JSP Expressions

- Current time: Mon Jan 17 10:40:10 EST 2000
- Your hostname: pm4-s40.dial-up.abs.net
- Your session ID: YCKX3NIAAAA0XAG2MVSQAAA
- The `testParam` form parameter: some data

Predefined Variables

- request
  - The HttpServletRequest (1st arg to doGet)
- response
  - The HttpServletResponse (2nd arg to doGet)
- session
  - The HttpSession associated with the request (unless disabled with the session attribute of the page directive)
- out
  - The stream (of type JspWriter) used to send output to the client
- application
  - The ServletContext (for sharing data) as obtained via getServletConfig(), getContext().

JSP Scriptlets

- Format
  - <% Java Code %>
- Result
  - Code is inserted verbatim into servlet's _jspService
- Example

  -
    ```
    <%
    String queryData = request.getQueryString();
    out.println("Attached GET data: " + queryData);
    %>
    ```
  - `<% response.setContentType("text/plain"); %>`
- XML-compatible syntax
  - <jsp:scriptlet>Java Code</jsp:scriptlet>

JSP/Servlet Correspondence

- Original JSP

```
<%= foo() %>
<% bar(); %>
```

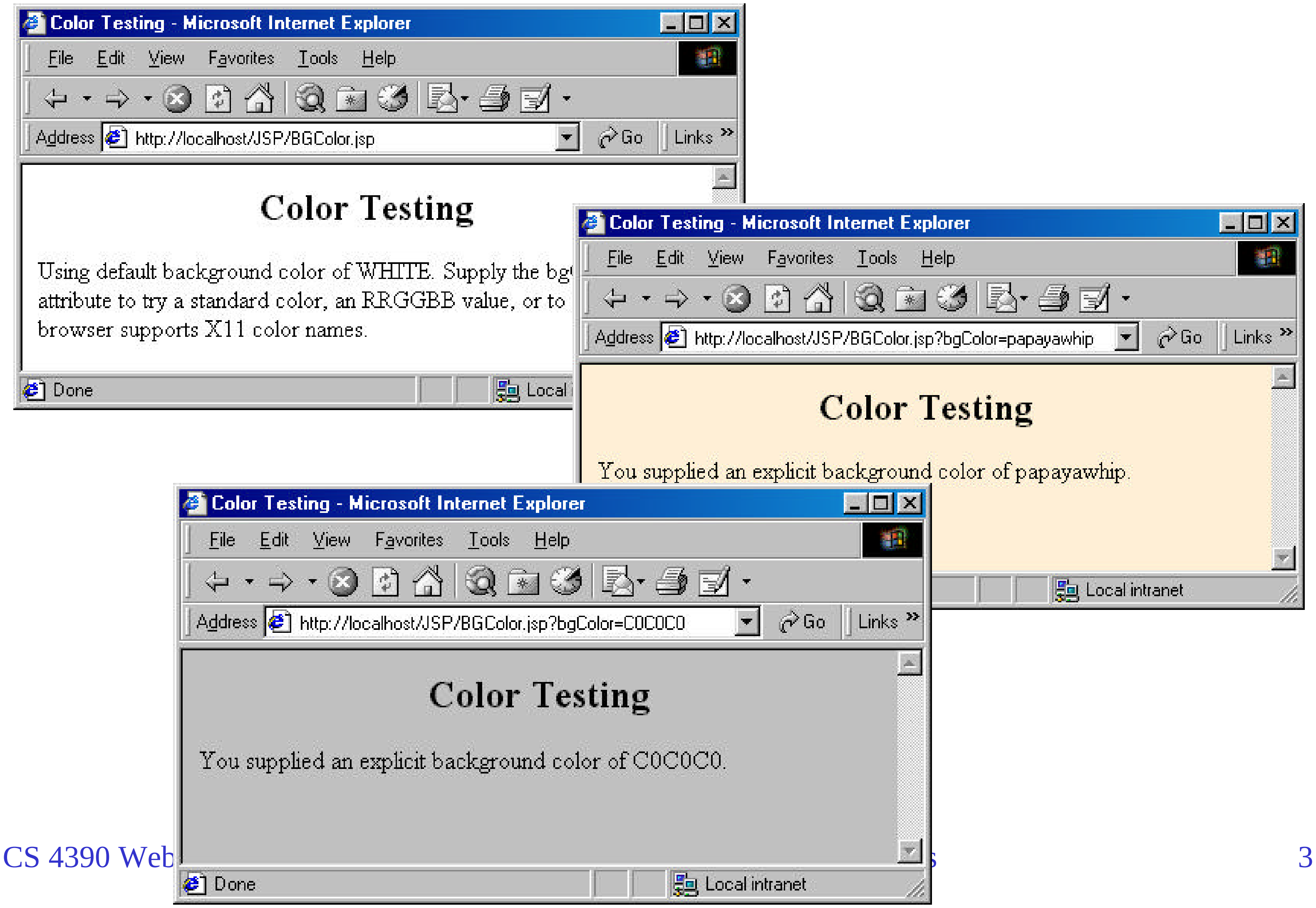
- Possible resulting servlet code

```
public void _jspService(HttpServletRequest request,
                        HttpServletResponse response)
    throws ServletException, IOException {
  request.setContentType("text/html");
  HttpSession session = request.getSession(true);
  JspWriter out = response.getWriter();
  out.println(foo());
  bar();
  ...
}
```

Example Using JSP Scriptlets

```
<!DOCTYPE HTML PUBLIC
           "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML>
<HEAD>
  <TITLE>Color Testing</TITLE>
</HEAD>
<%
String bgColor = request.getParameter("bgColor");
boolean hasExplicitColor;
if (bgColor != null) {
  hasExplicitColor = true;
} else {
  hasExplicitColor = false;
  bgColor = "WHITE";
}
%>
<BODY BGCOLOR="<%= bgColor %>">
```

JSP Scriptlets: Results


Color Testing - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address
Go
Links
Done
Local intranet

http://localhost/JSP/BGColor.jsp

Color Testing

Using default background color of WHITE. Supply the bg
attribute to try a standard color, an RRGGBB value, or to
browser supports X11 color names.

http://localhost/JSP/BGColor.jsp?bgColor=papayawhip

Color Testing

You supplied an explicit background color of papayawhip.

http://localhost/JSP/BGColor.jsp?bgColor=C0C0C0

Color Testing

You supplied an explicit background color of C0C0C0.

JSP Declarations

- Format
  - <%! Java Code %>
- Result
  - Code is inserted verbatim into servlet's class definition, outside of any existing methods
- Examples
  - <%! private int someField = 5; %>
  - <%! private void someMethod(...) {...} %>
- XML-compatible syntax
  - <jsp:declaration>Java Code</jsp:declaration>

JSP/Servlet Correspondence

- Original JSP

```
<H1>Some Heading</H1>
<%!
  private String randomHeading() {
    return("<H2>" + Math.random() +
 "</H2>");
  }
%>
<%= randomHeading() %>
```

JSP/Servlet Correspondence

- Possible resulting servlet code

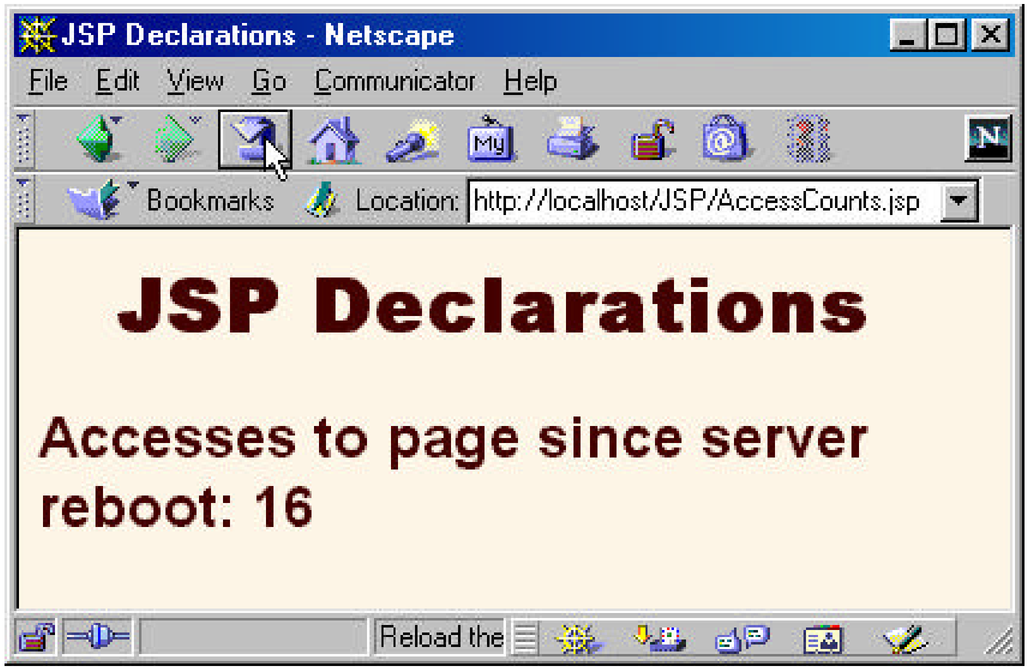
```
public class xxxx implements HttpJspPage {
 private String randomHeading() {
   return("<H2>" + Math.random() + "</H2>");
 }

 public void _jspService(HttpServletRequest request,
                         HttpServletResponse response)
     throws ServletException, IOException {
   request.setContentType("text/html");
   HttpSession session = request.getSession(true);
   JspWriter out = response.getWriter();
   out.println("<H1>Some Heading</H1>");
   out.println(randomHeading());
   ...
 }
```

Example Using JSP Declarations

```
<!DOCTYPE HTML PUBLIC
          "-//W3C//DTD HTML 4.0
  Transitional//EN">
<HTML><HEAD><TITLE>JSP Declarations</TITLE>
<LINK REL=STYLESHEET
      HREF="JSP-Styles.css"
      TYPE="text/css">
</HEAD>
<BODY>
<H1>JSP Declarations</H1>

<%! private int accessCount = 0; %>
<H2>Accesses to page since server reboot:
<%= ++accessCount %></H2>

</BODY>
</HTML>
```

JSP Declarations: Result

- After 15 total visits by an arbitrary number of different clients


JSP Declarations - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/JSP/AccessCounts.jsp
Reload the

JSP Declarations

Accesses to page since server reboot: 16

The JSP page Directive: Structuring Generated Servlets

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

- Format
  - <%@ page import="package.class" %>
  - <%@ page import="package.class1,...,package.classN" %>
- Purpose
  - Generate import statements at top of servlet
- Notes
  - Although JSP pages can be almost anywhere on server, classes used by JSP pages must be in normal servlet dirs
  - For Tomcat, this is install_dir/webapps/ROOT/WEB-INF/classes or …/ROOT/WEB-INF/classes/directoryMatchingPackage
  - For JRun, this is install_dir/servers/default/default-app/WEB-INF/classes or …/WEB-INF/classes/directoryMatchingPackage

Example of import Attribute

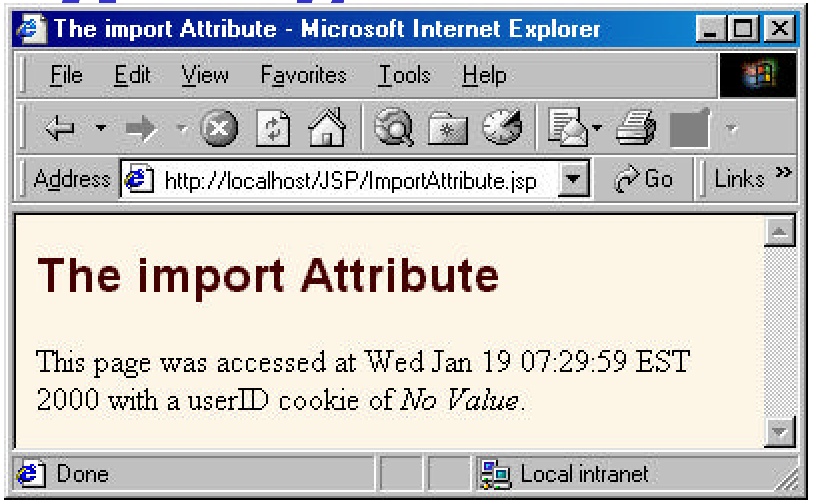
```
...
<BODY>
<H2>The import Attribute</H2>
<%-- JSP page directive --%>
<%@ page import="java.util.*,cwp.*" %>

<%-- JSP Declaration --%>
<%!
private String randomID() {
  int num = (int)(Math.random()*10000000.0);
  return("id" + num);
}

private final String NO_VALUE = "<I>No Value</I>";
%>
```

Example of import Attribute (Continued)

```
<%
Cookie[] cookies = request.getCookies();
String oldID =
  ServletUtilities.getCookieValue(cookies, "userID",
                                  NO_VALUE);
String newID;
if (oldID.equals(NO_VALUE)) {
  newID = randomID();
} else {
  newID = oldID;
}
LongLivedCookie cookie =
  new LongLivedCookie("userID", newID);
response.addCookie(cookie);
%>
<%-- JSP Expressions --%>
This page was accessed at <%= new Date() %> with a userID
cookie of <%= oldID %>.
 </BODY></HTML>
```

Example of import Attribute: Results

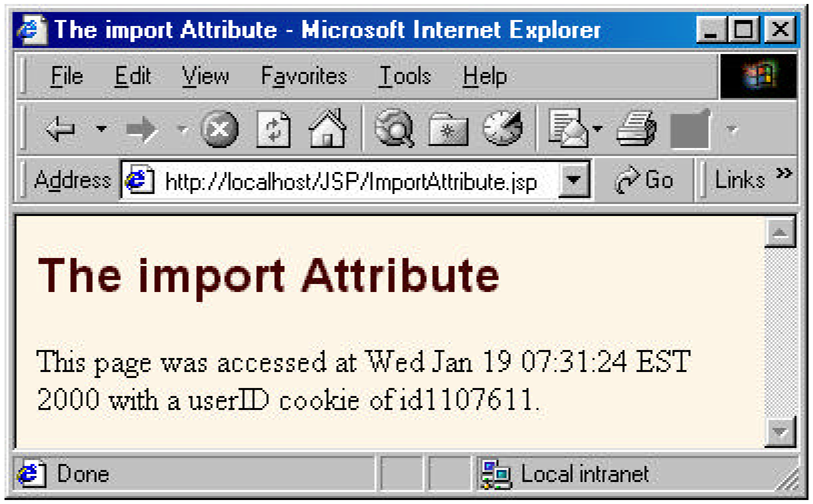
- First access


The import Attribute - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/JSP/ImportAttribute.jsp
Go
Links
Done
Local intranet

The import Attribute

This page was accessed at Wed Jan 19 07:29:59 EST 2000 with a userID cookie of *No Value*.

- Subsequent accesses


The import Attribute - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/JSP/ImportAttribute.jsp
Go
Links
Done
Local intranet

The import Attribute

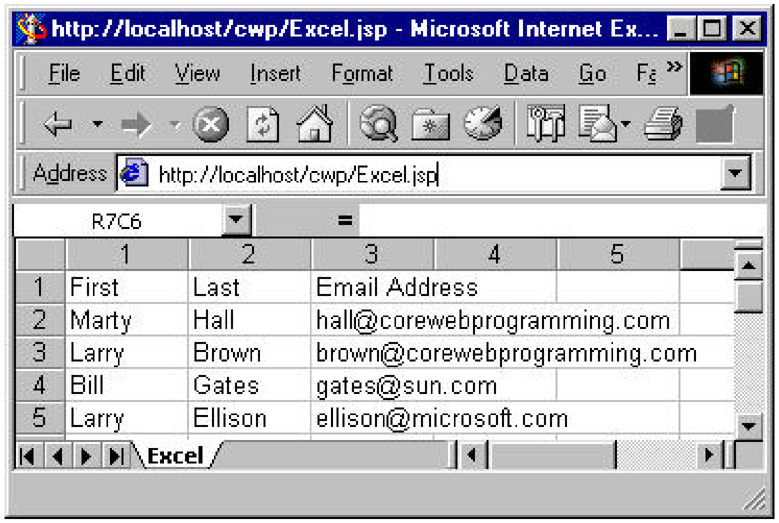
This page was accessed at Wed Jan 19 07:31:24 EST 2000 with a userID cookie of id1107611.

The contentType Attribute

- Format
  - <%@ page contentType="MIME-Type" %>
  - <%@ page contentType="MIME-Type;
    charset=Character-Set"%>
- Purpose
  - Specify the MIME type of the page generated by the servlet that results from the JSP page

Generating Excel Spreadsheets

```
First   Last    Email Address
Marty   Hall    hall@corewebprogramming.com
Larry   Brown   brown@corewebprogramming.com
Bill    Gates   gates@sun.com
Larry   Ellison ellison@microsoft.com
<%@ page contentType="application/vnd.ms-excel" %>
<%-- There are tabs, not spaces, between columns. --%>
```


http://localhost/cwp/Excel.jsp - Microsoft Internet Ex...
File Edit View Insert Format Tools Data Go Fa
Address http://localhost/cwp/Excel.jsp
R7C6
=
Excel

	1	2	3	4	5
1	First	Last	Email Address		
2	Marty	Hall	hall@corewebprogramming.com		
3	Larry	Brown	brown@corewebprogramming.com		
4	Bill	Gates	gates@sun.com		
5	Larry	Ellison	ellison@microsoft.com		

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
    - Instructs servlet to implement SingleThreadModel
- Notes
  - Default is true -- system assumes you have synchronized updates to fields & other shared data
  - Supplying a value of false can degrade performance

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;
%>
```

Is isThreadSafe Needed Here?

- No

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

- Totally safe, better performance in high-traffic environments

Other Attributes of the page Directive

- session
  - Lets you choose not to participate in sessions
- buffer
  - Changes min size of buffer used by JspWriter
- autoflush
  - Requires developer to explicitly flush buffer
- extends
  - Changes parent class of generated servlet
- errorPage
  - Designates a page to handle unplanned errors
- isErrorPage
  - Stipulates that page can be used as error page

Including Files in JSP Documents

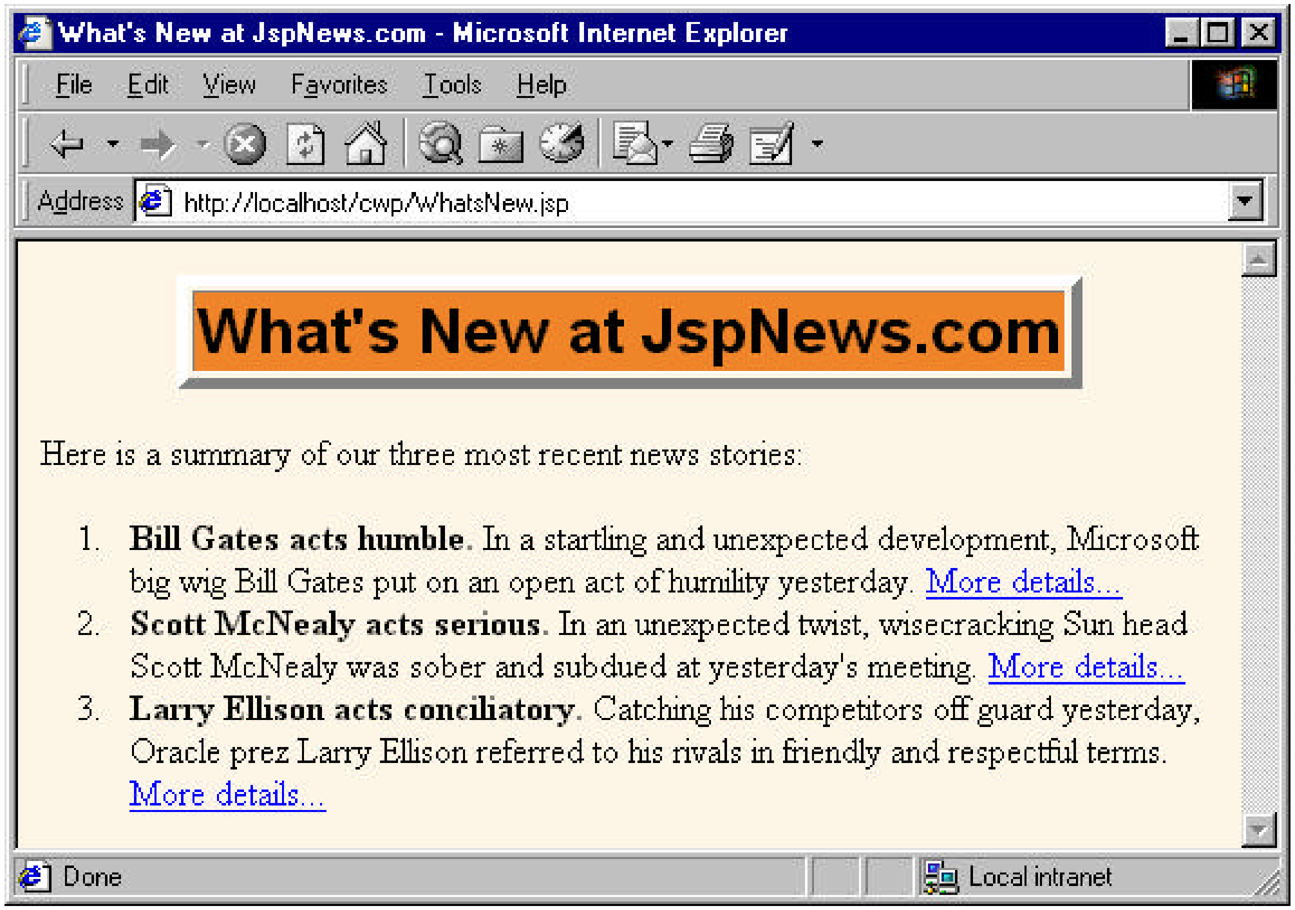
Including Pages at Request Time

- Format
  - <jsp:include page="Relative URL" flush="true" />
- Purpose
  - To reuse JSP, HTML, or plain text content
  - JSP content cannot affect main page:
    only output of included JSP page is used
  - To permit updates to the included content without changing the main JSP page(s)

Including Pages: Example Code

```
...
<BODY>
<TABLE BORDER=5 ALIGN="CENTER">
  <TR><TH CLASS="TITLE">
      What's New at JspNews.com</TABLE>
<P>
Here is a summary of our three most recent news stories:
<OL>
  <LI><jsp:include page="news/Item1.html" flush="true" />
  <LI><jsp:include page="news/Item2.html" flush="true" />
  <LI><jsp:include page="news/Item3.html" flush="true" />
</OL>
</BODY>
</HTML>
```

Including Pages: Example Result


What's New at JspNews.com - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/cwp/WhatsNew.jsp
Done
Local intranet

What's New at JspNews.com

Here is a summary of our three most recent news stories:

1. **Bill Gates acts humble.** In a startling and unexpected development, Microsoft big wig Bill Gates put on an open act of humility yesterday. More details...
2. **Scott McNealy acts serious.** In an unexpected twist, wisecracking Sun head Scott McNealy was sober and subdued at yesterday's meeting. More details...
3. **Larry Ellison acts conciliatory.** Catching his competitors off guard yesterday, Oracle prez Larry Ellison referred to his rivals in friendly and respectful terms. More details...

Including Files at Page Translation Time

- Format
  - <%@ include file="Relative URL" %>
- Purpose
  - To reuse JSP content in multiple pages, where JSP content affects main page
- Notes
  - Servers are not required to detect changes to the included file, and in practice many don't
  - Thus, you need to change the JSP files whenever the included file changes
  - You can use OS-specific mechanisms such as the Unix "touch" command, or
    - <%-- Navbar.jsp modified 3/1/02 --%>
      <%@ include file="Navbar.jsp" %>

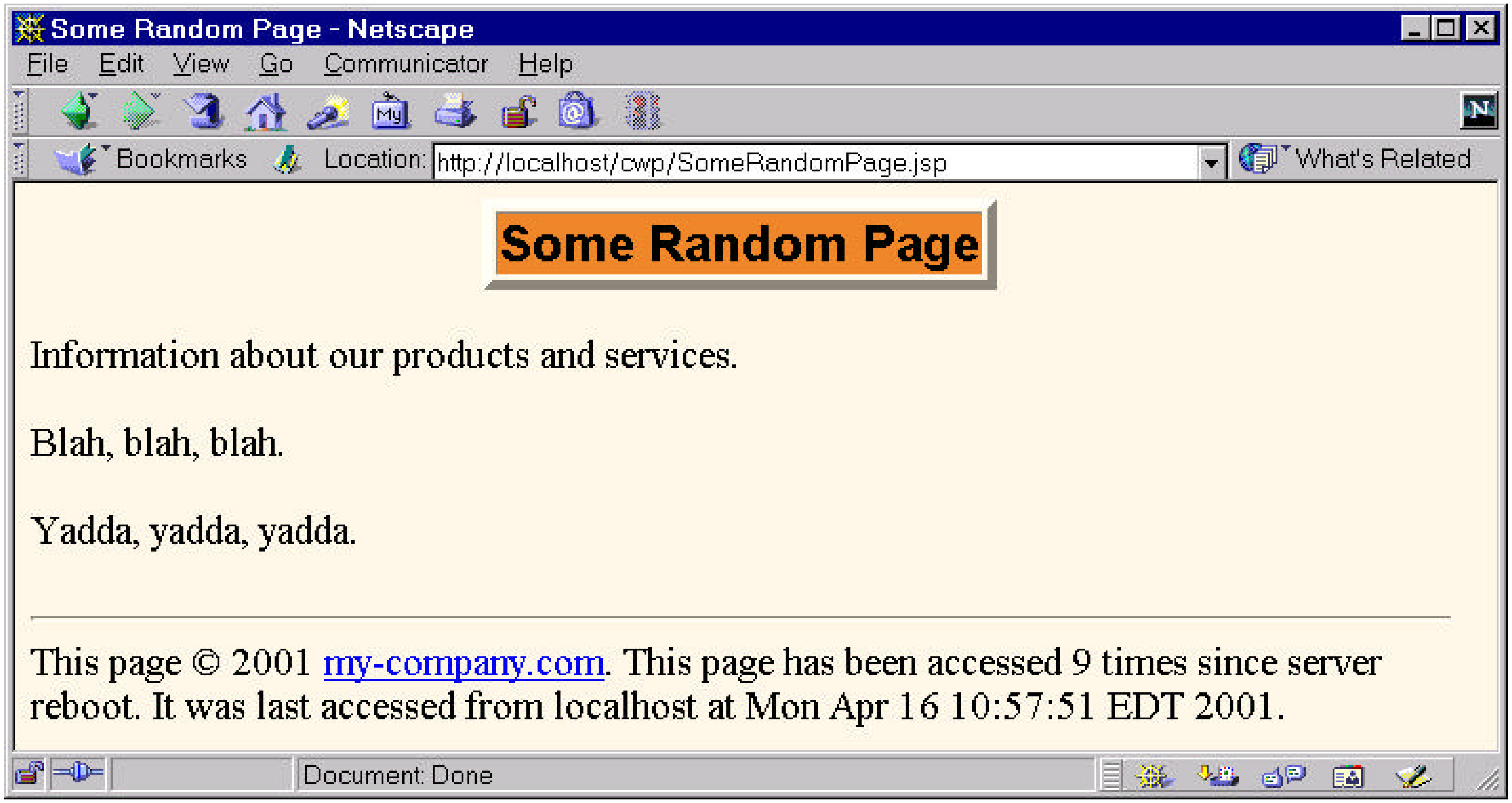
Reusable JSP Content: ContactSection.jsp

```
<%@ page import="java.util.Date" %>
<%-- The following become fields in each servlet that
     results from a JSP page that includes this file. --%>
<%!
private int accessCount = 0;
private Date accessDate = new Date();
private String accessHost = "<I>No previous access</I>";
%>
<P>
<HR>
This page &copy; 2000
<A HREF="http//www.my-company.com/">my-company.com</A>.
This page has been accessed <%= ++accessCount %>
times since server reboot. It was last accessed from
<%= accessHost %> at <%= accessDate %>.

<% accessHost = request.getRemoteHost(); %>
<% accessDate = new Date(); %>
```

Using the JSP Content

```
…
<BODY>
<TABLE BORDER=5 ALIGN="CENTER">
  <TR><TH CLASS="TITLE">
     Some Random Page</TABLE>
<P>
Information about our products and services.
<P>
Blah, blah, blah.
<P>
Yadda, yadda, yadda.
<%@ include file="ContactSection.jsp" %>
</BODY>
</HTML>
```

Using the JSP Content: Result


Some Random Page - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/SomeRandomPage.jsp
What's Related
Document: Done

Some Random Page

Information about our products and services.

Blah, blah, blah.

Yadda, yadda, yadda.

This page © 2001 my-company.com. This page has been accessed 9 times since server reboot. It was last accessed from localhost at Mon Apr 16 10:57:51 EDT 2001.

Using JavaBeans Components with JSP

Uses of JSP Constructs

Simple Application

- Scripting elements calling servlet code directly
- Scripting elements calling servlet code indirectly (by means of utility classes)
- Beans
- Custom tags
- Servlet/JSP combo (MVC architecture)

Complex Application

Background: What Are Beans?

- Classes that follow certain conventions
  - Must have a zero-argument (empty) constructor
  - Should have no public instance variables (fields)
  - Persistent values should be accessed through methods called getXxx and setXxx
    - If class has method getTitle that returns a String, class is said to have a String property named title
    - Boolean properties use isXxx instead of getXxx
- For more on beans, see http://java.sun.com/beans/docs/

Basic Bean Use in JSP

- Format
  - <jsp:useBean id="name" class="package.Class" />
- Purpose
  - Allow instantiation of classes without explicit Java syntax
- Notes
  - Simple interpretation: JSP action
    `<jsp:useBean id="book1" class="cwp.Book" />`
    can be thought of as equivalent to the scriptlet
    `<% cwp.Book book1 = new cwp.Book(); %>`
  - But useBean has two additional features
    - Simplifies setting fields based on incoming request params
    - Makes it easier to share beans

Accessing Bean Properties

- Format
  - <jsp:getProperty name="name" property="property" />
- Purpose
  - Allow access to bean properties (i.e., calls to getXxx methods) without explicit Java programming language code
- Notes
  - **`<jsp:getProperty name="book1" property="title" />`**

    is equivalent to the following JSP expression

    `<%= book1.getTitle() %>`

Setting Bean Properties: Simple Case

- Format
  - <jsp:setProperty name="name"
                              property="property"
                              value="value" />
- Purpose
  - Allow setting of bean properties (i.e., calls to setXxx methods) without explicit Java code
- Notes
  -
```
<jsp:setProperty name="book1"
                 property="title"
                 value="Core Servlets and JSP" />
```
    is equivalent to the following scriptlet
```
<% book1.setTitle("Core Servlets and JSP"); %>
```

Example: StringBean

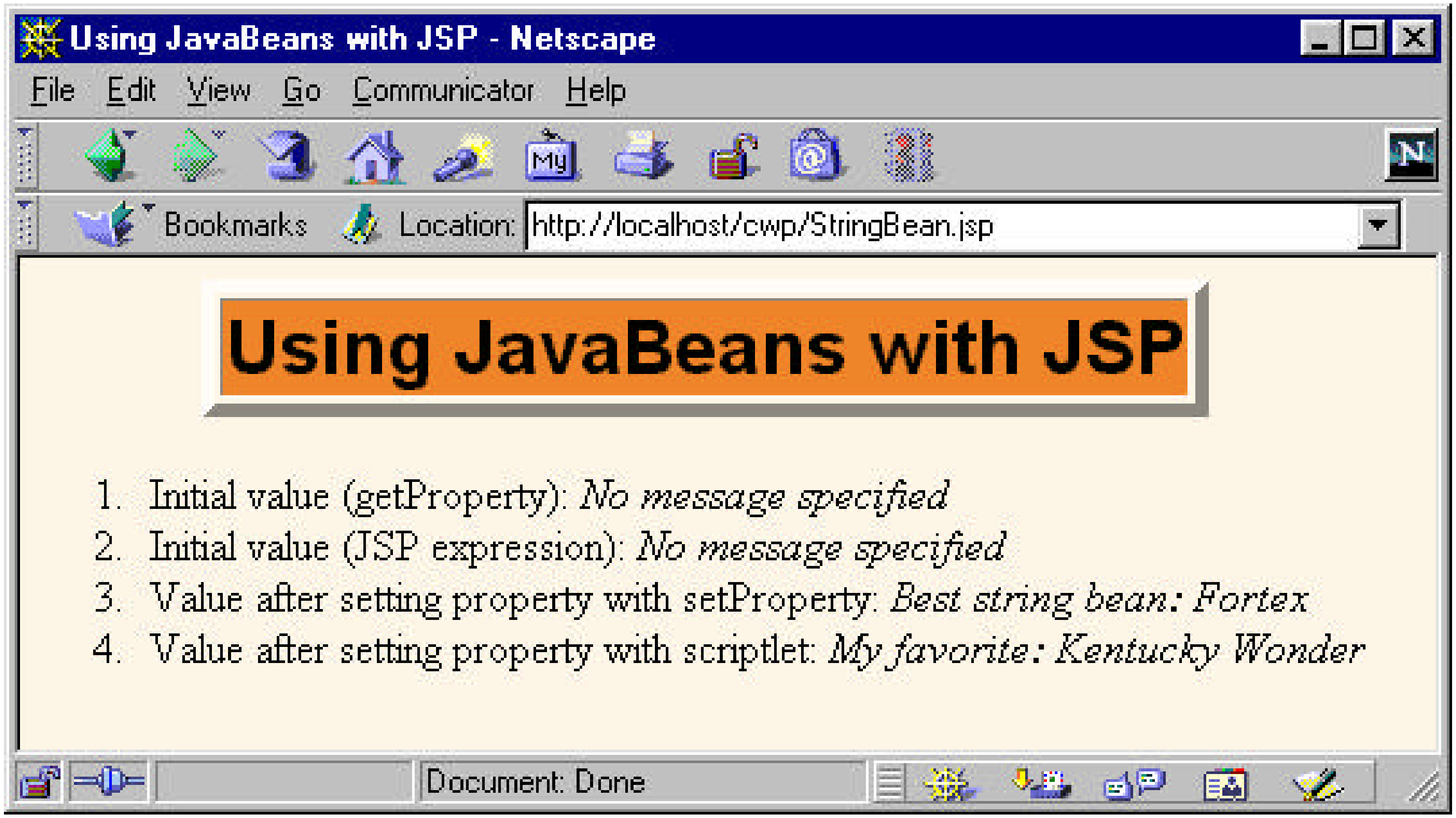
```
package cwp;
public class StringBean {
  private String message = "No message
   specified";
  public String getMessage() {
    return(message);
  }
  public void setMessage(String message) {
    this.message = message;
  }
}
```

- Installed in normal servlet directory

JSP Page That Uses StringBean

```
<jsp:useBean id="stringBean" class="cwp.StringBean" />
<OL>
<LI>Initial value (getProperty):
    <I><jsp:getProperty name="stringBean"
                        property="message" /></I>
<LI>Initial value (JSP expression):
    <I><%= stringBean.getMessage() %></I>
<LI><jsp:setProperty name="stringBean"
                     property="message"
                     value="Best string bean: Fortex" />
    Value after setting property with setProperty:
    <I><jsp:getProperty name="stringBean"
                        property="message" /></I>
<LI>
<% stringBean.setMessage("My favorite: Kentucky Wonder"); %>
    Value after setting property with scriptlet:
    <I><%= stringBean.getMessage() %></I>
</OL>
```

JSP Page That Uses StringBean


Using JavaBeans with JSP - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/StringBean.jsp
Document: Done

Using JavaBeans with JSP

1. Initial value (getProperty): *No message specified*
2. Initial value (JSP expression): *No message specified*
3. Value after setting property with setProperty: *Best string bean: Fortex*
4. Value after setting property with scriptlet: *My favorite: Kentucky Wonder*

Associating Bean Properties with Request (Form) Parameters

- If property is a String, you can do
  - <jsp:setProperty ... value='<%= request.getParameter("...") %>' />
- Scripting expressions let you convert types, but you have to use Java syntax
- The param attribute indicates that:
  - Value should come from specified request param
  - Simple automatic type conversion performed
- Using "*" for the property attribute indicates that:
  - Value should come from request parameter whose name matches property name
  - Simple type conversion should be performed

Setting Bean Properties Case 1: Explicit Conversion & Assignment

```
<!DOCTYPE ...>
...
<jsp:useBean id="entry"
             class="cwp.SaleEntry" />

<%-- getItemID expects a String --%>
<jsp:setProperty
    name="entry"
    property="itemID"
    value='<%=
  request.getParameter("itemID") %>' />
```

Setting Bean Properties Case 1: Explicit Conversion & Assignment

```
<%
int numItemsOrdered = 1;
try {
  numItemsOrdered =

   Integer.parseInt(request.getParameter("numItems"))
   ;
} catch(NumberFormatException nfe) {}
%>
<%-- getNumItems expects an int --%>
<jsp:setProperty
    name="entry"
    property="numItems"
    value="<%= numItemsOrdered %>" />
```

Setting Bean Properties Case 1: Explicit Conversion & Assignment

```
<%
double discountCode = 1.0;
try {
  String discountString =
    request.getParameter("discountCode");
  discountCode =
    Double.valueOf(discountString).doubleValue();
} catch(NumberFormatException nfe) {}
%>
<%-- getDiscountCode expects a double --%>
<jsp:setProperty
    name="entry"
    property="discountCode"
    value="<%= discountCode %>" />
```

Case 2: Associating Individual Properties with Input Parameters

```
<jsp:useBean id="entry"
             class="cwp.SaleEntry" />
<jsp:setProperty
    name="entry"
    property="itemID"
    param="itemID" />
<jsp:setProperty
    name="entry"
    property="numItems"
    param="numItems" />
<jsp:setProperty
    name="entry"
    property="discountCode"
    param="discountCode" />
```

Case 3: Associating All Properties with Input Parameters

```
<jsp:useBean id="entry"
             class="cwp.SaleEntry" />
<jsp:setProperty name="entry"
  property="*" />
```

Sharing Beans

- You can use scope attribute to specify where bean is stored
  - <jsp:useBean id="…" class="…" scope="…" />
  - Bean still also bound to local variable in _jspService
- Lets multiple servlets or JSP pages share data
- Also permits conditional bean creation
  - Create new object only if you can't find existing one

Values of the scope Attribute

- page
  - Default value. Bean object should be placed in the PageContext object for the duration of the current request. Lets methods in same servlet access bean
- application
  - Bean will be stored in ServletContext (available through the application variable or by call to getServletContext()). ServletContext is shared by all servlets in the same Web application (or all servlets on server if no explicit Web applications are defined).

Values of the scope Attribute

- session
  - Bean will be stored in the HttpSession object associated with the current request, where it can be accessed from regular servlet code with getAttribute and setAttribute, as with normal session objects.
- request
  - Bean object should be placed in the ServletRequest object for the duration of the current request, where it is available by means of getAttribute

Conditional Bean Operations

- Bean conditionally created
  - jsp:useBean results in new bean object only if no bean with same id and scope can be found
  - If a bean with same id and scope is found, the preexisting bean is simply bound to variable referenced by id
- Bean properties conditionally set
  - <jsp:useBean ... />
    replaced by
    <jsp:useBean ...>statements</jsp:useBean>
  - The statements (jsp:setProperty elements) are executed only if a new bean is created, not if an existing bean is found

Conditional Bean Creation: AccessCountBean

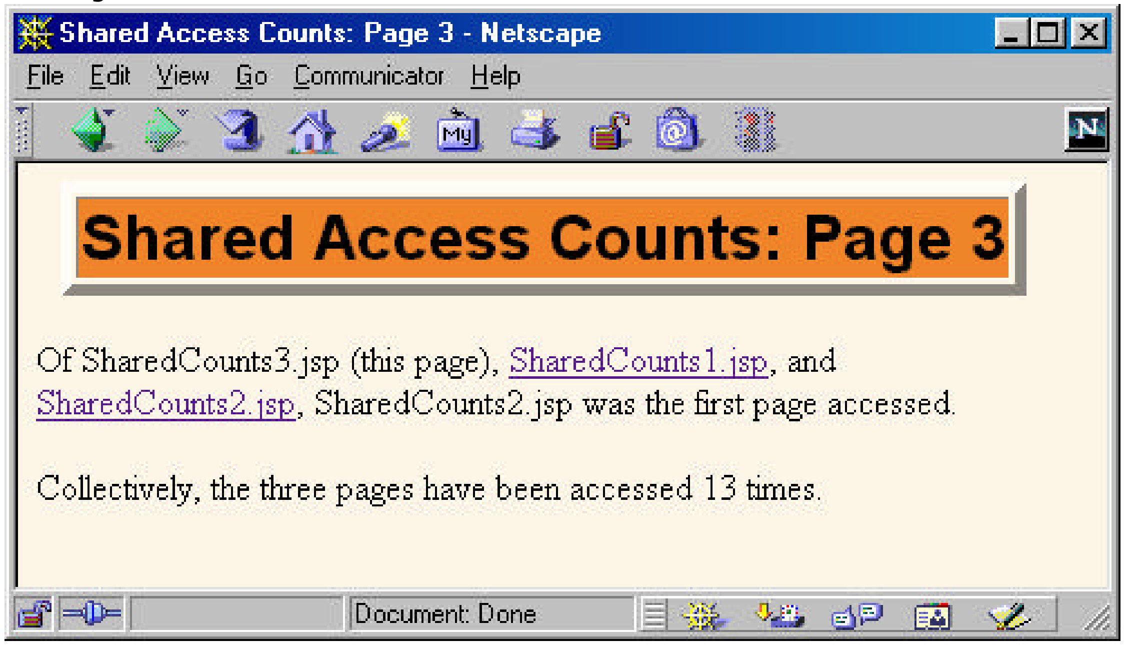
```
public class AccessCountBean {
  private String firstPage;
  private int accessCount = 1;

  public String getFirstPage() {
    return(firstPage);
  }

  public void setFirstPage(String firstPage) {
    this.firstPage = firstPage;
  }

  public int getAccessCount() {
    return(accessCount);
  }

  public void setAccessCountIncrement(int increment) {
    accessCount = accessCount + increment;
  }
}
```

Conditional Bean Creation: SharedCounts1.jsp

```
<jsp:useBean id="counter"
             class="coreservlets.AccessCountBean"
             scope="application">
  <jsp:setProperty name="counter"
                   property="firstPage"
                   value="SharedCounts1.jsp" />
</jsp:useBean>
Of SharedCounts1.jsp (this page),
<A HREF="SharedCounts2.jsp">SharedCounts2.jsp</A>, and
<A HREF="SharedCounts3.jsp">SharedCounts3.jsp</A>,
<jsp:getProperty name="counter" property="firstPage" />
was the first page accessed.
<P>
Collectively, the three pages have been accessed
<jsp:getProperty name="counter" property="accessCount" />
times.
<jsp:setProperty name="counter"
                 property="accessCountIncrement"
                 value="1" />
```

Accessing SharedCounts1, SharedCounts2, SharedCounts3

- SharedCounts2.jsp was accessed first.
- Pages have been accessed twelve previous times by an arbitrary number of clients


Shared Access Counts: Page 3 - Netscape
File Edit View Go Communicator Help
Document: Done

Shared Access Counts: Page 3

Of SharedCounts3.jsp (this page), SharedCounts1.jsp, and SharedCounts2.jsp, SharedCounts2.jsp was the first page accessed.

Collectively, the three pages have been accessed 13 times.

Creating Custom JSP Tag Libraries

Uses of JSP Constructs

Simple Application

↓

Complex Application

- Scripting elements calling servlet code directly
- Scripting elements calling servlet code indirectly (by means of utility classes)
- Beans
- Custom tags
- Servlet/JSP combo (MVC architecture)

Components That Make Up a Tag Library

- The Tag Handler Class
  - Must implement javax.servlet.jsp.tagext.Tag
  - Usually extends TagSupport or BodyTagSupport
  - Goes in same directories as servlet class files and beans
- The Tag Library Descriptor File
  - XML file describing tag name, attributes, and implementing tag handler class
  - Goes with JSP file or at arbitrary URL
- The JSP File
  - Imports a tag library (referencing descriptor file)
  - Defines tag prefix
  - Uses tags

Defining a Simple Tag Handler Class

- Extend the TagSupport class
- Import needed packages
  - import javax.servlet.jsp.*;
    import javax.servlet.jsp.tagext.*;
    import java.io.*;
- Override doStartTag
  - Obtain the JspWriter by means of pageContext.getOut()
  - Use the JspWriter to generate JSP content
  - Return SKIP_BODY
  - Translated into servlet code at page-translation time
  - Code gets called at request time

Defining a Simple Tag Handler Class: Example

```
package cwp.tags;
import javax.servlet.jsp.*;
import javax.servlet.jsp.tagext.*;
import java.io.*;
import java.math.*;
import cwp.*;

public class SimplePrimeTag extends TagSupport {
  protected int len = 50;

  public int doStartTag() {
    try {
      JspWriter out = pageContext.getOut();
      BigInteger prime =
        Primes.nextPrime(Primes.random(len));
      out.print(prime);
    } catch(IOException ioe) {
      System.out.println("Error generating prime: " + ioe);
    }
    return(SKIP_BODY);
  }}
```

Defining a Simple Tag Library Descriptor

- Start with XML header and DOCTYPE
- Top-level element is taglib
- Each tag defined by tag element containing:
  - **name**, whose body defines the base tag name. In this case, I use <name>simplePrime</name>
  - **tagclass**, which gives the fully qualified class name of the tag handler. In this case, I use <tagclass>cwp.tags.SimplePrimeTag</tagclass>
  - **bodycontent**, which gives hints to development environments. Optional.
  - **info**, which gives a short description. Here, I use <info>Outputs a random 50-digit prime.</info>

TLD File for SimplePrimeTag

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE taglib ...>
<taglib>
  <tlibversion>1.0</tlibversion>
  <jspversion>1.1</jspversion>
  <shortname>cwp</shortname>
  <info>
    A tag library from Core Web Programming 2nd
   Edition,
    http://www.corewebprogramming.com/.
  </info>
  <tag>
    <name>simplePrime</name>
    <tagclass>cwp.tags.SimplePrimeTag</tagclass>
    <info>Outputs a random 50-digit prime.</info>
  </tag>
</taglib>
```

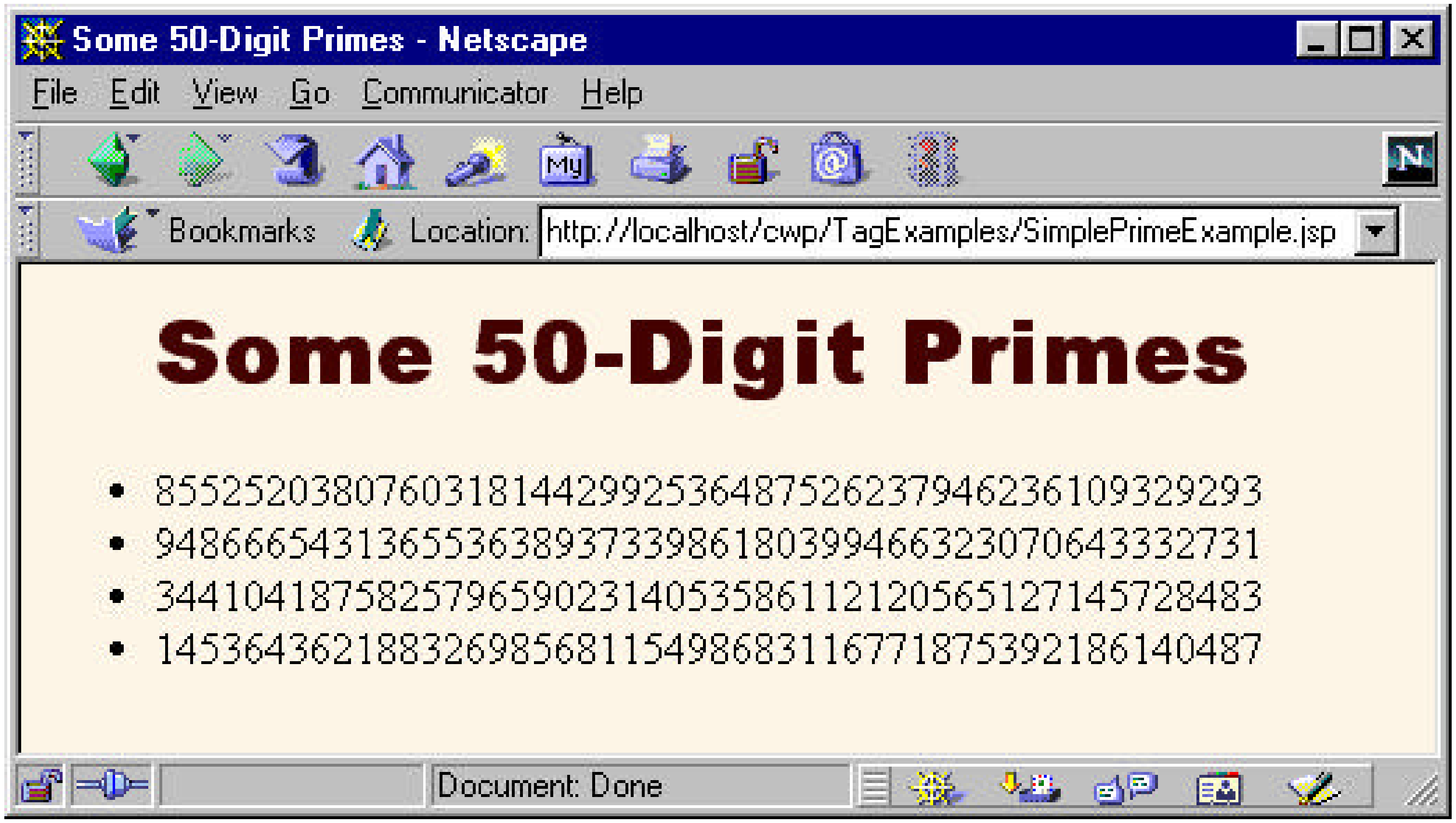
Accessing Custom Tags From JSP Files

- Import the tag library
  - Specify location of TLD file
    <%@ taglib uri= "cwp-taglib.tld" prefix= "cwp" %>
  - Define a tag prefix (namespace)
    <%@ taglib uri="cwp-taglib.tld" prefix= "cwp" %>
- Use the tags
  - <prefix:tagName />
    - Tag name comes from TLD file
    - Prefix comes from taglib directive
  - E.g., <cwp:simplePrime />

Using simplePrime Tag

```
…
<H1>Some 50-Digit Primes</H1>
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
<UL>
  <LI><cwp:simplePrime />
  <LI><cwp:simplePrime />
  <LI><cwp:simplePrime />
  <LI><cwp:simplePrime />
</UL>
```

Using simplePrime Tag: Result


Some 50-Digit Primes - Netscape
File Edit View Go Communicator Help
Bookmarks
Location:
http://localhost/cwp/TagExamples/SimplePrimeExample.jsp
Document: Done

Some 50-Digit Primes

- 85525203807603181442992536487526237946236109329293
- 94866543136553638937339861803994663230706433332731
- 34410418758257965902314053586112120565127145728483
- 14536436218832698568115498683116771875392186140487

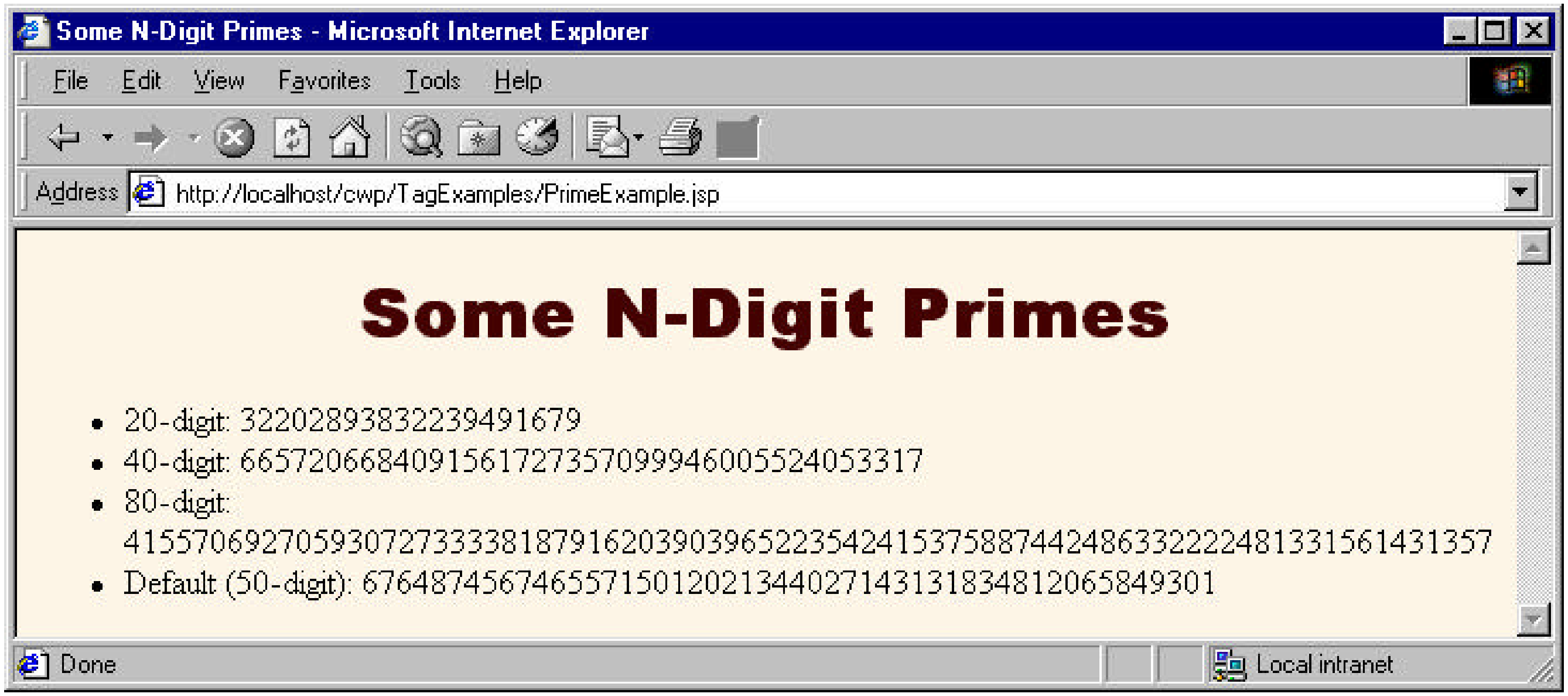
Intermediate and Advanced Custom Tags

- Tags with attributes
- Tags that include their body content
- Tags that optionally include their body
- Tags that manipulate their body
- Tags that manipulating their body multiple times (looping tags)
- Nested tags

Tags with Attributes: prime Tag

```
…
<H1>Some N-Digit Primes</H1>
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
<UL>
  <LI>20-digit: <cwp:prime length="20" />
  <LI>40-digit: <cwp:prime length="40" />
  <LI>80-digit: <cwp:prime length="80" />
  <LI>Default (50-digit): <cwp:prime />
</UL>
```

Using prime Tag: Result


Some N-Digit Primes - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/cwp/TagExamples/PrimeExample.jsp
Done
Local intranet

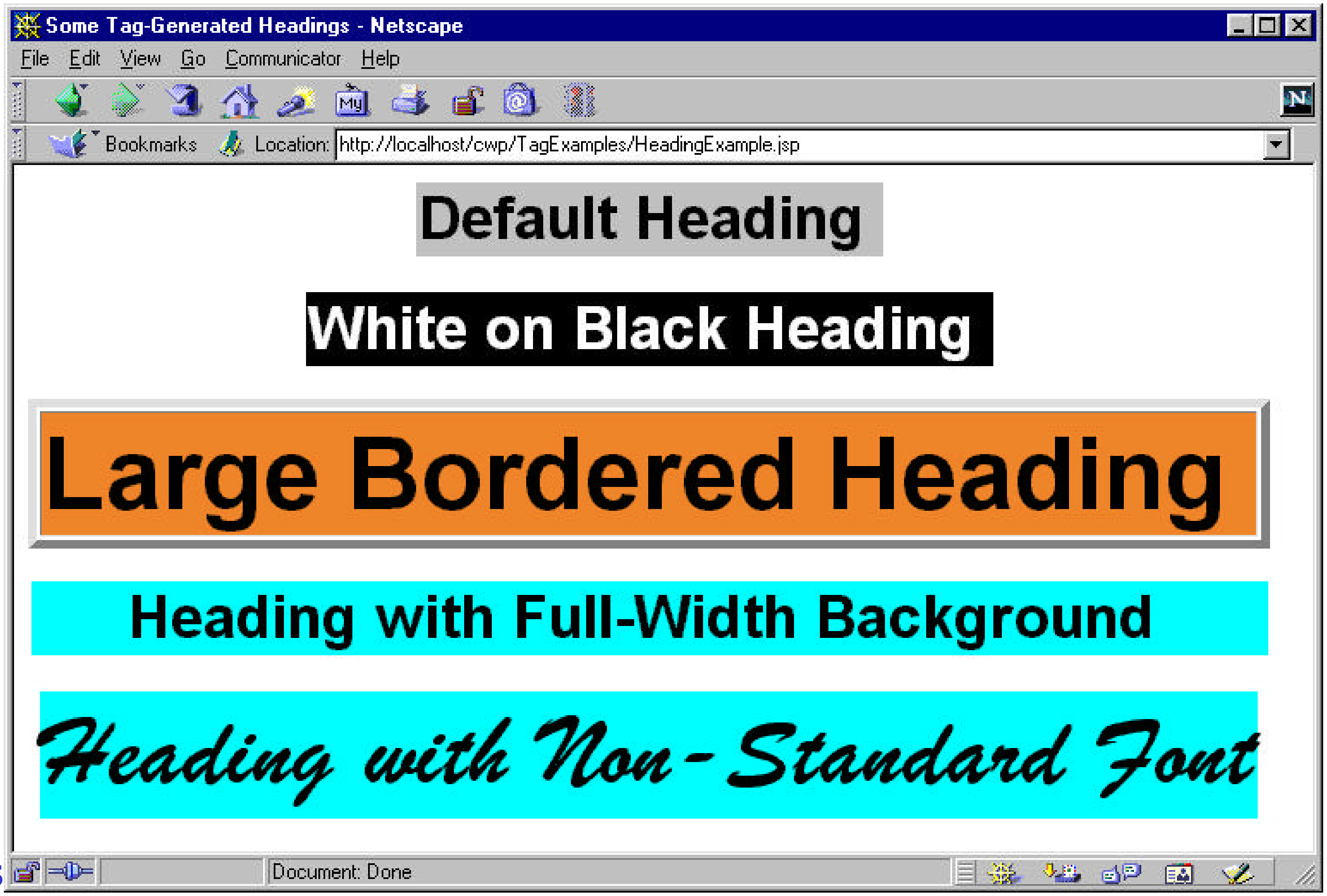
Some N-Digit Primes

- 20-digit: 32202893832239491679
- 40-digit: 6657206684091561727357099946005524053317
- 80-digit: 41557069270593072733338187916203903965223542415375887442486332222481331561431357
- Default (50-digit): 67648745674655715012021344027143131834812065849301

Including Body Content: heading Tag

```
…
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
<cwp:heading bgColor="#C0C0C0">
Default Heading
</cwp:heading>
<P>
<cwp:heading bgColor="BLACK" color="WHITE">
White on Black Heading
</cwp:heading>
<P>
<cwp:heading bgColor="#EF8429"
             fontSize="60" border="5">
Large Bordered Heading
</cwp:heading>
…
```

Using heading Tag: Result



Some Tag-Generated Headings - Netscape

File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/TagExamples/HeadingExample.jsp
Document: Done

Default Heading

White on Black Heading

Large Bordered Heading

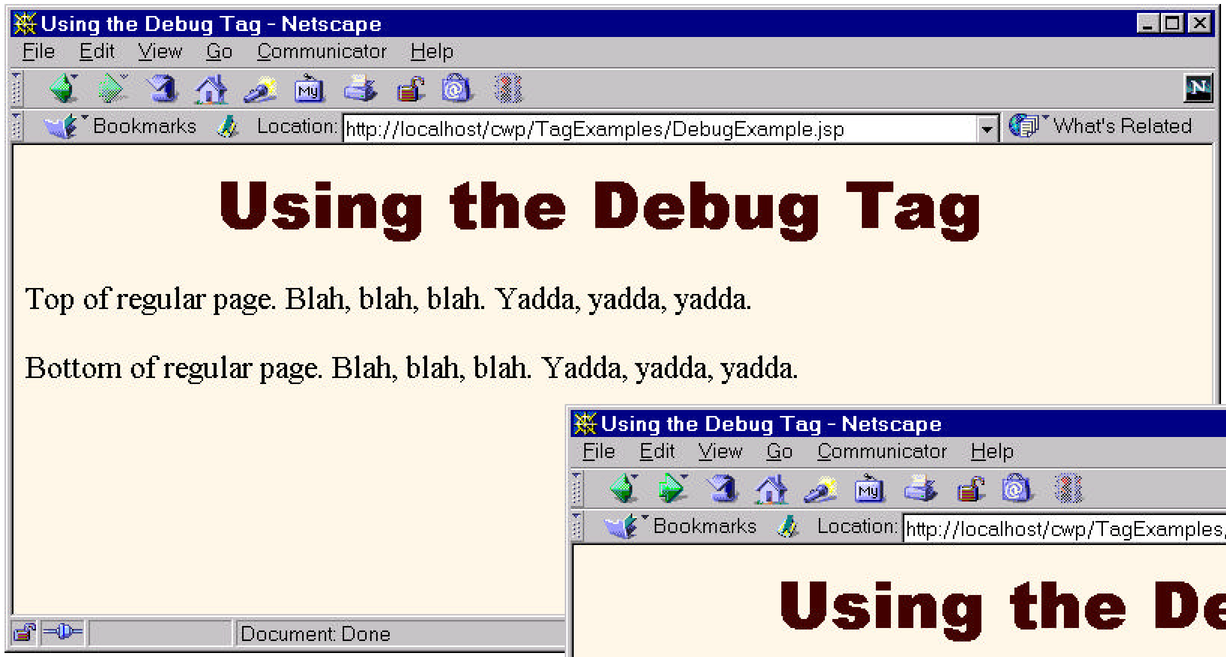
Heading with Full-Width Background

Heading with Non-Standard Font

Optionally Including Tag Body: debug Tag

```
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
Top of regular page. Blah, blah, blah.
Yadda, yadda, yadda.
<P>
<cwp:debug>
<B>Debug:</B>
<UL>
  <LI>Current time: <%= new java.util.Date() %>
  <LI>Requesting hostname: <%= request.getRemoteHost()%>
  <LI>Session ID: <%= session.getId() %>
</UL>
</cwp:debug>
<P>
Bottom of regular page. Blah, blah, blah.
 Yadda, yadda, yadda.
```

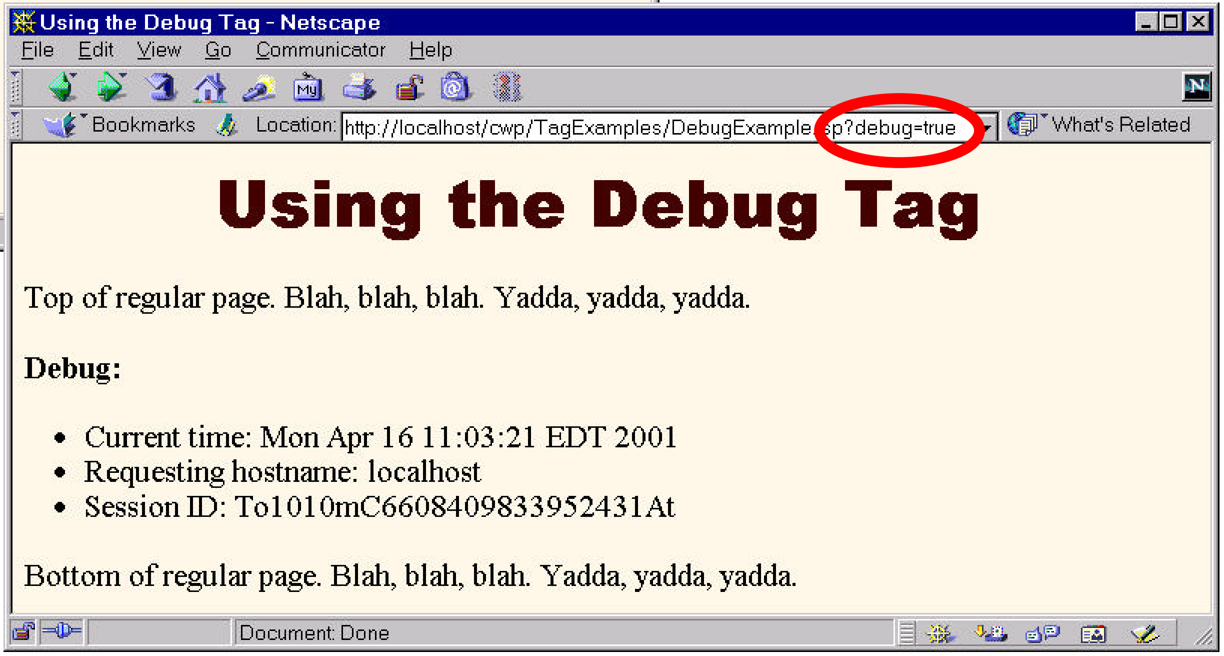
Using debug Tag: Results


Using the Debug Tag - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/TagExamples/DebugExample.jsp
What's Related
Document: Done

Using the Debug Tag

Top of regular page. Blah, blah, blah. Yadda, yadda, yadda.

Bottom of regular page. Blah, blah, blah. Yadda, yadda, yadda.


Using the Debug Tag - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/TagExamples/DebugExample.jsp?debug=true
What's Related
Document: Done

Using the Debug Tag

Top of regular page. Blah, blah, blah. Yadda, yadda, yadda.

Debug:

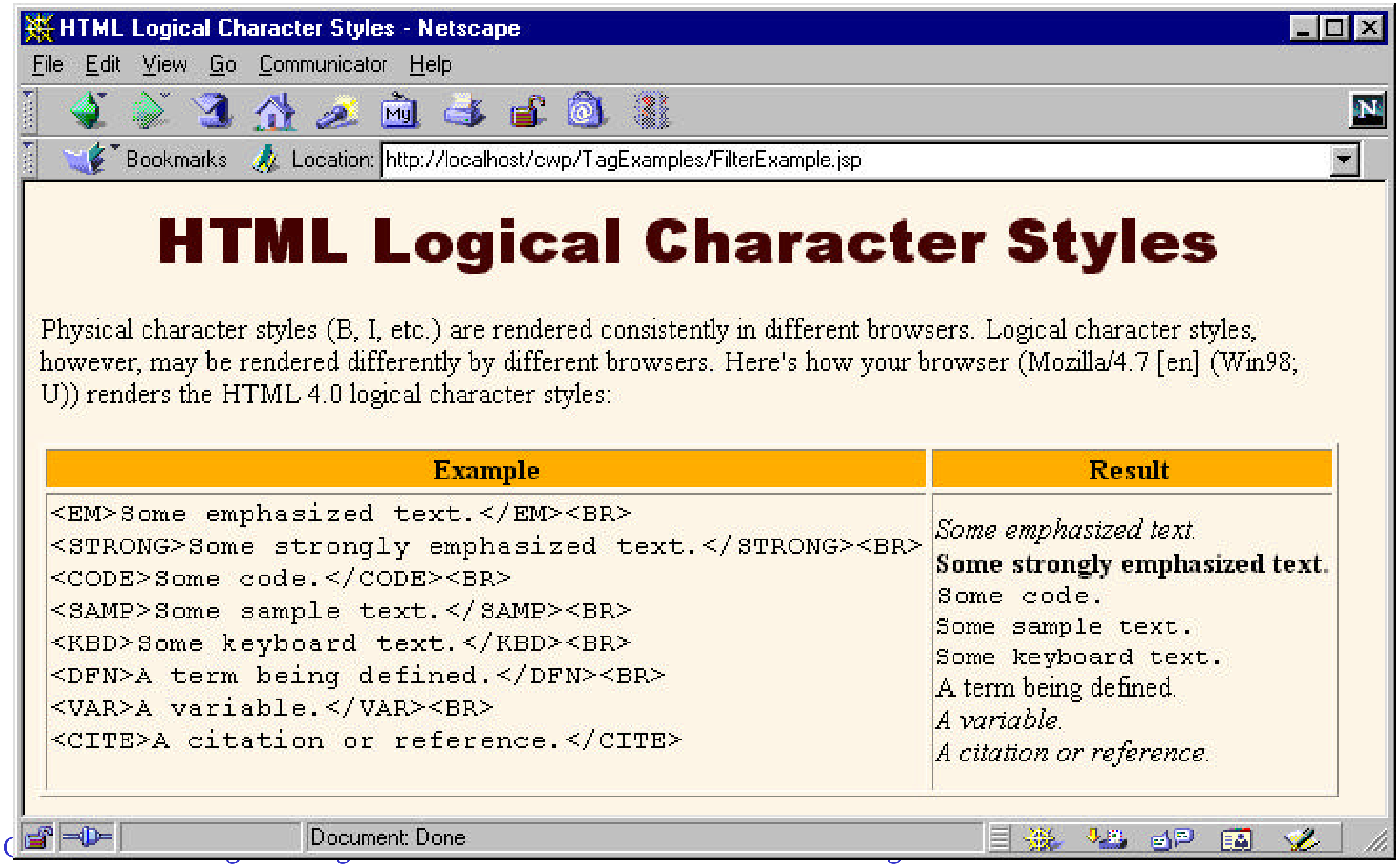
- Current time: Mon Apr 16 11:03:21 EDT 2001
- Requesting hostname: localhost
- Session ID: To1010mC6608409833952431At

Bottom of regular page. Blah, blah, blah. Yadda, yadda, yadda.

Manipulating Tag Body: the filter Tag

```
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
<TABLE BORDER=1 ALIGN="CENTER">
<TR CLASS="COLORED"><TH>Example<TH>Result
<TR>
<TD><PRE><cwp:filter>
<EM>Some emphasized text.</EM><BR>
<STRONG>Some strongly emphasized text.</STRONG><BR>
<CODE>Some code.</CODE><BR>
…
</cwp:filter></PRE>
<TD>
<EM>Some emphasized text.</EM><BR>
<STRONG>Some strongly emphasized text.</STRONG><BR>
<CODE>Some code.</CODE><BR>
…
</TABLE>
```

Using the filter Tag: Results


HTML Logical Character Styles - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/TagExamples/FilterExample.jsp
Document: Done

HTML Logical Character Styles

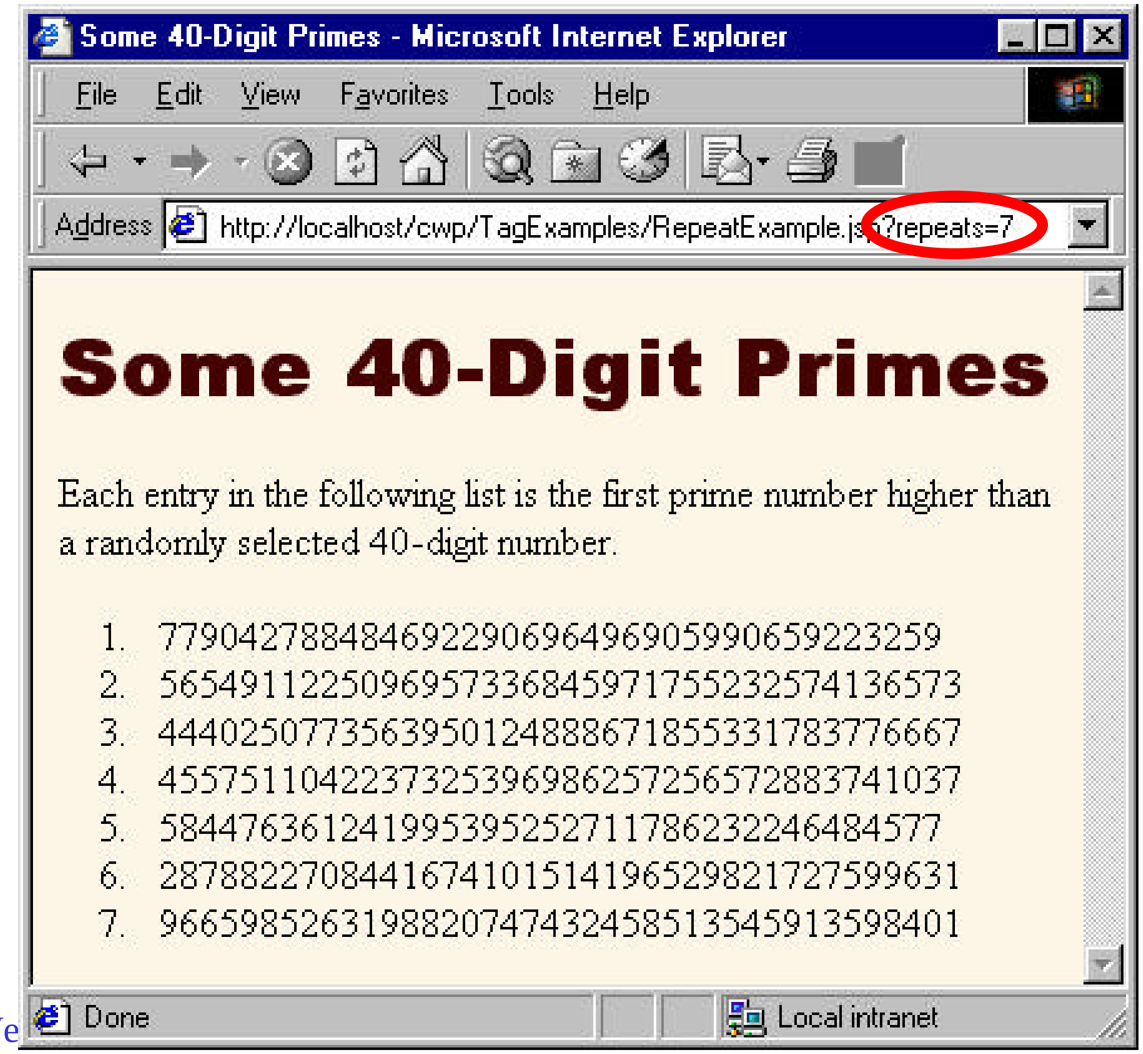
Physical character styles (B, I, etc.) are rendered consistently in different browsers. Logical character styles, however, may be rendered differently by different browsers. Here's how your browser (Mozilla/4.7 [en] (Win98; U)) renders the HTML 4.0 logical character styles:

Example	Result
`<EM>Some emphasized text.</EM><BR>`	*Some emphasized text.*
`<STRONG>Some strongly emphasized text.</STRONG><BR>`	**Some strongly emphasized text.**
`<CODE>Some code.</CODE><BR>`	`Some code.`
`<SAMP>Some sample text.</SAMP><BR>`	`Some sample text.`
`<KBD>Some keyboard text.</KBD><BR>`	`Some keyboard text.`
`<DFN>A term being defined.</DFN><BR>`	A term being defined.
`<VAR>A variable.</VAR><BR>`	*A variable.*
`<CITE>A citation or reference.</CITE>`	*A citation or reference.*

Manipulating the Body Multiple Times: the repeat Tag

```
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
<OL>
<!-- Repeats N times. A null reps value
     means repeat once. -->
<cwp:repeat
  reps='<%= request.getParameter("repeats") %>'>
  <LI><cwp:prime length="40" />
</cwp:repeat>
</OL>
```

Using the repeat Tag: Results


Some 40-Digit Primes - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/cwp/TagExamples/RepeatExample.jsp?repeats=7
Done
Local intranet

Some 40-Digit Primes

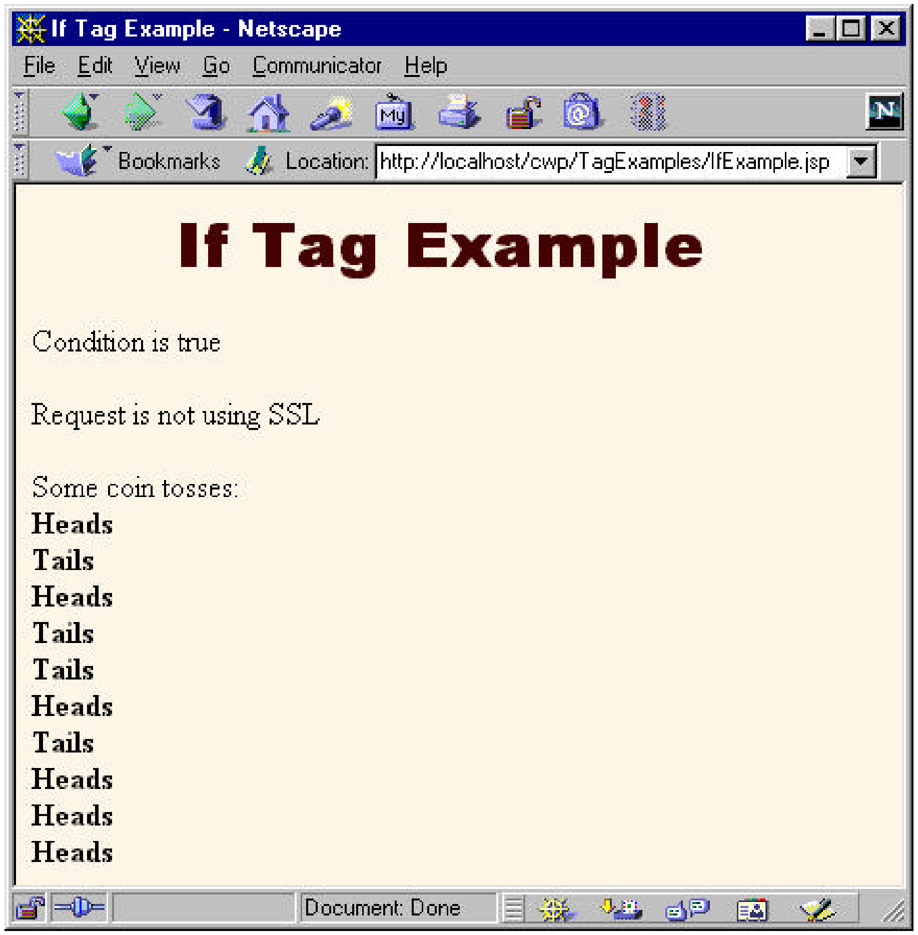
Each entry in the following list is the first prime number higher than a randomly selected 40-digit number.

1. 7790427884846922906964969059906592232599
2. 5654911225096957336845971755232574136573
3. 4440250773563950124888671855331783776667
4. 4557511042237325396986257256572883741037
5. 5844763612419953952527117862322464845777
6. 2878822708441674101514196529821727599631
7. 9665985263198820747432458513545913598401

Nested Tags: the if Tag

```
<%@ taglib uri="cwp-taglib.tld" prefix="cwp" %>
<cwp:if>
  <cwp:condition>true</cwp:condition>
  <cwp:then>Condition is true</cwp:then>
  <cwp:else>Condition is false</cwp:else>
</cwp:if>
…
Some coin tosses:<BR>
<cwp:repeat reps="10">
  <cwp:if>
    <cwp:condition>
      <%= Math.random() < 0.5 %>
    </cwp:condition>
    <cwp:then><B>Heads</B><BR></cwp:then>
    <cwp:else><B>Tails</B><BR></cwp:else>
  </cwp:if>
</cwp:repeat>
```

Using the if Tag: Results


If Tag Example - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://localhost/cwp/TagExamples/IfExample.jsp
Document: Done

If Tag Example

Condition is true

Request is not using SSL

Some coin tosses:
Heads
Tails
Heads
Tails
Tails
Heads
Tails
Heads
Heads
Heads

Integrating Servlets and JSP

The MVC Architecture

Uses of JSP Constructs

Simple Application

Complex Application

- Scripting elements calling servlet code directly
- Scripting elements calling servlet code indirectly (by means of utility classes)
- Beans
- Custom tags
- Servlet/JSP combo (MVC architecture)

Why Combine Servlets & JSP?

- Typical picture: use JSP to make it easier to develop and maintain the HTML content
  - For simple dynamic code, call servlet code from scripting expressions
  - For moderately complex cases, use custom classes called from scripting expressions
  - For more complicated cases, use beans and custom tags
- But, that's not enough
  - For complex processing, JSP is awkward
  - Despite the convenience of separate classes, beans, and custom tags, *the assumption behind JSP is that a single page gives a single basic look*

Architecture

- Approach
  - Original request is answered by a servlet
  - Servlet processes request data, does database lookup, accesses business logic, etc.
  - Results are placed in beans
  - Request is forwarded to a JSP page to format result
  - Different JSP pages can be used to handle different types of presentation
- Terminology
  - Often called the “Model View Controller” architecture or “Model 2” approach to JSP
  - Formalized further with Apache “Struts” framework
    - See http://jakarta.apache.org/struts/

Dispatching Requests

- First, call the getRequestDispatcher method of ServletContext
  - Supply a URL relative to the Web application root
  - Example
    - String url = "/presentations/presentation1.jsp";
      RequestDispatcher dispatcher =
        getServletContext().getRequestDispatcher(url);
- Second
  - Call forward to completely transfer control
    to destination page. See following example
  - Call include to insert output of destination page
    and then continue on. See book.

Forwarding Requests: Example Code

```
public void doGet(HttpServletRequest request,
                  HttpServletResponse response)
    throws ServletException, IOException {
  String operation = request.getParameter("operation");
  if (operation == null) {
    operation = "unknown";
  }
  if (operation.equals("operation1")) {
    gotoPage("/operations/presentation1.jsp",
             request, response);
  } else if (operation.equals("operation2")) {
    gotoPage("/operations/presentation2.jsp",
             request, response);
  } else {
    gotoPage("/operations/unknownRequestHandler.jsp",
             request, response);
  }
}
```

Forwarding Requests: Example Code (Continued)

```
private void gotoPage(String address,
                      HttpServletRequest request,
                      HttpServletResponse response)
    throws ServletException, IOException {
  RequestDispatcher dispatcher =

   getServletContext().getRequestDispatcher(address);
  dispatcher.forward(request, response);
}
```

Reminder: JSP useBean Scope Alternatives

- request
  - <jsp:useBean id="..." class="..." scope="request" />
- session
  - <jsp:useBean id="..." class="..." scope="session" />
- application
  - <jsp:useBean id="..." class="..." scope="application" />
- page
  - <jsp:useBean id="..." class="..." scope="page" />
    or just
    <jsp:useBean id="..." class="..." />
  - This scope is not used in MVC architecture

Storing Data for Later Use: The Servlet Request

- Purpose
  - Storing data that servlet looked up and that JSP page will use only in this request.
- Servlet syntax to store data

```
SomeClass value = new SomeClass(…);
request.setAttribute("key", value);
// Use RequestDispatcher to forward to JSP page
```

- JSP syntax to retrieve data

```
<jsp:useBean
    id="key"
    class="SomeClass"
    scope="request" />
```

Storing Data for Later Use: The Session Object

- Purpose
  - Storing data that servlet looked up and that JSP page will use in this request and in later requests from same client.
- Servlet syntax to store data

```
SomeClass value = new SomeClass(…);
HttpSession session = request.getSession(true);
session.setAttribute("key", value);
// Use RequestDispatcher to forward to JSP page
```

- JSP syntax to retrieve data

```
<jsp:useBean
    id="key"
    class="SomeClass"
    scope="session" />
```

Storing Data for Later Use: The Servlet Context

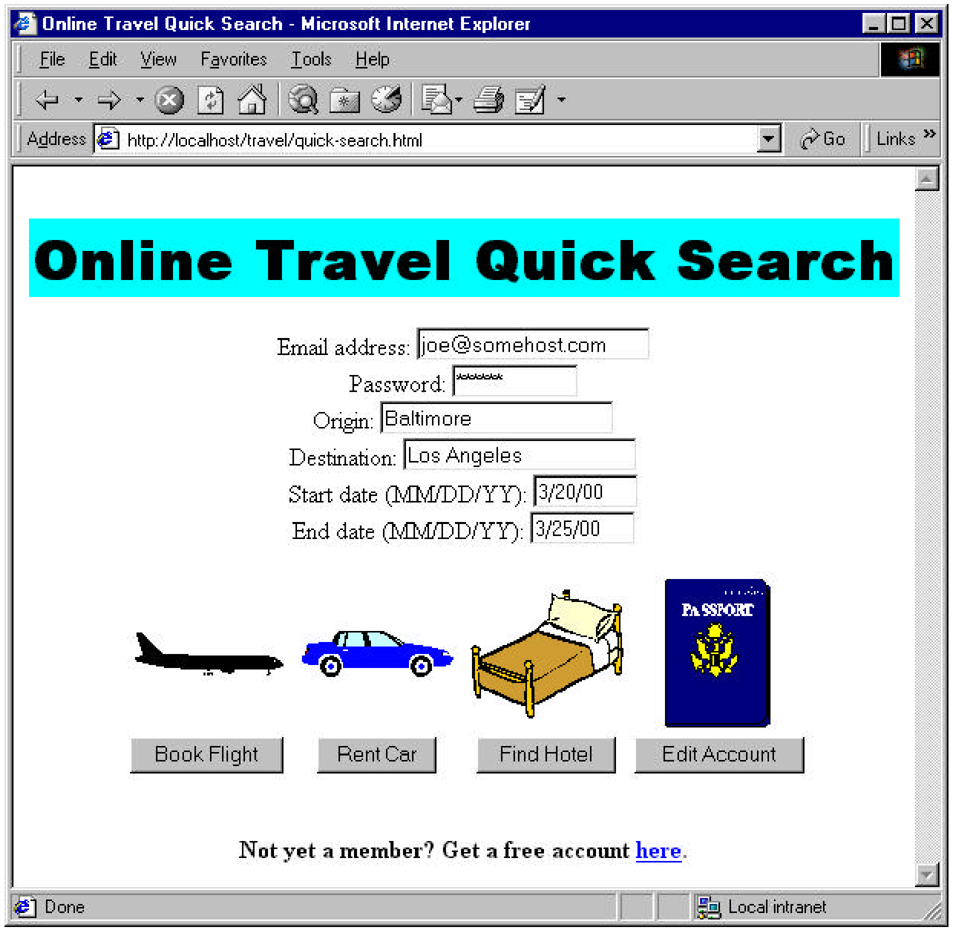
- Purpose
  - Storing data that servlet looked up and that JSP page will use in this request and in later requests from any client.
- Servlet syntax to store data

```
SomeClass value = new SomeClass(…);
getServletContext().setAttribute("key", value);
// Use RequestDispatcher to forward to JSP page
```

- JSP syntax to retrieve data

```
<jsp:useBean
     id="key"
     class="SomeClass"
     scope="application" />
```

An On-Line Travel Agent

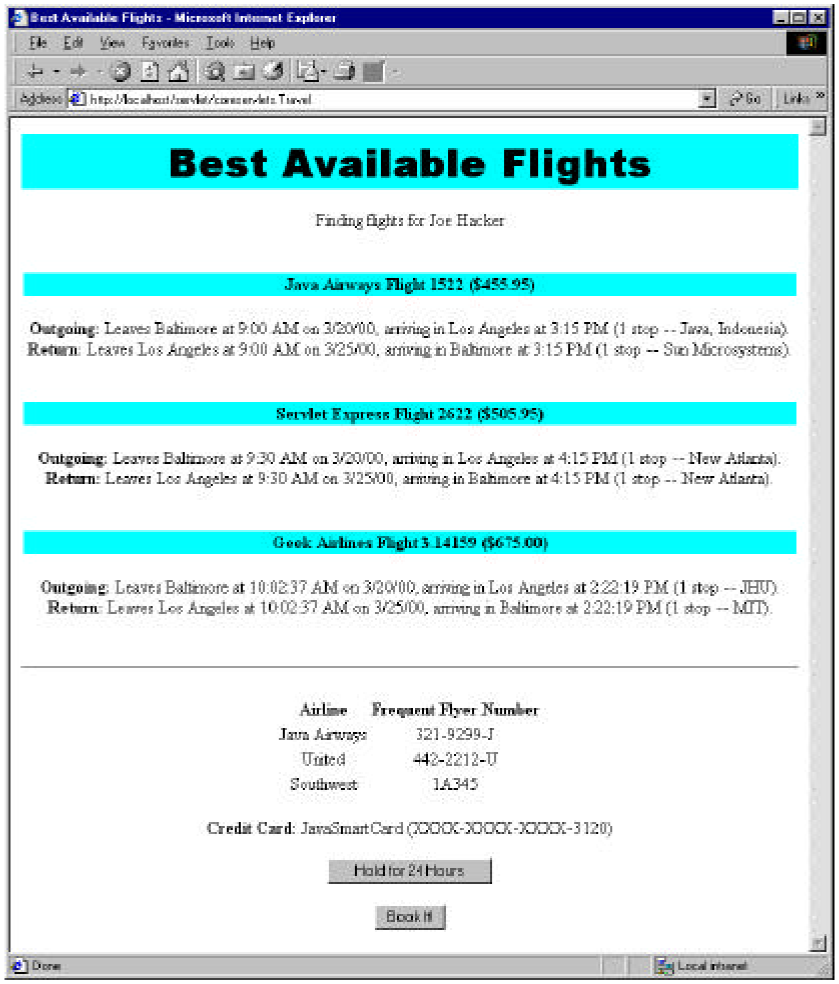

Online Travel Quick Search - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/travel/quick-search.html
Go
Links
Done
Local intranet

Online Travel Quick Search

Email address:	joe@somehost.com
Password:	******
Origin:	Baltimore
Destination:	Los Angeles
Start date (MM/DD/YY):	3/20/00
End date (MM/DD/YY):	3/25/00

PASSPORT
Book Flight
Rent Car
Find Hotel
Edit Account

Not yet a member? Get a free account here.


Best Available Flights - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/servlet/coreservlets.Travel
Go
Links
Hold for 24 Hours
Book It
Done
Local intranet

Best Available Flights

Finding flights for Joe Hacker

Java Airways Flight 1522 ($455.95)

Outgoing: Leaves Baltimore at 9:00 AM on 3/20/00, arriving in Los Angeles at 3:15 PM (1 stop -- Java, Indonesia).
Return: Leaves Los Angeles at 9:00 AM on 3/25/00, arriving in Baltimore at 3:15 PM (1 stop -- Sun Microsystems).

Servlet Express Flight 2622 ($505.95)

Outgoing: Leaves Baltimore at 9:30 AM on 3/20/00, arriving in Los Angeles at 4:15 PM (1 stop -- New Atlanta).
Return: Leaves Los Angeles at 9:30 AM on 3/25/00, arriving in Baltimore at 4:15 PM (1 stop -- New Atlanta).

Geek Airlines Flight 3.14159 ($675.00)

Outgoing: Leaves Baltimore at 10:02:37 AM on 3/20/00, arriving in Los Angeles at 2:22:19 PM (1 stop -- JHU).
Return: Leaves Los Angeles at 10:02:37 AM on 3/25/00, arriving in Baltimore at 2:22:19 PM (1 stop -- MIT).

Airline	Frequent Flyer Number
Java Airways	321-9299-J
United	442-2212-U
Southwest	1A345

Credit Card: JavaSmartCard (XXXX-XXXX-XXXX-3120)

JSP Review

Review: JSP Introduction

- JSP makes it easier to create/maintain HTML, while still providing full access to servlet code
- JSP pages get translated into servlets
  - It is the servlets that run at request time
  - Client does not see anything JSP-related
- You still need to understand servlets
  - Understanding how JSP really works
  - Servlet code called from JSP
  - Knowing when servlets are better than JSP
  - Mixing servlets and JSP
- Other technologies use similar approach, but aren’t as portable and don't let you use Java for the

Uses of JSP Constructs

Simple Application

- Scripting elements calling servlet code directly
- Scripting elements calling servlet code indirectly (by means of utility classes)
- Beans
- Custom tags
- Servlet/JSP combo (MVC architecture)

Complex Application

Review: Calling Java Code Directly: JSP Scripting Elements

- JSP Expressions
  - Format: <%= expression %>
  - Evaluated and inserted into the servlet's output.
- JSP Scriptlets
  - Format: <% code %>
  - Inserted verbatim into the _jspService method
- JSP Declarations
  - Format: <%! code %>
  - Inserted verbatim into the body of the servlet class
- Predefined variables
  - request, response, out, session, application

Review: The JSP page Directive: Structuring Generated Servlets

- The import attribute
  - Changes the packages imported by the servlet that results from the JSP page
- The contentType attribute
  - Specifies MIME type of result
  - Cannot be used conditionally
- The isThreadSafe attribute
  - Turns off concurrent access
  - Consider explicit synchronization instead

Review: Including Files in JSP Documents

- <jsp:include page="Relative URL"
  flush="true" />
  - Output inserted into JSP page at request time
  - Cannot contain JSP content that affects entire page
  - Changes to included file do not necessitate changes to pages that use it
- <%@ include file="Relative URL" %>
  - File gets inserted into JSP page prior to page translation
  - Thus, file can contain JSP content that affects entire page (e.g., import statements, declarations)
  - Changes to included file might require you to manually update pages that use it

Review: Using JavaBeans Components with JSP

- Benefits of jsp:useBean
  - Hides the Java programming language syntax
  - Makes it easier to associate request parameters with objects (bean properties)
  - Simplifies sharing objects among multiple requests or servlets/JSPs
- jsp:useBean
  - Creates or accesses a bean
- jsp:getProperty
  - Puts bean property (i.e. getXxx call) into output
- jsp:setProperty
  - Sets bean property (i.e. passes value to setXxx)

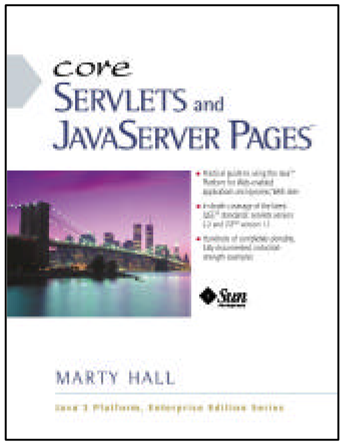
Review: Creating Custom JSP Tag Libraries

- For each custom tag, you need
  - A tag handler class (usually extending TagSupport or BodyTagSupport)
  - An entry in a Tag Library Descriptor file
  - A JSP file that imports library, specifies prefix, and uses tags
- Simple tags
  - Generate output in doStartTag, return SKIP_BODY
- Attributes
  - Define setAttributeName method. Update TLD file
- Body content
  - doStartTag returns EVAL_BODY_INCLUDE

Review: Integrating Servlets and JSP

- Use MVC (Model 2) approach when:
  - One submission will result in multiple basic looks
  - Several pages have substantial common processing
- Architecture
  - A servlet answers the original request
  - Servlet does the real processing & stores results in beans
    - Beans stored in HttpServletRequest, HttpSession, or ServletContext
  - Servlet forwards to JSP page via forward method of RequestDispatcher
  - JSP page reads data from beans by means of jsp:useBean with appropriate scope (request, session, or

More Information



- *Core Servlets and JavaServer Pages*
  - http://www.coreservlets.com
  - More detail on all topics presented here
- *More Servlets and JavaServer Pages*
  - http://www.moreservlets.com
  - New features in servlets 2.3 and JSP 1.2 (filters and listeners), Web applications, security, standard JSP tag library
- Servlet home page
  - http://java.sun.com/products/servlet/
- JavaServer Pages home page