

Web Development using Java, JSP, and Web Services

JavaServer Pages

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Server-Side Web Development

Web Applications

Web Servers

Java Servlets

JavaServer Pages (JSP)

Static HTML

Directives

Scripting Elements

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Tag Libraries

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Lecture #4 2008

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Server-Side Web Development

- Data access and logic rather than interfaces
- More technical than HTML/CSS design
- Several alternative technology platforms exists
- Dynamic content vs static content
- Content-driven solutions
- Focus on web applications
- Need for a structured programming model
- Need for a simpler way to do programming

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Web Applications

- Applications with a web interface
- Ideal for thin-client solutions
- Suffers from limitations of the web media
- Usually combines techniques (e.g., JSP + AJAX)
- Several development frameworks available
- Clear trend towards generated web interfaces
- Usually session-oriented
- Usually deployed in WAR files

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Web Archives (WAR)

- ZIP-file = compressed archive
- JAR-file = Java Archive (ZIP file with a manifest)
- WAR-file = JAR-file with web application information

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Sessions

- Used to store data for a series of HTTP requests
- E.g., a shopping cart, user preferences, site history
- A session identifier is sent with each request
- The session identifier is used to locate the session
- Data is stored in the session context

Three Layer Architectures

- 1 Interface - web pages
 - 2 Logic - software components (JavaBeans, EJB)
 - 3 Data - databases
- Clean separation of concerns
 - Scalable
 - Support role-based development cycles
 - Well suited for large sites and business logic integration

Two Layer Architectures

- 1 Interface (+ Logic)
 - 2 Data + Logic
- Requires fewer software components
 - Shorter development cycles for small development teams
 - Better suited for smaller web sites

Web Servers

- Serves resources via HTTP
- Can be anything that serves data via HTTP
- Usually a dedicated machine running web server software
- Can contain modules that processes requests

Request Processing

- 1 A Connection is established
- 2 A HTTP request is received
- 3 The (logical) path in the request is translated
- 4 The requested resource is identified (via the path)
- 5 A server module handling that resource is invoked
- 6 The module processes the request and generates a reply
- 7 A mime-type is provided and a HTTP response is created
- 8 The HTTP response is sent (possibly in increments)

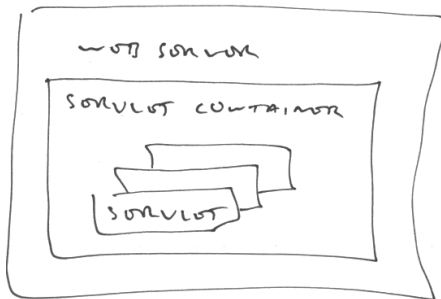
JSP Processing

- 1 A JSP page is requested
- 2 Server checks if a Java Servlet for the page exists
- 3 If no Servlet is found (or newer JSP is detected), the JSP is translated to Java (a Servlet class is created)
- 4 The Java Servlet is compiled
- 5 The Java Servlet is invoked and processes the request

Java Servlets

- Java classes
- Implements the Java Servlet API interfaces (predates JSP)
- Receives a request and generates a response
- Can be written manually
- Must be thread-safe
- Usually generated automatically from JSP
- Hosted in a Servlet container

Java Servlets



The Servlet Lifecycle

- 1 `init()` - called on Servlet instantiation
- 2 `service()` - called for each request
- 3 `destroy()` - called on container shutdown

The Servlet `service()` method

- Part of a service-pattern
 - Should not be implemented directly
 - Inherit base class and implement handler methods
 - Distinct handlers for each HTTP method (e.g., `doGet()`)
- 1 `service()` parses request and determines HTTP method
 - 2 `service()` calls appropriate handler method
 - 3 Handler method processes request

JavaServer Pages (JSP)

- HTML with extra XML-tags
- (Scripted server-side) Java for the web
- A way to provide dynamic content in web pages
- XML-tags act as front-ends for Java classes
- May include other pages dynamically
- JSPs are compiled into Java Servlets
- JSP code is never visible to clients
- Generates response (HTML) dynamically
- Model-View-Controller pattern recommended

JSP Syntax

- JSP may contain
- Static HTML
 - Directives
 - Scripting Elements
 - Actions
 - Comments
 - Tag Libraries
 - Implicit Objects

JSP Script Tags

- Directives
`<%@ ... %>`
- Declarations
`<%! ... %>`
- Scriptlets
`<% ... %>`
- Expressions
`<%= ... %>`
- Comments
`<%-- ... --%>`

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Static HTML

- All HTML is treated by JSP as static text
- HTML may be mixed with JSP in any way
- All non-JSP tags are treated as HTML

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Directives

<%@ ... %>

Types of JSP directives

- Page
- Include
- Tag Libraries (aka Custom Tags)

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Page Directives

<%@ page attribute="..." %>

- Instructs the JSP engine how to process the JSP
- Attributes determine directive content

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Page Directive Attributes

- language - selects scripting language (Java)
- extends - base class for generated Servlet
- **import** - Java class / package import
- **session** - enable session tracking (default: true)
- buffer - set output buffer size
- autoFlush - enable auto flushing of output buffer
- isThreadSafe - thread safe marker
- info - page information (author, version, copyright etc)
- **errorPage** - set default error page
- **isErrorPage** - enable exception tracking on page
- **contentType** - set response mime type

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Include Directive

<%@ include file="page.jsp" %>

- Includes another page at translation time
- Included page becomes part of Servlet
- Generates error if page not found

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Tag Libraries

<%@ taglib uri="taglib.tld" prefix="prefix" %>

- Loads a tag library
- Tags are usable via the specified tag prefix
- The JSP version of language extension

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Directive Examples

```
<%@ page import="examples.*, examples.tags.*" %>
<%@ taglib uri="/WEB-INF/examples-taglib.tld"
    prefix="examples" %>

<%@ include file="/includes/head.jsp" %>

...

<examples:ValidateParameters
    parameters="name,age"/>

...

<%@ include file="/includes/foot.jsp" %>
```

Scripting Elements

- Declarations
 <%! ... %>
- Scriptlets
 <% ... %>
- Expressions
 <%= ... %>

Declarations

- Content placed in Servlet body (members)
- Used to declare members and methods
- Does (usually) not produce HTML output
- Declared content is later used by Scriptlets or expressions
- Lines must be terminated with a semicolon

Declaration examples

```
<%!
    public int getSum (int x, int y)
    {
        return x + y;
    }
%>

<jsp:declaration>
    public int getSum (int x, int y)
    {
        return x + y;
    }
</jsp:declaration>
```

Scriptlets

- Content placed in Servlet `_jspService()` method (local variables and in-line code)
- Used to embed Java code directly in the page
- May produce HTML output (via `out.println()`)
- Lines must be terminated with a semicolon

Scriptlet examples

```
<%
    int x = 1;
    int y = 2;
    int sum = x + y;
%>

<jsp:scriptlet>
    int x = 1;
    int y = 2;
    int sum = x + y;
</jsp:scriptlet>
```

Expressions

- Content output directly to HTML
- Used as an alias for `out.println()`
- Code must evaluate to an expression
- Lines must **not** be terminated with a semicolon

Expression examples

```
1 + 2 = <%= 1 + 2 %>
```

```
1 + 2 =  
<jsp:expression>  
  1 + 2  
</jsp:expression>
```

Actions

- **include** - include another page
- **forward** - forward request to another resource
- **param** - specify parameters when calling or forwarding
- **plug-in** - generates browser-specific code for applets
- **fallback** - content if browser does not support applets
- **getProperty** - get a property from a JavaBean
- **setProperty** - set a property on a JavaBean
- **useBean** - use a JavaBean

Include Action

```
<jsp:include page="page.jsp"/>
```

- Includes another page at request time
- Generates a request to included page Servlet
- Ignored if page not found
- Usually used to call declared methods
- Control is returned

Forward Action

```
<jsp:forward page="page.jsp"/>
```

- Forwards request to another resource
- Control is not returned

Param Action

```
<jsp:forward page="page.jsp">  
  <jsp:param name="name" value="value"/>  
</jsp:forward>
```

- Used to specify parameters when including / forwarding

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HTML Comments

`<!-- HTML comment -->`

- Evaluated by server (as HTML)
- Part of the server response / web page
- Visible in page source from web browser

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JSP Comments

`<%-- JSP comment --%>`

- Not evaluated by server
- Not part of the server response / web page
- Not visible in page source from web browser

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Tag Libraries

- Java classes
- Implements the JSP Tag Extension API interfaces
- Usable as JSP tags in JSPs
- Java class coupled to a tag using a XML-descriptor
- Tags can control JSP processing

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Implicit Objects

- **request** - HTTP request
- **response** - HTTP response
- **out** - response stream
- **session** - web application session
- **pageContext** - page context data
- **application** - Servlet context data
- **config** - Servlet configuration data
- **page** - Servlet object
- **exception** - exception data

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