

Web Development using Java, JSP, and Web Services

JSP Web Development

Today

Requests
CGI
JSP
Cookies
Sessions

Responses
MIME Types
JSP

Client-Side Components
ActiveX Components
.NET Components
Java Applets

Next Time

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Lecture #5 2008

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Next Time

- 1 Requests
 - CGI
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 - Cookies
 - Sessions
- 2 Responses
 - MIME Types
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- 3 Client-Side Components
 - ActiveX Components
 - .NET Components
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JSP Web Development

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JSP
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Request Methods

- GET - data in URL-encoded name/value-pairs
- POST - data encoded in HTTP request body
- PUT - data stream in HTTP request body

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Sessions

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MIME Types
JSP

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Next Time

Common Gateway Interface (CGI)

- The original way to send dynamic data to web servers
- Data delivered URL-encoded in specific parameters
- Scripts located and invoked by the web server on demand
- Data parsing was difficult and error-prone
- Serious security issues

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Requests
CGI
JSP
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Sessions

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MIME Types
JSP

Client-Side Components
ActiveX Components
.NET Components
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Next Time

URL Encoding

- A way to escape data in text form
- Reserved and un-recognized characters are hex-coded
- Used to encode data-carrying URLs

Character	URL Encoding
A-Z, a-z, 0-9	not escaped
\$-.,+!*'(),	not escaped
others	hex-coded
e.g., (whitespace)	%20

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Requests
CGI
JSP
Cookies
Sessions

Responses
MIME Types
JSP

Client-Side Components
ActiveX Components
.NET Components
Java Applets

Next Time

CGI variables

- The original way to send dynamic data to web servers
- Data delivered URL-encoded in specific parameters
- Still available to web servers
- Contains useful metadata (such as client IP, username, length of data stream etc)

The Request Object

- Represents the HTTP request
- Contains all info in the request
- Exposes an API for traversing request data
- Performs URL-decoding of data
- Provides uniform ways to read data regardless of method

Reading Parameters

- `request.getParameter("name")`
- `request.getParameterValues("name")`
- `request.getParameterNames()`
- `request.getParameterMap()`

Reading Parameters

- Always check for null
- Always provide a default value (as appropriate)

Parameter	<code>getParameter()</code> returns
not present in request	null
contains empty string	empty string

Model View Controller

- Model represents data (JSP or Servlet)
- View represents interfaces (JSP)
- Controller manages state and control flow (Servlet)

Code Reuse

- Declare reusable functions in JSP fragments
- Use include directives to import them into JSP
- Very useful for small utility functions

Raw Data

- Can access (PUT) data streams directly
- `request.getReader()` - gets a character reader
- `request.getInputStream()` - get a binary input stream
- NOTE: request data no longer available via `getParameter()`
- Usually used for file upload scenarios
- Apache Jakarta common library contains utilities for accessing raw data streams
- Plenty of third party file upload Servlets available

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Requests

CGI

JSP

Cookies

Sessions

Responses

MIME Types

JSP

Client-Side Components

ActiveX Components

.NET Components

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Filtering Data

- Data validation necessary
- Always check data size
- Always check for illegal characters
- Consider site impact of invalid data

<	Escape to <	(XML, XHTML, HTML)
>	Escape to >	(- " -)
&	Escape to &	(- " -)
"	Escape to "	(- " -)
'	Escape to \'	(databases)

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Today

Requests

CGI

JSP

Cookies

Sessions

Responses

MIME Types

JSP

Client-Side Components

ActiveX Components

.NET Components

Java Applets

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Cookies

- HTTP connections may be closed at any time
- Need a way to identify requests from the same client
- Cookies are small text fragments sent in headers
- Cookies are stored on client computer file systems and are used to identify site visitors (track users)

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Today

Requests

CGI

JSP

Cookies

Sessions

Responses

MIME Types

JSP

Client-Side Components

ActiveX Components

.NET Components

Java Applets

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Browsers & Cookies

- Maximal cookie size 4096 bytes
- Max 20 cookies per site
- Max 300 cookies in total
- Stored on client computer
- Cookies can be blocked by browsers
- Cookies can be removed from client computer
- Cookies can be altered
- Don't store sensitive data in cookies
- Use cookies, but don't depend on them

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Requests

CGI

JSP

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Sessions

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MIME Types

JSP

Client-Side Components

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.NET Components

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Next Time

Sessions

- Data contexts stored on the web server and shared between requests from the same user
- Can store anything (POJO)
- Can be serialized to databases or short-lived
- Need a way to identify session for new requests
 - Cookies
 - URL rewrites
 - hidden form fields
- The JSP session API hides the session identification

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Requests

CGI

JSP

Cookies

Sessions

Responses

MIME Types

JSP

Client-Side Components

ActiveX Components

.NET Components

Java Applets

Next Time

Responses

- May be sent in one chunk
- May be sent incrementally

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CGI

JSP

Cookies

Sessions

Responses

MIME Types

JSP

Client-Side Components

ActiveX Components

.NET Components

Java Applets

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MIME Types

- Instructs the client how to interpret data returned
- Defaults to text/html is JSP
- Usually used for binary data
- NOTE: MIME type must be set before any data is sent

MIME Type Examples

MIME type	data type
text/css	HTML cascading style sheet
text/html	HTML (JSP default)
text/plain	plain text
application/pdf	PDF document
application/postscript	Postscript document
application/zip	ZIP file
application/octet-stream	binary data
image/gif	GIF image
image/jpeg	JPEG image
image/png	PNG image
audio/x-wav	Microsoft Windows sound
video/mpeg	MPEG video
video/quicktime	Quicktime video

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

JSP Translation

- JSP declarations become
 - Servlet class members
 - Servlet class methods
- JSP scriptlets become
 - local variables in the Servlet service() method
- JSP expressions become
 - out.print() calls in - " - "

Client-Side Components

- Compiled programs that execute on the client
- Downloaded from the server when needed
- Reduces client installation needs
- Description of the component part of the HTML
- Useful for providing advanced user interfaces
- Plenty of third party components available
- Commercial markets for special purpose components

ActiveX Components

- COM-components exposing user interfaces
- Commonly used in ASP environments
- No code validation performed
- Can be written in any MS language
- Distributed as Dynamic Link Libraries (DLLs)

.NET Components

- .NET-components exposing user interfaces
- Commonly used in ASP.NET environments
- Can be used interchangeably with (D)HTML interfaces
- Can be developed using any .NET language
- Strong development environment (Visual Studio)
- Supports code signing
- Distributed as Dynamic Link Libraries (DLLs)

Java Applets

- Java objects extending the Applet class
- Can be used in any HTML environment
- Developed in Java
- Contains a sandbox security model
- Supports code signing
- Distributed as standalone classes or JARs

Java Applets

- **Extend Applet**
 - creates a AWT container
 - functions as a Frame for your applet
- **Extend JApplet**
 - creates a heavy-weight Java Swing container
 - functions as a JFrame for your applet
- **Assure thread safe implementations of applets** (invoke worker threads via `SwingUtilities.invokeLaterAndWait()`)

Applet Lifecycle

- 1 **init()**
 - performs applet initialization
 - called after the applet has received its parameters
- 2 **start()**
 - activates the applet
 - called after `init()` and whenever an applet page receives focus
- 3 **stop()**
 - deactivates the applet
 - called when an applet page loses focus
- 4 **destroy()**
 - deinitializes the applet
 - called when the browser is shut down

Applet Restrictions

- Applets cannot load libraries or define native methods
- An applet cannot ordinarily read or write files on the host that is executing it
- An applet cannot make network connections except to the host that it came from
- An applet cannot start any program on the host that is executing it
- An applet cannot read certain system properties
- Windows that an applet brings up look different than windows that an application brings up

Each browser has a `SecurityManager` object that implements its security policies. When a `SecurityManager` detects a violation, it throws a `SecurityException`. Your applet can catch this `SecurityException` and react appropriately.

Applet Capabilities

- Applets provide a way to create non-web GUIs to web applications
- Applets can make network connections to the host they came from

```
String host = getCodeBase().getHost();
```
- Applets running within a Web browser can easily cause HTML documents to be displayed

```
getAppletContext().showDocument(url,browsertitle)
```
- Applets can invoke public methods of other applets on the same page
- Applets that are loaded from the local file system (from a directory in the user's CLASSPATH) have none of the restrictions that applets loaded over the network do

Applet Checklist

- Removed or disable debugging output
- Does the applet stop running when it's offscreen? (should it? it may be application dependent)
- Can the applet stop the annoying behavior? (rethink behavior that can be perceived as annoying)
- Make your applet as flexible as possible
- Make your applet accessible
- Implement the `getParameterInfo()` method
- Implement the `getAppletInfo()` method

Applets as Applications

```
PokerClockApplet applet = new PokerClockApplet();  
  
JFrame frame = new JFrame("Poker Clock Applet");  
frame.setDefaultCloseOperation(WindowConstants.EXIT_ON_CLOSE);  
frame.getContentPane().add(applet, BorderLayout.CENTER);  
applet.init();  
applet.start();  
frame.pack();  
frame.setVisible(true);
```

Next Time

- Custom Tag Libraries