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JEE Web

The Powerful Web Layer of JEE Spec

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About Me

- Maruthi R Janardhan
    - Been doing java since jdk 1.2
    - Been with IBM, ANZ, HCL-HP, my own startup Leviossa..
    - Total 16 years programming C, C++, Java, Javascript, Ruby, Perl, Python, PHP, etc

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Why JEE Web

- Java for Web is still the top in demand IT skill (Source dice.com survey)
- Stood the test of time and still going strong against new breed of languages such as groovy, scala, ruby, etc
- JVM based architecture is really robust
- Java is here to stay with android adding a boost

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Anatomy of HTTP

- Http is stateless protocol over TCP/IP
- Its a non binary text based protocol
- Supports Security over SSL
- Can be used for various content types
- Most widely implemented protocol

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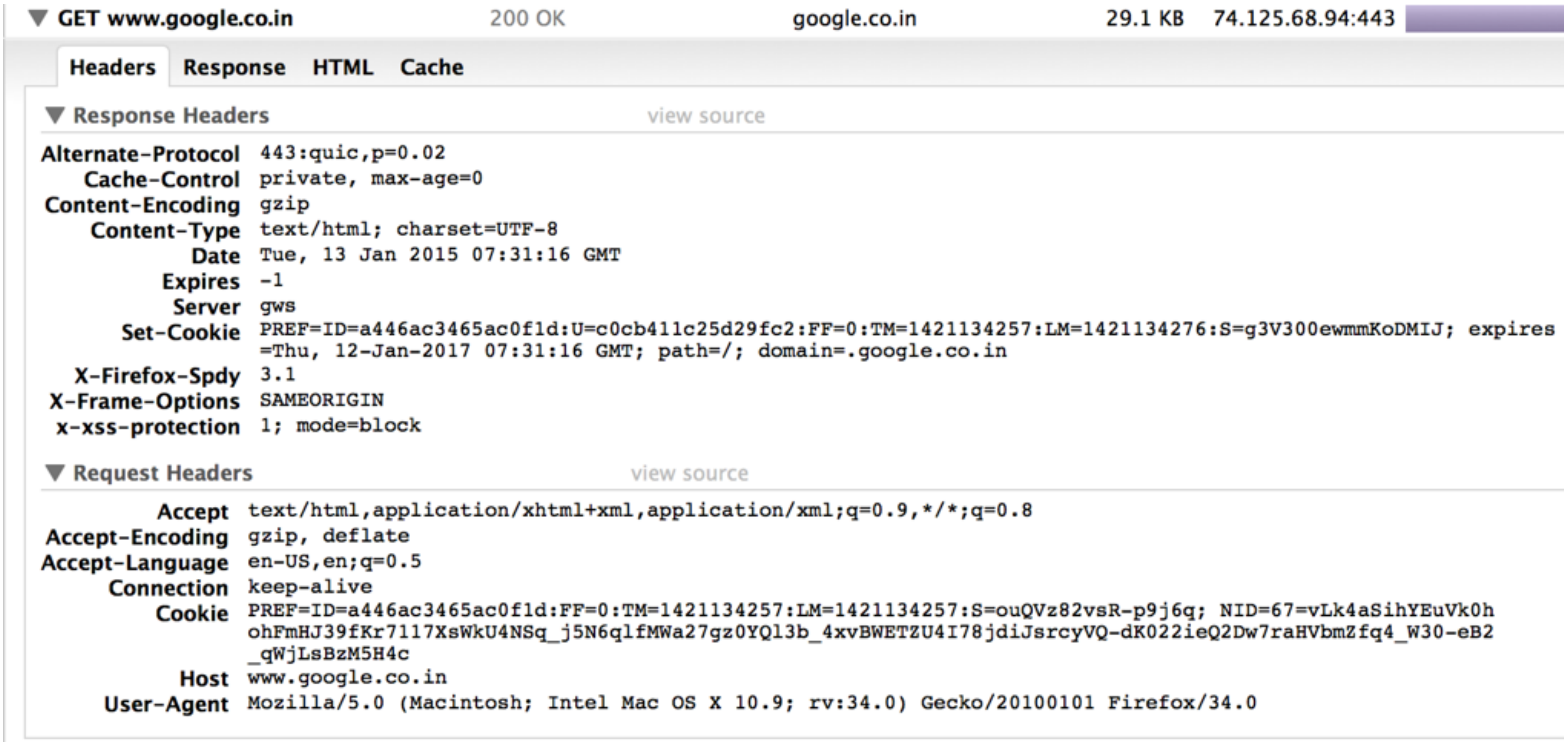
HTTP Interaction



```
Response Headers
Alternate-Protocol  443:quic,p=0.02
     Cache-Control  private, max-age=0
  Content-Encoding  gzip
      Content-Type  text/html; charset=UTF-8
              Date  Tue, 13 Jan 2015 07:31:16 GMT
           Expires  -1
            Server  gws
        Set-Cookie  PREF=ID=a446ac3465ac0f1d:U=c0cb411c25d29fc2:FF=0:TM=1421134257:LM=1421134276:S=g3V300ewmmKoDMIJ; expires
                    =Thu, 12-Jan-2017 07:31:16 GMT; path=/; domain=.google.co.in
   X-Firefox-Spdy  3.1
  X-Frame-Options  SAMEORIGIN
 x-xss-protection  1; mode=block

Request Headers
          Accept  text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
 Accept-Encoding  gzip, deflate
 Accept-Language  en-US,en;q=0.5
      Connection  keep-alive
          Cookie  PREF=ID=a446ac3465ac0f1d:FF=0:TM=1421134257:LM=1421134257:S=ouQVz82vsR-p9j6q; NID=67=vLk4aSihYEuVk0h
                  ohFmHJ39fKr7117XsWkU4NSq_j5N6qlfMWa27gz0YQl3b_4xvBWETZU4I78jdiJsrcyVQ-dK022ieQ2Dw7raHVbmZfq4_W30-eB2
                  _qWjLsBzM5H4c
            Host  www.google.co.in
      User-Agent  Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:34.0) Gecko/20100101 Firefox/34.0
```

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HTTP Response Codes

- Various response codes are outlined in HTTP Spec. Some of the common ones are
    - 200 - Success
    - 404 - Path not found
    - 302 - Redirect
    - 500 - Server error
    - 401 - Auth denied

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GET Request

- Used to retrieve a resource from the server
- Does not have a body
- Can carry parameters in the url.
    - https://www.google.co.in/search?q=Breakfast+Recipes&ie=utf-8&oe=utf-8&gws_rd=cr&ei=Pte0VIDGN4P8ugSGnIKQBQ
- Should be idempotent

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POST Request

- Used to send data to the server for action
- Can have a body
- Carries a content length and content type in the headers
- POST requests are not navigable via the back button of the browser.

HTML Forms

- HTML forms are a way of allowing user to input data to the server
- Default encoding of a form is application/x-www-form-urlencoded.

```
<form action="FormProcessing" method="post">
Name: <input type="text" name="name"/><br>
Address: <textarea rows="4" cols="100" name="address"></
textarea><br>
<input type="submit" value="send"/>
</form>
```

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Multipart Data

- Forms can be built to send data in multipart encoded format. Useful for sending files.
- Data is not encoded but data is separated using a boundary

```
<form action="MultipartHandler" method="post" enctype="multipart/
form-data">
Name: <input type="text" name="name"/><br>
Address: <textarea rows="4" cols="100" name="address"></
textarea><br>
Photo ID: <input type="file" name="photo"/><br>
<input type="submit" value="send"/>
</form>
```

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Multipart Data

```
-----------------------------5082650181867693407554623250
Content-Disposition: form-data; name="name" Maruthi
-----------------------------5082650181867693407554623250
Content-Disposition: form-data; name="address" 5th Avenue
-----------------------------5082650181867693407554623250
Content-Disposition: form-data; name="photo";
filename="SmallImage.jpg" Content-Type: image/jpeg
ÿØÿàJFIFHHÿâXICC_PROFILEHLinomntrRGB XYZ Î 1acspMSFTIEC
sRGBöÖÓ-HP
cprtP3desclwtptðbkptrXYZ6789:CDEFGHIJSTUVWXYZcdefghijstuv
wxyz¢£¤¥¦§¨©ª²³
´µ¶·¸¹ºÂÃÄÅÆÇÈÉÊÒÓÔÕÖ×ØÙÚáâãäåæçèéêñòóôõö÷øùúÿÄ

-----------------------------5082650181867693407554623250
```

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JEE Spec

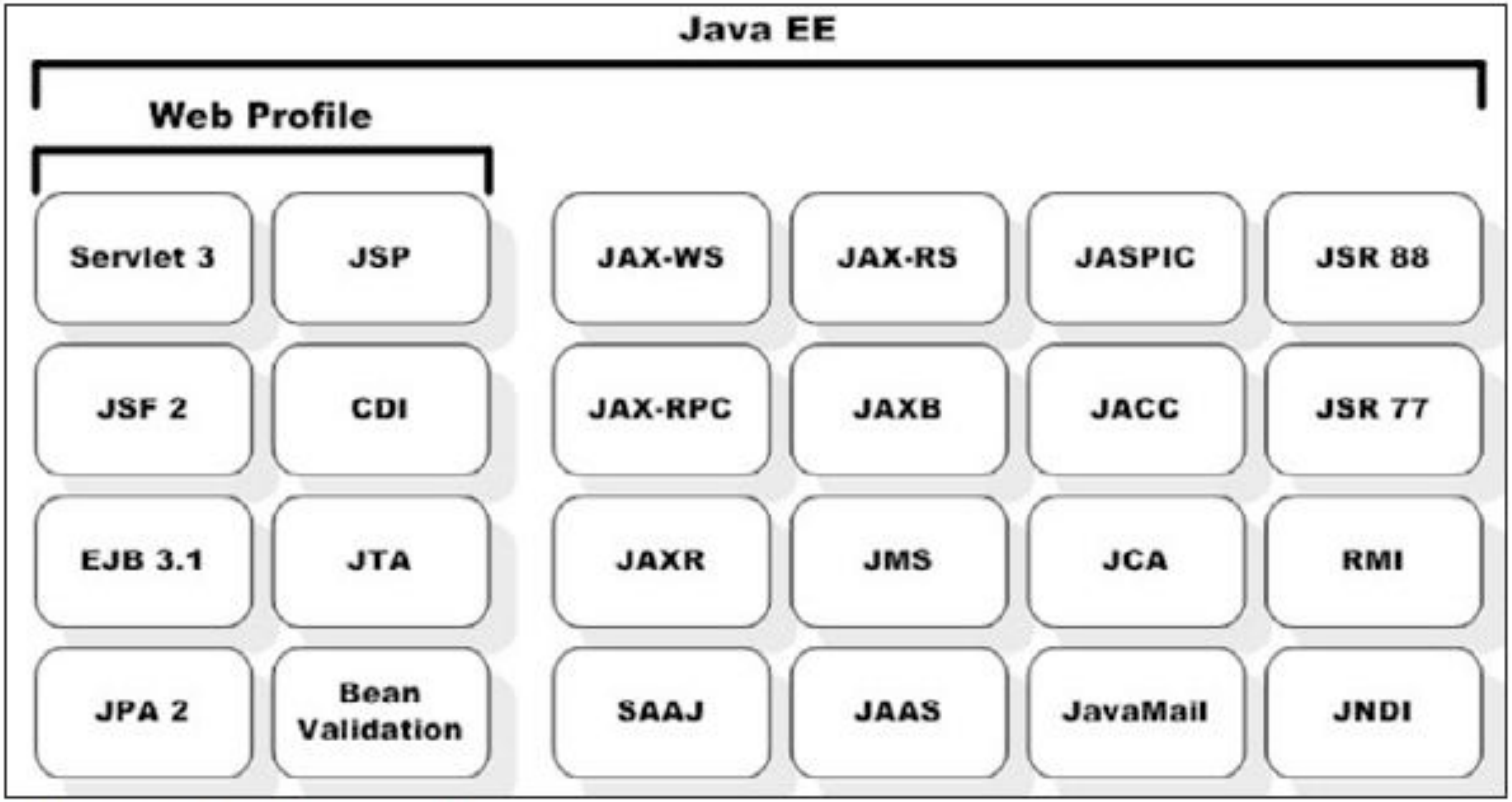

Figure 1: Java EE and the Web Profile

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Servlet

- Servlets are Java components that handle a HTTP request and provide a response
- Access this like this: http://localhost:8080/Web/FirstServlet?name=Jack

```
@WebServlet("/FirstServlet")
public class FirstServlet extends HttpServlet {
   protected void doGet(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
      String name = request.getParameter("name");
      response.getOutputStream().print("Hello "+name);
   }
}
```

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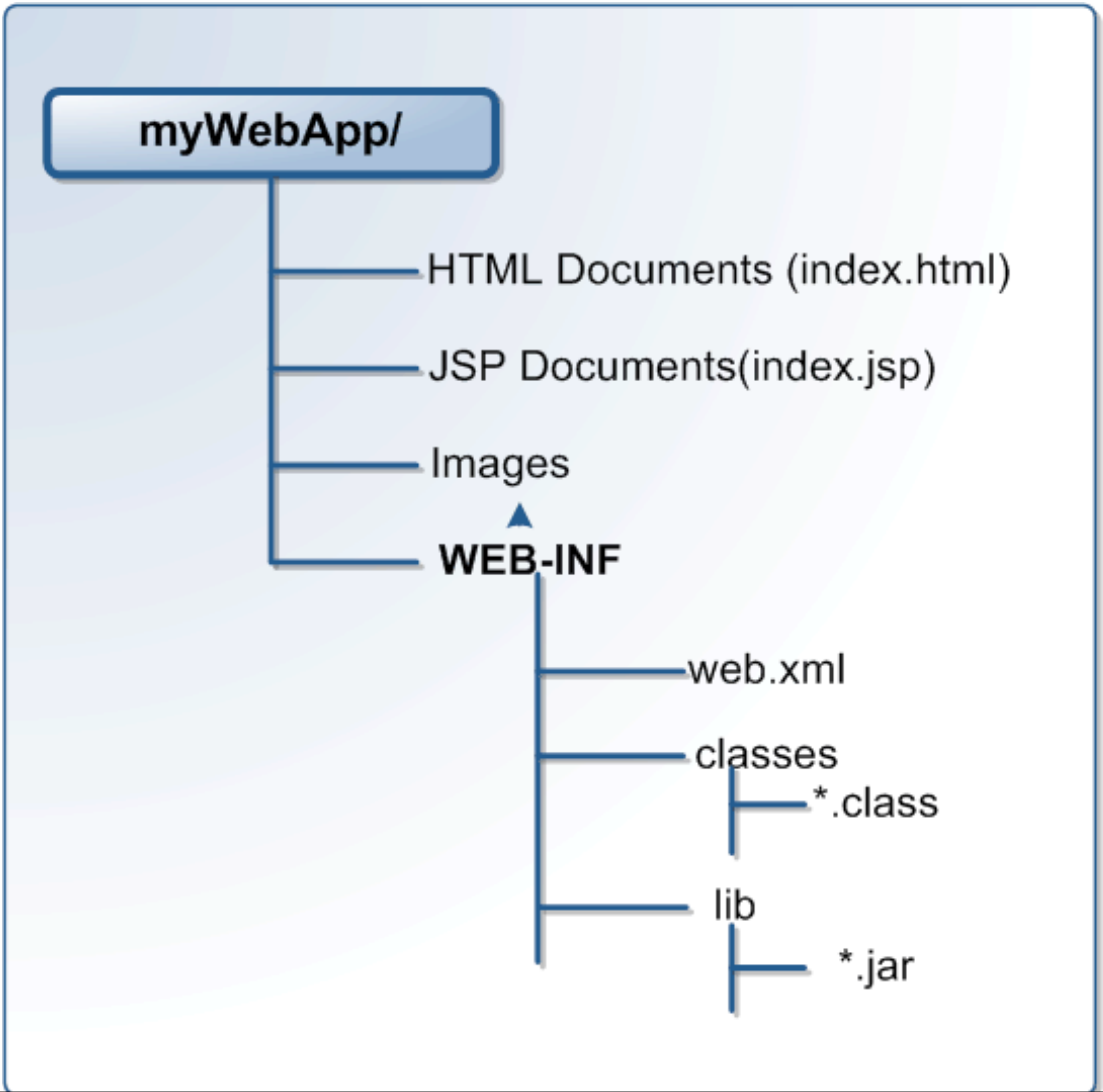
WAR Deployment Package

- Servlet classes have to be packaged in an archive of this folder structure for deployment



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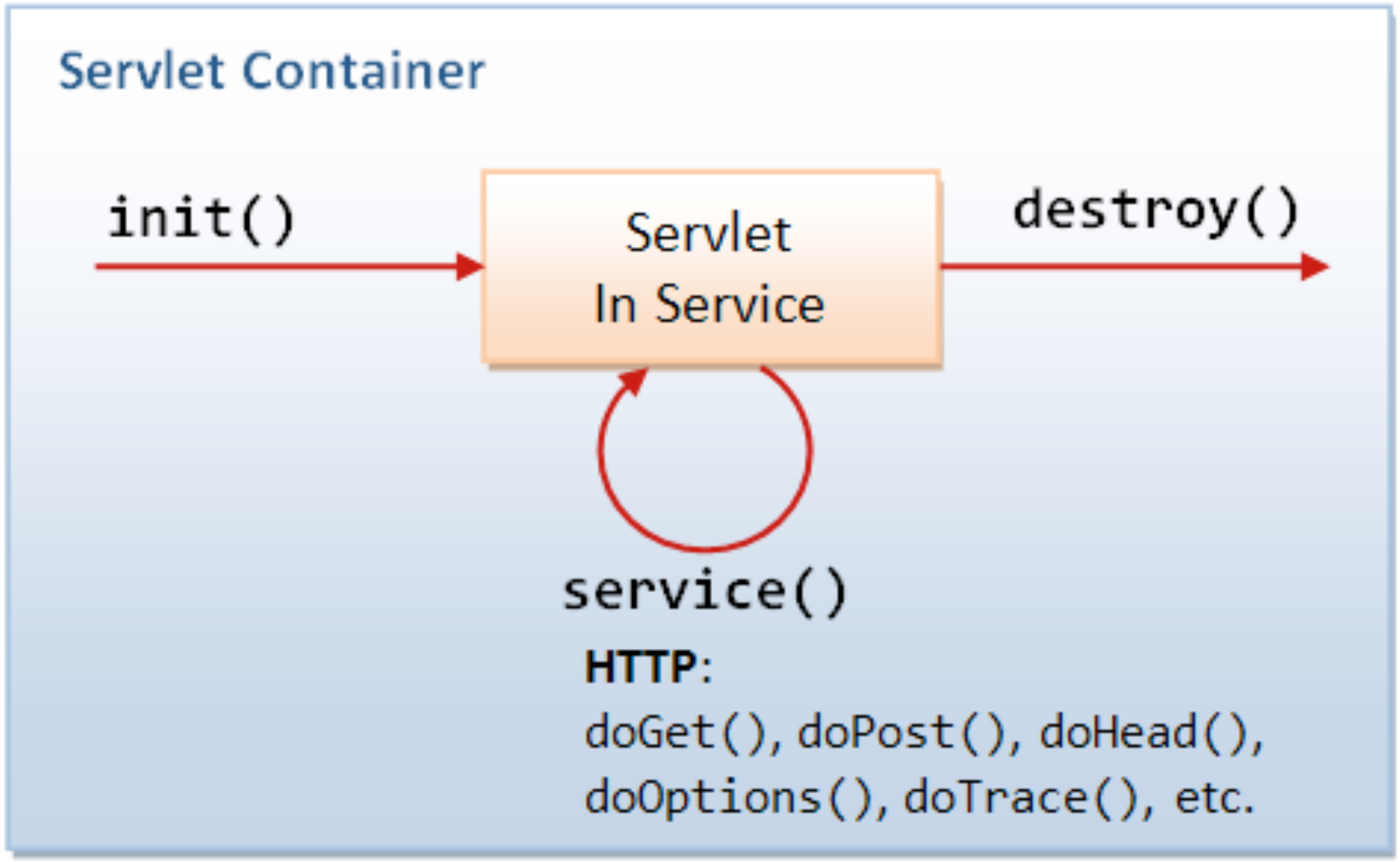
Handling Form Data

```
protected void doPost(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
      Enumeration<String> paramNames = request.getParameterNames();
      while(paramNames.hasMoreElements()){
         String paramName = paramNames.nextElement();
         System.out.println("Parameter: "+paramName+" =
"+request.getParameter(paramName));
      }
      request.getRequestDispatcher("thankyou.html").forward(request,
response);
   }
```

Life Of A Servlet



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Init Params & DD

```
@WebServlet(
        urlPatterns = { "/LifeCycleServlet" },
        initParams = {
                @WebInitParam(name = "plancks_constant", value = "6.62606957 × 10-34",
description = "Plancks constant in string format")
        })
public class LifeCycleServlet extends HttpServlet {

    public void init(ServletConfig config) throws ServletException {
        System.out.println("Planck's constant is: "+getInitParameter("plancks_constant"));
    }

    public void destroy() {
        System.out.println("Done with the short life.. time to go!!");
    }

    protected void doGet(HttpServletRequest request, HttpServletResponse response) throws
ServletException, IOException {
        System.out.println("Hello there! Good you thought of me!");
    }

}
```

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Threading In Servlets

- Servlet is a singleton
- It is invoked in multiple threads
- Thread safety has to be maintained by code

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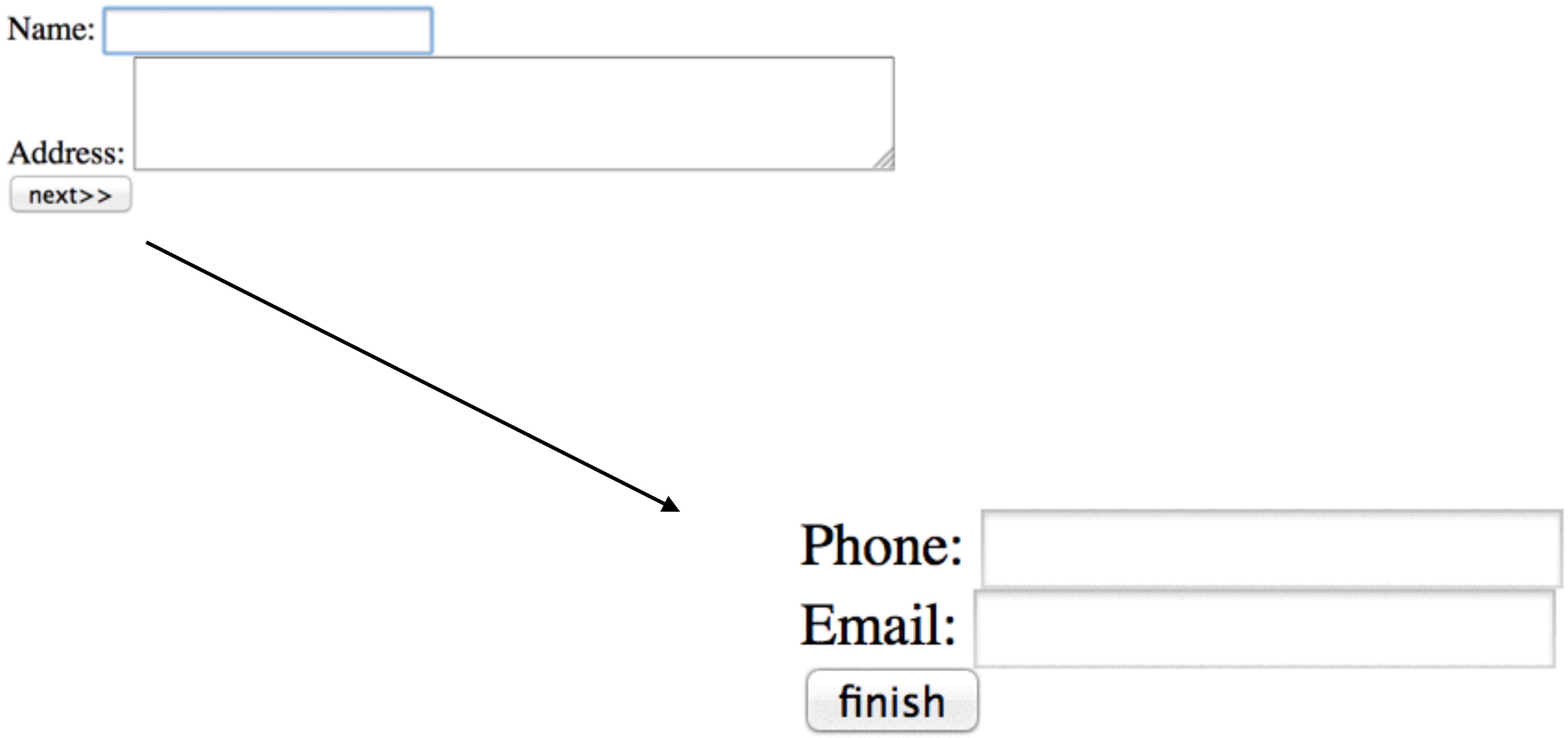
Lets Build A Wizard



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Redo the Wizards

- Now lets redo the wizards using the concept of sessions
- Sessions are like a map of maps. Key to the first level map is the session id.
- Session id is persisted to client browser in a cookie.
- Client browser sends the cookie back in subsequent requests.

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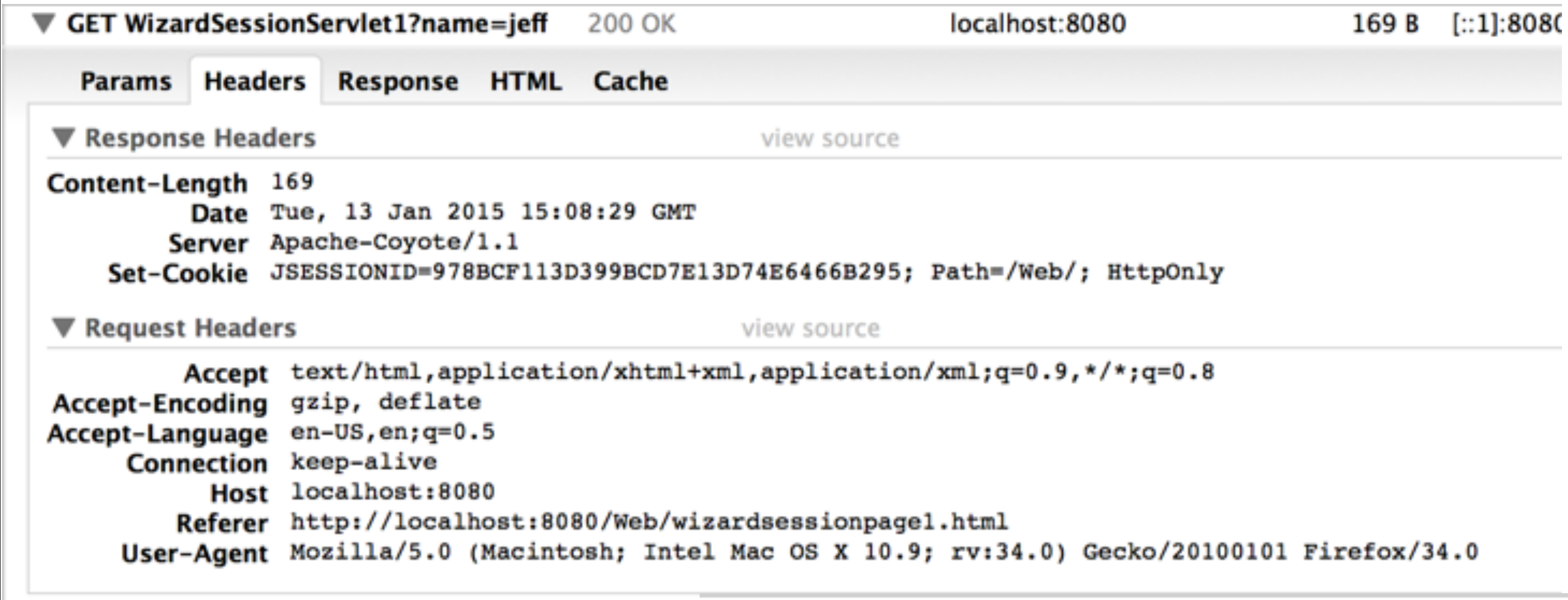
Yummy Cookies!

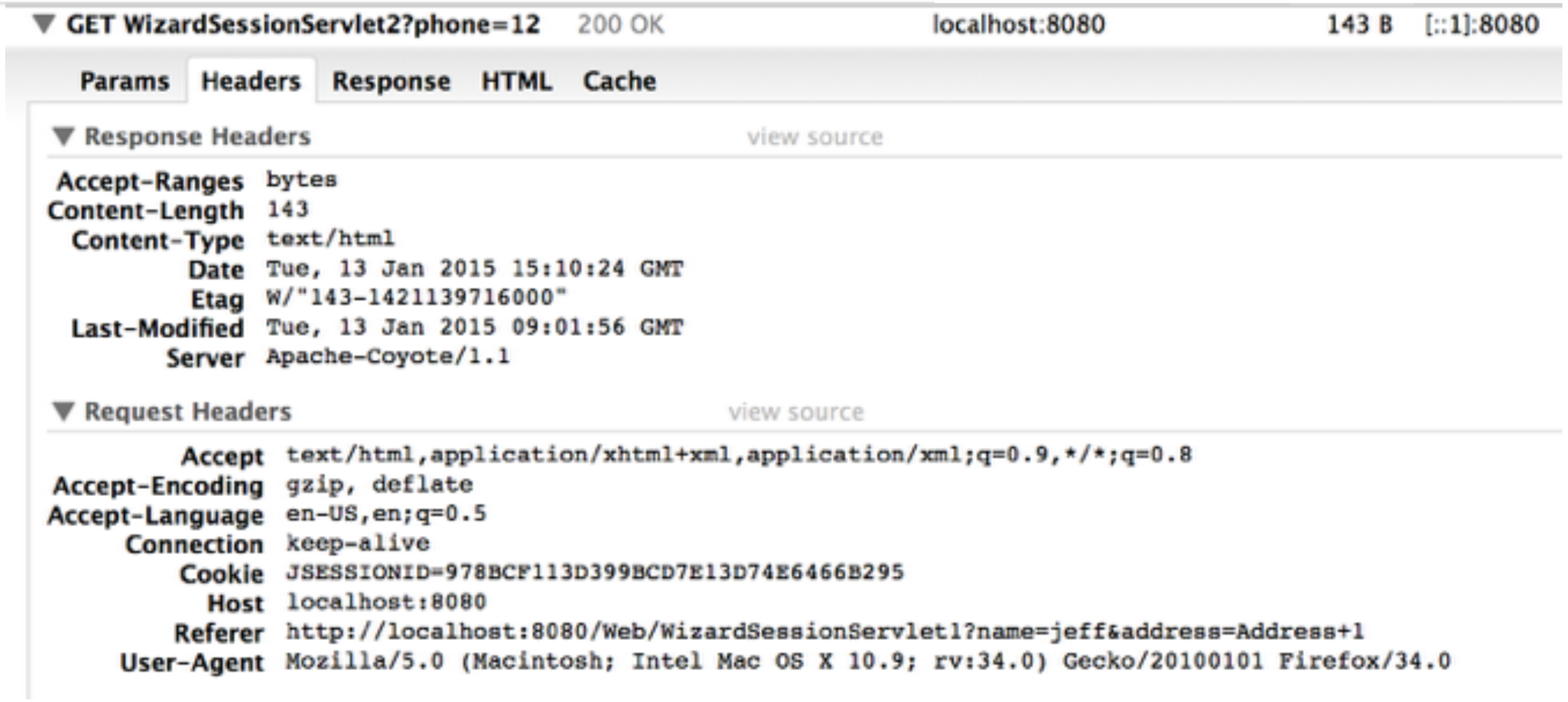


```
▼ GET WizardSessionServlet1?name=jeff    200 OK    localhost:8080    169 B    [::1]:808

Params  Headers  Response  HTML  Cache

▼ Response Headers                                   view source
Content-Length  169
          Date  Tue, 13 Jan 2015 15:08:29 GMT
        Server  Apache-Coyote/1.1
    Set-Cookie  JSESSIONID=978BCF113D399BCD7E13D74E6466B295; Path=/Web/; HttpOnly

▼ Request Headers                                    view source
         Accept  text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Encoding  gzip, deflate
Accept-Language  en-US,en;q=0.5
     Connection  keep-alive
           Host  localhost:8080
        Referer  http://localhost:8080/Web/wizardsessionpage1.html
     User-Agent  Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:34.0) Gecko/20100101 Firefox/34.0
```



```
▼ GET WizardSessionServlet2?phone=12    200 OK    localhost:8080    143 B    [::1]:8080

Params  Headers  Response  HTML  Cache

▼ Response Headers                                   view source
 Accept-Ranges  bytes
Content-Length  143
  Content-Type  text/html
          Date  Tue, 13 Jan 2015 15:10:24 GMT
          Etag  W/"143-1421139716000"
 Last-Modified  Tue, 13 Jan 2015 09:01:56 GMT
        Server  Apache-Coyote/1.1

▼ Request Headers                                    view source
         Accept  text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Encoding  gzip, deflate
Accept-Language  en-US,en;q=0.5
     Connection  keep-alive
         Cookie  JSESSIONID=978BCF113D399BCD7E13D74E6466B295
           Host  localhost:8080
        Referer  http://localhost:8080/Web/WizardSessionServlet1?name=jeff&address=Address+1
     User-Agent  Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:34.0) Gecko/20100101 Firefox/34.0
```

ServletContext

- Servlet Context is application level object
- getServletContext()
- Use this instead of statics in a class

Send Down Files

- Sevlets can be used to send files back to clients
- Can be used to send XML, JSON but typically not a good idea for large regular files

```
File f = new File("filename");
FileInputStream fis = new FileInputStream(f);
OutputStream os = response.getOutputStream();
byte[] data = new byte[(int)f.length()];
fis.read(data);
response.setContentType("application/pdf");
os.write(data);
fis.close();
```

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Code Restrictions

- Cant start threads
- Cant create server sockets
- Don’t persist to filesystem anything other than logging data
- Don’t use hostname of the server or refer to the context root
- Don’t use absolute paths to filesystem resources
- Don’t use JNI or any other platform API with an adapter

Special Situation 1

- Write code that runs on server startup: Cleanup a table every time the app starts.
  - Load on startup servlet

```
@WebServlet(urlPatterns = "/LoadOnStartupServlet", loadOnStartup = 1)
```

  - Servlet context listeners

```
@WebListener
public class EventProcessor implements ServletContextListener
```

Other Listeners

- There are other listeners in the web container as follows:
  - ServletContextAttributeListener
  - HttpSessionListener
  - HttpSessionActivationListener
  - HttpSessionAttributeListener
  - ServletRequestListener
  - ServletRequestAttributeListener

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How Clusters Work

- A cluster is a group of app servers that is going to behave like a single server
- Shares load via a load balancer
- Accesses the same database
- Sticky and non sticky sessions

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Java Server Pages

- JSPs are just another way of writing a servlet
- More friendly to produce large amounts of html output
- Can also be seen as a good templating engine

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JSP Elements

- Scriptlets <% %>
    - Content goes into your doGet/doPost body
- Declaration <%! %>
    - Content goes into the servlet class body outside methods
- Directives <%@ %>
    - Helps create the class by providing instructions such as imports
- Expressions <%= %>
    - Content goes inside an out.print() statement
- Lets convert our wizard servlets to JSPs

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JSP Implicit Objects

- out - printwriter object
- application - servletcontext object
- session - HttpSession object
- request - HttpServletRequest object for the current request
- page - current class instance - an alias for “this”
- response - HttpServletResponse for the current request
- Exception - current exception object visible in error pages only

The Page Directive

- Page directive of the form <%@ page %> is the most commonly used directive and it has the following important attributes:
  - **contentType** Defines the character encoding scheme.
  - **errorPage** Defines the URL of another JSP that reports on Java unchecked runtime exceptions.
  - **isErrorPage** Indicates if this JSP page is a URL specified by another JSP page's errorPage attribute.
  - **import** Specifies a list of packages or classes for use in the JSP as the Java import statement does for Java classes.
  - **session** Specifies whether or not the JSP page participates in HTTP sessions
  - **isScriptingEnabled** Determines if scripting elements are allowed for use.

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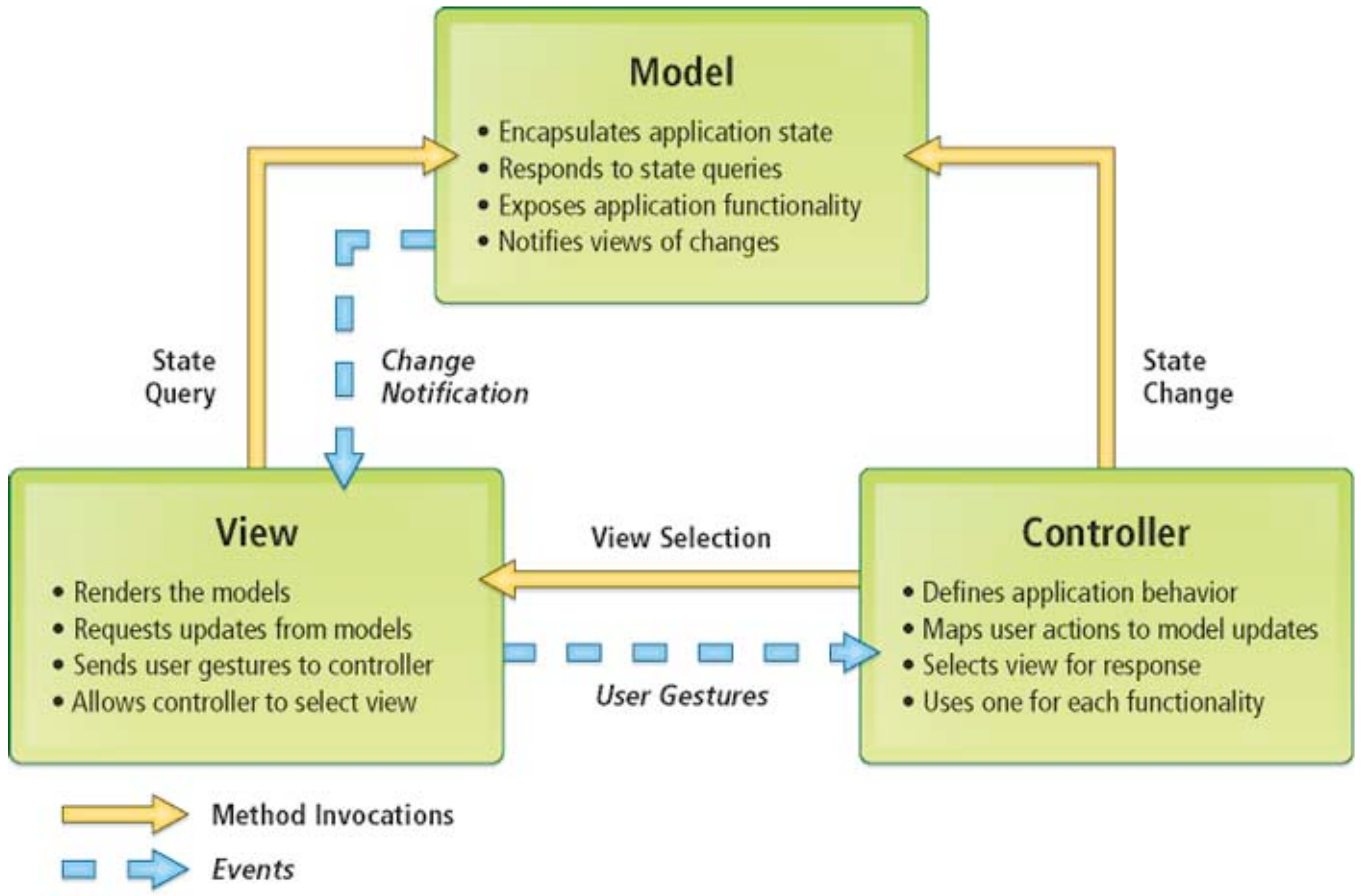
Model View Controller



Model
• Encapsulates application state
• Responds to state queries
• Exposes application functionality
• Notifies views of changes
State Query
Change Notification
State Change
View
• Renders the models
• Requests updates from models
• Sends user gestures to controller
• Allows controller to select view
View Selection
User Gestures
Controller
• Defines application behavior
• Maps user actions to model updates
• Selects view for response
• Uses one for each functionality
Method Invocations
Events

Passing Data Controller->View

- Data can be passed between a servlet and jsp using a forward

```
request.setAttribute("name", name);
request.getRequestDispatcher("thankyou.jsp").forward(request, response);
```

- request.setAttribute() and request.getAttribute()

```
Thank you for submitting your data <%=request.getAttribute("name") %>
```

Build An MVC App

- We build a basic CRUD app - the most common case
- List the records of a database table
- Allow add and edit operation of the records
- Allow multiple selection delete of records

Expression Language

- The EL allows page authors to use simple expressions to dynamically access data from JavaBeans components.

- ***<%= request.getAttribute("name") %>*** will be replaced with ***${name}***

- ***<%= ((User)request.getAttribute("user")).getName() %>*** will be replaced with ***${user.name}***

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Types of EL Expressions

- Immediate/deferred evaluation expressions.
- Value expression or method expression.
- Rvalue expression or lvalue expression.

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Expression Examples

- ${customer} - immediate evaluation, #{customer} - deferred evaluation
- ${user.name} is same as ${user[“name”]} is same as pageContext.findAttribute(“user”).getName()
- ${user.address[“city”]} - user.getAddress().getCity()
- user.phones[1] - Accesses the first item in collection
- user.phones[“home”] - Access the “home” value if phones is a map
- ${user.age + 15} - Does the arithmetic during rendering time

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EL Implicit Objects

Implicit object	Description
pageScope	Scoped variables from page scope
requestScope	Scoped variables from request scope
sessionScope	Scoped variables from session scope
applicationScope	Scoped variables from application scope
param	Request parameters as strings
paramValues	Request parameters as collections of strings
header	HTTP request headers as strings
headerValues	HTTP request headers as collections of strings
initParam	Context-initialization parameters
cookie	Cookie values
pageContext	The JSP PageContext object for the current page

Convert the CRUD project to use EL

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JSP Standard Tag Library (JSTL)

- The taglib directive is used to bring in a whole new set of tags for use in JSPs

```
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
```

- Provide delete options for all users in the list except the user with id=1

- This is achieved with a JSTL tag c:if

```
<c:if test="${user.age > 200}">
   <p>You are really really old!<p>
</c:if>
```

Attribute	Description	Required	Default
test	Condition to evaluate	Yes	None
var	Name of the variable to store the condition's result	No	None
scope	Scope of the variable to store the condition's result	No	page

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c:foreach

- Provide a drop-down for age input. Options for that should come from the server and should be between 18 and 70

```
<c:forEach var="i" begin="1" end="5">
   Item ${i}
</c:forEach>
```

Attribute	Description	Required	Default
items	Information to loop over	No	None
begin	Element to start with (0 = first item, 1 = second item, ...)	No	0
end	Element to end with (0 = first item, 1 = second item, ...)	No	Last
step	Process every step items	No	1
var	Name of the variable to expose the current item	No	None
varStatus	Name of the variable to expose the loop status	No	None

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Choose, When… Otherwise…

- There is no else clause in c:if tag. These set of 3 tags act like an if-else condition

```
<c:choose>
    <c:when test="${user.age <= 18}">
       You are not even legal here! get out.
    </c:when>
    <c:when test="${user.age>18 && user.age<70}">
        Welcome.. lets have fun.
    </c:when>
    <c:otherwise>
        Time to stay home and relax
    </c:otherwise>
</c:choose>
```

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Format Tags

```
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>

<c:set var="now" value="<%=new java.util.Date()%>" />
<fmt:formatDate pattern="yyyy-MM-dd" value="${now}" />
```

Attribute	Description	Required	Default
value	Date value to display	Yes	None
type	DATE, TIME, or BOTH	No	date
dateStyle	FULL, LONG, MEDIUM, SHORT, or DEFAULT	No	default
timeStyle	FULL, LONG, MEDIUM, SHORT, or DEFAULT	No	default
pattern	Custom formatting pattern	No	None
timeZone	Time zone of the displayed date	No	Default time zone
var	Name of the variable to store the formatted date	No	Print to page
scope	Scope of the variable to store the formatted date	No	page

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Other Tags

- There are many other format tags for numbers, timezones, strings etc
- SQL Tags - not recommended to use - allows interaction with DB directly from JSP
- There are other core tags
- XML tags - for dealing with XML data

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JSTL Functions

JSTL includes a number of standard functions, most of which are common string manipulation functions.

```
<%@ taglib uri="http://java.sun.com/jsp/jstl/functions" prefix="fn" %>

<c:if test="${fn:contains(user.name, 'admin')}">
   <p>Admin User!<p>
</c:if>

<c:set var="string1" value="This is first String."/>
<c:set var="string2" value="${fn:split(string1, ' ')}" />
<c:set var="string3" value="${fn:join(string2, '-')}" />
```

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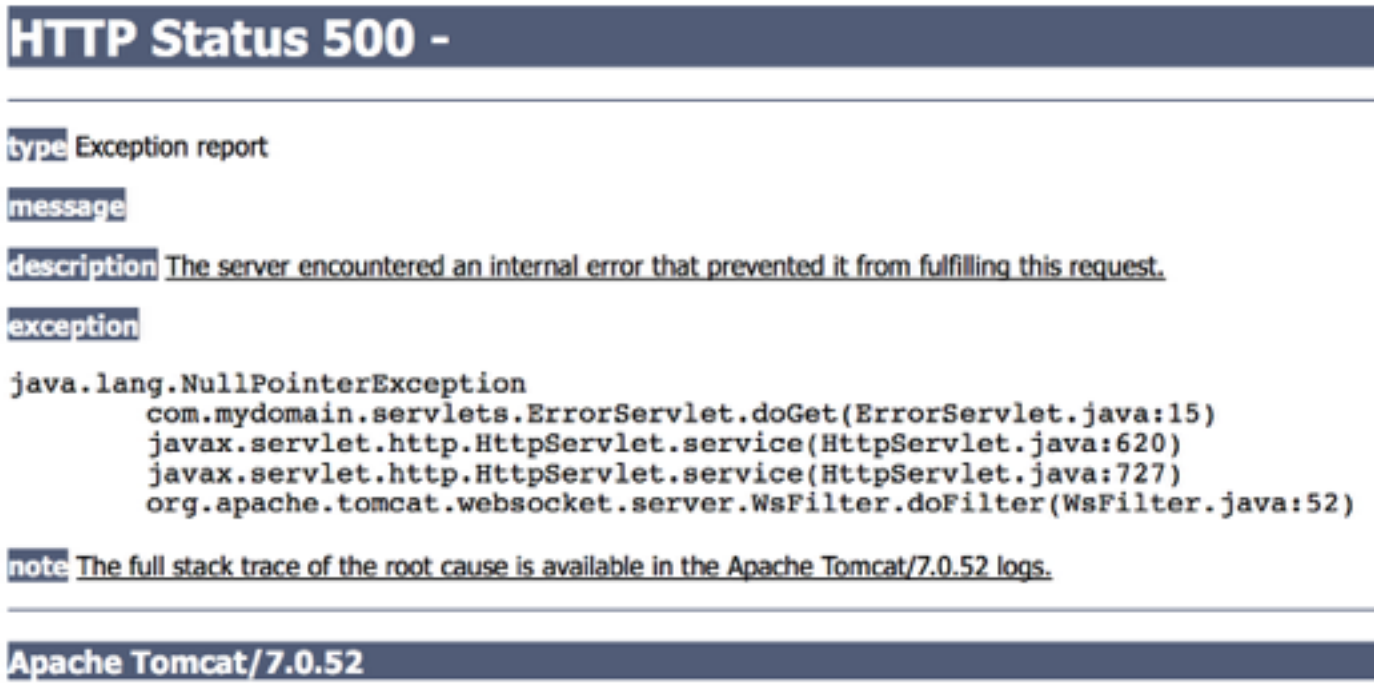
Tag Libraries

- JSTL is a standard library thats part of the JEE spec
- However there are other tag libraries provided by third parties.
    - DisplayTag
    - Struts
    - Tiles
    - Spring MVC
- Lets retrofit our listing screen to use DisplayTag library

Error Page



HTTP Status 500 -

type Exception report

message

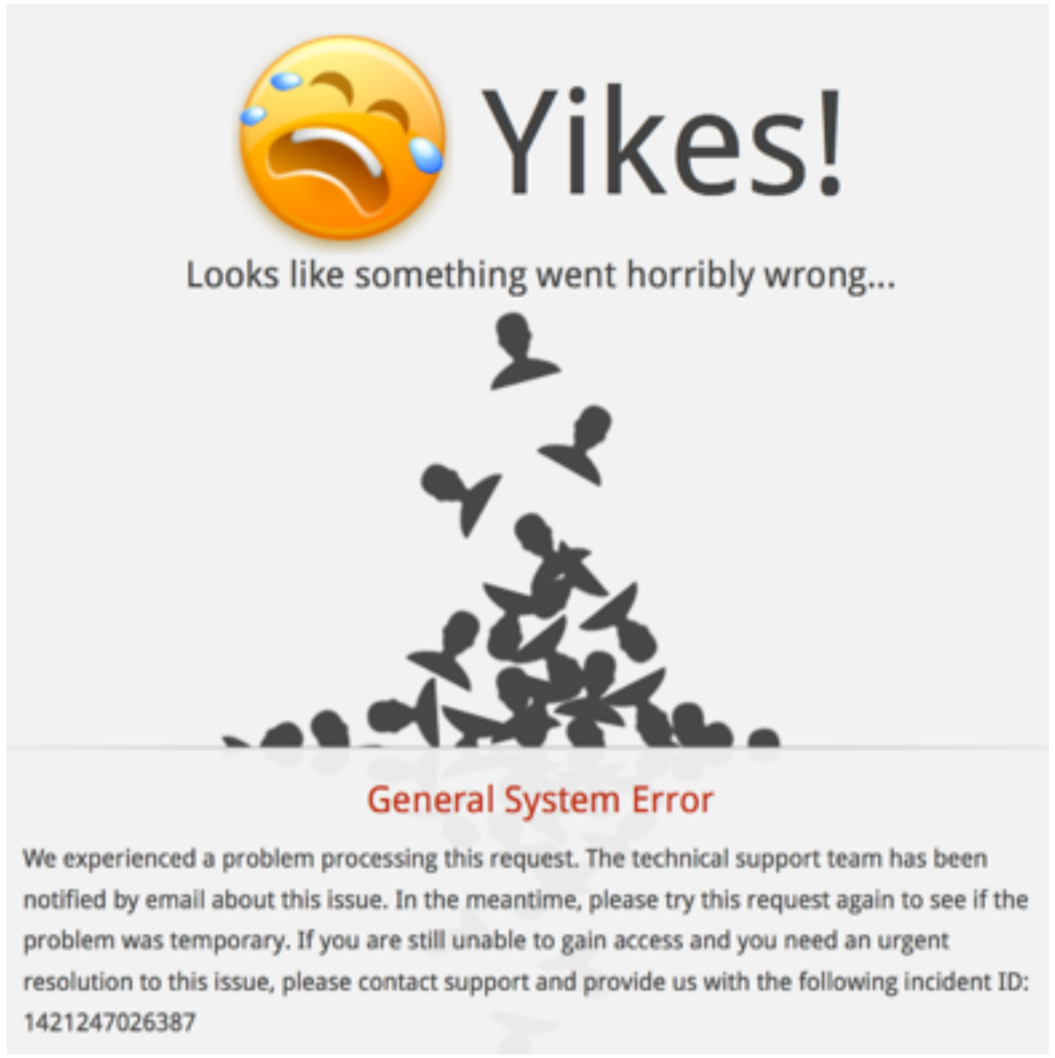
description The server encountered an internal error that prevented it from fulfilling this request.

exception

```
java.lang.NullPointerException
	com.mydomain.servlets.ErrorServlet.doGet(ErrorServlet.java:15)
	javax.servlet.http.HttpServlet.service(HttpServlet.java:620)
	javax.servlet.http.HttpServlet.service(HttpServlet.java:727)
	org.apache.tomcat.websocket.server.WsFilter.doFilter(WsFilter.java:52)
```

note The full stack trace of the root cause is available in the Apache Tomcat/7.0.52 logs.

Apache Tomcat/7.0.52



Yikes!

Looks like something went horribly wrong...

General System Error

We experienced a problem processing this request. The technical support team has been notified by email about this issue. In the meantime, please try this request again to see if the problem was temporary. If you are still unable to gain access and you need an urgent resolution to this issue, please contact support and provide us with the following incident ID: 1421247026387

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Error Handling

- Declare an error page in web.xml

```
<error-page>
  <error-code>500</error-code>
  <location>/error.jsp</location>
</error-page>
<error-page>
  <exception-type>java.lang.Exception</exception-type>
  <location>/error.jsp</location>
</error-page>
```

- Write an error page using these variables

```
${pageContext.exception} - Actual exception
${pageContext.errorData.requestURI} - url causing exception
${pageContext.errorData.statusCode} - http status code
${pageContext.exception.stackTrace} - stack trace element collection
```

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Creating Our Own Tags

We can create our own tags too when we need

- Create a Tag Library Descriptor (TLD)
- Define your tag
- Write a tag handler
- Include the tag library and use

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A Definition In TLD

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE taglib
  PUBLIC "-//Sun Microsystems, Inc.//DTD JSP Tag Library 1.2//EN"
  "http://java.sun.com/dtd/web-jsptaglibrary_1_2.dtd">
<taglib>
  <tlib-version>1.0</tlib-version>
  <jsp-version>2.0</jsp-version>
  <short-name>US States</short-name>
  <uri>http://com.mydomain/mytags</uri>
  <tag>
    <name>UsStates</name>
    <tag-class>com.mytag.UsStatesTag</tag-class>
    <body-content>empty</body-content>
  </tag>
</taglib>
```

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Tag Handler

```
public class UsStatesTag extends SimpleTagSupport {
   public void doTag() throws JspException, IOException {
      String selectTag = "<select name='states'><option 
value='GA'>Georgia</option><option value='CA'>California</option></
select>";
      getJspContext().getOut().println(selectTag);
   }
}
```

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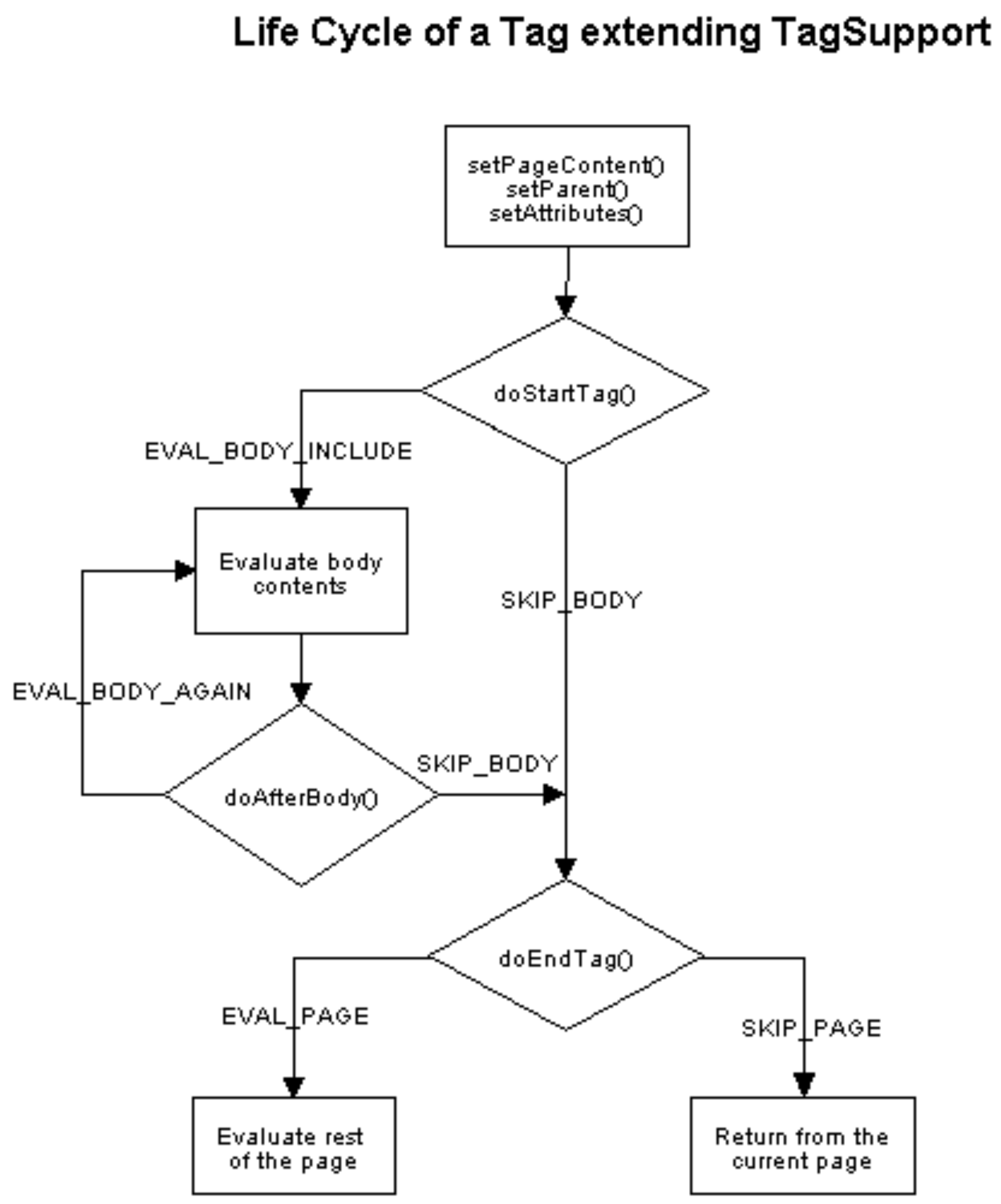
Tag Lifecycle



Redirect vs Forward

- Forwarding is done transparent to the browser only on the server side with in the same app server in the same request processing thread

```
request.getRequestDispatcher("myjsp.jsp").forward(request, response);
```

- Redirect is done by sending a 302 response to the browser so that the browser can send another request to the new url specified.

```
response.sendRedirect("http://google.com");
```

- Where to use what?

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Filters

- Request filters allow some processing before the request gets to the servlet or the JSP
- Response filters allow some processing after the request is processed by the servlet
- Filters can be mapped to one or more urls

```
<filter>
  <filter-name>usageStats</filter-name>
  <filter-class>com.lo.app.servlets.UsageStatsFilter</filter-class>
</filter>
<filter-mapping>
  <filter-name>usageStats</filter-name>
  <url-pattern>*.action</url-pattern>
</filter-mapping>
```

Filter Impl

```
public class UsageStatsFilter implements Filter {
   public void doFilter(ServletRequest req, ServletResponse resp,
FilterChain chain) throws IOException, ServletException {

      HttpServletRequest request = (HttpServletRequest) req;
      HttpServletResponse response = (HttpServletResponse) resp;
      //Do something before the servlet processes it
      chain.doFilter(request, response);
      //Do something after the servlet processes it
   }

}
```

Implement authentication with help from filters

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Async Servlets

- Async servlets allow us to unblock the request processing thread pool while the servlet performs its long running task in another thread
- Its like putting the request in cold storage and returning the thread till the request processing is done
- AsyncContext class maintains the state of the request thats dormant now
- Client browser sees it as just another long running request
- Helps in design patterns that dont need polling.

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Example AsyncServlet

```
ExecutorService serv = Executors.newFixedThreadPool(5);

protected void doGet(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
   request.setAttribute("org.apache.catalina.ASYNC_SUPPORTED", true);
   final AsyncContext context = request.startAsync();
   Callable<String> c = new Callable<String>() {
      public String call() throws Exception {
         context.getRequest().setAttribute("asyncdata","Hello World");
         context.dispatch("/asyncdone.jsp");
         return "Hello World";
      }
   };
   serv.submit(c);
}
```

Asynchronous JavaScript and XML

- AJAX is a technique for creating better, faster, and more interactive web applications with the help of XML, HTML, CSS and Java Script.
- JavaScript will make a request to the server, interpret the results and update the current screen.
- A user can continue to use the application while the client program requests information from the server in the background

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Examples

- Google Maps
    - A user can drag the entire map by using the mouse instead of clicking on a button or something
- Google Suggest
    - As you type, Google will offer suggestions. Use the arrow keys to navigate the results

XMLHttpRequest

- Main AJAX interaction API in browsers

Method	Description
void open(method, URL)	opens the request specifying get or post method and url.
void open(method, URL, async)	same as above but specifies asynchronous or not.
void open(method, URL, async, username, password)	same as above but specifies username and password.
void send()	sends get request.
void send(string)	send post request.
setRequestHeader(header,value)	it adds request headers.

Ready States

Property	**Description**
onReadyStateChange	It is called whenever readystate attribute changes. It must not be used with synchronous requests.
readyState	represents the state of the request. It ranges from 0 to 4 **0** UNOPENED open() is not called. **1** OPENED open is called but send() is not called. **2** HEADERS_RECEIVED send() is called, and headers and status are available. **3** LOADING Downloading data; responseText holds the data. **4** DONE The operation is completed fully.
reponseText	returns response as text.
responseXML	returns response as XML

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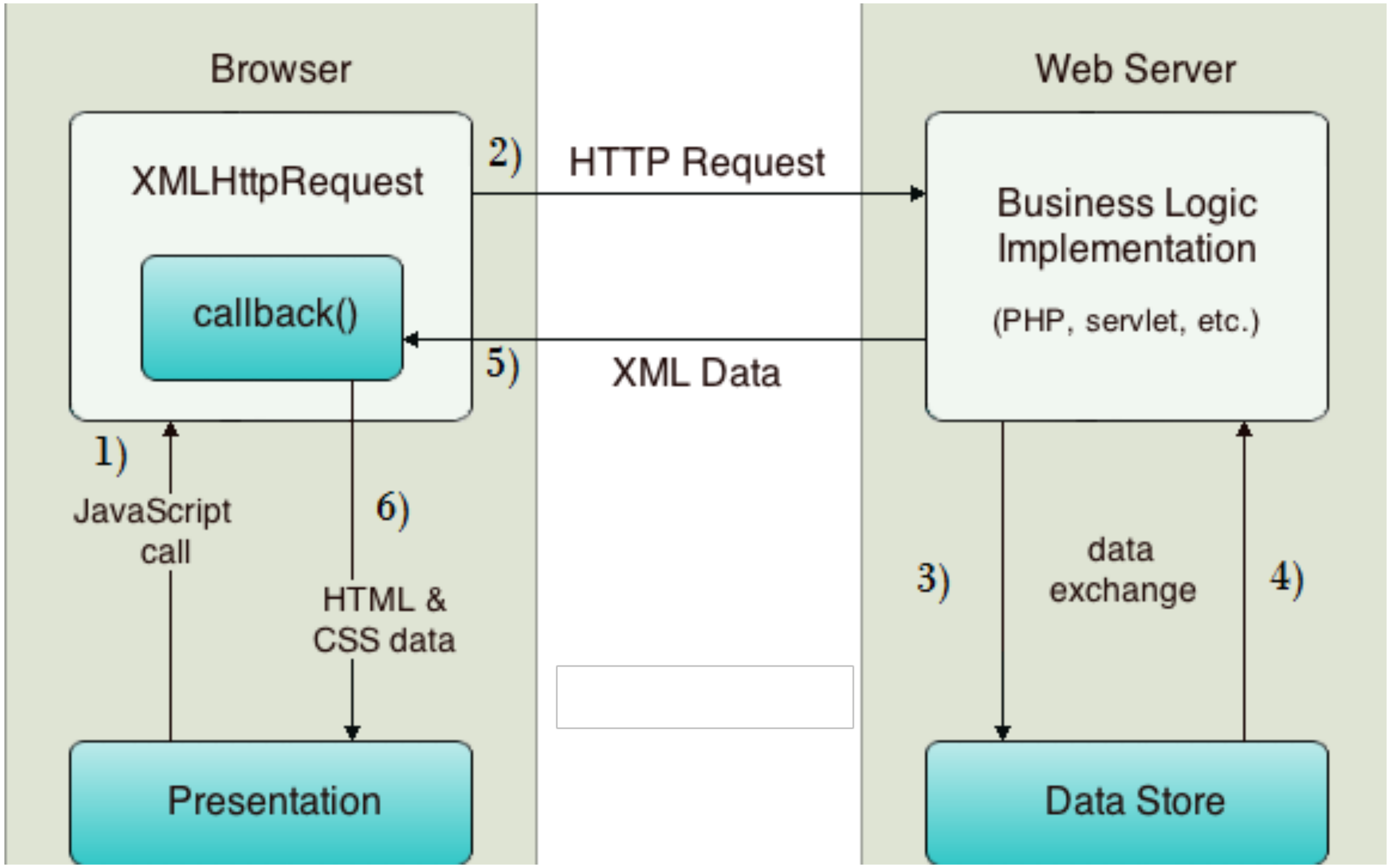
AJAX Interaction



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AJAX Conventional JS

```
<script type="text/javascript">
function loadAjaxPlain()
{
    var xmlhttp;
    xmlhttp=new XMLHttpRequest();
    xmlhttp.onreadystatechange=function(){
        if (xmlhttp.readyState==4 && xmlhttp.status==200){
            document.getElementById("myDiv").innerHTML=xmlhttp.responseText;
        }
    }
    xmlhttp.open("GET","answer.txt",true);
    xmlhttp.send();
}

</script>
<div id="myDiv"><h2>How many cars does Ferrari produce in an year</h2></div>
<button type="button" onclick="loadAjaxPlain()">Find out!</button>
```

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AJAX using JQuery

```
<script>

function loadAjaxJquery(){
   $.get("answer.txt", function(data){
      $("#myDiv2").html(data);
   })
}

</script>
<div id="myDiv2"><h2>How many cars does Ferrari produce in an year</h2></div>
<button type="button" onclick="loadAjaxJquery()">Find out!</button>
```

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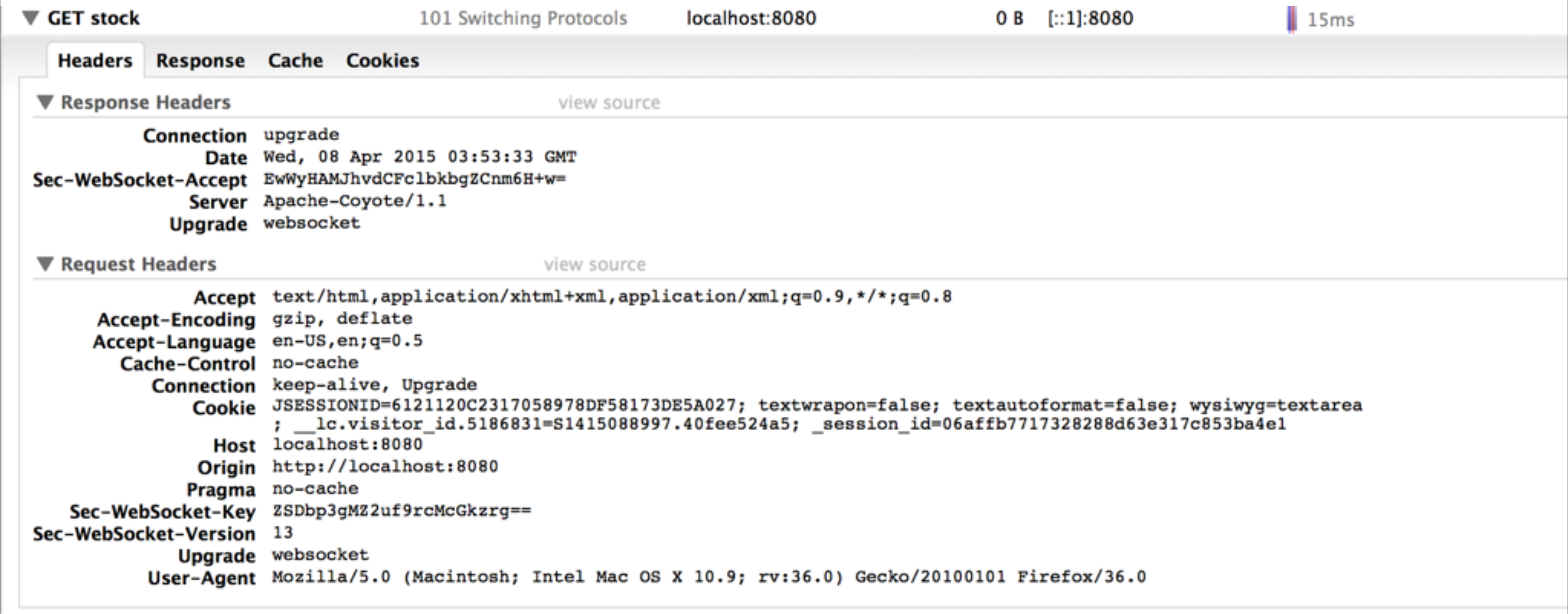
File Upload

- Multipart request parsing is not trivial. Hence we rely on libraries to do this for us
- One of the libraries are Apache commons fileupload
- Depends on apache IOUtils.
- Apache commons is a group of very useful libraries

WebSockets

- Web Sockets allow for full duplex communication between the browser and server.

- Http is used to initialise the WebSocket connection



```
▼ GET stock          101 Switching Protocols    localhost:8080    0 B   [::1]:8080    15ms

Headers  Response  Cache  Cookies

▼ Response Headers                    view source
           Connection  upgrade
                 Date  Wed, 08 Apr 2015 03:53:33 GMT
 Sec-WebSocket-Accept  EwWyHAMJhvdCFclbkbgZCnm6H+w=
               Server  Apache-Coyote/1.1
              Upgrade  websocket

▼ Request Headers                     view source
                Accept  text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
       Accept-Encoding  gzip, deflate
       Accept-Language  en-US,en;q=0.5
         Cache-Control  no-cache
            Connection  keep-alive, Upgrade
                Cookie  JSESSIONID=6121120C2317058978DF58173DE5A027; textwrapon=false; textautoformat=false; wysiwyg=textarea
                        ; __lc.visitor_id.5186831=S1415088997.40fee524a5; _session_id=06affb7717328288d63e317c853ba4e1
                  Host  localhost:8080
                Origin  http://localhost:8080
                Pragma  no-cache
     Sec-WebSocket-Key  ZSDbp3gMZ2uf9rcMcGkzrg==
 Sec-WebSocket-Version  13
               Upgrade  websocket
            User-Agent  Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:36.0) Gecko/20100101 Firefox/36.0
```

Web Socket Client

- Web Sockets are supported on most browsers now

```
var exampleSocket = new WebSocket("ws://www.example.com/socketserver");
exampleSocket.onopen = function (event) {
   exampleSocket.send("Hello from client");
};
exampleSocket.onmessage = function (event) {
   document.getElementById('content').innerHTML = event.data;
     exampleSocket.close();
}
```

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Web Socket Server

- Not part of the JEE spec till JEE 7. So there isnt any standard app server support
- WebSocket spec is JSR 356 - implemented in tomcat 7 and a few other app servers even without JEE 7 support
- Can be created with annotation driven classes

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Web Socket Server

```
@ServerEndpoint(value = "/stock")
public class StockPriceServlet {

    private Logger logger = Logger.getLogger(this.getClass().getName());

    @OnOpen
    public void onOpen(Session session) {
        logger.info("Connected ... " + session.getId());
    }


    @OnMessage
    public String onMessage(String message, Session session) {
        switch (message) {
            case "quit":
                try {
                    session.close(new CloseReason(CloseCodes.NORMAL_CLOSURE, "Server Ended Connection"));
                } catch (IOException e) {
                    throw new RuntimeException(e);
                }
                break;
        }
        return message;
    }

    @OnClose
    public void onClose(Session session, CloseReason closeReason) {
        logger.info(String.format("Session %s closed because of %s", session.getId(), closeReason));
    }
}
```