

Servlet

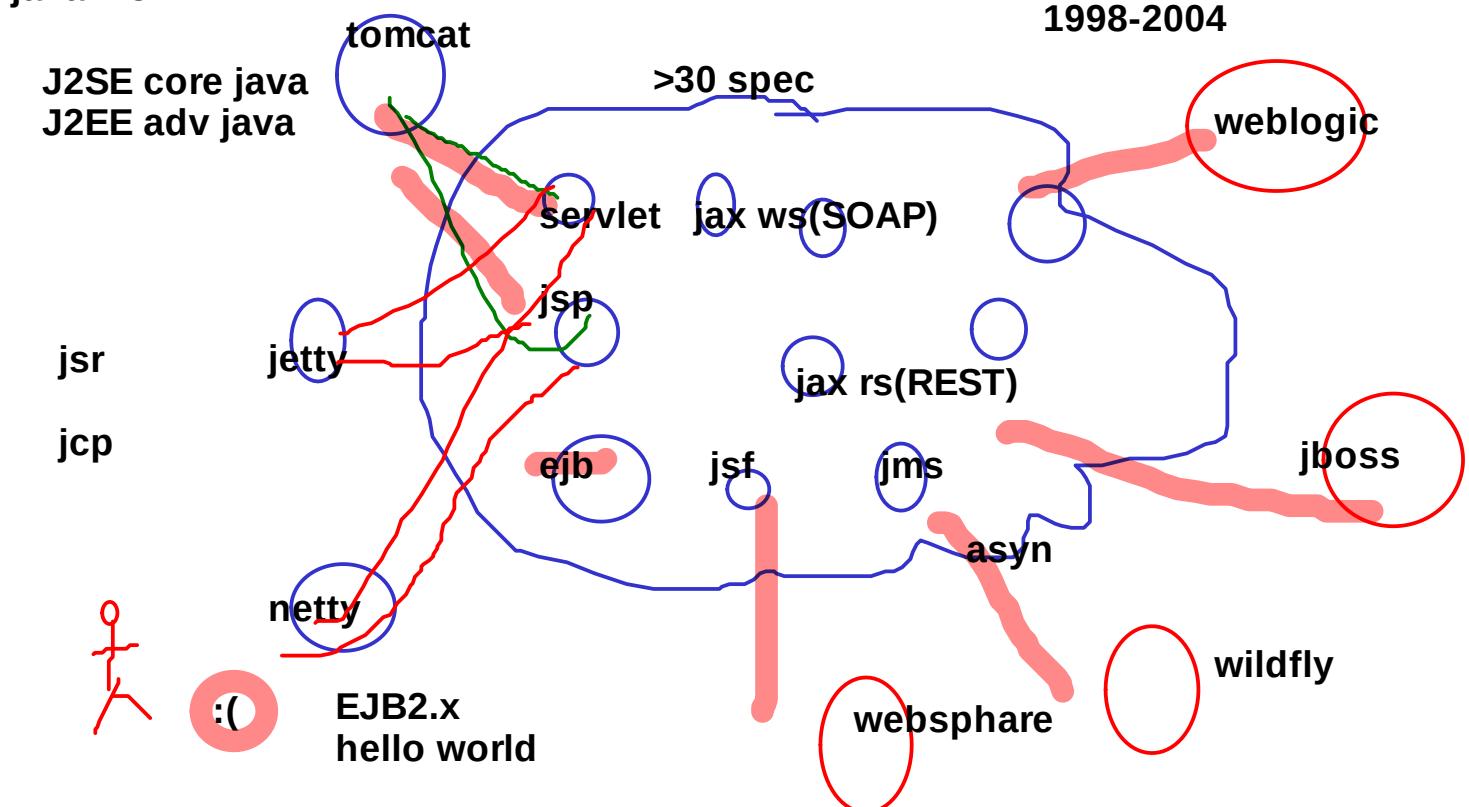
Rajeev Gupta
MTech CS

What is the eco system of web dev in java?

JEE

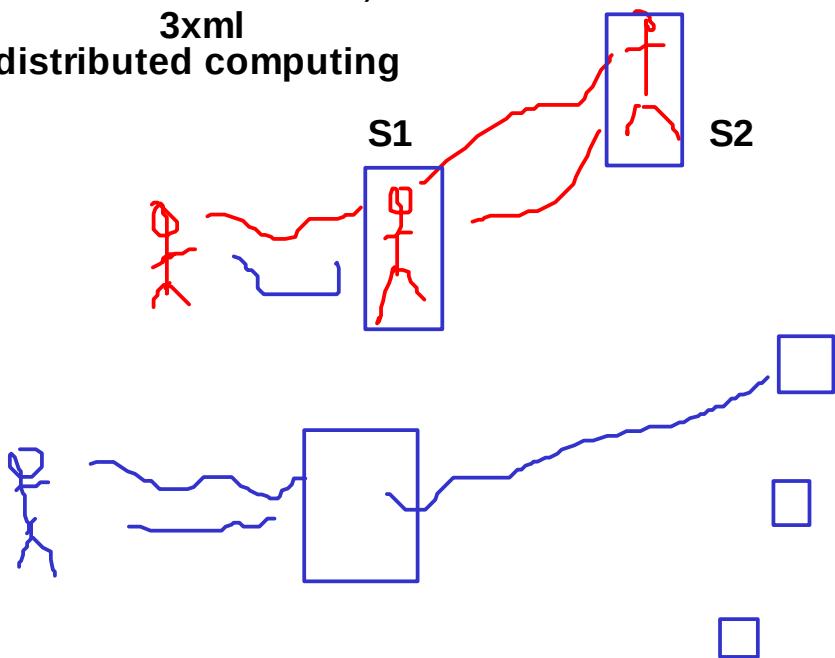
J2EE: java 2 enterprise edition?
specifications ie group of jsr
to create dynamic and distr web app in java

java 1.5



EJB(Enterprise java bean)

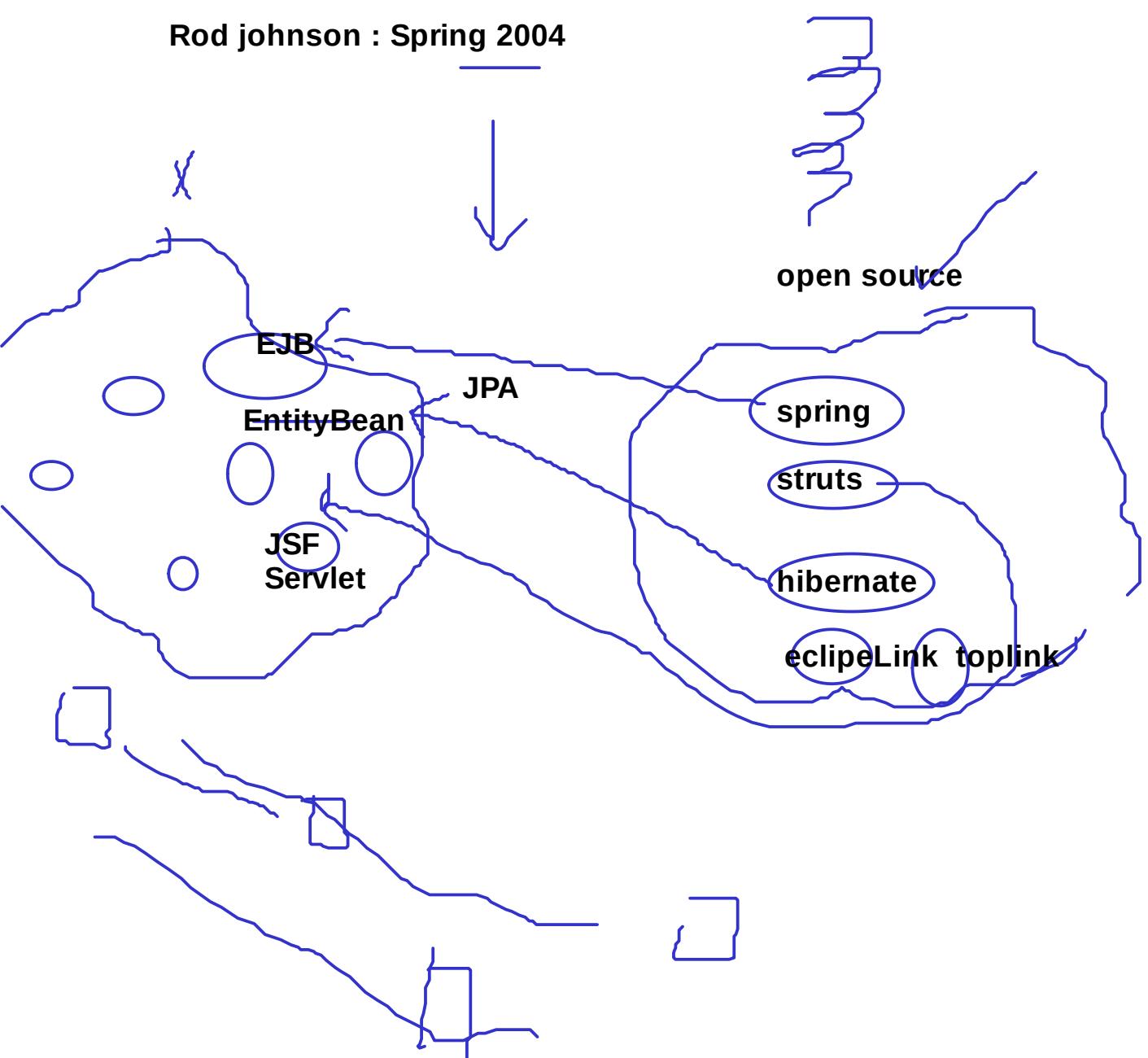
3 interface , 3 class
3xml
distributed computing



EJB

Sesison bean: BL
EntityBean : wrapper over jdb
MDB: asy processing jms*

Rod johnson : Spring 2004



static and dynamic web application

servlet jsp

servlet and jsp is used to create dynamic web app in java

asp php

servelet is a java code--> html dymic
main

jsp look like html---> internally it convrtd into servet---> dynamic html

servlet <-----> asp ---jsp

MVC

jsp fit in view layer

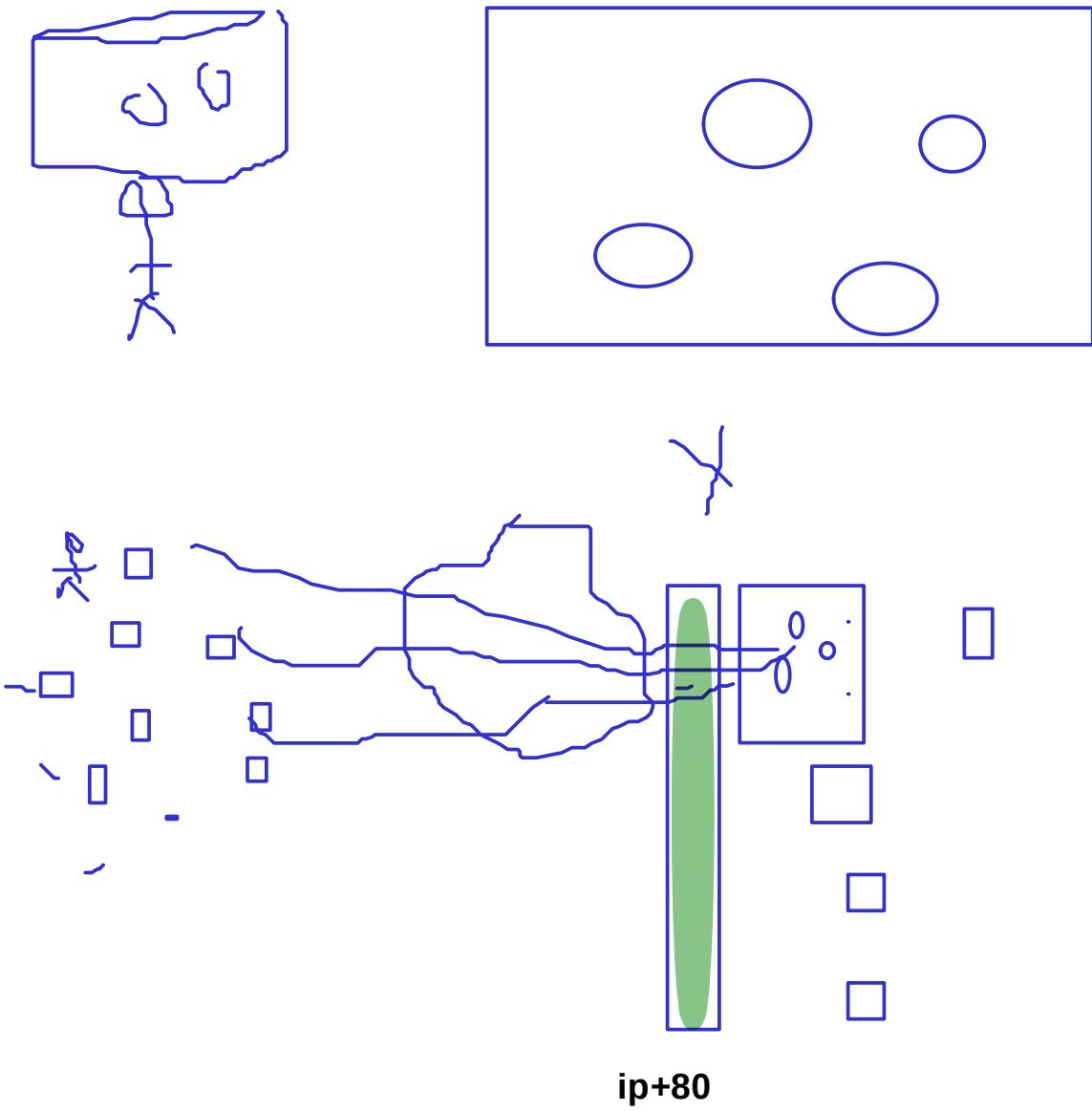
servlet fit in controller layer

web container vs web server vs application server

tomcat is a web container

web server : httpd server

app server: weblogic/jboss/ wildfly



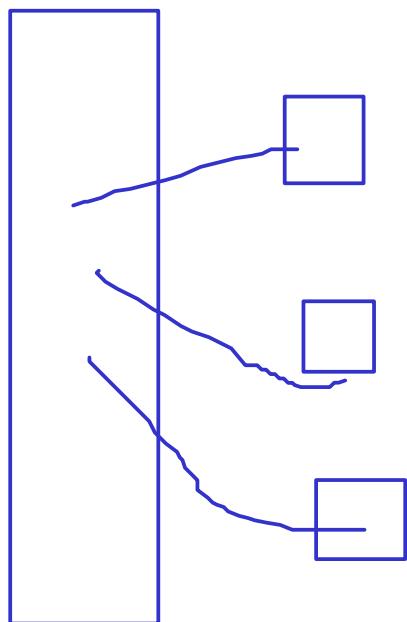
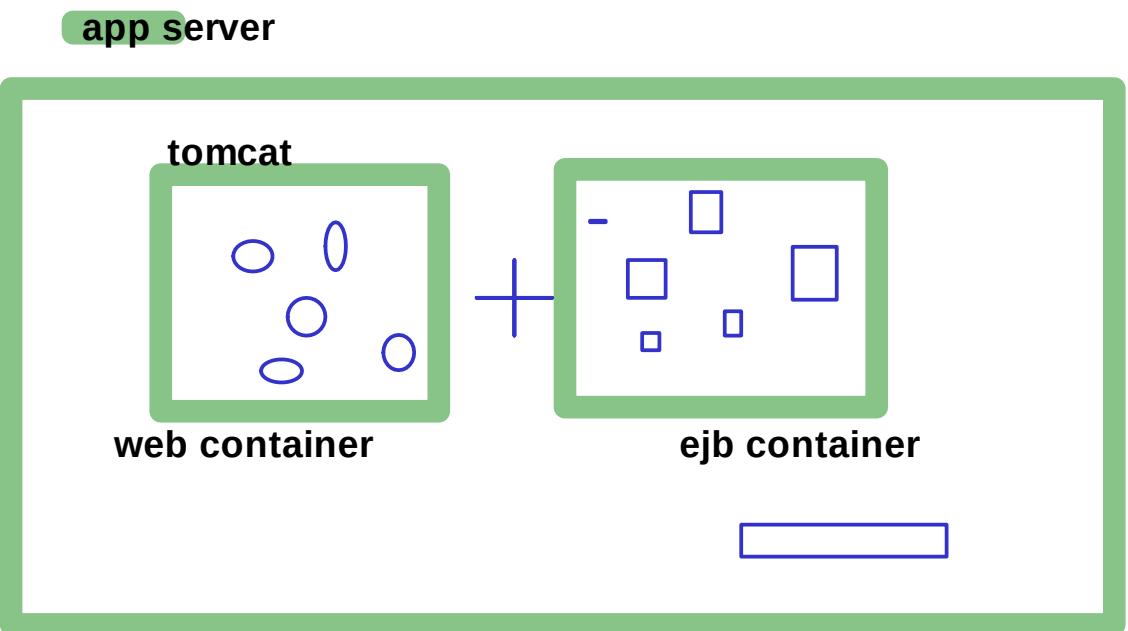
jdbc: localhost:3306
ip+ port no

tomcat
we will not use httpd or nginx

app server:
is a imp of all jsr of j2ee

wildfly

tomcat (F)



how to get started?

tools:

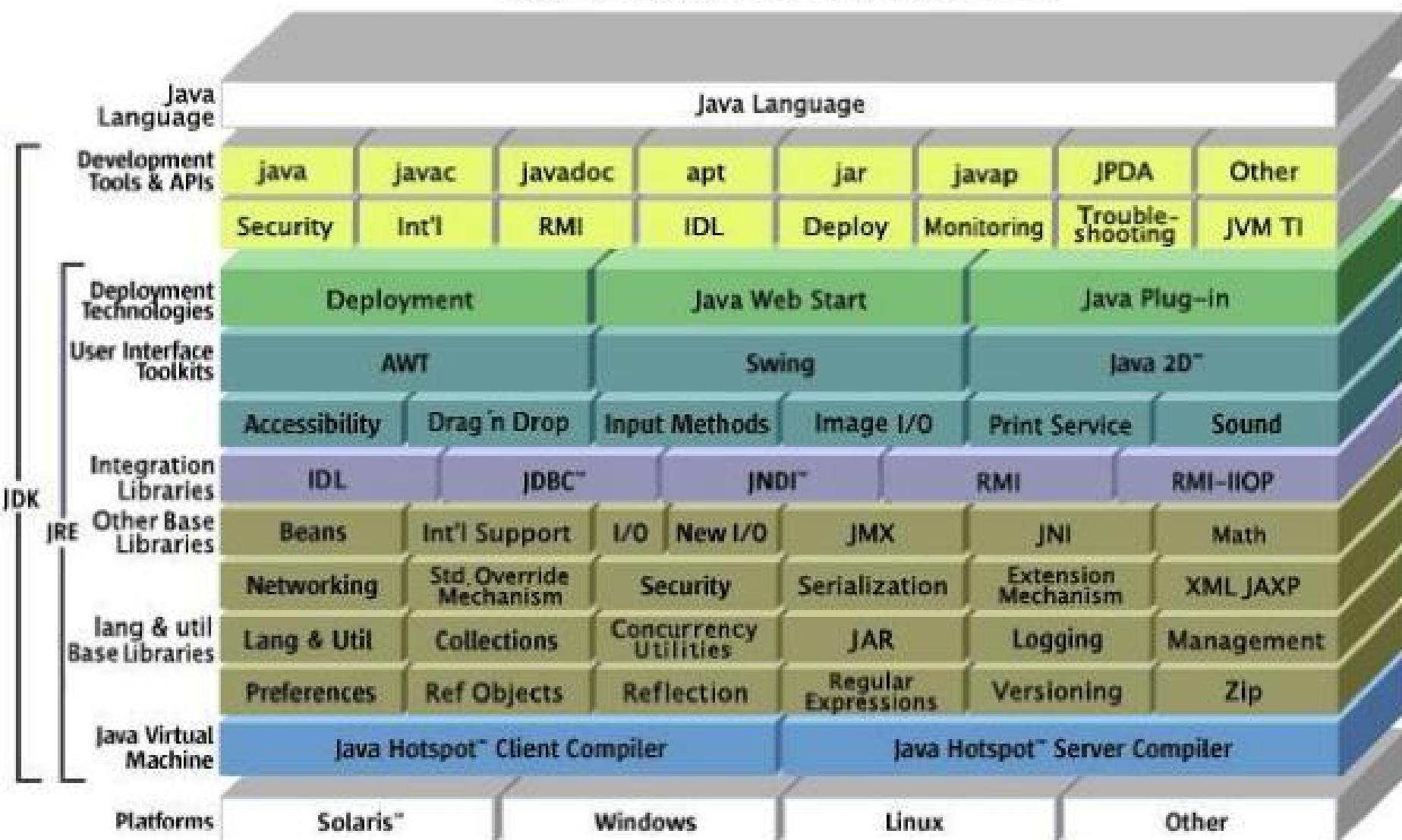
tomcat 9.x

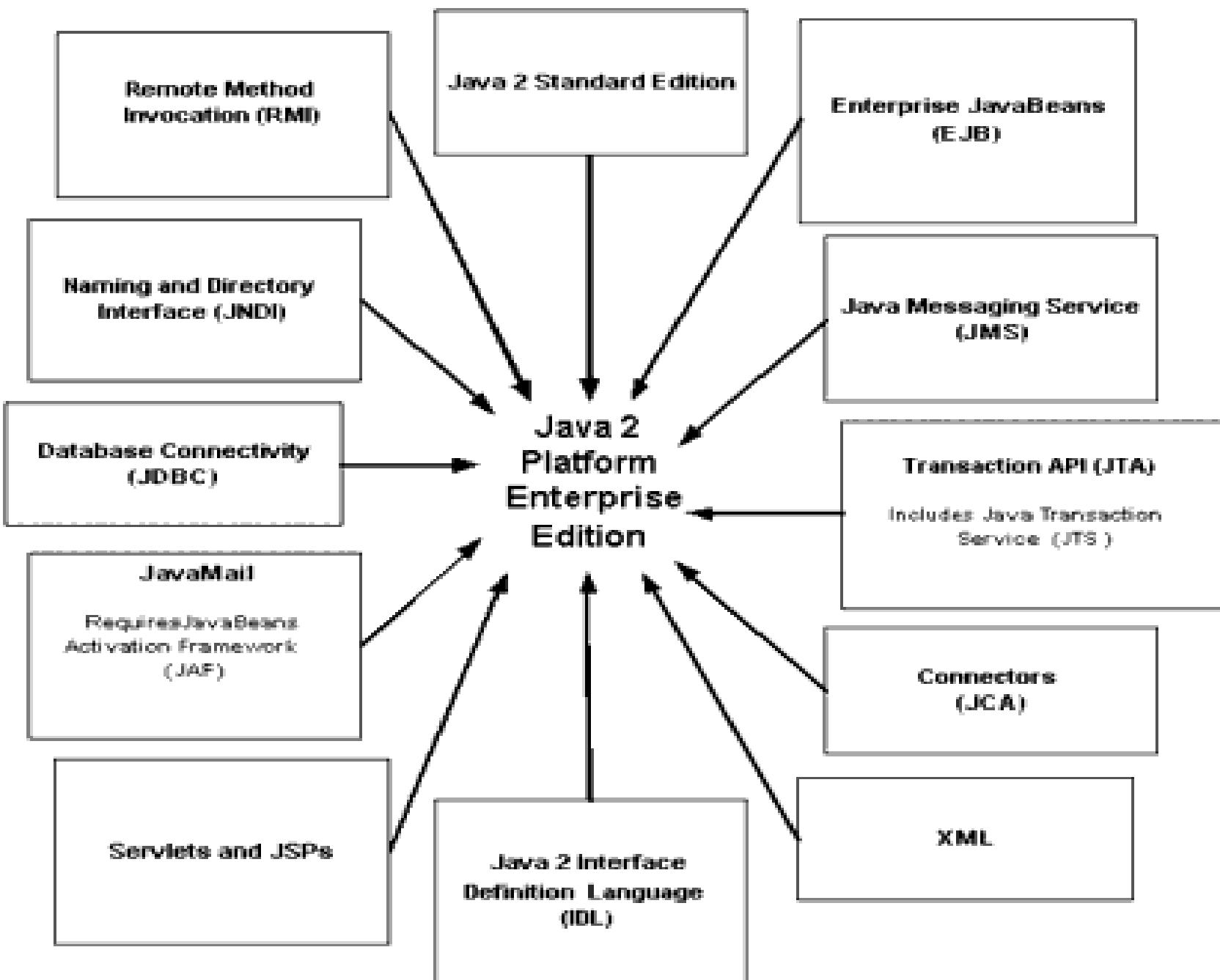
ide: intelliJ ide community edition + enterprise edition

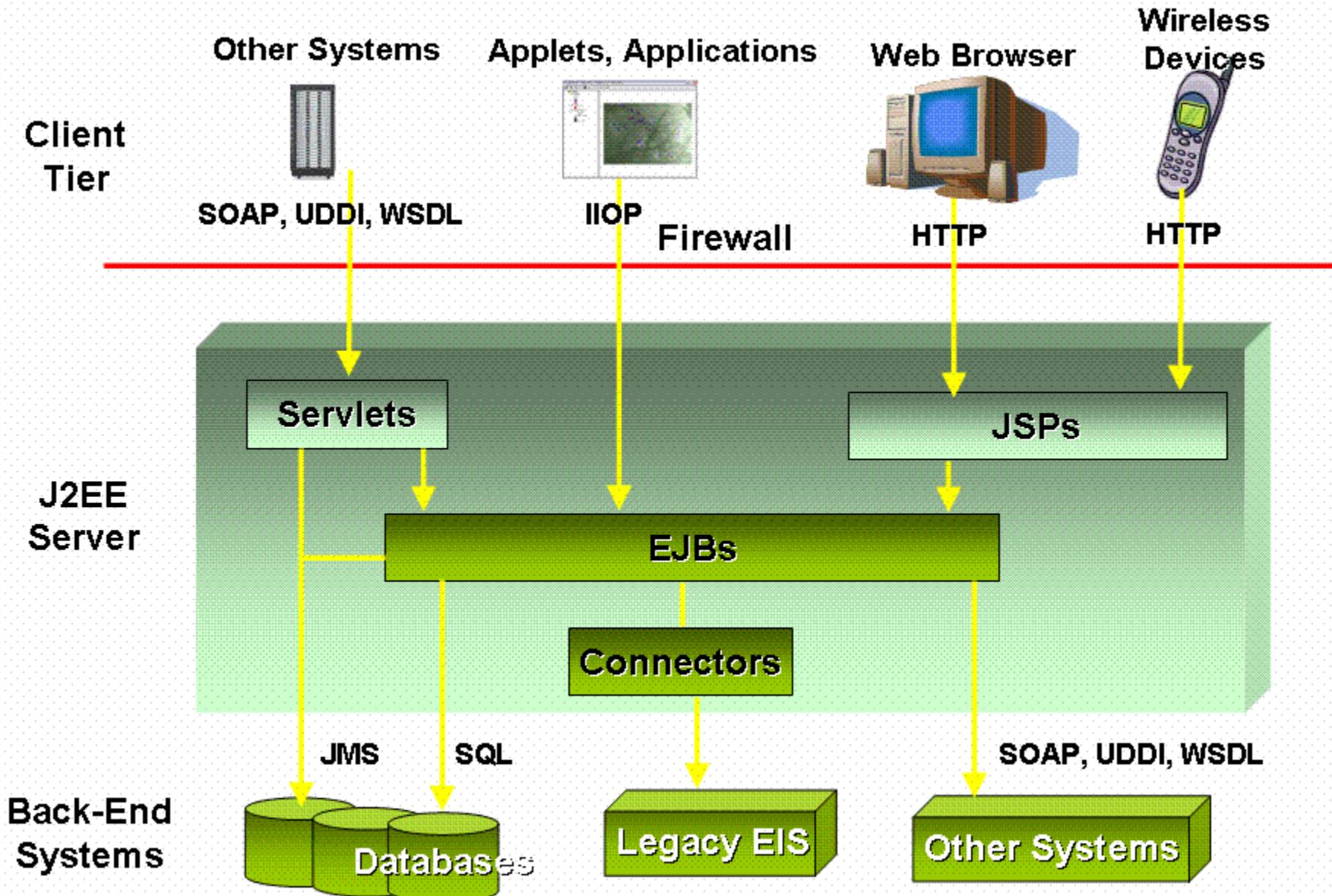
eclipse j2ee

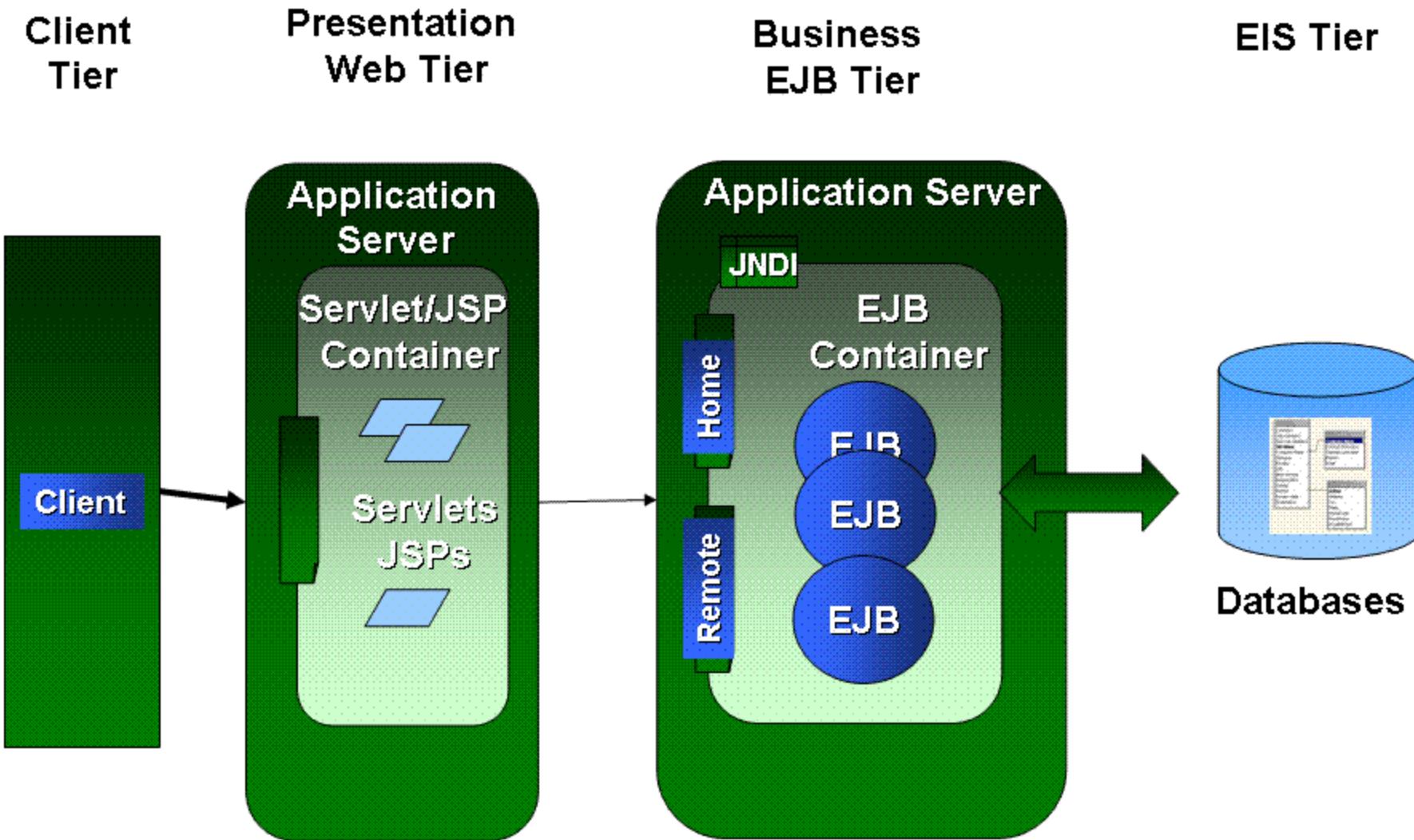
sts 3.x vs sts 4.x

Java™ 2 Platform Standard Edition 5.0

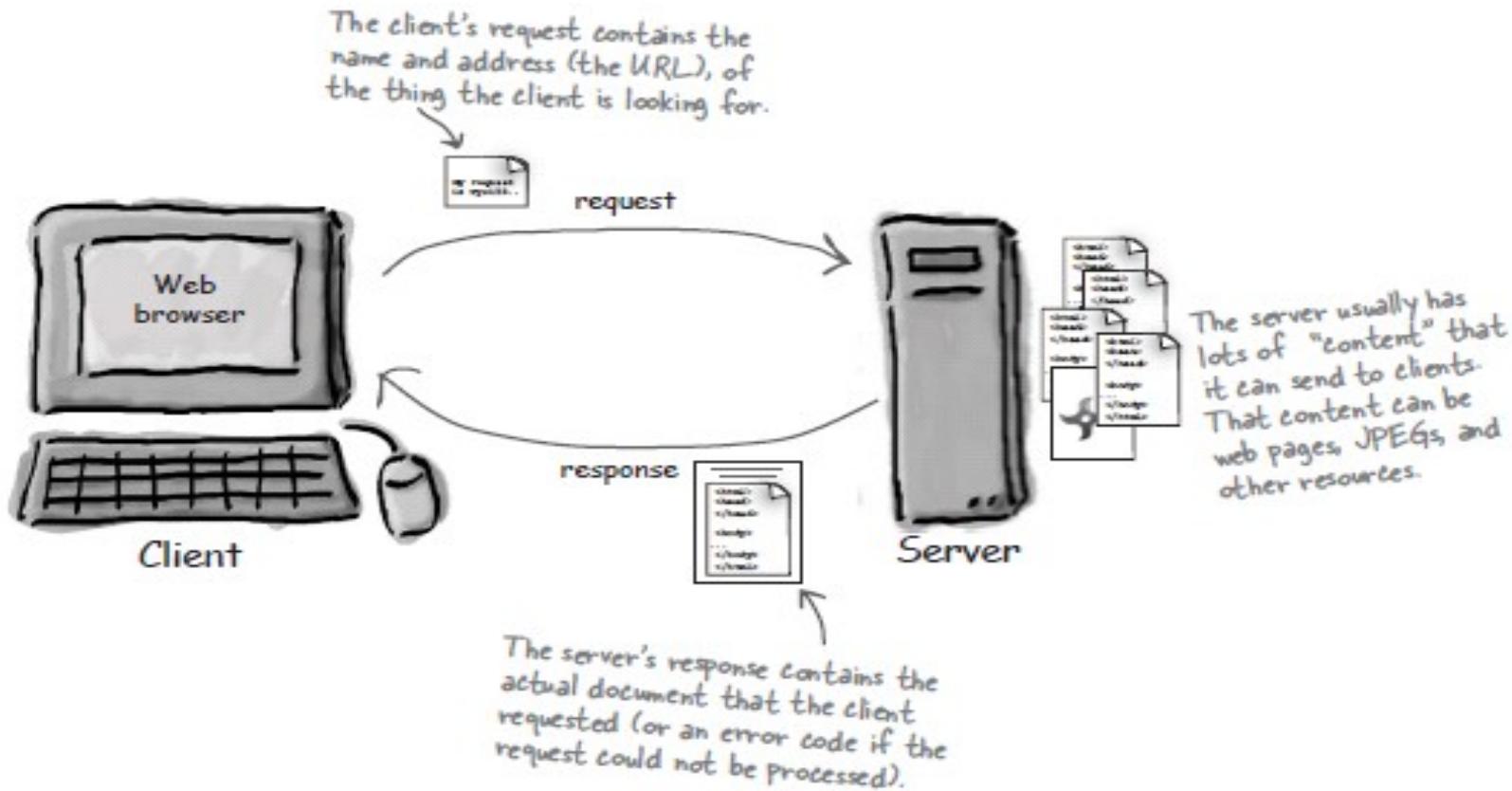


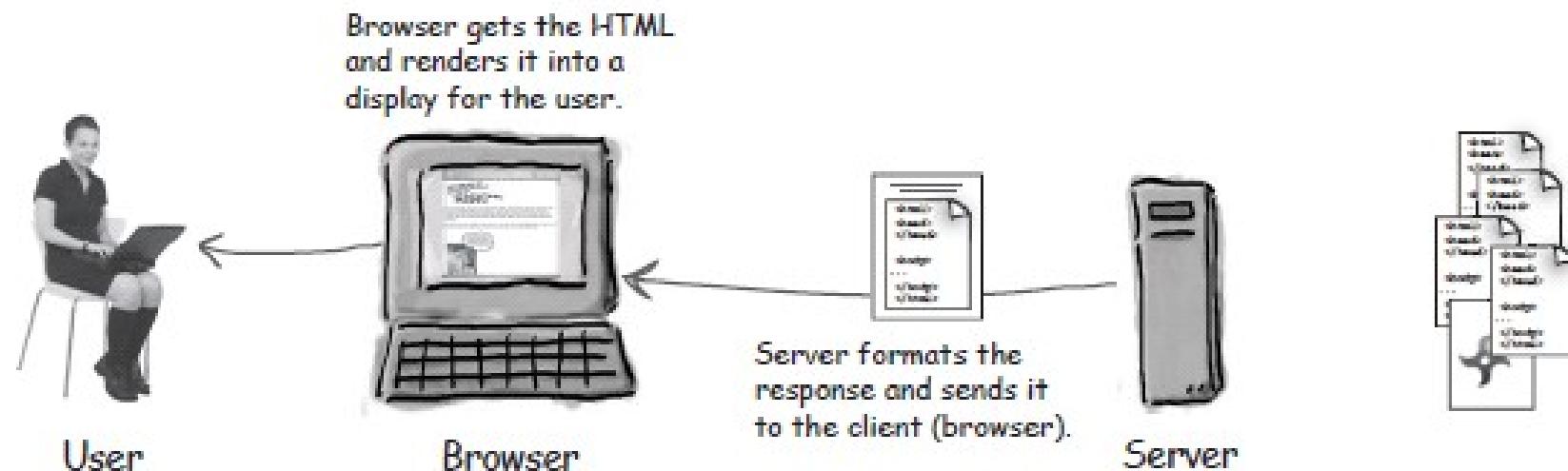
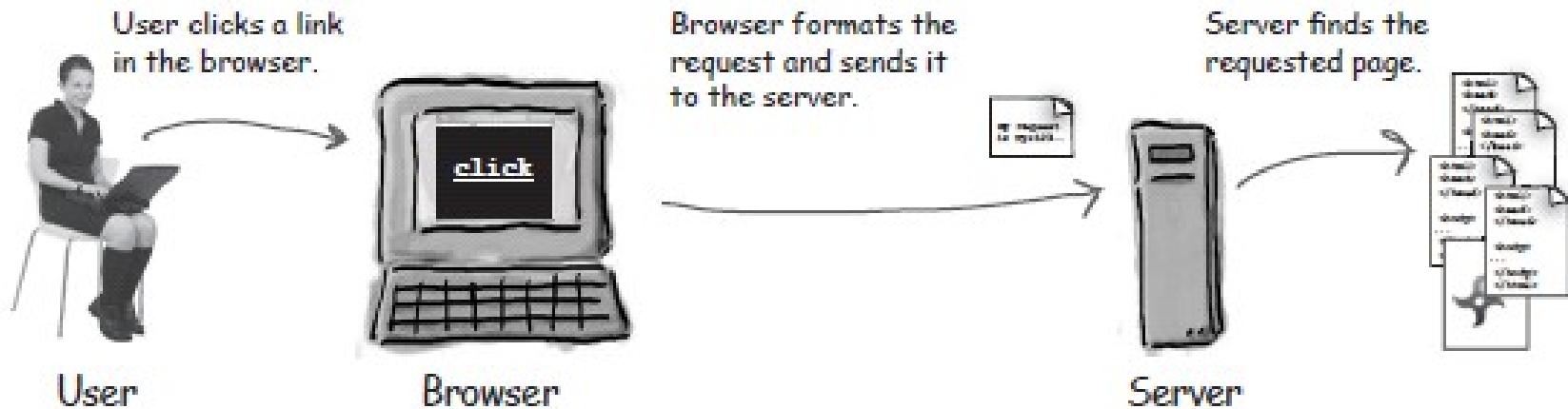






What does your web server do?

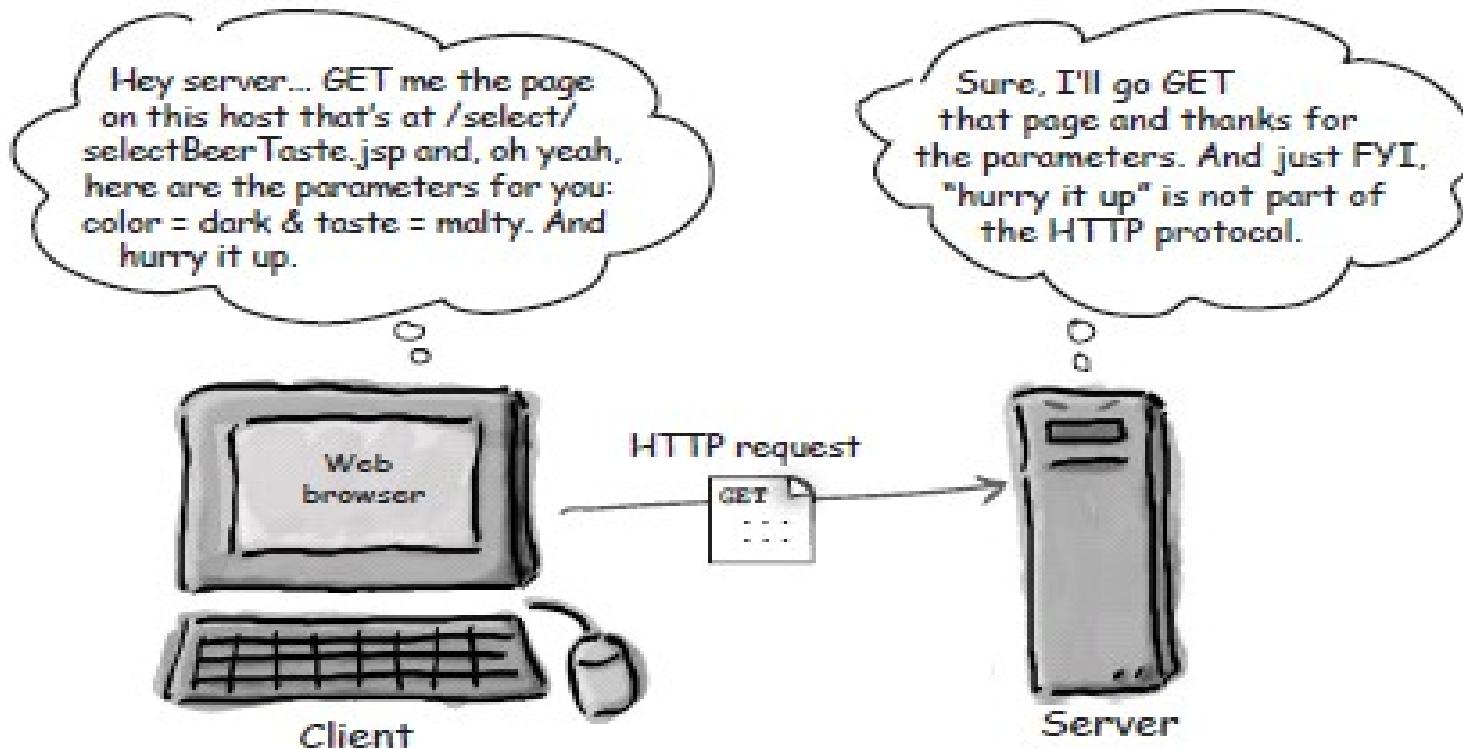




Clients and servers know HTML and HTTP

- **HTML tells the browser how to display the content to the user.**
- **HTTP is the protocol clients and servers use on the web to communicate.**
- **The server uses HTTP to send HTML to the client.**

Anatomy of an HTTP GET request



The Request line

The HTTP Method.

The Path to the resource on the web server.

In a GET request parameters ...
there are any) are appended to the first part of the request URL
starting with a "?". Parameters are separated with an ampersand "&".

The protocol version that the web browser is requesting

GET /select/selectBeerTaste.jsp?color=dark&taste=malty HTTP/1.1

The Request headers.

Host: www.wickedlysmart.com

User-Agent: Mozilla/5.0 (Macintosh; U; PPC Mac OS X Mach-O; en-US; rv:1.4) Gecko/20030624 Netscape/7.1

Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,video/x-mng,image/png,image/jpeg,image/gif;q=0.2,*/*;q=0.1

Accept-Language: en-us,en;q=0.5

Accept-Encoding: gzip,deflate

Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7

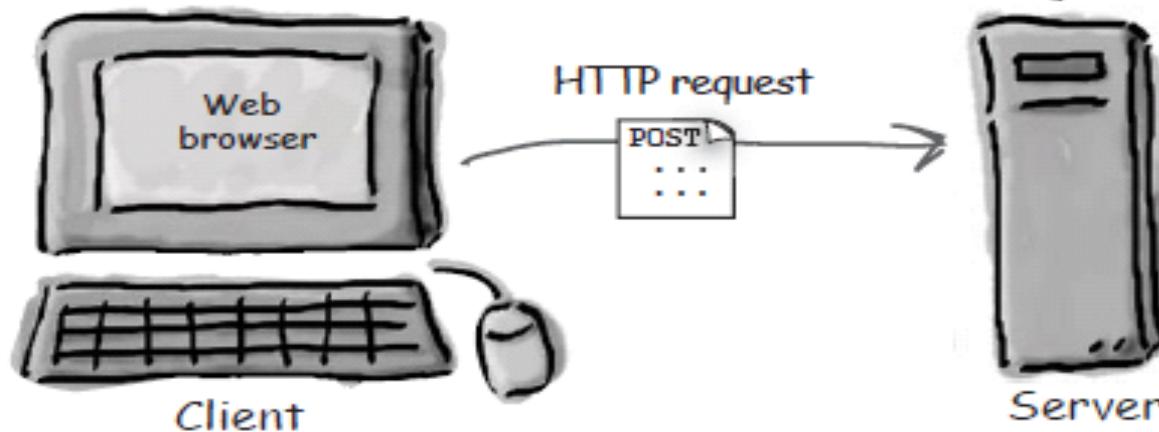
Keep-Alive: 300

Connection: keep-alive

Anatomy of an HTTP POST request

Hey server... please POST this to the resource at: /advisor/selectBeerTaste.do. Don't forget to look inside the body for the important data I'm sending.

Sure, I'll find that resource (it's actually a little application) and when I do, I'll give it the data in the request body you sent.



The Request line

The HTTP Method.

The Path to the resource on the web server.

The protocol version that the web browser is requesting.

POST /advisor/selectBeerTaste.do HTTP/1.1

Host: www.wickedlysmart.com

User-Agent: Mozilla/5.0 (Macintosh; U; PPC Mac OS X Mach-O; en-US; rv:1.4) Gecko/20030624 Netscape/7.1

Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,video/x-mng,image/png,image/jpeg,image/gif;q=0.2,*/*;q=0.1

Accept-Language: en-us,en;q=0.5

Accept-Encoding: gzip,deflate

Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7

Keep-Alive: 300

Connection: keep-alive

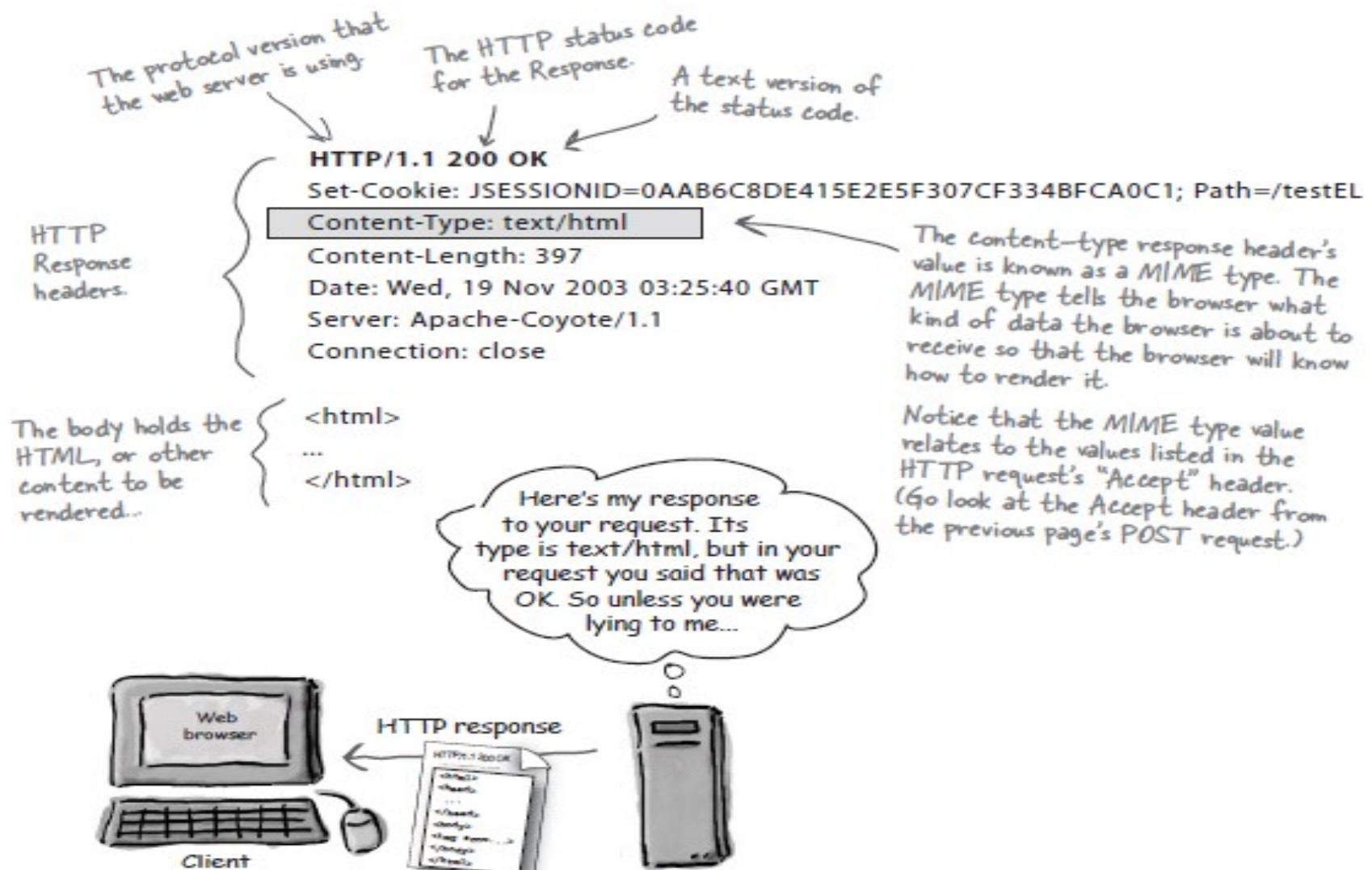
{ color=dark&taste=malty }

The Request headers.

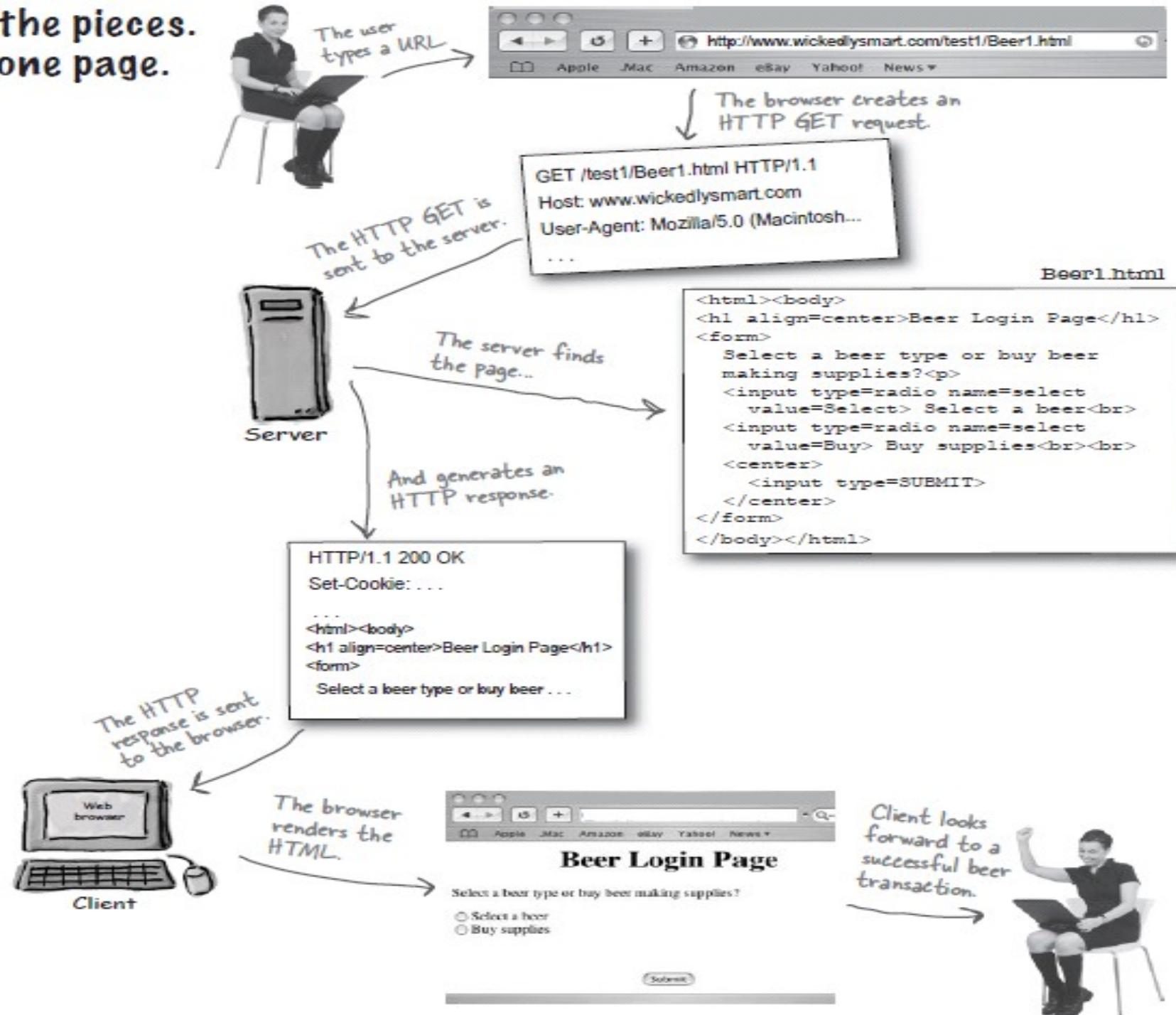
The message body, sometimes called the "payload".

This time, the parameters are down here in the body, so they aren't limited the way they are if you use a GET and have to put them in the Request line.

Anatomy of an HTTP response, and what the heck is a “MIME type”?



All the pieces. On one page.



Anatomy of URL

Protocol: Tells the server which communications protocol (in this case HTTP) will be used.

`http://www.wickedlysmart.com:80/beeradvice/select/beer1.html`

Server: The unique name of the physical server you're looking for. This name maps to a unique IP address. IP addresses are numeric and take the form "xxx.yyy.zzz.aaa". You can specify an IP address here instead of a server name, but a server name is a lot easier to remember.

Resource: The name of the content being requested. This could be an HTML page, a servlet, an image, PDF, music, video, or anything else the server feels like serving. If this optional part of the URL is left out, most web servers will look for index.html by default.

Path: The path to the location, on the server, of the resource being requested. Because most of the early servers on the web ran Unix, Unix syntax is still used to describe the directory hierarchies on the web server.

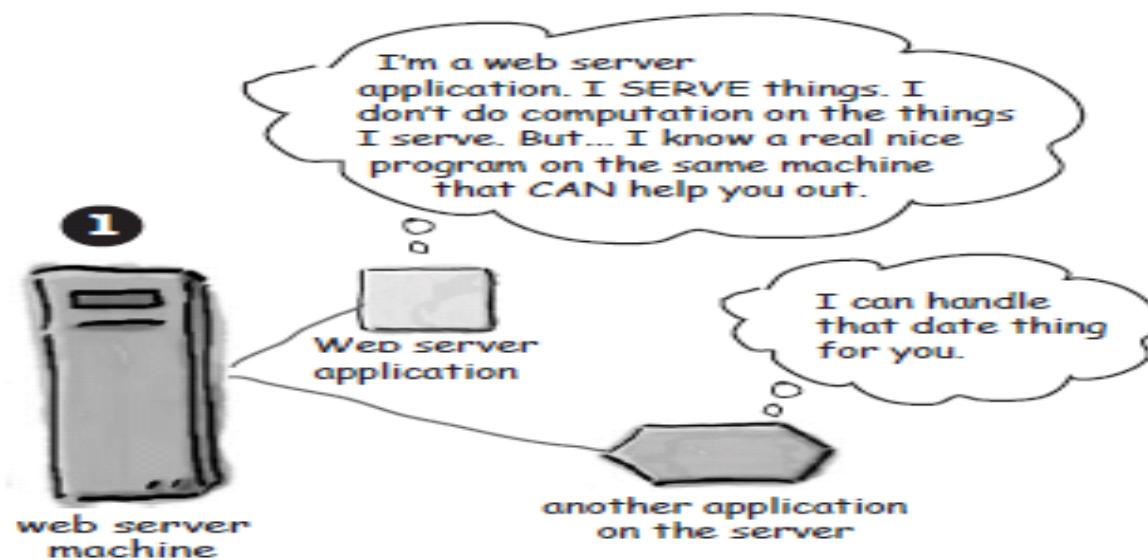
Not shown:

Optional Query String:
Remember, if this was a GET request, the extra info (parameters) would be appended to the end of this URL, starting with a question mark "?", and with each parameter (name/value pair) separated by an ampersand "&".

Why Server is not enough

- Dynamic Content
- Saving data on the server

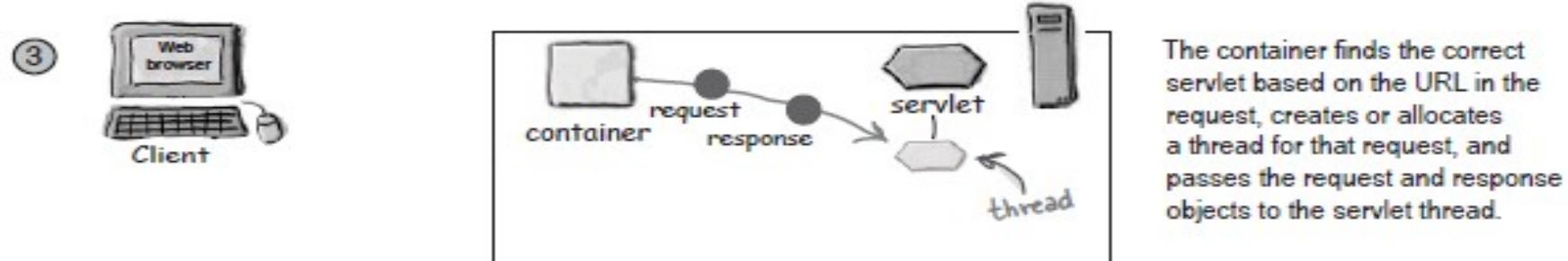
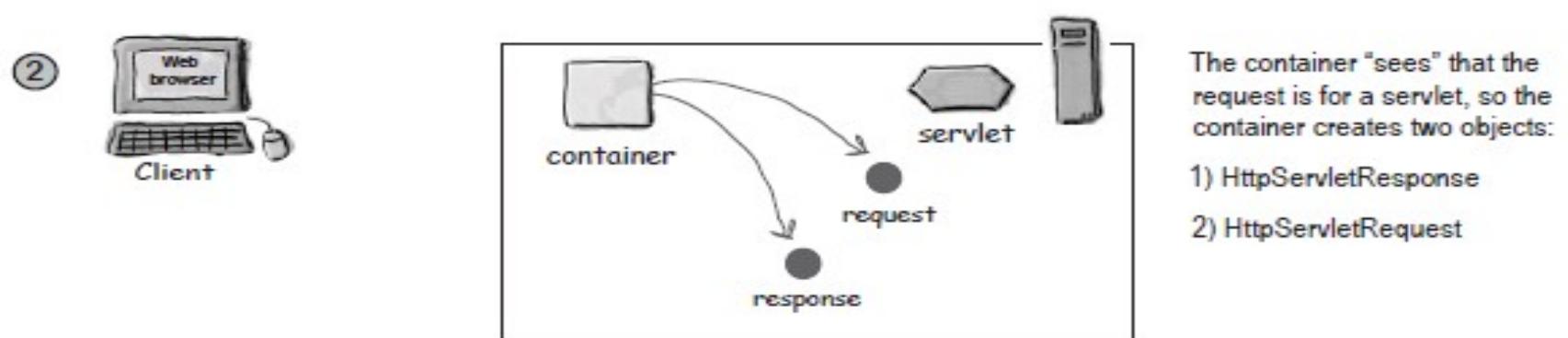
But sometimes you need more than just the web server



What a container?

- Communication support
- Lifecycle management
- Multithreading support
- Declarative security
- JSP Support

How a container handle a dynamic request?



④



The container calls the servlet's service() method. Depending on the type of request, the service() method calls either the doGet() or doPost() method.

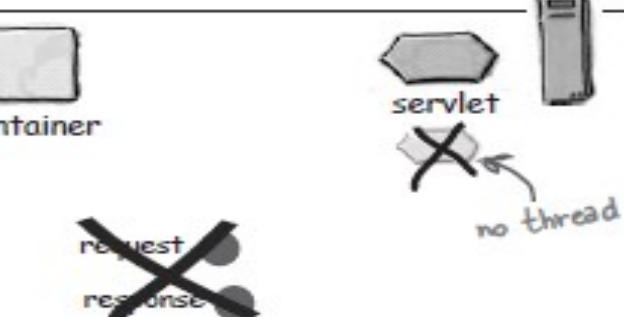
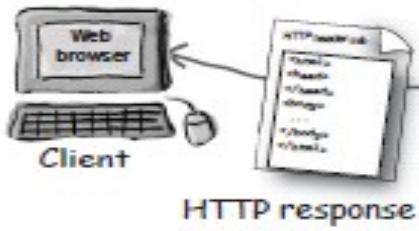
For this example, we'll assume the request was an HTTP GET.

⑤



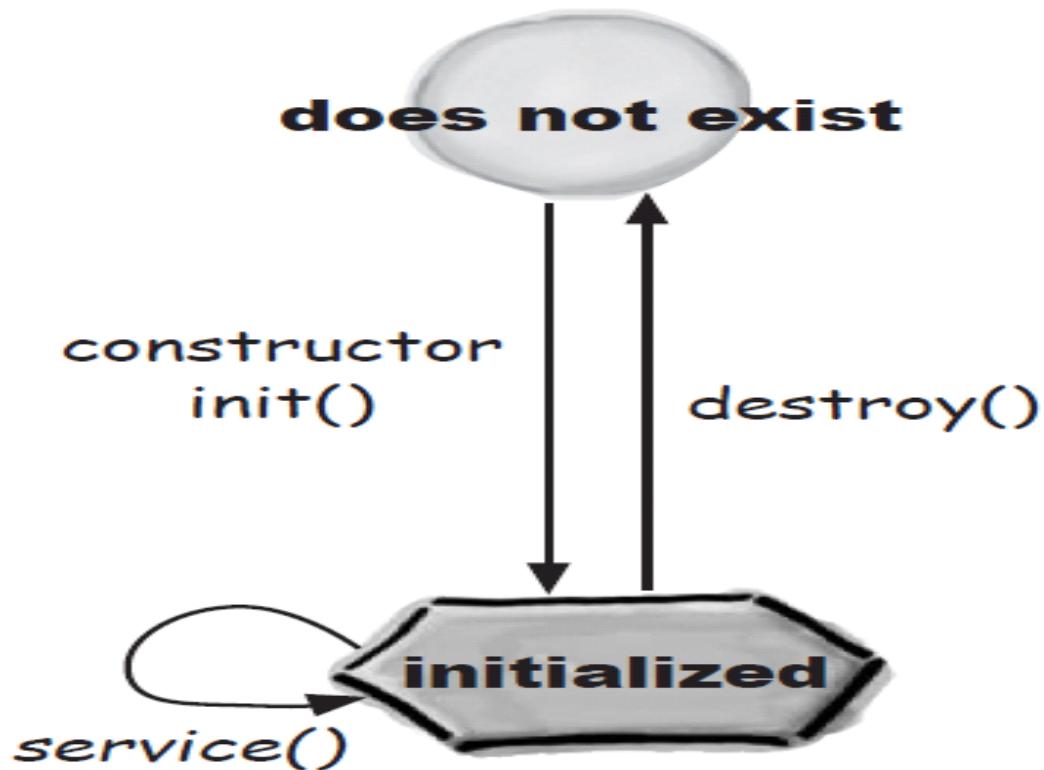
The doGet() method generates the dynamic page and stuffs the page into the response object. Remember, the container still has a reference to the response object!

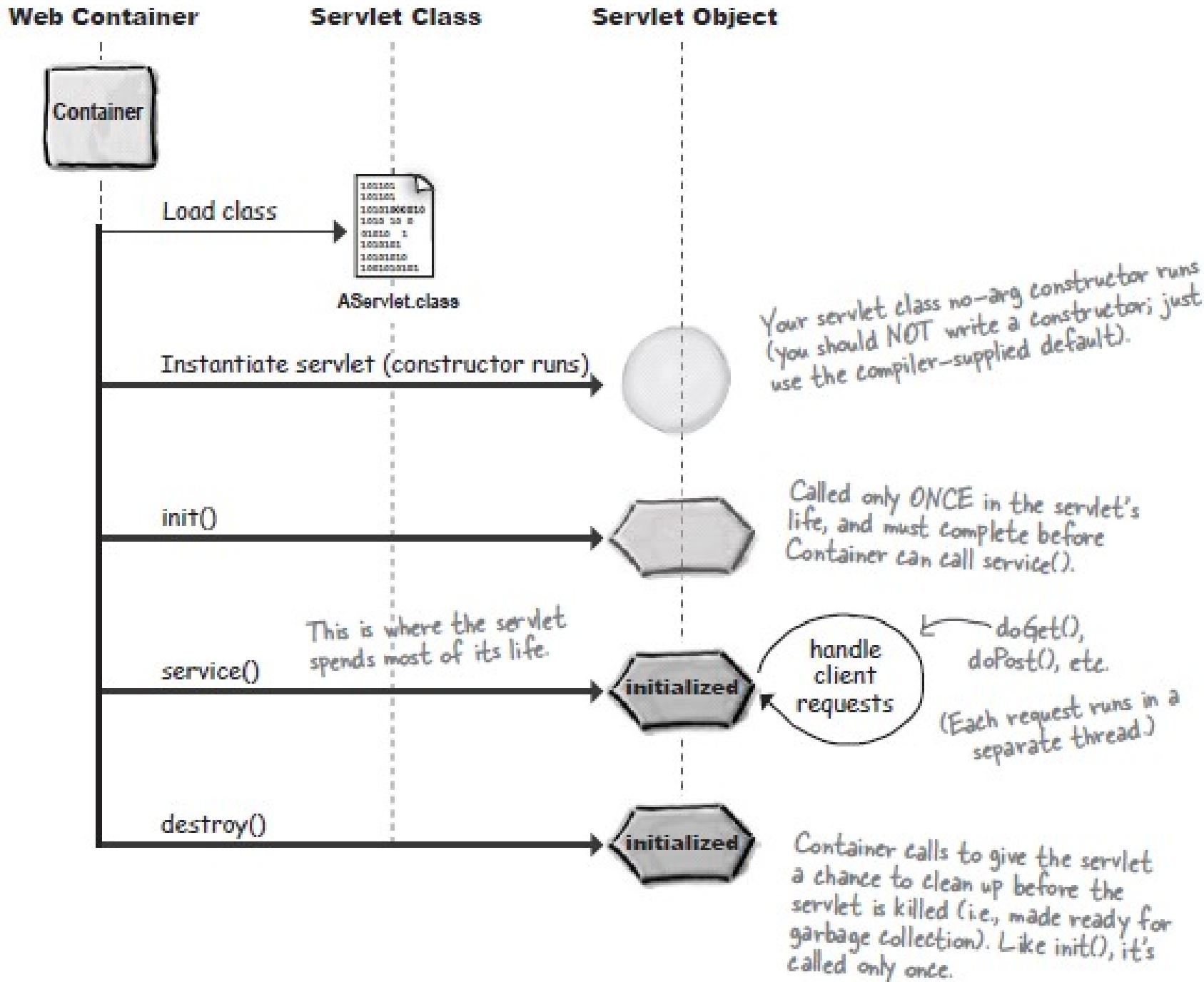
⑥



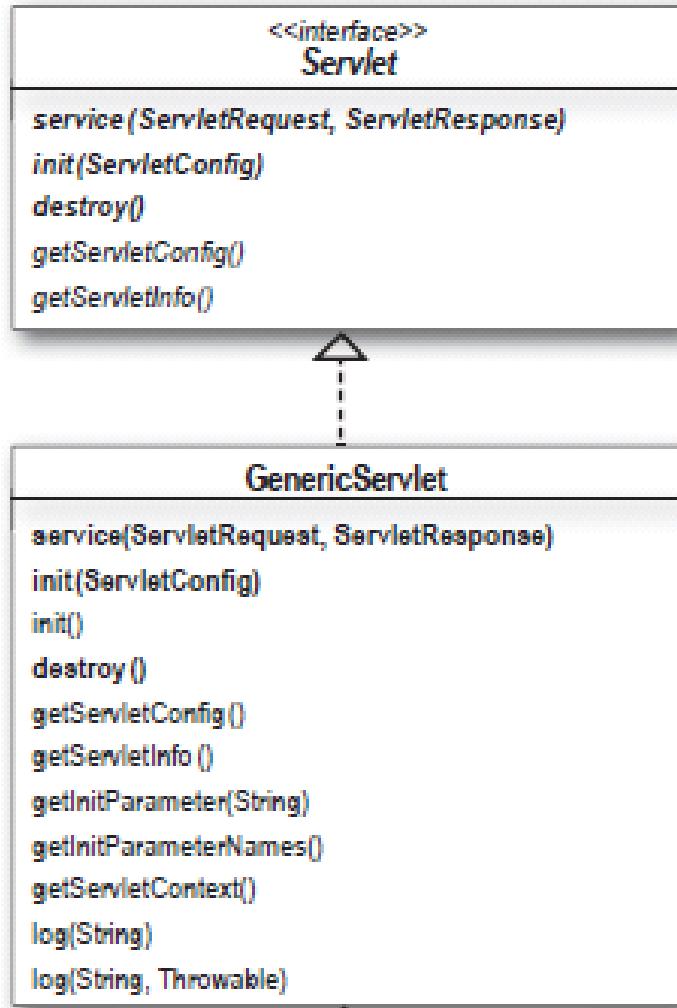
The thread completes, the container converts the response object into an HTTP response, sends it back to the client, then deletes the request and response objects.

Servlet Life Cycle





Servlet inherits the lifecycle methods



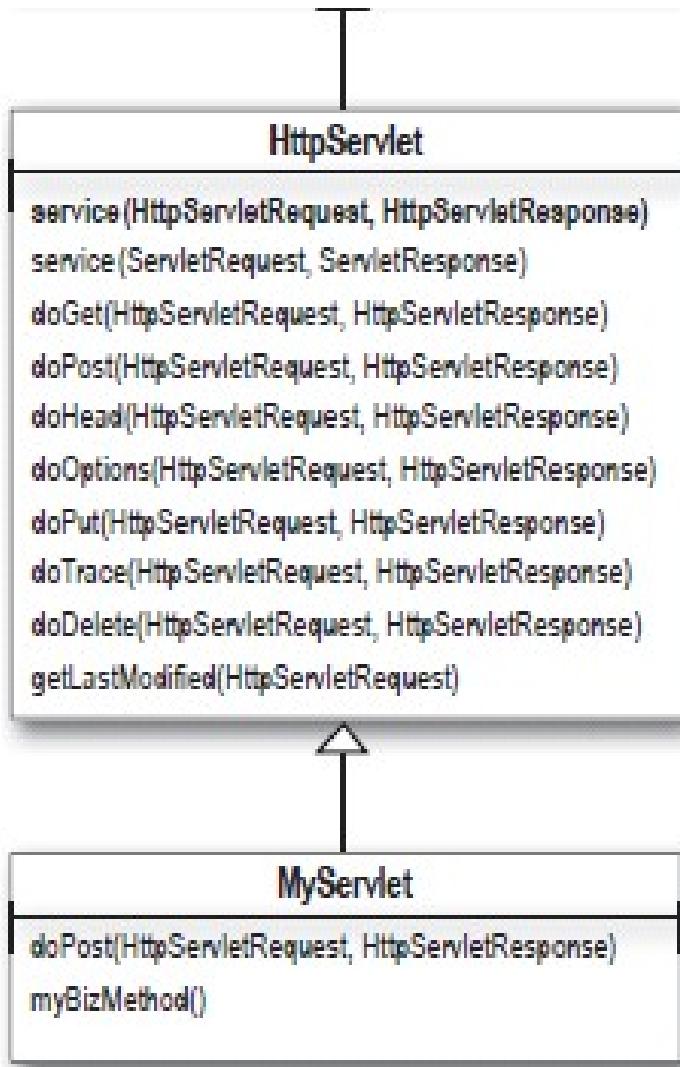
Servlet interface (javax.servlet.Servlet)

now! Just go -- --
how the API works.

The **Servlet** interface says that all servlets have these five methods (the three in bold are lifecycle methods).

GenericServlet class (javax.servlet.GenericServlet)

GenericServlet is an abstract class that implements most of the basic servlet methods you'll need, including those from the **Servlet** interface. You will probably NEVER extend this class yourself. Most of your servlet's "servlet behavior" comes from this class.



HttpServlet class

(javax.servlet.http.HttpServlet)

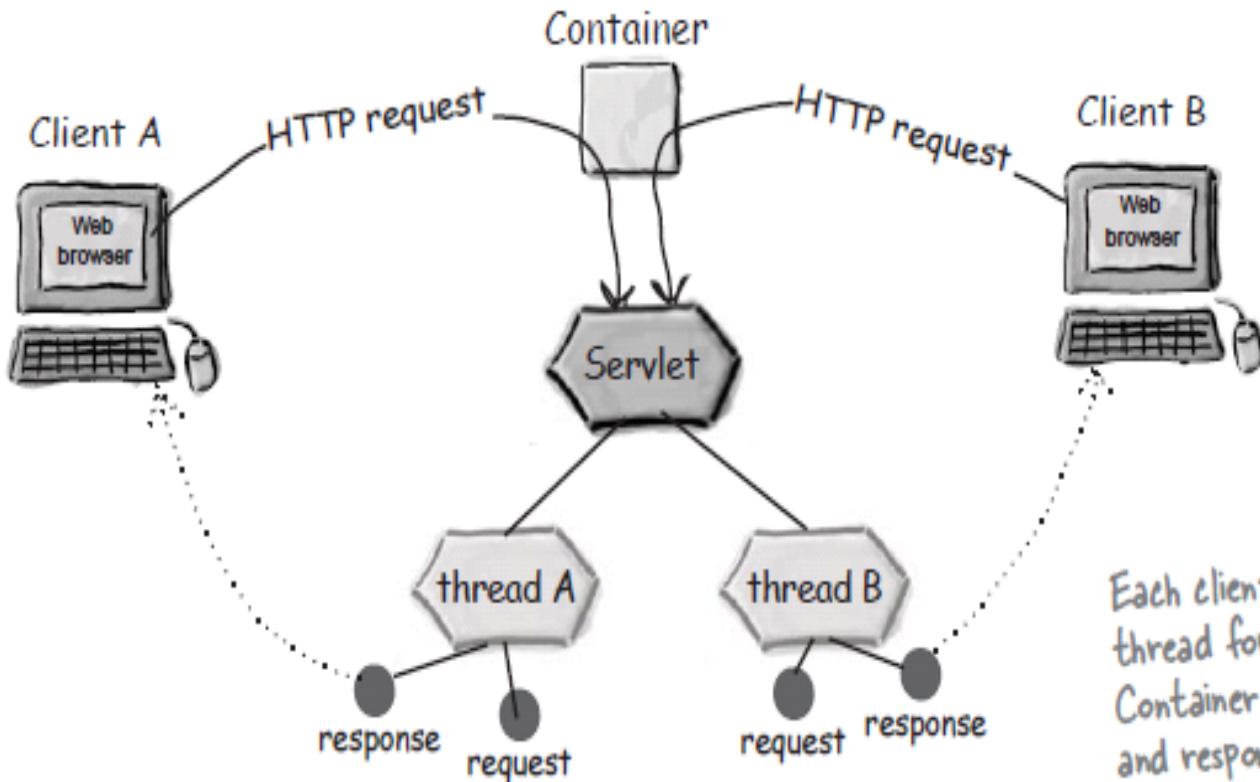
`HttpServlet` (also an abstract class) implements the `service()` method to reflect the HTTPness of the servlet—the `service()` method doesn't take just ANY old servlet request and response, but an HTTP-specific request and response.

MyServlet class

(com.wickedlysmart.foo)

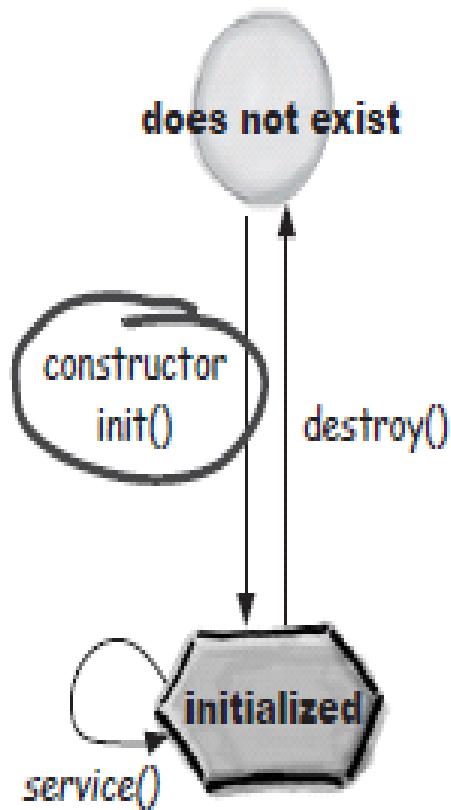
Most of your servletness is handled by superclass methods. All you do is override the HTTP methods you need.

Each request runs in a separate thread!

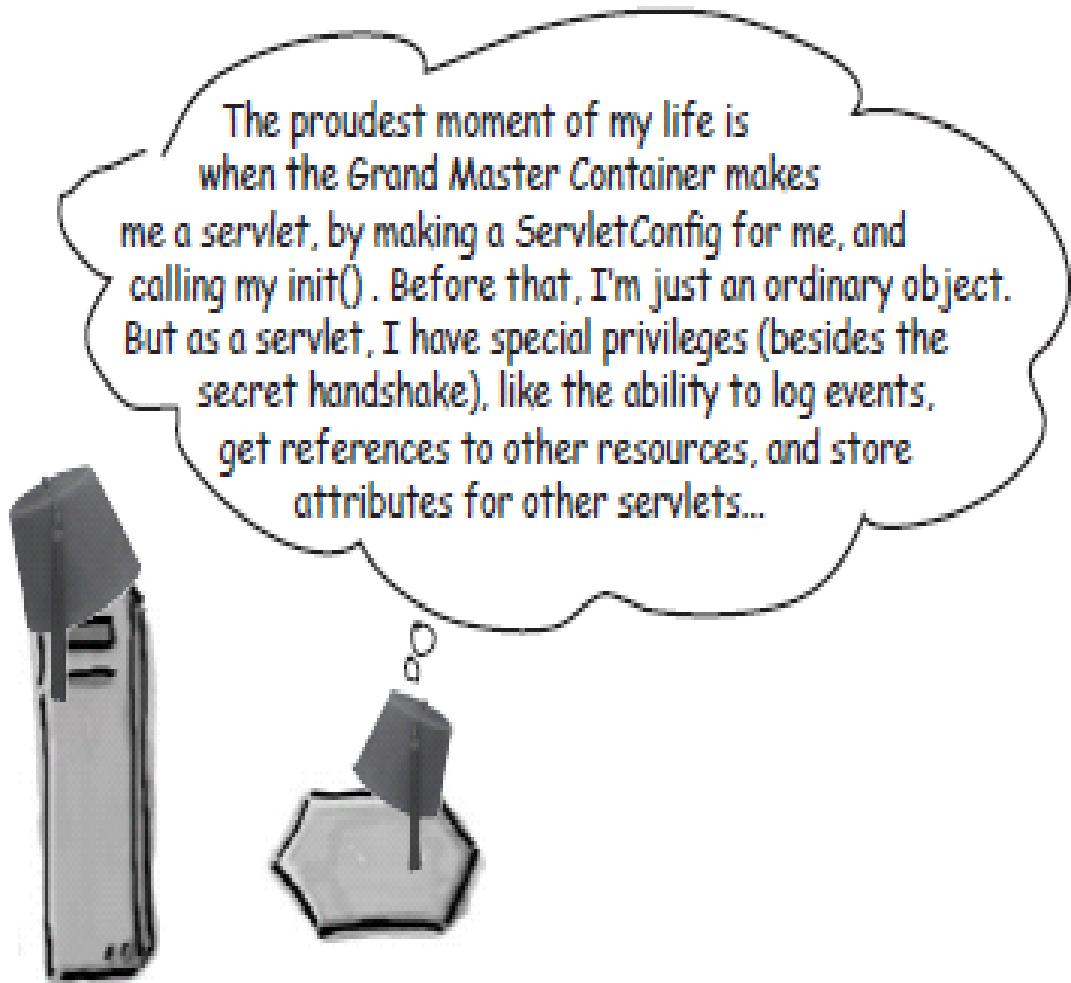


Each client gets a separate thread for each request, and the Container allocates new request and response objects.

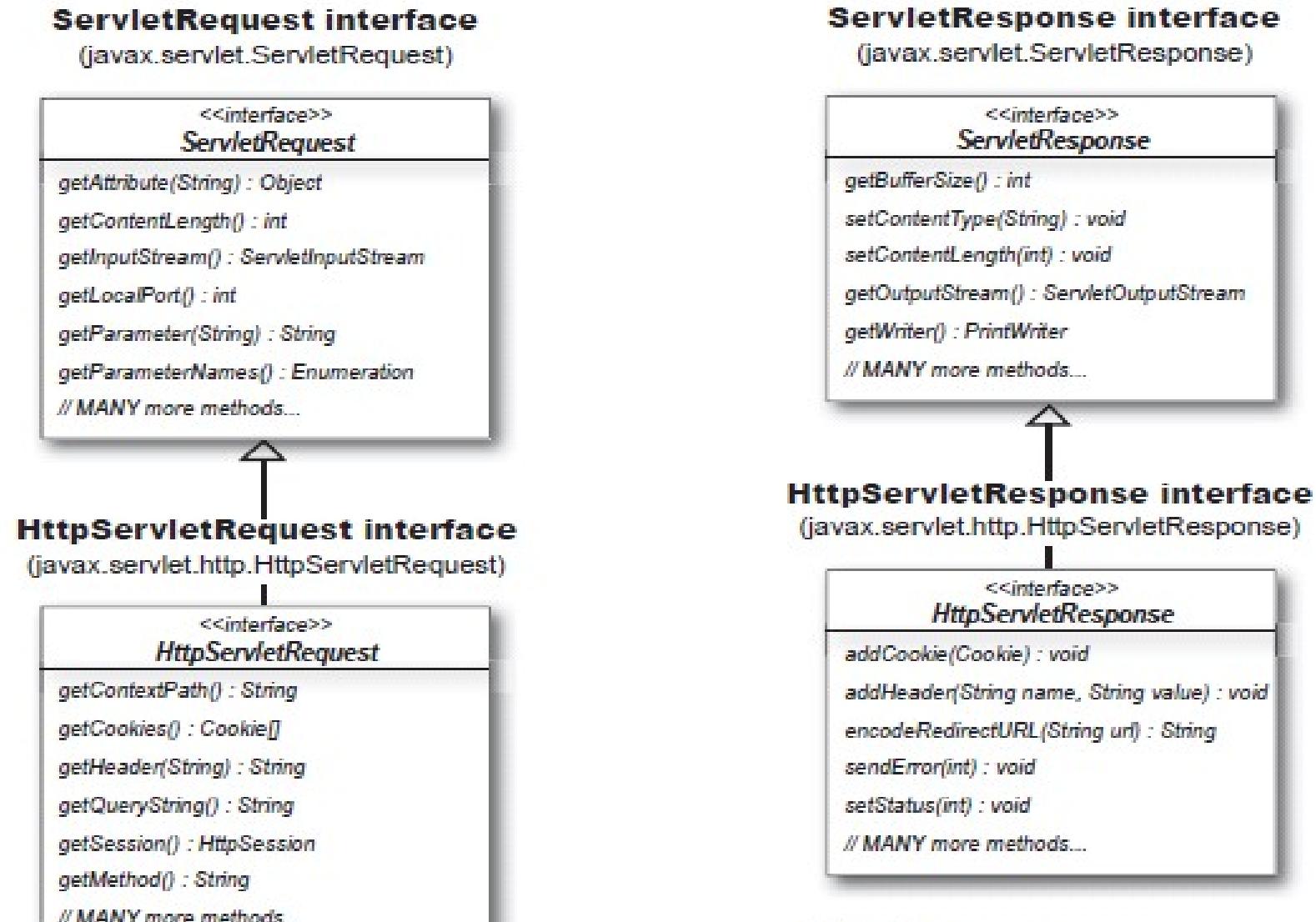
Servlet Initialization: when an object becomes a servlet



The `init()` runs only once in a servlet's life, so don't blow it! And don't try to do things too soon - the constructor is too early to do servlet-specific things.



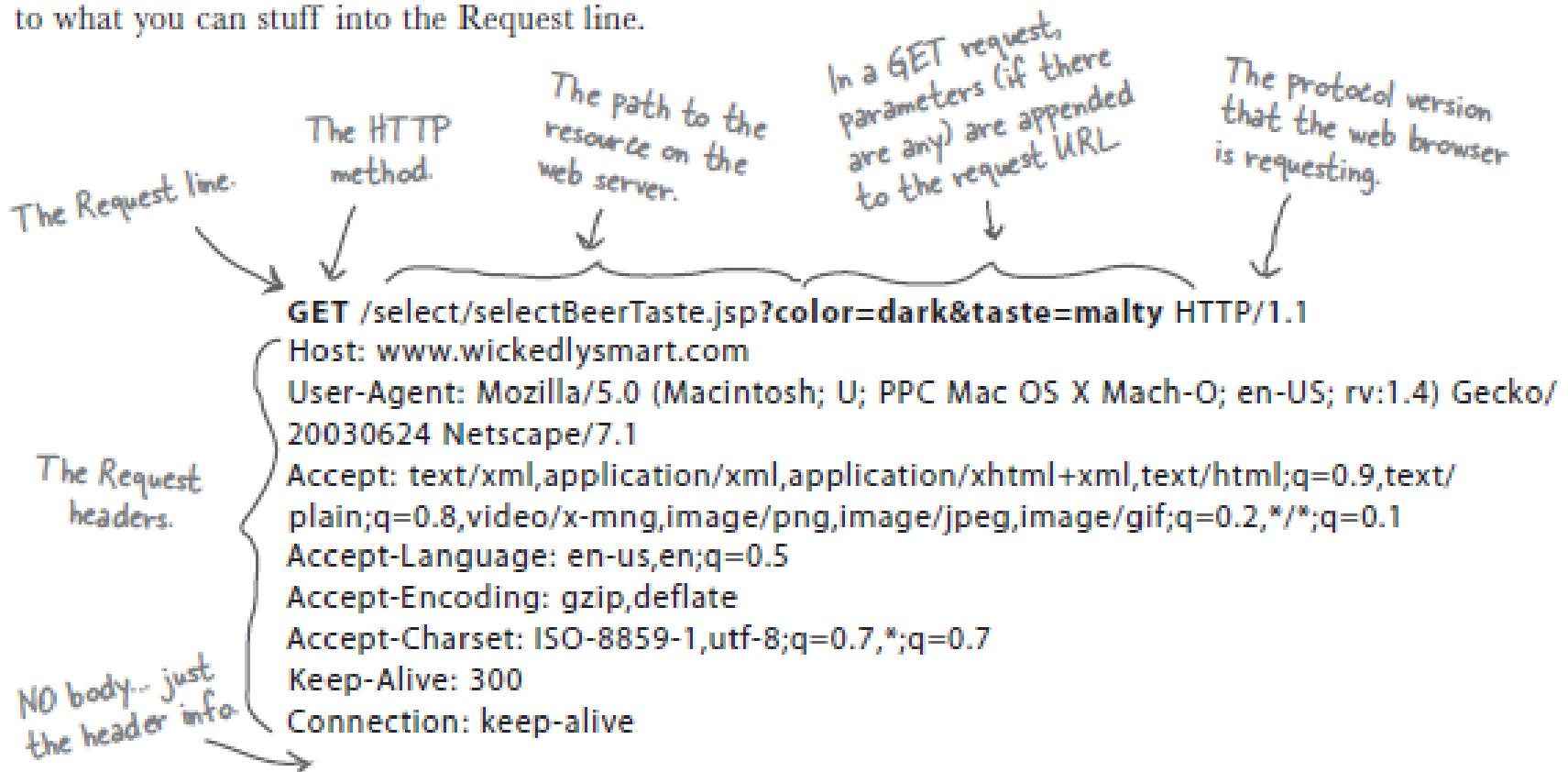
Request and Response: the key to everything, and the arguments to service()*



Same API methods...

The difference between GET and POST

POST has a body. That's the key. Both GET and POST can send parameters, but with GET, the parameter data is limited to what you can stuff into the Request line.



The Request line

The HTTP method.

The Path.

NO request parameters up here.

The Protocol.

POST /advisor/selectBeerTaste.do HTTP/1.1

Host: www.wickedlysmart.com

User-Agent: Mozilla/5.0 (Macintosh; U; PPC Mac OS X Mach-O; en-US; rv:1.4) Gecko/20030624 Netscape/7.1

Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,video/x-mng,image/png,image/jpeg,image/gif;q=0.2,*/*;q=0.1

Accept-Language: en-us,en;q=0.5

Accept-Encoding: gzip,deflate

Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7

Keep-Alive: 300

Connection: keep-alive

The Request headers.

The message body:
sometimes called
the "payload".

color=dark&taste=malty

This time, the parameters are down here in the body, so they aren't limited the way they are if you use a GET and have to put them in the Request line.

Besides parameters, what else can I get from a Request object?

The client's platform and browser info

```
String client = request.getHeader("User-Agent");
```

The cookies associated with this request

```
Cookie[] cookies = request.getCookies();
```

The session associated with this client

```
HttpSession session = request.getSession();
```

The HTTP Method of the request

```
String theMethod = request.getMethod();
```

An input stream from the request

```
InputStream input = request.getInputStream();
```

Servlet code to download the JAR

```
// a bunch of imports here

public class CodeReturn extends HttpServlet {

    public void doGet(HttpServletRequest request, HttpServletResponse response)
        throws IOException, ServletException {

        response.setContentType("application/jar");
        

We want the browser to recognize that this is a JAR, not HTML, so we set the content type to "application/jar".



        ServletContext ctx = getServletContext();
        InputStream is = ctx.getResourceAsStream("/bookCode.jar");
        

This just says, "give me an input stream for the resource named bookCode.jar".



        int read = 0;
        byte[] bytes = new byte[1024];

        OutputStream os = response.getOutputStream();
        while ((read = is.read(bytes)) != -1) {
            os.write(bytes, 0, read);
        }
        os.flush();
        os.close();
    }
}
```

Here's the key part, but it's just plain old I/O!! Nothing special, just read the JAR bytes, then write the bytes to the output stream that we get from the response object.

dispatching vs. redirecting

Redirect vs. Request Dispatch

I don't have time for this! Tell you what—why don't you call Barney. Maybe HE has time for this crap.

Redirect



When a servlet does a redirect, it's like asking the client to call someone else instead. In this case, the client is the browser, not the user. The browser makes the new call on the user's behalf, after the originally-requested servlet says, "Sorry, call this guy instead..."

The user sees the new URL in the browser.

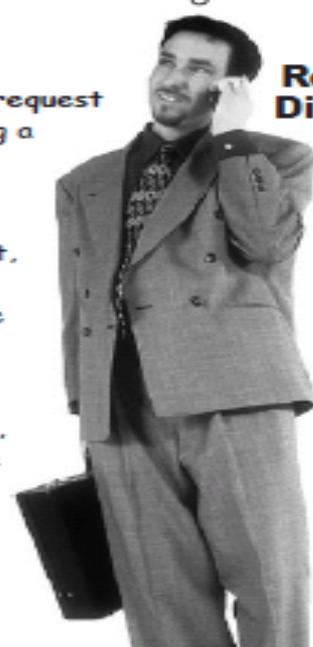
Hey Kari, this is Dan... I want your help with a client. I'll forward you the details on how to get back to him, but I need you to take over now.

Yes I KNOW you have needs too... yes, I KNOW how important the View is in Model View Controller...no, I don't think I can find another JSP just like that... what? I didn't catch that? You're breaking up... sorry... can't hear a thing... losing packets...

Request Dispatch

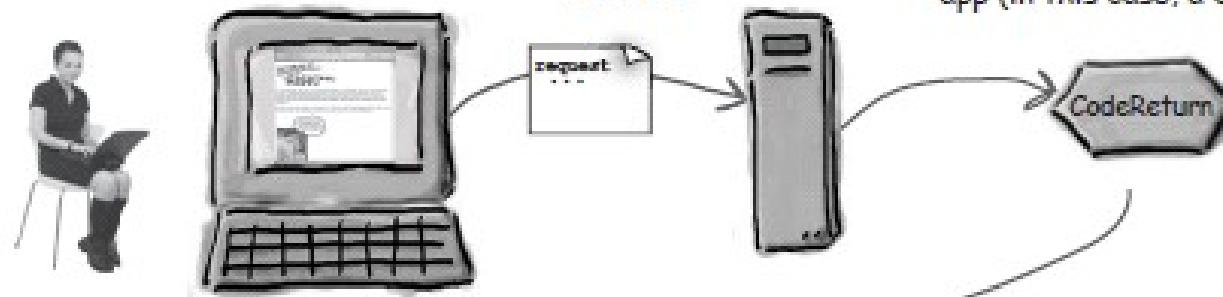
When a servlet does a request dispatch, it's like asking a co-worker to take over working with a client. The co-worker ends up responding to the client, but the client doesn't care as long as someone responds.

The user never knows someone else took over, because the URL in the browser bar doesn't change.



Request Dispatch

- ① User types a servlet's URL into the browser bar...

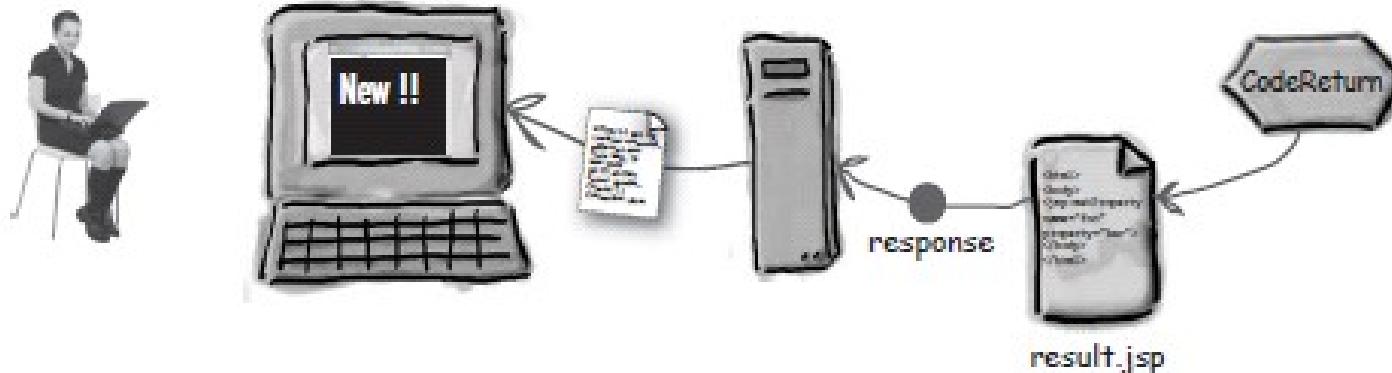


- ② The request goes to the server/Container

- ③ The servlet decides that the request should go to another part of the web app (in this case, a JSP)

- ⑤ The browser gets the response in the usual way, and renders it for the user. Since the browser location bar didn't change, the user does not know that the JSP generated the response.

④ The servlet calls
`RequestDispatcher view =
 request.getRequestDispatcher("result.jsp");
view.forward(request, response);`
and the JSP takes over the response



Servlet redirect makes the browser do the work

A redirect lets the servlet off the hook completely. After deciding that it can't do the work, the servlet simply calls the *sendRedirect()* method:

```
if (worksForMe) {  
    // handle the request  
} else {  
    response.sendRedirect("http://www.oreilly.com");  
}
```



The URL you want the browser
to use for the request. This is
what the client will see.

ServletContext vs. ServletConfig

A ServletConfig object

- One `ServletConfig` object per servlet.
- Use it to pass deploy-time information to the servlet (a database or enterprise bean lookup name, for example) that you don't want to hard-code into the servlet (`servlet init parameters`).
- Use it to access the `ServletContext`.
- Parameters are configured in the Deployment Descriptor.

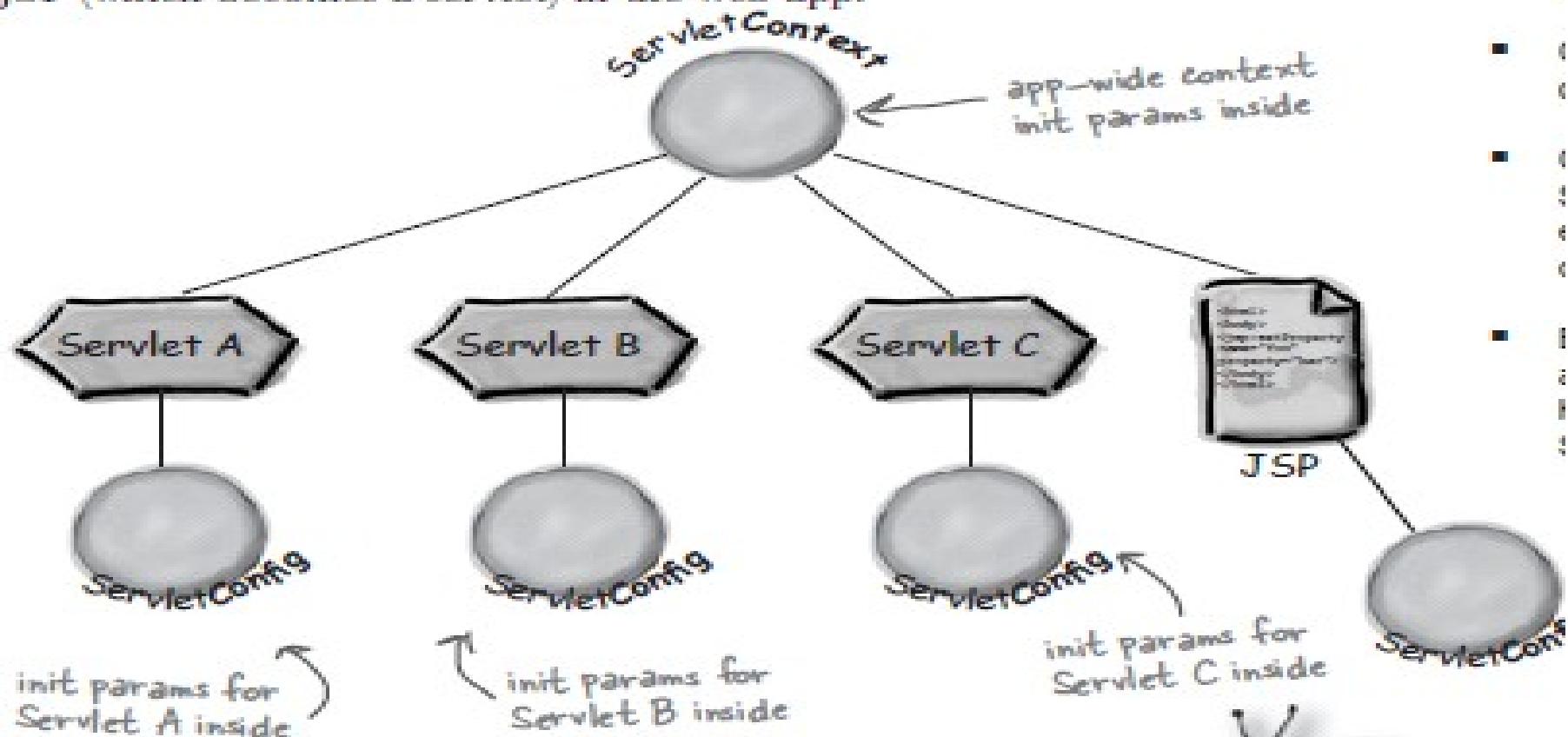
A ServletContext

- One ServletContext per web app. (They should have named it AppContext.)
- Use it to access web app *parameters* (also configured in the Deployment Descriptor).
- Use it as a kind of application bulletin-board, where you can put up messages (called attributes) that other parts of the application can access (way more on this in the next chapter).
- Use it to get server info, including the name and version of the Container, and the version of the API that's supported.

ServletConfig is one per servlet

ServletContext is one per web app

There's only one ServletContext for an entire web app, and all the parts of the web app share it. But each servlet in the app has its own ServletConfig. The Container makes a ServletContext when a web app is deployed, and makes the context available to each Servlet and JSP (which becomes a servlet) in the web app.



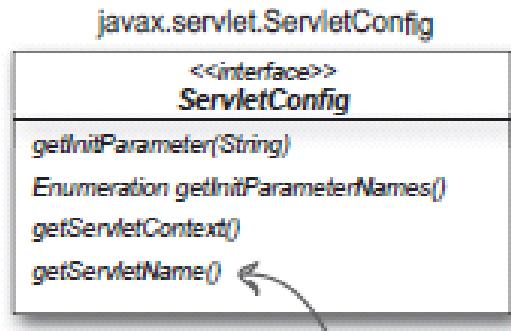
Setting ServletConfig

Testing your ServletConfig

ServletConfig's main job is to give you init parameters. It can also give you a ServletContext, but we'll usually get a context in a different way, and the getServletName() method is rarely useful.

In the DD (web.xml) file:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<web-app xmlns="http://java.sun.com/xml/ns/j2ee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd"
    version="2.4">
    <servlet>
        <servlet-name>BeerParamTests</servlet-name>
        <servlet-class>com.example.TestInitParams</servlet-class>
        <init-param>
            <param-name>adminEmail</param-name>
            <param-value>likewecare@wickedlysmart.com</param-value>
        </init-param>
        <init-param>
            <param-name>mainEmail</param-name>
            <param-value>blooper@wickedlysmart.com</param-value>
        </init-param>
    </servlet>
    <servlet-mapping>
        <servlet-name>BeerParamTests</servlet-name>
        <url-pattern>/Tester.do</url-pattern>
    </servlet-mapping>
</web-app>
```



Most people never
use this method.

and getting it in Servlet...

In a servlet class:

```
package com.example;
import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;

public class TestInitParams extends HttpServlet {
    public void doGet(HttpServletRequest request, HttpServletResponse response)
            throws IOException, ServletException {
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();
        out.println("test init parameters<br>");

        java.util.Enumeration e = getServletConfig().getInitParameterNames();
        while(e.hasMoreElements()) {
            out.println("<br>param name = " + e.nextElement() + "<br>");
        }
        out.println("main email is " + getServletConfig().getInitParameter("mainEmail"));
        out.println("<br>");
        out.println("admin email is " + getServletConfig().getInitParameter("adminEmail"));
    }
}
```

Setting and getting ServletContext

In the DD (web.xml) file:

```
<servlet>
    <servlet-name>BeerParamTests</servlet-name>
    <servlet-class>TestInitParams</servlet-class>
</servlet>

<context-param>
    <param-name>adminEmail</param-name>
    <param-value>clienttheaderror@wickedlysmart.com</param-value>
</context-param>
```

We took the `<init-param>` element out of the `<servlet>` element

IMPORTANT!! The `<context-param>` is for the WHOLE app, so it's not nested inside an individual `<servlet>` element!! Put `<context-param>` inside the `<web-app>` but OUTSIDE any `<servlet>` declaration.

You give it a `param-name` and `param-value`, just like with servlet init parameters, except this time it's in the `<context-param>` element instead of `<init-param>`.

In the servlet code:

```
out.println(getServletContext().getInitParameter("adminEmail"));
```

Every servlet inherits a `getServletContext()` method (and JSPs have special access to a context as well).

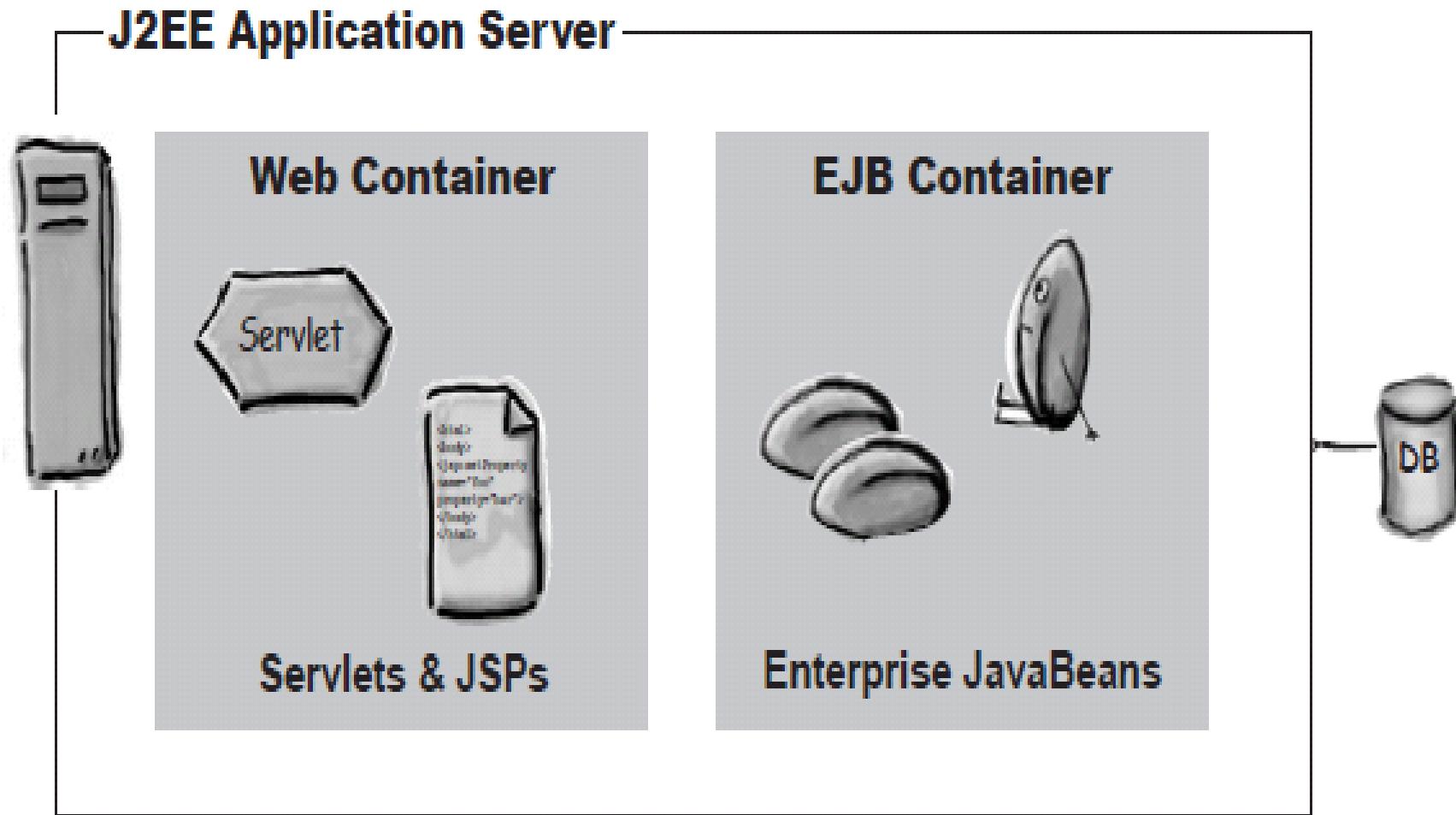
The `getServletContext()` method returns, surprisingly, a `ServletContext` object. And one of its methods is `getInitParameter()`.

OR:

```
ServletContext context = getServletContext();
out.println(context.getInitParameter("adminEmail"));
```

Here we broke out the code into TWO steps—getting the `ServletContext` reference, and calling its `getInitParameter()` method.

Where it fit in JEE context...



Exercise

- Hello World Servlet
- Login Application -I
- Login Application-II
- Use ServletContext and ServletConfig

MVC

Model

View

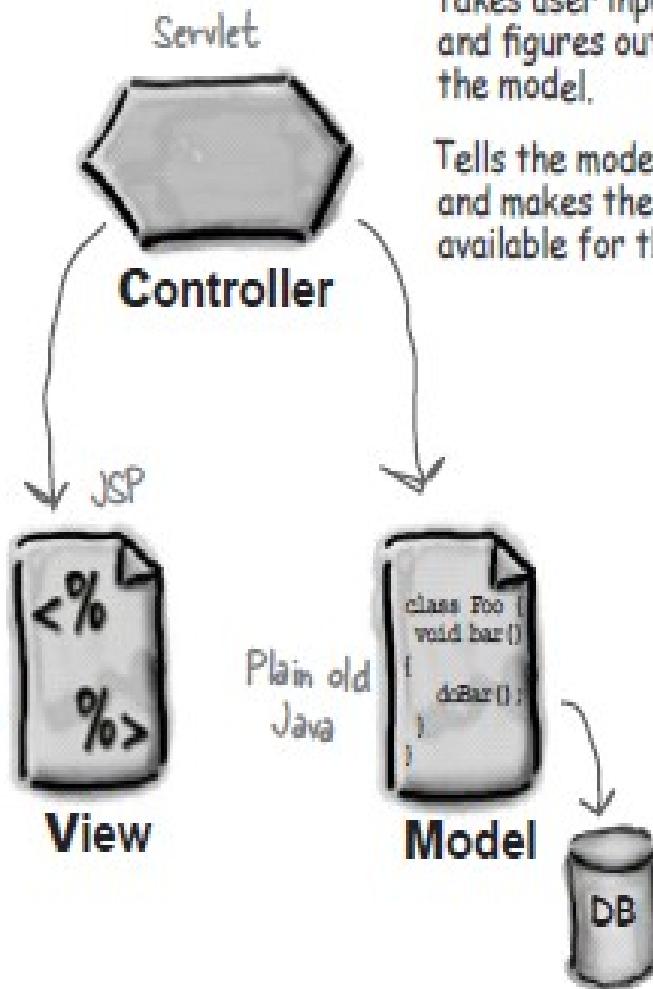
Controller

Where it fit all??

MVC in the Servlet & JSP world

VIEW

Responsible for the presentation. It gets the state of the model from the Controller (although not directly; the Controller puts the model data in a place where the View can find it). It's also the part that gets the user input that goes back to the Controller.



CONTROLLER

Takes user input from the request and figures out what it means to the model.

Tells the model to update itself, and makes the new model state available for the view (the JSP).

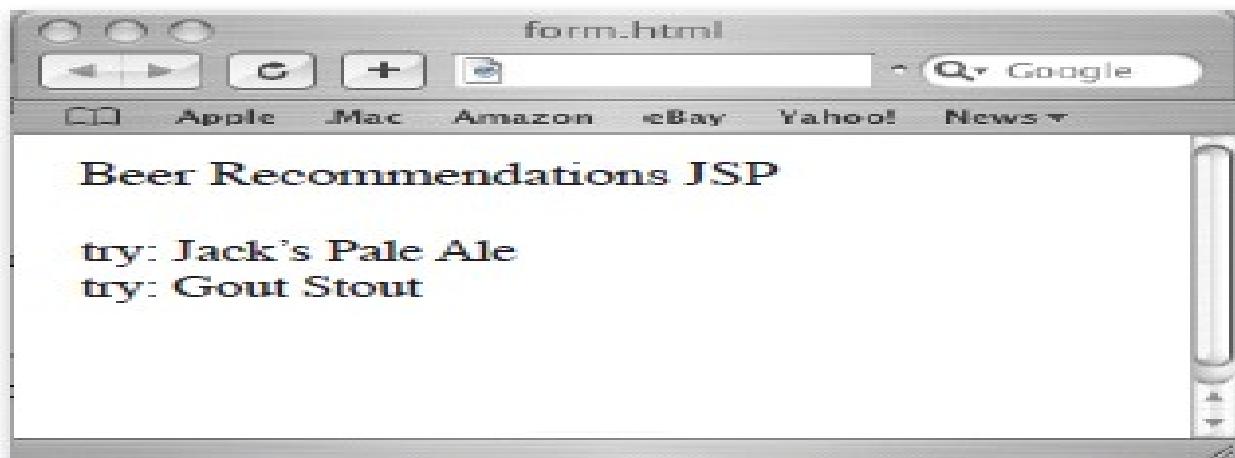
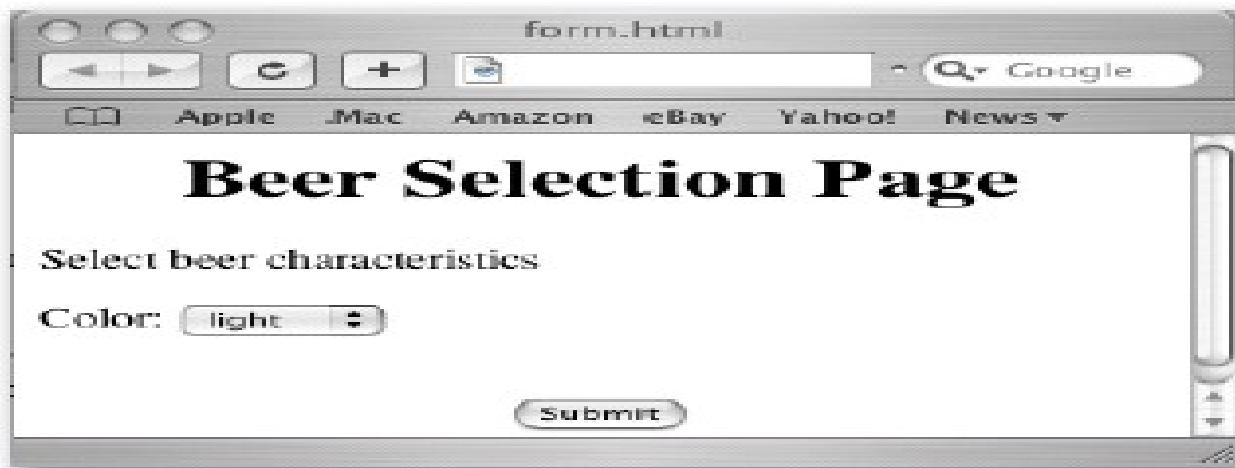
MODEL

Holds the real business logic and the state. In other words, it knows the rules for getting and updating the state.

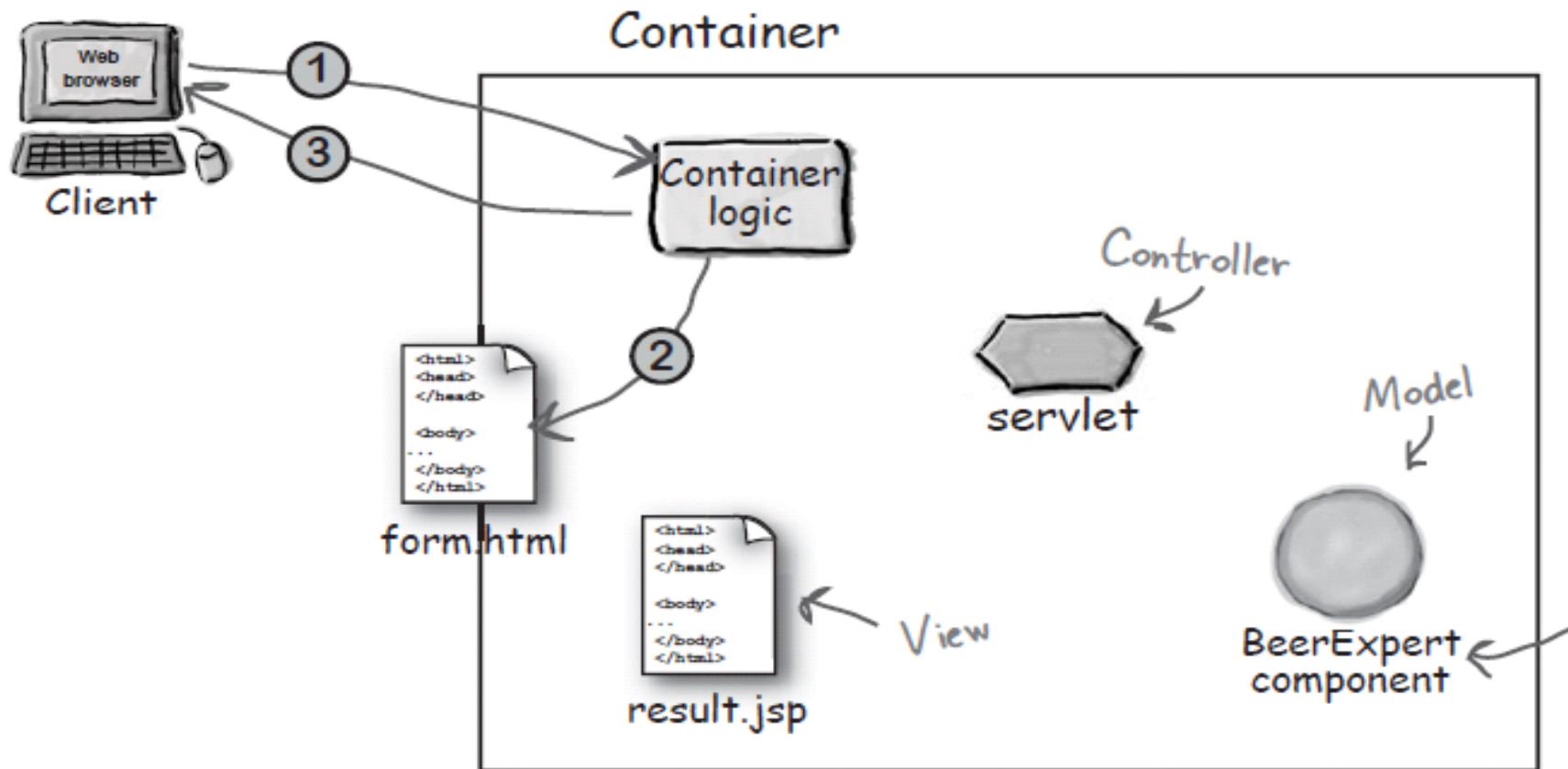
A Shopping Cart's contents (and the rules for what to do with it) would be part of the Model in MVC.

It's the only part of the system that talks to the database (although it probably uses another object for the actual DB communication, but we'll save that pattern for later...)

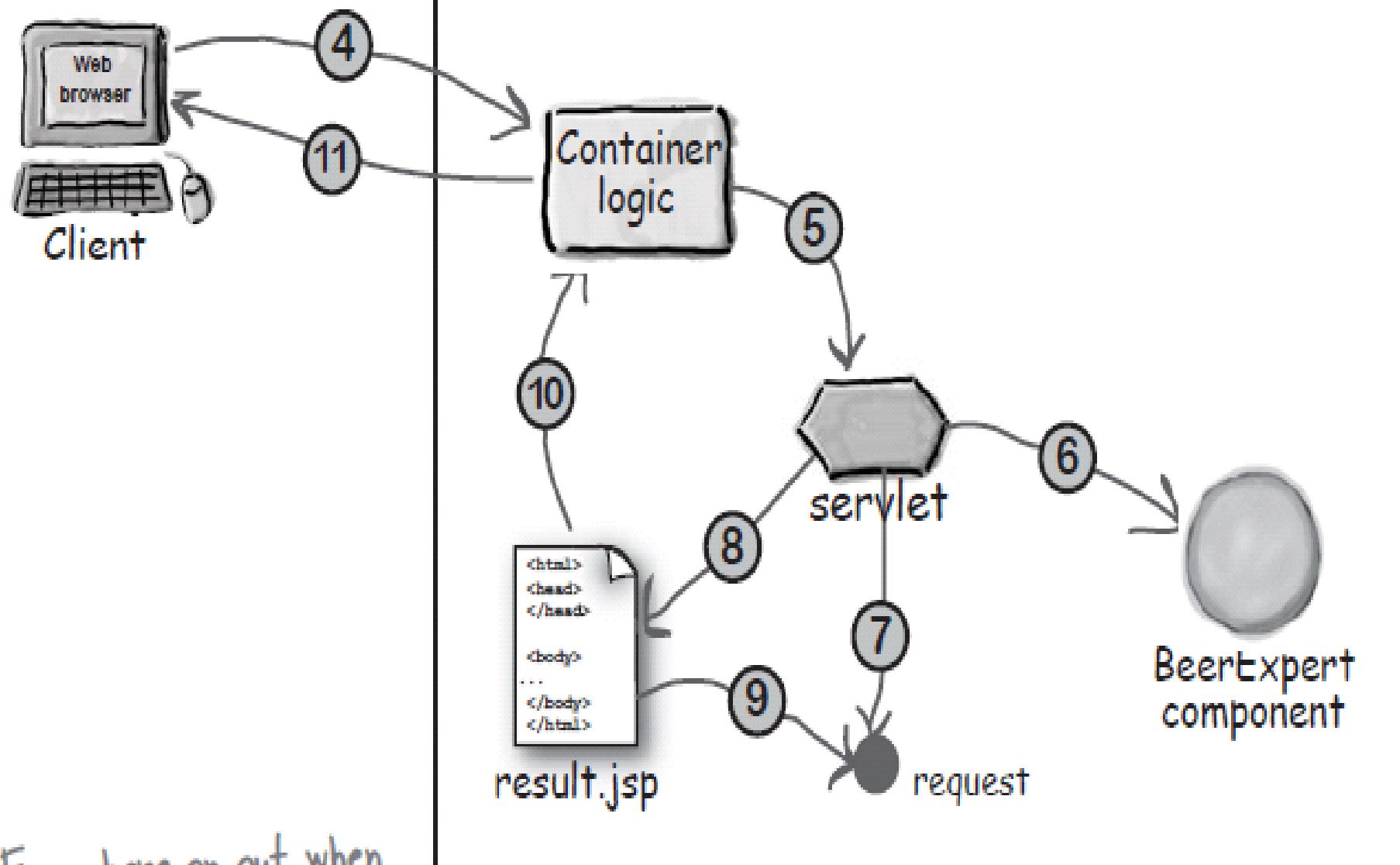
Beer Advice Application



MVC Arch



Container



Application flow MVC

- 1- The client makes a request for the *form.html* page.
- 2 - The Container retrieves the *form.html* page.
- 3 - The Container returns the page to the browser, where the user answers the questions on the form and...
- 4- Browser request data to the container
- 5- container find the correct Servlet based on the URL, an passes the request to the servlet
- 6 – The Servlet call BeerServlet for the help

Application flow MVC

- 7- BeerExpert class return an answer, which Servlet add to the request object
- 8- The Servlet forward request to the jsp
- 9-Jsp get the answer from the request object
- 10- JSP generate a page for the container
- 11- Container return page to the happy user

The HTML for the initial form

page

```
<html><body>
  <h1 align="center">Beer Selection Page</h1>
  <form method="POST"
        action="SelectBeer.do">
    Select beer characteristics<p>
    Color:
    <select name="color" size="1">
      <option value="light"> light </option>
      <option value="amber"> amber </option>
      <option value="brown"> brown </option>
      <option value="dark"> dark </option>
    </select>
    <br><br>
    <center>
      <input type="SUBMIT">
    </center>
  </form>
</body></html>
```

Web.xml

```
<web-app xmlns="http://java.sun.com/xml/ns/j2ee"  
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
         xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd"  
         version="2.4">  
  
<servlet>  
    <servlet-name>Ch3_Beer</servlet-name>  
    <servlet-class>com.example.web.BeerSelect</servlet-class>  
</servlet>  
  
<servlet-mapping>  
    <servlet-name>Ch3_Beer</servlet-name>  
    <url-pattern>/SelectBeer.do</url-pattern>  
</servlet-mapping>  
</web-app>
```

This is a made-up name
that you'll use ONLY in
other parts of the DD.

Fully-qualified name of the
servlet class file

Don't forget to
start with a slash.

just type "n"

This is how we want the client to refer to
the servlet. The "do" is just a convention.

The controller Servlet

```
package com.example.web;

import com.example.model.*;
import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;
import java.util.*;

public class BeerSelect extends HttpServlet {

    public void doPost(HttpServletRequest request,
                        HttpServletResponse response)
        throws IOException, ServletException {

        String c = request.getParameter("color");
        BeerExpert be = new BeerExpert();
        List result = be.getBrands(c);

        // response.setContentType("text/html");
        // PrintWriter out = response.getWriter();
        // out.println("Beer Selection Advice<br>");

        request.setAttribute("styles", result); ← Add an attribute to the request object for the JSP to use. Notice the JSP is looking for "styles".

        RequestDispatcher view =
            request.getRequestDispatcher("result.jsp"); ← Instantiate a request dispatcher for the JSP.

        view.forward(request, response);
    } ← Use the request dispatcher to ask the Container to crank up the JSP, sending it the request and response.
}
```

Now that the JSP is going to produce the output, we should remove the test output from the servlet. We commented it out so that you could still see it here.

← Use the request dispatcher to ask the Container to crank up the JSP, sending it the request and response.

Model....

```
package com.example.model;
import java.util.*;

public class BeerExpert {
    public List getBrands(String color) {
        List brands = new ArrayList();
        if (color.equals("amber")) {
            brands.add("Jack Amber");
            brands.add("Red Moose");
        }
        else {
            brands.add("Jail Pale Ale");
            brands.add("Gout Stout");
        }
        return (brands);
    }
}
```

And finally the view...

```
<%@ page import="java.util.*" %> ← (we're thinking it  
obvious what this  
<html>  
<body>  
<h1 align="center">Beer Recommendations JSP</h1> ←  
<p>  
  
<%  
    List styles = (List) request.getAttribute("styles");  
    Iterator it = styles.iterator(); ←  
    while(it.hasNext()) {  
        out.print("<br>try: " + it.next());  
    }  
%>  
</body>  
</html>
```

Some standard Java sitting
inside <% %> tags (this is
known as scriptlet code).

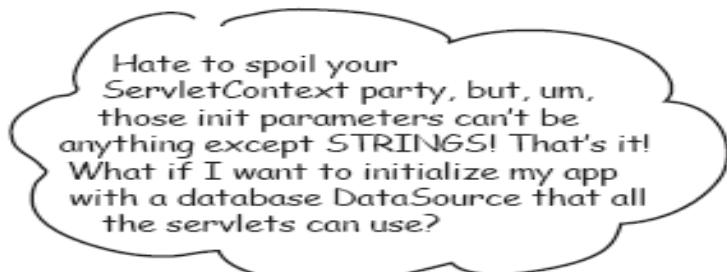
Web Applications

A Web app is structured as a directory:

- *myapp/*
 - contains HTML/CSS/GIF/... files
- *myapp/WEB-INF/*
 - contains the **deployment descriptor** `web.xml`
- *myapp/WEB-INF/classes/*
 - contains servlet class files
 - (in subdirs corresponding to package names)
- *myapp/WEB-INF/lib/*
 - contains extra jar files

Need for listener....

- Init parameter (key, value) are really are strings
- What if we need objects



Hate to spoil your
ServletContext party, but, um,
those init parameters can't be
anything except STRINGS! That's it!
What if I want to initialize my app
with a database DataSource that all
the servlets can use?



**What if you want an app
init parameter that's a
database DataSource?**

Context parameters can't be anything except Strings. After all, you can't very well stuff *Dog* object into an XML deployment descriptor. (Actually, you *could* represent a serialized object in XML, but there's no facility for this in the Servlet spec today... maybe in the future.)

Oh, if only there were a way
to have something like a *main*
method for my whole web app. Some
code that always runs before ANY
servlets or JSPs...



What she really wants is a *listener*.

She wants to listen for a context initialization event,
so that she can get the context init parameters and
***run some code before the rest of the app can
service a client.***

She wants a ServletContextListener

We need a separate object that can:

- Get notified when the context is initialized (app is being deployed).
 - Get the context init parameters from the ServletContext.
 - Use the init parameter lookup name to make a database connection.
 - Store the database connection as an attribute, so that all parts of the web app can access it.

- Get notified when the context is destroyed (the app is undeployed or goes down).
 - Close the database connection.

A ServletContextListener class:

```
import javax.servlet.*;  
public class MyServletContextListener implements ServletContextListener {  
  
    public void contextInitialized(ServletContextEvent event) {  
        //code to initialize the database connection  
        //and store it as a context attribute  
    }  
  
    public void contextDestroyed(ServletContextEvent event) {  
        //code to close the database connection  
    }  
}
```

*ServletContextListener is in
javax.servlet package.*

*A context listener
is simple: implement
ServletContextListene*

*These are the +
you get. Both gi
ServletContextL*

We will convert dog string to a real dog!!!

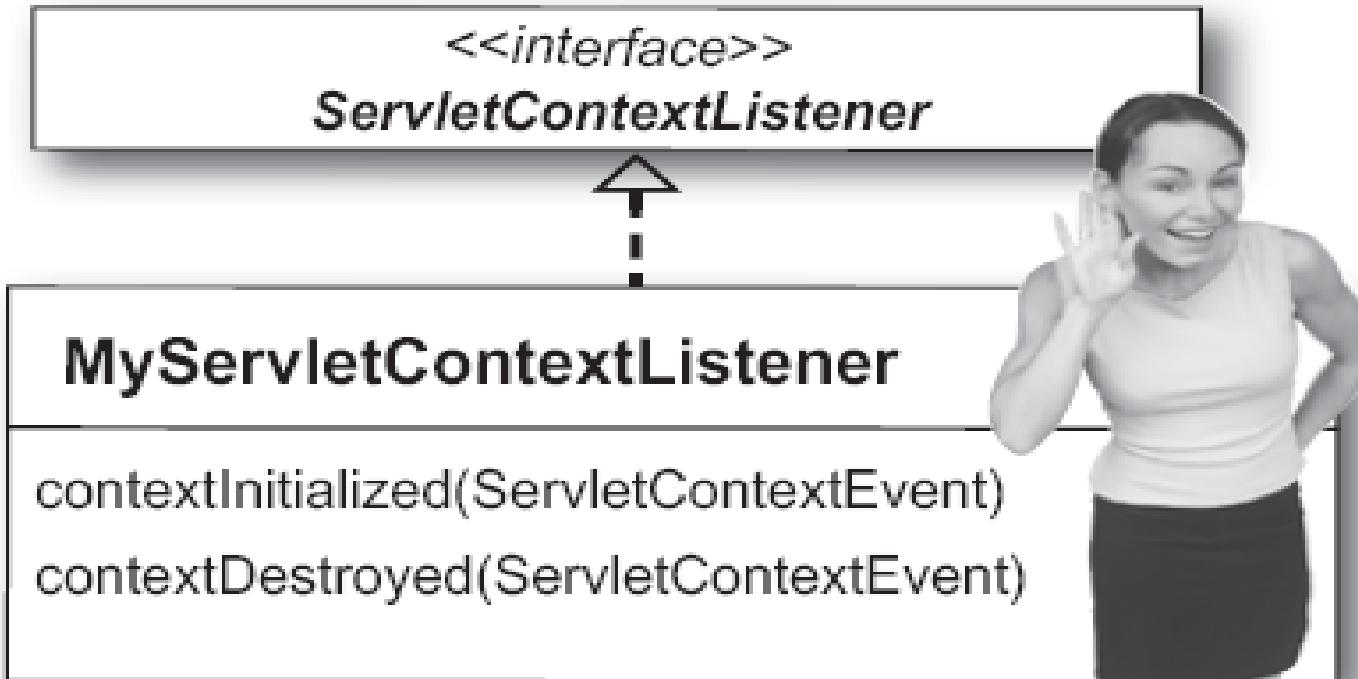
Our Dog example:

- The listener object asks the ServletContextEvent object for a reference to the app's ServletContext.
- The listener uses the reference to the ServletContext to get the context init parameter for "breed", which is a String representing a dog breed.
- The listener uses that dog breed String to construct a Dog object.
- The listener uses the reference to the ServletContext to set the Dog attribute in the ServletContext.
- The tester servlet in this web app *gets* the Dog object from the ServletContext, and calls the Dog's getBreed() method.

Making and using a context listener

- We need three classes and one DD
- **The ServletContextListener**
 - **MyServletContextListener.java**
- **The attribute class**
 - **Dog.java**
- **The Servlet**
 - **ListenerTester.java**

Writing the listener class



```
package com.example;  
import javax.servlet.*;  
  
public class MyServletContextListener implements ServletContextListener {  
  
    public void contextInitialized(ServletContextEvent event) {  
        ServletContext sc = event.getServletContext(); ← Ask the event for the ServletContext.  
        String dogBreed = sc.getInitParameter("breed"); ← Use the context to get  
        Dog d = new Dog(dogBreed); ← Make a new Dog  
        sc.setAttribute("dog", d); ← Use the context to set an attribute (a  
    }  
    name/object pair) that is the Dog. Now  
    other parts of the app will be able to get  
    the value of the attribute (the Dog).  
  
    public void contextDestroyed(ServletContextEvent event) {  
        // nothing to do here  
    }  
}
```

We don't need anything here. The Dog
doesn't need to be cleaned up... when the
context goes away, it means the whole
app is going down, including the Dog.

Writing the attribute class (Dog)

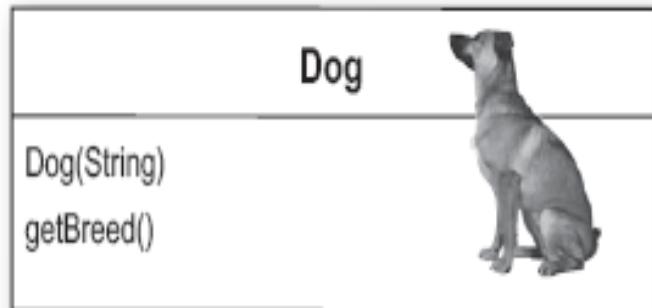
Oh yeah, we need a Dog class—the class representing the object we're going to store in the ServletContext, after reading the context init parameters.

```
package com.example;  
  
public class Dog {  
    private String breed;  
  
    public Dog(String breed) {  
        this.breed = breed;  
    }  
  
    public String getBreed() {  
        return breed;  
    }  
}
```

Nothing special here.
Just a plain old Java class.

(We'll use the context init
parameter as the argument for
the Dog constructor.)

Our servlet will get the Dog from the
context (the Dog that the listener sets
as an attribute), call the Dog's getBreed()
method, and print out the breed in the
response so we can see it in the browser.



Writing the servlet class

This is the class that tests the ServletContextListener. If everything is working right, by the time the Servlet's doGet() method runs for the first time, the Dog will be waiting as an attribute in the ServletContext.

```
package com.example;

import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;

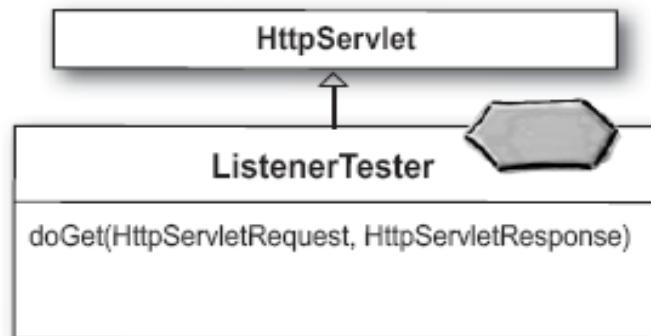
public class ListenerTester extends HttpServlet {
    public void doGet (HttpServletRequest request, HttpServletResponse response)
        throws IOException, ServletException {
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        out.println("test context attributes set by listener<br>");
        out.println("<br>");

        Dog dog = (Dog) getServletContext().getAttribute("dog");
        ↗ don't forget the cast!!
        out.println("Dog's breed is: " + dog.getBreed());
    }
}
```

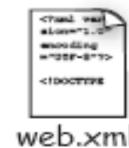
Nothing special so far...
just a regular servlet

Now we get the Dog from
the ServletContext. If
the listener worked, the
Dog will be there BEFORE
this service method is
called for the first time.



Writing the Deployment Descriptor

Now we tell the Container that we have a listener for this app, using the <listener> element. This element is simple—it needs only the class name. That's it.



This is the web.xml file inside the WEB-INF directory for this web app.

```
<web-app xmlns="http://java.sun.com/xml/ns/j2ee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd"
    version="2.4">

    <servlet>
        <servlet-name>ListenerTester</servlet-name>
        <servlet-class>com.example.ListenerTester</servlet-class>
    </servlet>

    <servlet-mapping>
        <servlet-name>ListenerTester</servlet-name>
        <url-pattern>/ListenTest.do</url-pattern>
    </servlet-mapping>

    <context-param>
        <param-name>breed</param-name>
        <param-value>Great Dane</param-value>
    </context-param>

    <listener>
        <listener-class>
            com.example.MyServletContextListener
        </listener-class>
    </listener>

</web-app>
```

We need a context init parameter for the app. The listener needs this to construct the Dog.

Register this class as a listener. **IMPORTANT:** the <listener> element does NOT go inside a <servlet> element. That wouldn't work because a context listener is for a ServletContext (which means application-wide) event. The whole point is to initialize the app BEFORE any servlets are initialized.

The full story...

Here's the scenario from start (app initialization) to finish (servlet runs). You'll see in step 11 we condensed the Servlet initialization into one big step.

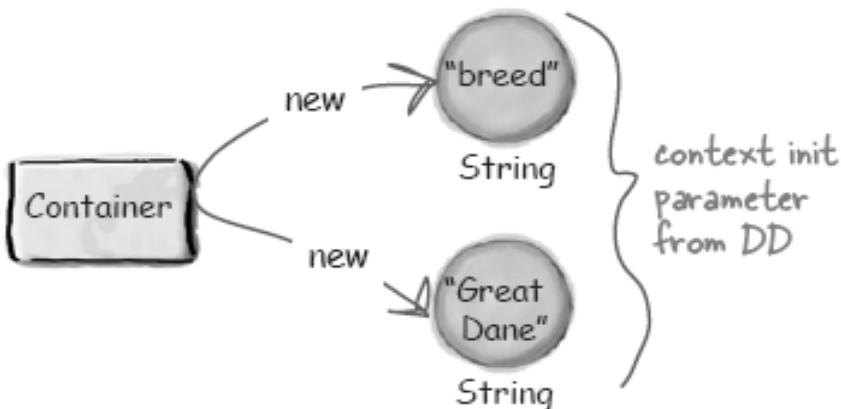
- ① Container reads the Deployment Descriptor for this app, including the <listener> and <context-param> elements.



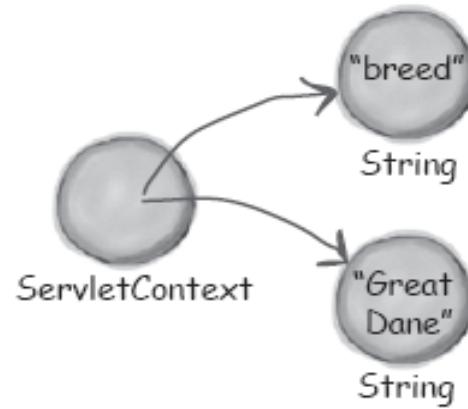
- ② Container creates a new ServletContext for this application, that all parts of the app will share.



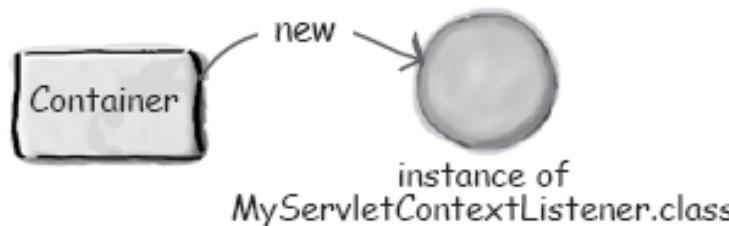
- ③ Container creates a name/value pair of Strings for each context init parameter. Assume we have only one.



- ④ Container gives the ServletContext references to the name/value parameters.

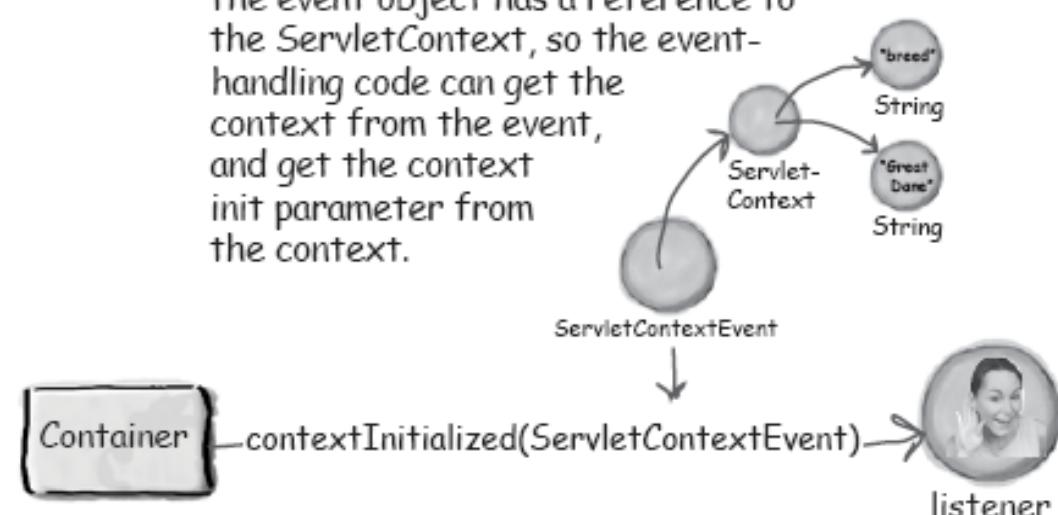


- ⑤ Container creates a new instance of the MyServletContextListener class.

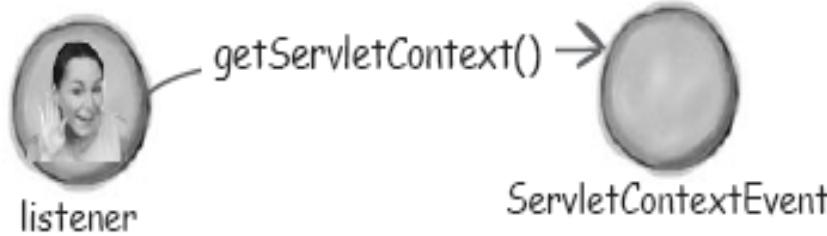


- ⑥ Container calls the listener's contextInitialized() method, passing in a new ServletContextEvent.

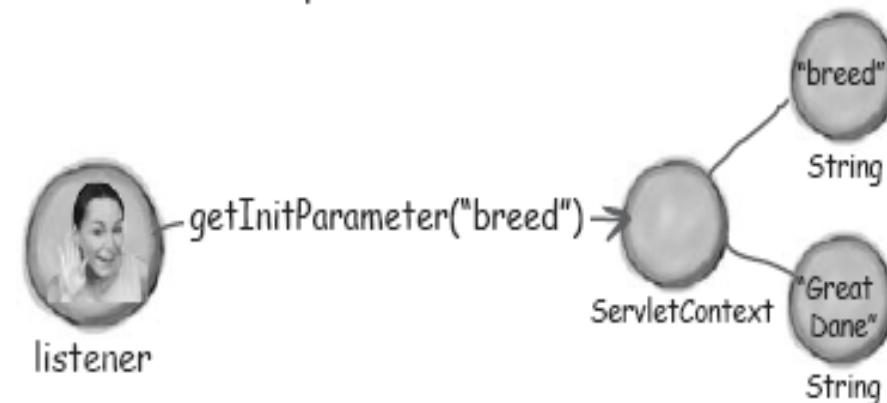
The event object has a reference to the ServletContext, so the event-handling code can get the context from the event, and get the context init parameter from the context.



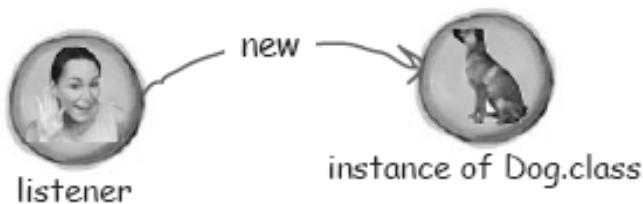
- ⑦ Listener asks ServletContextEvent for a reference to the ServletContext.



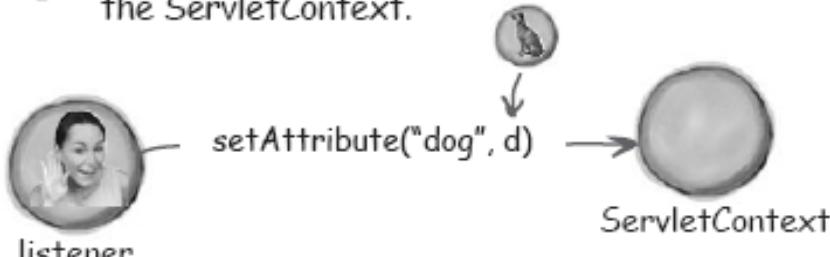
- ⑧ Listener asks ServletContext for the context init parameter "breed".



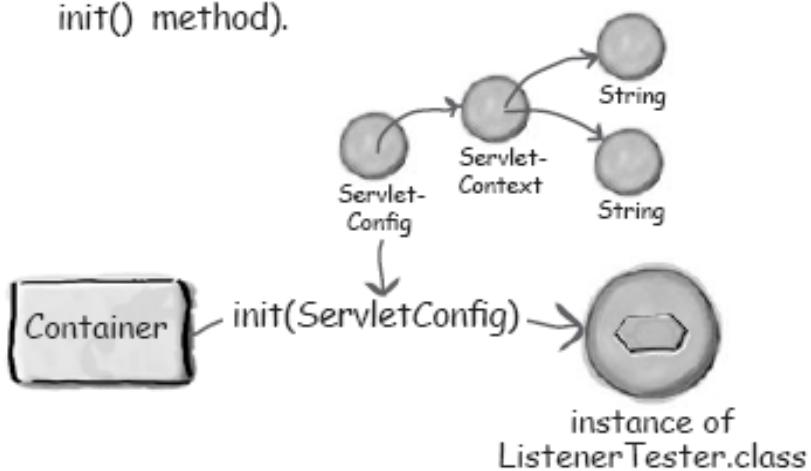
- ⑨ Listener uses the init parameter to construct a new Dog object.



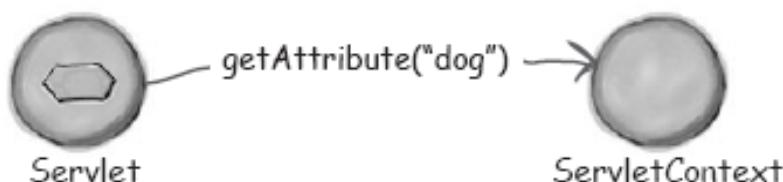
- ⑩ Listener sets the Dog as an attribute in the ServletContext.



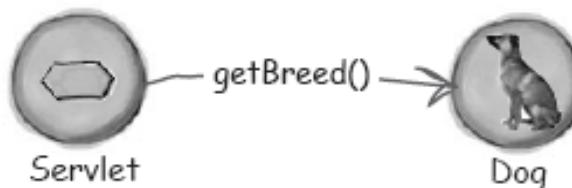
- ⑪ Container makes a new Servlet (i.e., makes a new ServletConfig with init parameters, gives the ServletConfig a reference to the ServletContext, then calls the Servlet's init() method).



- ⑫ Servlet gets a request, and asks the ServletContext for the attribute "dog".



- ⑬ Servlet calls getBreed() on the Dog (and prints that to the HttpServletResponse).



The eight listeners

Scenario	Listener interface	Event type
You want to know if an attribute in a web app context has been added, removed, or replaced.	javax.servlet.ServletContextAttributeListener <i>attributeAdded attributeRemoved attributeReplaced</i>	ServletContextAttributeEvent
You want to know how many concurrent users there are. In other words, you want to track the active sessions. (We cover sessions in detail in the next chapter).	javax.servlet.http.HttpSessionListener <i>sessionCreated sessionDestroyed</i>	HttpSessionEvent
You want to know each time a request comes in, so that you can log it.	javax.servlet.ServletRequestListener <i>requestInitialized requestDestroyed</i>	ServletRequestEvent
You want to know when a request attribute has been added, removed, or replaced.	javax.servlet.ServletRequestAttributeListener <i>attributeAdded attributeRemoved attributeReplaced</i>	ServletRequestAttributeEvent
You have an attribute class (a class for an object that will be stored as an attribute) and you want objects of this type to be notified when they are bound to or removed from a session.	javax.servlet.http.HttpSessionBindingListener <i>valueBound valueUnbound</i>	HttpSessionBindingEvent
You want to know when a session attribute has been added, removed, or replaced.	javax.servlet.http.HttpSessionAttributeListener <i>attributeAdded attributeRemoved attributeReplaced</i>	HttpSessionBindingEvent <small>Watch out for this naming inconsistency! The Event for HttpSessionAttributeListener is NOT what you expect (you expect HttpSessionAttributeEvent).</small>
You want to know if a context has been created or destroyed.	javax.servlet.ServletContextListener <i>contextInitialized contextDestroyed</i>	ServletContextEvent
You have an attribute class, and you want objects of this type to be notified when the session to which they're bound is migrating to and from another JVM.	javax.servlet.http.HttpSessionActivationListener <i>sessionDidActivate sessionWillPassivate</i>	HttpSessionEvent <small>It's NOT "HttpSessionActivationEvent"</small>

The HttpSessionBindingListener

You might be confused about the difference between an `HttpSessionBindingListener` and an `HttpSessionAttributeListener`. (Well, not *you*, but someone you work with.)

A plain old `HttpSessionAttributeListener` is just a class that wants to know when *any* type of attribute has been added, removed, or replaced in a Session. But the `HttpSessionBindingListener` exists so that the attribute *itself* can find out when *it* has been added to or removed from a Session.

```
package com.example;

import javax.servlet.http.*;

public class Dog implements HttpSessionBindingListener {
    private String breed;

    public Dog(String breed) {
        this.breed=breed;
    }

    public String getBreed() {
        return breed;
    }

    public void valueBound(HttpSessionBindingEvent event) {
        // code to run now that I know I'm in a session
    }

    public void valueUnbound(HttpSessionBindingEvent event) {
        // code to run now that I know I am no longer part of a session
    }
}
```



With this listener,
I'm more aware of **my role**
in the application. They tell **me**
when **I'm** put into a session
(or taken out).

This time the Dog attribute is ALSO a Listener... listening for when the Dog itself is added or removed from a Session. (Note: binding listeners are NOT registered in the DD... it just happens automatically.)

They use the word "bound" and "unbound" to mean "added to" and "removed from".

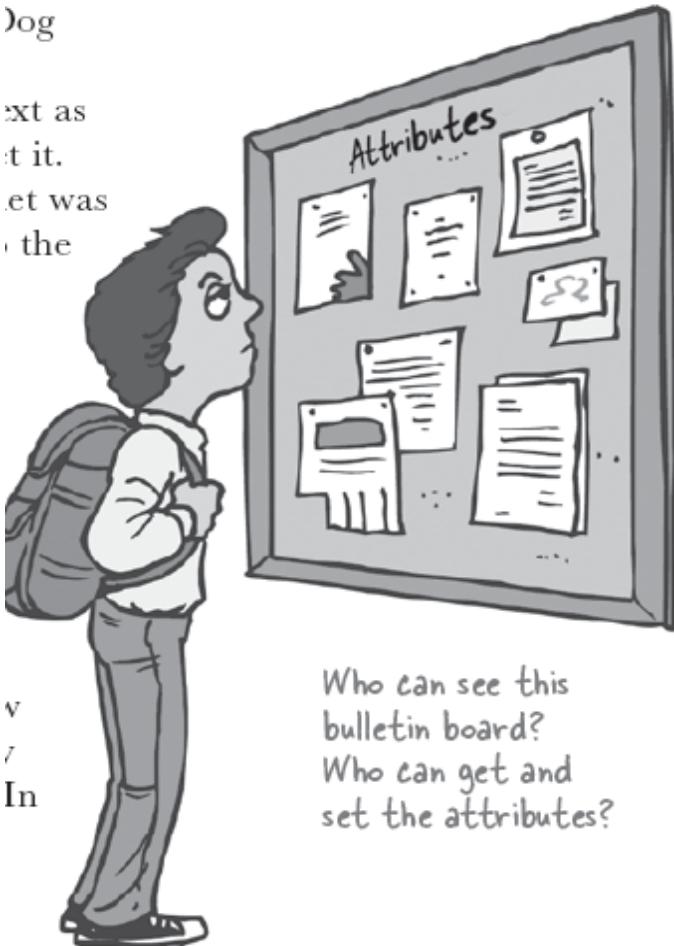
Attributes: What is it???

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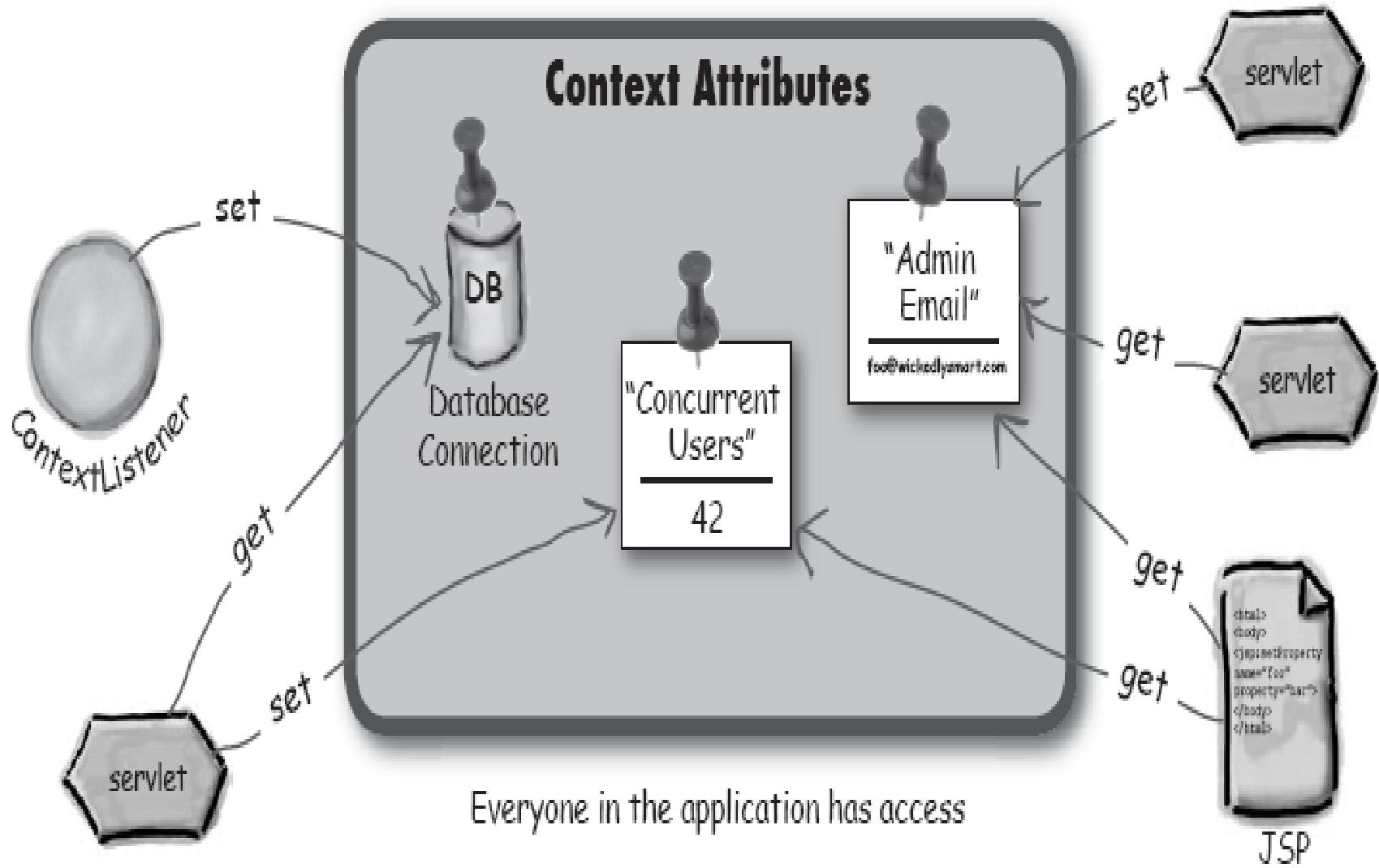


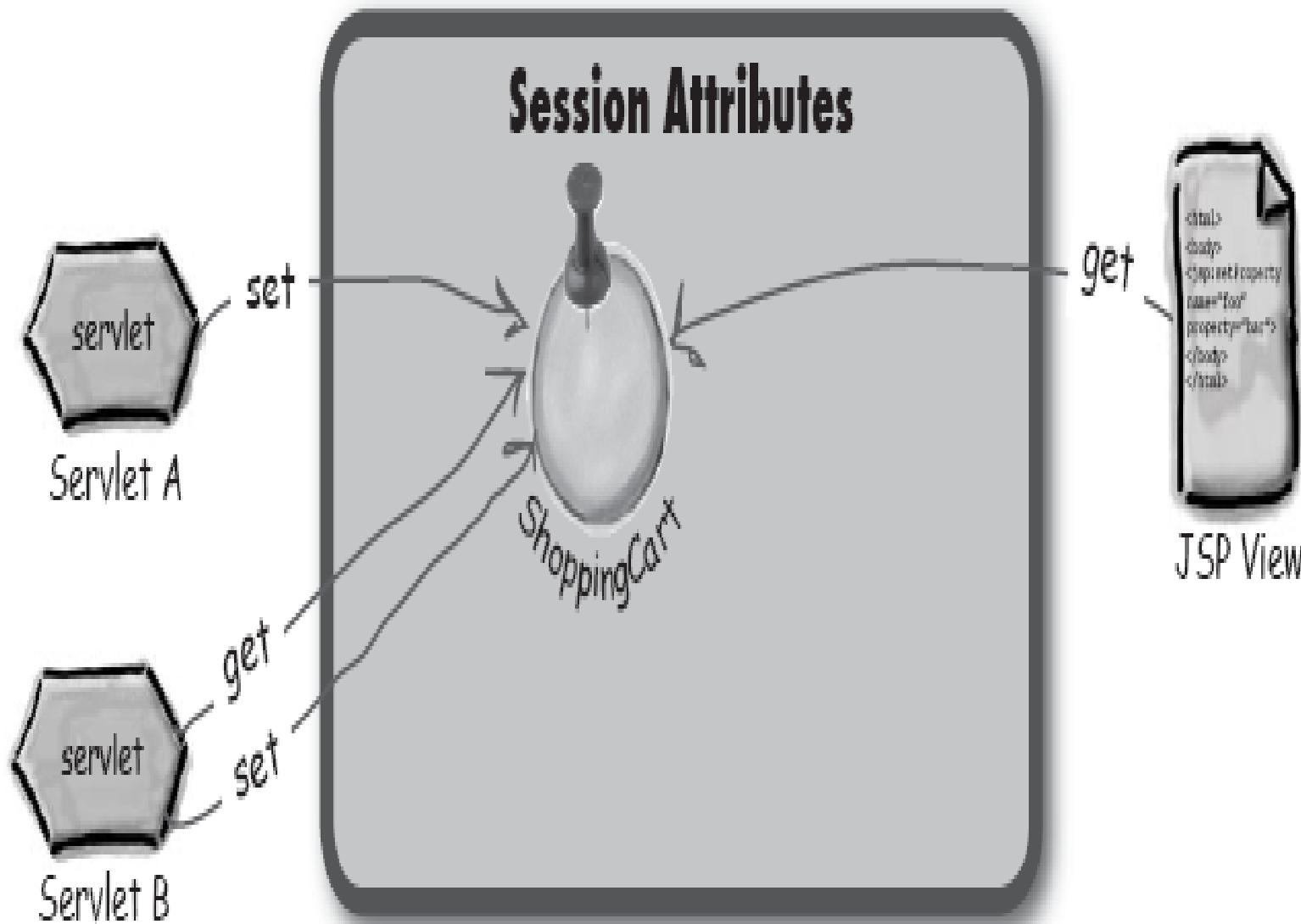
An attribute is like an object pinned to a bulletin board. Somebody stuck it on the board so that others can get it.

The big questions are: who has access to the bulletin board, and how long does it live? In other words, what is the scope of the attribute?

	Attributes	Parameters
Types	<p>Application/context</p> <p><u>Request</u> There is no servlet-specific attribute (just use an instance variable).</p> <p><u>Session</u></p>	<p>Application/context init parameters</p> <p>Request parameters</p> <p><u>Servlet init parameters</u> No such thing as session parameters!</p>
Method to set	<code>setAttribute(String name, Object value)</code>	You CANNOT set Application and Servlet init parameters—they're set in the DD, remember? (With Request parameters, you can adjust the query String, but that's different.)
Return type	Object	String ← Big difference!
Method to get	<code>getAttribute(String name)</code> <i>Don't forget that attributes must be cast, since the return type is Object.</i>	<code>getInitParameter(String name)</code>

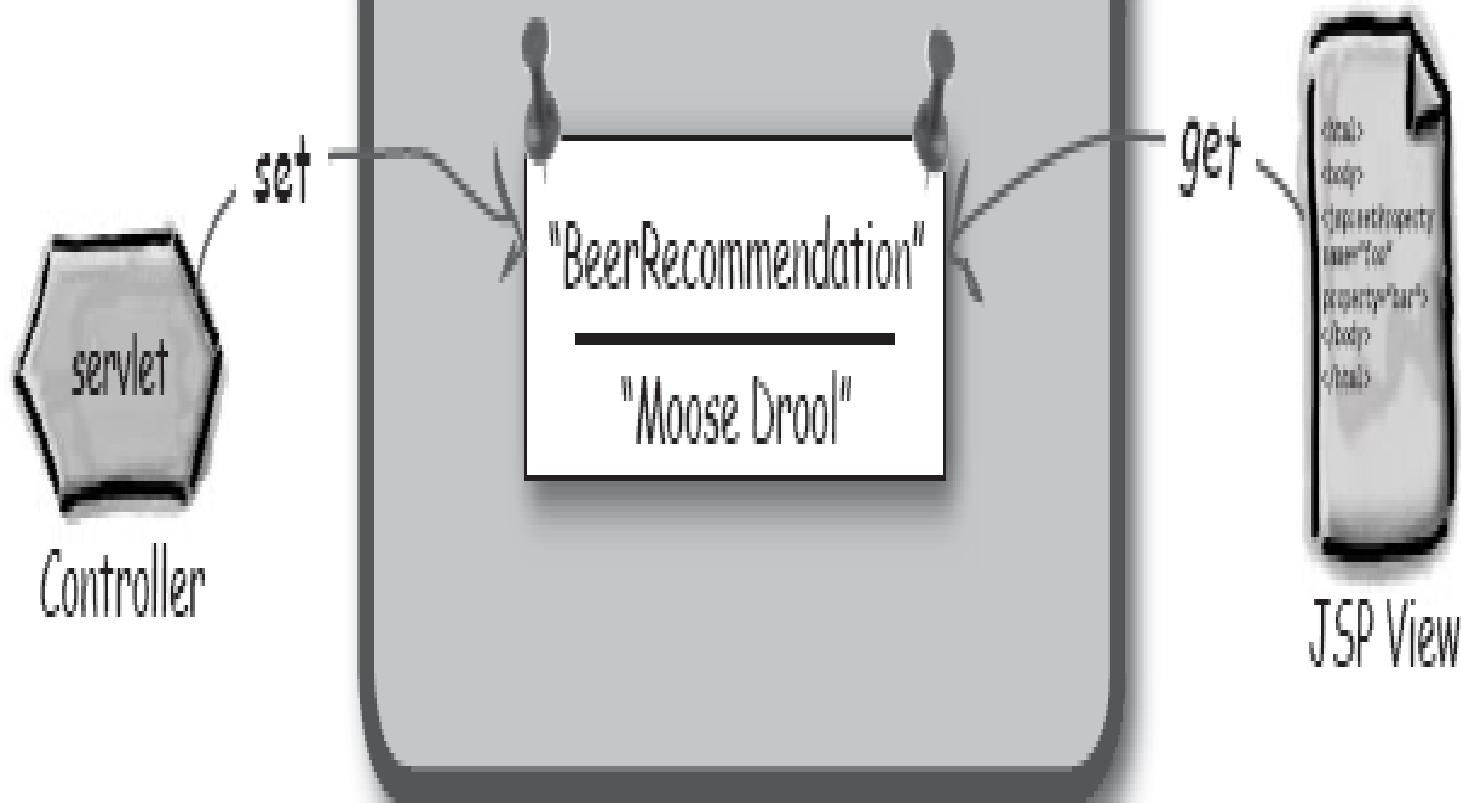
The Three Scopes: Context, Request, and Session





Accessible to only those with access to a specific HttpSession

REQUEST Attributes



Accessible to only those with access to a specific ServletRequest

Attribute API

The three attribute scopes—context, request, and session—are handled by the ServletContext, ServletRequest, and HttpSession interfaces. The API methods for attributes are exactly the same in every interface.

```
Object getAttribute(String name)
void setAttribute(String name, Object value)
void removeAttribute(String name)
Enumeration getAttributeNames()
```

Context

Request

Session

<code><<interface>></code> ServletContext
<code>getInitParameter(String)</code>
<code>getInitParameterNames()</code>
<code>getAttribute(String)</code>
<code>setAttribute(String, Object)</code>
<code>removeAttribute(String)</code>
<code>getAttributeNames()</code>
<code>getMajorVersion()</code>
<code>getServerInfo()</code>
<code>getRealPath(String)</code>
<code>getResourceAsStream(String)</code>
<code>getRequestDispatcher(String)</code>
<code>log(String)</code>
<code>// MANY more methods...</code>

<code><<interface>></code> ServletRequest
<code>getContentType()</code>
<code>getParameter(String)</code>
<code>getAttribute(String)</code>
<code>setAttribute(String, Object)</code>
<code>removeAttribute(String)</code>
<code>getAttributeNames()</code>
<code>// MANY more methods...</code>

<code><<interface>></code> HttpServletRequest
<code>getContextPath()</code>
<code>getCookies()</code>
<code>getHeader(String)</code>
<code>getQueryString()</code>
<code>getSession()</code>
<code>// MANY more methods...</code>

<code><<interface>></code> HttpSession
<code>getAttribute(String)</code>
<code>setAttribute(String, Object)</code>
<code>removeAttribute(String)</code>
<code>getAttributeNames()</code>
<code>setMaxInactiveInterval(int)</code>
<code>getId()</code>
<code>getLastAccessedTime()</code>
<code>// MANY more methods...</code>

multithreading issues????

What about multithreading issues????

Note easy to handle

But really not rocket science!!!!

The dark side of attributes...

Kim decides to test out attributes. He sets an attribute and then immediately gets the value of the attribute and displays it in the response. His doGet() looks like this:

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
                    throws IOException, ServletException

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();

    out.println("test context attributes<br>");

    getServletContext().setAttribute("foo", "22");
    getServletContext().setAttribute("bar", "42");

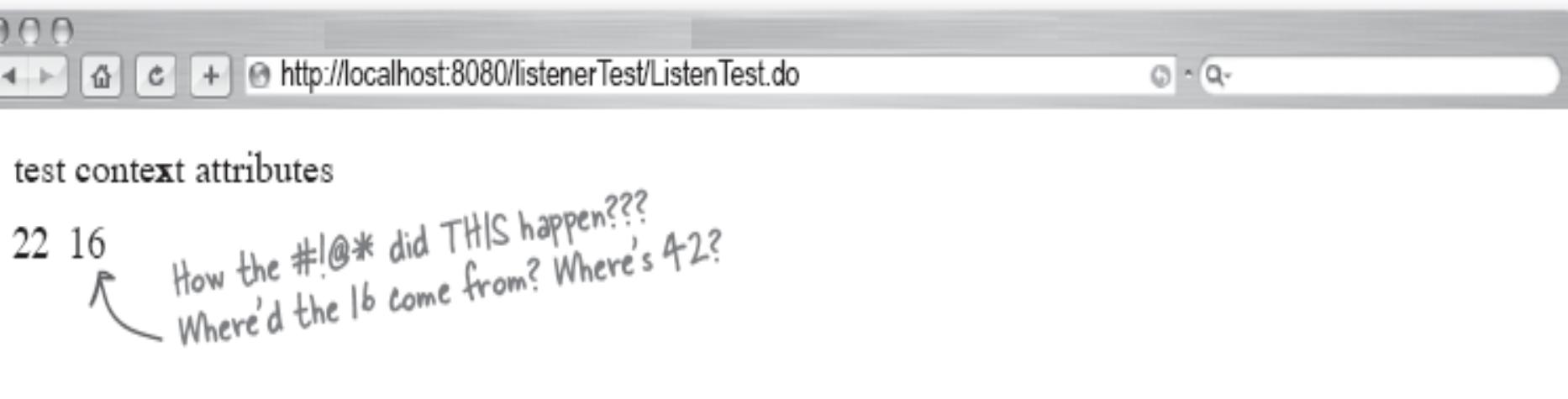
    out.println(getServletContext().getAttribute("foo"));
    out.println(getServletContext().getAttribute("bar"));
}
```

Here's what he sees the first time he runs it.

It's exactly what he expected.



The second time he runs it, he's shocked to see:

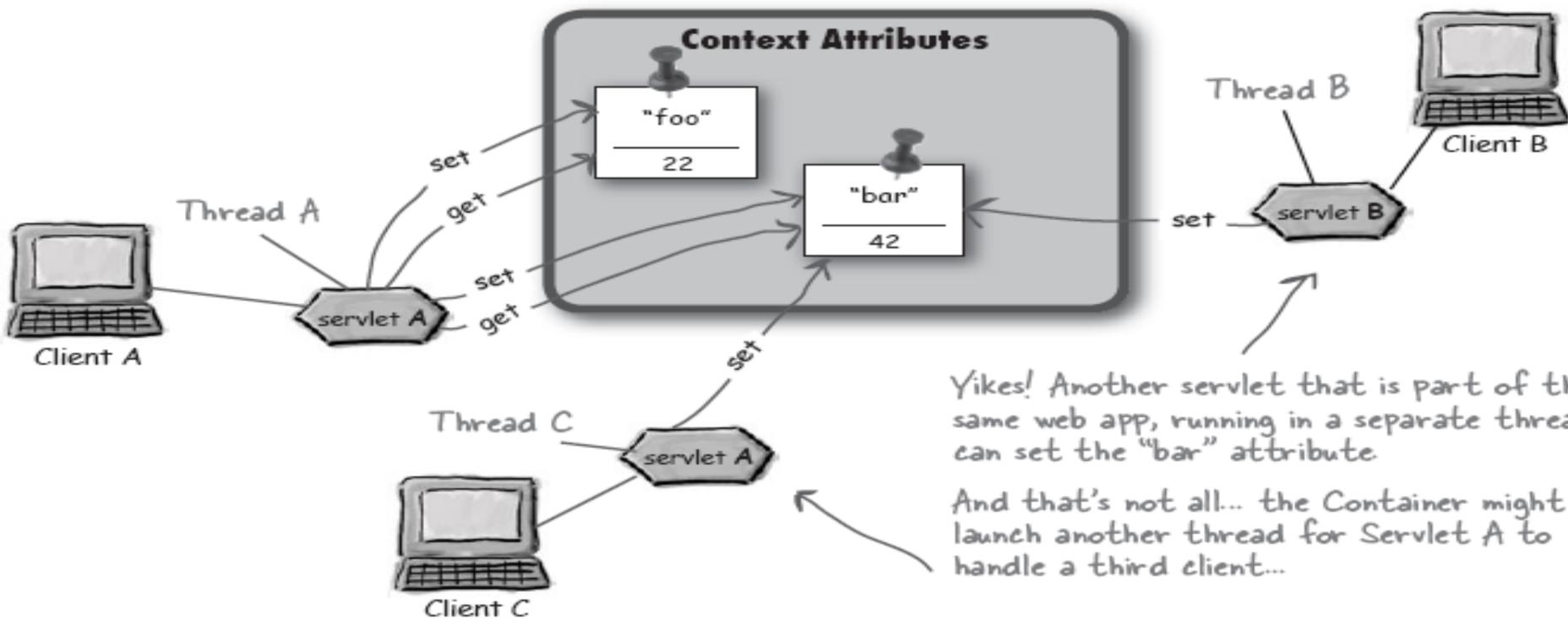




Context scope isn't thread-safe!

That's the problem.

Remember, everyone in the app has access to context attributes, and that means multiple servlets. And **multiple servlets means you might have multiple threads**, since requests are concurrently handled, each in a separate thread. This happens regardless of whether the requests are coming in for the same or different servlets.



How do we make context attributes thread-safe?

- Idea 1:
 - Synchronizing the service method is a spectacularly BAD idea
- Idea 2:
 - SingleThreadModel
- Idea 3:
 - » Synchronized Block

» What to Use????

Synchronizing the service method is a

~~bad idea~~

```
public synchronized void doGet(HttpServletRequest request, HttpServletResponse response)
                           throws IOException, ServletException {

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();

    out.println("test context attributes<br>");

    getServletContext().setAttribute("foo", "22");
    getServletContext().setAttribute("bar", "42");

    out.println(getServletContext().getAttribute("foo"));
    out.println(getServletContext().getAttribute("bar"));
}
```

Solution: You don't need a lock on the servlet... you need the lock on the context!

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
                  throws IOException, ServletException {
    response.setContentType("text/html");
    PrintWriter out = response.getWriter();

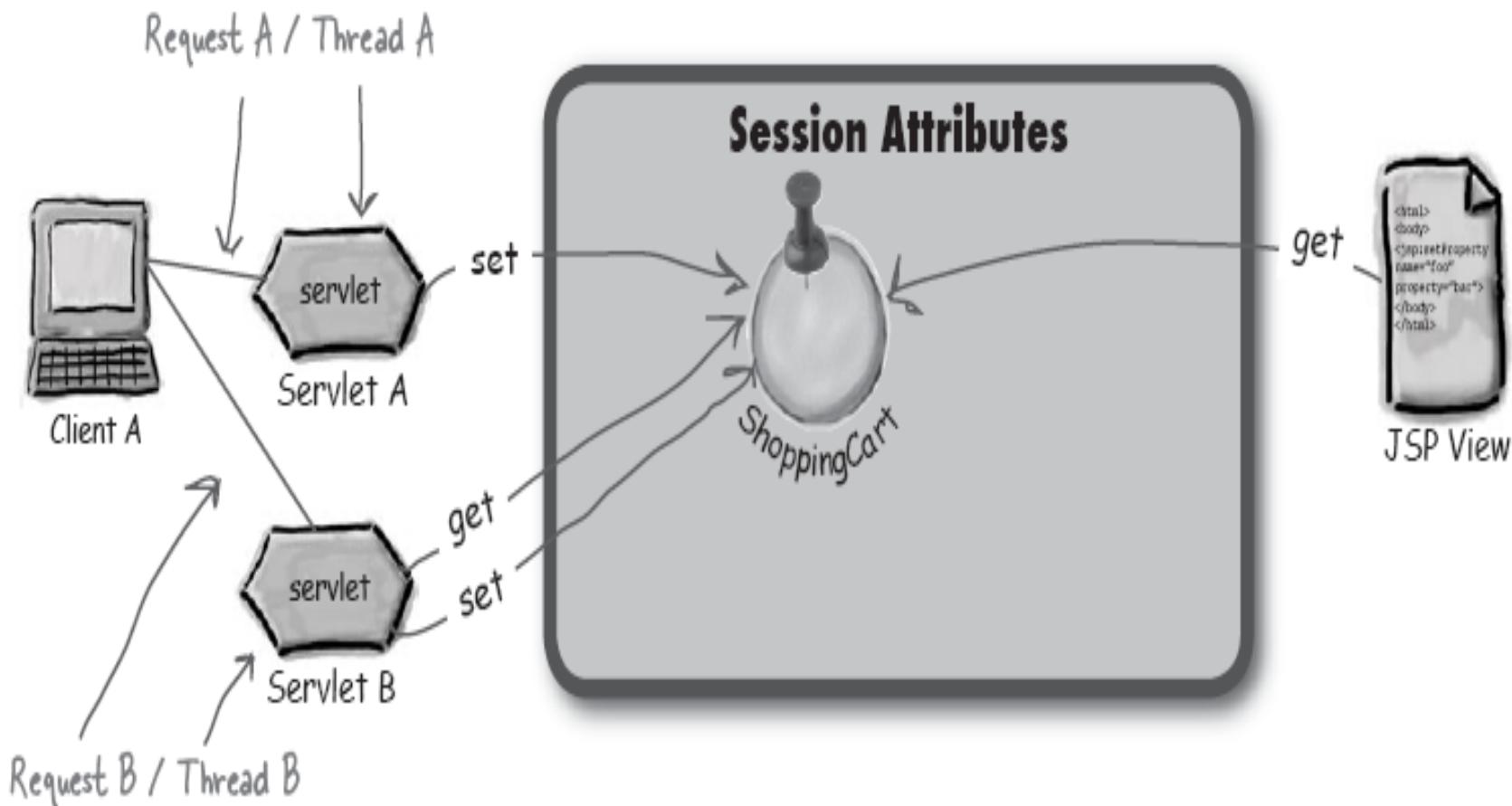
    out.println("test context attributes<br>");

    synchronized(getServletContext()) {
        getServletContext().setAttribute("foo", "22");
        getServletContext().setAttribute("bar", "42");

        out.println(getServletContext().getAttribute("foo"));
        out.println(getServletContext().getAttribute("bar"));
    }
}
```

Now we're getting the lock on the context itself!! This is the way to protect context attribute state. (You don't want synchronized(this).)

Are Session attributes thread-safe? Not really!!!



Protect session attributes by synchronizing on the HttpSession

Look at the technique we used to protect the *context* attributes. What did we do?

You can do the same thing with session attributes, by synchronizing on the HttpSession object!

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
                    throws IOException, ServletException {

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();

    out.println("test session attributes<br>");
    HttpSession session = request.getSession();

    synchronized(session) {  
        session.setAttribute("foo", "22");
        session.setAttribute("bar", "42");

        out.println(session.getAttribute("foo"));
        out.println(session.getAttribute("bar"));
    }
}
```

This time, we synchronize on the HttpSession object, to protect the session attributes.

request Attribute : thread safe hint

What's wrong with this code?

What do you think? Does this RequestDispatcher code look like it will work the way you'd expect?

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
                  throws IOException, ServletException {
    response.setContentType("application/jar");
    ServletContext ctx = getServletContext();
    InputStream is = ctx.getResourceAsStream("bookCode.jar");
    int read = 0;
    byte[] bytes = new byte[1024];
    OutputStream os = response.getOutputStream();
    while ((read = is.read(bytes)) != -1) {
        os.write(bytes, 0, read);
    }
    os.flush();
    RequestDispatcher view = request.getRequestDispatcher("result.jsp");
    view.forward(request, response);
    os.close();
}
```



Assume that all this works.

Session Management

Conversational state



One problem... how does the Container know who the client is?

The HTTP protocol uses *stateless* connections. The client browser makes a connection to the server, sends the request, gets the response, and closes the connection. In other words, the connection exists for only a *single* request/response.

Because the connections don't persist, the Container doesn't recognize that the client making a second request is the same client from a previous request. As far as the Container's concerned, ***each request is from a new client***.

How will the Container recognize it's Diane and not Terri? HTTP is stateless, so each request is a new connection...

But things were going so well... I thought we had a relationship...

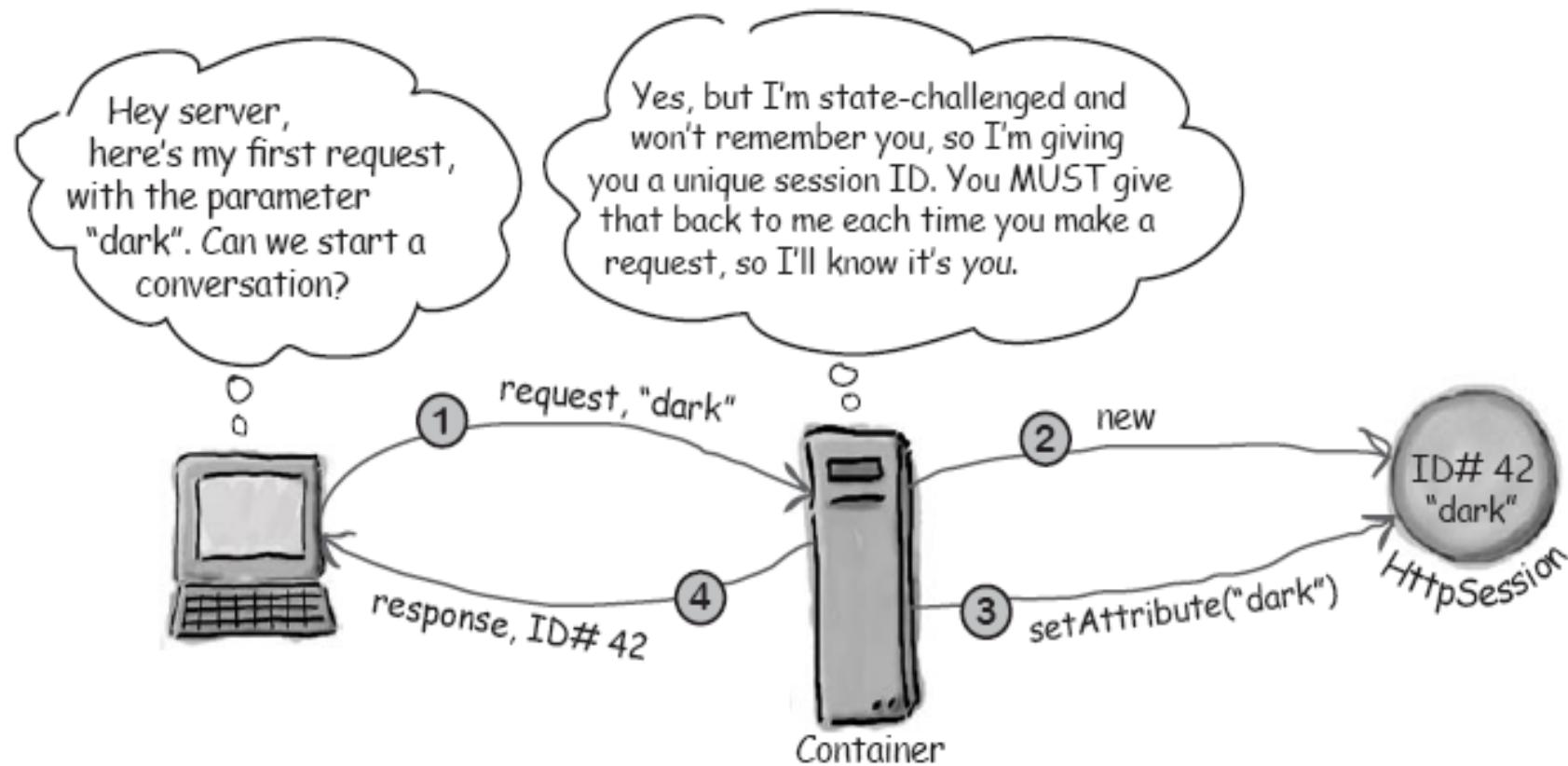


I'm sorry, but I don't remember you. I'm sure we shared good times together, but we'll have to start over.



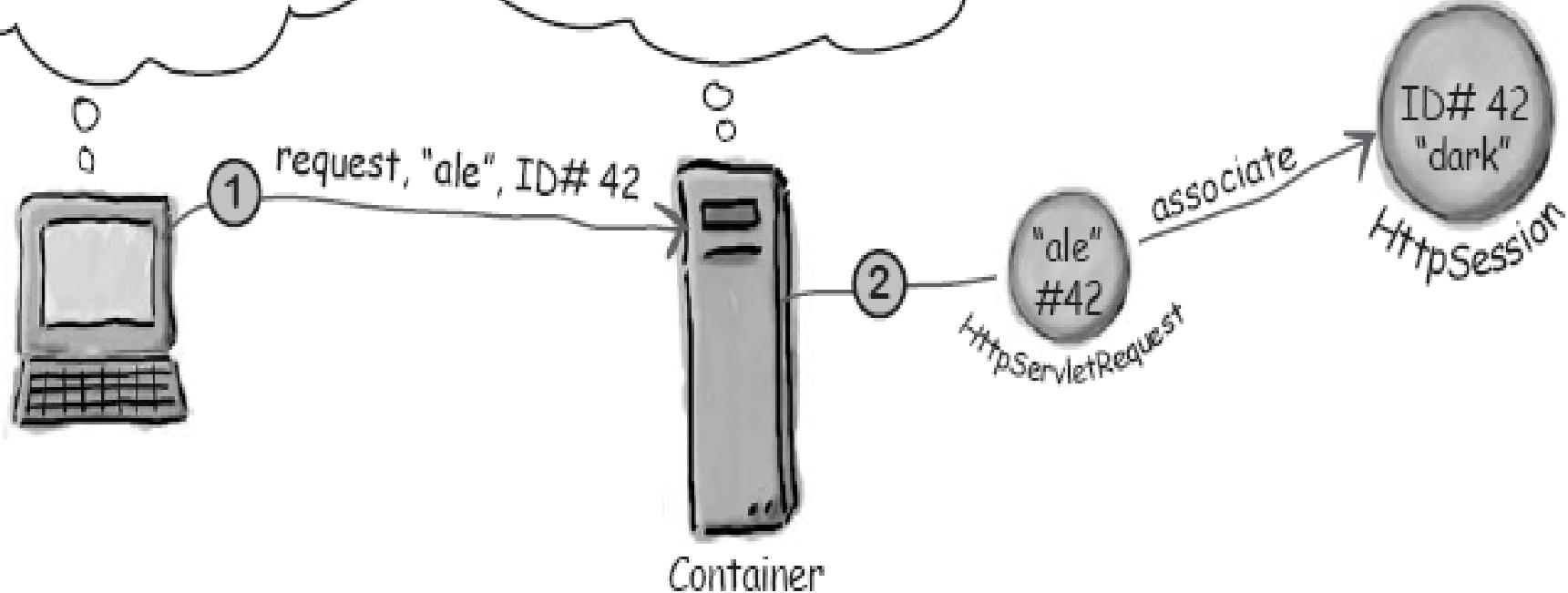
The client needs a unique session ID

The idea is simple: on the client's first request, the Container generates a unique session ID and gives it back to the client with the response. ***The client sends back the session ID with each subsequent request.*** The Container sees the ID, finds the matching session, and associates the session with the request.



Here's my second request, with the parameter "ale". My ID# is 42... do you remember me?

Let's see... #42... oh, there you are! Yes, I remember you now. Last time you said that you liked "dark" beer...



How do the Client and Container exchange Session ID info?

Somehow, the Container has to get the session ID to the client as part of the response, and the client has to send back the session ID as part of the request. The simplest and most common way to exchange the info is through *cookies*.

Cookies



"Set-Cookie" is just another header sent in the response.



HTTP/1.1 200 OK
Set-Cookie: JSESSIONID=0AAB6C8DE415
Content-Type: text/html
Content-Length: 397
Date: Wed, 19 Nov 2003 03:25:40 GMT
Server: Apache-Coyote/1.1
Connection: close

<html>
-->
</html>

HTTP Response



Here's your cookie with the session ID inside...



"Cookie" is another header sent in the request.

POST /select/selectBeerTaste2.do HTTP/1.1
Host: www.wickedlysmart.com
User-Agent: Mozilla/5.0
Cookie: JSESSIONID=0AAB6C8DE415
Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/x-mng,image/png,image/jpg,image/gif;q=0.2,*/*;q=0.1
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip,deflate

HTTP Request



The best part: the Container does virtually all the cookie work!

You *do* have to tell the Container that you want to create or use a session, but the Container takes care of generating the session ID, creating a new Cookie object, stuffing the session ID into the cookie, and setting the cookie as part of the response. And on subsequent requests, the Container gets the session ID from a cookie in the request, matches the session ID with an existing session, and associates that session with the current request.

Sending a session cookie in the RESPONSE:

```
HttpSession session = request.getSession(); ↴
```

That's it. Somewhere in your service method you ask for a session, and everything else happens *automatically*.

You don't make the new HttpSession object yourself.

You don't generate the unique session ID.

You don't make the new Cookie object.

You don't associate the session ID with the cookie.

You don't set the Cookie into the response
(under the *Set-Cookie* header).

All the cookie work happens behind the scenes.

Getting the session ID from the REQUEST:

```
HttpSession session = request.getSession();
```

Look familiar? Yes, it's exactly the same method used to generate the session ID and cookie for the response!

IF (the request includes a session ID cookie)

find the session matching that ID

ELSE IF (there's no session ID cookie OR there's no current session matching the session ID)

create a new session.

All the cookie work happens behind the scenes.

Whoa! The method session ID cookie with an existing se as SENDING a sess You never actually S ID yourself (although the session to give i

What if I want to know whether the session already existed or was just created?

Good question. The no-arg request method, `getSession()`, returns a session *regardless of whether there's a pre-existing session*. Since you *always* get an `HttpSession` instance back from that method, the only way to know if the session is new is to **ask the session**.

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
                    throws IOException, ServletException {

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();
    out.println("test session attributes<br>");

    HttpSession session = request.getSession();           ← getSessionFactory() returns a session no matter
                                                        what... but you can't tell if it's a new
                                                        session unless you ask the session.

    if (session.isNew()) {                                ← isNew() returns true if the
        client has not yet responded
        with this session ID.
        out.println("This is a new session.");
    } else {
        out.println("Welcome back!");
    }
}
```

What if I want ONLY a pre-existing session?

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
                  throws IOException, ServletException {

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();
    out.println("test sessions<br>");

    HttpSession session = request.getSession(false); ← Passing "false" means the method
                                                       returns a pre-existing session,
                                                       or null if there was no session
                                                       associated with this client.

    if (session==null) { ← Now we can test for whether
                           there was already a session
                           (the no-arg getSession()
                           would NEVER return null).

        out.println("no session was available");
        out.println("making one...");
        session = request.getSession(); ← Here we KNOW we're making a new session
    } else {
        out.println("there was a session!");
    }
}
```

URL rewriting: something to fall back on



```
HTTP/1.1 200 OK  
Content-Length: 397  
Date: Wed, 19 Nov 2003 03:25:40 GMT  
Server: Apache-Coyote/1.1  
Connection: close  
  
<html>  
<body>  
<a href="http://www.wickedlysmart.com/BeerTest.do;jsessionid=0AAB6C8DE415">  
click me  
</a>  
</body>  
</html>
```

We add the session ID to the end
of all the URLs in the HTML we
send back in the Response.

HTTP Response



```
GET /BeerTest.do;jsessionid=0AAB6C8DE415  
HTTP/1.1  
Host: www.wickedlysmart.com  
User-Agent: Mozilla/5.0  
Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/png,image/jpeg,image/gif;q=0.2,*/*;q=0.1  
Accept-Language: en-us,en;q=0.5  
Accept-Encoding: gzip,deflate
```

The session ID comes back as "extra" info
stuck to the end of the Request URL. (The
semicolon separator is vendor-specific.)

HTTP Request



Setting session timeout

Good news: you *don't* have to keep track of this yourself. See those methods on the opposite page? You don't have to use them to get rid of stale (inactive) sessions. The Container can do it for you.

Three ways a session can die:

- ▶ It times out
- ▶ You call `invalidate()` on the session object
- ▶ The application goes down (crashes or is undeployed)

① Configuring session timeout in the DD

Configuring a timeout in the DD has virtually the same effect as calling `setMaxInactiveInterval()` on every session that's created.

```
<web-app ...>
  <servlet>
    ...
  </servlet>
  <session-config>
    <session-timeout>15</session-timeout>
  </session-config>
</web-app>
```

The "15" is in minutes. This says if the client doesn't make any requests on this session for 15 minutes, kill it.*

② Setting session timeout for a specific session

If you want to change the session-timeout value for a particular session instance (without affecting the timeout length for any other sessions in the app):

```
session.setMaxInactiveInterval(20*60);
```

Simple Cookies Example: for session management

Servlet that creates and SETS the cookie

```
import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;

public class CookieTest extends HttpServlet {

    public void doPost(HttpServletRequest request, HttpServletResponse response)
            throws IOException, ServletException {

        response.setContentType("text/html");
        String name = request.getParameter("username"); ← Get the user's name submitted in the form.

        Cookie cookie = new Cookie("username", name); ← Make a new cookie so store the user's name.
        cookie.setMaxAge(30*60); ← Keep it alive on the client for 30 minutes.
        response.addCookie(cookie); ← Add the cookie as a "Set-Cookie" response header.

        RequestDispatcher view = request.getRequestDispatcher("cookieresult.jsp");
        view.forward(request, response);
    }
}
```

... read back about

Let a JSP make the response page.

JSP to render the view from this servlet

```
<html><body>
<a href="checkcookie.do">click here</a>
</body></html>
```

OK, sure, there's nothing JSP-ish about this, but we hate outputting even THIS much HTML from a servlet. The fact that we're forwarding to a JSP doesn't change the cookie setting. The cookie is already in the response by the time the request is forwarded to the JSP...

Servlet that GETS the cookie

```
import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;

public class CheckCookie extends HttpServlet {

    public void doGet(HttpServletRequest request, HttpServletResponse response)
        throws IOException, ServletException {

        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

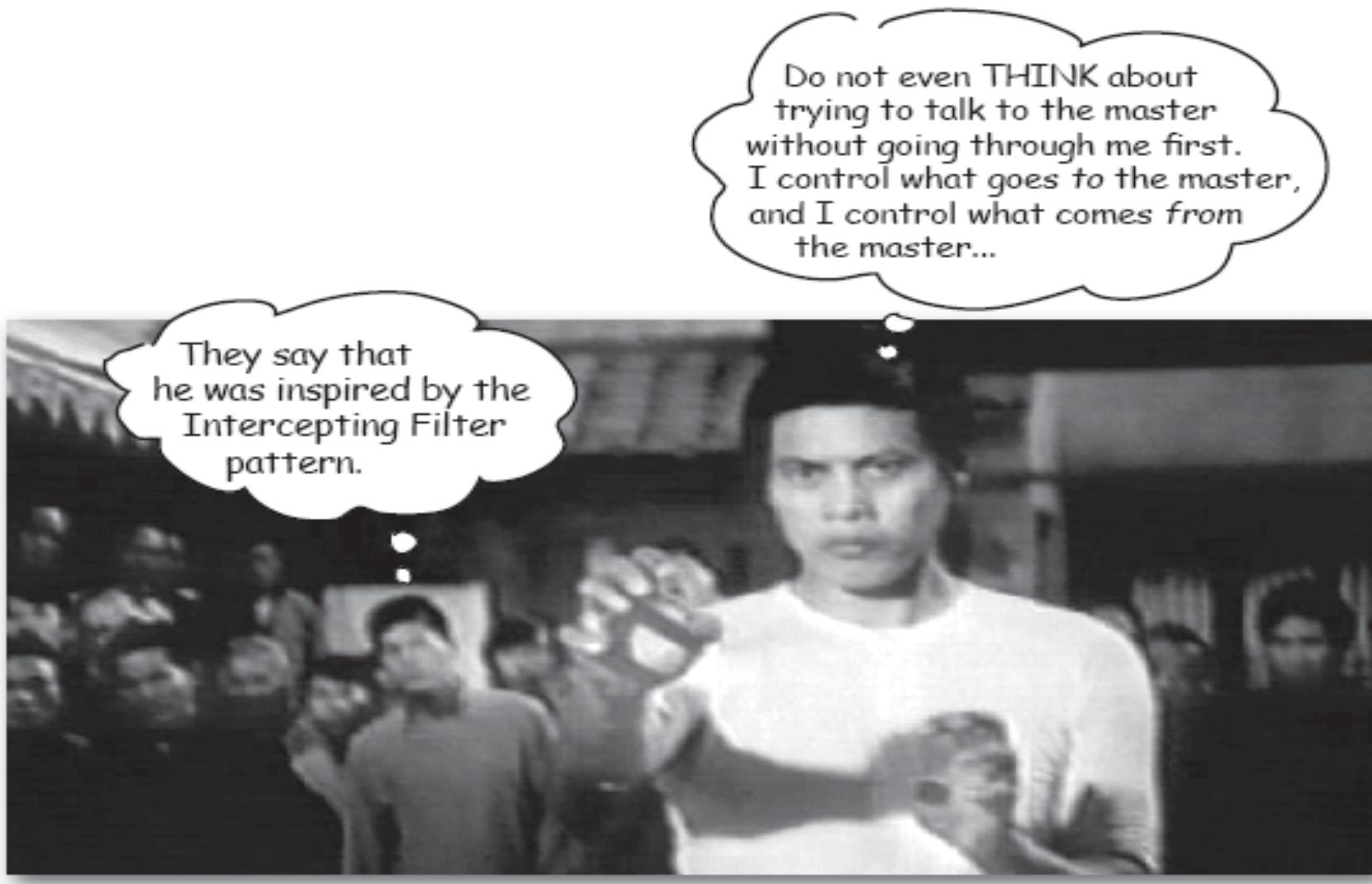
        Cookie[] cookies = request.getCookies(); ← Get the cookies
        from the request

        if (cookies != null) {
            for (int i = 0; i < cookies.length; i++) {
                Cookie cookie = cookies[i];
                if (cookie.getName().equals("username")) {
                    String userName = cookie.getValue(); ← Loop through the cookie array
                    out.println("Hello " + userName);
                    break;
                }
            }
        }
    }
}
```



Don't confuse Cookies with headers!

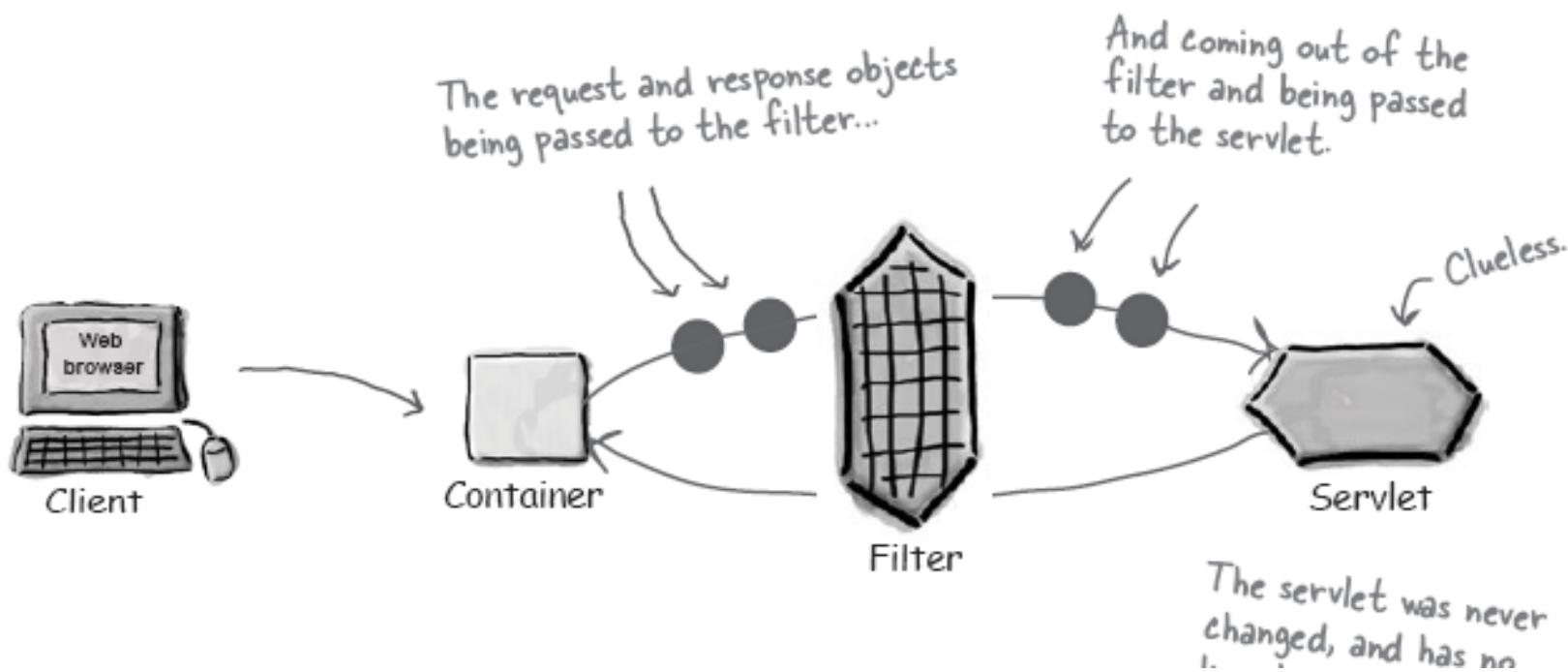
The Power of Filters



How about some kind of “filter”?

Filters are Java components—very similar to servlets—that you can use to intercept and process requests *before* they are sent to the servlet, or to process responses *after* the servlet has completed, but *before* the response goes back to the client.

The Container decides when to invoke your filters based on declarations in the DD. In the DD, the deployer maps which filters will be called for which request URL patterns. So it's the deployer, not the programmer, who decides which subset of requests or responses should be processed by which filters.



Fun things to do with Filters

Request filters can:

- ▶ perform security checks
- ▶ reformat request headers or bodies
- ▶ audit or log requests

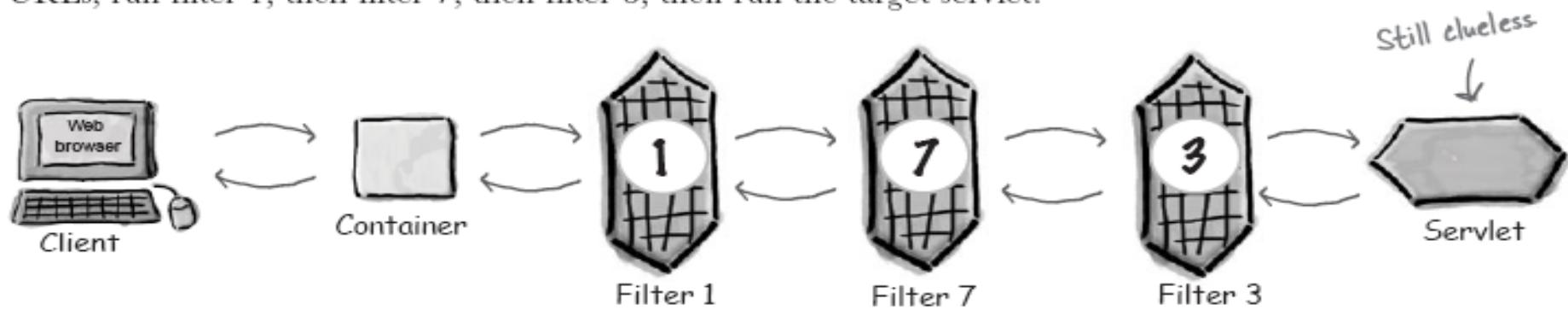
Response filters can:

- ▶ compress the response stream
- ▶ append or alter the response stream
- ▶ create a different response altogether

Filters are modular, and configurable in the DD

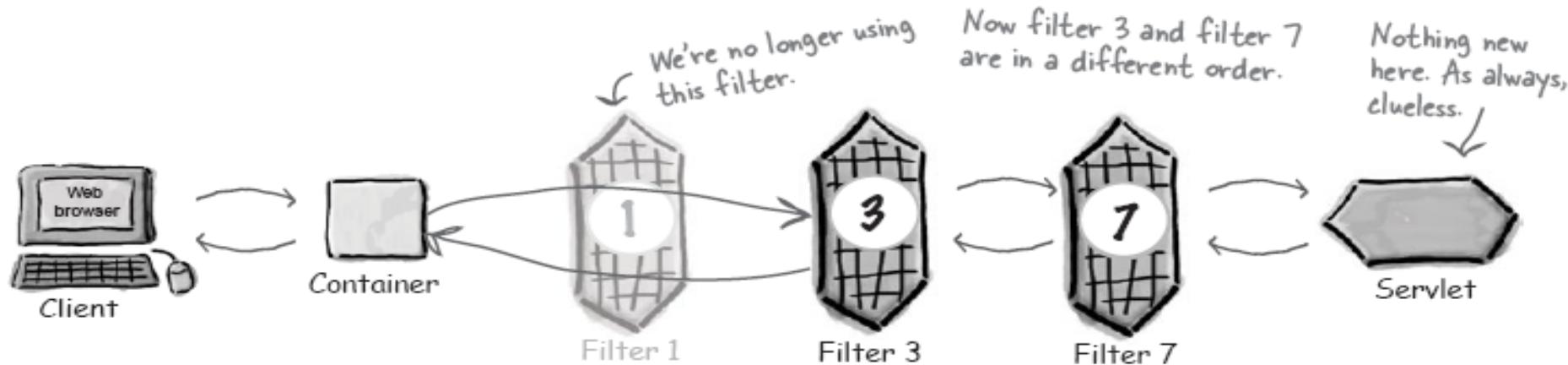
DD configuration 1:

Using the DD, you can link them together by telling the Container: "For these URLs, run filter 1, then filter 7, then filter 3, then run the target servlet."



DD configuration 2:

Then, with a quick change to the DD, you can delete and swap them with:
"For these URLs, run filter 3, then filter 7, and then the target servlet."



Three ways filters are like servlets

- **The Container knows their API**
- **Just like servlets, filters have a lifecycle.**
 - » Like servlets, they have **init()** and **destroy()** methods. Similar to a servlet's **doGet()/doPost()** method, filters have a **doFilter()** method.
- **They're declared in the DD**
 - » A web app can have **lots of filters, and a given request can cause more than one filter to execute. The DD is the place where you declare which filters will run in response to which requests, and in which *order*.**

Building the request tracking filter

```
package com.example.web;  
  
import java.io.*;  
import javax.servlet.*; ← Filter and FilterChain  
import javax.servlet.http.HttpServletRequest;  
  
public class BeerRequestFilter implements Filter {  
  
    private FilterConfig fc;  
  
    public void init(FilterConfig config) throws ServletException {  
        this.fc = config;  
    }  
  
    public void doFilter(ServletRequest req,  
                        ServletResponse resp, ← Every filter MUST implement  
                        FilterChain chain)           the Filter interface.  
                        throws ServletException, IOException {  
  
        HttpServletRequest httpReq = (HttpServletRequest) req; ← You must implement init(), usually you  
        String name = httpReq.getRemoteUser();                just save the config object.  
  
        if (name != null) {  
  
            fc.getServletContext().log("User " + name + " is updating");  
        }  
  
        chain.doFilter(req, resp); ← doFilter() is where you do the real  
    }                                              work.. Notice that the method doesn't  
                                                take HTTP request and response  
                                                objects... just regular ServletRequest and  
                                                ServletResponse objects.  
  
    public void destroy() {  
        // do cleanup stuff  
    }  
}
```

You must implement destroy()
but usually it's empty.

This is how the next filter or servlet
in line gets called - lots more on this
in the next couple of pages.

But we're pretty sure
that we can cast the
request and response to
their HTTP subtypes.

Declaring and ordering filters

When you configure filters in the DD, you'll usually do three things:

- Declare your filter
- Map your filter to the web resources you want to filter
- Arrange these mappings to create filter invocation sequences

Declaring a filter

```
<filter>
  <filter-name>BeerRequest</filter-name>
  <filter-class>com.example.web.BeerRequestFilter
    </filter-class>
  <init-param>
    <param-name>LogFileName</param-name>
    <param-value>UserLog.txt</param-value>
  </init-param>
</filter>
```

Declaring a filter mapping to a URL pattern

```
<filter-mapping>
  <filter-name>BeerRequest</filter-name>
  <url-pattern>*.do</url-pattern>
</filter-mapping>
```

Declaring a filter mapping to a servlet name

```
<filter-mapping>
  <filter-name>BeerRequest</filter-name>
  <servlet-name>AdviceServlet</servlet-name>
</filter-mapping>
```

Thanks:-

Reference:-

Head First Servlet and Jsp