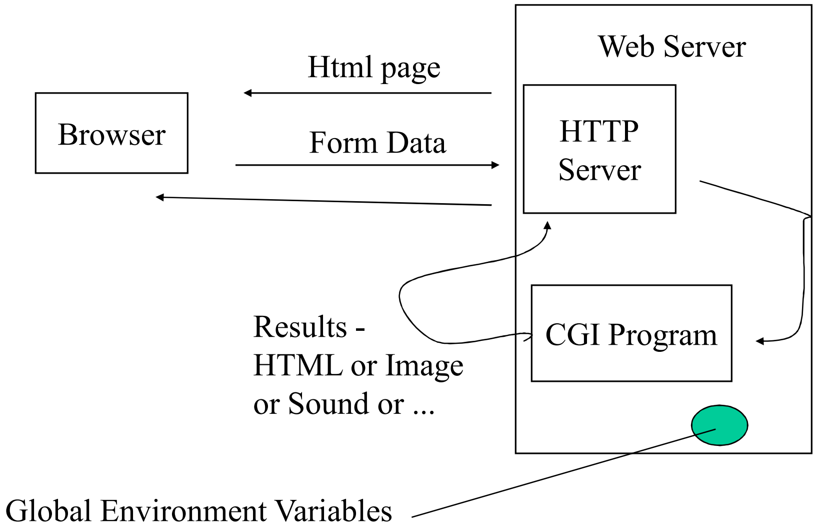
Extending Web Functionality

- Programming tools are needed to extend web functionality beyond pure publishing.
- CGI
  - Common Gateway Interface
  - Server Side Includes
- Java / Java Applet / Java Servlet / JSP
- ActiveX
- JavaScript / VBScript

CGI

- Programs (compiled or interpreted) running on the server
- Provide interactivity with the user for forms, images (e.g. counters)
  - User inputs data on a form
  - Upon submit, the data is transmitted to the CGI
  - CGI program operates on the data and typically transmits something back (HTML, image, etc.)

CGI


Web Server
Html page
Browser
Form Data
HTTP Server
Results - HTML or Image or Sound or ...
CGI Program
Global Environment Variables

CGI Problems

- Load on the server
- Security issues
  - if a leak, user could get access to the web server
- Inefficiencies
  - Program is loaded for each request
  - Possible to have in-memory modules for better efficiency

Two Methods of Sending Data

- GET method
  - Sends data like invoking a program with command line arguments
  - /cgi-bin/mycgi.exe?parm1=yes&parm2=no
- POST method
  - Invokes program first, then the program waits for the parameter data from the web server
  - Somewhat more secure than the GET method

CGI Examples

- Web bulletin board
- Graphical Counters
  - CGI returns an image, not HTML
- Guestbook
- Web log analysis

- CGI program generates the HTML that your browser sees

CGI Programming

- Often in Perl, ASP (Active Server Pages)
- Can use C, C++, .NET Languages
- We will use PHP
- Either an interpreted or compiled language

- NOT a language implemented in your browser, like Javascript or VBScript

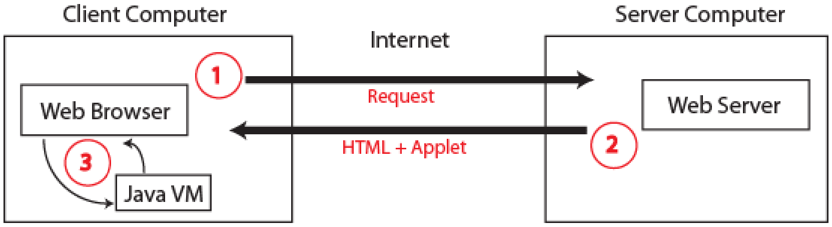
Server Side Includes

- Hidden directives in your HTML to execute a program and insert its output into the web page
- <!-- comment tag -->
- Format varies on different browsers

```
HTML Here blah blah...
<!--#include file="testssi.inc"-->
More html here…
<!--#exec cgi=“cgiprogram.exe”-->
```

Java Applet

Applets downloaded to local PC, execute there



1. The client's web browser sends a request to the server for a web page with a Java Applet.
2. The server sends the HTML for the web page and applet class files to the client.
3. The client runs the applet using the Java Virtual Machine and displays its output in the web browser.

Java Applet Usage

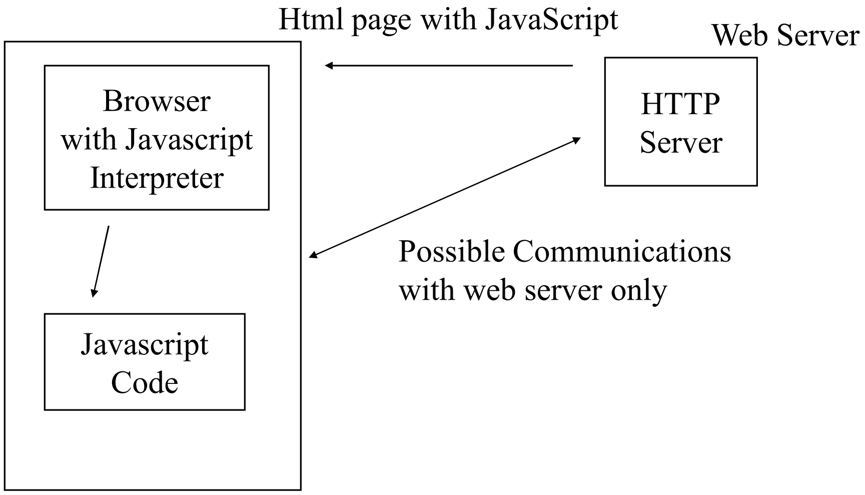
- The applet is embedded like a HTML tag:

```
<applet code=javaprog.class width=x height=y>
<param name=X value=Y>
…
</applet>
```

JavaScript / VBScript / DHTML

- JavaScript is quite different from Java
  - JavaScript started as LiveScript by Netscape
  - VBScript started by Microsoft
- Scripting language; interpreted by the web browser; code is embedded in the HTML itself
- Often used for “glue” between browsers and programs on the server (e.g. databases)

JavaScript



Html page with JavaScript

Web Server

Browser with Javascript Interpreter

HTTP Server

Possible Communications with web server only

Javascript Code

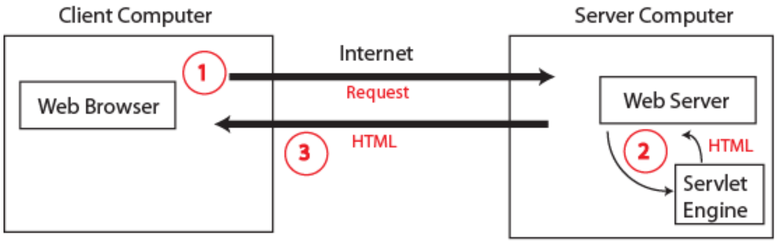
Example JavaScript Code

```
<script language="JavaScript">

var num=1;
num=num+5;
document.write("Hello world!  The number is ");
document.writeln(num);
document.write("<p>");

document.writeln;
var d=new Date();
document.writeln("The time is "+d);

</script>
```

Java vs. JavaScript?

- Both run on the client
- Interpreted Java/VBScript runs slower
- Somewhat limited programming language constructs available in JavaScript
- Easier to do simple tasks, formatting tasks, interface with Fields in Forms in JavaScript

Java Servlet

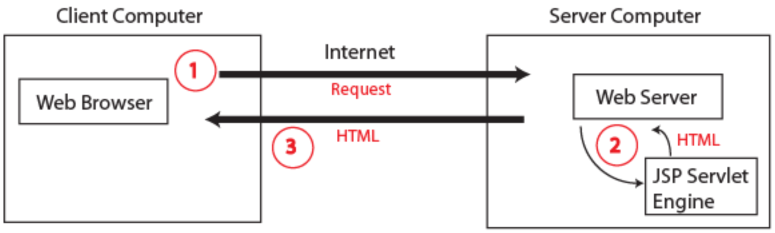


1. The client's web browser sends a request to the server for a web page that runs a Java servlet.

2. The web server instructs the Servlet engine to execute the requested servlet, which consists of running precompiled Java code. The servlet outputs HTML that is returned to the web server.

3. The web server sends the servlet's HTML to the client's web browser to be displayed.

Java Server Pages (JSP)



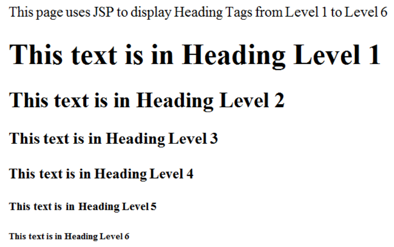
1. The client's web browser sends a request to the server for a web page that contains JSP code.

2. The JSP Servlet engine dynamically compiles the JSP source code into a Java servlet if a current, compiled servlet doesn't exist. The servlet runs and outputs HTML that is returned to the web server.

3. The web server sends the servlet's HTML to the client's web browser to be displayed.

Sample JSP Code

```
<html>
<title>
Displaying Heading Tags with JSP
</title>

<body>
<%!
  private static final int LASTLEVEL = 6;
%>

<p>
This page uses JSP to display Heading Tags from Level 1 to Level <%= LASTLEVEL %></p>

<%
  int i;
  for (i = 1; i <= LASTLEVEL; i++)
  {
                out.println("<H" + i + ">" +
                 "This text is in Heading Level " + i +
                 "</H" + i + ">");
  }
%>
</body>
</html>
```



This page uses JSP to display Heading Tags from Level 1 to Level 6

This text is in Heading Level 1

This text is in Heading Level 2

This text is in Heading Level 3

This text is in Heading Level 4

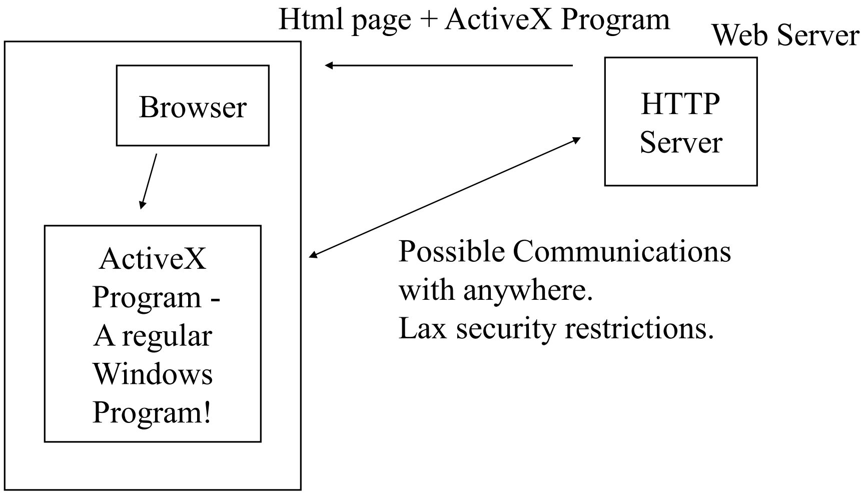
This text is in Heading Level 5

This text is in Heading Level 6

COM/ActiveX

- Microsoft-specific format
- Architecture that enables binary programs to be distributed and interface with one another
- For a web browser, the end result is similar to Java
  - Native compiled programs downloaded to the browser
  - Run on the client

ActiveX



Html page + ActiveX Program

Web Server

Browser

HTTP
Server

ActiveX
Program -
A regular
Windows
Program!

Possible Communications
with anywhere.
Lax security restrictions.

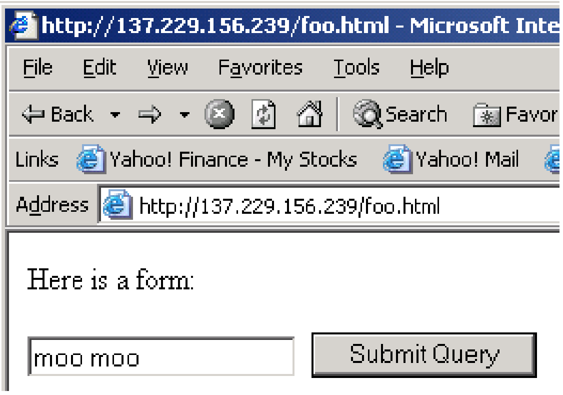
Basic CGI Example

- Receiving, Printing GET/POST Data

HTML:

```
<html>
<body>
Here is a form:
<form name="foo" method=post action="test.php">
<input type=text name=bah>
<input type=hidden name=foo value="hello">
<input type=submit>
</form>
</body>
</html>
```

Form


http://137.229.156.239/foo.html - Microsoft Inte
File
Edit
View
Favorites
Tools
Help
Back
Search
Favor
Links
Yahoo! Finance - My Stocks
Yahoo! Mail
Address

http://137.229.156.239/foo.html

Here is a form:

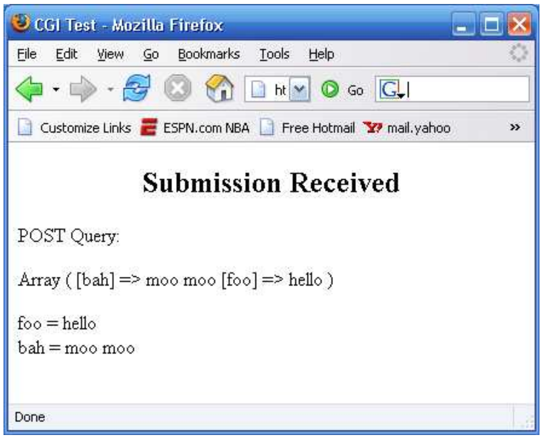
moo moo

Submit Query

CGI Code, in PHP

```
<?php
 header("Content-Type: text/html");

 print("<html><head><title>CGI Test</title></head><body>");
 print("<center>");
 print("<h2>Submission Received</h2>");
 print("</center>");

if ($_SERVER['REQUEST_METHOD'] == 'GET') {
        print(" GET Query: <P> ");
        print_r($_GET);
        print("<P>foo = " . $_GET['foo'] . "<BR>bah = " . $_GET['bah'] . "<p> ");
 }
 else {
        print(" POST Query: <P> ");
        print_r($_POST);
        print("<P>foo = " . $_POST['foo'] . "<BR>bah = " . $_POST['bah'] . "<p> ");
}

?>
```

Results


CGI Test - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
Go
Customize Links
ESPN.com NBA
Free Hotmail
mail.yahoo
Done

Submission Received

POST Query:

Array ([bah] => moo moo [foo] => hello)

foo = hello
bah = moo moo