



Presentation Layer

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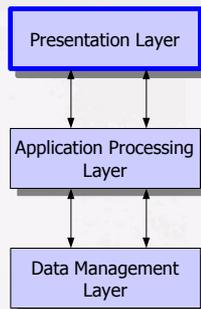
Technological Alternatives (Java)

- J2EE standards:
 - Servlets: Java with HTML
 - JSP: HTML with Java
 - Taglibs: pre-built JSP components
- Almost standard:
 - Struts: command oriented
 - JSF: web framework (still JSP)
- Others:
 - Tapestry
 - AngularJS
 - ...

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Layered Application Architecture

- **Presentation layer**
 - Concerned with presenting the results of a computation to system users and with collecting user inputs
- **Application processing layer**
 - Concerned with providing application specific functionality ex., in a banking system, banking functions such as open account, close account, etc.
- **Data management layer**
 - Concerned with managing the system databases



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Introduction to Servlets and JSP

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Requirements (Web)

- Easy to change
- Separation of roles:
 - programmer
 - Web designer
- WYSIWYG
- As easy as desktop UI
- UI components
- MVC
 - model: data
 - view: how data is displayed
 - controller: user commands

Web Page Designer



HTML Expert

Component Developer

Java Expert

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Introduction

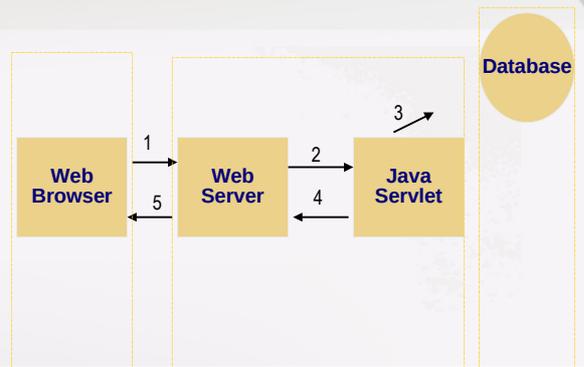
- Servlet Architecture Overview
- Servlets in Context
 - Other options for server side development
- Advantages of Servlets
- Introduction to Java Server Pages (JSP)
- Servlets vs. JSP

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Architectural Overview

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Life of a Servlet



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What is a Servlet?

- Java's answer to the Common Gateway Interface (CGI).
- **Applet**: a java program that runs within the web browser.
- **Servlet**: a java program that runs within the web server.
- The standard for building web applications.

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Servlets in Context

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Life of a Servlet

- Regardless of the application, servlets usually carry out the following routine:
 - 1) Read any data sent by the user
 - Capture data submitted by an HTML form.
 - 2) Look up any HTTP information
 - Determine the browser version, user, cookies, etc.
 - 3) Generate the Results
 - Connect to databases, connect to legacy apps, etc.
 - 4) Format the Results
 - Generate HTML on the fly
 - 5) Set the Appropriate HTTP headers
 - Tell the browser the type of document being returned or set any cookies.
 - 6) Send the document back to the client

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Server Side Options

- There are many options for creating server side applications.
- We will examine some of these options briefly.
- This better enables us to understand servlets within the broader context of web development.
- Also enables us to better understand the advantages and disadvantages of servlets.

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Server Side Options

- Common Gateway Interface (CGI)
- PHP
- Java: Servlets/JSP, JSF, ...
- ASP.NET
- NodeJS
- ...

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Option: CGI

- Represents one of the earliest, practical methods for generating web content.
- Primarily written in the Perl programming language.
- Unfortunately, traditional CGI programs suffer from scalability and performance problems.
- Let's examine these two problems...

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Common Features

- All server side frameworks share a common set of features:
 - Read data submitted by the user
 - Generate HTML dynamically based on user input
 - Determine information about the client browser
 - Access Database systems
 - Exploit the HTTP protocol

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CGI Architecture

- 1) Browser initiates request
- 2) Web server receives the request.
- 3) For each request, web server spawns a new operating system process to execute the CGI/Perl Program.



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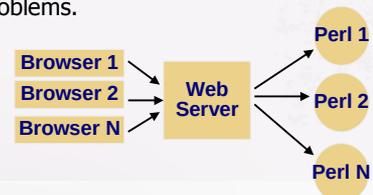
Decision Points

- Ease of development:
 - How easily can you build new applications?
- Performance:
 - How fast can the framework respond to queries?
- Scalability:
 - Can the framework scale to thousands, millions of users?
- Security:
 - Are there any inherent security vulnerabilities?
- ...

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CGI Architecture

- For each browser request, the web server must spawn a new operating system process:
 - takes time and memory
 - traditional CGI programs have performance and scalability problems.
 - Every other server architecture tries to address these problems.



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Option: PHP

- An open source project written entirely by volunteers
- Provides simple, but powerful database access.
- Also great for rapid development.
- For additional information:
<http://www.php.net>
- No OO...

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A Servlet: Looks like a regular Java program

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

public class HelloWorld extends HttpServlet {
    public void doGet(HttpServletRequest req, HttpServletResponse res)
        throws ServletException, IOException {
        res.setContentType("text/html");
        PrintWriter out = res.getWriter();
        out.println("<HTML>");
        out.println("<HEAD><TITLE>Hello World</TITLE></HEAD>");
        out.println("<BODY>");
        out.println("<BIG>Hello World</BIG>");
        out.println("</BODY></HTML>");
    }
}
```

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A Servlet That Generates Plain Text

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

```
public class HelloWorld extends HttpServlet {
    public void doGet(HttpServletRequest request,
        HttpServletResponse response)
        throws ServletException, IOException {
        PrintWriter out = response.getWriter();
        out.println("Hello World");
    }
}
```



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A JSP Page: Looks like a regular HTML page

```
<html>
<head>
<title>Hello, World JSP Example</title>
</head>
<body>
  <h2> Hello, World!
  The current time in milliseconds is
  <%= System.currentTimeMillis() %>
</h2>
</body>
</html>
```

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Java Server Pages

- Complementary to Java Servlets
- Can be used alone or in conjunction with servlets
- Represent (yet) another method for creating server side applications
- Servlets
 - code looks like a regular Java program.
- JSP
 - embed Java commands directly within HTML
- Let's examine a Servlet program next to a JSP program...
 - Each of these prints, "Hello, World!"

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Summary

- Servlet: a java program that runs within the web server.
- Servlets have lots of advantages over other server side scripting options.
- Servlets look like regular Java code with some HTML.
- Java Server Pages look like HTML with some Java.

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