

Web Programming Tutorial

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CS 411, Fall 2010

What is Web Development?

- **Web development** is a broad term for any activity related to developing a web site for the World Wide Web or an intranet.
- Usually refers to the non-design aspects of writing markup and coding

Why Web Programming

- One of the choices for building applications around DBMS (the front end)
- Many database applications require easy access to serve the public

The Objective of This Lecture

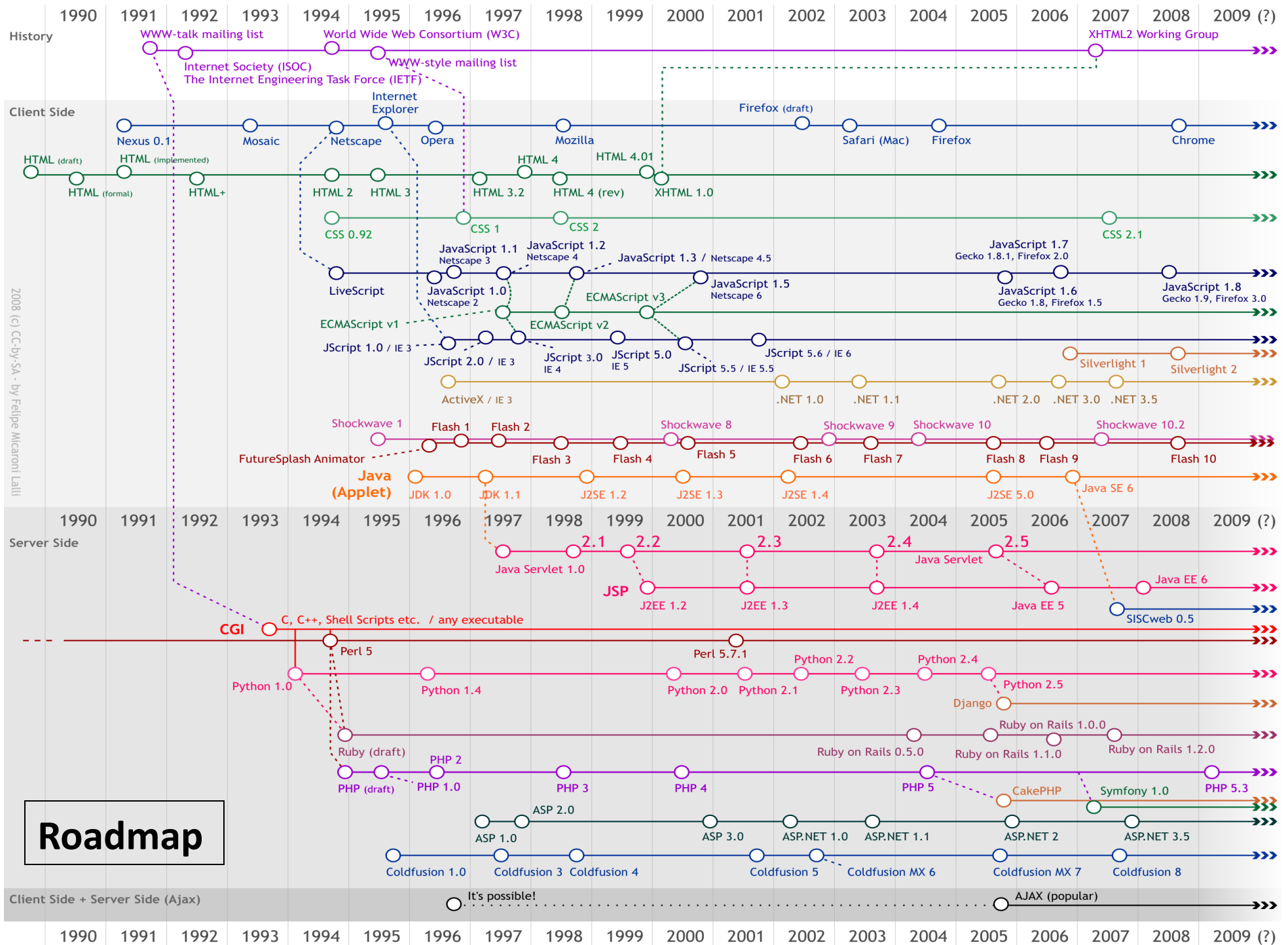
- To give you a very high-level overview of some of the tools for Web Programming
- Use several typical tools to show the basics of Web Programming
- Not meant for advanced Web developers
- The next in-class tutorial will be on DB Programming
- We will assume minimal interaction with DBMS in this lecture to focus on the Web programming part

Client Side Coding: Code that runs on the client side's browsers

- [HTML](#)
 - stands for HyperText Markup Language, and is the predominant markup language for web pages. It is written in the form of HTML elements consisting of "tags" surrounded by angle brackets within the web page content
- [Javascript](#)
 - Formally called EMCAScript, Javascript is a ubiquitous client side programming tool, often implemented as part of a web browser in order to provide enhanced user interfaces and dynamic websites. It's typically used to enable programmatic access to computational objects within a host environment.
- [Applet](#) and [ActiveX](#).
 - Applet (e.g. Java Applet): small application that performs one specific task, sometimes running within a larger program, perhaps as a plug-in.
- [AJAX](#) (Asynchronous Javascript And XML)
 - Group of technologies that provides new methods of using Javascript, PHP and other languages to improve the user experience

Server Side Coding: Code that runs on the server's side

- [CGI](#) (standard protocol for server-client communication)
- [PHP](#) (open source)
- [ASP.NET](#) (Microsoft proprietary)
- [JSP](#) (JavaServer Pages)
- [Python](#), e.g. [Django \(web framework\)](#) (open source)
- [Ruby](#), e.g. [Ruby on Rails](#) (open source)



Development of Web Programming

- The first generation mainly relied on [HTML](#) and [CGI](#) to interact with underlying executables, written in C, C++, Java, etc
- The next generation of web development tools used the strong growth in [LAMP](#) and [Microsoft .NET](#) technologies to provide the Web as a way to run applications online.

Plan of the Lecture

- Creating a simple page at projects.cs.illinois.edu
- Supporting Basic Web Programming using HTML + CGI
- More advanced programming using PHP (as in the LAMP architecture)
- Additional tools: Ajax, etc

Creating a simple html file at projects.cs.illinois.edu

- Go to your project page management site:
<http://accounts.cs.illinois.edu/projects>.
 - Web pages created here will appear at
netid.cs.projects.illinois.edu
- Create a folder called, e.g., "cs411project"
- Place a blank or "hello world" page called "index.html" in
"cs411project" and make sure that you can access it at
<http://netid.projects.cs.illinois.edu/cs411project/index.html>
 - replace "netid" with your netid.
 - Make sure to place all of this in the public_html folder, to have
the file show up
 - See my simple posted example file:
<http://danilev1.projects.cs.illinois.edu/cs411project/index.html>

HTML + CGI

- HTML: Hyper-Text Markup Language, the building blocks of all basic websites

```
<html>
  <head>
    <title>Hello HTML</title>
  </head>
  <body>
    <p>Hello World!</p>
  </body>
</html>
```

- CGI: a standard protocol for the communication between client software with an information server. CGI is completely independent of programming language, operating system and web server.

HTML + CGI: How to get input?

- Using the default GET method, the data sent is placed in the environment variable `QUERY_STRING` for the CGI script to process.
 - e.g. in C, write:
 - `char *data = getenv("QUERY_STRING");`
- When the method POST is used the data is sent by a separate stream and becomes the standard input to the CGI script.
- For examples & getting started with CGI Programming in C:
 - <http://www.cs.tut.fi/~jkorpela/forms/cgic.html>

HTML + CGI: How to generate output?

- How to generate output and display it as HTML?
- CGI returns its output (HTTP headers and HTML document, or XML) to the server by writing it to standard out.
 - In a Perl or Python script just use the print statement.
 - In C use printf or some equivalent (C++ uses cout <<)
 - In Java use System.out.println
- For examples & getting started with CGI Programming in C:
 - <http://www.cs.tut.fi/~jkorpela/forms/cgic.html>

Javascript

- The HTML `<script>` tag is used to insert a JavaScript into an HTML page.

```
<html>
<body>

<script type="text/javascript">
document.write("Hello World!");
</script>

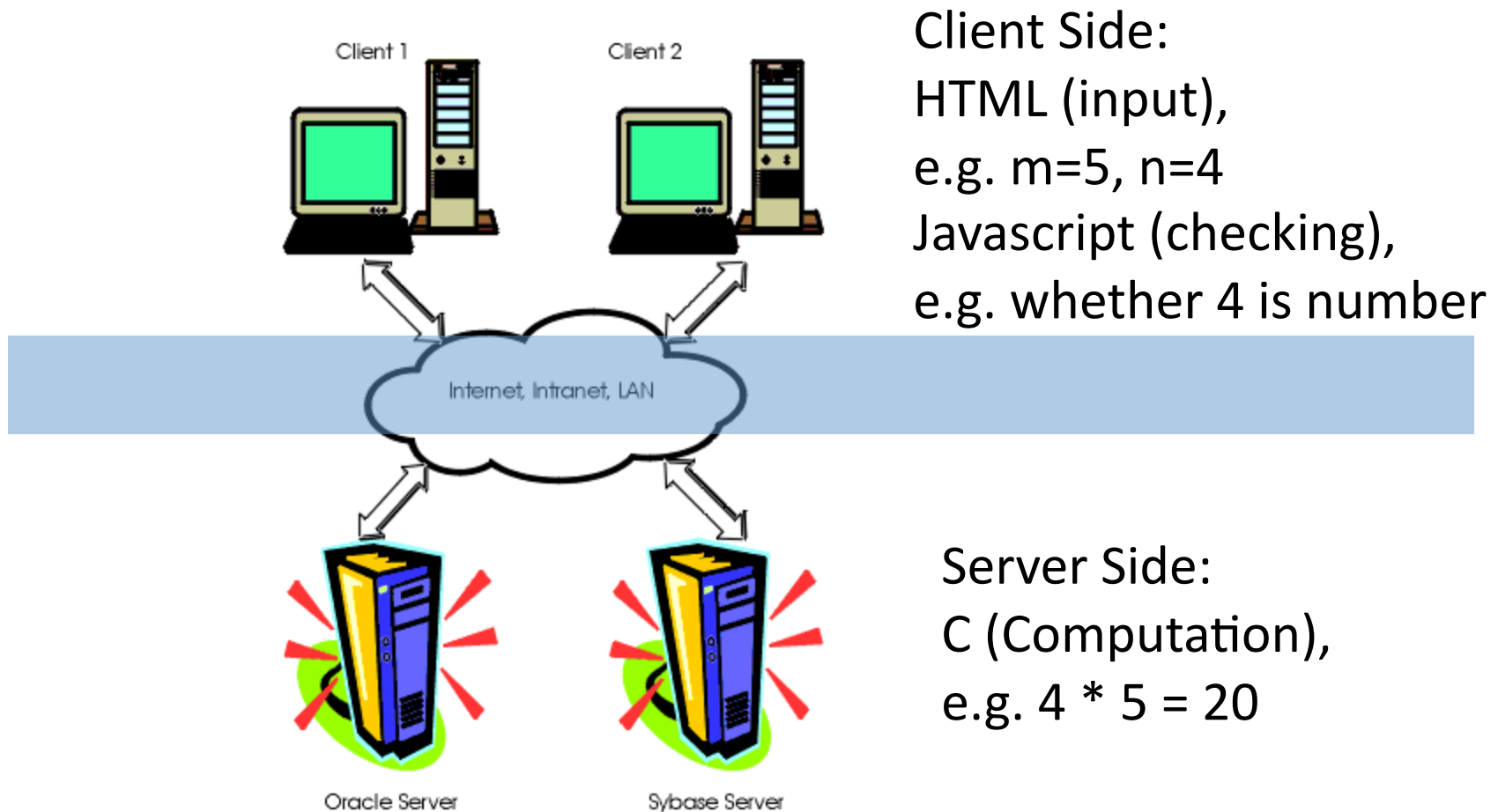
</body>
</html>
```

- Caution! Javascript may be browser dependent

Verification using Javascript

- Recall, Javascript is client-side. What is a good example of a task that could use Javascript?
 - Number verification (given input from HTML, we want to do some computation with it, but must first make sure the input is numeric)
 - Recommended to be done on client side, to reduce server load
 - Compare to the computation step (server-side)

Architecture



“LAMP”: Open Source Solution, Bundle of Software

- [Linux](#), referring to the operating system;
- [Apache](#), the Web server;
- [MySQL](#), the database management system (or database server);
- [PHP](#) or others, i.e., [Perl](#), [Python](#), the programming languages
- LAMP is easy to code locally and deploy, allows for cheap & ubiquitous hosting

What is “PHP”?

- Self-referentially short for ***PHP: Hypertext Preprocessor***, an open source, **server-side**, HTML embedded scripting language used to create dynamic Web pages.
 - PHP files can contain text, HTML tags and scripts
 - PHP files are returned to the browser as plain HTML
 - PHP files have a file extension of ".php", ".php3", or ".phtml"
- Contrast with Javascript, which is client-side, HTML embedded scripting language

PHP Basics

- A PHP file normally contains HTML tags, just like an HTML file, and some PHP scripting code
- A PHP scripting block always starts with **<?php** and ends with **?>**.
- A PHP scripting block can be placed anywhere in the document.
- All variables in PHP start with a \$ sign symbol.
 - `$var_name = value;`
 - for example, `$txt="Hello World!";`

PHP Hello World in browser

- Example of a simple HTML + PHP script which sends the text "Hello World" to the browser:

```
<html>
<body>

<?php
echo "Hello World!;
?>

</body>
</html>
```

- There are two basic statements to output text with PHP: **echo** and **print**. In the example above we have used the echo statement to output the text "Hello World".

PHP Basics

- Arrays and Regex
 - Arrays (syntax is: array(key => value), so create key-value pairs)
 - ```
<?php
$a=array("a"=>"Dog","b"=>"Cat","c"=>"Horse");
print_r($a);
?>
```

      - output: Array ( [a] => Dog [b] => Cat [c] => Horse )
    - Regular expression (preg\_match)
      - ```
<?php
// create a string
$string = 'abcdefghijklmnopqrstuvwxyz0123456789';
echo preg_match("/abc/", $string);
?>
```

 - output: '1' because 'abc' was found in \$string

How to Get User Input?

- `$_GET["var"]`
 - if the url sent to the server (e.g. after a form submission looks like:
 - `http://www.w3schools.com/welcome.php?fname=Peter&age=37`
 - The "welcome.php" file can now use the `$_GET` function to collect form data
 - Welcome `<?php echo $_GET["fname"]; ?>`
 - output: Displays "Welcome Peter"
- `$_POST["var"]`
 - similar to GET, but the information sent with a POST method is invisible, unlike if sent with GET method

Using Cookies in PHP

- A cookie is often used to identify a user
 - small file that the server embeds on the user's computer.
- Each time the same computer requests a page with a browser, it will send the cookie too.
- With PHP, you can both create and retrieve cookie values
 - create a cookie: `setcookie(name, value, expire, path, domain);`
 - The PHP `$_COOKIE` variable is used to retrieve a cookie value.

Using Session Control in PHP

- A PHP session variable is used to store information about, or change settings for a user session.
- Session variables hold information about one single user, and are available to all pages in one application.
 - To store and retrieve session variables, use the PHP `$_SESSION` variable

Cookie vs Session

- Cookie
 - More permanent
 - Typically small (need to be sent to server)
- Session
 - Typically in server memory (ends when you close browser)
 - Can be of any size

Authentication using PHP

- Can use [crypt\(\)](#) or [md5\(\)](#) for encrypting
 - md5() syntax:
 - string **md5** (string \$str [, bool \$raw_output = false])
 - Calculates the MD5 hash of \$str
 - crypt() syntax:
 - string **crypt** (string \$str [, string \$salt])
 - returns a hashed string using the standard Unix DES-based algorithm
- Authentication can also be done through DBMS

ASP.net and JSP

- They follow pretty similar architecture
- ASP.net
 - server side scripting technology that enables scripts (embedded in web pages) to be executed by an Internet server.
 - normally used together with SQLServer (MS proprietary)
- JSP
 - Roughly, allows Java code and certain pre-defined actions to be combined with static web markup content.
 - The resulting page is compiled and executed on the server-side to deliver an HTML or XML document
 - Since it's Java, JSP is Sun proprietary

AJAX

- **Ajax**, or **AJAX** (Asynchronous JavaScript and XML), is a group of interrelated web development techniques used to create interactive web applications or rich Internet applications.
- AJAX allows web pages to be updated asynchronously by exchanging small amounts of data with the server behind the scenes.
 - This means that it is possible to update parts of a web page, without reloading the whole page.

AJAX Suggestion Example

- [Google Suggest](#) is using AJAX to create a dynamic web interface:
 - When you start typing in Google's search box, a JavaScript sends the letters off to a server and the server returns a list of suggestions.
 - Note that the page does not reload as you type

Other Tools for Web Programming

- [Django](#)
 - open source web application framework written in [Python](#)
 - emphasizes reusability and "pluggability" of components, rapid development
- [Ruby on Rails](#)
 - open source web application framework for the [Ruby](#) programming language
 - similar philosophies of reusability, convention over configuration

Take Away Message

- Web Programming is not hard
- Many tutorials (with examples) available
 - W3Schools is a great place to start:
<http://www.w3schools.com>
- Choose your preferred tools early, and start to get familiar with them

References

- Getting starting with CGI Programming in C
 - <http://www.cs.tut.fi/~jkorpela/forms/cgic.html>
- PHP related examples, including PHP + MySQL
 - <http://www.w3schools.com/php/>
- W3Schools tutorials are generally very helpful, on almost all the tools we covered
- Also for using PHP with MySQL:
 - **[Hugh Williams](#) and [David Lane](#), ``Web Database Applications with PHP and MySQL" <http://www.webdatabasebook.com/>**