Chapter 4

HTTP and the Web Services

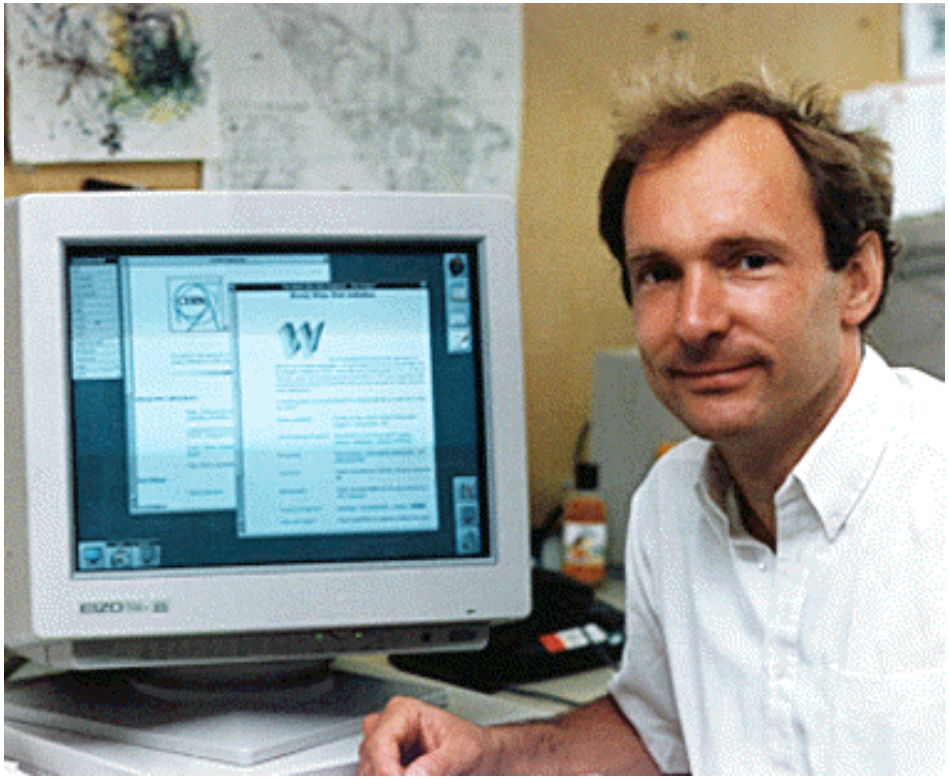
By Pavan Poudel

Overview

1. HTTP, Web Servers and Web Access
2. Universal naming with URLs
3. WWW Technology: HTML, DHTML, WML, XML
4. Tools: WYSIWYG Authoring Tools
5. Helper Applications: CGI, Perl, JAVA, JAVAScripts, PHP, ASP, .NET Applications
6. Introduction to AJAX (Programming)
7. Browser as a Rendering Engine: text, HTML, gif and jpeg

The World Wide Web (WWW)

- Affectionately called "The Web"
- It is a collection of information stored on the networked computers over the world.
- The WWW was proposed in 1991 by Tim Berners-Lee at CERN.



Web vs. Internet

- They are not the same things.
- The Internet is a collection of computers or networking devices connected together.
  - They have communication between each other.
  - Decentralized design that there is no centralized body controls how the Internet functions.
- The Web is a collection of documents that are interconnected by hyper-links.
  - These documents are accessed by web browsers and provided by web servers.

Internet terminologies

- Client
  - Any computer on the network that requests services from another computer on the network.
- Server
  - Any computer that receives requests from client computers, processes and sends the output.
- Web Page
  - Any page that is hosted on the Internet.
- Web Development
  - The process of creating, modifying web pages.

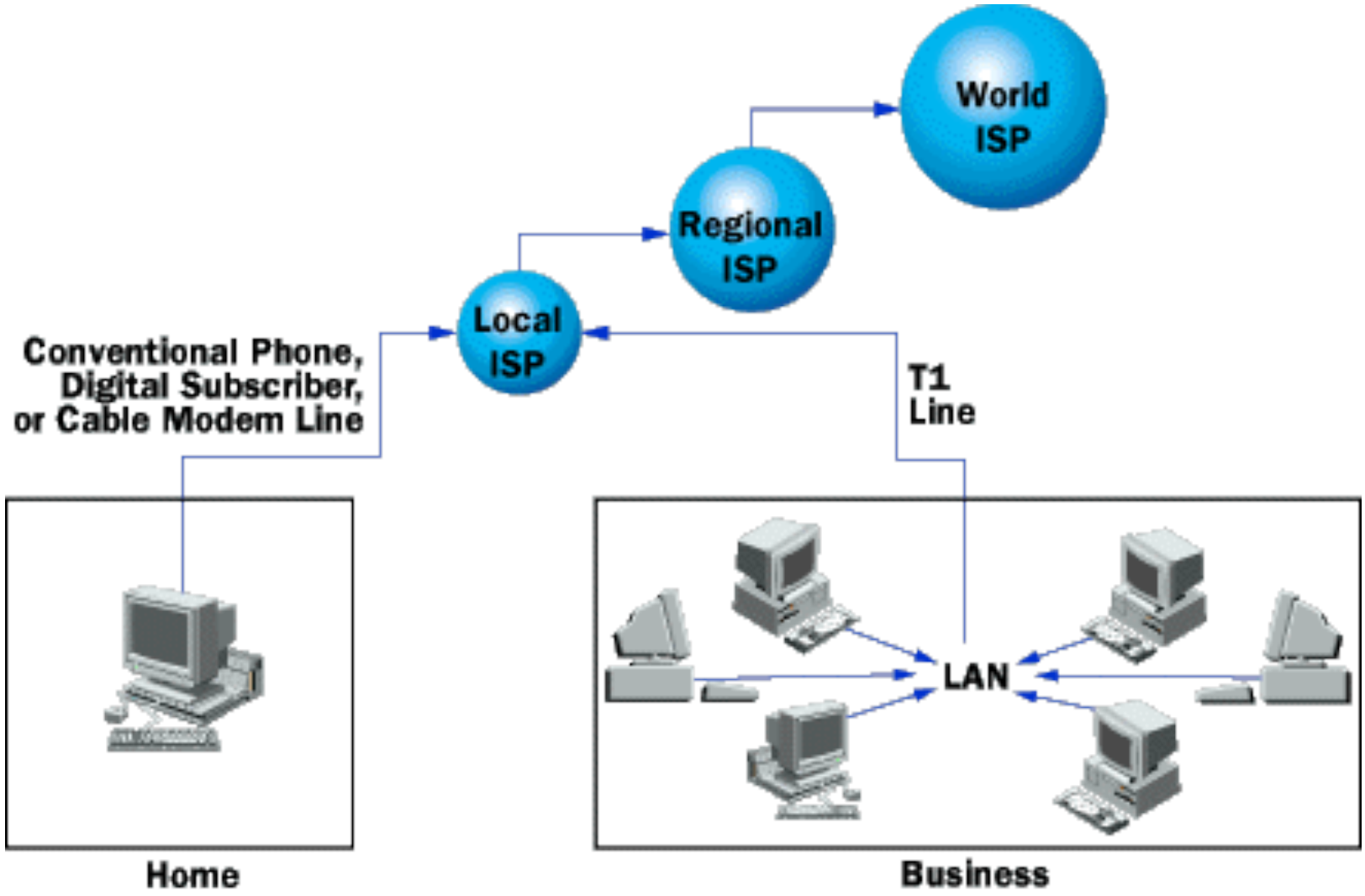
Web Browser (Web Client)

- It is a program that retrieves information from the Web.
  - Google Chrome
  - Microsoft Internet Explorer
  - Mozilla Firefox
  - Safari
  - Netscape, Mosaic
    - Many different computing platforms
  - Opera
    - The fastest browser on Earth
  - Lynx
    - Text based web client

Web Server

- It is a program that waits for requests from the web browser.
- It provides four major functions
  - Serving web pages
  - Running gateway programs (CGI) and returning output
  - Controlling access to the server
  - Monitoring and logging all access
- E.g. Apache, IIS, Netscape Web server, …

Web Connection



How does the Web work?

- The web information is stored in the Web pages.
  - In HTML format.
- The web pages are stored in the computers called Web servers.
  - In the Web server file system.
- The computer reading the pages is called web clients with specific web browser.
  - Most commonly Internet Explorer or Netscape.
- The web server waits for the request from the web clients over the Internet.
  - Internet Information Server (IIS) or Apache.

Who defines the Web Standard?

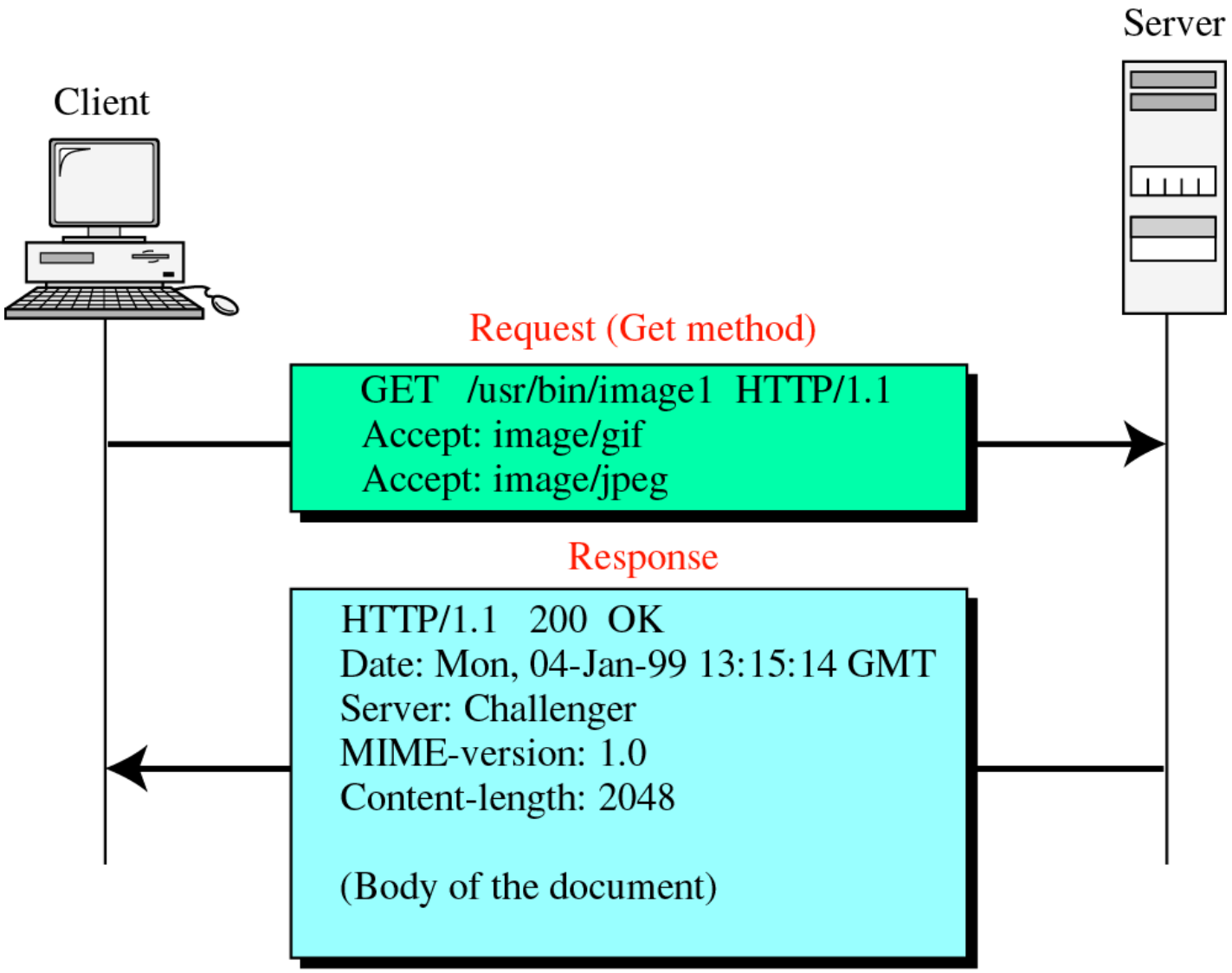
- The Web standards are not defined or setup by the browser companies or Microsoft, but the World Wide Web Consortium (**W3C**).
- The specifications form the Web standards.
  - HTML, CSS, XML, XHTML, …

- Quoted from W3C
  - W3C's long term goals for the Web are:
  1. *Universal Access*: To make the Web accessible to all by promoting technologies that take into account the vast differences in culture, languages, education, ability, material resources, and physical limitations of users on all continents;
  2. *Semantic Web* : To develop a software environment that permits each user to make the best use of the resources available on the Web;
  3. *Web of Trust* : To guide the Web's development with careful consideration for the novel legal, commercial, and social issues raised by this technology.

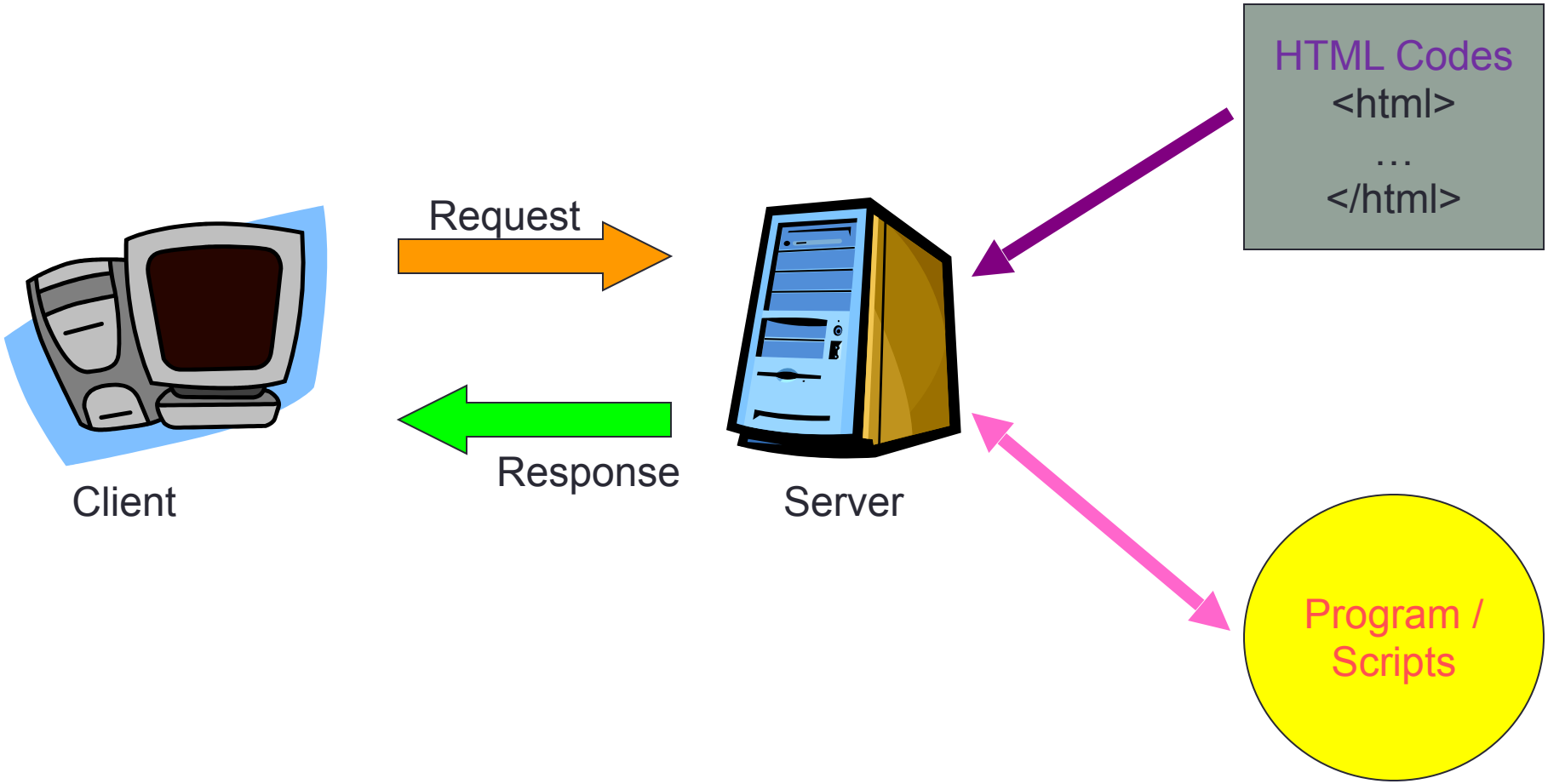
HTTP

- HTTP (Hypertext Transfer Protocol)
  - protocol used to access data on the WWW.
  - uses one TCP connection on well-known port 80.
  - two types of http messages:
    - Request, Response
  - transfer data in the form of plain text, hypertext, audio, video, and so on.

HTTP


Server
Client
Request (Get method)
GET /usr/bin/image1 HTTP/1.1
Accept: image/gif
Accept: image/jpeg
Response
HTTP/1.1 200 OK
Date: Mon, 04-Jan-99 13:15:14 GMT
Server: Challenger
MIME-version: 1.0
Content-length: 2048
(Body of the document)

The HTTP Request/Response Model



Valid HTTP Request/Response messages

- Provide additional information.

Request Message

```
GET /index.html HTTP/1.0
Host: www.anyhost.com
User-Agent : Mozilla/4.5 [en] (WinNT; I)
Accept : image/gif, image/jpeg, */*
Accept-language : en
Accept-charset : iso-8859-1, *, utf-8
```

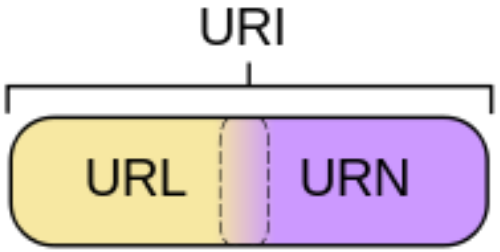
Response Message

```
HTTP/1.0 200 OK
Last-Modified: Mon, 20 Dec 1999 …
Date: Tue, 11 Jan 2002 …
Status: 200
Content-Type: text/html
Servlet-Engine: Tomcat Web Server
Content-Length: 59

<html>
…
</html>
```

Universal Naming with URLs

- A **uniform resource locator**, abbreviated **URL**, also known as **web address**, is a specific character string that constitutes a reference to a resource.



Uniform Resource Identifier (URI)

- An extensible scheme for identifying resources
  - Uniform :- common method for naming, locating things
  - Resource :- any entity (page, server, human)
  - Identifier :- character string that identifies the entity

- **URL** are the subset of **URI** that identify resources by their primary access mechanism (HTTP, ftp etc).

- **URN** are a subset of **URI** that identify resources that are globally unique and persist even when resource disappears.

URL Schemes

- ftp : // [user [:password] @] host / path
- news : newsgroup
- telnet : ipaddress
- mailto : userid @ hostname
- file: // pathname
- http: // host [: port][/ path]

URL Syntax

- scheme : path
- Reserved characters
  - % - escape character
    - % followed by @ hex digits
      - e.g.: '%' is %25, ' ' is %20
  - / .. . (slash, dot dot, dot) - hierarchical delimiters
  - # - separate URI from fragment identifier within object
  - ? - separate URI from query

URL contd.

- This is the symbol which starts the beginning of query.
- Format is:
  - www.serverhost.com/script.php?parameter1=A&parameter2=B
  - When browser requests server with this query the server parses it and passes parameters to the script, for example in PHP you will receive those parameters in $_GET array, i.e:

    $_GET['parameter1'] will contain 'A', and $_GET['parameter2'] will contain 'B'.

Partial (Relative) URIs

- Purpose
  - Allow relative reference among objects in the same hierarchy
  - Enable relocation of a set of objects in a hierarchy
- Enabled by hierarchical delimiters
  - / .. . (slash, dot dot, dot)

Web Authoring Tools

- It is easier than ever to create a website with an HTML editor, as software developers continue to add tools that let you develop advanced features with styles.
- Today's web authoring tools can provide the power to build an interactive, animated, state-of-the-art web site suitable for anything from personal web page to corporate business site.
- The commonly used three web authoring tools are :
  - NetObjects Fusion
  - Microsoft Frontpage
  - Macromedia Dreamweaver

Types of Web Authoring Tools

- Pure WYSIWYG Editor:
  - With a pure WYSIWYG editor, you work entirely in an interface that resembles a desktop publishing program. NetObjects Fusion and Drumbeat are examples of pure WYSWYG editor.
- Pure Code based Editor:
  - With pure code based editor, you work directly with raw HTML tags and set your own rules about how to lay out and organize your code. You have total control over your code. HomeSite, HotDog Professional, HTMLed Pro, WebberActive, WebEdit etc are examples of pure code based editor.
- Compound editor:
  - With a compound editor, you can accomplish most tasks in WYSIWYG editing mode but switch form word processor-style editing window to source code view to modify the pages underlying HTML. Macromedia Dreamweaver, Microsoft FrontPage, Visual Pages are examples of compound editor.

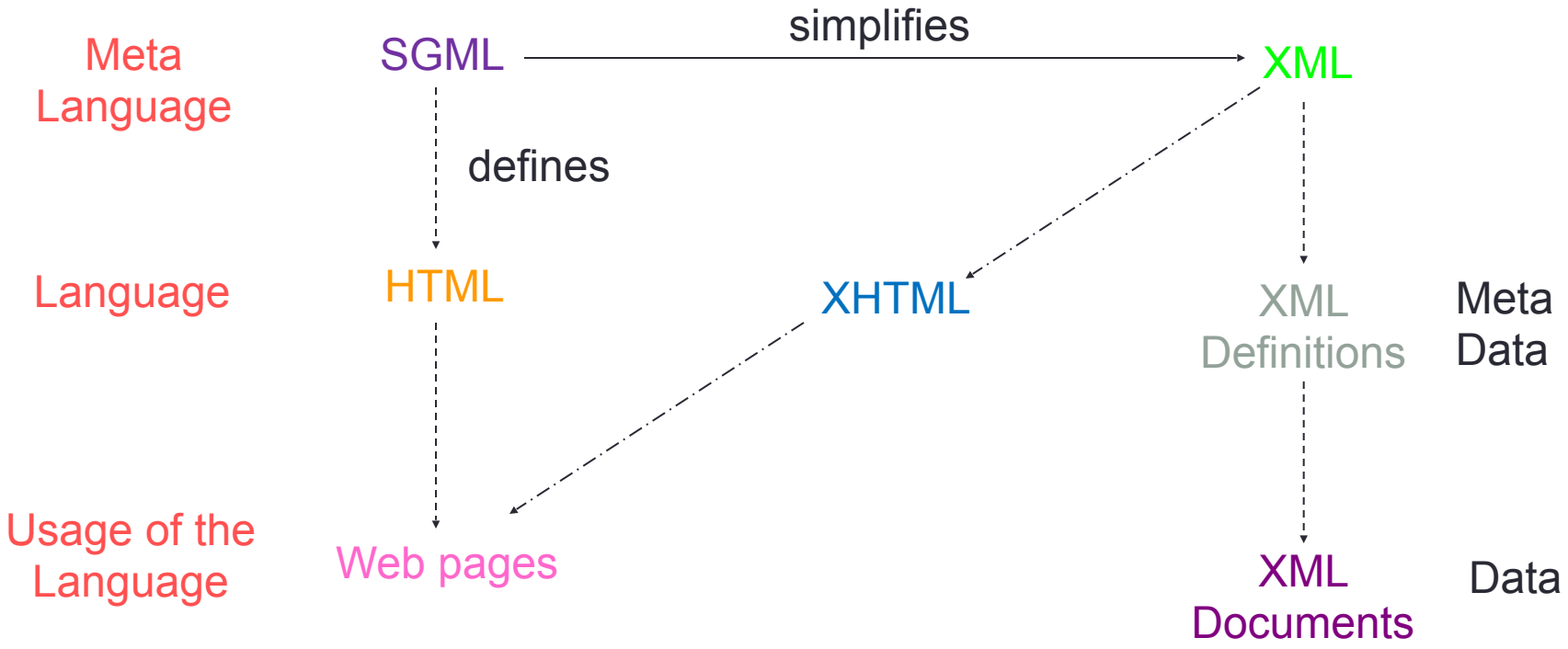
Web Programming Languages

- The Web is no longer just presenting information on a computer screen.
  - Many commercial sites include some methods of getting information from a browser to web servers.
    - How do you program your web site such that it can interact with people?
  - With XML, data from spreadsheets, reports or other applications can be easily displayed on the Web.
    - Can we learn XML without the understanding of HTML and other Web language?

The History of Markup

- In the early 1970s
  - GML (the Generalized Markup Language)
  - “:h1.The Content is placed here”
- Since the 1980s
  - SGML (the Standard GML)
  - HTML
- Currently
  - XML
    - Not intended to replace HTML!
    - XHTML does by providing better data description, …

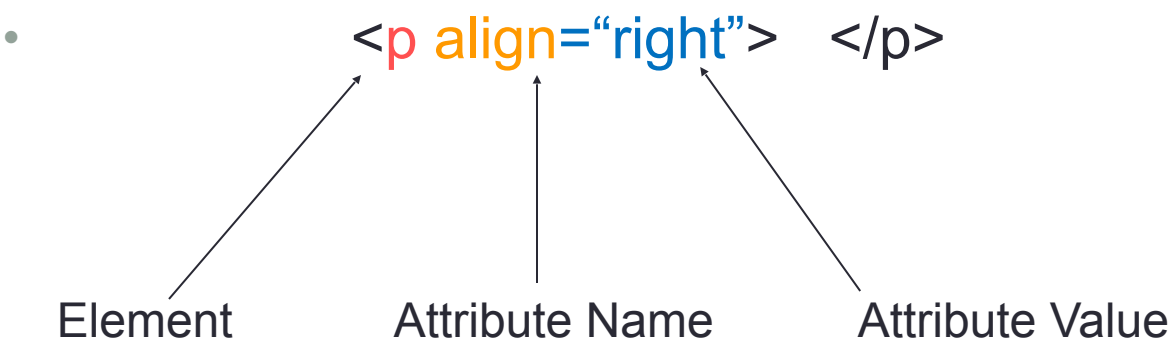
SGML, HTML and XML



HTML

- HyperText Markup Language
- It is not a programming language.
  - Cannot be used to describe computations.
  - Use to describe the general form and layout of documents to be displayed by the browser.
- Compose of “Content” and “Controls”

HTML Element / Tag



- **You have to understand the important terms related to HTML.**
- **Not case-sensitive.**

HTML

- HTML 1.0 was created in 1984 by CERN and is now controlled by the WWW Consortium (W3C), which sets its standards.
- www is only one of the protocols on the web and HTML is only one of many languages used to deliver information over the internet.
- Primarily use is to create web pages. It provides an international computer coding language that facilitates universal access independent of platform, network or terminal.
- Originally provided access to text-based environment and facilitated the exchange of research information.
- HTML is a markup language. This means it tells the browser how to treat the document that it is displaying. It shows where the headings and spaces are to be inserted for example.
- Another important function of HTML is to provide a reference system for linking documents or parts of documents.
- HTML enables this file or its URL to be linked to a key word or phrase in the text. Click on the word and the file is displayed.

HTML

- **HTML Features:**
  - Non-Linearity - it is the function of the architecture of web pages to make sense to visitors.
  - Supports XHTML - that enables you to use the features of XML while creating web pages.
  - Supports multiple languages - web pages can be created in multiple languages. Called internationalization. It provides language identifiers that describe the language in which the text on a web page is to be displayed.
  - Supports embedded controls, such as ActivX controls and plug-ins, are the interactive controls that are inserted in a web page from a file that exists at another location on the web.
  - Supports scripting - enables you to create dynamic web pages that allow user interactivity and personalized interface to a web site.
  - Supports enhanced printing options - for example you can print all web pages that are linked to a specific web page.

DHTML

- DHTML is a combination of HTML, the Document Object Model (DOM), style sheets and scripting languages.
- DHTML allows you to create web pages that are more animated and responsive to user interaction than HTML.
- There are three main parts of DHTML
  - Positioning
  - Style modifications
  - Event handing
- It relies on the browser for the display and manipulation of the web pages
- Many users still use old browsers. Therefore, you have to create 2 versions of each site and serve them to the different browser versions.
- DHTML uses the structure of HTML to create interactive features. Each HTML page element is seen as an object. This is known as the DOM. It provides a standard interface to make objects do what the developers want them to do. The DOM enables any HTML tag to be seen as an object.

DHTML

- A web page is composed of single objects that are elements with their own properties. This characteristic allows you to add script specific to the actions of that element.
- Web page style sheets describe the default style characteristics of a page as well as the default background color or image, hypertext link colors and content.
- Style sheets are used to ensure consistency across the pages of a web site. DHTML allows you to specify cascading style sheets.
- Dynamic fonts are also a characteristic of DHTML. They allow web page designers to include font files, containing specific styles, sizes and colors with the page. Therefore the font choice is not depended on what the browser provides.

DOM

- The document object model is an application-programming interface (API) that was developed by the W3C.
- It is a set of logical rules. It defines the logical structure of a document and the way it can be accessed and manipulated.
- Objects, properties and methods enable you to manipulate the content, structure and style of a web page and display the changes even as they are being displayed in a browser.
- Objects have properties and methods. A property is an essential characteristic for example fgcolor.
- A method is a programmed procedure for example: the contents of a frame can be printed by using the objects print method.
- The DOM is platform independent and language neutral.

DOM

- The document object model (DOM) is the proposed specification for how objects on a Web page are represented. Of course, Microsoft and Netscape each have their own versions of the DOM and have submitted them to the World Wide Web Consortium (W3C) to decide on a standard.
- A DOM defines each object on a Web page (images, text, scripts, links, etc.) and also defines what attributes are associated with these objects and how they can be manipulated.
- The fact that Netscape Navigator and Microsoft Internet Explorer use different DOMs is one reason why each browser's implementation of DHTML is different.

XHTML

- XHTML is a standard proposed by the W3C that adapts HTML into an extensible concept by using XML (extensible markup language).
- XML defines data that can be shared on the web. It is extensible because anyone can invent a set of purposes such as describing the appearance of a web page.
- To enhance web pages, HTML was redesigned by using XML to form XHTML.
- XHTML is portable to enable small devices to support embedded programming.
- XHTML brings different programming practices. It has strict code rules such as symmetrical form, use lowercase, enclose elements with quotes and end tag with a forward slash at the end of the element and before the closing angle bracket.

WML

- WML is loosely based on HDML (handheld device markup language). It allows you to present text portions of a web page on cell phones and PDAs (personal digital assistants) by wireless access.
- WML is an open source language that is the part of the WAP (wireless application protocol).
- It is also an XML that offers similar functionality to HTML4.0 but is used for small screen devices.
- **WML Features:**
  - Small display
  - Limited input capacity
  - Narrowband network connection
  - Limited memory
  - Limited CPU power
  - It provides WML users with games, email services and instant messaging.

WML

- WML supports the Meta element that supports names, schemes and content attributes. WML does not support the link element because there is no mechanism for linking to external metadata.
- WML files have strict parameters in order to maintain small file sizes.
- WML uses WAP, which has limited memory. It supports scripting and event handling for navigation or script invocation. These elements enable users to interact with the page and also to enable automated page jumps.
- WML syntax is used to manage text and graphics. It controls data input, hyperlinks and navigation.
- Decks are logical root element that contains the cards entities. Cards represent parts of tasks while decks represent the complete task. Decks minimize network time and reduce download because you download a deck at a time and you do not need network connection to navigate between the cards.
- WML is strictly defined language and it is domain specific.
- WML elements must be written in lowercase, attributes must be quoted and elements must have closing tags. Maximum size of a deck is 1492 bytes.

XML

- eXtensible Markup Language (XML)
- It provides a standard way to represent information so as to allow information to be stored and interchanged among any Internet-connected devices.
  - It is not a markup language.
  - It is a meta-markup language that specifies rules for creating markup languages.
  - Browsers use XML parsers to isolate and extract the information from XML documents.

XML

- XML is a flexible way to create common formats for data that client- and server-side developers use to enable them to control data. It enables developers to share the format and the data through intranets and on the web.
- XML is a W3C recommendation. It describes the content of a web page by what the data means.
- XML enables developers to use diverse data types.
- Converting data to XML can reduce the complexity of exchanging data and create data that can be read by different types of applications.
- It provides easy-to-parse syntax to represent data by isolating the content component from the descriptive rendering instructions. This capability separates content and presentation. XML tags are not predefined.
- XML allows you to define your own tags and your own document structure, to suit your needs.

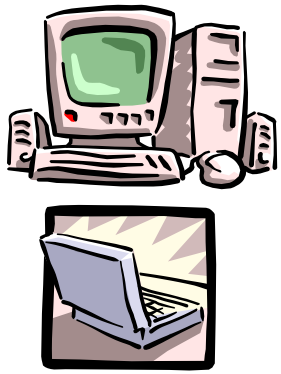
XML

- **XML Features:**
  - Written in plain text and is readable. You can edit or view an XML document with a simple text editor.
  - Cross-platform software and hardware independent tool that is used for transmitting information.
  - Used primarily for Web pages. XML allows the author to extend and customize basic HTML formatting by creating proprietary tags and text behaviors.
  - XML is meant to emphasize intelligent and logical formatting within technical documents in order to streamline searching and categorizing, and to ensure total cross-browser compatibility.

Examples of XML-based languages

Acronym	Name	Description
CDF	Channel Definition Format	One of the first real-world applications of XML, permits automatic delivery of updated web information (Microsoft)
CML	Chemical Markup Language	Conversion of current files into structured documents (chemical publications)
ETD-ML	Electronic Thesis & Dissertation ML	Converts theses from MS-Word into XML
FlowML		A format for storing audio synthesis diagrams for synthesizers
ITML	Information Technology ML	A set of specifications for protocols, message formats
MathML	Mathematical ML	Describes mathematical notations
VXML	Voice XML	Allows interaction with the Internet thru voice-recognition technology
XHTML	Extensible HTML	HTML 4.0.1 is written as an XML application
XSL	Extensible Stylesheet Language	The style standard for XML, specifies the presentation and appearance of an XML document
XSLT	XSL Transformation Language	Uses to transform XML documents into another XML files

XML Transformation
Same XML Document



HTML

WML

StyleSheet 1 (XSL)

XSL Transformation

StyleSheet 2 (XSL)

XML Document

MathML Example

- $E = mc^2$

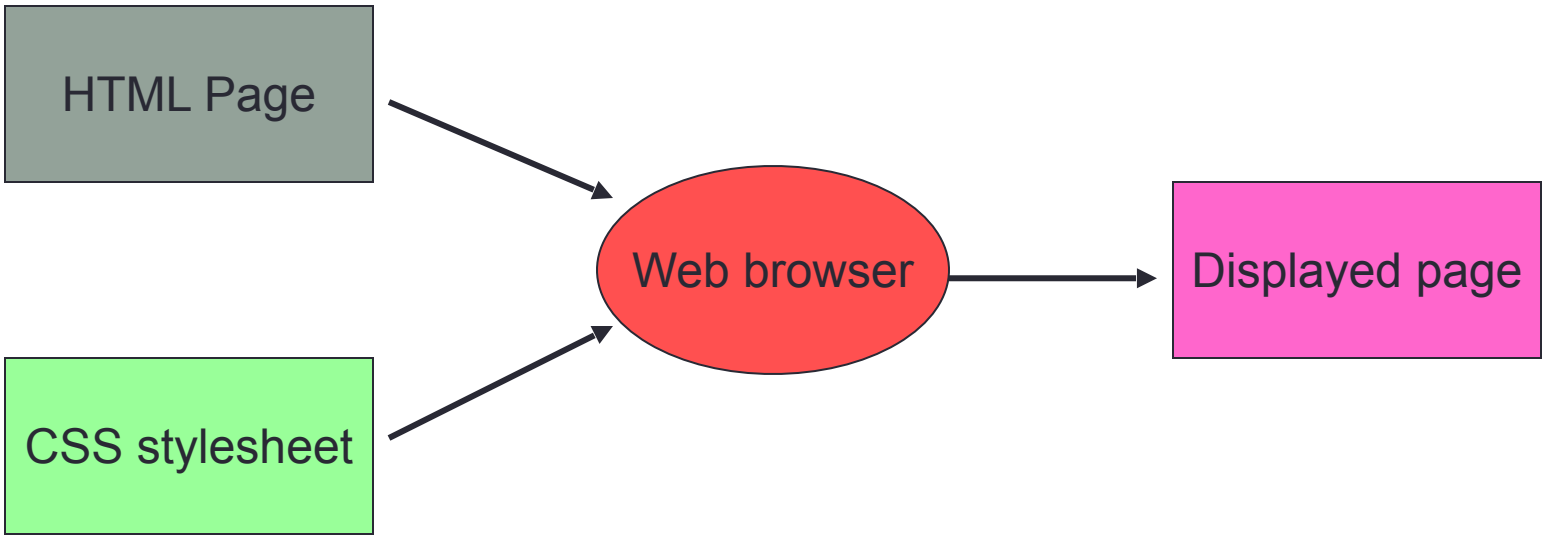
MathML Presentation Markup Example

```
<mrow>
        <mi>E</mi><mo>=</mo><mi>m</mi>
  <msup>
        <mi>c</mi>
        <mn>2</mn>
  </msup>
</mrow>
```

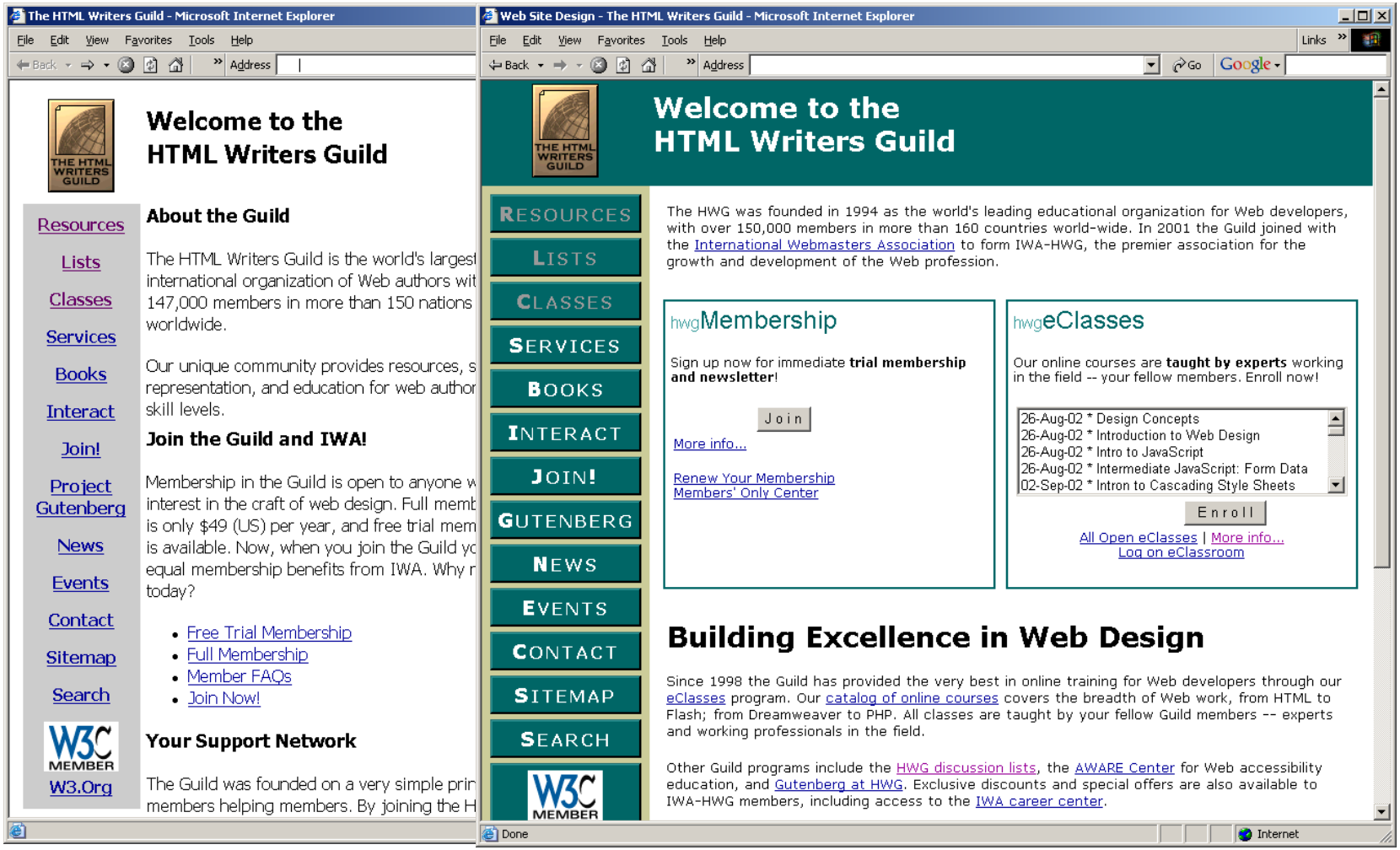
Cascading Style Sheets (CSS)

- Provides a powerful and flexible way to control the details of web documents.
- HTML is more concerned about the content, CSS is used to impose a particular style on the document.
- Named cascading style sheets because they can be defined at three different levels to specify the style of a document.
  - Inline, document level, external.

Using Stylesheets to add presentation



CSS Example


The HTML Writers Guild - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address
THE HTML WRITERS GUILD
Welcome to the HTML Writers Guild
Resources
Lists
Classes
Services
Books
Interact
Join!
Project Gutenberg
News
Events
Contact
Sitemap
Search
W3C MEMBER
W3.Org
About the Guild
The HTML Writers Guild is the world's largest international organization of Web authors wit 147,000 members in more than 150 nations worldwide.
Our unique community provides resources, s representation, and education for web author skill levels.
Join the Guild and IWA!
Membership in the Guild is open to anyone w interest in the craft of web design. Full memb is only $49 (US) per year, and free trial mem is available. Now, when you join the Guild yc equal membership benefits from IWA. Why r today?
Free Trial Membership
Full Membership
Member FAQs
Join Now!
Your Support Network
The Guild was founded on a very simple prin members helping members. By joining the H
Web Site Design - The HTML Writers Guild - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links
Address
Go
Google
THE HTML WRITERS GUILD
Welcome to the HTML Writers Guild
RESOURCES
LISTS
CLASSES
SERVICES
BOOKS
INTERACT
JOIN!
GUTENBERG
NEWS
EVENTS
CONTACT
SITEMAP
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W3C MEMBER
The HWG was founded in 1994 as the world's leading educational organization for Web developers, with over 150,000 members in more than 160 countries world-wide. In 2001 the Guild joined with the International Webmasters Association to form IWA-HWG, the premier association for the growth and development of the Web profession.
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More info...
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26-Aug-02 * Intro to JavaScript
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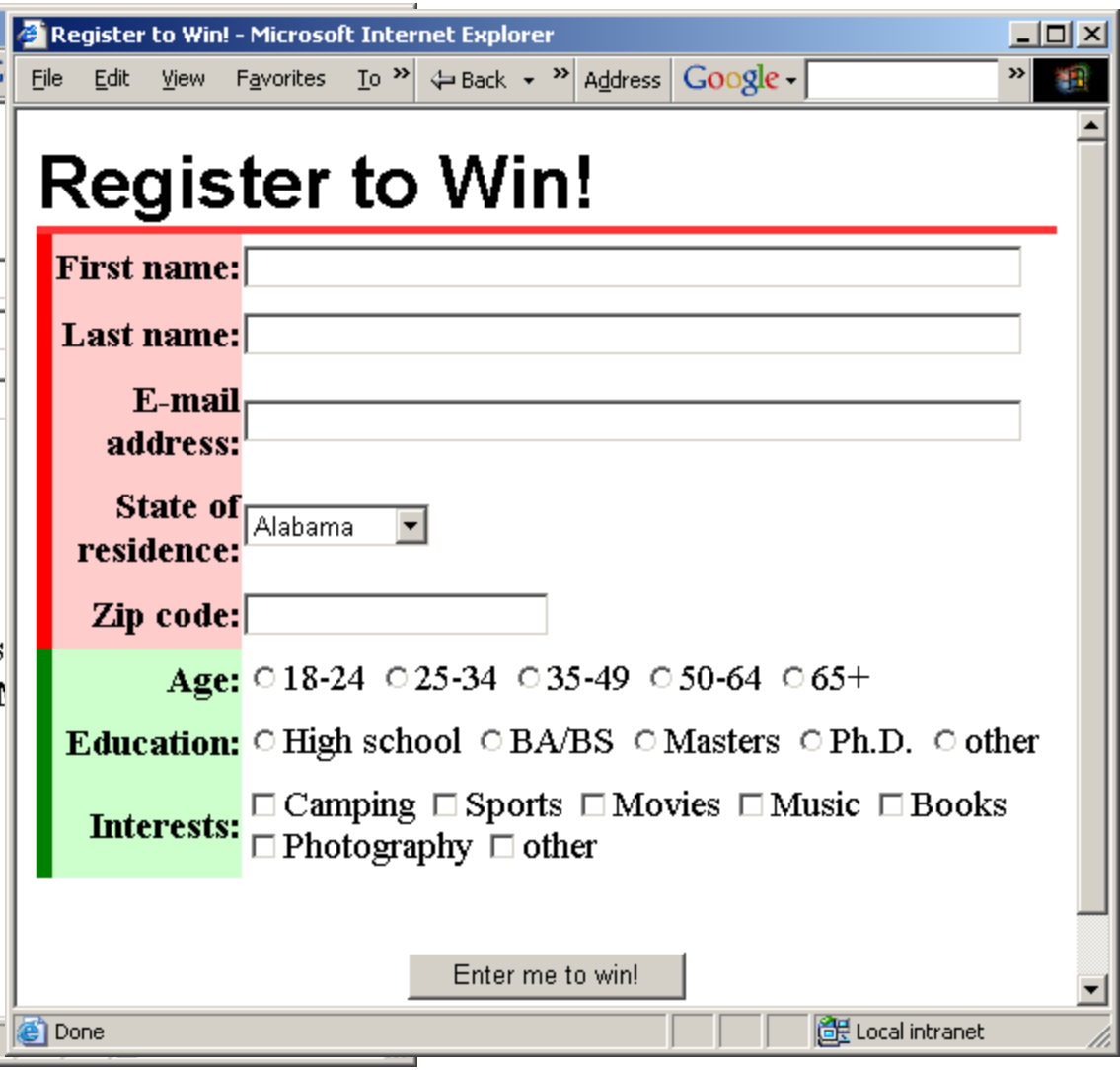
Building Excellence in Web Design
Since 1998 the Guild has provided the very best in online training for Web developers through our eClasses program. Our catalog of online courses covers the breadth of Web work, from HTML to Flash; from Dreamweaver to PHP. All classes are taught by your fellow Guild members -- experts and working professionals in the field.
Other Guild programs include the HWG discussion lists, the AWARE Center for Web accessibility education, and Gutenberg at HWG. Exclusive discounts and special offers are also available to IWA-HWG members, including access to the IWA career center.
Done
Internet

CSS Example: Skin an Input Form?



Client-Side and Server-side Programming

- Client-side code
  - ECMAScript
    - JavaScript, JScript – Microsoft
  - VBScript – Microsoft
  - Embedded in <script> elements and execute in the browser, provides immediate feedback to the user.
  - Reduces the load on a server, reduces network traffic.
- Server-side code
  - Execute on the server
  - CGI/Perl, ASP, PHP, ColdFusion, JSP
  - The code remains hidden from users, and browser independent.
- Can be combined with good results.

Client-side & Server-side Technologies

Client-Side	Server-Side
HTML, XML Cascading Style Sheets (CSS) Scripting languages - JavaScript, VBScript Java Applets ActiveX controls Plug-ins and Helpers application	CGI/Perl PHP ColdFusion Scripting Languages - Server-side JavaScript - ASP, JSP, Java Servlets ISAPI/NSAPI programs

JavaScript

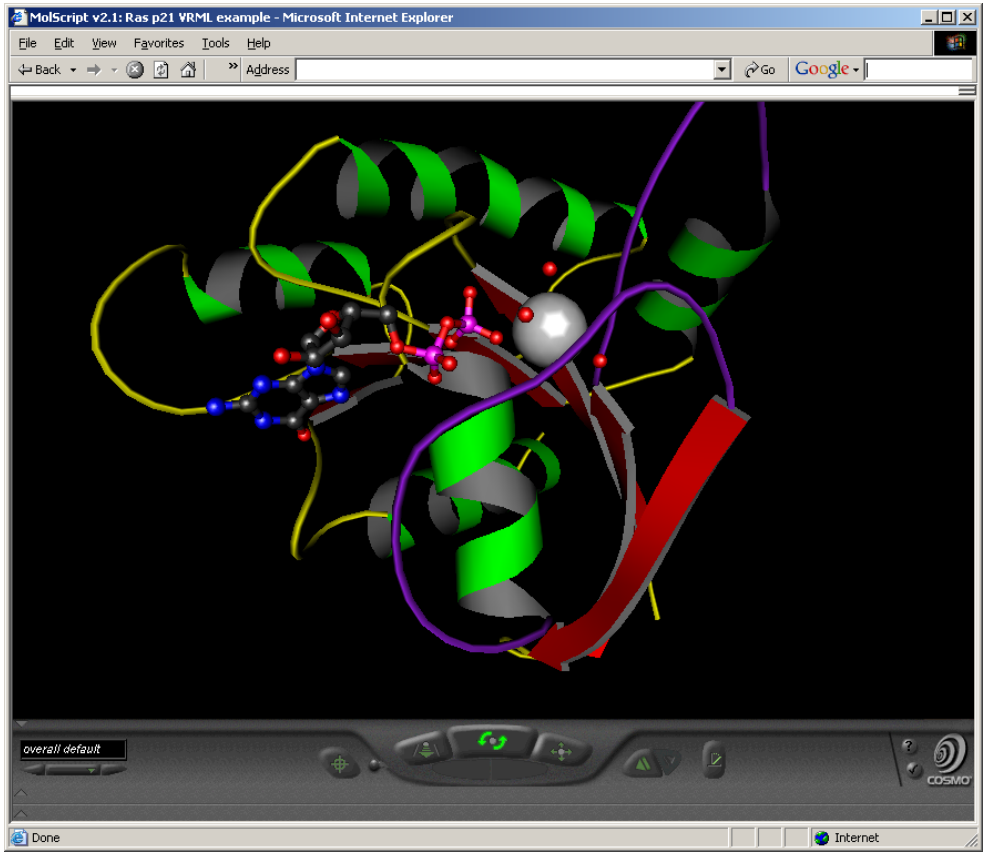
- JavaScript is the scripting language of the Web.
- JavaScript is used in millions of Web pages to add functionality, validate forms, detect browsers, and much more.
- JavaScript is the most popular scripting language on the internet, and works in all major browsers, such as Internet Explorer, Firefox, Chrome, Opera, and Safari.
- It provides a computational capability in web documents.
- It is used in creating, accessing, modifying a document.
- JavaScript was designed to add interactivity to HTML pages.
- JavaScript is usually embedded directly into HTML pages.
- JavaScript is an interpreted language (means that scripts execute without preliminary compilation).
- Everyone can use JavaScript without purchasing a license.
- There is no relationship between Java and JavaScript!

What can JavaScript do?

- Control document appearance and content
- Control the browser
- Interact with the user
- Read and Write Client State with Cookies
  - my.yahoo.com
- Interact with Applets
- What it cannot do?
  - Read/write files

VRML

- Virtual Reality Modeling Language (VRML) is a language for the animation and 3D modeling on the Internet.
- The user can connect the online VRML website and move around the “3D world”.



- Reference:
  - MolScript

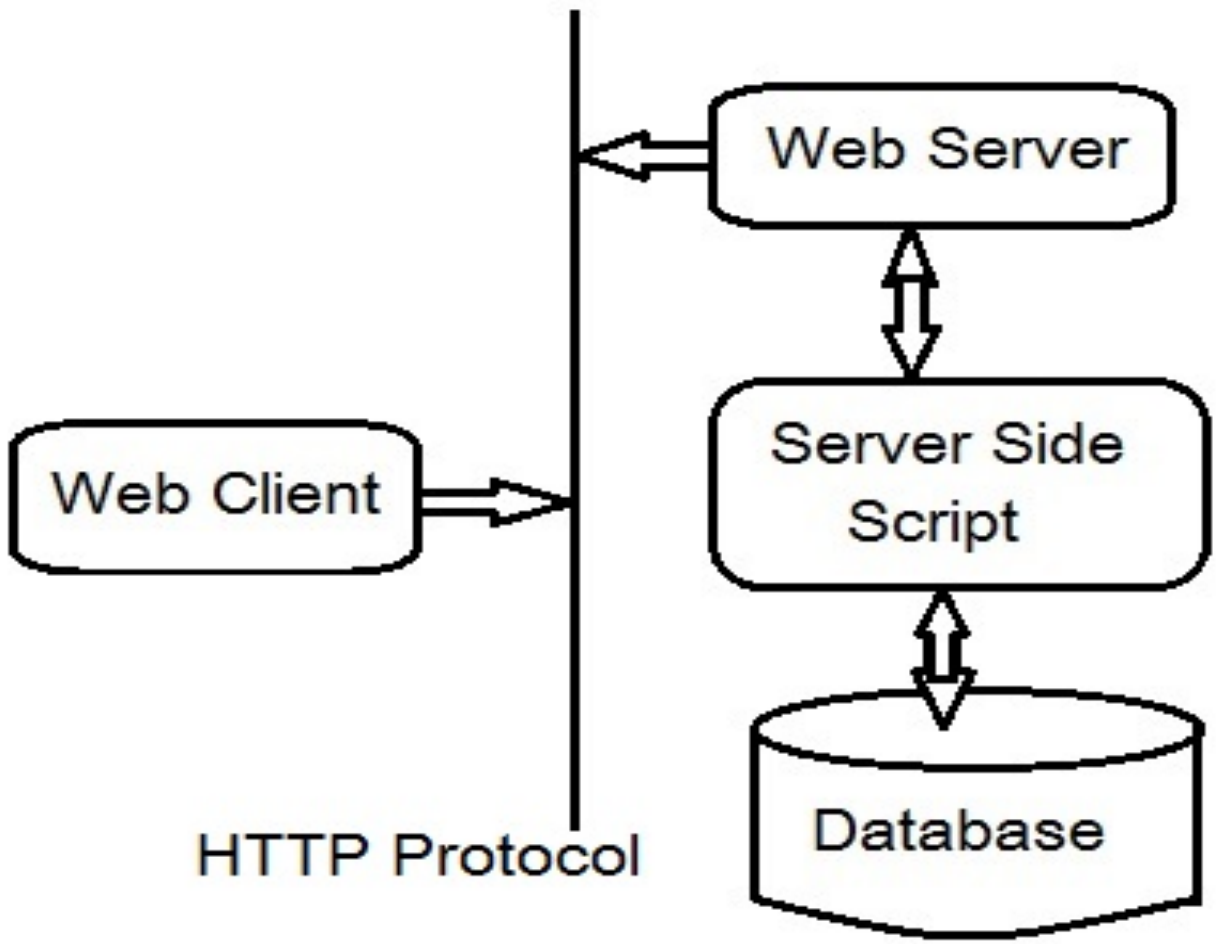
CGI / Perl

- **Common Gateway Interface** (**CGI**) is a standard method for web server software to delegate the generation of web content to executable files.
- CGI is a standard for external gateway programs to interface with information servers such as HTTP servers.
- Common Gateway Interface (CGI) is a standard way in which a browser communicate to run a program on the server and return the output to the browser.
  - It can be written in any programming language (most common is Perl).
  - It is a powerful string pattern-matching language.

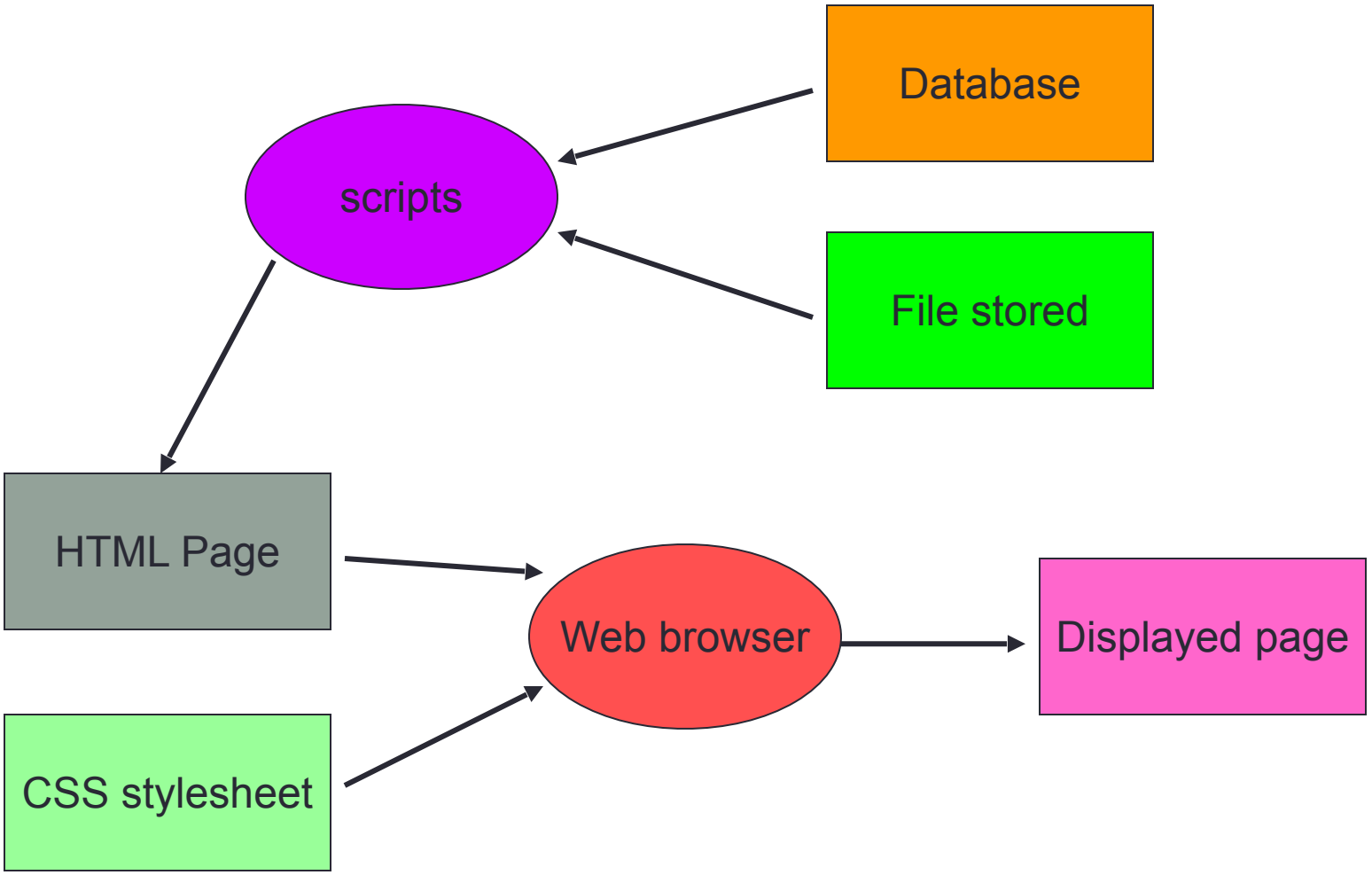
CGI / Perl

- To understand the concept of CGI, lets see what happens when we click a hyperlink to browse a particular webpage or url:
  - Your browser contacts the HTTP web server and demand for the URL i.e. filename.
  - Web server will parse the URL and will look for the filename and if it finds that file then sends back to the browser, otherwise sends an error message indicating that you have requested a wrong file.
  - Web browser takes response from web server and displays either the received file or error message.
- However, it is possible to set up the HTTP server so that whenever a file in a certain directory is requested that file is not sent back; instead it is executed as a program and the output is sent back for your browser to display. This function is called the Common Gateway Interface (CGI) and the programs are called CGI scripts. These CGI programs can be a Perl Script, Shell Script, C or C++ program etc.

CGI Architecture



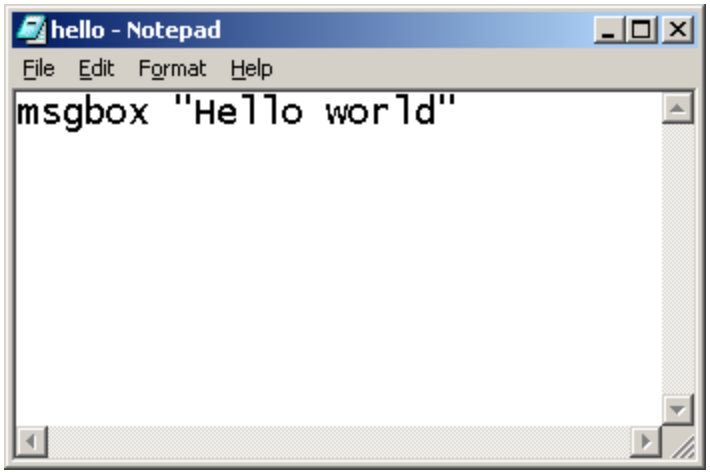
Using Scripts



VBScript

- VBScript is the short form for Visual Basic Scripting from Microsoft.
- VBScript is a Microsoft scripting language.
- VBScript is the default scripting language in ASP.

- Try to edit a file “hello.vbs”
  - Msgbox “Hello world”



ASP

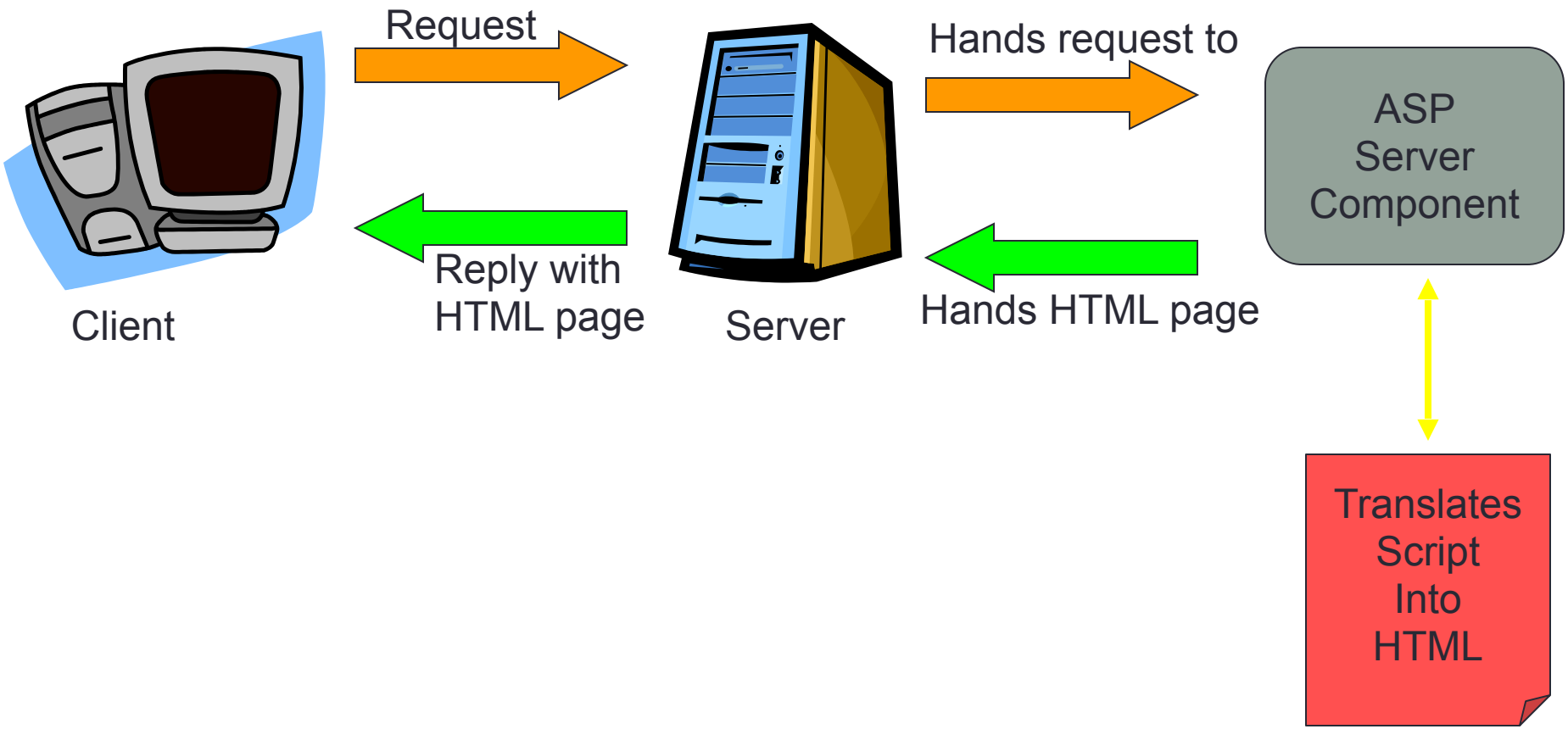
- Active Server Page was developed by Microsoft and it is a popular technology for developing dynamic web sites.
  - It allows the author includes scripting code (VBScript or JScript) in regular web pages.
  - In complex code, COM (ActiveX) components are used.
  - Must run on an active server pages server
    - IIS, MSSQLServer, Personal Web Server, …
  - The latest version is ASP.NET

- An ASP file is just the same as an HTML file
- An ASP file can contain text, HTML, XML, and scripts
- Scripts in an ASP file are executed on the server
- An ASP file has the file extension ".asp"

ASP

- **How Does ASP Differ from HTML?**
- When a browser requests an HTML file, the server returns the file
- When a browser requests an ASP file, IIS passes the request to the ASP engine. The ASP engine reads the ASP file, line by line, and executes the scripts in the file. Finally, the ASP file is returned to the browser as plain HTML
- **What can ASP do for you?**
- Dynamically edit, change, or add any content of a Web page
- Respond to user queries or data submitted from HTML forms
- Access any data or databases and return the results to a browser
- Customize a Web page to make it more useful for individual users
- The advantages of using ASP instead of CGI and Perl, are those of simplicity and speed
- Provide security - since ASP code cannot be viewed from the browser
- Clever ASP programming can minimize the network traffic

How to load an ASP page?



PHP

- PHP stands for: **H**ypertext **P**reprocessor
- PHP is a powerful tool for making dynamic and interactive Web pages.
- PHP is the widely-used, free, and efficient alternative to competitors such as Microsoft's ASP.
- PHP is a server-side scripting language like ASP. A PHP page is always interpreted by the server when it is requested.
- PHP supports many databases (MySQL, Informix, Oracle, Sybase, Solid, PostgreSQL, Generic ODBC, etc.).
- PHP is an open source software.
- PHP files can contain text, HTML tags and scripts and have a file extension of ".php", ".php3", or ".phtml“.
- PHP files are returned to the browser as plain HTML.

PHP

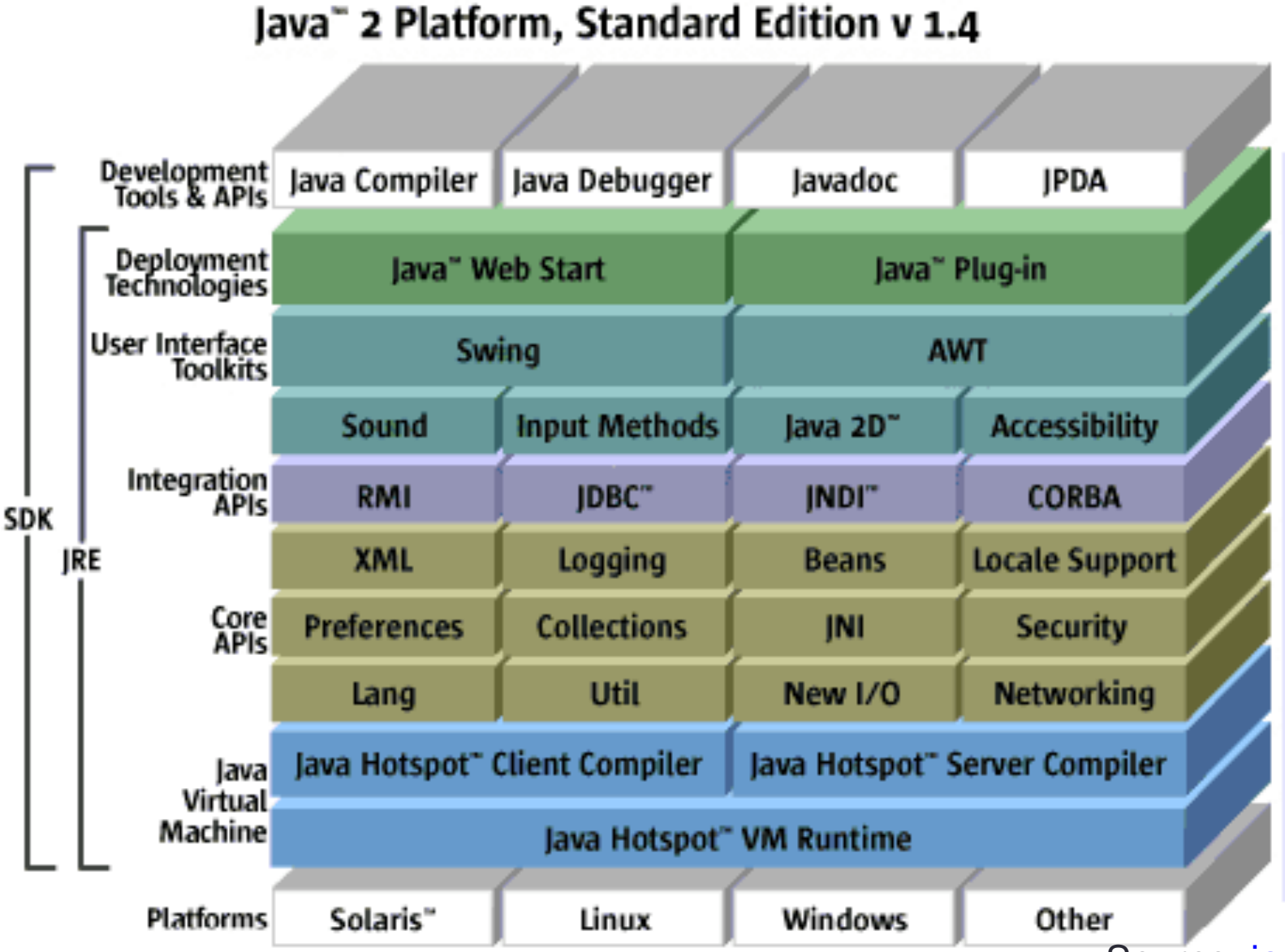
- PHP combined with MySQL are cross-platform (you can develop in Windows and serve on a Unix platform)
- **Why PHP?**
  - PHP runs on different platforms (Windows, Linux, Unix, etc.)
  - PHP is compatible with almost all servers used today (Apache, IIS, etc.)
  - PHP is FREE to download from the official PHP resource: www.php.net
  - PHP is easy to learn and runs efficiently on the server side

- To get access to a web server with PHP support, you can:
  - Install Apache (or IIS) on your own server, install PHP, and MySQL
  - Or find a web hosting plan with PHP and MySQL support

JAVA / Java applet

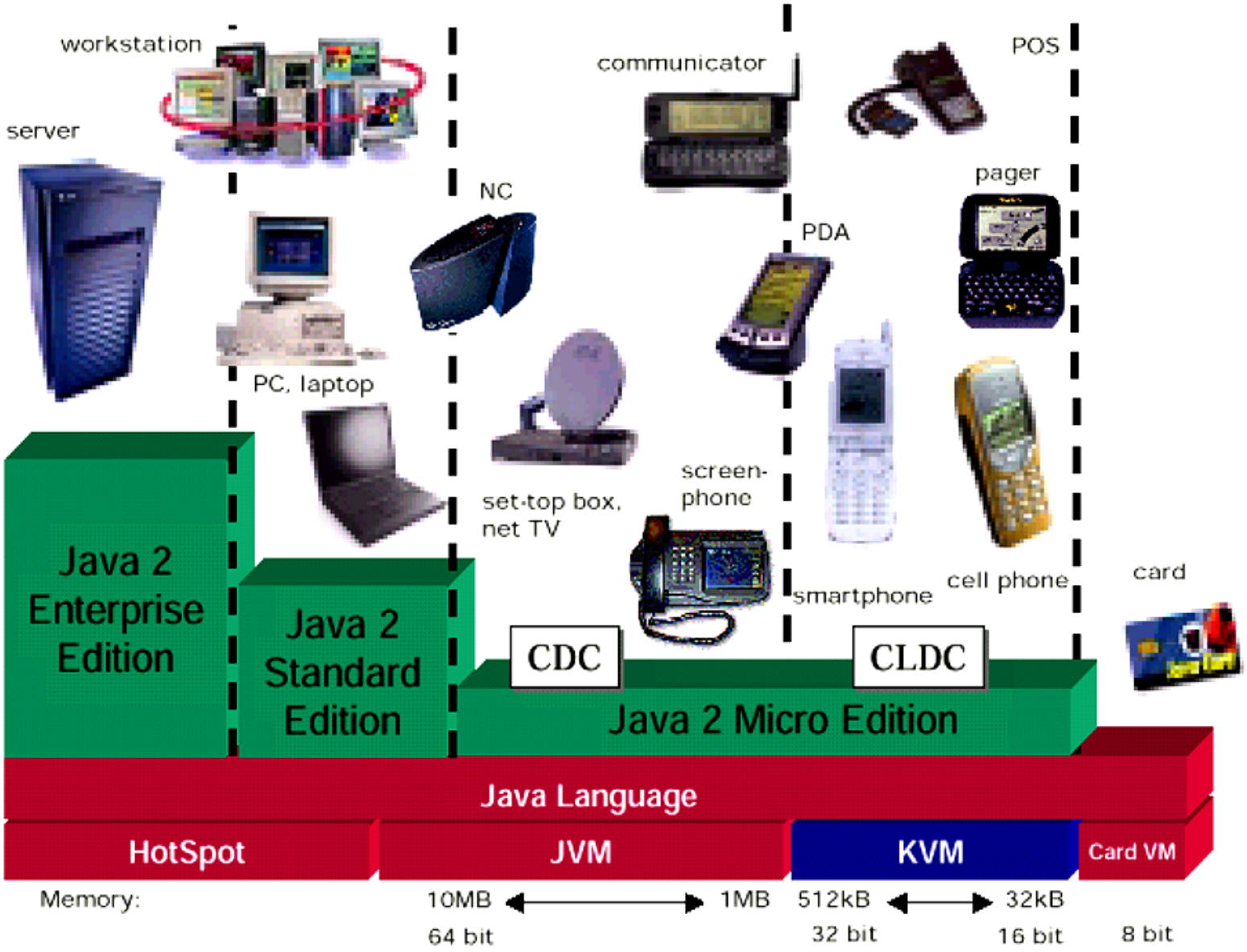
- It is used to solve the problem that HTML is not a programming language.
  - Instead of running a program on the web server, a special kind of Java program (applet) is downloaded to the browser.
  - JavaScript is less powerful than Java.
  - JavaScript code is physically part of an HTML document, but applets are stored separately from the HTML files.

Java 2, Standard Edition



Source: java.sun.com

Java 2 Platforms



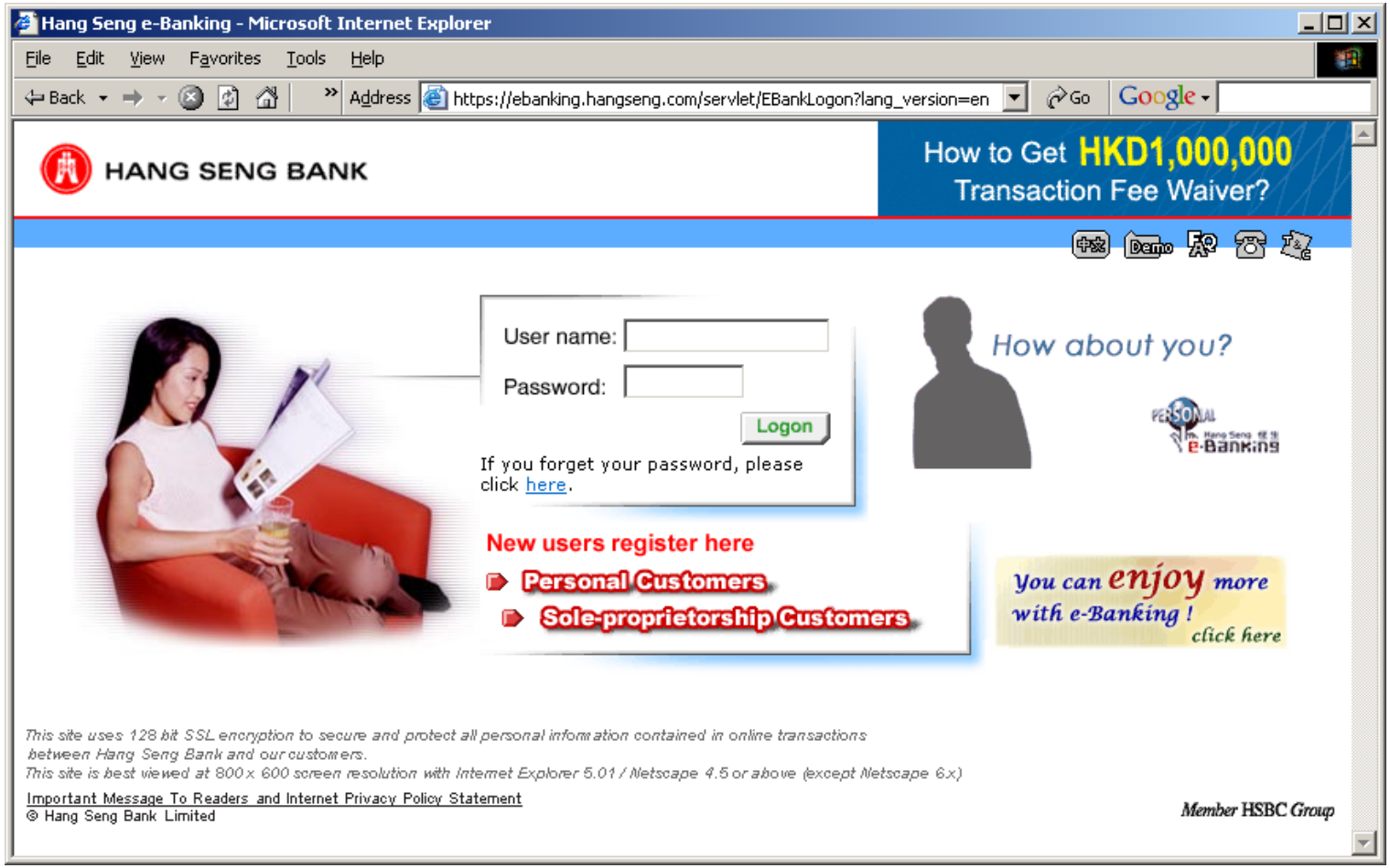
What are Java Servlets?

- They are Java application programs that are resident on the server and are alternatives to CGI programs.
- Java Servlets allow you to build
  - Web page based on the user's input data
  - Web page that changes frequently
- More efficient, easier to use, more powerful and portable.

Servlets Advantages

- Platform and vendor independence
  - Supported by all the major web servers
- Integration
  - Take advantages of all the Java technologies, JDBC, Enterprise JavaBeans (EJB).
- Efficiency
  - A single process that runs until the servlet-based application is shut down.
- Scalability – extremely scalable.
- Robustness and security
  - A strongly typed programming language.

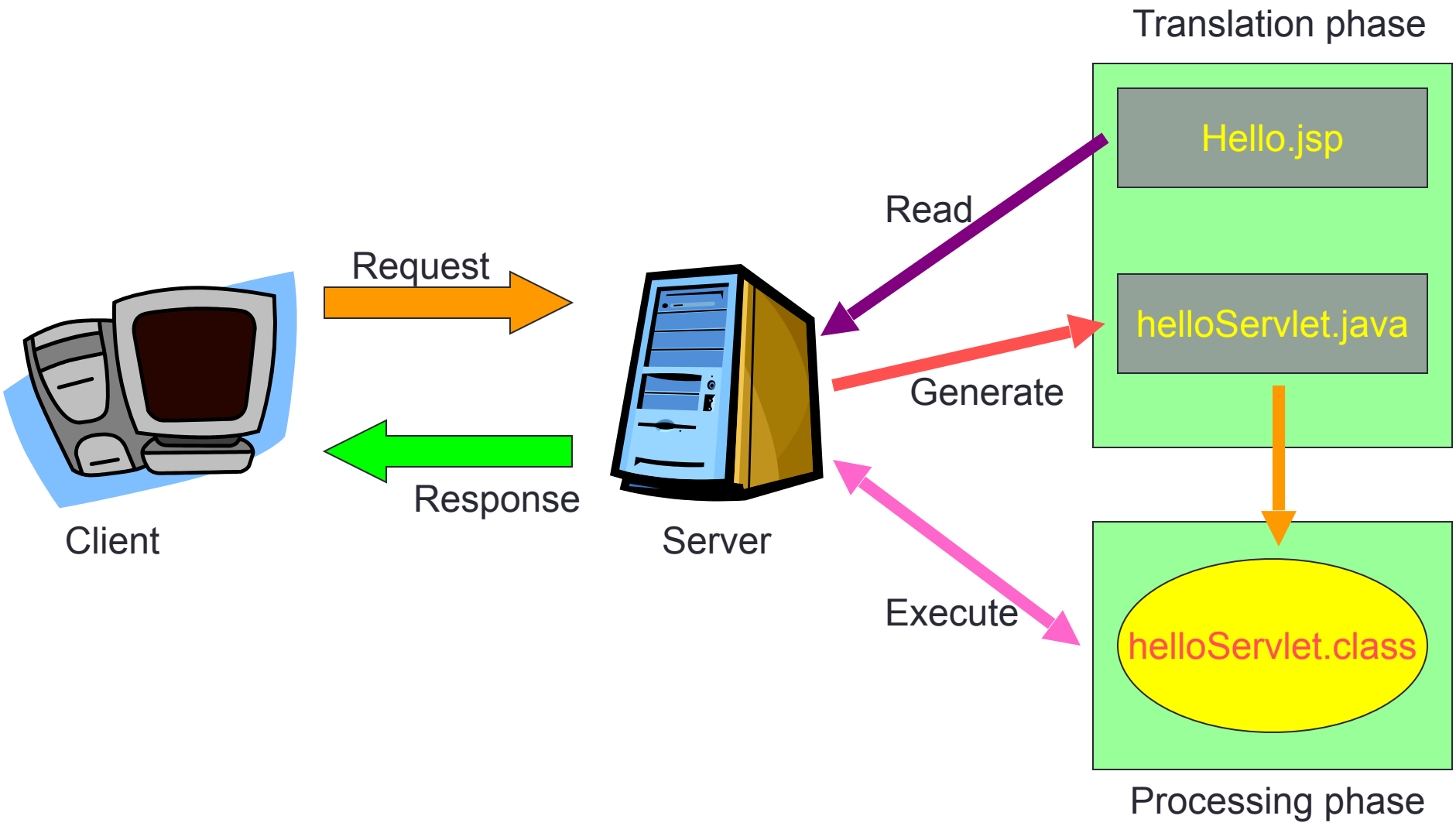
Servlet Example



What is JSP?

- It is JavaServer Pages that built on top of Java servlets in late 1999.
- In the early days of the Web, the only tool for developing dynamic web content was CGI. For every request, the web server creates a process (not efficient).
- The Java Servlet API has introduced in 1997, however, HTML code has to be embedded inside programs.
- JSP provides a development model for the web authors to experience all the server-side technologies.

JSP page translation and processing phases



A simple example Java Servlet & JSP

```
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></HEA
    out.println("<BODY>");
    out.println("<BIG>Hello World</BIG>");
    out.println("</BODY></HTML>");
  }
}
```

```
<HTML>
<HEAD>
<TITLE>Hello</TITLE>
</HEAD>

<BODY>
<H1>
<%
if (request.getParameter("name") == null)
{
  out.println("Hello World");
} else {
  out.println("Hello, " + request.getParameter("name"));
}
%>
</H1>
</BODY>
</HTML>
```

Template Pages

Server Page Template

```
<html>
<title>
A simple example
</title>

<body color="#FFFFFF">
The time now is
<%= new java.util.Date() %>
</body>
```

Resulting HTML

```
<html>
<title>
A simple example
</title>

<body color="#FFFFFF">
The time now is
Tue Nov 5 16:15:11 PST 2002
</body>
```

What you need to get started?

- A Personal Computer with an Internet connection, that allows you to download the software you need.
- A Java 2-compatible Java Software Development Kit (Java 2 SDK)
- A JSP 1.1-enabled web server, such as Apache Tomcat

JSP vs. ASP

	ASP Technology	JSP Technology
Web Server	IIS or Personal Web Server	Any Web Server
Platforms	Microsoft Windows	Most popular platforms
Reusable components	No	JavaBeans, JSP tags
Security against System crashes	No	Yes
Scripting Language	VBScript, Jscript	Java

- JSP is platform and server independent.
- ASP relies on Microsoft Platforms and Servers.

ASP & JSP

Microsoft

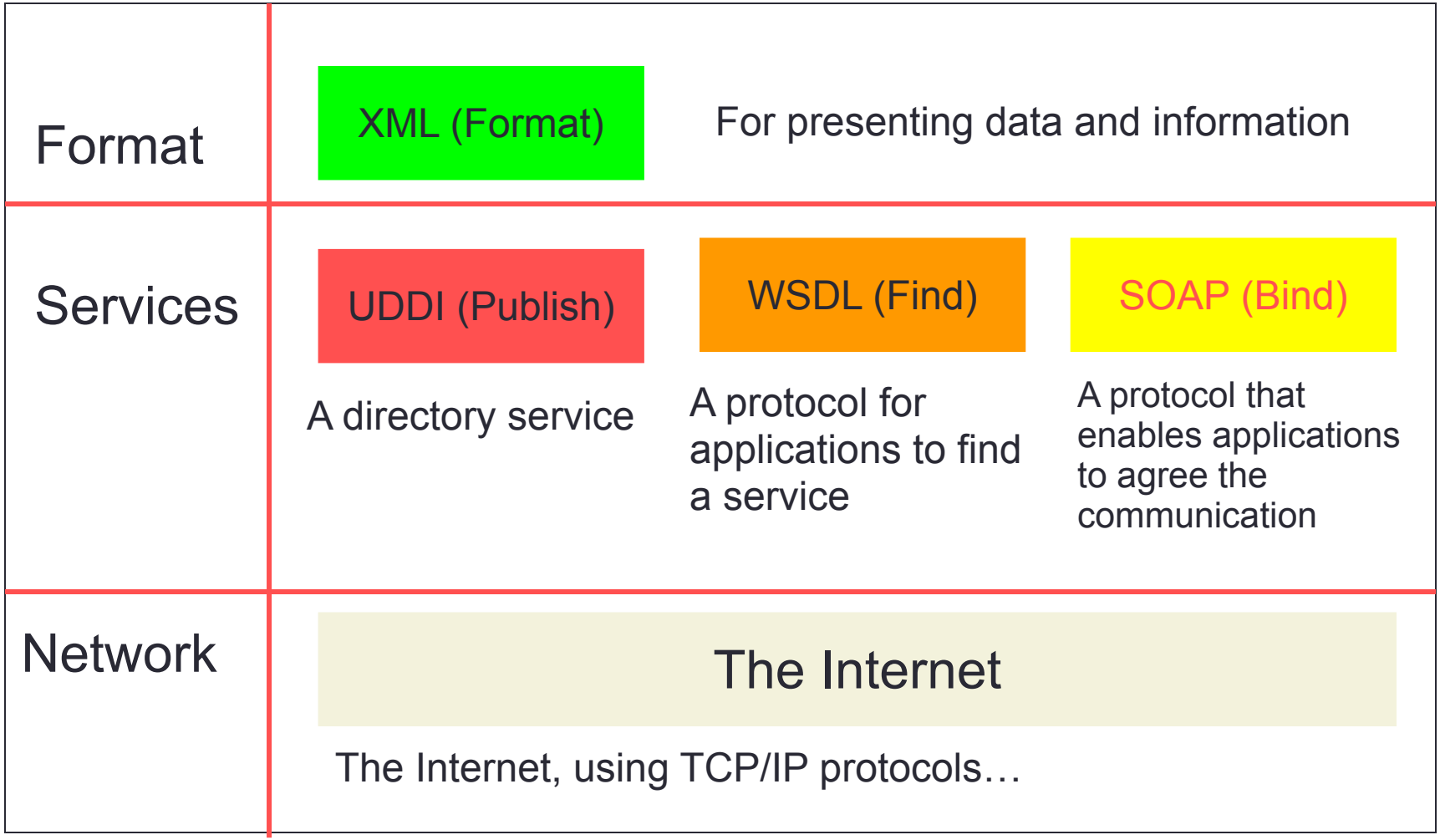
```
<html>
<head><title>Hello World by ASP</title></head>
<body>
<font size=12>
<%
response.write "Hello Students and the World!";
%>
</font>
</body>
```

```
<html>
<head><title>Hello World by JSP</title></head>
<body>
<font size=12>
<%
out.println("Hello Students and the World!");
%>
</font>
</body>
```

Web Services

- What are Web services?
  - They are a distributed computing architecture.
- Who is using Web services now?
  - Industry technologies
- Which approach should we use - .NET or J2EE?
- Requestor, Registry, Provider

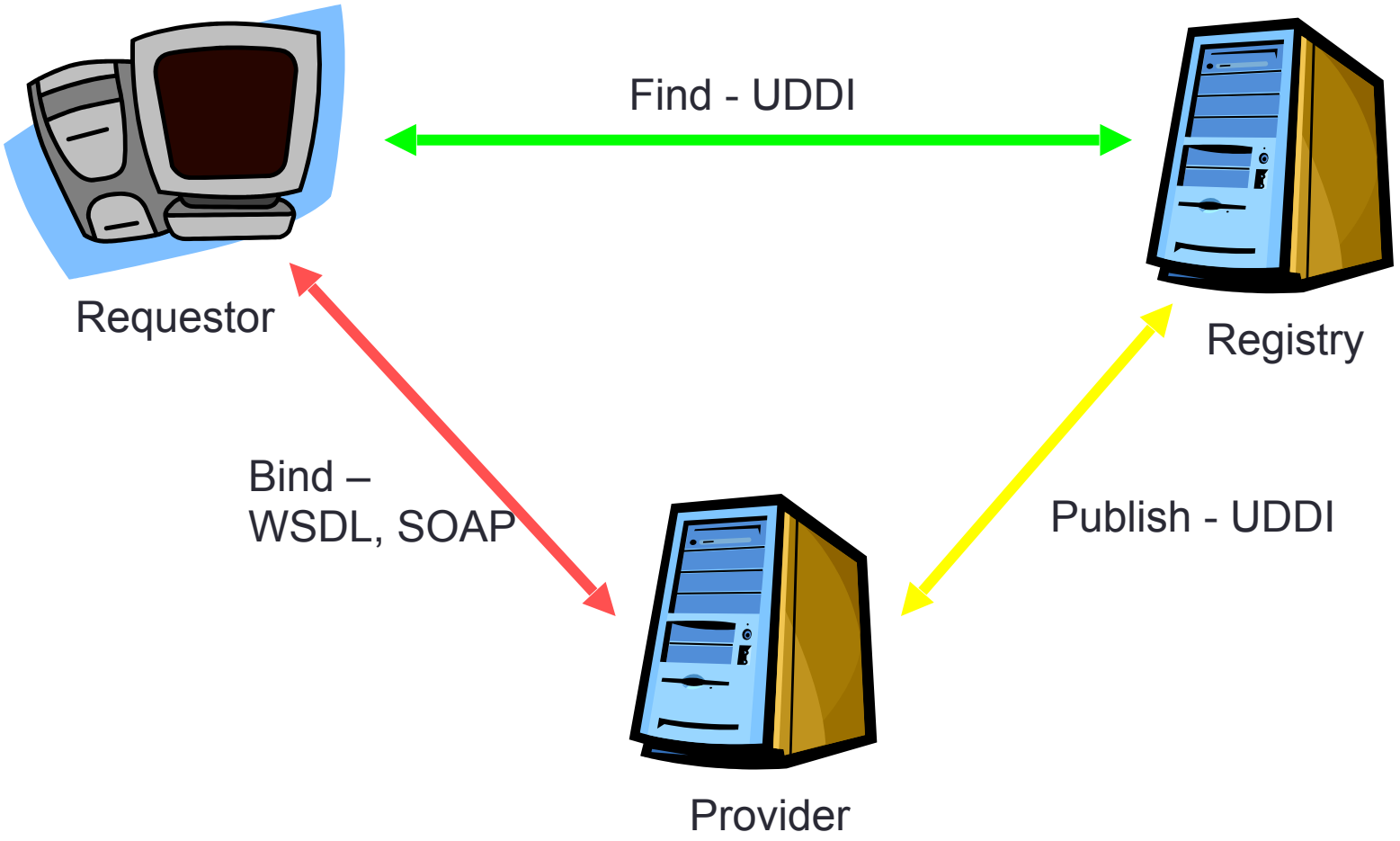
Critical Elements of a Basic Web Services Architecture



Web Services

- **Universal Description, Discovery and Integration** (**UDDI**) is a platform-independent, Extensible Markup Language (XML)-based registry by which businesses worldwide can list themselves on the Internet, and a mechanism to register and locate web service applications.
- The **Web Services Description Language** is an XML-based interface description language that is used for describing the functionality offered by a web service. A WSDL description of a web service (also referred to as a *WSDL file*) provides a machine-readable description of how the service can be called, what parameters it expects, and what data structures it returns.
- **Simple Object Access Protocol (SOAP)** is a protocol for exchanging structured information in the implementation of web services. It uses XML information set for its message format and relies on the application layer protocols like HTTP, SMTP etc. for message negotiation and transmission.

Service-Oriented Architecture



Introduction to AJAX (Programming)

- Asynchronous JavaScript and XML
- A Technique for developing more efficient interactive web application.
- AJAX enables complex interactive Web site elements to remain loaded while switching between pages, so that they do not have to be served up separately each time a visitor navigates to another site page.
- AJAX itself is not considered to be a unique technology, but a Web development method incorporating features from several different technologies and languages.
- AJAX uses a communication technology (typically SOAP and XML) to send and receive an asynchronous request/response to the server, and then leverages presentation technologies (JavaScript, DOM, HTML, and CSS) to process the response.

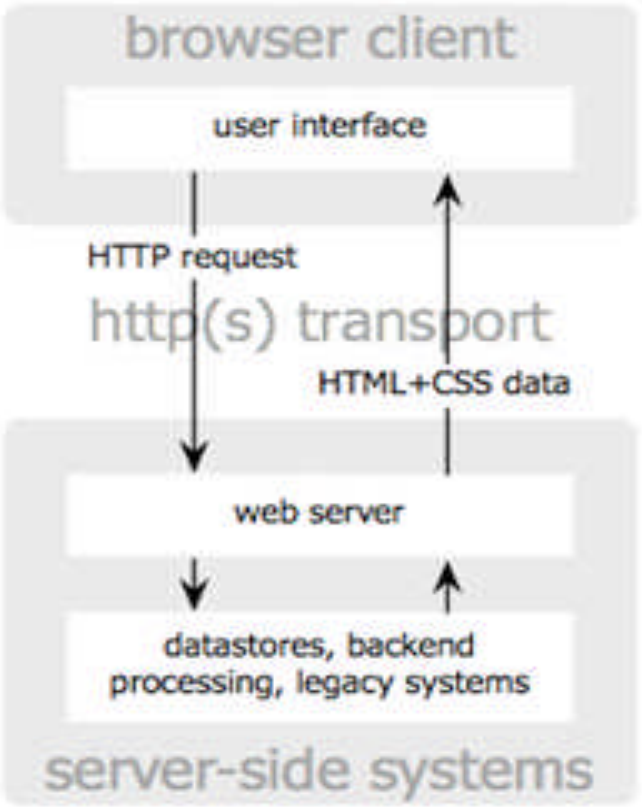
AJAX

- The AJAX method implements the following technologies to ease the process of producing consistent and interactive Web pages:
  - **XHTML (HTML)** and **CSS**, for marking up and styling information
  - The **DOM** with a client-side scripting language, like JavaScript and JScript, to dynamically display and interact with the information presented.
  - The **XMLHttpRequest** object to exchange data asynchronously with the Web server.
  - XML is commonly used as the format for transferring data back from the server, although any format will work, including preformatted HTML, plain text, JSON and even EBML (Extensible Binary Markup Language).

AJAX

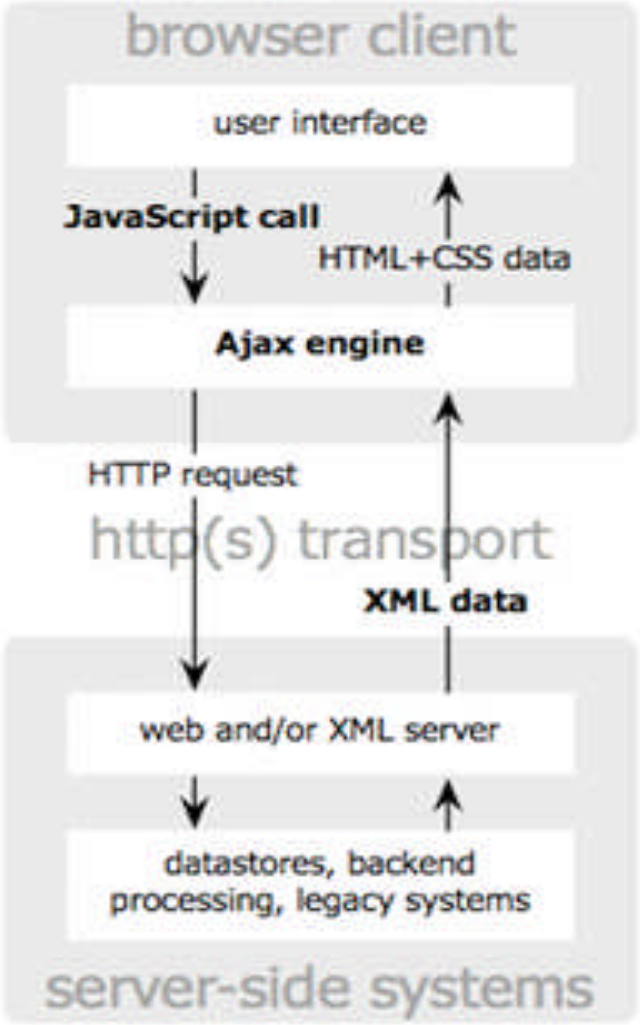
- AJAX incorporates:
  - Standard-based presentation using **XHTML** and **CSS**
  - Dynamic display and interaction using the **Document Object Model (DOM)**
  - Data interchange and manipulation using **XML** and **XSLT**
  - Asynchronous data retrieval using **XMLHttpRequest**
  - **JavaScript** binding everything together.

AJAX



classic
web application model

Jesse James Garrett / adaptivepath.com

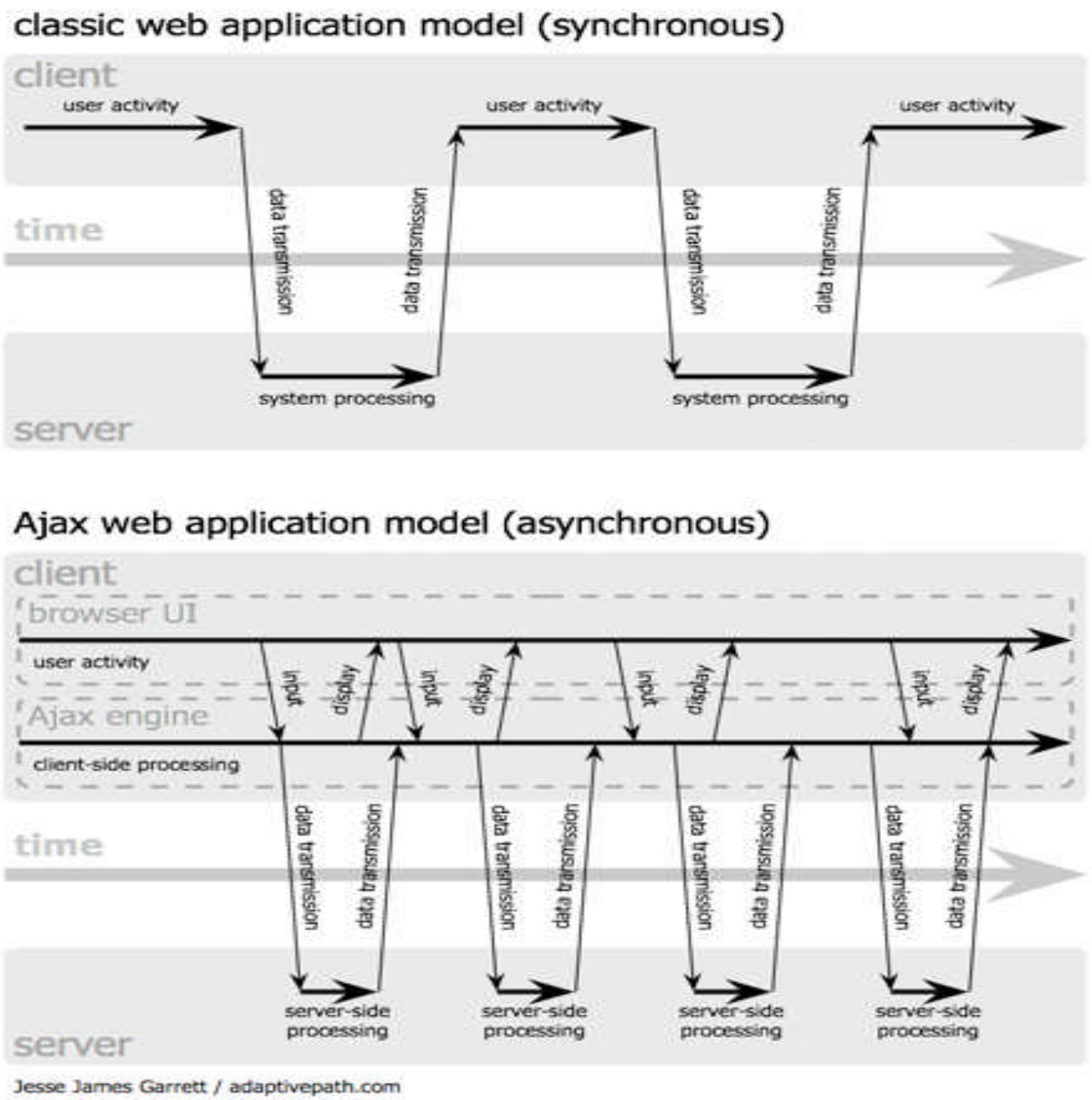


Ajax
web application model

How AJAX is different?

- An Ajax application eliminates the start-stop-start-stop nature of interaction on the Web by introducing an intermediary—an Ajax engine—between the user and the server.
- It seems like adding a layer to the application would make it less responsive, but the opposite is true.
- Instead of loading a webpage, at the start of the session, the browser loads an Ajax engine—written in JavaScript and usually tucked away in a hidden frame. This engine is responsible for both rendering the interface the user sees and communicating with the server on the user's behalf.
- The Ajax engine allows the user's interaction with the application to happen asynchronously—independent of communication with the server.
- So the user is never staring at a blank browser window and an hourglass icon, waiting around for the server to do something.

AJAX


classic web application model (synchronous)
client
user activity
user activity
user activity
data transmission
data transmission
data transmission
data transmission
time
system processing
system processing
server
Ajax web application model (asynchronous)
client
browser UI
user activity
input
display
input
display
input
display
input
display
Ajax engine
client-side processing
time
data transmission
data transmission
data transmission
data transmission
data transmission
data transmission
data transmission
data transmission
server-side processing
server-side processing
server-side processing
server-side processing
server
Jesse James Garrett / adaptivepath.com

AJAX

- Every user action that normally would generate an HTTP request takes the form of a JavaScript call to the Ajax engine instead.
- Any response to a user action that doesn't require a trip back to the server— such as simple data validation, editing data in memory, and even some navigation—the engine handles on its own.
- If the engine needs something from the server in order to respond—if it's submitting data for processing, loading additional interface code, or retrieving new data—the engine makes those requests asynchronously, usually using XML, without stalling a user's interaction with the application.

Browser as a Rendering Engine

- A **web browser engine**, (sometimes called **layout engine** or **rendering engine**), is a software component that takes marked up content (such as HTML, XML, image files, etc.) and formatting information (such as CSS, XSL, etc.) and displays the formatted content on the screen.