

CISC 3120

C22: Introduction to Web Application

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Outline

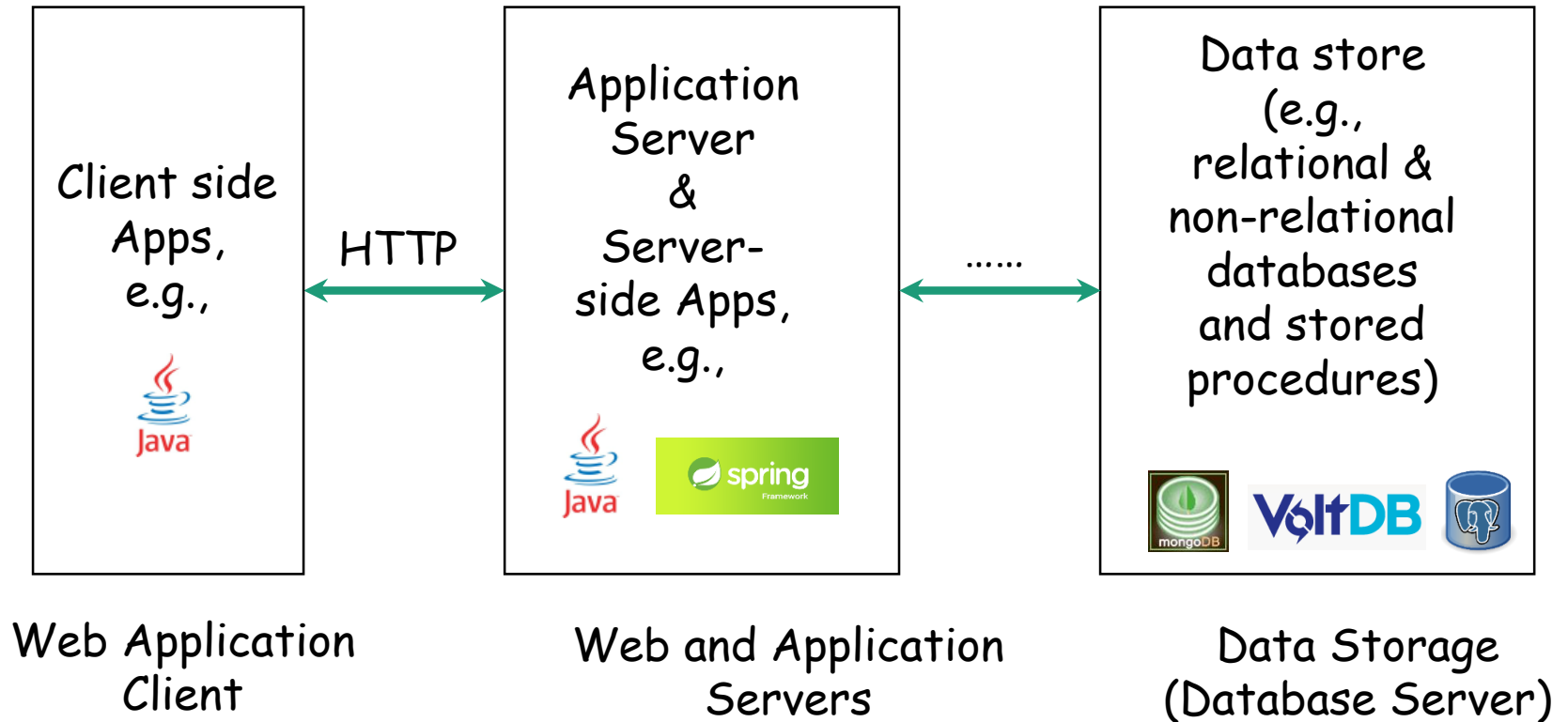
- 3-tier architecture and technology landscape
- The languages of the Web

Distributed Application

- Distributed application
 - Programs and user data logically are on multiple hosts
 - Processes communicate via computer networks to achieve some well defined functions
 - e.g.,
 - generating an online course transcript for a student
 - completing a purchase online
 - delivering an on-demand or a live video to users
- The Web is a distributed application deployed on the Internet

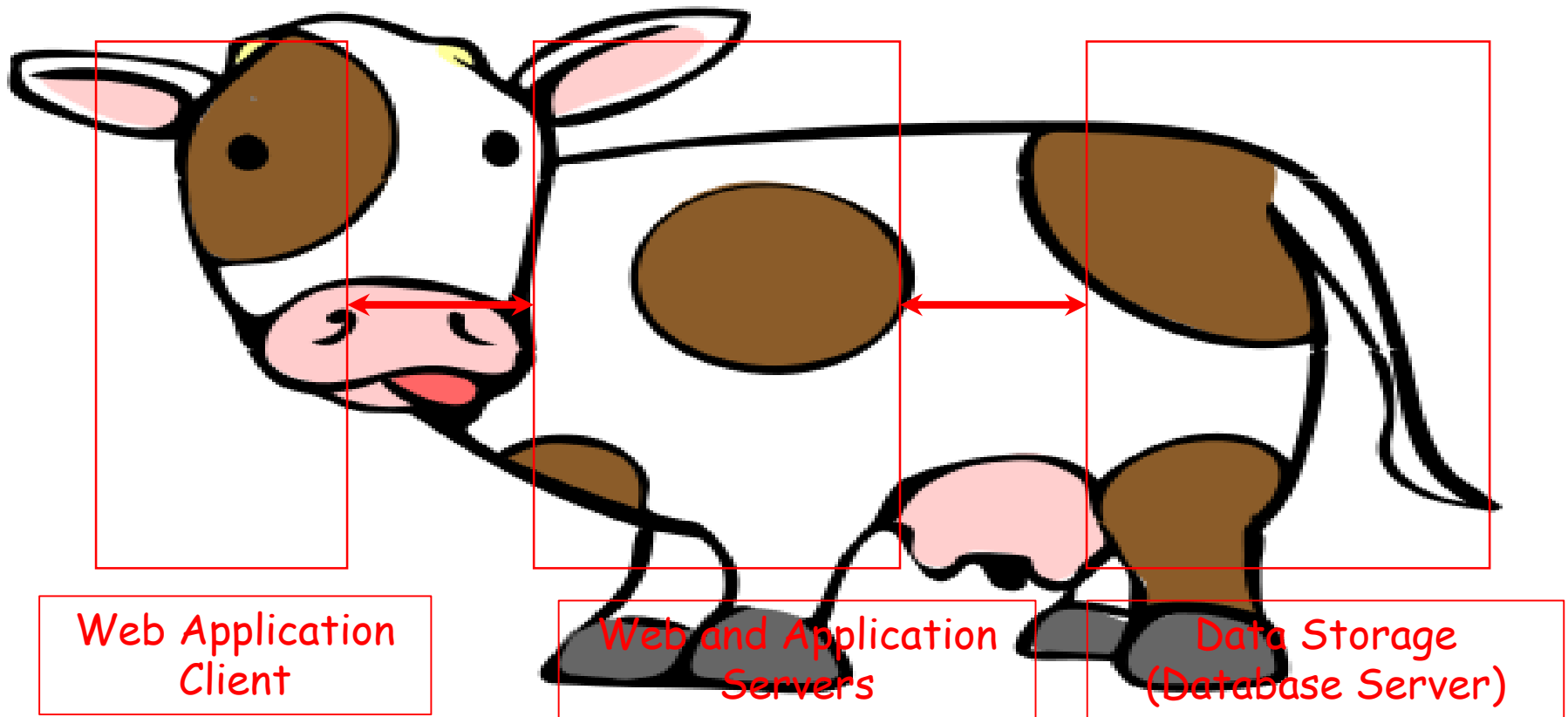
Web Application Architecture

- 3-tier (and n-tier)



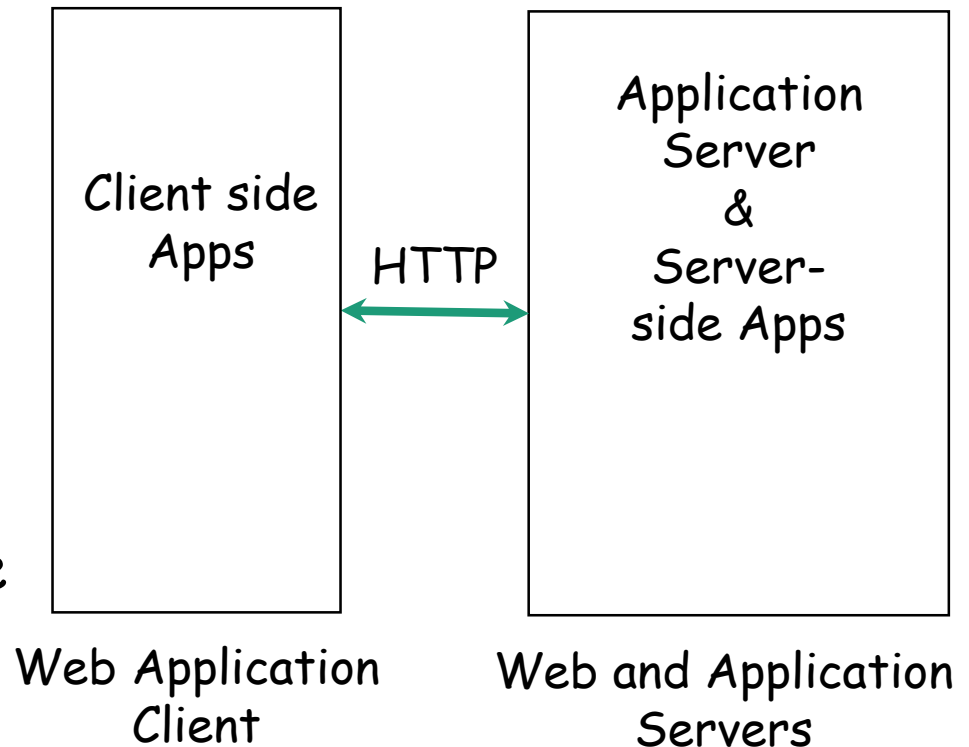
Some Lingo

- Front end, back end, and full stack



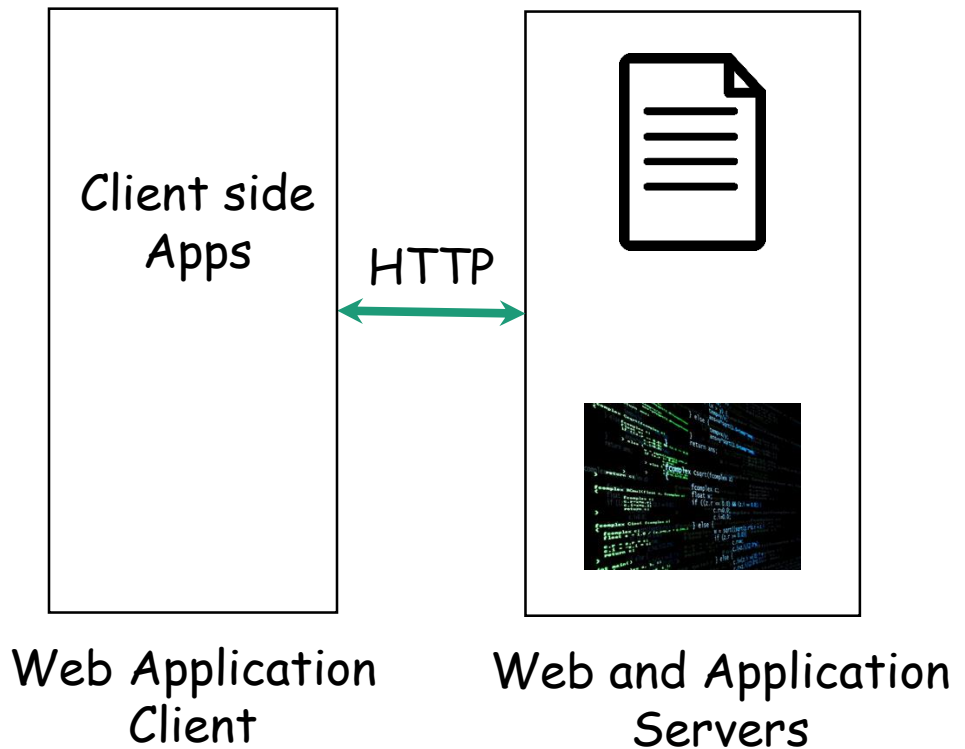
User Agent

- A client is a client to a Web server or Web service
- Called a user agent
 - Web browser
 - Mobile apps
 - Desktop apps
 - Other Web service



Web Resource

- Static
 - Documents
- Dynamic
 - Programs
 - Program output
- Any entity that can be identified on the Web



Questions

- Web architecture
- A few lingos and concepts

Evolving Web Application

- Web applications are distributed applications that communicates via HTTP
 - A diverse set of user agents and client technology
 - A diverse set of middleware and server-side technology
- Web development is perhaps taught more than often with the Web browsers as user agents
 - Keep in mind, many Web clients are not Web browsers
 - Examples
 - Google bots
 - Many mobile applications

Examples in the Technology Landscape

- Client user interface:
 - HTML/CSS/JavaScript
 - Document object Model (DOM) : Client UI organized as an marked-up language document
 - UI framework: e.g., AngularJS, ReactJS, ...
- Client & Server interfacing: HTTP
 - AJAX, REST, GraphQL, and more
 - Client & Server state exchange: Cookies/Sessions
- Data storage: DBMS: Schema, Objects, CRUD, indexes, transactions; SQL, No-SQL
- Scalability and security

Web Browsers

- Generic Web browsers
 - Chrome, Firefox, Edge, Safari, Opera, etc
- Custom Web browsers
 - Example
 - A JavaFX application with a WebEngine and a WebView component

Questions?

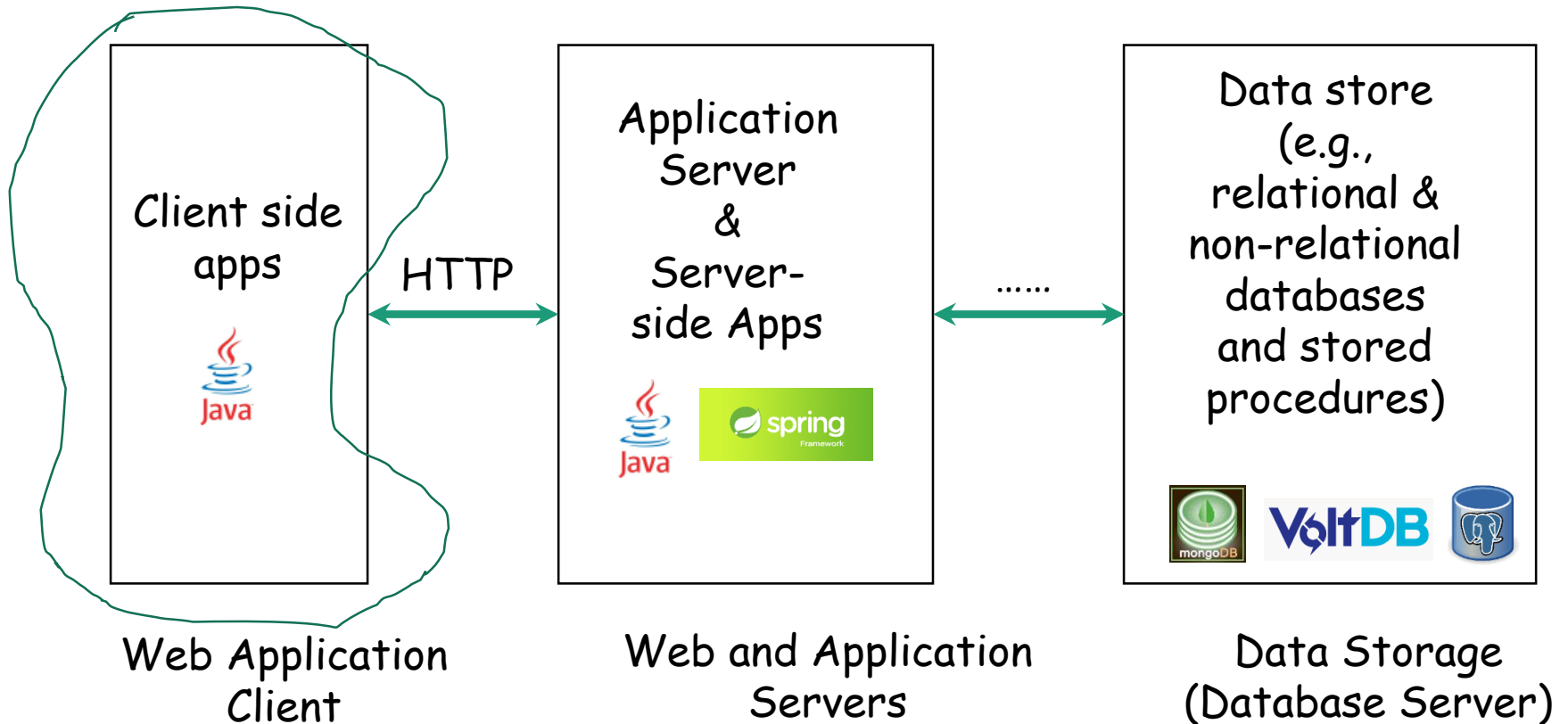
- What isn't a Web application?

The Languages of the Web

- A few frequently used languages
 - HTML
 - CSS
 - JavaScript
 - JSON
 - XML

Web Application Architecture

- 3-tier (and n-tier)



Roles of the Languages

- In a Web application, for the client,
 - HTML
 - Defines UI components
 - Buttons, forms
 - CSS
 - Defines look & feel of the above
 - JavaScript
 - Define client application logic (e.g., event handling)
 - JSON & XML
 - Define the format of exchange between the client and the server (e.g., argument & returned values of a method)

Questions

- Roles of the languages for the client (in particular, with a Web Browser as a user agent)
- There is a distinction between how we use these technologies to develop a “Web application” than how we use them to develop a “Web site”

Markup language

- Directive and content
 - Directive describe content or influence presentation
 - Example: `<i>this is italic</i>` where `<i></i>` is the directive
- Example markup languages
 - eXtensible Markup Language (XML)
 - Hypertext Markup Language (HTML)
- Write document in Marked language
 - Start with content, annotate content with directives or tags

HTML Tags

- HTML uses `<>` to indicate a tag
- Tags can provide the following
 - Formatting information, e.g., `<i>`, `<b>`, `<em>`
 - Meaning of content
 - `<h1>` means level 1 heading
 - `<ul>` unordered list, `<li>` a list item
 - `<ol>` ordered list, `<li>` a list item
 - `<p>` means paragraph
 - Type of information, `<img>` image to display
 - Tags can be nested

Example: Writing HTML Document

- Starting with content, annotate with tags

Class HttpURLConnection

A URLConnection with support for HTTP-specific features. See the spec for details.

Each HttpURLConnection instance is used to make a single request but the underlying network connection to the HTTP server may be transparently shared by other instances.



<h1>Class HttpURLConnection</h1>

<p>A URLConnection with support for HTTP-specific features. See the spec for details.</p>

<p>Each HttpURLConnection instance is used to make a single request but the underlying network connection to the HTTP server may be transparently shared by other instances.</p>

HTML and XHTML

- Important versions of HTML
 - HTML 2.0, 3.2, 4, 4.01, 5, and 5.1
- HTML 4 or earlier: application of SGML
 - Syntax is less restrictive
- HTML 5 or later: application of XML
 - Syntax is more restrictive
 - Consideration: efficiency, uniformity

Example: HTML 5 Document

- Add required DOCTYPE and head fields and values

```
<!DOCTYPE html>                                <!-- required by HTML 5 -->
<html lang="en">                                <!-- this is a comment -->
<head>
  <title>Example HTML 5: HttpURLConnection</title> <!-- required by HTML 5 -->
  <meta charset="utf-8" />                        <!-- required by HTML 5 -->
</head>
<body>
<h1>Class HttpURLConnection</h1>

<p>A URLConnection with support for HTTP-specific features. See the spec for details.</p>

<p>Each HttpURLConnection instance is used to make a single request but the underlying
network connection to the HTTP server may be transparently shared by other instances.
</p>
</body>
</html>
```

Questions

- Define UI components for a client (with a Web Browser as a user agent)
 - HTML 5
- Validating HTML

Validate HTML Document

- Always validate your HTML documents
 - Benefits: for improving parsing efficiency, rendering uniformity, and learning
- Example
 - W3C Markup Validation Service
 - Total Validator

Questions

- Validating HTML

Cascading Style Sheets

- How should a markup be rendered?
 - Example: font, font size, and color of the content of a `<h1>` tag
- CSS defines "styles" of documents
 - Initial motivation: separate content from presentation
- The same language used to define look & feel of JavaFX applications

Style Sheet and Rules

- A style sheet contains one or more rules
- Each rule consists of
 - A selector
 - A declaration block
 - That consists of in turn a list of property-value pairs

Example: CSS Rule

- Question:
 - What is the selector of this rule?
 - What is the declaration body of this rule?
 - How is a property-value pair is written?
 - What does it mean that a property has a list of values?

```
h1 {  
  font-family: Tahoma, Arial, sans-serif;  
  font-size: 12pt;  
  color: black;  
  background: white;  
}
```

Some CSS Selectors and HTML

CSS Selector	CSS Example	HTML Example
Type selector: tag name	<code>p { color: blue;}</code>	<code><p>Hello, World!</p></code>
Class selector: class attribute	<code>.highlight { color: red; font-weight: bold; }</code>	<code><p class=highlight>Hello, World!</p> <h1 class=highlight>Table of Content</h1></code>
Type + Class: tag name + class attribute	<code>p.highlight { color: red; font-weight: bold; }</code>	<code><p class=highlight>Hello, World!</p></code>
ID selector: id value	<code>#main_content {color: black;}</code>	<code><div id=#main_content> </div></code>

Some CSS Pseudo Selectors

- Typically associated with an action or a state
- `hover`: selected when the mouse is hovering on the element
- `link` and `visited`: whether a link is not visited or visited

Example: Pseudo Selectors

```
p:hover, a:hover /* selectors can be a list */ {  
  font-family: Tahoma, Arial, sans-serif;  
  font-size: 12pt;  
  color: blue;  
  background: white;  
}  
a.link {  
  color: blue;  
}  
a.visited {  
  color: brown;  
}
```

CSS Properties

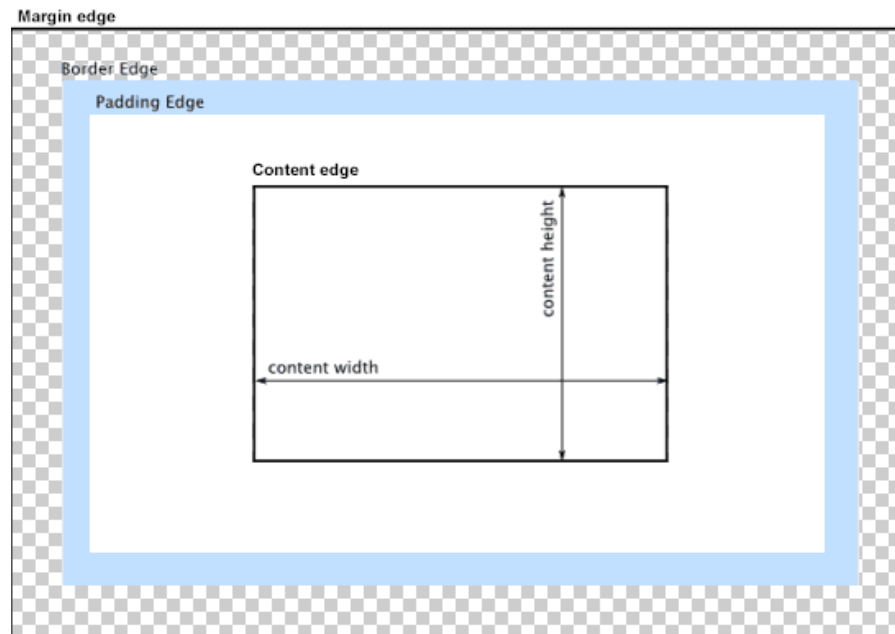
- See [MDN CSS Properties reference](#)
- Example categories:
 - Color
 - Size
 - Position
 - Visibility

Questions?

- Concept of CSS

CSS Box Model

- Positioning UI components: CSS Box model
- Each element is represented as a rectangular box (See [MDN Box Model](#))



CSS Length Units

- See [MDN Length](#)
- Examples
 - px: pixels
 - pt: printer point = 1/72 inch
 - mm: millimeter
 - in: inch
 - cm: centimeter
 - em: element's current font size

Size Properties

- width, height
- padding: padding-top, padding-right, padding-bottom, padding-left
- margin: margin-top, margin-right, margin-bottom, margin-left
- border: border-bottom-color, border-bottom-style, etc.
- See [MDN](#)

Position Property

- The position property controls how an element is positioned
- Values
 - static, relative, fixed, absolute
 - Static: normal flow
 - Relative: relative to position in the normal flow
 - Fixed: relative to the view port
 - Absolute: relative to the html or the nearest ancestor
- See [MDN position](#)

Visibility

- The display property
 - Values:
 - none, inline, block
 - See [MDN display](#)
- The visibility property
 - Values:
 - hidden, visible
 - See [MDN visibility](#)

Questions?

- CSS Box model

Fonts and Text Alignment

- Define font family, size, style, weight, etc.
 - See [MDN font](#)
- Define text alignment
 - See [MDN text alignment](#)

Color and Background

- See [MDN color](#)
- See [MDN background](#)

Questions?

- Font, text, and colors

Add Styles to HTML Documents

- Inline: deprecated, do not use
- Document: embedded in document head, discouraged.
- External: linked in head, written a separate file

Example: Inline CSS

- Use the style attribute. Deprecated. Do not use.

```
<!DOCTYPE html>                                <!-- required by HTML 5 -->
<html lang="en">                                <!-- this is a comment -->
<head>
  <title>Example HTML 5: HttpURLConnection</title> <!-- required by HTML 5 -->
  <meta charset="utf-8" />                        <!-- required by HTML 5 -->
</head>
<body>
<h1 style="color: red;">Class HttpURLConnection</h1>

<p>A URLConnection with support for HTTP-specific features. See the spec for details.</p>

</body>
</html>
```

Example: Document CSS

- Use the style tag in HTML head. Discouraged to use.

```
<!DOCTYPE html> <!-- required by any XHTML -->
<html lang="en"> <!-- this is a comment -->
<head>
  <title>Example HTML 5: HttpURLConnection</title><!-- required for HTML 5-->
  <meta charset="utf-8" />
  <style type="text/css">
    h1 {color: red;}
  </style>
</head>
<body>
<h1>Class HttpURLConnection</h1>

<p>A URLConnection with support for HTTP-specific features. See the spec for details.</p>
</body>
</html>
```

Example: External CSS

- Use the link tag in HTML head. Preferred.
 - Styles written in files. Example below: style.css

```
<!DOCTYPE html> <!-- required by any XHTML -->
<html lang="en"> <!-- this is a comment -->
<head>
  <title>Example HTML 5: HttpURLConnection</title><!-- required for HTML 5-->
  <meta charset="utf-8" />
  <link type="text/css" rel="stylesheet" href="style.css"/>
</head>
<body>
<h1>Class HttpURLConnection</h1>
</body>
</html>
```

```
h1 {color: red; }
```

Questions?

- Methods to add CSS to a UI document in HTML?

Validate CSS

- Always validate CSS
- Example
 - W3C CSS Validator (<https://jigsaw.w3.org/css-validator/>)

Questions?

- Validating CSS

JavaScript

- Standardized as ECMAScript
- JavaScript: Core, Client, and Server
- Client-side
 - Collection of objects that support the control of a browser and interactions with users
 - Example: JavaScript + HTML: users inputs (keyboards or mouse clicks)
- Server-side
 - Collection of objects that make the language useful on a Web server
 - Example: communicate with a database server
 - Gaining momentum (e.g., node.js or <http://nodejs.org>)
- This lecture introduces client-side JavaScript

Writing JavaScript

- Syntax is somewhat similar to C/C++/Java
- Scripting language
 - Interpreted, dynamically typed.
 - Declare variable
 - Example: `var sum;`
 - Control structures
 - Selection and iterations are similar to C/C++/Java
 - Subroutines
 - Example: `function doSomething(i) { return i * 10;}`
 - Objects: unordered name-value pairs

Add JavaScript to HTML Document

- Use the script tag
- Inline or include as a separate file

Add JavaScript to HTML Document: Inline

```
<!DOCTYPE html> <!-- required by any XHTML -->
<html lang="en"> <!-- this is a comment -->
<head>
  <title>Example HTML 5: HttpURLConnection</title><!-- required for HTML 5-->
  <meta charset="utf-8" />
  <link type="text/css" rel="stylesheet" href="style.css"/>
</head>
<body>
<h1>Class HttpURLConnection</h1>
<p>A URLConnection with support for HTTP-specific features. See the spec for details.</p>
<script type="text/javascript">
  alert("Hello, World");
  document.write("<p>Hello, Word in the document</p>");
</script>
</body>
</html>
```

Add JavaScript to HTML Document: As a Separate File

- JavaScript is in helloworld.js

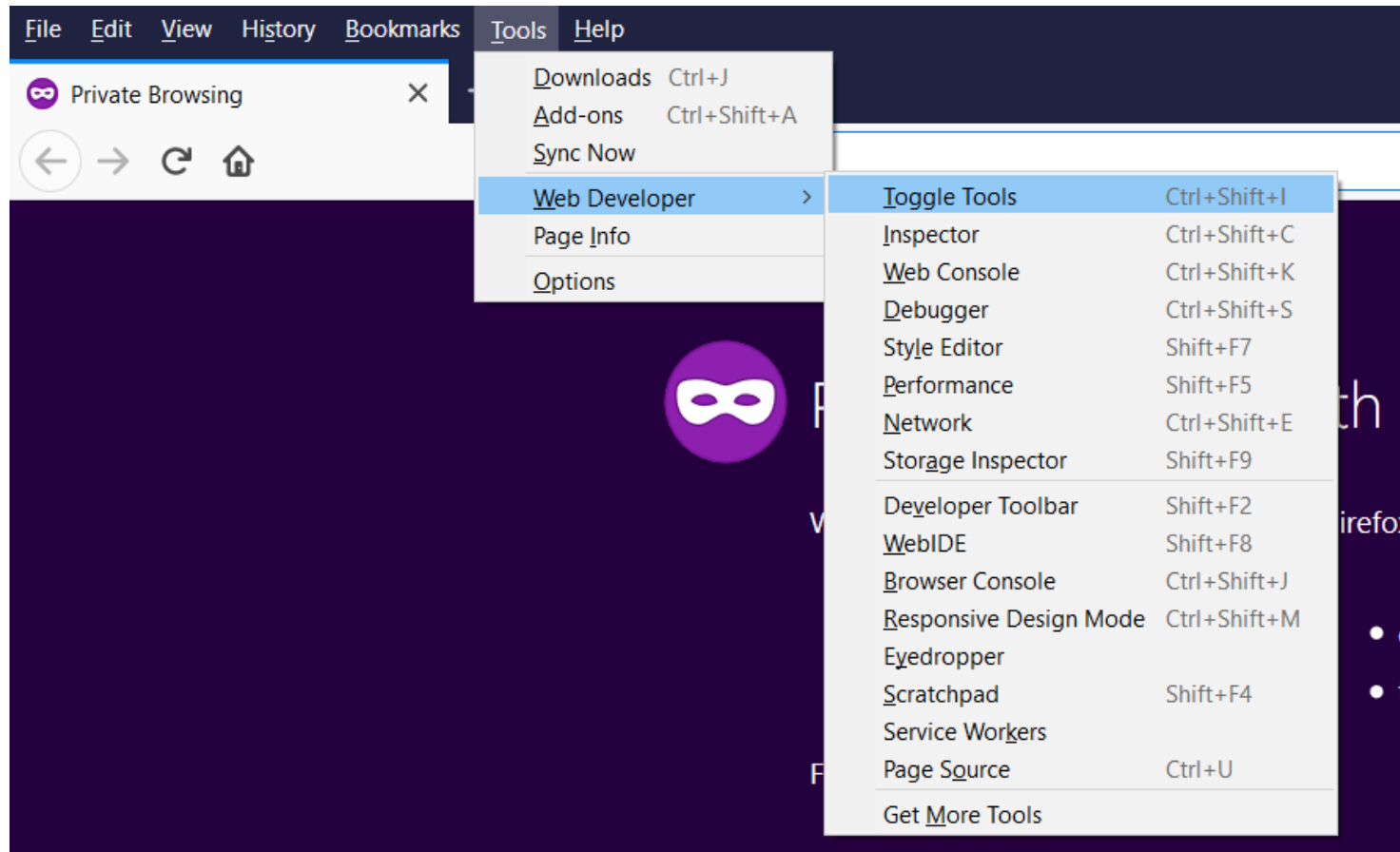
```
<!DOCTYPE html> <!-- required by any XHTML -->
<html lang="en"> <!-- this is a comment -->
<head>
  <title>Example HTML 5: HttpURLConnection</title><!-- required for HTML 5-->
  <meta charset="utf-8" />
  <link type="text/css" rel="stylesheet" href="style.css"/>
</head>
<body>
<h1>Class HttpURLConnection</h1>
<p>A URLConnection with support for HTTP-specific features. See the spec for details.</p>
<script type="text/javascript" src="helloworld.js"></script>
</body>
</html>
```

```
alert("Hello, World");
document.write("<p>Hello, Word in the document</p>");
```

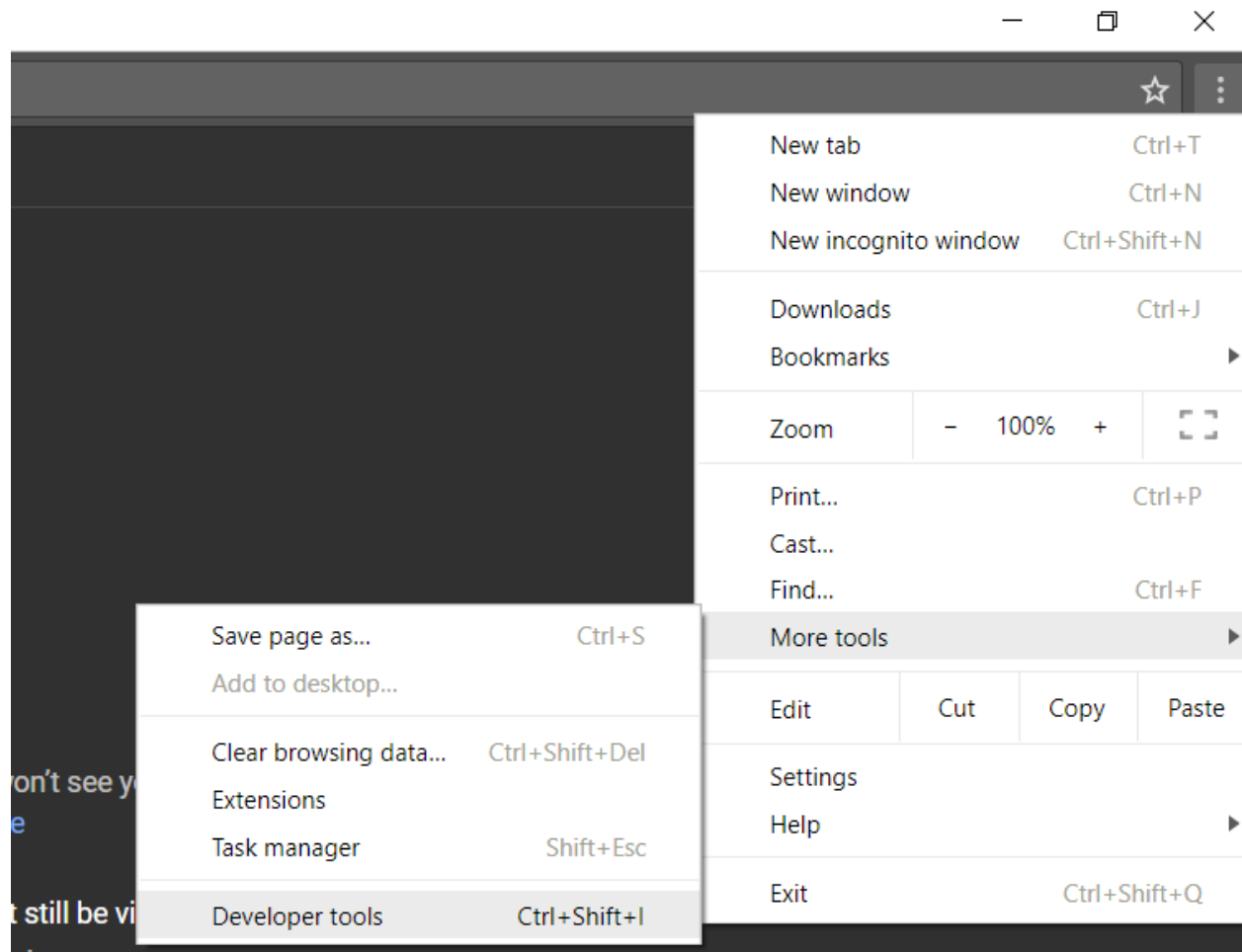
Questions

- Concept of JavaScript (ECMAScript)
- Add JavaScript to a HTML document

Web Development Tools: Firefox

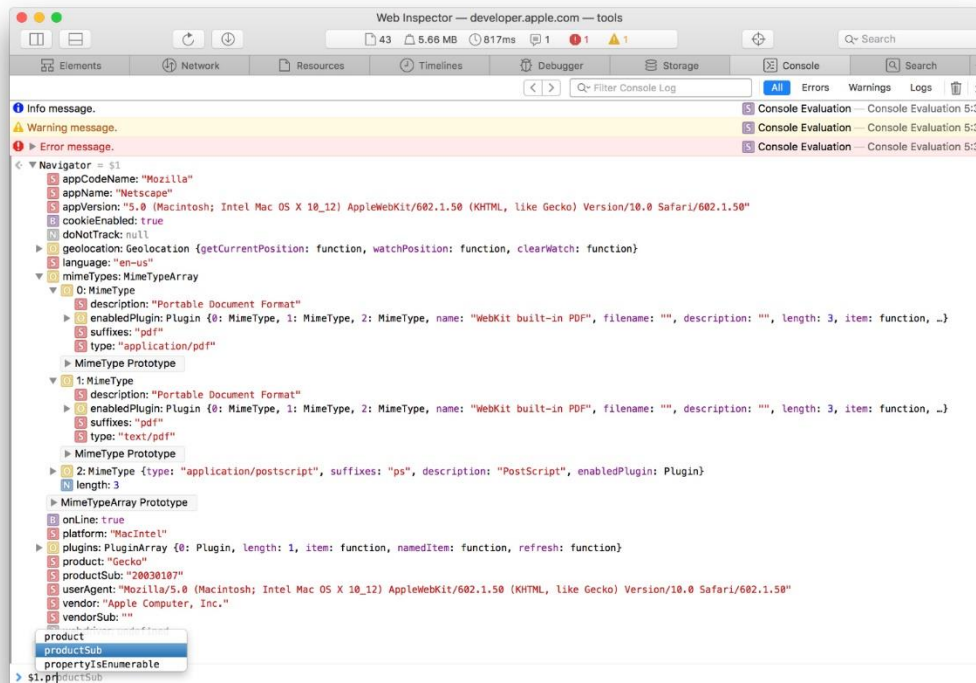


Web Development Tools: Chrome



Web Development Tools: Safari

- First go to Preferences, Advanced, and check the "Show Develop menu in menu bar".



Resources

- MDN tutorials
 - HTML: <https://developer.mozilla.org/en-US/docs/Web/Tutorials>
 - CSS: https://developer.mozilla.org/en-US/docs/Learn/Getting_started_with_the_web/CSS_basics
 - JavaScript: https://developer.mozilla.org/en-US/docs/Learn/JavaScript/First_steps

Questions?

- Web development with Web browsers as user agents
 - Markup language
 - HTML
 - CSS
 - JavaScript
 - Web development tools in modern browsers