Algorithms and Programming IV
Introducing Web Application Development (23-1)

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Our topics today

Web Application Architecture
- HTML
- CSS
- JS

Frontend Web Application Frameworks
Client-Server Architectures

Alternative Client-Server Architectures

Example of Web Application Architecture

Example taken from https://engineering.videoblocks.com/web-architecture-101-a3224e126947
Basic Architecture

User

Frontend
(Browser, Smartphone, Wearable...)

Internet

Web Server

Application Logic
PHP/Python/JavaScript

Database
MySQL/MongoDB/PostgreSQL

Web Application

Backend
Frontend: Overview

- User-facing part of the Web Application
- Interpreted by the Browser
- Separation of concerns:
  - Content
  - Presentation
  - Behaviour

Frontend

Content/Structure: HTML
Presentation: CSS
Behaviour: Javascript
Frontend Overview: Example

**Content**
```html
<!doctype html>
<html lang="en">
<head>
  <title>Display Date</title>
  <link rel="stylesheet" href="css/styles.css?v=1.0"/>
</head>
<body>
  <button onclick="displayDate()">The date is?</button>
  <p id="date"></p>
</body>
</html>
```

**Behavior**
```javascript
function displayDate() {
  document.getElementById("date").innerHTML = Date();
}
```

**Presentation**
```css
body {
  font-family: Consolas;
}

p {
  color: blue;
}

button {
  background-color: #888888;
  border-color: black;
}
```
Web Application Development I

HyperText Markup Language (HTML)
Basics of HTML

• HTML is not a programming language, it is a markup language
• It is a language for specifying the static content of Web pages (based on SGML, the Standard Generalized Markup Language)

• Hypertext: more than just text; links for jumping within the same document & to other documents; contain multimedia
• Markup: augmenting text with special symbols (tags) that identify the document structure and content type
Tags and Elements

HTML specifies a set of tags that are enclosed in < > which identify structure of the document and the content type

<img src="image.gif" /> specifies an image

Most tags come in pairs

<title>My Home Page</title> is a TITLE element

<a href="/">Home</a> this is a LINK

<p>Part of this text is <b>bold</b>. </p>

is a PARAGRAPH element that contains a BOLD element (nesting)

An HTML document is a collection of elements (text/media with context).
Structure of an HTML Document

Doctype declaration
- defines the type of the document
- ‘html’ means it is an HTML5 document (for older versions the tag was more complicated)

Main Container: <html></html>
- encloses the document
- defines start and end

```html
<!doctype html>
<html lang="en">
<head>
  <meta charset="utf-8">
  <title>Basic HTML Document</title>
  <meta name="description" content="This is an example">
  <meta name="author" content="John Doe">
  <link rel="stylesheet" href="css/styles.css?v=1.0">
</head>
<body>
  <script src="js/scripts.js"></script>
</body>
</html>
```
**<head> element**

The `<head>` element can contain:

- Metadata (e.g. Author, Encoding, Title, Description)
- JavaScript code
- CSS code
- links to external resources (e.g. external stylesheet)

```html
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<html lang="en">
<head>
  <meta charset="utf-8">
  
  <title>Basic HTML Document</title>
  <meta name="description" content="This is an example">
  <meta name="author" content="John Doe">
  <link rel="stylesheet" href="css/styles.css?v=1.0">
</head>

<body>
  <script src="js/scripts.js"></script>
</body>
</html>
```
<body> element

The <body> element contains:
• main content displayed on the webpage
• Paragraphs, tables and lists
• multimedia (images, videos, SVG...)
• structural elements (Buttons, Menus...)

```html
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  <meta name="author" content="John Doe">
  <link rel="stylesheet" href="css/styles.css?v=1.0">
</head>
<body>
  <script src="js/scripts.js"></script>
</body>
</html>
```
Text Appearance

You can specify styles for fonts

<b>...</b> specify bold
<i>...</i> specify italics
<tt>...</tt> specify typewriter-like (fixed-width) font

<big>...</big> increase the size of the font
<small>...</small> decrease the size of the font
<em>...</em> put emphasis
<strong>...</strong> put even more emphasis
...
Structure

Websites can be structured with specific Tags

- `<div>`: Container
- `<p>`: Paragraph
- `<h1>`... `<h5>`: Headlines
- `<ul>`: unordered List
- `<li>`: list element
- `<section>`: Section

```html
<nav>
  <ul>
    <li><a href="/">Home</a></li>
    <li><a href="/news">News</a></li>
    <li><a href="/examples">Examples</a></li>
    <li><a href="/legal">Legal</a></li>
  </ul>
</nav>
```
Media

Different tags exist to include media

<img> Image
<svg>... </svg> Scalable vector graphics
<video>... </video> video
<canvas>... </canvas> canvas (raster graphics)
HTML - Attributes

- All HTML elements can have attributes
- Attributes provide additional information about elements
- Attributes are always specified in the start tag
- Attributes usually come in name/value pairs like: name="value"

Examples:

- `<a href = "www.example.com">example link </a>` Path
- `<div id = "example1" >example link </div>` unique identifier
- `<div class = "examples" >example link </div>` class identifier

HTML Tutorial: [http://www.w3schools.com/html/default.asp](http://www.w3schools.com/html/default.asp)
HTML specification: [https://www.w3.org/TR/html52/](https://www.w3.org/TR/html52/)
Content vs. Presentation

Most HTML tags define content type, independent of presentation.

**Cascading Style Sheets (CSS)** allow us to maintain this separation, which allows for easier maintenance of webpages, and for a consistent look across a collection of webpages.

Style definitions are normally saved in external `.css` files

With an external stylesheet file, the look of an entire website can be changed by updating just one file.