Web Dev Basics 2

CS571: Building User Interfaces

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Before Lecture

- Clone today's code to your machine.
- Download and install Postman!

Learning Objectives

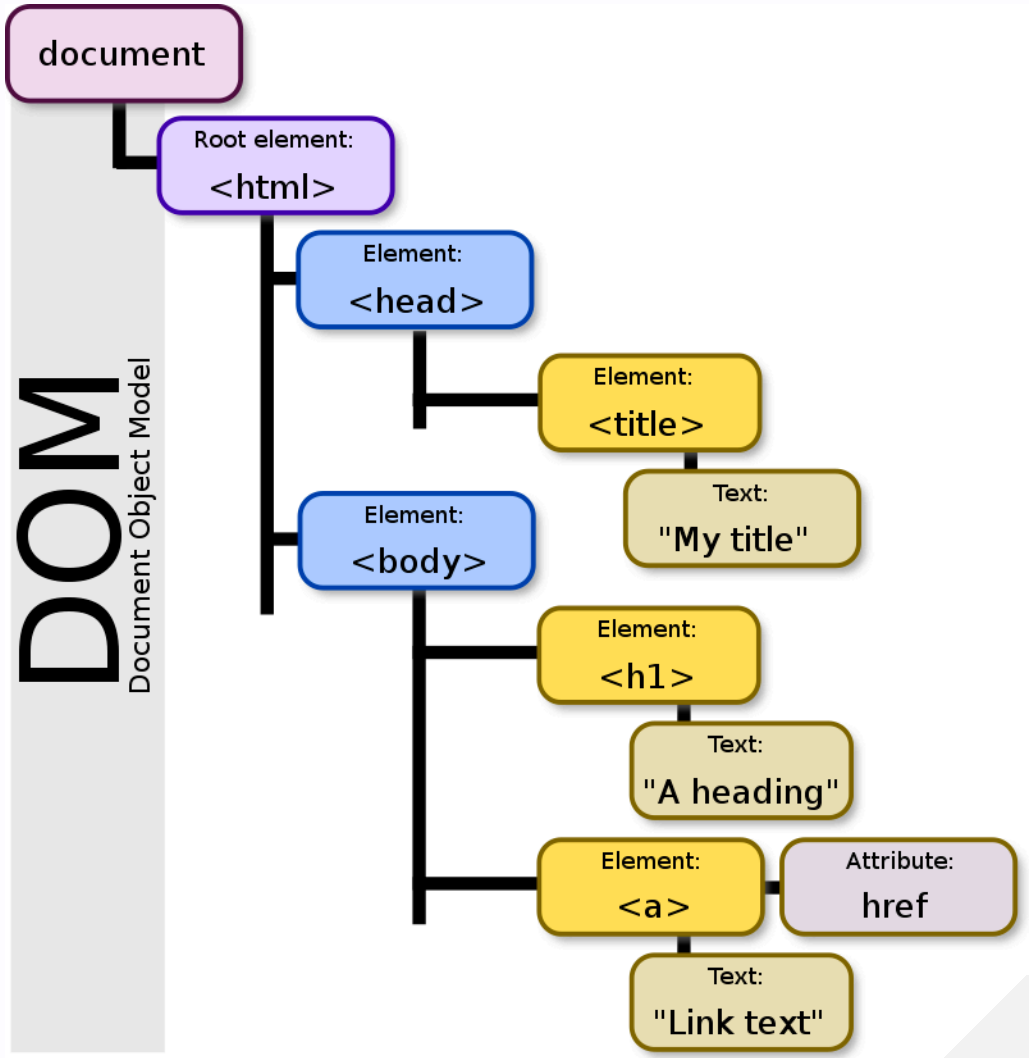
1. Perform DOM Manipulations
2. Define a callback function.
3. Understand how asynchronous code executes.
4. Fetch, parse, and use JSON data from an API to populate webpage.

Document Object Model (DOM)

HTML is just a tree, where each element is a node!

We use JavaScript to manipulate this tree.

Document Object Model



Manipulating the DOM

Use `document` to reference the DOM.

```
let title = document.getElementById("articleTitle");
let loginBtn = document.getElementsByTagName("button")[0];
let callouts = document.getElementsByClassName("callout"); // *
```

*class refers to a **CSS** class

We can add *event listeners* or read/modify *properties*.

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Manipulating the DOM

Using these DOM elements, we can change the title of the article, add an action for when the button is clicked, and make all of the callouts red.

```
title.innerText = 'My Website!';
loginBtn.addEventListener("click", () => {
  alert("You are advancing to the next part of the site...");
});

for (let callout of callouts) {
  callout.style.color = "red";
}
```

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Your Turn!

Update the name of the chili using JavaScript.

Why? (1) (2)

What is JSON?

Definition: JavaScript Object Notation (JSON) is a structured way to represent text-based data based on JS object syntax.

Refresher: JS Objects

Definition: Objects are unordered collection of related data of primitive or reference types defined using key-value pairs.

```
const instructor = {
  firstName: "Cole",
  lastName: "Nelson",
  roles: ["student", "faculty"]
}
```

JSON Equivalent

```
{
  "firstName": "Cole",
  "lastName": "Nelson",
  "roles": ["student", "faculty"]
}
```

What's the difference? A JS Object is executable code; JSON is a language-agnostic representation of an object. There are also slight differences in syntax.

You can write comments in JS Objects...

```
const drinks = [
  {
    name: "Mimosa",
    ingredients: [
      {name: "Orange Juice", hasAlcohol: false},
      {name: "Champagne", hasAlcohol: true}
    ]
  },
  {
    name: "Vesper Martini", // shaken, not stirred
    ingredients: [
      {name: "Gin", hasAlcohol: true},
      {name: "Vodka", hasAlcohol: true},
      {name: "Dry Vermouth", hasAlcohol: true},
    ]
  }
]
```

... but not in JSON!

```
[
  {
    "name": "Mimosa",
    "ingredients": [
      { "name": "Orange Juice", "hasAlcohol": false },
      { "name": "Champagne", "hasAlcohol": true }
    ]
  },
  {
    "name": "Vesper Martini",
    "ingredients": [
      { "name": "Gin", "hasAlcohol": true },
      { "name": "Vodka", "hasAlcohol": true },
      { "name": "Dry Vermouth", "hasAlcohol": true }
    ]
  }
]
```

Conversion

Because JS Objects and JSON are so similar, it is easy to convert between them.

- `JSON.parse` JSON String → JS Object
- `JSON.stringify` JS Object → JSON string

Data fetched from an API does an implicit `JSON.parse`

What is an API?

Definition: An application programming interface (API) is a set of definitions and protocols for communication through the serialization and de-serialization of objects.

JSON is a language-agnostic medium that we can serialize to and de-serialize from!

How do we make an API request?

- Your browser!
- cURL
- Postman
- JavaScript

Try making an API request to...

- https://v2.jokeapi.dev/joke/Any?safe-mode
- https://cs571api.cs.wisc.edu/rest/f25/ice/chili

Your Turn!

Fetch from the Jokes and CS571 APIs using...

- Your browser!
- Postman

Note: You can't get CS571 API data directly in your browser; you must pass a `X-CS571-ID` !

Request for JSON

- Requests can be `synchronous` or `asynchronous`.
- `asynchronous` requests are recommended as they are *non-blocking*. Typically, they use a *callback* when the data is received and lets the browser continue its work while the request is made.

More on synchronous/asynchronous requests

Making Asynchronous HTTP Requests

Two key methods: `XMLHttpRequest` (old) and `fetch` (new). `fetch` is a promise-based method.

- `Promise` objects represent the eventual completion/failure of an *asynchronous* operation and its resulting value.
- `async` / `await` — keywords to indicate that a function is *asynchronous* -- will learn later!

fetch()

```
fetch(url)
  .then((response) => response.json()) // ignore the headers, get the data
  .then((data) => {                    // implictly parses JSON to JS Object
    console.log("Data received!");
    console.log(data);
  })
  .catch(error => console.error(error)) // Print errors (if any)
```

Fetching Jokes

`fetch()`

Fetch happens *asynchronously*.

```
fetch(url)
  .then((response) => response.json())
  .then((data) => {
    console.log("I won't be printed 'til later!")
    console.log("Data takes time to fetch!")
  })
  .catch(error => console.error(error))

console.log("I will print first!")
```

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`fetch()` from a CS571 API

```
fetch(url, {
  method: "GET",
  headers: {
    "X-CS571-ID": "bid_xxxxxxxxxxx" // generally bad practice
  }
})
.then(response => response.json())
.then(data => {
  // Do something with the data
})
.catch(error => console.error(error)) // Print errors
```

There is a database that maps your BID to a WISC ID!

`fetch()` from a CS571 API

```
fetch(url, {
  method: "GET",
  headers: {
    "X-CS571-ID": CS571.getBadgerId() // better!
  }
})
.then(response => response.json())
.then(data => {
  // Do something with the data
})
.catch(error => console.error(error)) // Print errors
```

There is a database that maps your BID to a WISC ID!

Callback Functions

`then` and `catch` take a *callback function* as an argument.

Definition: A *callback function* (sometimes called a *function reference*) is passed into another function as an argument, which is then invoked inside the outer function to complete a routine or action.

More on callback functions

Callback Functions

Reminder: All of these define a function.

```
function fToC (temp) {
  return (temp - 32) * 5/9;
}
```

A *function definition*

```
const fToC = (temp) => {
  return (temp - 32) * 5/9;
}
```

An *arrow function*

```
const fToC = (temp) => (temp - 32) * 5/9
```

With an *implicit return*

Your Turn!

Let's fetch some recipes.

https://cs571api.cs.wisc.edu/rest/f25/ice/chili
https://cs571api.cs.wisc.edu/rest/f25/ice/pasta
https://cs571api.cs.wisc.edu/rest/f25/ice/pizza

Remember: You'll need a Badger ID to access these!

Badger IDs

You *cannot* view CS571 API data from your browser!

You need to send an `X-CS571-ID` header with each request. You can get your CS571 Badger ID with `CS571.getBadgerId()`, which grabs your Badger ID from `localStorage`, a concept we'll discuss later in the semester!

DOM Manipulation

Earlier, we learned how to get elements from the DOM and change their text.

```
let title = document.getElementById("articleTitle");
title.innerText = "My New Title!"
```

What if we want to *add* elements?

```
title.innerHTML = "<strong>My New Title!</strong>"
```

DOM Manipulation

We typically prefer to *not* use `innerHTML` when adding things to the DOM. Why?* Instead, we would...

```
const title = document.getElementById("articleTitle")
const newNode = document.createElement('strong')
newNode.innerText = 'My New Title!'
const newlyInsertedNode = title.appendChild(newNode);
```

* We could still safely clear the existing text with `title.innerHTML = ''`

Your Turn!

Let's display recipes to the page *dynamically*.

Questions?