香港中文大學
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JS DOM, EVENTS, AND OBJECTS

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Building Web Applications

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OUTLINE

- The DOM Tree
- Accessing HTML elements
- Navigation
- Events
- Objects
- Something about `this`
- JSON
- The jQuery legacy

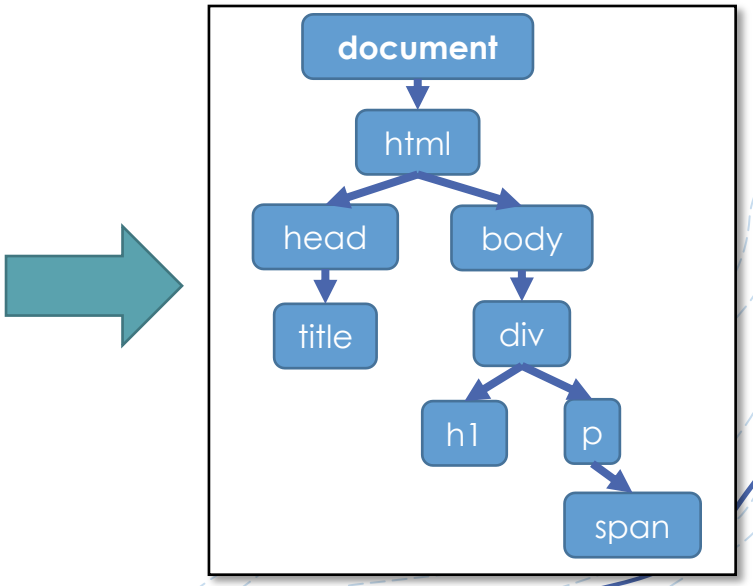
THE DOM TREE

- To render an HTML document, the browser builds a tree data structure as the **`window.document`** object
  - The **`window`** object represents the browser window
  - All global variables and functions are by default *members* of **`window`** without explicitly mentioning
    - **`document`** refers to **`window.document`**
- The tree is built when the page is loaded, only *once*!

THE DOM TREE

- The tree is called the ***Document Object Model*** (DOM)
  - Objects of all elements
  - Properties of elements
  - Methods to access
  - Events
- DOM Level 4 (2015)
  → Living Standard
  of DOM by WHATWG

```
<html>
<head>
  <title>Hello!</title>
</head>
<body>
  <div>
  <h1>Nice try</h1>
  <p>DOM is <span>fun</span>!</p>
  </div>
</body>
</html>
```



ACCESSING HTML ELEMENTS

- Selectors API
  - Using the same selectors as in CSS, returning only the first match: **`querySelector()`**
  - Similar but returning all matches as a list: **`querySelectorAll()`**
- Traditional techniques
  - Document method – specifying unique ID in document: **`getElementById()`**
  - Element methods – can search for children within one element, as a list: **`getElementsByClassName()`**, **`getElementsByTagName()`**
- Object collections
  - E.g., **`document.images`**, **`document.links`**, **`document.scripts`**

ACCESSING HTML ELEMENTS

- Contents and properties can be fetched or modified
  - `element.innerHTML` – contents including tags
  - `element.innerText` – contents in plain text
  - `element.value` – only for form elements
  - `element.attribute` – setting HTML attributes directly (e.g. class)
  - `element.style.property` – setting CSS property directly
    - CSS property in ***camelCase***, e.g. `border-left` → **`borderLeft`**

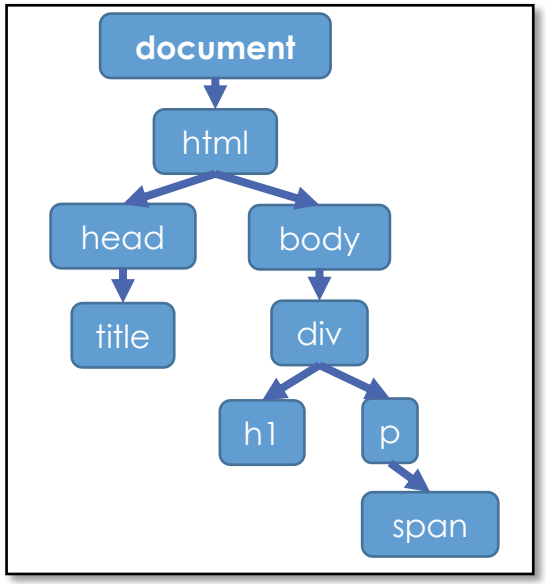
ACCESSING HTML ELEMENTS

```
<h2 id="head">Coding for the web</h2>
  <p id="para1">Something about <span>DOM</span></p>
<p id="para2">Another paragraph...</p>
<input type="text"><input type="text">

<script>
// get the <span> inside id=para1, change CSS bg color
document.getElementById("para1")
.getElementsByTagName("span")[0]
.style.backgroundColor = "lightblue";

// get the id attribute of h2
console.log(document.querySelector("h2").id);

// change the value entered in the text input box
document.querySelectorAll("input")[0].value = "Hello";
document.querySelectorAll("input")[1].value = "World";
</script>
```

https://codepen.io/chuckjee/pen/MWbgobd

NAVIGATION

- Navigation between nodes
  - `parentNode`
  - `children[`*`node#`*`]`
  - `firstElementChild`
  - `lastElementChild`
  - `nextElementSibling`
  - `previousElementSibling`

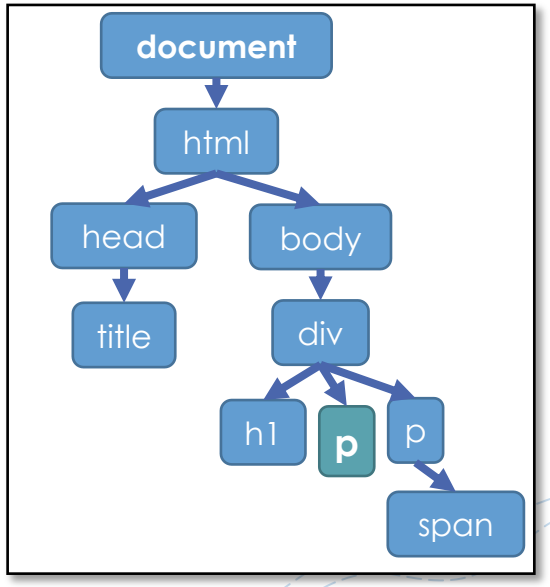


- Node editing
  - `createElement()`
  - `createTextNode()`
  - `appendChild()`
  - `insertBefore()`
  - `remove()` / `removeChild()`
  - `replaceChild()`

NAVIGATION

https://codepen.io/chuckjee/pen/qBqWjvj

```
<div>
  <h1>Nice try</h1>
  <p>DOM is <span>fun</span>!</p>
</div>

<script>
// these are document methods!
let para = document.createElement("p");
let node = document.createTextNode("Are you sure?");
para.appendChild(node);

let child = document.querySelector("div").lastElementChild;
document.querySelector("div").insertBefore(para, child);
</script>
```



EVENTS

- Events have a vital role for web interaction, e.g.
  - `onclick`
  - `onload` / `onunload`
  - `onchange`
  - `onmouseover` / `onmouseout`
  - `onfocus`
- Either specify event to object, or use the `addEventListener()` method

EVENTS

https://codepen.io/chuckjee/pen/MWbgvYy

```
<p id="p1">Click me</p>
<p id="p2">Mouseover me</p>
<input type="text" value="Change me">

<script>
// show an alert box on click
document.querySelector("#p1").onclick = function() { alert("Clicked!"); }

// change CSS sytle on mouse over/out
document.querySelector("#p2").onmouseover =
  function() { document.querySelector("#p2").style.color = "red"; }
document.querySelector("#p2").onmouseout = () =>
  document.querySelector("#p2").style.color = "blue"; // similar idea but with arrow function

// print to console when input box is changed
document.querySelector("input").onchange = () =>
console.log(document.querySelector("input").value);
</script>
```

OBJECTS

- JavaScript is not really an object-oriented programming language, and its objects are basically…
  - A ***collection of properties***: key/value pair, e.g.
    - `{ name: "John", age: 18 }`
- The key must be a string or symbol
  - `obj[1]` and `obj['1']` are equivalent
  - `obj.1` is not possible because `1` is not a valid identifier
  - But `obj.x` is all right, meaning `obj['x']`
- The value can be anything, even another object or `null`

CREATING OBJECTS

- Many ways to create an object
  - Use ***literal notation***

```
let stu1 = { name:"John", age:18 }   // the most commonly seen method
```

  - Define properties directly

```
let stu1 = new Object();
stu1.name = "John";                  // equivalent to stu1['name']
stu1.age = 18;                       // equivalent to stu1['age']
```

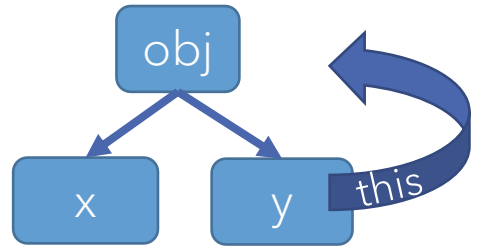
  - Use a constructor (function/class)

```
function Student(name, age) {        // this is slightly different
  this.name = name;                  // from the examples above
  this.age = age;
}
let stu1 = new Student("John", 18); // instantiate Student
let stu2 = new Student("Jim", 19);  // i.e. make a new instance
```

SOMETHING ABOUT `this`

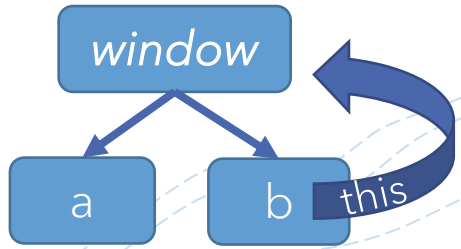
- Usually, this refers to the parent object

```
let obj = {
    x: 10,
    y: function() { console.log(this.x) }
}
obj.y(); // outputs 10
```



- What if **`obj.y`** is copied to another local/global variable?

```
x = 20;
let a = obj.y;
b = obj.y;
a(); // outputs 20
b(); // outputs 20
```



SOMETHING ABOUT `this`

- In most cases, the keyword **`this`** in a function refers to the object through which the function is being called
  - See: *https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/this*
- Note: It is special for ***arrow functions***!
  - See: *https://www.codementor.io/@dariogarciamoya/understanding-this-in-javascript-with-arrow-functions-gcpjwfyuc*

JSON: JAVASCRIPT OBJECT NOTATION

- Getting popular as a lightweight data-interchange format
  - `Content type: application/json`
- Closely resembles a subset of JavaScript syntax, although it is not a strict subset
- String literals within a JSON string must be enclosed by double quotes
- Support nested structures
  - e.g., objects within objects, array of objects, etc.
- For the detailed syntax of JSON, *see:* *http://json.org*

JSON

- Two ways of JSON representation:
  - A collection of name/value pairs – Object literal
    - In various languages, this can be realized as an object, record, struct, dictionary, hash table, keyed list, or associative array (***more common***)
      - e.g.: An object with three properties named **a**, **b**, and **c**

```
{ "a":1, "b":2, "c":3 }
```

  - An ordered list of values – Array literal
    - In most languages, this is realized as an array, vector, list, or sequence
      - e.g.: An array of three integers and one string value

```
[ 1, 2, 3, "value #4" ]
```

- Note: JSON supports UTF-8 for non-ASCII characters

USING JSON IN JAVASCRIPT

- JSON is a piece of ***string***, but can be easily parsed into JS objects

```
let myJSONtext = '{"name":"John", "age": 18}'; // pay attention to quotes!
```

- Decode JSON encoded data

```
let myData = JSON.parse(myJSONtext);
// returning a String, Number, Boolean, Null, Object, or Array
```

- Encode data

```
let myJSONText = JSON.stringify(myData); // returning a string
```

THE JQUERY LEGACY

- *jQuery* has been around in the web for over 10 years, yet fading out now because of the improvement in JS…
- jQuery is a JavaScript library built ***on top of*** DOM
  - Performance: DOM performs faster than jQuery
  - Ease-of-use: jQuery is convenient!
    - less code to write, uniform interface, functionalities, selectors, etc.
  - Cross-browser compatibility: jQuery is better perhaps
- Which one to use? What is the difference?
  - *http://youmightnotneedjquery.com*

READ FURTHER…

w3schools.com JavaScript HTML DOM Tutorial

https://www.w3schools.com/js/js_htmldom.asp

MDN Introduction to DOM

https://developer.mozilla.org/en-US/docs/Web/API/Document_Object_Model/Introduction

MDN: Working with JSON

https://developer.mozilla.org/en-us/docs/Learn/JavaScript/Objects/JSON