

# Document Object Model (DOM)

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# Browser JavaScript interface to HTML document

- HTML document exposed as a collection of JavaScript objects and methods

The **D**ocument **O**bject **M**odel (DOM)

- JavaScript can query or modify the HTML document
- Accessible via the JavaScript global scope, aliases:

`window`

`this` (When not using `'use strict';`)

# DOM hierarchy

- Rooted at `window.document` (`html` tag)
- Follows HTML document structure

`window.document.head`

`window.document.body`

- Tree nodes (DOM objects) have tons (~250) of properties, most private

Objects (representing elements, raw text, etc.) have a common set of properties and methods called a DOM "Node"

# DOM Node properties and methods

- Identification

`nodeName` property is element type (uppercase: `P`, `DIV`, etc.) or `#text`

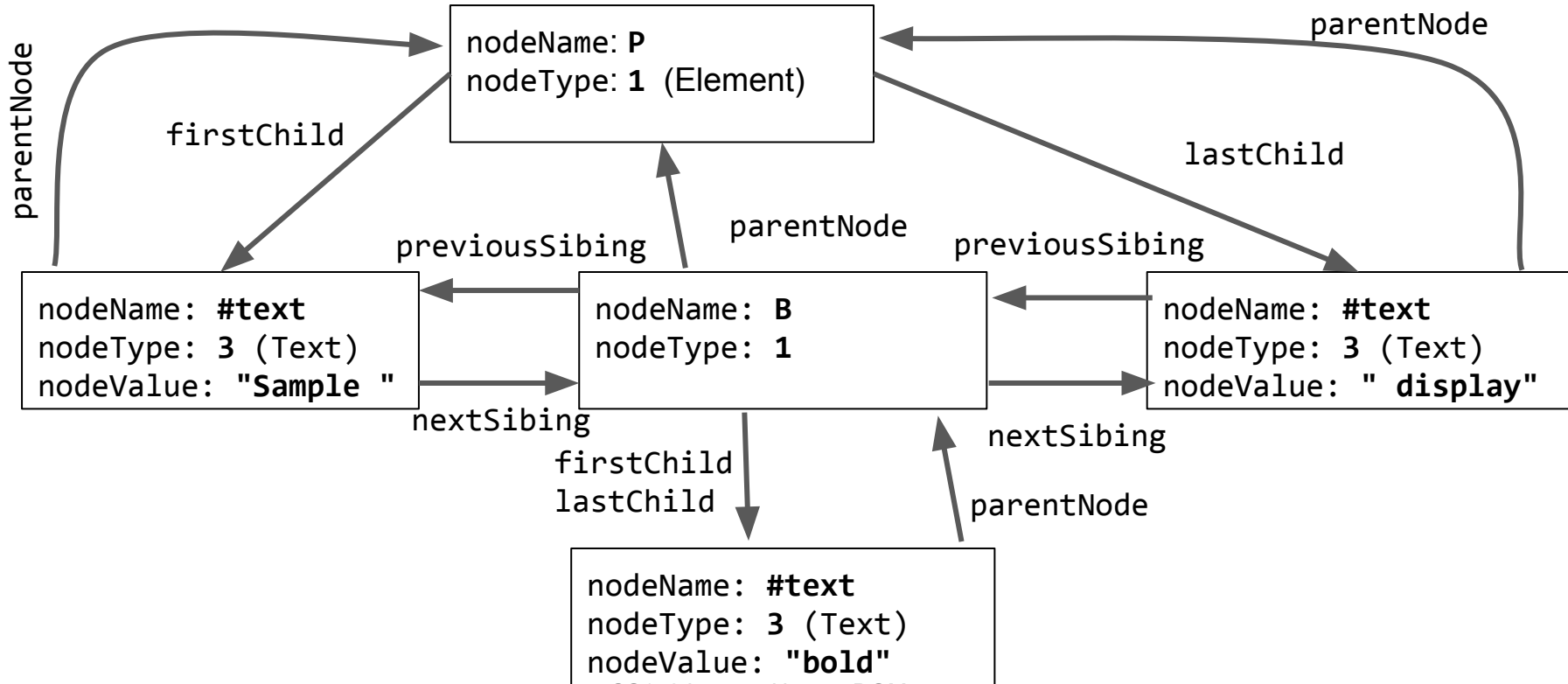
- Encode document's hierarchical structure

`parentNode`, `nextSibling`, `previousSibling`, `firstChild`, `lastChild`.

- Provide accessor and mutator methods

E.g. `getAttribute`, `setAttribute` methods, etc..

<p>Sample <b>bold</b> display</p>



# Accessing DOM Nodes

- Walk DOM hierarchy (not recommended)  
`element = document.body.firstChild.nextSibling.firstChild;`  
`element.setAttribute(...`
- Use DOM lookup method. An example using ids:  
HTML: `<div id="div42">...</div>`  
`element = document.getElementById("div42");`  
`element.setAttribute(...`
- Many: `getElementsByClassName()`, `getElementsByTagName()`, ...
  - Can start lookup at any element:  
`document.body.firstChild.getElementsByTagName()`

# More commonly used Node properties/methods

- `textContent` - text content of a node and its descendants

Previous slide example: P Node `textContent` is "Sample bold display"

- `innerHTML` - HTML syntax describing the element's descendants.

Previous slide example: P Node `innerHTML` is "Sample **bold** display"

- `outerHTML` - similar but includes element "<p>Sample **bold** display</p>"
- `getAttribute()/setAttribute()` - Get or set the attribute of an element

# Common DOM mutating operations

- Change the content of an element

```
element.innerHTML = "This text is <i>important</i>";
```

Replaces content but retains attributes. DOM Node structure updated.

- Change an `<img tag src attribute (e.g. toggle appearance on click)`

```
img.src="newImage.jpg";
```

- Make element visible or invisible (e.g., for expandable sections, modals)

Invisible: `element.style.display = "none";`

Visible: `element.style.display = "";`



# DOM and CSS interactions

- Can update an element's class

```
element.className = "active";
```

- Can update element's style

```
element.style.color = "#ff0000";    // Not preferred way!
```

- Can also query DOM by CSS selector

```
document.querySelector() and document.querySelectorAll()
```

# Changing the Node structure

- Create a new element (can also `cloneNode()` an existing one)

```
element = document.createElement("P");  
or  
element = document.createTextNode("My Text");
```

- Add it to an existing one

```
parent.appendChild(element);  
or  
parent.insertBefore(element, sibling);
```

- Can also remove Nodes: `node.removeChild(oldNode);`
- But, setting innerHTML can be simpler and more efficient.

# More DOM operations

- Redirect to a new page

```
window.location.href = "newPage.html";
```

Note: Can result in JavaScript script execution termination

- Communicating with the user

```
console.log("Reached point A");    // Message to browser log
```

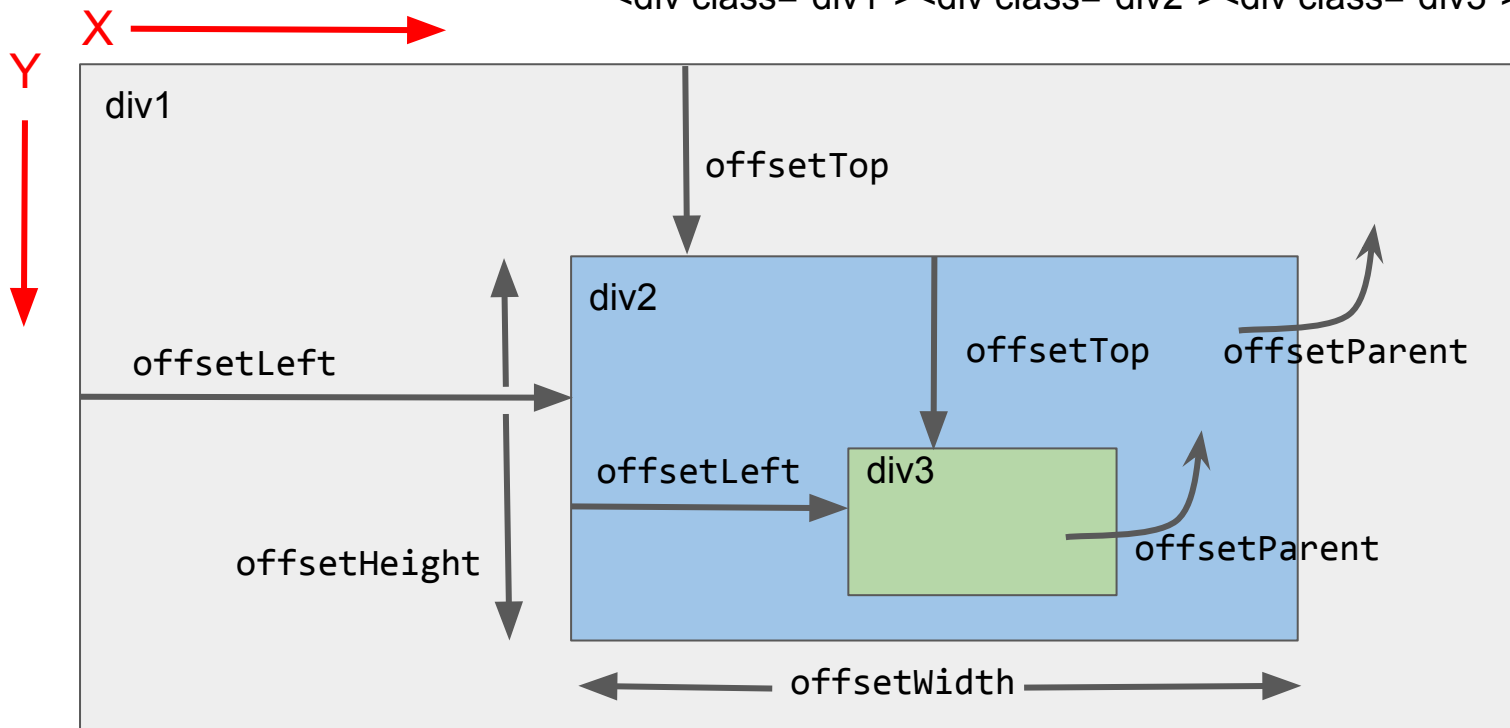
```
alert("Wow!");  confirm("OK?");    // Popup dialog
```

# DOM's Coordinate System

- The screen origin is at the upper left; y increases as you go down
- The position of an element is determined by the upper-left outside corner of its margin
- Read location with `element.offsetLeft`, `element.offsetTop`
- Coordinates are relative to `element.offsetParent`, which is not necessarily the same as `element.parentNode`

# DOM Coordinates

```
<div class="div1"><div class="div2"><div class="div3"></div></div></div>
```



# Positioning elements

- Normally elements are positioned automatically by the browser as part of the document
- To pull an element out of the document flow and position it explicitly:  

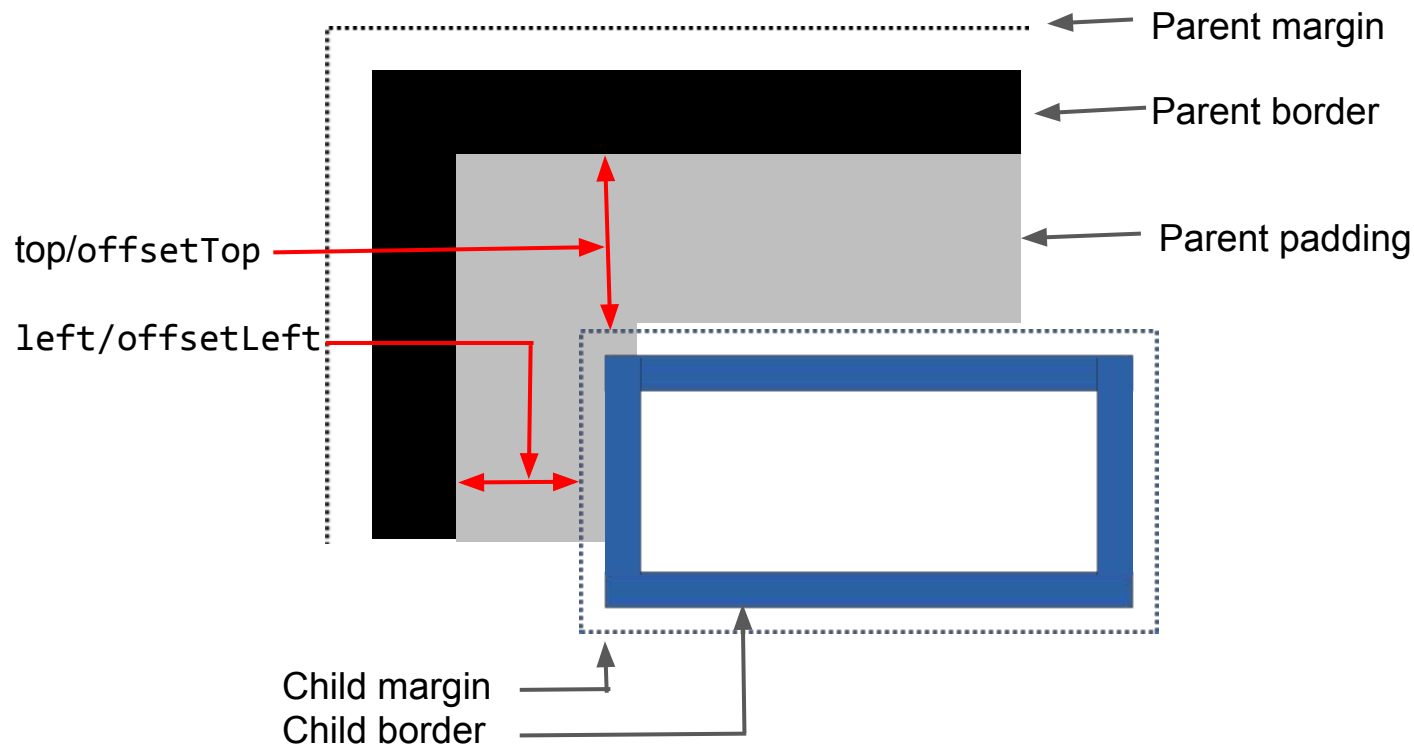
```
element.style.position = "absolute"; // anything but "static"  
element.style.left = "40px";  
element.style.top = "10px";
```

"absolute" - the element no longer occupies space in the document flow.
- The origin inside an offsetParent (for positioning descendants) is just inside the upper-left corner of its border.

# Positioning context

- Each element has an `offsetParent` (some ancestor element).
- When an element is positioned, coordinates such as `element.style.left` are relative to its `offsetParent`.
- Default `offsetParent` is the `<body>` element.
- Some elements define a new positioning context:
  - `position` CSS attribute is `absolute` (element is explicitly positioned)
  - `position` CSS attribute is `relative` (element is positioned automatically by the browser in the usual way)
  - This element will become the `offsetParent` for all its descendents (unless overridden by another positioning context)

# Positioning Children





# Element dimensions

- Reading dimensions: `element.offsetWidth` and `element.offsetHeight`  
Include contents, padding, border, but not margin
- Updating dimensions: `element.style.width` and `element.style.height`

# Positioning

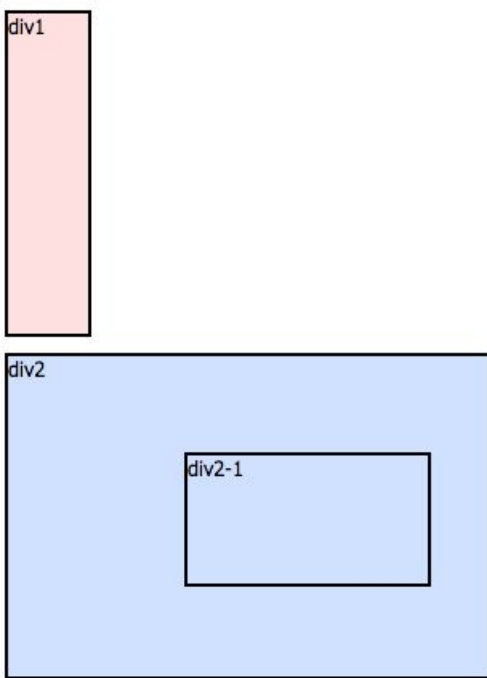
```
<body>
  <div id="div1">
    <p>div1</p>
  </div>
```

```
#div1 {
  width: 50px;
  height: 200px;
  background: #ffe0e0;
}
```



# Positioning

```
...  
<div id="div2">  
  <p>div2</p>  
  <div id="div2-1">  
    <p>div2-1</p>  
  </div>  
</div>  
#div2 {width: 300px; height:  
200px; position: relative;  
background: #d0e0ff;}  
#div2-1 {width: 150px; height:  
80px; position: absolute;  
top: 50px; left: 100px;  
background: #d0e0ff;}
```



# Positioning

...

```
<div id="div3">  
  <p>div3</p>  
  <div id="div3-1">  
    <p>div3-1</p>  
  </div>  
</div>
```

```
#div3 {width: 300px; height:  
200px; background: #ffffe0;}
```

```
#div3-1 {width: 150px; height:  
80px; position: absolute; top:  
50px; left: 100px; background:  
#ffffe0;}
```

