Dynamic Webpages

SWE 432, Fall 2017
Design and Implementation of Software for the Web
Today

• How to layout elements using CSS

• How to interact with HTML and CSS using frontend JavaScript

• Next time: making and responding to HTTP requests
CSS "Box" Model

- Boxes, by default, are sized *just* large enough to fit their contents.
- Can specify sizes using px or %
  - % values are relative to the container dimensions
- margin: 10px 5px 10px 5px; (clockwise order - [top] [right] [bottom] [left])
- border: 3px dotted #0088dd; ([width] [style] [color])
  - style may be solid, dotted, dashed, double, groove, ridge, inset, outset, hidden / none
Centering content

• How do you center an element inside a container?

• Step 1: Must first ensure that element is *narrower* than container.
  • By default, element will expand to fill entire container.
  • So must usually explicitly set width for element.

• Step 2: Use *auto* value for left and right to create equal gaps.
Visibility and layout

- Can force elements to be inline or block element.
  - display: inline
  - display: block

- Can cause element to not be laid out or take up any space
  - display: none

- Very useful for content that is dynamically added and removed.

- Can cause boxes to be invisible, but still take up space
  - visibility: hidden;
Positioning schemes

Normal flow (default)

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Block level elements appear on a new line. Even if there is space, boxes will not appear next to each other.

Relative positioning

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p.example {
  position: relative;
  top: 10px;
  left: 100px;
}

Element shifted from normal flow. Position of other elements is not affected.

Absolute positioning

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h3 {
  position: absolute;
  background-color: LightGray;
  left: 350px;
  width: 250px;
}

Element taken out of normal flow and does not affect position of other elements. Moves as user scrolls.

Fixed positioning

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h3 {
  position: fixed;
  background-color: LightGray;
  left: 40px;
  width: 250px;
}

Element taken out of normal flow and does not affect position of other elements. Fixed in window position as user scrolls.

Floating elements

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h3 {
  float: left;
  background-color: LightGray;
  left: 40px;
  width: 250px;
}

Element taken out of normal flow and position to far left or right of container. Element becomes block element that others flow around.
Stacking elements

- Elements taken out of normal flow may be stacked on top of each other
- Can set order with z-index property
  - Higher numbers appear in front
- Can set opacity of element, making occluded elements partially visible

```css
h3 {
  position: absolute;
  background: LightGray;
  opacity: 0.6;
  z-index: 10;
}
```
Transform - examples

```
.box {
    width: 100px;
    height: 100px;
    color: White;
    text-align: center;
    background-color: #0000FF;
}

.transform1 {
    transform: translate(12px, 50%);
}

.transform2 {
    transform: scale(2, 0.5);
}

.transform3 {
    transform: rotate(0.3turn);
}

.transform4 {
    transform: skew(30deg, 20deg);
}
```

• Can modify coordinate space of element to rotate, skew, distort
Transitions

- transition: [property time], ..., [property time]
  - When new class is applied, specifies the time it will take for each property to change
  - Can use *all* to select all changed properties
Fixed width vs. liquid layouts

• Fixed width
  • Use width="[num]px" to force specific sizes
  • Allows for tightest control of look and feel
  • But can end up with extra whitespace around edge of web page

• Liquid layout
  • Use width="[num]%" to size relative to container sizes
  • Pages expand to fill the entire container size
  • Problems
    • Wide windows may create long lines of text can be difficult to read
    • Very narrow windows may squash words, breaking text onto many lines
  • (Partial) solution
    • Can use min-width, min-height, max-width, max-height to set bounds on sizes
Designing for mobile devices

- Different devices have different aspect ratios.

- Important to test for different device sizes.

- May sometimes build alternative layouts for different device sizes.

- Using specialized controls important.

- Enables mobile browsers to use custom device-specific widgets that may be much easier to use.
CSS Best Practices

• When possible, use CSS to declaratively describe behavior rather than code
  • Easier to read, can be optimized more effectively by browser

• Don’t repeat yourself (DRY)
  • Rather than duplicating rules, create selectors to style all related elements with single rule

• CSS should be readable
  • Use organization, indentation, meaningful identifiers, etc.
Activity: Build a simple homepage

- In groups of 2
- Build a simple static homepage
  - Should have
    - A title
    - Tags: `<table><div><span><a>`
    - Use CSS selectors to apply styles
Deployment: serving static content from Node

```javascript
const express = require('express');
const app = express();

app.use(express.static('public'));

app.listen(3000, function () {});
```

- Usually have specific directory where static content is located
  - ONLY want content in the folder to be directly visible to clients
  - Security vulnerability to enable clients to download server side scripts, as it makes it possible to build targeted attacks
  - Directory can be called anything. Often called public or client
Demo: Hello world static content
Frontend JavaScript

• Static page
  • Completely described by HTML & CSS
  • May have interactivity (e.g., CSS transforms, hover pseudo-classes)
  • But described in HTML & CSS

• Dynamic page
  • Adds interactivity, updating HTML based on user interactions
Strict mode

• In order to use ES6 features, need to force browser to use current version of JS
• "use strict";
  • Should be first statement in every script tag.
  • ES6 modules are always in strict mode
• Turns mistakes into errors
  • Code that is illegal but tolerated by browser now throws an exception
• Goal: if a typo creates behavior that is never reasonable, throw an error

DOM: Document Object Model

- API for interacting with HTML browser
- Contains objects corresponding to every HTML element
- Contains global objects for using other browser features

Reference and tutorials
Global DOM objects

- window - the browser window
  - Has properties for following objects (e.g., `window.document`)
  - Or can refer to them directly (e.g., `document`)
- document - the current web page
- history - the list of pages the user has visited previously
- location - URL of current web page
- navigator - web browser being used
- screen - the area occupied by the browser & page
Working with popups

- alert, confirm, prompt
- Create *modal* popups
Working with location

- Some properties
  - `location.href` - full URL of current location
  - `location.protocol` - protocol being used
  - `location.host` - hostname
  - `location.port`
  - `location.pathname`

- Can navigate to new page by updating the current location
  - `location.href = '[new URL]';`
Traveling through history

- history.back(), history.forward(), history.go(delta)

- What if you have an SPA & user navigates through different views?
  - Want to be able to jump between different views *within* a single URL

- Solution: manipulate history state
  - Add entries to history stack describing past views
  - Store and retrieve object using history.pushState() and history.state
DOM Manipulation

Multiply two numbers

\[ 2 \times 3 = 6 \]

`function multiply()
{
  var x = document.getElementById('num1').value;
  var y = document.getElementById('num2').value;
  var productElem = document.getElementById('product');
  productElem.innerHTML = x * y;
}

var compute = document.getElementById('compute');
compute.addEventListener('click', multiply);

“Get compute element”

“When compute is clicked, call multiply”

May choose any event that the compute element produces. May pass the name of a function or define an anonymous function inline.
DOM Manipulation

Multiply two numbers

3  *  4  =  12

```javascript
function multiply() {
  var x = document.getElementById('num1').value;
  var y = document.getElementById('num2').value;
  var productElem = document.getElementById('product');
  productElem.innerHTML = '<b>' + x * y + '</b>;
}
document.getElementById('compute').addEventListener('click', multiply);
```

“Get the current value of the num1 element”

“Set the HTML between the tags of productElem to the value of x * y”

Manipulates the DOM by programmatically updating the value of the HTML content. DOM offers accessors for updating all of the DOM state.
DOM Manipulation Pattern

- Wait for some event
  - click, hover, focus, keypress, ...
- Do some computation
  - Read data from event, controls, and/or previous application state
  - Update application state based on what happened
- Update the DOM
  - Generate HTML based on new application state
Examples of events

• Form element events
  • change, focus, blur
• Network events
  • online, offline
• View events
  • resize, scroll
• Clipboard events
  • cut, copy, paste
• Keyboard events
  • keydown, keypress, keypup
• Mouse events
  • mouseenter, mouseleave, mousemove, mousedown, mouseup, click, dblclick, select
Loading pages

• What is the output of the following?

```html
<script>
    document.getElementById('elem').innerHTML = 'New content';
</script>

<div id="elem">Original content</div>
```
Loading pages

- Code in script tags will run in the order in which it is contained in the page
- Solution: should put script tags at the bottom of the body after elements in the document.
The Event Loop

• Remember that JS is **event-driven**
  
  ```javascript
  $(window).on('hashchange', function () {
    show(location.hash);
  });
  ```

• Event loop is responsible for dispatching events when they occur

• Main thread for event loop:
  
  ```javascript
  while(queue.waitForMessage()) {
    queue.processNextMessage();
  }
  ```
Event Dispatching

- Each event target can have (0...n) listeners registered for any given event type, called in arbitrary order
- What happens with nested elements?

What happens when we click in button?
What happens when we click in **button**?

Called

- **Listener1**: `body` `on` `click`
- **Listener2**: `form` `on` `click`
- **Listener3**: `button` `on` `click`

This is the default behavior
Enable event capturing when you register your listener:
```
function myListener(event) {
    // My event handler code
}

var body = document.body;
var form = document.querySelector('form');
var button = document.querySelector('button');

// Register listeners
body.addEventListener('click', myListener, true);
form.addEventListener('click', myListener, true);
button.addEventListener('click', myListener, true);
```

What happens when we click in `button`?

Called:
- `Listener1: body onClick`
- `Listener2: form onClick`
- `Listener3: button onClick`
Event Dispatching

- An individual listener can stop bubbling/capturing by calling `event.stopPropagation();`
  - Assuming that `event` is the name of your handler’s parameter
- Or in jQuery, simply `return false;`
Activity: Build an interactive page

• In groups of 2 or 3
  • Build a 4 function calculator page that lets users add, delete, multiply divide