

Building User Interfaces

Javascript

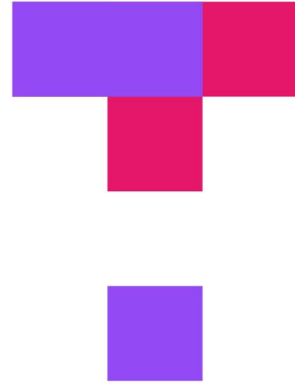
Intermediate Concepts

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What we will learn today?

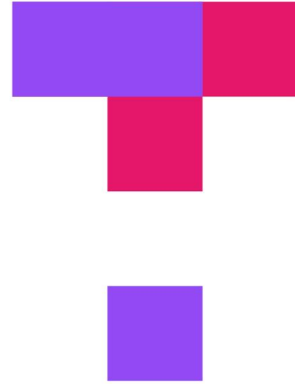
- >> Working with JSON data
- >> <div>, CSS/No-CSS
- >> Working with APIs
- >> Working with component libraries

TopHat Attendance



TOP HAT

TopHat Questions



TOP HAT

Working with JSON data

What is JSON?

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

JSON can include any JS data type. Do you remember how many types there are?

```
{ string : value, .....
```

Refresher: JS Objects

Definition: Objects are unordered collection of related data of primitive or reference types.

Object elements are defined using key: value statements.

```
var teachingAssistant = {  
  firstName: "Andy",  
  lastName: "Schoen",  
  age: 28  
}  
teachingAssistant;  
> {firstName: "Andy", lastName: "Schoen", age: 28}
```

JSON Objects:

```
{ "firstName": "Andrew",  
  "lastName": "Schoen",  
  "role": "TA",  
  "email": "andrew.schoen@wisc.edu" }
```

JSON Arrays:

```
{ "TAs" : [  
(0) { "Name": "Andrew Schoen" , "Year": "Fourth" },  
(1) { "Name": "Hanna Strohm" , "Year": "First" } ] }
```


How to use JSON data¹

```
<p id="TANames"></p>
```

```
var text = '{ "TAs": [' +  
  '{ "Name": "Andrew Schoen" , "Year": "Fourth" },' +  
  '{ "Name": "Hanna Strohm" , "Year": "First" } ] }';
```

text, defined
within
javascript

```
obj = JSON.parse(text);
```

```
document.getElementById("TANames").innerHTML =  
  "Our TAs are " + obj.TAs[0].Name +  
  " and " + obj.TAs[1].Name + ".";
```

(string concatenation)

¹See a working example in [CodePen](#)

How to request JSON from a server

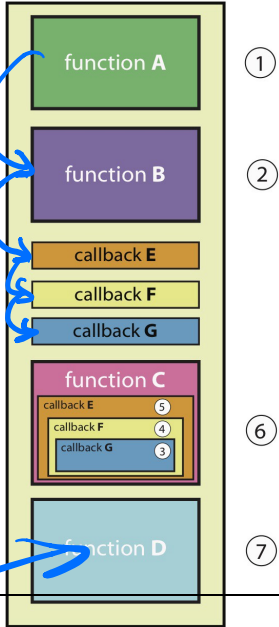
Usually, this is how you do things

- >> Requests can be synchronous OR asynchronous.
- >> asynchronous requests are recommended as they produce a *callback* when the data is received and lets the browser continue its work while the request is made.²
- >> Two methods for asynchronous requests: XMLHttpRequest() (old) and fetch() (new)

²[More on Synchronous/asynchronous Requests](#)

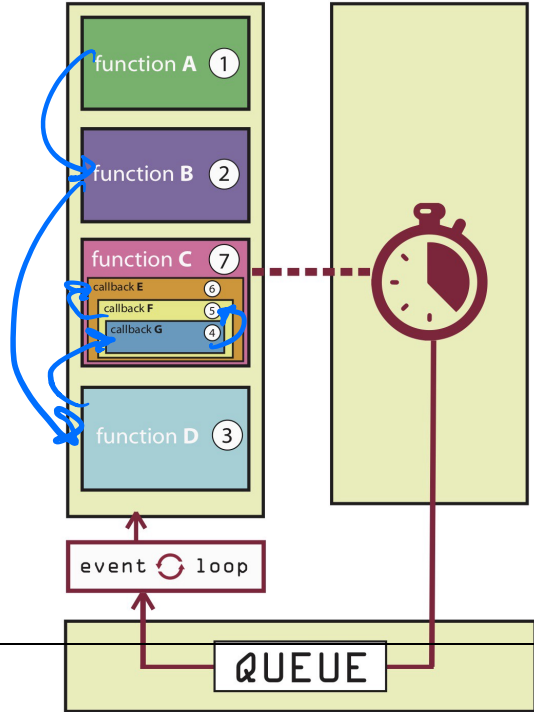
(BLOCKING)
SYNCHRONOUS

STACK



(NON-BLOCKING)
ASYNCHRONOUS

STACK



XMLHttpRequest() ⁴

```
var requestURL = 'tas.json';  
var request = new XMLHttpRequest();  
request.open('GET', requestURL, true); // true for asynchronous  
request.responseType = 'json';  
request.send();
```

⁴[See a working example in CodePen](#)

fetch() ⁵

fetch(url)

```
.then(response => response.json())
```

```
.then(data => {
```

```
  // Do something with the data
```

```
})
```

```
.catch(error => console.error(error)) // Print errors
```



catch case

you can click
these in the
original slides!

⁵ See a working example in [CodePen](#)

parse and stringify

parse() takes a JSON string and returns JS objects.

```
var tas = JSON.parse(request.response);
```

stringify() takes a JS object and returns JSON string.

```
var tas = { "name": "Chris", "age": "38" };
```

```
var tasJSON = JSON.stringify(tas);
```

// now, send the string to a server, etc.

Accessing JS objects from JSON data

```
{ "firstName": "Andrew", "lastName": "Schoen",  
  "role": "TA", "email": "andrew.schoen@wisc.edu" }
```

```
var myTA = JSON.parse(request.response);
```

```
console.log(myTA.firstName);
```

```
console.log(myTA["firstName"]);
```

object



Using JS to render content

Document Object Model

DOM Container

Definition: <div> defines a "division" or a section in an HTML document.

You can place <div>s anywhere on the page and as many as you like.

They will serve as canvases for us to manipulate using JS/React.

Prototype declaration:

```
<div id="name"></div>
```

make up the sections of your web page's canvas

CSS⁶

Consider the following button:

```
<button id="button">Submit</button>
```

We can use CSS to style it:

```
button {  
  background-color: #008CBA;  
  border: none;  
  color: white;  
  padding: 15px 32px;  
  font-size: 16px; }
```

⁶See live at [CodePen](#)

No CSS⁷

Consider the following button:

```
<button id="button">Submit</button>
```

We can also style it using JS:

```
document.getElementById("button").style.color = "white";  
document.getElementById("button").style.padding = "15px 32px";  
document.getElementById("button").style.border = "none";  
document.getElementById("button").style["background-color"] = "#008CBA";  
document.getElementById("button").style["font-size"] = "16px";
```

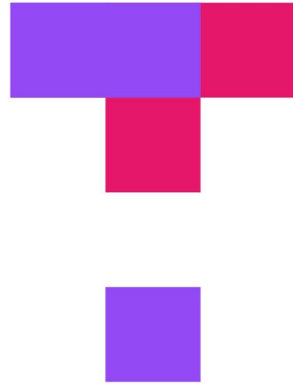
Javascript
uses camel-case
↓
background-color (css)
backgroundColor (js)
→

both
acceptable

⁷ See live at [CodePen](#)

Working with APIs

TopHat Quiz



TOP HAT

What are APIs for Web Development?

Definition: Application Programming Interfaces (APIs) are constructs that facilitate the programming of complex functionality.

APIs abstract away the low-level implementation of tools and services and provide the programmer with easier syntax.

How do APIs work?

Browser APIs (e.g., fullscreen API, screen orientation API, vibration API), vs. **third-party APIs** (e.g., Google Maps API, Twitter API).

JS interacts with APIs over JS objects.

An Example ⁸ ⁹

Play an mp3 file using the *Audio API*:

1. Create the audio and control elements — HTML
2. Create an *audio context* — JS
3. Create an audio element — JS
4. Control the element — JS

⁸ See live at [CodePen](#)

⁹ The version on CodePen will not play the audio due to [Cross-Origin Resource Sharing \(CORS\) errors](#)

Step 1: Create elements

```
<audio src="Haydn_Adagio.mp3" type="audio/mpeg"></audio>  
<button data-playing="false" role="switch" aria-checked="true">  
  <span>Play | Pause</span>  
</button>
```

Step 2: Create an audio context

```
const AudioContext = window.AudioContext;  
const audioContext = new AudioContext();
```

Step 3: Create an audio element

```
const audioElement = document.querySelector('audio');
```

```
const track = audioContext.createMediaElementSource(audioElement);
```

```
track.connect(audioContext.destination);
```

Step 4: Control the element

```
playButton.addEventListener('click', function() {  
  if (audioContext.state === 'suspended') { audioContext.resume();}  
  if (this.dataset.playing === 'false') {  
    audioElement.play();  
    this.dataset.playing = 'true';  
    console.log("Playing...");  
  } else if (this.dataset.playing === 'true') {  
    audioElement.pause();  
    this.dataset.playing = 'false';  
    console.log("Stopped..."); }  
}, false);
```

```
audioElement.addEventListener('ended', () => {  
  playButton.dataset.playing = 'false';  
}, false);
```

Working with Component Libraries

What are Component Libraries?¹⁰

Definition: Software libraries that abstract away the low-level CSS implementation of user-facing elements.

Some popular libraries:

- * Bootstrap
- * Foundation
- * Semantic UI
- * Pure
- * UIKit

¹⁰ [A comparison of the frameworks](#)

Bootstrap

>> Download for offline development

\$ npm install bootstrap

>> BootstrapCDN (Content Delivery Network)

```
<link
  rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css"
  integrity="sha384-ggOyR0iXCbMQz3Xipma34MD+dH/1fQZ84/j6cY/iJTQUOhcWr7x9JvoRxT2MZw1T"
  crossorigin="anonymous">
<script
  src="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/js/bootstrap.min.js"
  integrity="sha384-Jj5mVgypod3pXB1rRibZUAYoIIy60RQ@Vr:jiEaFf/njGzIxFDsF4xoxIM+B07jRM"
  crossorigin="anonymous">
</script>
```

*↑
just grab
it here!*



How Bootstrap Works

Main categories of HTML specification:

- * Layouts ← structural organization
- * Content ← the web content
- * Components ← styled thing that show content
- * Utilities ← preconfigured stylings, etc.

There is much more!

Bootstrap Categories: Layouts

» **Containers** are the most basic element of layouts.

» *Responsive, fixed-width, fluid-width.*

```
<div class="container">
```

```
...
```

```
</div>
```

```
<div class="container-fluid">
```

```
...
```

```
</div>
```

Layouts: Responsive Design¹¹

Definition: Responsive web design (RWD) is an approach that adapts web content to a variety of devices and window or screen sizes.¹²

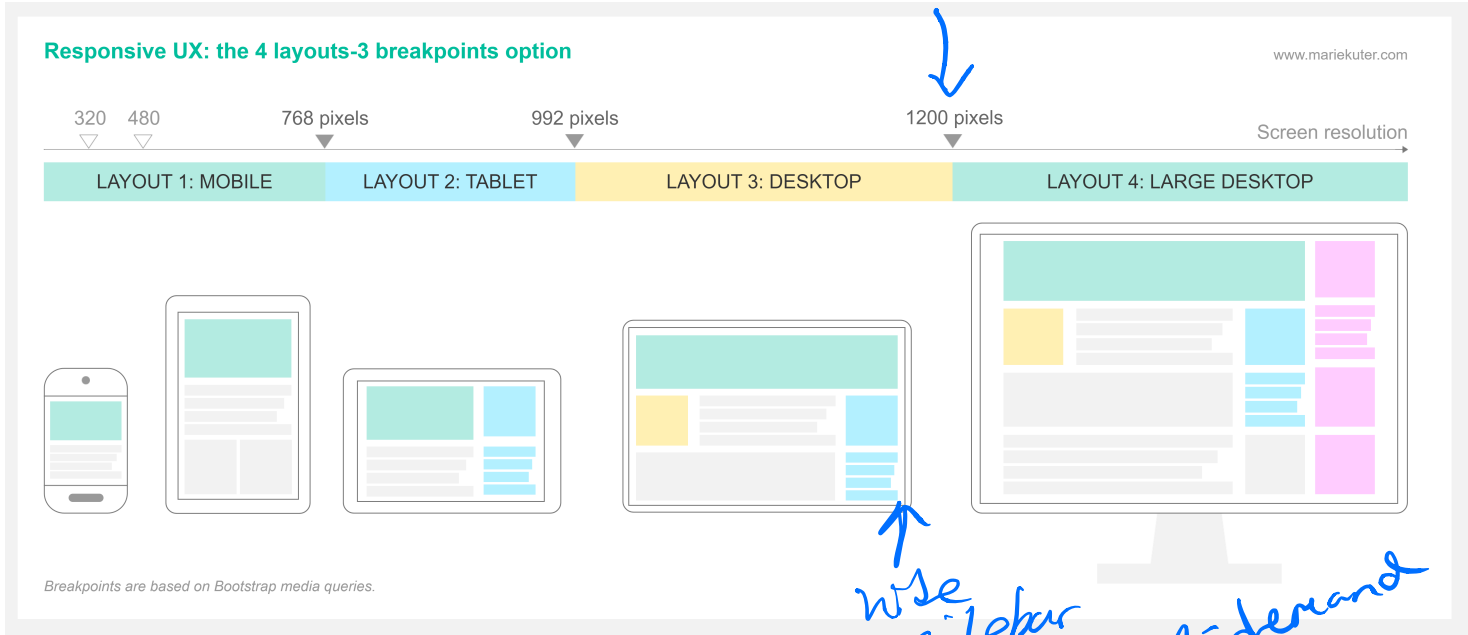
Width breakpoints determine whether the design will scale or be reorganized.

¹¹ [Wikipedia: Responsive Web Design](#)

¹² Image Source: [InVision](#)



breakpoint



¹³ Image Source: Marie Kuter

How does Bootstrap do this?¹⁴

```
// Extra small devices (portrait phones, less than 576px)
// No media query for `xs` since this is the default in Bootstrap

// Small devices (landscape phones, 576px and up)
@media (min-width: 576px) { ... }

// Medium devices (tablets, 768px and up)
@media (min-width: 768px) { ... }

// Large devices (desktops, 992px and up)
@media (min-width: 992px) { ... }

// Extra large devices (large desktops, 1200px and up)
@media (min-width: 1200px) { ... }
```

¹⁴[Bootstrap Layout Overview](#)

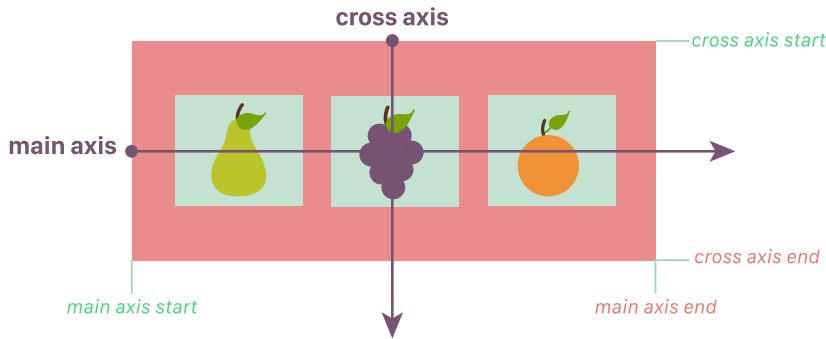
Detour: Responsive Layouts using CSS Flexbox

Definition: A CSS layout mode for responsive content.^{15 16}

```
.flex-container {  
  display: flex;  
}
```

```
<div class="flex-container">  
  <div>Content A</div>  
  <div>Content B</div>  
  <div>Content C</div>  
</div>
```

static size



¹⁵ [Excellent Flexbox Cheatsheet](#)

¹⁶ See example on [CodePen](#)

Layouts: Grids

Basic usage:

```
<div class="row">  
  <div class="col-*-*"></div>  
  <div class="col-*-*"></div>  
</div>
```

Where the first * is *grid class*.

The Bootstrap grid system has four classes:

- » **xs** — phones (widths < 768px)
- » **sm** — tablets (widths >= 768px)
- » **md** — small laptops (widths >= 992px)
- » **lg** — laptops & desktops (widths >= 1200px)

Second * is the number of grid columns (max = 12).^{17 18}

span 1	span 1	span 1	span 1	span 1	span 1	span 1	span 1	span 1	span 1	span 1	span 1
span 4				span 4				span 4			
span 4				span 8							
span 6						span 6					
span 12											

```
<div class="row">  
  <div class="col-sm-4">.col-sm-4</div>  
  <div class="col-sm-4">.col-sm-4</div>  
  <div class="col-sm-4">.col-sm-4</div>  
</div>
```

¹⁷ [W3 Schools: Bootstrap](#)

¹⁸ [See in CodePen](#)

Bootstrap Categories: Content

Content styling includes basic HTML elements, typography, code, images, tables, figures.

Basic HTML examples:

```
<h1></h1>
```

```
<ul></ul>
```

```
<input></input>
```

```
<button></button>
```

Pro Tip: Note the possibility of using, e.g., `<h1>` and `class="h1"`.

Styling of other elements

```

```

```
<table class="table">
```

```
  <thead class="thead-dark">
```

```
    <tr>
```

```
      <th scope="col">...</th>
```

```
    ...
```

```
<div class="table-responsive-sm">
```

```
  <table class="table">
```

```
  ...
```

Bootstrap Categories: Components

Components include all other visual/interactive elements that make up the design, e.g., buttons, forms, navbar, tooltips, etc.

```
<button type="button" class="btn btn-primary">Fill button</button>
```

```
<button type="button" class="btn btn-outline-primary">Outline button</button>
```

```
<div class="btn-group-toggle" data-toggle="buttons">
```

```
  <label class="btn btn-secondary active">
```

```
    <input type="checkbox" checked autocomplete="off"> Switch
```

```
  </label>
```

```
</div>
```

Button Group

button w/ label

Bootstrap Categories: Utilities

Utilities are not elements themselves, but they modify/control other elements, e.g., adding rounded corners to an image.

```

```

```
<div class="shadow p-3 mb-5 bg-white rounded">Shadow</div>
```

Example HomePage²¹

²¹[See in CodePen](#)

Additional Resources

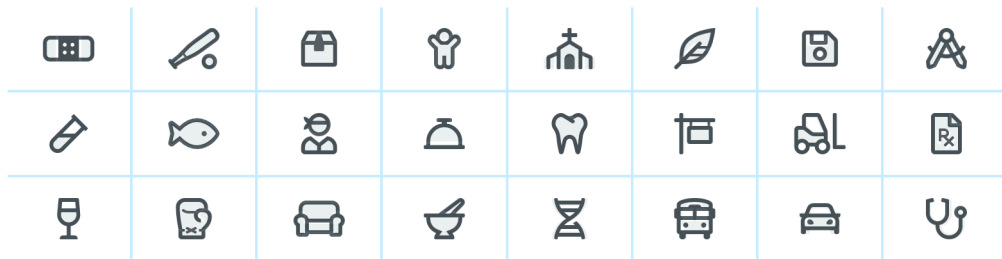
- >> [Bootstrap documentation](#)
- >> [Tutorial Republic](#)
- >> [W3 Schools](#)



very helpful
resources

Assets

Asset libraries, e.g., icons, are usually used in conjunction with frameworks such as Bootstrap.^{19 20}



¹⁹ [Icon libraries](#)

²⁰ [Image source](#)

What we learned today

- >> Working with JSON data
- >> <div>, CSS/No-CSS
- >> Working with APIs
- >> Working with component libraries