

IN4MATX 133: User Interface Software

Lecture 4:

Responsive Design & Javascript 1

Professor Daniel A. Epstein

TA Eunkyung Jo

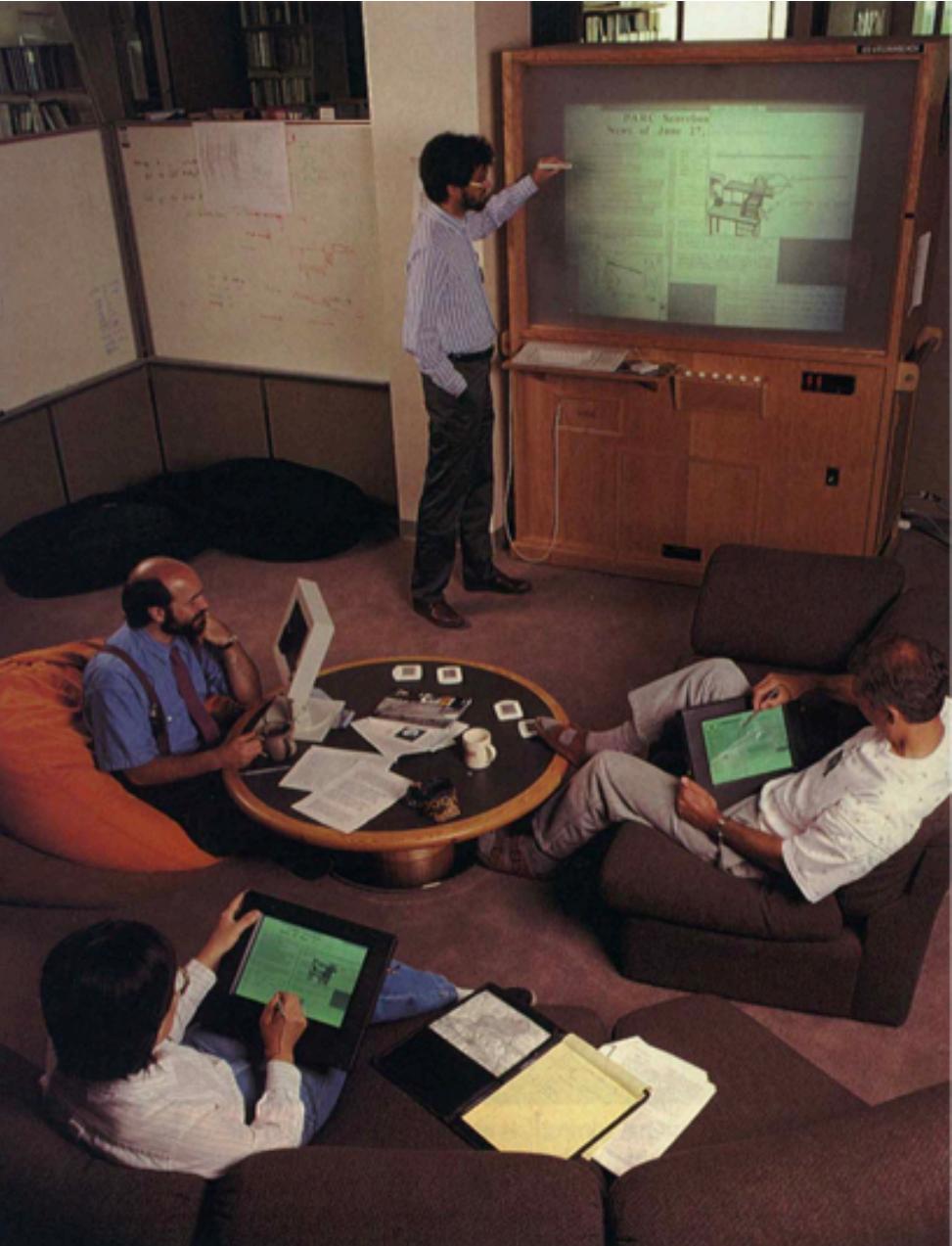
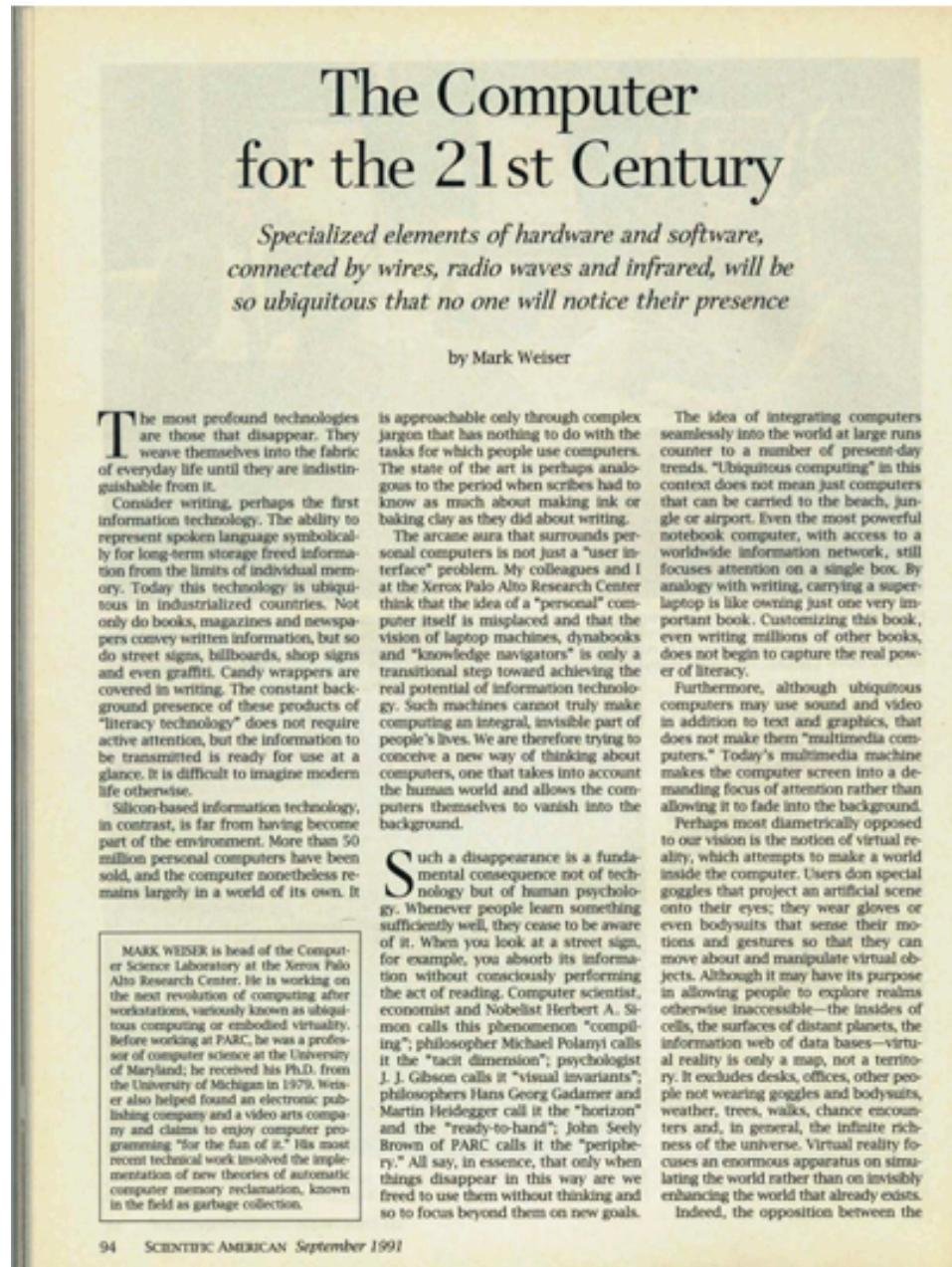
TA Lucas de Melo Silva

Today's goals

By the end of today, you should be able to...

- Describe how responsive and adaptive design differ and when you might prefer one or the other
- Explain the advantages and disadvantages of a mobile-first design
- Begin implementing responsive designs with Bootstrap
- Explain the role of JavaScript

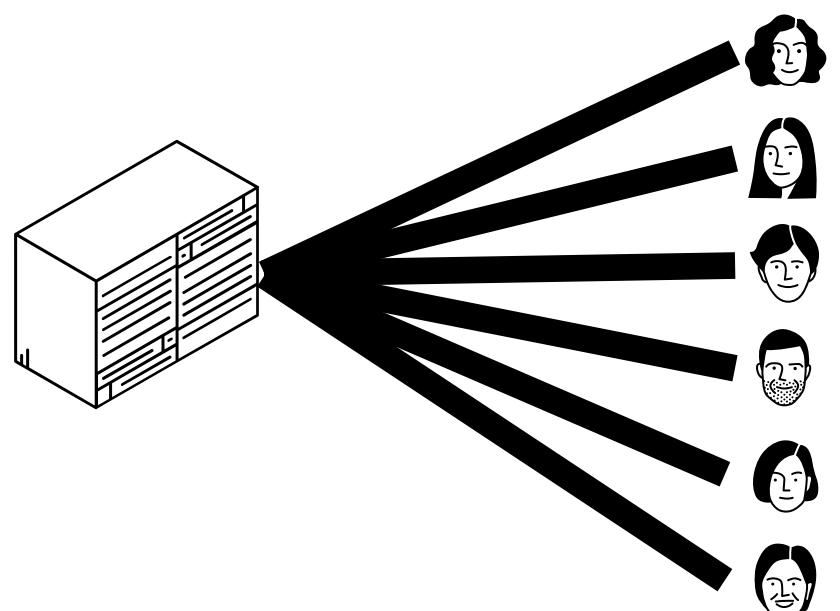
Recall the three waves of computing...



Three waves of computing



Mainframe
computing



“Many to one”



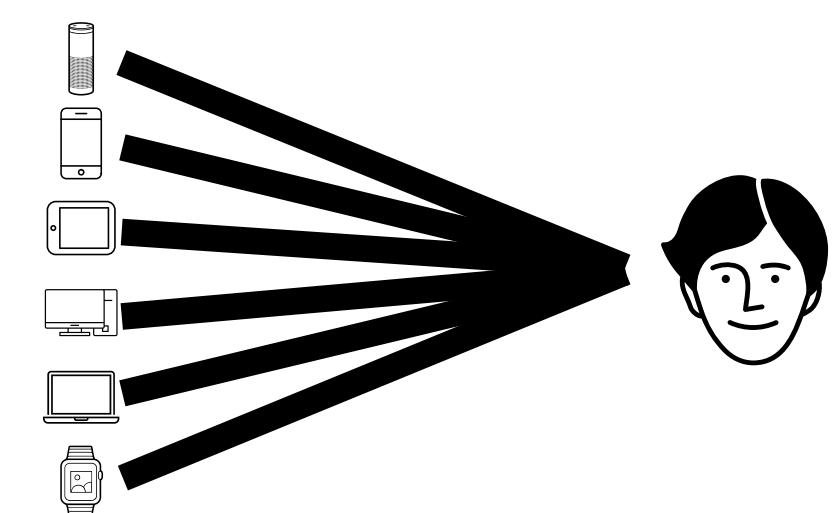
Personal
computing



“One to one”



Ubiquitous
computing



“One to many”

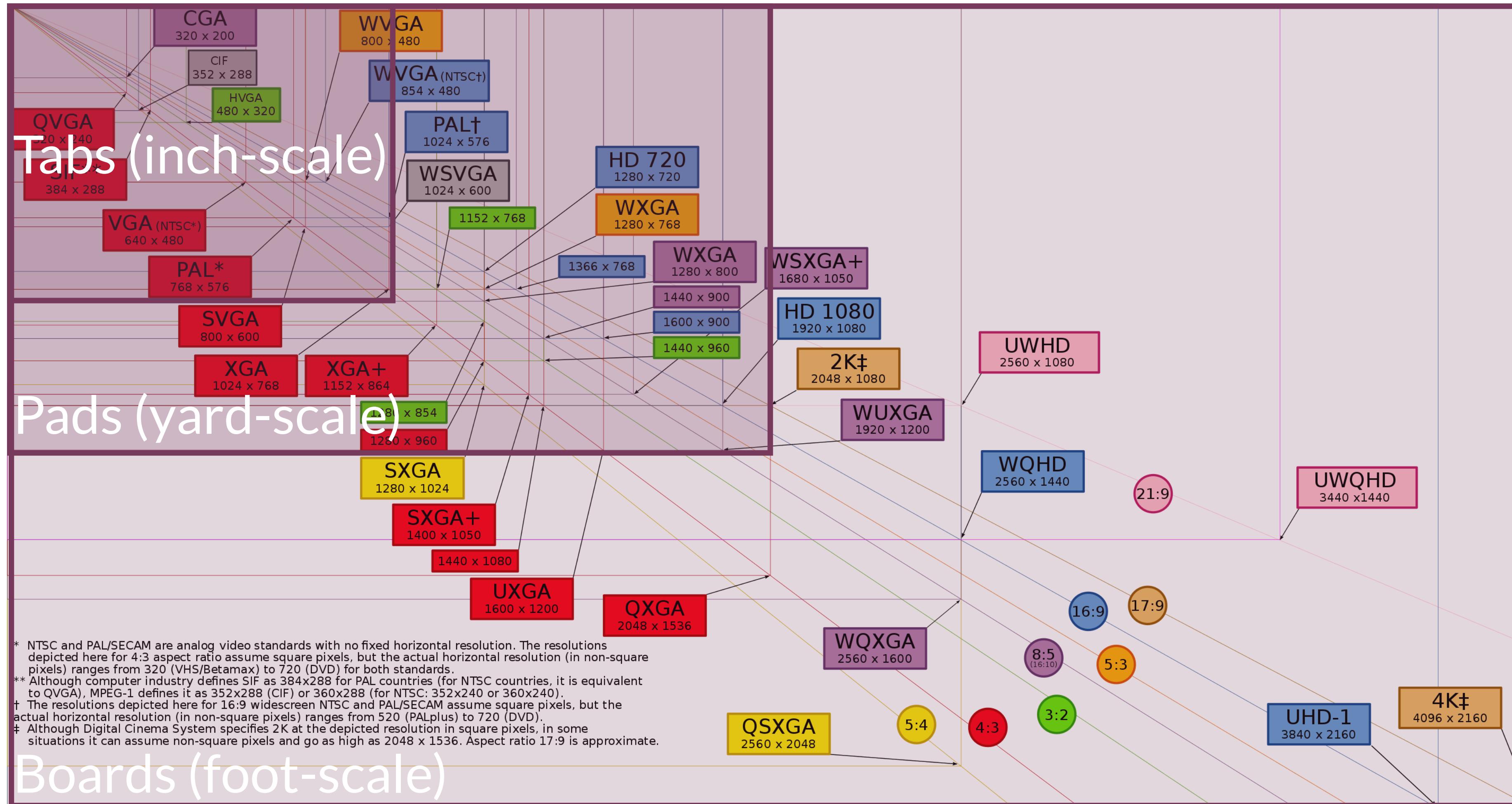
Websites in the personal computing era

- 960 px wide was pretty common
 - Most screens were 1024x978, leave some room for vertical scrollbar
 - Nicely divisible, can create even columns



<https://960.gs/>

Websites today: ubiquitous computing



https://en.wikipedia.org/wiki/Display_resolution

Websites today: just the iPhone!



So... how do we account for this?

Responsive design or Adaptive design

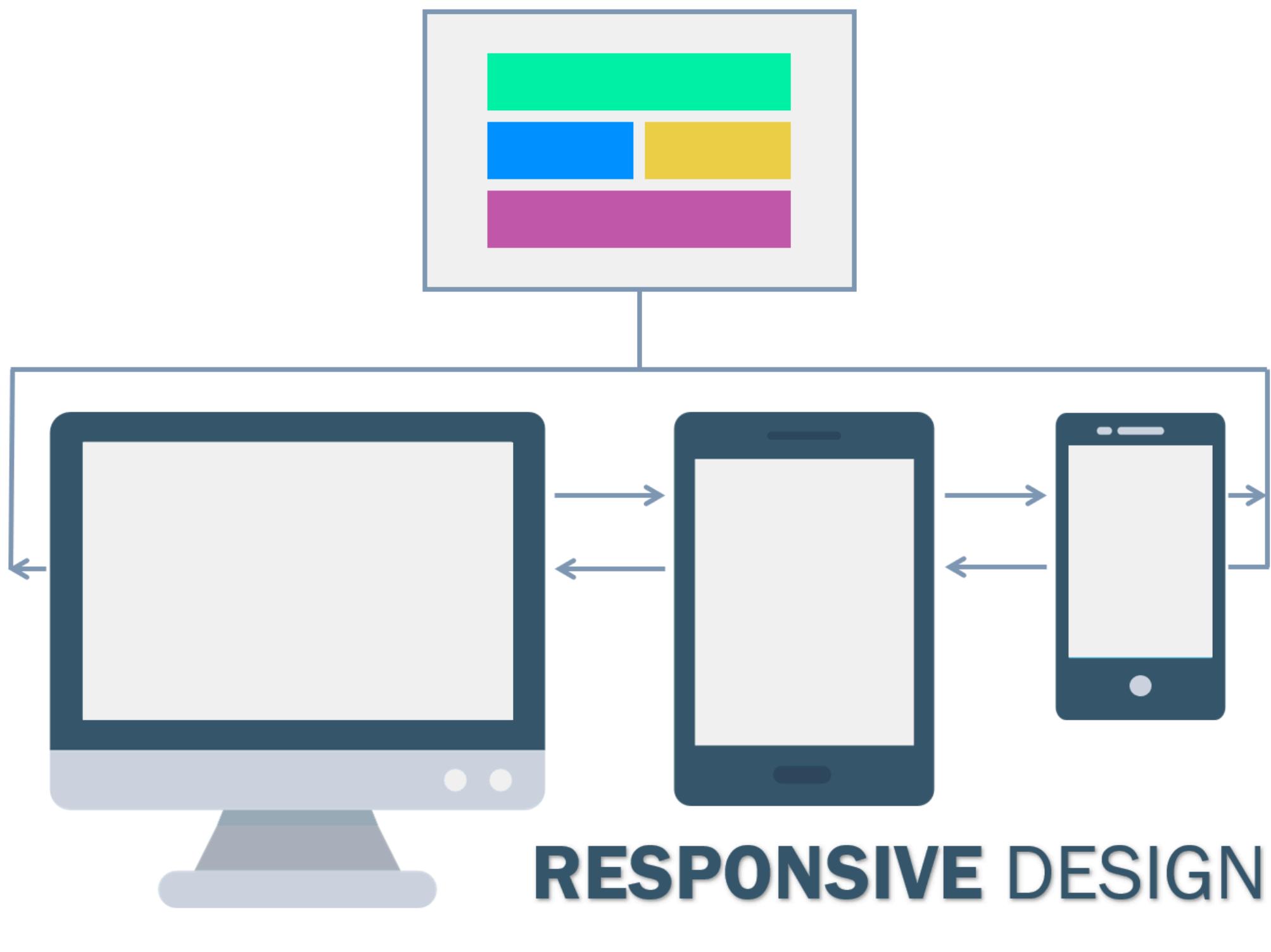
Responsive design

- Develop one set of HTML and CSS which changes layout depending on screen sizes

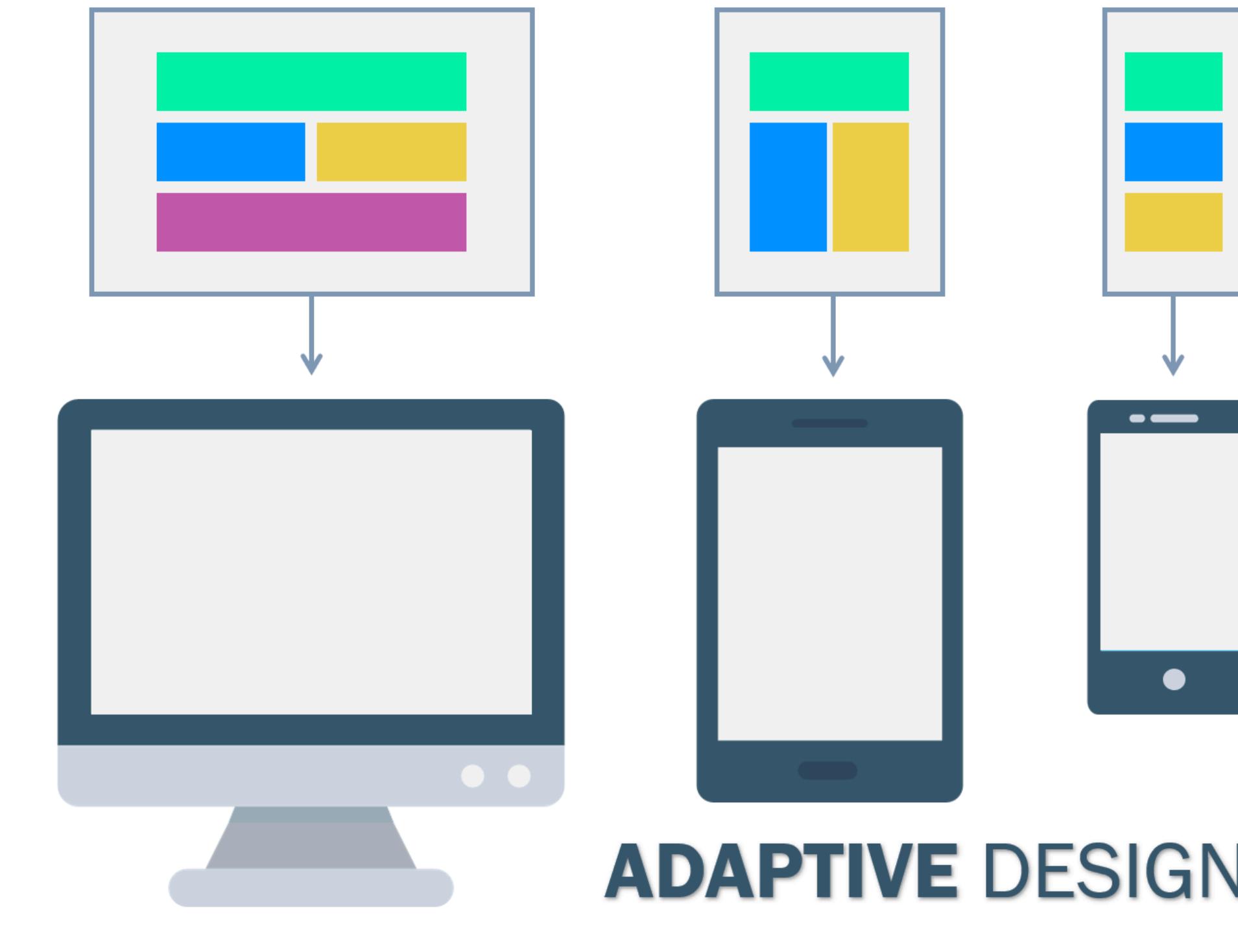
Adaptive design

- Develop and maintain multiple sets of code, change layout depending on device type and screen size

Responsive design



Adaptive design



<https://webflow.com/blog/adaptive-vs-responsive-design>

Question



adapt

Generally, which *performs* better (lower loading time)?
Generally, which is *easier to develop*?

- A Responsive performs better and is easier to develop
- B Responsive performs better, but adaptive is easier to develop
- C Adaptive performs better, but responsive is easier to develop
- D Adaptive performs better and is easier to develop
- E There are no differences (this answer is incorrect)

Question



adapt

Generally, which *performs* better (lower loading time)?
Generally, which is *easier to develop*?

- A Responsive performs better and is easier to develop
- B Responsive performs better, but adaptive is easier to develop
- C Adaptive performs better, but responsive is easier to develop
- D Adaptive performs better and is easier to develop
- E There are no differences (this answer is incorrect)

Responsive design

- + Easier to maintain one code base, future-proof
- Worse performance; requires downloading entire stylesheet
- Emphasis on making it “look right” rather than creating an experience

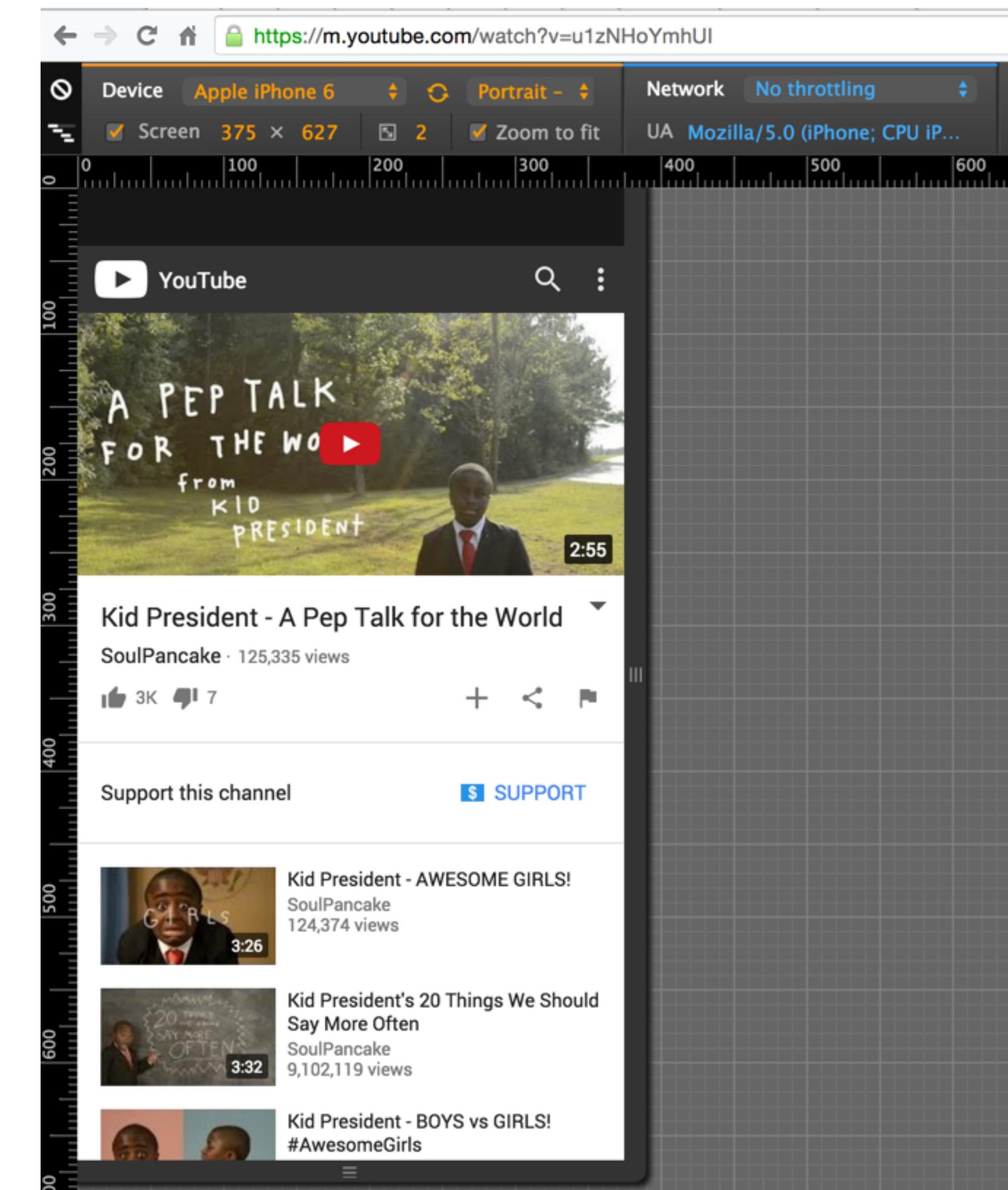
Adaptive design

- + Can cater experience to a device’s capabilities and performance
- Much more difficult to maintain separate codebases
- Limits development to a few key capabilities because you have to implement for everything

**Most pages are responsive,
but sometimes it's crucial
to create the best experience**

Adaptive design

- Video = a lot to load
 - Why send a higher resolution than the screen can render?
 - Why use up your own bandwidth?
 - Laggy videos mean unhappy users
- Google can afford the development burden



Adaptive design

- User agent string accessible via JavaScript
 - `navigator.userAgent`
- There's usually a better way
 - Do you care about the browser or operating system?
Or is resolution sufficient?
 - Can be spoofed or incorrect

The screenshot shows a Chrome browser window displaying the User Agent String.com website. The URL in the address bar is `www.useragentstring.com`. The page title is "User Agent String.Com". The main content area is titled "User Agent String explained :" and contains the user agent string: "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/69.0.3497.100 Safari/537.36". Below this, there is a form with the placeholder "Copy/paste any user agent string in this field and click 'Analyze'" and a "Analyze" button. The analyzed results are listed in a table:

Chrome 69.0.3497.100	
Mozilla	MozillaProductSlice. Claims to be a Mozilla based user agent, which is only true for Gecko browsers like Firefox and Netscape. For all other user agents it means 'Mozilla-compatible'. In modern browsers, this is only used for historical reasons. It has no real meaning anymore
5.0	Mozilla version
Macintosh	Platform
Intel Mac OS X 10_13_6	Operating System: OS X Version 10_13_6 : running on a Intel CPU
AppleWebKit	The Web Kit provides a set of core classes to display web content in windows
537.36	Web Kit build
KHTML	Open Source HTML layout engine developed by the KDE project
like Gecko	like Gecko...
Chrome	Name : Chrome
69.0.3497.100	Chrome version
Safari	Based on Safari
537.36	Safari build

Below the table, there is a "Description:" section with the text: "Free open-source web browser developed by Google. Chromium is the name of the open source project behind Google Chrome, released under the BSD license." At the bottom of the page, there are links for "All Chrome user agent strings" and copyright information: "© 2005 - 2018 UserAgentString.com" and "Wordconstructor - Random Word Generator".

https://developer.mozilla.org/en-US/docs/Web/HTTP/Browser_detection_using_the_user_agent

Adaptive design

- Media queries in CSS

```
/* CSS */  
@media screen and (device-width: 375px) and (device-height: 667px)  
and (-webkit-device-pixel-ratio: 2) {  
    /* iPhone 8-specific CSS */  
}
```

- Load appropriate external stylesheet

```
<!--HTML-->  
<head>  
    <link rel="stylesheet" media="screen and (device-width: 375px)  
        and (device-height: 667px) and (-webkit-device-pixel-ratio: 2)" href="iPhone8.css">  
</head>
```

Media query syntax

- @media
- screen, print, speech, all
- min-width, max-width
- orientation, -webkit-min-device-pixel-ratio
- Many, many more

https://www.w3schools.com/cssref/css3_pr_mediaquery.asp

**Moving away from adaptive design,
transitioning to responsive design**

Breakpoints

- The point at which your design “breaks” and is no longer visually appealing or usable
- Designs vary, but most have 3-5 breakpoints
 - extra small (old mobile), small (mobile), medium (tablet), large (laptop or desktop), extra large (wide desktop or wall display)
 - Again, somewhat similar to Weiser’s three types of computers

Breakpoints

```
@media screen and (max-width: 640px) {  
    /* small screens */  
}
```

```
@media screen and (min-width: 640px and max-width:  
1024px) {  
    /* medium screens */  
}
```

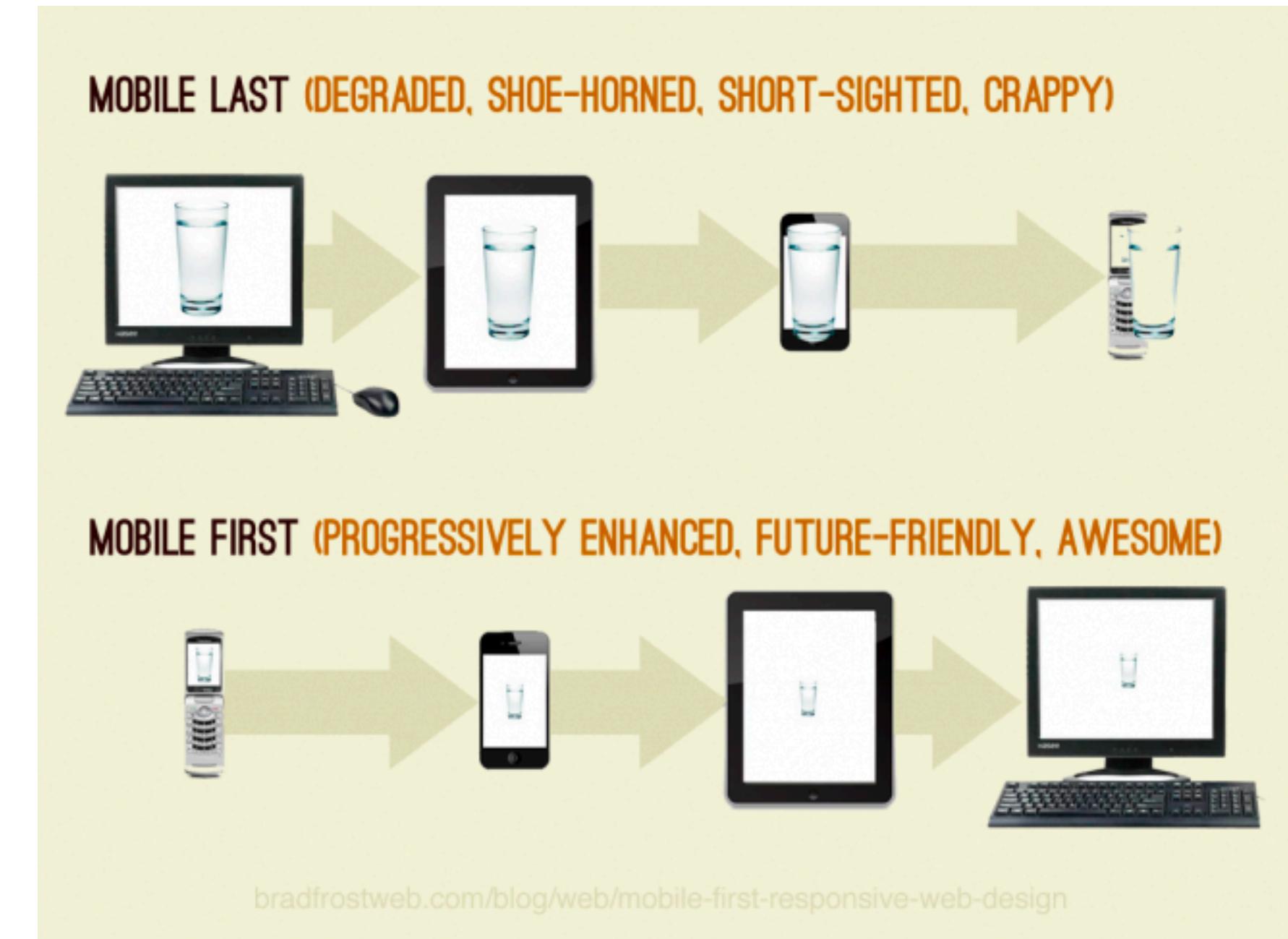
```
@media screen and (min-width: 1024px) {  
    /* large screens */  
}
```

Responsive design

- Fluid grids
 - Lay out content in columns whose widths can vary
 - Bootstrap helps with this; more on that in a bit
- Flexible images
 - Let image size change based on screen layout
 - Put images in containers which will scale appropriately
 - Set `width: 100%, max-width: 100%, height: auto`

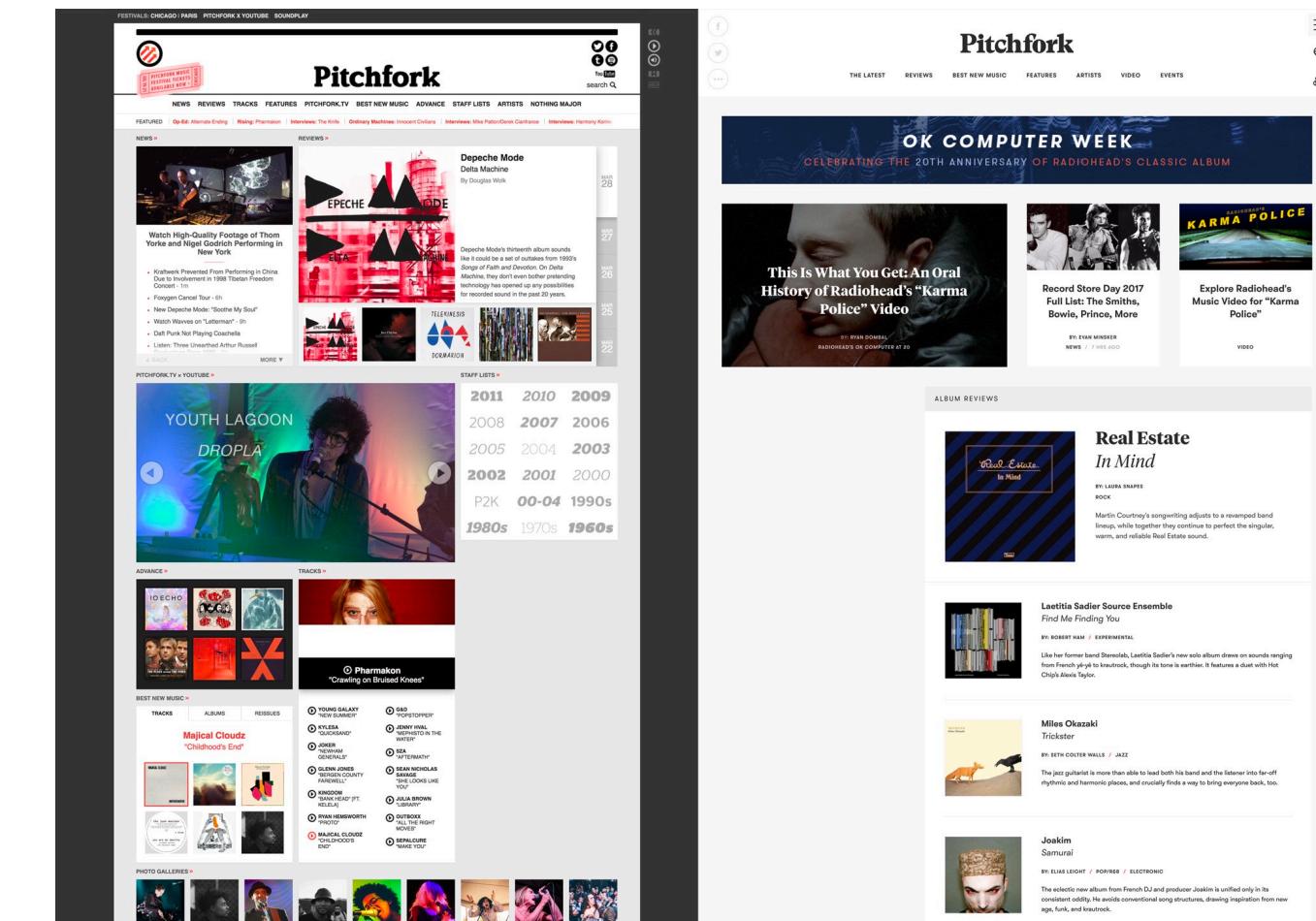
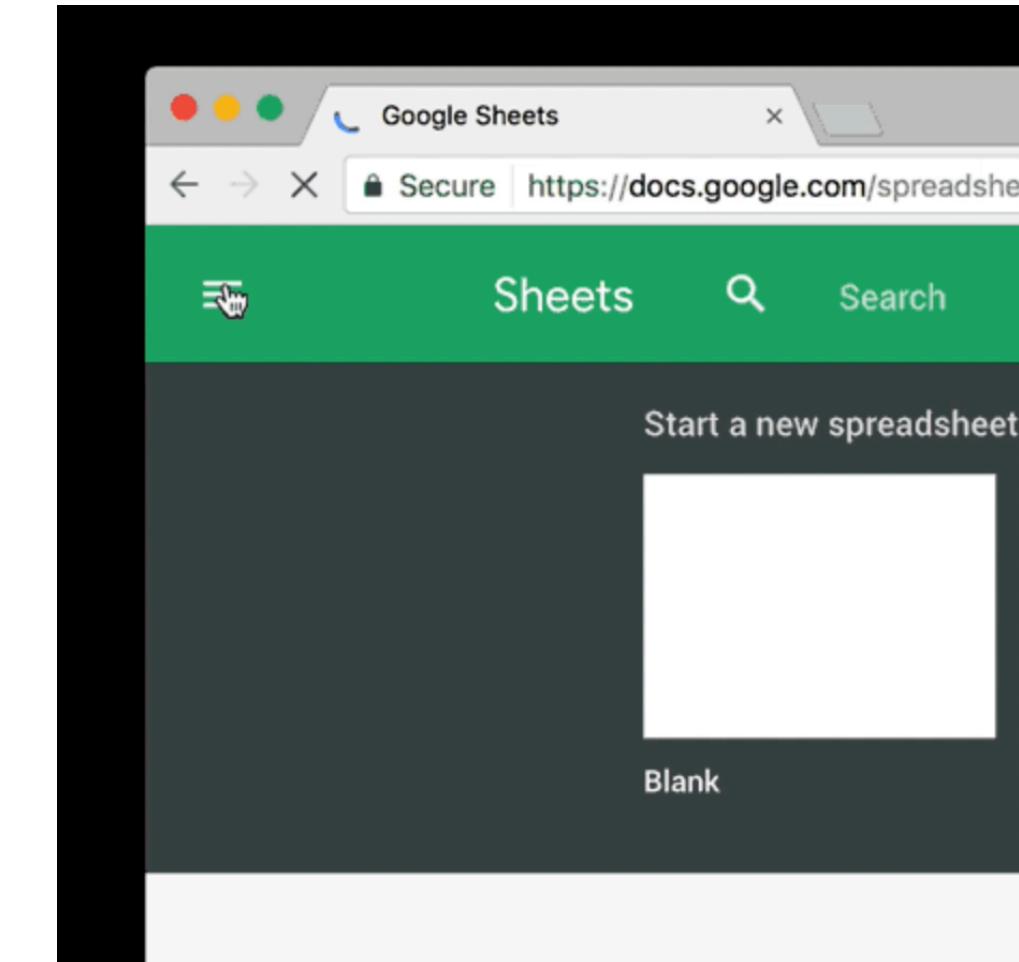
Mobile-first design

- “Graceful degradation” vs. “progressive enhancement”
- Plan your design for mobile
- Then make your app *better* with more real estate
 - Add more features
 - Make existing features easier to navigate



Mobile-first, not mobile-only

- Copying mobile UI to desktop creates inefficiencies
 - Extra clicks to navigate
 - Underutilized real estate



<https://blog.prototypypr.io/mobile-first-desktop-worst-f900909ae9e2>

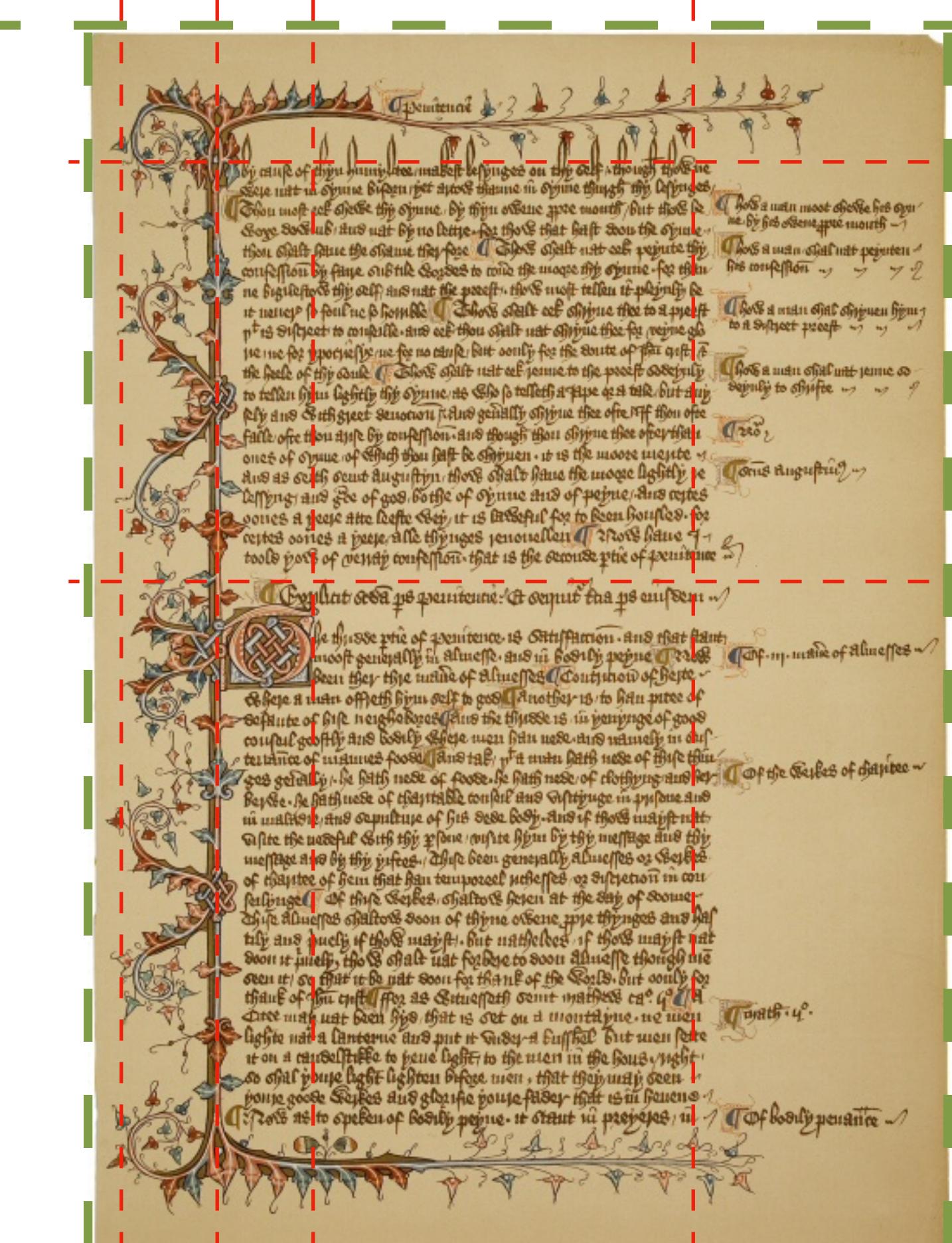
Mobile-first, not mobile-only

- Plan your design for mobile
- But consider how the experience should change on desktop, etc.
- Go beyond making everything bigger
 - *Enhance* your design

Grid-based layouts

Grid-based layouts

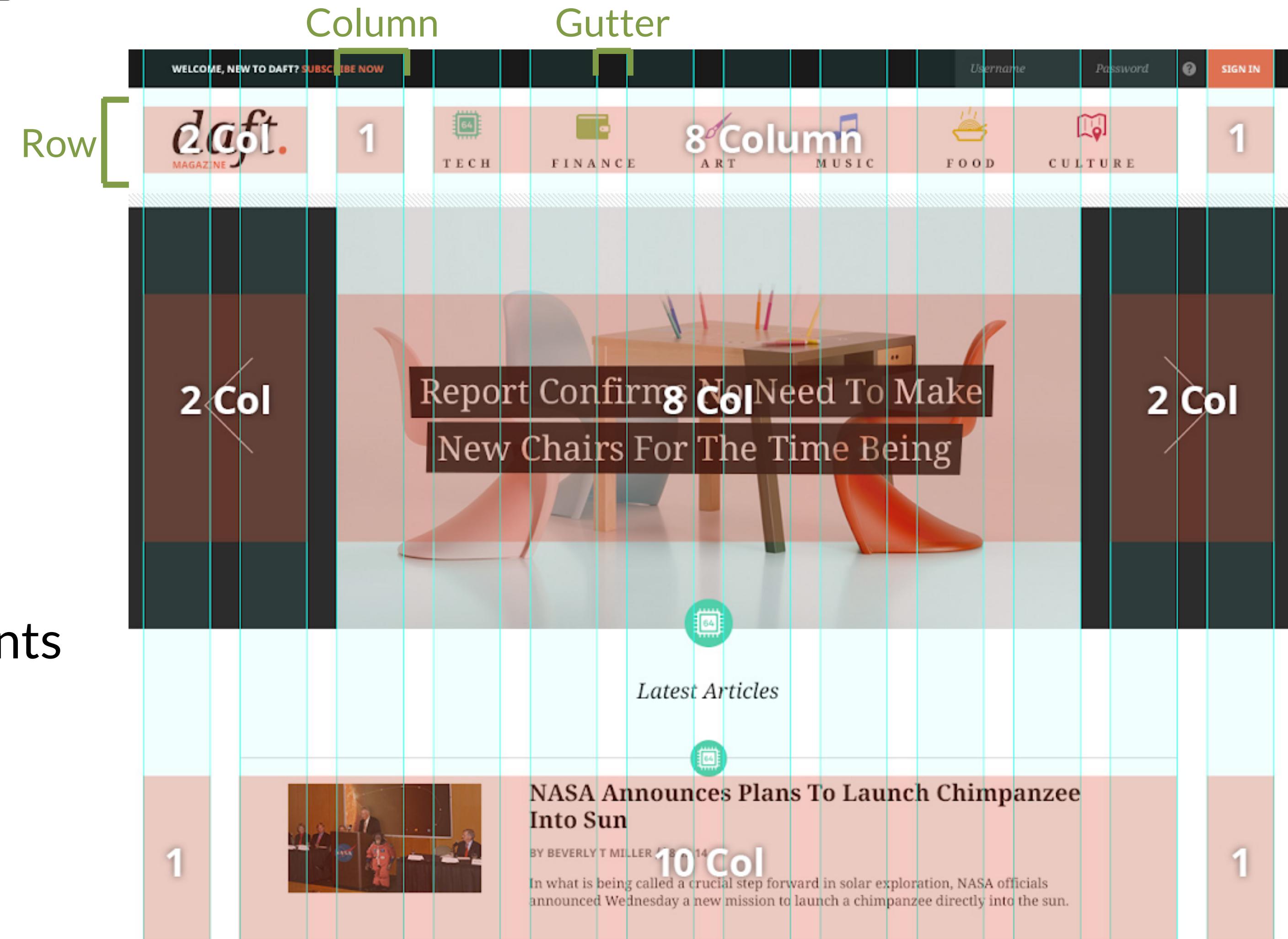
- Established tool for content arrangement
- Gridded content is familiar and easy to follow
- In general, it's good to target fewer lines
- But breaking that rule is important for creativity and attention-grabbing



<http://printingcode.runemadsen.com/lecture-grid/>

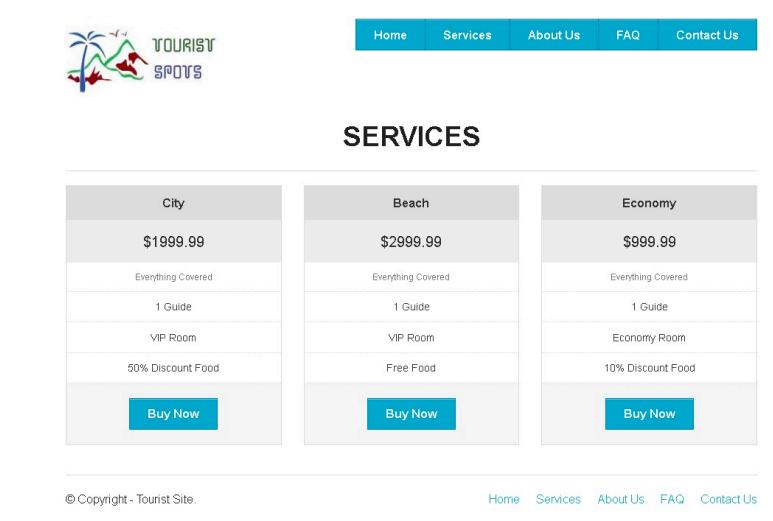
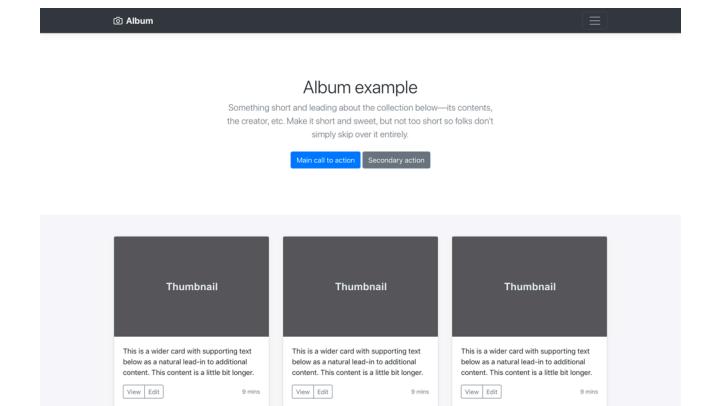
Grid-based layouts

- Rows
- Columns
- Gutters
- Padding/spacing
 - Defined by specific elements

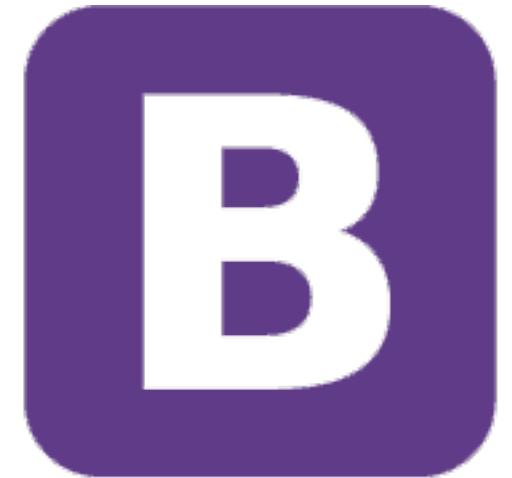


Grid-based frameworks

- Bootstrap (<https://getbootstrap.com/>)
 - Most popular, most extensions
- Foundation (<https://foundation.zurb.com/>)
 - Includes icons, drag&drop editor
- Pure.css (<https://purecss.io/>)
 - Small file size, 3.8KB



Digging into Bootstrap



Bootstrap

Bootstrap

- Direct download
 - <http://getbootstrap.com/docs/4.1/getting-started/download/>
- CSS and JavaScript files
- Minified files are compressed, will load faster
- .map files support editing preprocessed files
 - We won't really touch on those in this class
- We'll use bootstrap.min.css for now

Name	Date Modified	Size	Kind
css	Jul 23, 2018 at 5:49 PM	--	Folder
bootstrap-grid.css	Jul 23, 2018 at 6:37 PM	38 KB	CSS
bootstrap-grid.css.map	Jul 23, 2018 at 6:37 PM	99 KB	Document
bootstrap-grid.min.css	Jul 23, 2018 at 6:37 PM	29 KB	CSS
bootstrap-grid.min.css.map	Jul 23, 2018 at 6:37 PM	68 KB	Document
bootstrap-reboot.css	Jul 23, 2018 at 6:37 PM	5 KB	CSS
bootstrap-reboot.css.map	Jul 23, 2018 at 6:37 PM	61 KB	Document
bootstrap-reboot.min.css	Jul 23, 2018 at 6:37 PM	4 KB	CSS
bootstrap-reboot.min.css.map	Jul 23, 2018 at 6:37 PM	26 KB	Document
bootstrap.css	Jul 23, 2018 at 6:37 PM	174 KB	CSS
bootstrap.css.map	Jul 23, 2018 at 6:37 PM	430 KB	Document
bootstrap.min.css	Jul 23, 2018 at 6:37 PM	141 KB	CSS
bootstrap.min.css.map	Jul 23, 2018 at 6:37 PM	562 KB	Document
js	Jul 23, 2018 at 5:49 PM	--	Folder
bootstrap.bundle.js	Jul 23, 2018 at 6:37 PM	212 KB	JavaScript
bootstrap.bundle.js.map	Jul 23, 2018 at 6:37 PM	359 KB	Document
bootstrap.bundle.min.js	Jul 23, 2018 at 6:37 PM	71 KB	JavaScript
bootstrap.bundle.min.js.map	Jul 23, 2018 at 6:37 PM	294 KB	Document
bootstrap.js	Jul 23, 2018 at 6:37 PM	124 KB	JavaScript
bootstrap.js.map	Jul 23, 2018 at 6:37 PM	212 KB	Document
bootstrap.min.js	Jul 23, 2018 at 6:37 PM	51 KB	JavaScript
bootstrap.min.js.map	Jul 23, 2018 at 6:37 PM	176 KB	Document

Bootstrap

- Load bootstrap

```
<link rel="stylesheet" href="css/bootstrap.min.css">
```

```
<link rel="stylesheet" href="css/override.css">
```

Bootstrap

- Content Delivery Networks (CDN)
 - Browser-side caching reduces burdens of loading files
 - Integrity: hashes to ensure the downloaded file matches what's expected
 - Protects against server being compromised
 - Crossorigin: some imports require credentials, anonymous requires none
- ```
<link rel="stylesheet"
 href="https://stackpath.bootstrapcdn.com/bootstrap/4.1.3/css/bootstrap.min.css"
 integrity="sha384-MCw98/SFnGE8fJT3GXwEOngsV7Zt27NXFoaoApmYm81iuXoPkFOJwJ8ERdknLPMO"
 crossorigin="anonymous">
```

# Bootstrap

## Specifying a viewport

- In page's head
- Sets device width and scale level (for zooming)

```
<head>
 <meta name="viewport" content="width=device-
width,initial-scale=1">
</head>
```

# Bootstrap

## Designating a container

- All bootstrap content lives in a container

```
<div class="container">
 <!--Bootstrap content-->
</div>
```

- Just a class; anything can be a container

```
<main class="container">
 <!--Bootstrap content-->
</main>
```

# Bootstrap

## Grid System

- Grid system has 12 columns
  - 12 has a lot of factors (1, 2, 3, 4, 6)
- Content over 12 columns will wrap
  - (3+6+4=13, the 4 will wrap)
- 15px gutter for each
- Classes for `row` and `col-[size]-[number]`

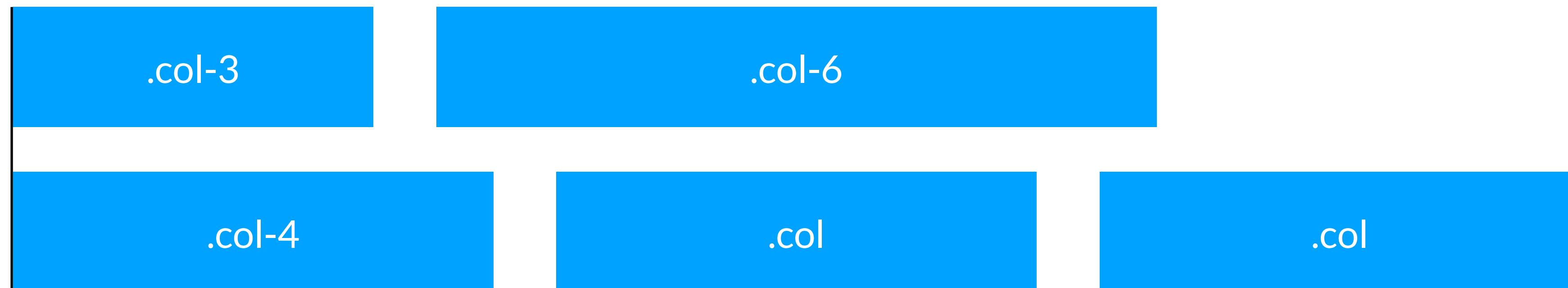
	Extra small <576px	Small ≥576px	Medium ≥768px	Large ≥992px	Extra large ≥1200px
<b>Max container width</b>	None (auto)	540px	720px	960px	1140px
<b>Class prefix</b>	<code>.col-</code>	<code>.col-sm-</code>	<code>.col-md-</code>	<code>.col-lg-</code>	<code>.col-xl-</code>
<b># of columns</b>	12				
<b>Gutter width</b>	30px (15px on each side of a column)				
<b>Nestable</b>	Yes				
<b>Column ordering</b>	Yes				

# Bootstrap

## Grid System

- Within the same row, content will wrap once it goes over 12 columns
  - Size parameter is optional; will divide space proportionally

```
<main class="container">
 <div class="row">
 <div class="col-3">A</div>
 <div class="col-6">B</div>
 <div class="col-4">C</div>
 <div class="col">D</div>
 <div class="col">E</div>
 </div>
</main>
```

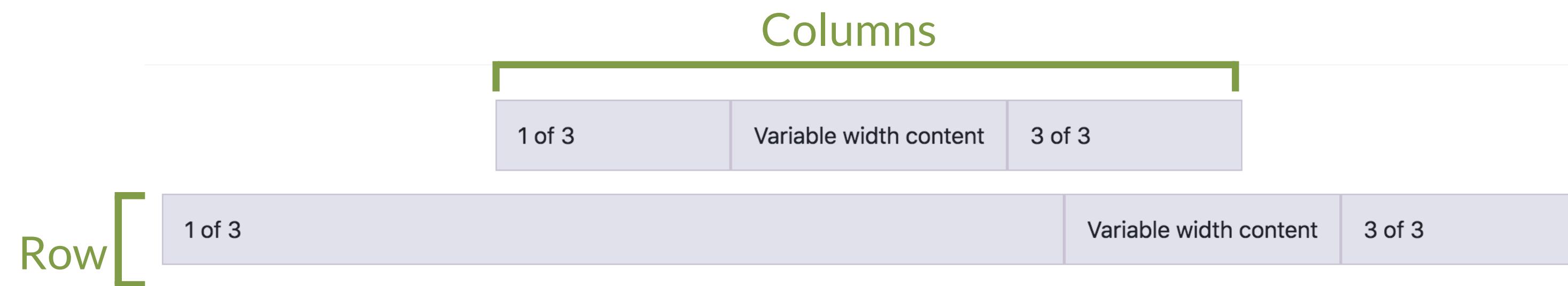


# Bootstrap

## Grid System

- Rows are block elements, while columns are inline

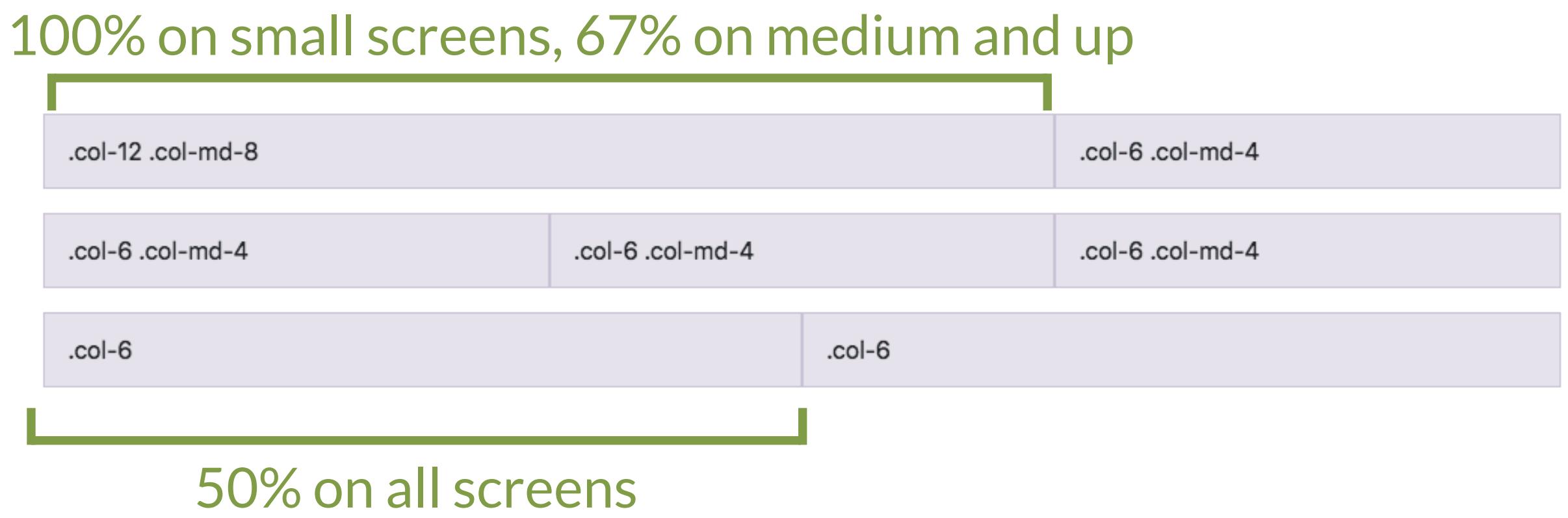
<https://getbootstrap.com/docs/4.1/layout/grid/>



# Bootstrap

## Grid System

- `.col` with no size defaults to the smallest (`xs`)
- The largest size listed will cover any larger sizes which are not-listed
- Will default to width 12 when no size is specified

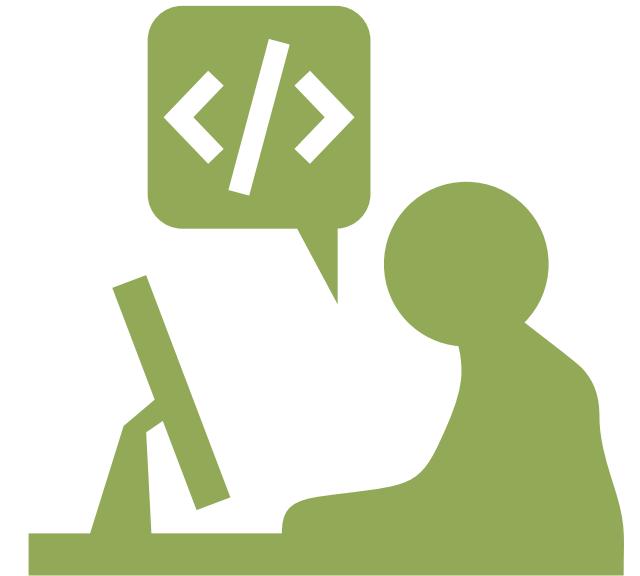


# Bootstrap

## Grid System

- Display property supports applying a display type (like `none` or `block`), can be combined with size properties
- `.d-none` will hide on all sizes
- `.d-md-none` will hide everything md and larger
- `.d-md-block .d-none` will hide only on xs

# Responsive class schedule



A screenshot of a Mac OS X application window titled "My 133 Schedule". The window contains a title bar, a menu bar with items like File, Edit, View, and Help, and a toolbar with icons for Back, Forward, Stop, Refresh, and others. Below the toolbar is a search field and a status bar. The main content area is titled "My 133 Schedule" and features a weekly grid from Monday to Friday. The grid has five columns labeled "Monday", "Tuesday", "Wednesday", "Thursday", and "Friday". The first row shows "Discussion" in the Monday slot and "Lecture" in the Tuesday slot. The second row shows "Discussion" in the Monday slot and "Assignment due" in the Tuesday slot. The third row shows "Lecture" in the Tuesday slot and "Lecture" in the Thursday slot.

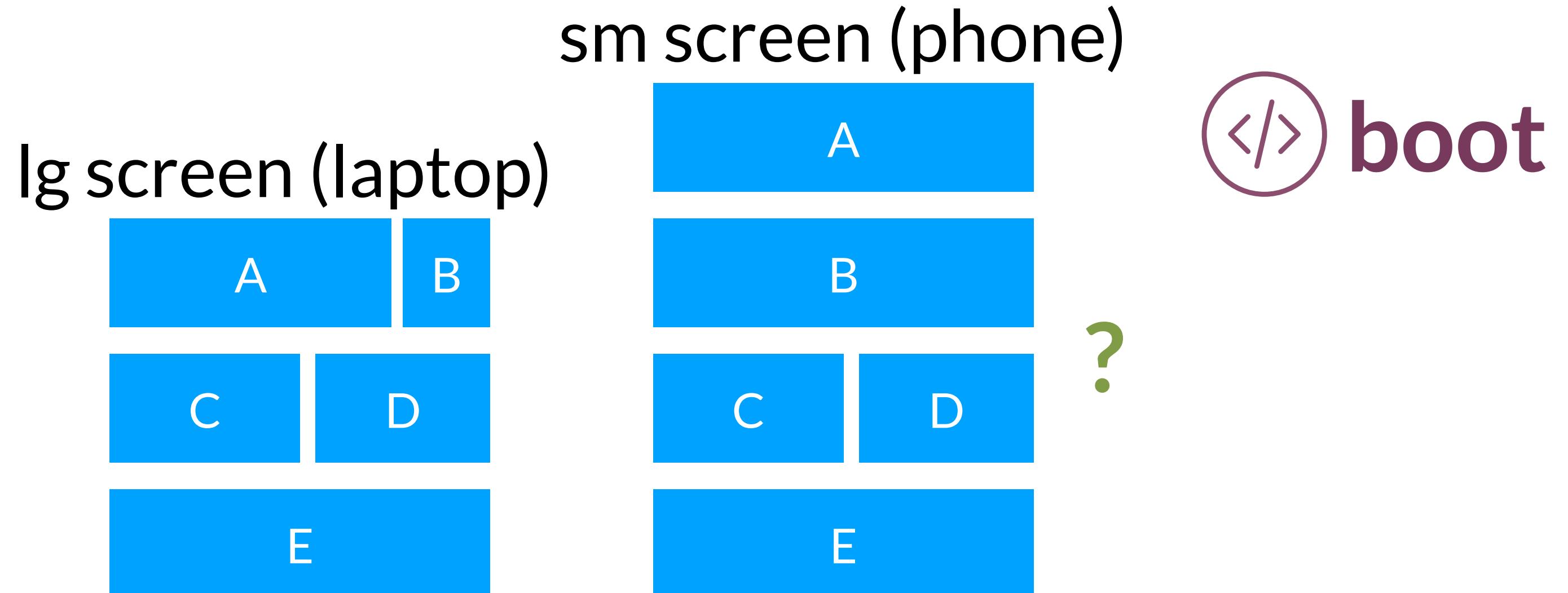
My 133 Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Discussion	Lecture			
Discussion	Lecture			
Assignment due			Lecture	

# Question



Which code creates



A

```
<div class="row">
 <div class="col-md-8 col-sm-12">A</div>
 <div class="col-md-4 col-sm-12">B</div>
 <div class="col-md-6">C</div>
 <div class="col-md-6">D</div>
 <div class="col-12">E</div>
</div>
```

B

```
<div class="row">
 <div class="col-md-8 col-sm-12">A</div>
 <div class="col-md-4 col-sm-12">B</div>
</div>
<div class="row">
 <div class="col-6">C</div>
 <div class="col-6">D</div>
 <div class="col-12">E</div>
</div>
```

C

```
<div class="row">
 <div class="col-8">A</div>
 <div class="col-4">B</div>
 <div class="col-sm-6">C</div>
 <div class="col-sm-6">D</div>
</div>
<div class="row">
 <div class="col-md-6 col-xl-4">E</div>
</div>
```

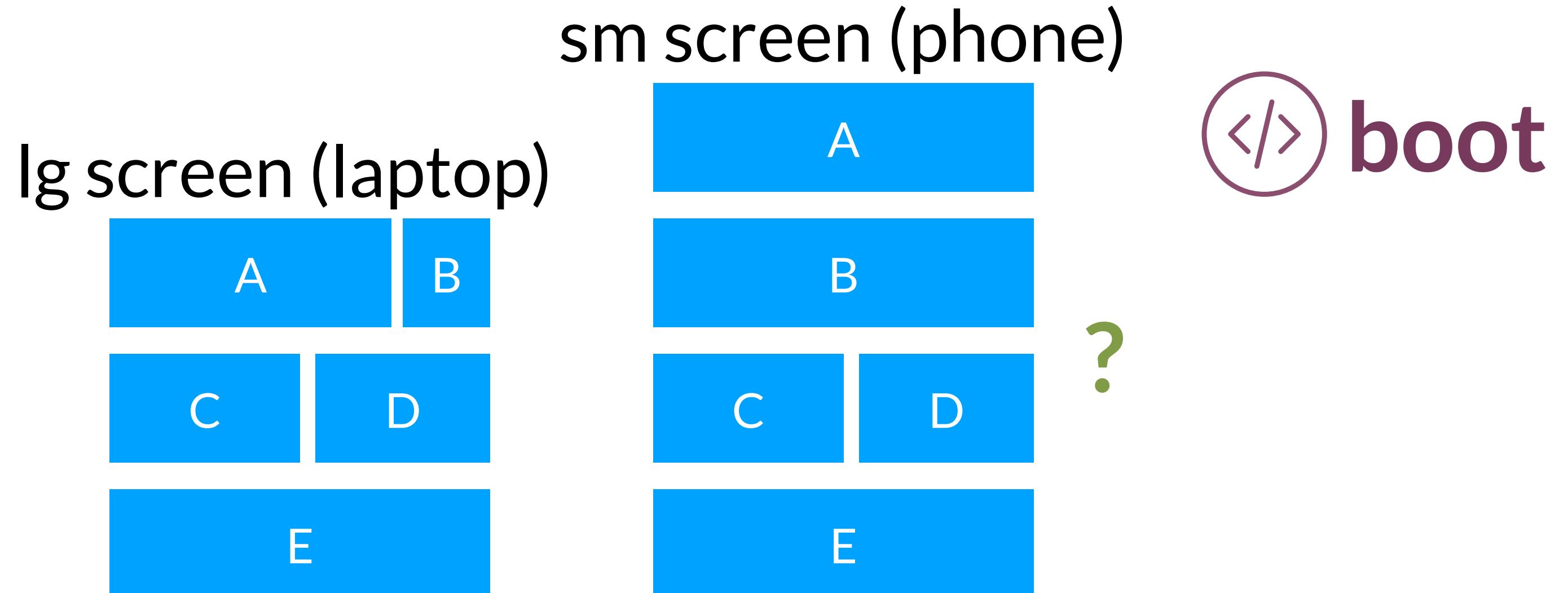
D A and B

E B and C

# Question



Which code creates



**A**

```
<div class="row">
 <div class="col-md-8 col-sm-12">A</div>
 <div class="col-md-4 col-sm-12">B</div>
 <div class="col-md-6">C</div>
 <div class="col-md-6">D</div>
 <div class="col-12">E</div>
</div>
```

**B**

```
<div class="row">
 <div class="col-md-8 col-sm-12">A</div>
 <div class="col-md-4 col-sm-12">B</div>
</div>
<div class="row">
 <div class="col-6">C</div>
 <div class="col-6">D</div>
 <div class="col-12">E</div>
</div>
```

**C**

```
<div class="row">
 <div class="col-8">A</div>
 <div class="col-4">B</div>
 <div class="col-sm-6">C</div>
 <div class="col-sm-6">D</div>
</div>
<div class="row">
 <div class="col-md-6 col-xl-4">E</div>
</div>
```

**D** A and B

**E** B and C

# Breakpoints

```
@media screen and (max-width: 640px) {
 /* small screens */
}
```

```
@media screen and (min-width: 640px and max-width:
1024px) {
 /* medium screens */
}
```

```
@media screen and (min-width: 1024px) {
 /* large screens */
}
```

# Bootstrap

## Media queries

```
/* Extra small devices (old phones, less than 768px) */
```

```
@include media-breakpoint-up(xs) { ... }
```

```
/* Small devices (phones, 768px and up) */
```

```
@include media-breakpoint-up(sm) { ... }
```

```
/* Medium devices (tablets, 992px and up) */
```

```
@include media-breakpoint-up(md) { ... }
```

```
/* Large devices (desktops, 1200px and up) */
```

```
@include media-breakpoint-up(lg) { ... }
```

- Variables are Sass mixins, we'll discuss those later in the quarter

# Bootstrap

## Media queries

```
// Example usage:
@include media-breakpoint-up(sm) {
 .some-class {
 display: block;
 }
}
```

# Bootstrap

## Default styling

- Bootstrap will change a lot of styles for you
- There are other custom styles involving various suffixes

**h1. Bootstrap heading**

Semibold 36px

**h2. Bootstrap heading**

Semibold 30px

**h3. Bootstrap heading**

Semibold 24px

Email address

Email

Password

Password

EXAMPLE

Default Primary Success Info Warning Danger Link

<!-- Standard button -->  
<button type="button" class="btn btn-default">Default</button>

Copy

<!-- Provides extra visual weight and identifies the primary action in a set of buttons -->  
<button type="button" class="btn btn-primary">Primary</button>

<!-- Indicates a successful or positive action -->  
<button type="button" class="btn btn-success">Success</button>

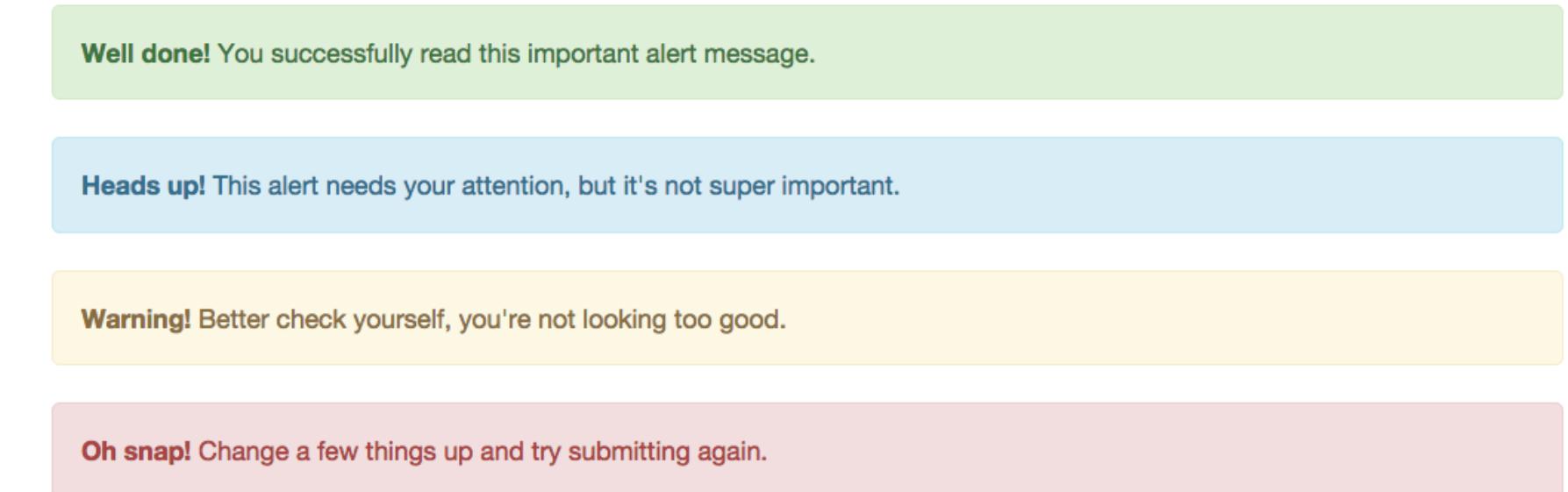
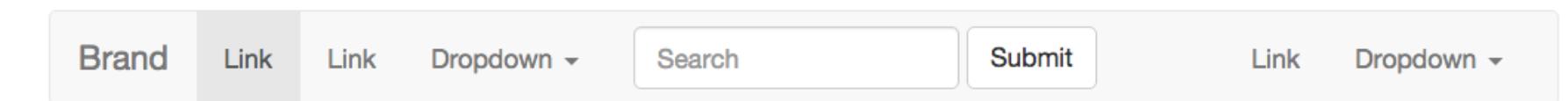
<http://getbootstrap.com/css>

# Bootstrap

## Components

- Components are elements pre-arranged into common patterns
- Makes making navigation bars, dropdowns, alerts, etc. simpler
- Some require JavaScript

<http://getbootstrap.com/css>



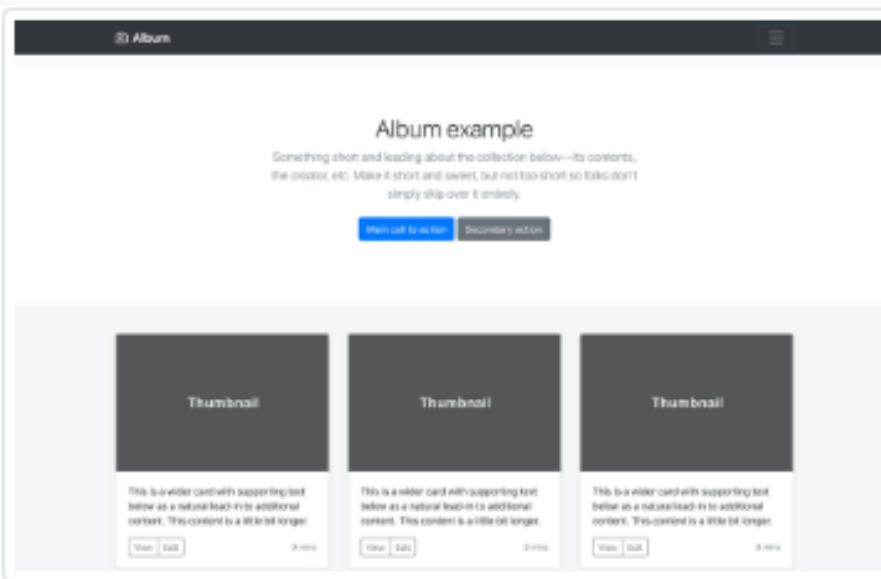
Panel heading
Some default panel content here. Nulla vitae elit libero, a pharetra augue. Aenean lacinia bibendum nulla sed consectetur. Aenean eu leo quam. Pellentesque ornare sem lacinia quam venenatis vestibulum. Nullam id dolor id nibh ultricies vehicula ut id elit.
Cras justo odio
Dapibus ac facilisis in
Morbi leo risus
Porta ac consectetur ac
Vestibulum at eros

**Grid frameworks  
make development easier.**

**What are the downsides?**

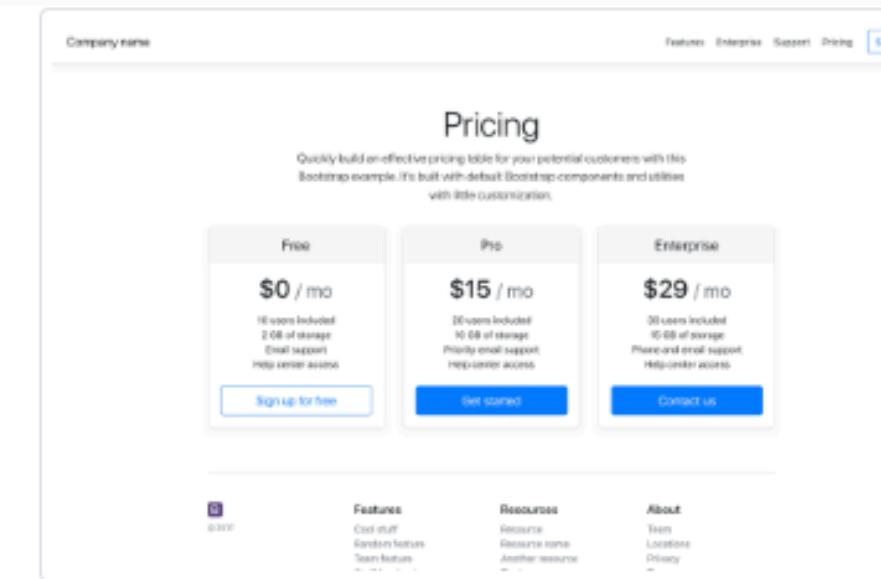
# Opposition to Grid-based frameworks

Can lead to similar-looking webpages



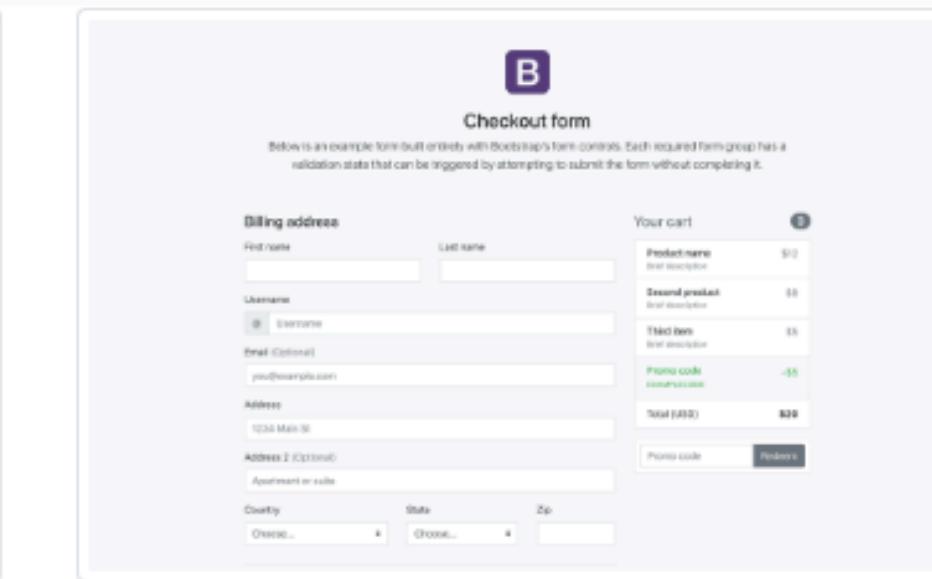
## Album

Simple one-page template for photo galleries, portfolios, and more.



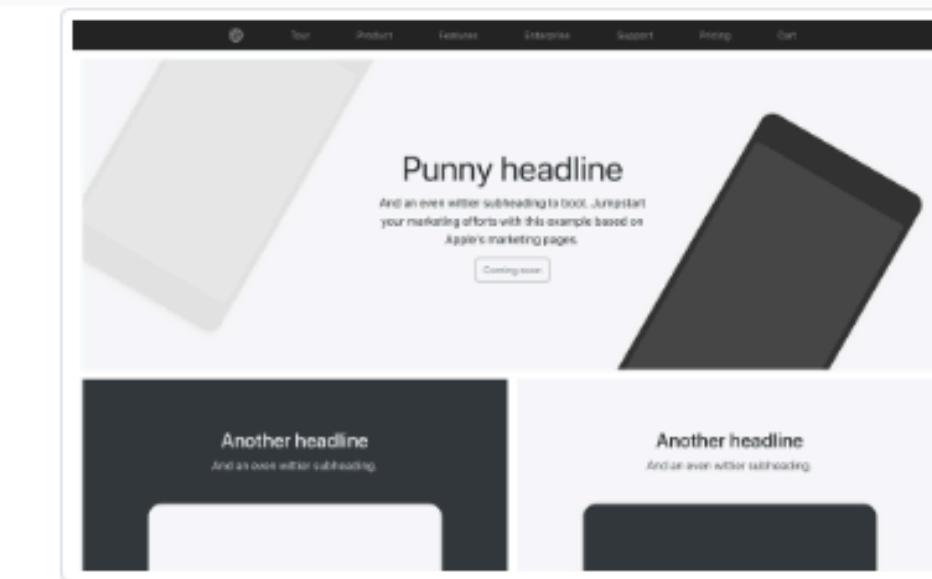
## Pricing

Example pricing page built with Cards and featuring a custom header and footer.



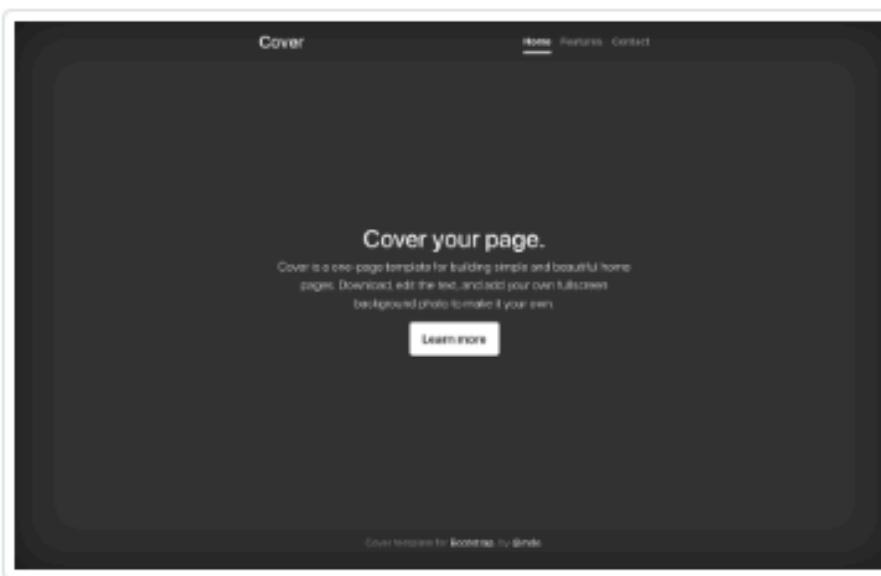
## Checkout

Custom checkout form showing our form components and their validation features.



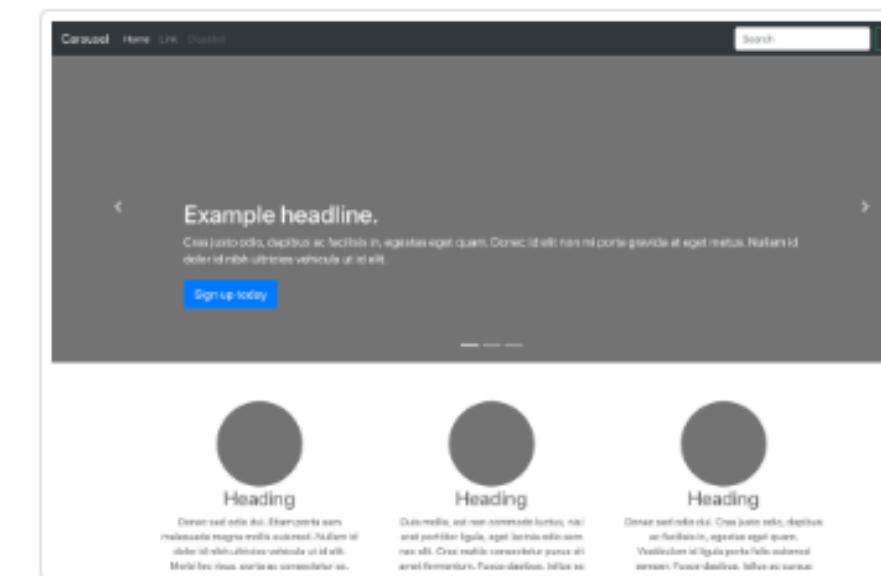
## Product

Lean product-focused marketing page with extensive grid and image work.



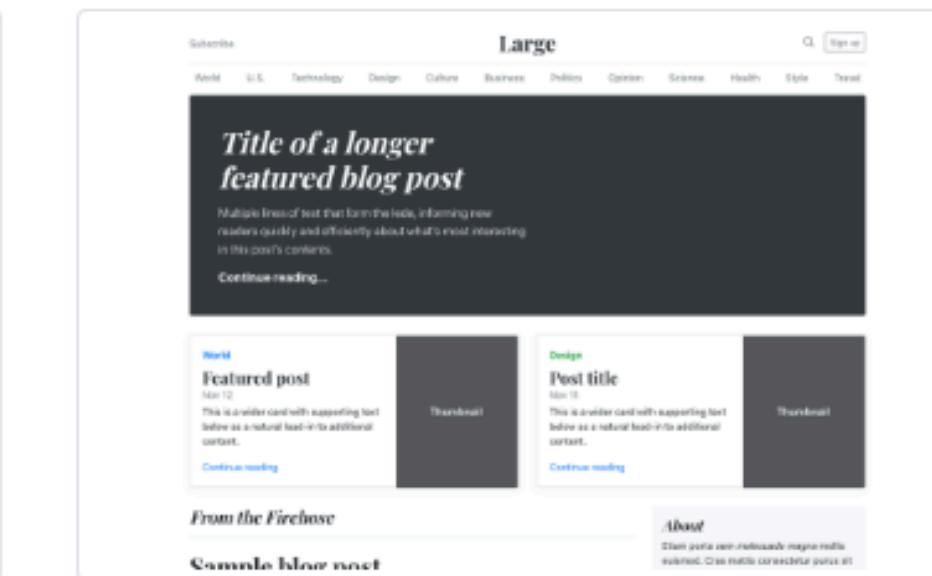
## Cover

A one-page template for building simple and beautiful home pages.



## Carousel

Customize the navbar and carousel, then add some new components.



## Blog

Magazine like blog template with header, navigation, featured content.

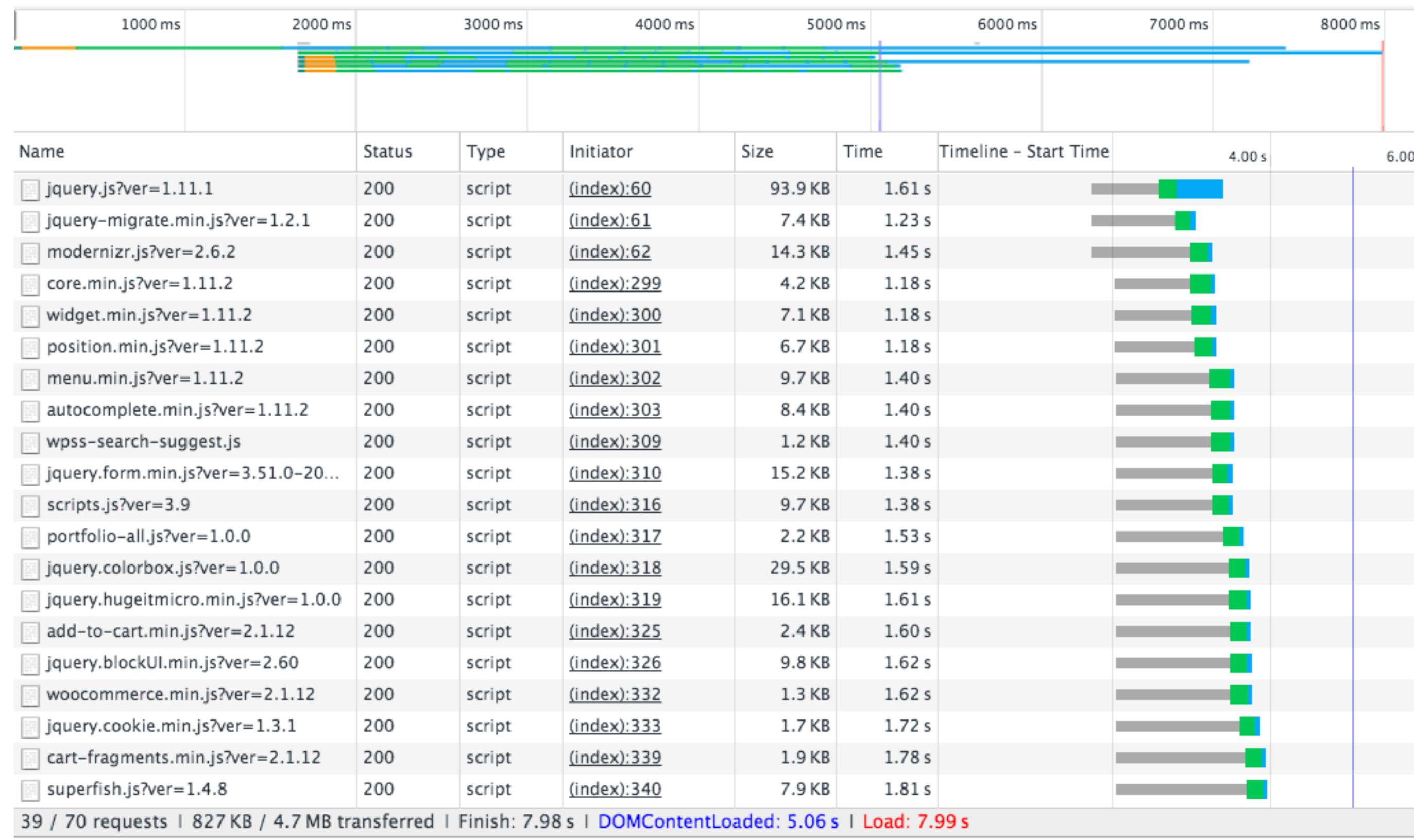


## Dashboard

Basic admin dashboard shell with fixed sidebar and nav bar.

# Opposition to Grid-based frameworks

Can involve loading many files, hurting performance



# Opposition to Grid-based frameworks

## Can stifle creativity

Themes built by or reviewed by Bootstrap's creators.

Why our themes?

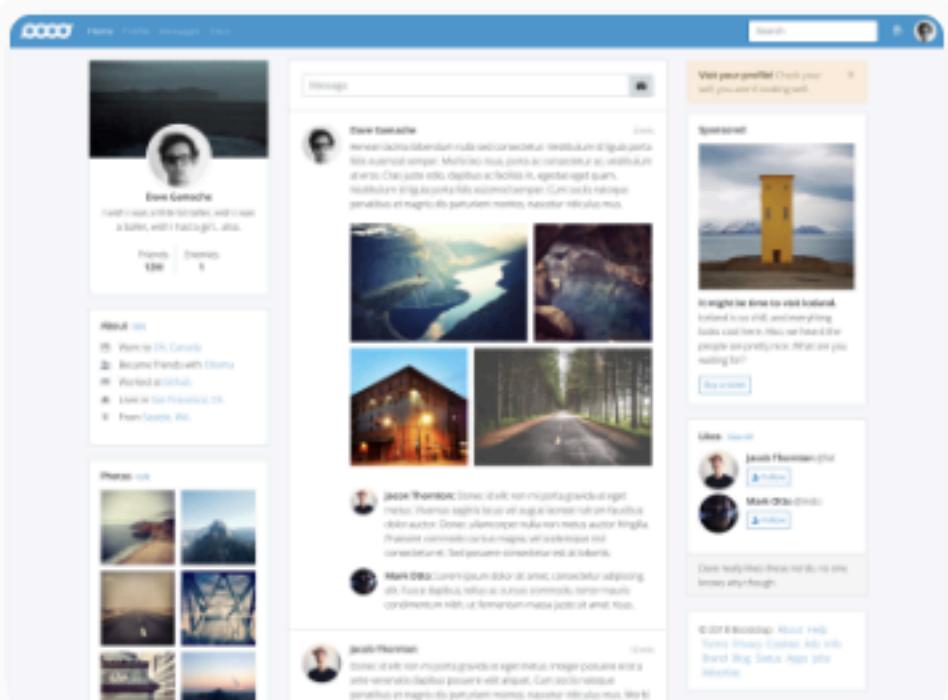
### Built by Bootstrap Team

Component-based frameworks designed, built, and supported by the Bootstrap Team.



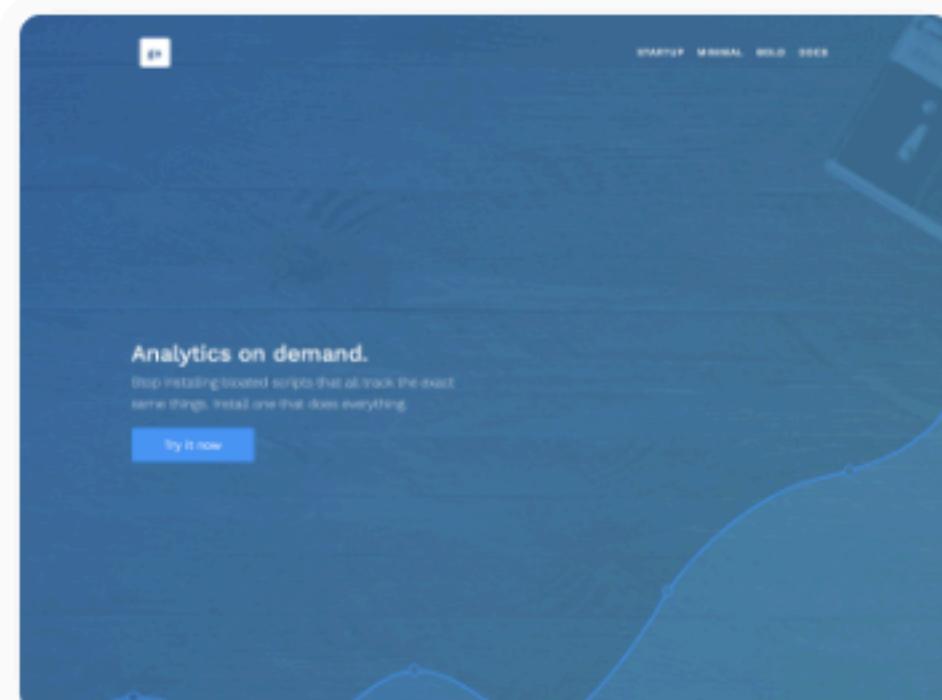
Dashboard  
Admin & Dashboard

\$49.00  
★★★★★



Application  
Application

\$49.00  
★★★★★



Marketing  
Landing & Corporate

\$49.00  
★★★★★

# **Switching gears: Javascript**

# Language Roles



Specify how content  
is rendered



Visually style  
content



Dynamically  
manipulate content

# Language Roles



Markup  
language



Styling  
language



Programming  
language

# Why JavaScript?

- Make pages dynamic
- Make pages personalized
- Make pages interact with other sources, like databases and APIs



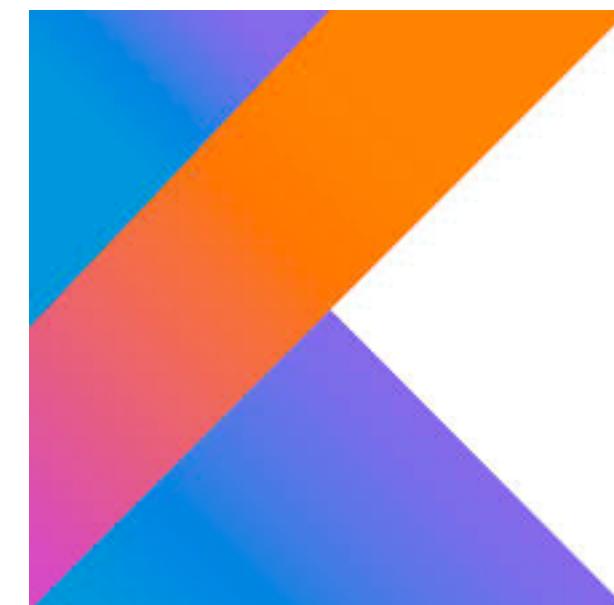
# Other web programming languages

- Ruby, via Ruby on Rails
- Python, via Django or web2py
- These days, you can  
create a dynamic website  
in almost any language

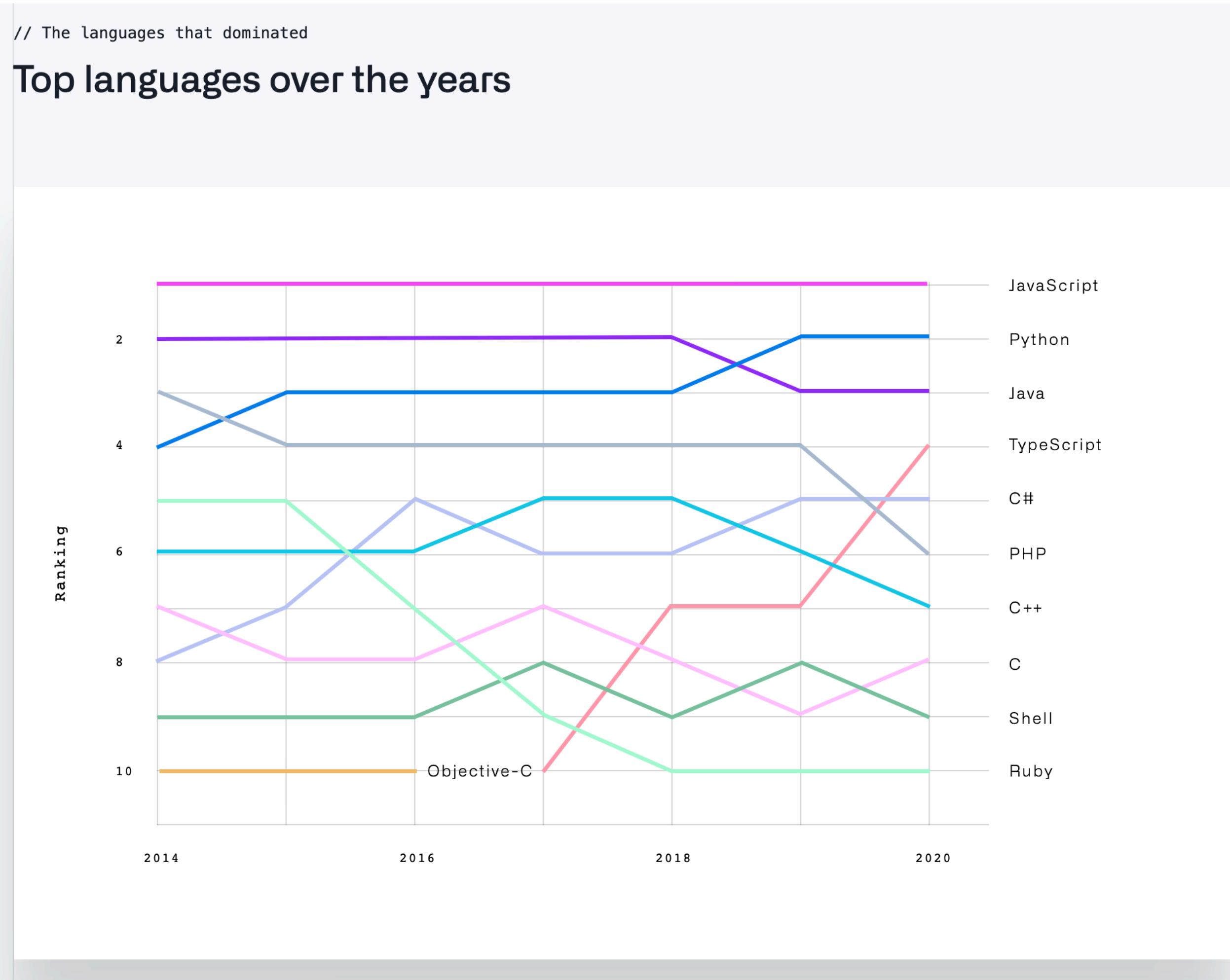


# Other web programming languages

- Some languages transpile to JavaScript
- TypeScript, by Microsoft, introduces types
  - More on TypeScript later
- Kotlin, by Google, runs on the Java virtual machine and compiles to JavaScript
  - Links all of Google's platforms



# JavaScript's popularity

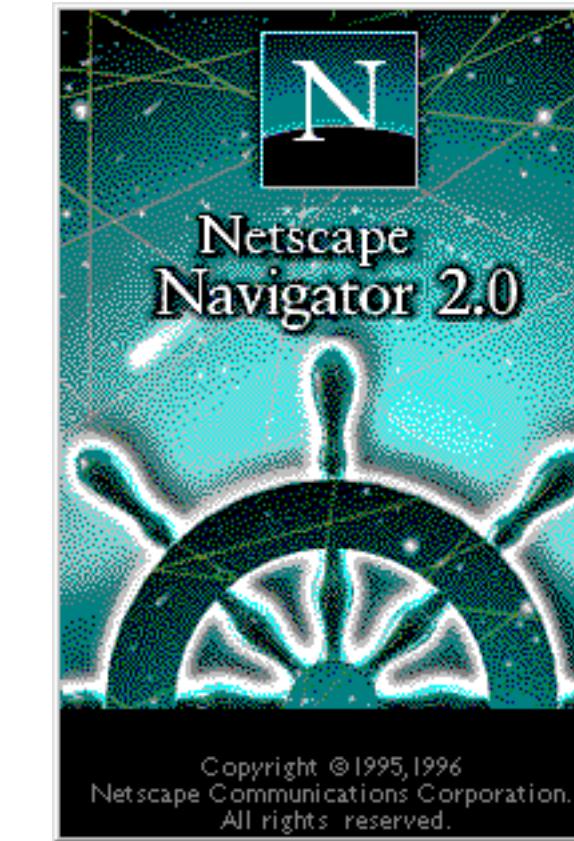


<https://octoverse.github.com/>

**How did JavaScript become  
the most popular language  
for web development?**

# History of JavaScript

- “Developed under the name Mocha, the language was officially called LiveScript when it first shipped in beta releases of Netscape Navigator 2.0 in September 1995, but it later was renamed JavaScript”



- Java's popularity was on the rise
  - Marketing ploy
  - Intended to be the “web” language to Java’s “desktop”

<https://medium.com/@benastontweet/lesson-1a-the-history-of-javascript-8c1ce3bffb17>

# History of JavaScript

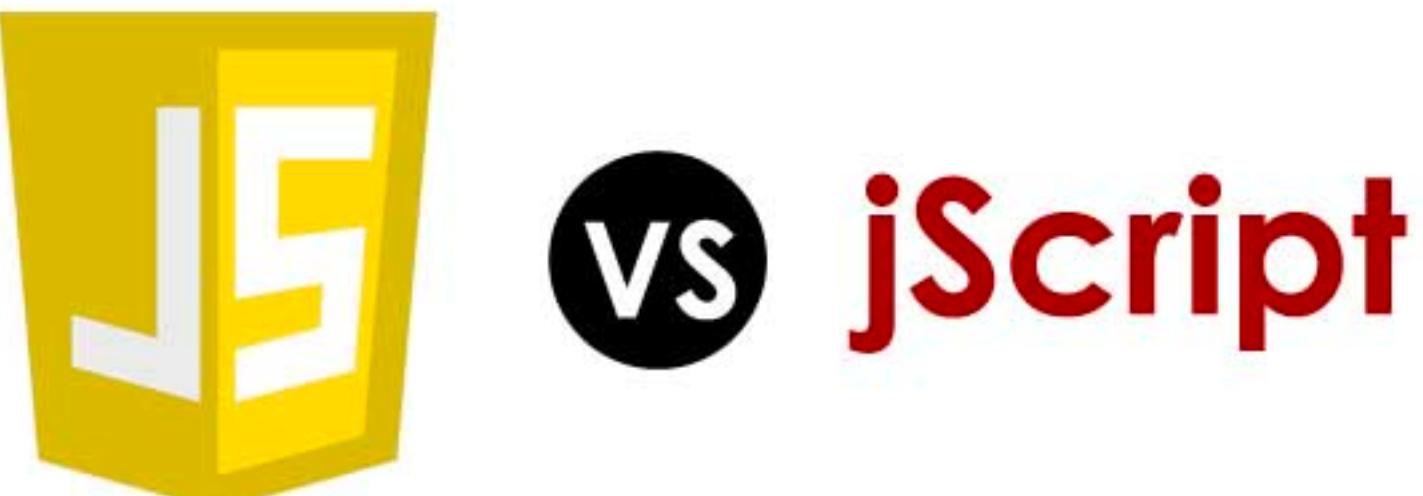
- Netscape submitted JavaScript to ECMA International for consideration as an industry standard
- Subsequent versions were standardized as “ECMAScript”



European Computer Manufacturers Association

# History of JavaScript

- Alternatives started springing up in the late 1990s and early 2000's
  - Microsoft introduced JScript engine
  - Macromedia Flash was popular for facilitating the dynamic web
- Both were vaguely JavaScript-like, but standards differed



# History of JavaScript

- Standards later converged
  - Firefox came out in 2005
  - Adobe bought Flash
  - JScript followed the standards
- But browser's implementations of the language still vary

Feature name	Current browser	PhantomJS 2.0	iOS7/8	CH 23+, OP 15+	IE 10+	WebKit	SF 6+	BESEN	FF 21+	Android 4.4+	OP 12.10	IE 9	EJS	Rhino 1.7	Konq 4.13
Object.create	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.defineProperty	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.defineProperties	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.getPrototypeOf	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.keys	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.seal	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.freeze	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.preventExtensions	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.isSealed	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.isFrozen	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.isExtensible	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.getOwnPropertyDescriptor	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.getOwnPropertyNames	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

# History of JavaScript

## ● JavaScript Engines

- SpiderMonkey (Firefox)

- V8 (Chrome)

- JavaScriptCore (Safari)

- Chakra (IE & Edge, no longer)

Feature name	Current browser	PhantomJS 2.0	iOS7/8	CH 23+, OP 15+	IE 10+	WebKit	SF 6+	BESEN	FF 21+	Android 4.4+	OP 12.10	IE 9	EJS	Rhino 1.7	Konq 4.13
Object.create	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.defineProperty	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.defineProperties	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.getPrototypeOf	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.keys	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.seal	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.freeze	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.preventExtensions	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.isSealed	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.isFrozen	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.isExtensible	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.getOwnPropertyDescriptor	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Object.getOwnPropertyNames	c Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

# Versions of JavaScript

- You may see references to ECMAScript
- ECMAScript is just the standard for JavaScript
  - The last “major” release was ECMAScript 6, or ES6, or ECMAScript 2015, or ES2015
  - The latest is ECMAScript 2020, or ES11, or ES2020

# Versions of JavaScript

- Engines/Browsers continually play catch-up, so many tools support slightly older versions of the standard

Feature name	Current browser	Compilers/polyfills					Desktop browsers												
		Babel 7 + core-js 3	Closure 2020.05	Type-Script + core-js 3	es7-shim	IE 11	FF 78 ESR	FF 83	FF 84	FF 85 Beta 2/2	FF 86 Nightly 2/2	CH 86	CH 87	CH 88 7/7 2/2	CH 89 7/7 2/2	Edge 18	Edge 86	Edge 87	
<a href="#">array-formatted-json-consumption</a>	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	
<b>2020 features</b>																			
<a href="#">String.prototype.matchAll</a>	2/2	2/2	2/2	2/2	0/2	0/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	0/2	2/2	2/2	
<a href="#">BigInt</a>	8/8	0/8	0/8	0/8	0/8	0/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	0/8	8/8	8/8	
<a href="#">Promise.allSettled</a>	Yes	Yes <sup>[5]</sup>	Yes	Yes <sup>[6]</sup>	?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	
<a href="#">globalThis</a>	2/2	2/2	2/2	2/2	0/2	0/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	0/2	2/2	2/2	
<a href="#">optional chaining operator (?)</a>	4/4	4/4	0/4	4/4	0/4	0/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	0/4	4/4	4/4	
<a href="#">nullish coalescing operator (??)</a>	Yes	Yes	Yes	Yes	?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	
<b>2021 features</b>																			
<a href="#">String.prototype.replaceAll</a>	Yes	Yes <sup>[5]</sup>	?	Yes <sup>[6]</sup>	?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	
<a href="#">Promise.any</a>	2/2	2/2	0/2	2/2	0/2	0/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	0/2	2/2	2/2	
<a href="#">WeakReferences</a>	2/2	0/2	0/2	0/2	0/2	0/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	0/2	2/2	2/2	
<a href="#">Logical Assignment</a>	9/9	0/9	0/9	0/9	0/9	0/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	0/9	9/9	9/9	
<a href="#">numeric separators</a>	Yes	Yes	?	Yes	?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	

<https://kangax.github.io/compat-table/es2016plus/>

# Versions of JavaScript

- Polyfills ensure a user’s browser has the latest libraries
  - Downloads “fill” versions of added functions, re-written using existing functions
- Sometimes called a “shim” or a “fallback”



## ► About

[Browsers and features](#)

[API reference](#)

[Live examples](#)

[Usage stats](#)

[Contributing](#)

[Privacy Policy](#)

[Terms and Conditions](#)

Just the polyfills you need for your site, tailored to each browser. Copy the code to unleash the magic:

```
<script src="https://cdn.polyfill.io/v2/polyfill.min.js"></scr
```

# JavaScript

- Interpreted language
- Executed by a JavaScript engine
- Engine runs the same code that a programmer writes

# Java

- Compiled language (into bytecode)
- Run in a Java Virtual Machine (JVM)
- Bytecode is unreadable by people

# JavaScript

- Standardized through ECMAScript, but discrepancies exist
- Debugging dependent on execution environment
- Prototype based
- Used in every browser without a plugin

# Java

- “Write once, deploy anywhere”
- Bugs found at compile time
- Class-based
- Requires a plugin to be run in most browsers

# Today's goals

By the end of today, you should be able to...

- Describe how responsive and adaptive design differ and when you might prefer one or the other
- Explain the advantages and disadvantages of a mobile-first design
- Begin implementing responsive designs with Bootstrap
- Explain the role of JavaScript

# **IN4MATX 133: User Interface Software**

Lecture 4:

Responsive Design & Javascript 1

Professor Daniel A. Epstein

TA Eunkyung Jo

TA Lucas de Melo Silva