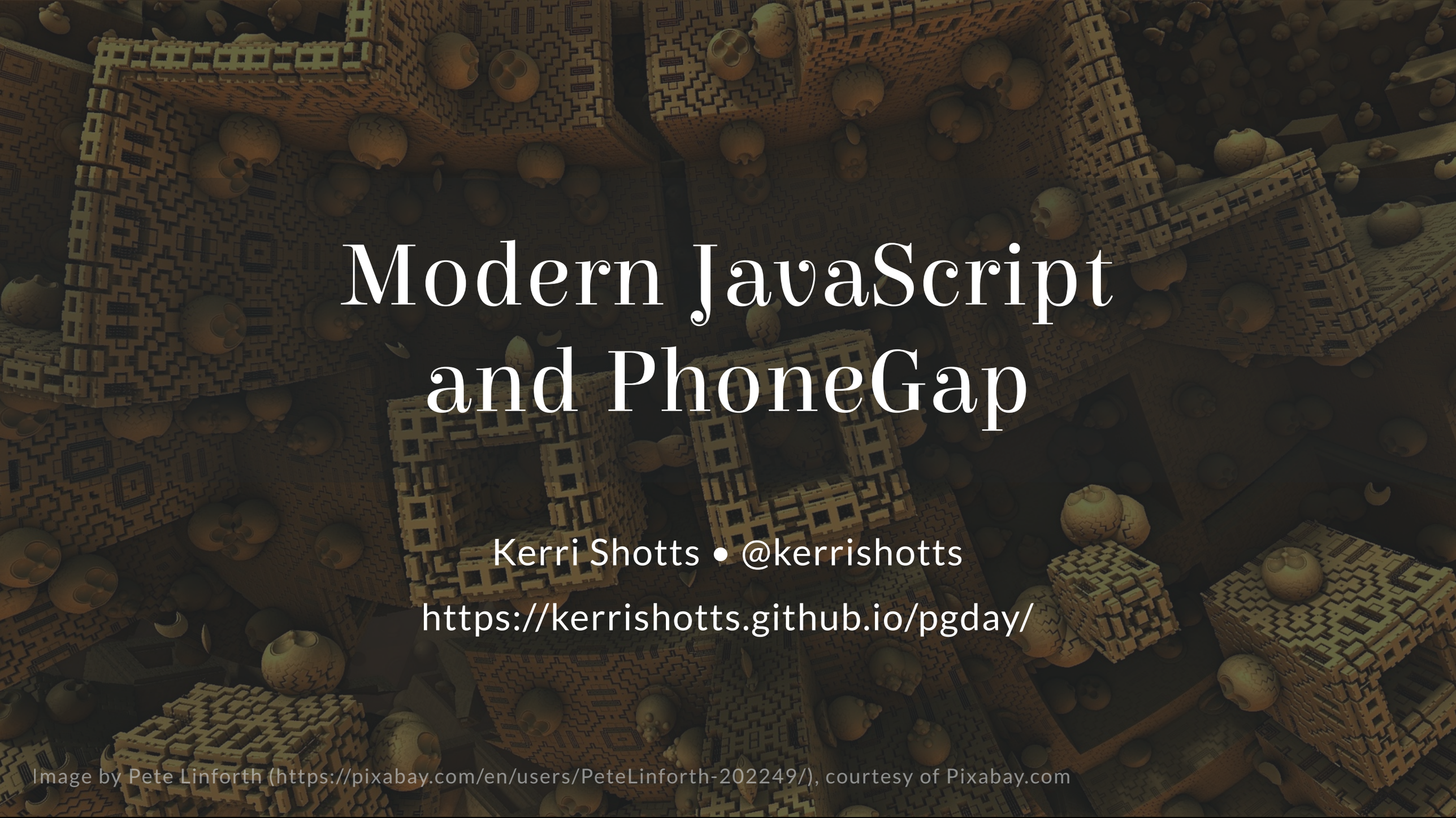


Modern JavaScript and PhoneGap

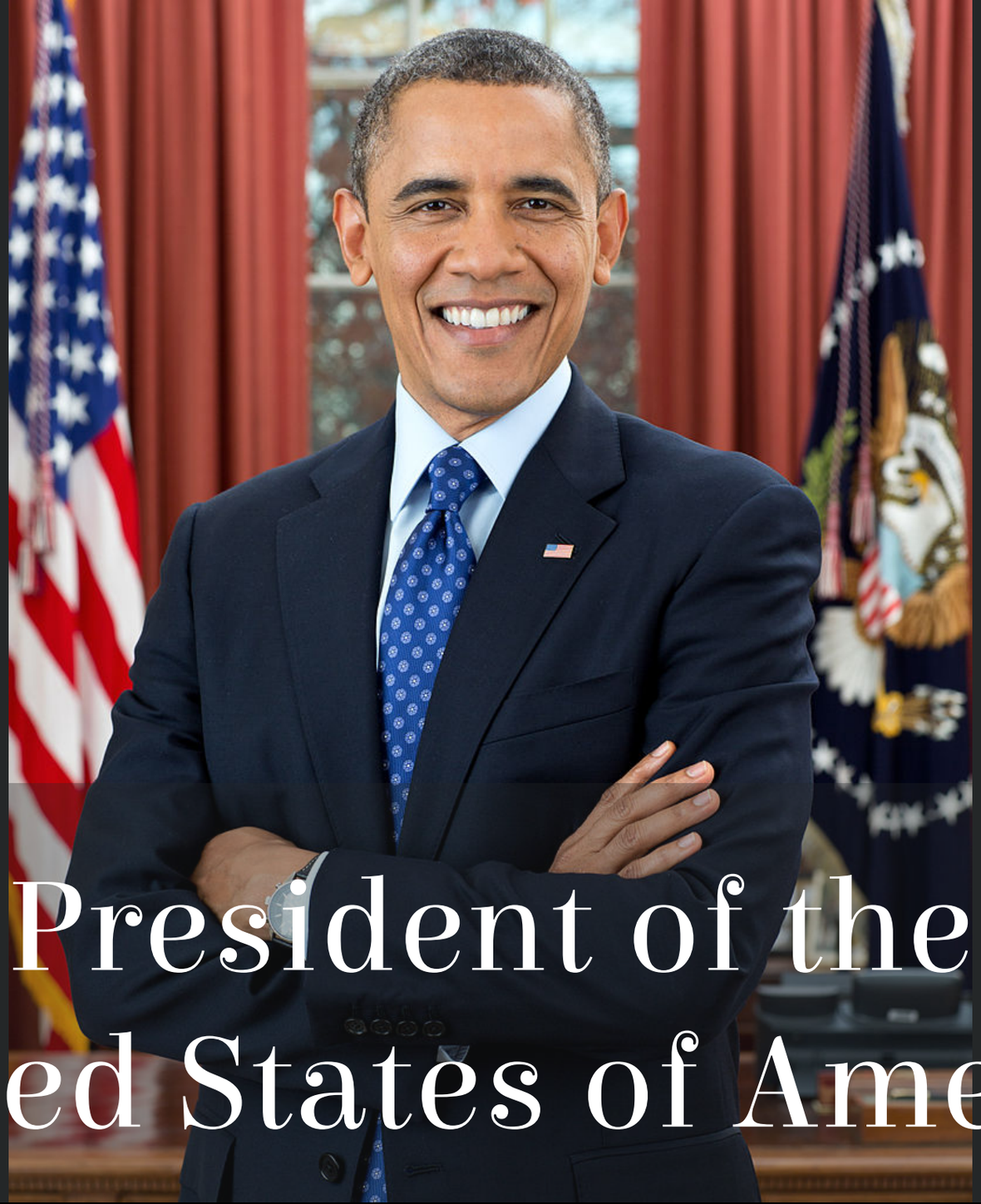
Kerri Shotts • @kerrishotts

https://kerrishotts.github.io/pgday/

About Me

- Used PhoneGap for over six years
- Authored Five books about PhoneGap
- Apache Cordova committer
- One of many moderators at:
  - Cordova Google Group
  - PhoneGap Adobe Forums

2009

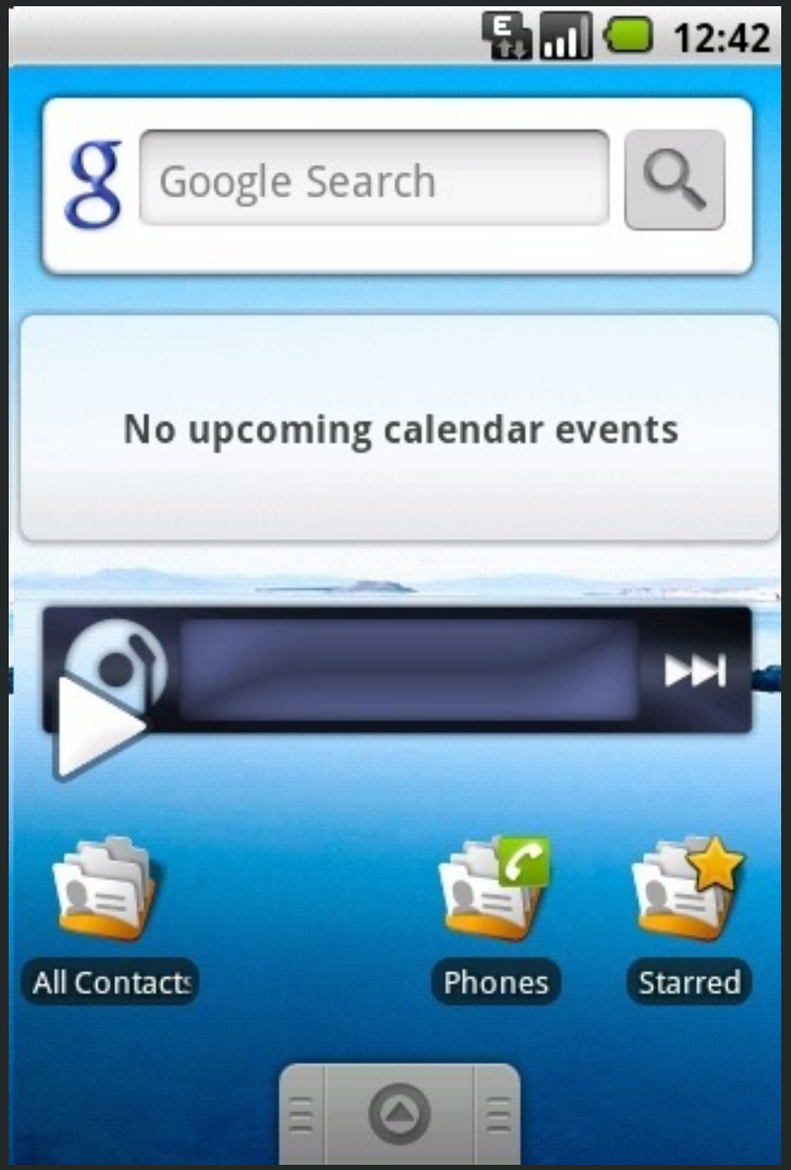


President of the United States of America

iOS 3

ES3 (1999)

HTC Hero



Android 1.5

ES3 (1999)

 PhoneGap is born! 

By Ramaksoud2000 via Chris Williams - Wikipedia via GitHub logo.js, Public Domain, https://commons.wikimedia.org/w/index.php?curid=18434372

ES5

- The version we all know and love (~ish?)
  - `'use strict';`
  - `map`, `reduce`, `Object.create`, `Object.freeze`, `trim`!
  - JSON parsing
- Supported by all modern mobile web views[1]
  - iOS 6+, IE 10+, Edge (forever), Android 4.4+
  - But not in 2009 — *no one supported it*

1 http://caniuse.com/#feat=es5

2012

Still President of the United States of America

iPhone 5

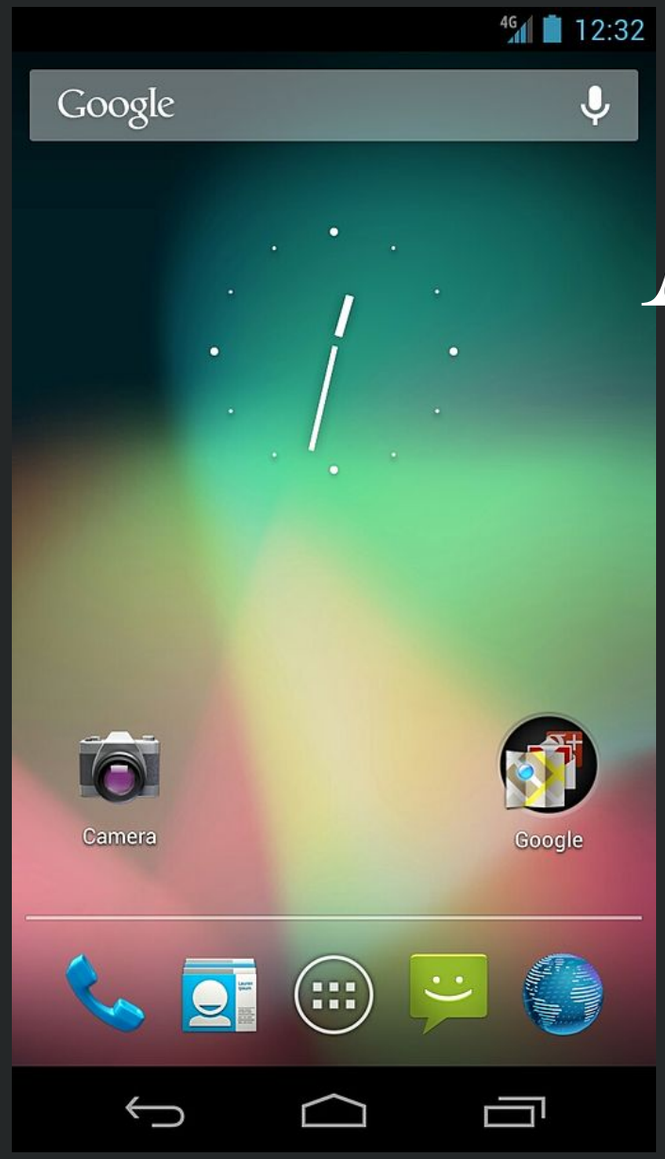
iOS 6

93% support for ES5

http://kangax.github.io/compat-table/es5/

By Self-taken screenshot from an iPhone 5., https://en.wikipedia.org/w/index.php?curid=37500638

Samsung Galaxy S3



Android 4.1 Jelly Bean

85% support for ES5

http://kangax.github.io/compat-table/es5/

2015


Second term 😄

 ES2015 (née ES6) 

iOS 9

54% ES2015

http://kangax.github.io/compat-table/es5/ & http://kangax.github.io/compat-table/es6/

Android 5.1

25% ES2015

http://kangax.github.io/compat-table/es5/ & http://kangax.github.io/compat-table/es6/

ES2015 (ES6)

It had been quite a while, so the list is long…

Block-scoped `let` & `const`	Destructuring and named parms
Default parameters	Rest and Spread operator (`...`)
`for...of` loops and Iterators	Arrow functions (`=>`)
Template strings & interpolation	Improved literals (object, `0b10`)
Generators (`*` / `yield`)	Symbols, Maps & Sets, Promises
`class` syntactic sugar & `super`	Modules (`import` , `export`)

1: https://github.com/lukehoban/es6features#readme; **not** a complete representation of *all* features

2016


We'll miss you! 😢

Brexit

Wait… what?

iOS 10

100% ES2015 *

* Except module implementation; source: http://kangax.github.io/compat-table/es6/

Android (Chrome 50)

92% ES2015

* Except module implementation; source: http://kangax.github.io/compat-table/es6/

ES2016 / ES7

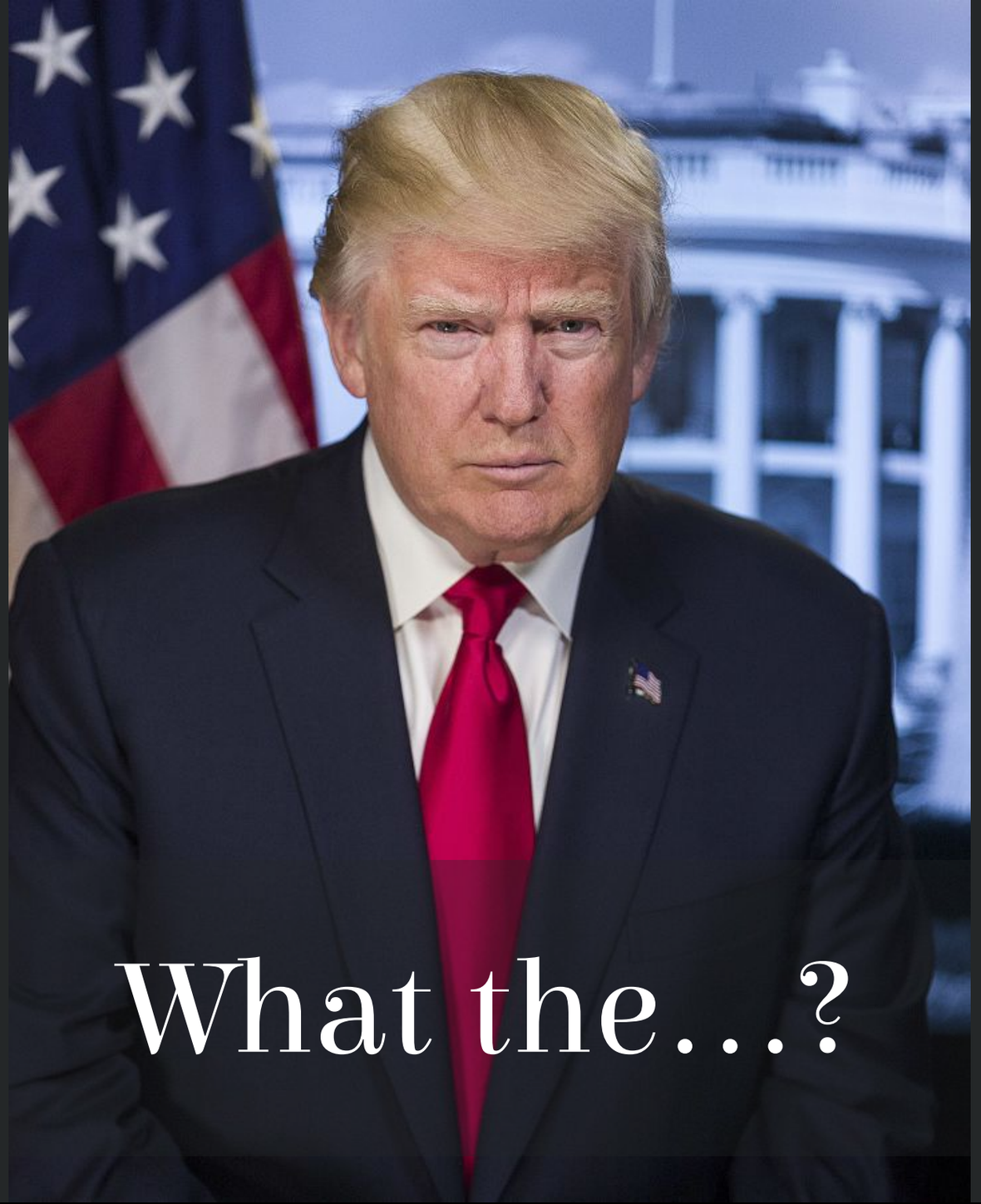
ES2016 (ES7)

Fewer features, but still important:

Exponent (`**`)
`Array.prototype.incudes()`

Source: http://www.2ality.com/2016/01/ecmascript-2016.html

2017


What the…?

ES2017

Ah, that's better...

ES2017

Finally — proper string padding!

`async` / `await`
String padding 😉
Shared memory
Atomics

Source: http://www.2ality.com/2016/02/ecmascript-2017.html

ES2018 and beyond

https://esdiscuss.org

A quick intro to ES2015+

Block. Scoped. Variables. Finally.

```
let i = 50;
for (let i = 0; i < 100; i++) {
  console.log(i); // 0...99
}
console.log(i); // 50
```

Constant references too:

```
const SECONDS_IN_A_MINUTE = 60;
const CREATE_ACTION = "action";
```

Constants aren’t constant

Only the reference is constant:

```
const DEFAULT_OPTIONS = {
  quality: 50
};

DEFAULT_OPTIONS.quality = 100;
console.log(DEFAULT_OPTIONS.quality); // 100
```

Dang it, *this!*

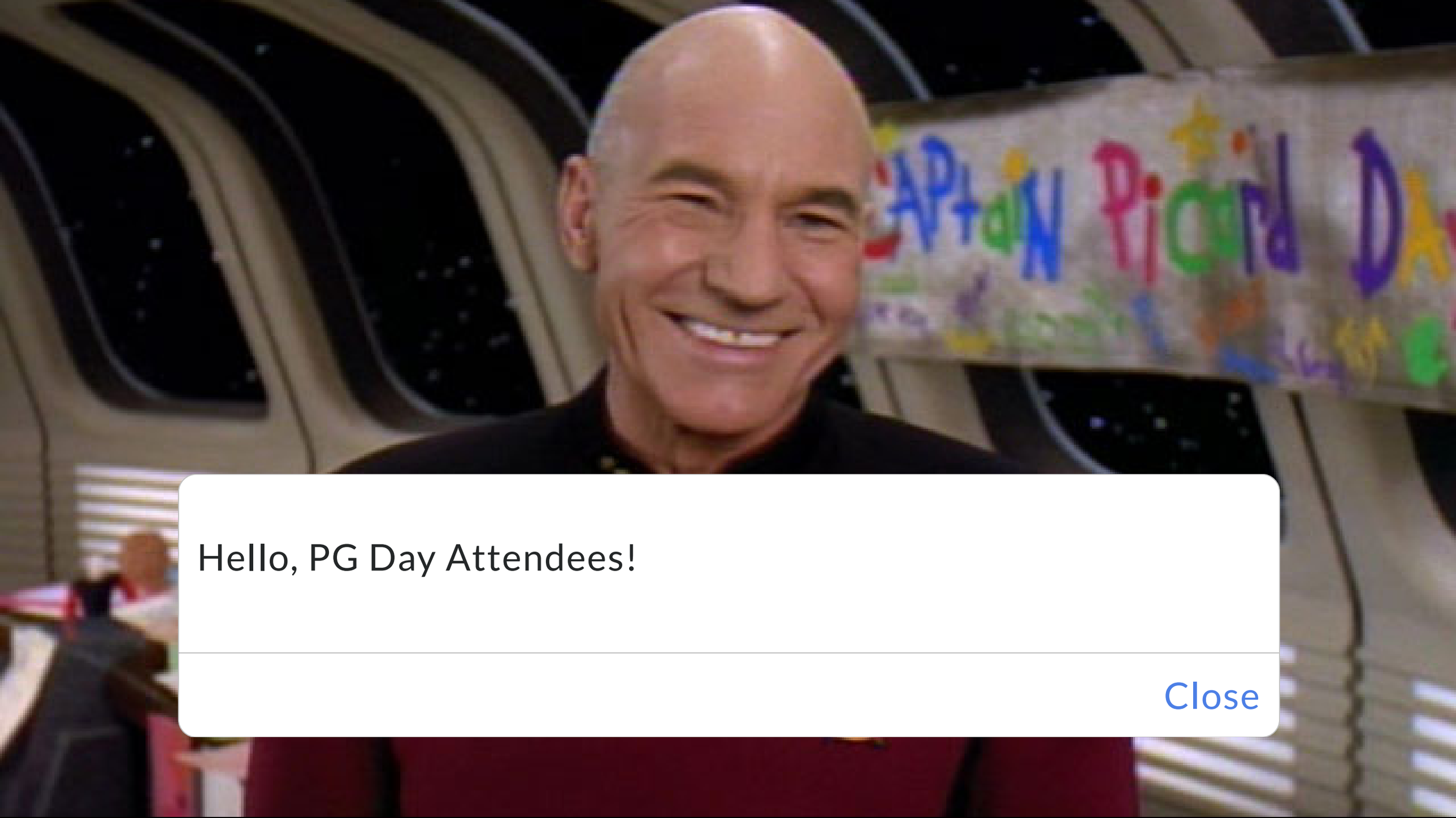
```
1  var app = {
2    text: "Hello, PG Day Attendees!",
3    sayHi: function() { alert(this.text); },
4    start: function() {
5      document.querySelector("#clickme")
6        .addEventListener("click", this.sayHi, false);
7    }
8  }
9
10 app.start();
```


undefined
Close

Arrow functions

```
1  class App {
2    constructor() { this.text = "Hello, PG Day Attendees!"; }
3    sayHi() { alert(this.text); }
4    start() {
5      document.querySelector("#clickme")
6        .addEventListener("click",() => this.sayHi(), false);
7    }
8  }
9  const app = new App();
10 app.start();
```

Line 6 ES5 equivalent: `.addEventListener("click", (function() { this.sayHi(); }).bind(this), false)`


Hello, PG Day Attendees!
Close

Arrow function quirks

No parameters? Use parentheses:

```
[1, 2, 3].forEach(() => console.log("hi"));
```

One parameter? Convention is no parentheses:

```
[1, 2, 3].map(i => i * 2);
```

Multiple parameters? Use parentheses:

```
[1, 2, 3].map((i, idx) => i * idx);
```

Arrow function returns

Single line arrow functions should use implicit `return`:

```
[1, 2, 3].map(i => i * 2);
```

Multi-line arrow functions should use blocks:

```
[1, 2, 3].map(i => {
  let x = Math.floor(Math.random() * 100);
  return i * x;
});
```

Arrow function ambiguity

But what if we return an object? This won't work:

```
[1, 2, 3].map(i => {i: i * 2}); // is equivalent to
[1, 2, 3].map(i => {            // this, which is
i:                              // obviously not what
    i * 2;                      // we want :-(
});
```

Instead, wrap the return in parentheses:

```
[1, 2, 3].map(i => ({i: i * 2}));
```

Template Strings

Single quotes, double quotes, and now... backticks!? Just after I remapped underscore to the backtick, no less!

```
function sayHello(name) {
  return `Hello, ${name}!`;
}

sayHello("World");  // Hello, World!
```

Template Strings

Complex expressions (*use with care*):

```
function sayComplexHello(name) {
  return `Hello, ${name ? name : "Jane Doe"}!`;
}

sayComplexHello("Alex");     // Hello, Alex!
sayComplexHello();           // Hello, Jane Doe!
```

Promises, Promises

More concise with arrow functions:

```
function getPos(options) {
  return new Promise((resolve, reject) => {
    navigator.geolocation.getCurrentPosition(
      resolve, reject, options);
  });
}
```

Promises, Promises, Promises

Easier-to-read chaining:

```
getPos.then(pos => {
  console.log(JSON.stringify(pos);
}).catch(err => {
  console.error(err);
});
```

Destructuring

Do be careful with how far you nest, though.

```
function gotPos(data) {
  let {timestamp, coords:{latitude, longitude}} = data;
  console.log(`${latitude},${longitude}@${timestamp}`);
}
function gotError(err) {
    console.log(`Error ${err.code}: ${err.message}`);
}
getPos().then(gotPos).catch(gotError);
```

Destructuring

Not just for objects; arrays work too:

```
function divide(a, b) {
  if (b === 0) {
    return [undefined, new Error("Divide by zero")];
  } else {
    return [a / b, null];
  }
}
let [results, error] = someFunction();
```

async / await (ES2017)

```
async function start() {
  try {
    let pos = await getPos(),
        {coords:{latitude, longitude}} = pos;
    console.log(`${latitude}, ${longitude}`);
  } catch(err) {
    console.log(`Error ${err.code}: ${err.message}`);
  }
}
```

Note: `async` poisons the call tree; all callers must also be `async` or treat the response like a `promise`.

Array-like conversion

If only I had a € for every time I've written:

```
var elList = document.querySelectorAll("a"),
    elArr = [].slice.call(elList, 0);
```

Array-like conversion

Using the standard library:

```
let elArr = Array.from(document.querySelectorAll("a"));
```

Using the spread operator:

```
let elArr = [...document.querySelectorAll("a")];
```

Rest

Easy variable arguments:

```
function sum(start = 0, ...nums) {
  return nums.reduce((acc, val) => acc + val, start);
}
console.log(sum(1, 5, 10, 99)); /* 115 */
```

Named Parameters & Defaults

```
function getPicture({quality = 50, width = 512,
                     height = 512} = {}) {
  return new Promise((resolve, reject) => {
    navigator.camera.getPicture(resolve, reject, {
      allowEdit: false,
      correctOrientation: true, quality,
      targetWidth: width, targetHeight: height,
    });
  });
}
```

Named Parameters & Defaults

```
// use all the defaults
getPicture().then(/*...*/);

// specify only quality
getPicture({quality:75}).then(/*...*/);

// specify only height & width
getPicture({height: 1024, width: 1024}).then(/*...*/)
```

Modules

Static Analysis, FTW!

math.js:

```
export function add(a, b) { return a+b; }
```

index.js:

```
import {add} from "./math.js";
console.log(add(4, 3));        // 7
```

Cool! Where can I use it?

Native support is a moving target

OS	ES2015	ES2016	ES2017
Android (Chrome)	97% (51+)	100% (55+)	53% (56+)
Windows (Edge 15)	100%	100%	39%
Windows (Edge 14)	93%	-	-
iOS 10.3	100%	100%	98%
iOS 10	100%	61%	42%
iOS 9	54%	-	-

Sources: ES2015, ES2016+

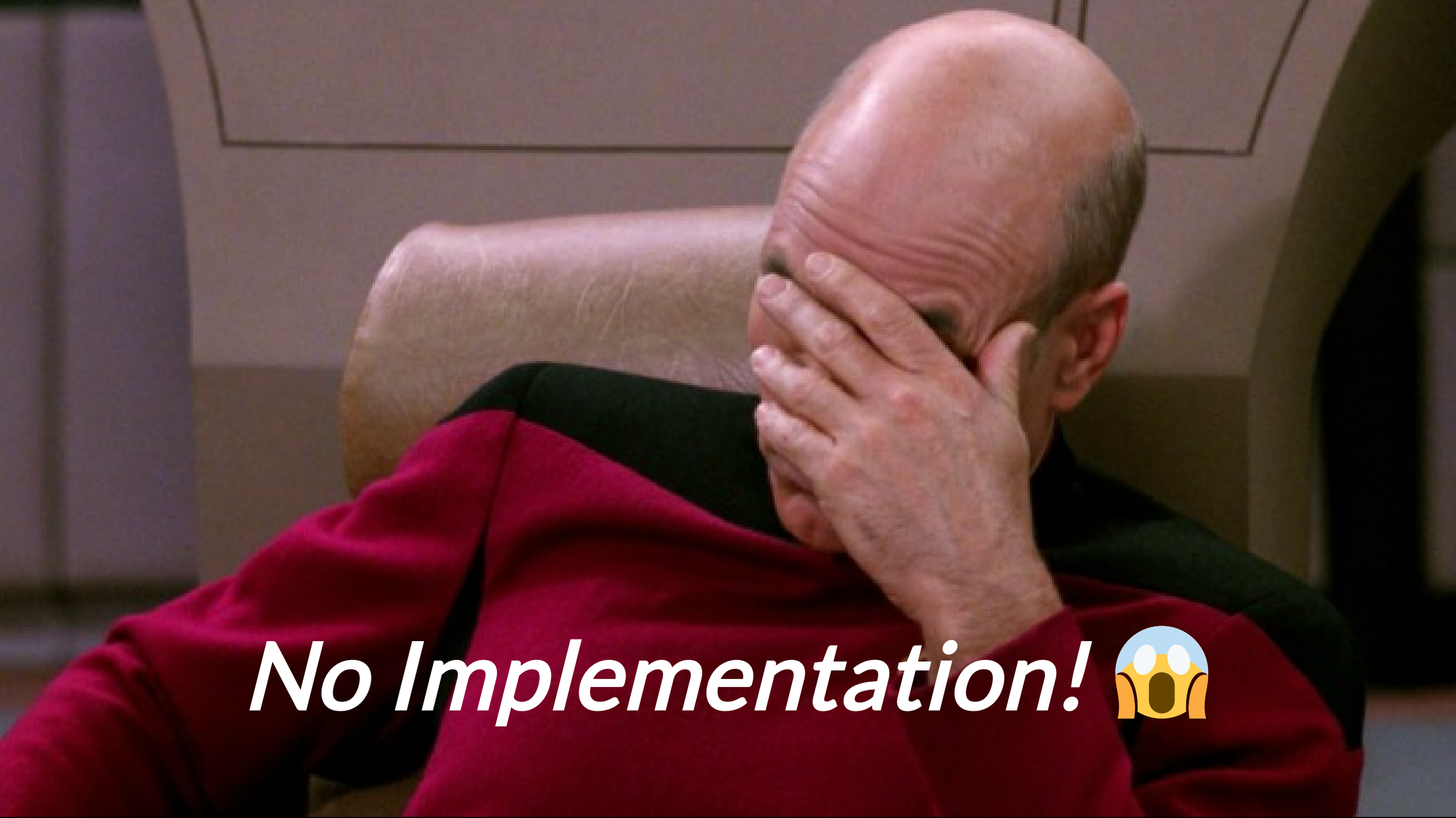
The Rise of the Transpilers

These can all transpile ES2015+* (feature support may vary)

- Babel (née es6to5)
- TypeScript
- Bublé **
- Traceur

* **Note:** Not every ES2015+ feature can be transpiled effectively (if at all), such as proxies, shared memory, atomics, built-in subclassing, and tail call elimination. Also, most transpilers need core-js to polyfill the standard library.
** Doesn't attempt to transform non-performant or non-trivial ES6 features; *also very young*

Remember module support?


No Implementation! 😱

I lie...

Browsers have *finally* started shipping implementations:

- Available now:
  - Safari 10.1, iOS 10.3
- Behind a flag:
  - Edge 15
  - Firefox 54
  - Chrome and Android WebView 60

Source: http://caniuse.com/#feat=es6-module

Native Modules

js/index.js:

```
import Game from "./Game.js";
const game = new Game();
game.start();
```

index.html:

```
<script type="module" src="./js/index.js"></script>
```

There’s always a catch

- No “bare” `import`!
  - Must include the path
  - Must include the extension
  - No aliases
- iOS module loading does not work in PhoneGap / Cordova
  - Why?
  - Timo Ernst, Building PhoneGap apps with Vue.js and Framework7
  - 1:30pm-2:10pm


But we can fix that...

Module support using Bundling 

Dependency management & `import` / `export` (and CommonJS, AMD, etc.) support

- Webpack
- JSPM
- Browserify

You can do more than just bundling:

- Convert SASS to CSS, lint, copy assets, compress assets, etc.

Execution Options

- Manual
  - Just run each tool's CLI… *every time*…
  - Um… no.
    - Error prone — you might forget!
- Automatic
  - Task runners (`gulp` , `grunt` , etc.)
  - `npm` scripts
  - Plugin or Project hooks

Automating with npm scripts

- Pick your bundler and transpiler
  - Bundler: Webpack 2
  - Transpilers: TypeScript & Babel (showing both configs)
- Install Webpack & Transpiler
- Configure Webpack & Transpiler
- Add scripts to `package.json`

Install Webpack

Easy (assuming `package.json` exists):

```
$ npm install --save-dev webpack
```

Install Transpiler

Typescript:

```
$ npm install --save-dev ts-loader typescript core-js
```

Babel:

```
$ npm install --save-dev babel-loader babel-core
    babel-polyfill babel-preset-es2015
    babel-preset-es2016 babel-preset-es2017
    babel-plugin-transform-runtime
```

Note: `core-js` is a standard library polyfill; depending on your feature use and targets you may not need it.

Configure Transpiler

```
// tsconfig.json
{ "compilerOptions": {
    "allowJs": true,
    "target": "es5",
    "module": "es2015", // DCR
    "lib": ["es2015", ...]
    "inlineSourceMap": true
  },
  "include":
    ["www.src/es/**/*"]
}
```

```
// .babelrc
{ "presets": [
    ["es2015", {
      "loose": true,
      "modules": false // DCR
    }],
    "es2016", "es2017"
  ],
  "plugins":["transform-runtime"]
}
```

* Don't forget to import `core-js` (ts)/ `babel-polyfill` in your `index.?s` if targeting older runtimes. DCR = tree shaking

webpack.config.js

```
module.exports = {
  devtool: "inline-source-map",
  context: path.resolve(__dirname, "www.src"),
  entry: { app: ["./es/index.js"] },
  output: {
    filename: "bundle.js",
    path: path.resolve(__dirname, "www", "js")
  },
  module: { /*...*/ }
}
```

webpack.config.js

```
module: {
  rules: [ {
      test: /\.([t|j]sx?)$/,
      exclude: /node_modules/,
      loader: "ts-loader",                  // or babel-loader
      options: { entryFileIsJs: true } // excl if babel
    } /*, ... other rules as needed */
  ]
}
```

npm Scripts

```
"scripts": {
  "sim:ios": "webpack -d && cordova emulate ios",
  "run:ios": "webpack -d && cordova run ios",
  "build:ios": "webpack -d && cordova build ios",
  "build:ios:rel": "webpack -p && cordova build ios --release"
}
```

-d : debug
-p : production (minifies as well)

```
$ npm run build:ios
```

Code Splitting

```
module.exports = {
  entry: {
    app: ["./es/index.js"],
    vendor: ["core-js"]
  }, /*...*/
  module: { /*...*/ },
  plugins: [
    new webpack.optimize.CommonsChunkPlugin({
      name: "vendor", filename: "vendor.js"})
  ]
```

Automating with Plugin Hooks

cordova-plugin-webpack-transpiler transforms at `prepare`-time.

```
$ cordova plugin add cordova-plugin-webpack-transpiler
    --variable CONFIG=typescript|babel|...
```

Executes when `prepare` is called: `build`, `run`, `emulate`, etc.

```
$ cordova build ios                  # debug mode
$ cordova build ios --release        # production mode
$ cordova run ios --notransform      # skip transform/bundling
```

Automating with Templates

Template	Author	Bundler	Transpiler	Frameworks	Automation
cordova-template-webpack-ts-scss	Me	Webpack	TypeScript	Vanilla	`cordova`
cordova-template-webpack-babel-scss	Me	Webpack	Babel	Vanilla	`cordova`
cordova-template-framework7-vue-webpack	centrual	Webpack	Babel	Vue, F7	`cordova`
phonegap-template-react-hot-loader	devgeeks	Webpack	Babel	React	`npm`
phonegap-vueify	lemaur	Browserify	Babel	Vue	`npm`

Automation: “cordova” = Cordova hooks; “npm” = npm scripts

Video

Linting

`eslint` works just fine with ES2015! (`tslint` for Typescript)

```
$ | npm install --save-dev eslint
```

`package.json`:

```
"scripts": {
  "lint": "eslint www.src/es"
}
```

```
$ | npm run lint    # or, write a plugin/project-level hook!
```

Tests and Coverage

```
$ npm install --save-dev chai mocha mocha-webkit
    webpack-node-externals source-map-support
    istanbul-instrumentor-loader cross-env
```

- Create `mocha-webpack.opts`
- Create `.nycrc`
- Create webpack config for testing and coverage
- Add npm scripts

Based on: https://github.com/istanbuljs/nyc/issues/176#issuecomment-286738545

mocha-webpack.opts

```
--webpack-config ./webpack.config-test.js
--require source-map-support/register
--full-trace
test/*.js
```

.nycrc

```
{
  "extension": [".js", ".jsx", ".ts", ".tsx"],
  "reporter": ["html", "text-summary"],
  "cache": true,
  "sourceMap": false,
  "instrument": false
}
```

webpack.config-test.js

```
var path = require("path");
var coverage = process.env.NODE_ENV === "cover";
module.exports = {
  context: path.resolve("test"),
  target: "node",
  externals: require("webpack-node-externals")(),
  devtool: "inline-source-map",
  resolve: {
    extensions: [".js", ".jsx",".ts", ".tsx"],
    modules: ["node_modules"]
  }, module: { /*...*/ }
};
```

webpack.config-test.js

```
module: {
  rules: [{
    test: /\.(j|t)sx?/,
    exclude: /node_modules/,
    rules: [{ test: () => coverage,
              enforce: "post",
              loader: "istanbul-instrumenter-loader?esModules"
    }, { loader: "ts-loader", // or babel-loader
         options: { entryFileIsJs: true } // not if babel
    }]
 }]
}
```

Add npm scripts

Add scripts to `package.json:scripts` *

```
"test": "mocha-webpack",
"cover": "cross-env NODE_ENV=cover nyc npm test",
```

And then:

```
$ npm test
$ npm run cover
```


Reality Check…

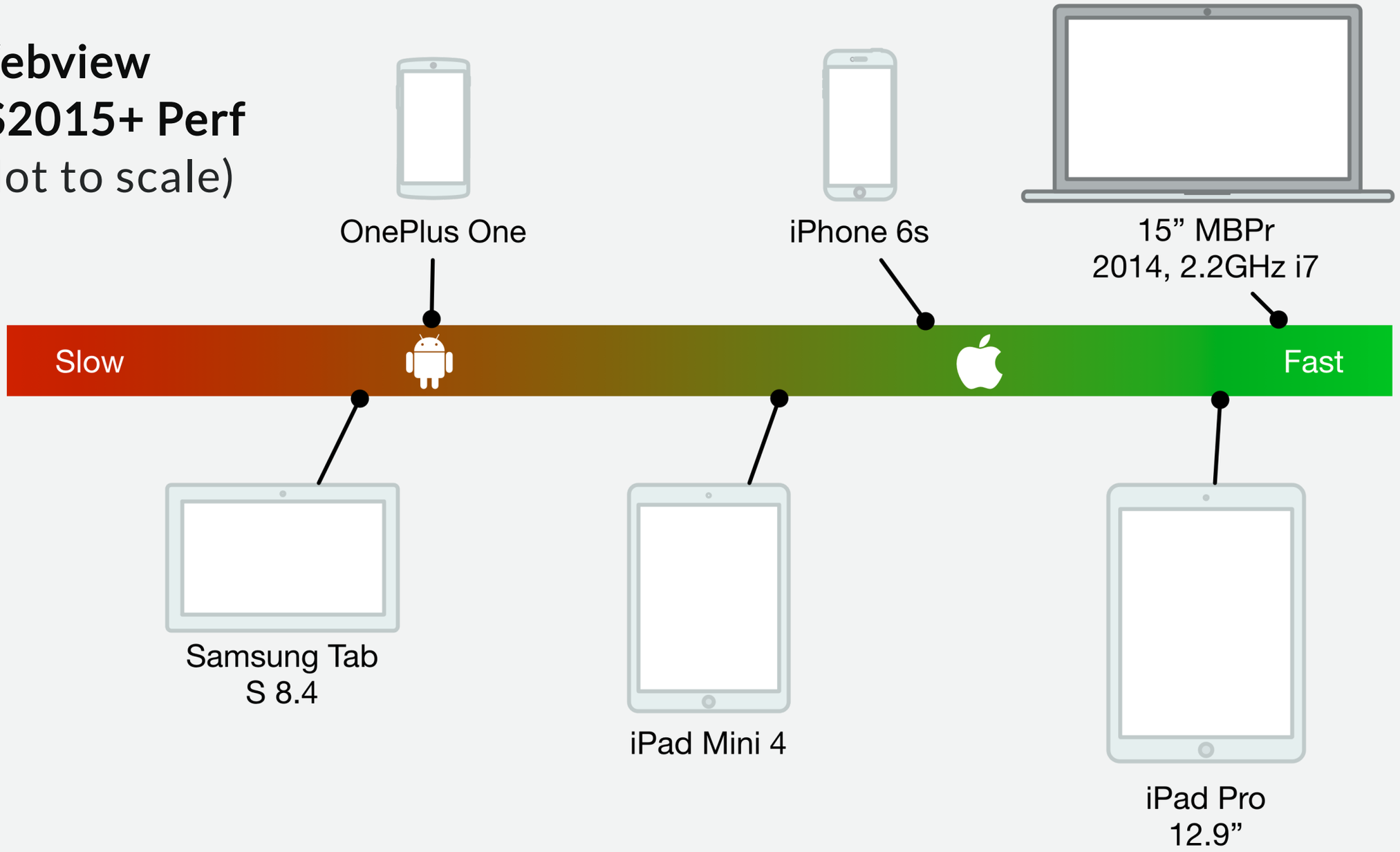
Reality Check...

- ES2015+ is **NOT** a performance optimization
  - See https://kpdecker.github.io/six-speed/ (as of 2017-01-04)

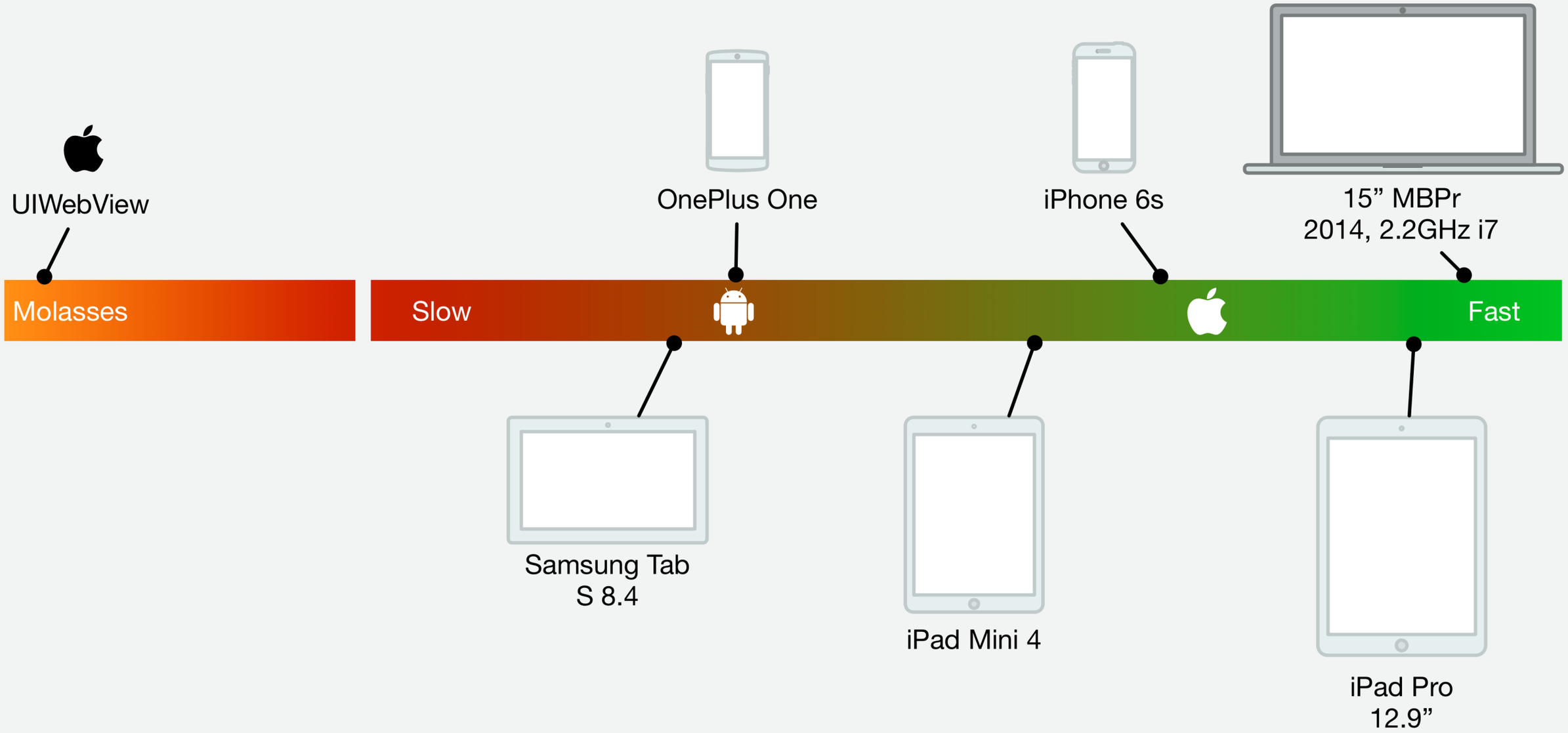
		node		chrome		firefox		edge		safari	webkit
		6.9.3	7.3.0	55	49	50	53	14.14393	15.14959	10	604.1.2+
arrow tests	babel	1.2x slower	Identical	Identical	Identical	Identical	Identical	Identical	1.2x slower	Identical	Identical
	typescript	Identical	Identical	Identical	Identical	Identical	Identical	1.2x slower	1.2x faster	Identical	1.2x slower
	es6	Identical	Identical	Identical	Identical	Identical	Identical	Identical	1.2x faster	Identical	Identical
arrow-args tests	babel	Identical	Identical	Identical	Identical	Identical	Identical	Identical	1.5x slower	Identical	Identical
	typescript	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect
	es6	Identical	Identical	Identical	Identical	Identical	Identical	Identical	Identical	69x slower	71x slower
arrow-declare tests	babel	1.6x slower	1.5x slower	1.4x slower	1.4x slower	30x slower	23x slower	1.3x slower	1.7x slower	Identical	Identical
	typescript	1.4x slower	1.3x slower	1.3x slower	1.4x slower	15x slower	23x slower	1.5x slower	1.4x slower	Identical	Identical
	es6	1.4x slower	1.3x slower	1.3x slower	1.3x slower	38x slower	56x slower	1.2x slower	1.5x slower	Identical	Identical
bindings	babel	Identical	Identical	Identical	Identical	Identical	Identical	Identical	1.4x slower	Identical	1.2x slower

Webview ES2015+ Perf

(Not to scale)




UIWebView strikes again



UIWebView's performance is highly dependent upon language features in use; this is a worst-case representation.

More Reality Checks

- Build step
- Debugging can be “fun”
- Some of the syntax can be a little *sharp* — handle with care

Euuuuggghhhh!!!

Way to crush my dreams!

Not really...

- Micro-benchmarks aren't the entire story
  - Engines are continually improving
- Actual performance deltas are highly variable
  - Depends on platform and the language features in use
- Lots of benefits:
  - Expressive and concise
  - Less boilerplate
  - `padStart` and `padEnd`! 😉

Tips

- ES5 still works
- Use ES2015+ as needed and when you're ready
- `var` is alive and well
  - Use where performance is critical (e.g., tight nested loops)
- Declare `const` / `let` at the top of each scope
  - Benefits Chrome's optimizer
  - Good practice anyway
- Arrow functions aren't drop-in

Tips

- Minify & remove dead code for release builds
  - Reduces bundle sizes and startup time
- Split code bundles
  - Vendor code can be separately bundled
  - Easier to blacklist in debuggers
- Use `WKWebView` on iOS for best performance

Resources

- https://esdiscuss.org
- ECMAScript 2015 Support in Mozilla
- ES2015 Compatibility Table
- 2ality - JavaScript and more
- Can I Use
- WebKit Feature Status
- Chrome Platform Status


That’s all, folks!

Thanks!

@kerrishotts

https://kerrishotts.github.io/pgday/

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