# Modern JavaScript and PhoneGap

## PhoneGap Day EU 2017

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Image by Pete Linforth (https://pixabay.com/en/users/PeteLinforth-202249/), courtesy of Pixabay.com

# 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
- I love retro technology and ST:TNG 😉

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Remember ECMAScript 5?

Release year: 2009

- The version we all know and love (~ish?)
- Supported by all modern mobile web views[1]
  - iOS 6+, IE 10+, Edge (forever), Android 4.4+
- Lots of good things:
  - `map`, `reduce`, getters/setters, etc.

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

# ES2015 and beyond

| | | |
|---|---|---|
| 2015[1] | 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` ) |
| 2016[2] | Exponent ( `**` ) | `Array.prototype.incudes()` |
| 2017[3] | `async` / `await` | String padding 😉 |
| | Shared memory | Atomics |

1: https://github.com/lukehoban/es6features#readme; the list here is not a complete representation of *all* features
2: http://www.2ality.com/2016/01/ecmascript-2016.html; 3: http://www.2ality.com/2016/02/ecmascript-2017.html


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# Important Caveats

- ES2015+ is **NOT** a performance optimization
  - See https://kpdecker.github.io/six-speed/
- Typically requires a build step
- Debugging can be interesting
- Some of the syntax is a little *sharp* — use with care

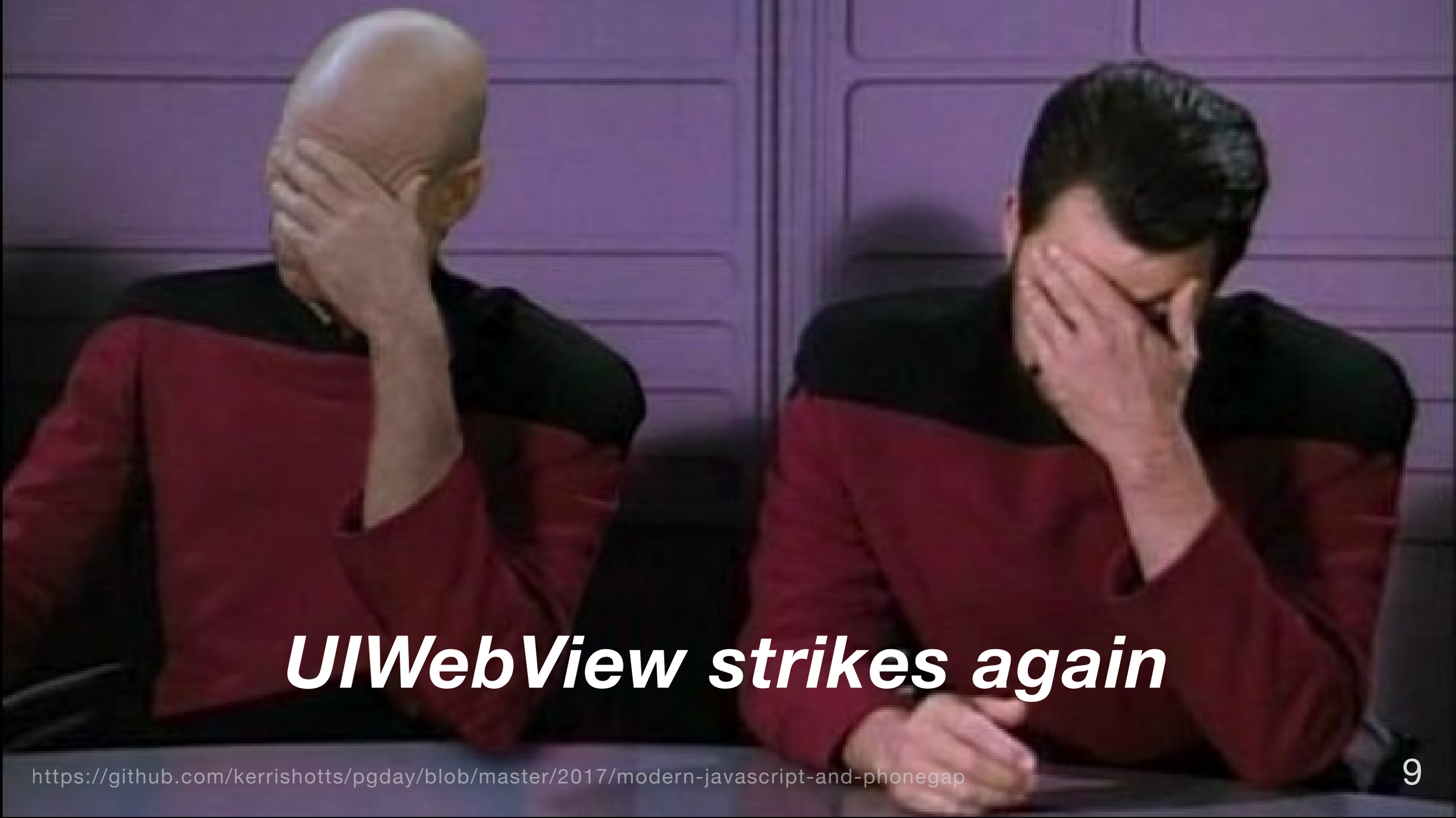
| | | node 6.9.3 | node 7.3.0 | chrome 55 | chrome 49 | firefox 50 | firefox 53 | edge 14.14393 | edge 15.14959 | safari 10 | webkit 604.1.2+ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| arrow tests | babel | 1.2x slower | Identical | Identical | Identical | Identical | Identical | Identical | 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 tests | babel | Identical | Identical | Identical | Identical | Identical | Identical | Identical | 1.4x slower | Identical | 1.2x slower |
| | typescript | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical |
| | es6 | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical |
| bindings-compound tests | babel | Identical | Identical | Identical | Identical | Identical | Identical | Identical | 1.2x slower | Identical | Identical |
| | typescript | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical |
| | es6 | Identical | 1.6x slower | 1.6x slower | 1.5x slower | Identical | Identical | 1.2x slower | Identical | Identical | Identical |
| classes tests | babel | 1.9x slower | 9x slower | 1.5x slower | 1.4x slower | 15x faster | 33x slower | 1.5x slower | 1.2x slower | 7x slower | 7x slower |
| | babel-loose | 1.7x slower | 9x slower | 1.6x slower | 1.4x slower | 14x faster | 34x slower | 1.7x slower | 1.6x slower | 8x slower | 8x slower |
| | babel-runtime | 1.8x slower | 9x slower | 1.5x slower | 1.4x slower | 13x faster | 40x slower | 1.5x slower | 2.0x slower | 7x slower | 8x slower |
| | typescript | Identical | Identical | Identical | Identical | 391x faster | Identical | Identical | Identical | Identical | Identical |
| | es6 | Identical | Identical | Identical | 2.4x slower | 389x faster | Identical | 1.4x slower | 1.5x slower | Identical | Identical |
| defaults tests | babel | 1.5x slower | 1.5x slower | 1.4x slower | 1.5x slower | Identical | Identical | 2.0x slower | 575x slower | 2.2x slower | 10x slower |
| | typescript | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical |
| | es6 | Identical | Identical | Identical | 3x slower | Identical | Identical | Identical | Identical | Identical | Identical |
| destructuring tests | babel | 2.4x slower | 1.3x slower | 1.4x slower | 1.8x slower | Identical | Identical | 3x slower | 3x slower | 16x slower | 1.3x slower |
| | babel-loose | Identical | Identical | Identical | Identical | Identical | Identical | Identical | 1.3x slower | Identical | Identical |
| | babel-runtime | 2.5x slower | 1.4x slower | 1.4x slower | 1.4x slower | Identical | Identical | 2.9x slower | 4x slower | 21x slower | 7x slower |
| | typescript | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical | Identical |
| | es6 | 17x slower | 15x slower | 16x slower | | 83x slower | 98x slower | 20x slower | 53x slower | 9x slower | 23x slower |

# Webviews & Performance

- **WKWebView** (iOS) single-core performance is **excellent**
- Compared to Safari on MBPr*
  - iPad Pro 12.9″: roughly equal
  - iPhone 6s: 2× slower
  - iPad Mini 4: 2.5× slower

- **Android Webview / Chrome** performance is **slow**; by roughly an order of magnitude
- Compared to Chrome on MBPr:
  - OnePlus One: ~10× slower
  - Samsung Tab S 8.4″: ~33× slower

**Note:** Results *highly sensitive* to the JavaScript features in use. *MacBook Pro: Late 2014, 2.2GHz i7 16GB RAM
Left Picture by TPSDave (Pixabay); Right Picture by leovalente (Pixabay)




https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Webviews & Performance (2)

- UIWebView: *ugh*
  - “Slower than molasses in January”
  - e.g: ~75× slower on an iPad Pro 12.9″
  - No JIT 😢

**Note:** Results *highly sensitive* to the JavaScript features in use. MacBook Pro: Late 2014, 2.2GHz i7 16GB RAM
Picture by Mhy (Pixabay)

# Performance Takeaways

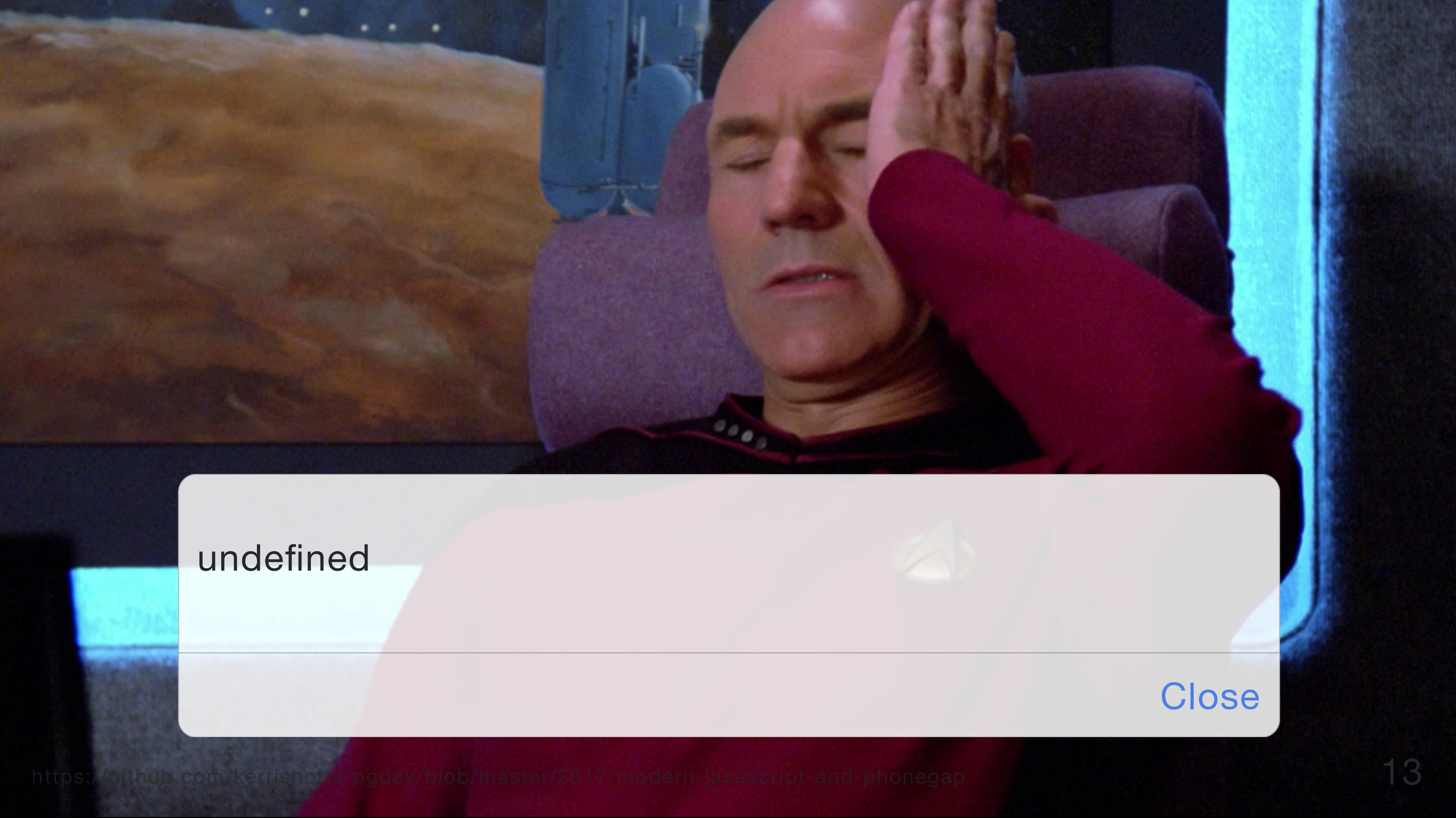
- Micro-benchmarks aren't the entire story
  - Performance is steadily improving
- Not "News" that most webviews are slow — true of ES5 too
  - Expected: iOS `WKWebView` is fast (JIT, faster single-core perf)
  - Expected: Android webviews aren't (slower single-core perf)
  - Expected: `UIWebView` is slower than a snail (no JIT)
- Frameworks are using ES2015 more
- More expressive & less boilerplate

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# 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();
```

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

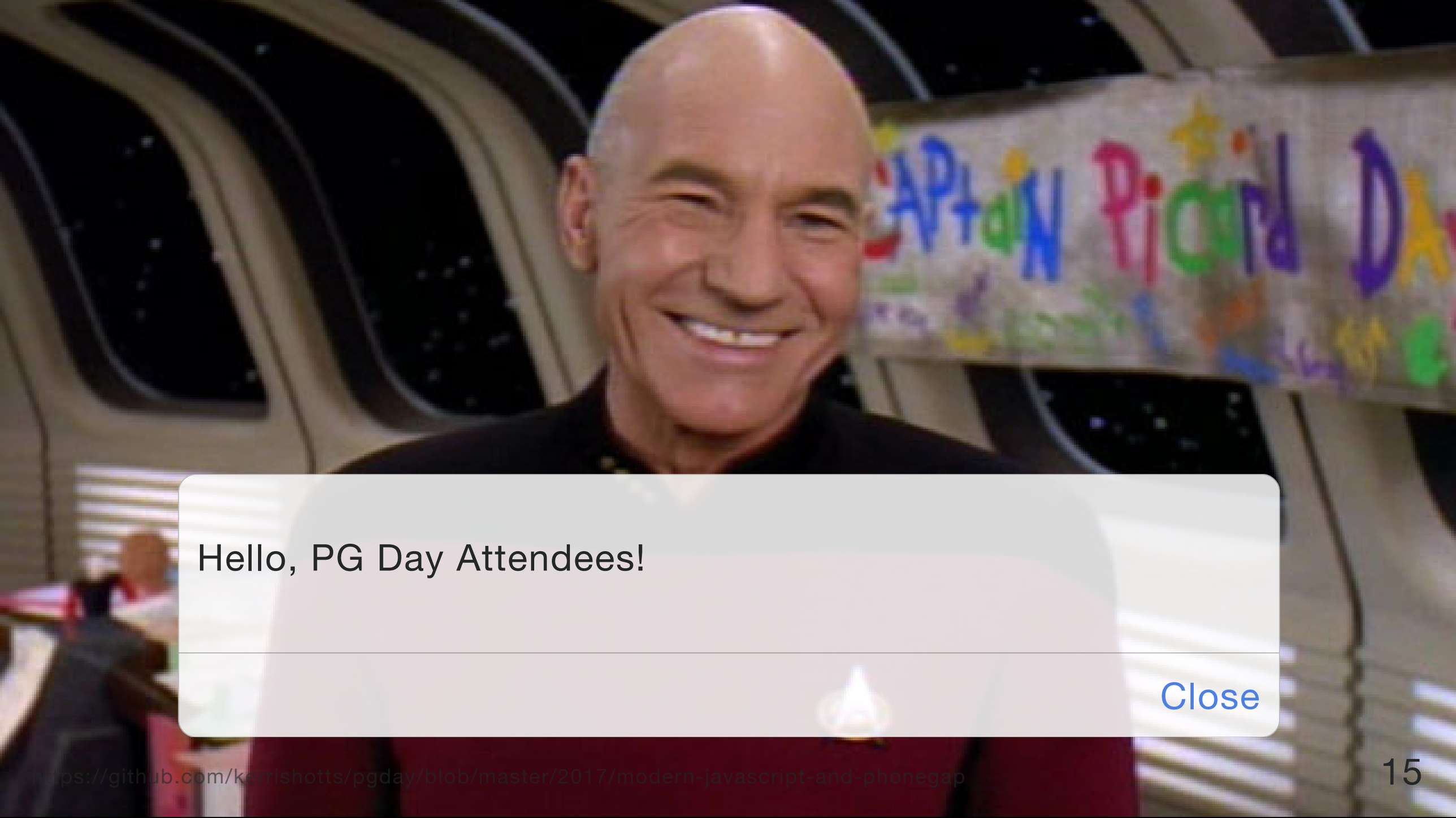



https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# 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

# Template Strings

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

Complex expressions (*use with care*):

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

# Promises, Promises

Now with arrow functions:

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

# Destructuring

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

// Arrays work too:
[a, b] = [b, a]  // swap!
```

# async / await (ES2017)

```
async function start() {
  try {
    const pos = await getPos();
    const {timestamp, coords:{latitude, longitude}} = pos;
    console.log(`At ${latitude},${longitude} on ${timestamp}`);
  } 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);
```

ES2015+*:

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

* with the standard library

# Spread/Rest is awesome (...)

Even shorter than `Array.from`:

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

Easy variadic arguments:

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

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Named Parameters & Defaults

```
function getPicture({quality=50, width=512, height=512}={}) {
  return new Promise((resolve, reject) => {
    navigator.camera.getPicture(resolve, reject, {
      quality, targetWidth: width, targetHeight: height,
      allowEdit: false, correctOrientation: true });
  });
}
getPicture().then(/*...*/);
getPicture({quality:75}).then(/*...*/);
getPicture({height: 1024, width: 1024}).then(/*...*/)
```

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# 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
```

# Native support is a moving target

| OS | ES2015 | ES2016 | ES2017 |
|---|---|---|---|
| Android (Chrome) | 97% (51+) | 100% (55+) | 53% (56+) |
| Edge 15 | 100% | 100% | 39% |
| Edge 14 | 93% | - | - |
| iOS 11* | 100% | 100% | 98% |
| iOS 10 | 100% | 61% | 42% |
| iOS 9 | 54% | - | - |

* Based on current status in Safari Technological Preview 11
**Note**: Some of the tests are based on existence, not completeness. **Sources**: ES2015, ES2016, ES2017

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# ES2015: 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?*

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap


https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap


But we can fix that...

# Module support using Bundling 

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

- Webpack
- JSPM
- Browserify

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Execution Options

- Manual
  - Just run each tool's CLI… *every time*…
  - Error prone — you might forget!
- Automatic
  - Task runners ( `gulp` or `grunt` ; out-of-scope)
  - `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 & Transpiler

```
[user@dev] $ npm install --save-dev webpack
```

Typescript:

```
[user@dev] $ npm install --save-dev ts-loader typescript core-js
```

Babel:

```
[user@dev] $ 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|ts)/**/*"]
}
```

```
// .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

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# webpack.config.js

```
var src = path.resolve(__dirname, "www.src"),
    www = path.resolve(__dirname, "www"),
    loader = "ts-loader"; // or babel-loader
module.exports = {
  context: src, entry: "./es/index.js",
  devtool: "inline-source-map",
  output: { filename: "bundle.js", path: www + "/js" },
  module: {
    rules: [
      { test: /\.(ts|js|jsx)$/, exclude: /node_modules/,
         use: loader, options: { entryFileIsJs: true } //excl if babel
    } /*, ... other rules as needed */ ]}
}
```

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Add Scripts

In package.json:

```
"scripts": {
  "build:ios": "webpack -d && cordova build ios",
  "build:release:ios": "webpack -p && cordova build ios --release",
  // below requires http-server & npm-run-all to be installed
  "_watch:webpack": "webpack -d -w",
  "_watch:serve": "http-server -p 8080 -c-1 www",
  "watch": "run-p _watch:*"
}
```

```
[user@dev] $ npm run build:ios
[user@dev] $ npm run watch
```

# Automating with Plugin Hooks

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

```
[user@dev] $ cordova plugin add --save                \
               cordova-plugin-webpack-transpiler      \
               --variable CONFIG=typescript|babel|...
```

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

```
[user@dev] $ cordova build ios                 # debug mode
[user@dev] $ cordova build ios --release       # production mode
[user@dev] $ cordova run ios --notransform # don't transform
```

# 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

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# Linting

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

```
[user@dev] $ npm install --save-dev eslint
```

📄 `package.json`:

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

```
[user@dev] $ npm run lint    # or, write a plugin /
                             # project-level hook! ;-)
```

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Tests

```
[user@dev] $ npm install --save-dev mocha chai
[user@dev] $ npm install --save-dev ts-node         # for TypeScript
[user@dev] $ npm install --save-dev babel-register # for Babel
```

Add test to package.json:scripts*

```
"test": "mocha" // TypeScript (needs ./test/_bootstrap.js)
"test": "mocha --compilers js:babel-register"     // Babel
```

Then npm test

* Assumes tests are in `./test`
_bootstrap.js: `require("ts-node").register();`

# Code coverage (Babel)

First, `npm install --save-dev instanbul cross-env nyc`

```
{ // .babelrc
  "presets": ["es2015", ...],
  "plugins": [...],
  "env": {
    "cover": {
      "plugins": ["transform-es2015-modules-commonjs",
                  "istanbul"]
    }
  }
}
```

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Code coverage (Babel, 2)

```
// package.json
"nyc": {
  "require": ["babel-register"],
  "reporter": ["text", "html"],
  "sourceMap": false,
  "instrument": false
},
"scripts": { //...,
  "cover": "cross-env NODE_ENV=cover nyc npm test"
}
```

# Tips

- ES5 still works; adjust to ES2015+ at your own speed
- `var` hasn't gone away; it's OK to use it!
  - Use where performance is critical (e.g., tight nested loops)
- Try to declare `const` / `let` at the top of each scope
  - Benefits Chrome's optimizer
  - Good practice anyway
- Arrow functions aren't necessarily drop-in replacements
  - Can be risky with `describe & it` in your tests

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Tips (2)

- 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

https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap


https://github.com/kerrishotts/pgday/blob/master/2017/modern-javascript-and-phonegap

# Thanks!

**@kerrishotts**

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