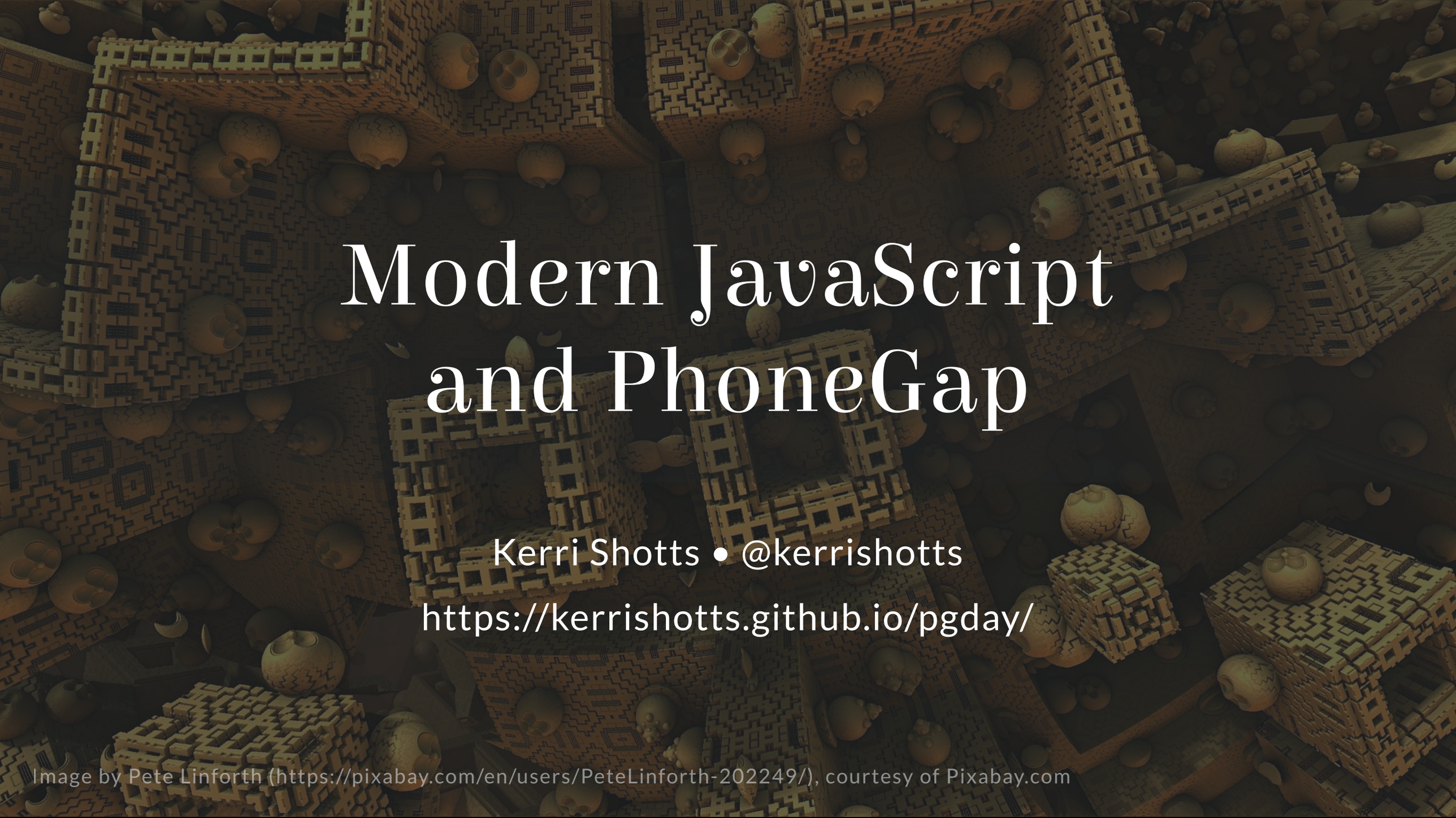


Modern JavaScript and PhoneGap

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
- Just started at Adobe

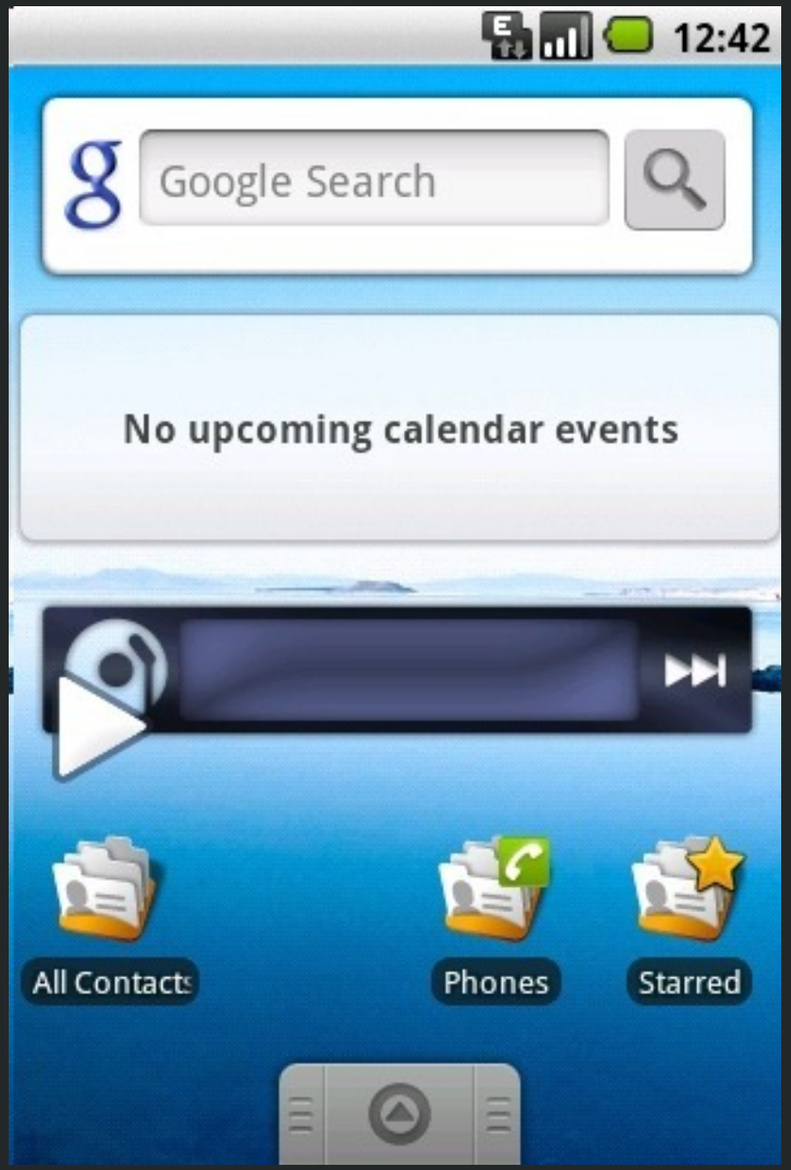
2009

iPhone 3GS

iOS 3

ES3 (1999)

HTC Hero



Android 1.5

ES3 (1999)

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

Time Vortex by Cosmic Thunder (https://cosmicthunder.deviantart.com/)

iPhone 5

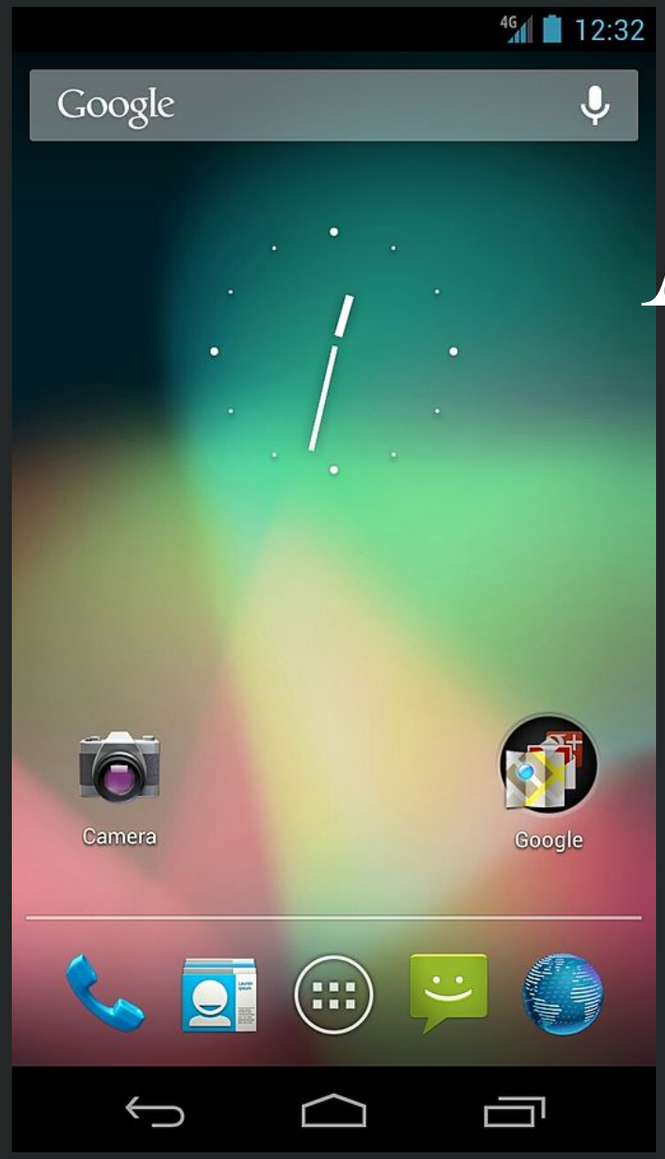
iOS 6

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/

Time Vortex by Cosmic Thunder (https://cosmicthunder.deviantart.com/)

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)

New to the language...

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

Time Vortex by Cosmic Thunder (https://cosmicthunder.deviantart.com/)

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.includes()`

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

Time Vortex by Cosmic Thunder (https://cosmicthunder.deviantart.com/)

ES2017

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

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

Time Vortex by Cosmic Thunder (https://cosmicthunder.deviantart.com/)

ES2018 and beyond

Template Literal Revision: https://tc39.github.io/proposal-template-literal-revision/

Stage 3 Proposals

`global`	Object Rest/spread
async iteration	`import()`
RegExp improvements	`Promise.prototype.finally`
BigInt	Class Fields
Optional `catch` binding	`import.meta`

https://esdiscuss.org

(https://mail.mozilla.org/listinfo/es-discuss)

https://github.com/tc39/ecma262

A quick intro to ES2015+

Block. Scoped. Variables. Finally.

```
const NUMBER_OF_DOCTORS = 13;
const MY_DOCTOR = "David Tennant";

let i = NUMBER_OF_DOCTORS;
for (let i = 0; i < 100; i++) {
  console.log(MY_DOCTOR, i); // David Tennant 0, ...
}
console.log(i);                  // 13
```

Constants !== immutable

The variable can’t be reassigned, but the contents are still mutable.

```
const THE_DOCTOR = {
  person: "Peter Capaldi"
};

THE_DOCTOR.person = "Jodie Whittaker";
console.log(THE_DOCTOR.person); // Jodie Whittaker
```

this is such a pain...

```
var doctor = {
  greeting: "Hello, %target%! I'm the Doctor!",
  sayHi: function(evt) {
    alert(this.greeting.replace(/%target%/g,
      evt.target.dataset.target));
  },
  start: function() {
    document.querySelector("#sayHiToK9")
      .addEventListener("click", this.sayHi, false);
  }
}
```

TypeError: undefined is not an object (evaluating ‘this.greeting.replace’)

Arrow functions

```
const doctor = {
  greeting: "Hello, %target%! I'm the Doctor!",
  sayHi: function(evt) {
    alert(this.greeting.replace(/%target%/g,
      evt.target.dataset.target));
  },
  start: function() {
    document.querySelector("#sayHiToK9")
      .addEventListener("click",
        evt => this.sayHi(evt), false);
```


Hello, K9! I'm the Doctor!

Arrow function quirks

Zero or 2+ parameters? Use parentheses:

```
[1, 2, 3].map(() => Math.floor(Math.random() * 100));
[1, 2, 3].map((i, idx) => i * idx);
```

One parameter? Convention is no parentheses:

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

Need only the second?

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

Arrow function returns

Single line arrow functions use implicit `return`:

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

Block arrow functions use explicit `return`:

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

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 => {
i:                                  // obviously not what
    i * 2;                          // we want :-(
});
```

Arrow function ambiguity

Instead, wrap the object in parentheses:

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

Or, just use the block form:

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

Template Literals

Multiline and expression interpolation:

```
function sayHelloAndGoodbye(name) {
  return `Hello, ${name},
Goodbye, ${name}`;
}

console.log(sayHelloAndGoodbye("Doctor"));
// Hello, Doctor!
// Goodbye, Doctor!
```

Template Literals

Arbitrary expressions (*use with care*):

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

sayComplexHello("Sarah");    // Hello, Sarah!
sayComplexHello();           // Hello, Doctor!
```

Promises, Promises

More concise with arrow functions:

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

Promises, Promises, Promises

Chaining is easier to read:

```
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.error(`Error received! ${err}`);
}
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];
  }
}
const [results, error] = divide(4, 0);
```

async / await (ES2017)

```
async function start() {
  try {
    const pos = await getPos(),
      {coords:{latitude, longitude}} = pos;
    console.log(`${latitude}, ${longitude}`);
  } catch(err) {
    console.error(`Error received! ${err}`);
  }
}
```

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

Array-like conversion

```
// ES 5 way to convert a NodeList to an Array
var elList = document.querySelectorAll("a"),
    elArr = [].slice.call(elList, 0);

// ES2015 method
const elArr=Array.from(document.querySelectorAll("a"));

// Can also construct series:
const series = Array.from({length: 8},
  (_, idx) => idx * idx); // [0, 1, 4, 9, 16, 25, ...]
```

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();

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

// specify only height & width
getPicture({height: 1024, width: 1024});
```

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

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+* to ES5:

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

---

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

Module Support is problematic

Browsers have only *recently* started shipping implementations:

- Available now:
  - Safari 10.1+, iOS 10.3+
  - Chrome and Android Webview 61+
- Behind a flag:
  - Edge 15
  - Firefox 54

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

```
import Game from "./Game"; // bare import (won't work)
import Decimal from "Decimal"; // also won't work
```

- No “bare” `import`!
  - Must include the path
  - Must include the extension
  - No node-style resolution
- iOS module loading does not work in PhoneGap / Cordova

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.

We can supply bundled and unbundled versions:

If you want...

```
<!-- this script will have modules, and executes in
     modern browsers -->
<script type="module" src="./es/index.js"></script>

<!-- this script won't, and will only execute in
     older browsers * -->
<script nomodule src="./js/index.js"></script>
```

---

* Except Safari 10.1. See https://gist.github.com/samthor/64b114e4a4f539915a95b91ffd340acc
See https://jakearchibald.com/2017/es-modules-in-browsers/ for more.

Execution Options

- Manual
- Task runner
  - `gulp`, `grunt`, etc.
  - `npm` scripts
- Automatic
  - Plugin Hooks
  - Project hooks

Automating with npm scripts

- Pick your bundler and transpiler
  - Bundler: Webpack
  - 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-env
    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", ...],
    "sourceMap": true
  },
  "include":
    ["www.src/es/**/*"]
}
```

```
// .babelrc
{ "presets": [
    ["env", {
      "loose": true,
      "modules": false // DCR
    }]
  ],
  "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"})
  ]
```

… don’t forget to update index.html

www/index.html:

```
<body>
  <script type="text/javascript" src="js/vendor.js">
  </script>
  <script type="text/javascript" src="js/bundle.js">
  </script>
</body>
```

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/bundle
```

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-template-vue-f7-blank	devgeeks	Webpack	Babel	Vue, F7	`npm`
phonegap-template-vue-f7-split-panel	devgeeks	Webpack	Babel	Vue, F7	`npm`
phonegap-template-vue-f7-tabs	devgeeks	Webpack	Babel	Vue, F7	`npm`
phonegap-vueify	lemaur	Browserify	Babel	Vue	`npm`

Video

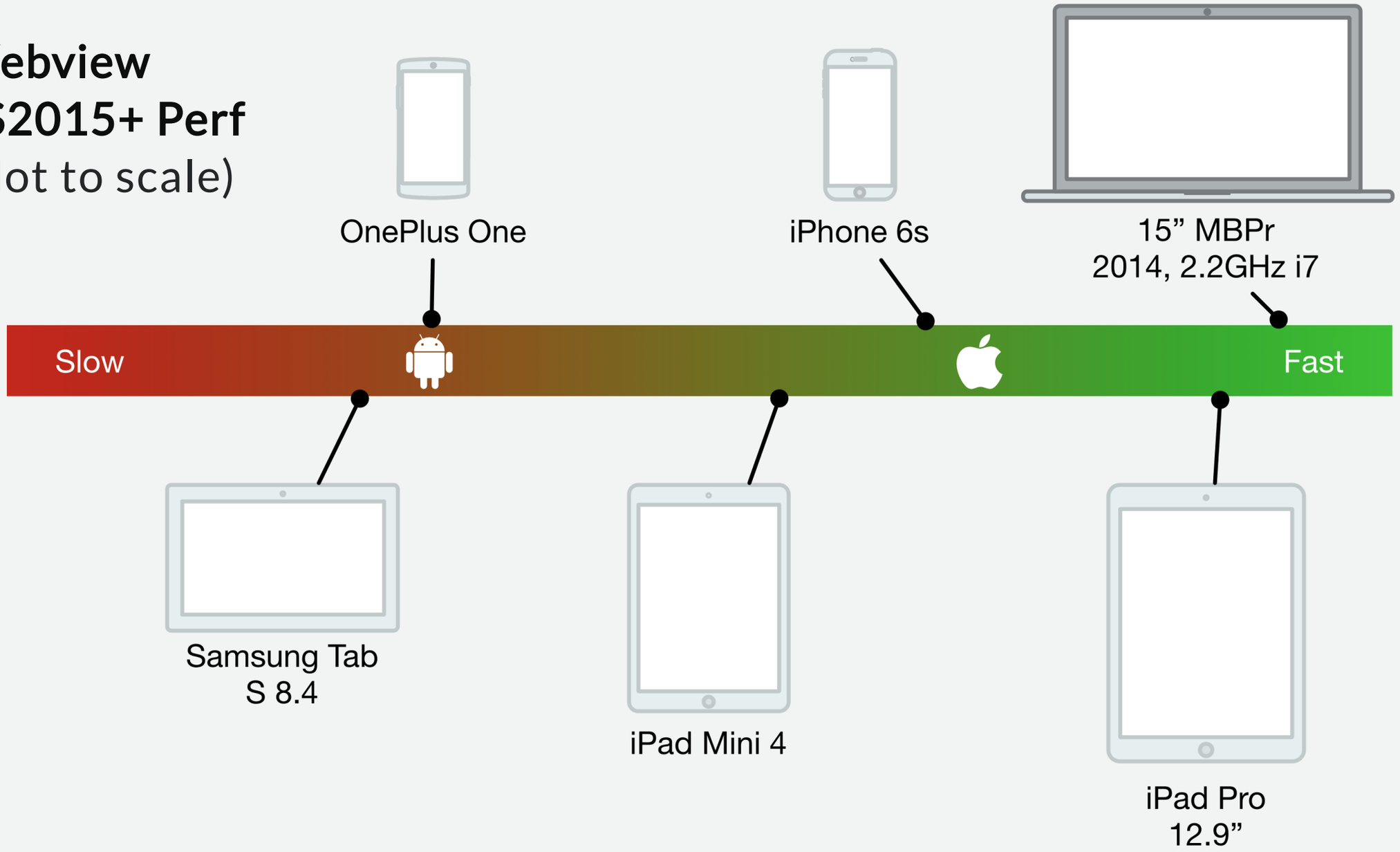
Reality Check...

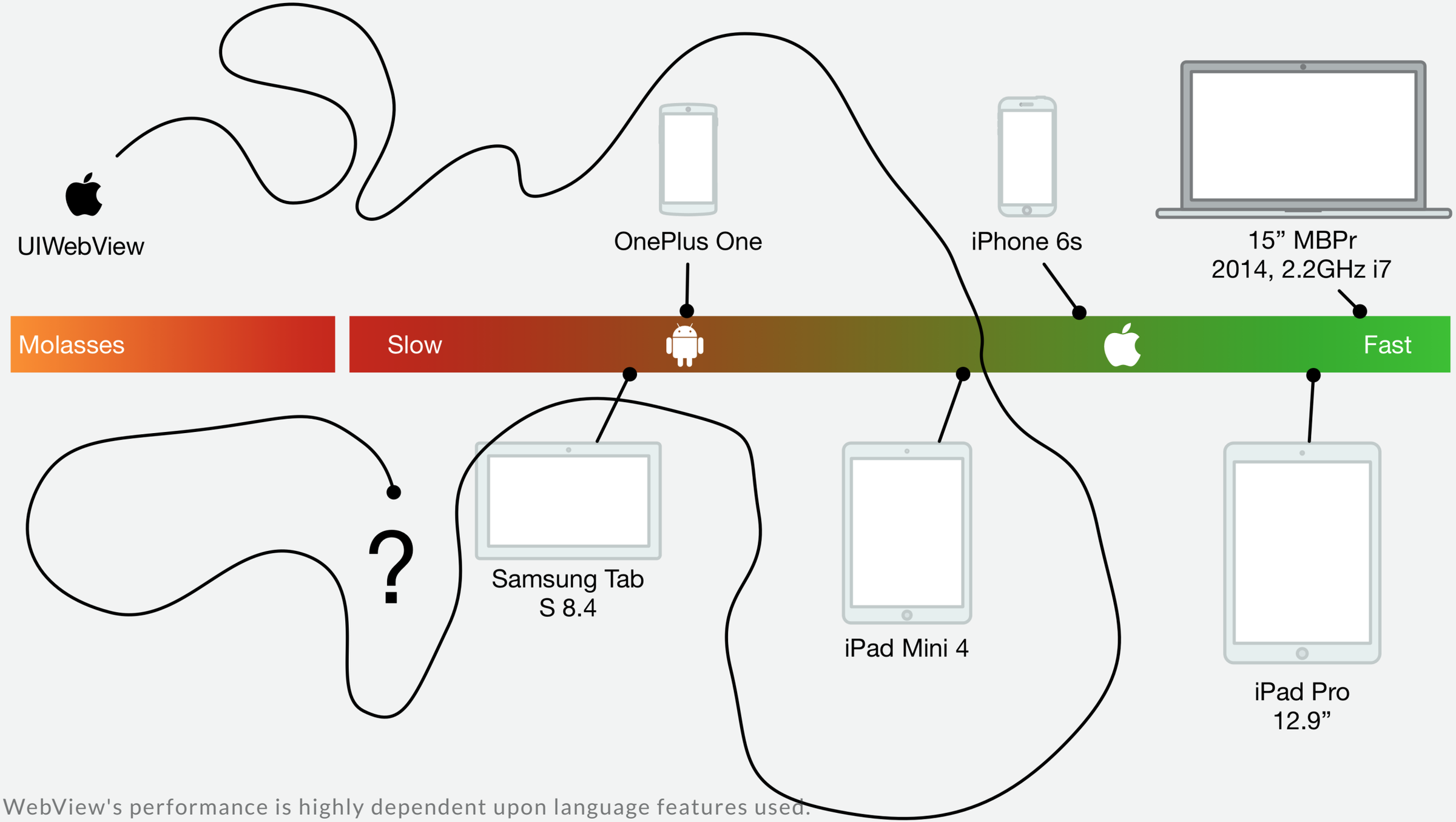
- Don't switch to ES2015+ because you expect performance improvements
  - See https://kpdecker.github.io/six-speed/ (as of 2017-01-04)

		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

Webview ES2015+ Perf

(Not to scale)





UIWebView's performance is highly dependent upon language features used.

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
  - Modules, Template literals, and more!

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)
- Arrow functions aren't drop-in
  - `this` is lexically scoped

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

Thanks!

@kerrishotts

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

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