Modern JavaScript and PhoneGap

PhoneGap Day EU 2017

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Hi!

- I've Used PhoneGap for over six years
- I've written five books about PhoneGap
- I work with clients to create various kinds of apps
- I'm an Apache Cordova committer
- I'm one of several moderators on the Cordova Google Group and PhoneGap Adobe Forums — If you haven't checked out the latter, you should!
- I love retro technology! :-)

Modern JavaScript Versions

Remember ECMAScript 5?

Release year: 2009

- The version of JavaScript we all know and love (~ish?)
- Supported by all modern mobile web views[1]
  - iOS 6+, IE 10+, Edge (forever), Android 4.4+
- Reasonably modern (`map` , `reduce` , getters/setters, etc.)
- Things have changed a lot since then...

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

ECMAScript 6 / ES2015

Block-level scoped `let` & `const`	Destructuring and named parameters
Default parameters	Rest and Spread operator (`...`)
`for...of` loops and Iterators	Lexical function binding (`=>`)
Template strings & interpolation	Improved literals (object, binary, octal)
Generators (`*` / `yield`)	Symbols, Maps, Sets, WeakMaps, WeakSets, Promises
`class` syntactic sugar & `super` *	Modules (`import` , `export`)

* Debatable if this is a good thing or not! 😉

Source: https://github.com/lukehoban/es6features#readme

ECMAScript 2016

Small point release, essentially:

- Exponentiation operator (`**`)
- `Array.prototype.includes()`

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

ECMAScript 2017

A bit more this year…

- `async` / `await`
- String padding, *finally* 😉
- Shared memory and atomics

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

Before we go any further…

Some Very Important Caveats!

Caveats

- **Not** a performance optimization: ES2015+ code often slower than ES5[1]
- Introduces a build step to your processes
- Debugging can be difficult / confusing *even with source maps* (but this is steadily improving)
- For iOS, *you really need `WKWebView`* and all that entails
    - `UIWebView` perf is abysmal
- For Android, 4.4+ should be OK
    - <4.4 use Crosswalk.

1. https://kpdecker.github.io/six-speed/

Feature	Chrome 55	Edge 15	Safari 10
Arrow functions	N/C	**+1.2x**	N/C
`let` compound	-1.6x	N/C	N/C
Classes	N/C	-1.5x	N/C
`super`	-4x	-1.7x	-15x
Destructuring	-16x	-53x	-23x
`for` ... `of Array`	-17x	-7x	-1.3x
`for` ... `of Object`	-1.8x	-4x	-2.3x
`Map & Set`	-4.x	-23x	-8x
rest `...`	**+1.3x**	**+14x**	-33x
spread `...`	-22x	-1.7x	-5x
Template string	-1.2x	**+1.4x**	-18x

Source: https://kpdecker.github.io/six-speed/ (2017/01/04) | N/C: "no change"

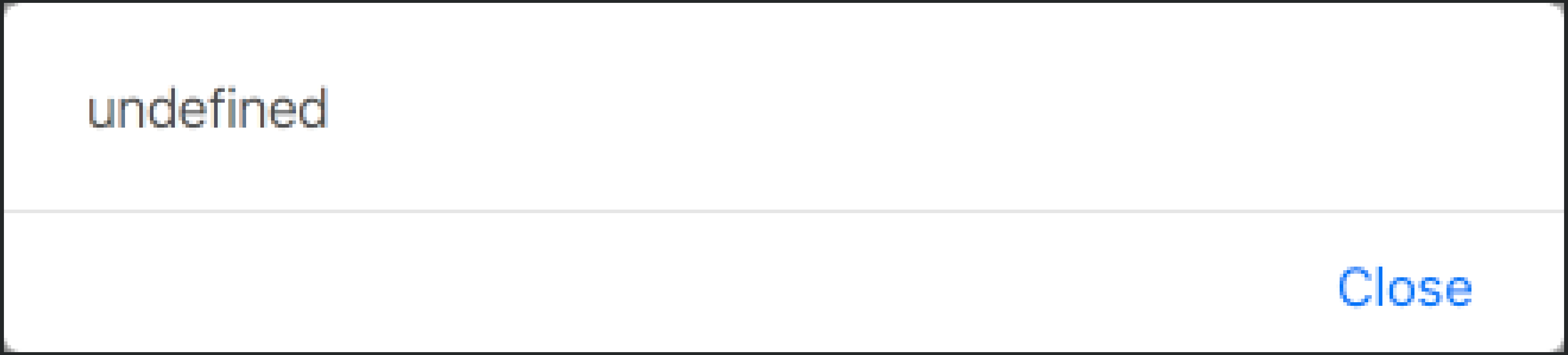
A whirlwind tour

Dang it, *this!*

```
var app = {
  text: "Hello, PhoneGap Day Attendees!",
  sayHi: function() { alert(this.text); },
  init: function() {
    document.getElementById("clickme")
        .addEventListener("click", this.sayHi, false);
  }
}

app.init();
```

Wah wah 🚫

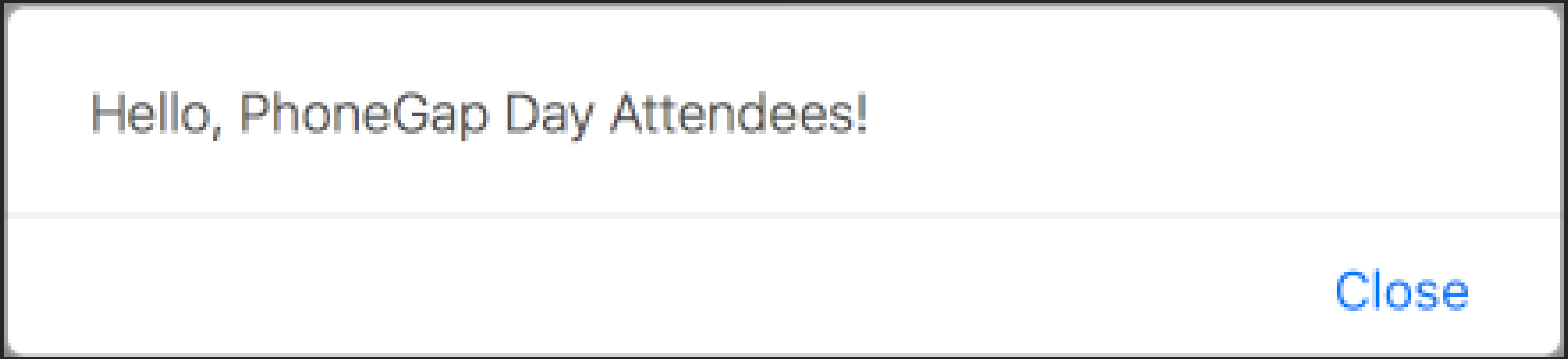

```
undefined
```

Arrow functions (=>)

```
class App {
  constructor({text = "Hello, world!"} = {}) {
    this.text = text;
  }
  init() {
    document.getElementById("clickme")
        .addEventListener("click", () => this.sayHi(), false);
  }
  sayHi() { alert(this.text); }
}
const app = new App({text: "Hello, PhoneGap Day Attendees!"});
app.init();
```

ES5 equivalent: `(function() { this.sayHi(); }).bind(this)`

Hi! 🎉


Hello, PhoneGap Day Attendees!

Array.from

Remember doing this?

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

Now we can do this:

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

Spread/Rest is awesome (...)

Even shorter than `Array.from`:

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

Easy variadic arguments:

```
function sum(...nums) {
    return nums.reduce((a, v) => a + v, 0);
}
console.log(sum(1, 5, 10, 99));
```

⇒ 115

Spread/Rest is awesome (...) (2)

Easy sprintf-like:

```
function sprintf(str, ...replacements) {
    return str.match(/\%[0-9]+/g)
        .reduce((a, v) => a.replace(v,
                          replacements[v.substr(1)]), str);
}
console.log(sprintf ("%1, %0", "world", "hello"));
```

⇒ Hello, world

Destructuring

Easy swap:

```
[a, b] = [b, a]
```

Multiple return values:

```
function someFunction(str) {
  return {result: str + str, error: str === "" ? "no string" : null};
}
let {result, error} = someFunction("that might error");
// renaming:
let {result:r, error:err} = someFunction("that might error");
```

Named Parameters & Defaults

```
class Button {
    constructor({type = "default", text = "",
                 x = 0, y = 0, w = 100, h = 44} = {}) {
        this.type = type;
        this.text = text;
        this.frame = {x, y, w, h};
        this.bounds = {x: 0, y: 0, w, h};
    }
}

let button = new Button ({type: "round", text: "Click me",
                          x: 100, y: 100});
```

Template Strings

```
let x = 4;
let y = 10;
console.log(`x + y => ${x} + ${y} => ${x + y}`);
```

⇒ x + y => 4 + 10 => 14

Allows multi-line strings (preserving ↵):

```
let template=`<ul>
    <li><span></span></li>
</ul>`;
```

Sets and Maps

Easy Dedup:

```
function dedup (arr = []) {
    return Array.from(new Set(arr));
}

let arr = dedup([ 1,  4,  9,  3,  4,  9, 12,
                 20, 12, 32, 94,  9, 12,
                 94, 34,  1]);
```

Modules (friendly to static analysis)

📄 math.js:

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

📄 index.js:

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

⇒ 7

Where can I use this now?

Native support (%coverage)

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%	-	-

* Forget about Android 4.4 or lower without Crosswalk
** Based on current status in Safari Technological Preview — Admittedly this is a bit of a guess

But, I want it everywhere!

ES2015+ ⇒ ES5!

or, *The Rise of the Transpilers*

The Transpilers

These can all transpile ES2015* (with varying degrees of success):

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

There is no wrong answer here.

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* **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
* **Note:** 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 syntax?

No implementation! 😱

But we can fix that...

Module support using Bundling 🛍️

Dependency management & `import` / `export` support

Bundler	Babel	Bublé	Coffee	Typescript	Traceur
Webpack	✓	✓	✓	✓	✓
JSPM	✓	—	—	✓	✓
Browserify	babelify	bubleify	coffeeify	tsify	traceurify

There is no wrong choice here (unless you need a transpiler that isn't supported).
However, Webpack probably has the most momentum at present.

PhoneGap Integration

- If you're sadistic, you can do it manually — just run each tool's CLI... *every time*...
- But you're a developer, so you like automation, right? 🤖
  - 🏃 `gulp` / `grunt` task runners
  - 📜 `npm run` scripts ← great if you are already comfortable with npm and node
  - 🐟 Plugin hooks ← *this is really fun!* 😁
    - Project-level hooks work too

Building (npm scripts)

- Where to put your ES2015+ code?
  - Sibling (sibling of `js`)
  - External (sibling of `www`)
- Install Webpack & Transpiler
- Configure Webpack & Transpiler
- Add scripts to `package.json`

Sibling Structure

```
📁 project-root/
  📄 config.xml
  📁 www/
    📄 index.html
    📁 esm/
      📄 index.(ts|js)
    📁 js/
      📄 index.js ← (gen)
```

External Structure

```
📁 project-root/
  📄 config.xml
  📁 esm/
    📄 index.(ts|js)
  📁 www/
    📄 index.html
    📁 js/
      📄 index.js ← (gen)
```

Which one?

	Pros	Cons
Sibling	Easier path resolution (completion)	Code duplication in builds*
External	No duplication in app	Outside of `www`

No right or wrong answer — depends on your needs

* … but we can delete those files

Install Webpack & Transpiler

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

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-preset-react \
  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 TypeScript

Create `tsconfig.json`:

```
{
    "compilerOptions": {
        "allowJs": true,
        "target": "es5",
        "module": "es2015",      // required for tree shaking
        "inlineSourceMap": true
    },
    "include": [
        "www/esm/**/*"           // or esm/**/* if external
    ]
}
```

Configure Babel

Create `.babelrc`:

```
{
    "presets": [
        ["es2015", {
            "loose": true,     // Use LOOSE for best perf
             "modules": false // required for tree shaking
        }],
        "es2016", "es2017", "react"
    ],
    "plugins": ["transform-runtime"] // reduces repetition in
                                      // output files
}
```

Configure Webpack

Create `webpack.config.js`:

```
var path = require("path");
module.exports = {
    devtool: "inline-source-map",
    context: path.resolve(__dirname, "www"),
    // if external, use __dirname, "esm", "index.js"
    entry: path.resolve(__dirname, "www", "esm", "index.js"),
    output: { filename: "app.bundle.js",
              path: path.resolve(__dirname, "www", "js") },
    module: { loaders: [ {
                test: /\.(ts|js)$/,
                loader: 'ts-loader',                // or babel-loader
                exclude: /node_modules/,
                options: { entryFileIsJs: true } // only for js with typescript
            } ] }
}
```

Add run script to package.json

In `package.json` (assuming `cordova` is local):

```
{
   "scripts": {
        "cordova": "cordova",
        "webpack": "webpack",
        "build:ios": "npm run webpack && \
                      npm run cordova -- build ios && \
                      rm ./platforms/ios/www/esm/*.*"
   }
}
```

Webpack Transpiler Plugin 😁

```
$ cordova plugin add cordova-plugin-webpack-transpiler \
  --variable TRANSPILER=typescript|babel \
  --variable MODE=sibling|external
```

- Runs `npm init` and `npm install` for dependencies
- Creates initial configuration files
- Hooks `prepare` to perform the transforms and clean up
  - Sorry, **PGB** users; this means it won't work for you 😢

Fork, translate, and/or improve it: https://github.com/kerrishotts/cordova-plugin-webpack-transpiler

What about tests?

...and code coverage?

Tests

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

Add `test` to `package.json:scripts` *

```
"test": "mocha" // TypeScript (need ./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)

`npm install --save-dev instanbul`, then in `.babelrc`:

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

Code coverage (Babel, 2)

`npm install --save-dev cross-env nyc` and configure (in `package.json`):

```
"nyc": {
  "require": ["babel-register"],
  "reporter": ["text", "html"],
  "sourceMap": false,
  "instrument": false
}
```

And create a `npm run` script:

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

Tips

Tips

- Be careful of arrow functions to `describe` & `it` in your tests
    - `this` will not be what your test runner expects!
- Use `var` instead of `let` in tight nested loops where performance is critical
- Minified code is not necessarily more performant (depends on the optimizer)
-

Tips (2)

- Chrome *deopt*'s for odd reasons
  - The inspector will indicate `[deopt]` and the reason

Reason	Workaround
Declaration not at top (TDZ issues)	Move declaration to top of function
Compound assignments	Use `var` in declaration instead

Some device ES2015 perf stats...

Device	GB 4 SC	Web View	MIPS	IPF	FPS
MacBook Pro 2014	3574	Safari	4.74	79,248	~60
iPad Pro 12.9"	3013	`WKWebView`	4.52	75,602	~60
MacBook Pro 2014	3574	Chrome	3.94	66,092	~60
iPhone 6s	2359	`WKWebView`	2.49	41,552	~60
iPad Mini 4	1633	`WKWebView`	2.00	33,806	~59
Samsung Tab S 8.4"	783	Chrome	0.13	~2,166	~53
iPad Pro 12.9"	3013	`UIWebView`	0.01	~166	~42

Note: Of course, this is *highly sensitive* to the ES2015+ features that you use.

To bundle or not to bundle?

Yes.

To transpile or not to transpile?

Yes.*

* Technically, it depends on your targets, and what flavor of Modern JavaScript you intend on using.

Questions?

Thanks!

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

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