Fantastic Plugins & How to Make Them

Kerri Shotts (@kerrishotts)

Jesse MacFadyen (@purplecabbage)

https://github.com/kerrishotts/pgday/blob/master/2017/fantastic-plugins-and-how-to-make-them

Based on http://purplecabbage.github.io/slides/pgd16Plugins/index.html by Jesse

Photo by AlexanderStein (https://pixabay.com/en/users/AlexanderStein-45237/), courtesy of Pixabay.com

About Kerri

- Used PhoneGap for six+ years
- Author of five books about PhoneGap
- IT Consultant for eight years
- Apache Cordova comitter
- One of many moderators:
  - Adobe PhoneGap Forums
  - Google Cordova Group
- @kerrishotts

About Jesse

- PhoneGap Developer since 2008
- Apache Cordova committer
- at Adobe for nearly 6 years now
- @purplecabbage

What is a Cordova Plugin?

noun A mystical collection of machine incantations which grant access to amazing and magical capabilities

ahem…

noun A module consisting of code and settings extending the essential functionality of Cordova with the goal of providing access to device capabilities, enhancing existing capabilities, or improving the developer’s workflow

What can plugins do?

- Anything native at these times:
  - run time
  - build time
  - install time
- Two sources
  - Core — used to be built in
  - Community — people like you!

Plugins at run time

Full access to the native SDK and device features. Some examples:

- Push Notifications: PhoneGap, Pushwoosh, AeroGear, OneSignal
- Storage Plugins: Native Storage, SQLite, SQLite 2
- Social Plugins: Email, X SocialSharing
- Audio Plugins: DBMeter, Native Audio, Media Picker
- Misc: Barcode Scanner, In App Purchase, Google Maps, Vuforia (AR), Microsoft ACE (native controls)
- Creative Cloud: Auth, Asset Browser, Image Editor, Send to Desktop

Plugins at build time

Full access to the build-time environment and Cordova project. Some examples:

- Transpile and Bundle ES2015+: Webpack & Transpiler (Me!)
- Pre-process CSS files (SASS, less, auto-prefixer)
- Check code quality (eslint, tslint, jshint)
- Etc.

Plugins at install time

Full access to the Cordova project and environment at install time. Some ideas:

- Bundle other plugins
- Configure the project environment
- Provide tests for another plugin…
    - cordova-plugin-test-framework

Plugin-ception 🎇

The Core Plugins

Core Cordova Plugins (used to be built-in)

battery-status	camera	console
contacts	device	device-motion
device-orientation	dialogs	file
file-transfer	geolocation	globalization
inappbrowser	media	media-capture
network-information	~~splashscreen~~	statusbar
vibration	whitelist	

Community Plugins

Devoloped and supported by the community — like you!

Repository	Plugins
https://cordova.apache.org/plugins	~2,066 plugins & templates (excl. core)
http://www.plugreg.com	~1,592 plugins (excl. core)
http://plugins.telerik.com/cordova	~77 plugins

Managing Plugins

npm

Plugins are typically downloaded from npm:

```
[user@dev] $ | cordova plugin add --save cordova-plugin-device

[user@dev] $ | cordova plugin ls                        # or list
             | cordova-plugin-device 1.1.1 "Device"

[user@dev] $ | cordova plugin rm --save \
             |         cordova-plugin-device            # or remove
```

Note: `--save` persists the plugin to `config.xml` so that plugins can be easily restored (done at `prepare`-time)
Note: `--save` will the default action in `cordova@7.0.0`; `--nosave` will turn it off

Github

Plugins can also be installed from a Github repository.

```
[user@dev] $ | cordova plugin add --save \
             |   http://github.com/apache/cordova-plugin-device
[user@dev] $ | cordova plugin rm --save cordova-plugin-device
```

Specify a branch: (useful for testing pre-release/edge plugins):

```
[user@dev] $ | cordova plugin add --save \
             |   http://github.com/apache/cordova-plugin-device#branch
```

Note: Use the plugin's identifier when removing — not the URL.

Local Filesystem

```
[user@dev] $ | cordova plugin add --save [--link] \
             |   path/to/cordova-plugin-device
             |
[user@dev] $ | cordova plugin rm --save cordova-plugin-device
```

`--link` is useful when developing plugins

Important: Adding a plugin to a child project (relative to the plugin) automatically symlinks the plugin
Note: Careful with parent plugins and child projects — easy to get circular references in the file system

Finding Plugins

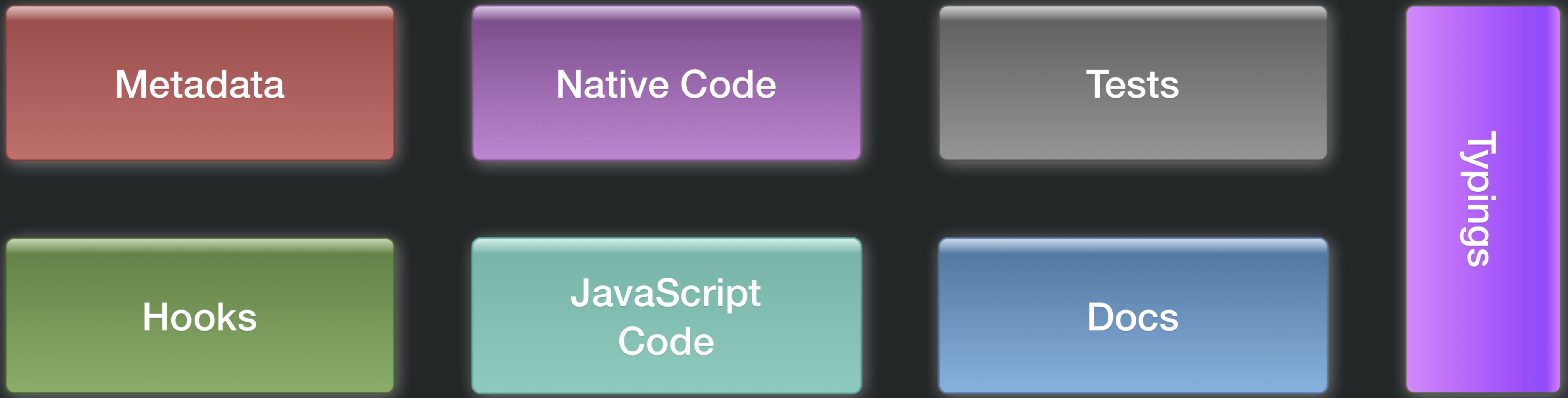
- Cordova Plugin Search: https://cordova.apache.org/plugins
- npm: https://www.npmjs.com/search?q=ecosystem:cordova
- Or, if the CLI is more your thing:

```
[user@dev] $ │ npm install -g npms-cli
[user@dev] $ │ npm search cordova-plugin device --size=5
             │ ┌──────────────────────────────────────────────
             │ │ Package
             │ ├──────────────────────────────────────────────
             │ │ cordova-plugin-device • https://github.com/apache/cordc
             │ │ Cordova Device Plugin
             │ │ updated 2 months ago by shazron
             │ ├──────────────────────────────────────────────
```

Plugin X-ray 🏥

or, what's inside these things?

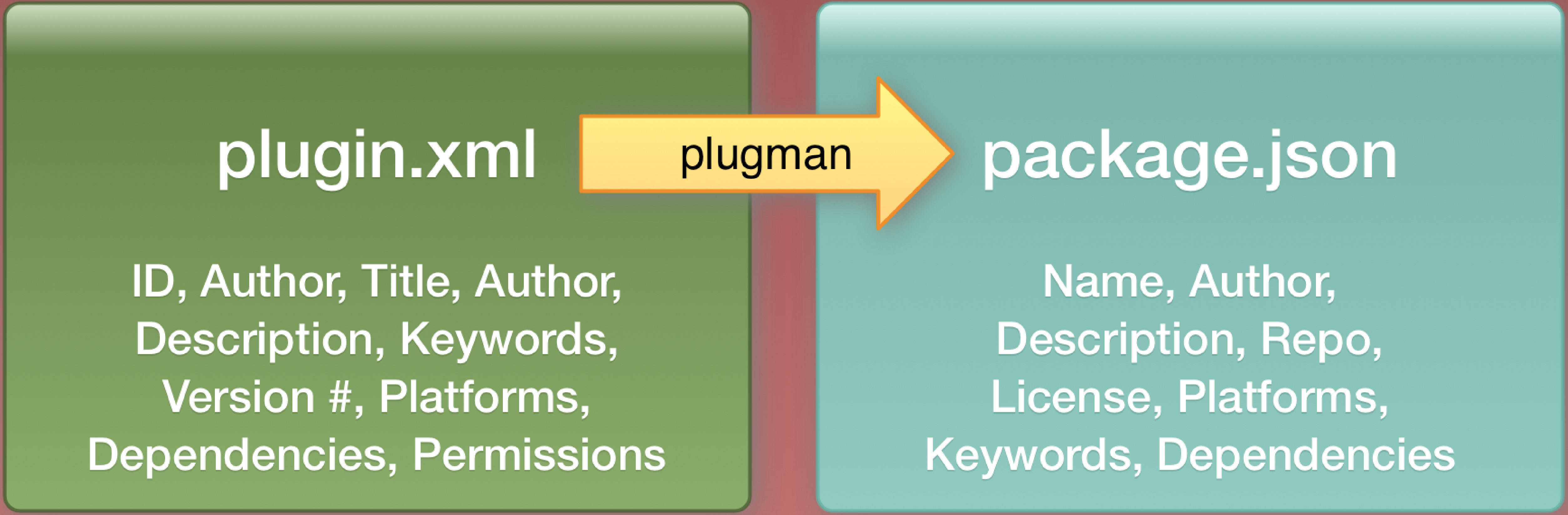
ref: cordova-plugin-device


Metadata
Native Code
Tests
Typings
Hooks
JavaScript Code
Docs

```
cordova-plugin-device/          # plugin root
    doc/<locale>                # documentation other than English
    src/<platform>              # Platform-specific native code
    |   android/
    |   +   Device.java         # Native Android code
    |   ios/
    |   |   CDVDevice.h         # Native iOS header
    |   +   CDVDevice.m         # Native iOS code
    tests/                      # Please add tests!
    types/                      # Types for Typescript
    www/                        # Web assets
    +   device.js               # API for JavaScript consumers
    package.json                # npm metadata
    plugin.xml                  # plugin metadata and configuration
    README.md                   # English documentation
```

(representational only; not every file is included here); Device Plugin Code

Metadata



plugin.xml

ID, Author, Title, Author,
Description, Keywords,
Version #, Platforms,
Dependencies, Permissions

$\xrightarrow{\text{plugman}}$

package.json

Name, Author,
Description, Repo,
License, Platforms,
Keywords, Dependencies

Example Metadata (plugin.xml)

```xml
<?xml version="1.0" encoding="UTF-8"?>
<plugin xmlns="http://apache.org/cordova/ns/plugins/1.0"
    xmlns:rim="http://www.blackberry.com/ns/widgets"
    xmlns:android="http://schemas.android.com/apk/res/android"
    id="cordova-plugin-device" version="1.1.5-dev">
    <name>Device</name>
    <description>Cordova Device Plugin</description>
    <license>Apache 2.0</license>
    <keywords>cordova,device</keywords>
    <repo>https://link/to/git/repository.git</repo>
    <issue>https://link/to/issue/reporter.html</issue>
```

Device Metadata

JavaScript API Entry

In `cordova-plugin-device`'s `plugin.xml`:

```
<js-module src="www/device.js" name="device">
    <clobbers target="device" />
</js-module>
```

- Unless creating a polyfill, use `cordova.plugins.xyz`
- Examples: Multiple `clobbers`[1], `runs`[2], `merges`[3]

1: clobbers, in app browser; 2: runs, file transfer; 3: merges, vibration

Indicate Platform Support

Using `<platform>` tags:

```
<platform name="android">
    ...
</platform>
<platform name="ios">
    ...
</platform>
```

Note: Visible platform support on plugin repo is separately controlled (`package.json` keywords)

Specifying headers, frameworks, etc.

```xml
<platform name="android">
  <source-file src="src/android/Device.java"
    target-dir="src/org/apache/cordova/device" />
</platform>
<platform name="ios">
    <header-file src="src/ios/CDVDevice.h" />
    <source-file src="src/ios/CDVDevice.m" />
    <framework src="libz.tbd" />
</platform>
```

Note: Can include third-party libraries too. iOS supports Cocoapods too! Android supports AARs with Gradle.

Manifest modifications

- `config-file` [1]
  - Adds elements to manifests / plist or platform `config.xml`
- `edit-config` [2]
  - Edits attributes of existing elements in manifests

1: android, file transfer; ios, geolocation; windows, geolocation, 2: android, transparent status bar

npm Metadata Example

```
{ "name": "cordova-plugin-device",
  "author": "Apache Software Foundation",
  "license": "Apache-2.0",
  "version": "1.1.5-dev",
  "description": "Cordova Device Plugin",
  "types": "./types/index.d.ts",
  "cordova": { "id": "cordova-plugin-device",
    "platforms": ["android", "ios", "windows", "wp8", ... ] },
  "repository": { "type": "git". "url": "https://..." },
  "keywords": ["cordova", "device", "ecosystem:cordova", "cordova-ios",
               "cordova-android", ... ],
```

Device Plugin package.json

Dependencies

```
<!-- plugin.xml -->
<dependency id="cordova-plugin-device" />
<dependency id="cordova-plugin-console" version="^1.0.0" />
// or in package.json
"engines": {
  "cordovaDependencies": {
    "2.0.0": { //plugin version (applies to any ver 2+)
      "cordova-plugin-console": "> 1.0.0",
      "cordova": "> 6.0.0" // cordova-cli above version 6
    }
  }}
```

Note: don't forget about XML entities! So " < " becomes " `lt;` "; Ex 1: engine, in app browser; Ex 2: dependency, file transfer

Creating and Publishing Plugins

or, the art of crafting plugins

💶 And getting rich, maybe? 💶

Or maybe not…

plugman

plugman is a `node` library that manages plugins in your projects. `cordova-cli`, `phonegap-cli`, etc., use `plugman` internally.

- It can also create plugins:

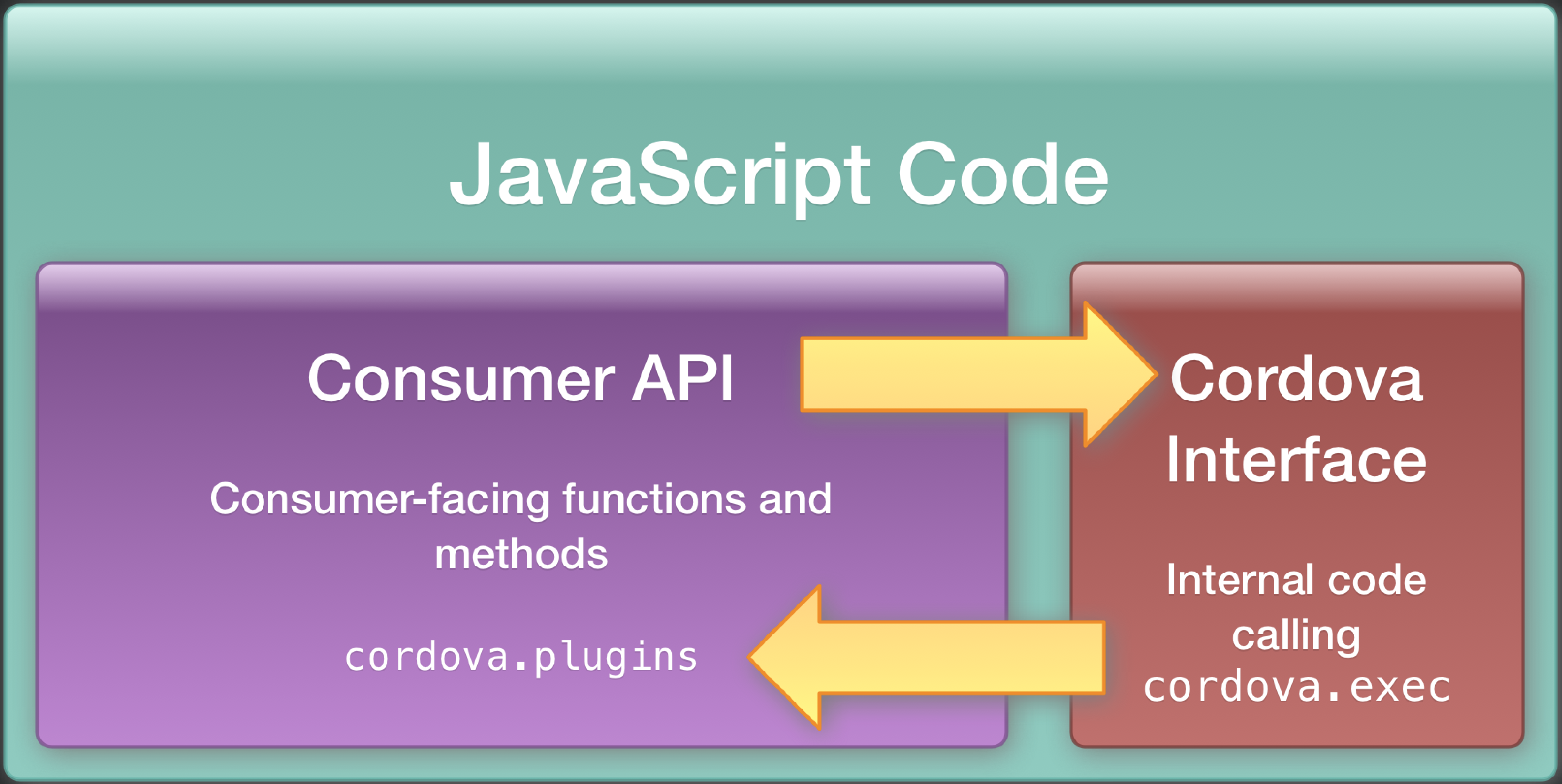
```
[user@dev] $ | npm install -g plugman
[user@dev] $ | plugman create --name Abracadabra \
             |                --plugin_id cordova-plugin-abracadabra \
             |                --plugin_version 0.0.1 \
             |                --path .
```

- Pass `--variable-name=value` strings to supply extra config

phonegap-plugin-template

Or, use PhoneGap's plugin template to create a plugin:
https://github.com/phonegap/phonegap-plugin-template

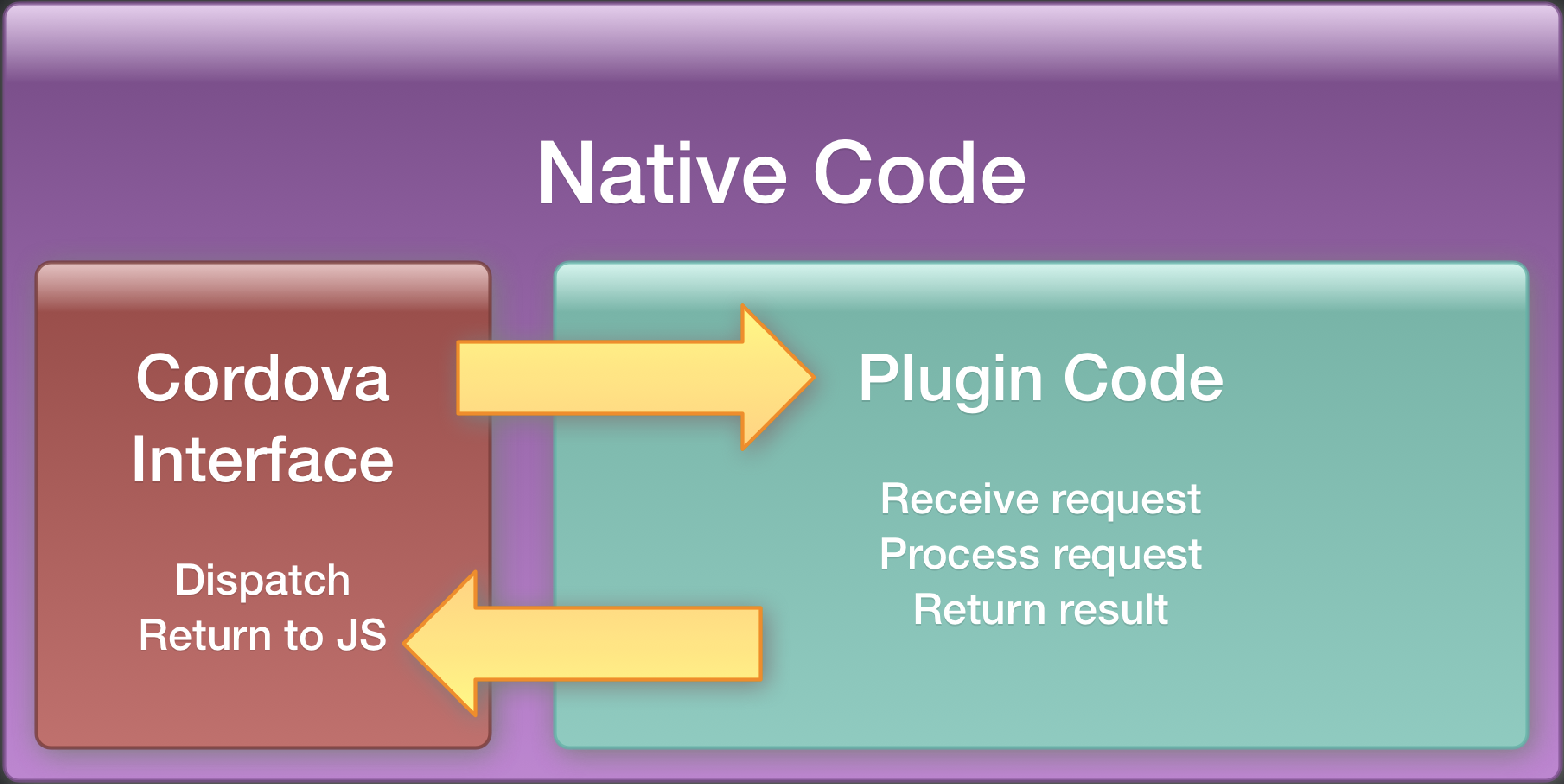
```
[user@dev] $ │ npm install -g \
             │   https://github.com/phonegap/phonegap-plugin-template
             │
             │ # phonegap-plugin-create path name plugin-id
[user@dev] $ │ phonegap-plugin-create ./abracadabra Abracadabra \
             │   cordova-plugin-abracadabra
```


JavaScript Code
Consumer API
Consumer-facing functions and methods
cordova.plugins
Cordova Interface
Internal code calling cordova.exec

Wiring it all up...

📄 `www/<plugin>.js` (consumer API)

```
function doSomething(successFn, failureFn, ...args) {
  if (typeof successFn !== "function") {
    throw new Error ("Success callback not function!");
  }
  /* ... */
  cordova.exec(successFn, failureFn, "PluginName",
               "pluginMethod", args);
}
```


Native Code
Cordova Interface
Dispatch
Return to JS
Plugin Code
Receive request
Process request
Return result

Wiring it all up… (2)

- `plugin.xml` (class mapping)

```
<feature name="PluginName">
    <param name="ios-package" value="CDV<PluginClass>" />
    <param name="onload" value="true" />
</feature>
```

- `src/ios/CDV<PluginClass>.m` (native code)

```
- (void) <pluginMethod>:(CDVInvokedUrlCommand*)command {
    // do something useful and optionally return results
}
```

StatusBar Example

📄 `www/statusbar.js` (consumer API)

```
// this example has no success/failure callbacks and no
// parameters that need to be passed.

function styleDefault() {
    cordova.exec(null, null, "StatusBar", "styleDefault", []);
}
```

Ref

StatusBar Example (2)

```
<!-- plugin.xml -->
<config-file target="config.xml" parent="/*">
  <feature name="StatusBar">
    <param name="ios-package" value="CDVStatusBar" />
    <param name="onload" value="true" /> <!-- ... -->

// src/ios/CDVStatusBar.m (native code)
- (void) styleDefault:(CDVInvokedUrlCommand*)command {
    [self setStyleForStatusBar:UIStatusBarStyleDefault];
}
```

Refs: plugin.xml, CDVStatusBar.m

StatusBar Example (3)

Remember the JS API's call to `cordova.exec`?

```
cordova.exec(null, null, "StatusBar", "styleDefault", []);
```

```
"StatusBar"      --> <feature name="StatusBar"> (plugin.xml)
                 --> <param name="ios-package"
                            value="CDVStatusBar"/>
                 --> CDVStatusBar interface & implementation
"styleDefault"   --> - styleDefault: command (CDVStatusBar.m)
```

Returning data back to JavaScript

```
// in CDVStatusBar.m
- (void) fireTappedEvent {
    if (_eventsCallbackId == nil) { return; }
    NSDictionary* payload = @{@"type": @"tap"};
    CDVPluginResult* result = [CDVPluginResult
        resultWithStatus:CDVCommandStatus_OK
        messageAsDictionary:payload];
    [result setKeepCallbackAsBool:YES]; // default is NO
    [self.commandDelegate sendPluginResult:result
        callbackId:_eventsCallbackId];
}
```

Ref

Follow the yellow brick bridge?

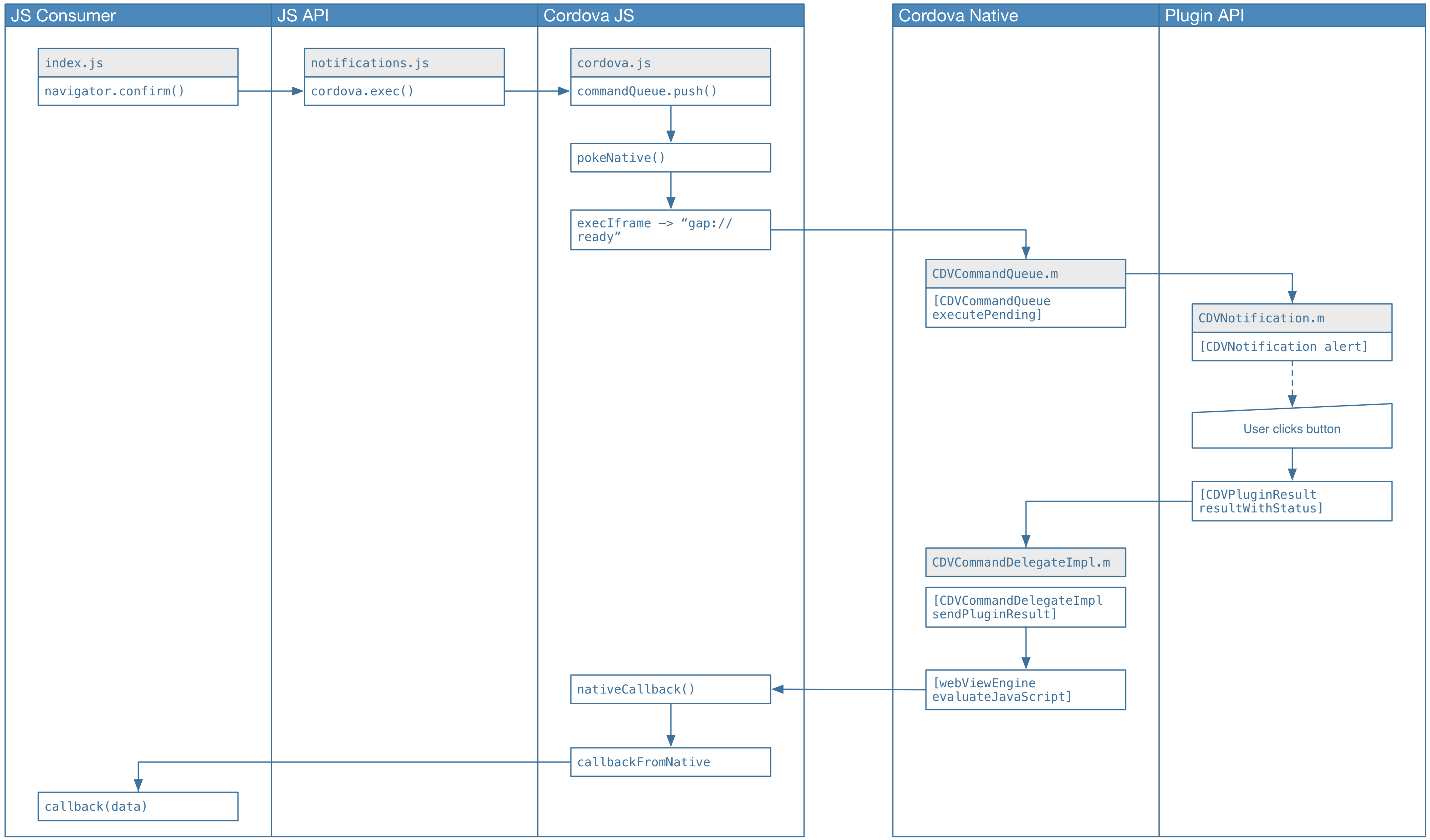
or, a look at the code behind the curtain!

Lots of bridges

A bridge is used to cross the gap between the native code context and the web view context.

- iOS
- Android
- Windows is an exception…
  - Careful, the bridge is a **mirage**! 🏜️
  - JavaScript is **native** 🎇
  - `cordova.exec` uses a proxy

Cordova iOS Bridge (abridged)



Publishing your plugin

- If you want to publish to `npm`, you'll need a `package.json`
- `plugman` can fill create it based on `plugin.xml` for you:

```
[user@dev] $  plugman createpackagejson .
[user@dev] $  npm publish
```

- Don't panic if the repo doesn't immediately show your plugin
    - wait a while — the underlying index has to catch up
    - (TODO: check; this is getting fixed)

A cool plugin demo

Testing your plugins

or, the art of making sure it works like it should

and improving the lives of developers who use your plugin 😄

Tests

Cordova Test Harness

cordova-paramedic
cordova-plugin-test-framework

Test Cases

Your Jasmine tests
Automatic & Manual

Testing plugins

`cordova-medic` is a test tool designed to run all the core Cordova plugin tests as part of Cordova's continuous integration system

- Tests are written in Jasmine 2.0
- Tests run asynchonously
- Plugins have a dependent test plugin which is installed separately (usually in `/tests` by convention)
- Many of these pieces of `cordova-medic` are reusable, so Jesse spun them into another purpose-based tool…

cordova-paramedic

n. provides advanced levels of care at the point of illness or injury, including out-of-hospital treatment, and diagnostic services

```
[user@dev] $ npm install -g cordova-paramedic
[user@dev] $ cordova-paramedic --platform ios --plugin .
```

Repo & docs: https://github.com/apache/cordova-paramedic

Automates Jasmine Tests

- Creates a new project (in temporary location)
- Adds the platform specified (`ios` , `android` , `windows` , etc.)
- Installs the `cordova-plugin-test-framework` plugin
- Installs the plugin specified (in `.`) (current working directory)
- Installs the plugin's tests (in `./tests`)
- Sets start page to `cordova-plugin-test-framework` 's test runner
- Creates a local server to listen for results
- Exits with success/fail based on results

Note: Only supports npm-published platforms

How to write tests

- Copy a core plugin's tests – we all do it!
- Create a `tests` folder in your plugin's repository
- Add a `plugin.xml` file (doesn't need to be complex) eg

```
<plugin xmlns="http://apache.org/cordova/ns/plugins/1.0"
xmlns:rim="http://www.blackberry.com/ns/widgets"
xmlns:android="http://schemas.android.com/apk/res/android"
id="cordova-plugin-statusbar-tests" version="2.2.3-dev">
  <name>Cordova StatusBar Plugin Tests</name>
  <license>Apache 2.0</license>
  <js-module src="tests.js" name="tests"></js-module>
</plugin>
```

Debugging

or, mastering the dark art of reading your computer's mind

Debugging

- Be sure to `--link` your plugin for easier development
- Xcode (macOS) / Safari
  - But not concurrently!
- Android Studio / Google Chrome
- Visual Studio (Windows)

What is linked?

- `/plugins/<your-plugin>` is symlinked to your plugin location
- Native code in `/platforms`

Exceptions & notes:

- `plugin.xml` changes require an `rm & add`
- `www` only propagates to `platforms/` at next `prepare`
- `platform rm & add` won't preserve `--link`s (CB-TODO)

Documentation

README.md

English in plugin root (convention)

docs/<locale>/README.md

Other languages in docs/<locale>

Hooks

- Before Prepare
- Before Compile
- After Plugin Install
- etc.

Hook

noun A piece of code that hooks into a Cordova process in order to perform some action on behalf of the plugin; see dev guide.

Possibilities:

- Create entitlements as needed
- Transform code (transpile, version # replacement, etc.)
- Create launch images and icons
- Check plugin versions and warn if out-of-date
- **Note:** NOT supported by PhoneGap Build

Some more cool plugin ideas

- Game controller support
- Apple Pencil, anyone?
- iOS Storage providers
- Audio/video processing

Tips & Tricks

or, wisdom from those who have gone before

and face-palmed for you in your stead…

JS API (2)

- Promisify your API
- Preprocess arguments in JavaScript
  - convert to appropriate types
  - throw type-mismatch errors, etc.
- Transpile ES2015+ to ES5
- Stick to the `cordova.plugins` namespace
  - Unless creating a polyfill; **window** is crowded!
- Return useful error messages to error callbacks

Native

- Return useful error information
- Use background threads!
- Be respectful of other plugins

Miscellany

- Don't forget the `browser` platform!
    - Useful when testing on the desktop
        - May need to mock results if no equivalent browser support
- Be kind when using hooks!
    - **Don't be evil!** Your hook executes on your user's machine!
    - `before_prepare` plugin hooks not run on discovery; run the `cordova` command again
    - `events.emit("verbose", ...)` and `--verbose` are your friends when troubleshooting

Homework

- Create a new plugin and add it to a Cordova project
- Extend and/or improve a plugin
    - For example, the globalization plugin's API is asynchronous, which is really irritating.
        - All the formatting / globalization information could be determined up-front instead
        - Try it: https://github.com/apache/cordova-plugin-globalization
- The sky's the limit!

Questions?

Thanks!

Jesse (@purplecabbage)

Kerri (@kerrishotts)

https://github.com/kerrishotts/pgday/blob/master/2017/fantastic-plugins-and-how-to-make-them

Based in part on http://purplecabbage.github.io/slides/pgd16Plugins/index.html

This slide intentionally left blank