

**PWA ALL THE
THINGS!!!**

Let's Do This!

WHAT are PWAs?

WHY are PWAs cool?

HOW are PWAs built?

- create a PWA
 - Angular
 - React
 - Vue

Let's Do This!



- WHAT are PWAs
- WHY are PWAs
- HOW are PWAs
- create a PWA w/
 - Angular
 - React
 - Vue

tara z. manicsic

- developer advocate for Progress
- Google developer expert
- founder & director of Cincy WWC
- co-organizer of Cincy NodeSchool
- human mama of #toshmagosh

@tzmanics



@TZMANICS

What a PWA is NOT

- Replacing Native Mobile Apps
- Just Mobile
- Anything New
- A Reason to Burn it to the Ground
- Scary

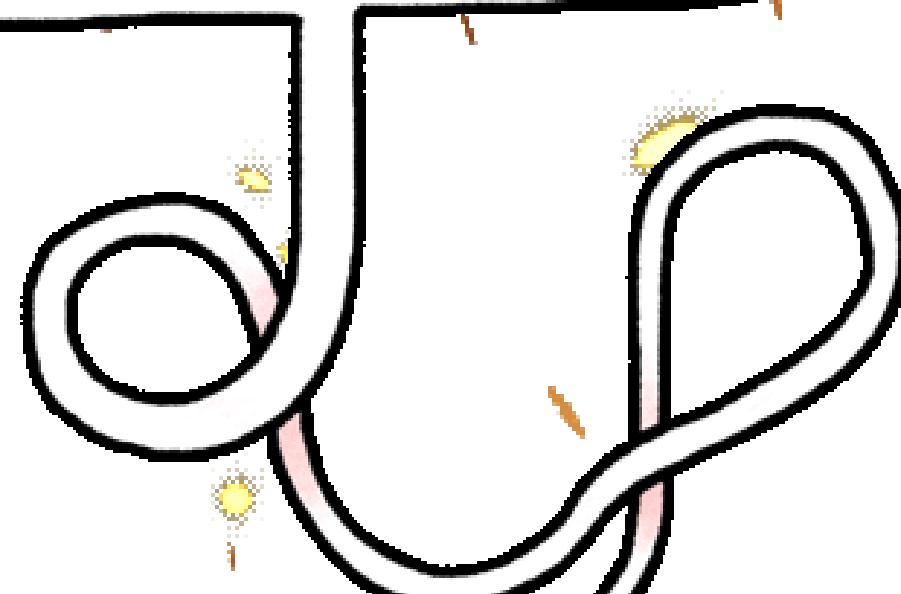




“These apps leverage the latest web capabilities to deliver an experience that combines the unique features of native mobile apps with the advantages of the web.”

Tal Ater (@talater)
Building Progressive Web Apps

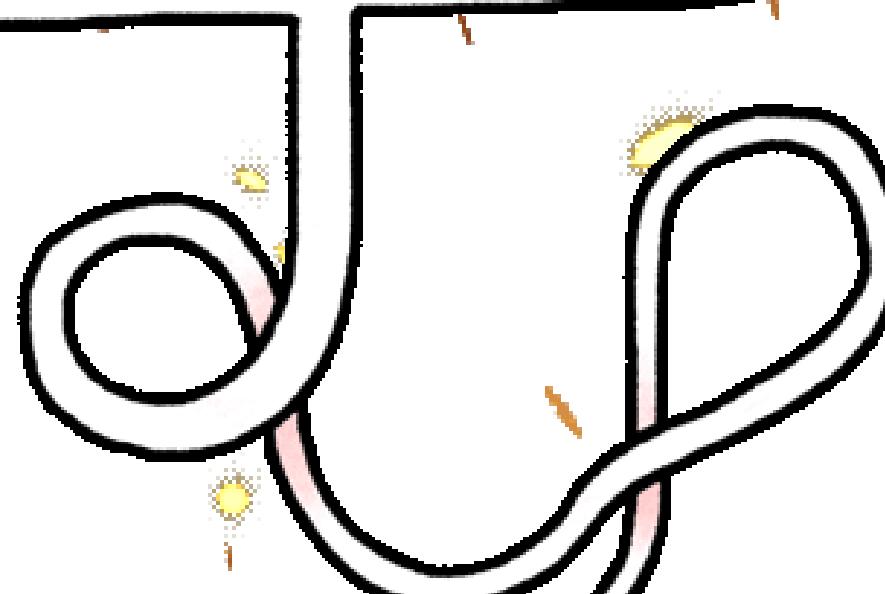
RAP CHALLENGE



my name is Tara & I'm here to say
to build the modern web this is the way
manifests & service workers are bae
& will help you build a ...



PWA



“...the latest web capabilities ...”

service workers



- it's just JavaScript
 - use at will
 - served over https
- implementation is progressive

serviceworker.js

```
if ('serviceWorker' in navigator && 'PushManager' in window) {  
    console.log('Service Worker and Push is supported');  
  
    navigator.serviceWorker.register('sw.js')  
        .then(function(swReg) {  
            console.log('Service Worker is registered', swReg);  
  
            swRegistration = swReg;  
        })  
        .catch(function(error) {  
            console.error('Service Worker Error', error);  
        });  
} else {  
    console.warn('Push messaging is not supported');  
    pushButton.textContent = 'Push Not Supported';  
}
```

“... unique features of native mobile apps ...”

- push notifications
- offline functionality
- home screen icons
- full screen display



manifest.json

```
{  
  "name": "pwa-ftw",  
  "short_name": "PWA-FTW",  
  "icons": [  
    {  
      "src": "/static/img/icons/android-chrome-192x192.png",  
      "sizes": "192x192",  
      "type": "image/png"  
    },  
    {  
      "src": "/static/img/icons/android-chrome-512x512.png",  
      "sizes": "512x512",  
      "type": "image/png"  
    }  
  "start_url": "/index.html",  
  "display": "standalone",  
  "background_color": "#000000",  
  "theme_color": "#4DBA87"  
}
```

“... advantages of the web ...”

- no install needed
- easily shared
- browser prompts “install”
- no app/play store ~~hassle~~



PROGRESSIVE

the user's journey



WHY are PWAs

- reliability independent of network
- make go fast now
- user engagement
- making the web better



HOW are PWAs

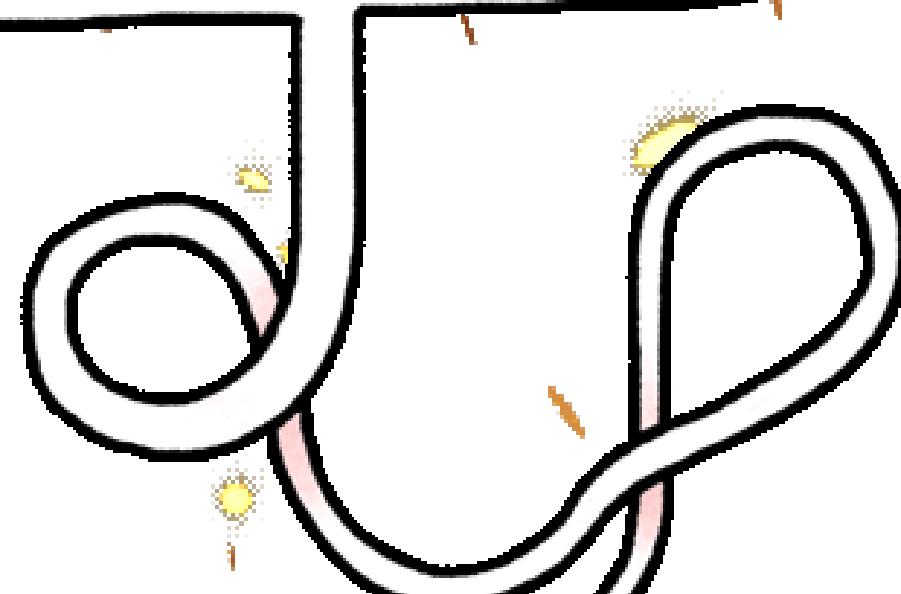


Let's Do This!

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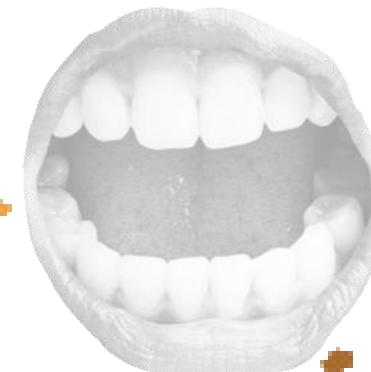
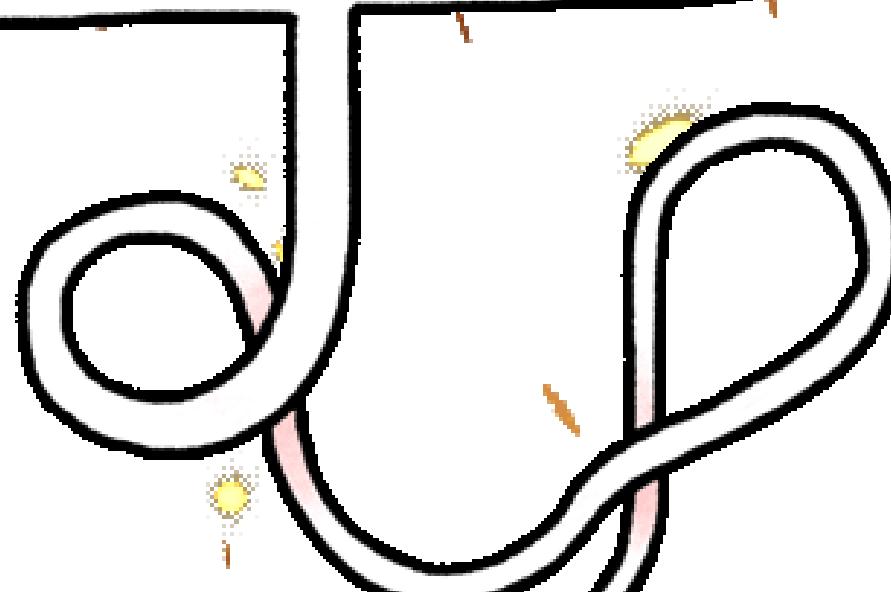


RAP CHALLENGE



this framework has raised the bar
after switching from 1 to 2 it went real far
at Google this framework is the star
let's build a PWA with ...

ANGULAR







```
npm i angular-cli -g
```

```
ng new --style scss progressive-angular
```

```
npm i @progress/kendo-theme-material
```

A screenshot of a Kendo UI application interface. At the top, there are three red buttons with white text labeled 'Browse'. Below them is a search input field with the placeholder 'Type the name of a European country:' and a dropdown menu. The dropdown is open, showing a list of countries starting with 'A': Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, and Belgium. The first item, 'Albania', is highlighted.

A screenshot of a Kendo UI application interface. On the left, a text input field shows the selected value '03/10/2000'. Below it is a label 'Select a date:' followed by a date picker. The date picker shows the month of May 2020. The day '10' is selected. A 'TODAY' button is visible in the top right corner of the calendar grid. To the right of the calendar, a text instruction says '↑ to increment and ↓ to'.

```
npm i @progress/kendo-angular-dropdowns  
@progress/kendo-angular-buttons  
@progress/kendo-angular-dateinputs  
@progress/kendo-angular-l10n  
@progress/kendo-angular-intl  
@angular/animations
```



src/app/app.module.ts

```
import { AutoCompleteModule } from '@progress/kendo-angular-dropdowns';
import { BrowserModule } from '@angular/platform-browser';
import { BrowserAnimationsModule } from '@angular/platform-browser/animations';
import { ButtonModule } from '@progress/kendo-angular-buttons';
import { DatePickerModule } from '@progress/kendo-angular-dateinputs';
import { NgModule } from '@angular/core';

import { AppComponent } from './app.component';

@NgModule({
  declarations: [
    AppComponent
  ],
  imports: [
    AutoCompleteModule,
    BrowserModule,
    BrowserAnimationsModule,
    ButtonModule,
    DatePickerModule
  ],
  providers: [],
  bootstrap: [AppComponent]
})
export class AppModule { }
```

src/app/app.component.html

```
<!--The content below is only a placeholder and can be replaced.-->
<div style="text-align:center">
  <h1>
    Welcome to {{title}}!
  </h1>
  
  <div class="kendo-components">
    <p> Choose your FAVE planet: </p>
    <kendo-autocomplete
      [data]="listItems"
      [placeholder]="'e.g. Saturn'"
      class="planets"
    ></kendo-autocomplete>
    <p> Selected value is: {{value | date}} </p>
    <p> Select a date: </p>
    <kendo-datepicker
      [(value)]="value"
    ></kendo-datepicker>
    <br />
    <button kendoButton (click)="onButtonClick()" [primary]="true">
      Submit
    </button>
  </div>
```

src/app/app.component.ts

```
import { Component } from '@angular/core';

@Component({
  selector: 'app-root',
  templateUrl: './app.component.html',
  styleUrls: ['./app.component.scss']
})
export class AppComponent {
  title = 'PWAs at AT0';
  public value: Date = new Date(2020, 2, 22);
  public listItems: Array<string> = [
    "Earth",
    "Jupiter",
    "Mars",
    "Mercury",
    "Neptune",
    "Saturn",
    "Uranus",
    "Venus"
  ];
}
```

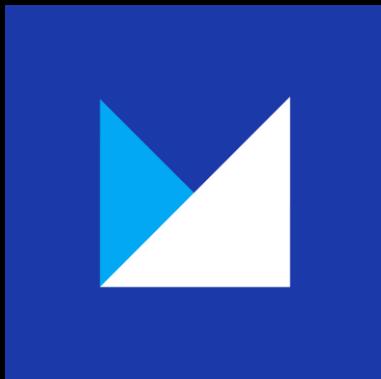
src/styles.scss

```
/* You can add global styles to this file, and also import other style files */
@import url('https://fonts.googleapis.com/css?family=Fascinate+Inline');
@import "~@progress/kendo-theme-material/scss/all";
html {
    background-image: url(http://www.publicdomainpictures.net/pictures/70000/velka/graphic-space.jpg);
}

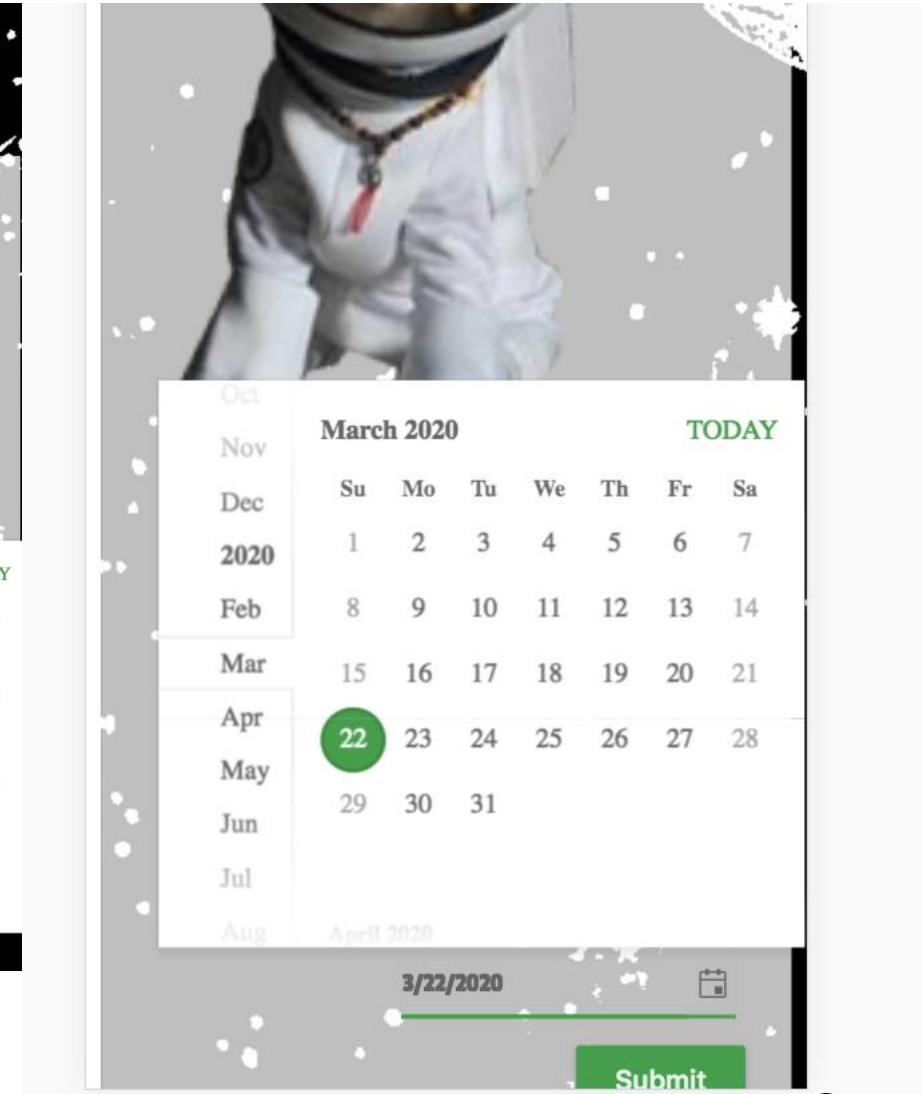
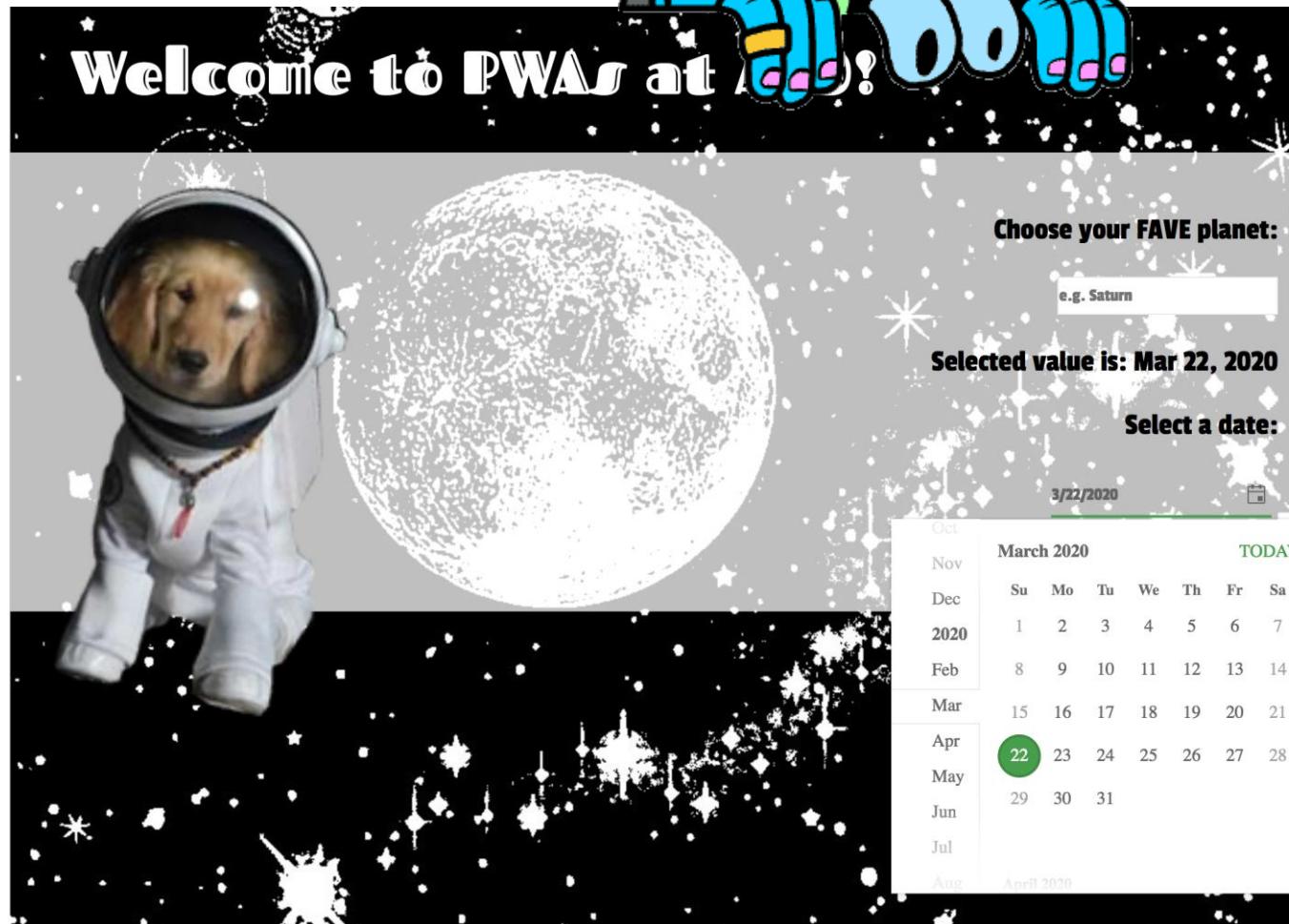
h1 {
    color: white;
    font-family: 'Fascinate Inline', cursive;
    font-size: 3em;
    padding-left: 1em;
    text-align: left;
}

img {
    float: left;
}

button {
    margin-top: 1em;
}
```



it looks like this:



src/index.html

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <title>ProgressiveAngular</title>
    <base href="/">

    <meta name="viewport" content="width=device-width, initial-scale=1">
    <meta name="theme-color" content="#009688">
    <link rel="manifest" href="assets/manifest.json">
    <link rel="icon" type="image/x-icon" href="favicon.ico">
  </head>
  <body>
    <app-root></app-root>
  </body>
</html>
```



src/assets/manifest.json



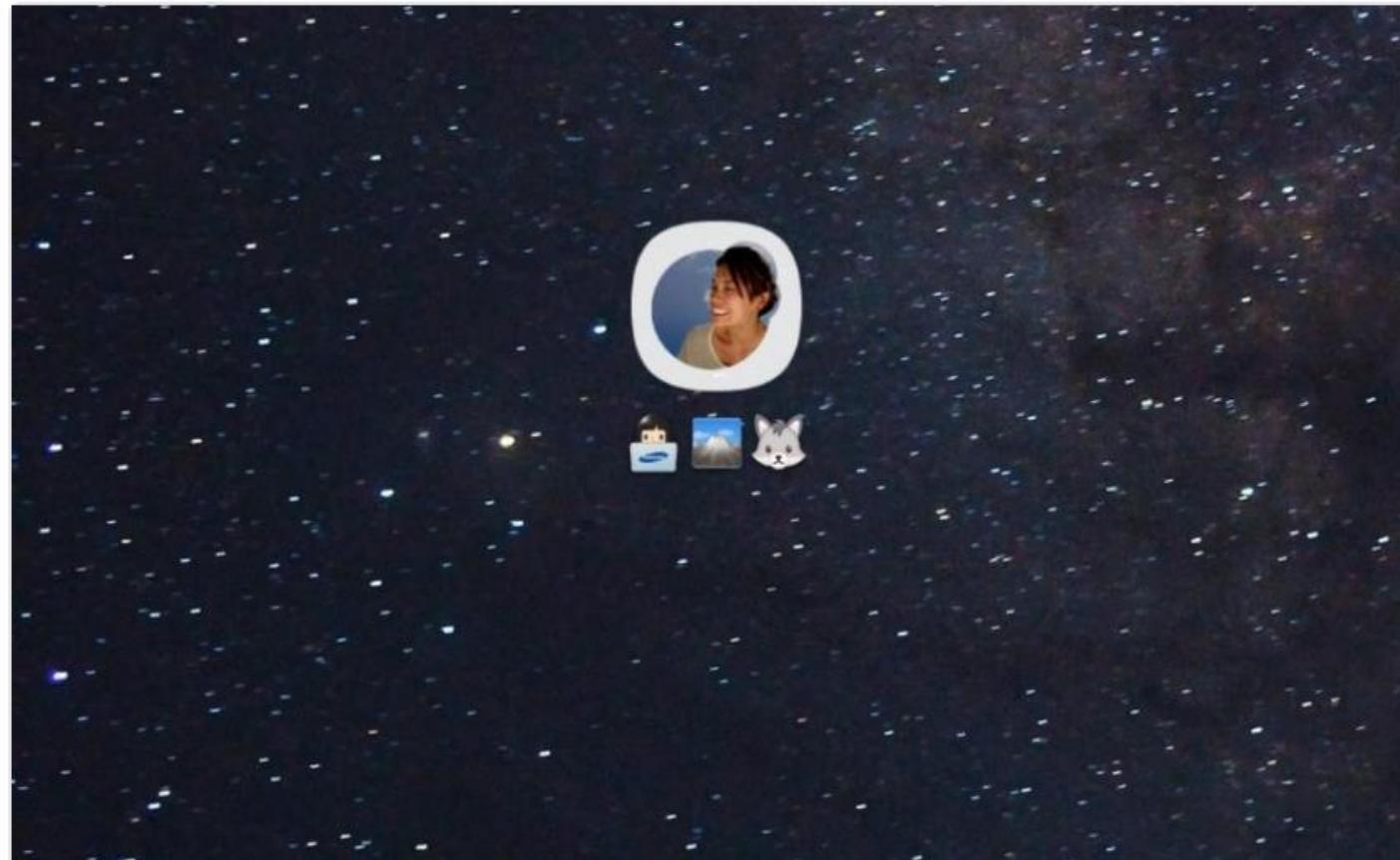
```
{  
  "name": "AOT Angular PWA",  
  "short_name": ".angular",  
  "icons": [  
    {  
      "src": "./icons/android-chrome-192x192.png",  
      "sizes": "192x192",  
      "type": "image/png"  
    },  
    {  
      "src": "./icons/android-chrome-512x512.png",  
      "sizes": "512x512",  
      "type": "image/png"  
    }  
  "start_url": "/",  
  "display": "standalone",  
  "background_color": "#DEDEDE",  
  "theme_color": "#DEDEDE"  
}
```



😄 Tara Z. Manicsic 🐾
@Tzmanics



I am always strongly advocating for emoji use in your #pwa app manifest. Come on, who doesn't want to 🖤 that adorable #toshmagosh emoji?!?



@TZMANICS

Install workbox & create a service worker

```
$ npm install workbox-cli -g
```

[GET STARTED](#)[OVERVIEW](#)[EXAMPLES](#)[HOW Tos](#)[REFERENCE](#)[GITHUB](#)

Workbox

JavaScript Libraries for Progressive Web Apps

- OFFLINE CACHING
- OFFLINE ANALYTICS
- BACKGROUND SYNC

Overview

Workbox is a collection of libraries and build tools that make it easy to store your website's files locally, on your users' devices. Consider Workbox if you want to:

- Make your site work offline.
- Improve load performance on repeat-visits. Even if you don't want to go fully-offline, you can use Workbox to store and serve common files locally, rather than from the network.

[Learn more](#)

Install workbox & create a service worker

```
$ ng build && workbox generate:sw
```

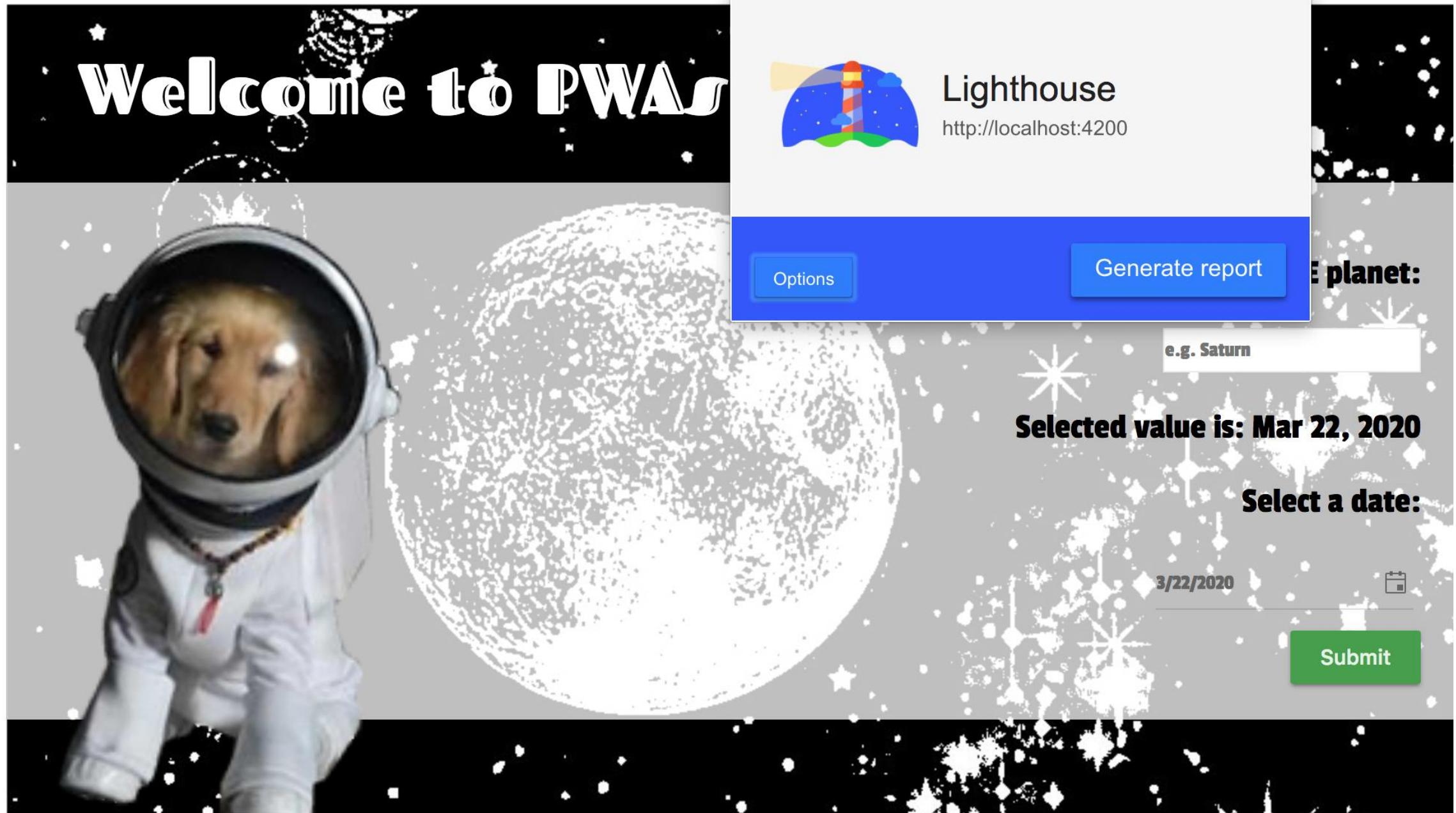
```
[kiwish-4.2]-(talks/progressive-angular)-[git:master]-∞
> workbox generate:sw
? What is the root of your web app? (Use arrow keys)
> dist
e2e
src
Manually Enter Path
↳ workbox generate:sw
? What is the root of your web app? dist
? Which file types would you like to cache?
 png
 json
 ico
 html
 js
 map
↳ workbox generate:sw
? What is the root of your web app? dist
? Which file types would you like to cache? png, html, js
? What should the path of your new service worker file be (i.e. './build/sw.js')? (bu
ild/sw.js) dist/sw.js
↳ workbox generate:sw
? What is the root of your web app? dist
? Which file types would you like to cache? png, html, js
? What should the path of your new service worker file be (i.e. './build/sw.js')? dis
t/sw.js
? Last Question - Would you like to save these settings to a config file? (Y/n) Y
```

src/index.html

```
<!doctype html>
<html lang="en">
<head>
  <meta charset="utf-8">
  <title>ProgressiveAngular</title>
  <base href="/">

  <meta name="viewport" content="width=device-width, initial-scale=1">
  <meta name="theme-color" content="#009688">
  <link rel="manifest" href="assets/manifest.json">
  <link rel="icon" type="image/x-icon" href="favicon.ico">
</head>
<body>
  <app-root></app-root>
</body>
<script>
  if ('serviceWorker' in navigator) {
    window.addEventListener('load', function() {
      navigator.serviceWorker.register('/sw.js').then(function(registration) {
        // Registration was successful
        console.log('ServiceWorker registration successful with scope: ', registration.scope);
      }, function(err) {
        // registration failed :
        console.log('ServiceWorker registration failed: ', err);
      });
    });
  }
</script>
</html>
```



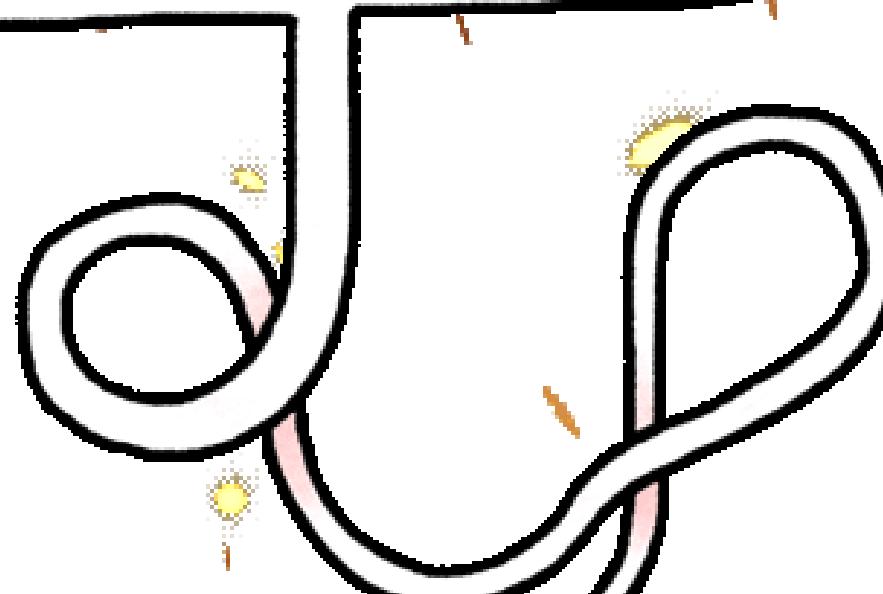


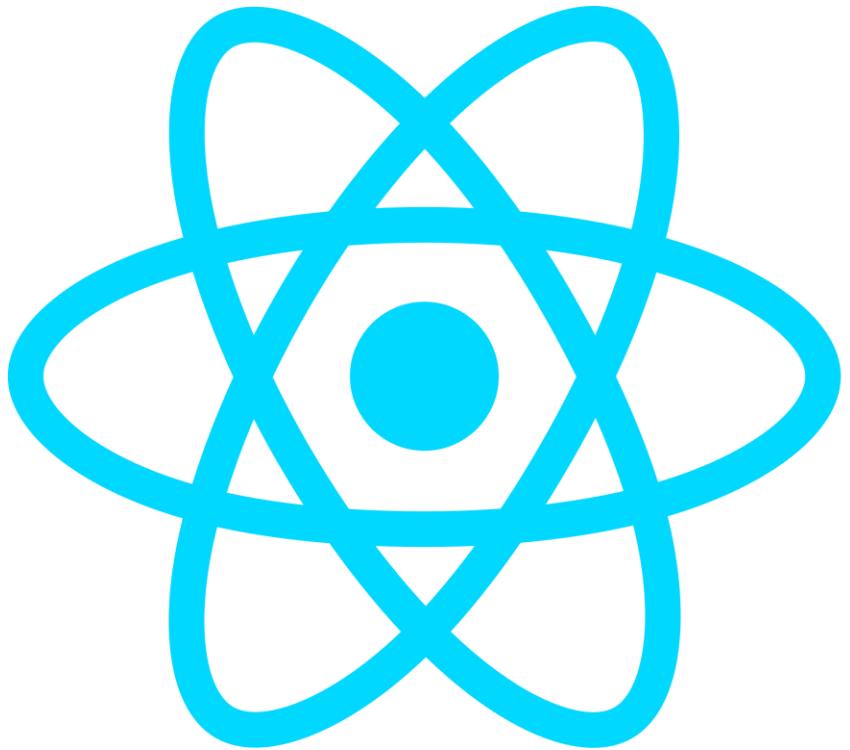
RAP CHALLENGE

this library is Facebook backed
& very well-known that is a fact
if you dis it to a fan, you might get smacked

let's build a PWA with ...

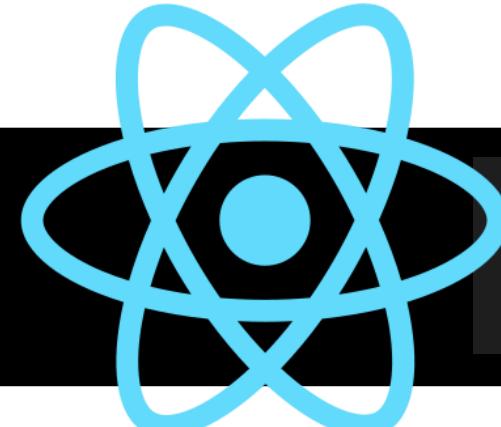
REACT





React





```
npm i create-react-app -g
```

```
create-react-app kendo-ui-for-reactjs
```

```
npm i @progress/kendo-charts-react-wrapper @progress/kendo-ui
```

```
npm i @progress/kendo-theme-default
```

create-react-app PWA Files



```
my-app
├── README.md
├── node_modules
├── package.json
├── .gitignore
├── public
│   └── favicon.ico
│   └── index.html
│   └── manifest.json
└── src
    └── App.css
    └── App.js
    └── App.test.js
    └── index.css
    └── index.js
    └── logo.svg
    └── registerServiceWorker.js
```

public/index.html

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
    <meta name="theme-color" content="#000000">
    <link rel="manifest" href="%PUBLIC_URL%/manifest.json">
    <link rel="shortcut icon" href="%PUBLIC_URL%/favicon.ico">
    <title>React App</title>
  </head>
  <body>
    <noscript>
      You need to enable JavaScript to run this app.
    </noscript>
    <div id="root"></div>
  </body>
  <script src="/bundle.js"></script>
</html>
```

src/App.js

```
import React, { Component } from 'react';
import { Chart } from '@progress/kendo-charts-react-wrapper';
import '@progress/kendo-ui';
import '@progress/kendo-theme-default/dist/all.css';

class App extends Component {
  render() {
    return (
      <div className="App">
        <Chart series={[{ data: [1, 2, .5] }, { data: [.5, 1, 2] }]}/>
      </div>
    );
  }
}

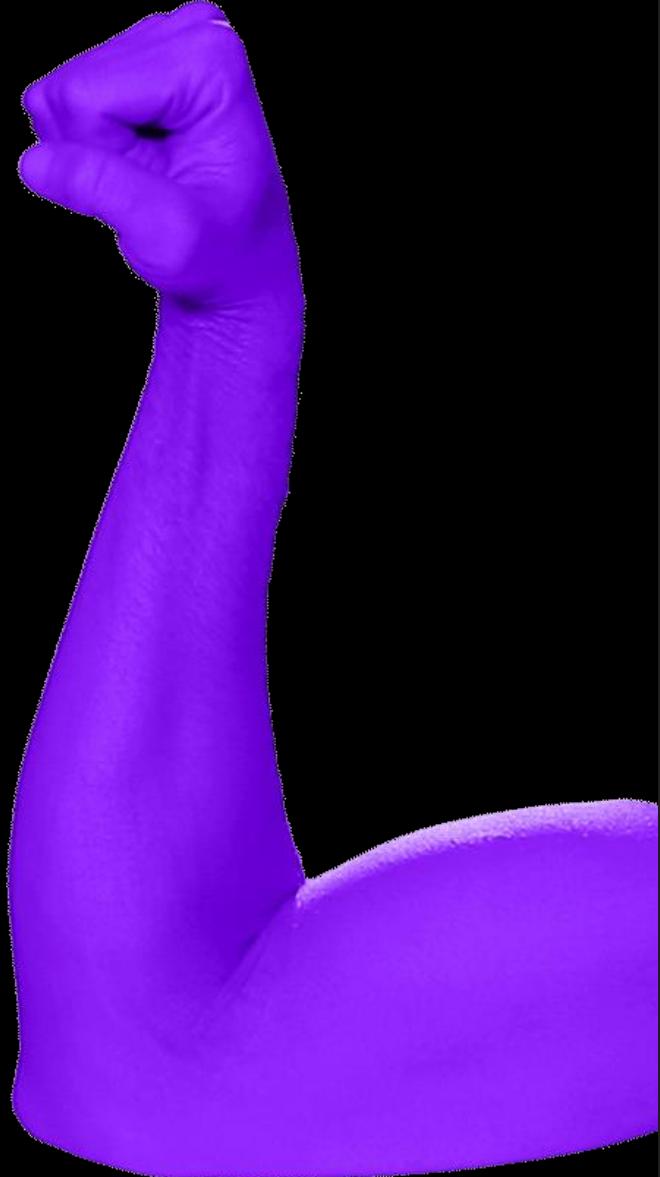
export default App;
```

public/manifest.json

```
{  
  "short_name": "React App",  
  "name": "Create React App Sample",  
  "icons": [  
    {  
      "src": "favicon.ico",  
      "sizes": "192x192",  
      "type": "image/png"  
    }  
  ],  
  "start_url": "./index.html",  
  "display": "standalone",  
  "theme_color": "#000000",  
  "background_color": "#ffffff"  
}
```

```
{  
  "short_name": "Kendo UI + React.js",  
  "name": "KUI ❤️ RJS",  
  "icons": [  
    {  
      "src": "/static/img/icons/android-chrome-192x192.png",  
      "sizes": "192x192",  
      "type": "image/png"  
    },  
    {  
      "src": "/static/img/icons/android-chrome-512x512.png",  
      "sizes": "512x512",  
      "type": "image/png"  
    },  
    {  
      "src": "favicon.ico",  
      "sizes": "192x192",  
      "type": "image/png"  
    }  
  ],  
  "start_url": "./index.html",  
  "display": "standalone",  
  "theme_color": "#000000",  
  "background_color": "#ffffff"  
}
```

src/registerServiceWorker.js



```
// In production, we register a service worker to serve assets from local cache.

// This lets the app load faster on subsequent visits in production, and gives
// it offline capabilities. However, it also means that developers (and users)
// will only see deployed updates on the "N+1" visit to a page, since previously
// cached resources are updated in the background.

// To learn more about the benefits of this model, read https://goo.gl/KwvDNY.
// This link also includes instructions on opting out of this behavior.

const islocalhost = Boolean(
  window.location.hostname === 'localhost' ||
  // ::1 is the IPv6 localhost address.
  window.location.hostname === '::1' ||
  // 127.0.0.1/8 is considered localhost for IPv4.
  window.location.hostname.match(
    /^127(?:\.(?:25[0-5]|2[0-4][0-9]|0[1-9][0-9]?|[0-9]{1,2}){3}$/
  )
);

export default function register() {
  if (process.env.NODE_ENV === 'production' && 'serviceWorker' in navigator) {
    // The URL constructor is available in all browsers that support SW.
    const publicUrl = new URL(process.env.PUBLIC_URL, window.location);
    if (publicUrl.origin !== window.location.origin) {
      // Our service worker won't work if PUBLIC_URL is on a different origin
      // from what our page is served on. This might happen if a CDN is used to
      // serve assets; see https://github.com/facebookincubator/create-react-app/issues/2374
      return;
    }

    window.addEventListener('load', () => {
      const swUrl = `${process.env.PUBLIC_URL}/service-worker.js`;

      if (!islocalhost) {
        // Is not local host. Just register service worker
        registerValidSW(swUrl);
      }
    });
  }
}

function registerValidSW(swUrl) {
  navigator.serviceWorker.register(swUrl)
    .then(registration => {
      console.log(`Service worker registered for ${registration.scope}`);
    })
    .catch(error => {
      console.error(`Service worker registration failed: ${error}`);
    });
}
```

PROJECT

Dashboard

Issues

ACCOUNT

My Profile

Sign Out

Active Issues

252

ACTIVE ISSUES

**104**

CLOSED ISSUES

**148**

OPEN ISSUES



All issues

30

20

10

8/13

8/20

8/27

9/3

9/10

9/17

9/24

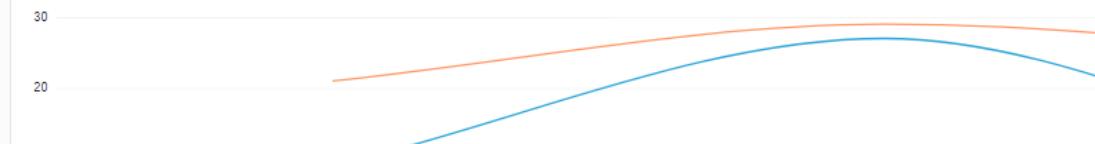
10/1

10/8

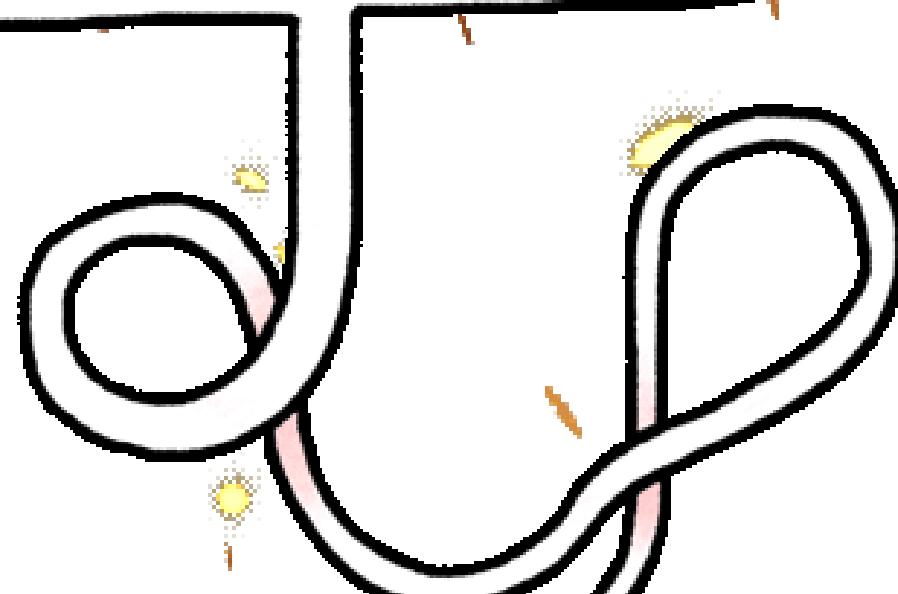
Issue Types

36%
SEV: LOWSEV: LOW — SEV: MEDIUM — SEV: HIGH
ENHANCEMENT — FEATURE — OTHER

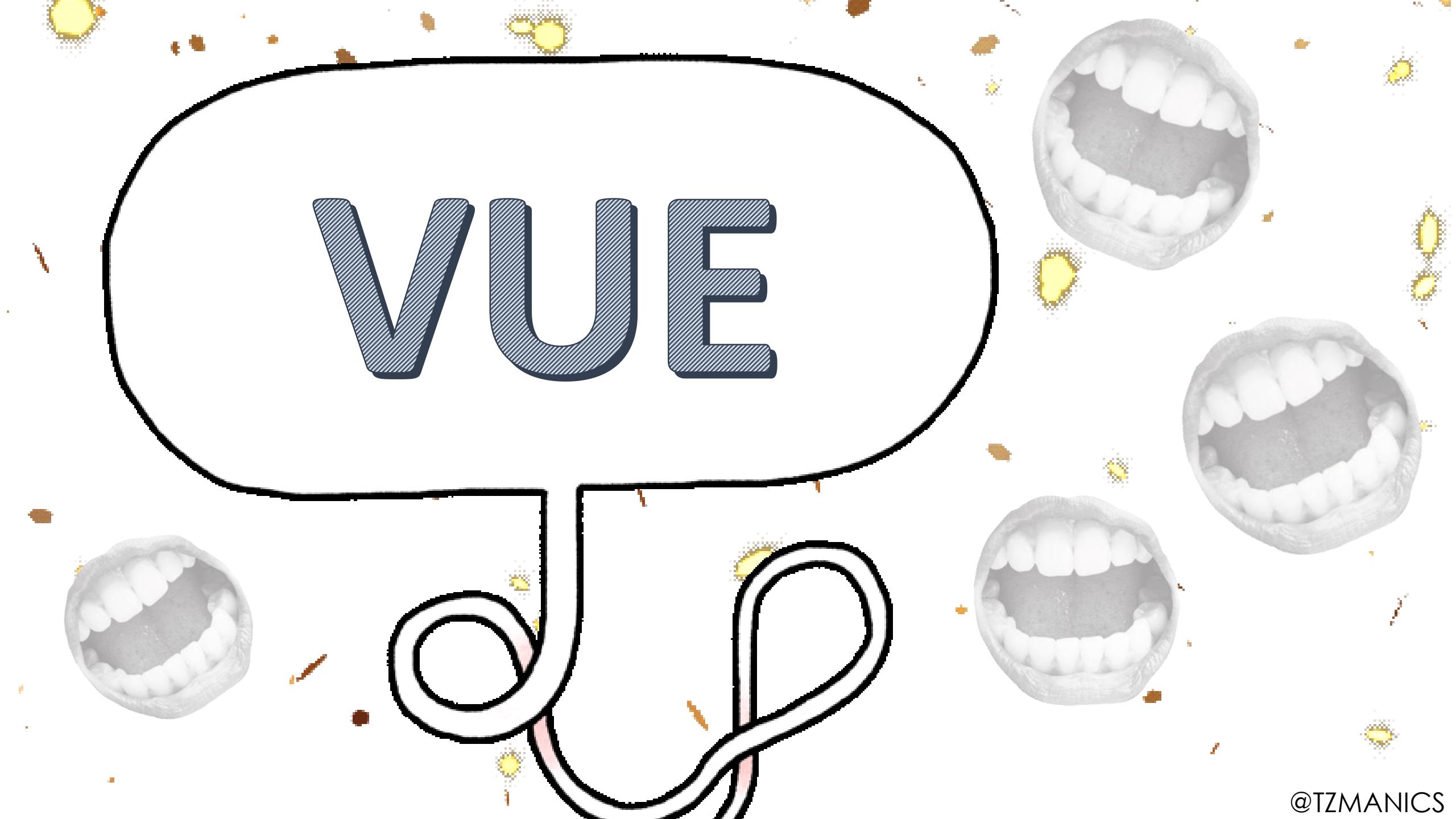
Types Distribution

85
SEV: LOW**70**
SEV: MEDIUM**20**
SEV: HIGH

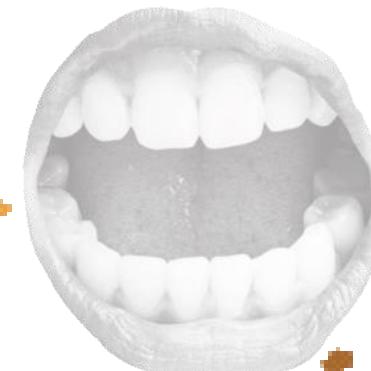
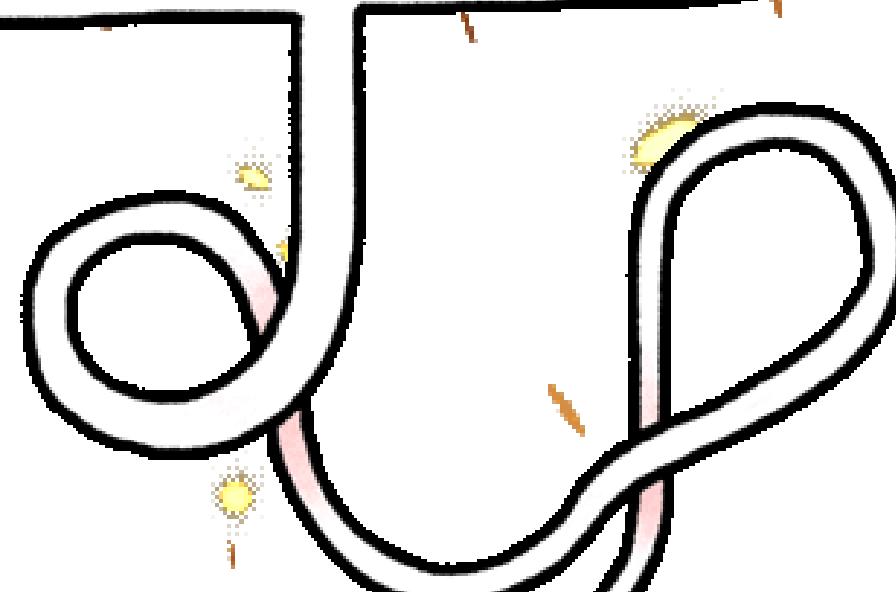
RAP CHALLENGE



now this library is on version two
built by a man named Evan You
you can use all the things or just a few
now let's build a PWA with ...

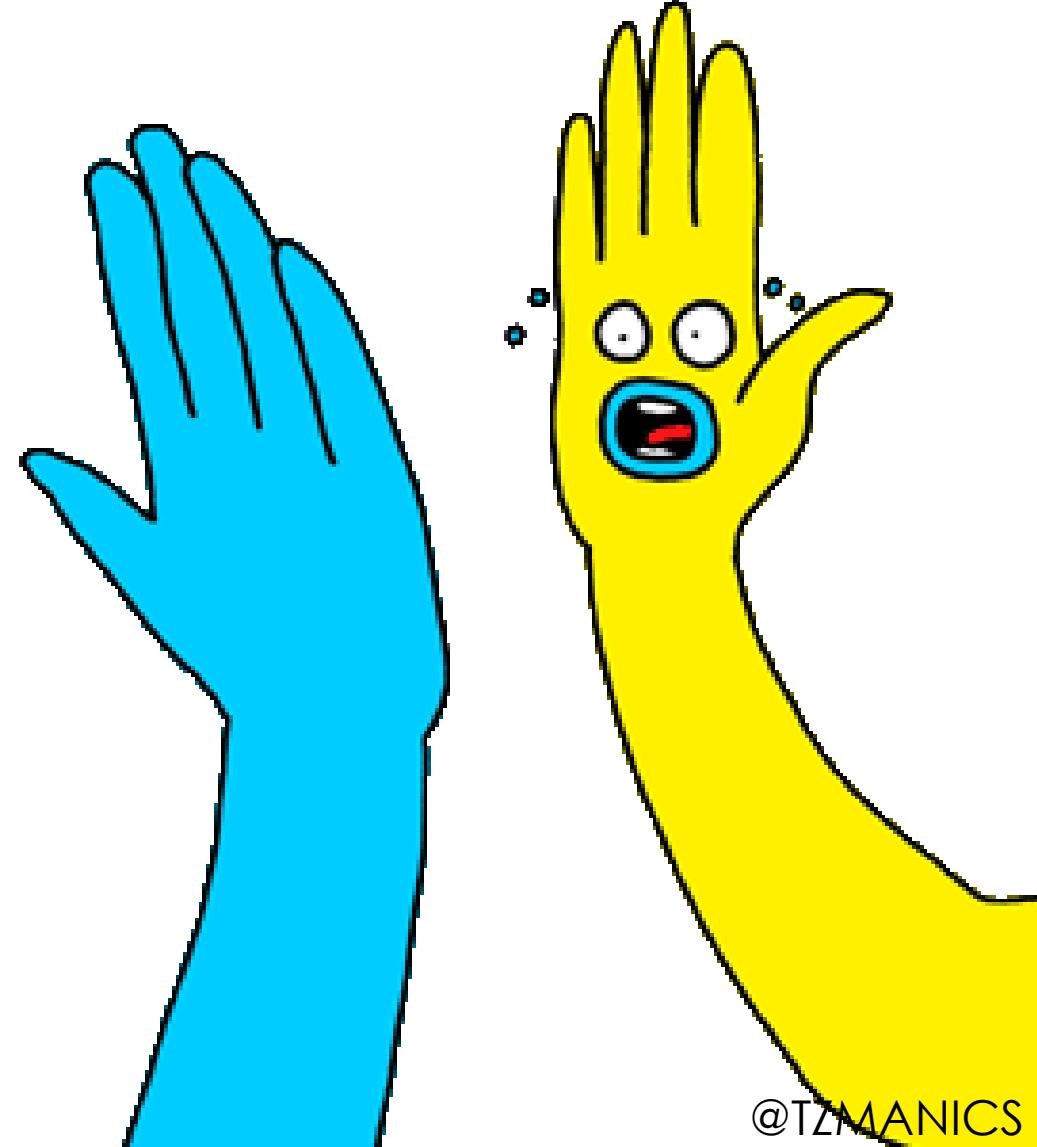


VUE





Vue.js





```
npm i vue-cli -g
```

```
vue init pwa kendoui-vue
```

```
npm i @progress/kendo-ui
```

```
npm i @progress/kendo-datasource-vue-wrapper @progress/kendo-grid-vue-wrapper
```

VUE-cli PWA Files

img/icons

manifest.json

- `npm run build` : Production ready build.
 - JavaScript minified with [UglifyJS](#).
 - HTML minified with [html-minifier](#).
 - CSS across all components extracted into a single file and minified with [cssnano](#).
 - All static assets compiled with version hashes for efficient long-term caching, and a production `index.html` is auto-generated with proper URLs to these generated assets.
 - Use `npm run build --report` to build with bundle size analytics.
 - Generates a Service Worker for offline caching your static assets using [sw-precache-webpack-plugin](#)

static/

build/

build.js
check-versions.js
dev-client.js
dev-server.js
load-minified.js
service-worker-dev.js
service-worker-prod.js
utils.js
vue-loader.conf.js
webpack.base.conf.js
webpack.dev.conf.js
webpack.prod.conf.js

build/service-worker-prod.js

```
(function() {
  'use strict';

  // Check to make sure service workers are supported in the current browser,
  // and that the current page is accessed from a secure origin. Using a
  // service worker from an insecure origin will trigger JS console errors.
  const islocalhost = Boolean(window.location.hostname === 'localhost' ||
    // [::1] is the IPv6 localhost address.
    window.location.hostname === '[::1]' ||
    // 127.0.0.1/8 is considered localhost for IPv4.
    window.location.hostname.match(
      /^127(?:\.(?:25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)){3}$/,
    )
  );

  window.addEventListener('load', function() {
    if ('serviceWorker' in navigator &&
        (window.location.protocol === 'https:' || islocalhost)) {
      navigator.serviceWorker.register('service-worker.js')
        .then(function(registration) {
          // updatefound is fired if service-worker.js changes.
          registration.onupdatefound = function() {
            // updatefound is also fired the very first time the SW is installed,
            // and there's no need to prompt for a reload at that point.
            // So check here to see if the page is already controlled.
          }
        })
    }
  });
})()
```

src/main.js

```
import Vue from 'vue'
import App from './App'

import '@progress/kendo-ui'
import { KendoGridColumn, KendoGrid, KendoGridInstaller } from '@progress/kendo-grid-vue-wrapper'
import { KendoDataSource, KendoDataSourceInstaller } from '@progress/kendo-datasource-vue-wrapper'

Vue.config.productionTip = false
Vue.use(KendoGridInstaller)
Vue.use(KendoDataSourceInstaller)

/* eslint-disable no-new */
new Vue({
  el: '#app',
  template: '<App/>',
  components: {
    App,
    KendoGrid,
    KendoGridColumn,
    KendoDataSource
  }
})
```

src/components/Hello.vue

```
<template>
  <div class="hello">
    <div class="grid">
      <kendo-datasource
        ref="datasource"
        :type="'odata'"
        :pageSize="20"
        :transportRead="https://demos.telerik.com/kendo-ui/service/Northwind.svc/Customers"
      ></kendo-datasource>
      <kendo-grid
        :height="550"
        :dataSourceRef="'datasource'"
        :groupable='true'
        :sortable='true'
        :pageable-page-sizes='true'
        :pageable-button-count="5">
        <kendo-grid-column
          field="ContactName"
          title="Contact Name"
          :width="250">
        </kendo-grid-column>
        <kendo-grid-column
          field="ContactTitle"
          title="Contact Title">
        </kendo-grid-column>
        <kendo-grid-column
          field="CompanyName"
          title="Company Name">
        </kendo-grid-column>
      </kendo-grid>
    </div>
  </div>
</template>
```

index.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <title>kendoui-vue</title>
    <link rel="stylesheet" href="https://kendo.cdn.telerik.com/2017.2.621/styles/kendo.common.min.css">
    <link rel="stylesheet" href="https://kendo.cdn.telerik.com/2017.2.621/styles/kendo.rtl.min.css">
    <link rel="stylesheet" href="https://kendo.cdn.telerik.com/2017.2.621/styles/kendo.default.min.css">
    <link rel="stylesheet" href="https://kendo.cdn.telerik.com/2017.2.621/styles/kendo.default.mobile.min.css">
    <link rel="icon" type="image/png" sizes="32x32" href="<%= htmlWebpackPlugin.files.publicPath %>static/img/icons/favicon-32x32.png">
    <link rel="icon" type="image/png" sizes="16x16" href="<%= htmlWebpackPlugin.files.publicPath %>static/img/icons/favicon-16x16.png">
    <!--[if IE]><link rel="shortcut icon" href="/static/img/icons/favicon.ico"><![endif]-->
    <!-- Add to home screen for Android and modern mobile browsers -->
    <link rel="manifest" href="<%= htmlWebpackPlugin.files.publicPath %>static/manifest.json">
    <meta name="theme-color" content="#4DBA87">

    <!-- Add to home screen for Safari on iOS -->
    <de>
      <meta name="apple-mobile-web-app-capable" content="yes">
      <meta name="apple-mobile-web-app-status-bar-style" content="black">
      <meta name="apple-mobile-web-app-title" content="kendoui-vue">
      <link rel="apple-touch-icon" href="<%= htmlWebpackPlugin.files.publicPath %>static/img/icons/apple-touch-icon-152x152.png">
      <link rel="mask-icon" href="<%= htmlWebpackPlugin.files.publicPath %>static/img/icons/safari-pinned-tab.svg" color="#4DBA87">
    <!-- Add to home screen for Windows -->
    <meta name="msapplication-TileImage" content="<%= htmlWebpackPlugin.files.publicPath %>static/img/icons/msapplication-icon-144x144.png">
    <meta name="msapplication-TileColor" content="#000000">
    <% for (var chunk of webpack.chunks) {>
      <% for (var file of chunk.files) {>
        <% if (file.match(/\.(js|css)$/)) { %>
          <link rel="<%= chunk.initial?'preload':'prefetch' %>" href="<%= htmlWebpackPlugin.files.publicPath + file %>" as="<% file.match(/\..css$/)>">
        <% } %>
      <% } %>
    <% } %>
  </head>
  <body>
    <noscript>
      This is your fallback content in case JavaScript fails to load.
    </noscript>
    <div id="app"></div>
    <!-- Todo: only include in production -->
    <%= htmlWebpackPlugin.options.serviceWorkerLoader %>
    <!-- built files will be auto injected -->
  </body>
</html>
```

Drag a column header and drop it here to group by that column

it looks like this:

Contact Name	Contact Title	Company Name
Maria Anders	Sales Representative	Ana Trujillo Comercios y Servicios
Ana Trujillo	Owner	
Antonio Moreno	Owner	Antonio Moreno Taquería
Thomas Hardy	Sales Representative	Around the Horn
Christina Berglund	Order Administrator	Berglunds snabbköp
Hanna Moos	Sales Representative	Blauer See Delikatessen
Frédérique Citeaux	Marketing Manager	Blondel père et fils
Martín Sommer	Owner	Bólido Comidas preparadas
Laurence Lebihan	Owner	Bon app'
Elizabeth Lincoln	Accounting Manager	Bottom-Dollar Markets
Victoria Ashworth	Sales Representative	B's Beverages
Patricia Simpson	Sales Agent	Cactus Comidas para llevar

there's our manifest info



The screenshot shows the Chrome DevTools Application tab open. On the left, there's a sidebar with sections for Application, Storage, and Cache. The Application section is expanded, showing the 'Manifest' item which is currently selected and highlighted with a blue background. A blue arrow points from the text 'there's our manifest info' towards this selected item. The main content area displays the manifest information:

- App Manifest:** 8080/static/manifest.json
- Identity:** Name: kendoui-vue, Short name: 🎨
- Presentation:** Start URL: </index.html>, Theme color: #4DBA87, Background color: #000000, Orientation: standalone.

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Lead, Product Management, Mozilla

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This book has got you covered!”**

Kenneth Rohde Christiansen

Web Platform Architect, Intel

**“Everything you need to build
a high-quality PWA”**

Jeff Posnick

Web DevRel and Platform Engineer, Google

“A great resource!”

Nitya Narasimhan PhD

Google Dev Group NYC Organizer



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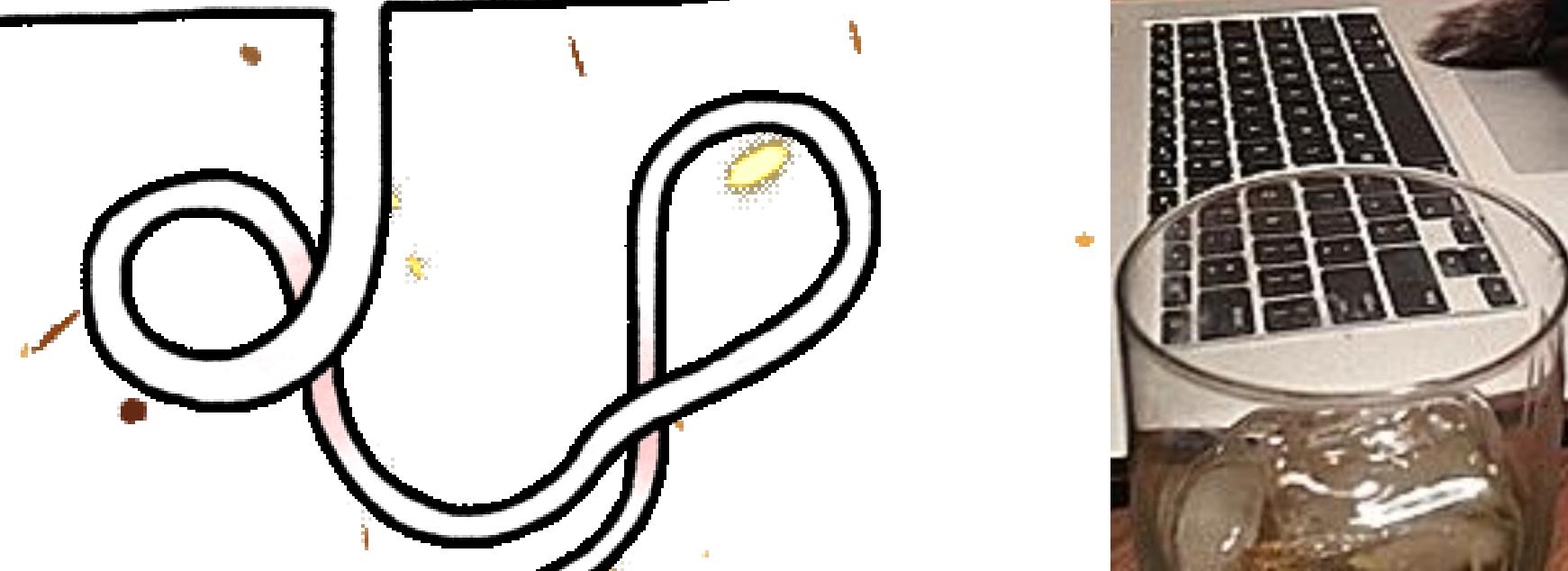


Building Progressive Web Apps

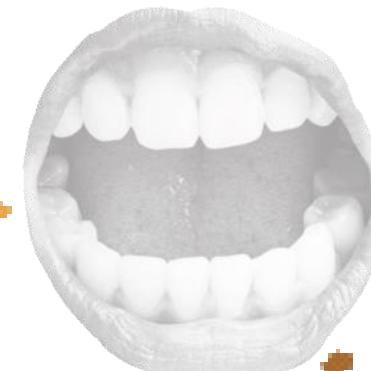
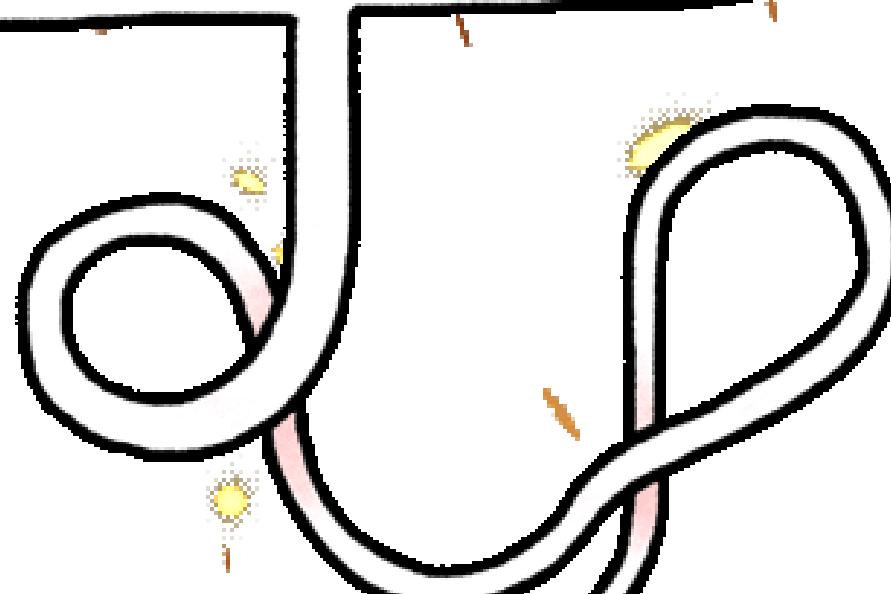
BRINGING THE POWER OF NATIVE TO THE BROWSER

Tal Ater

THANK YOU!!!
**Code & Slides will be
tweeted from @tzmanics**

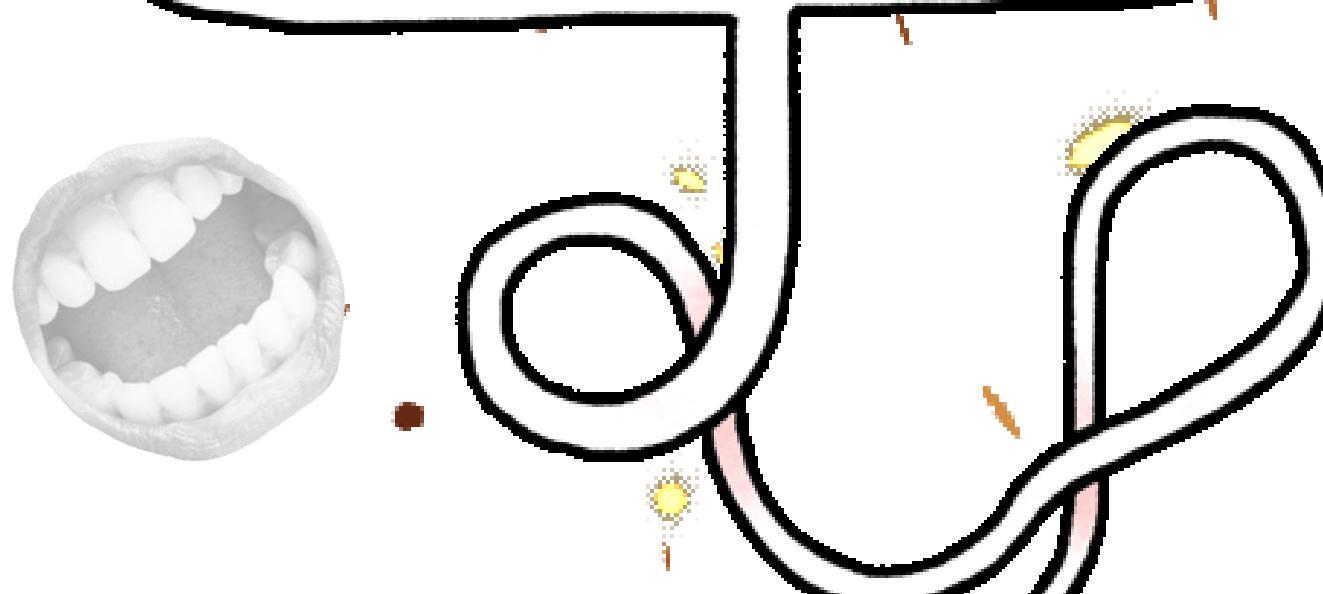


RAP CHALLENGE



Kalahari is cool & made me want to dash
to Sandusky for this awesome bash
you're all so great, y'all should have a sash
thanks for having me here at ...

CODEMASH!



THANK YOU!!!
**Code & Slides will be
tweeted from @tzmanics**

