JavaScript Frameworks: React vs Angular vs Vue.js

Research document

Name: Mohammed Aljader

Student number: 4219090

Semester 3 individual project

Contents

Abstract

There are several JavaScript frameworks to choose from, but which one is the right one? And which one will be the best to use for the web application. This essay research three of the biggest JavaScript frameworks right now; Angular, React and Vue.js to decide which one is to use as a frontend. I am going to use the DOT framework to research which framework is the best to use in the frontend.

Introduction

There are many JavaScript frameworks to choose from, all these frameworks and libraries have different advantages and disadvantages. Choosing the right one can be tricky, which is what this essay will help with. The goal of this essay is to compare three popular JavaScript frameworks; Angular, React, and Vue.js.

The main question of this essay is: **What will be the best JavaScript framework to use for your web application?**

The essay will put these frameworks in the spotlight to figure out what makes them attractive to use. Every framework shares common categories which will be researched. These include:

- Background information
- The installation processes
- The structure of the file system
- Languages and syntax used within the framework, focusing on components and the template views.
- Documentation

These points do a good job on giving a quick rundown on what the specific framework is all about in an objective and fair viewpoint. This information will be the basis of the conclusions drawn about the research questions provided in the next section.

Research Questions

1- Are the frameworks easy to install?
2- Do the frameworks have steep learning curves?
3- When should the frameworks be used?
4- Are the frameworks trending up or downwards in popularity?
5- What is the actual job demand and available jobs with each of the 3 libraries and frameworks?

5

ANALYSIS

React

Background

React is a JavaScript framework designed to allow users to build user interfaces capable of handling data with speed, efficiency, and scalability. The applications created are dynamically loaded without having to refresh the page. It was initially released in March 2013 and is maintained by primarily Facebook and Instagram.[1]

Compared to other JavaScript frameworks, React does not adhere to the MVC pattern. Instead, React is focused on the view in MVC. The core purpose is to create reusable interface components to enhance and help create powerful views, much like directives in Angular.[2]

Installation

Installing React can be smooth and easy, or a hassle depending on what the user wants from it. The "Creating React App" is the fastest and easiest way to get right into development application. The create-react-app is basically a module for creating React projects without you must configure build options such as babel and webpack. If the user is starting from scratch, Create React App is the best way. Node.js and NPM are required.

Three commands are all it takes to get started:

```
npx create-react-app my-app
cd my-app
npm start
```

[1] Wikipedia, React (JavaScript library)
[2] Eric Simons, what exactly is React? October 2017

The most annoying way to install React is to try to implement React into an already existing project. This is a process which requires a package manager like NPM to install React, a bundler to optimize the apps performance and a compiler to enable JSX and ES6 features in your project.[3]

Structure of filesystem

Create React Apps file structure is impressively minimal. Index.html and index.js are the only two files that cannot be deleted or renamed. The former contains the template view, and the latter contains the JavaScript entry point.[4]

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

[3] React, Installation
[4] GitHub, create-react-app README.md

Syntax

React uses an extension to JavaScript called JSX. With JSX, users can define react elements for rendering to the scene with a syntax like html.

```
const element = (
  <h1>
    Hello, {formatName(user)}!
  </h1>
);
```

Similar to interpolation in Angular, users can embed JavaScript directly in JSX with the help of curly braces.[5]

React elements function the same as a regular JavaScript object. They work similar when used in conjunction with conditional statements and loops which means being able to be returned, used as an argument, and assigned to a variable.12 Components in React are created by defining a function. The only rules are that the function must have an input as argument and return a React element. The component can then be used in JSX by writing the component name in the same syntax as an html tag.

```
function Avatar(props) {
  return (
    <img className="Avatar"
      src={props.user.avatarUrl}
      alt={props.user.name}
    />
  );
}
```

Event binding is done similarly to HTML and Angular. The event followed by the statement that the user wants to execute.[6]

```
handleClick() {
  console.log('Click happened');
}
render() {
  return <button onClick={this.handleClick}>Click Me</button>;
}
}
```

[5] React, Introducing JSX
[6] React, Handling Events

Overall, using React with JSX provides an easier experience and learning curve for framework of action. Programmers with JavaScript backgrounds will have no problem getting in React and its syntax. The fact that JSX is optional and can be expressed in regular JavaScript and the latest ES6 features make the framework attractive to all kinds of developers.

Documentation

The React homepage is the first place a beginner should go to learn all about the framework. It houses a quick start section with guides ranging from installation help, both beginner and advanced techniques about the framework as well as how to get into the mindset of building apps with React. The page also has an entire tutorial where users can follow along a guide explaining how to create a simple tic tac toe game. There is also an API reference section which is handy to fully immerse yourself in the framework's details.

There is a discussion forum available for conversation around best practices, versions, and the like. Asking for help with code is mainly done on Stackoverflow though, which currently houses over 60000 questions asked.[7]

[7] Stackoverflow, Tagged questions React.JS

Angular

Background

Angular is a framework designed to help developers create modern applications with complex requirements in simple ways. It is maintained by the Angular team at Google and released in September 2016 as a rewrite from the predecessor Angular.js written by the same team[8]. Angular applications structure consists of a MVC-like pattern where components act as the controller / model and templates as the view[9]. Angular is written in typescript which is a superset of JavaScript.

Installation

Installing Angular is a quick and efficient process. First, Angular requires the user to install Node.js and NPM. Angular provides a zip download but the easiest way is to clone Angular from Git and install it using NPM. Angular also offers a quick start for beginners which includes a playground to make it easier for the user to learn the architecture. If the user were to use Angular in a professional environment, generating a project through the Angular command line tool would be preferable.

Installing a quick start seed is as simple as the following four commands:[10]

```
1  npm install -g @angular/cli
2  ng new my-app
3  cd my-app
4  ng serve --open
```

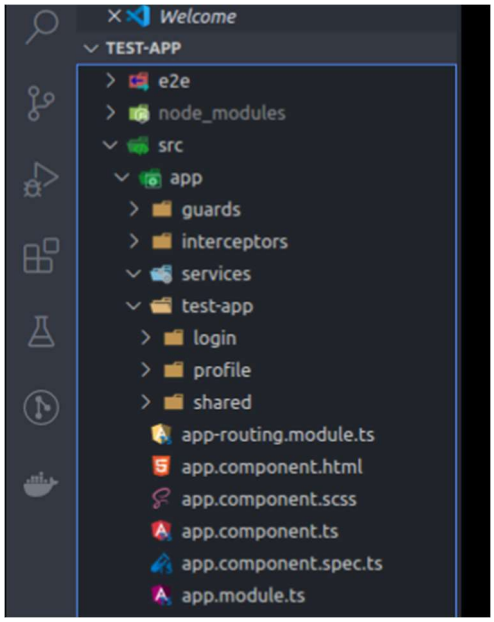
[8] Wikipedia, Angular (application platform)
[9] Angular, Template Syntax
[10] Angular, Setup for local development

Structure of filesystem

The structure made of installation is simple at first sight. Angular installs a lot of files but most of them are so safe that the user completely ignores them. The folders of interest to the user are the folder called src/ and e2e/.

The e2e folder handles all the tests written end to end. It is not of interest to beginners, but more experienced user may visit it frequently.

The src folder is where the source code of the project exists. This is where the files used for the application can be found. The root houses an index file and a bootstrap file. The app folder includes the components and views to help you create a top-notch interface. [11]



[11] Angular, Anatomy of the Setup Project

Syntax

Angular is unique in the way that the user is free to choose to write their code in TypeScript or JavaScript. TypeScript is a big reason to choose Angular. It is a good choice when working in large groups due to its tools. Typescript is efficient when it comes to autocompletion and refactoring which makes working in a group reliable. It may take a while to learn the language but the profit of writing a statically typed language with the same pros as ES6 JavaScript can be something to consider.[12]

The templates are the user-facing part of an Angular application and are written in HTML, but with an "Angularized" twist. This is where the users get to see the changes of their application visually.

Interpolation is a common and simple way to display data in a template. The object property between the curly braces gets replaced by the actual value of the property in a string format.[13]

src/app/app.component.ts

```
currentCustomer = 'Maria';
```

Use interpolation to display the value of this variable in the corresponding component template:

src/app/app.component.html

```
<h3>Current customer: {{ currentCustomer }}</h3>
```

Angular also provides the functionality to use loops and conditional statements in markup which is a powerful tool in displaying specific data simple and efficient. Structural directives are distinguished with a *.

*ngIf is used to show or hide elements from the DOM.

```
<div *ngIf="true">This will be added to DOM by ngIf</div>
<div *ngIf="false">This will be removed from DOM by ngIf</div>
```

[12] Victor Savkin, Angular: Why Typescript? 2016 – 07 - 22
[13] Carlos Menezes, Angular 2 – A quick intro about template syntax, 2016 – 04 - 12

*ngFor is used to iterate through objects and arrays.

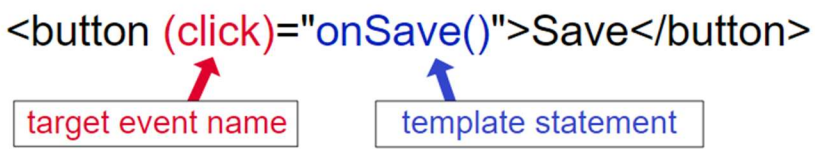
```
<li *ngFor="let user of users; index as i; first as isFirst">
  {{i}}/{{users.length}}. {{user}} <span *ngIf="isFirst">default</span>
</li>
```

*ngSwitch is used to switch template depending on which statement being true.

```
<container-element [ngSwitch]="switch_expression">
  <!-- the same view can be shown in more than one case -->
  <some-element *ngSwitchCase="match_expression_1">...</some-element>
  <some-element *ngSwitchCase="match_expression_2">...</some-element>
  <some-other-element *ngSwitchCase="match_expression_3">...</some-other-element>
  <!--default case when there are no matches -->
  <some-element *ngSwitchDefault>...</some-element>
</container-element>
```

These are all familiar directives to a programmer. The difference is that you now can use them in the context of a HTML template.

Event binding is a way to associate an event with a specific object and is a simple way to make applications functional and interactive. The event binding syntax is marked with parentheses followed by the statement. The events are bundled into the angular/common package which can be easily imported.



Property binding is distinguished by the square brackets []. Property binding is used to easily transfer data from the component to the class.[14]

src/app/app.component.html

```
<img [src]="itemImageUrl">
```

[14] Gitter, angular/angular

Documentation

The Angular homepage is a comprehensive source of information. It provides a beginner's guide to getting started with the framework and detailed tutorials that explain each step thoroughly. There are also sections about fundamentals in the framework that is good to learn when taking a deep dive into the framework as well as a section about certain techniques worth discussing such as safety and deployment.

The most important section of Angular's website is the API section. This is where developers will spend most of their time searching for framework specific help. This includes docs about core packages included in Angular such as animations, routers, http, and testing.

The footer of Angular's page links to gitter and Stackoverflow which houses impressive numbers. The gitter channel has over 13000[15] people joined and there is over 75000[16] questions tagged with Angular at Stackoverflow.

Vue.js

Background

Vue.js is a front-end JavaScript framework released by Evan You in February 2014.[17] Vue.js was designed to be a lightweight framework focused on the view part of an application that could be integrated into the system incrementally.[18] Vue.js is similar to React more so than Angular because of this.

Vue.js has gained popularity in recent years for its ability to be powerful while remaining lightweight and simple. You don't need to learn TypeScript or JSX, just JavaScript is all you need.

---

[15] Gitter, angular
[16] Stackoverflow, Tagged questions Angular
[17] Wikipedia, Vue.js
[18] Vue.js, Introduction

Installation

Installing vue.js could not be easier if the goal is to get up and running immediately. Vue provides either a downloadable version or a CDN that the user can include easy and fast in their index file.[19]

```HTML
<script src="https://cdn.jsdelivr.net/npm/vue@2.6.14/dist/vue.js"></script>
```

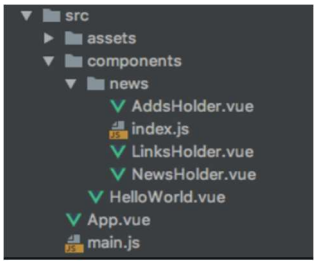
Vue also provides a CLI tool to install a production-ready build used for larger projects. It takes a little more time to set up but offers a wide variety of builds that may suit your application.

```
npm install -g @vue/cli
vue create my-project
```

Structure of filesystem

As mentioned in the installation section, Vue can be installed or just imported with a script tag from a CDN. This means that Vue is flexible in the projects it carries out. Vue can work with a single file in a project, making the file structure difficult to analyze. The file structure when installing a bare bone project with the CLI is similar to other frameworks. A large folder with dependencies, a config folder and of course the src/ folder. We can see the simplicity in the src/ directory with only an App.vue file and a HelloWorld.vue component.

[19] Vue.js, Installation



Syntax

Vue does not force you to use any JavaScript extensions or the like when writing code. Vue supports JSX and even typescript but it is in no way required to use when utilizing Vue. This makes development in Vue familiar due to the basic knowledge needed to create something. It also makes it easier for already existing projects to implement Vue in its ecosystem without having to write additional code to accommodate.[20]

Template syntax is crucial in a framework like Vue and luckily, it's very easy to pick up. Interpolation is done like the other two frameworks mentioned by having {{ }} curly braces with for example a property in it. Interpolation in Vue supports JavaScript expressions as well.

```
<div v-pre>{{ data }}</div>
```

Directives are used to manipulate the DOM. Conditional statements can be done with the “v-if” directive and for loops with “v-for”.[21]

```
<h1 v-if="awesome">Vue is awesome!</h1>
<h1 v-else>Oh no 😢</h1>
```

```
<ul id="example-1">
  <li v-for="item in items" :key="item.message">
    {{ item.message }}
  </li>
</ul>
```

[20] Vue.js, Comparison with other frameworks
[21] Vue.js, Template syntax

Directives also includes event binding with examples like bind and on. These types of directives can take arguments to specify what is going to happen.[22]

```
<!-- DOM attribute binding with prop modifier -->
<div v-bind:text-content.prop="text"></div>
```

```
<!-- method handler -->
<button v-on:click="doThis"></button>
```

An important factor why to use Vue is components. Like React, components can be created to reuse code in a simple and reusable way. Scalability is a factor that makes these frameworks relevant, and components are the key factor to scale.[23]

```
const state = Vue.observable({ count: 0 })

const Demo = {
  render(h) {
    return h('button', {
      on: { click: () => { state.count++ }}
    }, `count is: ${state.count}`)
  }
}
```

Components generated by custom tags created by Vue. This is an easy concept to understand and makes the learning curve a lot easier.

Documentation

Vue.js provides an extensive website in terms of both installation, introduction, and advanced techniques for the framework. Angular and React both had educational pages and Vue is no exception. The introduction is well written and easy to follow with code examples for everything. The API page is the same as other frameworks and there is also small example programs for the user to learn from. What differentiates Vue's website is the comprehensive style guide.[24]

---

[22] Vue.js, Template syntax
[23] Vue.js, Comparison with other frameworks
[24] Vue.js, Official website

The style guide is a best practice guide on how to write code with Vue. They use a ranking from A to D to explain the importance of using said practice. Vue also contains over 10,000 questions asked on Stackoverflow.[25]

Results

Are the frameworks easy to install?

It depends on the purpose for which the framework will be used. All three frameworks are easy to install if the user just wants a quick start. To get a production-ready development project up and running, it gets even more difficult. Vue.js is the easiest quick start because of the simple script tag that users can include with a link to the CDN[26]. React and Angular is not that far behind though with React having the Create-React-App[27] and Angular with its 4-command installation.

Angular wins when having to setup a professional development build because you already get everything with the normal installation. React and Vue.js are trickier due to the time it takes to enable ES6 features with Babel and Webpack / Browserify to bundle code together.

Do the frameworks have steep learning curves?

Angular is the most difficult of the three to learn. Angular is a framework that works with an MVC-like structure using typescript. This means that everything from components, directives and modules will be written in TypeScript.[28] It is possible to write everything in JavaScript, but it is not recommended and would defeat the purpose of using Angular. Angular's learning curve involves learning TypeScript, getting familiar with the framework which contains a heavy library compared to React and Vue.js, and not being able to implement step-by-step into existing projects.

---

[25] Stackoverflow, tagged questions vuejs
[26] Vue.js, Installation
[27] React, Installation
[28] Victor Savkin, Angular: Why Typescript? 2016 – 07 - 22

React only focus on the view part of MVC[29] which makes it easier to implement into existing projects. JSX is an extension to JavaScript that is used to make it easier for developers to write and read code intended for React. It has similarities to HTML language which makes it easy to learn.

Vue.js has the flattest learning curve of the three. It supports TypeScript and JSX but is not the default language to code in[30]. All you need in Vue.js is a basic understanding of JavaScript. It is the lightest framework out of the three, and also the easiest to pick up due to the limited knowledge you need. Regular JavaScript is used to create reusable components for use in a template that includes some syntax of the framework.

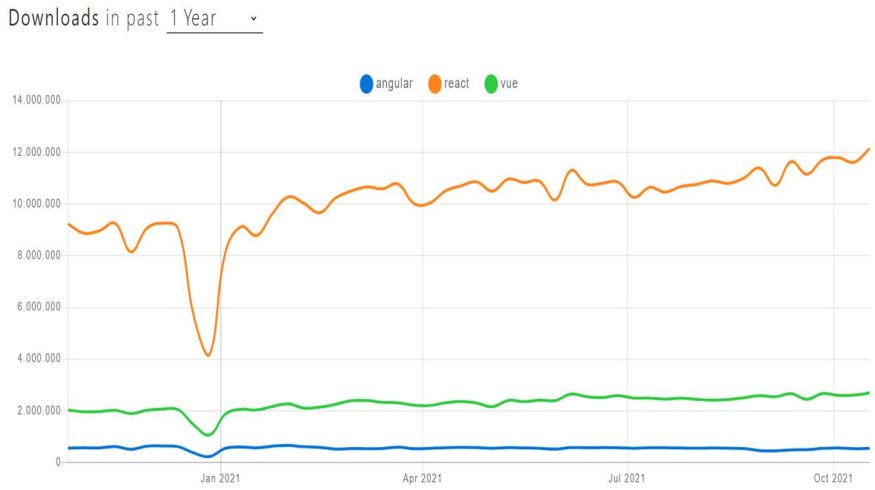
When should the frameworks be used?

The user ultimately must decide which framework to use depending on the application conditions in mind and the degree of user experience. The learning curve goes from Angular which is the steepest and Vue which has the flattest with React somewhere near Vue in between.

A complete beginner creating an app will have more problems with Angular than the other two, while a team of experienced developers with a background in object-oriented programming will certainly welcome Angular as opposed to the others.

[29] Eric Simons, what exactly is React? October 2017
[30] Gitter, angular/angular

Are the frameworks trending up or downwards in popularity?



GitHub Stats

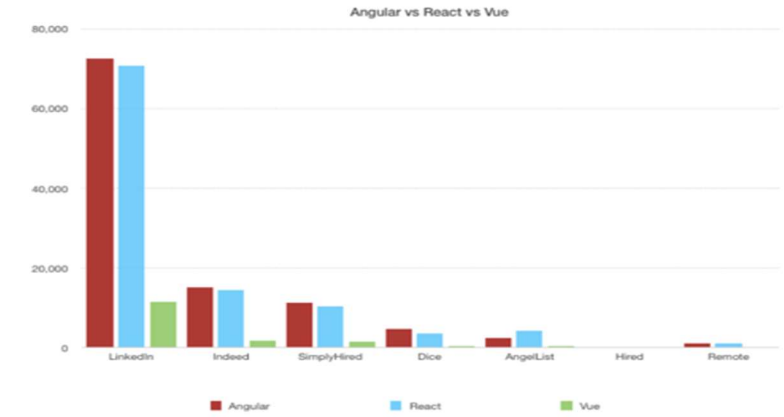
	stars	forks	issues
angular	43294	11074	2596
vue	121380	17356	229
react	117122	21210	492

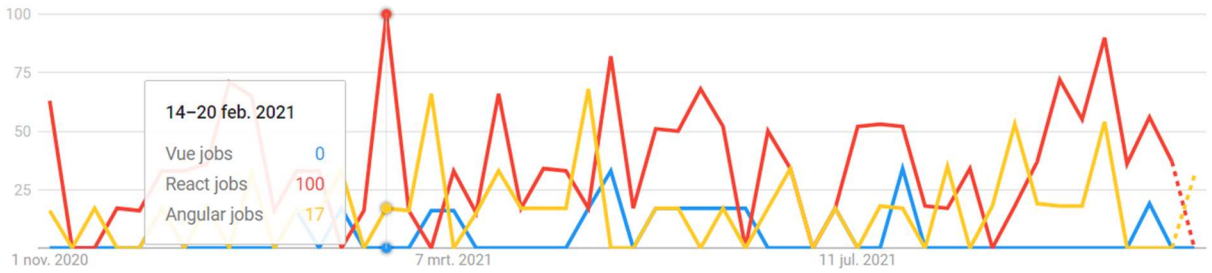
If we measure popularity purely by stars given on GitHub, we can see that Vue (121380 stars) leads by a small margin next to React (117122 stars) while Angular (43294 stars) which is behind the other two.[31]

All three frameworks are currently growing in the industry and are clearly on the rise. Vue with the steepest curve of the three in terms of GitHub stars, Vue is the best competitor to fight against React and Angular. Aside from trends and general analysis of user satisfaction, it is impossible to determine which one to bet on in the future.

[31] Npmtrends, react vs vue vs @angular/core

What is the actual job demand and available jobs with each of the 3 libraries and frameworks?





32

Google Trends breaks it down by geographic location if you want to look up job search trends in your area.

If you are looking very thoroughly from the point of view of the current job market, your best bet is to learn Angular or React. However, since Vue has been gaining popularity over the past three years, it may take some time for projects to use Vue, or new projects adopting Vue, to reach a level of maturity that requires more developers.

---

[32] Google, Google trend

Conclusion

Angular, React, and Vue are three frameworks that thrive in the world of JavaScript. Each of them offers something unique and attractive to different demographics. The trend upwards does not seem to stop for a while and there has not been a better time as now to pick one up. Choosing one is a hard process depending on what the user wants to accomplish and ultimately it comes down preference.

Overall, which one you choose is less important. All three of these options are excellent options and the best of them will be the one that allows you to express yourself naturally in the code and enjoy yourself.

Recommendation

This essay is a cursory examination of three different frameworks to help the reader understand what they are about and the difference between them. Future work would include a more in-depth look at each framework and spend more time examining performance, testing, and statistics. It would be more appealing to an advanced user who already knows the frameworks but wants to learn more about the inner structure, design philosophies and demographics it adheres to.

References

Angular

- GitHub, “Front-end JavaScript frameworks” Available at: https://github.com/collections/front-end-javascript-frameworks
- Wikipedia, “Angular (Application platform)" Available at https://en.wikipedia.org/wiki/Angular_(application platform)

- Angular, “Template syntax". Available at: https://angular.io/guide/template-syntax
- Angular, “Setup for local develop". Available at: https://angular.io/setup
- Angular, “Anatomy of the setup project". Available at: https://angular.io/guide/setupsystemjs-anatomy
- Savkin, Victor. 2016-07-22. "Why typescript?" Available at: https://vsavkin.com/writingangular-2-in-typescript-1fa77c78d8e8
- Menezes, Carlos. 2016 – 04 – 12 "Angular 2 – A quick intro about template syntax" Available at: https://medium.com/front-end-hacking/angular-2-a-quickintro-about-template-syntax-121f9b160a64
- Gitter, "angular/angular" Available at: https://gitter.im/angular/angular
- Stackoverflow, “Tagged questions" Available at: https://stackoverflow.com/questions/tagged/angular
- Angular, "Architecture Overview". Available at: https://angular.io/guide/architecture
- Angular, “What is Angular?". Available at: https://angular.io/docs
- Angular, “Cheat sheet". Available at: https://angular.io/guide/cheatshee
- Angular/angular, "CLI tool for angular". Available at: https://github.com/angular/angular-cli

React

- Wikipedia, “React (JavaScript library)" Available at: https://en.wikipedia.org/wiki/React_(JavaScript_library)

- Simons, Eric. October 2017. "What exactly is React?" Available at: https://thinkster.io/tutorials/what-exactly-is-react
- React, "Installation" Available at: https://reactjs.org/docs/installation.html
- React, "Introducing JSX" Available at: https://reactjs.org/docs/introducing-jsx.htm
- React, "Handling Events" Available at: https://reactjs.org/docs/handling-events.html
- Stackoverflow, “Tagged questions" Available at: https://stackoverflow.com/questions/tagged/reactjs

Vue.js

- Wikipedia, "Vue.js" https://en.wikipedia.org/wiki/Vue.js
- Vue.js, "Introduction" https://vuejs.org/v2/guide/
- Vue.js, "Installation" https://vuejs.org/v2/guide/installation.html
- Vue.js, "Comparison with other frameworks" https://vuejs.org/v2/guide/comparison.html
- Vue.js, "Template syntax" https://vuejs.org/v2/guide/syntax.html
- Stackoverflow, "Tagged questions" https://stackoverflow.com/questions/tagged/vue.js
- Vue.js, "List rendering" https://vuejs.org/v2/guide/list.html [Accessed: 2017-10-17]

Others

- Krause, Stefan. “Results for js web frameworks benchmark – round 4" Available at: http://stefankrause.net/js-frameworks-benchmark4/webdriver-ts/table.html
- Npmtrends, "react vs Vue vs @angular/core" Available at: http://www.npmtrends.com/react-vs-vue-vs-@angular/core
- Qian, Tim. "Star History" Available at: http://www.timqian.com/starhistory/#facebook/react&angular/angular&vuejs/vue
- Job market for Angular vs React vs Vue, Google trends Available at: https://trends.google.com/trends/explore?cat=31&q=Vue%20jobs,React%20jobs,Angular%20jobs