

Comparative Analysis Of Reactjs And Vuejs

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Abstract

We live in a period of the web, we need a different approach to build a web application that is very interactive and speedy, that's where JavaScript comes into picture. JavaScript has gained its own popularity and numerous designers are making numerous new JavaScript Frameworks. JavaScript Frameworks act as a spine of a single page application and it adds more advanced functionalities to HTML and JavaScript. React JS and Vue JS are two most used JavaScript frameworks in current web development. Both of them are used to develop an interactive single web page application. This paper helps us to understand the concepts of React JS and Vue JS.

Index Terms — *JavaScript, React JS, Vue JS, Virtual DOM*

I. INTRODUCTION

JavaScript is a client side scripting language that enables us to create a dynamically updating content of HTML pages. JavaScript is a client side rendering language, its code is executed on the user's processor instead of the web server thus it saves bandwidth and load on the web server. As JavaScript supports asynchronous communication, results and processing is completed almost instantly depending on the task, thus it reduces the processing work of the web server and sending back the processed result to the client local server. Normally, HTML pages are always static. JavaScript provides an interaction to the website and makes it more user-friendly.

Many frameworks emerged from JavaScript, which provides various new functionalities to develop a dynamic web page. JavaScript is a Platform-independent language, so many developers support JavaScript to build their websites.

JavaScript language possesses all features of a procedural language like looping, branching, event click actions. JavaScript is easy to learn and is also easy to debug, as it provides a DOM model with various predefined functionalities to various objects on the pages making it easier to develop a website. JavaScript also allows developers to use the Application programming Interface (API), the predefined set of building blocks which allows implementing programs easily.

II. JavaScript Framework

A JavaScript Framework is a collection of JS code libraries that allows the developers to use the pre-design JS code for routine programming functionalities. JavaScript frameworks give structure and design for the entire web-page and it saves the time of website development. JavaScript Frameworks makes the web-page, device responsive. Some JavaScript Frameworks supports component based models, where components can be reused any number of times. Some JavaScript Frameworks supports Model-View-Controller (MVC) model, where Model component is related to the data-logic and View component deals with the UI for a web-page and the Controller Component provides interaction between model and view components.

2.1 REACT JS

React JS is a JavaScript Framework for building a user interactive website. React JS is used for developing a single page web application, which loads in milliseconds. React JS allows the developer

to create many reusable components. React JS supports JSX syntax which is very easier than HTML code. React JS can be used with client and server rendering and also with other frameworks.

2.1.1 HISTORY

React JS was created by Mr. Jordan Walke, a software engineer at Facebook in the year 2011. React JS is created on the influence XHP, an HTML framework for PHP. Firstly, React JS is used in the news feed of Facebook. React JS is made open-source and it supports both Android and IOS development. Later, it is used to create many web applications and mobile applications. Instagram is developed using React JS. As its features and functionalities are numerous, many developers now choose it to develop their own site.

2.1.2 COMPONENT BASED

React JS is purely component based framework. React JS supports independent and reusable chunks of code. The react components are more similar to that of the JavaScript functions, but it returns HTML contents via rendering function. React components support modularity, improving developer's productivity and accelerating the development process.

2.1.3 LIFECYCLE

React components have their own lifecycle methods. Each component can be mounted, updated and unmounted. Once the webpage is loaded, the mounting phase of a life cycle takes place. Mounting phase is supported by built-in components like constructor, render and componentDidMount. On every update to the contents in the page, Update phase of a lifecycle is called by the built-in functionalities like ComponentDidUpdate and componentShouldUpdate. Once the component is removed from the DOM, the ComponentWillUnmount functionality is called.

2.1.4 Virtual DOM Concept

React JS supports the concept of Virtual Dom. It is a programming concept, where an ideal representation of UI is kept in memory, and is synced with the real Dom for every updation of contents of the webpage. Many developers prefer the concept of virtual DOM, as it saves memory and time and it avoids re-rendering of contents of the webpage that are static and the content that are not updated.

2.2 VUE JS

Vue JS is a JavaScript Framework for building interactive web-pages. Vue JS mainly focuses on the 'view' phase of MVC model. Vue JS can be easily integrated with any other libraries and frameworks. Vue JS scripts are light-weighted and are very fast in performance. Vue JS supports routing concepts, which is used for the navigation of the web-pages. Vue JS makes the development process of the web-page an easier one and is supported by many developers to create their user interface.

2.2.1 HISTORY

Vue JS was created by Evan, an ex-employee of Google in the year 2014. Vue JS is based on the concepts of AngularJS, but it is comparatively light-weight when compared to Angular JS. Vue Js is open source progressive JavaScript, which is used to build and develop very powerful web apps. Vue JS supports flexibility, that it allows developers to write code in any format like HTML1 file, JavaScript file and also pure Javascript file. The Vue JS allows applications to directly run on the browser.

2.2.2 DATA BINDING

The traditional technologies supports one way binding of data. It means JavaScript variables are bound to the DOM. But Vue JS supports two way binding of data. It first binds the JavaScript variables to the DOM elements and in return it also binds the data from DOM to the JavaScript variables. Data Binding helps to keep the data sync with DOM always without any efforts by the developer

2.2.3. TEMPLATE BASED

An Vue JS application needs to render HTML contents. In Vue JS, HTML rendering is done via Vue JS Template language. Vue JS Template consists HTML format mixed with the dynamic content with insertion points. Developers can easily develop their own web application by inserting their content in the pre-defined JavaScript variables.

2.2.4 DIRECTIVES

Vue JS supports Directives, which is responsible for the updation of DOM contents. Directives are like HTML attributes, which are added inside the templates. Directives will check for the change of expression values of the DOM, on updation it will modify it in DOM. Directives give low level access to the HTML elements to control the behaviour.

III. COMPARISON

3.1 LEARNING CURVE

For developing very fast, dynamic and interactive websites, developers depend on new frameworks everyday. The newly developed Frameworks must be very easy to learn, even though they contain many complex functionalities.

ReactJS consists of very complex setup, properties, functionalities, so that requires a deep knowledge of concepts to build an interactive webpage. Vue JS is very simple in nature. Other than the knowledge of HTML, JavaScript, Vue JS does not require any further advanced concepts to build a website. Vue JS is easy to learn when compared to React JS, as it decouples the HTML, CSS and JavaScript. Vue JS documentation is well defined than React JS. Vue JS is more developer-friendly than React JS.

3.2 BUILDING TOOLS

Both React JS and Vue JS support a good development environment. For easy access and development, both React JS and Vue JS provide CLI. React JS provides a CLI that makes it easy to develop a react project, which is create-react-app. Vue provides a resource called Vue-CLI which allows developers to create Vue projects easily. The Vue CLI comes already customized, developers can add plugins anytime during the development lifecycle. These CLI gives developers a comfortable and flexible development environment.

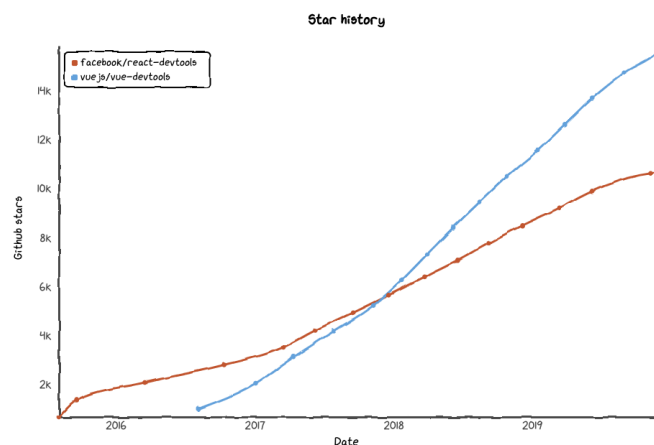


Fig: Star Rating of React DevTools And Vue DevTools given by the developers

3.3 DATA BINDING

Data binding is a method of binding data from the variables to the DOM and DOM to Javascript variables. One way data flow is easy to implement and understand, as data flows from the JavaScript variables to the DOM. In Two way data flow, DOM also binds the changed data to the JavaScript variables, it is a complicated process. On considering the frameworks, React JS supports one way data binding, whereas Vue JS supports two way data binding mechanism. In React JS, models can only change the state of a variable, but in Vue JS, when an UI element changes, then the model data is also changed to it. On comparing, Vue JS can be more better than React JS in data binding technique, but in React JS maintenance of the data is very easy and understandable.

3.4 MOBILE AND DESKTOP APPLICATION DEVELOPMENT

The web application must support all types of user's devices. Frameworks must allow developers to create a website, which supports both mobile and desktop devices. React native, allows developers to create UI, supports various platforms. Vue JS's Weex platform is an emerging cross

platform UI framework. Vue JS also provides NativeScript plugins for developing cross-platform supporting web applications. Both JavaScript frameworks allow developers to create interactive, efficient, cross-platform supporting web applications.

3.5 VIRTUAL DOM

In the traditional web technologies, when the content of a component in DOM is changed, then the whole DOM is updated and reloaded. This updation process takes place for every action clicks and events. This re-rendering concept of the entire webpage for every small change in the DOM affects the performance of the webpage. In order to overcome this issue, the trending web technologies uses the concept of Virtual DOM. This Virtual DOM (Document Object Model) will get updated changes in the contents of the DOM components by the render method and then it compares the new webpage DOM elements with the past one. Virtual DOM will update only the changed contents in the Real DOM. Using the concept of Virtual DOM, React JS and Vue JS develop a single page web application. Single page web applications are very interactive and it is loaded faster. As it updates only the changed content of the element, it saves memory.

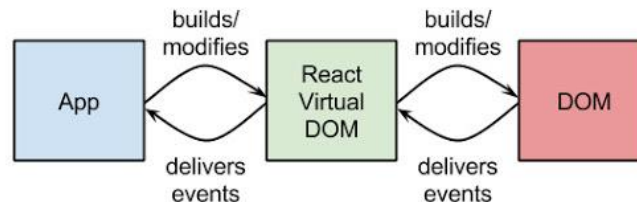


Fig: VIRTUAL DOM CONCEPT

React JS is fully based on the concept of Virtual DOM. React JS maintains state for every updating variable to detect their changes. Once it finds any change in the variable value, then it will automatically updates the only the changed content in the webpage. Vue JS avoids unnecessary reloading of webpage by combining the concept of Virtual DOM with the dependency tracking system. Developers can easily identify the changed contents and decide when and what to re-render in a webpage.

React JS supports Virtual DOM with state maintenance concept and Vue JS supports Virtual DOM with HTML Templates.

3.6 COMPONENT BASED

The trending JavaScript frameworks allows the developers to build small, reusable, and robust components.

Components represent the data that needs to change frequently. Components are the key reason for the frameworks to have the ability to re-render the contents without any additional actions. React JS supports components based models for developing interactive and reusable contents of a webpage. Vue JS Supports component based model but it mainly depends on the templates of HTML. React JS treats everything as a component and every component has its own component lifecycle. Vue JS also has component lifecycle, but they are very simple and not preferred mostly. react Js enables the developers to use reusable components or refactor code, to improve productivity and performance.

3.7 MODULARITY

Developers must be able to create an application that is easily divisible into many modules, with each module holding a unique functionality. The JavaScript framework supports modularity

concept. ReactJS is based on the component based model, application consists of many components with their own functionalities. An application developed on the basis of React JS consists of many small, reusable chunks of code. Vue JS follows the concept of “single-file components”, which will keep scripts, templates, styles in different files. On the time of rendering, it will merge them into a single file and render as a single web page application. On comparing both frameworks, React JS supports modularity than Vue JS, as it is completely component based Frameworks.

3.8 ROUTING

Both React JS and Vue JS support Component based models and provide Single Page Application. In a component based model, there are many components, which interact with one another and share data. Single web page Application cannot share the exact link of a sub page to the main webpage, which is a major disadvantage. In order to overcome these disadvantages, Routing came into existence. Routing is a process which allows users to navigate between the pages and also to share and communicate data. Routing supports dynamic URL changes and smooth navigation between the pages. React JS and Vue JS supports routing, to update UI when URL changes. React JS does not have their own routing option. Instead they make use of the React-Router library, an official third party which supports Routing. Vue JS has its own library Vue Router to support Routing, which provides API to update the application URL. Vue Router supports mapping of nested routes to nested components and allows smooth transition of UI changes in webpages. Both React JS and Vue JS provide parameters, which make the routing dynamic. As Vue JS has its own Routing library, it is much better than React JS in supporting Routing concept.

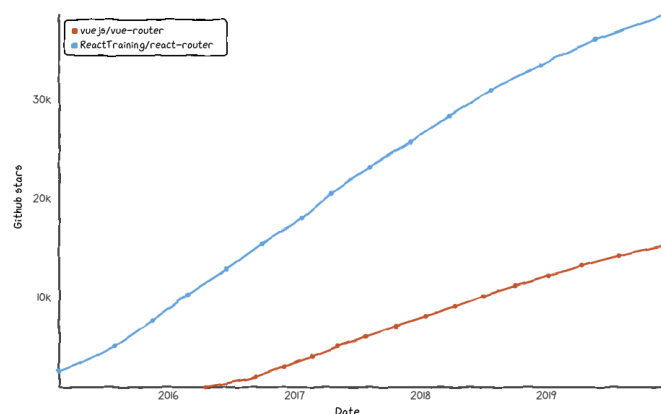


Fig: USAGE OF REACT-ROUTER AND VUE-ROUTER

3.9 SERVER SIDE RENDERING

Most of the webpages use client side rendering, where HTML, CSS, JavaScript is sent and rendered on the client browser. Server Side Rendering is rendering of HTML. But the page loads slowly, that the user has to wait for a while. Server Side Rendering renders the HTML content on the server side and other CSS, JavaScript on the client side browser. It enables fast loading of the web page. Vue JS framework builds a client side supporting web applications. As the page loads very slowly, it extends to support Server side rendering. Nuxt JS, a Vue JS library which acts as a static page generator, renders web application as a static page on the server itself. Vue JS also supports a vue-server-renderer package, to render web applications on the server side. React JS has built-in ReactDOMServer object to support Server Side rendering. It also supports Next JS and After JS, an third party library to support SSR. SSR enhances the SEO performance, as the crawler crawls the web page, if it is in CSR it can see only the blank page. But when SSR is used, the HTML page is loaded at the time of Crawling, which enhances the performance. On comparing React JS and Vue JS, the SSR support is relatively high on Vue JS.

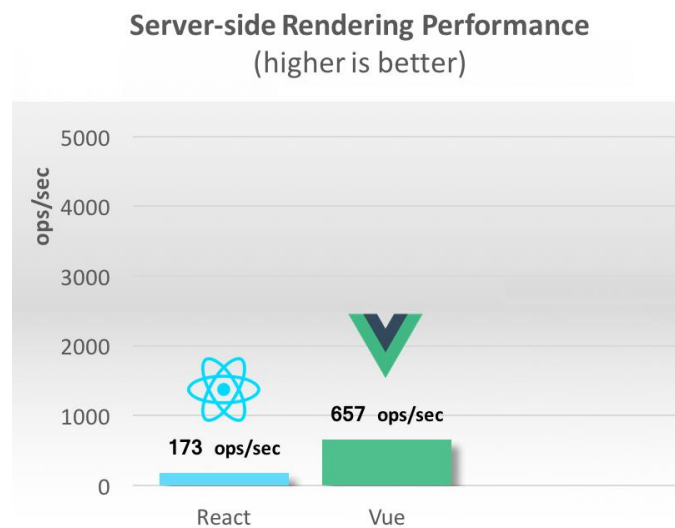


Fig : SERVER SIDE RENDERING PERFORMANCE OF REACT JS AND VUE JS

3.10 TEMPLATE

JavaScript frameworks will have their own Templates to create web applications. React JS uses JSX approach for web page development. JSX is a declarative XML-like syntax. HTML, CSS all needs to be written in JavaScript only. It uses many advanced features of JavaScript EcmaScript like arrow functions. Vue JS supports HTML based templates to develop web applications. All HTML, CSS, JavaScript can be used separately in Vue JS, which makes the web development process easier. HTML based template makes it easier to migrate to support the advanced features in further development. On comparing, if developers want to create a web application with many presentational components, then HTML based templates can be preferred or if web page is with many logical components, then JSX templates are preferred.

3.11 STATE MANAGEMENT

JavaScript Frameworks must maintain state of all the variables in a component, to provide interactive and dynamic web pages. Both the frameworks provide similar approaches for managing the component state. Vuex, is a Vue JS data flow library. Component describes a UI, at a specific time. When data changes, the framework redraws the entire component UI. Vuex automatically keeps tracking the dependencies of the component during rendering. So the system knows exactly what to be re-rendered when the state changes. Vuex provides a central repository store for all the states and the store mutates the state. Every component that depends on the state will access it using the getter on the store and components update it as soon as change happens. But a disadvantage of the Vuex, it follows unorganized props and event changes which makes it complicated. React JS is flexible in support state management as it supports third-party libraries like Redux, Flux and Hooks. Flux stores every state in a store and maintains it. Flux supports unidirectional data flow. Redux stores all the components of an application in a single store. Redux maintains the state in a read only format. States can be changed only using the Reducers function. Hooks are used to maintain the state of a functional component. Hooks uses usestate function to get and set the values of the variables in a component. Mobx also used for state maintenance. It uses observables for the variable, which tends to change in a component. Observables keep on listening to the state of a variable. When there is a change in the component, then Observer is used, which will track the change and update the value of the variable.

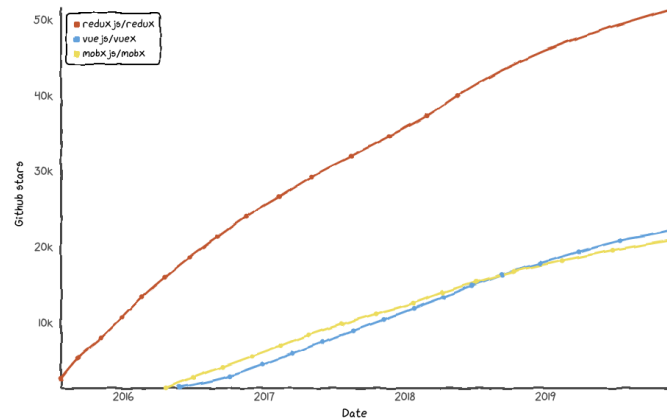


Fig : USAGE OF DIFFERENT LIBRARIES FOR STATE MAINTENANCE

Developers have a choice to choose their state maintenance library or a plugin to create an interactive and dynamically changing web page.

3.12 FLEXIBILITY

The emerging new frameworks must be more flexible. The code must be easily modifiable, so that it can meet the requirements and new changes. Vue JS provides many flexible features for developers like Vuex for state management and Vue Router for routing. But React JS is more flexible than Vue JS as it supports many third-party libraries, which provides many ways for routing and state management. Developers can choose their own method of implementation to create their Single page web application.

3.13 STATIC TYPE CHECKING

Both the frameworks support type checking at compile time. React supports static type checking using Flow. Flow is a third party static type checker of JavaScript code. Flow checks code for errors through static type annotations. TypeScript can also be used for static type checking, which gives good support for JSX. Vue JS also supports flow to enable static type checking. The Flow code can be removed from the code leaving JavaScript code alone during the build of an web application.

3.14 PERFORMANCE

Performance evaluation and memory consumption are the major factors for evaluating frameworks. On comparing speed, both the React JS and Vue JS share an equal measure. On comparing the re-rendering concept, React's mechanism re-render the entire component of the DOM tree when the component change is made. React makes some unnecessary extra re-renders of components. Vue JS offers an optimized re-rendering concept in which the system keeps on tracking of the changes and renders them. React JS is slower in performance than Vue JS, on comparing Re-rendering concept. Another factor to consider is library-size of framework, on comparing this Vue JS library size is half than the React JS library size. Vue JS exceeds on comparing the library size. Virtual DOM concept plays an important role. Both React JS and Vue JS supports Virtual DOM. Another factor to consider is interaction of components and dynamic updation of contents, both React JS and Vue JS supports communication of data between various components by using a library.

	React	Vue
Replace all rows	173.21 ms	168.47 ms
Create 10.000 rows	2085.16 ms	1615.71 ms
Startup time	72.4 ms	48 ms
Creating/clearing 1k rows (5 cycles)	4.93 MB	3.75 MB
Run memory	8.79 MB	6.98 MB

Fig: PERFORMANCE ANALYSIS OF REACT JS AND VUE JS

3.15 MEMORY

Memory consumption of the web application must be very small. Developers should build an web application, which consumes less space for storage and less time for loading. React JS consumes a considerable amount of memory, as it supports many third-party libraries and component based models. Vue JS consumes less memory on the initial state but once the DOM is manipulated, its storage capacity increases than React JS.

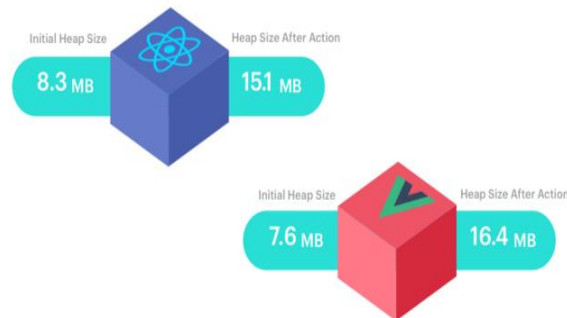


Fig : MEMORY CONSUMPTION OF REACT JS AND VUE JS

3.16 POPULARITY AND USAGE

Both JavaScript frameworks are preferred by the developers to create their own interactive, dynamically varying, fast loading Single Page Web application. On considering performance, speed, new functionalities, reusable code, developers prefer React JS to create their web pages. Vue JS is also preferred, but it is still in the progress. On considering flexibility, responsiveness, scalability, and cross platform support, React JS is popular among the Front-End developers.

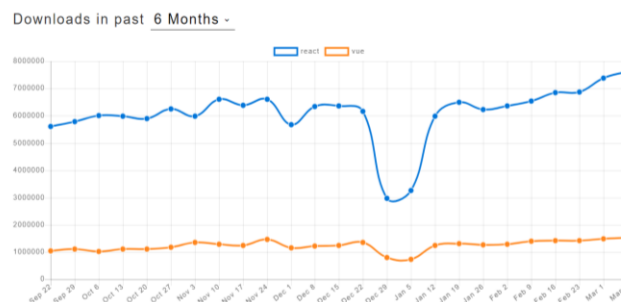


Fig : Downloads and Usage of JavaScript Frameworks

Both React JS and Vue Js are amazing JavaScript Frameworks. They do have many similarities and differences.

Table : COMPARATIVE ANALYSIS OF REACT JS AND VUE JS

FACTOR	REACT JS	VUE jS
Ideal for	Suitable for modern web development and native rendering Apps for android and IOS.	Suitable for the advanced SPA development and started to support native Apps
Model	Virtual Dom	VirtualDOM HTML based templates
Simplicity	Complex	Simpler
Code maintainability	Tedious process	Easy process
Code reusability	Only CSS	HTML and CSS
Abstraction	Medium	Comparatively Strong
Coding Speed	Normal	Fast
Testing and Debugging	Easy	Moderate
Extensibility	Supported by third-party libraries	Supported by plug-ins

IV.CONCLUSION

JavaScript will continue to be the heart of mobile and desktop web development. JavaScript provides a flexible and efficient way of coding. The decision of selecting an appropriate JavaScript framework depends on the project undertaken. Both the frameworks have their own advantages and disadvantages that make them the ideal choice. On considering some parameters, React JS is better, on others, Vue JS is better. Both JavaScript frameworks support the development of fast loading, dynamically changing interactive web pages. React JS takes less code to support large functionalities and provides modularity and flexibility. Vue Js is better in performance, speed, and memory consumption. The support for React JS is much better, with large community support, as Vue JS is getting started. Future work of this paper includes the analysis and comparison of various JavaScript frameworks of front-

end to develop a web application.

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