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**Web Application Framework Analysis**

**Abstract**

Web development frameworks are tools that allow for better scalability and organization in comparison to traditional web development. These tools can vastly improve the performance, quality, and scalability of a developer’s web application. However, in recent years the issue hasn’t been finding a framework, it’s been knowing which framework is right for you. This paper examines three of the most popular web development frameworks today. These frameworks include ReactJS, Vue.js and Angular. React and Vue are both front-end frameworks only which will need other technologies to create a full stack application. Angular on the other hand is a full stack technology. The paper examines the pros and cons of each framework individually and then goes on to discuss which framework I will be using for my final course project and why.

**Introduction**

Over the past couples of years there has been vast improvements in web development infrastructure. While there have been improvements in many areas of web development infrastructure one of the most impactful and interesting has been in front-end web development. Front-end frameworks such as React, Vue, Angular and Ember have recently gained popularity because of their ease of use. Where once it took many hours to create complex interactive UIs now an experienced developer using the power of one of these frameworks can create a similar product in a fraction of the time. This is because of the power of these frameworks.

**Problem Definition**

Tools like frameworks can make the lives of developers much simpler and impower them to create cleaner and more efficient applications These frameworks also provide a basis for smoother development which can help later on when applications are deployed at greater scale. However, there are many different frameworks out there it can be challenging for developers to know which one is the right one. Because of this an analysis of multiple frameworks will be covered in this paper. The frameworks that will be analyzed are Vue, React and Angular. These were chosen because they are three of the most popular frontend frameworks being used today. I will examine each of these frameworks and go over their pros and cons and try to identify the one that is the most useful.

**Solutions/approaches**

**ReactJS**

ReactJS is technically not a framework but is a JavaScript library. The key feature of react is the ability to create reusable UI components. According to the official React documentation the definition is “React is a library for building composable user interfaces. It encourages the creation of reusable UI components, which present data that changes over time. Lots of people use React as the V in MVC (Model View Controller). React abstracts away the DOM from you, offering a simpler programming model and better performance. React can also render on the server using Node, and it can power native apps using React Native. React implements one-way reactive data flow, which reduces the boilerplate and is easier to reason about than traditional databinding.” In short, this essentially says that React will take many of the challenging tasks that old UI design came with and simplify and do them for you. For this reason, React is used by various well known tech giants such as Facebook, Instagram and Netflix. Reacts advantages are that it uses virtual DOM, which is a JavaScript object, this improves the apps performance because virtual DOM is faster than the regular DOM. Also, it can be used on client and server side as well as with other frameworks which make it easy to use and implement. Lastly, splitting things up into smaller reusable components and patterns allow for improved readability which helps maintain larger apps and is more intuitive to use. However, React does have its limitations. One major limitation is that React only covers the view of the app meaning that developers still need to choose and use other technologies to have a full stack application.   
**Vue**

Like ReactJS Vue is a frontend framework which requires the use of other technologies to handle the backend and database. Vue was created in a 2013 by an ex google employee named Evan You. Evan claims that he wanted to take the best of Angular which was its data driven way of dealing with the DOM but make it light weight. Like ReactJS, Vue handles the view in the traditional MVC framework. It’s used to create single-page applications by dynamically rendering new elements on a single page. One of the advantages of Vue is that it is very lightweight. The downloaded zip of the framework is only 18KB which makes it fast and easy to install. Another advantage is the use of virtual DOM, the DOM represents an HTML page with its styles and elements. Usually, when a user interacts with a page and objects change their state the browser must update the information and render it on the screen. Updating the whole DOM for this however is cumbersome and inefficient. The fact that Vue uses a virtual DOM means that Vue knows which elements need to be updated from the original DOM without having to render the whole tree node. This means that rendering the page is much faster and performance is vastly improved. Another advantage of Vue is its fast-learning curve. Vue doesn’t require knowledge of additional technologies such as JSX and TypeScript like ReactJS and Angular. One of the cons of Vue is the language barrier. Vue has been gaining popularity in China and with the restrictions that are placed on information in China this most likely will be the case going forward. This means that a lot of the discussion and support surrounding Vue is in Chinese making it somewhat limited if you are not a Chinese speaker. Another con is that Vue’s community and development team is small in comparison to React and Angular. This means that the support for Vue for large scale projects is smaller. The final con of Vue is that there is a lack of skilled developers. Because Vue is the newest framework covered in this paper it means that it most likely has the least number of skilled developers in the work force. This problem will take time to fix itself as new talent immerges and adopts Vue as their framework.

**Angular**

Angular is one of the most popular web development frameworks since it was first introduced by google in 2009. Angular framework makes it easy to develop web applications and unlike Vue and React is full stack meaning that it enables developers to quickly write and entire application, front-end, back-end and database, using only JavaScript. This framework is used by various well-known companies such as Gmail, PayPal and Forbes. (2) The advantage of using Angular is that it has an enhanced design architecture. As web applications get larger and more complex more components are needed which can make onboarding people who haven’t been involved in the project difficult. Angular solves some of this problem by simplifying the management of these components making them easier to locate and understand. Another pro of Angular is that it is written in typescript. This provides better scalability and helps spot and eliminate common mistakes while coding. While this isn’t as useful for smaller projects as projects are scaled this can help a lot. The final advantage of Angular is that it is a full stack framework. This means that all you need is angular. This can make running your program easier because there is no need for downloading other packages to handle database and backend infrastructure. Some disadvantages of angular are that they limit Search Engine Optimization options and offer poor accessibility for search engine crawlers. This means that it is more difficult for people who are using web crawlers to gain information from your web application. Another drawback is that Angular is complex. This means that it has a steep learning curve and isn’t super easy to pick up and use. Because of this onboarding people can be more challenging than for instance React and Vue. Although these cons are problematic, once one is familiar with how to use Angular it can be a very powerful tool in creating excellent and efficient web applications.

**Discussion/analysis**

React, Vue and Angular are all very viable options that will help speed up development and empower developers to create more user friendly and efficient applications. I believe that react is the best framework to use for my project. While I think that in the long-term Angular framework might be best due to it being full stack, I think that React has a lot of information that will help me quickly ramp up and start using the framework. I will be choosing React over Vue because React is an older technology that has more resources. Also, with Vue being a framework that is widely used in China means a lot of the resources aren’t in English which would make it difficult for me to understand.

**Conclusion**

In conclusion, all three frameworks would allow a developer to make an efficient and modern web application. Vue and React are front-end applications which give you good flexibility when choosing technologies for backend infrastructure and databases. Angular on the other hand is more robust and complex however, is the one stop shop for making a web application. Angular allows you to make a full stack web application without needing other technologies.

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