

## FRONTEND FRAMEWORK AND LIBRARIES

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### Abstract

The development of web technology has accelerated recently. Front-end development is crucial if you want to be at the forefront of Internet history as Hypertext Markup Language (HTML5) develops into a worldwide web consortium. There are numerous front-end development frameworks and libraries, though, including Angular and React. How can we pick front-end framework libraries that will be more significant and simple for users to comprehend and use? This article begins with an overview of the top front-end development frameworks and libraries, as well as performance testing of each in web services. It thoroughly comprehends frontend framework libraries to examine both their advantages and disadvantages. The paper finishes with a potential future for front-end development in websites after summarizing the contributions.

**Keyword:** *Front-end; JavaScript; Web Development; HTML5.*

## 1. INTRODUCTION

As internet technology has grown rapidly in the last decade, users show more and more dependence on websites as a medium. Daily life like getting information, watching news and shopping. HTML5 technology is a markup language used to establish layout and rendering Content on World Wide Web's [1]. The importance of many semantic elements such as <footer>, <aside>, <nav> is increasing in HTML 5 to define more clearly than before HTML and it continues to improve and it helps the web developers to create their websites with digital permission. This includes hard copies of all or parts of the work so that people can easily view the web. Abstracts with credit are permitted. Furthermore, HTML5 adds more elements gained access application programming interfaces (APIs). For instance, element allows the website to access the mobile phone's canvas section [2]. The fifth version of HTML is HTML5. With the advent of HTML5 technologies, it is now possible

to build dynamic websites in addition to improved web pages. In HTML5, the majority of the code is rendered or cached on the client-side, making it simple for the user to retrieve the full document. It is not a good idea to put any important site data in local storage because it is also readily available and may be susceptible. In 2008, Google released the Chrome V8 engine which adequately addresses the issue which brings JavaScript to the front with HTML5 [3]. Prior to the release of Chrome V8, JavaScript's only use in a webpage was to run JavaScript code. JavaScript was initially created to be used by web browsers. Server-side scripting is feasible thanks to Chrome V8, often known as V8, which can run JavaScript code both within and outside of a browser. Chrome V8 appearance redefines JavaScript because Chrome V8 JavaScript engine has such an extraordinary speed that more than 56 times faster than any version of Internet Explorer (IE) [3]. Traditional web browsers usually use some complicated process to compile JavaScript like interpreting byte-code and compiling the entire web project to generate the code then execute it from a file system [7]. Consequently, their JavaScript running time is much longer than compiled languages like Java and C++ [7]. V8 engine's optimized solution is using inline caching technology to improve performance without traditional compiling [5].

When the V8 engine is made available, JavaScript may behave similarly to Java or C++. Thus, the V8 JavaScript engine enables web projects to run as quickly as conventional desktop software. Due to the excellence of the V8 JavaScript engine, numerous JavaScript platforms based on it emerged and ushered in a new era in the history of internet development. In 2009, Node.js were released which combine with V8 JavaScript engine as a development platform [6]. Node.js extends developers' eyesight that JavaScript cannot only carry out a simple script in a website but also use in writing an event-driven server-side application with simpleness [7]. Despite the fact that Node.js was introduced nine years ago, other new JavaScript frameworks have emerged and are impacting web development.

## **2. LITERATURE REVIEW**

- a. The V8 engine's invention has resulted in a large number of JavaScript-based front-end frameworks and tools.
- b. To find out the leading front-end framework and library in the development sector standard, we collect usage statistics from Github which is the largest Git-repository hosting service globally.

## 1. Front-end Frameworks and Libraries

However according to recent studies and polls, Angular and React are currently the most widely used front-end frameworks.

	React	Angular
Popularity	72.6%	20.39%
Loved	68.19%	52.27%
Want	22.57%	7.18%

Table 1: Github front-end frameworks usage statistics in 2022

React and Angular's use and popularity in 2022 are depicted in Table 1. The following sections of the paper will concentrate on Angular and React.

### 2.1 React.js and React Native

In order to establish Facebook and Instagram website with better user experience, Facebook developed the React JavaScript library [8]. Due to React's powerful features, Facebook released React as an open source JavaScript ES6 based library to global developers and companies in 2013 [8]. Besides, Facebook also launches React Native to develop a mobile application with React under major mobile platforms such as IOS and Android in 2015 [9].

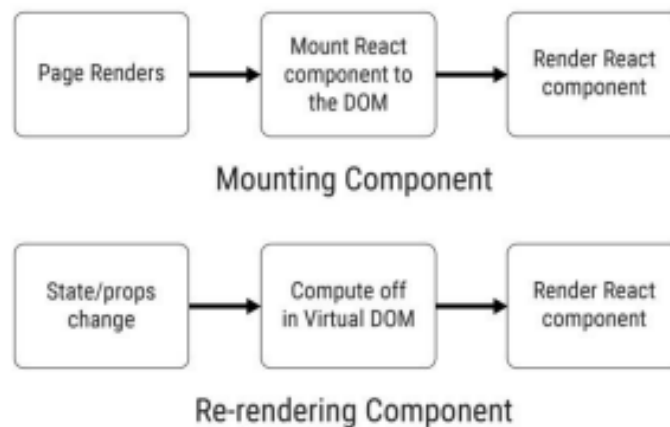


Figure 1: Mounting components in React & Re-rendering components in React [9]

Figure 1 shows how to render a page using the React technology. Website content is mounted by React as various components in the Document Object Model (DOM). The component will be rendered by JavaScript in the browser. The JavaScript rendering speed will be faster with Chrome V8 technology than the rendering of conventional dynamic websites. Another React's core wisdom is creating a virtual DOM [8].

It is not up to the user to render components; rather, React invokes it as part of the React Component Lifecycle at different points of the app, usually when the React Component is first created. Re-rendering is the term for a second or subsequent render that updates the state. Every time their state or props change, React components instantly re-render. The state change to update a variable can come through a prop or set (say). React re-renders the component to reflect the change on the app after the component receives the new state. Similar to how changing the prop causes a state change, changing the state causes React to re-render the component. Whenever the components render function is called, all its subsequent child components will re-render, regardless of whether their *props* have changed or not.

## 2.2 Angular 1&2

Angular is a famous JavaScript ES5 based open source front-end web application framework and developed by Google in 2010 [10]. Angular's first development intention is assisting web designer in creating a persistent web form with more efficiency [10].

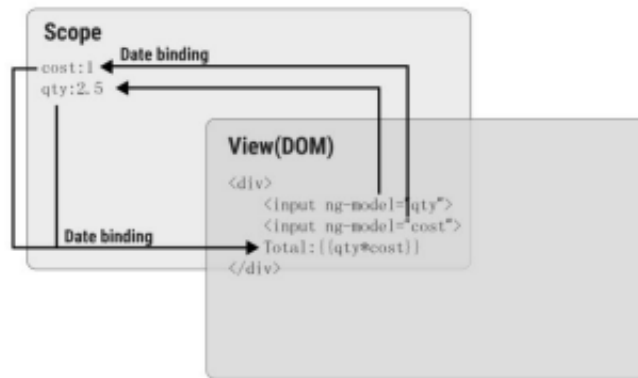


Figure 2: Angular 1 two-way binding [12]

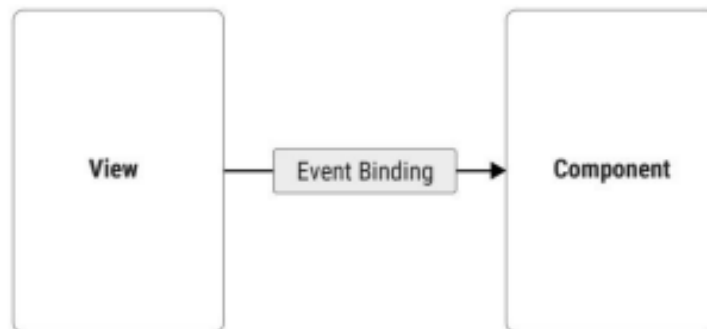


Figure 3: Angular 2 one-way binding

### 3. PROBLEM DEFINITION

React: - A complicated and lengthy list of things is a common recurring performance issue in React JS. For low-end computers and mobile devices, the slowdown could be observed right away. React must track every change in every list element, which is why this occurs. Many resources are used in this procedure.

Angular: - The verbosity of the tool is the most common complaint from the Angular development community. Since AngularJS, this issue has not changed. Despite the fact that the main advantage of Angular is its component-based architecture, managing components is too difficult. For instance, with Angular, a single component may require up to five files, the injection of dependencies, and the declaration of the component lifecycle interfaces. Third-party libraries that are particular to Angular and Angular syntax are additional issues. In Angular, a lot of the development effort is spent on repeated tasks.

### 4. OBJECTIVE

They are designed to minimize and streamline the amount of bespoke code needed for the front end of your web application. If anything is a framework or a library depends on how much freedom they provide you to build that specific bespoke code. A library is a group of patterns or a starting point for writing your code. Alongside a standardized, more efficient, and reliable solution, they reduce the amount of code you must write, do a lot of the heavy lifting, and be more flexible than code written to solve one problem for a specific application. [9]

### 5. RESEARCH METHODOLOGY

Larger volume means the framework or library contains more features and functions, but it will spend more time on loading the framework or library. [10]

Activity	Angular	React
Ready memory	7.8±0.0 (1.7)	7.5±0.1 (1.3)
run memory	10.9±0.1 (2.7)	9.7±0.1 (2.6)

Table 3: Front-end frameworks and library memory allocation performance [10]  
 The most substantial volume is occupied by Angular 2 (173 KB), followed by React (73 KB). Due to its massive size, Angular 2 includes more sophisticated, extensive

functionalities and capabilities. Yet, due to its complex structure, there is a chance that Angular 2 would operate slower than React, especially when it comes to memory allocation. Table 3 demonstrates that Angular 2 takes more time to prepare and operate the memory.

## 6. ANALYSIS FINDINGS

React and Angular are without a doubt the most widely used frontend development tools in contemporary web development. They do, however, differ in terms of traits and motivation. It implies that various commercial criteria must choose an appropriate framework or library to maximize the use and efficiency of their applications.

## 7. CONCLUSION

This essay lists alternative options for creating a web application while also describing three major front-end development frameworks and libraries. By comparing data between React and Angular in a number of areas, such as data binding, language-based, technical support, volume, and performance, we can draw some conclusions. It is feasible to get the conclusion that Angular has the most complete features and functionalities suitable for huge commercial projects. Live streaming, communication, blogging, and small- to medium-sized apps are all ideal for React. A UI framework must be used when creating a full front-end area to show off the expert UI design. Our research area will be expanded in the future to include discussions of more front-end development methodologies and analyses of their guiding principles for creating web apps.

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