React vs. Angular Framework

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Abstract: In recent years, web development has changed extensively. With the rapid expansion of web technology, the hypertext markup language (HTML) 5 has evolved into a world wide web federation, with a significant trend to lead front-end development and be at the forefront of the history of the Internet. Therefore, developers should choose the proper framework or library to erect an e-business and enhance the user experience is becoming a precedence for web development. This paper outlines the powerful front-end development frameworks and libraries and examines their performance in web services. Next, this paper lists the strengths and weaknesses of each framework and library under individual commercial criteria by analyzing research data on numerous aspects. Then, this evaluated each of them based on the default standard. Finally, this article summarizes the contributions and concludes with some possible futures of front-end development in e-business.

Index Terms - JavaScript framework, React, Angular, DOM, Binding.

I. INTRODUCTION

Nowadays, web development uses JavaScript in most applications in production and support. It began as a small scripting language for use with the Netscape Communicator in 1995, when the World Wide Web was still a juvenile invention. The cutting-edge marvel of JavaScript weariness was new. The makers of the Communicator chose that the web had to end up more dynamic, which drives the advancement of the dialect Mocha by Brendan Eich. JavaScript may be a client-side scripting dialect that gives energetic properties and HTML-web page features. JavaScript was developed to support browsers with Asynchronous communication capabilities, browser control, and user interaction Website component.

HTML pages are also called static pages. Developer is using the JavaScript in their website for more interactive and user-friendly, and JavaScript helps make your website easier to navigate and provide interactivity. JavaScript has developed many frameworks, and many new features have been added to the Server-side script. JavaScript appears very often in the web industry, and when you look at its Today's websites have no web technology that doesn't use JavaScript. JavaScript is a dynamic scripting language that tells the browser to make adjustments to the page. It is easy to learn. A text editor and browser are needed to start writing and executing code.

In this paper, popularity, the difficulty of learning, and performance were compared between React.js and Angular Js. We found that react was the most popular of these two frameworks by taking the data and analyzing the two most used software development cooperation platforms. In framework's learning curve, syntax, architecture, data management, lifecycle, and ease of using third-party libraries were compared by using its official technical documentation. Finally, we tested its performance to compare both the frameworks by building a simple single-page application. React proved to be the fastest-performing framework.

II. LITERATURE SURVEY

React and AngularJS are well-known web development frameworks in Today's technology business. The best framework is determined entirely by its deliberate usage, functionality, scalability, and long-term viability [2]. Both React and AngularJS are excellent choices When it comes to single-page applications. However, these are two very different frameworks. There may be chances that React is superior to Angular or vice versa. Whatever your opinion on the React Vs. AngularJS debate is that you must make decisions based on your functional and usability requirements [9].

Even though there are enough fundamental differences between these two platforms to make a comprehensive comparison difficult, I still prefer AngularJS to ReactJS in the future because Angular is much better supported and more commonly used. Sure, if you're working with Facebook, react is the way to go. Still, Angular has so many significant stakeholders that it will continue to exist in the industry even if some corporations abandon it [25]. Furthermore, there's no doubting that businesses are increasingly relying on online applications that offer the most pleasing user experience available. As a result, the concept of an e-commerce website is becoming an area of knowledge in its own right as companies grow and expand their online businesses.

When it comes to data binding, AngularJS offers two options, whereas ReactJS only provides one. ReactJS uses a virtual DOM to store its components, whereas AngularJS uses the real DOM. Both structures are extendable in terms of functionality. AngularJS

is bigger, coming about in expanded stack times and slower versatile execution. ReactJS is littler than AngularJS and so marginally faster. In common, both AngularJS and ReactJS have effective environments. ReactJS is simpler to get but requires as numerous integrative as Redux to completely abuse its potential. Both platforms are in the tall request within the showcase and have incredible adaptability to form perfect web applications for businesses of all sizes. It depends on your venture's wants, which can be the most choosing calculated when choosing one of these systems for your line of work [26]. Different people and companies use these frameworks according to their requirements.

III. FRAMEWORKS

Angular Js

AngularJS, open-source JavaScript framework prolonged by Google and the community to help in create single-page applications by developers. AngularJS is built on the best of JavaScript, making the life of engineers exceptionally simple. The objective behind using AngularJS in your web application is to modularize and maintain your web application. Its purpose is to help develop a web application with ModelViewController (MVC) functionality, i.e., the development, maintenance, and testing. After using the minimized file in the application, reduce the size to a few KB, and the page loads faster. AngularJS is ideal for skyscrapers of active and interactive web applications. AngularJS helps to create web applications based on HTML, CSS, and JavaScript. Developers can make customized Document Object Model (DOM) components utilizing AngularJS. Back-end communication is taken care of, and views and controllers are essential in making the UI. Dependency injection is a prominent plus feature that automatically loads new modules you may need. Two-way data binding or automatic data synchronization between model and view components is another unique feature of AngularJS.

Bidirectional Binding: In AngularJS, data binding is synchronization between models and views. When data comes in, the model changes, the statement reflects the change, and the model will update simultaneously when the data changes. It is an immediate and automatic process.

REACT.JS

React is an interactive, stateful, civilized at Facebook. Reusable UI component used in production at Facebook. ReactJS is great for rendering high-performance and complex user interfaces. The pivotal foundation behind React is the Virtual DOM concept. ReactJS uses virtual DOM very effectively. The virtual DOM renders a subtree of a node based on state changes. Both back and forth communication on the client-side or server-side can be manifest by this Virtual DOM. To keep the components up to date, perform as few DOM activities as feasible. React is lighter than Angular, filled with minor adjustments, and eliminates the usage of additional elements such as plugins. The reaction is anti-two-way Binding; therefore, it aside off from it and rather uses explicit updates.

Virtual DOM: like the genuine DOM, the virtual DOM is a hub tree that rundowns components and their characteristics and Content as articles and properties. In ReactJS, the render () technique makes a hub tree from React part and updates this tree in light of advancement in the information model brought about by activities. Each time the fundamental information in the React application changes, that prompts making another virtual DOM portrayal for the UI.

IV. FRAMEWORK POPULARITY

GitHub

GitHub promotes itself as a product improvement stage utilized by 73 million engineers to Host and oversees open source and business projects. Facilitating code composed by such countless various engineers for some, different purposes makes GitHub interesting. This reliable source of information to understand the software development market and trends. GitHub users can star the repositories of interest to make them easier to find. From GitHub, users may know the trending topic by seeing the stars. After that, GitHub archives are positioned and can be arranged in search in light of the quantity of stars. What's more, GitHub has an implicit bug tracker called Issues. It makes it more straightforward to follow and perform assignments to impart them to your group. Moreover, the quantity of issues might give signs about the extension and intricacy of the task and the local area's help for the venture. The below table represents the number of users using GitHub for both Angular and React repositories last year.

Out of these two frameworks, React has the most forks. The difference in the number of forks, on the other hand, is not as significant as the difference in the number of stars. It's large enough to be dependable. Based on the number of concerns raised, Angular is either the most popular or the most troublesome of the two. There were 2331 bugs open in Angular, and 453 in React. The oldest of these frameworks is Angular, which is followed by React. That may explain why so many questions have been raised about it, but Angular is the least popular framework when compared to the rest of the data.

	Angular	React
Topic repositories	27619	118042
Users used these repositories	1,630,131	5,294,660
Users used these packages	24,240	155,148
Satisfaction Factor	83.65%	44.73%
Popularity	22.96%	40.14%
Regular use	18%	49%

Table1: Information about Angular, React repositories on GitHub

NPM TRENDS

Node Package Manager is the world's largest software registry. JavaScript packages can now be shared and borrowed by open-source developers. Private Project Management NPM Trends, the number of JavaScript packages downloaded via NPM, is also used by many enterprises. The graph of Angular and React downloads over the previous two years is shown in Figure 1.
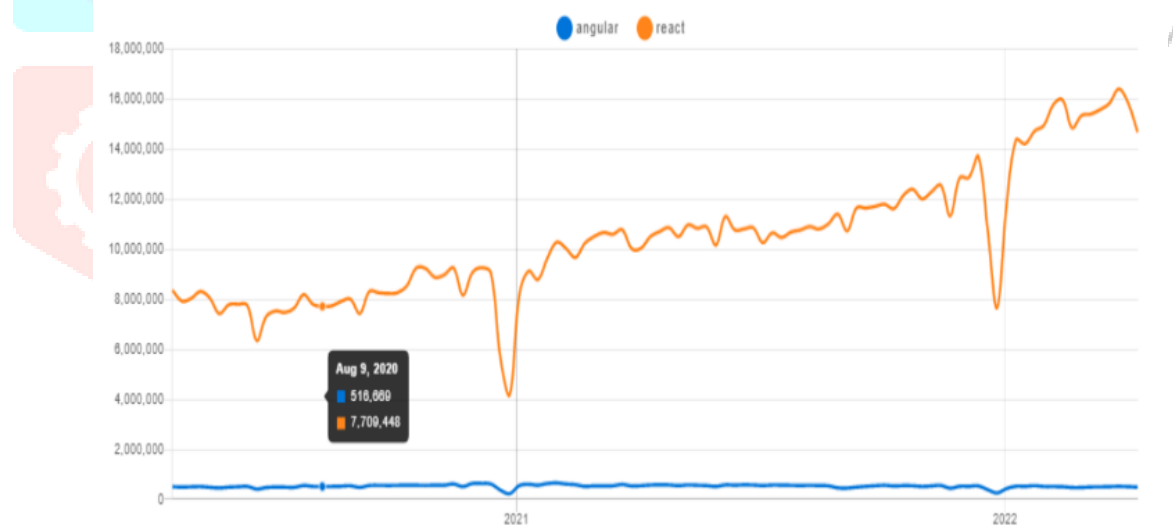

Fig1: Graph was taken by NPM trends

NPM Patterns data displays how many bundles have been downloaded for each framework over time. However, this information could be misleading because some systems are more powerful and require fewer third-party support bundles. Angular, for example, is far more important and has far more highlights than React, resulting in less downloads in NPM patterns.

Stack Overflow

Stack Overflow is a website where software developers can ask and answer questions about programming. Over 50 million individuals visit their stack, according to their website. Overflow every month. This massive user base of developers and engineers discussing different programming languages is a great place to understand the global developer community's use.

Angular and React have accomplished their dormant on Stack Overflow. However, the distinction between them is so tiny, so it is difficult to say which one is more well known.
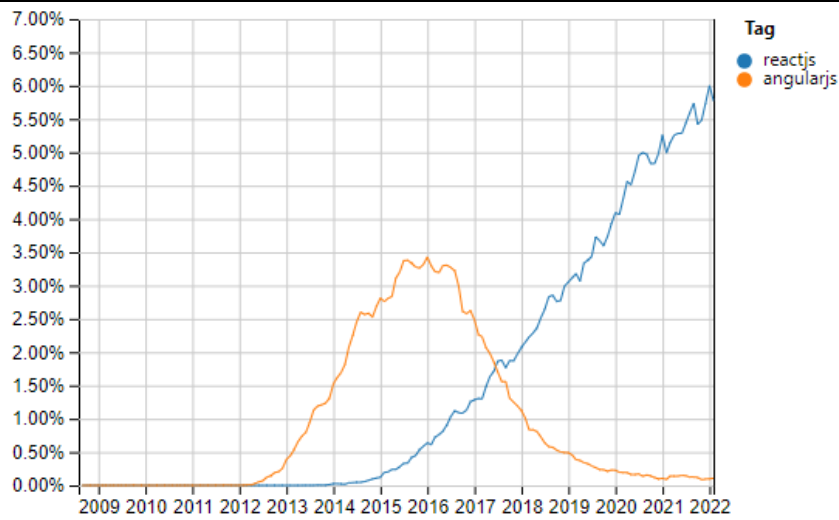
Fig 2: Graph was taken by stack Overflow

V. FRAMEWORK LEARNING CURVE

Angular

Syntax:

Angular is composed of HTML and TypeScript. It is an open-source programming dialect created and maintained by Microsoft that includes static writing choices. Compiles into JavaScript and JavaScript.

HTML is used in the Angular template syntax, and practically all HTML is reusable. Except for the [removed] tag, which Angular ignores in order to prevent script injection attacks. By exposing a few JavaScript function expressions in HTML, Angular enhances conventional HTML. To render JavaScript Content into the screen, double wavy braces are used.

Architecture:

Angular applications consist of containers of code blocks, as it is composed of NgModules, dedicated for scope, workflow, or closely related functionality. Modules provide content compilation context, and they can include components and services in Provider and other files. You can export or import functions with others module. Each angular app features a root module, that is that the name of the normal app module and provides the Bootstrap mechanism to launch the application. the basis module will embrace unlimited hierarchies within the kid module. Management is useful once you organize code into completely different practical modules.
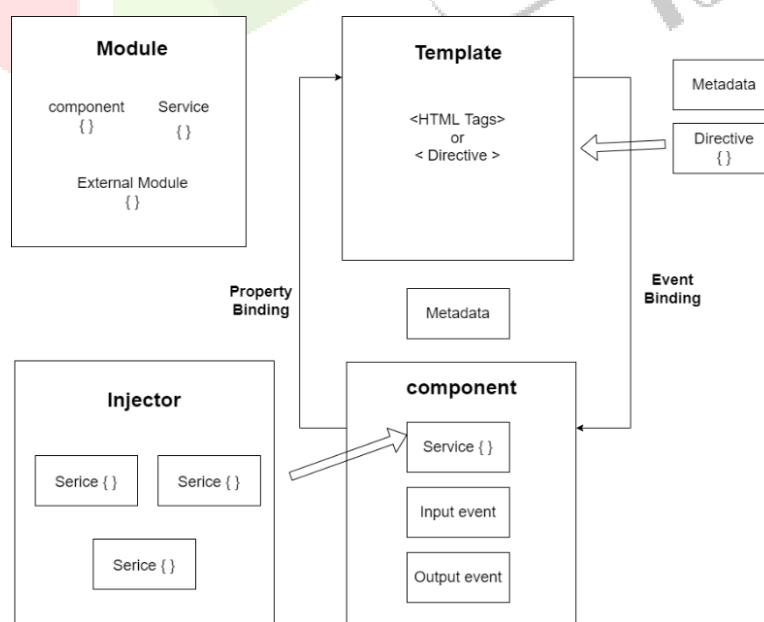

Fig 3: Architecture of Angular framework

The Model View Controller concept is used in Angular, with the component acting as the controller and the template serving as the view. The patch of the screen represented by the component control was visible. Component use services that can be injected into parts as dependencies. These helps make the code modular, reusable, and efficient. Decorators were used in modules,

components, and services to modify the look and feel of the code. These decorators allow you to specify the type of data they will act on. This metadata can be helpful when using them.

Data management:

Angular supports two-way data binding, which allows for coordination between template parts and actual DOM elements. Data flows from the component to the template, which then binds the data properties and events. Angular processes all information ties once for each JavaScript event. This includes the event's root, through all child components in the component tree. The application contains a product catalog with two views: a list of products and more specific information about a product at this level of development. Click on a product name from the list to open a new view with a unique URL or route.
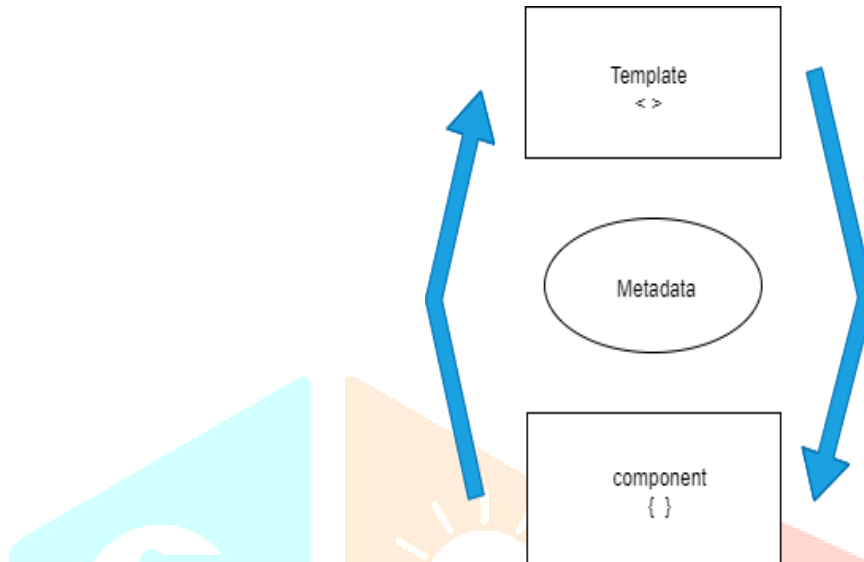

Fig 4: Data management in the Angular framework

Lifecycle:

Angular manages the lifespan of a component. It constructs the part, renders it, and updates it when the data changes. In addition, angular has lifecycle hooks, allowing users to interact with the code at various stages of a component lifespan. The life cycle consists of three phases: bootstrap, compilation, and runtime. Understanding the life cycle of an AngularJS application will assist you in getting how planning and actualizing your code. The total lifecycle of the AngularJS application happens each time, when a web page is stacked into the browser. The following fragment talk about these phases of your AngularJS application.

The bootstrap phase is the first phase of the AngularJS lifecycle. The bootstrap phase happens when the AngularJS JavaScript library is downloaded to your browser. Next, AngularJS sets up the necessary components, and then tells the module where to find it. Finally, the modules are stacked, and all dependencies are embedded in the module and accessible to code within the module. The HTML compilation phase is the second phase of the web development life cycle. When a web page is loaded, the static DOM structure is created and inserted into the browser. The static DOM is replaced with a dynamic DOM that reflects the AngularJS view as the compilation step proceeds

In this phase, there are two parts. First, iterate through the static DOM to collect all the statements and then link the messages to the built-in AngularJS library or the appropriate JavaScript functionality in your custom policy code. Combine the steps with a pane to create a dynamic or live view. The runtime phase of an AngularJS application lasts until the user reloads the page or navigates away from it. Any changes within the scope are reflected within the view at that time. In addition, any changes within the view are updated explicitly within the Content, making the Content look like the view's single source of information. AngularJS behaves differently than traditional data binding techniques. Traditional techniques mix a template with engine data before manipulating the DOM each time the data changes. AngularJS compiles the DOM only once and then connects the built template as needed, saving time over older techniques.

These are lifecycle processes explained on the Angular website:

- ngOnChanges() gets called whenever one or more data properties change

- ngOnInit() initializes the component when it is first created or when the NgOnChanges() is called

- ngDoCheck() is called during every change detection run, right after ngOnChanges() and ngOnInit(). It is used to detect changes that Angular cannot or won't detect itself

- ngOnChanges() and ngOnInit(). It is used to detect changes that Angular cannot or won't detect.

- ngAfterContentInit() – is called once after the first ngDoCheck(). Respond after Angular projects external content into components view.

- ngAfterContentChecked() – is called after the ngAfterContentInit(). Let's user respond after Angular has checked the Content projected into the component.

- ngAfterViewInit() – is called after ngAfterContentChecked(). Let's user respond after Angular initializes the component and its children's views.
- ngAfterViewChecked() – called after ngAfterViewInit() and every following ngAfterContentChecked(). Let's user respond after Angular has checked all the rendered component and its children views.

- ngOnDestroy() – called just before Angular destroys the component. Cleans up before component destruction by unsubscribing to any observables to avoid memory leaks
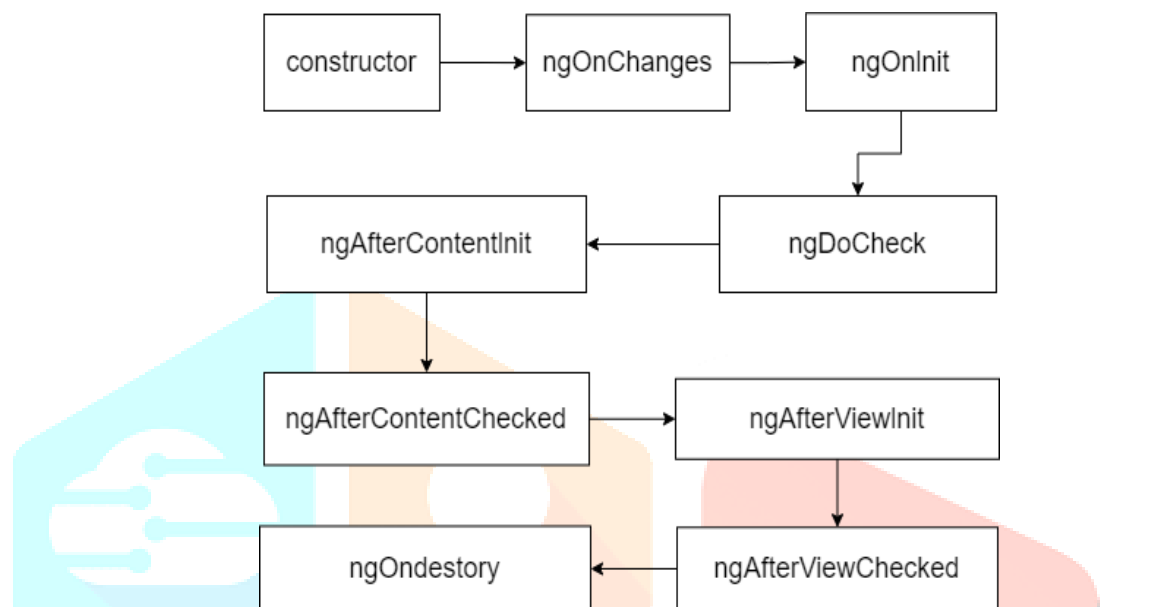
Fig 5: Lifecycle of the Angular framework

Third-party packages:

AngularJs can use third-party libraries by installing and importing via the NPM Features provided. In addition, third-party libraries extend the ease of use of Angular by adding Completed styling and functionality. One of the most popular style libraries for Angular is Angular Material. Angular Material is a collection of pre-built components designed with Material Design in mind. They are designed for performance and work seamlessly with Angular.

Migration:

The application has an updated command-line interface (CLI) with built-in commands that make upgrading to Angular's current version simple. In addition, the development process is made easier and faster with automated upgrades.

React

Syntax:

React uses JSX syntax, a JavaScript syntax extension. It's a hybrid of JavaScript and HTML that some people might mistake for a template language, except it has all of JavaScript's capabilities.

Architecture:

React uses the JSX programming language to create components. React elements are simpler objects than browser DOM elements, and therefore they are easy to generate. React's virtual DOM handles browser DOM updates. Virtual DOM (VDOM) is an idea in which a "virtual" representation of the user interface stored in memory and the "real" DOM are synchronized using a library such as React DOM. This eliminates the need to manually handle the theme and events and allows the DOM to be updated automatically.

The React library is merely a user interface library that does not impose any particular structure for developing a complicated application. Developers can use whatever design pattern they like. The React community promotes a specific design pattern. The flux pattern is one of the patterns. Higher-Order Components, Context, Render props, Refs, and other ideas in the React library help you create better code. React Hook is a growing approach for managing state in large projects. Let's take a look at a React application's high-level architecture.
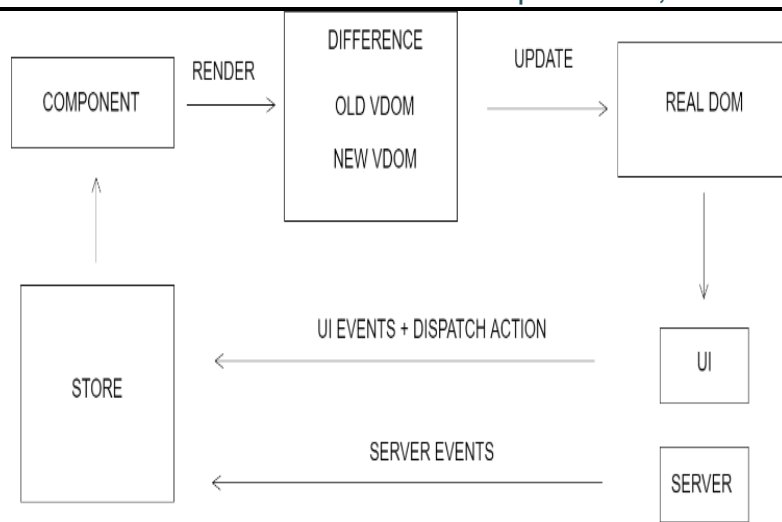
Fig 6: Architecture of React framework

Data management:

React components are the application's building pieces, allowing the user interface to be broken down into reusable portions that may be considered separately. Components are similar to JavaScript functions in that they take props as input and return React elements. Components are reusable because they may relate to other components. On top of the view hierarchy, react projects typically contain a single "App" component.

Any React component can use a state, although it isn't required. In React, the state is kept within a single part of the application, which is convenient for keeping track of. Data may be exchanged between parent and child components to help communicate information. Mounts can't be changed and can't be passed up the component tree hierarchy. React can alter a component's state, and the feature will be re-rendered due to the state change.
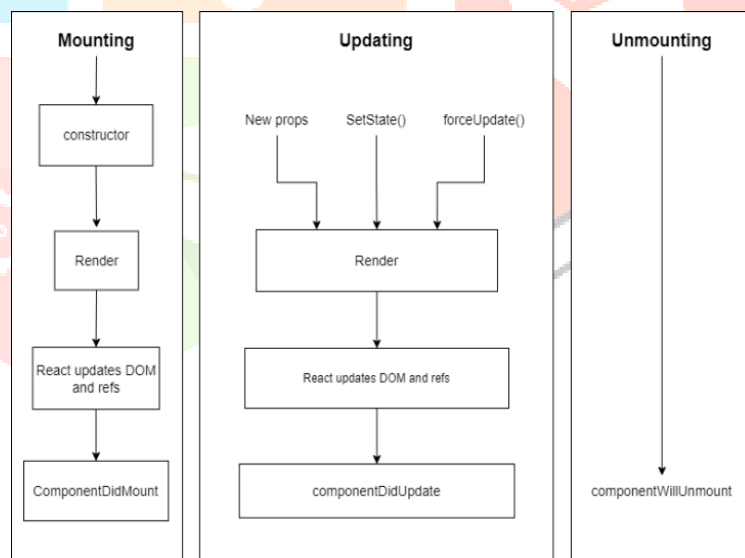
Lifecycle:

Figure 7: Lifecycle of React framework

The cache stores a representation of the virtual document object model. The data is passed down from the topmost level to the lowest one. The discrepancies between virtual DOM and the real DOM are then compared, and any necessary modifications are made. React documentation includes a component lifecycle description and a few lifecycle methods, but does not provide a complete lifecycle overview of lifecycle hooks. Each React component has a lifecycle that you can follow and modify as it progresses through its three stages. Mounting, updating, and unmounting are the three phases.

Mounting is the process of inserting items into the DOM. React calls the following four built-in methods in this order when mounting a component:
- constructor ()
- getDerivedStateFromProps ()
- render ()
- componentDidMount ()

The render () function is required and will always be called; the other methods are optional and will only be contacted if specified.

The lifecycle goes on to the next stage once a component is updated. When the state or props of a component change, the component will be updated. When a component is changed, react calls the following five built-in methods in this order:

- getDerivedStateFromProps ()
- shouldComponentUpdate ()
- render ()
- getSnapshotBeforeUpdate ()
- componentDidUpdate ()

The component gets removed from the DOM or unmounted, as React likes to call it, in the following step of the lifecycle. When a component is unmounted, React calls only one built-in method:

- componentWillUnmount ()

Third-party Packages:

React may use NPM to install third-party packages in React. Third-party libraries run on top of React to improve usability and offer new features like two-way data binding and routing. Redux is perhaps one of the most popular third-party libraries for React. Redux is a JavaScript state container that React may use in conjunction. The whole app state is kept in an object tree within a single store in Redux. The Redux store expands with the application and may be separated into a tree-like structure, similar to the app component tree. It may appear overkill for smaller applications, but it will be helpful as the application grows in size and complexity.

Migration:

Although it relies on other libraries to update and migrate third-party components, it allows for smooth transitions. However, the developers must constantly monitor third-party libraries to verify that they are compatible with the most recent versions, which is time-consuming and tiresome.

VI. COMPARISION

React is a collection of libraries. Angular is a framework. Even though React and Angular are ordinarily utilized and traded as JavaScript systems, unobtrusive contrasts can make an engineer select between a plan and a library, particularly when controlling the library or system. On the other hand, when you use a framework, the framework takes care of the presentation layer for you. A framework lets you write code that is called automatically when needed.

React	587KB
Angular	15.7MB

Table 3: Production Build sizes

Angular's stubborn attitude can be frustrating for many front-end developers seeking real-time control and organization of their code and final web application output. But unfortunately, outside of the confines of flow, management can't change it. The size, community, debugging, DOM, and mobile variations are intriguing. The Angular JS community is enormous. The React community is still growing. There are several significant differences between React and Angular in terms of size. Because react doesn't perform as much with the MVC model as Angular, its size is smaller.

Attribute	AngularJS	ReactJS
DOM	Regular DOM	Virtual DOM
Learning curve	High	Low
Packing	Weak	Strong
Abstraction	Weak	Strong
Debugging and testing	Single tool required	Set of tools required
Debugging General	Bad JS Good HTML	Good JS Bad HTML
Debug Line no	No	Yes
Unclosed tag mentioned	No	Yes
Compilation error occur	Runtime	Compile-time
Binding	two ways	One way
Templating	In HTML	In JSX files
Component model	Weak	Medium
Building mobile	Ionic framework	React native
MVC	Yes	View layer only
Rendering	Client-side	Server-side
Architecture	Model-view controller	flux

Table 2: Comparison between React and Angular

VII. CONCLUSION

Angular is superior in certain areas, whereas react is superior in others. React provides flexibility and simplicity, but it lacks Angular's declarative capabilities. Angular is a considerably more feature-rich framework than React. Still, it doesn't matter much when most things Angular offers aren't needed—in React, writing less code to do more because React implementation of a virtual DOM performs better than Angular. Because react is still in its infancy, Angular's support is significantly more remarkable, with a much larger community. Angular and Reactjs are different. However, Reactjs developers and AngularJS developers agree on one thing. With a bit of experience, you can build great applications with either framework. When dealing with AngularJs, the choice of framework depends heavily on your project needs and personal preferences. ReactJS is relatively simple for inexperienced developers and may be a safer alternative. However, AngularJS development provides a comprehensive front-end solution that can be useful for large projects.

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