Internet Programming I

Chapter 4
JavaScript: Frameworks

Group:1
3rd Year Sec B Students,
Dept. of Software Eng.
Feb 2022, AASTU

Objectives

After success completion of the session you will be able to:

- Define a framework
- List some JavaScript frameworks currently available
- Difference between JavaScript library and JavaScript Frameworks
- Features and components of respective frameworks
- Comparing different form of Frameworks
- How to choose the best frameworks

Outline

Java Script Framework

- General information on framework
- What is Java Script framework
- Uses of Java Script framework
- Difference between JS library and Framework
- Most popular JS Frameworks and their key components
- Comparison of JS Frameworks
- Summary

1. What is Framework

- Framework
  - A framework is a structure that you can build software on. It serves as a foundation, so you're not starting entirely from scratch.
  - Frameworks are typically associated with a specific programming language and are suited to different types of tasks.
  - Using a software framework to develop applications lets you focus on the high-level functionality of the application.
  - This is because any low-level functionality is taken care of by the framework itself.

2. Why do we use frameworks?

- Using frameworks saves time and reduces the risk of errors. You don't need to write everything from the ground up, so there's less chance of introducing errors.
- Plus, frameworks have already been tested, so there's less to worry about. Other advantages include:
  - More secure code
  - Simpler testing and debugging
  - Avoiding duplicate code
  - Able to focus on writing code specific to the project
  - The time required to develop an application is reduced significantly
  - Several code segments and functionalities are pre-built and pre-tested. This makes applications more reliable.

3. Types of Framework

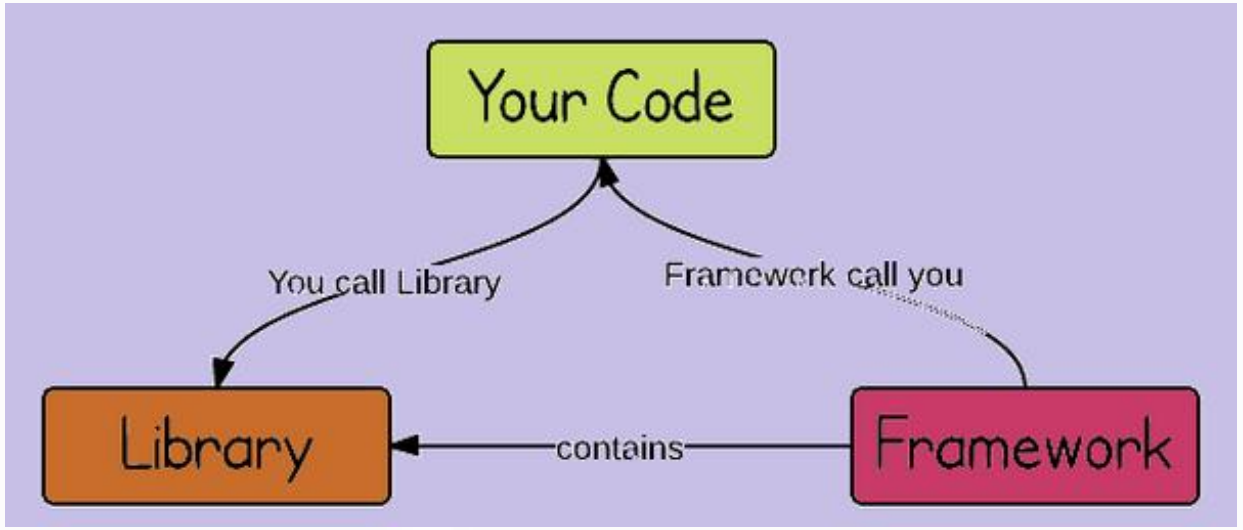
- Web application frameworks
  - **Angular** is a typescript-based, open-source JS framework that makes it easy to build applications on the web.
  - **Django** is a free and open-source web application framework written in Python.
  - **Laravel** is a PHP-based web application framework with an expressive, elegant syntax.
- Mobile Development Frameworks
  - **Flutter** is Google's UI toolkit for building beautiful, natively compiled applications for mobile, web, and desktop from a single codebase.
  - **Ionic** is a free, open-source mobile UI toolkit for developing high-quality, cross-platform native applications for Android, iOS, and the Web—all from a single codebase.

3. Types of Framework

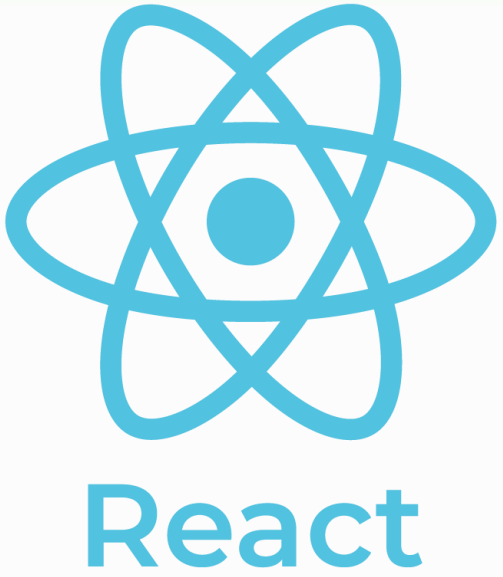
- Data Science Frameworks
  - 1. Apache Spark
    - Apache Spark is a unified analytics engine for large-scale data processing. You can write applications quickly in Java, Scala, Python, R, and SQL using the Apache Spark.
  - 2. PyTorch
    - PyTorch is an open-source machine learning framework that accelerates the process from research and prototyping to production deployment.
  - 3. TensorFlow
    - TensorFlow is an end-to-end open-source framework for machine learning (ML). It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that lets researchers dive in ML, and developers quickly build and deploy ML-powered applications.

4. JavaScript libraries VS framework

- Experts have suggested that the line between them can be blurry, but it is useful to make the distinction.
- While a JS framework is a full toolset that helps shape and organize your website or application, a JS library, on the other hand, is a collection of pre-written code snippets that are less about shaping your application and more about providing a use-as-needed library of features.



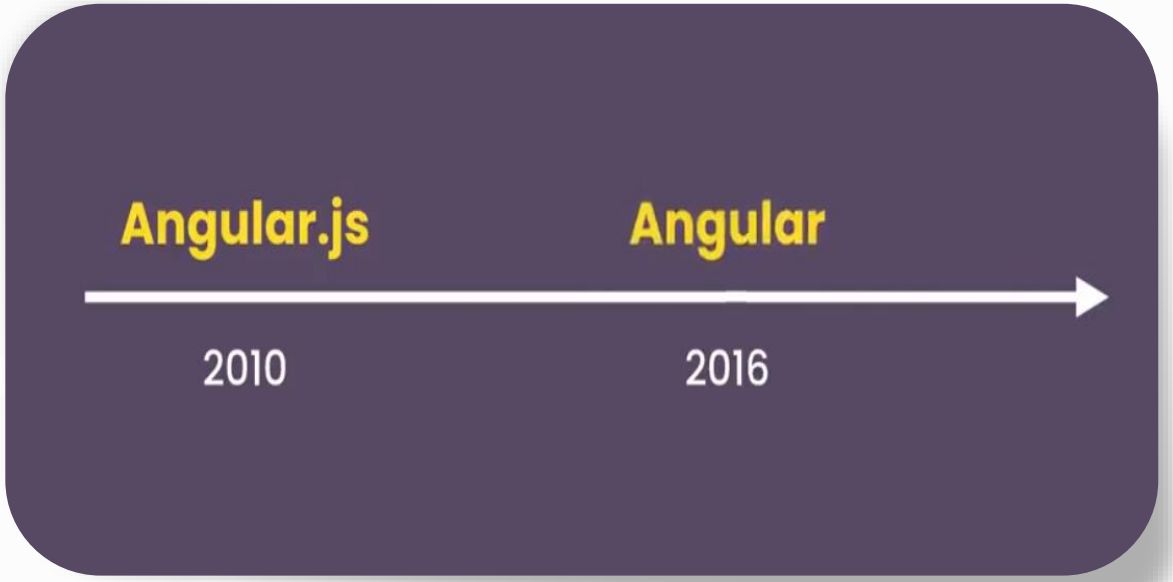
4. Some JavaScript Frameworks



5. Angular

- AngularJS is a JavaScript MVC client-side framework for creating dynamic web applications. AngularJS began as a **Google** project, but it is now an open-source framework.
- There is no need to gain knowledge of another syntax or language because AngularJS is entirely based on HTML and JavaScript.

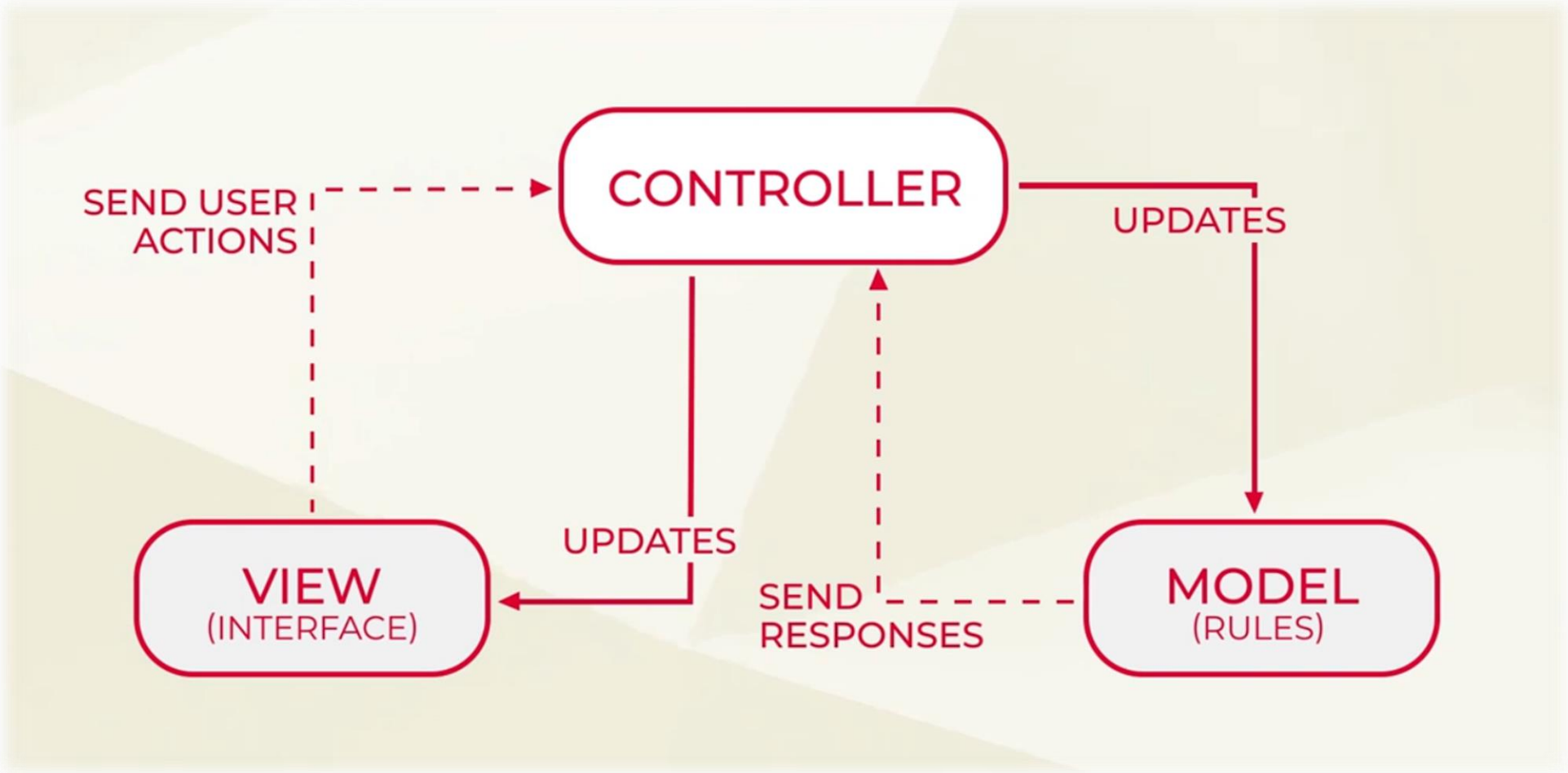
  - It is also one of JavaScript's oldest frameworks and was first released over a decade ago in 2010.
  - Several breaking changes have been made since it's inception.



5.1. Pillars of Angular

- **Two way binding Data:**
  - It is the synchronization between the model and the view. ng-bind and ng-model directives provide the functionality of data-binding.
- **Dependency Injection:**
  - Is technique in which an object receives other objects it depends on. Instead of attaching dependency to object, Angular it injectors to dependency stored in central location. So you can reuse code and mock dependency when riding unit tests.
- **Directives**
  - Directives are markers on DOM elements (such as elements, attributes, CSS, and more). It has a set of built-in directives which offers functionality to your applications. We can also create our own directives in Angular JS.

5.2. Architecture of Angular



5.3. Pros and Cons of Angular

Pros:

- Switched to Typescript as base language which have many additional features.
- Mobile development closer than ever using native script for class platform that can transfer 90% of the code.
- Single page application
- Some uses of framework such as less code, DOM manipulation & Code Reusability.

Cons:

- Not Secure. Server-side authentication and authorization are required to keep the application secure.
- Not degradable.
- JavaScript support is mandatory.
- Difficulty in learning.

6.1 React

- React was first created by Jordan Walke , a software engineer working for Facebook.
- React is the most popular Front End JavaScript frameworks , that is based on building reusable components of the code base which makes web apps very lightweight.
- React is a declarative, efficient, and flexible JavaScript library for building user interfaces.
- It lets you compose complex UIs from small and isolated pieces of code called "components".

6.2 Properties of React

React.JS properties includes the following properties:-

- React.JS is simple
- React.JS is component based
- React.JS supports server side
- React.JS is extensive
- React.JS is fast

6.3 Pros and cons of React

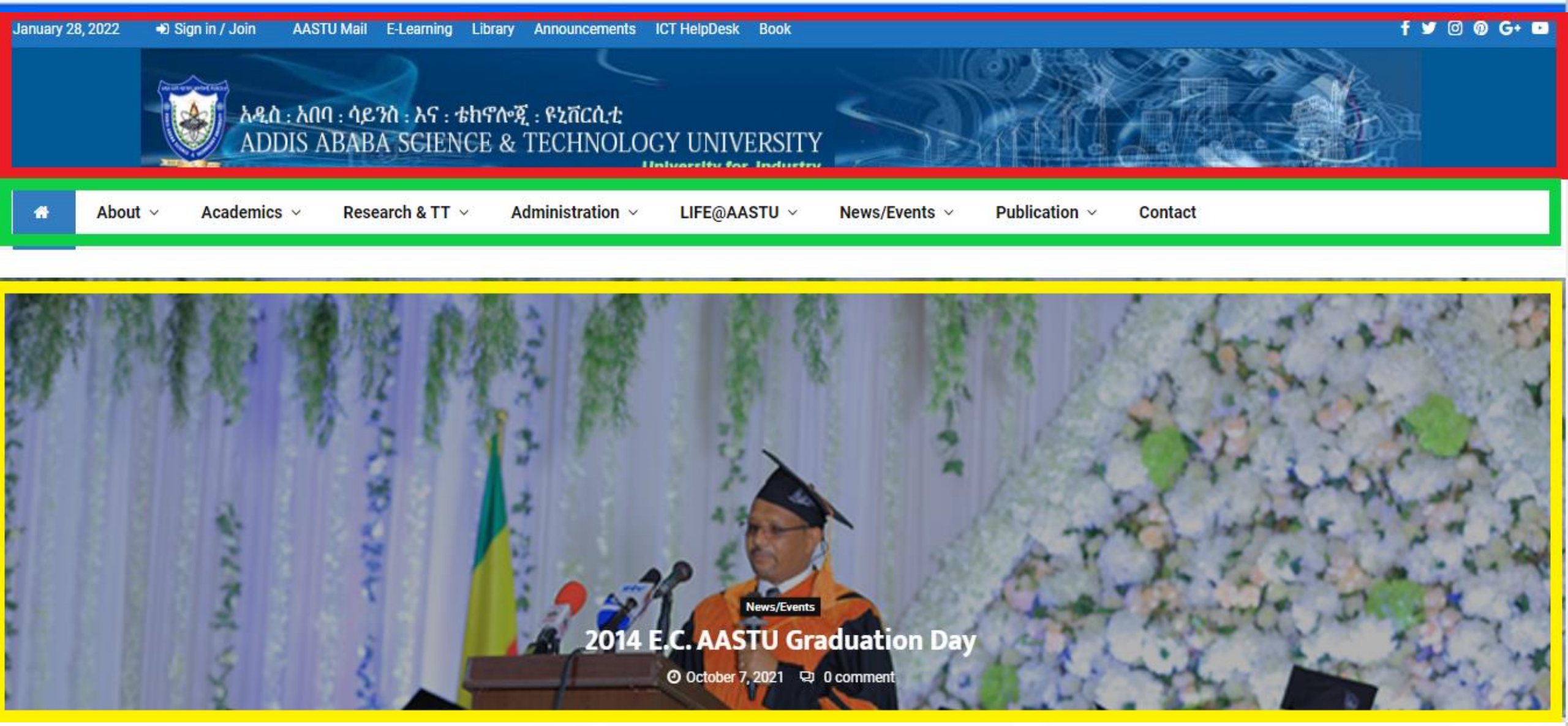
Pros:

- The frameworks count with a virtual DOM. It transforms the real DOM into a virtual one. Allowing developers to execute code faster and makes the user interface better.
- Child elements do not affect parent elements.
- It also reuses code components, allowing developers to create components that don´t have to be built multiple times. The development process is fast and precise.

Cons:

- Developers say that the documentation for React.js could be better. The catalog is a framework with poor documentation.
- The platform advances faster than what they document.
- The learning curve is steep, meaning that it is not so easy to learn the framework.

6.4 Components-based example:



7.1 Vue Js

Vue JS: With the help of Vue.js, we can create UIs(User Interfaces) and SPAs(Single-page Applications) because it is a progressive JavaScript framework.

- Its a very easy framework and we can make web applications in it with little knowledge of HTML, CSS, and JavaScript.

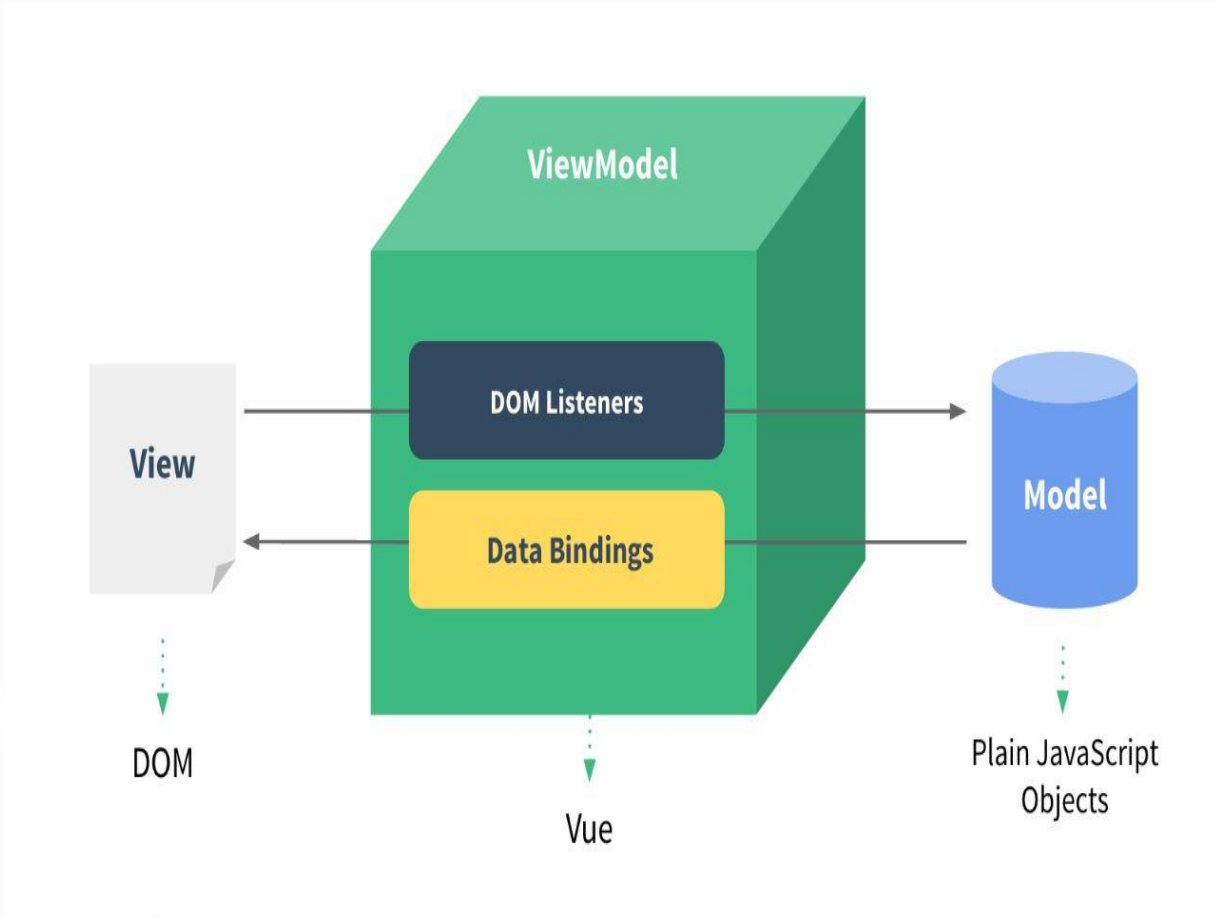
- Vue.js itself is not full-blown framework. It is focused on the view layer only. It is therefore easy to pick up and integrate with other libraries or existing projects.

- On the other hand when used in combination with proper tooling and supporting libraries, Vue JS is also perfectly capable of powering sophisticated SPA.

7. 2 Vue Js

Reactive Data Binding

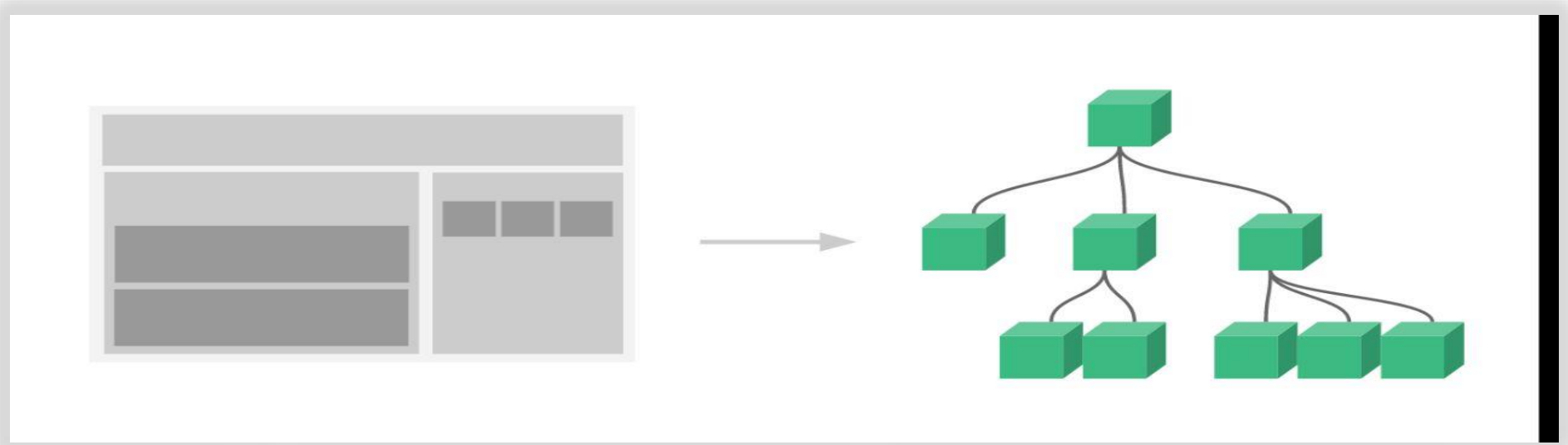
- At the core of Vue.js is a reactive data-binding system that makes it extremely simple to keep your data and the DOM in sync.
- It means we use special syntax in our normal HTML templates to “bind” the DOM to the underlying data.
- Once the bindings are created, the DOM will then be kept in sync with the data. Whenever you modify the data, the DOM updates accordingly.



7.3 Vue Js

Component System

- The Component System is another important concept in Vue.js, because it's an abstraction that allows us to build large-scale applications composed of small, self- contained, and often reusable components.



7.4 Pro and cons of Vue

Pros:

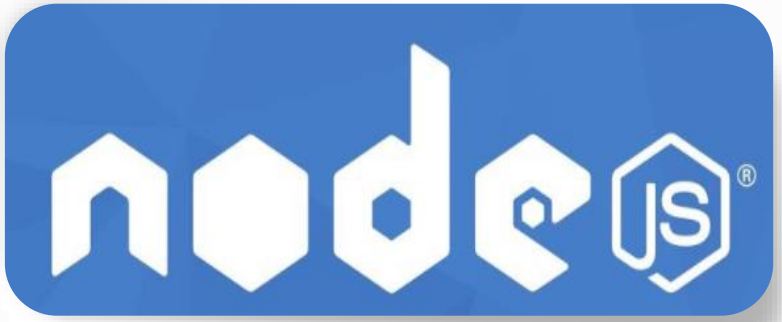
- Vue JS uses HTML templates
- Data is gathered with the DOM
- The data is transferred in Bi-Directional
- Vue JS is more Reactive than others
- It is simple to integrate with other frameworks.

Cons:

- It overcomplicates the developer by its flexibility.
- It is the latest library and the developers are fewer.

8.1 Backend JS frameworks

- Node.js is a runtime environment that helps run JavaScript on servers. It takes the chrome v8 engine and compiles the JavaScript code on the servers.
- Node.js helps developers build applications on server-side, desktop, and mobile applications. Having Node.js as the base, a lot of frameworks have evolved in recent years.
  - Some of the popular websites like Netflix, eBay, PayPal, and LinkedIn use Node.js in their application development
  - 85% of developers use Node.js to develop web applications.
  - Since Node.js uses JavaScript to build the backend, it's easy for JavaScript developers to create a complete product.



8.2 Backend JS frameworks

EXPRESS

- Express.js is a flexible, minimalistic, lightweight, and well-supported framework for Node.js applications. It is likely the most popular framework for server-side Node.js applications.
- Express provides a wide range of HTTP utilities, as well as high-performance speed. It is great for developing a simple, single-page application that can handle multiple requests at the same time.

NEXT.JS

- Next.js is a minimalistic framework that allows a JavaScript developer to create a server-side rendering and static web applications using React.js. It is one of the newest and hottest frameworks that takes pride in its ease of use.
- Many of the problems developers experience while building applications using React.js are solved using Next.js

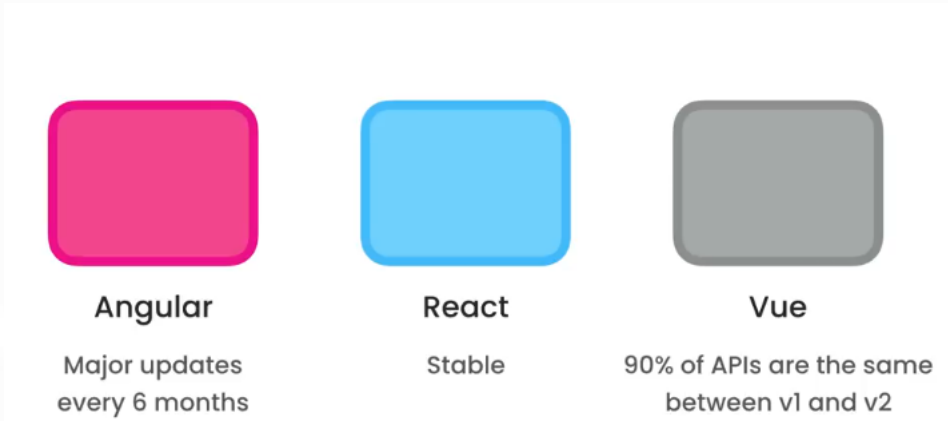
9. Comparison of JS frameworks performance

DOM Manipulation (ms)

Name	inferno-v5.6.1-keyed	angular-optimized-v6.1.0-keyed	vanillajs-keyed	marionette-v4.0.0-beta.1-keyed	preact-v8.3.1-keyed	elm-v0.19.0-bugfix2-keyed	svelte-v2.13.5-keyed	vue-v2.5.17-keyed	redom-v3.13.1-keyed	react-v16.5.2-keyed	choo-v6.13.0-keyed
create rows Duration for creating 1000 rows after the page loaded.	161.1 ± 9.1 (1.0)	198.7 ± 12.2 (1.3)	158.7 ± 10.5 (1.0)	248.0 ± 16.0 (1.6)	217.1 ± 1.0 (1.4)	267.8 ± 73.6 (1.7)	282.2 ± 21.4 (1.8)	251.1 ± 29.8 (1.6)	187.1 ± 11.5 (1.2)	235.4 ± 23.4 (1.5)	213.0 ± 24.5 (1.3)
replace all rows Duration for updating all 1000 rows of the table (with 5 warmup iterations).	158.0 ± 2.4 (1.0)	205.7 ± 9.4 (1.3)	192.3 ± 20.3 (1.2)	184.3 ± 5.2 (1.2)	183.9 ± 3.6 (1.2)	203.1 ± 9.5 (1.3)	286.5 ± 13.5 (1.8)	186.3 ± 17.6 (1.2)	181.0 ± 6.9 (1.1)	196.1 ± 21.3 (1.2)	579.7 ± 30.0 (3.7)
partial update Time to update the text of every 10th row (with 5 warmup iterations) for a table with 10k rows.	76.2 ± 6.7 (1.0)	72.6 ± 3.6 (1.0)	74.3 ± 3.5 (1.0)	94.8 ± 14.2 (1.3)	110.1 ± 2.7 (1.5)	126.4 ± 22.7 (1.7)	87.1 ± 4.7 (1.2)	201.7 ± 39.6 (2.8)	86.4 ± 2.2 (1.2)	88.8 ± 2.8 (1.2)	2,493.7 ± 363.2 (34.3)
select row Duration to highlight a row in response to a click on the row. (with 5 warmup iterations).	5.4 ± 4.5 (1.0)	5.5 ± 3.7 (1.0)	6.4 ± 4.1 (1.0)	8.7 ± 3.4 (1.0)	12.5 ± 6.4 (1.0)	10.4 ± 6.8 (1.0)	11.1 ± 1.1 (1.0)	10.9 ± 2.3 (1.0)	5.8 ± 4.6 (1.0)	8.0 ± 7.1 (1.0)	140.4 ± 8.8 (8.8)
swap rows Time to swap 2 rows on a 1K table. (with 5 warmup iterations).	15.8 ± 4.6 (1.0)	19.6 ± 3.2 (1.2)	26.4 ± 3.9 (1.6)	15.3 ± 2.2 (1.0)	21.5 ± 6.2 (1.3)	19.6 ± 2.1 (1.2)	19.8 ± 5.8 (1.2)	23.4 ± 4.5 (1.5)	117.3 ± 5.4 (7.3)	119.3 ± 3.0 (7.5)	280.9 ± 14.5 (17.6)
remove row Duration to remove a row. (with 5 warmup iterations).	49.1 ± 1.1 (1.0)	49.5 ± 0.9 (1.0)	55.9 ± 5.3 (1.1)	57.4 ± 3.4 (1.2)	53.3 ± 1.7 (1.1)	64.1 ± 6.4 (1.3)	53.8 ± 1.8 (1.1)	57.0 ± 1.6 (1.2)	53.4 ± 0.6 (1.1)	61.9 ± 7.2 (1.3)	290.1 ± 20.4 (5.9)
create many rows Duration to create 10,000 rows	1,563.7 ± 37.7 (1.0)	1,690.5 ± 111.4 (1.1)	1,610.3 ± 73.9 (1.0)	1,960.6 ± 135.7 (1.3)	2,112.7 ± 101.8 (1.4)	2,211.4 ± 173.3 (1.4)	2,767.1 ± 56.5 (1.8)	1,829.1 ± 91.4 (1.2)	1,837.7 ± 9.3 (1.2)	2,727.3 ± 1095.2 (1.7)	2,102.9 ± 150.5 (1.3)
append rows to large table Duration for adding 1000 rows on a table of 10,000 rows.	241.1 ± 7.2 (1.0)	265.7 ± 14.9 (1.1)	249.7 ± 22.4 (1.0)	285.2 ± 8.1 (1.2)	313.3 ± 6.5 (1.3)	299.3 ± 6.7 (1.2)	412.0 ± 18.0 (1.7)	408.0 ± 10.9 (1.7)	290.2 ± 10.6 (1.2)	302.3 ± 11.2 (1.3)	2,773.3 ± 538.7 (11.5)
slowdown geometric mean	1.01	1.12	1.12	1.19	1.26	1.34	1.41	1.43	1.44	1.61	6.27

9. Comparison of JS frameworks

- Learning curve:
  - Angular is the hard one to learn.
  - Vue and react are subjective to students some but in our case Vue is more easy.
- Talent Availability
  - React have more developers while Vue and angular are little bit less
- Major Update for Frameworks



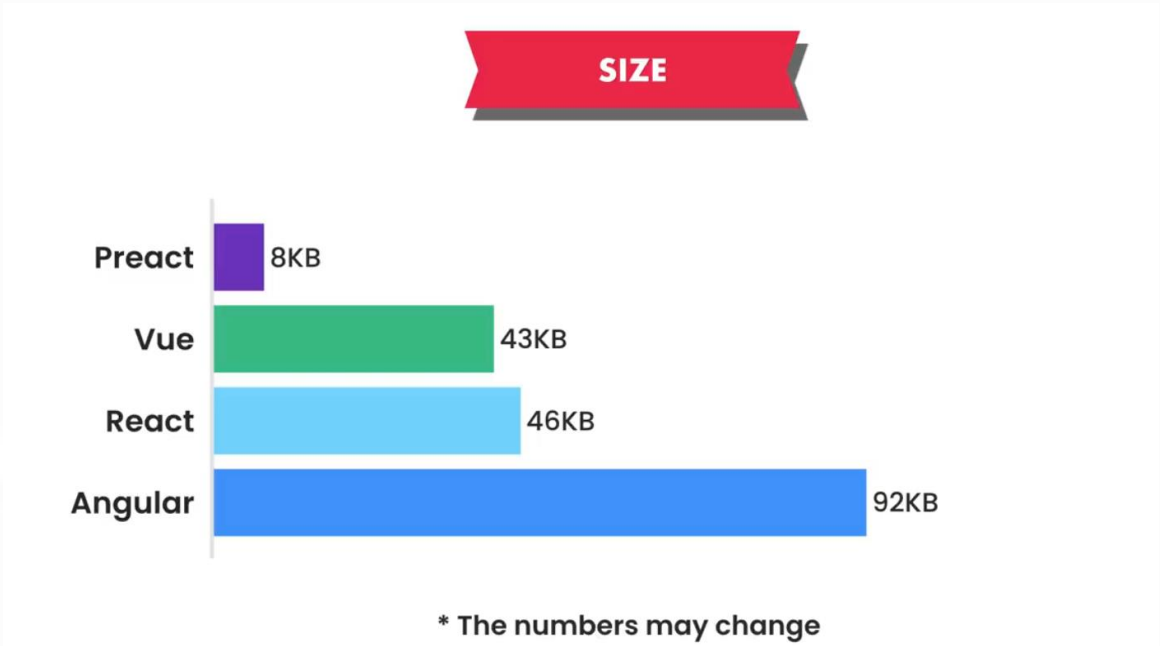
Continued

- Open source community on GitHub.

POPULARITY

	React	Vue	Angular
GitHub Stars	126K	135K	47K
Contributors	1291	270	900
Weekly Downloads	5M	980K	440K

- Size wise



Our recommendation

- Angular is full-blown Framework which means it is used in High level or enterprise level Webapps. It includes routing, testing utilities and so on.
  - Vue is suitable for lightweight projects you want to build by yourself
  - In react you don't get much out of the box. You have to use some extra dependencies for routing and others like state management.

Practical Exercises

1.Discuss the difference between JavaScript Library and JavaScript Frameworks

2. Discuss the document structure of React , Vue and Angular JavaScript

3. Discuss pros and cons of React, Vue and Angular JavaScript frameworks

4. Compare and contrast Front End Frameworks and Back End Frameworks

5. List components of React, Vue and Angular JS Frameworks

Reading Resources/Materials

Links

- ✔ https://www.w3schools.com/w3css/w3css_web_javascript.asp

- ✔ https://www.frameworktraining.co.uk/courses/coding/javascript-js-libraries-frameworks

Thank You
For Your Attention!!