Web Development with ReactJS and Spring Boot

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Abstract: Web development has come a long way since the start of the world wide web and it will go a long way with the development of web3, virtual reality and augmented reality. As the internet improved and its reach extended to almost every corner of the world, many new technologies have been developed to build websites and one of the most used is ReactJS. It is developed and maintained by Meta and a few developer communities. For the backend functionalities JAVA Springboot is one of the most used frameworks. Springboot has a strong connection with the database using JDBC APIs. And spring boots ability to make production grade code with minimal configuration makes it more desirable to most of the users.

Keywords: Configuration, DOM, HTML, JSX.

I. INTRODUCTION

The process of developing a web application has become a lot easier over the past decade with the development of new technologies. ReactJS and Spring boot have played a visible role in making this happen. According to the official website ReactJS is a declarative, efficient and flexible library for developing reusable UI components. ReactJS is an open source library developed by Meta(formerly Facebook), it is now improved and updated by a group of developers. Most of the websites are developed using MVC architecture and in that react is the view part. ReactJS application is divided into small pieces of code known as components and it can be reused multiple times. React uses virtual DOM, this will be discussed later. Spring Boot is based on the Spring framework. It is an open source Java based framework used to create micro services. It can be used to develop standalone and production ready spring applications.

II. REACTJS FEATURE

A. JSX
JSX stands for JavaScript XML. It allows writing HTML elements in JavaScript and allows it to place them in DOM. JSX is a language derived from XML, but without all the brackets and angle brackets. JSX is not required to build a ReactJS app, but it is an incredibly popular tool that is used to make development incredibly fast.

B. Virtual DOM
DOM stands for Document Object Model. It represents the HTML present in a web page in a structured way. It uses trees to represent all elements in the page and each node is considered as an element. In a traditional JavaScript based application when an element needs updating, that particular element is searched and all its child nodes are erased. Once the actual change is done all other child elements are rendered again. This method decreases the overall performance of the application. But in ReactJS it uses Virtual DOM which is a copy of the actual DOM, so for every object that is present in the DOM, there is an object in the virtual DOM. Whenever there is change in element then virtual DOM is initially updated, then it is compared to actual DOM and necessary change is made to the actual DOM in a batch manner. This helps in avoiding re rendering of all the elements.

C. One-way data binding
In any website there is data to be displayed on the screen and this part has a logic, so the data displayed and data in logic are connected. What ReactJS does is it binds both the view and logic in just one way so we can have one of the following: if there is change in value in logic it reflects in view or if there is change in view it reflects in logic. This makes understanding of code much easier. Although this may be less helpful if you are building a larger website where multiple components have to communicate with each other.

D. Performance
ReactJS is known for its highly efficient performance. This is one of the factors that make the framework stand out from many other frameworks in the industry. The main reason behind the framework's great performance is its use of the virtual DOM.

III.SPRING BOOT FEATURES

E. Events and Listeners

Events are an easier way to make the application with loosely coupled components. As the name suggests spring allows creation of an event and listener to that particular event, when the particular event is executed the listener will note down the event and can take necessary actions. Unlike normal calls the event will notify all the components regarding the change and whichever components wants can listen to it and take the appropriate change. Spring events can be broadcast synchronously or asynchronously.

F. Admin server

It is a server which provides a UI based management tool to manage all the spring applications from one space without any codes. Many applications can be registered with the admin server by registering their actuators with the server.

G. Security

Spring security allows users to add authentication and authorization to the application. It works well with other standards like OAuth 2.0 and SAML. It provides login/logout pages as well. It protects against common exploits like CSRF. Spring security has three main features: Authentication, Authorization and Servlet Filters. Authentication allows the user to verify the user, Authorization gives features like adding roles and permissions. Servlet filters allow you to add filters in front of servlets even before hitting controllers.

IV.   WORKING

Most of the modern UI uses MVC architecture. Here M stands for Model, V stands for View and C stands for Controller. As the name implies, the model corresponds to all the data related parts that users work with. View corresponds to the UI logic of the application. Controller acts as an intermediate between model and view, it handles all the data from models and gives an appropriate component to display in view.
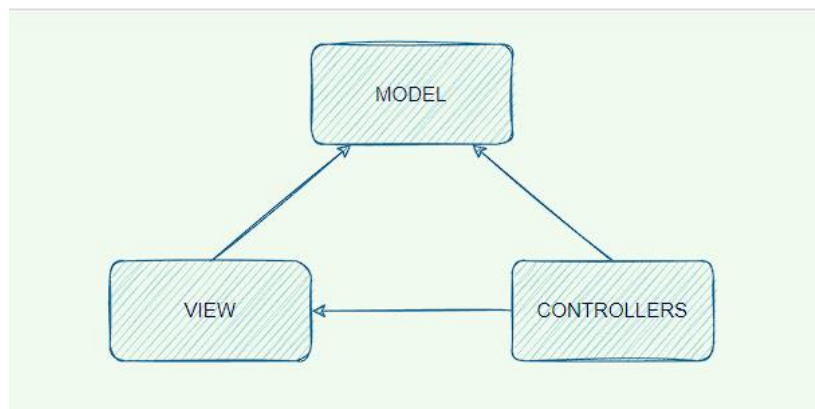

Fig. 1 A sample graph

ReactJS uses something known as a component . Components are like structures in ReactJS. Each component has its own DOM tree, which is created by the render function of react library. Whenever render is called it starts creating a tree from bottom and works up recursively and creates intermediate DOM. After all the components intermediate DOMS are created everything is combined to form actual HTML DOM. ReactJS uses XML based extended JavaScript also known as JSX. Using JSX helps in the creation of the DOM tree. Each component is stored in the form of a XML node. JSX also handles relationships between properties and occasion handlers. JSX is not a must for react to work, it can be implemented using plain JavaScript and HTML. JSX acts as a helping tool which makes the whole process of web development easier. As mentioned above each component acts as a node, each node can have child nodes with simpler and broken down components. JSX helps in disentangling all the intermediate nodes. Each component has three stages: Unmounted, Update and Mounted state. In the mounting state the trees are created, this happens when the render function is called. Once the component is mounted it goes to the Update state only when the component is in unmounted state or mounting state. In the update state the DOM is updated according to the change in view. Once the state is updated the component is unmounted.

There are some interesting open source libraries that will be of great help in adding functionality and styling. ReactJS bootstrap is one of them. It is developed and maintained by a group of developers in github. Some features like cards, navbars, modals, etc are of great use in any web development project. Material UI is also one of the react libraries which

provides functionalities. Material UI is a bit more sophisticated than ReactJS Bootstrap. Material UI has features like date time filters, backdrop, etc, which are not present in React Bootstrap. Material UI is more flexible when compared to React Bootstrap.

Spring Boot works based on the dependency imported. These imported dependencies will load the JAR files related to JPA repositories. @SpringBootApplication is one of the important annotations in Spring Boot. It is used with the main class of the project. This annotation is the combination of the three annotations in Spring framework, those three are @Configuration, @EnableAutoCOnfiguration and @ComponentScan. When the project is run it searches for the class annotated with @Configuration and creates beans for those classes. These beans are stored in a JVM in a specific space called an IOC container. This is done based on the scope of the bean. All these beans automatically configure the dispatcher servlet and register the default handler mapping. There are basically four steps that take place while the project is running,

- To relate application context
- Check application type
- Register the annotated class bean with the context.
- Create an instance of TomcatEmbeddedServletContainer and add the context

Once all these are done, @CeateApplicationContext creates application context and based on the context type in the servlet it will return context. Constructor will register the annotated class bean with the context. All the annotated classes with @Component @Server and @Configuration will be registered.

There are many annotations like @Data @Repository @Service, etc which are used in the project development. @Data is used for the entity or models. As the name suggests it is used on the classes that are used to handle data. This helps in generation g connection to the database. @Repository annotation is used to store, retrieve and update data from the database. @Service annotation is used on the class that mostly contains business logic.
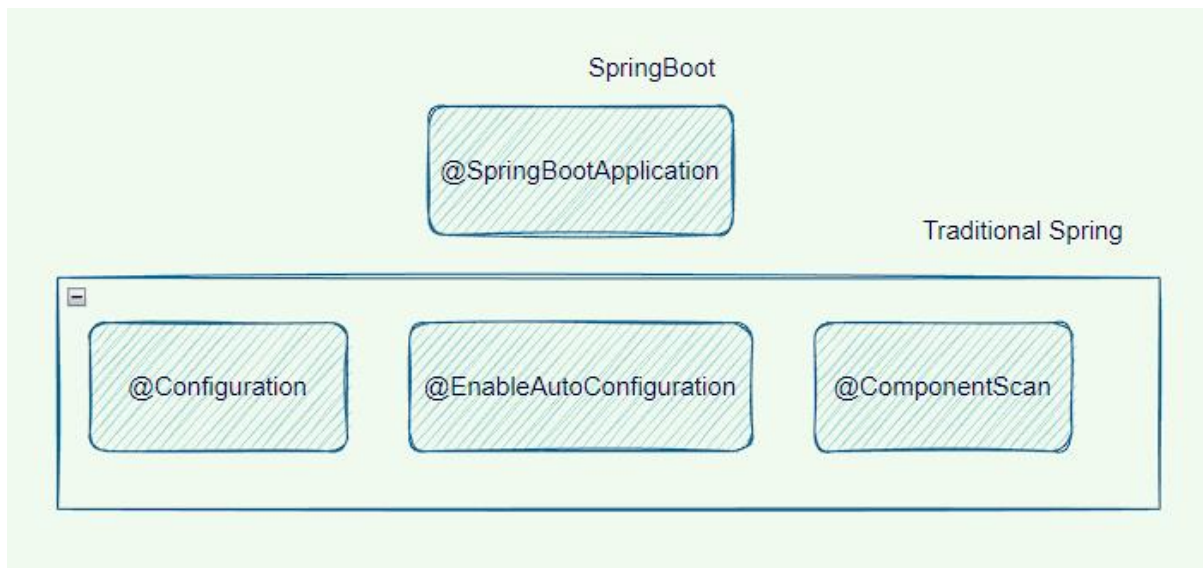

Fig. 2 A sample graph

Spring boot allows us to create RESTful api endpoints using the @RestController. RESTful is a type of architecture for application program interface(API). It uses HTTP requests to access data. It can manipulate data using PUT,GET,POST,PATCH and DELETE data types. These refer to create, read, update and delete operations. Controller classes use service and repository classes to manipulate data and apply business logic and send back appropriate output in the form of JSON format.

These API endpoints can be used in ReactJS with the help of the fetch function or Axios library. Axios is one of the most used HTTP clients used for API requests. The data received from axios is stored in state so that when there is an update in state the render updates the UI.
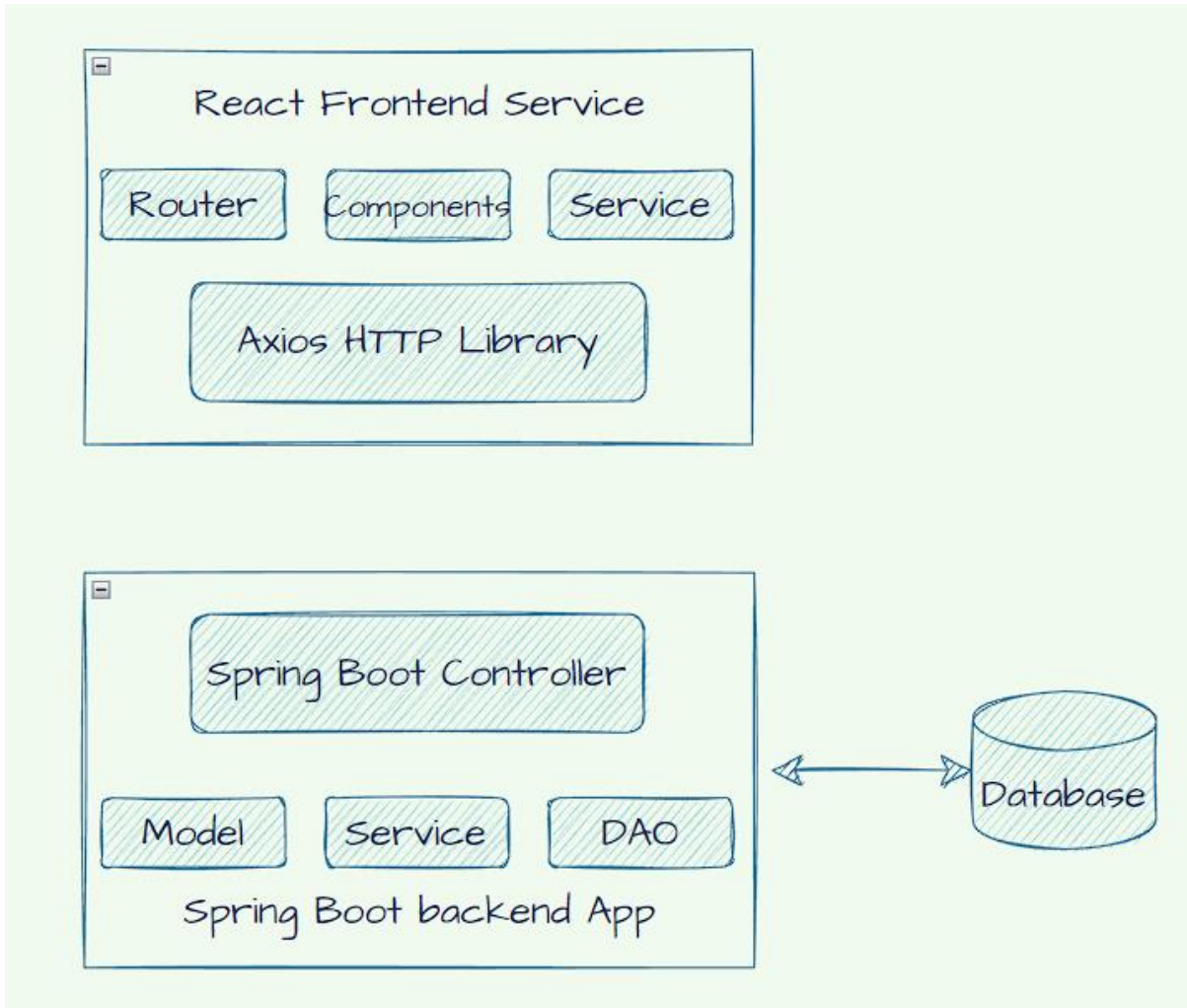
Fig. 3 A sample graph

V.   LIMITATIONS

One of the most talked about limitations of ReactJS is the lack of its documentation. ReactJS is a widely used library with regular updates but developers have little to no time to document all the changes. Regular updates are mostly viewed as positive but sometimes we may have to regularly update our project. Learning jsx can be a little difficult initially. And the last limitation is it needs expertise form developers to avoid problems with google with dynamic websites with client-side.
Spring boot is extensively used but it has its own share of limitations like it creates a lot of unused dependencies which leads to large deployment files. Process of migration of legacy spring projects to spring boot is time consuming. And the last limitation is its unsuitability for large scale projects.

VI.   CONCLUSION

Despite few minor limitations ReactJS is considered one of the most used libraries for developing web applications. As the world moves toward 100% internet coverage, the need for better and user-friendly web applications will rise accordingly. ReactJS with its regular updates from the hard working community of developers will play a big role in this. Similarly spring boot has been revolutionising the micro service space for some time such that it has become an integral part of the Java ecosystem, offering a scalable and efficient tool box to create API endpoints. ReactJS and Spring boots withs its internal unit and integration testing makes the development and deployment process much easier.

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