SNS COLLEGE OF ENGINEERING

An Autonomous Institution

Coimbatore-107

CS8651-INTERNET PROGRAMMING

UNIT-1

JAVASCRIPT AND BASICS OF MERN STACK

MERN Components

MERN Components

React

- React anchors the MERN stack. In some sense, it is the defining component of the MERN stack.
- React is an open-source JavaScript library maintained by Facebook that can be used for creating views rendered in HTML.
- Unlike AngularJS, React is not a framework. It is a library. Thus, it does not, by itself, dictate a framework pattern such as the MVC pattern.
- You use React to render a view (the V in MVC), but how to tie the rest of the application together is completely up to you.

- Why Facebook Invented React
- The Facebook folks built React for their own use, and later they open-sourced it. Why did they have to build a new library when there are tons of them out there?
- React was born not in the Facebook application that we all see, but rather in Facebook's Ads organization.
- Originally, they used a typical client-side MVC model, which had all of the regular two-way data binding and templates. Views would listen to changes on models, and they would respond to those changes by updating themselves.
- This is more complex in case of cascading updates

- Then they decided to use templates to manage the state changes?
- That’s when they started thinking of building something declarative rather than imperative.

- Declarative
- React views are declarative. What this really means is that you, as a programmer, don’t have to worry about managing the effect of changes in the view’s state or the data.
- In other words, you don’t worry about transitions or mutations in the DOM caused by changes to the view’s state. How does this work?

- A React component declares how the view looks like, given the data.
- When the data changes, if you are used to the jQuery way of doing things, you'd typically do some DOM manipulation.
- Not in React. You just don't do anything! The React library figures out how the new view looks, and just applies the changes between the old view and the new view. This makes the views consistent, predictable, easier to maintain, and simpler to understand.

- Won’t this be too slow? Won’t it cause the entire screen to be refreshed on every data change? Well, React takes care of this using its virtual DOM technology.
- You declare how the view looks, not in the form of HTML or a DOM, but in the form of a virtual representation, an in-memory data structure.
- React can compute the differences in the virtual DOM very efficiently, and can apply only these changes to the actual DOM.

- Component-Based
- The fundamental building block of React is a component, which maintains its own state and renders itself.
- In React, all you do is build components. Then, you put components together to make another component that depicts a complete view or page.
- A component encapsulates the state of data and the view, or how it is rendered. This makes writing and reasoning about the entire application easier, by splitting it into components and focusing on one thing at a time.

- Components talk to each other by sharing state information in the form of read-only properties to their child components and by callbacks to their parent components.
- No Templates
- Many web application frameworks rely on templates to automate the task of creating repetitive HTML or DOM elements.
- The templating language in these frameworks is something that the developer will have to learn and practice. Not in React.

- React uses a full-featured programming language to construct repetitive or
- conditional DOM elements. That language is none other than JavaScript. For example,
- when you want to construct a table, you write a for(...) loop in JavaScript, or use the map() function of an Array

- There is an intermediate language to represent a virtual DOM, and that is JSX, which is very similar to HTML.
- It lets you create nested DOM elements in a familiar language rather than hand-construct them using JavaScript functions.
- Note that JSX is not programming language; it is a representational markup like HTML.
- It’s also very similar to HTML so you don’t have to learn too much.

- You don’t have to use JSX; you can write pure JavaScript to create your virtual DOM if you prefer. But if you are used to HTML, it’s simpler to just use JSX.
- Isomorphic
- React can be run on the server too. That’s what isomorphic means: the same code can run on both server and the browser.
- This allows you to create pages on the server when required, for example, for SEO purposes.
- The same code can be shared on the server to achieve this. On the server, you’ll need something that can run JavaScript, and this is where we need Node.js.

Node.js

- Node.js is simply JavaScript outside of a browser. The creators of Node.js just took Chrome’s V8 JavaScript engine and made it run independently as a JavaScript runtime.
- If you are familiar with the Java runtime that runs Java programs, you can easily relate to the JavaScript runtime: the Node.js runtime runs JavaScript programs.

Node.js Modules

- Modules are like libraries. You can include the functionality of another JavaScript file by using the keyword require.
- Node.js ships with a bunch of core modules compiled into the binary. These modules provide access to the operating system elements such as the file system, networking, input/output, etc. They also provide some utility functions that are commonly required by most programs.

Node.js and npm

- npm is the default package manager for Node.js. You can use npm to install third-party libraries (packages) and also manage dependencies between them. The npm registry (www.npmjs.com) is a public repository of all modules published by people for the purpose of sharing.

Node.js Is Event Driven

- Node.js has an asynchronous, event-driven, non-blocking input/output (I/O) model, as opposed to using threads to achieve multitasking.
- Node.js, on the other hand, has no threads. It relies on callbacks to let you know that a pending task is completed.
- Node.js achieves multitasking using an event loop. This is nothing but a queue of events that need to be processed and callbacks to be run on those events.

Express

- Node.js is just a runtime environment that can run JavaScript.
- To write a full-fledged web server by hand on Node.js directly is not that easy, nor is it necessary.
- Express is the framework that simplifies the task of writing your server code.
- The Express framework lets you define routes, specifications of what to do when a HTTP request matching a certain pattern arrives.

- Express parses request URL, headers, and parameters for you. On the response side, it has, as expected, all of the functionality required by web applications. This includes setting response codes, setting cookies, sending custom headers, etc.,
- Express does not have a template engine built in, but it supports any template engine of your choice such as pug, mustache, etc.

MongoDB

- MongoDB is the database used in the MERN stack. It is a NoSQL document-oriented database, with a flexible schema and a JSON-based query language.
- NoSQL
- NoSQL stands for “non-relational”. It’s essentially not a conventional database where you have tables and columns (called a relational database).

- Document-Oriented
- MongoDB is a document-oriented database. The unit of storage (comparable to a row) is a document, or an object, and multiple documents are stored in collections (comparable to a table). Every document in a collection has a unique identifier by which it can be accessed. The identifier is indexed automatically.

- Schema-Less
- Storing an object in a MongoDB database does not have to follow a prescribed schema.
- All documents in a collection need not have the same set of fields.
- JavaScript Based
- MongoDB’s language is JavaScript.
- For relational databases, there is a query language called SQL. For MongoDB, the query language is based on JSON: you create, search for, make changes, and delete documents by specifying the operation in a JSON object.

- Data is also interchanged in JSON format.
- In fact, the data is natively stored in a variation of JSON called BSON (where B stands for Binary) in order to efficiently utilize space. When you retrieve a document from a collection, it is returned as a JSON object.

Tools and Libraries

- It’s hard to build any web application without using tools to help you on your way.
- Here’s a brief introduction to the other tools apart from the MERN stack components.
- React-Router
- React supplies only the view rendering capability and helps manage interactions in a single component.

- When it comes to transitioning between different views of the component and keeping the browser URL in sync with the current state of the view, we need something more. This capability of managing URLs and history is called routing.
- It is similar to the server-side routing that Express does: a URL is parsed, and based on its components, a piece of code is associated with the URL.

- React-Router not only does this, but also manages the browser’s Back button functionality so that we can transition between what seem as pages without loading the entire page from the server.
- React-Bootstrap
- Bootstrap, the most popular CSS framework, has been adapted to React and the project is called React-Bootstrap.

- This library not only gives us most of the Bootstrap functionality, but the components and widgets provided by this library also give us a wealth of information on how to design our own widgets and components.
- There are other component/CSS libraries built for React (such as Material-UI, MUI, Elemental UI, etc.) and also individual components (such as react-select, react-treeview, and react-date-picker). All these are good choices too, depending on what you are trying to achieve.

- Webpack
- Webpack is indispensable when it comes to modularizing code. There are other competing tools such as Bower and Browserify which also serve the purpose of modularizing and bundling all the client code.
- webpack not just to modularize and build the client-side code into a bundle to deliver to the browser, but also to “compile” some code.

- The compilation step is needed to generate pure JavaScript from React code written in JSX.
- Other Libraries
- body-parser (to parse POST data in the form of JSON, or form data), ESlint (for ensuring that the code follows conventions), and express-session, all on the server side, and some more like react-select on the client side.

Thank You