Enhancing Web Application Performance with MERN Stack Optimization

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ABSTRACT-

Given the rapidly evolving corporate environment of today, it is quite challenging to comprehend customer demands in the most efficient and in advance. Our consumers' daily lives would be more impacted if they could access our products and services online and conduct business with us. This would also establish an ecosystem for conducting business online and providing large-scale customer support. The younger generation has made online shopping and business a way of life. E-commerce web applications that sell a variety of goods have made luxury goods and necessities accessible to everyone. Several technologies have been studied and acknowledged to contemplate the establishment of an e-commerce web application. Technologies included are React.js, MongoDB, Node.js, Express.js. This is a project that eases access to various products and establishes a   web application where a customer is delivered with an exhaustive   web application and also to understand the technologies used to demonstrate application. In this paper will talk about each of the fundamental technologies to create and implement the ecommerce web application.

Technologies—ReactJS, NodeJS, MongoDB, ExpressJS, Optimization using MERN STACK

I. INTRODUCTION

In reality, e-commerce refers to conducting business online with goods and services through the use of technology including supply chain management, online marketing, electronic funds transfers, mobile commerce, and electronic data interchange. Along with other technologies like email, e-commerce often depends on the world wide web at least a portion of one stage of the transaction processes.

E-commerce businesses use web applications for direct retail sales (B2C), online marketplaces (C2C), and business-to-business (B2B) transactions. They also collect demographic data through web and social media interactions, engage in digital marketing, and launch new products.

A study by the Associated Chambers of Commerce and Industry of India estimated that India's e-retail market would grow from Rs.20 billion in 2011 to Rs.70 billion by 2015, with increased internet penetration. In fact, with such a massive population and rapid expansion of economy, India is becoming one great hub for e-commerce. Increasing penetration of technology in the rural areas and also increasing job opportunities increased mass awareness and purchasing power, paving the way for huge growth in online shopping.

E-commerce web applications allow for the smooth flow of transactions by managing interactions between trade and data processing. More corporations are embracing this development to reach more people as online shopping becomes a normal way. Online stores also operate like virtual markets where customers search through catalogues, place selected items in the cart, and make their purchases by adding shipping, billing, and payment information.

E-commerce changed the traditional manner in which businesses traded by changing logistics, timing, and consumer behaviour. It also helped reduce the carbon footprint, reduced the need for the
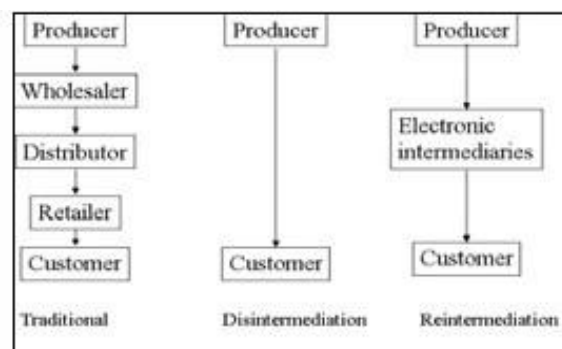

Fig. 1. Disintermediation/Reintermediation physical presentation of products, and extended the duration of used goods.

II. RELATED WORK

A. DEVELOPMENT OF THE WEB PAGES

The commercial internet underpinnings of today were established in 1990. Tim Berners-Lee developed the fundamental idea of the World Wide Web and other tools for effective web use toward the end of 1990. These technologies are using HTML, HTTP, the first web server, and the first web page that introduced the term world wide web and explained how to create a web page. The internet began to expand quickly in 1990, and as Fig. 2 illustrates, its evolution may be divided into four generations. The original generation of online pages were static, users could only see web material, and content was not regularly updated.

The internet underpinnings of today were established in 1990. Tim Berners-Lee developed the fundamental ideas of the world wide web and other tools for effective web use toward the end of 1990. These technologies include HTML, HTTP, the first web browser and code editor, the Global user connections were made possible by those social networks. New technologies like JavaScript, Document Object Model, Ajax, Cascading Style Sheets, eXtensible HTML, eXtensible Markup Language , eXtensible Stylesheet Language , and Flash also emerged at that time, making it possible to present and deliver web services without any issues with web distribution. The semantic web, which adds meaning to web content customization, intelligent search, and computers' capacity to generate many kinds of content are the hallmarks of the third web generation, which started in 2010. Ontologies are used to represent and reason about meaning. The Resource Description Framework, Web Ontology Language, and other technologies are also used in a third generation of webs in addition to ontologies.
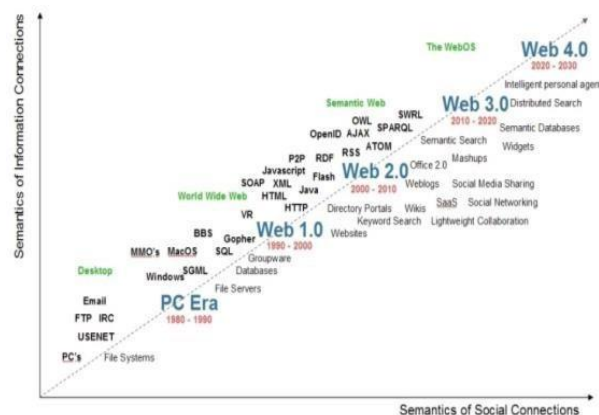

Fig. 2. Semantics

Internet 4.0 is likely to be referred to as the "active web" in the fourth generation. Search engine usage is still significant in the present web 3.0, and it provides us with information in its most extensive content online applications that we can utilize to suit our demands.

This will not be the case with Web 4.0. When completely developed, it will not require many of the procedures required for web 3.0, allowing for more straightforward and undetectable use.

B. DESIGNING THE STAGES OF WEB PAGES

Web designs it's like universal language in visual world because its designing the key aspect or reason, henceforth; content focusing with which ease reach out web users so to access them on use of their services or whatever related is meant in. The face of web design had changed significantly as a advancements trends. First-generation websites only displayed content in a basic text format; second-generation websites featured numerous graphics and colors to create a memorable experience; and finally, today's websites are simple and easy to use. The content of the webpage must always be up to date and current.

III. METHODOLOGY

For establishing applications, the MERN stack is using. The MERN stack-based web application develop by using Mongoose and MongoDB database. The chrome developer tool is used during the testing by using the redux tooling for simulation. MERN stack components along with implementation have been discussed in the following section:
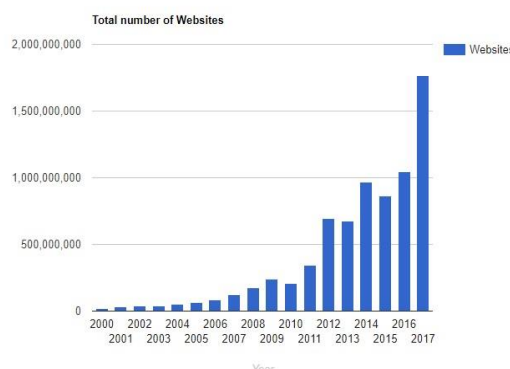
A. *NodeJS*

Fig. 3. Increase in total no. of websites

The C ++ language, a JS operating environment, is used to write Node.js. For efficiency Node.js leverages the google chrome engine. Callback functions in Node.js are designed with a single-thread architecture.

There are a lot of APIs that are asynchronous and event-based, it has aided us in creating websites with back-end development using Node.js. Event-driven is the primary core concept for environment in Node.js designs. We utilized Node.js in accordance with the business logic of our web application and for the related callback function. These callback functions are asynchronous, which means that even though they seem using a single-threaded architecture is the primary benefit of both asynchronous and event-driven programming. This architecture was appropriate for our system's backend development process, which was another objective. Because blocking held the top spot and handling synchronous requests was a major task in server building, we avoided wasting our resources. With the help of asynchronous callback methods and a single thread architecture, we were able to improve our website's performance and use more resources, which produced the desired results during testing. In contrast to other languages, Node.js has a large number of functions related to file operations that are carried out asynchronously, as we can plainly see in the module. Node.js is using big network modules, such as HTTP, DNS, NET, UDP, HTTPS, TLS and many things to make the building of the server much easier. Developers can use these network modules to create a Web server.

B. ExpressJS

Express.js is the light in weight for the Node.js. It uses to creating RESTful APIs and easy to manage, it allows the frontend and backend of the application to communicate with each other. Express handles routing, request processing, and implement with middleware to manage security, authentication, and data validation.
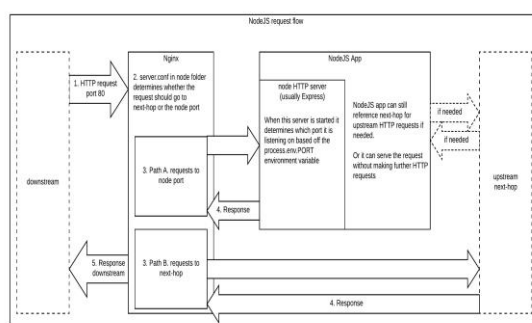

Fig. 4. NodeJS Request Flow

Because Express includes numerous middlewares that make writing code shorter and easier, it assisted us in building the web apps and APIs that were necessary for our project. The two main benefits of using Express in our web apps are asynchronous programming and single-threaded architectures. To begin our Express project, our web apps' sophisticated APIs generated a new folder.
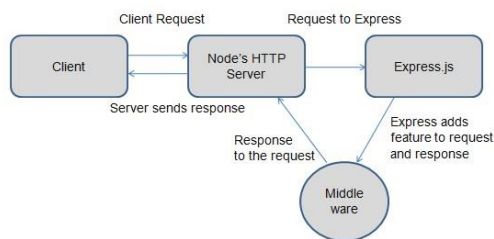
Fig. 5. ExpressJS Flow

C. ReactJS

The client-side JavaScript programming language library is called React.JS. We used it when creating this web application's user interface; we selected the program to be used for the single-page application development since it would provide a fast render of dynamically changing data. It makes it easier for developers to write code inside. Objects in React there. They have used JavaScript in our project. Whenever we made modifications to our e-commerce web application. This enables us to contrast those possible distinctions Virtual DOM and the DOM Object. Adopted JSX because writing code for our React application easier and more straightforward. Components are used by React.JS. Each component site e-commerce application. Components are the fundamental units of User-Interface. Reusable components improved the overall efficiency of the web application and made our code easier for other developers to understand.

Installing construct react app using npm was the first step in starting our react application. The commands to use npm is npm install create react app global, respectively. Next, we used the app name create react app to create a new react application. Next, enter npm start to launch your application after navigating to the app name folder.

D. MongoDB

MongoDB, a document-oriented database, was used for our project. The MongoDB database contains records in the form of documents. Our JSON data is converted into a binary representation on the server by MongoDB to facilitate better storing and querying. MongoDB uses JSON to query databases. Despite saving in BSON format both the internally and over the internet, MongoDB a JSON database. This format can be used to show any information that can be in easier way accessible in the JSON type and natively stored in MongoDB.

IV. RESULT AND DISCUSSION

The work on project concerning the ecommerce web application project uses MERN stack. Aims to be critical review relevant literature concerning the current scope of study that falls into e-Business area Critical account of aspects involved in describing this methodology followed and applied while progressing with this whole project; at the moment the project did pretty well managing the understanding issues concerning various themes. that while building a ecommerce application.
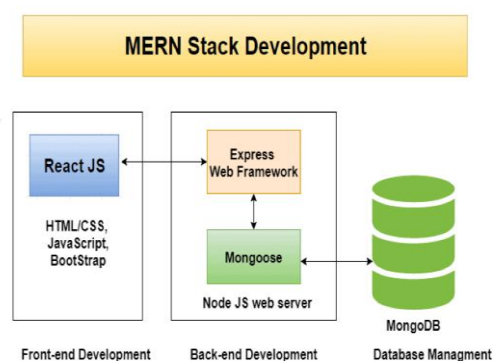

Fig. 6. MERN Stack Architecture

Ecommerce websites aren't straight forward software, according to our research. It is essential to become proficient in the technologies required to create any online application. We concentrated on other issues that arise during the development process, such as evaluating websites, researching the market, and selecting the best business strategy. Created in accordance with market demands and tailored to the needs of its customers. Additional investigation and attention were paid to the software tools and testing. Since the results of the problem analysis stage were the most important in determining the specific demands of the customer for the web application, all the necessary decisions on the construction of the website were made based on those findings.

V. CONCLUSION AND FUTURE WORK

The present e-commerce web application tries to critically examine relevant literature within the e-Business domain by outlining the important aspects of methodology used during the project. Further exploration and adaptation of new emerging technologies, frameworks, and testing tools will bring further growth and performance in the application. The future advancement of web development through various technologies will help Indian and global businesses thrive, establish a digital ecosystem, and simplify business activities for all people.

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