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Trending Web Development Stacks Performance Analyser

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ABSTRACT: Web applications are increasing day by day and the choice of technology for building a web application is a tedious task. A good website needs to be scalable, functional, responsive, reliable, secure etc. Therefore, comparing the different trending technologies for web design is crucial. The entire design of our website requires the selection of the programming languages. It is difficult to give a quick solution to this issue without first considering what our website will do both now and in the future. One of the initial decisions to be made is whether the website will be static, interacting with users relatively little, or dynamic, displaying personalised information to users in response to interactions. Also, there are many stacks trending and available in the market for web development like MERN stack, MEAN stack, MEVN stack or ruby on rails or DERN technology. It's very necessary to understand all, the key differences between them and which one is right to choose when. This paper attempts to assist web developers through conducting an empirical comparison of the most significant web-based programming languages and databases. The paper compares frontend technologies like React and Angular based on certain parameters like DOM, architecture and data binding, in each case comparing their performance and also do the performance analysis of backend technologies like MongoDB and PostgreSQL, which are no-SQL and SQL databases respectively, based on e-commerce use case application. The paper finally suggests which technology to choose for which use case and under what conditions and requirements.

I. INTRODUCTION

Nowadays, a "stack" of several technologies is used to create web apps. A stack is a set of tools and frameworks used to create software. Two of the most well-liked and potent stacks used in web development are MEAN and MERN.

The online programme has also largely depended on a variety of websites and random data, including files, movies, images, music, text, and other offensive material. Icon Random data management is challenging for the Relational Database Management System (RDBMS). A new technology called Firebase is used to manage massive volumes of random data. It is very quick when compared to RDBMS. Also choosing an effective database can offer a great option for data mining since the storing of unstructured data is crucial to the installation of a big data environment. Performance studies for the storage of unstructured data are conducted using MongoDB, Firebase and PostgreSQL, three database systems.

The most notable example is probably the development of several functions by data storage systems to effectively handle spatiotemporal data operations. The primary topic of this research is which of those systems for storing information is best suited to satisfy the requirements of industrial applications. Also, JavaScript offers the ability to construct web applications using both the MEAN and MERN stacks without the need to transfer code. Both MEAN and MERN offer a fantastic set of tools that may be used to create software solutions that work effectively. Instead of the traditional practise of using different languages for the front end and back end of web applications, we now only use one language for both, which ensures faster development of web applications, helps developers quickly bring products to market, and ultimately results in a significant reduction in development costs and increases efficiency

For newbies, choosing the appropriate stack for their apps might be overwhelming. This study intends to present the numerous benefits and drawbacks of MEAN and MERN stacks, enabling beginners to choose the most suitable one for developing.

The main goal of this paper is to provide the new web developers the preferred choice of choosing between top trending frontend, backend, and database technologies. It recommends the use of best programming language for developing best and quality application required. It is accomplished through:

- Comparison based study of database management systems- PostgreSQL, MongoDB, and Real time Firebase.
- Comparison based study of frontend technologies React and Angular.
- It offers some advice, particularly for novice web developers, on how to pick web technologies that are appropriate for their level of competence.
- Compares the performance aspect of various technologies.
- Use cases of respective technologies

Research based work- Initially the related work done with mspect to the project was research work done comparing MERN web stack and ins trending alternatives The research technique cmployed in this study considers web developers expertise and experience as well as their perceptions of various programming languages, libraries, and frameworks. The alternative technique is based on data that has been released in many sources (including books and websites) and compares them to various stacks that use web apps and have the same needs and requirements

The research paper also compared various SQL and no-SQL databases like MongoDB and PostgreSQL. The main difference between the PERN and MERN stacks is that the PERN stack uses the PostgreSQL database rather than MongoDB Enterprise-grade PostgreSQL is a SQL-based database system that prioritizes flexibility and compliance. It was initially developed in 1996 at the University of California, Berkeley, and has since seen tremendous popularity. In fact, the 2021 Web Developer Survey by Stack Overflow places it as the second most used database now.

Lighthouse Parade- One of Lighthouse Parade's greatest strengths is its capacity to gather performance information from every location and combine it into one easily analysed spreadsheet. Don't worry if you aren't a spreadsheet ninja genius. You may input your data intu a Google spreadsheet template that we created It has various helpful features, including:

- simple formatting
- Highlighted are the three primary online vitals columns.
- Histograms are automatically created for each web core essential metric.
- Next to each histogram are averages and median scores for the web core vitals.

Pagespeed Insights- Three separate metrics make up The Core Web Vitals as of the writing of this article:

- Largest Contentful Paint (LCP)
- First Input Delay (FID)
- Cumulative Layout Shift (CLS)

Above three parameters may be found in a performance audit carried out using the well-known online performance tool Pagespeed Insights Google PageSpeed Insights has long been the preferred tool for evaluating and testing websites. It's a simple Google tool that rates webpages for desktops as well as mobile devices on an index of 1 to 100. The number increases the quicker the webpage is.

Web page Test- An open-source website performance assessment application called WebPageTest.org enables you to benchmark your website across 40 different locales and a variety of devices. Additionally, you have the option of simulating your tests on a 4G network or a sluggish mobile network. The final product, which will be rated from F to A, will include details on caching, waterfall charts for resource load speed, TTFB, compression, and other topics.

Additionally, there is a fairly unique test that runs three times and shows the results for each time. This assists in determining whether the DNS or CDN could cause any lag and whether the server can adequately handle all requests.

II. METHODOLOGY FOR FRONTEND COMPARISON

The research technique employed in the study takes into account web developers' expertise and experience as well as their perception of various programming languages, libraries and frameworks The alternative technique is based on data that has been released in many sources (including books and whites) and compares them to various stacks that use web apps and have the same needs and requirements.

Parameters considered while choosing a stack for development.

i. Your website project's size or intricacy-

For complex and large-scale web applications to function properly, higher stacks and more sophisticated technologies are frequently required. Let's explore the various application kinds and proposed web development stacks in a brief manner using a straightforward classification Simple, **low-cost web apps** for startups and small online stores. They typically call for simple- to-use technologies that can function "out of the box," without the need for extra libraries or modules

Government initiatives or sizable online retailers, particularly those that offer both physical products and digital material, are examples of **medium-sized web apps.** They offer extra features that may be used with different frameworks

Social networks, extensive trade platforms, and financial apps are examples of **large/complex online applications.** Their extensive range of capabilities necessitates the merging of several web application development techniques.

ii. Extensibility-

This choice decides, if required, whether your programme may extend. Horizontal scalability is the ability to handle more requests while maintaining the same number of functions. vertical scalability is the ability to add additional functionality using different modules to appeal to a wider audience. Make sure your app servers can handle high loads without lagging or going unavailable if you anticipate serving a big number of people.

In this case, you may consider adding Angular and Node is to your stack because they offer outstanding scalability.

iii. Platform-

A web app is frequently made with a target platform in mind, whether it be a home computer, a mobile device, or both. This necessitates a variety of techniques and tools. Even if native and hybrid programmes are more suited to mobile devices and may take use of the hardware characteristics, web applications mobile are nevertheless widely used on the platform for mobile device.**[5]**

React and Angular: Technology Comparison

The React JavaScript framework was developed by Facebook to enhance the user experience on the Facebook and Instagram websites. React has powerful features, so in 2013. Facebook released the framework a free download for businesses and developers everywhere. React Native, a framework for leveraging React to construct mobile applications for well- known platforms like iOS and Android is also introduced by Facebook in 2015.

Google developed the well-known open-source Angular framework for front-end web applications in 2010It is based on JavaScript ESS. Due to the limitations of its initial design strategy, Angular has greatly lagged other front-end frameworks in recent years. The Google development team completely revamped Angular's update

React must evaluate more complicated data flows since it must compare the variations among the virtual DOM and the visible DOM. Two-way binding can cause components to transition into unexpected states a result of data that is inconsistent being distributed from several sources, however one-way bonding can prevent conflict issues in multiple data sources, especially in event-based circumstances. The Angular 2 team therefore extends the notion that developers may use one-way and two-way binding. The ideal way to combine the benefits of one-way and two-way approaches is to use a hybrid approach in various situations.

More memory for a framework signifies that it has more libraries and functionalities, but the problem is it will spend more time loading. The most notable volume is 143 kilobytes (KB) for Angular 2, followed by KB for React. Because of its enormous size. Angular 2 has more advanced, comprehensive features and capabilities. But given its intricate design, there's a potential that Angular 2 would perform more slowly than react, particularly with regard to comes to memory allocation. Table I demonstrates that setting up and running the memory for Angular 2 takes more time.
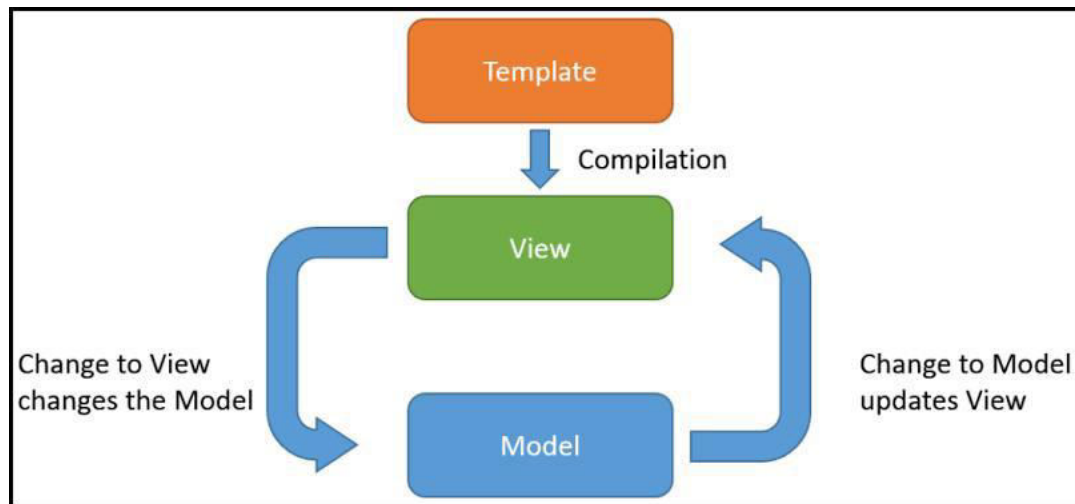
Because Angular 2 uses TypeScript, it offers superior type inference and eliminates a variety of issues that might occur in web applications. Additionally, by improving the language's structure, TypeScript enables programmers to do away with the standard JavaScript programming model. However, there aren't many people using TypeScript. When another syntactically strict superset of JavaScript appears. TypeScript may become obsolete. The generation of JavaScript using JavaScript ES6 can be enhanced but not replaced considering it is the norm in the sector**.**

React compares the Virtual DOM with the Real DOM in order to identify any changes that have happened, whereas Angular 2 and the versions that followed don't. Instead, they make use of change detection, which acknowledges changes to the model and only modifies the DOM in reaction to those changes. The process known as "change detection" is made to keep track of alterations to an application state and display the newly updated state on the screen. It makes sure that the user interface and the program's internal state are constantly in sync.
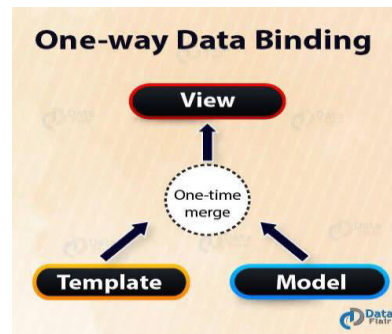
III. METHODOLOGY FOR BACKEND COMPARISON

MongoDB, PostgreSQL, and Firebase

A database where the app's data is kept. Depending on the data management model, these objects could be relational or not. Non-relational (non-SQL) databases utilize different methods for storing and retrieving information while relational databases operate using the Structured Query Language (SQL). The top 5 databases are Oracle, MySQL, Microsoft SQL Server, PostgreSQL, Firebase and MongoDB, according to the DB-Engines portal. Notably, all of them---- apart from the last two----- are relational.

Main trending and popular databases are MongoDB, PostgreSQL, Firebase.

In conclusion, relational databases employ SQL as its query language, are organized, have a rigid schema, and well-defined connections between tables. They work well with smaller data sets that demand tight ACID compliance and consistency. Non-relational databases, on the other hand, employ native APIs or particular query languages, are semi-structured or unstructured, and have a dynamic schema. They work best with bigger, more complicated data sets that need scalability and flexibility.

i.   A document-oriented, NoSQL database is MongoDB. NoSQL. is a method of managing data and creating databases that is most helpful when we have large amounts of data NoSQL databases are are primarily made to allow us to input data for which we do not already have a predefined schema because our data's structure is not predetermined

ii. Without a predetermined schema, MongoDB allows us to experiment with modelling our data and select the best alternative based on the requirements of the application. As a result, we have an easy approach to change the structure of our data

iii. We have a more adaptable model termed a "document" rather to the idea of a "row" in a database like MongoDB. The file type used to store the documents is known as BSON, which is short for binary JSON and gives us a binary representation of the JSON documents.

iv. While MongoDB offers numerous capabilities that make CRUD operations easier, several functions, like joins, that we most frequently use in relational databases are not supported by MongoDB.

v.   The ever-increasing volume of data that our apps deal with is the most difficult issue that developers face. Scaling becomes an issue as a result of the necessity to store this data.

vi. Therefore, we have two options: scale up, which involves updating the system we presently have and essentially adding more resources, or scale out, which involves distributing our data across other machines. The cost of scaling up often increases, and the physical limit will eventually be attained. Although scaling out will involve more work to manage the many computers, it is often less expensive and simpler to expand.

vii. It is important to realise that scaling out a relational database is typically not a simple issue to resolve. However, MongoDB was developed with this procedure in mind from the beginning. It is simple to divide the data since it is document-oriented, and MongoDB determines how to distribute the data across the newly additional servers.

IV. ANALYSIS AND RESULT

Overall, e-commerce applications can benefit from React and Angular's performance. Faster rendering times and better caching can be achieved with React's virtual DOM and reduced bundle size, but a more complete framework for bigger apps can be achieved with Angular's built-in capabilities and modules. In conclusion, each of Angular and React's advantages and disadvantages must be considered. React excels in creating quick and responsive single page apps, mobile applications, and e-commerce websites whereas Angular excels at creating massive, complicated applications that call for a lot of out-of-the-box functionality. Therefore, the choice of technology for particular use-case depends on various performance parameters of Angular and React.

MongoDB could be a better choice if you need to do real-time analytics while working with significant amounts of unstructured data. PostgreSQL can be a better option if you're working with relational data and need extensive analytics features.

The document-based model of MongoDB is great for handling large traffic loads and is ideally suited for e-commerce applications since it enables quick readings and writes. While PostgreSQL's powerful indexing and query optimisation features make it suitable for managing complicated transactions in e-commerce systems, it is also extremely scalable because to its ability to shard data across numerous nodes. Moreover, it guarantees that data is always consistent and dependable thanks to its support for ACID-compliant transactions.

As a result, it can be said that MongoDB may offer quick, dependable data retrieval and storage when utilised in an e-commerce application, which can improve the consumer experience. Due to its scalability, which is necessary for e-commerce applications, it is also perfect for managing enormous amounts of data.

Complex queries in e-commerce systems may be handled with PostgreSQL thanks to its extensive capabilities, which include support for window functions and common table expressions. As a result, reporting and insights may be more precise, which may aid organisations in making better decisions.

With a variety of capabilities that may help enhance user engagement, boost revenue, and streamline the development process, Firebase can also be a potent tool for creating e-commerce apps. Before deciding to integrate Firebase in your project, it's crucial to compare the potential advantages with the potential drawbacks and security risks.

Offline support, easy integration, Scalability, Real time updates are some of the potential results of using Firebase as a database in an e-commerce application. Also, one may measure user engagement and behaviour by integrating Firebase database with Firebase analytics. The user experience can be enhanced, the app's performance can be optimised, and revenues may be raised by using this data. In addition, to prevent unauthorised access and data loss, Firebase database offers strong security features including encrypted connections and data backups.

V. CONCLUSION

Web development stacks are essential for business leaders to comprehend since they serve as the basis for building websites and apps. Developers that are familiar with one stack of web development may not be able to work with another since each stack uses unique collection of technologies. As a result, it could be difficult for business owners to find engineers who are familiar with their specific technological stack.

When choosing a technology for web development or other developments, development costs must be taken into consideration. Before selecting a technology, business owners should be aware of the expenditures involved. The most widely used front-end technologies among developers are Angular and React. React is more effective than Angular, yet they both have a tonne of wonderful advantages. Additionally, React JS is supported by a sizable developer community.

React outperforms Angular in the comparison because to its Virtual DOM and render optimizations. Moreover, it makes it possible for developers to easily switch between React versions. Its installation procedure is simpler and easier than Angular's. In a word, React provides developers with a host of benefits and reliable solutions that speed up development and reduce mistakes. In light of your usages, project needs, and features, you should examine it while selecting the best front-end technology from React vs. Angular.

Also, both MongoDB and PostgreSQL offer advantages and disadvantages when used for e-commerce. Although PostgreSQL excels in handling intricate transactions and analytical queries, MongoDB excels at handling enormous volumes of unstructured data and horizontal scalability. Developers may build a more adaptable, scalable, and effective e-commerce solution by combining the two databases. For instance, businesses can use MongoDB to store and easily retrieve product information while PostgreSQL is used to manage complicated transactions and reporting. Using PostgreSQL as the main database and MongoDB as a supplementary database for storing non-transactional data is one way to combine the two databases. Another strategy is to use PostgreSQL for analytics and reporting and MongoDB as the main database. The method used will rely on the requirements of the e-commerce application.

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