

# State-of-Art Frameworks for Front-end and Back-end Web Development

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## Abstract

Identifying software requirements, designing, coding, and testing using frameworks and technologies are all part of the web application development process. Frameworks are collections of libraries and classes that provide a wide range of capabilities. For front-end and back-end development, there are a variety of frameworks that support multiple programming languages. Front-end development employs front-end programming languages to create what the user sees on a website; back-end development employs back-end programming languages to fulfill those requests on the server side. When used together, it produces a unified look and feel. The database is where the data for web applications is stored for usage by back-end frameworks. Choosing the proper combination of front-end and back-end frameworks is the most critical component of the web development lifecycle. This paper discusses front-end and back-end frameworks. A systematic review was conducted utilizing highly cited publications, narrowed down to the most recent and relevant works in the research area. This study intends to give researchers and industry developers a brief reference to web development tools through a critical review.

**Keywords:** web application, front-end frameworks, back-end frameworks, angular js, Laravel

## I. INTRODUCTION

The expression "web application" was initially reported in early 1999 as another technique for executing an application program from a web worker. Web applications are used to develop web applications that preserve and conduct operations using data. The framework results from aggregate knowledge, including numerous libraries and advantageous apparatuses from different engineers. They help diminish the vast majority of the monotonous undertakings and complex errands in the primary interface while implying that designers can compose less and accomplish more with the best caliber in a specific e. In this way, utilizing a dependable structure also helps bring down the improvement cost (Nguyen, 2015). Frameworks may comprise source code libraries, utilities, modules, advancement models, and a wide range of devices, the aim of which is to speed up the improvement speed of an application. Frameworks can help us carry out capacities like security, see layouts, confirmation, and approval of the information, and techniques for taking care of information in a database (Gallardo, C. 2011). MVC helps web development frameworks in detecting architectural design complexity and increase code flexibility and reuse (Cui *et al.*, 2009).

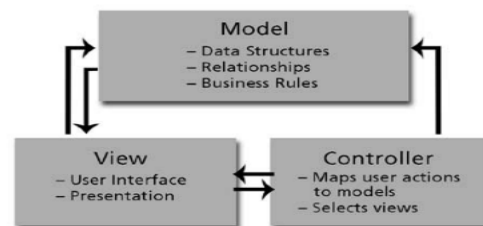


Figure 01: MVC architecture

The frontend service and the backend service are the two independent services that make up the web application. Through API calls, these two may talk to one another. While the back end of the program handles the business logic, the front end of the application manages user interaction. There are several benefits to having a distinct service handle the front end and back end independently, including quick development, simple upgrades, and high maintainability. But this also has drawbacks, one of which is the danger of running two different instances of the same program simultaneously. This interferes with the pipeline for continuous integration and deployment (Dinku, Z. 2022)

## II. METHODOLOGY

This section outlines the chosen review topic and the data collection, processing, and analysis procedures. Finally, it concludes with an overview of the review framework.

Identifying product requirements, designing, coding, and testing by using frameworks and technologies are all part of the web application development process. Frameworks are collections of libraries and classes that provide a wide range of capabilities. For front-end and back-end development, there are a variety of frameworks that support multiple programming languages. Choosing the proper combination of front-end and back-end frameworks is the most critical component of the web development lifecycle. So, hopefully, this article has covered a couple of the essential front-end and back-end frameworks.

This review article referred to information from several reputed online articles and journals. It helped me to learn about the pros and cons and other details of all frameworks. This paper is mainly divided into two categories such as front-end frameworks and back-end frameworks. This framework is summarized into many main parts: introduction, advantages, disadvantages, and performance.

## III. DISCUSSION

### A. Front-End Frameworks

Shetty, J. *et al.* (2020), this paper discusses the front-end framework as Front End Framework is the part of an application or website where users interact with it. It incorporates all that clients run over straightforwardly, including pictures, buttons, text color, diagrams, and tables. A front-end framework creates the behavior, architecture, substance, and design of all of it visible on-screen while versatile/web apps are launched.

### FRONT-END DEVELOPMENT

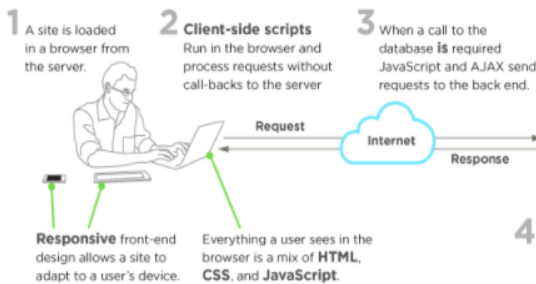


Figure 02: Front-End Development

### 1) Angular JS

Hutagikar, V. and Hegde, V. (2020) discuss the Angular JS introduction. This framework was first distributed in 2009 and was renamed AngularJS. This term reflects refreshes past to rendition 2.0 – the later forms are named Angular. Ollila, R. (2021), the topic of Angular js is discussed in this article. Another point is that AngularJS is one of the soonest broadly utilized web front-end systems with an express objective of empowering the explanatory programming model. AngularJS is at this point considered out of date, having been supplanted by a replacement confusingly likewise called Angular.

The first one is Right away into sees given two-way information restricting in a straightforward, viable, and natural way. Another one is Construction and engineering fabricated particularly for better adaptability of ventures.

The first disadvantage is that Angular has different structures (Injectable, Components, Pipes, Modules) in examination with React and Vue.js have just part, the previous is harder to learn. Another one is continually refreshing: new, significant upgrades are constantly made. This can cause issues for designers concerning adjusting to them Hutagikar, V. and Hegde, V. (2020)

Angular is more reasonable for Applications with dynamic substance Enterprise applications and large applications.

### 2) React JS

Shetty, J. *et al.* (2020) reviewed ReactJS. ReactJS was a JavaScript package that created a dynamic web application. It has been created and kept up via Facebook. Respond was a productive, definitive, and adaptable JavaScript package for creating web applications. Because of React's amazing highlights, Facebook delivered React as a free-source JavaScript ES6 base package to worldwide designers and organizations in 2013 Xing, Y.K., Huang, J.P. and Lai, Y.Y. (2019). ReactJS utilizes JSX to improve on composing HTML. JSX is a pre-processor that adds XML linguistic structure to JavaScript.

The first advantage is React, a virtual DOM that accomplishes ideal proficiency by redelivering hubs as wanted. Another point is that functional programming of response helps in making reusable code.

The main point is that need to import libraries for state and model, as the response does not carry Out. Another disadvantage is that react moves from class-based modules and can impede Object-Oriented Programming (OOP) for engineers to feel looser.

React is a plausible structure for applications that requires fast. Applications that require adaptability Hutagikar, V. and Hegde, V. (2020)

### 3) Vue

Shetty, J. *et al.* (2020) the topic of Vue explained in this section. Vue was a platform for creating singular software applications but also user interfaces. Vue intended to exit steadily versatile engineering that spotlights on standard delivery and segment piece. Vue expands HTML with HTML ascribes called "directives".

The first advantage is that Vue.js assists with generally building expansively secluded. Another point is its reactivity is perhaps the most grounded highlight of Vue.js, and Vue is treating unique two-way information restricting like nothing else at the point when the information is refreshed, the DOM ought to consistently be altered as needs be, which is ideal for SPA Hutagikar, V. and Hegde, V. (2020).

The first drawback is that compared to Respond or Angular, Vue.js just has a moderately low portion of the overall industry, which implies that data trade in this structure is just in the beginning phases. Another point is the risk of being over-adaptable while coordinating with enormous ventures because of the absence of assets.

Vue.js is more reasonable for applications such Lightweight applications, when there is a prerequisite to incorporate into existing applications, Where speed is a primary boundary.

Table 2 displays how each platform and library handles data binding.

Table 01: 2021 Related Framework Version

Frameworks	Version
Vue	3.0.7
Angular	11.2.3
React	17.0.1

Table 02: Comparison of angular js and react js

Criteria of comparison	ReactJS	AngularJS
Level	A fantastic JavaScript package	JavaScript platform with excellent performance
Why make a choice?	if the "everything is JavaScript" method	if you are coding in typescript
originators	Preserved by Facebook	Preserved by google
Learning experience.	Compared to angular, it is a lot easier to understand.	Rough learning process
design	according to virtual DOM	according to the model view controller
in writing	JavaScript	Typescript
Help from the community	excellent support from the community	excellent support from the community
popular	utilized by 75% of programmers	utilized by 20% of programmers

Table 03: Front-end frameworks with data binding

	Vue	Angular 1	Angular 2	React
Data Binding	One-way/Two-way	Two-way	One-way & Two-way	One-way

Table 04: Performance of front-end frameworks and library memory allocation

Activity	React	Vue	Angular 2
Run memory	9.7 +_0.1 (2.6)	7.5+_0.1 (1.9)	10.9+_0.1 (2.7)
Ready Memory	4.5+_0.1 (1.3)	3.8+_0.0 (1.1)	4.8+_0.0 (1.4)

#### 4) Next JS

With production-ready capabilities like server-side rendering, Typescript support, smart bundling, route prefetching, etc., Next.js combines developer experience. There are numerous crucial aspects to Next.js. Hot code reloads, often known as the capacity of the Next.js server to recognize updated files and immediately reload them, are the initial feature. Since the files must be placed in the pages folder and are mapped to all URLs with the option of customization, automatic routing is another feature that does away with the requirement to set up URLs for routing. For online applications that demand speedy load times, next.js is used to construct landing pages, SEO-friendly websites, e-commerce storefronts, and other web apps. Dinku, Z. (2022)

### B. BACK-END FRAMEWORKS

Shetty, J. *et al.* (2020) discuss the back-end framework. Back-end platforms were assessed by their programming techniques, backed dialects, and interfaces. Likewise, platforms that give work in devices and formats assist originators after numerous web progression speedily completing projects. An excellent level back-end configuration assembles the headway speed, which saves time. These frameworks should allow originators to make interoperable applications that can build the obligation

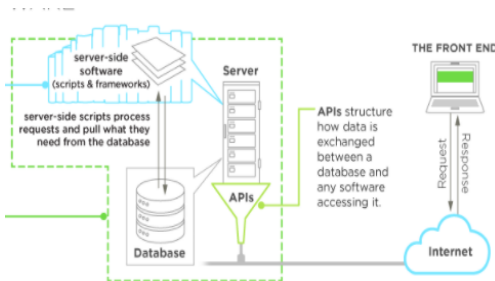


Figure 03: Back-End Development

#### 1) Node.js

Shetty, J. *et al.* (2020) reviewed Node.js. NodeJS is a publicly released climate with an extraordinary number of clients worldwide that add to its archive or bundles or modules. These days, Node.js is dynamically becoming a go-to innovation for various organizations. Another thing is that Node.js is an offbeat occasion-driven JavaScript runtime intended to fabricate adaptable organization applications. It upholds the treatment of numerous associations simultaneously. Get back to is set off for every association, and it sleeps if there is no work to be finished.

The first benefit is that it is tremendous respect for execution. Another one has a strong Angular-like design. The Disadvantages of Node.js is that the, absence of documentation, absence of local area support.

#### 2) Django

Linowes, J.S. (2007) this paper discusses Django's introduction. Django is a web structure dependent on the python programming language. It deals with a large part of the battle of web application advancement, permitting engineers to zero in on composing the real business rationale of the application without expecting to waste time. It is unimaginably flexible. Django deals with numerous important undertakings of web improvement like client confirmation, website maps, content organization, and RSS (Really Simple Syndication) channels Shetty, J. *et al.* (2020). Something that Django is "popular" for is its implicit authoritative highlights. The system can produce a pleasantly planned arrangement of administrator pages to make, recover, update, and erase (CRUD) things in the model. It can likewise look, channel, and sort the rundowns. Every model presented to the admin class shows up on the administrator/landing page. Dissimilar to Rails' platform, the administrator is cleaned sufficiently that it very well may be given to end clients in a creation site.

#### 3) Ruby on Rails.

Dawson, K. (2010)], this paper discusses Ruby on rails. The Ruby language and the Ruby on Rails framework are both free. Ruby, for the most part, alluded to as Rails for short, is much more current than the Ruby language in reality. Ruby (the language) was first delivered in 1993, while the primary rendition of Rails (the structure) was not delivered until 2004. The Rails system, including the just-delivered Rails 3.0.

#### 4) Laravel

Laravel 5 is ideal for PHP designers who need to make a quick model just as an enormous scope project later. The learning curve is also not so steep because its documentation is very comprehensive and precise. The Laravel people group is likewise enormous, and web engineers can undoubtedly discover responses to their inquiries and assets on the web. Laravel 5 is a full-stack and rich element web structure, and it has all that web engineers may require. From advancement climate, information base movement, and MVC structure. It is worth specifying that Laravel is outfitted with the craftsman, who has an exceptionally

Table 05: Comparison of node.js and Django

Criteria of comparison	Django	NodeJS
costs	free and open sources	free and open sources
scale	lower scalability	more scalability relatively
structure	model -template -view	programming based on events
protection	It is new, and it has powered by Node.js.	Many nations use node.js, and it has a competitive advantage.
performances	Its performance is excellent.	Its performance has improved.
complexities	It is a little more complicated than Node.js.	It is a simpler version.

convenient toolset. The system additionally accompanies its ORM (Eloquent), a lovely and straightforward Active Record execution. Also, Laravel 5 is exceptionally simple to test, contrasting with Laravel 4 (Nguyen, 2015).

The first benefit is that applications requiring a dark back-end are more appropriate to make with Laravel, whether enormous or little in scale. Another one is a transient box, estate prepackaged in Laravel that made it simpler to work. And speed, security, and consistent data migration.

Table 06: In terms of MVC Architecture, there is a comparison between PHP and the .net framework.

NO	Criteria	PHP	ASP.NET
1	page load time	676	370
2	The transmission speed of response	0.101	0.612
3	time till the first byte	383	213
4	speed of transfer request	5.93	10.68
5	time till the last byte	293.47	165.69

The results of the tests are displayed in Table 6. It indicates that a web application built with .net produced better results in page load time, time to the first byte, and time to the final byte compared to a PHP-based web application. The PHP-based site, on the other hand, provides substantially better results in terms of solicitation and response time Jailia, M. (2016)

### 5) Spring Boot

Microservices work well with Spring Boot, but huge monolithic systems are not recommended. Direct deployment of the artifacts into Docker containers is possible. Web application development is made simpler with Spring Boot. A

cutting-edge web development paradigm that facilitates the improvement of server-side UI apps, REST APIs, and bidirectional, event-based frameworks are supplied in standard code and setup connected to web advancement. Developers may monitor and get insight into the application with the use of spring's production-ready capabilities, such as health status monitoring, metrics reporting, and tracking. Shetty, J. *et al.* (2020)

It supports a variety of widely used authentication methods, including LDAP (Lightweight Directory Access Protocol), OAuth, and SAML (Security Assertion Markup Language). Numerous relational and non-relational databases, cloud-based data services, and frameworks for map-reduce operations like Spark, Flume, etc. are supported. Java, Kotlin, and Groovy are all supported by spring.

## IV. CONCLUSION

Each web framework, information base, and web framework have benefits and drawbacks. The picking of web framework ought to be done dependent on many essential components like time expected to take the item to advertise, long haul adaptability and upkeep, simplicity of writing computer programs, and engineer's capability with the advancements. So, every one of these variables is imperative to be thought of while building present-day web applications.

This paper examined the appropriateness of the front-end frameworks and back-end frameworks for creating Web applications. The front-end frameworks Angular, Vue.js, and React described their advantages and disadvantages. The back-end frameworks NodeJS, Laravel, Ruby, and Django described their advantages and disadvantages. The criteria for the selection of a specific framework were identified.

## REFERENCES

- DEVELOPING BACK-END OF A WEB APPLICATION WITH NESTJS FRAMEWORK* Case : Integriify Oy ' s student management system, 2020
- (Nguyen, 2015) *BUILDING A WEB APPLICATION WITH LARAVEL 5* & middot; PDF file Bean, Laravel 5 Essentials, page 8) View is the layer that presents data in suitable and in the desired format for - [PDF Document]. [online] Available at: <https://vdocuments.mx/quang-hung-nguyen-building-a-web-application-with-laravel-5-bean-laravel-5-essentials.html>

Gallardo, C. (2011) 'Bachelor thesis Web Development Frameworks'.

Cui, W. et al. (2009) 'The Research of PHP Development Framework Based on MVC Pattern', in *2009 Fourth International Conference on Computer Sciences and Convergence Information Technology*, pp. 947–949. doi:10.1109/ICCIT.2009.130.

Shetty, J. et al. (2020) 'Review Paper on Web Frameworks, Databases and Web Stacks', *International Research Journal of Engineering and Technology (IRJET)*, pp. 5734–5738

Hutagikar, V. and Hegde, V. (2020) 'Analysis of Front-end Frameworks for Web Applications', *International Research Journal of Engineering and Technology (IRJET)*, 07(04), pp. 3317–3320. Available at: <https://www.irjet.net/archives/V7/i4/IRJET-V7I4639.pdf>

Xing, Y.K., Huang, J.P. and Lai, Y.Y. (2019) 'Research and analysis of the front-end frameworks and libraries in e-business development', *ACM International Conference Proceeding Series*, pp. 68–72. doi:10.1145/3313991.3314021.

Ollila, R. (2021) 'MSc thesis Master's Programme in Computer Science A performance comparison of rendering strategies in open source web frontend frameworks'.

Linowes, J.S. (2007) 'Evaluating Web Development Frameworks : Rails and Django', pp. 1–45.

Dawson, K. (2010) 'An Introduction to Ruby on Rails', pp. 1–64. Available at: [http://www.ita-software.com/papers/borup\\_ruby\\_published.pdf](http://www.ita-software.com/papers/borup_ruby_published.pdf).

He, R.Y. (2015) 'Design and Implementation of Web-Based on Laravel Framework', *Proceedings of the 2014 International Conference on Computer Science and Electronic Technology*, 6(Iccset 2014), pp. 301–304. doi:10.2991/iccset-14.2015.66.

Julia, M. (2016) 'Behavior of MVC ( Model View Controller ) based Web Application developed in PHP and . NET framework'.

Plekhanova, J. (2009) 'Evaluating web development frameworks: Django, Ruby on Rails and CakePHP', *Institute for Business and Information Technology, (September)*, p. 20. Available at: <http://ibit.temple.edu/wp-content/uploads/2011/03/IBITWebframeworks.pdf>.

Dinku, Z. (2022) 'React.js vs. Next.js', (May).