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# PERFORMANCE ANALYSIS BETWEEN INTERPRETED LANGUAGE-BASED (LARAVEL) AND COMPILED LANGUAGE-BASED (GIN) WEB FRAMEWORKS

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ABSTRACT

*Web frameworks are essential for web developers, allowing them to build web applications more efficiently and effectively. This research paper compared two web frameworks with different programming language implementations: interpreted programming language and compiled programming language. PHP/Laravel was chosen as the representative interpreted programming language, and Go/Gin was chosen as the representative compiled programming language, because they were the most popular based on their star counts on GitHub. Based on a research paper by the University of Minho, Go was nearly 10 times faster than PHP in terms of execution time. Despite this, PHP is still the most commonly used web technology among the top 1 million websites. The results of a series of tests comparing the two showed that Gin was over 86 times faster than Laravel in terms of requests per second and time per request. The choice of which web framework to use will depend on the specific needs and goals of the project. However, if performance is the only criterion, then Gin is a better choice than Laravel.*

## I. Introduction

Web frameworks have played a crucial role in the world of web development. Web frameworks help developers write web applications faster and easier than without one. Web frameworks are now even taught academically. Web frameworks can benefit students in learning server-side programming, as they provide a more intuitive and organized way to develop web applications. A study in which the researchers compared the use of web frameworks in a server-side programming course with a traditional approach, and it was found that students using web frameworks performed significantly better on various assessment measures [1].

Web frameworks are usually divided into front-end or client-side and back-end or server-side. The front-end or client-side is run on the user's web browser, and the back-end or server-side is run on a web server. The web server executes some processes to create the document sent to the user to be displayed by the web browser.

There are many programming languages and web frameworks to choose from nowadays. Programming languages are generally divided into two categories based on their implementation: interpreted and compiled. In interpreted programming languages, the source code is executed directly by an interpreter, which translates each statement into machine code as it is executed. In compiled programming languages, the source code is first transformed into machine code by a compiler, which is then executed by the computer [2]. Compiled languages tend to be the fastest among programming languages [3]. Other than being faster, they are also more energy efficient [4].

This research paper compared two web frameworks: Laravel (written in PHP) and Gin (written in Go). Laravel was chosen as the representation of interpreted programming language-based web framework, while Gin was chosen as the representation of compiled programming language-based web framework. These choices were based on the number of stars each framework had on GitHub, as they were the most popular in their respective categories when the research paper was written [5].

Taken from the normalized global results table in a research paper by the University of Minho, Go, a programming language developed by Google, took 2,83 milliseconds to run a series of tests. In contrast, PHP, a programming language commonly used for web development, took 27,64 milliseconds to run the same tests. The difference in execution time between the two languages suggests that Go is almost 10 times faster than PHP in running the same tests [6]. However, PHP is still the most used web technology in the top 1 million websites [7].

Laravel is a free and open-source PHP web application framework designed to develop web applications following the model-view-controller (MVC) architectural pattern. One of its key features is its extensive use of Composer, a dependency management tool for PHP. This allows developers to manage the libraries efficiently and packages their application depends on, making it easier to install and update dependencies as needed. It also includes a built-in command-line interface (CLI) called Artisan, which provides several valuable tools for tasks such as database migrations and seeding, as well as application deployment. It is known for its elegant syntax and easy handling of complex applications. It includes several features that make it easier for developers to build applications, including routing, middleware, blade templates, and job queues. It also includes support for several databases and cache systems, making it a versatile and robust framework for web development [8]. Laravel is also the best performer among other PHP web frameworks [9].

Gin is a high-performance HTTP web framework written in Go designed to be simple and easy to use while providing a powerful and flexible set of features for building distributed applications. One of its key features is its fast request-response cycle, which makes it well-suited for building high-traffic web applications. It also has a lightweight and minimalistic design, focusing on simplicity and performance. This makes it easy for developers to get up and running with Gin quickly and to build and deploy applications with minimal overhead. It includes several built-in middleware functions for tasks such as logging, error handling, request validation, and custom middleware support. It also has a powerful routing system, which allows developers to easily define and handle different HTTP verbs and routes in their applications [10].

Laravel and Gin are two web frameworks that are built using different programming languages and have their own unique features and capabilities [11]. As such, it can be difficult to compare them directly in terms of their overall functionality and capabilities. In this research paper, the focus was specifically on comparing the performance of Laravel and Gin, rather than trying to compare the frameworks as a whole. The interest was to understand whether the programming languages used to build these frameworks would have any impact on their performance, and whether one framework might be faster or more efficient than the other. By comparing the performance of Laravel and Gin, this research paper aimed to provide insights and knowledge for developers who are considering using one of these frameworks for their web development projects and need to consider performance as a factor in their decision-making process.

## II. Methodology

The research process was conducted in seven steps:

1. Choosing the programming language and web framework for each programming language implementation to be studied.
2. Identifying the indicators for performance measurement.

3. Selecting the tool to measure these indicators.
4. Building the same app for both web frameworks.
5. Testing both web frameworks and measuring their performance.
6. Recording the test results.
7. Analyzing the results to reach a conclusion.

The web framework representing each programming language implementation was chosen based on the number of stars on its GitHub repository. Laravel (written in PHP), an interpreted programming language-based web framework, was selected with over 70000 stars on its GitHub repository. Gin (written in Go), a compiled programming language-based web framework, was chosen with over 65000 stars on its GitHub repository [5]. The versions for each software were as follows: PHP on version 8.1.13, Laravel on version 9.42.2, Go on version 1.19.3, and Gin on version 1.8.1.

The indicators for this research were requests per second and time per request. The indicators were adopted from a research paper from Riga Technical University. Some indicators were taken out because they were PHP-specific features, so they could not be performed with Go [12].

The tests were conducted using a command-line tool called ab, the same tool used by the same research. ab is a command-line tool for benchmarking the performance of a web server [13]. Version 2.3 of the tool was used for this test, as it was the built-in version of the machine.

A simple hello world webpage was built for each web framework for testing purposes. The "hello, world" text was enclosed in an h1 tag. Because this was a performance test, a simple hello world webpage was sufficient, as some researchers had done it [14], [15].

hello, world

Figure 1. "hello, world" webpage built for each web framework

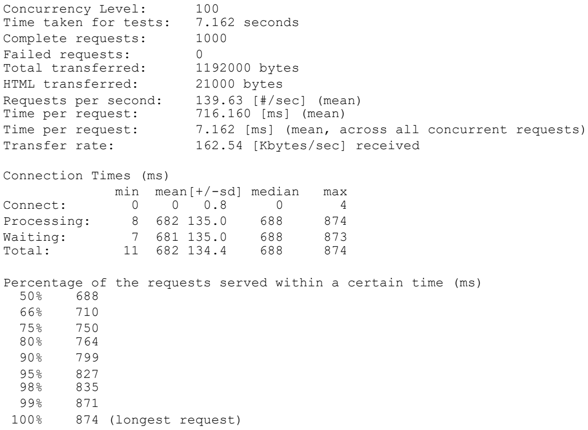
The machine used for testing was MacBook Pro (15-inch, 2019). The specification of the machine was 2,4 GHz 8-Core Intel Core i9 with 16 GB 2400 MHz DDR4 running on macOS Monterey 12.6.1. Each test was run using ab with 1000 requests and 100 concurrent requests, so the command was ab -n 1000 -c 100.

After running each test using ab for each web framework, the tool printed out the results. The results included both indicators, requests per second and time per request.

Both results were compared to each other to measure performance differences between them. Two column charts were made to visualize the results.

## III. Discussion

The following was the printed result of Laravel with ab.



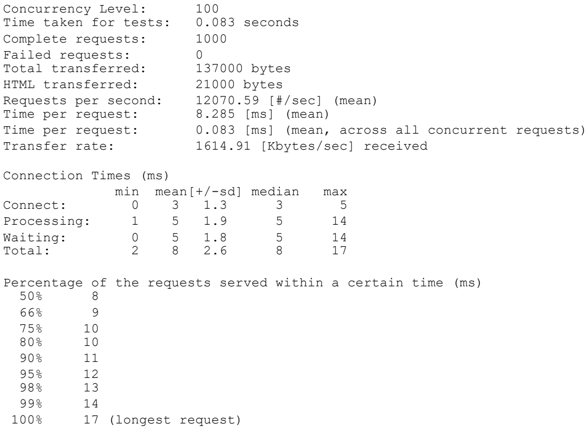
```
Concurrency Level:      100
Time taken for tests:   7.162 seconds
Complete requests:      1000
Failed requests:        0
Total transferred:      1192000 bytes
HTML transferred:       21000 bytes
Requests per second:    139.63 [#/sec] (mean)
Time per request:       716.160 [ms] (mean)
Time per request:       7.162 [ms] (mean, across all concurrent requests)
Transfer rate:          162.54 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.8      0       4
Processing:     8  682 135.0    688     874
Waiting:        7  681 135.0    688     873
Total:         11  682 134.4    688     874

Percentage of the requests served within a certain time (ms)
  50%    688
  66%    710
  75%    750
  80%    764
  90%    799
  95%    827
  98%    835
  99%    871
 100%    874 (longest request)
```

Figure 2. Output printed by ab from testing "hello, world" webpage running on Laravel

The following was the printed result of Gin with ab.



```
Concurrency Level:      100
Time taken for tests:   0.083 seconds
Complete requests:      1000
Failed requests:        0
Total transferred:      137000 bytes
HTML transferred:       21000 bytes
Requests per second:    12070.59 [#/sec] (mean)
Time per request:       8.285 [ms] (mean)
Time per request:       0.083 [ms] (mean, across all concurrent requests)
Transfer rate:          1614.91 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    3   1.3      3       5
Processing:     1    5   1.9      5      14
Waiting:        0    5   1.8      5      14
Total:          2    8   2.6      8      17

Percentage of the requests served within a certain time (ms)
  50%      8
  66%      9
  75%     10
  80%     10
  90%     11
  95%     12
  98%     13
  99%     14
 100%     17 (longest request)
```

Figure 3. Output printed by ab from testing "hello, world" webpage running on Gin

1. Requests per second

The requests per second result for Laravel was 139,63 #/sec, and for Gin was 12070,59 #/sec. Gin was more than 86 times faster than Laravel in terms of requests per second

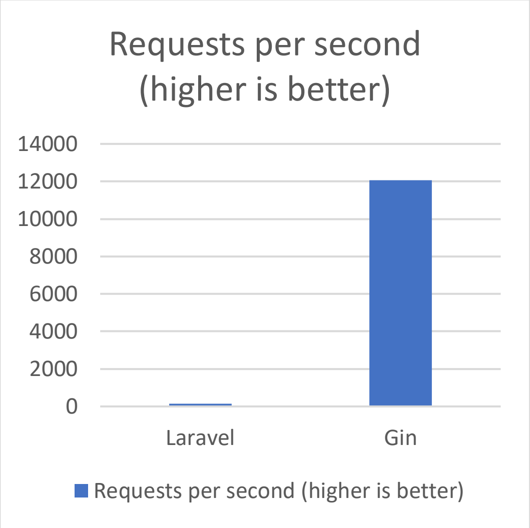


Figure 4. Column chart representing requests per second of Laravel and Gin (higher is better)

2. Times per request

The time per request result for Laravel was 7,162 ms and for Gin was 0,083 ms. Again, Gin was more than 86 times faster than Laravel in terms of time per request.

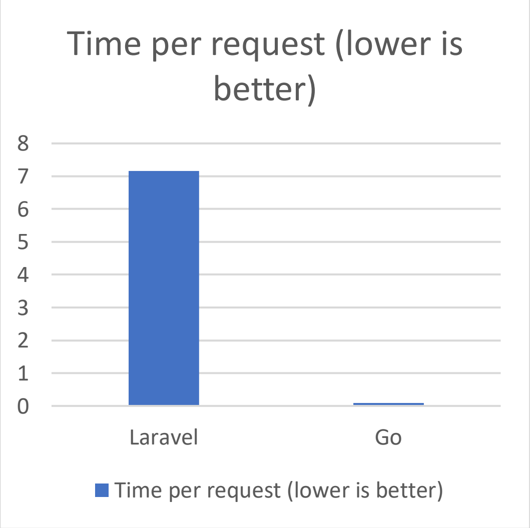


Figure 5. Column chart representing time per request of Laravel and Gin (lower is better)

The results may vary depending on the machine specification and software versions. Regardless, the result aligned with the previously mentioned research by the University of Minho. The result was even more shocking as the performance differences in both indicators were over 86 times compared to just almost 10 times by that research [6].

## IV. Conclusion

In conclusion, this research paper compared two web frameworks with different programming language implementations: PHP/Laravel as the interpreted programming language and Go/Gin as the compiled programming language. The results of a series of tests comparing Gin and Laravel showed that Gin was over 86 times faster than Laravel in terms of requests per second and time per request. While the choice of which web framework to use will depend on the specific needs and goals of the project, if performance is the only criterion, then Gin is a better choice than Laravel.

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