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Comparative Analysis of AWS EC2 and Heroku Hosting Performance on Interbank Transfer Application Using Atlantic Pedia API

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Abstract

Amazon Web Services (AWS) EC2 is a cloud computing service that offers highly flexible and customizable infrastructure, giving users complete control over specific server configurations. Heroku, on the other hand, is a platform-as-a-service (PaaS) focused on ease of use and application management, making it ideal for developers who prioritize speed and simplicity. Optimal hosting performance is crucial, especially for interbank transfer applications, which require fast response and a smooth user experience. Therefore, this study aims to compare which hosting platform is most optimal for an interbank transfer application developed using the Atlantic Pedia API. The hosting performance testing method between AWS EC2 and Heroku was conducted comprehensively using Google PageSpeed Insights. The metrics measured included performance, accessibility, best practices, and SEO for both mobile and desktop views. The analysis results show that AWS EC2 excels in the Performance metric, with a score of 97/100 for Mobile and 100/100 for Desktop. For Accessibility, both EC2 views scored 92/100, Best Practices 79/100, and SEO 91/100. Meanwhile, Heroku showed a Mobile Performance of 89/100 and Desktop 92/100, but excelled in Mobile Accessibility at 100/100, followed by Best Practices 75/100 and SEO 91/100.

1. Introduction

Amazon Web Services (AWS) Elastic Compute Cloud (EC2) has emerged as a leading Infrastructure-as-a-Service (IaaS) service. AWS EC2 offers the ability to provision virtual servers (called instances) with a variety of configurations, giving users complete control over the operating system, software, storage, and networking. This flexibility makes AWS EC2 a popular choice for many companies and developers for hosting applications that require fine-grained control and high scalability [1], [2], [3], [4].

On the other end of the cloud computing spectrum is Heroku, a platform-as-a-service (PaaS) offering a different approach. Heroku is designed to simplify application development, scaling, and management, allowing developers to focus solely on writing code without worrying about the servers behind the scenes. This PaaS model provides a preconfigured runtime environment, database, and other integrated add-ons, ideal for teams that prioritize development speed and operational efficiency [5], [6], [7], [8].

Selecting the right hosting platform is a strategic component in developing web applications that demand high performance and service reliability [9], [10]. This need becomes increasingly significant in web-based applications, such as the interbank transfer system studied in this research, because these applications require fast system response and continuous service availability to support a quality user experience. Application usage patterns involve intensive data interaction, repetitive computational processes, and real-time information presentation. If the hosting platform is unable to meet these demands, various problems will arise, such as increased page load times, processing delays, and service disruptions. This condition directly impacts user satisfaction and application operational effectiveness. Therefore, evaluating the hosting platform's ability to manage workloads and maintain stable performance is a key prerequisite for implementing reliable web applications.

Rapid advances in cloud computing have prompted numerous studies focused on analyzing hosting platform performance. One such study examined web server performance on Elastic Cloud Compute (EC2) services on Amazon Web Services (AWS) [11], [12], [13], [14] . Performance testing was conducted using a load testing approach with the help of Apache Meter, which included measuring throughput, response time, latency, and system resource utilization. The analysis results show that an AWS EC2-based web server configuration can provide optimal performance compared to several similar services, particularly when handling up to 500 user requests in 10-second intervals. However, under very high load conditions, namely a simulation of 1,000 users per second, the system experienced performance degradation to the point of being unable to maintain service stability. Furthermore, there is research analyzing application usage using Heroku hosting. Although their primary focus was on content-based filtering algorithms, the results also indicate that Heroku is a relevant choice for developers who prioritize efficiency and speed in deploying their applications to production environments, although they did not directly analyze Heroku hosting performance in depth like previous studies on AWS EC2 [15], [16].

Notably, most existing studies rely heavily on server-side load testing approaches that primarily assess backend scalability and stress tolerance. While such methods are effective for identifying system limits under concurrent user simulations, they provide limited insight into user-perceived performance, particularly for modern web applications where front-end rendering efficiency, accessibility, and best-practice compliance play a significant role in shaping user experience. Consequently, performance evaluations that neglect user-centric metrics may fail to fully represent real-world application behavior from the end-user perspective.

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To address these limitations, this study proposes a user-centric performance evaluation approach using Google PageSpeed Insights. Unlike conventional load testing tools, PageSpeed Insights assesses application performance based on front-end performance indicators and web best practices, including performance, accessibility, best practices, and search engine optimization (SEO) metrics across both mobile and desktop environments. Although this approach does not simulate high concurrent user loads, it provides valuable insights into performance aspects directly perceived by users. Therefore, this method is positioned as a complementary evaluation technique rather than a substitute for load testing.

Furthermore, this study presents a direct comparative analysis between AWS EC2 (IaaS) and Heroku (PaaS) hosting platforms within the context of a Laravel–Flutter-based interbank transfer application. The comparison across different cloud service models, combined with a user-experience-oriented evaluation framework, constitutes the primary novelty of this research. By integrating standardized web performance metrics with a transaction-intensive application scenario, this study aims to fill the research gap left by prior works and provide a more comprehensive understanding of hosting platform suitability for high-performance financial web applications.

2. Methods

This section will explain the methods of the proposed research, starting from system requirements analysis, system planning, application development, deployment on hosting on both EC2 and Heroku, as well as hosting comparison analysis.

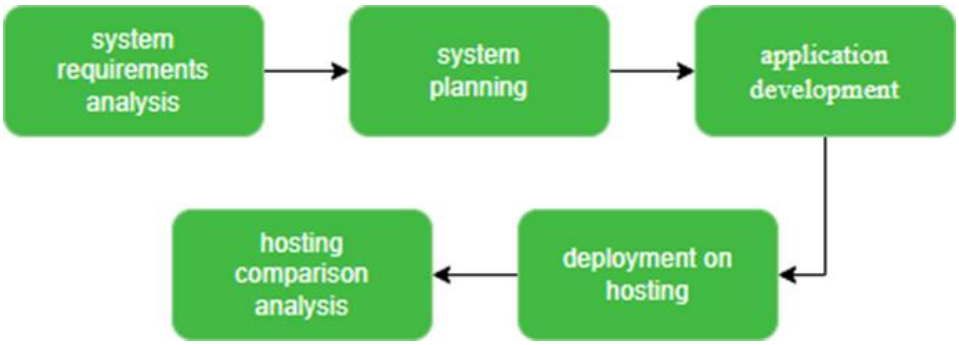

Figure 1. The methodology of this research

2.1. System requirements analysis

The first stage in this research methodology is requirements analysis. At this stage, all functional and non-functional requirements that must be met by the interbank transfer application using the Atlantic Pedia Application Programming Interface (API) are carefully identified. Functional requirements include authentication and authorization, an interbank transfer transaction module with a strict account and nominal data validation process, and a transaction management module capable of accurately recording, monitoring, and displaying transaction status based on responses from the Atlantic Pedia API. Meanwhile, non-functional requirements focus on the quality aspects of the application, including performance, security, and usability. Furthermore, technical specifications for the hosting performance testing environment are also established, such as minimum resource requirements for the application and initial server configuration on both platforms. The purpose of this analysis is to ensure that the application to be built and tested can represent real-world usage scenarios and meet the quality standards required for accurate comparison.

2.2. System planning

Once the application requirements are clearly identified, the next step is to build the system design. At this stage, these requirements are translated into a structured and detailed system architecture design. Figure 2 below shows the system architecture of an interbank transfer application using the Atlantic Pedia API. This interbank fund transfer system architecture is designed using a tiered approach that prioritizes modularity and separation of concerns, divided into three main domains: the client interface, core business logic, and third-party executors. Transaction initiation begins at the Users & Clients layer (Mobile App/Web UI), where the transfer request is sent securely using the HTTPS protocol (Step 1) to a backend system hosted in a cloud environment such as AWS EC2 or Heroku. At the Backend System layer (Green Box), the request is first processed by the API Gateway & Load Balancer for initial authentication and load distribution. Next, the request is forwarded to the Transaction & Business Logic Service, which serves as the primary orchestrator. This service is responsible for validating the availability of funds and recording the initial status of the transaction as pending before interacting with external services.

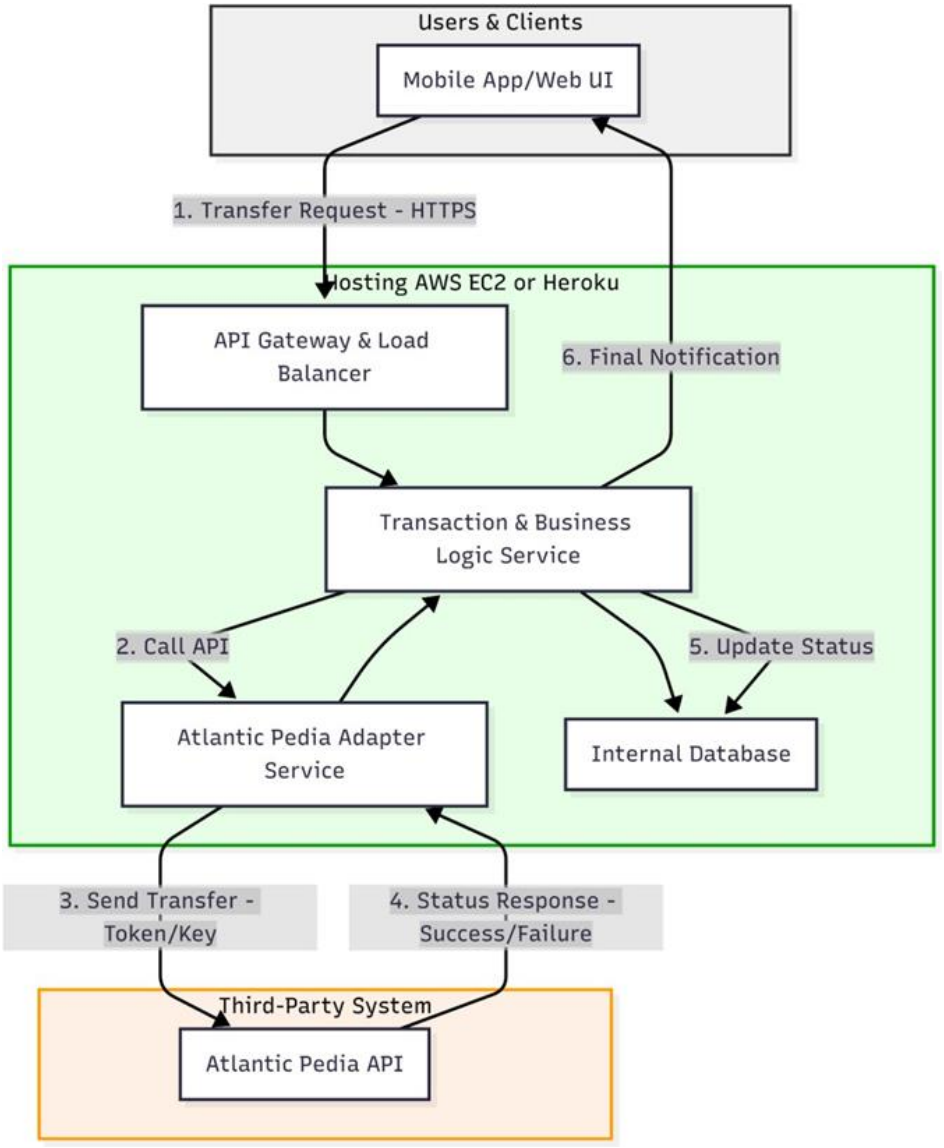

Figure 2. System Architecture of interbank transfer application using Atlantic Media API

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2.3. Application development

The application development phase is the concrete implementation of the system design created in the previous phase. At this stage, the interbank transfer application using the Atlantic Pedia API was developed using the Laravel framework version 12 as the website admin page and Flutter to create the mobile application. Laravel was chosen for its ability to accelerate web development, support for a structured Model-View-Controller (MVC) architecture, and a rich ecosystem of libraries and tools. The development process includes writing source code, integrating with a database, and implementing all functional features defined during the requirements analysis. The application is designed to be efficient and responsive, making it a representative unit test when evaluated in different hosting environments. Internal testing, such as unit testing and integration testing, is also conducted periodically to ensure the application's basic functionality runs as expected before entering the deployment and performance analysis phase.

2.4. Deployment on hosting

After the interbank transfer application using the Laravel-based Atlantic Pedia API was completed and tested internally, the next step was deployment to the two hosting platforms being compared: Heroku and AWS EC2. The system architecture used in this deployment involved a Laravel 12 backend that provided an API, connected to an AWS Aurora RDS MySQL database, and accessed by a Flutter UI/UX frontend.

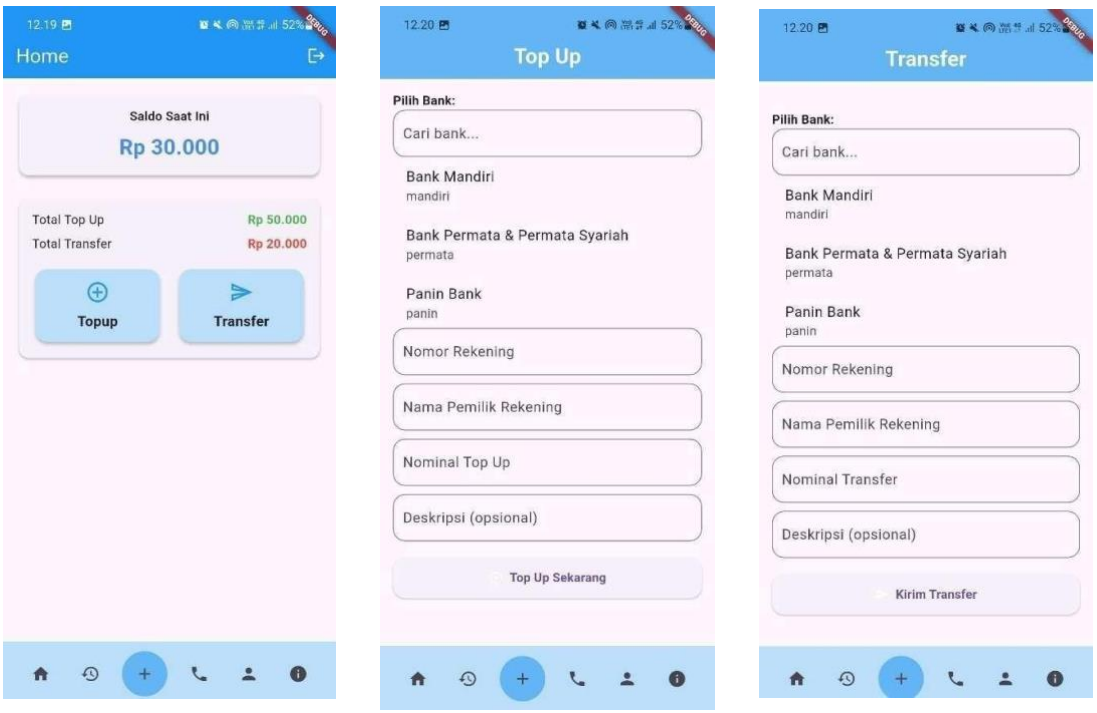
For the Heroku deployment, the process utilized Platform-as-a-Service (PaaS) features, simplifying code pushes from a Git repository. Heroku automatically managed the underlying infrastructure and ensured connectivity to a separately configured AWS Aurora RDS MySQL database. Meanwhile, the AWS EC2 deployment involved manual virtual server configuration. This included selecting the appropriate instance type, installing an operating system (e.g., Ubuntu Server), configuring the web server (Apache or Nginx), configuring PHP for the Laravel 12 backend, and ensuring secure connectivity to the AWS Aurora RDS MySQL database. The goal of this deployment was to create a functional and publicly accessible hosting environment on both platforms, allowing for performance comparisons under real-world operational conditions with the same database.

2.5. Hosting comparison analysis

The final and most crucial stage is a comparative hosting analysis. At this stage, web performance testing is conducted on an interbank transfer application using the Atlantic Pedia API that has been deployed on Heroku and AWS EC2. Testing is carried out comprehensively using Google PageSpeed Insights. The metrics analyzed include performance (measuring page loading speed and responsiveness), accessibility (evaluating how easily the application can be accessed by users with various abilities), best practices (assessing the application's compliance with the best web development standards), SEO (Search Engine Optimization) to examine factors that affect application visibility in search engines. This testing is carried out for both Mobile and Desktop views to obtain a complete and comprehensive picture. The results of this comparative analysis are expected to identify significant differences in performance between AWS EC2 and Heroku, as well as provide in-depth insights into which hosting platform is more optimal for interactive web applications with similar characteristics.

3. Results and Discussion

This section will explain the results of creating an interbank transfer application using the Atlantic Pedia API, as well as the results of a comparison of hosting options, including AWS EC2 and Heroku. Figure 3 shows the interbank transfer application using the Atlantic Pedia API, including the homepage, top-up feature, and transfer page. The application was built using Flutter for mobile development. The backend was built using Laravel and a MySQL database [17][18].



(a) (b) (c)

Figure 3. Home page (a), Top Up Feature (b). Transfer page (c)

To determine whether the application's performance is running well or not, an analysis was conducted using four parameters: performance analysis, accessibility analysis, best practice analysis, and SEO analysis. Testing was conducted using PageSpeed Insights, and by comparing it with other applications such as Flip. Figure 4 is a performance comparison analysis between the developed application and the existing Flip application. The results show that the proposed application performs better than Flip, with a score of 92 compared to 60. Figure 5 shows the comparison results in terms of accessibility. The proposed application also has a higher accessibility level than Flip. Meanwhile, for the best practice and SEO parameters, the proposed application has a lower score than Flip. This is because the Flip application has been released for a long time and has quite a lot of users. Therefore, in terms of usage and improvements, it has often been made according to user input, both regarding the user interface and user experience. The results of the analysis related to best practice and SEO are shown in figures 6 and 7.

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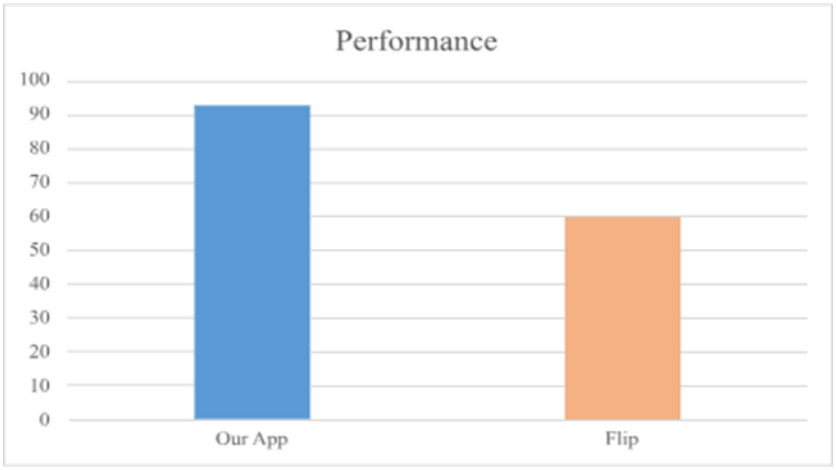

Figure 4. Comparison of Performance

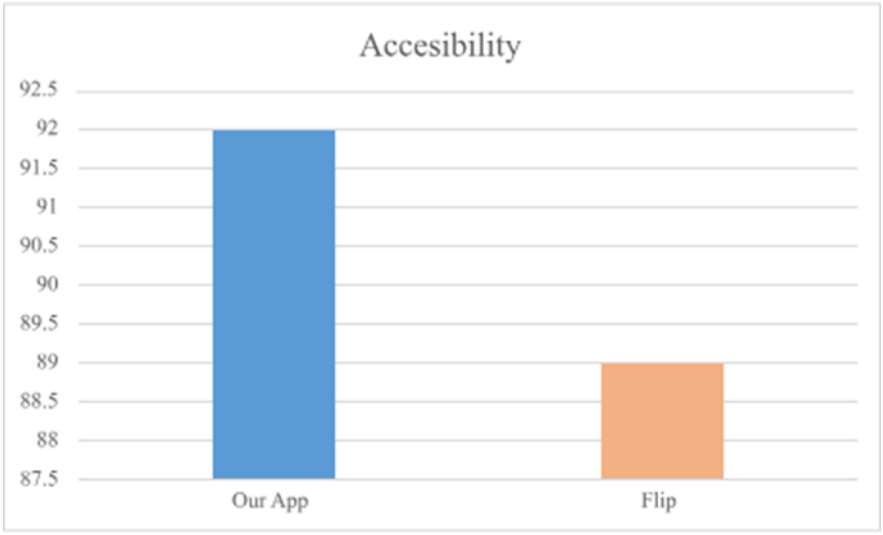

Figure 5. Comparison of accesibility

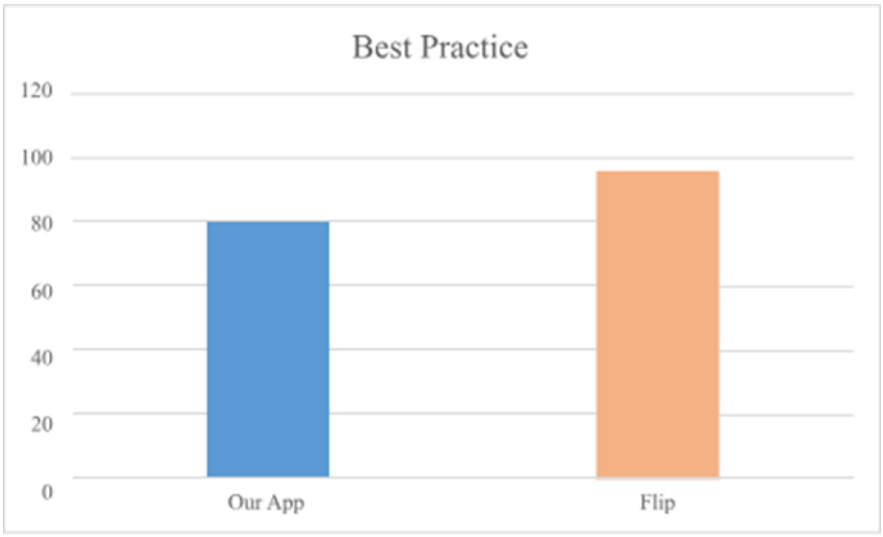

Figure 6. Comparison of best practice

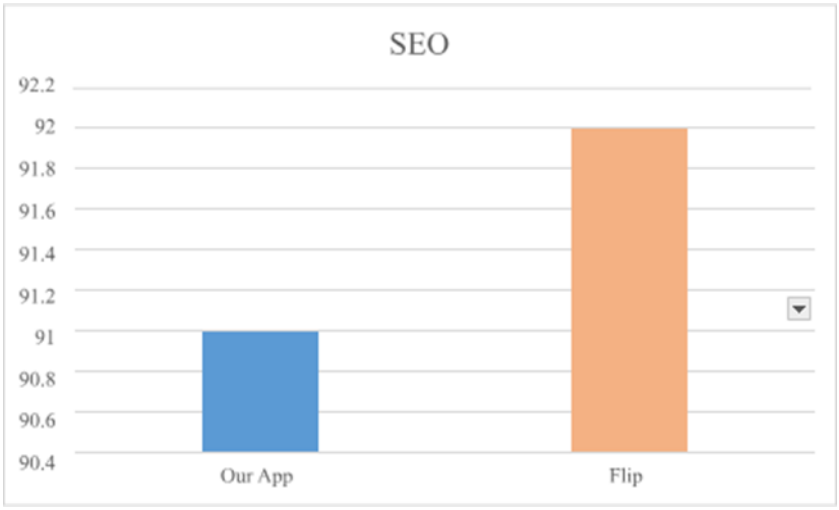

Figure 7. Comparison of Search Engine Optimization (SEO)

In addition to analyzing trials comparing other applications, such as Flip, this study also analyzed the performance of the hosting used. The trials compared hosting using the EC2 service on AWS with hosting using Heroku. Figures 8 and 9 represent analysis graphs comparing EC2 and Heroku performance data collected through Google PageSpeed Insights, including Performance, Accessibility, Best Practices, and SEO metrics for mobile and desktop views.

In terms of Performance metrics, AWS EC2 consistently outperforms Heroku, including achieving the highest score in the Desktop test. These results indicate that the Infrastructure-as-a-Service (IaaS) environment on AWS EC2 is capable of providing low latency and more stable processing throughput. The flexibility in selecting instance types, allocating computing resources, and utilizing high-performance storage allows for more specific system optimizations, positively impacting page load speeds and application responsiveness, especially under intensive workload conditions. In contrast, Heroku, as a Platform-as-a-Service (PaaS), offers easy infrastructure management, but limited control over basic server configuration can potentially limit performance optimization to a low level, reflected in its slightly lower Performance score.

In the Accessibility aspect, Heroku performed very well, with perfect scores across all test scenarios. This indicates that the Heroku environment implicitly supports compliance with web accessibility standards. Meanwhile, AWS EC2 also scored highly, although not on par with Heroku. This difference is likely influenced more by application configuration and development practices than by the characteristics of the hosting platform itself.

For the Best Practices metric, AWS EC2 scored slightly higher than Heroku. This advantage reflects the benefits of greater infrastructure control in implementing security practices and application optimization. However, the difference in scores on this metric is relatively small and does not represent a practical difference. In the Search Engine Optimization (SEO) metric, both platforms scored identically. This finding confirms that SEO performance is more determined by the content structure and implementation of Laravel applications than by the type of hosting platform used.

Overall, the research results indicate that AWS EC2 is more suitable for Laravel applications that require high performance and fast responsiveness, especially for applications with intensive user interaction. On the other hand, Heroku remains a

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competitive alternative for application development that prioritizes ease of deployment and accessibility compliance. Therefore, the choice of hosting platform should be tailored to the performance requirements and characteristics of the application being developed. This research provides an empirical contribution to selecting the right hosting platform for developing interactive web applications based on Laravel.

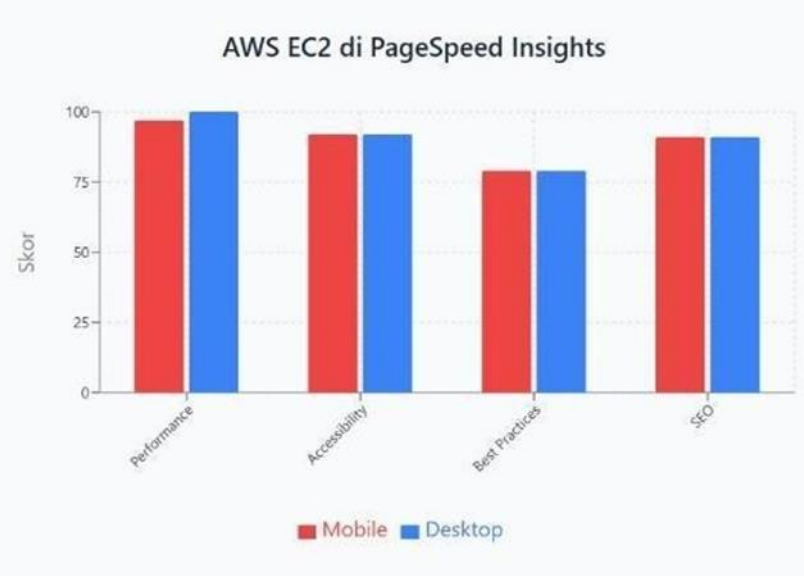

Figure 8. AWS EC2 performance analysis in PageSpeed Insight

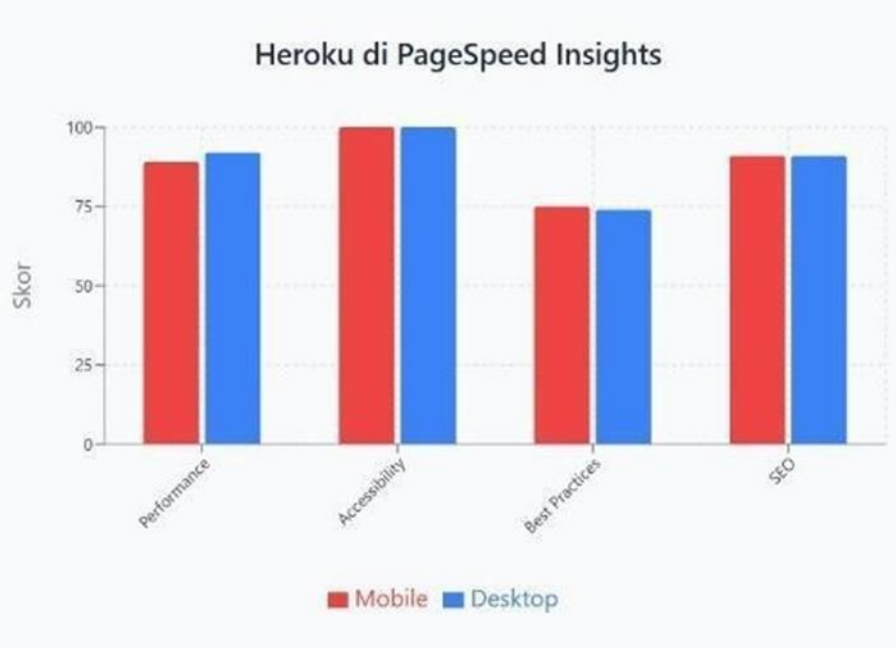

Figure 9. Heroku performance analysis in PageSpeed Insight

Table 1 presents the PageSpeed Insights performance comparison between AWS EC2 and Heroku. The results indicate that AWS EC2 achieves superior scores in the Performance metric, attaining 97/100 on mobile and a perfect score of 100/100 on desktop. In terms of Accessibility, AWS EC2 records consistent scores of 92/100 for both display modes, with Best Practices and SEO scoring 79/100 and 91/100, respectively. Conversely, Heroku demonstrates slightly lower Performance scores, with 89/100 on mobile and 92/100 on desktop, but outperforms AWS EC2 in Mobile Accessibility by

achieving a perfect score of 100/100, while recording 75/100 for Best Practices and an equivalent SEO score of 91/100.

Table 1. Analyze performance between EC2 and Heroku in PageSpeed Insight

Cloud	Platform	Performance	Accessibility	Best Practice	SEO
EC2	Mobile	97	92	79	91
	Dekstop	100	92	79	91
Heroku	Mobile	89	100	75	91
	Dekstop	92	100	75	91

4. Conclusion

This study concludes that AWS EC2 and Heroku have different performance characteristics in supporting an interbank transfer application using the Atlantic Pedia API. Test results using Google PageSpeed Insights show that AWS EC2 excels in the Performance metric, reflecting greater flexibility and resource control to achieve high application speed and responsiveness. Conversely, Heroku excels in the Accessibility metric, which indicates the platform's support for accessibility standards compliance and ease of application management. In the Best Practices and SEO metrics, both platforms show relatively comparable performance, indicating that these aspects are more influenced by application implementation and development practices than the type of hosting platform. Based on these findings, AWS EC2 is more recommended for interactive web applications that prioritize performance, while Heroku is a suitable alternative for development that prioritizes ease of deployment and accessibility. Further research is recommended to involve load testing, long-term cost analysis, and security evaluations to obtain a more comprehensive picture in selecting a hosting platform.

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