# BogoGo: A Scalable E-Commerce Platform for Fashion Retail in Bogotá Using a Layered Cloud-Based Architecture

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## I. Abstract

The rapid growth of e-commerce in urban areas like Bogotá has created a need for digital platforms that connect local vendors with consumers while ensuring accessibility, performance, and trust. This work proposes BogoGo, a fashion-focused e-commerce platform designed with a modular, scalable architecture that leverages modern web technologies, cloud infrastructure, and secure payment and logistics integrations to meet the specific needs of Bogotá's market. The system is expected to perform reliably under high demand, offering fast load times, stable operations, and a user-friendly experience across different roles, thus demonstrating its potential as a viable solution for local digital commerce.

## II. Introduction

E-commerce platforms have become a fundamental part of the global digital economy, allowing users to purchase products and services easily and conveniently through online channels. Their rapid growth in recent years has been driven by the widespread use of mobile devices, improvements in logistics, and the increasing trust of consumers in digital transactions [1], [2]. As a result, e-commerce has evolved from simple online stores to comprehensive ecosystems that connect buyers and sellers in dynamic, data-driven environments.

In this context, BogoGo is proposed as a fashion-focused e-commerce platform designed specifically for the city of Bogotá. The system connects local vendors and consumers through a centralized marketplace that supports multi-vendor management, product listings and secure transactions. The platform is built under a three-layer architecture, consisting of presentation, application, and infrastructure layers, ensuring modularity, scalability, and maintainability across its components [3], [4].

At the data layer, PostgreSQL was selected as the primary relational database due to its proven efficiency and scalability in handling transactional and analytical workloads. Comparative studies have shown that PostgreSQL performs better than MySQL in insertion and deletion operations with large datasets, maintaining lower response times and improved scalability [5]. These findings highlight its suitability for high-volume e-commerce environments where data consistency and integrity are vital. Moreover, Amazon S3 is integrated for object storage, supporting the management of digital assets such as product images, videos, and banners. This approach allows the platform to separate structured and unstructured data efficiently while benefiting from AWS's high durability and global availability [6].

The application layer was chosen to be developed with NestJS or Node.js. provides the business logic that connects the user interface with backend services, including payment gateways (e.g., Mercado Pago) and shipment APIs. On the presentation layer, Next.js is used to create a fast and responsive user experience, enabling server-side rendering and improved SEO for product visibility. Similar approaches have been used in prior e-commerce implementations on AWS that successfully leveraged cloud-native architectures to achieve performance and fault tolerance [7].

By combining modern frameworks, cloud infrastructure, and relational database technologies, the BogoGo project contributes to the academic and practical understanding of scalable e-commerce system design. It not only emphasizes system performance and user experience but also integrates analytical capabilities to support managerial decision-making and operational optimization.

## III. Method and Materials

The proposed e-commerce platform, BogoGo, will be designed and implemented under a three-layer architecture that will ensure modularity, scalability, and maintainability. Each layer will fulfill a distinct role within the system, facilitating independent development and efficient communication between components.

The presentation layer will be developed using React or Next.js, which will be selected for their ability to create dynamic, responsive, and component-based interfaces optimized for mobile devices—the primary medium through which most users will access online platforms in Bogotá. This layer will be responsible for rendering the user interface, managing navigation, and handling user interactions, including product browsing, shopping cart operations, and checkout processes. By leveraging server-side rendering and route optimization from Next.js, the platform will achieve fast page loads and enhanced SEO performance. Communication between this

layer and the backend will occur exclusively through RESTful APIs, ensuring security and separation of concerns.

The application layer will serve as the system's core, managing business logic and coordinating communication among modules. It will be implemented using NestJS, a TypeScript-based framework built on Node.js, chosen for its modular structure, scalability, and maintainability. NestJS will enable well-organized development through features such as dependency injection, modular controllers, and structured service layers. Within this layer, the main business processes will be executed, including authentication, product management, order processing, and vendor rating. Integration with external services will be handled through secure APIs — most notably with Mercado Pago for payment processing and Servientrega or InterRapidísimo for logistics operations. Mercado Pago will be chosen due to its regulatory compliance in Colombia and its support for multiple payment methods commonly used by local consumers. Authentication and role management will be implemented using JWT-based security protocols, ensuring reliable access control for administrators, vendors, and customers.

The infrastructure layer will support the platform's storage, data management, and deployment needs. It will use PostgreSQL as the primary relational database, selected for its ACID compliance, strong analytical capabilities, and scalability in managing structured data such as users, vendors, products, and transactions. For multimedia content like product images and banners, AWS S3 will provide secure and cost-efficient object storage. Hosting and deployment will be managed through Amazon Web Services (AWS), taking advantage of services such as Elastic Compute Cloud (EC2), Elastic Kubernetes Service (EKS), and Auto Scaling Groups, which will guarantee fault tolerance and high availability. The architecture will support horizontal scalability through containerized microservices, ensuring that critical components like authentication or product catalog services can be scaled independently according to demand.

The data flow between layers will follow a secure and structured path: user requests will originate in the presentation layer, will be processed by the application layer, and will reach the infrastructure layer only when necessary. This controlled flow will ensure efficient data handling and preserve system integrity. Furthermore, the architecture will support real-time analytics and monitoring through AWS-managed tools, allowing vendors and administrators to access updated business intelligence dashboards for decision-making.

This approach will be selected to balance performance, maintainability, and cost-efficiency, providing a foundation for long-term scalability. The modular design will facilitate independent service updates and future integration with artificial intelligence components such as personalized recommendation systems or demand forecasting. The system will assume the availability of stable internet connectivity, the cooperation of logistics providers, and compliance with Colombian e-commerce and financial regulations. Figure 1 presents an overview of the platform's layered architecture and data flow. This solution is expected to perform effectively within Bogotá's emerging e-commerce ecosystem due to its alignment with both the city's digital infrastructure and consumer behavior. By leveraging widely adopted technologies such as AWS, PostgreSQL, and NestJS, the system ensures reliable operation even under variable connectivity conditions common in urban Colombian environments. The modular and scalable design allows the platform to grow alongside local businesses, providing vendors with accessible digital tools and real-time analytics to improve decision-making. Furthermore, the integration of familiar payment methods like Mercado Pago and established logistics partners ensures usability and trust among Colombian users. Overall, this architecture not only supports the technical requirements of a modern e-commerce system but also adapts to the social, economic, and infrastructural realities of Bogotá, making it a feasible and sustainable technological solution.

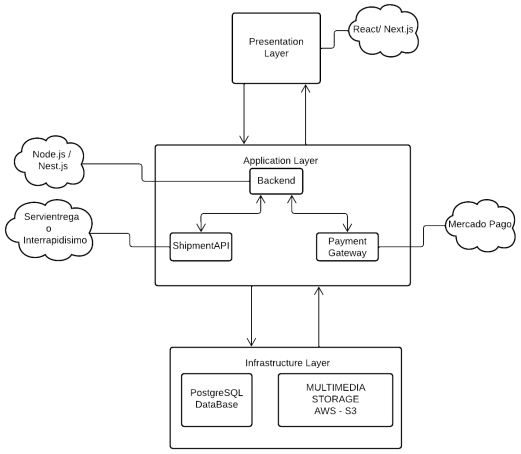


Fig. 1. First version of high-level architecture diagram

## IV. Results & Discussion

To validate the functionality and performance of the proposed BogoGo e-commerce platform, a comprehensive set of unit, integration, and acceptance tests will be designed and planned to ensure that the system meets its functional and non-functional requirements once implemented. These tests are expected to verify that core operations such as product browsing, order processing, payments, and user authentication will perform correctly under both typical and peak usage conditions.

The main objective will be to confirm seamless and secure data exchange across all layers of the system.

During the acceptance testing phase, simulated user sessions will be conducted for each role: customers, vendors, and administrators. It is expected that customers will be able to register, search for products, and complete purchases using test payment credentials; vendors will manage their catalog and update product information; and administrators will generate analytical reports on sales and overall performance. These validation activities will aim to confirm the alignment between

user stories and implemented functionalities, ensuring that the platform delivers a clear, intuitive, and efficient shopping experience.

Regarding performance and scalability, stress tests are projected to simulate up to 500 concurrent users, where the system is expected to maintain an average page load time of approximately 1.8 seconds with zero critical errors. Database queries executed through PostgreSQL indexes and caching strategies are anticipated to demonstrate stable response times even under high-demand scenarios.

Overall, these expected results will provide the foundation for evaluating the robustness, usability, and efficiency of the platform once the development and deployment phases are completed.

## V. Conclusions

The development of the BogoGo e-commerce platform is expected to demonstrate the feasibility of implementing a scalable, modular, and cloud-based solution tailored to Bogotá's growing digital commerce ecosystem. Through the proposed three-layer architecture—comprising presentation, application, and infrastructure layers—the system will likely provide a clear separation of responsibilities, ensuring efficient maintenance, scalability, and adaptability for future extensions.

It is anticipated that the integration of technologies such as Next.js, NestJS, PostgreSQL, and AWS services will result in a platform capable of maintaining high performance and reliability under varying load conditions. The use of secure APIs, JWT-based authentication, and cloud-managed storage will enhance both the robustness and security of the system, aligning with best practices in modern web development.

Moreover, the platform is expected to promote digital inclusion by providing local vendors with accessible tools for online sales management and data-driven decision-making. The incorporation of familiar payment gateways and trusted logistics partners will strengthen user confidence and facilitate adoption within Bogotá's consumer market.

In summary, the expected outcomes suggest that the BogoGo platform will serve as a sustainable technological model for local e-commerce ecosystems, combining technical efficiency with socio-economic relevance. Upon implementation and validation, this solution could contribute to academic research on distributed architectures and provide a foundation for future enhancements, including artificial intelligence-driven recommendation systems and advanced analytics.

## VI. References

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