

pointing out that with the help of deep learning technology, the marine industry has made great strides and the technology is developing rapidly. It is hoped that this paper will inspire readers to pay attention to marine affairs and encourage more people to participate in scientific research.

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DATABASE DESIGN FOR MULTI-TENANT E-COMMERCE PLATFORM

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Summary. *The purpose of this article is to propose a complete database design scheme that meets the specific needs of multi-tenant e-commerce platforms. This includes essential strategies such as multi-tenant isolation policies, permission management, index optimization, performance improvements, and scalability considerations, all aimed at building a high-performance, scalable database system.*

The article identifies core functional needs in modules like user, merchant, product, order, and payment management. These requirements guide design strategies that ensure effective data isolation, optimized performance, scalability, and robust security.

The purpose of this article is to propose a comprehensive database design scheme tailored to the specific needs of multi-tenant e-commerce platforms. This design incorporates widely used technologies, including schema-based multi-tenancy for data isolation [1], role-based access control (RBAC) for permission management [2], adaptive indexing for query optimization [3], caching and load balancing for performance enhancement [4], and data partitioning for scalability [5]. Through these well-established techniques, this design aims to achieve a high-performance, scalable database system that meets the rigorous demands of e-commerce platforms.

The design addresses core modules like user management, merchant management, product management, order management, and payment management, while proposing strategies for effective data isolation, performance optimization, and security. Eight core entities are identified: Tenant, User, Role, Permission, Product, Order, OrderItem, and Payment. Tenant serves as the central entity, with

a one-to-many relationship to the other entities. Additionally, the design includes many-to-many relationships between User and Role, and Role and Permission.

To ensure proper data isolation and permission control, the system employs row-level isolation and RBAC. A tenant id field is added to key tables, and data is filtered automatically via triggers. The system defines three roles – super administrator, tenant administrator, and common user – each with specific permissions based on resource and operation types.

Performance is optimized using compound indexes for specific query patterns, in addition to regular primary and foreign key indexes. Scalability is achieved through modular design and the inclusion of reserved expansion fields, supporting future business growth. Overall, the design delivers a scalable, high-performance database system suitable for multi-tenant e-commerce platforms.

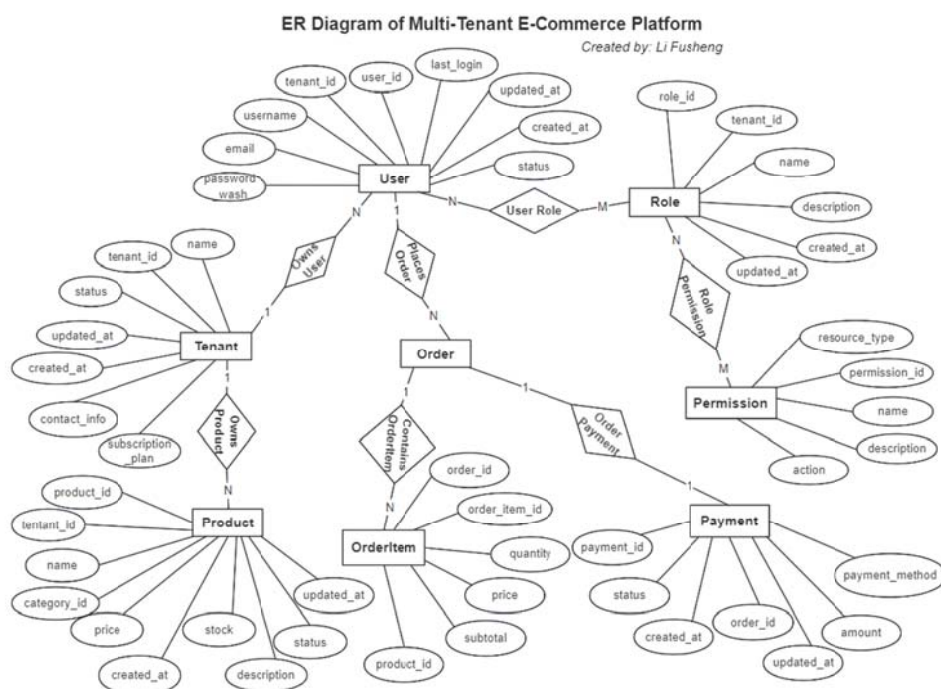


Figure 1 – ER diagram design for Multi-Tenant E-Commerce Platform

Figure 1 depicts the entity-relationship (ER) diagram of the system, with tenants at the core. Tenants form one-to-many relationships with other entities like users and products, while users and roles, and roles and permissions, are linked in many-to-many relationships. Orders link to OrderItems with one-to-many relationships, and each Order links to a Payment through a one-to-one relationship.

In conclusion, the multi-tenant e-commerce platform database design proposed in this article realizes a high-performance and scalable e-commerce database system through key technologies such as multi-tenant isolation, permission management, performance optimization, and scalability design. In the future, it is recommended to continue to explore NoSQL database technology and distributed database architecture to further improve the performance and scalability of the system.

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NFC TECHNOLOGIES FOR IDENTIFICATION AND CONTACTLESS PAYMENT

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Summary. *Since the birth of Internet, electronic money and electronic payment system have gradually appeared in various forms in the trade transaction scene, but the payment method and information security of the transaction are still one of the problems that need to be improved. With the popularity of intelligent electronic devices and the improvement of electronic money payment system, NFC payment, as a new mobile payment method, has gradually received widespread attention and application in all walks of life and our Daily life. This paper aims to explain the working principle, characteristics and future trend of NFC payment system in electronic money payment system.*

Today, the application of digital technologies both in the scientific field and in everyday life is widely developed. In everyday life, the application of IT technologies is an integral part of modern society. For example, NFC technologies are widely used for payment, discount programmes, e-ticketing, identification, online and physical access, and, of course, various smart home technologies (figure 1). The basis for all this is contactless data exchange, conversion and processing systems such as NFC and RFID.

Near Field Communication (NFC) technology is a short-range high-frequency wireless communication technology based on the integration and evolution of contactless radio frequency identification (RFID) technology and interconnection technology. When electronic devices with NFC function are close to each other, data can be exchanged. The initiating device excites the antenna with a 13.56 MHz signal to generate a magnetic field, and then transmits the energy to the target through near-field coupling. The target device to complete communication [2]. IT is mainly divided into active, two devices with NFC function, such as smartphones and payment terminals, each generate their own RF field to