Development of Distributed E-commerce System Based on Dubbo

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Abstract. China’s e-commerce is developing steadily towards intelligence, extension, standardization, division of labour, regionalization, popularization and internationalization. The competition of domestic e-commerce market has shifted from Tier 1-2 cities to tier 3-6 cities and to rural areas. Online e-commerce platform and offline stores begin to accelerate the industrial integration. This new retail mode will be close to consumers and provide operational efficiency. The technology of e-commerce development platform is also changing with each passing day. According to the idea of service-oriented, the system uses Dubbo, a distributed service framework based on Java, and uses zookeeper as the service registry to provide consistent coordination services for applications. Using the framework of Spring boot and the method provided by TkMybatis, the system realizes an e-commerce online shopping mall system with high concurrency, distribution and high availability e-commerce system - a comprehensive B2C shopping platform. In addition, the system also greatly reduces the coupling of the system, enhances the high availability, and has significant characteristics in maintainability and scalability.

Keywords: Distributed, Dubbo, Spring Boot, E-Commerce System

1. Introduction
Online shopping has entered thousands of households in China and become an important part of Chinese residents' social life consumption. Due to the impact of the current new coronavirus epidemic, online shopping has become one of the few means of consumption when residents live in isolation. E-commerce platform represented by online shopping, as the media and material carrier for users in online shopping, still has strong market demand for its development and construction. Faced with the increasing number of users, the shortcomings of traditional project architecture are increasingly obvious, mainly reflected in the poor concurrency and fault tolerance. According to the problems of the traditional project architecture, in order to achieve the best concurrent access on a given number of servers, this system adopts the service-oriented Dubbo distributed architecture, and realizes the design and development of online shopping mall system [1-5,10-11]. It not only meets the needs of e-
commerce system in function, but also opens the way for software in high concurrency, high load, robustness and scalability, and it also provides a good solution.

System analysis
System requirement analysis

This system adopts the distributed development mode to solve the network congestion caused by high concurrency, improve the user experience of consumers, so that consumers can browse goods, shop and consume at any time and place, and make the consumption time flexible [6-8].

E-commerce system is a web-based system, which aims to transform the traditional offline retail to online shopping mode and improve the user's shopping experience. So the system will be designed into the following seven modules: user authentication module, commodity query module, commodity details module, shopping cart module, order module, payment module and administrator background commodity management module. Fig. 1 describes the functional structure of the e-commerce system.

![Figure 1. Functional structure of e-commerce system](image)

1.1. Analysis of User Functional Requirements

The system provides the following services to meet the needs of consumers:

1. Users can enter the home page of the website through the browser, search products through product classification or keywords, and enter the product list.

2. In the product list, you can further filter according to the product attributes; click the product to enter the details page

3. On the details page, you can select the sales attributes and quantity of the goods, and then add them to the shopping cart.

4. On the shopping cart page, select the goods you want to buy and the quantity of goods. The total price is displayed on the page, and submits order.

5. If the user does not log in at this time, the system will jump to the login interface, and the user must use the account password to log in; after successful login, it will jump back to the shopping cart page, and the products added to the shopping cart before login will be merged with the original products in the user's shopping cart.

6. On the order page, display the statistical information of the selected commodity and generate the order number; click settlement.

7. Page skips to the Ali-pay settlement page. When the user sweeps the code, the Alipay order is generated. After the payment is successful, the page is turned back to the successful page of the system, and the order status is updated.

Fig. 2 shows the use case diagram of the not-logged in user, and Fig. 3 shows the use case diagram of the logged in user.
1.2. System Administrator Function Requirement Analysis
The system administrator can log in the commodity background management system of the e-commerce system through the account, and can manage the platform attributes of commodities (such as adding, deleting, modifying and checking operations), add commodity SPU (standardized product unit), add commodity SKU (inventory unit), etc.

2. E-commerce System Design

2.1. Distributed Architecture Design
Based on Dubbo framework, this system constructs a service-oriented distributed architecture, and uses zookeeper as the service registry to provide consistent coordination services for applications and realize the coordination between system business logic servers. Redis cache server is used to reduce the access pressure of database server [5-10]. MySQL database and fastDFS file system are used to realize data persistence. The distributed deployment architecture is shown in Fig. 4.
2.2. File System Design
This system uses fastDFS distributed file system to manage image data, improve storage capacity and reduce coupling between servers.

Users can directly access the image data in fastDFS with HTTP protocol. There are three kinds of nodes in fastDFS: client, tracker and storage. In the underlying storage, the concept of logical grouping is used to configure multiple storage in the same group, so as to realize soft RAID10, improve the performance of simple load balancing, concurrent IO and redundant backup of data; at the same time, the linear expansion of storage capacity is realized by adding new logical storage groups.

2.3. Database Design
According to the entity object analysis of the system, the E-R diagram of e-commerce system is designed to show the relationship between entities. E-R diagram of e-commerce system is shown in Fig. 5.
In the logical design of the database, five data tables are used: user table (UMS). Member design, which mainly introduces user information; standardized product unit list (PMS)_ product_ Information) design, mainly describes the key attributes of goods; inventory unit table (PMS)_ sku_ Info) design, mainly describes the sales attributes of goods; shopping cart table (OMS)_ cart_ Item) design, which mainly displays each item record purchased by the current user; order table (OMS)_ Order), which mainly describes the order information generated by the user's shopping. Each order can have multiple items, etc.

2.4. System Implementation

Construction of Dubbo environment

The system is based on Dubbo, a high-performance distributed service framework, and uses zookeeper as the service registry to provide consistent coordination services for applications. Dubbo itself is not service software. It is actually a jar package, which can help your Java program connect to zookeeper, and use zookeeper to consume and provide services. So the first step to build an environment is to install zookeeper.

In the second step, Dubbo admin provides a visual monitoring service for many users.

The third step is to introduce Dubbo's dependency into the project.

It is different from the configuration file provided at the consumer end. The provider configuration codes are as follows:

```java
spring.dubbo.application=cart-service
spring.dubbo.protocol.name=dubbo
spring.dubbo.registry.address=192.168.134.128:2181
spring.dubbo.registry.protocol=zookeeper
spring.dubbo.base-package=com.xin.gmal1
```

And the consumer configuration codes are as follows:

```java
spring.dubbo.application=cart-web
spring.dubbo.protocol.name=dubbo
spring.dubbo.registry.address=192.168.134.128:2181
spring.dubbo.registry.protocol=zookeeper
spring.dubbo.base-package=com.xin.gmal1
```

2.5. Function Module Realization

The system is mainly implemented from seven functional modules, including system home page, commodity query, and commodity details, shopping cart, commodity order, commodity payment and background commodity management.

1) The realization of the system home page. The first step to attract users to consume is the facade of the whole system. If the user's demand is clear, he can use the search to query the goods he wants to buy; if the user's demand is not clear, he can use the category label to further query the interested commodity categories of the system.
(2) The realization of commodity inquiry. Product query is an important part of e-commerce system, which shows users the content they need to query and guides users to view products. In order to improve the user experience, in order to improve the query speed of the system, this system uses the elastic search full-text search engine, abandons the sequential scanning method, and uses the index scanning method to solve the problem of slow search. The breadcrumb navigation bar is added to the query result page to facilitate users to further screen products.

(3) The realization of commodity details. The product details page is a key step for users to decide whether to consume or not. The details page arranges and combines commodity information (pictures, descriptions, prices, etc.) to attract users, improve their browsing efficiency, and enable users to better understand the details of commodities and make better decisions on consumption. In order to deal with the congestion caused by multiple people accessing the same product, the system uses redis to cache the product data.

(4) The realization of shopping cart. When the user decides to buy, click Add shopping cart and the page will jump to the shopping cart page. At this time, it is necessary to judge the login user status of the user. If the user does not log in at this time, the product data will be stored in the cookie; if the user has logged in at this time, the product data will be stored in redis.

(5) The realization of commodity order. After checking the goods you want to buy, click to settle and jump to the order page. Before jumping, you need to judge whether the user logs in or not. If not, the page Jump will be intercepted by the interceptor and jump to the login page. After successful login, the order information will be generated. In order to prevent the user from entering the settlement page repeatedly, the settlement sequence number is hidden in the browser. Each time the user submits the page, the serial number will be checked to see if it matches the user's serial number. After saving the order, the background serial number is deleted.

(6) The realization of commodity payment. After clicking the submit order, the user chooses Alipay to pay, clicks immediately, and jumps to the Alipay page. After the user sweeps the code, Alipay generates the payment order. After payment, call back to the payment success page.

(7) The realization of background commodity management. Background commodity management is the basis of an e-commerce system. It is easy to manage the platform attributes, standardized product units and inventory units of commodities. When uploading images, the images are stored on the fastDFS distributed file server through HTTP protocol to enhance the availability of the system.

3. Conclusion
With the rapid development of the Internet industry, all parties begin to rely on the network, which makes life faster. This project is an e-commerce system based on distributed Dubbo architecture. It adopts B/S software structure and uses the framework combination of spring boot and MyBatis to realize business functions. In the persistence layer, MySQL is used for data storage, and redis technology is used to cache the data that is prone to high concurrent access, so as to reduce the pressure of database server and improve the access efficiency. FastDFS distributed file system is used to manage image data. ElasticSearch and ActiveMQ message queue are used to improve the system performance. In the process of development, the system fully considers the high concurrency brought by the current prosperity and development of e-commerce market, and creates a simple, convenient and fast e-commerce shopping platform for consumers. At the same time, it provides a good reference value for the development of the current e-commerce shopping platform.

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