

# Build a Used Car Export Comprehensive Service Platform Based on Distributed Architecture

Qi Hao<sup>1,2</sup>, Wenbo Chang<sup>1,2</sup>, Xudong Luan<sup>1,2</sup>, Fan Zhang<sup>1,2,\*</sup>

<sup>1</sup> China Automotive Technology and Research Center Co., Ltd., Tianjin, China

<sup>2</sup> China Auto Information Technology (Tianjin) Co., Ltd., Tianjin, China

\*Corresponding Author: [m13502037247\\_3@163.com](mailto:m13502037247_3@163.com)

## ABSTRACT

To establish an authoritative comprehensive platform for the export of used cars, this paper proposes the design and implementation of a distributed architecture for a comprehensive service platform for used car exports. Firstly, it centers around export orders to connect the entire business process. Secondly, it builds the platform based on distributed systems, distributed caching, cloud technology, and load balancing technology for used car export services. Lastly, it verifies the system's performance through metrics such as maximum concurrent users, transaction response time, throughput rate, success rate, and resource utilization. The results indicate that this system can assist used car export enterprises in completing their business operations. The platform, centered around export orders, connects the entire business process, achieving efficient data utilization, collection, and query of documentary evidence, promoting efficient business operations. It supports one-click generation of documents and certificates, and features vehicle-specific query functions, positioning the platform at a leading level in the field of used car exports.

## KEYWORDS

Used car export; Distributed system; Cloud computing; Load balancing

## 1. INTRODUCTION

In recent years, China's vehicle ownership has continued to grow, with annual new car production and sales ranking first globally. The large number of vehicles in use means a sufficient supply of cars in the second-hand market, providing a solid foundation for used car exports. Particularly in the context of an oversupply of new cars and fierce price competition, used car exports have become an important channel for absorbing domestic vehicle inventory. Globally, especially in regions with relatively lagging economic development, there is a huge demand for cost-effective used cars. These regions, due to factors such as economic development level, environmental standards, or car ownership rates, are more inclined to purchase used vehicles. At the same time, with the advancement of the Belt and Road Initiative, the demand for Chinese used cars from countries and regions along the route has further increased. As the used car export market rises, more and more companies are entering the used car export business. Therefore, the used car export industry urgently needs a relatively authoritative comprehensive service platform.

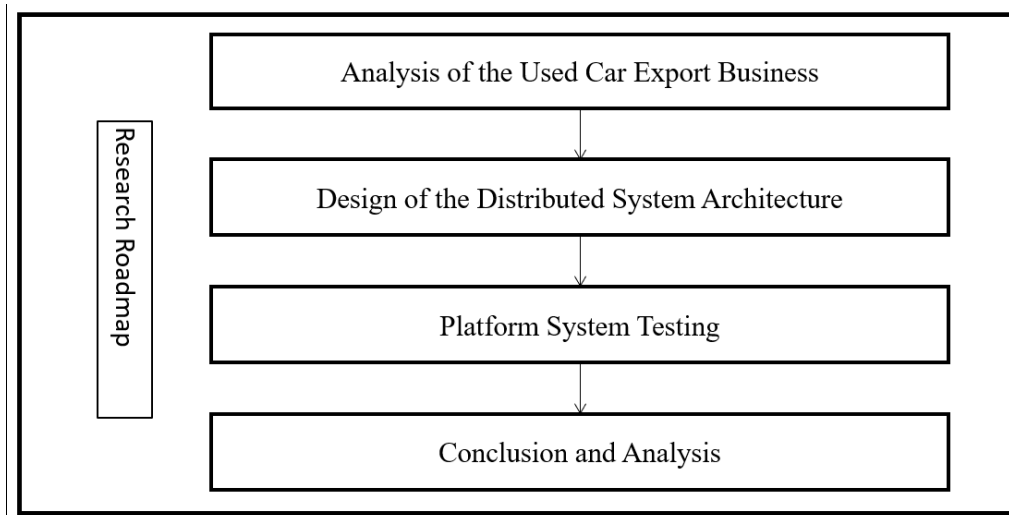
Distributed architecture has been widely used in system construction, and has been widely concerned by all walks of life. For example, Li Taizeng [1] et al. put forward a multi-source traffic big data visualization system based on distributed architecture based on the research knowledge in the context of the acceleration of urbanization and the diversification of transportation modes, and the increasing scale and complexity of urban traffic data, aiming at efficient storage and analysis of urban traffic

data and providing support for urban traffic management and planning. The system adopts the Hadoop distributed storage framework to build HBase and HDFS distributed databases and file systems to realize the storage and management of traffic data, and MapReduce and Zookeeper are used to process data and provide collaborative services. The experimental results show that the system can efficiently store and process multi-source traffic data, and has good practicability and scalability. Peng Haonan [2] and other scholars faced with the backward level of intelligent information technology of urban parking lots, opaque parking resource information, low efficiency of manual management and other problems, which exacerbated the contradiction between supply and demand between parking space gap and vehicle growth. A research method for the design and implementation of intelligent parking platform based on Dubbo distributed architecture is proposed. This paper gives a scheme for the construction of intelligent parking platform through advanced development technology and intelligent parking design ideas. Firstly, through the demand analysis of the parking platform, following the design principles of business modularization and low coupling of components, the core business design of the mobile terminal of the owner, the mobile terminal of the toll collector and the background management system is completed. Then, according to the goals of high concurrency, scalability, easy maintenance and high performance of the server cluster, the distributed microservice architecture based on Dubbo+Zookeeper+SSM is presented, and the load balancing service of the front and back ends is realized through Nginx server, which improves the platform's high concurrency transaction processing capability. Finally, the performance test of the platform shows that the platform has excellent practicability and stability, and has become a helpful assistant to improve traffic congestion. Chen Yingda [3] and other experts put forward a general technical architecture of distributed microservice application system to solve the problems of distributed microservice governance and distributed data storage during the construction of distributed microservice application system. Practice cases show that this architecture can provide good support for the efficient operation of distributed microservice application system and promote the deep integration of micro service technology and power business. And realize the enterprise management goal of the power grid company's digital transformation.

Based on the good performance of distributed architecture in the construction system and the good development momentum of used car export, this paper proposes to build a comprehensive service platform for used car export based on distributed architecture. The platform takes the various business processes of used car export as the framework and the business processing related to each process as the context to build a clear trunk and clear context of used car export comprehensive service platform.

## **2. THIS PAPER STUDIES THE ROAD MAP**

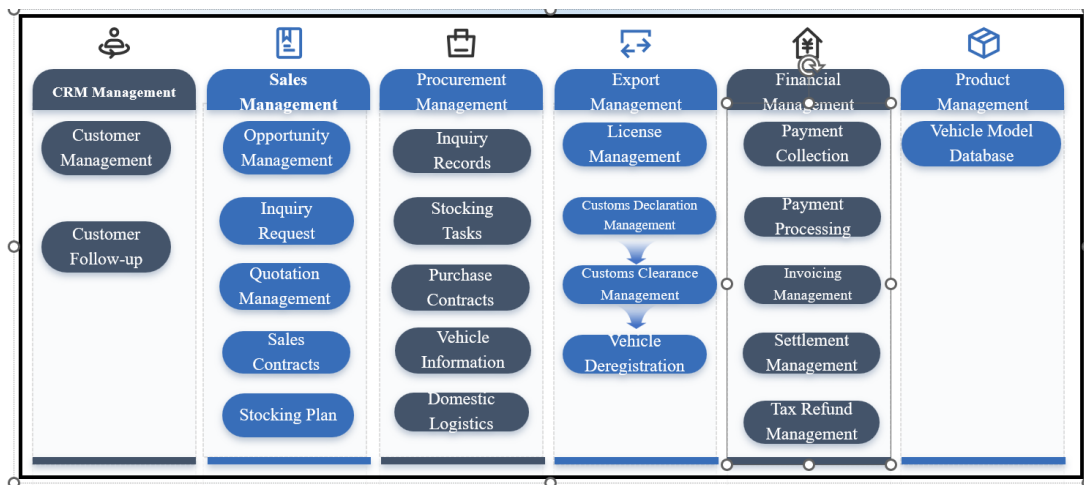
The research method of this paper is based on four parts. The first part is the analysis of second-hand car export business, sorting out the relevant process of second-hand car export business; The second is the distributed system architecture design, mainly introduces the distributed system principle; The third is the platform system test, using the demo prototype built to test the performance of the system; The fourth step is the conclusion and analysis of this paper. Figure 1 shows the roadmap of research methods in this paper.



**Figure 1.** Research method roadmap of this paper

## 2.1. Related Business Analysis

The whole process digital management tool for the internal management of second-hand car export enterprises can help enterprises improve business efficiency, reduce management costs and avoid business risks through business collaboration, information sharing, node reminder and document management, etc. The functions of the integrated service platform for second-hand car export are shown in Figure 2 below.



**Figure 2.** Schematic diagram of functions of the used car export comprehensive service platform

As can be seen from Figure 2, the main functions of the platform include CRM management, sales management, procurement management, export management, financial management and product management. At the same time, the platform takes export orders as the main line and connects the whole business process, realizes the efficient use of data and the collection and query of documents, promotes the efficient operation of the business, supports the one-click generation of documents and documents, and supports the related query of vehicle dimension.

## 2.2. Related Theories and Technologies

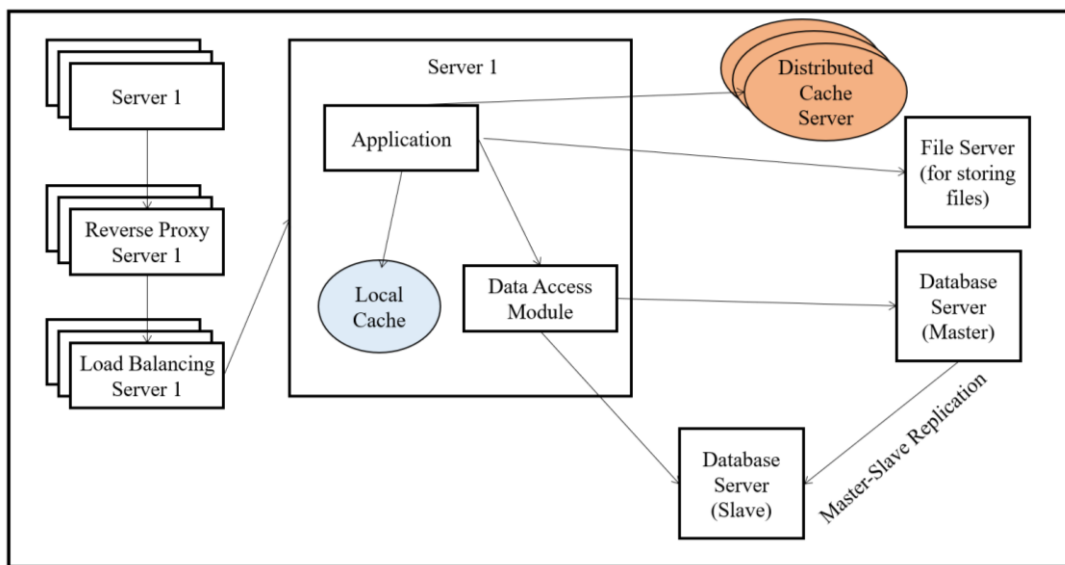
### 2.2.1. Distributed system

Distributed system: A computing system in which multiple independent computers (such as physical servers, virtual machines, or containers) connected over a network work together to accomplish a specific task. The four characteristics of distributed system are: (1) Scalability: By adding more nodes,

the processing power and storage capacity of the system can be improved; (2) High availability: the system can continue to provide services when some nodes fail, usually through data redundancy and failover; (3) Fault tolerance: the system can detect and process node failures to ensure the continuity of services and the integrity of data; (4) Concurrency: multiple nodes: can process different requests in parallel, improve the throughput and response speed of the system.

### 2.2.2. Distributed cache

The main function of distributed cache is to speed up data access, reduce the pressure on back-end storage such as database, and improve the performance and throughput of the system. Distributed cache also stores cached data on multiple nodes, utilizing the memory resources of multiple machines, which can not only provide a larger cache capacity, but also a faster access speed. In addition, distributed cache can be scaled horizontally, that is, by adding cache nodes to increase the cache capacity and processing power, so as to cope with the growing needs of the system. The distributed cache frame diagram is shown in Figure 3 below.



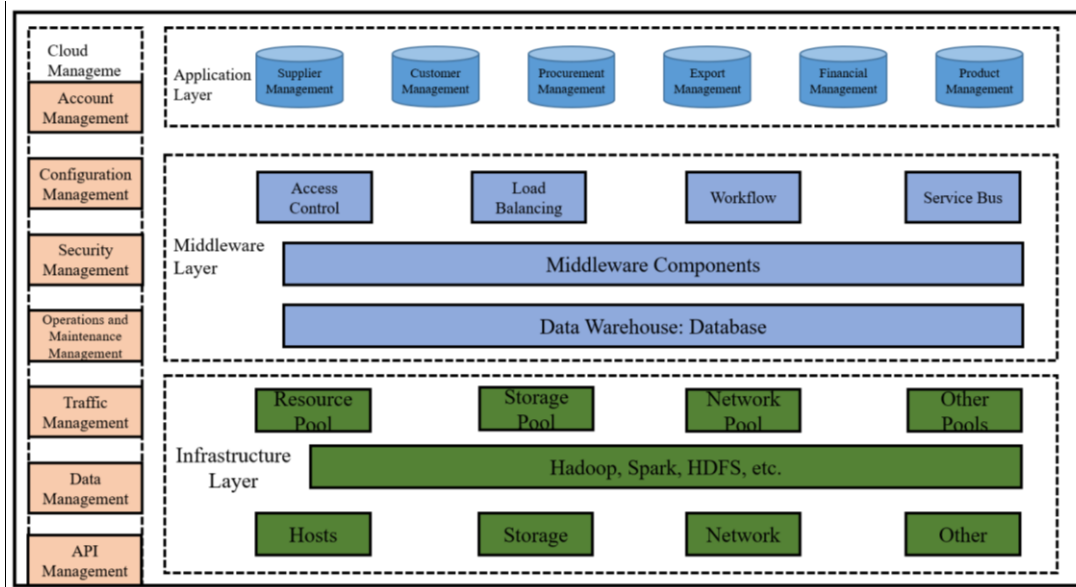
**Figure 3.** Distributed cache frame diagram

### 2.2.3. Cloud computing technology

Cloud computing refers to a model in which scalable, resilient, shared pools of physical and virtual resources are supplied and managed on an on-demand, self-service basis, and network access is provided. Cloud computing service providers use technologies such as distributed computing and virtual resource management to gather dispersed ICT resources through the network to form a shared resource pool, and provide services [4] to users in a dynamic on-demand and measurable way.

### 2.2.4. Cloud computing technology architecture

From the perspective of cloud computing service providers, the cloud computing technology architecture can be roughly divided into: Infrastructure layer: Through virtualization technology, all available resources are unified virtual resources in the resource pool. Middle layer: On the basis of the infrastructure layer, different vendors build cloud computing platforms according to their own cloud computing solutions through middleware, database, access control, load balancing and other means; Application layer: The application layer is the top layer of the cloud service technology architecture. Cloud service providers can deploy various enterprise application templates, such as IM and CIM [5], in the application layer.



**Figure 4.** Cloud computing platform

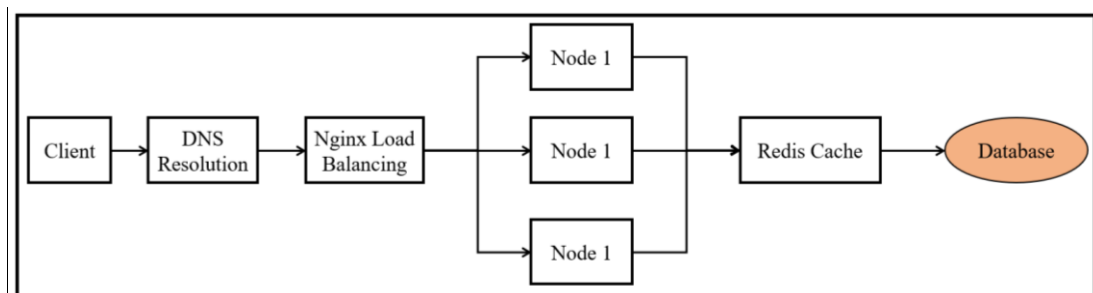
### 2.2.5. Comparison between cloud computing and traditional mode

Traditional IT service model: each is fixed on a certain server and storage, when the application access is low, because the hardware and the application are tied, unable to provide resources to other applications, the server and storage resources will be idle. Cloud computing can dynamically allocate appropriate amount of storage, service and network resources in the system pool, automatically deploy corresponding software resources, and automatically recycle them after use. Through cloud computing, the original dispersed data center resources including servers, storage, and network equipment can be gathered together, and specialized service providers can operate and maintain the cloud computing center. Virtualization technology can be used to break through physical restrictions, improve resource utilization, and realize dynamic allocation and aggregation of resources. This is the cloud computing industry business model to the traditional IT business model of the fundamental favorable change [6].

### 2.2.6. Load balancing

Load balancing is a technique to achieve better performance, reliability, and scalability by distributing workloads across multiple computing resources or system components. Load balancing is designed to deal with situations such as high load, high concurrency, and large traffic occurring in the system to ensure that the system can provide high performance, high availability, and scalability.

In the face of a large number of user requests to access the system at the same time, a single server may not be able to effectively process all requests, load balancing can spread the requests across multiple servers to ensure that the load of each server is relatively light and improve the concurrent processing capability [7-8]. The load balancing flow chart is shown in Figure 5 below.



**Figure 5.** Load balancing flow chart

Load balancing algorithms are mainly divided into the following 5 categories:

(1) Round robin

Polling algorithm This is one of the simplest load balancing algorithms, assigning each new request in turn to the next server in the list of servers. It is suitable for scenarios where servers have similar performance, ensuring that requests are relatively evenly distributed across all servers.

(2) Weighted round robin

Weighted Round Robin is similar to the polling algorithm, but assigns a weight value to each server, with the higher the weight the server has the greater probability of getting the request to process. Based on the polling, the packets are distributed to different servers by weight based on hardware configurations. In this way, the packets can better adapt to scenarios with different server performance.

(3) Randomization

Random algorithm, the basic idea of this algorithm is to randomly select a server to process each new request in order to achieve the purpose of load balancing. The advantage of stochastic algorithm is that it is simple to implement, however, due to its randomness, it cannot ensure that every server gets the same number of requests, so in practical application, it may lead to some servers with heavier load and others with lighter load.

(4) Minimum connection

The least connection algorithm is a commonly used load balancing algorithm, its basic idea is to assign new requests to the server with the least number of current connections, in order to achieve the purpose of load balancing. Record the number of requests being processed by each server, and distribute new requests to the server with the fewest connections, because it is not recommended to maintain internal state.

(5) Hash

Hash based Load Balancing calculates the hash value according to certain characteristics of the request, such as IP address, URL, etc., and then assigns the request to the server with the corresponding hash value.

### 2.3. Platform System Testing

The test results of each index are shown in Table 1.

**Table 1.** shows the performance test results of the system

Serial Number	Test indicators	Remarks
1	Maximum concurrent users	10000
2	Response time	0.28 seconds
3	Throughput/throughput rate	Throughput is the number of customer requests handled by the system per unit time
4	Success Rate	99.5%
5	Resource utilization	45%, bid resource utilization is stable

(1) Maximum number of concurrent users

Definition: refers to the maximum number of user requests that a system can process and successfully respond to at the same time.

Test method: Use the stress test tool to simulate multiple users accessing the system at the same time, and gradually increase the number of concurrent users until the system starts to experience performance bottlenecks (such as significantly prolonged response time, increasing error rate, etc.).

Business impact: For used car export business, high concurrency means that the system can maintain stable operation during peak trading periods, support a large number of buyers and sellers to operate online at the same time, and improve user experience and business efficiency.

#### (2) Response time

Definition: refers to the time interval between the user initiating a request and the system returning a response.

Test Method: Record and collect statistics on the response time in different scenarios (such as high concurrency and low load), including the average response time and maximum response time.

Business impact: Quick response is the key to improving user experience. In the used car export business, the shorter response time can enable users to complete the vehicle information query, transaction order and other operations faster, and improve customer satisfaction.

#### (3) Throughput/throughput rate

Definition: The number of transactions or data transfers successfully processed by the system per unit time.

Test method: By simulating a large number of user requests, the processing capacity of the system is measured over a certain period of time.

Business impact: High throughput means that the system can efficiently process a large number of transactions and support rapid business growth.

#### (4) Success Rate

Definition: The percentage of requests successfully processed by the system.

Test method: The success and failure of all requests during the test are counted and the success rate is calculated.

Business impact: A high success rate is an important reflection of system stability and directly affects user experience and business continuity.

#### (5) Resource usage

Definition: The usage of resources such as CPU, memory, and disk I/O during system operation.

Test Method: Use the monitoring tool to obtain the usage of system resources in real time and analyze resource bottlenecks.

Service impact: Proper resource allocation and usage can improve system performance and avoid resource waste and bottleneck problems.

### **3. CONCLUSION AND ANALYSIS**

To sum up, a monitoring platform with used car export business as the core process is developed by integrating distributed, cloud computing and load balancing technologies. This platform not only effectively solves the project schedule delay management problem, but also significantly reduces the incidence of human error in the data processing link, so as to achieve a double leap in monitoring efficiency and quality. With the rapid development of information technology and the continuous upgrading of hardware facilities, the traditional manual monitoring mode is gradually being replaced by a comprehensive and automated intelligent monitoring system, indicating that the monitoring technology is moving forward to a higher level of intelligence.

The construction of a nationwide second-hand car export service comprehensive platform aims to build a comprehensive platform integrating efficient internal management, seamless information sharing and flexible allocation of resources. This not only greatly facilitates the daily operation and

strategic planning of enterprises, but also ensures the smooth execution and efficient operation of used car export business. The in-depth implementation of digital transformation is expected to further stimulate the vitality of the used car export industry, promote its development toward a more standardized and high-quality direction, and lay a solid foundation for the sustainable development of the industry.

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