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Optimization and Upgrade Path of Tax Management Software System Based on Cloud Platform

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Abstract: Due to the digital age, the US tax system is confronted with a complex tax environment and data processing requirements. The current tax management software system (the tax system) has many challenges in terms of performance, security and elasticity, and it is necessary to improve the service level of the tax system through technological updates. The elastic scalability of the cloud platform can effectively make up for the drawbacks of the tax system and improve the system efficiency. This paper analyzes the technical architecture and existing problems of the current system, demonstrates the process of optimizing the tax system by using the cloud platform, and puts forward suggestions for the upgrade of the tax system in line with the cloud platform, including enhancing the storage and computing capabilities of the tax system, improving the architecture of the tax system, ensuring security, and meeting regulatory requirements, with the aim of providing technical suggestions and practical references for the tax department.

1. Introduction

The tax system is an important support for current tax work and an effective way to improve work efficiency and service effectiveness. However, with the development of society and economy, traditional electronic tax systems are confronted with problems such as an increasing amount of data, low system processing capacity and unreliability. The emergence of cloud computing technology has solved the problems faced by traditional electronic tax systems. It can provide elastic computing, massive storage and highly available services, assisting the tax information system to achieve the goal of scalability and efficient operation. How to optimize the traditional electronic tax system and enhance its practicability through the application of cloud platform technology has become an urgent problem for the tax department to solve. This article discusses the current situation of the traditional system, the advantages of the cloud platform, and the optimization and construction of the tax system based on the cloud platform.

2. Analysis of the Current Situation and Evaluation of the technical Architecture of THE TAX Management SOFTWARE SYSTEM

2.1 The Architecture and Operation Mode of the traditional Electronic tax system

Traditional systems are mainly built on centralized systems, using local databases and servers to store, process and manage data. They usually have only a single design, including functions such as tax declaration, tax calculation and tax report generation. Tax information is stored in a relational database. The system then uses relevant operators to calculate the data. Tax staff enter the system through the client, input the required data and submit it. After that, the system completes the data calculation and generates a tax report. However, traditional tax systems lack flexibility and cannot adapt to the constantly changing needs of enterprises and technical challenges. From the perspective of efficiency, as the volume of tax data increases and customers make more frequent requests, the system may experience slow response and processing speeds, compromising the user experience. Moreover, system maintenance and expansion are difficult, and the system upgrade frequency is low and relatively complex, making it hard to adapt to new regulations or enterprise demands and receive timely updates, which affects the level and accuracy of tax management.

2.2 Main Problems Currently faced by THE TAX Management SOFTWARE SYSTEM

With the development of tax business and the increase of tax-related data and information, the traditional system has gradually shown obvious disadvantages in many aspects, directly sowing hidden dangers for the stability and operational efficiency of the system, and also restricting its future development and flexibility. The core issues and actual manifestations of the existing tax system are shown in Table 1 as follows.

Table 1. Main Problems and Manifestations Currently faced by the tax management software system

Problem category	Specific manifestations
Performance bottleneck	When dealing with a large amount of data processing and high concurrent requests, the system often experiences response delays, resulting in low efficiency of the tax process
Safety risk	Insufficient security protection measures during data transmission and storage may lead to the leakage of tax data or external attacks
Insufficient scalability	With the growth of tax demands, the existing system is difficult to expand or adjust rapidly, resulting in the inability of hardware resources and computing power to meet the demands
Poor user experience	The system interface is outdated, the operation process is cumbersome, and it lacks modern design and intelligent functions, which reduces the operational efficiency of users
Technological aging	Relying on traditional technical architectures makes it impossible to fully utilize emerging technologies such as cloud computing, big data and artificial intelligence, which limits the upgrade of the system

These problems make the traditional tax system inadequate in responding to the demands of modern tax management. Therefore, it is urgent to solve these problems through technological innovation and platform optimization, so as to enhance the overall performance and service quality of the tax system.

2.3 Evaluation of the Existing Tax System by Cloud Platform Technology

The use of cloud platforms in the optimization of electronic tax systems provides significant

support to a large extent. The cloud platform can provide excellent data storage and computing capabilities. The distributed structure and elastic computing resources designed according to the cloud platform can meet the concurrent processing capacity of huge amounts of information. This transformation enables all the tax information stored on local servers to be dumped and processed on the cloud, thereby shortening the processing speed of the information and improving its accuracy. In terms of anti-interference capability, the cloud platform, based on its high reliability and automatic repair ability, has a relatively high anti-interference capability. That is, when problems occur in the cloud platform, they can be repaired immediately to avoid system interruption. In terms of security performance, the cloud platform adopts multiple encryption methods, real-name systems, and permission restrictions and other data processing measures to ensure the complete inviolability of tax information security and secrets. In terms of scalability, the convenience brought by the cloud platform lies in the fact that the application of the tax system can be changed according to the actual situation, avoiding various constraints during the expansion period in traditional systems.

3. Optimization direction of tax system based on cloud platform

3.1 Optimization of data storage and processing capabilities

The cloud platform has the functions of big data storage and processing, solving the data processing bottleneck problem of traditional taxation. By using distributed storage and flexible elastic computing resources, it improves the efficiency of tax data storage and processing. For example, using a distributed computing framework (such as Apache Spark) for parallel data processing reduces the computing time. The formula is as follows:

$$T_{total} = \sum_{i=1}^{n} T_i \tag{1}$$

Among them, T_{total} It is the total calculation time, T_i The calculation time for each sub-task, n It is the total number of sub-tasks. Through parallel processing, the completion of tasks can be accelerated and the total computing time can be reduced. Under high concurrency conditions, the cloud platform can dynamically adjust computing resources to reduce the average processing time of query requests. The formula is as follows:

$$T_{aug} = \frac{T_{total}}{N} \tag{2}$$

Among them, T_{aug} Is the average processing time, T_{total} is the total time of all queries, N For the total number of query requests. Dynamic resource allocation reduces the average time of each request and improves processing efficiency.

3.2 Optimization of System Architecture and Deployment Mode

The cloud platform makes the architecture design and operation of the tax system more flexible and efficient. The structure of traditional tax systems is generally unified as a whole. When designing functional modules, they are highly integrated and lack expansion functions. The cloud platform can be designed with microservices, dividing the entire system into many decentralized service modules. Each service module can be deployed, maintained and expanded independently. The main advantage of the microservice architecture is that it increases the maintainability and

scalability of the system, and at the same time, it can improve fault isolation to a certain extent. When a certain module has a problem, the other modules can still operate normally, thus effectively ensuring the stability of the system. Through containerization technologies (such as Docker), each microservice will run in an independent container. Containerization makes the dependencies between services looser, thereby simplifying the processes of upgrading, migration and expansion. For a system, container management tools (such as Kubernetes) can be scheduled at any time, ensuring system stability even when dealing with a vast number of users. Its optimized resource allocation model can be expressed by the following formula:

$$R_{allocated} = R_{total} \times \frac{U_{task}}{U_{max}} \tag{3}$$

Among them, $R_{allocated}$ For the allocated amount of resources, R_{total} It is the total resource quantity, U_{task} It is the demand of the current task, U_{max} For the maximum possible demand that the task can achieve. This formula demonstrates how to dynamically allocate resources based on the requirements of tasks, thereby enhancing the operational efficiency of the system.

3.3 Security and Compliance Optimization

The cloud platform provides a solid security guarantee for the tax system, enabling the entire tax system to effectively solve various security problems. The transmission and storage of tax data have been protected by using encryption technology. When data is transmitted, SSL/TLS encrypts it to prevent the data from being leaked. When storing data, the cloud platform uses high-strength encryption methods, such as AES-256, to protect data privacy and security. During the encryption process, key management and encryption and decryption operations can be optimized through the following formula:

$$C = E(K, P) \tag{4}$$

Among them, C It is encrypted data, E For encryption operation, K For the encryption key, P It is the original data. This formula indicates that through the encryption key K For the original data P Perform the encryption operation to obtain the encrypted data C, to ensure the security of the data. Meanwhile, the identity authentication and access control mechanism of the cloud platform adopts Multi-Factor Authentication (MFA) and Role-Based Access Control (RBAC) to prevent unauthorized personnel from accessing sensitive data. Access control policies can be described by the following formula:

$$A = R \cap P \tag{5}$$

Among them, A For authorized access, R It is a set of user roles, P It is the set of access permissions. This formula explains that access will only be authorized when the user role and access rights match, further enhancing the security of the system.

3.4 User Experience and Interface Optimization

Cloud platforms can significantly enhance the user experience of the tax system, especially in terms of the user interface and interaction methods. Traditional systems often have complex interfaces that are perplexing, reducing the working efficiency of tax officials and providing taxpayers with a poor experience. The cloud platform can apply a responsive layout, meaning that

all devices can present the user interface in the same form, regardless of whether they are computers, mobile phones or tablet devices. It can also achieve the visualization of dynamic data, enabling tax officials to intuitively obtain relevant tax information in the form of charts and dashboards, so as to make decisions more quickly. It can also be combined with the cloud platform to utilize artificial intelligence and machine learning technologies to provide intelligent suggestion functions. Based on user behavior and past records, the system can automatically propose some relevant operations or reports, significantly improving work efficiency. For example, based on historical data, the system can predict the demand for certain types of tax returns. The system will generate reports in advance and provide early warnings. The optimization of the interface also includes the simplification of interactive operations, such as intelligent form filling, automated guidance and reminders, one-click submission and other functions, reducing manual operations by users and improving user satisfaction.

4. Upgrade path of tax SOFTWARE system Based on Cloud platform

4.1 Cloud Platform Technology Selection and System Migration Strategy

When selecting cloud platform technologies, the tax system needs to comprehensively consider multiple factors such as computing power, storage capacity, security and compliance. Public cloud and private cloud are currently the two mainstream technical solutions. The former is widely used due to its strong scalability and on-demand billing advantages, and is suitable for tax systems with relatively large traffic fluctuations. The latter performs well in terms of security and controllability, and is mainly applicable to the major data processing modules carried and stored by the tax system itself. During the selection process, it is necessary to evaluate the technical capabilities, customer management levels and data compliance of each cloud service provider. For the diversion during the platform system transfer process, the gradual system migration approach is more secure. During the migration process, non-core business modules should be migrated to the cloud first, and performance tests and evaluations should be conducted gradually, ensuring that the cloud platform can undertake functions such as high-traffic data operations and complex data calculations. To ensure a smoother transition, it is necessary to avoid data loss and guarantee data consistency during the data migration process, which can be achieved through data synchronization and mirroring technologies. The computational load for migration can be estimated through the following formula:

$$Load_{total} = \sum_{i-1}^{n} Load_i \tag{6}$$

Among them, $Loadt_{otal}$ It is the total computing load, $Load_i$ The load for each module, n It is the number of modules. This formula helps evaluate the computing power required during the migration process.

4.2 Transformation and Implementation of CLOUD MicroService Architecture

The microservice architecture splits the traditional monolithic application into multiple independent and autonomous small services. Each service is responsible for completing some tasks, and information is transferred among the services through standard interfaces (such as RESTful API). When implementing microservices in a tax system, it is necessary to analyze the overall program structure of the original system and extract the more critical parts in the system, such as tax declaration, tax calculation, invoice processing, etc., as an independent microservice. Each

microservice has an independent life cycle, being independently installed, updated and expanded, thereby increasing system resilience and facilitating better maintenance. To enable different microservices to operate and maintain independently, containerization technologies (such as Docker) are used to encapsulate services, and container scheduling tools (such as Kubernetes) are used for automatic management. Different services can also be decoupled through message queues (such as RabbitMQ and Kafka) to keep performance within an acceptable range. When using microservices, how to ensure data consistency is also a difficult problem, which is generally solved through eventual consistency mechanisms and event-driven architecture (EDA). For the transformation of the tax system microservice system, during the transformation process, the functions of each module can be moved one by one to ensure the normal and smooth operation of the system and avoid business interruption caused by the collapse of a large number of business systems.

4.3 Integration of intelligent and automated functions

Intelligent and automated functions are widely applied in the tax system, which can enhance system efficiency and reduce errors caused by human factors. Machine learning algorithms can extract information from past data, identify risks and predict future trends, and then give corresponding suggestions to tax workers. Machine learning models change based on data to play a better role in the system. For example, by analyzing tax payment history records, machines can identify potential tax issues and notify tax staff to take corresponding measures for such problems. The key points of the automation function lie in the system's tax filing, inspection, forms, etc., which can carry out automated process control, minimize human intervention and errors as much as possible, and improve operational efficiency and accuracy. The tax system can calculate the tax amount to be paid by itself through automation technology, check invoices and generate reports, improve work efficiency and handle large amounts of data more efficiently. A similar approach can also be adopted to run batch instructions during off-peak hours to prevent system overload and sluggish response. After integrating intelligence and automation, the tax system can minimize manual operations to the greatest extent, improve the speed and accuracy of data processing, and enhance the overall experience of the tax department and taxpayers.

4.4 Continuous feedback on user education and system optimization

The continuous optimization of the tax system cannot be separated from effective user education and system feedback mechanisms. Tax officials and taxpayers need to be aware of the upgrades and changes in its various functions to ensure the correct use of the system. Tax authorities should regularly offer online or offline training courses to help users master the operation methods of the new system and ensure its maximum effectiveness in tax work. Its training methods can be video teaching or online instruction, etc., to meet the needs of different levels. For the software system, corresponding change plans should also be formulated based on the needs of users. Understand their views on the new system and put forward feasible suggestions. Timely corrections should be made for its shortcomings. The contents of system improvement mainly include enhancing efficiency, strengthening functions and optimizing the interface, etc. Only by gradually improving can it better meet the needs of users and promote the informatization development of tax work.

5. Conclusion

The application of cloud platform technology in the tax system can greatly solve the construction and update of the tax system to meet the needs of contemporary tax work. With the complication of tax affairs, the traditional tax system can no longer meet the current informatization requirements.

By applying cloud platform technology, the tax system can have an elastic architecture, an intelligent structure and the ability of efficient data processing, thereby greatly enhancing its efficiency and security. The application of the micro service platform makes the tax system highly modular, convenient for individual expansion and upgrade, and maintains maintainability and sustainability. After adding intelligent and automated functions to the platform, the tax management process can be significantly reduced. Through the training of tax staff and the feedback and correction of the system, the tax department can continuously develop new functions of the system to ensure that it keeps pace with the times.

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