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High Availability Design and Information Technology Architecture Optimization of Data Center Network

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Abstract: With the rapid development of the Internet, enterprise informatization construction is becoming more and more important, and the rationality of data center network design has become the top priority of enterprise informatization construction. This paper mainly analyzes the high-availability design of the data center network and the optimization of the information technology architecture. When designing a data center network, it is necessary to analyze and plan the network architecture in combination with the specific conditions of the enterprise data center, so as to maximize the reliability of the network system, thereby improving the availability of the data center network. The optimization of information technology architecture also needs to comprehensively consider various factors such as system architecture, equipment functions, performance, and cost, so as to establish an information technology architecture suitable for its own development. Experimental results show that the bandwidth of the optimized data center network can reach 11.5TB/s.

1. Introduction

Data center network is an important part of enterprise informatization construction, and network high availability design is the top priority of data center network design. In the data center network design process, it is necessary to combine the company's own situation, carry out overall planning, and optimize the network structure to ensure the high availability of the data center network. In the process of enterprise informatization construction, the rationality and feasibility of information technology architecture directly determine the effectiveness of enterprise informatization construction. Information technology architecture optimization is based on the existing data center network, and optimizes network equipment, application systems, and business processes on the premise of ensuring the stable operation of the core business of the enterprise.

With the rapid development of Internet technology, the traditional data center network design can

no longer meet the needs of enterprises for information construction. Enterprises need to improve work efficiency, reduce production costs and improve management level through information construction. To achieve these goals, enterprises must have certain network technology capabilities. By analyzing the problems and deficiencies in the current data center network design, advanced technical means are introduced to optimize and transform the existing data center network.

In recent years, many outstanding experts at home and abroad have conducted in-depth research and discussions on data center networks. Among them, Cao Bin proposed a high-speed wireless topology suitable for WLAN applications, established a wireless transmission model based on temperature field, and analyzed the line-of-sight and interference problems in WLAN. Experiments have proved that this method has better optimization effect and higher convergence speed [1].Wang and Meng conducted research on the configuration of service centers in distributed control networks. The evaluation results show that the method he proposed is better than the existing results. On the premise of maintaining availability, the delay of SFC (System File Checker) can be reduced by 30%, and the link loss can be reduced by 40%[2]. Chkirbene, Zina proposed a new scalable and economical data center topology-LaScaDa (Hierarchical Scalable Data Center). The test results showed that the performance of LaScaDa was better than that of dynamic honeycomb and super dynamic honeycomb [3]. Fan Weibei proposed an intelligent resource scheduling method based on the Regulated Specification Policy (RSLP). On this basis, he proposed an algorithm based on genetic algorithm, which realized the dynamic search and effective scheduling of large-scale tasks [4]. Han, Feixue focused on how to reduce the impact of queuing delay in switches. After briefly examining recently developed features and the complexity of their deployment, he divided these features into three phases, introduced their design rationale, and identified their goals. Finally, the future work was prospected [5]. Although these studies are of great help to data center networks, there are still deficiencies.

This article studies the data center network design and information technology architecture optimization, and puts forward some methods that can improve the availability of data center networks and the rationality of information technology architecture. These methods are mainly through comprehensive consideration of factors such as network architecture, equipment functions, performance, and cost, so as to achieve the purpose of improving the availability of the data center network and the rationality of the information technology architecture, so that the construction of enterprise informatization can proceed smoothly.

2. Problems in Current Data Center Network Design

In the traditional data center network design, enterprises generally adopt the OSI model, that is, the Open System Interconnection Reference Model. In the OSI model, the data center network consists of three layers: physical layer, link layer, and transport layer. The three-layer structure determines the network transmission mode of the enterprise. Only the correct transmission mode can ensure the smooth transmission of data information in the network [6]. However, in the actual data center network design process, due to the large number of devices involved, the large number of connected users, and the relatively complicated user operations, the following problems exist in the design process of the data center network:

(1) The three-tier structure cannot meet the bandwidth and delay requirements of the current data center network. The three-layer structure is the most basic and important layer in the entire network design, and its performance directly affects the entire network system. However, in the current data center network design, bandwidth and delay issues are still the bottlenecks restricting the construction of enterprise informatization [7].

(2) The traditional OSI model does not take into account the impact of factors such as routing

and links on the performance of the entire network, resulting in low network efficiency. Although routing protocols play a great role in the transmission of data information in the network, with the rapid development of Internet technology, network routing protocols are also facing great challenges [8]. For example, currently commonly used routing protocols such as iLocation and iLayer require complex path calculations during the data packet forwarding process, and this process will cause large errors in the entire system and reduce the efficiency of data information transmission.

(3) When building a data center network, enterprises often do not make an overall plan for it, but only consider that as a part of the production system, it cannot meet the future development needs of the enterprise. If the enterprise does not consider the future development needs during the data center network design process, then the enterprise will face many problems after the construction is completed [9]. For example, with the expansion of enterprise scale, the increase of business types, the increase of the number of users and other factors, the original equipment cannot meet the needs of users.

3. Design Points of Data Center Network

Data center network design mainly includes two aspects, one is the design of the network, and the other is the optimization of the information technology architecture. Network design: the data center network design is to realize the information construction of the enterpris, so when designing the data center network, it is necessary to analyze and plan the network architecture according to the actual situation of the enterprise data center, so as to realize the optimization of the information technology architecture [10]. Network architecture optimization is mainly to improve the availability of the data center network by configuring and optimizing different devices. The topology diagram of the data center network is shown in Figure 1.

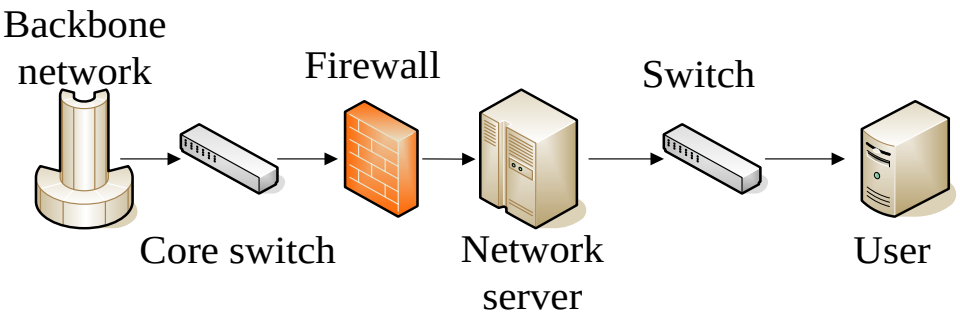

Figure 1. Data center network topology diagram

The optimization of information technology architecture is mainly to better meet the needs of enterprise information construction, and to realize the maximum value of information technology construction through the optimization of information technology architecture. It includes the structure of the data center, information system, application system, etc.

When designing a data center network, the first thing to consider is how to integrate the internal and external information of the enterprise to realize data sharing. Second, it is necessary to ensure that there will be no failures during network transmission and exchange. Finally, it is necessary to ensure seamless connection between different systems [11].

In addition, the requirements of enterprise informatization construction for data center network design should also be considered. When designing the data center network, it is necessary to fully consider the needs of enterprise information construction, so as to better meet the needs of enterprise information construction. This point should also be fully considered for data exchange

between different regions, so as to realize the unified management, maintenance, and update of information systems. And this is also a key factor to ensure the rationality of data center network design [12].

3.1 Network Design

1) The network design should take into account the connection with the internal network of the enterprise, and also the connection with the external network. Therefore, when designing a data center network, attention should be paid to the connection with the internal network of the enterprise.

2) It has to select the appropriate switch. In order to better meet the high availability of the data center network, switches with high reliability and high availability should be selected when designing the data center network.

3) It must ensure port flexibility. Since there are many devices that need to be connected in the data center, when designing the data center network, it is necessary to ensure that the ports can be flexibly connected to the devices. In addition, it is necessary to ensure the flexibility of the ports, and be able to flexibly expand and reduce the number of ports as required.

4) It must ensure that each device is isolated from each other. Since there are many kinds of equipment in the data center, the isolation between each equipment should be considered when designing the data center network, so as to avoid the entire network being affected due to a problem with a certain equipment.

5) It ensures that the different areas are connected to each other. When designing a data center network, it is necessary to ensure that different areas can be connected to each other, so that data can be exchanged and shared, and at the same time, it is necessary to ensure that different areas are isolated from each other. If there is a problem in some areas, other areas will not be affected [13].

3.2 Information Technology Architecture Optimization

When optimizing the information technology architecture, it is necessary to analyze the current status of enterprise information construction. It is necessary to analyze the gap between the existing information system and future development needs, and realize the goal of enterprise information construction through effective integration of information systems [14]. Therefore, when optimizing the information technology architecture, it is necessary to fully consider the actual needs of the enterprise, analyze the gap between the existing information system of the enterprise and the future development needs, and then formulate the optimal solution.

1) The relationship between information systems and application systems. Different systems have different functions and performances, so it is necessary to optimize these systems after analyzing them. At the same time, it is also necessary to consider how to realize the interconnection between these systems.

2) The relationship between IT architecture and data centers. When optimizing the data center network architecture, it is necessary to reasonably arrange the data center network according to the actual needs of the enterprise. It includes how to achieve data sharing and data exchange between different regions [15].

When optimizing the business application system, the relationship between it and the information technology architecture should be fully considered. Only after fully considering these issues can it be made more perfect and reasonable, thereby ensuring the quality of data center network design.

4. Information Technology Architecture Optimization

With the rapid development of the Internet, enterprises have higher and higher requirements for informatization construction, especially the development of emerging technologies such as the Internet, big data, and cloud computing, which put forward higher requirements for enterprise informatization construction. Therefore, enterprises need to optimize the information technology architecture to meet the future development needs of enterprises.

First of all, it is necessary to analyze and evaluate the existing information technology architecture to determine whether it is necessary to optimize the information technology architecture. Information technology architecture optimization is mainly based on the analysis of the current network situation, and adjusts and optimizes the network structure and equipment performance [16].

Secondly, it is necessary to fully consider the basic requirements of information technology architecture optimization, including meeting business needs, scalability, availability, security, etc. At the same time, factors such as the company's future development plan and personnel training needs must also be considered.

Again, the following aspects should be paid attention to when optimizing the information technology architecture:

(1) Focus on system security;

(2) Focus on business service capabilities;

(3) Focus on system scalability.

Finally, in the process of optimizing the information technology architecture, factors such as the future development needs of the enterprise and personnel training needs should be fully considered. In addition, it is also necessary to evaluate and analyze the original information technology architecture of the enterprise, and formulate a corresponding transformation plan [17].

4.1 Focus on System Security

An important goal of information technology architecture optimization is to improve the security of information systems, which mainly guarantees the security of information systems through network security protection, system security protection, etc. This requires enterprises to pay attention to network security protection measures when optimizing their information technology architecture.

(1) Paying attention to the access control of the information system, especially the access control of the application server and database server. When performing access control, measures such as identity authentication and authorization management are required to ensure the security of the system. When recording system security logs, it is necessary to check the security of the system through log audit and log analysis, so as to discover and deal with security risks in a timely manner. When analyzing system logs, it is necessary to use multiple log sources for analysis, and to find vulnerabilities and risks by analyzing, judging, and processing the log content.

(2) Paying attention to network traffic monitoring and auditing. When monitoring and auditing network traffic, it is necessary to monitor and manage data traffic, so as to discover data anomalies and deal with them in a timely manner. In this process, it is also necessary to pay attention to the monitoring of the network topology, so as to discover and deal with abnormal conditions of equipment in time [18].

4.2 Focus on Business Service Capabilities

There are many deficiencies in the use of traditional enterprise information systems, such as poor

system security, inability to meet business needs, high operation and maintenance costs, single functions, etc. Therefore, enterprises need to optimize the existing information systems. Among them, business service capabilities are the key to optimizing the information technology architecture and the core of enterprise information construction [19].

(1) The information system needs to provide comprehensive service capabilities, including supporting multiple service types, multiple service levels, and multiple business models.

(2) Information systems need to provide flexible service capabilities, and service strategies can be flexibly adjusted according to business needs to meet business development needs.

(3) The information system needs to have good scalability, and it can easily realize the flexible allocation of resources under the condition of ensuring the normal operation of the business.

(4) The information system needs to have a good fault recovery capability in order to repair the fault in time.

(5) The information system needs to have high security to provide security for users.

(6) The information system needs to be manageable and maintainable so that it can be maintained and upgraded in a relatively short period of time.

4.3 Focus on System Scalability

The informatization construction of enterprises should be gradually implemented and expanded according to business development, so as to avoid excessive one-time investment. Therefore, when optimizing the information technology architecture, we must pay attention to system scalability.

First of all, when an enterprise optimizes its information technology architecture, it must fully consider the scalability of the system, not only to meet the needs of existing businesses, but also to consider future development. Secondly, when optimizing the information technology architecture, it is necessary to fully consider the disaster recovery capability of the data center, and ensure the high availability and business continuity of the data center by establishing a virtual machine system. During data center construction, active-active mode can be used to achieve high availability of the data center. In order to improve the disaster tolerance capability of the data center, the original physical network can be split or integrated into multiple virtual networks. If a network failure occurs, the virtual network will automatically switch to another virtual network; in the event of data loss and other unexpected situations, the business can be quickly restored through the active-active method [20].

After splitting the server from one physical server into multiple physical servers, a virtual machine system is deployed on the multiple physical servers. When the main server fails, its workload can be transferred to the standby server; when the main server returns to normal, the main server can continue to complete the business logic processing work.

5. Data Center Network Design Measurement Analysis

Next, the article analyzes the optimized data center network from the three perspectives of bandwidth, delay and packet loss rate, and adopts a comparative method. The results are shown in Figure 2 (bandwidth), Figure 3 (latency) and Figure 4 (packet loss rate).

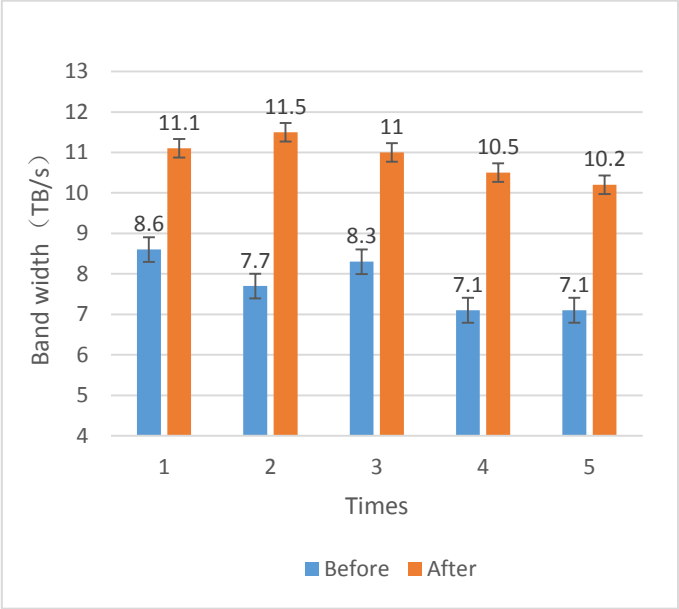

Figure 2. Bandwidth

It can be seen from Figure 2 that the highest bandwidth of the data center network before optimization is 8.6TB/s, the lowest is 7.1TB/s, and the calculated average bandwidth is 7.76TB/s; the highest bandwidth of the optimized data center network is 11.5TB/s, the lowest is 10.2TB/s, and the calculated average bandwidth is 10.86TB/s. It can be seen that the optimization method used in the article can effectively improve the network bandwidth.

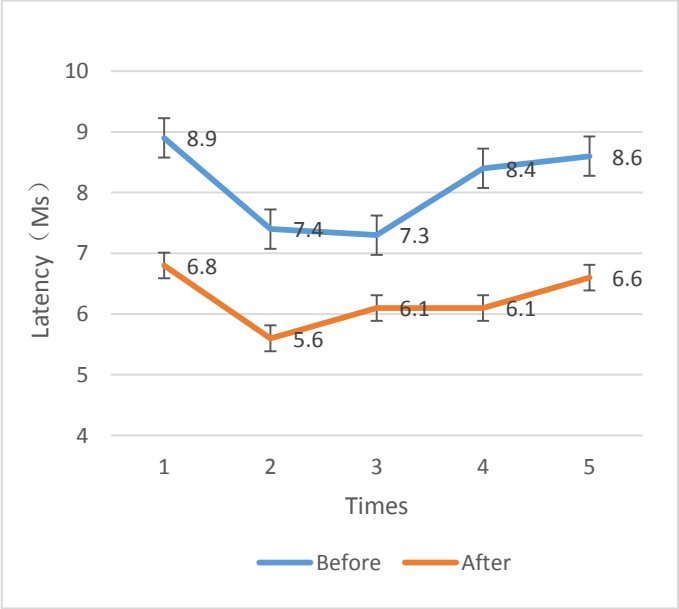

Figure 3. Latency

It can be seen from Figure 3 that the highest network delay before optimization is 8.9Ms, the lowest is 7.3Ms, and the calculated average delay is 8.12Ms; the highest network delay after optimization is 6.8Ms, the lowest is 5.6Ms, and the calculated average delay is 6.24Ms. It can be seen that the optimization method used in the article can effectively reduce the network delay.

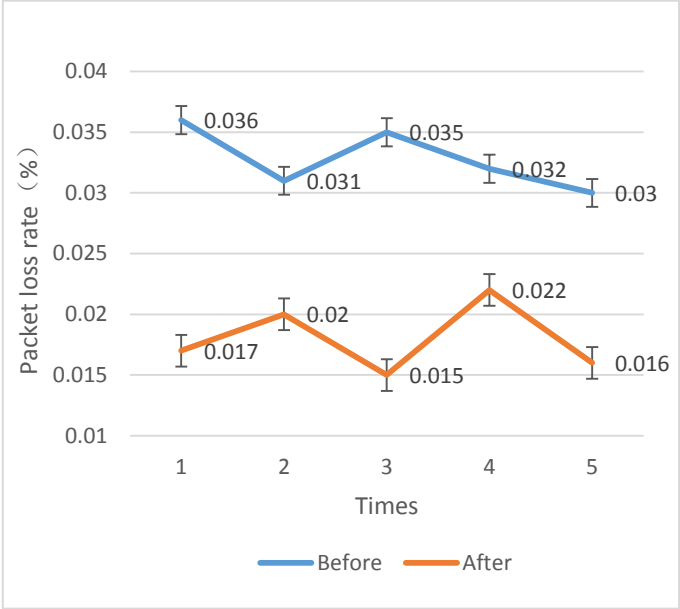

Figure 4. Packet loss rate

As can be seen from Figure 4, the highest packet loss rate before optimization is 0.036%, the lowest is 0.03%, and the calculated average packet loss rate is 0.0328%; the highest packet loss rate of the optimized network is 0.022%, the lowest is 0.015%, and the calculated average packet loss rate is 0.018%. It can be seen that the optimization method used in the article can effectively reduce the network packet loss rate.

6. Conclusions

When designing an enterprise data center network, it is necessary to determine the network architecture and select appropriate network equipment based on the actual situation of the enterprise. In the actual construction process, the principles of network design should be considered comprehensively, including security, reliability, and availability. Under the premise of ensuring security, the reliability of the data center network is maximized, thereby ensuring the security of the enterprise data center. With the continuous development of computer technology and network technology, the design of data center network should also be adjusted and optimized according to the new situation. On the basis of ensuring the security of the data center, optimizing the information technology architecture and design it into a scalable, reconfigurable, and high-availability information technology architecture. When optimizing the information technology architecture, it is necessary to optimize the system architecture, equipment functions, performance, cost, etc., so as to establish an information technology architecture suitable for its own development. As enterprise information construction becomes more and more important, data center network design should be combined with the actual situation of the enterprise, and analysis and planning should be carried out in terms of security, reliability, and availability, so as to improve the availability of the data center network.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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