The exploration of digital campus network flow control and its application

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Abstract: This paper carries out the analysis and comparison from the multi-angle of flow characteristics, the complexity of modeling, prediction accuracy and the application scenarios, and selects the flow control devices in the network bandwidth management to promote active, efficient and intelligent bandwidth management services. Based on the log the flow control device generates, this article summarizes the rules of campus network traffic, and takes measures to control the assignment of the flow, so as to enhance the utilization ratio of the network. The results show that this method is simple, and has better performance to meet the demand of real-time control of campus network traffic.

With the continuous development of informationization and the computer technology, the demands of the users of the network have become increasingly high, and the network bandwidth resources are increasingly tense. Some unpredicTable and unexpected performance bottlenecks will affect the operational efficiency of critical applications, and there will be network congestion or transient network disconnection. At present, the digitized campuses of colleges and universities generally take the access method of the multiple exits, which could improve the speed of users' access to the campus network to the network to a certain extent. But with the rapid enlargement of network users, network size and more and more complex network to a certain extent. But with the rapid enlargement of network users, network size and more and more complex network application, the contradiction between the bandwidth demand of the diversification of network application and limited bandwidth resources is increasingly prominent. Especially the applications of the P2P download / upload and HD VOD and so on occupy a lot of bandwidth resources, plus the abnormal flow of network attacks, which result in the bandwidth demand of the key network applications of the teaching, scientific research and management can not be effectively guaranteed, and even emerge the situation that the common webpage cannot access in the Internet boom. Therefore, the rational use of campus network bandwidth resources will optimize the existing network application folw, so as to ensure that the normal development of key network businesses has become one of the urgent needs to solve the problem.

1. The current status of campus networks

At present, the campus network access at the same time joins up 3 export links, respectively the 1000 MB China education and research network link(Cernet, hereinafter referred to as "education network"), the 100 MB China Unicom Link(China Unicom) and the 100 MB China Telecom link(China Net). At present there are more than 20 thousand school students and more than 7000 information points, covering the teaching and research office, the student areas, the family areas and so on, and providing network services such as the WWW, FTP, E-mail, network forum, video on demand and so on, which greatly facilitate the teachers' and students' study, life and work.

At the same time, with the rapid increase in the number of network users and computers, the network bandwidth resources are facing great pressure. Due to the reasonable use of the limited network bandwidth resources, the phenomena have occurred from time to time that the outlets of the network congestion, and the network speed becomes slow, and the network billing gateways are overloaded and collapsed and the critical applications cannot be effectively guaranteed. By collecting and analyzing the campus network flow for a period of time, it is found that the applications such as the thunderbolt, the eDonkey Network, PPLive, P2P download account for

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70% above of the campus network bandwidth resources. In addition, the network worms, viruses and the spam consume network bandwidth, which have a serious impact on the normal development of the key network applications such as the teaching research and office work. It is necessary to optimize and shape the campus network traffic, so as to ensure the normal development of the key network services, improve service quality and the users' Internet experience of campus networks.

2. Technology and equipment selection of the flow control

In order to reduce the negative impact of the problems above, the administrator can deploy flow control hardware devices to solve the problems between the campus network core switch and the firewall. The flow control first of all needs a certain detection method. The detection techniques mainly include deep packet inspection (hereafter referred to as DPI), deep dynamic flow inspection,(hereinafter referred to as the DFI).

DPI technology is a kink of flow measurement and control technology based on the application layer. When the data packet and the data flow run through the bandwidth management system, the system analyzes and reorganizes the information of the application layer of the open systems interconnection of the seventh protocol through deeply reading the packet payload, in order to get the original content, and then do a plastic operation on the flow according to the system definition management strategy.

DFI is a service identification technology proposed of DPI technology, i.e. different application types are reflected in the different state session connection or the data streams, which can ensure the recognition encryption transmission of the application flow. DFI focus on the universal characteristics of the network traffic. It needs no deep packet inspection and the agreement reduction technology. Only by acquiring points of each parameter on the flow, it analyzes spatial and temporal characteristics of peer-to-peer traffic, constructs the corresponding point of the flow model, and explores effective point-to-point network traffic flow control strategy. The equipment the network flow control uses based on the application layer control should have both the technology of DPI(deep packet inspection technology) and DFI(deep flow inspection technology). Through access to a variety of information and test equipment, the TTNET1000 (the traffic control facility) is selected.

3. Analysis and application of the strategy of flow control

3.1 Strategy analysis

According to the analysis, due to the large amount of burst of the TCP communication protocol, various applications of the network seize the resources with each other. Especially the P2P and the network video take up most of the bandwidth, sometimes up to more than 90%, leading to the occurrence of network congestion. How to effectively and transparently control the occupation of various applications of the Internet resources, and also do not interrupt the applications, and guarantee the key applications smooth is the problem the colleges need to solve. Taking the total bandwidth of 100MB as an example, the following discusses the customization of the strategies from the aspects of bandwidth management, IP speed control, connection limit, and the time management.

3.1.1 Bandwidth management

Foreign security services: foreign services of the college, such as the college website, mail service, digital campus portal platform, excellent course website, are the window of the college, which shall be ensured of the network access in any case. So se should set up certain bandwidth guarantee, creating a server group, and reserve 10MB bandwidth settings of the uplink and the downlink.

Common service grarantee:P2P download and the network video occupy a lot of bandwidth, seriously affecting the access of the intranet users of WebPages, mails and other common services. Therefore, under the premise of the normal access of intranet users to the common services(such as

HTTP, email, DNS),then consider the use of its application. The recommended settings of the uplink and downlink should be about 30MB bandwidth guarantee.

Instant communication service guarantees: the instant communication such as QQ, MSN, Yahoo!, Net-ease bubbles, especially the QQ service, the use rate of which is more than 90% and the use of QQ file transference is a common phenomenon. They should also be provided with a certain bandwidth, which can ensure the normal service. T he recommended setting of the uplink and downlink should be about 10MB bandwidth guarantee.

P2P restriction: the flood flow of P2P takes up most of the bandwidth, which needs to limit it. Under the premise of the download, limit the descending speed. The recommended downlink limit of the bandwidth should be 10MB, and the uplink 5MB, with the last execution.

Network video restriction: network video including the network television, streaming video, FLV video, should be limited to a certain range. Under the premise of the normal service, carry on the limit. The recommended downlink limit of the bandwidth should be 20MB, and the uplink 10MB.

3.1.2 IP speed limit

In order to prevent the phenomenon of individual users occupying the bandwidth, the bandwidth, the single IP needs traffic restrictions. But the school has internal IP, such as the computer room and the training room and so on. So we need to group IP users according to the usage, such as the teachers group, student group, the computer room group, and the training group. Then suitably restrict IP flow for each group.

3.1.3 Connection limit

Connection limit method and IP speed restriction are similar. According to the group of the group of the last step, limit the number of connections for a single IP, and also should consider that the single IP of the computer room has more outlets included, so it should be appropriate to relax the connection number, otherwise it may affect the normal operation of the student computer room network.

3.1.4 Time management

If the above method still fails to achieve the rational use of the bandwidth, according to the Internet peak periods or working time, set different time scheduling for different strategies. In the work time, the limited bandwidth is allocated to the office, teaching and research users, to ensure the daily teaching work. At the nonworking time, the bandwidth is assigned to students, staff quarters main area, to meet the huge demand for bandwidth of the dormitory area.

3.2 Strategy application

According to the analysis of the above strategy and network traffic use, create the policy of the two groups of “leisure” and “busy”, and then according to the Internet peak time of the school network users, different strategies are scheduled. The flow control strategy corresponding to “busy” guarantees the server and the common services, and restricts on P2P and network video, and limits the speed of single IP through the way of grouping. In addition, by blocking the garbage bags filter the virus and network attacks, which save bandwidth and improve the network security.

After the application strategies, the thunderbolt and the network video flow are effectively controlled. As can be seen from the graph, through the implementation of the above strategy flow management, all kinds of applications can be reasonable and guaranteed of the bandwidth, and the export bandwidth resource are of efficient use. In the un-busy network time3, release the application of P2P and network video, while the network bandwidth of the critical applications such as Web browsing is guaranteed. In the busy periods of the network, the P2P application is limited in scope, to give priority to ensure the bandwidth of the key application.

4. Application of flow control

After the operation of the flow control equipment is normal, the system administrator can analyze the campus network through the log flow. Generally the peak is in the morning and four thirty and ten thirty in the evening, the flow gradually decreases, until the next day at 8 a.m. In view of this, the administrator can formulate a strategy in accordance with the time. In the daytime, control point to point traffic flow and the restrictions should be smaller. In the night, amplify the point-to-point traffic flow and rationally use bandwidth resources in accordance with the laws.

Through the logs, the administrator observes part of the terminal computer after completing download functions continue to download for other users. The administrator can correspondingly limit the speed and the channel of the upload bandwidth, which can effectively protect the network bandwidth management and users, the administrator arranges the control strategies of different rules, so that the limited bandwidth resources can obtain the reasonable use, and meet the needs of college staff and students, which guarantees the core businesses including webpage browsing, email, SQL(Structured Query Language) database and others, But for the point-to-point download and the video flow limit of the rate efficiently, effectively manage the Internet users in the network, improve the working efficiency of internal staff, and provide a scientific basis for the school network planning and bandwidth expansion.

Of course, the flow control devices have the defects. The key technical indexes of the flow control equipment are the signature. The new network protocol and the application type should update feature code library in flow control equipment, to meet new users' needs. The updates of the general characteristic code database are after the new network protocol and the application type, so there exists the phenomenon that the temporary network traffic is not controlled. The administrator can also customize the character code, and customize the code base for the characteristics of different environment, thus making the staff have a good network environment.

5. Conclusion

With the development of the construction and the application of digital campus, the network size and the volume of business continue to increase, and the network security situation is increasingly serious. How to guarantee the bandwidth requirement of the key network application and at the same time improve the bandwidth utilization of the network security is a new problem we are facing. Through the deployment of the professional equipment of flow control, implement traffic control strategies in the network equipment, improve the network security defense ability, strengthen the construction of cyber source method, optimize the campus network bandwidth resources, effectively ease the traffic of campus network export, and guarantee the bandwidth demand of the key network application on the campus network. The practice has proved that this scheme can effectively optimize the network bandwidth resource, reduce the abnormal network attack traffic grooming, reasonably ease the flow of exports of the campus network, and effectively guarantee the bandwidth requirements of key network applications of the campus network.

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