

Implementation and Evaluation of the Educational IP Network using QoS Appliance

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Abstract

This dissertation proposes a hierarchical IP network structure in order to achieve the fairness of communication service and the bandwidth guarantee of important traffic. The basis of the concept is a technology of Network Computing and QoS (QoS: Quality of Service) & traffic management. Experimental results confirm both the feasibility and the effectiveness of the proposed method for Internet multimedia traffic control.

1. Introduction

As in the field of education as well, such as Virtual University, Archive Museum and so on, the practical use of IP network has been finally started. But, the present IP network has been developed in the frame of voice telephone network so far. This IP network does not distinguish the large quantity group of the "bits" who are flowing in the network over the border with no distinction of day and night. Thus, the situation begins to occur that necessary service cannot be received when it is necessary.

At first, problems of the present communication service are analyzed by this dissertation, and then it is stated about a hierarchical network structure using the technology of Network Computing. At last, in order to achieve the fairness of communication service and the

bandwidth guarantee of important traffic, it is also stated about the traffic control by using the QoSWORKS. (QoS: Quality of Service)

2. Problems of the present communication service

There are the following problems in the network since the present network had been developed and practically used from the voice telephone network.

Connectivity has the priority (It is securely to be connected with the companion), network quality such as data rate and latency time depends on the condition of the network at that time, and it can't be selected or changed by the user side (Best-Effort communication service).

Although all the time access is indispensable of IP communication, network resources such as call detection and so on are being used even under the use-less condition because basically the network is a circuit switching system.

Because the signal channel is not opened to users, it cannot be controlled of priority & non-priority choice according to the contents of communication and the usage bandwidth cannot be controlled either.

There is lack of policy towards the heavy users who roll up the network once being connected, and towards those large quantities of mischief traffic

from the strange companion.

To secure quality over such a network, the use rate of the network will be very low; or the voice network and data network should be different. But, equipment investment is uneconomical in this way, and multi-media information can't be transmitted, either.

3. Hierarchical network structure

Most of LAN being used in college premises is a Client/Server System (2-layer structure). As for the characteristic of Client/Server System, the practice of application program is done on the client side while the common function of network like the management of users and database is done on the server side.

Therefore there come the following problems .

The response speed in the WAN environment is remarkably slow.

There is no assurance of centralization and real-time control of the database contents with the management increase caused by the plural form of servers.

In order to carry out an application program, the client's high specifications are needed, such as the speed of CPU and the capacity of memory. Furthermore, it takes a lot of time and resources to do the work of distribution、management and upgrade the version of application program.

To solve these problems, first there is a way called Thin Client/Server System (3-layer structure) of which an application server is set up between the database server and the client. Next, a QoSWORKS (a bandwidth control appliance manufactured by the Sitara, Inc.) that acts as an edge appliance for the purpose of communication traffic control is added between the database server and the WAN router. Thus, the whole system comes to a 4-layer structure by this implementation. The construction is shown in [figure 1](#). It becomes possible to administrate the server

centralized due to the hierarchical structure. And the balance of the centralization and distribution of the whole system's function is attempted as well as to correspond with the QoS technology importantly from now on.

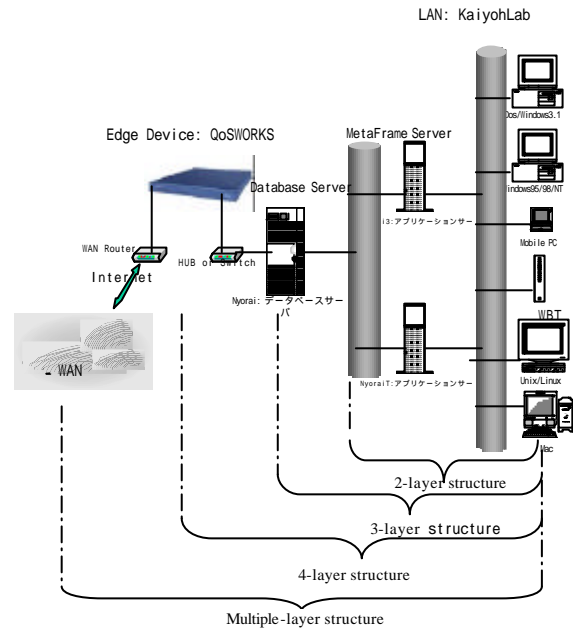


Figure 1: Hierarchical network structure

4. Fairness of communication service and traffic control

As a basic principle of the communication service, it should be wide, extensive and fair towards users. The necessary service should be received when it is necessary. And high function and high quality service could be received if a charge is provided. So far, as for the present network, information that flows in the network is handled monistically as a "bit" line with the principle of "first in & first out". Furthermore, it is lack for general-purpose router to watch and control the usage traffic such as bandwidth control and priority/non-priority control based on IP header data rewrite (ToS: Type of Service). Therefore, there is lack of policy toward the heavy users who roll up the network.

Putting QoSWORKS at the edge of network in the following process controls the priority/non-priority of traffic. [Priority (Diff-Serv) communication service]

“ Differentiated Service Code-Point ” six bits are written down in the Type of Service field (eight bits) of the IPv4 packet. The example of DS Code-Point is shown in the [table 1](#).

Table for the movement of DS Code-Point and Packet Scheduler is transmitted to each gateway.

Every gateway controls traffic according to the corresponding table. All the work is completed only with the gateway itself, so there is no influence on the work of the next gateway.

Table 1 . Example of DS Code-point

	Class 1	Class 2	Class 3	Class4
Priority occasion 1 (low scrapping)	001010	010010	011010	100010
Priority occasion 2 (middle scrapping)	001100	010100	011100	100100
Priority occasion 3 (high scrapping)	001110	010110	011110	100110

Note 1. Whole packet treated by common QoS is called a class.

Note 2. Four classes are necessary to support express transfer and reliable transfer in gateway.

5. Traffic control using the QoSWORKS

To keep the network from legacy traffic and mission critical traffic, an indoor experiment of traffic control and bandwidth guarantee by using the QoSWORKS is carried out by using the LAN

inside the Ryukoku university.

At first, the amount of traffic flowing in the experimental network is observed according to the application and the IP address. The result is shown in [figure 2](#).

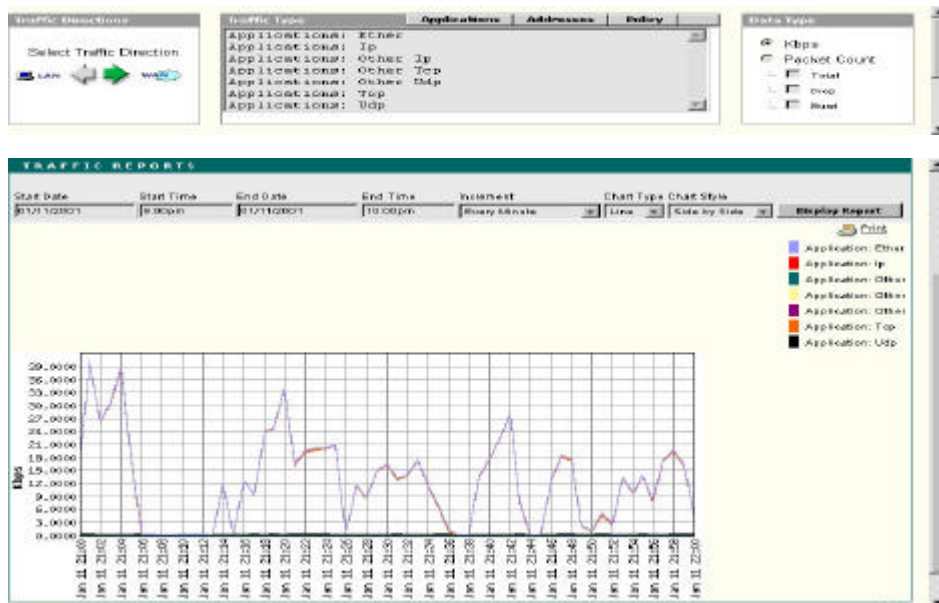


Figure 2: The amount of traffics of the laboratory

And figure 3 is the executive example that the bandwidth allotment experiment is carried out by the QoSWORKS. There are 2 kinds of traffic assigned 16kbps respectively. The vertical axis is

the throughput; it shows that the bandwidth allotment is done correctly and fairly. It took for the average of 30-seconds of the start-up time.

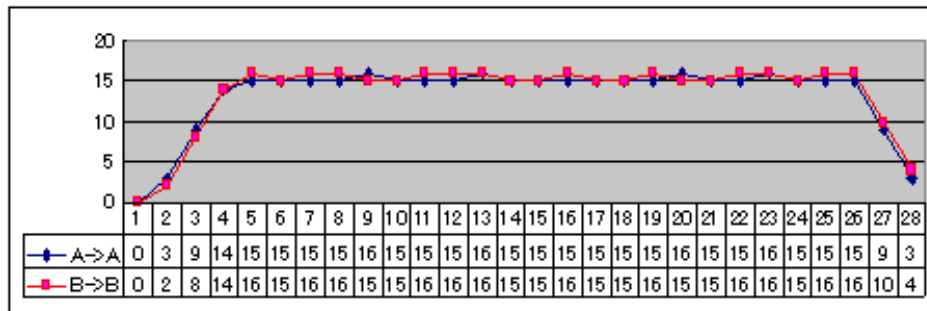


Figure 3: The throughput getting from the clients

6. Conclusion

It is examined about the IP communication service with the present problem analysis and the solving method. It is necessary to control the harmful traffic, and necessary service should be received when it is necessary so that the Internet may be used more from now on. QoS technology will be the kernel technology to turn the usual voice and data centralized Internet into an ideal multi-media network remarkably. Also the QoS technology with the function of traffic control and bandwidth guarantee is going to be achieved in the next generation IP communication network as well as to be used for Education and Training.

7. References

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