

A Comparative study on CBR and UBR

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Abstract- This paper is used to represent the efficiency of constant bit rate and Unspecified Bit rate transmission. CBR class is used for ATM virtual circuit needs static bandwidth which is continuously available during the active connection period and UBR class is used for those which do not require tightly constrained delay and delay variation. This paper represents the performance of the two service classes CBR and UBR of an ATM network on different application compared to each other and prove the most suitable service class for each application. Both CBR and UBR classes have been determined using some parameters and based on these parameters, it is analyzed that how the CBR_UBR class works more efficiently than UBR_UBR class for those applications which require tightly constrained delay and delay variation.

[1]

INTRODUCTION

The Asynchronous Transfer Mode is nothing but a connection-oriented; cell based packet-switched technology where packets in a fixed length of 53 bytes also called as cells are switched in an ATM network. There are four different classes of service an ATM network provides is the Quality of Service (QoS) [2,5]. The four classes are: CBR, VBR, ABR, and UBR. In this paper we will be analyzing ATM and its performance on different service classes. Here we will focus on CBR versus UBR by comparing their performance on transferring data of different types and the effectiveness of various service classes will also be demonstrated. When an ATM virtual circuit needs a static amount of bandwidth that is continuously available for the duration of an active connection then CBR class provides that. CBR can be used for services which have a specified bandwidth, such as voice transmission [1,8]. For those which do not require tightly constrained delay and delay variation the UBR service classes are designed.

It is intended for delay-tolerant or non-real-time applications. It does not provide any guarantee for service. UBR service is also interpreted as the "best effort service". Now to compare performance of CBR and UBR we are concerned about the three statistics and they are download response time, packet delay variation, jitters in two applications, which are Voice, and Ftp. After studying these statistics we will be able to determine the best choice for each application [10].

II. OPNET

OPNET Modeler is an object oriented simulation tool, which provides a visualized simulation environment for network modelling. OPNET can be used to test new protocols and various applications in a networked environment. Network equipment manufacturers also use this tool to evaluate the performance of newly developed products prior to manufacturing. OPNET is structured into a number of hierarchical modelling layers. The modelling layer details are hidden from its higher layers. So users can concentrate on a specific modelling problem and frees them from the unnecessary details of lower layers [9, 11]. OPNET can be run in UNIX (e.g. Solaris, HP) or Windows NT / Windows 2000. It supports concurrent users. The required number of concurrent licenses can be specified at the time a purchase is made. OPNET's built-in model libraries contain most popular network protocols and products added to the libraries each year. For example, TCP/IP, ATM, frame relay, MPLS, IP QoS and RSVP are explicitly modelled by OPNET [4].

OPNET also models a wide range of network equipment (e.g. routers, switches, links, etc.) manufactured by leading network equipment manufacturers in the world, such as 3Com, Cisco, Bays Network, Fore Systems, etc. OPNET offers network modellers with great freedom and convenience in simulating networks they want to study [6,7]. For example, a network can be built by selecting the desired from the Object-Network Palette and connecting them with appropriate link models, just like the way we build networks in real life. Alternatively, a network can be built automatically by using the network configuration Wizard supported by OPNET [3].

III. OPNET SIMULATION

A. Workspace -

To develop our topology of ATM network we need the objects below:

atm8_crossconn_adv; Application config; Profile config; ATM_adv; & Subnet.

To simulate an ATM network in US, we put four subnets in the different locations of US and two switches in the middle of workspace. Atm_adv links are used to connect among them.

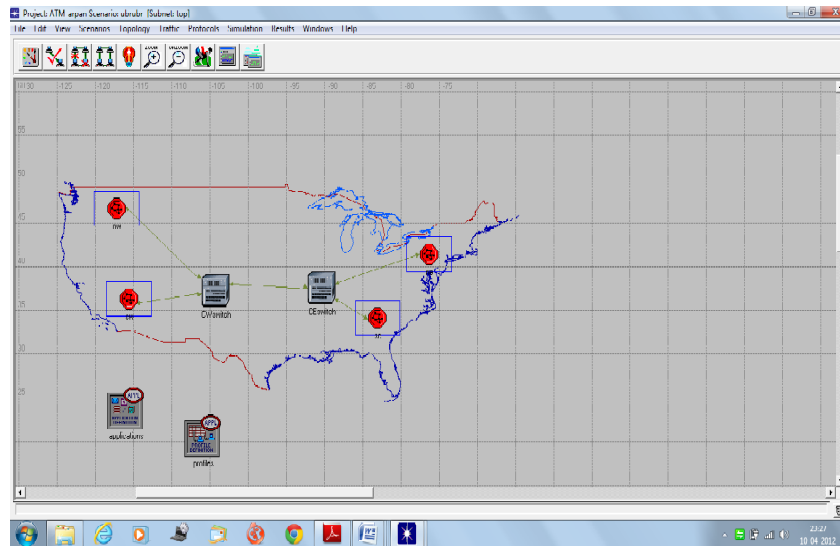


Figure 1. Network Topology

B. Attribute Setting -

We focus on two applications FTP and VOICE. For the application node, we set two applications inside, which are High Load FTP and PCM Quality Speech for VOICE.

For the profile node, we also set number of row to two, row one is for FTP and row two is for VOICE.

C. Creation of Subnet -

To create the topology of four subnets and we need the following objects:

atm8_crossconn_adv; atm_uni_client_adv; atm_uni_server_adv; ATM_adv.

Similarly as we have done the topology before, the switch in the middle of workspace, on the top; two client nodes are there for voice application, on the bottom, there are two client nodes for FTP applications, also, there is one server which support the data transfer in each subnet. The following graph is the topology of subnet.

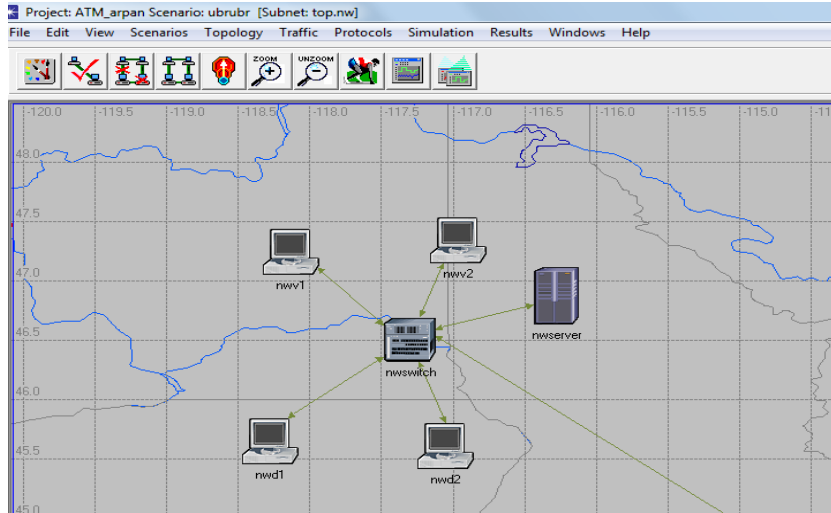


Figure 2. Subnet view

Now we create two scenarios, and one is named CBR, which stands for CBR for FTP and VOICE application. Another one is named UBR, which stands for UBR for FTP and VOICE application. For scenarios CBR, we set the ATM application parameters and Queue Configuration of four client nodes as CBR ONLY. For scenario UBR, similar as CBR, we set the ATM application parameters and Queue Configuration of four client nodes and one data server node as UBR ONLY. Now to set the ATM application parameters and Queue Configuration of data server to the related class: CBR and UBR.

For all switches, we also need to set the Max_Avail_BW, it is the maximum bandwidth allocated. To test the performance of the applications defined in the network, we will collect the following statistics: Download Response time for FTP application, Packet Delay Variation, end-to-end delay and Jitter for VOICE application

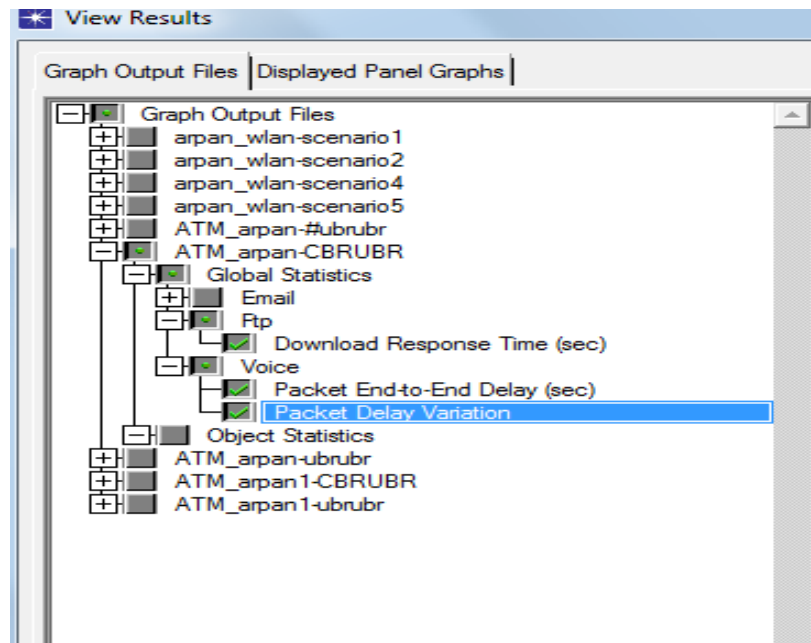


Figure 3. Results collected from simulation

#	Scenario Name	Saved	Results	Sim Duration	Time Units
1	CBRUBR	saved	out of date	10	minute(s)
2	ubrubr	saved	up to date	10	minute(s)

Figure4. Simulation settings table

IV. RESULTS ANALYSIS

A. Downloading response time of FTP

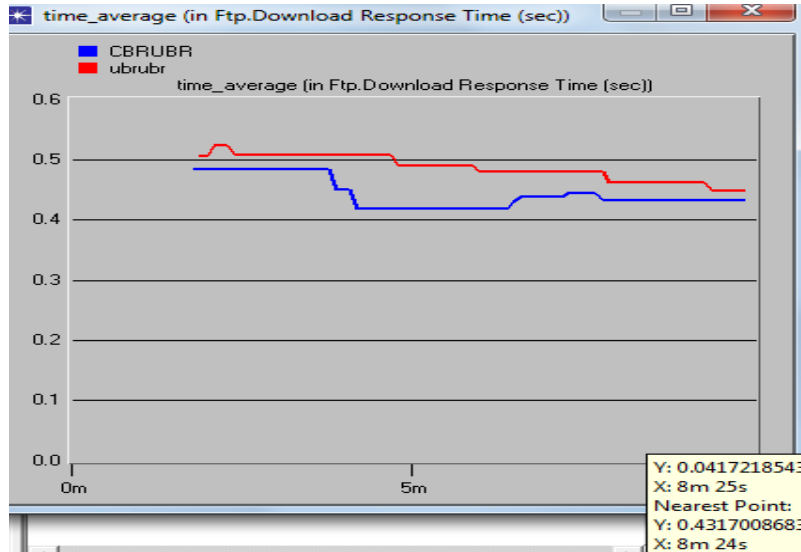


Figure 5. Ftp & its Downloading response time

From the graph we can clearly see this the download response time of CBR_UBR (indicates the blue line) is much lesser than UBR_UBR(indicating the red line). This signifies the scenario CBR_UBR is more suitable for Ftp application. As we have stated above, UBR is suitable for the application which does not require tightly constrained delay and delay variation, such as traditional computer communications applications. Thus, we can determine that our result is reasonable and totally matches the specification of UBR class.

B. Packet Delay Variation of VOICE

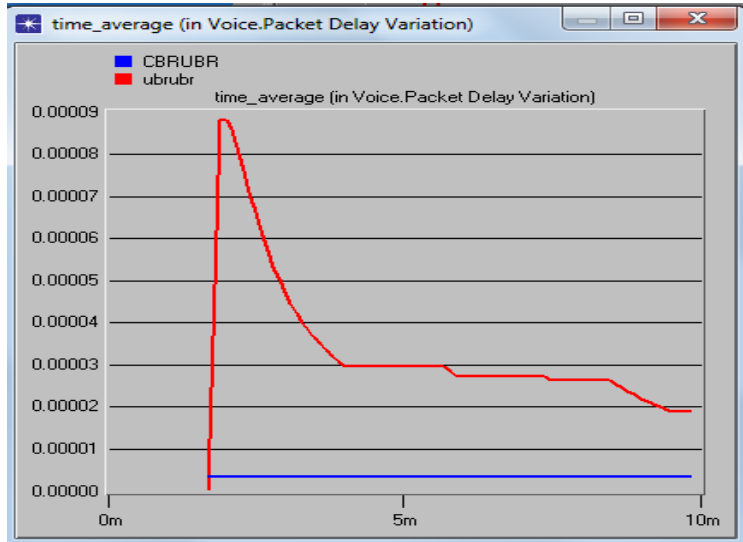


Figure 6. Packet delay variation of Voice

We can see that packet delay of UBR_UBR which is red line fluctuates dramatically; the delay goes very high at first and then goes down, however, the packet delay in CBR_UBR class which is blue line goes very stable and is very close to zero. Thus we can ignore the delay in CBR_UBR as it is negligible. Just as expected, the CBR_UBR class is intended for real-time applications, i.e. those requiring tightly constrained delay and delay variation: Voice application. UBR_UBR is for the service which does not require constrained delay. So the above graph is meaningful and reasonable. The graph shows the advantage of CBR_UBR class compared with UBR_UBR class based on Voice application.

C. Packet End-to-End Delay of VOICE

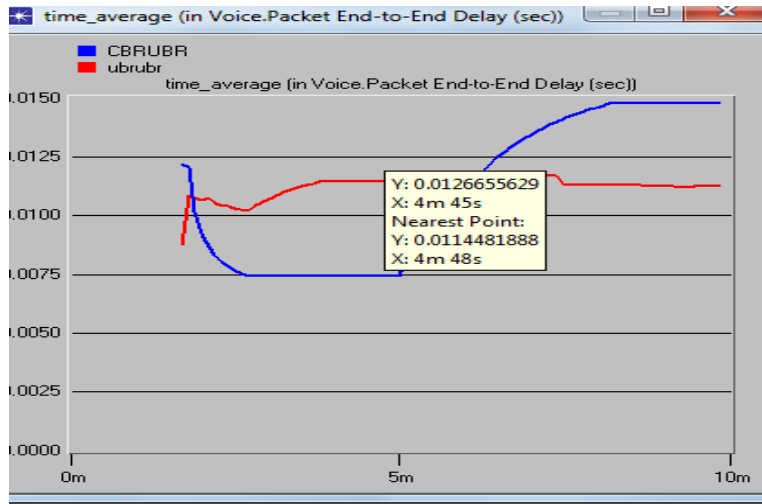


Figure.7. Packet End-to-End Delay of Voice

It is very difficult to tell the difference of time delay between CBR_UBR class and UBR_UBR class roughly. As time going, the end-to-end delay of UBR_UBR class which is red line goes a little bit higher than CBR_UBR class which is blue line at the beginning. Then the blue line jumps abruptly. Although there is no large difference between them, considering we only develop four subnets to simulate the whole

ATM network, in the real life, there are millions of subnets located in the world. Thus, as the numbers of clients go higher, the end-to-end delay of CBR_UBR class would be smaller and smaller than UBR_UBR. We clearly see from the above results CBR_UBR class is extremely advanced and most suitable for those applications which require tightly constrained delay and delay variation.

V. CONCLUSION

In this paper we have studied the effect of UBR and CBR classes in an ATM network. By using OPNET we have successfully created the network topology of ATM and set its attributes to demonstrate these two service classes. After comparing and studying results, we claim that CBR_UBR would be much better for data transmission. It is consistent with what we expect by researching from other related websites and books.

The biggest challenge in the project was lacking of related knowledge in ATM field, since many attributes had to be set up in the OPNET model. This required many trials to determine which attributes are appropriate for a successful simulation.

VI. REFERENCES

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