Assignment Report II

Using network topology as shown in Fig.1. Do NS2 simulation and answer the following questions. In report, please specify the scenario and the values of parameter in your simulation. SID(Student ID) is the last digit of your student ID number.

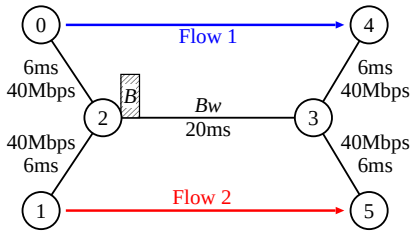

Figure 1: Network Topology

1. Use UDP (Flow 1) for experiment in Fig. 1. The application is CBR.

   (a) Parameters are set as left below table. Calculate throughput for 4 cases in right table and investigate the relationship between transmit rate, data size and transmit packet interval. Write out the data transmission mechanism of UDP(CBR).

Setting value of parameters	
Bottle-neck link bandwidth(Bw)	10 [Mbps]
Bottle-neck link queue size(B)	32 [kbytes]

Case	CBR transmit rate	CBR data size
1	8 [Mbps]	1000 [bytes]
2	4 [Mbps]	1000 [bytes]
3	4 [Mbps]	500 [bytes]
4	SID [Mbps]	1000 [bytes]

   Throughput T can be calculated by equation (1). Take care to the unit of throughput. (bps = bit/sec)

$$Throughput\ T\ [\text{Mbps}] = \frac{(total\ sent\ packet)(packet\ size(include\ header))}{sent\ time} \tag{1}$$

   (b) Do simulation with various values of Bw and then calculate throughput, packet drop rate. Graph and analyze the result. In which condition, packet will be dropped? Analyze the problem of UDP(CBR) when the user demand a high rate transmission.

Bw	B	CBR sent rate	CBR data size
1 – 20 [Mbps]	32 [kbytes]	8 [Mbps]	1000 [bytes]

   Packet drop rate P_d can be calculated by equation (2).

$$Packet\ drop\ rate\ P_d\ [\%] = \frac{Total\ drop\ packet}{Total\ send\ packet} \times 100 \tag{2}$$

2. The UDP traffic of Flow 1 in Fig. 1 is varied by time as Fig. 2. Do experiment about the monitor queue in bottle-neck link. The application is CBR.

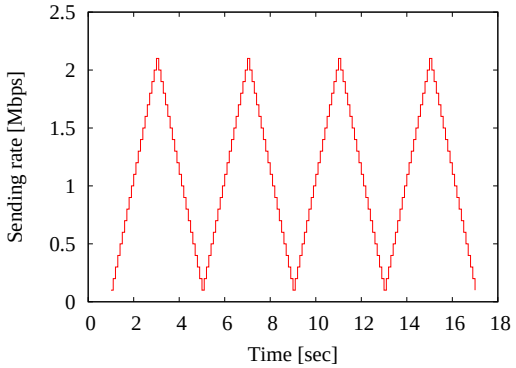

Figure 2: Sending traffic

(a) Bottle-neck queue B is 32[kbytes], data size of CBR is 1000[bytes]. Do simulation when the bandwidth of bottle-neck link Bw is set to $1.0, 1.4, 1.8, 2.2$[Mbps]. Graph the sending traffic, bottle-neck bandwidth, varying of queue size and packet dropped from queue. Using the result to explain about DropTail queue mechanism.

(b) Do the simulation when the data size of CBR is 1000[bytes], bottle-neck bandwidth Bw is 1.4[Mbps] and bottle-neck queue size B is set to $32, 48, 64$[kbytes]. Graph the varying of queue size and amount of dropped packet from queue. Write out the influence of B to UDP(CBR) transmission. Analyze the effect of increasing queue size to avoid packet drop .

3. Using TCP (Flow 2) in Fig. 1 for experiment. The application is FTP.

(a) Parameters are set as the below table. Do simulation with various values of Bw and then graph the throughput, packet drop rate, and analysis the result. Compare the packet drop rate with UDP.

Bw	B	TCP maximum window size	TCP packet size (not include header)
1 – 20 [Mbps]	32 [kbytes]	64 [packets]	1000 [bytes]

(b) (a) Observe the dropped packet, check if the same data in dropped packet (same sequence number) is received at receiver or not. (retransmit is working or not).

(c) **[Develop Problem]** Use the parameter which occur drop packet. Do simulation with various values of B then analyze the influence of B to TCP transmission. Analyze the effect of increasing queue size to avoid packet drop.

4. Survey using reference on internet and experiment 1, 2 to understand about the characterize of TCP,UDP. Which service is suit for each protocol?

5. **[Develop Problem]** Analyze the influence of TCP maximum window size. Using TCP (Flow 2) in Fig. 1 for experiment.

(a) Parameters are set as below. Do simulation with various value of Bw, calculate and graph the throughput. Put the graph upon the graph of experiment 2-(a) for comparing.

Bw	B	TCP maximum window size	TCP packet size (not include header)
1 – 30 [Mbps]	32 [kbytes]	128 [packets]	1000 [bytes]

(b) Analyze the significant of increasing the TCP maximum window size (buffer size of receiver) in broad band network, which is developing recent years.

6. **[Develop Problem]** Mixing the UDP (Flow 1) and TCP (Flow 2) in Fig. 1 and do simulation. (for example, mixing the experiment 1-(b) of UDP and experiment 2-(a) of TCP). Calculate and analyze the throughput and packet drop rate of UDP, TCP, respectively. Since the results are depended on the value of Bw, do simulation with various values of Bw. Consider about the problem of mixing UDP and TCP in large scale of network (for example, internet).

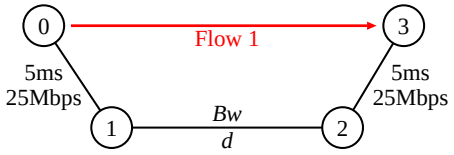

Figure 3: Network Topology

7. Use TCP Tahoe for flow 1 in Fig. 3. The application is FTP. The delay of bottle-neck link d is 5[ms].

(a) Set bottle-neck bandwidth Bw to 18[Mbps] then do simulation. Analyze about the change of window size. In the graph, specify about window size, slow start threshold and send window size. Calculate the throughput and compare with theoretical maximum throughput value.

(b) Bw is set to 9[Mbps] for simulation. Do the simulation similar to (a) and analyze about the change of TCP and describe about algorithm of TCP Tahoe. Calculate throughput and compare with Bw.

(c) Do simulation while Bw is varied from 5 to 25[Mbps]. Calculate the throughput and graph it. With a large enough value of Bw, the throughput is saturated. Explain why throughput is saturated at that value. Which factor affect to TCP throughput.

8. Use TCP Reno for flow 1 in Fig. 3. The application is FTP

(a) Do simulation similar to experiment 1-(a) and analyze the result.

(b) Do simulation similar to experiment 1-(b) and analyze the result. Write out about the algorithm of TCP Reno

9. Use TCP Tahoe or TCP Reno for flow 1. The application is FTP and Bw is 18[Mbps].

(a) Using TCP Tahoe for flow 1 in Fig. 3. Do simulation when d vary from 5 to 100[ms]. Calculate the throughput and graph it. In graph, X-axis is RTT(Round Trip Time) and Y-axis is throughput.

(b) Using TCP Reno and do simulation similar to (a). Graph the throughput upon the throughput of experiment (a).

(c) Set d to 5[ms], (B(SID×10)[ms], 100[ms] and do experiment using TCP Reno. Graph the change of send window size. Put them in the same graph for comparison. Similarity, graph the change of sequence number, *seqno*.

(d) There is a relationship between throughput and RTT which is not depend on type of TCP. Analyze the result of experiment (c) and discover that relationship. Comparing with the result of experiment (a), (b).

(e) The network between Japan-USA, Japan-Euro or the satellite network have very large delay. In these network, describe the meaning of increase maximum window size (the buffer size of sender).