ECE 541 Project: NS Simulation with Poisson Traffic

Objective:

The objective of this project is to learn the use of NS3, a standard discrete-event simulator for network analysis. You will build a simple network topology and implement/install a traffic generator, and derive network performance metrics from the simulation results.

Instructions:

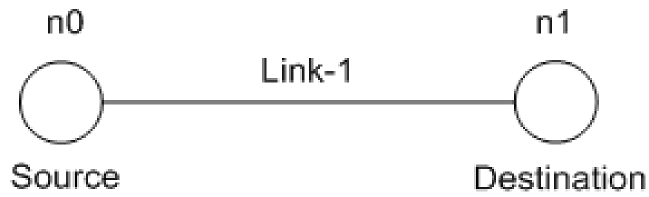
- You have to finish the project **by yourself, independently**. You **need to submit one project report, along with the simulation scripts for your experiments and the generated trace files and graphs. We should be able to execute your codes in our computers to examine your work.**
- You need to type your project report using some editing software, and submit it as a PDF file. Your report should be written with good readability. You need to clearly describe the problem, your codes for the simulation, the generated trace files and the associated graphs, and your analysis.
- **Electronically submit** your documents through Blackboard. Compact all of your files into a zip package, named as "**ID_lastname.zip**" or "**ID_lastname.rar**". If your documents are not named according to this rule, you will get a penalty of "-10" points from your final grade of this project.
- Your report is due at **23:59 pm, Nov. 24, 2019, Chicago time.** Late submission penalty is 20% of the total grade for this project per day.
- In the week **Nov. 25 to Nov. 29**, TA will allocate each on-site student a time slot of 15 minutes to demonstrate your simulation. The demonstration is not required for remote students, but TA will double-check your codes.
- Please use TA's office hours to discuss project-related problems.
- If we identify any "copy" issues, the involved persons will be directly given a "Fail" to this course, and reported to the department. NO second chance will be available.

Grading:

- **Implementation 50%, Graphs 20%, Analysis 30%**

Detailed project descriptions:

With NS-3 simulator, build the following topology and collect simulation data.



Link-1: **duplex link, 1Mbps, 10ms latency, drop-tail queue, queue size 50**

Experiment 1: Throughput and loss rate under constant-rate traffic

1. Run simulations under different scenarios, with the CBR traffic rate set to be 0.1 Mbps, 0.25Mbps, 0.5Mbps, 1 Mbps, 1.5 Mbps, 2 Mbps and 3 Mbps, respectively. Analyze the trace file and calculate the throughput and loss rate in each case. (You may need to change the trace-file name in different cases.)
2. We define the throughput to be "*N/T*", where *N* is the total number of packets received by n1 and *T* represents the simulation duration. Plot the curve of the throughput (at node n1) versus the input traffic rate (at node n0). Recommend to use the input traffic rate (i.e., 0.1Mbps, 0.25Mbp, and so on) as the x-axis. (***Note: Please map your throughput from packets/second to bits/second.***)
3. We define the loss rate to be "*L*/*M*", where *L* is the total number of lost packets and *M* represents the total number of packets sent out from n0. Plot the loss rates of the CBR flow versus the input traffic rate at node n0.
4. Explain your simulation results.

Experiment 2: Throughput and loss rate under Poisson traffic

1. Apply Poisson traffic sending from node n0 to node n1. Keep the rest of configurations unchanged.
2. Run simulations under different scenarios, with the mean rate of the Poisson traffic set to be 0.1 Mbps, 0.25Mbps, 0.5Mbps, 1 Mbps, 1.5 Mbps, 2 Mbps and 3 Mbps, respectively. Analyze the trace file and calculate the throughput and loss rate in each case. (You may need to change the trace-file name in difference cases.)
3. Plot the "throughput vs. input rate" and "loss rate vs. input rate" curves, as you have done in Experiment 1. Compare the results from Experiments 1 and 2, explain your observations.

Experiment 3: Queuing effect under Poisson traffic

1. Set the rate of Poisson traffic to be 0.95Mbps. In previous experiments, we use 50 as the queue size. Now, run simulations under six scenarios, with queue size set to be 5, 10, 30, 50, 70, and 100, respectively.

2. Based on your simulation results, plot the “throughput vs. queue size” and “loss rate vs. queue size” curves. Explain your simulation results.

Your report should contain the simulation script, plotted figures based on the trace files from your simulations, explanations and analysis to your simulation results.