ECE 671 – Computer Networks
Fall 2011 – Lab 3

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Please answer the following questions and submit your lab report electronically on SPARK. Grading will be based on the rubric posted on the course website.

Lab Goals

- The goal of the lab is to observe the queue length in a real router under different traffic loads. The obtained results are compared to those obtained from queuing theory.

ONL Setup

- Download the new ONL configuration file from the course web site into your personal directory. You need to start ONL with the "-logfile" option (i.e., "java -jar RLI.jar –logfile").
- In this assignment, we use two "NPRs" and three PCs. The Monitor window is the Bandwidth, we monitor the bandwidth in port 4.4, 4.3(incoming link) and 4.1(outgoing link).
- You need to create the queue length monitor by yourself (the tutorial is in http://wiki.arl.wustl.edu/onl/index.php/NPR:_Examples#Create_the_queue_length_chart)
  In the queue length chart, we monitor the length of queue 64 at port 4.1. Choose the check box "log to file" and create a file (such as "ql_2.58ms.txt") to save your data of queue length in your local directory.
- The threshold of port 4.1 (storage capacity of queue) is 8MB and the port rate is 10Mbps. Two UDP connections share a single queue (queue id is 64) at port 4.1. We using the default delay and routing table.

Prepare: Learn to build the TG program

The Traffic Generator (TG) is the program generates and receives one-way packet traffic streams between traffic source and traffic sink nodes in a network. In this lab assignment, we use it to generate the exponential interarrival distribution of packets in the UDP client part and observe the change of queue length in the outgoing link.

Read and follow the TG User's Manual (http://128.9.160.29/tg/) to set the TG specification file. Learn to use the command specification language.

- In the UDP server part, the example of TG specification file is

  on 0:15
  udp 192.168.10.1.5001 server
  at 1.1 wait

  Note: 192.168.10.1.5001 is the IP address and port number of server

  This script instructs TG to execute in the server or the sink mode in which it only receives packets and records the information in the binary log file. TG is initialized at time 15 secs from the start, and starting at 1.1 secs after initialization it waits for clients to send data.

- In the UDP client part, the example of TG specification file is:

  on 0:15
  udp *192.168.10.1.5001*
  at 5 setup
  at 6 arrival exponential *0.00255* length constant 1470
  time 500

  This file specifies the following to TG: At 15 secs open a UDP socket to send packets to the server waiting at 192.168.10.1 and port 5001. After 5 secs perform setup (times specified are relative to the start time -15 secs here.) Starting at time 6 secs send constant packets (1470 bytes) to the server with an exponential interarrival distribution with a mean of 0.00255 seconds for 500 secs.

In this assignment, you could set the starting time, setup time by yourself or using the values like above example. The port number of server is 5001. You should set the packet length distribution as constant and value as 1470 Byte, set the total transmitting time as 500 seconds. At the same time, you need to set the interarrival time distribution as exponential and choose 8 group values of mean: 0.00255s, 0.00256s, 0.00257s, 0.00258s, 0.00259s, 0.00260s, 0.00270s and 0.00300s separately to observe the change of queue length.

Lab Assignment: Observe Queue Length

1. Finish the ONL setup and create the queue length monitor window.
2. After using the SSH terminal to log into the end-system, you should using the "vim" command to create the tg script in the current directory and enter the corresponding tg command (the content introduced in the prepare part) in the script. You need to create three tg scripts: "server.tg", "client1.tg" and "client2.tg", which are separately using in the server part and two client parts.
3. After creating the TG file, using the following command to invoke the TG:
   - in the server part:

/users/onl/bin/tg_kw –f –i *server.tg* –o *server.log*

- in the client part:

  /users/onl/bin/tg_kw –f –i *client1.tg* –o *client1_(mean_value).log*

  /users/onl/bin/tg_kw –f –i *client2.tg* –o *client2_(mean_value).log*

The server.tg, client1.tg and client2.tg are the input-file names (you just create). The server.log, client1_(mean_value).log and client2_(mean_value).log are the output-file names. For example, if you set the mean of exponential distribution as 0.00255, you could enter the /users/onl/bin/tg_kw –f –i client1.tg –o client1_2.55ms.log in the SSH terminal of client1.

Note: You should first invoke the TG in the server part and then enter the corresponding command in the client part, because the TG program should wait indefinitely for incoming connections or traffic and act upon the received messages.

4. Observe the change of bandwidth and queue length in the corresponding monitor windows.

Change the value of "mean" of exponential distribution in the TG file, and then repeat the step 3 and 4. You need to choose 8 group values of mean**:** 0.00255s, 0.00256s, 0.00257s, 0.00258s, 0.00259s, 0.00260s, 0.00270s and 0.00300s separately to observe the change of queue length.

Note: when you want to change the value of mean, you need to close the queue length monitor window at first, then change the value of mean in the "client1.tg" file and "client2.tg" file, create the queue length monitor again and set the corresponding log file name and location, then run the command in step 3 to observe the change of queue length and bandwidth.

5. Process the experiment data. In the saved log file, you need to choose around 20 data to calculate the average value of queue length. There are two rows showed in the log file. The first row is time; the second row is the corresponding value of queue length. You should choose the data with the latest time to calculate the average value, because the connection approach to stable state with the increasing time.

Lab Report

- You need to create a clearly readable graph of your measurement results. This graph should show the (1/mean) on the x-axis and queue length value on the y-axis. Please use a proper x-y graph. Please show the data points of your measurement as well as a line / line(s) interconnecting them. Make sure all aspects of the graph a legible.
- Attach the queue length graph with the corresponding mean value
- A discussion (around 2-3 paragraphs) on the results you have obtained, illustrate the method you use to resolve the problems appeared in the process of experiment.