CS 39006: Networks Lab
Assignment 1: Understand Mininet Environment for Network Experiments

Date: 17th January, 2017

Objective:

The objective of this assignment is to understand the basic Mininet (http://mininet.org/) usage for network experiments. Apart from this, you will learn several network management and traffic generation tools, like ping and iperf (https://iperf.fr/). This is basically a 'Hello World' type of experiment to give you an exposure of the fundamental networking ideas, like how to connect multiple devices via switch and routers, how to send data from one machine to another, what is the impact of different configuration parameters on network performance, and so on.

Submission Instructions:

You need to preparte a report that will contain the followings.
1. Steps followed in executing the experiments.
2. Observations from the experiments.
3. Intuitive justification behind the observations.

You need to submit the report and relevant scripts (source files) in a single compressed (tar.gz) file. Rename the compressed file as Assignment_1_Roll1_Roll2.tar.gz, where Roll1 and Roll2 are the roll numbers of the two members in the group. Submit the compressed file through Moodle by the submission deadline. The submission deadline is: **January 24, 2017 02:00 PM.** Please note that this is a strict deadline and no extension will be granted.

Please note that your submission will be awarded zero marks without further consideration, if it is find to be copied. In such cases, all the submissions will be treated equally, without any discremination to figure out who has copied from whom.

Assignment Statement:

This assignment has three parts.

Part 1: Construct the following topology using Mininet.

The two hosts are connected via a switch. Both the links from H1 to the switch and H2 to the switch have 1 Mbps bandwidth, 1 ms of propagation delay and no channel loss.
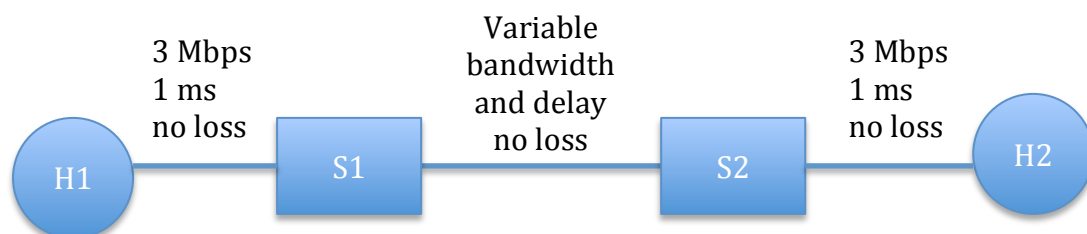
Now run a *iperf* server at H2. From *iperf* client at H1, compute the followings,

    (a) TCP throughput between the server and the client (use default TCP parameters as provided by *iperf*)

    (b) UDP throughput for following cases of UDP traffic generation rates (bandwidth),

          I.   64 Kbps
         II.   128 Kbps
       III.   256 Kbps
       IV.   512 Kbps
        V.   1024 Kbps
       VI.   2048 Kbps
      VII.   4096 Kbps

Plot the UDP throughput with respect to the UDP bandwidth. What is your observation from this plot.

NB: You may use the open source utility gnuplot (http://www.gnuplot.info/) to plot the graph.

Part 2: Costruct the following topology using Mininet.

In this experiment, you need to check the effect of bandwidth and delay of the link between the switches S1 and S2 (written as S1-S2) over TCP and UDP throughput.
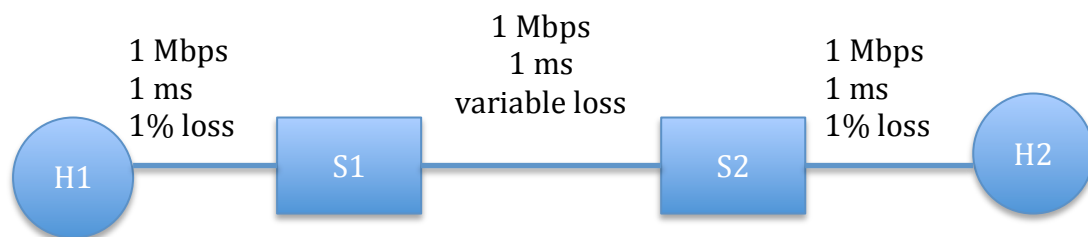
Run *iperf* server at H2, and from the *iperf* client at H1, execute the sequence of experiments for TCP and UDP as given in the previous part (Part 1) of the assignment. Generate the graphs for following configurations of S1-S2 link,

(a) Bandwidth = 512 Kbps, Delay = 1 ms
(b) Bandwidth = 512 Kbps, Delay = 10 ms
(c) Bandwidth = 512 Kbps, Delay = 100 ms
(d) Bandwidth = 1 Mbps, Delay = 1 ms
(e) Bandwidth = 1 Mbps, Delay = 10 ms
(f) Bandwidth = 1 Mbps, Delay = 100 ms
(g) Bandwidth = 2 Mbps, Delay = 1 ms
(h) Bandwidth = 2 Mbps, Delay = 10 ms
(i) Bandwidth = 2 Mbps, Delay = 100 ms

Answer the followings based on your observations from the graphs,

1. What is the effect of S1-S2 link bandwidth on TCP and UDP throughput
2. What is the effect of S1-S2 link delay on TCP and UDP throughput.

Part 3: In this assignment, we shall observe the effect of channel loss (or sometime called link loss) on the performance of TCP and UDP. Construct the following topology which is similar to Part 2, but with loss rate associated with

the links.

Run *iperf* server at H2, and from the *iperf* client at H1, execute the sequence of experiments for TCP and UDP as given in the Part 1 of the assignment. Plot the graphs by changing the S1-S2 link loss rate as follows,

(a) loss rate = 1%
(b) loss rate = 3%
(c) loss rate = 5%
(d) loss rate = 10%
(e) loss rate = 15%

What is your observation regarding the impact of loss rate on the TCP and UDP throughput performance?