Lab Assignment 1

(Due on Jan 23)

Objective. This lab assignment is designed to get you familiarized with DETERlab -- a network emulation environment where most of the lab assignments in this course will be performed.

Background Information.

The DETERlab tutorial slides on the course website provide essential information for you to use DETERlab. Additional information about DETERlab is available at https://trac.deterlab.net/wiki.

Iperf is a tool to provide measurement of maximum TCP and UDP bandwidth performance and report bandwidth, delay jitter, datagram loss. A tutorial of iperf can be found at http://openmaniak.com/iperf.php

Usage of Online Grading System.

We use an online grading system for Lab assignment submission. Its URL is http://129.59.88.58:8080/OnlineGrading/. Please register an account with your vnetID, full Vanderbilt email address and a password. For security reason, please pick a password that is different from your VUnetID E-password. Please keep your experiment swapped in while you are submitting your results to the Online Grading System.

1. [System setup (10 pts)] Get familiar with DETERlab basic usage by running a simple experiment. First create a network of three end nodes: nodeA, nodeB and nodeC, and a router. nodeB, nodeC and the router form a Local Area Network (LAN). nodeA connects to the router using a duplex link. A sample TCL file can be found in file Lab1.tar.gz. Name your experiment as “[username-Lab1]”. Once the experiment is swapped in, access the experiment node (e.g., nodeA) and install iperf.

NOTE: Please create a new directory with name “Lab1” under your home directory in DETERlab, and put all the associated files with this assignment in ~/Lab1/.

iperf-2.0.5.tar.gz is provided in file Lab1.tar.gz. The following commands can be used for installation.

```
nodea$ tar zxvf iperf-2.0.5.tar.gz
nodea$ cd iperf-2.0.5
nodea$ ./configure
nodea$ make
```

NOTE: Please do not rename the directory name “iperf-2.0.5”, leave it as it is.

There is no need to “make install” iperf to a system directory. Please just access iperf in the src directory directly in your experiment.
Please record the information as requested by the Online Grading System, after the experiment is swapped in and the iperf is installed. The Online Grading System will access your experiment based on the information provided and test your iperf setup for grading.

2. [Basic network performance measurement (20 pts)] In the following experiments, please take nodeA as the server and nodeC as the client. First measure the network performance using TCP (i.e., TCP throughput along the path between nodeA and nodeC). Run the following command under directory iperf-2.0.5/src/.

```
nodea$./iperf -s
nodec$./iperf -c 10.1.1.3 (replace with your server(nodeA)’s experiment IP address, if it is different)
```

Please record the measured Bandwidth (in nodeC) in the Online Grading System. Then measure the network performance using UDP traffic. Here is a sample code:

```
nodea$./iperf -s -u -i 1
nodec$./iperf -c 10.1.1.3 -u -b 3m
```

What are the measured bandwidth and loss? If no loss is incurred, try increasing the sending rate of the UDP client from 3m (3Mbps) to 4m, 10m, etc... until loss can be observed. What is the maximum bandwidth measured with UDP where only negligible loss (loss < 0.1%) is incurred? Record the Maximum Bandwidth measured with UDP (in nodeC) in the Online Grading System.

**Note:** Please complete and submit your results in the “Basic Setting Test” section in the Online Grading System before conducting the next experiment.

3. [Network performance measurement with smaller delay (10 pts)]. Modify the experiment configuration so that the delay between nodeA and the router is changed from 50ms to 10ms. Note that once your experiment is modified, the previous experiment will be swapped out and the experiment with the new configuration will be swapped in. This process will take a few minutes and the experiment nodes will be rebooted during this process. After the modified experiment is successfully swapped in, please measure the bandwidth between nodeA and nodeC again using TCP. Record the Bandwidth (in nodeC) in the Online Grading System. Compare it with the result in question 2. What do you find out?

Now measure the bandwidth using UDP. Again please try different sending rates from the client node and record the Maximum Bandwidth measured with UDP (in nodeC) with negligible loss (loss < 0.1%) in Online Grading System. Compare it with the UDP result in question 2. What do you find out?

4. [Network performance measurement with link losses (10 pts)]. Keep the delay between nodeA and the router as 10ms. Introduce a 5% packet loss to link0 using the following command:

```
tb-set-link-loss $link0 0.05
```
Repeat the experiment again. Record the TCP Bandwidth in the Online Grading System. What do you observe? Now try the UDP measurement with different sending rates, observe the bandwidth and the loss. What is the minimum loss rate you can get? Under this minimum loss rate, what is the maximum bandwidth you measure? Record these two numbers, Minimum Loss Rate and Maximum Bandwidth in the Online Grading System.