Lab Assignment 4  
(Due on 04/20/12)

**Objective.** This lab assignment is designed to have a better understanding on the network routing algorithm.

**Team.** You can work in a team of no more than 3 students in this lab assignment. A description of each team member’s task in this lab assignment is required with your submission.

**Submission.** Electronic submission is accepted via email to yuan.xue@vanderbilt.edu and xujie.si@vanderbilt.edu. The submission package should include the following components: 1) document that provides the answers to the questions in this assignment; 2) code; 3) team task assignment (if applied).

1. (10 pts) Find out the route from your computer (which is connected to wireless network in FGH) to www.google.com using “tracert” on Windows machines, and copy the output as the answer to this question. Now find out the route from your computer (which is connected to wireless network in FGH) to www.vanderbilt.edu. Copy the output as the answer to this question. Based on the results, could you please tell the IP addresses of the Vanderbilt routers on these two routes? Can you estimate the IP address range (address block) of Vanderbilt? Now use “whois” command to find the registration information for IP address “129.59.90.20”. Copy the output as the answer. From the output, can you tell the IP address range and CIDR of Vanderbilt?

2. (60 pts + 10 pts) In this experiment, we will setup network routing in DETERlab. Refer to the document at [https://trac.deterlab.net/wiki/Tutorial/CreatingExperiments](https://trac.deterlab.net/wiki/Tutorial/CreatingExperiments) (section “Setting up IP routing between nodes”) for the detailed information. Lab4.tcl file (available on the course website) provides an example TCL script for manual route setup. We will also use the network topology provided in this script in this experiment.

   a) (10 pt) Load the lab4.tcl file into DETERlab. What is the route used between z and u? what is the route used between w and t (command?) Set up two TCP connections – one between z and u, the other between w and t. Measure the throughput of these two TCP connections. Write down the value of the throughput. Now set up two UDP flows at rate of 50Kbps – one between z and u, the other between w and t. Measure the throughput of these two UDP flows. Write down the value of the throughput.

   b) (10 pt) On the same network topology as in lab4.tcl, using delay as the cost metric, compute the minimum-cost routes – one between z and u, the other between w and t. Write down these two routes. Configure your own TCL script to set up these two minimum cost paths as the routes. Similar to experiment a), please set up two TCP connections – one between z and u, the other between w and t. Measure the throughput of these two TCP connections. Write down the value of the throughput. Set up two UDP flows at rate of 50Kbps – one between z and u, the other between w and t. Measure the throughput of these two UDP flows. Write down the value of the throughput.
c) (10 pt) On the same network topology as in lab4.tcl, using the multiplicative inverse of the link capacity as the cost metric, compute the minimum-cost routes – one between z and u, the other between w and t. Write down these two routes. Configure your own TCL script to set up these two minimum cost paths as the routes. Similar to experiment a), please set up two TCP connections – one between z and u, the other between w and t. Measure the throughput of these two TCP connections. Write down the value of the throughput. Set up two UDP flows at rate of 100Kbps – one between z and u, the other between w and t. Measure the throughput of these two UDP flows. Write down the value of the throughput.

d) (15 +5 pt) Now, could you please design two routes -- one between z and u, the other between w and t, on the same network topology to improve the throughput of UDP flows? Outline your idea of design and write down the routes. Measure the UDP throughput and write down the values. If your UDP throughput is better than the result from experiment a) (the lab4.tcl configuration), you will get 5 points extra credits. Then measure the TCP throughput and write down the values.

e) (15 +5 pt) Now, could you please design two routes -- one between z and u, the other between w and t, on the same network topology to improve the throughput of TCP flows? Outline your idea of design and write down the routes. Measure the TCP throughput and write down the values. If your TCP throughput is better than the result from experiment a) (the lab4.tcl configuration), you will get 5 points extra credits. Then measure the UDP throughput and write down the values. If you are the administrator of the network, which routing scheme from the above configurations (experiment a, b, c, d, e) you will pick?