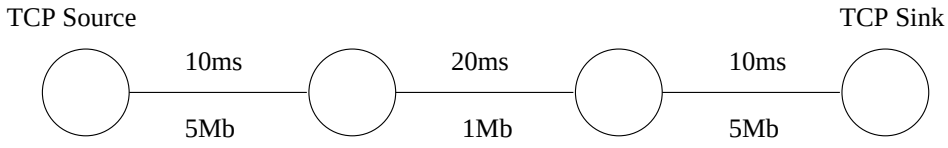
ECE6110 **Spring Semester, 2013**

Project 1 – TCP Throughput Measurements

Assigned: January 14, 2015 *Due: January 30 2015 11:59pm*



Topology for Project 1

For this project, we will use the *ns-3* simulator to measure the throughput of a single TCP connection through a bottleneck link, as a function of queue limits, segment sizes, and window sizes.

1. Download the ns-3 tarball from the `www.nsnam.org` web page. The most recent release is `ns-allinone-3.21.tar.bz2`.
2. Use `rsync` to copy the tarball to your deepthought account. To do this be sure your current working directory on your desktop/laptop contains the 3.21 tarball, then:

   ```
   rsync -avzu ns-allinone-3.21.tar.bz2 your-prism@deepthought-login.cc.gatech.edu
   ```

   This will copy the tarball to your root directory on deepthought.
3. Log into the *deepthought* cluster using the instructions found on the class web page.
4. Install ns-3 under your home directory following install instructions on the `nsnam` web page.
5. Once *ns-3* has been properly compiled, create a simulation model of the topology shown in the figure above. You MUST name your program `p1.cc` and put it in the `scratch/` directory in the *ns-3* directory tree.
6. Use command line arguments (see several examples in the examples directory) to specify the number of flows, queue length, window size and segment sizes. These arguments **MUST** be called nFlows, queueLength, windowSize, and segSize.
7. To test your program, enter: `./waf --run p1`. To use command line arguments with your program, you should wrap the run parameters in quotes:

   ```
   ./waf --run 'p1 --nFlows=1 --segSize=512 --queueSize=64000 --windowSize=2000',
   ```
8. Use the TCP-Tahoe variation of TCP for all experiments in this assignment.
9. Create a single TCP flow that connects to a server and sends an infinite number of bytes using `BulkSendApplication`. For the bulk send application a value of zero for the `MaxBytes` attribute indicates infinity. Set the send application sendSize attribute to 512. The flow should start at a random time between 0 and .01 seconds.
10. Stop the simulation at time 10 seconds and calculate the goodput for this connection. The goodput is simply the number of bytes received by the sink divided by the elapsed time. The goodput is in units of **BYTES per SECOND**.

11. Run the simulation 48 times with the following independent variables: receiver window sizes (2000, 8000, 32000, and 64000 bytes), queue limits on the bottleneck link (2000, 8000, 32000, and 64000 bytes), and TCP Segment sizes (128, 256, and 512 bytes).

12. **IMPORTANT**. For each experiment, write exactly one line of output to `stdout` indicating the values for the parameters and the calculated goodput. The line must look exactly like the following, excepting the number of spaces between value:

    ```
    flow 0 windowSize 2000 queueSize 8000 segSize 128 goodput 12345.5
    ```

    Clearly the values for the independent variables in the above line will vary depending on which set of parameters are used for each run.

13. Repeat the experiments, except use 10 *simultaneous* flows. For this experiment, change the topology to have 10 source nodes and 10 sink nodes, all sharing the same bottleneck link. Each of the 10 flows should have the same advertised window size setting. Observe the relative fairness of the flows and comment on it in your report. Each of the 10 flows should start at a random time between 0 and 0.1 seconds. IMPORTANT! seed the random number generator with the seed 11223344. This means you should bet the same results each time your run, and in fact should get the same results as all other students in the class.

14. Write out 10 lines to standard out as follows:

    ```
    flow 0 windowSize 2000 queueSize 8000 segSize 128 goodput 12345.5
    ```

15. Repeat the above for the remaining 9 flows.

16. Procedure to turn in your ns3 code will be discussed later.

17. EMail the instructor (`riley@ece.gatech.edu`) and the TA (`chood8@ece.gatech.edu`) a three or four page PDF file of your report. The report MUST be named `P1-(your prism name)-6110.pdf`