Project 1 – TCP Throughput Measurements

TCP Source   TCP Sink

```
         10ms              20ms              10ms
  ◯───────────◯───────────◯───────────◯
         5Mb               1Mb               5Mb
```
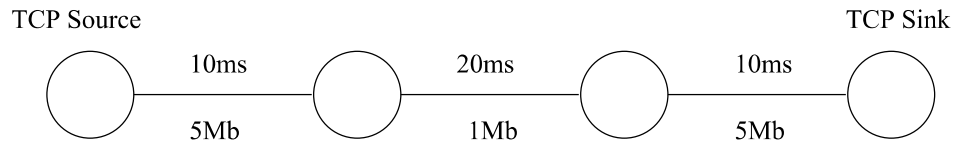
Topology for Project 1

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-3.24.1.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 3.24.1 tarball, then:

   `rsync -avzu ns-allinone-3.24.1.tar.bz2 your-prism@deepthought19.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.

6. To test your program, enter: `./waf --run scratch/p1`. Note, if you wish to use command line arguments with your program, you should wrap the run parameters in quotes: `./waf --run 'scratch/p1 --segSize=512 --queueSize=64000'`, as an example.

7. Use the TCP-Tahoe variation of TCP for this step.

8. Create a single TCP flow that connects to a server and sends 100,000,000 bytes. It might be easiest to use the `BulkSendApplication` and the `PacketSinkApplication` for this.

9. In the simulation, measure the *goodput* of a single TCP connection, using combinations of maximum receiver advertised 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). This results in a total of 48 different combinations and 48 simulation runs. Here, the term *goodput* refers to the amount of data received at the packet sink application divided by the simulation time (resulting a value in units of bytes/sec).

10. Repeat the experiments, except use 10 *simultaneous* flows all sharing the same links. 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.

11. Repeat both of the above experiments using TCP Reno instead of TCP Tahoe.

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

13. EMail the instructor (`riley@ece.gatech.edu`) and the TA (`bswenson3@gatech.edu`) a four or five page PDF file of your report.