

CSE 473S – Introduction to Computer Networks Fall 2011

Lab Assignment 2

Preliminaries

- You should have completed lab assignment 1
 - Download configuration file *lab2.exp* from the course web page <http://www.cse.wustl.edu/~jain/cse473-11/> (right-click on lab2.exp and save link as or save target as)
 - Save the file in *.onldir* directory

The configuration file sets up a topology enabling two senders at hosts n2p1 and n2p4 to communicate with their receivers at host n1p1 as shown in Figure 1.

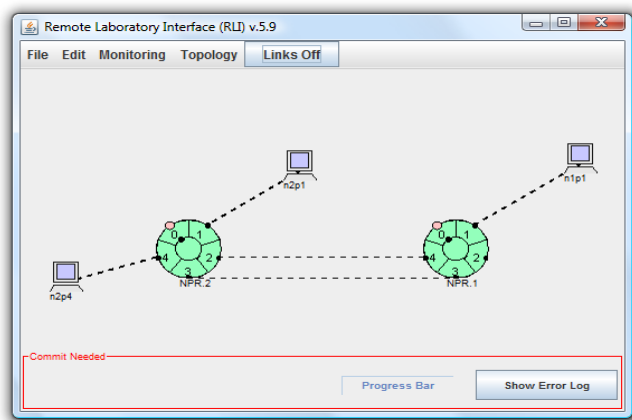


Figure 1: Network topology for lab assignment 2

Start the RLI and open the configuration file.

Three windows are supposed to appear and contain:

- Configured network topology
- Display monitoring the bitrate of traffic going out of port 1 of NPR1
- Display monitoring the queue size at output port 1 of NPR1

1) Run-time ONL Experiment

Before you can make an ONL reservation or run an experiment, you must build an SSH tunnel to the testbed. You must make a reservation for the hardware resources for a time period when you plan to run an ONL experiment. You can make the reservation days (or even weeks) in advance. You do NOT need to make a reservation if all you are doing is constructing or examining an experiment (configuration) file.

To make a reservation for this assignment, start the RLI and open the configuration file *lab2.exp*. Then, select *File => Make Reservation* from the File menu and respond to the prompt by requesting a reservation for 60 (sixty) minutes. The RLI will respond with a message about the reservation. You can monitor your reservation through the ONL web page by logging into the ONL website and selecting *My Reservations* in the sidebar.

When your reservation time comes, reestablish the SSH tunnel and run the RLI. Open the configuration file *lab2.exp*. Request the configured topology by selecting *Commit* in the File menu. It might take several minutes for ONL to commit the requested resources. The RLI provides a Progress Bar that shows the progress of the Committing process and ends with the message *Commit Completed*. Once the topology is realized (e.g., links turn from dashed lines to solid ones, and hosts turn from light to dark blue).

ONL hosts have two network interfaces: control network interface name (e.g. *pc1core49*) and internal data network interface IP address (e.g. *192.168.1.65*). Click on the hosts *n2p1*, *n2p4* and *n1p1*, and determine their control network interface names and internal data network interface IP addresses. Log into *n1p1* through its control

network interface name (e.g., onlusr> ssh pc1core49) and execute the command **iperf -s -u** to start the UDP receiver. Similarly log into n2p1 and n2p4 through their control network interface names and start the UDP senders: first, execute the command **iperf -c n1p1 -u -b 20m -t 40** at n2p1; about 20 seconds later, execute the command **iperf -c n1p1 -u -b 6m -t 40** at n2p4.

The first sender transmits at rate 20 Mbps, and the second sender transmits at rate 6 Mbps. Each of the transmissions lasts for 40 seconds. After the senders stop transmitting, execute the command **ping -c 10 n1p1** at both n2p1 and n2p4 to measure round-trip times (RTTs) for small packets when the paths serve no other traffic. The RTTs include all propagation and processing delays of the paths.

- a) Include two screen shots covering the duration of your experiment: one for the bitrate of traffic going out of port 1 of NPR1 and the other for the queue size at output port 1 of NPR1. Report the ping measurements of the empty-path RTTs as well as the overall amount of data received by n1p1 from each sender (as reported by iperf).
- b) Monitor the bitrate of traffic going to input port 4 of NPR1 by opening the Monitoring menu, selecting Add Monitoring Display, clicking port 4, proceeding to the RXBYTE submenu, and choosing rate. Similarly, monitor the bitrate of traffic going to input port 3 of NPR1 by adding another monitoring display. Repeat the experiment: execute the command **iperf -c n1p1 -u -b 20m -t 40** at n2p1; about 20 seconds later, execute the command **iperf -c n1p1 -u -b 6m -t 40** at n2p4.
How much traffic do you see on the link from port2 of NPR2 to port4 of NPR1 during your experiment? What causes this traffic? (Include a screenshot of the monitoring display for traffic going to input port 4 of NPR1)
How much traffic do you see on the link from port3 of NPR2 to port3 of NPR1 during your experiment? What causes this traffic? (Include a screenshot of the monitoring display for traffic going to input port 3 of NPR1)
Are your answers consistent with the logical network topology that you inferred in lab assignment 1?
- c) Change the forwarding table of port 4 of NPR2 by adding an entry that suggests forwarding to port 2 of NPR2 all traffic with addresses that match prefix 192.168.1.32/28. This can be done as follows.
Open route table of port 4 of NPR2, highlight row that contains entry 192.168.1.0/24, click Operations and then edit route, change prefix to 192.168.1.32, mask to 28, and next hop to 2. Click on Enter and commit changes.
Repeat the experiment: execute the command **iperf -c n1p1 -u -b 20m -t 40** at n2p1; about 20 seconds later, execute the command **iperf -c n1p1 -u -b 6m -t 40** at n2p4.
Monitor the bitrate of traffic going to input port 4 of NPR1.
Monitor the bitrate of traffic going to input port 3 of NPR1.
Monitor traffic going out of port 1 of NPR1.
Monitor the size of queue id 64 at output port 1 of NPR1.
Does the change affect the outcome of the earlier experiment? Explain.
(Include screenshots of the respective monitoring displays)

2) Post-run Analysis for original configuration (before the change in 1c)

- a) Analyze queuing at output port 1 of NPR1 during the one-minute experiment. In your analysis, assume that each traffic flow on an overloaded link loses the same fraction of traffic. When and why does the queue start to grow? When and why does the queue start to drain?
- b) Compute rates for the queue growth and queue drain and explain why the slopes are different.