

# CSE 473S – Introduction to Computer Networks Fall 2011

## Lab Assignment 1

### Objectives:

- Learn how routing tables work
- Determine bottlenecks

### Preliminaries

1. Read ONL tutorial
  - a. The ONL Tutorial, [http://wiki.arl.wustl.edu/onl/index.php/The\\_ONL\\_Tutorial](http://wiki.arl.wustl.edu/onl/index.php/The_ONL_Tutorial)
  - b. Remote Laboratory Interface, [http://wiki.arl.wustl.edu/onl/index.php/Remote\\_Laboratory\\_Interface\\_%28RLI%29](http://wiki.arl.wustl.edu/onl/index.php/Remote_Laboratory_Interface_%28RLI%29)
  - c. Getting started, <https://onl.wustl.edu/restricted/getting-started.html>
2. Prepare your computer for ONL:
  - a. Create a local directory `.onldir` on your machine
  - b. SSH (on MACs and Linux) or Windows Putty, <http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>
  - c. Install Java Runtime Environment (JRE) V1.6 or higher, Check “java -version”, if necessary download from <http://java.com/en/download/manual.jsp>
  - d. Download configuration file `lab1.exp` from the course web page <http://www.cse.wustl.edu/~jain/cse473-10/> (right-click on `lab1.exp` and save link as or save target as). Save in `.onldir` directory on your computer.
3. Log into ONL testbed using dialog box provided in the sidebar of <https://onl.wustl.edu/>
  - You have been provided with username and password for an ONL account
  - Successful log in indicates that your account is active; otherwise, contact the TA
  - The following commands are available only after a successful login:
    - You can check for the availability of resources through *Resource Availability* link in the sidebar of <https://onl.wustl.edu/>
    - You can monitor your current resource reservations through *My Reservations* link in the sidebar of <https://onl.wustl.edu/>
    - Download the latest *RLI.jar* (executable jar file) from *Get RLI* link in the sidebar of <https://onl.wustl.edu/> and put it in the `.onldir` directory on your computer
4. Create SSH tunnel required by the Remote Laboratory Interface (RLI)
  - Click on *Getting Started* link in the sidebar of <https://onl.wustl.edu/>
  - Click on *RLI SSH Tunneling* link in the middle of the Getting Started webpage and follow instructions
5. Launch RLI on your machine
  - Double click on the *RLI.jar* file or run the command `java -jar RLI.jar`

## 1) ONL Tutorial

The objective of this section is to familiarize you with the Open Network Laboratory (ONL) and its Remote Laboratory Interface (RLI), which you will use to perform your laboratory experiments for this class.

- Click on the *Examples* link in the sidebar of <http://wiki.arl.wustl.edu/onl/>. You can also get to this webpage by clicking the *NEW ONL Wiki Tutorials* link in the sidebar of <https://onl.wustl.edu/> and then click on the *Examples* link in the sidebar.
- Follow the Examples tutorial. Work on the following sections:
  - a) Create the SSH tunnel required by the RLI
  - b) Start the RLI on your client host
  - c) Add two NPRs and four hosts to the experiment
  - d) Save the configuration
  - e) Make a reservation for 1 hour
  - f) Commit the experiment
  - g) Set up default routing at each port
  - h) Monitor some packet rates
  - i) Rescale the bandwidth display
  - j) Monitor some traffic bandwidths

- k) Monitoring menus
- l) Common problems/mistakes

## 2) Analyze a Network Topology

The objective of this section is to enable you to apply the knowledge you have acquired in class in a real networking experiment.

In the previous section, you placed *lab1.exp* configuration file in the directory *.onldir*. 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.

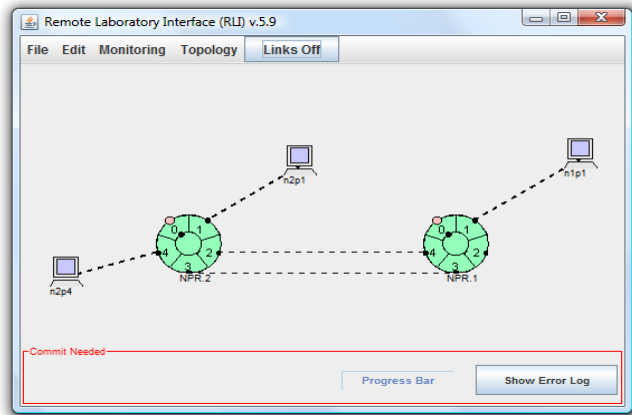


Figure 1: Network topology for lab assignment 1

Start the RLI and open the configuration file

- Double click on the *RLI.jar* file or run the command `java -jar RLI.jar`
- Click *File*, click *Open* and browse for 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

- a) Find out the threshold of the queue by clicking on port 1 of NPR1, opening the Queue Table menu, and looking up the value in the threshold (bytes) entry for queue id 64. Report the size of the queue.
- b) Use the RLI to examine the forwarding tables at the ports of NPR1 and NPR2, and determine the logical topology for the configured packet paths (sequences of ingress and egress ports) from *n2p1* and *n2p4* to *n1p1* and back from *n1p1* to the senders. To find the forwarding table of a port, select the port in the RLI and proceed into the Route Table menu. Report the sequences of ingress and egress ports for the 4 paths.
  - i. Packet path from host *n2p1* to host *n1p1*
  - ii. Packet path from host *n2p4* to host *n1p1*
  - iii. Packet path from host *n1p1* to host *n2p1*
  - iv. Packet path from host *n1p1* to host *n2p4*
- c) Determine the capacity for each of the links on these four paths by selecting the corresponding port, opening the Queue Table menu, and looking up the value in the bandwidth entry. Report the capacities for all ports on each of the four paths and indicate the bottleneck capacity for each of the four paths.
  - i. Packet path from host *n2p1* to host *n1p1*
  - ii. Packet path from host *n2p4* to host *n1p1*
  - iii. Packet path from host *n1p1* to host *n2p1*
  - iv. Packet path from host *n1p1* to host *n2p4*