Open Network Laboratory
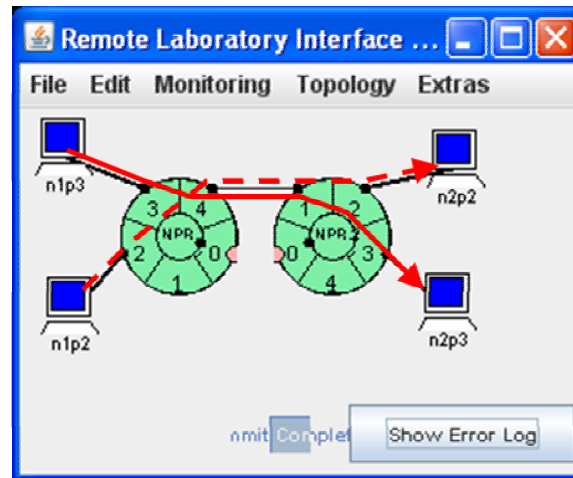

Raphael Njuguna

TA: CSE 473S (Fall 2010)
Introduction to Computer Networks
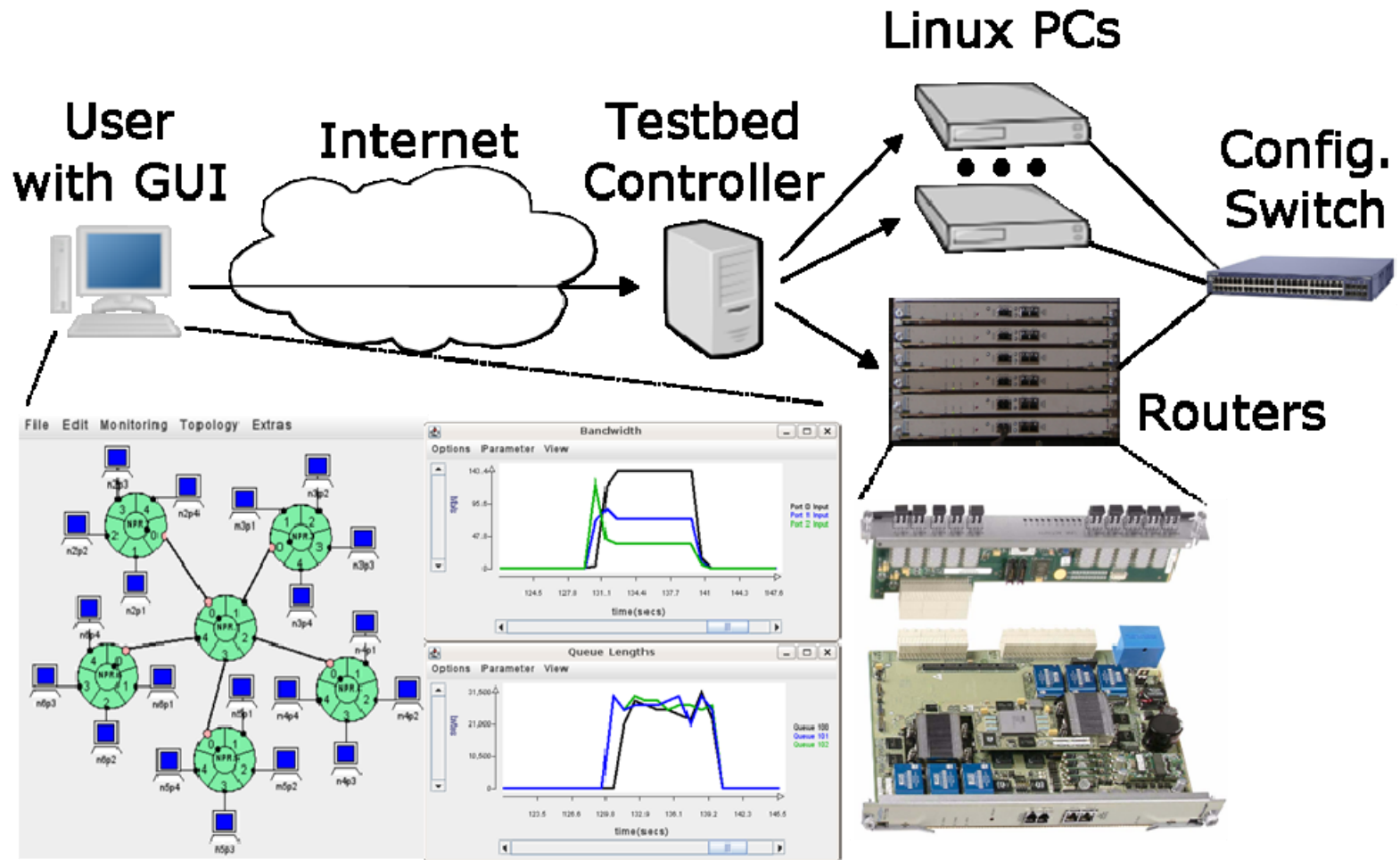
These slides are available on-line at:

http://www.cse.wustl.edu/~jain/cse473-10/

Outline

1. Open Network Laboratory (ONL)
2. Remote Laboratory Interface (RLI)
3. ONL accounts
4. SSH tunneling
5. Network interfaces
6. Routing and forwarding
7. Running ONL experiment
8. Lab assignments
9. Summary

Overview of ONL

Open Network Laboratory (ONL)

ONL - Remotely accessible gigabit network testbed

Infrastructure

- Routers (NSP, NPR)
- 1-core and 8-core hosts
- Gigabit Ethernet switches
- NetFPGAs
- Gbps links
- Filters, Plugins, Packet scheduling
- Remote laboratory interface (RLI)

What can you do with ONL

- Configure experiments
- Real-time data visualization
- Evaluate protocols & applications
- Hands-on experience with real hardware

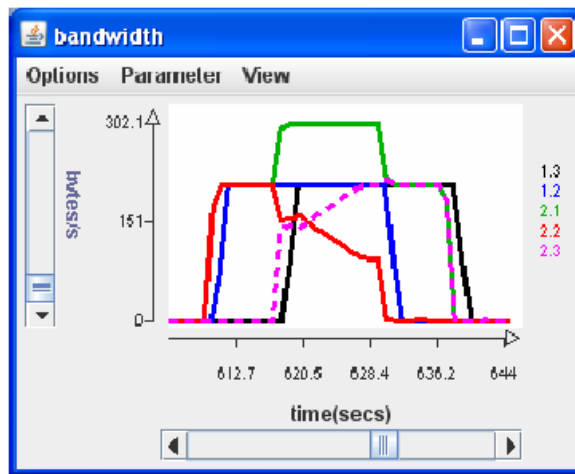# Remote Laboratory Interface (RLI)
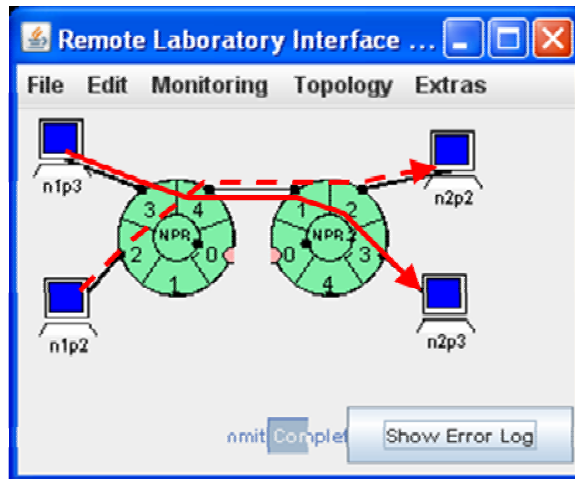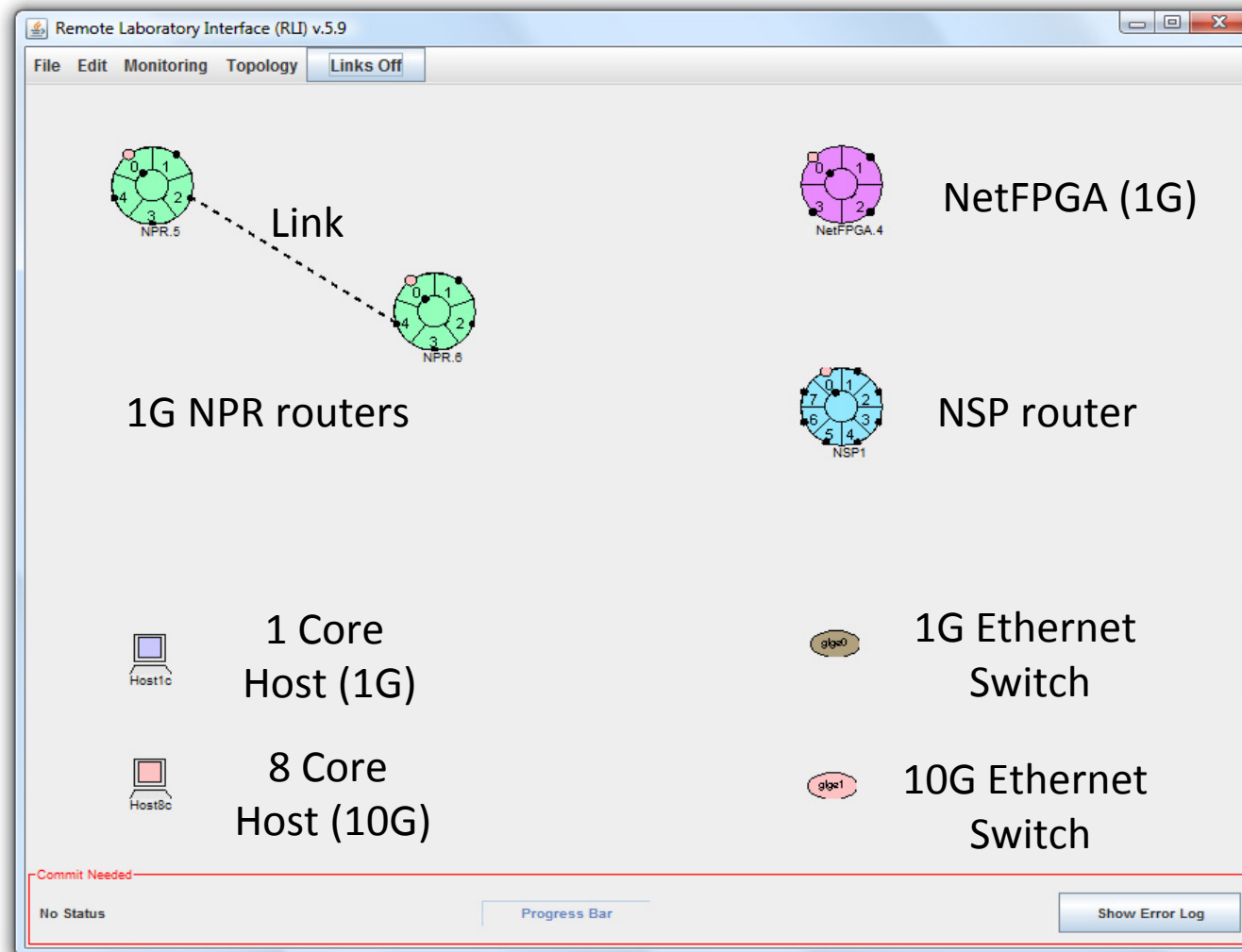

Configure network topology

Routing and forwarding

Real-time charts

Adding filters

Hardware as It Appears on RLI

ONL Accounts

- Username and password will be provided
- Same password for web login and host login
- Host account restrictions
    - Firewall blocks all connections from within ONL
    - SSH to onl.arl.wustl.edu from remote host
    - Only access hosts assigned to your experiment
- Password-free SSH between ONL hosts
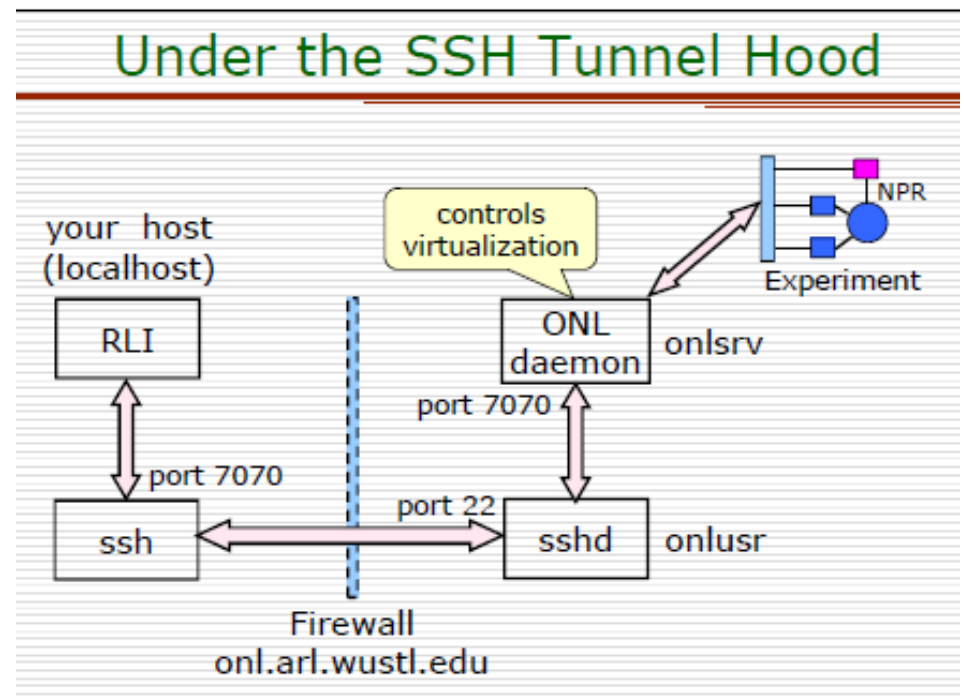
SSH Tunnel Configuration

- Build before each experimental session
- Allows your RLI to communicate with ONL daemon
- Needed to make reservation and commit experiment
- SSH tunneling
  - Unix or Unix-like command line
    - ssh -L 7070:onlsrv:7070 username@onl.arl.wustl.edu
  - Windows PuTTy
  - Windows SSH client
  - *Getting Started, RLI SSH Tunneling*

Under the SSH Tunnel Hood

Running an Experiment

1. Create local directory *.onldir* on your machine
2. Download latest *RLI.jar* file and put in *.onldir*
3. Launch RLI (double click or run *java -jar RLI.jar*)
4. Open or create network topology
5. Build SSH tunnel to onl.arl.wustl.edu
6. Make reservation for resources
7. Commit network topology
8. Monitor your experiment
9. Commit after any topology modification
10. Completed experiment
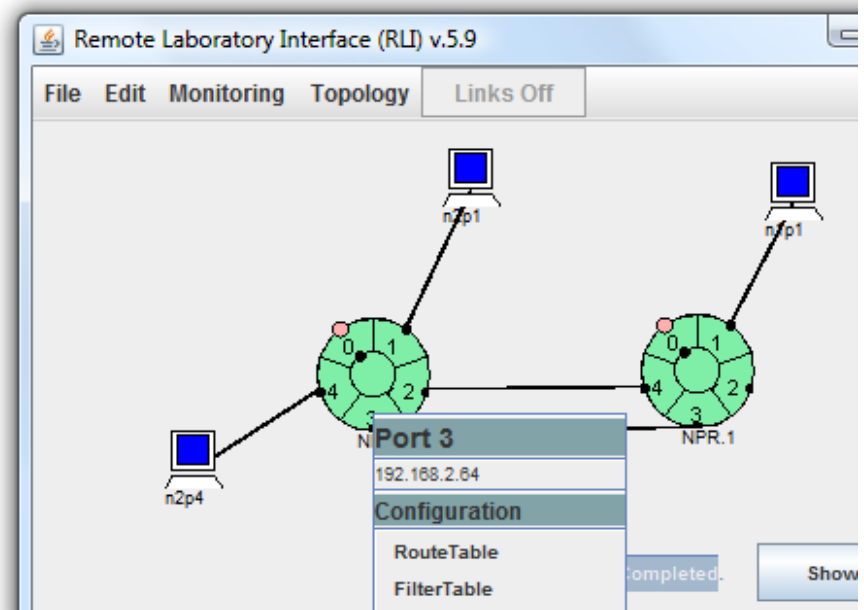   Save & close topology, exit RLI

Network Interfaces

After commit, ONL hosts have two network interfaces:

❑ Control network interface name (e.g. pc1core49)

❑ Internal data network interface IP address (e.g. 192.168.1.65)

Port Y of NPR X gets an IP address of the form 192.168.X.Z

❑ nXpY is interface name of host attached to port Y of NPR X

❑ Y is the port number

❑ X is the logical NPR number

❑ $Z = 16*(Y+1)$

Routing and Forwarding

Lab Assignments

Objective: Hands-on experience & apply concepts

Lab assignment 1:

- ❑ Familiarize with ONL through ONL tutorial
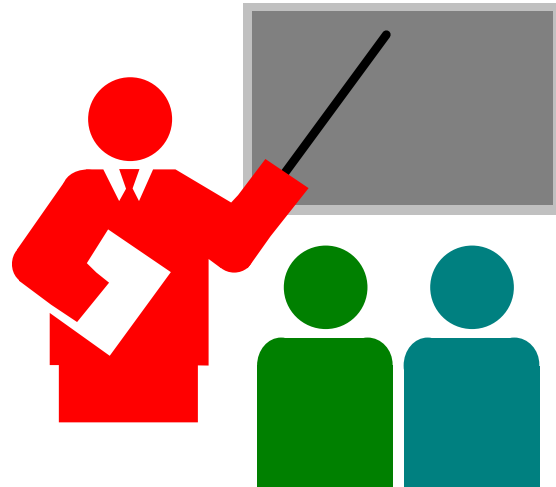- ❑ Network topology, packet path (forwarding), link capacity

Lab assignment 2:

- ❑ Transmit and monitor packet traffic
- ❑ Routing (edit routing table)
- ❑ Analyze behavior of a queue

Lab assignment 3:

- ❑ XSTCP protocol

Summary

- ❏ ONL - Remotely accessible gigabit network testbed
- ❏ RLI – Remote laboratory interface for ONL
- ❏ Labs - Hands-on experience & apply concepts
- ❏ Work on your labs as soon as possible, do not wait until the last minute