CSCI 558L Fall 2014
Laboratory 9: Custom Network
Due: October 13 and October 20
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1) Building Custom Network Protocols

Before hardware routers were available, the routers were made with a computer with many network ports. These routers were like the Quagga software router completely programmable and definable using software. Therefore, these routers along with simple network interface cards used under an OS can be seen as software defined network. This is exactly how you should look at them before continuing with this lab assignment. The main goal of the network is to obtain maximum packets per second routing – thus maximum sustainable throughput.

As with the previous labs, you should use the raw socket to build your new interface for your custom network protocol. You may work together as a team clearly identifying who is doing what. Go through the assignment requirement and list these things before starting the assignment.

a) Backward engineer to find the static bits
This assignment is designed to free your mind from having to deal with OSI models. Therefore, you should not use them. You should come to understand that the data that you put on the physical line is under your control. Therefore, you are to experiment with different data on network and identify the constraints that the NICs have placed.

As part of the assignment, describe the constraints of the network data using diagrams and packet format.

b) Custom Packet Format
Once the bits are identified, design your own custom protocol and its data structure around the bits that cannot be changed. The payload size can flexible or fixed and I will leave it up to you to make decisions in terms of how to handle them. As part of the assignment, describe the packet format of the network packet around the unusable bits.

The packet length may be fixed or arbitrary. But the address space should be able to support a cloud system consisting on the order of 10000s of nodes.

c) Protocol Functionality
While there are many different ways to send and receive data over the network, two of the most popular protocols are UDP/IP or TCP/IP. Therefore, your custom protocol should support UDP/TCP like functionality; only faster and reliable.

For this part, the protocol should support UDP/IP like data transfers only. Do not constrain yourself to the limitations found in UDP/IP packets such as packet length. The protocol can also be source-routed.

2) Building a Custom Router

You are to modify your custom IP router to support your new network protocol.
The router should forward the packets of any sizes as quickly as possible using whatever the means without making the systems unusable in a realistic scenario.

You must demonstrate this router to the TA(s) on the first demo day identified above.

In the lab report, include a graph showing different throughput performance for different packet sizes if your packet size is variable. If your packet size is fixed, identify and describe different scenarios for variations in throughput (i.e. congestion).

3) Building a Custom Application

You are to modify your custom fast reliable FTP application to use your new protocol.

You must demonstrate this application reliably transferring 10MB files through your custom router on the second demo day identified above.

For the competition, reserve 3 nodes send/receive nodes and 1 node for your router sitting in between the nodes. All 3 nodes are to send and receive to one another at the same time through the router; each node sending 2 files to the other nodes. The end time stamp is when all of the files are successfully transferred.