Course Name: Digital Control in Mechatronics
Course Number: EML 4804C, EAS 4404C

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Internet Communications for Engineering Purposes

Objective
This lab was developed to provide an overview of internet communications using the UDP/IP protocol. The lab makes use of Open Source software from GNU and Cygwin as well as the *SDF Public Access UNIX System*, **`sdf.lonestar.org`**, located in Bellevue Washington.

Activity
- Review the programs **`main.udp.sender.c`** and **`main.udp.receiver.c`** from the appendix:
  - The program: setting up the socket, internet address, and port
  - Copying data into the udp data buffer on sender
  - Retrieving data from the udp buffer on the receiver
  - Computing dropped and mis-ordered packets
  - Computing round-trip delay time
- Review the udp tunneling software and why it is necessary outside the UCF firewall
- Review moving files and executing commands: ftp / ssh / telnet
- Compiling both programs at the command line
- Running the UDP experiments

Assessment and Grading
Students will be required to report all of their findings in a semi-formal lab report.
The assessment of the assignment is based upon:
- student's ability to log into the remote machines and compile the provided software
- student's ability to setup the experiment and collect the necessary data
- student's ability to explain the characteristics of UDP communications compared to tcp communications
- student's ability to explain how and why the round-trip-delay, dropped packets, and mis-ordered packets experiments work

Learning Outcomes
After completing this lab, students should be able to identify the characteristics of UDP/IP communications and contrast those with TCP/IP communications. The students should also be able to characterize a specific network communications channel by providing a latency measurement, bandwidth as a function of packet size, and percentage of dropped and mis-ordered packets.

Assignment

For this lab, the students will be provided with five pieces of software:

1. **main.udp.sender.c**
2. **main.udp.receiver.c**
3. **main.udp.repeater.cc**
4. **main.tcp.client.udpsend.cc**
5. **main.tcp.server.udprecv.cc**

The students will also be provided with two computer accounts on remote unix machines in addition to the local windows machines in the lab.

Experiment part 1:

1. Using the supplied software, perform a network characterization experiment from one lab computer to another. These computers are all on the same hub so this should define the best performance of the three experiments.
2. Like the demonstration in class, compile both the UDP sender and receiver programs on separate machines. Select a udp port above the restricted range (>1000) and not being used by any other groups.
3. Characterize the UDP/IP communications channel by selecting representative packet size and packet send rates. Record the number of dropped packets, the number of mis-ordered packets, and estimated round-trip latency measurements for a test between 1 and 5 minute long.

Experiment part 2:

1. Repeat steps in Experiment Part 1 using the same local lab computer but replacing the second, or remote computer with the MMAE departmental unix computer: **biot.mmae.ucf.edu**
2. Remember to use your groups login username and password.
3. Move the UDP receiver program over to remote computer, log in via ssh, compile using gcc, then run the UDP communications channel experiment.

Experiment part 3:

1. Repeat steps in Experiment Part 2 using the same local lab computer but replacing the second, or remote computer with the SDF Public Access Unix computer: **tty.freeshell.org**
2. Remember to use your groups login username and password.
3. Before running the UDP characterization experiment, because of inbound udp firewall restrictions you must setup the UDP tunneling software, then run the network characterization experiment.
4. Move the UDP receiver program over to remote computer, log in via ssh, compile using gcc, then run the UDP communications channel experiment.

Acquire and discuss results. Submit as a report according to the Mechatronics Lab Report Format. Your answers can be brief but must be clear and in complete sentences.