CMPE 206 Computer Network Design Spring 2020

HW#1 Due February 12th, 11:59 PM, on Canvas

Total points: 60

5 points early bird bonus for submitting **before February 7th, 11:59pm.**

Note: You can submit your homework multiple times, but only the last submission will be graded and considered for early bird bonus

Problem 1) (12 points) The following questions are about the TCP/IP network stack. Please keep your answers concise.

1.1. (2 points) What is the purpose of a routing protocol?

1.2. (3 points) (Q.10 in the textbook) What are two reasons for using layered protocols? What is one possible disadvantage of using layered protocols?

1.3. (2 points) How does the functionality of link layer differ from the functionality of physical layer?

1.4. (2 points) What are the names of the units of data transmission at the Physical layer, Link layer, Network Layer, and Transport Layer.

1.5. (3 points) Give 3 examples of functionality provided by the Transport Layer (1 sentence each).

Problem 2) (4 points) What is the principal difference between connectionless communication and connection-oriented communication? Explain with an example.

Problem 3) (8 points) Amazon web services (AWS) has a service called Snowball that physically transports data to and from their cloud servers. Through this problem, we will identify the conditions when it is faster to physically transfer the data, rather than using the Internet to upload/download the data from the cloud.

Suppose you want to transfer D bits of data to the cloud. The rate at which you can upload this data is 100 Mbps. Suppose the datacenter is 100 miles away and the delivery truck travels at a speed 40 mph. The total time to process the transfer, excluding the physical transport by the delivery truck, is 10 hours. What is the minimum value of D for which it makes sense to use the physical delivery rather than upload over the Internet?

Problem 4) (6 points) (Q. 23 in the textbook) An image is 1600 x 1200 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it

(i) over a 56-kbps model channel
(ii) over a 1-Mbps cable modem
(iii) over a 10 Mbps Ethernet
(iv) over a 100-Mbps Ethernet
(v) over a gigabit Ethernet

Problem 5) (30 points) ns-3 simulations.

Download ns-3 and setup github to share your code with the instructor. Instructions to download ns-3 are attached in the assignment specification. Instructions for github setup is also provided. Please ask on Piazza if the setup is not clear or if you run into issues. **In your submission, you MUST include the link to your github repository.**

Follow the tutorial (attached) until Chapter 6. Run first.cc, second.cc, and third.cc, modifying them in myfirst.cc, mysecond.cc, and mythird.cc, as described in the tutorial. **Make sure you push all your changes to github before submitting.**

3.1. Copy myfirst.cc into myfirst-hw1.cc. Make the following changes:
Add the data rate for the channel, and packet size as command line arguments. Run the following experiment:
For data rates 512bps, 1Kbps, 512Kbps, and 1Mbps, change the packet size to 128, 256, and 1024. Set the delay for the point to point channel as 1ms.

3.1.1. You may not see a response from the server in some cases. What change should you make to ensure that you can see the server's reply no matter how long the client message takes? Make the change and proceed to the next step.

3.1.2. Report the time at which the server receives the message for each of the experiments in the table below.

Pkt size\Data rate	512bps	1Kbps	512Kbps	1Mbps
128				
256				
1024				

Time at which message was received at the echo server

Pkt size\Data rate	512bps	1Kbps	512Kbps	1Mbps
128				
256				
1024				

Time at which message was received at the echo client

3.2. Copy mysecond.cc into mysecond-hw1.cc. Make the following changes:
Add another echo client application to the left-most p2p node (n0), and another echo server application to the right-most CSMA node (n4). Answer the following questions:

3.2.1. Comment on the port number attribute of the echo server and client. Should you pay special attention to it while setting up your new server and client? Why?

3.2.2. Report the time at which a message is received at the server and the client with 1 and 2 applications running.

3.3. Copy mythird.cc into mythird-hw1.cc. Make the following changes:
Instead of the placing the echo server in the CSMA nodes, place it in one of the mobile WiFi stations. Record the mobility of the echo server as well.

You will now record the throughput of the application using a `FlowMonitorHelper`. We suggest that you set up a flow monitor as shown in the attached file called *first-mon.cc* (lines 71 – 93)

3.3.1. Run the new code and report the throughput:

a) from the echo client to the server:

b) from the echo server to the client:

3.3.2. From the command line, change the number of WiFi devices to the number: 9 + the last digit of your SJSU ID. E.g., if your SJSU ID is 11100111, run the experiment for 9+1 = 10 devices. Now report the following:

a) Final position of the echo server in (x,y) format:

b) Final position of the echo client in (x,y) format:

c) Throughput from echo server to client:

d) Throughput from echo client to server:

e) IP address of the echo server:

f) IP address of the echo client:

References Section: VERY IMPORTANT
Please include all the sources you used, including classmates you discussed with. Failure to include sources counts as an act of dishonesty and will be taken VERY seriously.

Submission instructions:

- Your completed homework should be in pdf format. Name your file "hw1-<your SJSU ID>".pdf, e.g., hw1-11100111.pdf.
- Commit and push your code in github every time you make changes. Your activity on github will be checked to finally assign your grade. Having your code go from 0% to 100% in a short time will attract unnecessary attention.