Problem Set 01

(Worth 20% - Due date June 28, 2021)

Submission Instructions

1. This is an individual assignment. Not a group assignment
2. The assignment must be typed, using at least font size 12 and uploaded as pdf/word file
3. Submission after the deadline will result in a 4% penalty for each late day
4. Make sure the answers submitted are yours and probably cite an external reference you have used (e.g. textbooks, lecture notes, academic or white paper), do not simply copy and paste from any source.
5. Cheating or any form of plagiarism will result at least in receiving zero

Networking Concepts and Definitions [20 points]

Q1.1) Compare and contrast between compare and contrast between access network and core network.

Q1.2) DNS is a stateless protocol running over the UDP protocol. Why is it appropriate to run DNS over UDP and not TCP? How DNS handle message loss and data corruption?

Q1.3) What are the primary services a transport layer protocol can provide for network applications, and which of these services are provides by the TCP and UDP protocols?

Q1.4) Explain the between network bandwidth, throughput, and latency.

Q1.5) Use the end-to-end design principle to argue the placement of the data encryption and error correction in the network layered architecture.

Network Layers and Services [30 points]

Q2.1) What are connection-oriented protocols, and what makes TCP connection-oriented?

Q2.2) Does the TCP protocol uses Go-Back N (GBN) or Selective Repeat when implementing pipelining? Make sure to explain your answer.

Q2.3)Why TCP uses flow control, and how is it different from congestion control in TCP?

Q2.4)A UDP socket is identified by the destination IP address and the destination port number. If two UDP segments have different source IP addresses and/or source port numbers but have the same destination IP address and destination port number. The two segments will be passed to the same destination process via the same destination socket. Given this fact on how UDP sockets work, would we implement a UDP server using multiple threads or a single thread, explain your answer

Q2.5) In pipelining protocols like GBN or SR, what is the relation between the range of sequence numbers and the pipeline window size? For example, if the window size is N, what is the minimum range of the sequence numbers.

Q2.6) Two hosts A and B are downloading a file of size 8 Gigabytes from a remote host C with an access link with a transmission rate of 120 Mbps. Host A has an access link with a transmission rate of 32 Mbps, and host B has an access link with a transmission rate of 64 Mbps. What is the time needed for host A and host B to download the file from host C. Assume the queuing and propagation delays are neglectable

Network Protocols Design [20 points]

Q3.1)What are the motivations that led to proposing the QUIC (Quick UDP Internet Connections) protocol?

Q3.2)Discuss briefly the message syntax and semantic of QUIC protocol.

Q3.3)Explain the main differences between QUIC and TCP, focus on congestion control, reliable communication, and communication overhead.

Q3.4)Use finite-state machines (FSM) to illustrate the data transport services of an unreliable transport protocol such as UDP.

Network Traffic Analysis [30 points]

Start your course Linux VM and execute the following steps Use either tcpdump or Wireshark to capture network traffic. Open the command line window and run the following command

```
traceroute facebook.com
traceroute 8.8.8.8
traceroute -n 196.219.60.10
```

Ensure to save the network trace "in pcap or tcpdump format" that results from running the above commands. You may save the traffic of each traceroute run into a separate file

Q4.1) When traceroute Facebook, how many protocols traceroute use to figure the route from your machine to Facebook.

Q4.2) Show the content of the DNS packet that returns the IP address of Facebook. [You can take a screenshot]

Q4.3) When you traceroute to 196.219.60.10 with -n option, how that affect the behaviours of traceroute

Q4.5) Explain How traceroute work and use the traffic trace your collected to support your explanation.

Q4.6) What is the main difference between traceroute to 196.219.60.10 and traceroute to 8.8.8.8