CNT 4700C Computer Networks Fundamentals, Fall 2019
Instructor: Prof. Ahmed Helmy
Homework 1: Internet Architecture & Application Layer
Due Date: Sept 24th, through canvas

Instructions: Be precise and to the point. Many questions require answers using a sentence or two). Some questions will ask you to elaborate, use visual aids or graphs, or show traces/code. Use your own words and phrases, do not copy from any other source.

Q1. A. What is a network protocol?

    B. What is the body that standardizes the Internet protocols?

    C. In which language are the protocol specifications largely written? What is the main problem with that format?

    D. [Extra:] Write a simple protocol spec for the following task: consider two people playing a game where one has a secret number in 1 to 10 and the other is attempting to guess it. But the two people can only communicate by each alternatively saying a single number.

Q2. A. What are the basic paradigms (or models) of communication? (mention 3)

    B. What are the processes are needed to support all these paradigms?

Q3. What are the advantages and disadvantages of:

    A. Hierarchical network architectures

    B. Protocol layering

    C. Stateless protocols

Q4. A. What is the *hour-glass* Internet model? (use simple drawing to illustrate)

    B. What does the Internet *thin waist* mean?

    C. [Extra:] Give two examples of protocols at the *thin waist* of the hourglass? Why are these protocols at the *thin waist*?

Q5. Can the Internet provide guarantees for message delivery and bandwidth? Provide reasons for your answer [hint: you may compare/contrast your answer with the telephone network]

Q6. A. How were the original Internet requirements met through its design?

    B. What are the two main requirements that you see missing from the original design that are much needed today?

Q7. How does the Internet scale its routing tables?

Q8. Give an example in which wireless mobile networks may be more secure than wired networks. [hint: you can use examples given in the class/lecture].

Q9. A. What is statistical multiplexing and what is the value it provides over TDM? Give example with numbers to support your argument(s).

   B. What is the main disadvantage of statistical multiplexing?

Q10. A. What is a DDoS attack? And why is it harder to control than a DoS attack?

Q11. [Extra:] What is the first Internet worm, and how did it harm the Internet? [hint: Watch video link posted on canvas]

Q12. A. Why is UDP preferred over TCP for IP-telephony/VoIP (like Skype)?

   B. Why would Skype sometimes use TCP? Give two reasons.

Q13. Would an application that needs congestion control ever use UDP? Give two examples to support your argument.

Q14. What are the identifiers needed for process communication across the network? Give example of a connection between two hosts. You can use a simple drawing to aid your answer.

Q15. Someone suggested that 'HTTP' is a stateful protocol. Argue for or against this statement.

Q16. How do web caches/proxy servers help Internet performance? Explain its benefits from the user and network perspectives. [hint: explain using your understanding of elementary queueing theory and delays, and use graphs as needed]

Q17. What is the effect of customized content, video streaming and encrypted traffic (e.g., HTTPS) on proxy caching?

Q18. A. When is peer-to-peer (p2p) network architecture needed or preferred?

   B. What is the main problem in the p2p design?

   C. Suggest a solution to the problem in B above.

Q19. Use '*traceroute*' and '*ping*' commands/tools to measure and analyze delays in the Internet:

   A. Use *traceroute* to measure delays between your location and an overseas location (e.g., www.eurecom.fr). Show the trace and annotate it showing the transoceanic link.
   B. Identify machines/routers along the way with:
   1. less than1ms delay, 2. 2–10ms delay, 3. 11–100ms delay, more than 100ms delay

      then *ping* those machines for 15seconds each and analyze their delays

   C. Identify the locations of the machines and reason about the differences in delays

   [hints: look at the traceroute example in the lecture/book and perform something similar. *traceroute* is called *tracert* on windows. On some machines you need to be super user (sudo) to run traceroute. You may run the commands from your machine or from a UF machine (e.g., storm.cise.ufl.edu), so try and see what works for you.]

Q20. [Extra:] Visit the wireshark website at wireshark.org, read the user's manual
(https://www.wireshark.org/docs/wsug_html_chunked/), then answer these questions:

    A. What is wireshark?

    B. What are some of intended purposes? (mention four)

    C. What are two unintended purposes?

[hints: install wireshark and start using it to prepare for future hwks. Read intro posted on canvas.]