CNT 4700C Computer Networks Fundamentals, Fall 2019

Instructor: Prof. Ahmed Helmy

Homework 2: Application Layer Continuation and Transport Layer

Due Date: Oct 7th, 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- DNS-related: Consider a scenario of a user browsing the web from the machine storm.cise.ufl.edu, accessing an article in a website at URL:

www.nytimes.com/2019/09/26/technology/ai-computer-expense.html

The user performs three accesses: - using http, - using https and - using port 8080.

A. Show the sequence of DNS servers queried to resolve the URLs (assume no caching)
B. Write the complete URL for each of the three accesses [you may have to edit the URL]
C. Write the four tuple [src address, src port, dst address, dst port] for each of the accesses

Q2- Discuss how the following technologies (or their variations) help in improving the performance of content distribution networks (CDNs):

A. HTTP
B. DNS

Q3- Elaborate on the data '*push*' vs '*pull*' in the context of

A. http vs SMTP
B. peer-to-peer network hierarchy communication (e.g., super nodes, group leaders)
C. Proxy and web caching
D. CDNs

Q4- Someone suggested to use a local file called *hosts.txt* on each machine instead of DNS. Discuss the advantages (at least 2) and disadvantages (at least 2) of such suggestion.

Q5- What is '*saw-tooth*' behavior in TCP, and what is causing it?

Q6- A TCP flow and a UDP flow walk into a network, sharing a bottleneck link …. Complete the story, detailing the packet rate dynamics if the link gets congested, and comment on the end result.

Q7- TCP is supposedly fair, dividing the bandwidth between competing TCP flows. You want to transfer a huge file fast, suggest a way of doing so using TCP to get over the fairness delays, and approximate your new bandwidth share.

Q8- Given that most data-link layers perform error checking (and correction to some extent) why do we need checksum in UDP (and TCP)?

Q9- Comment on response to *packet-loss* vs *ack-loss* in

A. Go-back-N
B. selective repeat

Q10- Congestion Signaling:

A. What is meant by implicit congestion signaling and explicit congestion signaling? Give examples of congestion control protocols that use each type signaling.
B. Discuss the advantages and disadvantages of each of the above schemes.
C. What kind of signaling does TCP use to detect network congestion? Explain the different signals that TCP uses for that task.

Q11- Network congestion phases:

A. Describe (with the aid of a graph) the different phases of network load/overload outlining the degrees of congestion with increase of load. Indicate the point of congestion collapse and explain why it occurs.
B. Where does TCP operate on that graph? Explain for the various phases of TCP; slow start, congestion avoidance (due to timeout), fast retransmit-fast recovery triggered by duplicate ACKs.

Q12- Argue for or against this statement (reason using examples as necessary): "Packets are lost only when network failures occur (e.g., a link goes down). But when the network heals (e.g., the failed link comes back up again), packets do not get lost."

Q13- Compare and contrast *AIMD* vs *MIMD*. Focus on network stability.

[A *lab* part will be added to hwk2 later on using tracing tools as relates to this homework. Instructions will be posted separately for the lab part.]