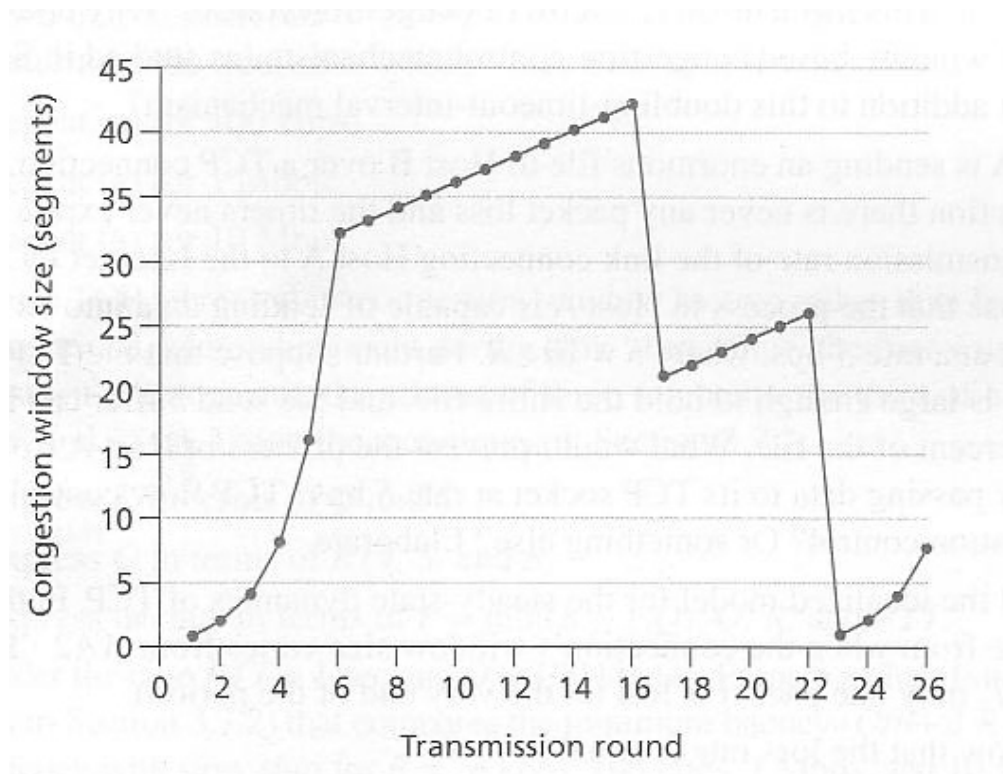


CSIT5610: Computer Networks An Internet Perspective

Fall 2022: Homework 2

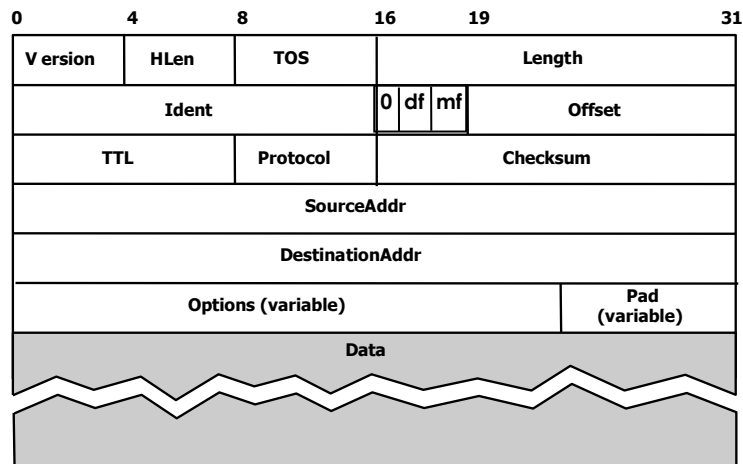
Problems:

- (28pts) Consider the following plot of TCP congestion window size as a function of the transmission round (or RTT, i.e., each point summarizes what happens in the RTT). Answer the following questions, **explain all your answers**



- Which version of TCP is this Tahoe or Reno? (2pts)
- Identify the intervals of time when TCP slow start is operating. (3pts)
- Identify the intervals of time when TCP congestion avoidance is operating. (3pts)
- After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? (3pts)
- After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? (3pts)
- What is the initial value of Threshold at the first transmission round? (3pts)
- What is the value of Threshold at the 18th transmission round? (3pts)
- What is the value of Threshold at the 24th transmission round? (2pts)
- During what transmission round is the 90th segment sent? (6pts)

2. (28pts) The IP packet header format is shown hereafter for reference:

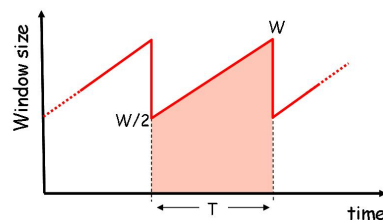


Considering that a router receives the following packets (in hexadecimal) on a network with a link layer MTU size of 1500 bytes and must forward them on a network with an MTU size of 512 bytes, explain clearly (in the form of bullet points) what would a router that receives the following packets do when processing them and what it will do with them and why? (If the packet must be fragmented show only the offset values).

- (7pts) 45 00 05 DC 08 DB 20 00 40 06 8E F1 8F 59 56 7B 8F 59 28 22
- (7pts) 45 00 05 DC 08 DB 40 00 40 06 8E F1 8F 59 56 7B 8F 59 28 22
- (7pts) 45 00 05 DC 08 DB 00 00 01 06 0D F2 8F 59 56 7B 8F 59 28 22
- (7pts) 45 00 05 DC 08 DB 00 00 40 06 CE F1 8F 59 56 7B 8F 59 28 22

3. (20pts) Recall the macroscopic description of TCP throughput. Assuming the network load is stable, TCP will operate in AIMD, with the source rate varying from $W/(2 \cdot RTT)$ to W/RTT and only one packet is lost (at the very end of the period).

- Determine the loss rate L as a function of W . (Show the relation between L and W).



- Use the loss rate expression to show that if a TCP connection experiences loss events at the rate of L , its average throughput is approximately given by $1.22 \cdot \text{MSS} / (\text{RTT} \cdot \sqrt{L})$. (Hint: for large W , W is negligible compared to W^2)

Practical Exercises (**compulsory Must be done**): (24pts)

Wireshark TCP Lab: Check the course website under canvas in the Labs to find instructions for Wireshark TCP Lab. Follow the instructions given there. Submit your own answers with cropped screen captures in PDF for questions 3, 4, 5, and 6 only (6 points each)