Practice Problem (1)

- Consider a TCP connection with initial congestion window of one segment and a constant RTT of 1 second. The ssthresh parameter is initially set to 32,000 bytes. All segments carry 1,000 bytes of data. The receiver's advertising window is 64,000 bytes. Suppose that the connection does not experience any losses or queuing delays. How long will it take to transfer a 200,000 bytes file? You may ignore the connection establishment latency.

Practice Problem (1)

Answer: Since each segment carries 1000 bytes, the file will be transferred in 200 segments. The RTT is a constant 1 second. To compute the latency, we will determine how many RTTs (i.e. rounds) it takes to transfer the file. The initial sstresh is 32 segments and the receiver window is 64 segments. The following table lists the size of the transmission window and the cumulative delivered data in each round

Round	CongWin (in segments)	RcvWin (in segments)	Data Sent (in segments) = min (CongWin, RcvWin)	Cumulative Data Sent (in segments)
1	1	64	1	1
2	2	64	2	3
3	4	64	4	7
4	8	64	8	15
5	16	64	16	31
6	32	64	32	63
7	33	64	33	96
8	34	64	34	130
9	35	64	35	165
10	36	64	36	201

So it takes 10 rounds, i.e. 10 seconds to transfer the file

Practice Problem (2)

- Consider a TCP Reno connection between two hosts with a large amount of data packets flowing in only one direction. Assume a malicious router along the path drops every other data segment of this connection (i.e. it drops 2, 4, 6, etc.). Assume that the receiver's advertised window is 256 MSS. Also assume that there is plenty of bandwidth available on the path, so as to accommodate a TCP window size of 64 MSS in the absence of the malicious router.
  - (a) What is the maximum window size achieved on this connection?
  - (b) Repeat (a) for the case when the malicious drops every eight packet (say 8, 16, 24, etc.)

Practice Problem (2)

- Answer:

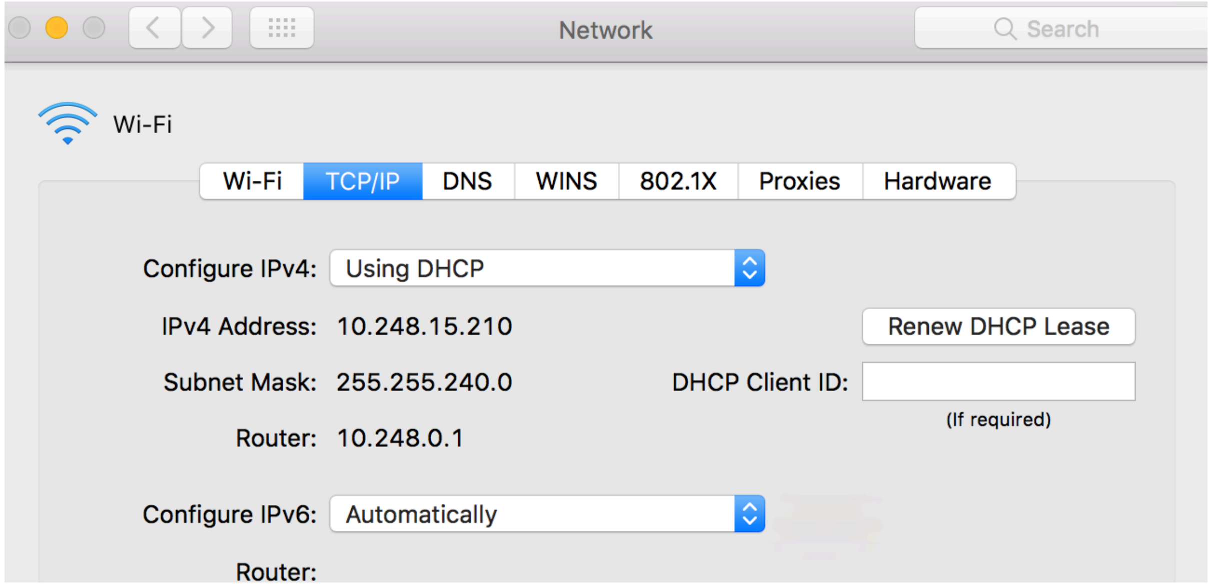
(a) Maximum window size = 2. This is because the transmission of every second packet causes a timeout followed by slow start. In other words, the window size will oscillate between 1 and 2.

Practice Problem (2)

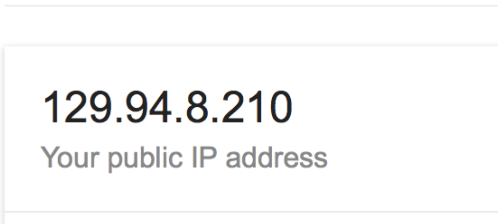
(b) Window size will increase as follows: 1, 2, 4, 8 (slow star). When packet # 8 is dropped, the congestion window = 8. So the first packet in this window is dropped. The rest are delivered successfully. Several duplicate ACKs are returned which would trigger fast retransmit and the window would be cut to 4 (threshold also would be 4). The first packet in this window is dropped, since it is the 16th packet. This will trigger a timeout and the window will be cut back to 1. The subsequent behaviour will be similar to that described above. Thus, the window size will never increase beyond 8.

Practice Problem (3)

- The picture below shows you the IP address of my machine connected to the uniwide wireless network.



- However when I ask Google it says my IP address is as noted below. Can you explain the discrepancy?

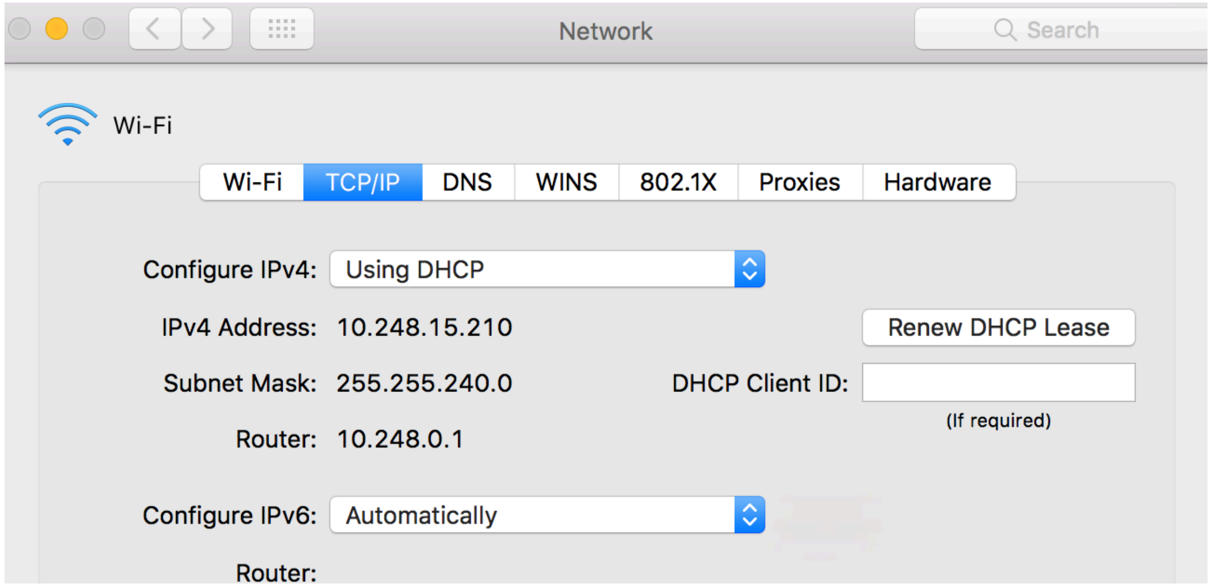


Practice Problem (3)

- Answer:

The IP address assigned by Uniwide is a private IP address that is only relevant in the private UNSW network. The IP address noted by Google is the WAN side IP address for the NAT router that is connecting the private subnet that my computer is a part of, to the rest of the Internet

Practice Problem (4)



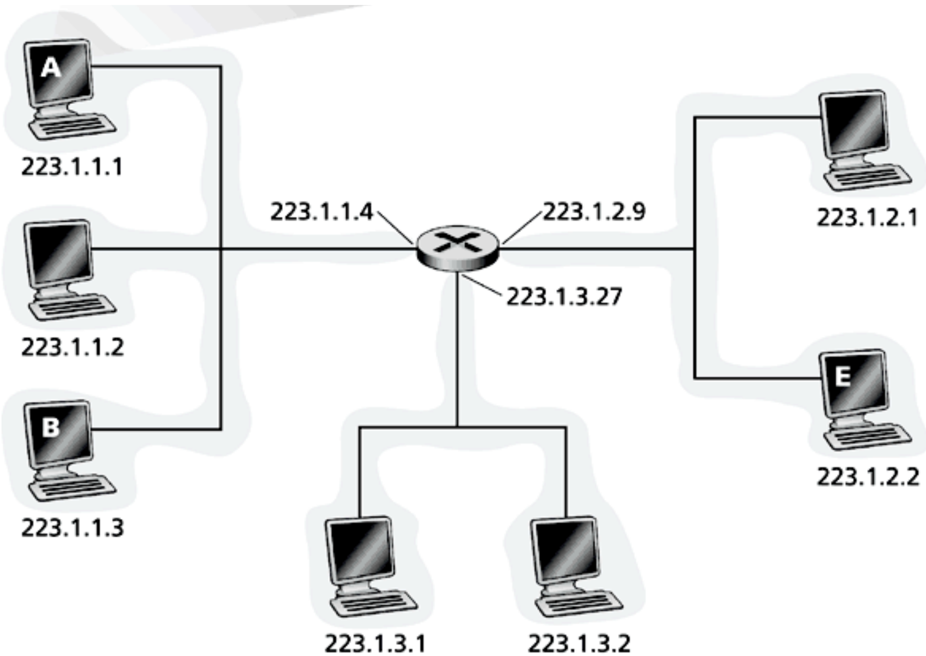
- Can you express the subnet address for the subnet that my machine belongs to (see picture above) in the CIDR format (i.e. a.b.c.d/x) ?
- What is the broadcast address for this subnet?
- How many hosts can be part of this subnet?

Practice Problem (4)

- Answer:
- The subnet mask is 255.255.240.0 which indicates that the network part of the address is 20 bits and the host part is 12 bits. Thus the CIDR address of the subnet is 10.248.0.0/20.
- The broadcast address in the subnet is 10.248.15.255
- The total # of usable address (and thus hosts) is $2^{12} - 2 = 4094$

Practice Problem (5)

Describe the complete sequence of steps involved for getting data sent from the network layer of host A to the network layer of host E. Be sure to include all steps involved at the network layer and data link layers.



Practice Problem (5)

- Answer:

Check slides 11-16 from the Week 11 Lecture notes.

Practice Problem (6)

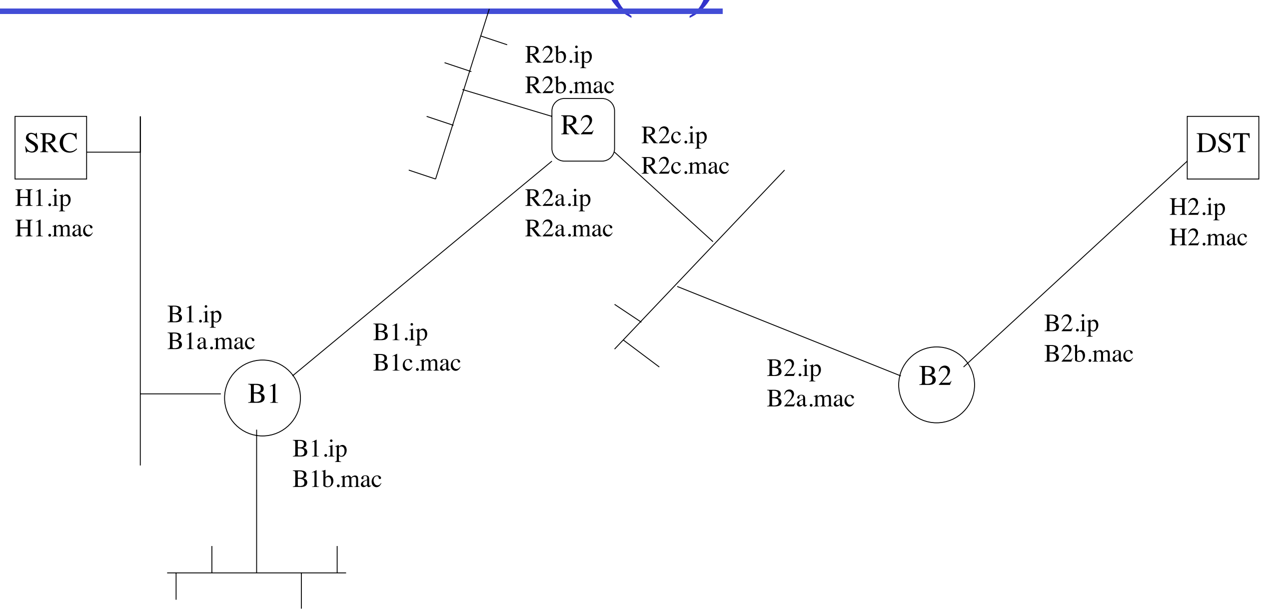
Q: Suppose Ethernet was the only existing LAN technology, so every host in the Internet was part of a local Ethernet and thus had a globally-unique Ethernet address. Would you recommend getting rid of IP addresses by simply using Ethernet addresses instead of IP addresses? Why or why not?

Practice Problem (6)

- Answer:

No. It would not scale due to (1) the need for broadcast for discovery and (2) forwarding tables would be very large as MAC addresses are not topologically assigned and thus cannot be aggregated.

Practice Problem (7)



Above is a picture of a network with 2 switches (bridges) and 1 router. Each interface is labeled with an IP address and a MAC address. Imagine that host H1 is sending packet to host H2. Answer the following:

- How many subnets in the above topology?
- Just before the packet reaches bridge B1, what is the destination MAC address in the Ethernet frame?
- Just before the packet reaches bridge B2, what is the source MAC address in the Ethernet frame?
- Just after the packet leaves router R2, what is the source IP address in the datagram?

Practice Problem (7)

- Answers:
  - Total 3 subnets
  - R2a.mac
  - R2c.mac
  - H1.ip

Practice Problem (8)

- Consider the following 3 applications over a wireless network
  - Voice-over-IP, where packets are very small and the send rate is constant
  - MPEG movie streaming, where the packet size is large and the send rate is variable
  - Instant messenger chat, where packet size is small and send rate is variable
- For each application, list and explain which of the following MAC protocols you would use – (i) TDMA, (ii) plain CSMA/CA (iii) CSMA/CA + RTS/CTS

Practice Problem (8)

- Answer:
- VoIP: TDMA, because we can easily split up each constant rate flow into constant size slots.
- Movies: CSMA/CA + RTS/CTS because collisions of large packets are expensive and we want to avoid them. TDMA would not allow efficient use of the medium because the send rate is variable.
- Messaging: plain CSMA/CA since the overhead of RTS/CTS is not worth it for small packets. TDMA is not suitable for the same reason as above

Practice Problem (9)

- Assume that a group of 10 people wishes to communicate securely with each other. Each member of the group needs to send secret data to the other 9 people within the group. All communication between any two people p and q is visible to all other people in this group and no other person in the group should be able to decode their communication.
  - (a) If the group decides to use symmetric key encryption, how many keys are required in the system as a whole?
  - (b) Instead if public key encryption is chosen, how many keys would be required?

Practice Problem (9)

- Answer:

(a) if symmetric key encryption is used, then each pair of people communicating would require their own unique key. For N people this comes out to N(N-1)/2. Hence, for N=10, we have 45 (= 1 + 2 + 3 + ...+ 9)

(b) For public key encryption, each user needs its own public private key pair. All the other users to send data to him can use the public key. So in this case, 10 pairs of public and private keys will be needed