CSC458 Computer Networks
Problem Set #1 Tutorial

Hossein Bijanrostami

Winter 2025

Let the following be addresses of (destination) IP networks:

Network 1: 131.21.0.0/16 **Network 2:** 131.22.0.0/16 **Network 3:** 133.22.12.0/24

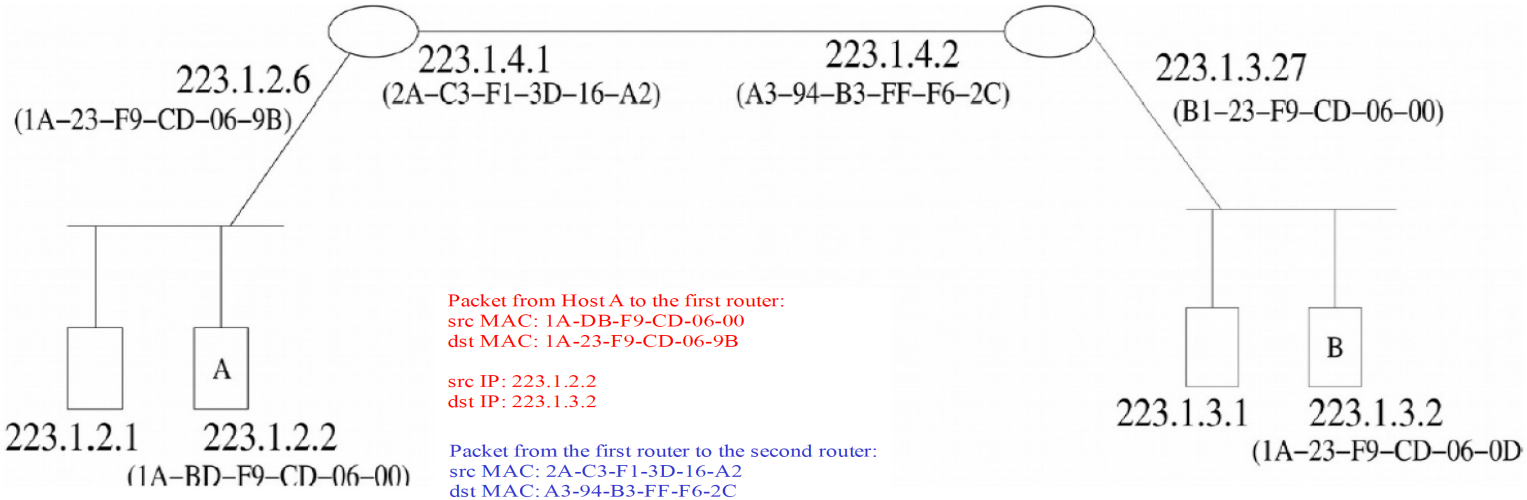
And consider the following hosts with IP addresses:

Host A: 131.21.12.19 **Host B:** 133.21.12.19 **Host C:** 133.22.11.19 **Host D:** 131.21.21.21

To which (destination) network do the different hosts belong? Are there any hosts that do not belong to any of the above networks?

Host A: Net 1
Host B: none
Host C: none
Host D: Net 1

The figure below gives a network topology of hosts and routers, and the corresponding MAC and IP addresses. Assume that host **A** sends a message/packet to host **B** (using the route that is indicated in the above figure). For each hop over which the message/packet travels, indicate the source and destination MAC and IP addresses that are used in link layer, and network layer, packets.



Packet from Host A to the first router:
src MAC: 1A-DB-F9-CD-06-00
dst MAC: 1A-23-F9-CD-06-9B

src IP: 223.1.2.2
dst IP: 223.1.3.2

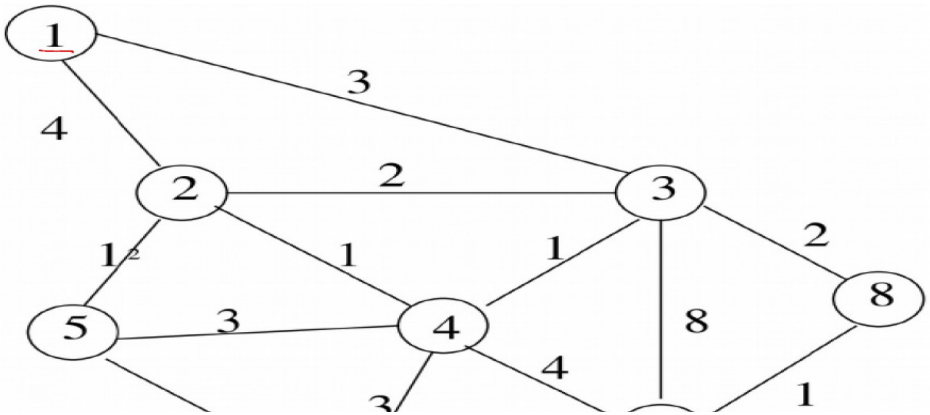
Packet from the first router to the second router:
src MAC: 2A-C3-F1-3D-16-A2
dst MAC: A3-94-B3-FF-F6-2C

src IP: 223.1.2.2
dst IP: 223.1.3.2

Packet from the socond router to Host B:
src MAC: B1-23-F9-CD-06-00
dst MAC: 1A-23-F9-CD-06-0D

src IP: 223.1.2.2
dst IP: 223.1.3.2

Question 6. [6 points] Consider the weighted graph given below. Using Dijkstra's algorithm, find the shortest-path spanning-tree for routing packets from node 1 to every other node in the graph. Clearly show each step of the algorithm, including the evolution of the shortest-path set, **S**. Write your answer in the table below. Each entry in the second column should be a triple: (New node in the shortest path set, Next-node from node 1 to reach the new node, cost to reach the node).



Step	(Destination node, next node, cost), S
1	(1,1,0), S = {1}
2	(3, 3, 3), S = {1, 3}
3	(2, 2, 4), S = {1, 2, 3}
4	(4, 3, 4), S = {1, 2, 3, 4}
5	(5, 2, 5), S = {1, 2, 3, 4, 5}
6	(8, 3, 5), S = {1, 2, 3, 4, 5, 8}
7	(7, 3, 6), S = {1, 2, 3, 4, 5, 7, 8}
8	(6, 3, 7), S = {1, 2, 3, 4, 5, 6, 7, 8}

A message of size 10,000 bytes is sent from a source node A to a destination node B passing through two routers R1 and R2. All three links on the path have a delay of 20 ms. Node A has a transmission rate of 100 bits/sec, R1 and R2 have a transmission rate of 1000 bits/sec. We assume this is a store and forward system, there is no queueing delay, and we ignore all header overheads for simplicity.

1. Find the end-to-end latency of the message when it is sent as a whole.

Let $M = 8 \times 10^4$ bits denote the message size, $D = 20$ ms denote the propagation delay of each link, and $r_0 = 100$ bits/sec and $r_1 = r_2 = 1000$ bits/sec denote the transmission rate of node A and R1 and R2, respectively. The end-to-end latency of the message is $\left(D + \frac{M}{r_0}\right) + \left(D + \frac{M}{r_1}\right) + \left(D + \frac{M}{r_1}\right) = 3 \times 0.02 + 800 + 80 + 80 = 960.06$ seconds.

2. Find the end-to-end latency of the message when it is broken into packets each of size 1KB and then transmitted to the destination.

Let $L = 8 \times 10^3$ bits denote the packet size. The end-to-end latency is $\frac{M}{r_0} + 3D + \frac{L}{r_1} + \frac{L}{r_2} = 800 + 0.06 + 8 + 8 = 816.06$ seconds.