IK1203
Networks and Communication

Recitation 3 – Network layer and data link layer

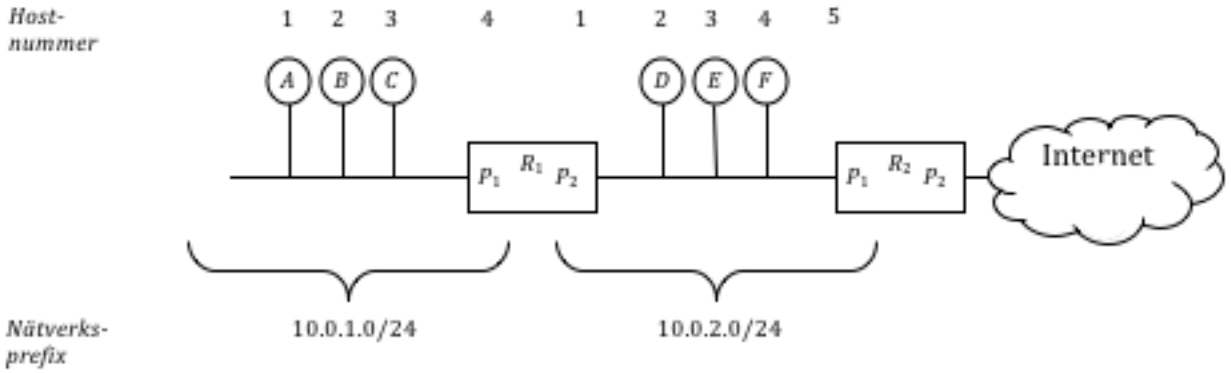
1. A router R has two network interfaces (ports) P1 and P2 connected to the subnets 130.237.160.128/25 and 130.237.160.0/25 respectively. On the subnets there are two routers: one (with address 130.237.160.131) connecting also to subnet 130.237.160.192/26, and one (with address 130.237.160.32) connecting to the rest of the Internet. The table below shows the forwarding table of router R.

Destination	Next hop
130.237.160.128/25	P1
130.237.160.0/25	P2
130.237.160.192/26	130.237.160.131
0/0	130.237.160.32

Show how router R will forward IP packets with the following destination addresses. For each address, give the outgoing port and the IP address to the next hop of the packet.

a) 130.237.224.44
b) 130.237.160.33
c) 130.237.160.132
d) 130.237.160.200
e) 130.237.162.11

2. The network in the figure below consists of two subnets, sig computer (A to F), and two routers (R_1 and R_2). The IP addresses are given by the combination of network prefix for the subnet and the network interface number, which is given for each host and for the two routers. As an example, Computer E has IP address 10.0.2.3. MAC addresses are as follows: Computer A has MAC address MAC_A, computer B has MAC address MAC_B, and so on. The MAC addresses for the router ports are as follows: Port P_1 on R_1 has MAC address MAC_{1-1}, P_2 on R_1 has MAC address MAC_{1-2}, and so on.



a) Computer A has recently communicated with all other units in the figure. Illustrate the ARP table of A.

b) Draw the routing table in router R_1, by completing the table below. Assume that the table is comlete, in the sense that it allows R_1 to communicate with all other units in the figure as well as with the Internet.

Destination	**Network mask**	**Gateway**	**Interface (port number)**

c) Computer A sends an IP packet to computer E. This packet will thus pass through R_1. Give the MAC addresses and IP addresses that are present in the packet when it is received by R_1, and when it is sent out by R_1.

d) Assume that you would like to replace router R_1 with a switch (bridge). What would the changes be in the network?

e) Give one advantage and one disadvantage by using a router instead of a switch.

3. Consider a router R_1 in a network where RIP is used. R_1 has the following routing table:

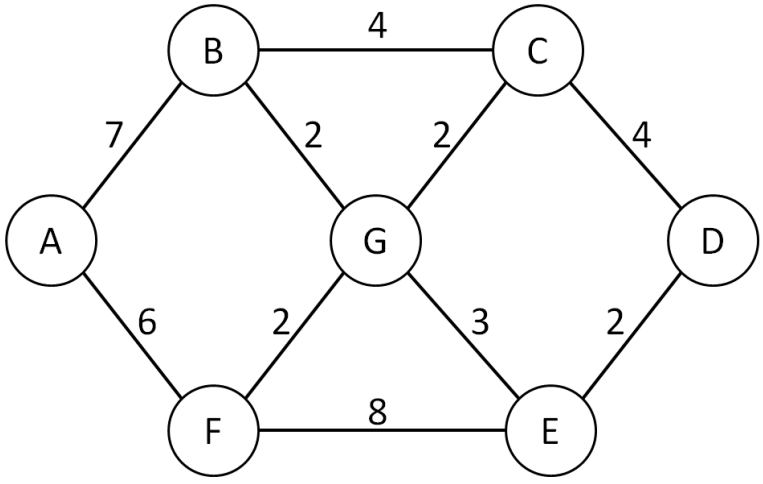
Network	Next router	Distance
N_1	R_2	11
N_2	R_3	5
N_3	R_3	6
N_4	R_2	6
N_5	R_4	7
N_7	R_4	2
N_8	R_3	2

R_1 receives a routing message from router R_2, with the following information:

Network	Distance
N_1	3
N_2	15
N_3	6
N_4	5
N_5	5
N_7	2

What does the updated routing table in R_1 look like when R_1 has processed the routing message?

4. Use Dijkstra's algorithm to find the shortest path between node A and all other nodes in the network below. Your solution should clearly show what happens in each step of the algorithm.



5. CSMA/CD is a method to control access in a broadcast network, and is used in the original version of Ethernet. Assume that we have such a network with a capacity of 10 megabit/s over the shared medium and that we use frames with sizes between 64 and 1518 bytes.

a) Explain why such an Ethernet is limited in physical length,.i.e., why there cannot be an arbitrarily long distance between two machines connected to the medium. (We disregard from noise and reduction of the signal strength in the cable).
b) Assume that we upgrade the network aboe to a capacity of 1 gigabit/s. What will then be the maximum distance between two machines connected to this network (i.e., what is the maximum physical length of the medium?)

(Note that the network we defined in b) above will <u>not</u> be same thing as Gigabit Ehternet.)

6. No system is perfect, so to detecting and handling bit errors is an important function of a communication system. How this is done depends on the type of errors and the frequency of errors, as well as on the consequences an error will cause. Three common methods for bit error detection are parity, checksum, and CRC (Cyclic Redundancy Check). For each one of these, answer the questions below:

a) Briefly explain how the method works.
b) Explain strengths and weaknesses of the method.
c) Give at least one example of where (protocols, type of communication, networks) the method is used.