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Exercise Sheet 9

Computer Engineering and Communication Networks

Handout: 05.12.2019
Discussion: 12.12.2019 (start 10:00 am.)

1. Media Access

1.1. Which multiplexing method is used in Aloha?
- a) Time Division
- b) Frequency Division
- c) Space Division
- d) Wavelength Division

1.2. What does the Aloha algorithm do before sending a frame for the first time?
- a) Waits until the medium becomes free
- b) Waits for random amount of time
- c) Waits for a predefined amount of time
- d) Sends packets immediately without waiting

1.3. What is the influence of the distance between two communicating machines on the minimum frame size in a network with common transmission medium, if collisions should be reliably detected?
- a) Distance has no influence
- b) Distance and min. frame size are inversely proportional
- c) That depends on the bit error rate of the selected medium
- d) The min. Frame size increases exponentially to the distance
- e) Distance and min. frame size are proportional

1.4. What is the difference between CSMA and CSMA / CD?
- a) CSMA/CD is less computationally intensive than CSMA
- b) There is no difference
- c) CSMA/CD sends a collision signal when the medium is busy
- d) CSMA/CD detects collisions while sending

1.5. Consider a CSMA / CD network with two computers connected directly (i.e. without a repeater) via a 2 km cable at 100 Mbps. The signal speed in the cable is 200'000 km / s. What is the minimum frame size?

1.6. How long does the 1-persistent CSMA wait to send after a previously occupied channel has been released?

a) Doesn't wait
b) Random amount
c) Predefined amount

1.7. Is the following statement correct?
The p-persistent CSMA always sends with probability p in a free line.

1.8. In an Ethernet network, two hosts (A and B) are directly connected by a crossed UTP cable. The two hosts start at the same time to send a frame on what they consider to be free medium. A collision is detected and an interference signal (jam signal) is sent. Considering that "Exponential Back-off" Algorithm is used for media access, answer the following questions:

1.8.1. After how long (time) host B tries again?
1.8.2. What is the probability that at least two more collisions occur?
1.8.3. How many collisions must occur so that the probability of the next collision becomes 0.0625.
1.8.4. After how many iterations of the exponential back-off algorithm is the first frame transmitted successfully?(The first try counts two)
1.8.5. Does a lager frame length increase throughput in any case?

1.9. What is the role of Padding and Preamble in a CSMA / CD frame?

2. Switching

2.1. Which switching variant (a, b, c, d) corresponds to the following examples:

2.1.1. Lukas dials a number on his landline phone, in the central office his line is connected to that of the destination number.

2.1.2. Sarah sends a SMS to her mother. The SMS is transmitted from the mobile phone to the central office. There it is cached. If the message arrives correctly, it will be delivered as soon as her mother is reachable.

a) Store and forward switching
b) Cut-through switching
c) Hybrid switching
d) Circuit switching

2.2. Which of the following statements is/are correct?

2.2.1 In a communication between two stations using a “virtual circuit-switched network”, packets always travel the same route through the network.

2.2.2. In a “virtual circuit-switched network” available bandwidth is dynamically allocated.

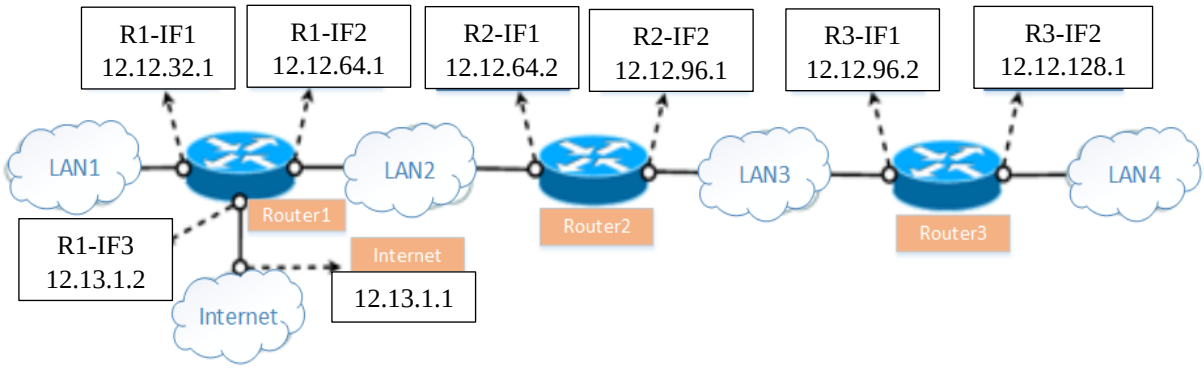
2.2.3. Virtual Circuit switching can guarantee bandwidth when an end-to-end connection is established.

3. IP Addresses and Routing

3.1. Specify the network and broadcast addresses for the following IPv4 addresses (each with subnet masks). Note: The network address is defined as the lowest possible address, the broadcast address is known as the highest possible accordingly.

3.1.1. 192.168.200.40/24
3.1.2. 8.159.9.201/22
3.1.3. 167.1.127.96/27

3.2. The following figure depicts a network topology constituted by routers, ports, LANs, and the Internet. Routers, LANs, and ports are labeled according to the following well-defined scheme: Routers and LANs are identified/labeled by a number, *e.g.*, “Router1” or “LAN3”. Routers may have one or more ports. Ports are labeled as “Rx-IFy”, where “x” is the number of the respective router and “y” is the number of the port on that device. “Router1” is connected to the Internet via a gateway named “Internet”.



The following routing table contains for every router considered entries to networks being reachable (denoted by “1.2.3.4/19), the respective outgoing port, and the respective gateway. Assume a 19 digit subnetmask for all networks. Cells in the gateway column may either contain an IP address or the symbol “*”. The symbol “*” implies that no gateway is needed. Assume that every routing table needs to contain explicitly all routes and that every routing table needs to contain a “default”-route. The “default”-route is used, when there is no other known route for an IP address and it is equal to all routers.
Based on these explanations, definitions, and assumptions complete the already partially filled in routing tables below, such that no field remains empty.

Router	Destination Network	Port	Gateway
Router1	12.12.32.0	R1-IF1	*
		R1-IF2	
	12.12.128.0	R1-IF2	
	default		12.13.1.1
Router3			12.12.96.1
		R3-IF2	
	12.13.1.0		
		R3-IF1	

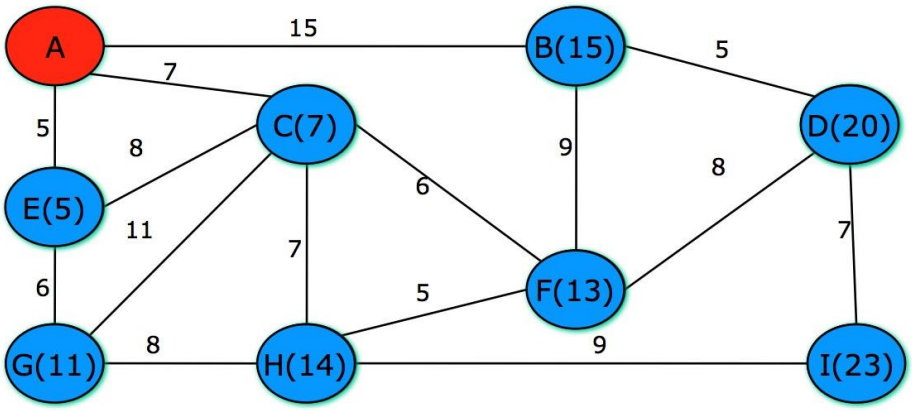
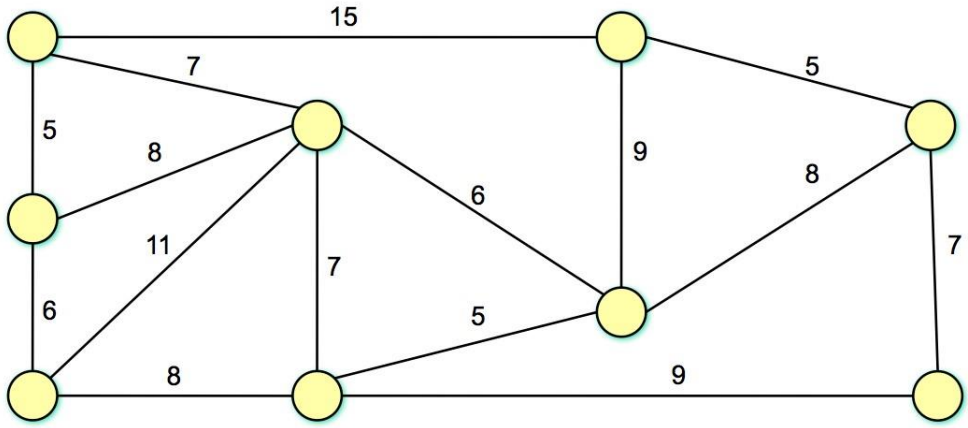
4. General Questions

4.1. For the following statements indicate which are correct:

4.1.1. The DHCP protocol is used to resolve IP addresses to physical MAC addresses.
4.1.2. Since there is no default IP address for DHCP servers, the first DHCP message is sent from a client to the IP broadcast address and also the subsequent response from the DHCP server must be sent to that broadcast address.
4.1.3. Thanks to Network Address Translation (NAT), end systems in the same home network can share an IP address on the Internet.
4.1.4. With Network Address Translation (NAT), only port numbers are replaced, but IP addresses are always left unchanged.
4.1.5. ARP requests are resolved by a dedicated server.
4.1.6. The minimum spanning tree (MST) of a graph contains the shortest paths between all nodes.
4.1.7. The minimum spanning tree (MST) of a graph is unique.
4.1.8. If all edges have different weights, the minimum spanning tree (MST) of a graph is unique.
4.1.9. There is exactly one shortest path tree for each node in a graph.
4.1.10. Distance Vector Routing is a distributed routing protocol.
4.1.11. Inter-AS routing uses a link state routing algorithm.
4.1.12. Every machine of an autonomous system has to implement the Border Gateway Protocol.

5. Graph Algorithms

5.1. What is the shortest path in the following graph based on the Dijkstra's shortest-path algorithm starting from node A and ending with node I ?



5.2. Indicate if the following statement is correct or not?
For the following graph, Kurskal's MST algorithm first adds the edges with weight 6 and then the edges with weight 5.