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Winter 98-99

EE384A: Network Protocols and Standards
Midterm Examination
Closed Book / Closed Notes
Thursday, February 11, 1999
8:00 AM – 9:15 AM

NAME: ____

Honor code observed: ________________________________
(signature)

Assigned Grade:
1) ________________/ 8
2) ________________/ 15
3) ________________/ 8
4) ________________/ 11
5) ________________/8

Total _______/ 50

For questions 1, 2 and 3, consider the topology depicted in Figure 1. Company X has three locations, each one with a LAN (A, B, and C). The LANs in these three locations need to be interconnected; the company then deploys three Gateway devices, interconnecting the LANs as shown.

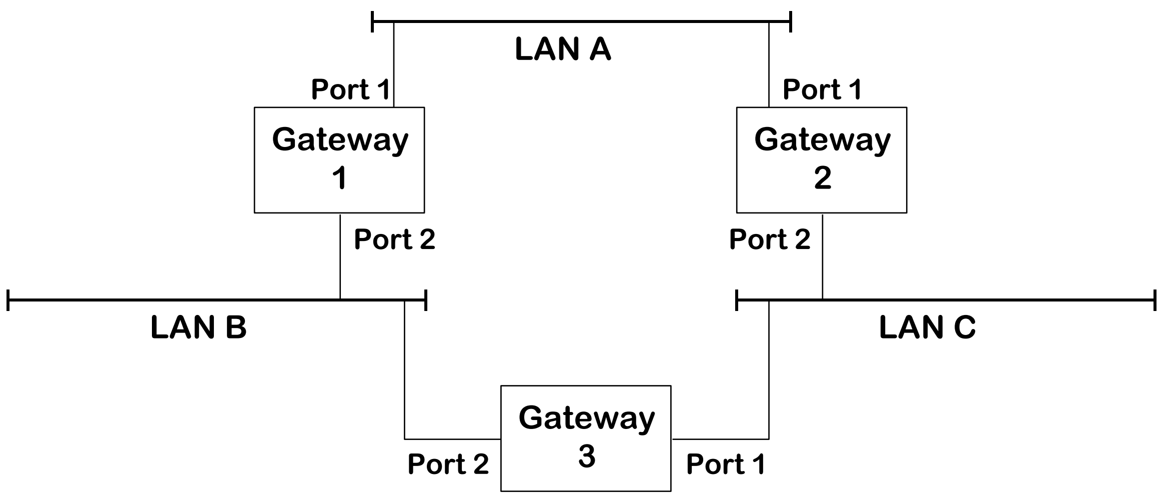

Figure 1: Company X Network Topology

Problem 1: Transparent Bridging (8 points)

For this problem, assume that Gateways 1, 2, and 3 are transparent bridges, and their ID numbers are the ones shown (i.e., 1 for Gateway 1, 2 for Gateway 2, etc).

a. Assume that the spanning three algorithm has reached steady state. In the table below, indicate the state of each port in the network. Use ***DP*** for Designated Port, ***RP*** for Root Port, and ***B*** for Blocking. (3 points)

Bridge	Port	State
Gateway 1	Port 1	
	Port 2	
Gateway 2	Port 1	
	Port 2	
Gateway 3	Port 1	
	Port 2	

b. Assume that each LAN segment is a shared-medium LAN, with a perfect contention mechanism, i.e., the entire capacity of the LAN segment may be used. The capacity of each LAN segment is C bits/sec. The stations connected to each segment generate T bits/sec of traffic (i.e., the traffic that originates at ***each*** segment is T bits/sec). Assume that the traffic on each segment is uniformly addressed, i.e., out of the T bits/sec offered, $T/3$ bits/sec are addressed to stations in the same segment, and $T/3$ bits/sec are addressed to stations on each of the other two segments. Derive the maximum value of T as a function of C under these conditions. (5 points)

Problem 2: IP Routing (15 points)

For this problem, assume that Gateways 1, 2, and 3 are IP Routers. The network is connected to the Internet through a third port on Gateway 3, as shown in Figure 2 below.

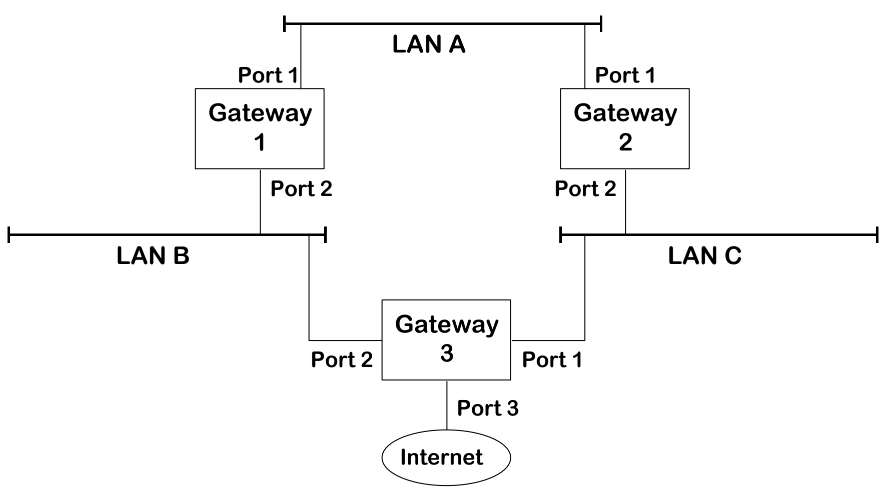

Figure 2: Connecting Company X to the Internet

a. Assume that the class-C network number 204.240.18.0 has been assigned to the company. Assume that there are 100 hosts on LAN A, 50 hosts on LAN B, and 50 hosts on LAN C. The organization uses subnetting, and each LAN should be a distinct subnet. It is required that all machines and all router interfaces be given IP addresses. You are asked to assign IP addresses to the stations and router interfaces, and to indicate the entries in each router's table needed to route IP datagrams destined to stations within the company network. The IP address of Port 3 of Gateway 3 is assigned by the organization's ISP on its backbone range; the assigned value is 38.100.20.78 (and it has no bearing to this problem). Write your answers in the tables provided.

Subnetworks: (2 points) Note: IP Address Range refers to the valid range of IP addresses for each of the three subnets.

	IP Address Range		**Subnet Mask**	**Total # of Addresses**
Subnet	**From IP**	**To IP**		
LAN A				
LAN B				
LAN C				

Assigned Router Interface IP Addresses: (1 point)

Router	**Port**	**IP Address**
Gateway 1	Port 1	
	Port 2	
Gateway 2	Port 1	
	Port 2	
Gateway 3	Port 1	
	Port 2	
	Port 3	38.100.20.78

Assigned Host IP Addresses: (1 point)

Subnet	**From IP**	**To IP**
LAN A		
LAN B		
LAN C		

Routing Tables (the supplied tables may have more rows than required; you do not necessarily need to use all the rows). For Output Port, indicate Port 1 or Port 2 (or Port 3, in case of Gateway 3). For next Hop IP, use the word "Direct" when the packet is destined to a directly attached network. (6 pts)

Routing Table for Gateway 1			
Destination IP	Mask	Output Port	Next Hop IP

Routing Table for Gateway 2			
Destination IP	Mask	Output Port	Next Hop IP

For this table, use the word "ISP" in the Next Hop IP column when the output port is Port 3.

Routing Table for Gateway 3			
Destination IP	Mask	Output Port	Next Hop IP

b. Similarly to question 1.b, assume that each LAN segment is a shared-medium LAN, with a perfect contention mechanism. The capacity of each LAN segment is C bits/sec. The stations connected to each segment generate T bits/sec of traffic (i.e., the traffic that originates at ***each*** segment is T bits/sec). Assume that the traffic on each segment is uniformly addressed, i.e., out of the T bits/sec offered, $T/3$ bits/sec are addressed to stations in the same segment, and $T/3$ bits/sec are addressed to stations on each of the other two segments. For the purposes of this question, there is no traffic to or from the Internet. Derive the maximum value of T as a function of C under these conditions. (5 points)

Problem 3: Comparison between Bridges and Routers (8 points)

Based on your answers to Problems 1 and 2 and your general knowledge of how transparent bridges and routers work, compare the two approaches to interconnecting the three locations of Company X. You should be able to identify at least one advantage and one disadvantage for each approach.

Comment: 8 points seems like a large weight compared to other questions.

Problem 4: GARP/GMRP/GVRP (11 points)

a. GARP is said to be a scalable protocol (i.e., it can scale well to large numbers of devices). What makes it scalable? What prevents the number of protocol messages from growing with the number of devices? (2 pts)

b. The table below shows all the possible states of the GARP Applicant (this is table 12-2 from IEEE P802.1D/D15). Note that there is no Leaving Passive Member State. Why is that? What happens when a Quiet Passive Member (QP) decides to withdraw a declaration? Does it send any messages? If yes, which one(s)? (3 pts)

	Very Anxious	Anxious	Quiet	Leaving
Active Member	VA	AA	QA	LA
Passive Member	VP	AP	QP	--
Observer	VO	AO	QO	LO

c. What is the purpose of GMRP? Why can't GMRP-unaware bridges filter the multicast traffic in the same (transparent, learning) fashion as with unicast traffic? (2 pts)

d. What is the purpose of a VLAN? (Why is a VLAN useful?) (2 pts)

e. VLANs can be created manually through static management (i.e., the network administrator configures every bridge). What is the use of the GVRP protocol, which enables dynamic VLAN Registration? Give an example. (2 pts)

Problem 5: RIP (8 points)

a. Explain split horizon routing. Indicate why something like that is needed, and what would happen if the routers did not do it. (3 pts)

b. What are triggered updates in RIP? What is the benefit of using them? (2 pts)

c. Routing loops are always a problem in most environments. However, they are a much more severe problem in bridged networks than in IP routed networks. Explain why. (3 pts)