Computer Network 2009 Final Exam.

Question 1: (30%)``Short Answer Questions``

Answer each of the following questions *briefly, i.e., in at most a few sentences.*

a) (5%) *Consider the BGP protocol, an autonomous system (AS) A, and some destination network X. How does A control whether or not other autonomous systems route traffic destined to X through A?*
b) (5%) What does it mean to be "multi-homed"?
c) (5%) Does an ATM cell carry a source or destination address in its header? Explain.
d) (10%) What is meant by network-assisted congestion control? Give an example of a congestion control protocol that takes this approach. Does TCP take this approach? Explain your answer.
e) (5%) What is the purpose of the ARP protocol?

Question 2: (30%) Multiple access protocols
We studied a number of multiple access protocols in this course, including (1) TDMA, (2) CSMA, (3) Slotted Aloha and (4) Token passing.

10 points each.

- *Suppose you were charged with putting together a LAN to support IP telephony (only) and that multiple users may want to carry on a phone call at the same time. Recall that IP telephony digitizes and packetizes voice at a constant bit rate when a user is making an IP phone call. How well suited are these four protocols for this scenario? Provide a brief (e.g. one sentence) explanation of each answer.*

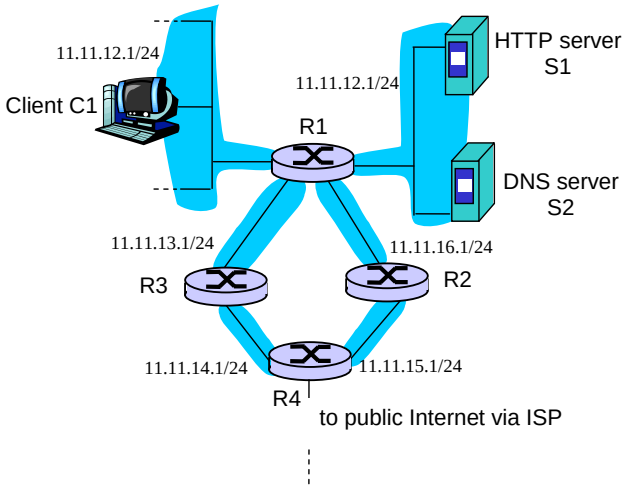
- *Now suppose you were charged with putting together a LAN to support the occasional exchange of data between nodes. That is, any individual node does not have data to send very often. How well suited are these four protocols for this scenario? Provide a brief (e.g. one sentence) explanation of each answer.*

- *Now suppose the LAN must support both voice and data and you must choose one of these multiple access strategies in order to support both applications on the same network, with the understanding that voice calls are more important than data. Which would you choose and why? How would voice and data be sent in this scenario? That is, which access protocol would you use, or adapt/modify, and why?*

Question 3: (30%) Where are the protocols?

Consider the network scenario shown below. Client C1, servers S1 and S2, and routers R1 through R4 are all part of the same autonomous system (e.g., the NTU network) and are connected to other ASs in the rest of the Internet via router R4.

a) *[10 %] Suppose the user at C1 enters a URL into the browser for a document at S1 and refers to S1 by its name (e.g., S1.csie.ntu.edu.tw). The document stored in S1 and returned to the user at C1 contains an embedded URL that is at another site that it*



outside the autonomous system shown above (e.g., www.remotesite.com). Which of the elements C1, S1, R1 – R4 will make a query to DNS server S2 to resolve the name S1.csie.ntu.edu.tw ? Which of the elements C1, S1, R1 – R4 (if any) will make a query to DNS server S2 to resolve the name www.remotesite.com? If S2 does not know the IP address corresponding to www.remotesite.com, which of C1, S1, S2, R1 – R4 will contact an external DNS server, assuming recursive queries?

b) *[5%] Which of C1, S1, S2, R1 – R4 must be running the TCP protocol? Explain your answer.*

c) *[5%] Identify the individual networks (in an IP addressing sense) in the figure above. Specify an internet address for one interface in each of the networks.*

d) *[5%] Which of C1, S1, S2, R1 – R4 run an intra-domain routing protocol?*

e) *[5%] Which of C1, S1, S2, R1 – R4 run an inter-domain routing protocol? Given your answer in c), what address prefix is advertised to ASs outside this network?*

f) *[5%] Assume that the client and servers are connected to R1 using Ethernet, and that the routers are interconnected using a point-to-point protocol. Which of C1, S1, S2, R1 – R4 must be running the ARP protocol? Explain your answer.*