

ENGINEERING TRIPOS PART IIB

Wednesday 5th May 2004 2.30 to 4.00pm

Module 4B15

ADVANCED TELECOMMUNICATIONS NETWORKS

*Answer not more than **three** questions.*

All questions carry the same number of marks.

*The **approximate** percentage of marks allocated to each part of a question is indicated in the right margin.*

There are no attachments

You may not start to read the questions
printed on the subsequent pages of this
question paper until instructed that you may
do so by the Invigilator

(TURN OVER

1. (a) Describe in detail both the layer 2 medium access control (MAC) address structure and the layer 3 internet protocol (IP) address structure. Highlight any relevant features within the structure of each address type. [20%]
- (b) Explain why the search process within an address look-up table is much simpler in the case of the MAC address than the search process within an address look-up table for an IP address. [20%]
- (c) Suggest two mechanisms for speeding up the MAC address look-up process outlined in part b). Could these two mechanisms be applied to the IP address look-up process? [20%]
- (d) Explain the role of the address resolution protocol (ARP) in looking up a suitable IP address. Describe three possible scenarios for this process. [20%]
- (e) An IP network has a subnet mask 255.255.252.0. How many stations can be uniquely identified with the IP address? How could the number be expanded using ARP? [20%]
- 2 (a) Describe the functionality of a bridge and a router when interconnecting local area network (LAN) structures. Explain the relative advantages and disadvantages of each type of interconnection device. [20%]
- (b) Explain the process of ageing in a LAN bridge address table. Why it is an important process in maintaining LAN interconnections? Does a router address table undergo a similar process? [20%]
- (c) Describe a scenario where accelerated address table aging is required in a LAN bridge. Include in your description possible mechanisms for how such a process could be managed and maintained. [20%]
- (d) Explain how the system of source routing works in interconnecting LAN structures. Identify how the MAC frame format is used to implement this system. [20%]
- (e) Do you think that address table entries in a source routed network need to undergo an ageing process? Explain your answer. [20%]

3 (a) Design a 3-stage symmetrical Clos network that has 64 transmitters and 64 receivers and is strictly non-blocking.

Compare the number of crosspoints required with the number required for a 64x64-crossbar switch. What are the advantages and disadvantages of using the Clos network?

[40%]

(b) Describe the basic functionality of cross-connections and add-drop multiplexers in the Synchronous Digital Hierachry.

[30%]

(c) Suggest a scalable structure for an optical cross-connect switch that uses active beam deflectors.

How many active beam steering elements are required in a 64x64 switch?

[30%]

4 (a) Compare the basic connectivity requirements of circuit switches and packet switches.

[20%]

(b) Estimate the fraction of packets that would be lost in a fully loaded crossbar switch that is used to switch packets if it is assumed that the packet arrivals follow Poisson statistics and if each output can only accept one packet during each transfer across the switch.

[40%]

(c) Is this a reasonable assumption concerning the traffic statistics?

[15%]

(d) Outline the way in which the rate of packet loss could be reduced.

[25%]

END OF PAPER