ENGINEERING TRIPOS PART IIB

Wednesday 30 April 2008 2:30 – 4.00pm

Module 4B15

ADVANCED TELECOMMUNICATION NETWORKS

*Answer not more than **two** 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.

STATIONERY REQUIREMENTS
Single-sided script paper

SPECIAL REQUIREMENTS
Engineering Data Book
CUED approved calculator allowed

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

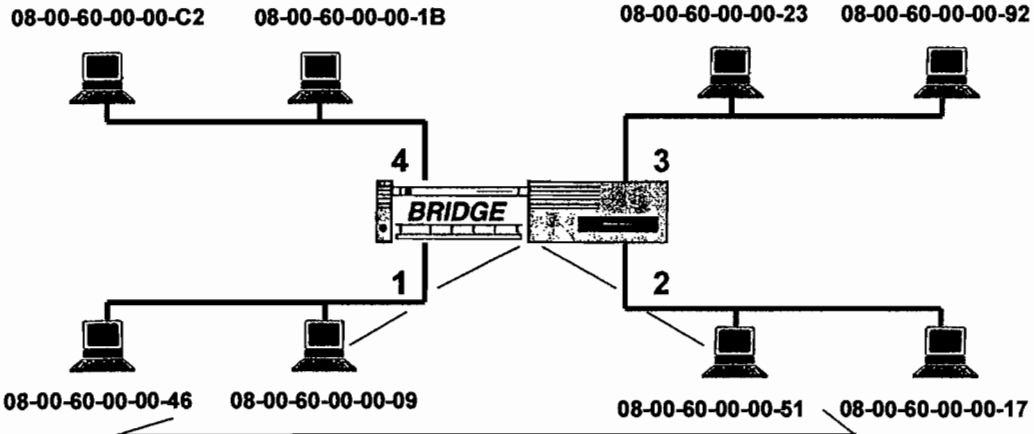
1. (a) Give a brief definition of a *transparent bridge* in the context of a local area network (LAN) and how it can be used to create a *catenet*. Define the operating conditions for such a bridge and what is meant by hard and soft invariants. [20%]

(b) Explain the basic address table management processes of a transparent bridge and how it would operate between two Ethernet LANs using type encapsulation with a 48 bit medium access control (MAC) addresses. [20%]

(c) Given the catenet in Fig. 1, explain how the bridge would react to the following destination addresses from the source 08 00 60 00 00 1B:
(i) 08 00 60 00 00 C2; (ii) 08 00 60 00 00 92; (iii) 08 00 61 00 60 51 [20%]

(d) A bridge should be able to translate between different MAC protocols. Use an example of connecting a length encapsulated Ethernet LAN to a Token ring LAN to explain the potential problems in such a MAC translation. [20%]

(e) Explain why the process in part (d) is not possible in the case when the Token ring LAN uses source routing. How might this problem be avoided? [20%]



Address	Port	Address	Port
08-00-60-00-00-09	1	08-00-60-00-00-51	2
08-00-60-00-00-C2	4	08-00-60-00-00-92	3
08-00-60-00-00-23	3	08-00-60-00-00-17	2
08-00-60-00-00-46	1	08-00-60-00-00-1B	4

Fig. 1

2 (a) Explain what is meant by a *layer 3 switch* or *router* and how it differs from a transparent bridge. Why does this mean it is possible to go beyond the physical limits of a catenet? What features of the internet protocol (IP) make this possible? [20%]

(b) Explain how the IP address is structured and define the role of the *subnet mask* in this process. Show with a simple example how a further level of subnet can be defined using this mask. [20%]

(c) Why did the structure of the IP address lead to a fear that they would run out in about 2000? What two techniques were proposed to rectify this shortage? Which one is now the most common and why? [20%]

(d) One of the key aspects in the efficient running of an IP router is the *fast path*. Draw a sketch of the function of the fast path and give examples of two particular operations which would not be included on the fast path. [20%]

(e) The user datagram protocol (UDP) and the transmission control protocol (TCP) are often used as means of controlling a network using IP. Explain how TCP can be used to control the flow of IP packets. Can this be done with UDP? How did this control lead to a vulnerability in TCP which was used create *denial of service* attacks? How could this vulnerability have been avoided? [20%]

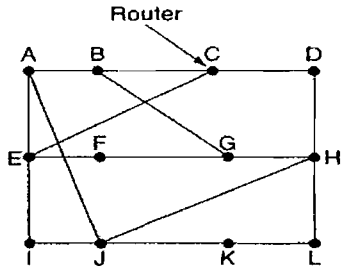
3 (a) Describe what is required when setting up a basic routing algorithm. What are the two main classes of routing algorithm and what sorts of metrics can be used in the optimisation of routes. [20%]

(b) What is meant by the *optimality principle* when considering a routing strategy? How does this principle lead to the concept of *sink trees*? Give a simple example based on node J in the subnet of Fig. 2(a). [20%]

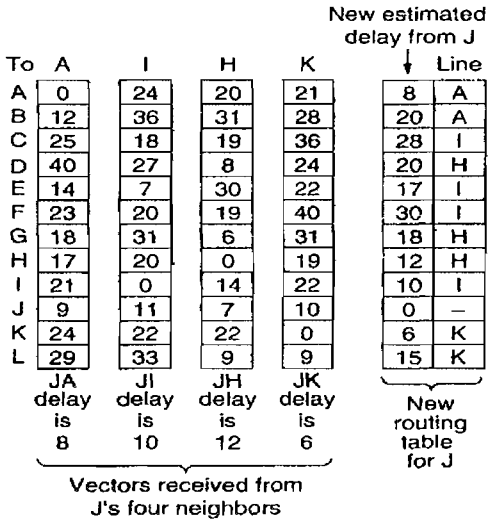
(c) Explain how the routing strategy known as *shortest path routing* was developed to solve complex network topologies. How does Dijkstra's algorithm ensue that the optimality principle is always satisfied in this routing strategy? [20%]

(d) Explain why shortest path routing has limitations when applied to a network such as the internet. Why is *distance vector routing* a more reliable choice of routing strategy. Use the data in Fig. 2 from node J to G to demonstrate how it works. [20%]

(e) How would distance vector routing be useful in a protocol such as multiple protocol label switching (MPLS)? Where in the MPLS network might it be implemented? [20%]



(a)



(b)

Fig, 2

END OF PAPER