Computer Science Department

1997 Examinations

D52 Network Architecture

Answer THREE questions

The use of Electronic Calculators is not permitted in this examination.

Q1.a) Both the OSI and Internet management frameworks have adopted an object-oriented approach, based on manager / agent interactions and operations on a cluster of managed objects via a management protocol. Explain the terms *manager*, *agent*, *management protocol*, *managed object* and discuss how they are combined to achieve open inter-operable management. Discuss the relationship of the manager-agent model to the single distributed object model projected by *Open Distributed Processing*.

[14 marks]

b) The *Telecommunication Management Network* (*TMN*) is a framework aimed to support administrations in managing telecommunications networks and services. The TMN projects a hierarchical model of management organisation. What are the benefits of this hierarchical model compared to centralised or flat management models? What are the layers of management activity the TMN proposes? Describe briefly the functionality of each TMN layer. (Note: you may ignore the business management layer).

[12 marks]

c) The TMN has chosen OSI management as the basis of its open inter-operable interfaces (Q for intra-domain, X for inter-domain interactions). OSI management proposes a connection-oriented, event-driven mode of operation with sophistication at the agent end of the manager-agent model. Discuss this choice and relate it to the management needs of telecommunications environments e.g. ATM WAN with guaranteed quality end-to-end services such as video-conferencing.

[7 marks]

Q2. a) Describe how information is stored in the X.500 Directory Information Base. Define the distinguished name of an object. How might you specify a directory entry in ASN.1?

[11 marks]

b) Directory agents often need to interact to resolve requests that cannot be answered by one agent. Compare and contrast different possible communication models for resolving such requests.

[11 marks]

c) Unicol is a consultancy company specialising in open systems. A client company currently uses a single instance of an Internet Domain Name Server (DNS) and have noticed a steady increase in the number of queries, particularly across the transatlantic link. Write a report that identifies possible deficiencies in the current system, and proposes a range of solutions giving the advantages and disadvantages of each solution

[11 marks]

Q3. a) Both ATM and the Internet (through RSVP) allow applications to influence the *Quality of Service* (*QoS*) they receive. Summarise the differences in the approaches that have been adopted especially with respect to: the responsibilities for specifying QoS; the maintenance of state in the network; and the relationship to routing. [You do **not** have to give details of the operation of specific protocols, e.g. RSVP].

[11 marks]

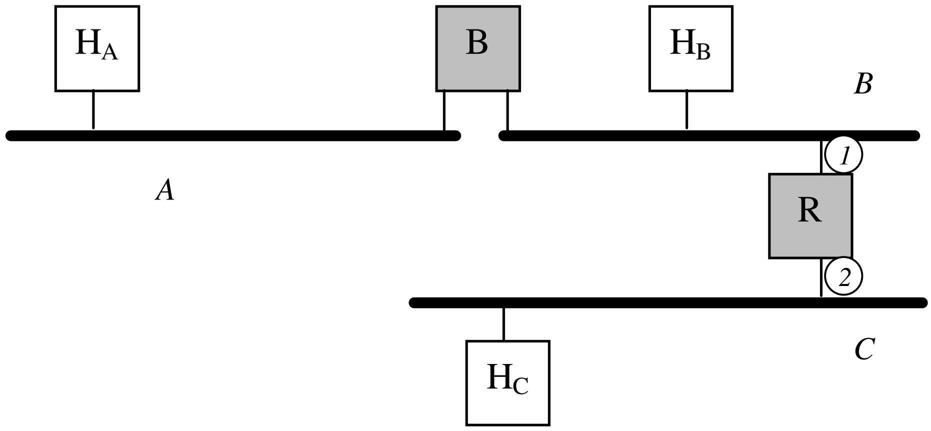
b) Compare and contrast the QoS requirements of: WWW access; packetised voice, real-time control of a robot arm.

[11 marks]

c) Discuss which features of the design of ATM make it more adaptable to different QoS requirements than a virtual-circuit packet-switched service such as X.25.

[11 marks]

Q4. In the diagram below: B is a transparent MAC bridge between two Ethernets *A* and *B,* R is an Internet *router* between Ethernets B and C, H_A, H_B and H_C are hosts each of which employs the *Internet Protocol* (IP). H_A and H_C have Internet addresses 192.15.8.31 and 128.17.4.16 respectively.



a) Assuming that B has just been switched on and so has empty forwarding tables describe the activity in B as H_A transmits a MAC frame to H_B and H_B replies.

[6 marks]

b) Describe the purpose and operation of the Internet "Address Resolution Protocol" (ARP) as it applies to the Ethernet. Say what role (if any) is played by the bridge B in the diagram as H_A resolves H_B's IP address.

[8 marks]

c) State what can be said about the Internet addresses of R's two interfaces

[2 marks]

d) Outline the address resolution and routing steps which occur as H_A transmits its first IP datagram to H_C.

[9 marks]

e) Assuming no other changes are made, state what changes (if any) will occur to the routing of IP datagrams in the system when a new transparent bridge is connected directly between Ethernets A and C. Justify your answer.

[8 marks]

Q5. a) Draw a Pictorial Representation of an IPM (Inter-Personal Message), and suggest a suitable specification in ASN.1. Which X.400 Protocol is responsible for constructing messages in this format?

[13 marks]

b) Compare and contrast the naming schemes used in the following services:

- Telephony
- X.400
- Internet e-mail

What do you think about the scalability and user-friendliness of each scheme?

[13 marks]

c) What functions might an Internet to Telephone Network gateway have to perform?

[7 marks]

END OF PAPER