Computer Science Department

1999 Examinations

D52 Questions

Answer THREE questions

(Electronic calculators may not be used in this examination)

1. a) i) One reason the designers of *Asynchronous Transfer Mode* (ATM) adopted a small cell size was to minimise end-to-end delay. Provide an argument to support this view, (possibly with the aid of a time-sequence diagram).

[3 marks]

ii) It is also claimed that the use of small fixed-size cells in ATM enables better control of jitter. Provide an argument to support this view.

[3 marks]

iii) Give two *dis*advantages of adopting a small cell size.

[2 marks]

b) What is a *Virtual Circuit* (VC)? Briefly outline the actions which may be performed when a VC is set up. Explain how VCs are identified and how these identifiers are processed at network switches. Why might the use of VCs be a good choice for networks which employ a small packet size?

[8 marks]

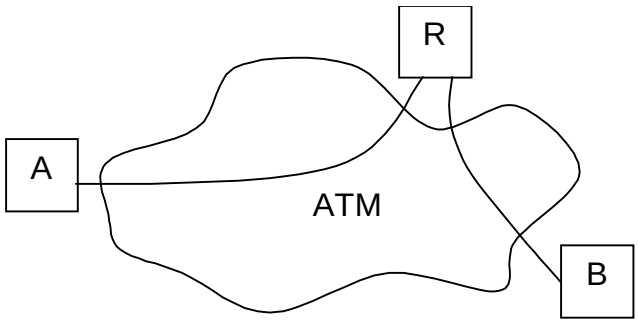
c) *Asynchronous Transfer Mode* (ATM) uses two sorts of Virtual Circuit; *Virtual Path Connections* (VPC) and *Virtual Channel Connections* (VCC). Briefly explain the roles of VPCs and VCCs especially with respect to; how and when they are set up, how they are identified and how the identifiers are processed at the switches. What are the advantages of this two-level hierarchy of VCs?

[11 marks]

[Question 1 continued on next page]

[Question 1 continued]

d) The diagram below shows two IP hosts and an IP router interconnected by a pair of ATM VCCs. Explain the role that might be played by an *ATM Adaptation Layer* (AAL) in the configuration. Explain how so-called "cut-through" routing can improve the performance of the router *R*.



[6 marks]

2. A new network is being set up across the country for hospital consultants to have easy access to medical journals, and other relevant material, such as case studies, which may include multimedia information. You have been asked to provide a document outlining such an OSI system. Include in your report the following information:-

a) If the electronic information is stored in a multitude of teaching hospital archives, design a system that hides distributed operation from the user.

[8 marks]

b) Assuming that the network provides the OSI transport layer service for end-to-end communication, outline the functionality provided by the upper layer architecture for this type of service.

[14 marks]

c) Some parts of the information require password authentication before the material can be accessed. Outline the interaction between the user and the remote system.

[11 marks]

3. a) i) Describe the manager-agent model used in network and system management. How does this model contribute to “openness” (e.g. the interworking between products from different vendors)?

[6 marks]

ii) OSI Management and Internet Management differ in terms of:

- Object-oriented vs. object-based MO definitions;
- Separation of naming and registration trees;
- Scoping and filtering;
- Event granularity and control;
- Connection Oriented vs. connectionless operation.

Briefly describe how these mechanisms differ between the two management architectures and explain the extent to which, in your opinion, these differences impact on the openness of the two architectures.

[10 marks]

b) i) Compare and contrast the architectures of *Frame Relay* and *X.25* networks. Where possible, provide technical justification for any differences you note.

[9 marks]

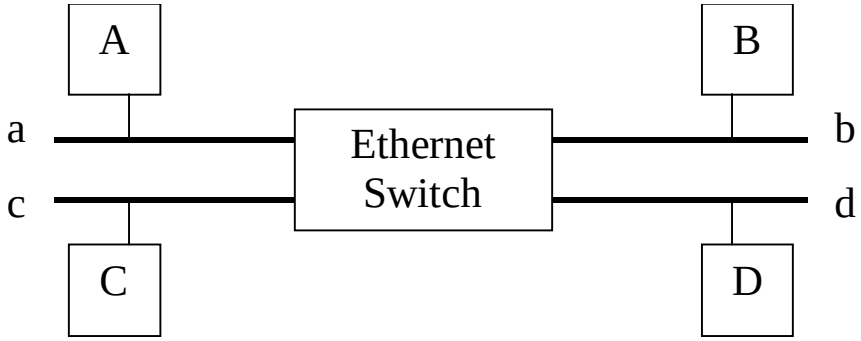
ii) Comment on the suitability of *X.25* and *Frame Relay* for carrying packetised voice traffic.

[4 marks]

iii) Permanent *Frame Relay* connections are often used as a means of providing LAN interconnect. This is usually a more economic solution than hiring digital leased lines. What features of the service and the application promote such economies?

[4 marks]

4. a) The diagram below shows a four-port *Ethernet Switch* (i.e. a multiport MAC bridge), four Ethernet LANs (*a, b, c, d*) and four IP hosts (*A*, *B*, *C*, *D*). *A* and *B* are on one IP network, *C* and *D* are on another. The switch does no frame filtering and relays traffic between any pair of LANs.



i) Host *A* wishes to send an IP datagram to host *B* and begins by using the Ethernet *Address Resolution Protocol* (ARP). Describe the sequence of events that occur during the ARP exchange. Your answer should make clear why the components behave as they do and what information they learn at each stage. Assume that all relevant tables are empty initially.

[8 marks]

ii) A router (*R*) is added to the network with one interface on LAN *a* and one on LAN *b*. Sketch the new configuration and assign IP addresses to each of the host and router interfaces. Describe the sequence of events that occur as host *A* attempts to send an IP datagram to host *D*. [Concentrate on the IP-level events. Do not include ARP exchanges.]

[8 marks]

b) i) Briefly describe the multicast model used on the Internet. Your answer should explain the roles of multicast routing and group management protocols but need not give details of the operation of these protocols.

[7 marks]

[Question 4 continued on next page]

[Question 4 continued]

ii) 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].

[10 marks]

5. The air-sea rescue co-ordination centre for the UK currently has an OSI open systems network for the distribution of weather maps to locations around the UK. The network operates via a satellite and is, therefore, error prone. The centre wishes to upgrade their service to provide additional, new, IP-based systems as well as weather map distribution. You have been asked to recommend a pragmatic approach to the problem, and to provide a report for consideration.

a) Assuming a reliable bit transfer service is provided by the OSI transport layer, include background information in your report that briefly describes the functionality that is provided on top of the OSI transport layer. In particular, identify a suitable set of application service elements (ASEs) for the application layer, and briefly describe their functionality. Include in your report, details of their usage of other OSI upper layers.

[11 marks]

b) If the existing weather information systems were all converted to use the TCP/IP stack, what application-specific functionality would you expect to provide on top of TCP? What would the pragmatic approach be?

[11 marks]

c) If instead of upgrading all existing weather systems, any new remote location weather systems are built using TCP, with connection to the existing network using gateway(s). Discuss whether you think an application level gateway or a transport level gateway would be the easiest to implement.

[11 marks]

[END OF PAPER]