

## UNIVERSITY OF ABERDEEN

## SESSION 2001-02

## Degree Examination in EG 3567 Communications Engineering 1A

Wednesday 29th May 2002 (2:00 pm - 5:00 pm)

## Notes:

- (i) Candidates are permitted to use approved calculators
- (ii) Candidates are not permitted to use the Engineering Mathematics Handbook
- (iii) An information sheet of protocol headers is provided

Candidates should attempt THREE questions. All questions carry 20 marks.

1. (a) Sketch a diagram showing each of the layers in the *Open Systems Interconnection (OSI) Reference Model*. Include the position of each protocol layer in the diagram. [6 marks]

(b)

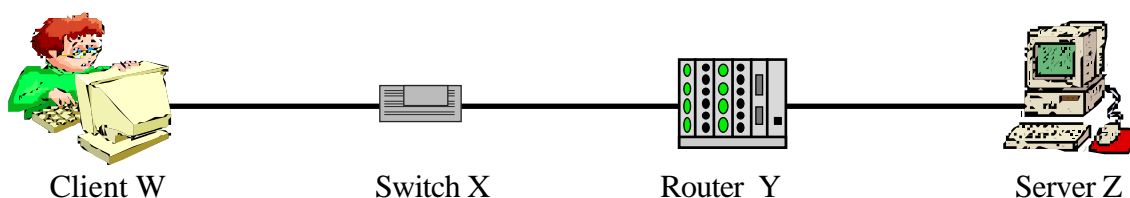


Figure 1: An Internet Path between two End Systems, W and Z

Explain (using appropriate diagrams) the packets that are exchanged when the *traceroute program* is used by the client W to find the *Internet Path* to the server Z. [8 marks]

- (c) What is the difference between a *Flat* and a *Hierarchical* address organisation? Which organisation is used for *Ethernet Medium Access Control* addresses? [6 marks]

2. (a) The *Ethernet Local Area Network (LAN)* uses *Carrier Sense Multiple Access with Collision Detection (CSMA/CD)*. Define the following terms:

- (i) *Carrier Sense* [4 marks]
- (ii) *Collision Detection* [4 marks]
- (iii) *Collision Domain* [4 marks]

- (b) What is *Ethernet Capture* ? [5 marks]

(c) A session uses the *User Datagram Protocol (UDP)*. It sends a series of packets over an *Ethernet LAN*. The payload of each UDP packet has a size of 530 B. Determine the total size of the *Ethernet frame* using the information provided in the *PDU header chart*. [3 marks]

- 3 (a) Some protocols are said to provide a *Reliable* service. What guarantees must a reliable protocol offer? [4 marks]

(b) The *Trivial File Transfer Protocol (TFTP)* may be used to provide a reliable service over an *IP network*. Explain in detail (using appropriate diagrams) how *TFTP* may recover from missing *IP packets*. [8 marks]

- (c) Define the term *Throughput*. [2 marks]

(d) An end system sends 50 packets per second using the *User Datagram Protocol (UDP)* over a full duplex 100 Mbps *Ethernet LAN* connection. Each packet consists 1500B of *Ethernet frame payload data*. What is the throughput, when measured at the *UDP layer*? [6 marks]

*continued over*

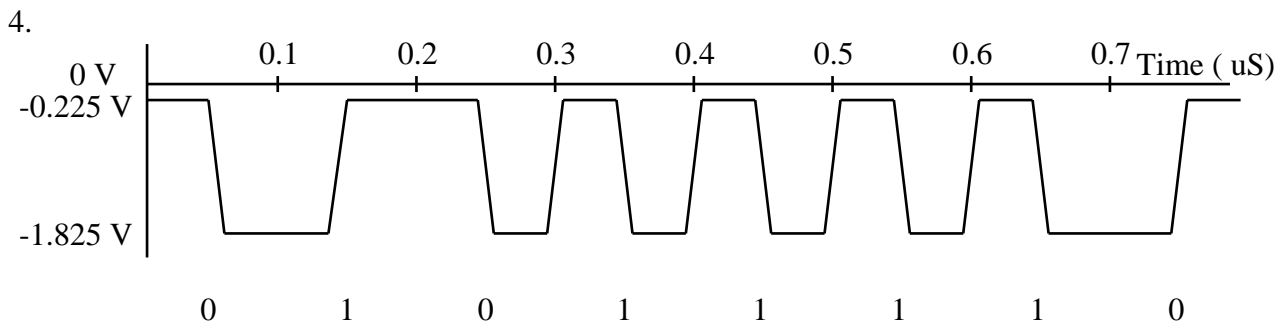


Figure 2: Waveform as seen on an oscilloscope.

- (a) The waveform above (voltage v. time) was observed on an oscilloscope when a byte was transmitted along a coaxial Ethernet cable. What is the value of the byte that was sent? [4 marks]
- (b) What is the purpose of a *Pre-amble* and why is it sometimes needed for synchronous communications? [5 marks]
- (c) Describe the role of the *Ethernet Frame Type* field. Give **two examples** of protocols that use this field. [4 marks]
- (d) Explain the reason why there can be no more than 5 segments in series on the longest path between two systems using an Ethernet *Local Area Network* built using hubs. [5 marks]
- (e) Given that the Ethernet CRC-32 protects the integrity of frames sent across a *Local Area Network*, why does a transport protocol also include a checksum? [2 marks]

5.

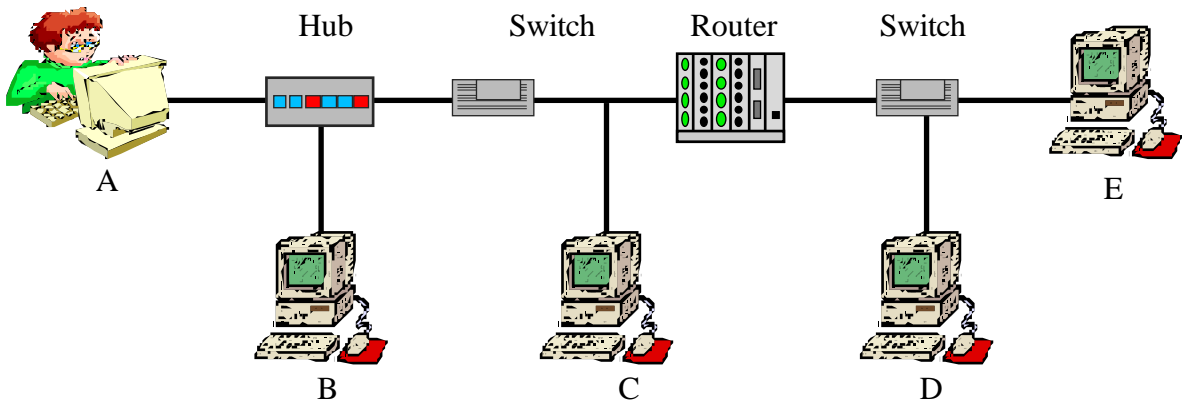


Figure 3: An Ethernet LAN

- (a) The end system *A* uses the *Transmission Control Protocol* (TCP) to send a packet to end system *D* with a payload of 100B, sketch the Ethernet frame that is sent. Ensure you show the **addresses at both the MAC and IP layers**. [6 marks]
- (b) An *Internet Protocol* packet is broadcast by *B*. Which *End Systems* receive this? [2 marks]
- (c) Outline the process used by *A* to determine the largest Maximum Transfer Unit (MTU) supported by the router on the internet path to *E*. [4 marks]
- (d) Explain the operation of a *Switch*, and describe how it performs *Learning*. [8 marks]