UNIVERSITY *of* LIMERICK

O L L S C O I L   L U I M N I G H

Faculty of Science and Engineering

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	08/09	Semester:	Autumn
Module Title:	Telecommunication Networks Architectures	Module Code:	CS4218
Duration of Exam:	2½ Hours	Percent of Total Marks:	85
Lecturer(s):	Dr Séamus O'Shea	Paper marked out of :	100

Instructions to Candidates:

- Answer any THREE Questions

Q1.

(a) Explain how Pulse Code Modulation (PCM) is used to digitally encode the human voice in fixed telephone networks. If the speech phase of a telephone call lasts for three minutes, how many bytes are transferred in the forward direction through the network corresponding to this call? (5 marks)

(b) Suggest how a sparse population of users may be economically served by a telephone service provider, alluding especially to the types of equipment that may be used in the corresponding access network. (6 marks)

(c) Describe the structure of the first level of multiplexing in the European PDH standard. What is the corresponding data rate? If the average RSS traffic load corresponds to 1024 telephone calls, how many PCM trunks are required to connect the RSS to the rest of the service provider's network? (5 marks)

(d) Describe how a digital Time Switch, as used in the telephone network, operates. Draw a diagram to show the main components within the switch. What is the maximum time available in the switching of incoming samples to corresponding outgoing samples? (5 marks)

(e) If a digital time switch module is dimensioned to handle 8 x 2.048 PCM trunks, what size must the internal speech and control stores be? (6 marks)

(f) Compare the processing that takes place within a local exchange when a non-routable number like 1-800-xxx-xxx is received with that corresponding to the normal routable number like 01-123-4567. (6 marks)

Q2.

(a) Differentiate between IP routing and IP switching alluding especially to network conditions which would suggest the use of each type of router behaviour.   (4 marks)

(b) In the case of MPLS, in what sense is it applicable to several link technologies? Give an example of how the use of a label stack may be useful.   (5 marks)

(c) Explain the term: 'Forwarding Equivalence Class' (FEC). Give examples of typical events which would lead to the binding of a label to an FEC.?   (5 marks)

(d) When a router decides to assign a label to a FEC, discuss options regarding how labels may be distributed to other routers and give examples of suitable distribution protocols.   (5 marks)

(e) If a router is to function as an LSR, what additional demands on the router's capability does this imply?   (5 marks)

(f) Discuss the suitability of both RIP and OSPF in a network that provides MPLS service.   (5 marks)

(g) Briefly describe the processing that takes place within an LSR when a label-bearing packet arrives at an incoming interface when this is a path-terminating LSR for the packet.   (5 marks)

Q3.

(a) Draw a diagram to show the structure of the ISDN physical layer frames which are transmitted in the TE to NT direction, and vice versa, corresponding to the shared bus arrangement in BRA. How many frames are transmitted per second?   (5 marks)

(b) Show how the structure of the physical frames in (a) above can be used to calculate the bandwidth of both the D and the E channels.   (4 marks)

(c) If more than two connected devices on the bus try to connect to the ISDN network simultaneously, how is the contention arbitrated?   (5 marks)

(d) Describe the features of the D channel alluding especially to how priority of signalling traffic is ensured, and also how fairness of access amongst connected devices is ensured.   (5 marks)

(e) In what respects does LAPD on the D channel differ from the HDLC link protocol? Give plausible reasons for such differences. Draw a diagram to show the nodes at both ends of the data link over which LAPD operates in BRA.   (5 marks)

(f) If an LAPD frame, of size 8192 bytes, is transferred from a TE to the local ISDN exchange at the UNI, how many physical layer frames (S interface) will be involved in the actual transfer of the LAPD frame?   (5 marks)

(g) In relation to (f) above, how long will it take to transfer the frame from TE to the local exchange?   (4marks)

Q4.

(a) Describe the salient characteristics of a Frame Relay (FR) network by comparing it's operation with other packet-based networks like X.25, IP and ATM.   (6 marks)

(b) Differentiate between frame switching and frame relaying alluding especially to the kind of network conditions to which each is suitable. Draw a diagram to show the frame structure used in each case.   (5 marks)

(c) Suppose that a FR connection is established via signalling. Give examples of the kind of connection parameters that can be selected at establishment time and explain how such parameters affect the connection.   (6 marks)

(d) When a FR connection is established, discuss the impact of the new connection on intermediate nodes between source and destination. Discuss also the 'clean up' that nodes have to do after a FR connection is terminated.   (5 marks)

(e) Discuss potential network vulnerabilities that may arise as a result of FR nodes having no mechanism to effect flow control, and how such vulnerabilities may be mitigated. (6 marks)

(f) Give examples of how a 'leaky bucket' algorithm may be used to advantage in FR networks. (5 marks)

Q5.

(a) Set out the demands that the various media types (e.g voice, data, video, music) make on packet-based transport multi-service networks. (5 marks)

(b) In relation to (a) above, compare how well ATM and IP networks meet such demands, and discuss the corresponding trade-offs. (6 marks)

(c) Give plausible reasons why the need for Quality of Service (QoS) guarantees, on the part of network users, has emerged in recent years. (6 marks)

(d) Give examples of parameters which can be used to measure Quality of Service (QoS) in an ATM network. (6 marks)

(e) What is the purpose of adaptation layer protocols in ATM networks? Discuss the adaptation requirements of the various media. Are adaptation tasks performed in ATM switches within the network? Explain. (5 marks)

(f) Briefly describe the purpose of 'Connection Admission Control (CAC)' and 'Usage Parameter Control (UPC)' in ATM networks. (5 marks)