University of KwaZulu-Natal
Electrical, Electronics and Computer Engineering
Examination: October, 2015
Subject, Course code: Internet Engineering: ENEL4IE

Examiners: Dr. T Quazi (Internal Examiner)

Prof. S Masupe (External Examiner)

Duration: Two Hours Total Marks: 80

Instructions to candidates:

1) Attempt all questions. Questions carry equal marks.
2) Scientific Calculators may be used.
3) Show your computations step-by-step; otherwise, you will receive no credit.
4) **NO NOTES/reference sheets of any form** are allowed in this examination.

Question 1 [20]

a. Explain by means of diagrams what the Hidden Station Problem is in a wireless LAN and how it is overcome in 802.11b. [4]

b. Explain how Classless Inter-Domain Routing (CIDR) reduces the number of entries in a routing table. [4]

c. Assume that a host H1 with IP address 200.1.2.10/25 sends a packet to a host H2 with IP address 200.1.2.130/25. Discuss, using a calculation, whether this delivery is direct or indirect. Assume that sub-netting is not used. [5]

d. Consider the network diagram shown in Figure 1. Assume that the packet arrives at router R1 with the destination address 147.26.50.30. Explain how the router R1 does forwarding of the received packet to the destination. Use classful addressing without sub-netting. Show your computation/answer step-by-step; otherwise, you will receive no credit. [7]

Class A

Network address	Next-hop address	Interface
111.0.0.0	----------	m0

Class B

Network address	Next-hop address	Interface
145.80.0.0	----------	m1
170.14.0.0	----------	m2

Class C

Network address	Next-hop address	Interface
192.16.7.0	111.15.17.32	m0

Default: 111.30.31.18, m0

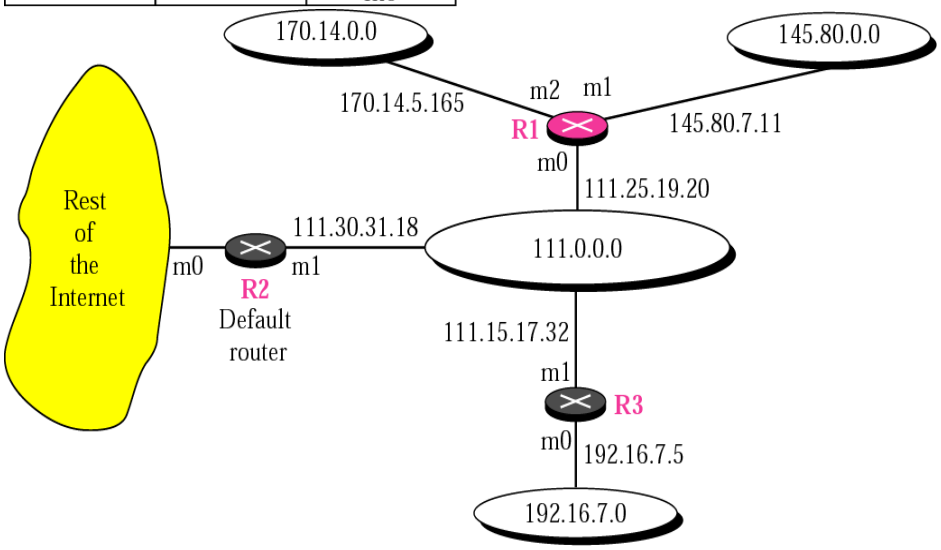

Figure 1: Network diagram.

Question 2 [20]

a. An organization has been granted the block of addresses from 211.17.180.0/24. The system administrator responsible for maintaining the organization's network would like to create 32 fixed length subnets. Answer the following questions:

i. Find the subnet mask, (*n*). [2]

ii. Find the number of addresses in each subnet. [2]

iii. Find the first and last address in the first subnet. [3]
iv. Find the first and the last address in the last subnet, (subnet 32). [3]

b. If the fields in the ICMP timestamp-request and timestamp-reply hold the following values, what is the round trip time? [4]

Original timestamp = 46; Receive timestamp = 59;
Transmit timestamp = 60; Return time = 67

c. Consider sending a 1500-byte datagram into a link that has a Maximum Transfer Unit (MTU) of 500 bytes. Suppose the original datagram is stamped with the identification number 1. Assume that IPv4 with a header size of 20 bytes is used.
i. How many fragments are generated? [2]
ii. In addition to the identification number, what are the other two fields in the IP datagram that are related to fragmentation? [2]
iii. What are the values of the fragment offsets? [2]

Question 3 [20]

a. Explain, with examples of each, the differences between Intra- and Inter- Domain routing protocols. [4]

b. Give the pseudo code for the algorithm used in Link State Routing. [8]

c. Use the algorithm described in Question 3b. to find the shortest paths for node A in the network shown in Figure 2. Show the resulting routing table for Node A. [8]

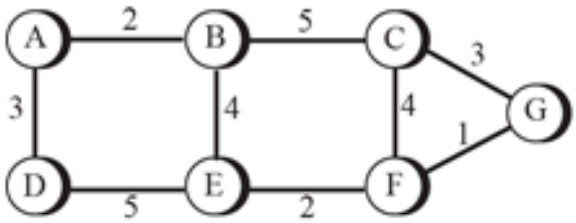

Figure 2: Network diagram.

Question 4 [20]

a. Assume that an IP header without options is divided into 16-bit sections. Explain and compute the checksum for the IP header in Figure 3 shown below. [6]

4	**5**	**0**	**28**
1		**0**	**0**
4	**17**	**0**	
10:12:14:5			
12:6:7:9			

Figure 3: IP header.

b. Assume that a sender at the transport layer is trying to get 10 packets through to a receiver and every 5th packet is lost. How many transmissions would be required [6]

if the i. Stop-and-Wait , ii. Go-Back-3 or iii. Selective Repeat algorithm is being used. Clearly show how the final number is derived.	
c. Assume that the TCP connection between a client and a server is in the CLOSED state. Show, by means of a time-line diagram, the sequence of states and the interaction between the client and server as the connection goes from the CLOSED to the ESTABLISHED state.	[5]
d. Discuss why UDP would be preferred over TCP for a Voice over IP application?	[3]

USEFUL INFORMATION

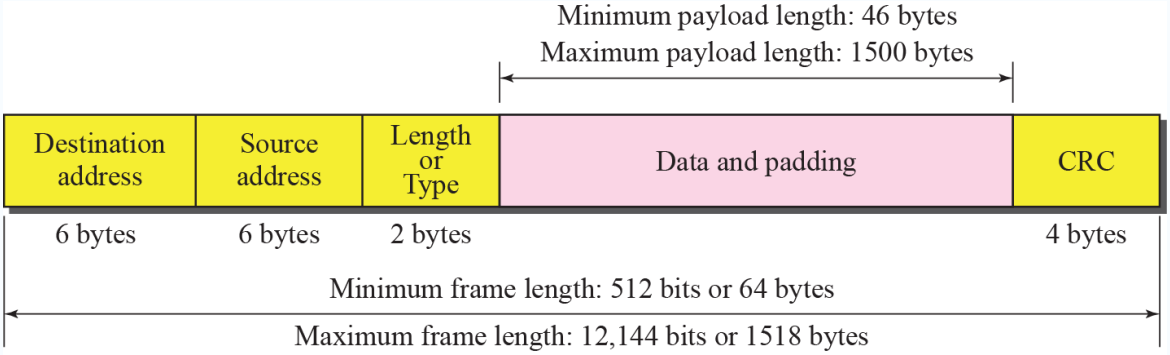

Figure A: Ethernet Frame Format

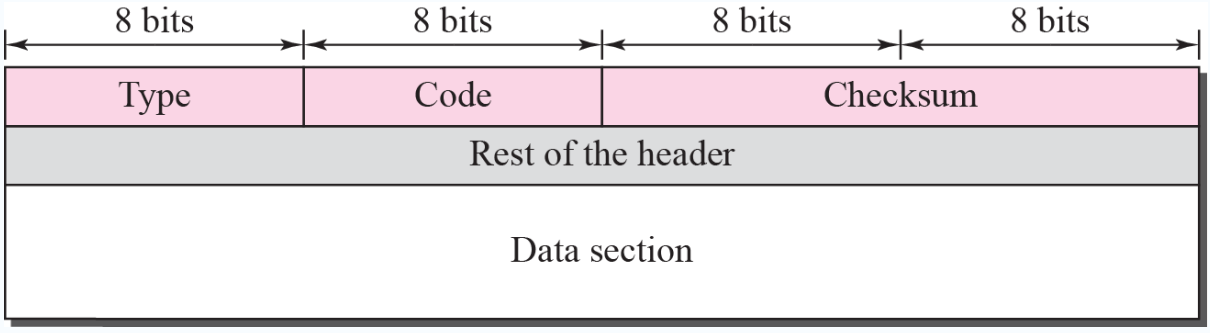

Figure B: General Format of ICMP Messages

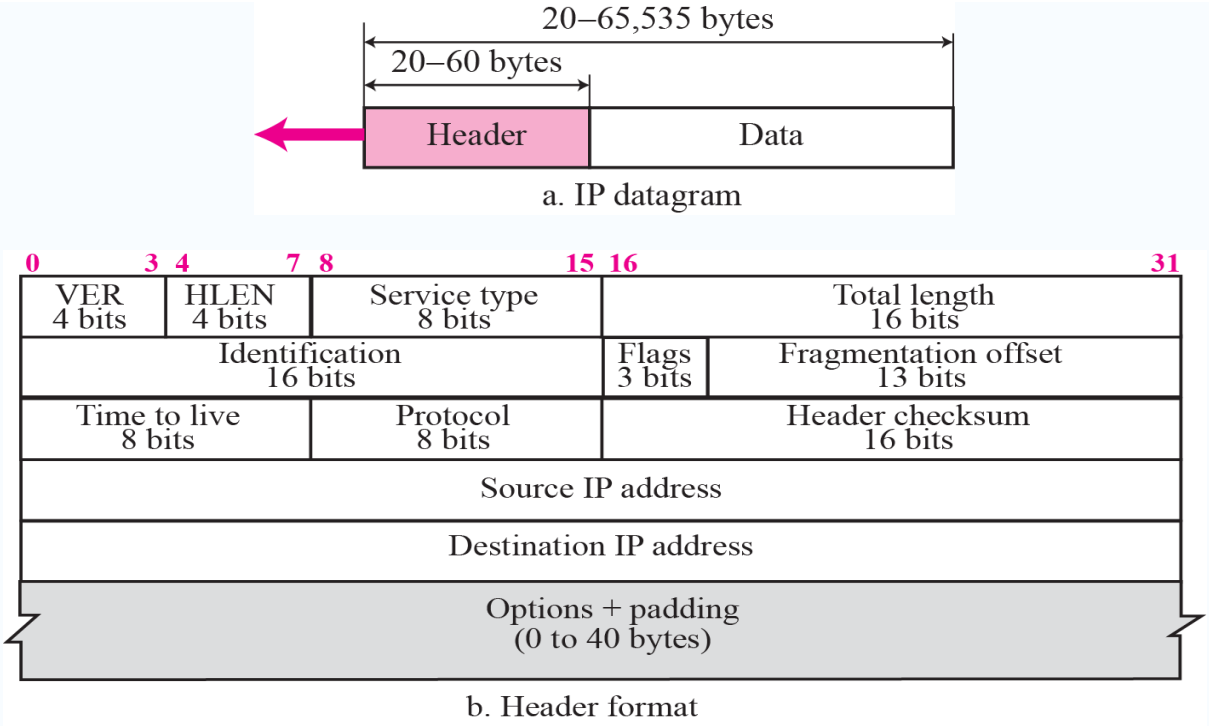

Figure C: IP Datagram (a) and Header (b) Format

Hardware Type		Protocol Type
Hardware length	Protocol length	Operation Request 1, Reply 2
Sender hardware address (For example, 6 bytes for Ethernet)		
Sender protocol address (For example, 4 bytes for IP)		
Target hardware address (For example, 6 bytes for Ethernet) (It is not filled in a request)		
Target protocol address (For example, 4 bytes for IP)		

Figure D: ARP Packet Format

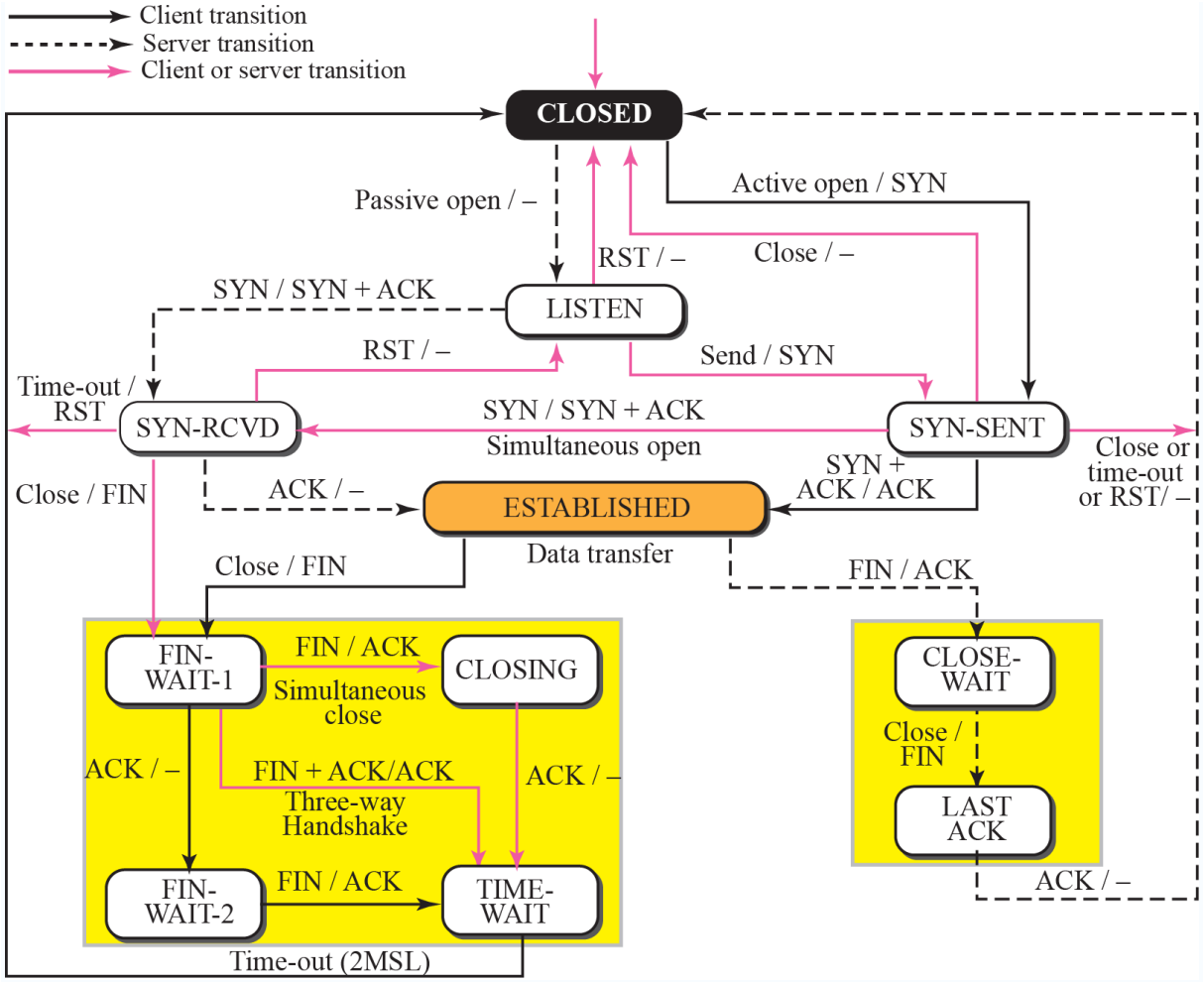

Figure E: TCP State Transition Diagram