UNIVERSITI SAINS MALAYSIA

Semester II Examination

Academic Session 2011/2012

Jun 2012

EEE 521 – COMPUTER AND DATA COMMUNICATIONS NETWORKS

Time: 3 Hours

INSTRUCTION TO CANDIDATE:

Please ensure that this examination paper contains **EIGHT** printed pages and **SIX** questions before answering.

Answer **FIVE** questions.

Answer to any question must start on a new page.

Distribution of marks for each question is stated accordingly.

All questions must be answered in English.

1. Figure 1 below shows three laptops in a data communication using the Carrier Sense Multiple Access/Collision Detection (CSMA/CD) protocol over a wired Local Area Network which has a data rate of 10Mbps. Both laptop A and C have data to send to Laptop B

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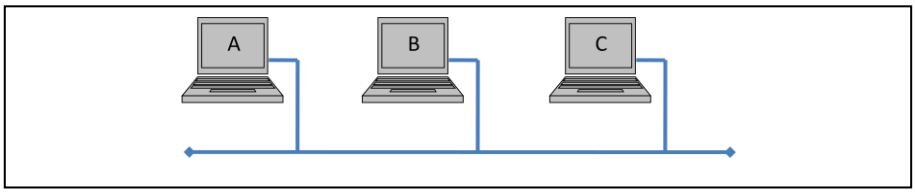

Figure 1

(a) The relationships between the normalised throughput, *S* and the normalised load,*G* of the network in Figure 1 is given by ,

$$S = \frac{Ge^{-aG}}{Ge^{-aG} + 3aG(1-e^{-aG}) + (2-e^{-aG})}$$

Where a is the ratio of the propagation time, T_p to the frame transmission time, T_{fr}

(i) Calculate the frame transmission time, T_{fr} if the Medium Access Control (MAC) layer fragments the data into 512-bits frames.

(10 marks)

(ii) Assuming that the propagation speed inside the LAN cable is $2x10^8$ ms^{-1}, calculate the frame propagation time if the propagation distance is 100m.

(20 marks)

(iii) Calculate the difference in the normalised throughput, S when the frames are sent at 1 million and 1 billion frames per second. Explain the reason for the difference.

(30 marks)

(b) A cable fault has caused the wired Local Area Network in Figure 1 to stop functioning. The three laptops switch to a wireless local area network as shown in Figure 2 below.

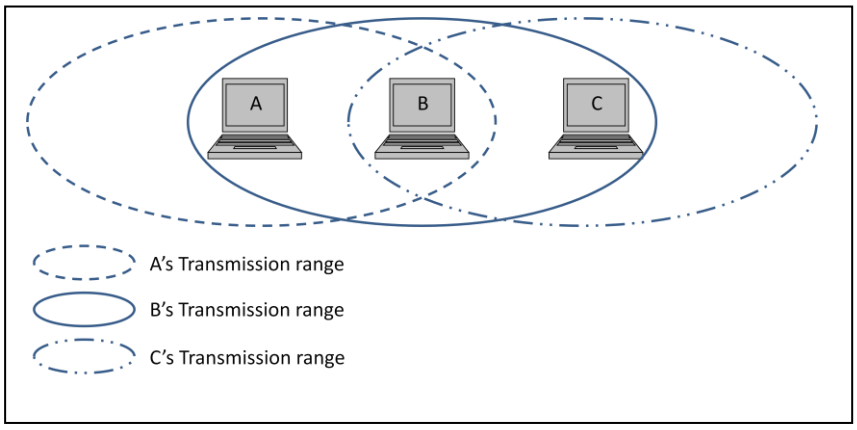

Figure 2

Propose a set of actions to be taken by A, B and C so that the hidden node problem between A and C can be avoided.

(25 marks)

(c) Assess the effectiveness of your proposed set of actions in your answer to questions (b) above if a new laptop D joins the network as shown in Figure 3 and the communication pattern changes to the following: B is sending data to A and C is sending data to D.

(15 marks)

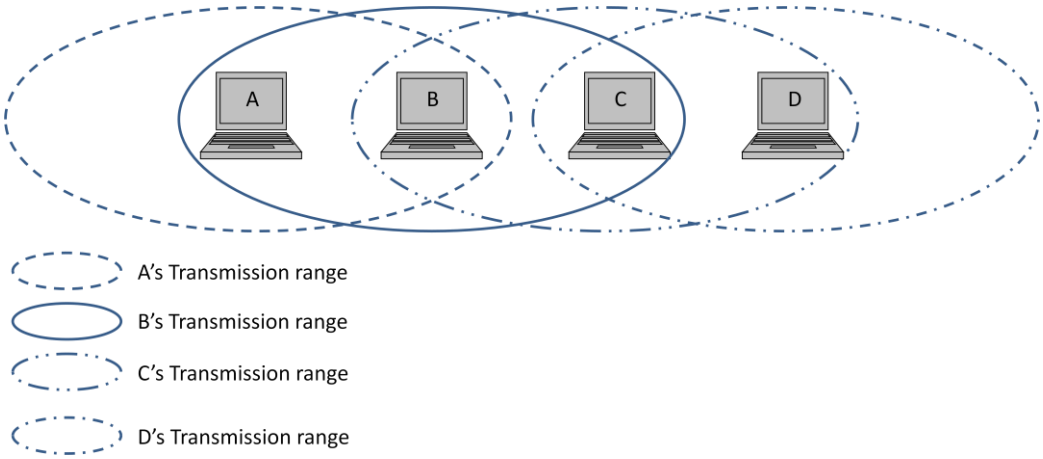

Figure 3

2. Figure 4 shows 6 laptops A,B,C,D,E and F and an Access Point in wireless local area network operating at a data rate of 11Mbps. In this set up, the Access Point is the destination for data transfer. All laptops are at a distance of 15m from the Access Point. Figure 5 shows the timing diagram with the necessary frames when a data source has a data to send to the destination. Table 1 gives the parameters used in the MAC protocol.

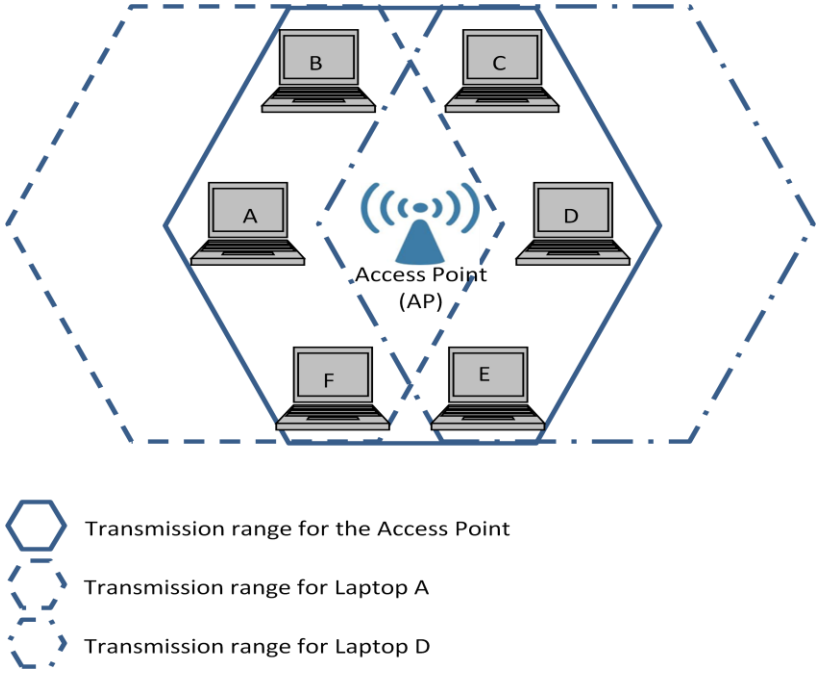

Figure 4

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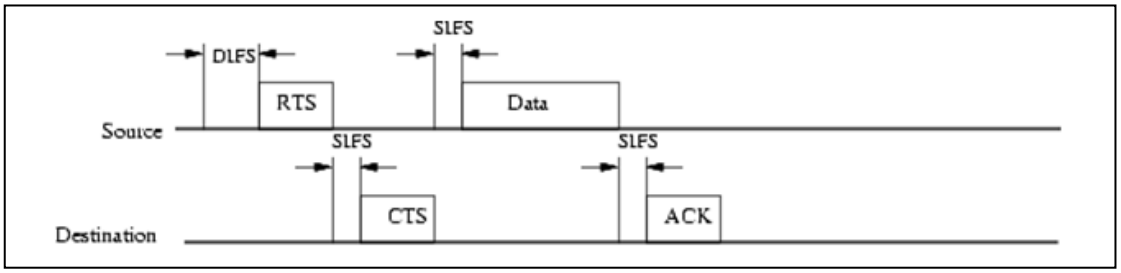

Figure 5

Table 1

Timeslot duration, T_{slot}	20µs
SIFS duration	10µs
DIFS duration	$DIFS = SIFS + 2T_{slot}$
RTS frame size	20 bytes
CTS frame size	14 bytes
ACK frame size	14 bytes
Dataframe size	1024 bytes

(a) Assuming that the propagation speed in the wireless medium is 3×10^8 ms^{-1},

(i) Calculate the duration that B and F must back-off while A is using the medium

(30 marks)

(ii) Calculate the duration of the timer that should be set by A to wait for the ACK from the AP.

(40 marks)

(b) Laptop A, B, C and D has time critical data that must be collected by the Access Point in timely manner. The Point Coordination Function (PCF) is used. The Access Point sends out beacon frames every 10ms interval to start the data collection process for all laptops A, B C , D, E and F. Propose the suitable point within this time interval for the Access Point to send out the CF-end frame.

(20 marks)

(c) Assess the efficiency of using the RTS/CTS frames when the MAC layer fragment the data into 64 Byte instead of a frame size of 1024 Byte.

(10 marks)

3. (a) A new university is allocated a block of addresses with the beginning address 193.190.187.0/24. It needs to distribute the IP Addresses for its three schools. The Mechatronic Engineering School needs 11 addresses while the Electrical Engineering School and the Electronic Engineering School require 62 addresses and 123 addresses respectively. The university also installed one router, R1 which is connected to the Internet Gateway, G1.

(i) Determine the ranges of IP addresses that the university should allocate to the three schools.

(30 marks)

(ii) Produce suitable forwarding tables for the university's router, R1 and the Internet Gateway, G1.

(40 marks)

(b) One year later, the university opens a new Communication Engineering School which has two divisions; the Wired Communication and the Wireless Communication divisions. Each division needs to have 14 IP Addresses. Propose suitable address allocations for this new school and its subnets.

(15 marks)

(c) The new Communication Engineering School has to move to another location. This requires its local area network to change its connection from R1 to G1. Assess the implication of using the following forwarding table for G1.

(15 marks)

Table 2

Network Address/mask	Next-hop address	Interface
193.190.187.0/24	Address of R1	m0
IP address of the Communication Engineering School	----------	m1
0.0.0.0/0	Default router	m2

4. (a) With an appropriate diagram, describe the following terms:

(i) TCP 3-way handshake

(ii) TCP termination (30 marks)

(b) With reference to TCP sliding window, demonstrate the silly window syndrome, and highlight the Nagle algorithm and the Clark solution

(40 marks)

(c) Compare and contrast between the Java support for UDP and TCP implementation

(30 marks)

5. (a) With an appropriate diagram, describe the following protocols:

(i) Telnet protocol

(ii) FTP protocol (30 marks)

(b) Compare and contrast between connection oriented datagram socket and connectionless datagram socket

(30 marks)

(c) Using the TCP/IP model, elaborate at least 5 networking issues and concerns pertaining to the adoption cloud computing in all government agencies.

(40 marks)

6. (a) Describe all the primitives for Linda based Distributed Shared Memory implementation.

(30 marks)

(b) Highlight the advantages and limitations of (Distributed) Shared Memory architecture over the traditional Von Neuman architecture.

(30 marks)

(c) One of the key issues in network programming is the inter-process communication. Describe the inter-process communication for:

(i) Fork and join programming model

(ii) Shared memory programming model

(iii) Message passing programming model

(40 marks)

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