Advanced Computer Network Final (106/06/21)

1. (a) What is the multiple access protocol? (2%) (b) List three types of multiple access protocols and describe how they work briefly. (9%) (c) Which type of the multiple access protocol does slotted ALOHA, Token Passing, TDMA, polling and CSMA/CD belong to? (5%) (16% total)

Ans:

(a) a distributed algorithm that determines how nodes share channel, i.e., determine when node can transmit (2%)

(b) Three broad classes:

a. Channel Partitioning (2%)
divide channel into smaller "pieces" (time slots, frequency, code) to node for exclusive use (1%)

b. Random Access (2%)
channel not divided, allow collisions (1%)

c. "Taking turns" (2%)
Nodes take turns, but nodes with more to send can take longer turns (1%)

(c) a. Channel Partitioning: TDMA (1%)
b. Random Access: slotted ALOHA, CSMA/CD (1% each)
c. "Taking turns": polling, Token Passing (1% each)

2. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) in detail (8%)

Ans:

- adapter doesn't transmit if it senses that some other adapter is transmitting, that is, carrier sense (2%)
- transmitting adapter aborts when it senses that another adapter is transmitting, that is, collision detection (2%)
- Before attempting a retransmission, adapter waits a random time, that is, random access with Exponential Backoff. (2%)
  - after *m*th collision, NIC chooses *K* at random from $\{0,1,2, \ldots, 2^m-1\}$. (2%) NIC waits K·512 bit times

3. (a) List three different characteristics of wireless and wired networks? (6%) (b) How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? (畫圖並加以說明 8 %, 14% total)

Ans:

(a)

- decreased signal strength (2%): radio signal attenuates as it propagates through matter (path loss)
- interference from other sources (2%): standardized wireless network frequencies (e.g., 2.4 GHz) shared by other devices (e.g., phone); devices (motors) interfere as well
- multipath propagation (2%): radio signal reflects off objects ground, arriving at destination at slightly different times

(b)

- sender first transmits small *request-to-send (RTS)* packets to BS using CSMA; RTSs may still collide with each other (but they're short) (2%)
- BS broadcasts *clear-to-send (CTS)* in response to RTS; CTS heard by all nodes (2%)
- sender transmits data frame, other stations defer transmissions (2%)
- BS replies ACK to sender (2%)

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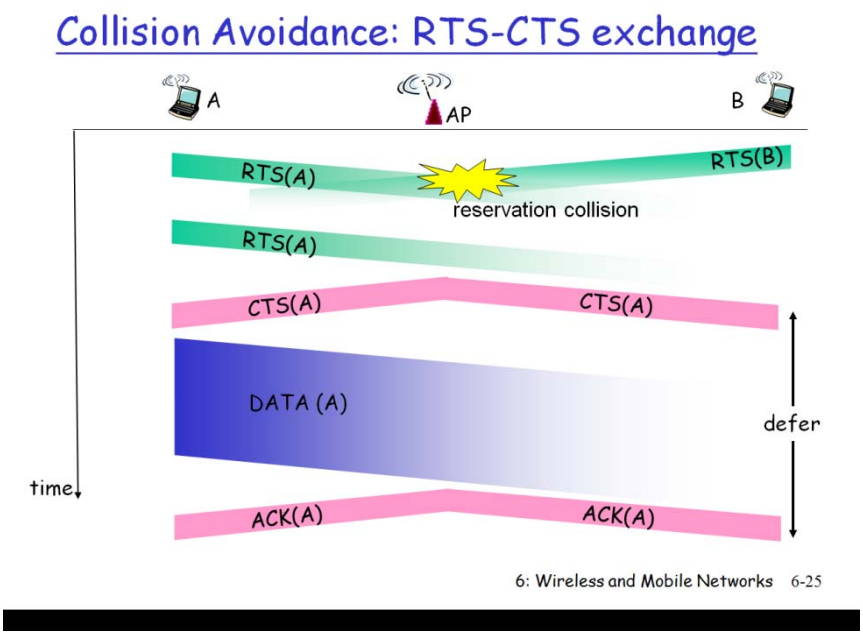


4. (a) Explain why IEEE 802.11 cannot detect collision. (4%) (b) Draw a figure to explain the Hidden terminal problem. (4%) (8% total)

Ans:

(a)

- difficult to receive (sense collisions) when transmitting due to weak received signals (fading) (2%)
- can't sense all collisions in any case: hidden terminal (2%)

(b)

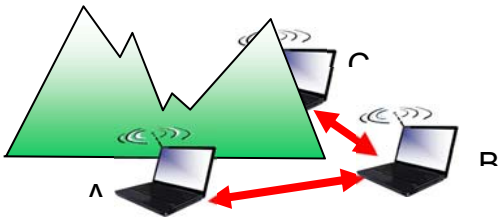
Hidden terminal problem

B, A hear each other (1%)

B, C hear each other (1%)

A, C can not hear each other (1%)

It means A, C unaware of their interference at B (1%)



5. Consider sending an IP datagram from host B to host A in the LANs shown below. Write down two generated frame headers (B->Router and Router->A) with the Destination MAC address and Source MAC address and the IP header with the Source IP address and Destination IP address. (1% each, 8% total)

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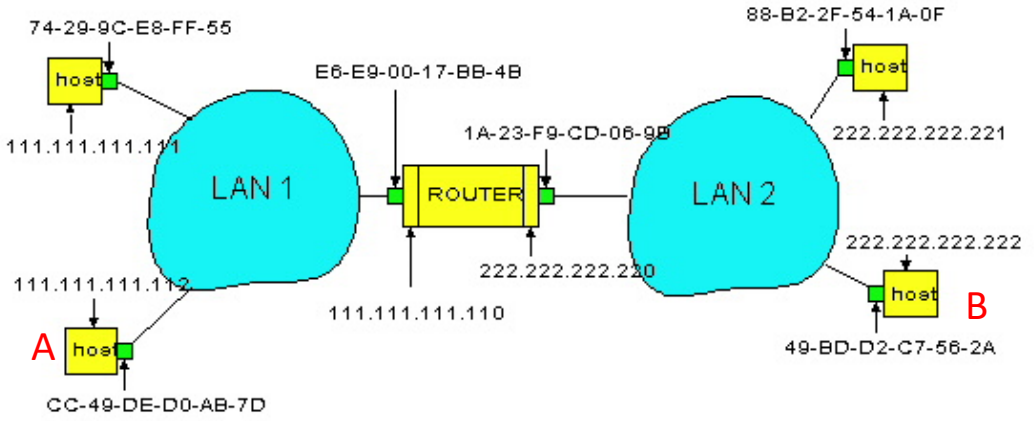


Ans:

From source B to Router

Destination MAC address	Source MAC address	Source IP address	Destination IP address
1A-23-F9-CD-06-9D	49-BD-D2-C7-56-2A	222.222.222.222	111.111.111.112

From Router to A

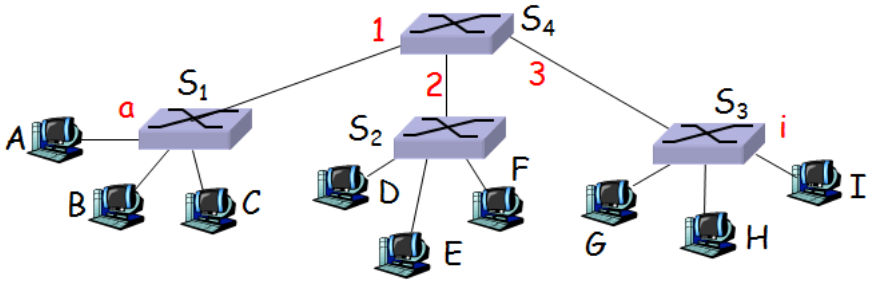
Destination MAC address	Source MAC address	Source IP address	Destination IP address
CC-49-DE-D0-AB-7D	E6-E9-00-17-BB-4B	222.222.222.222	111.111.111.112

6. (a) What does 100BaseTX mean? (4%) (b) 雙絞線 Ethernet 網路線的插頭是一種只能沿固定方向插入並自動防止脫落的塑料接頭，這種接頭的專有名詞是？(2%) (c) 我們做接頭時用 568B 的標準，這幾根線排列順序為何？(由 pin 1 至 8, 由左而右, 8%) (d) Ethernet 標準的名稱是 IEEE ？ (4%) (18% total)

Ans:

(a) 100Mbps, Twisted Pair (4%)
(b) RJ-45 (2%)
(c) 1、白橙　2、橙　3、白綠 4、藍　5、白藍 6、綠　7、白棕 8、棕 (8%)
(d) 802.3 (4%)

7. Describe the filtering/forwarding operations of four switches when (a) node I sends a frame to A (8%) (說明時要提到 frame 經過每個 switch 時的詳細動作與列出 switch table 的內容) (8% total)



Ans:

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(a) When the frame received, S3 records link associated with sending host I in S3's table (1%)

MAC address	Interface	TTL
I	i	XX

index switch table using MAC dest address **A**
entry not found for destination, then flood to G, H and interface 3! (1%)

When the frame received, S4 records link associated with sending host **I** in S4's table (1%)

MAC address	Interface	TTL
I	3	XX

index switch table using MAC dest address **A**
entry not found for destination, then flood to interfaces 1 and 2! (1%)

When the frame received, S2 records link associated with sending host I in S2's table (1%)

MAC address	Interface	TTL
I	2	XX

index switch table using MAC dest address **A**
entry not found for destination, then D, E and F! (1%)

When the frame received, S1 records link associated with sending host I in S1's table (1%)

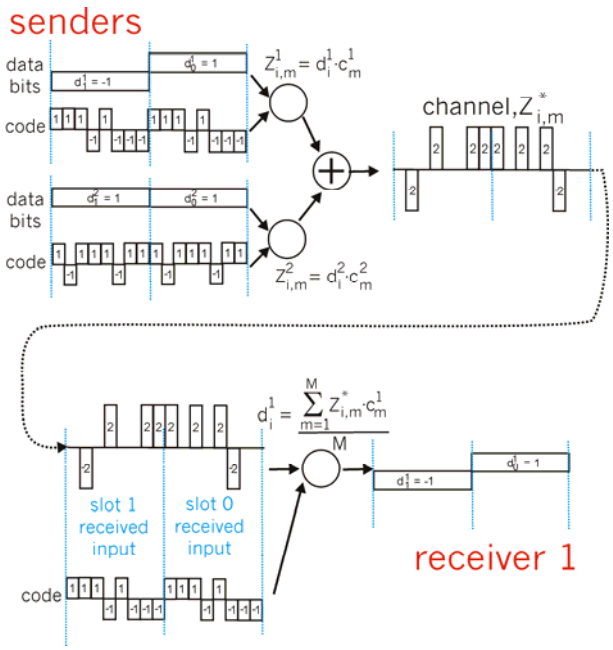
MAC address	Interface	TTL
I	1	XX

index switch table using MAC dest address **A**
entry not found for destination, then flood to A, B and C! (1%)

8. Draw a figure to show the CDMA encoding and decoding processes for two senders and receivers if the CDMA code of sender1 and receiver 1 is (-1, 1, 1, 1, -1, -1, -1, -1) and that of sender 2 and receiver 2 is (1, -1, 1, 1, -1, -1, 1, 1). Please note source bits of sender 1 are (1, 1) and those of sender 2 are (1, -1). (計算過程要寫出來，encoding 時不能只寫相加的結果，decoding 時只寫出來 receiver2 的過程 10%)

Ans:

(10%) （類似以下過程，必要部分要改）



9. (a) Classify the following wireless network standards "*LTE, Bluetooth, GSM, 802.11*" into (1) wireless

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LAN (2) wireless personal area network (3) 2G cellular network (4) 3G cellular network (5) 4G cellular network (4%) (b) draw a figure to describe Components of 2G cellular network architecture (6%) (要寫出 6 項) (10% total)

Ans:

(a) (1% each)

(a) wireless LAN : *802.11*

(b) personal area network: *Bluetooth,*

(c) 2G cellular network: *GSM*

(d) 4G cellular network: *LTE*

(b) 2G: MS, BTS; BSC; MSC; GMSC, Public Telephone network (1%)