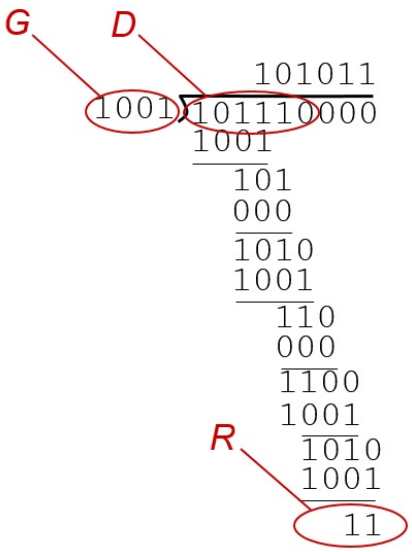
Advanced Computer Network Final (105/06/15)

1. If the data bit is 101110 and the generator is 1001, how to calculate the Cyclic Redundancy Check (CRC)? (要寫出計算過程, 10%)

Ans:

First, we append 000 to the end of 101110. (2%) Then we divide 1001 into 101110000 we get 101011 (6%，計算過程一步驟一分), with a remainder of R = 11. (2%)



2. (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 ALOHA, Token Passing, CDMA, polling and CSMA/CA 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: CDMA (1%)
b. Random Access: ALOHA, CSMA/CA (1% each)
c. "Taking turns": polling, Token Passing (1% each)

3. 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

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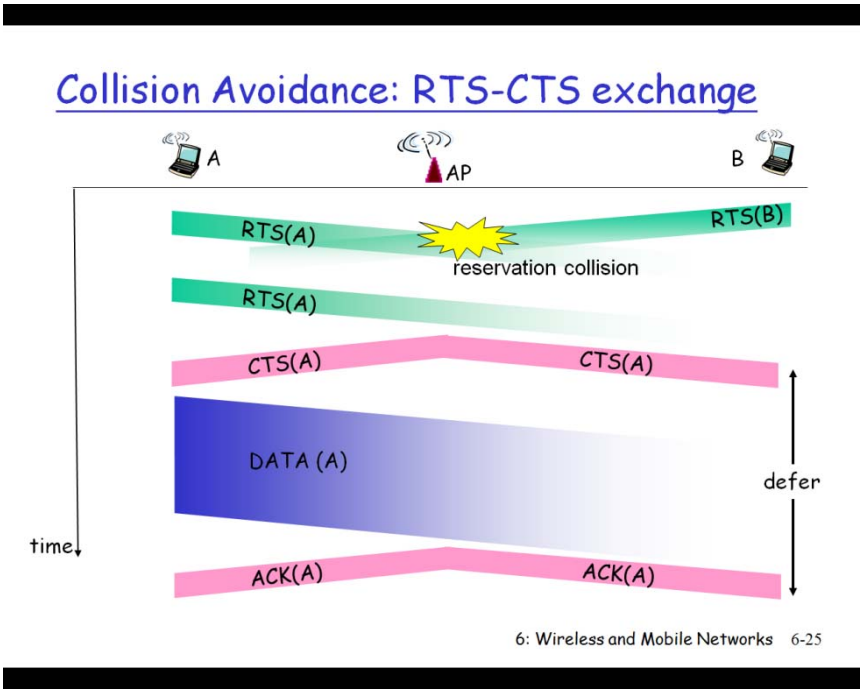
4. (a) List three different characteristics of wireless and wired networks? (6%) (b) How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? (畫圖並加以說明 8 %, 14% total)

Ans:

- 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%)



5. List and explain two modes of wireless networks (名稱 4%, 說明 6%, 10% total)

Ans:

infrastructure mode: (2%)

- base station connects mobiles into wired network (2%)

ad hoc mode: (2%)

- no base stations (1%) nodes can only transmit to other nodes within link coverage (1%)
- nodes organize themselves into a network: route among themselves (2%)

6. Explain the following terms: (a) Handoff (b) Hidden terminal problem (c) Basic Service Set (BSS) in infrastructure mode (d) ARP protocol (e) air-interface (f) care-of-address (g) 100BaseTX (2% each, 14% total)

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Ans: (a) handoff: mobile changes base station providing connection into wired network

(b) Hidden terminal problem

B, A hear each other

B, C hear each other

A, C can not hear each other

It means A, C unaware of their interference at B

(c) Basic Service Set (BSS) in infrastructure mode: i.e., cell, contains:

- wireless hosts (1%)
- access point (AP): base station (1%)

(d) ARP: Address Resolution Protocol => IP/MAC address mappings for LAN nodes (2%)

(e) air-interface: physical and link layer protocol between mobile and BS (2%)

(f) care-of-address: used by home agent to forward datagrams to mobile (2%)

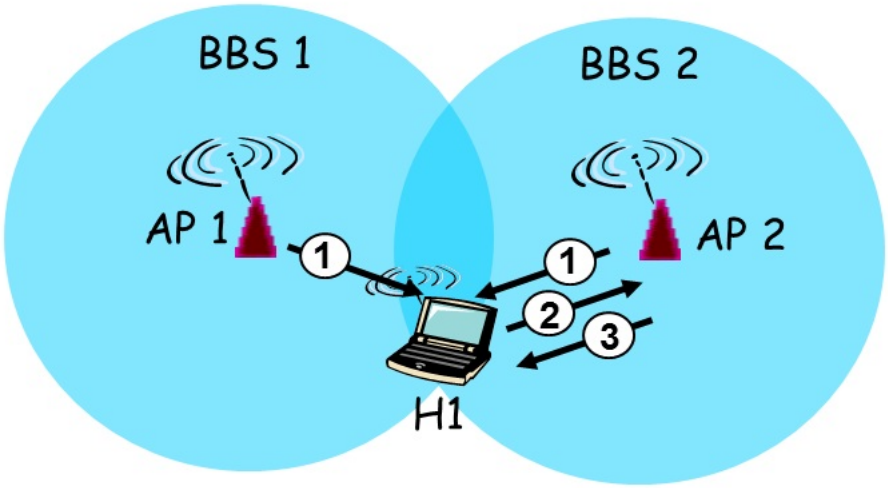
(g) 100Mbps (1%), Twisted Pair (1%)

7. (a) Explain the passive scanning process of 802.11 AP. (6%) (b) List two different steps of active scanning. (4%) (10% total)

Ans: (a)

Passive Scanning:

(1) beacon frames sent from APs (2%)
(2) association Request frame sent: H1 to selected AP (2%)
(3) association Response frame sent: H1 to selected AP (2%)



(b)

Active Scanning:

(1) Probe Request frame broadcast from H1 (2%)
(2) Probes response frame sent from APs (2%)
(3) Association Request frame sent: H1 to selected AP
(4) Association Response frame sent: H1 to selected AP

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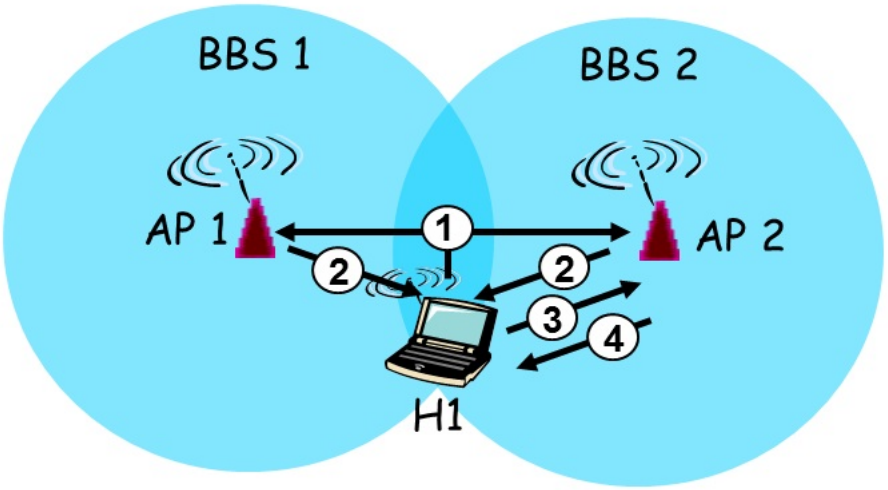


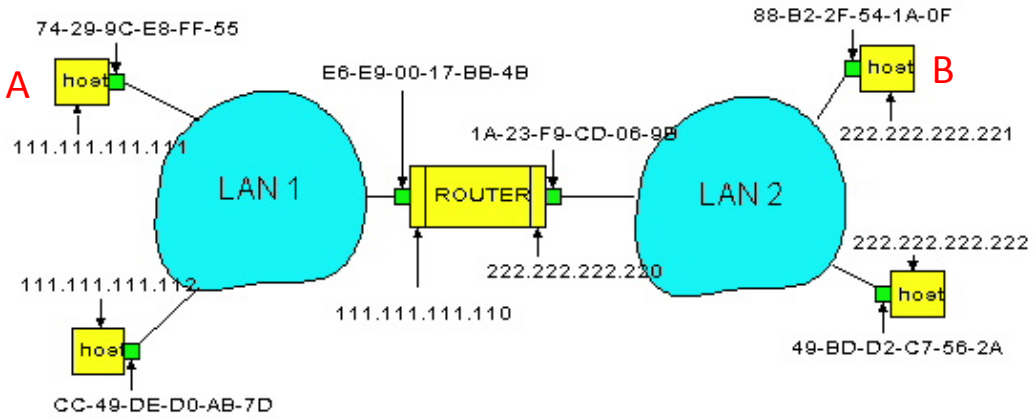
8. Describe the filtering/forwarding operation (algorithm) of the switch. (10%)

Ans:

When frame received:

1. record link associated with sending host (2%)
2. index switch table using MAC dest address (2%)
3. **if** entry found for destination
   then {
   if dest on segment from which frame arrived
   then drop the frame (2%)
   else forward the frame on interface indicated (2%)
   }
   else flood (2%)

9. 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)



Ans:

From source B to Router

Destination MAC address	Source MAC address	Source IP address	Destination IP address
1A-23-F9-CD-06-9D	88-B2-2F-54-1A-0F	222.222.222.221	111.111.111.111

From Router to A