Advanced Computer Network Final (102/06/19)

1. Draw a figure to describe Components of cellular network architecture (12%) (要畫圖並寫出 6 項，並說明其功能)

2. Explain the following terms: (a) Handoff (b) Hidden terminal problem (c) Basic Service Set (BSS) in infrastructure mode (d) ARP protocol. (3% each, 12% total)

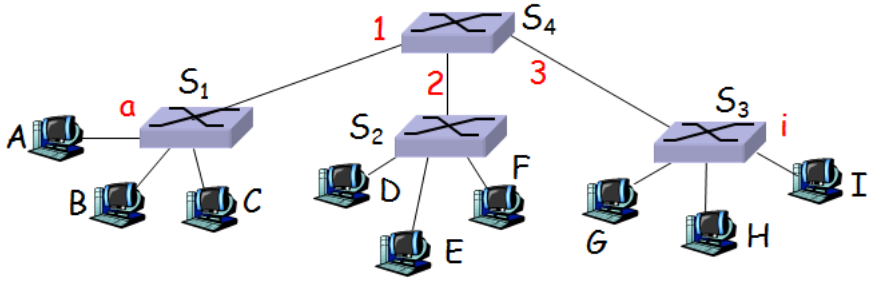
3. (a) Describe and draw two topologies of Ethernet. (要畫圖並說明其特點，10%) (b) What does 100BaseTX mean? (4%)

4. (a) Explain why IEEE 802.11 cannot detect collision. (4%)
   (b) How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? 畫圖並加以說明(8 %)

5. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) in detail (12%)

6. List three types of multiple access protocols and describe how they work briefly. (9%)

7. Describe the filtering/forwarding operations of four switches when (a) node A sends a frame to I (8%) (b) node I sends back a frame to A (6%) (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. Draw figures to describe the ad hoc mode of wireless networks. (要畫圖並說明，6%)

9. Describe and explain three different characteristics of wireless and wired networks? (9%)

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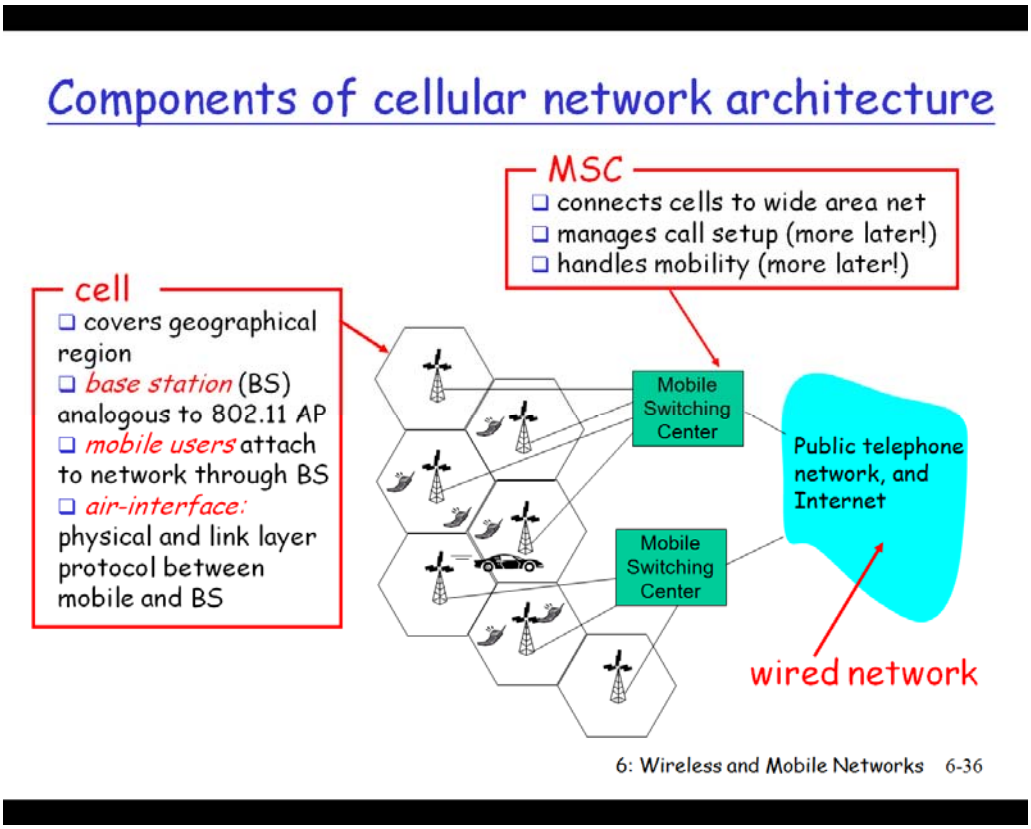
1. Draw a figure to describe Components of cellular network architecture (12%) (要寫出 6 項，並說明其功能)

Ans: MSC (2%); Cell (2%); BS (2%); Mobile user (2%); air interface (2%), wired core network (2%)



2. Explain the following terms: (a) Handoff (b) Hidden terminal problem (c) Basic Service Set (BSS) in infrastructure mode (d) ARP protocol. (3% each, 12% total)

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 (2%)

(d) ARP: Address Resolution Protocol => IP/MAC address mappings for LAN nodes (3%)

3. (a) Describe and draw two topologies of Ethernet. (要說明其特點，10%) (b) What does 100BaseTX mean? (4%)

Ans:

(a) bus topology (2%)

all nodes in same collision domain (can collide with each other) (2%)

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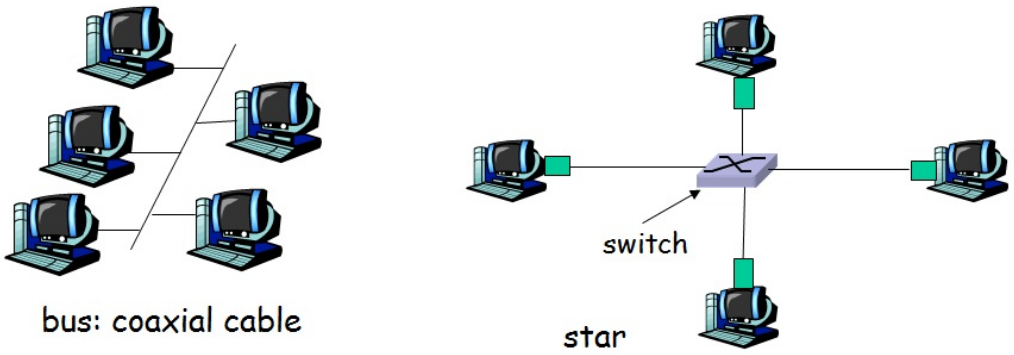
star topology (2%)

active *switch* in center (2%)

each "spoke" runs a (separate) Ethernet protocol (nodes do not collide with each other) (2%)



(b) 100Mbps, Twisted Pair (4%)

4. (a) Explain why IEEE 802.11 cannot detect collision. (4%)

(b) How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? 畫圖並加以說明(8%)

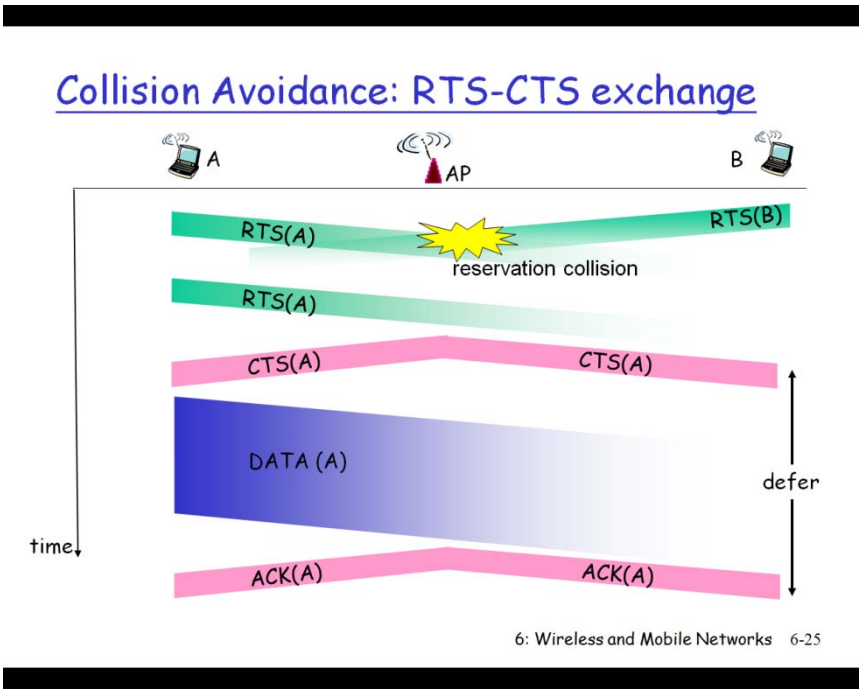
Ans:

(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)

- 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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5. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) in detail (12%)

Ans:

- adapter doesn't transmit if it senses that some other adapter is transmitting, that is, carrier sense (3%)
- transmitting adapter aborts when it senses that another adapter is transmitting, that is, collision detection (3%)
- Before attempting a retransmission, adapter waits a random time, that is, random access with Exponential Backoff. (3%)
  - first collision: choose K from {0,1}; delay is K· 512 bit transmission times (1%)
    after second collision: choose K from {0,1,2,3}…(1%)
    after ten collisions, choose K from {0,1,2,3,4,…,1023} (1%)

6. List three types of multiple access protocols and describe how they work briefly. (9%)

Ans:

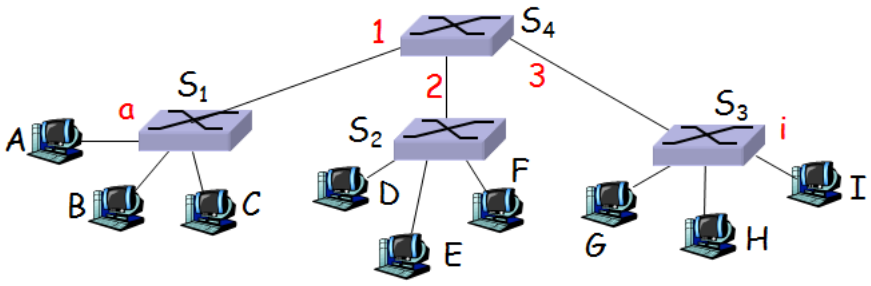
Three broad classes:

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%)

7. Describe the filtering/forwarding operations of four switches when (a) node A sends a frame to I (8%) (b) node I sends back a frame to A (6%) (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)



Ans:

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

MAC address	Interface	TTL
A	a	XX

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

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

MAC address	Interface	TTL
A	1	XX

index switch table using MAC dest address **I**
entry not found for destination, then flood to interfaces 2 and 3! (1%)

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

MAC address	Interface	TTL
A	2	XX

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

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

MAC address	Interface	TTL
A	3	XX

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

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

MAC address	Interface	TTL
A	3	XX
I	i	XX

index switch table using MAC dest address **A**
entry found for destination, then forward the frame on interface **3** (1%)

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

MAC address	Interface	TTL
A	1	XX
I	3	XX

index switch table using MAC dest address **A**
entry found for destination, then forward the frame on interface **1** (1%)

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

MAC address	Interface	TTL
A	a	XX
I	1	XX

index switch table using MAC dest address **A**
entry found for destination, then forward the frame on interface **a** and A receives the frame (1%)

8. Draw figures to describe the ad hoc mode of wireless networks. (要說明，6%)

Ans:

ad hoc mode:

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

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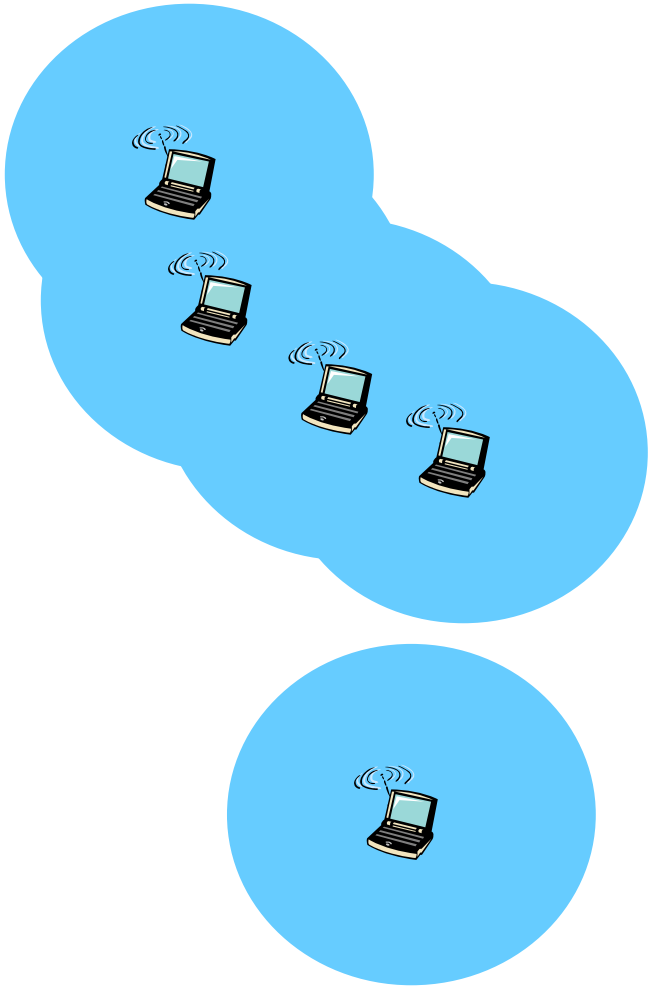

9. Describe and explain three different characteristics of wireless and wired networks? (9%)

Ans:

- decreased signal strength (2%): radio signal attenuates as it propagates through matter (path loss) (1%)
- 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 (1%)
- multipath propagation (2%): radio signal reflects off objects ground, arriving at destination at slightly different times (1%)