

4th Year IT-IS-SW

Cellular Network –
(Lecture 4)

Hand Off

! active call to hand off cell changing

- A handoff refers to the process of transferring an active call or data session from one cell in a cellular network to another or from one channel in a cell to another.
- Changing frequency resources from one cell to another adjacent cell by a MS with an active call

(بعد الـ Handoff من نص)

Handoff depends on:

- Cell size
 ➤ Boundary length
 ➤ Signal strength
 ➤ Fading
 ➤ Noise

أمثلة

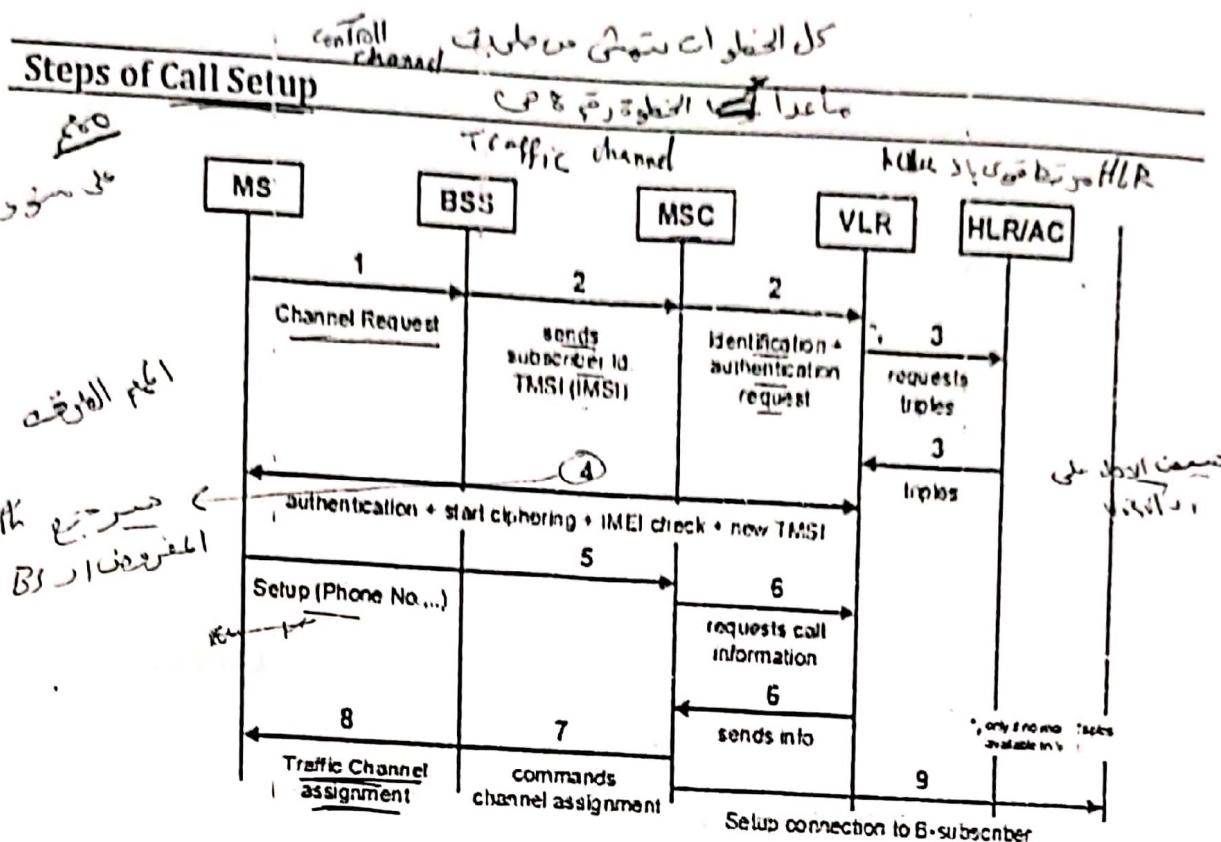
- Signal strength is affected by:
 - Height of the transmitting antenna
 - Presence of hills, valleys, and tall buildings
 - Atmospheric conditions

- دائم الموبايل يتحقق strength من ار S يتبع الموبايل او كل ما لا يشترى بمنطقة
- MS periodically measures signal strength of BS of the cell where MS is currently located
 - If signal strength drops below a threshold, the MS will handoff to another adjacent cell (BS)

Handoff Types

- Hard handoff (break before make)
 - Release current radio resource from BS before acquire new resources from next BS
 - FDMA and TDMA

- Soft handoff (make before break)
 - Communicate with both current and next BS for a short time period
 - CDMA



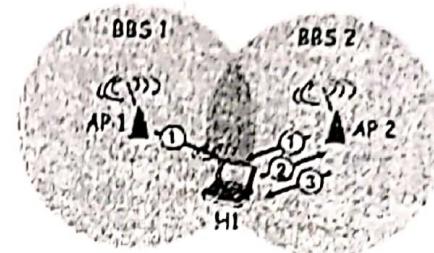
Wifi Connection Steps

1. **Beacon frame** is sent periodically from AP to announce its presence and provide the SSID and other parameters for WNICs within range.
2. **Authentication frame** is sent by WNIC to the AP containing its identity.
3. AP responds with an **authentication response frame** of its own indicating acceptance or rejection.
4. **Association request frame** is sent from WNIC with its supported data rates, and the SSID of the network to AP.
5. If **request is accepted**, AP reserves memory and establishes an association ID for the WNIC through an **association response frame**.

PASSIVE and ACTIVE Scanning

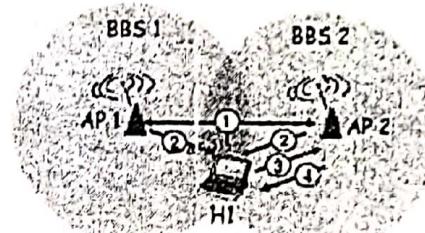
Passive Scanning

1. Beacon frame sent from AP
2. Association request frame sent from host to select AP
3. Association response frame sent back from AP to host if connection is accepted



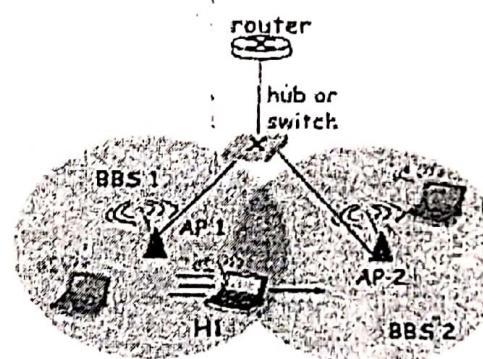
Active Scanning

1. Probe Request frame broadcast from host
2. Probes Response frame sent from APs
3. Association request frame sent from host to select AP
4. Association response frame sent back from AP to host if connection is accepted



WLAN Handoff

- H1 can detect weakening signal from AP1
 - If SNR decreases, BER increases
 - Because of, node moves away from BS
 - When BER becomes too high
 - Then, host must switch to lower transmission rates but with lower BE



Power Management in WLAN

- ❖ node-to-AP: "I am going to sleep until next beacon frame" (power management bit in header)
 - ✓ AP knows not to transmit frames to this node
 - ✓ node wakes up before next beacon frame (every 100 msec)

- ❖ beacon frame (AP-to-node): contains list of mobiles with buffered AP-to-mobile frames
 - ✓ node will stay awake if AP-to-mobile frames to be sent
 - ✓ otherwise sleep again until next beacon frame

PAN Network

- IEEE 802.15
- less than 10 meters
- technology used to replace cables of mouse and keyboards
- used in ad-hoc (no infrastructure)
- Bluetooth involved (2.4-2.5GHz and up to 721kps)
- use master and slave model
 - ✓ slave request permission to send to master
 - ✓ master grants requests

WiMax Network

- IEEE (802.16)
- like 802.11 cellular network- base station model
- transmission between hosts to/from BS using (omnidirectional antenna)
- transmission between BS each other using (point to point directional antenna)
- unlike 802.11
 - ✓ range 6 miles (city - with 14Mbps)

CSMA (carrier sense multiple access)

- Don't collide with ongoing transmission by another node
- But with no collision detection (problem)
- Can't sense all collisions in any cases like hidden terminal or fading

CSMA-CD

(Sender)

1. If sense channel is idle for DIFS then transmit entire frame
2. If sense channel is busy then
 - Start random backoff time (delay or random time)
 - Timer counts down while channel is idle
 - Transmit when timer expires
 - If no ack, increase random backoff interval and repeat step 2

(Receiver)

1. If frame received OK then return ACK after SIFS
 - ACK needed due to hidden terminal problem

CSMA-CA

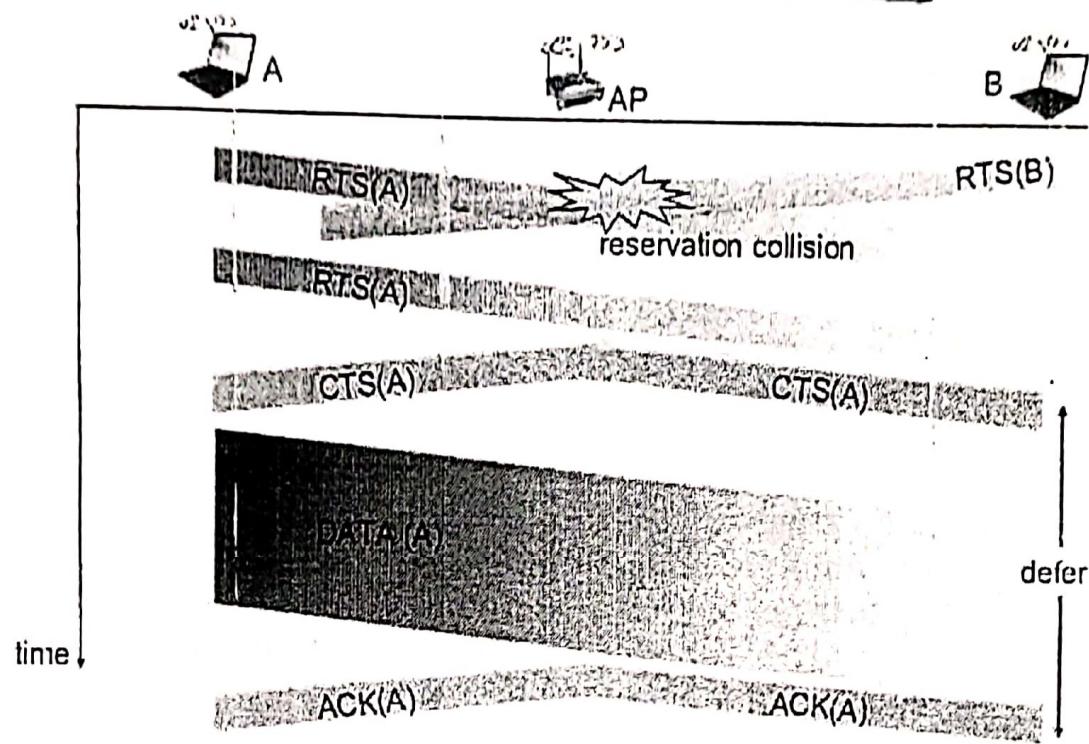
(Sender)

- First transmit small packet RTS (request to send) to receiver or BS using CSMA
- RTS packets may collide with each other but they short

(Receiver)

- BS or receiver broadcast CTS (clear to send) in response of certain RTS
- CTS heard by all nodes in the range of BS or receiver

Collision Avoidance: RTS-CTS exchange



Wireless, Mobile Networks 6-27

$$\frac{18}{3 \times 160} = 0.03125$$

$$a = L \cdot n$$

MCQ

Consider a cell of 4 channels, If 18 requests are generated by users per half an hour, and the average holding time is 200 sec then:

1. Average call arrival rate λ is Erlang

- | | | | |
|-------|------|--------|--------|
| a) 36 | b) 2 | c) 100 | d) 300 |
|-------|------|--------|--------|

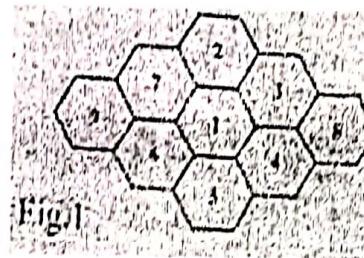
2. The blocking probability B_c is %

- | | | | |
|------|--------|--------|-------|
| a) 4 | b) 9.5 | c) 1.2 | d) 12 |
|------|--------|--------|-------|

3. The QoS is %

- | | | | |
|-------|---------|---------|--------|
| a) 96 | b) 98.8 | c) 90.5 | d) 100 |
|-------|---------|---------|--------|

A user multiplexed-based system, shown in figure 1, has total bandwidth of 30MHz and contains 20 control channels per cell with equal channel spacing of 30KHz. The area of each cell is equal to 8Km^2 and total area 3600km^2



4. Total number of required cluster cells

- | | | | |
|-------|------|-------|-------|
| a) 20 | b) 9 | c) 50 | d) 10 |
|-------|------|-------|-------|

5. The cell radius km

- | | | | |
|--------|---------|-------|------|
| a) 1.6 | b) 33.8 | c) 12 | d) 8 |
|--------|---------|-------|------|

6. The reuse distance km

- | | | | |
|---------|--------|----------|-------|
| a) 62.3 | b) 8.3 | c) 175.6 | d) 36 |
|---------|--------|----------|-------|

7. Total number of traffic channels/cell

- | | | | |
|--------|-------|---------|--------|
| a) 820 | b) 91 | c) 1000 | d) 100 |
|--------|-------|---------|--------|

8. If each channel is multiplexed among 5 users, then the total number of calls by each cell is

- | | | | |
|--------|--------|---------|--------|
| a) 455 | b) 164 | c) 2000 | d) 500 |
|--------|--------|---------|--------|

- | |
|----|
| e) |
|----|

9. Which of the following is a universally adopted shape of cell?			
a) circle	b) hexagon	c) triangle	d) square
10. What is the condition for handoff?			
a) Move to different cell with idle	b) remain in same cell with call	c) Move to different cell with call	d) remain in same cell with
11. Hexagon shape is used for radio coverage for a cell because			
a) Maximum coverage area	b) Fewer number of cells required	c) No intersections	d) All
12. Set of properties that distinguish between mobile computing and station system			
a) Dimension of mobility	b) Mobility condition	c) all spectrum	d) none
13. is the ability of mobile software to obtain location information			
a) Location awareness	b) localization	c) Location sensitivity	d) none
14. mobility includes moving between different			
a) networks	b) application	c) geographic area	d) All
15. QoS provide information about			
a) Bandwidth	b) probability of connectivity loss	c) traffic measurements	d) All
16. Battery management is the job of			
a) network	b) base station	c) OS	d) none
17. mobile computing differs from station devices in all the following except			
a) functional requirement	b) non-functional	c) design	d) tasks
18. affects memory and CPU capacities			
a) Mobility	b) Size of device	c) Platform proliferation	d) none
19. VLR and HLR in wireless mobile communications are			
a) gateway	b) database	c) routers	d) none

$$i^2 + j^2 + ij = 28$$

20. Traffic intensity is expressed in ^{b1st & 4th} _{days}			
a) Erlang	b) Erlang b	c) Erlang c	d) none
21. Which standard uses DSSS process			
a) IEEE 802.11 a	b) IEEE 802.11 b	c) IEEE 802.11 g	d) IEEE 802.15
22. The cluster cell structure identified by i=4 and j=2 contains cells			
a) 20	b) 28	c) 14	d) none
23. in CSMA/CA, sender first transmit small Packets to BS			
a) RTS	b) CTS	c) ACK	d) none
24. scanning frame are sent from Aps to hosts			
a) passive	b) active	c) handoff	d) non
25. is responsible for authentication information of MS SIM card			
a) HLR	b) VLR	c) AuC	d) none
26. unlike 802.11, network has more range and data rates			
a) Bluetooth	b) Wifi	c) WiMAX	d) GSM
27. is important to measure QoS			
a) Type of device	b) Type of OS	c) Type of Network	d) none
28. Who maintain handoff			
a) BS	b) MSC	c) PSTN	d) none
29. IEEE 802.11 standard, ACK is considered a message			
a) Broadcast	b) unicast	c) multicast	d) none
30. IEEE 802.11 standard, RTS is considered a message			
a) Broadcast	b) unicast	c) multicast	d) none
31. CSMA/CD used in ^{CSMA-CA}			
a) LAN	b) WLAN	c) WAN	d) none
32. is the responsibility of MSC			
a) Connect MS,BS	b) Connect MS,PSTN	c) Connect BS, PSTN	d) All
33. If the size of the cell is kept small in cellular network then			
a) the capacity increased	b) slow handoff process	c) decrease user density	d) none

Channel
group