

Lec ④

IEEE 802.11 wireless lan → wireless network protocol
↳ data through channel

802.11 (b)

2.4 - 5 GHz unlicensed spectrum
up to 11 mbs

→ data rate
→ Cover area

Direct Sequence, spread spectrum (DSSS)
↳ all hosts uses same Chipping mode

802.11 (a) < 5-6 GHz
54 mbs

802.11 (g) < 2.4-5 GHz
54 mbs

802.11 (n) < multiple antennae
5-2.4 GHz
200 mbs

all use : CSMA/CA → for multiple access
Collision Avoidance

all have base station, ad-hoc network versions

Pan < lan < Man < WAN

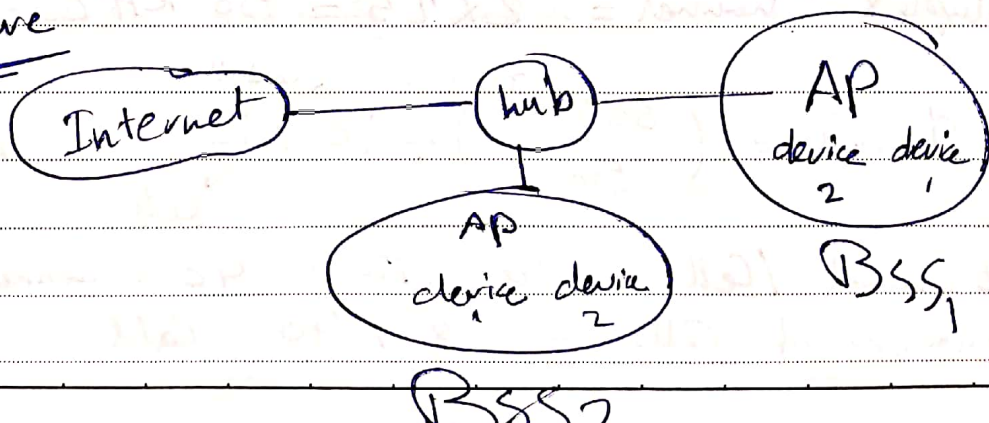
802.15

802.11

802.16

802.20

802.11
LAN Architecture



wireless host \rightarrow Communicate \rightarrow Base station = Access Point

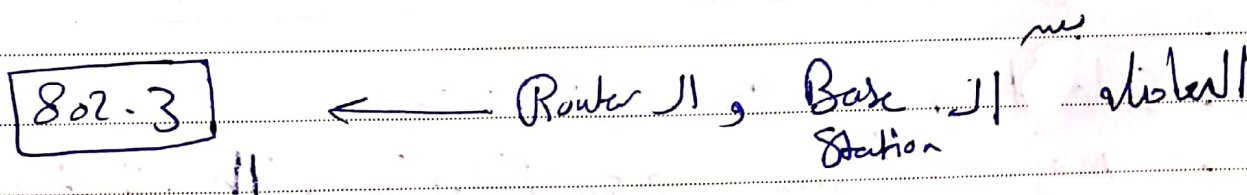
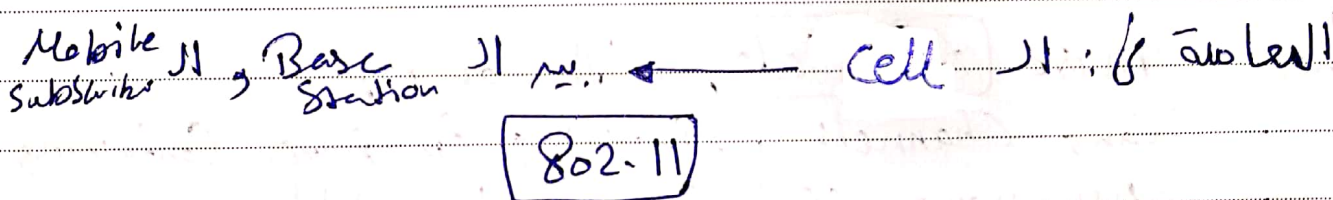
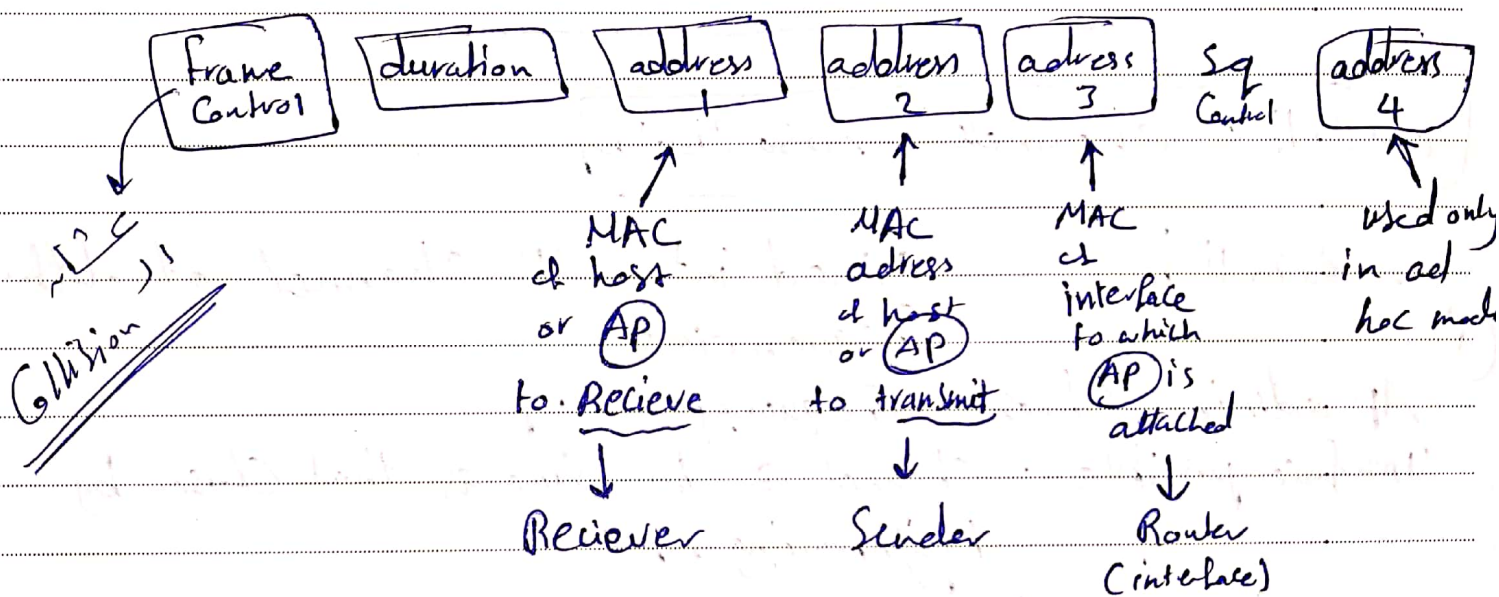
Basic Service Set (BSS) = Cell

① wireless host

③ ad-hoc Mode \rightarrow hosts only

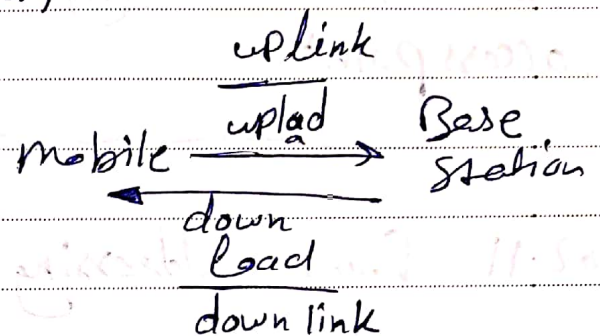
② access point

802.11 Frame addressing



Signaling → Control Plane
↳ Control bearer traffic
(authentication, subscriber info, Call param...)

Data (user) plane
↳ subscriber traffic (voice / data)



802.11: Channels, Association

802.11 b → divided into 11 channels at diff. frequencies

1) AP admin choose frequency of AP
Interference possible: channel can be same as that chosen by neighbouring AP!

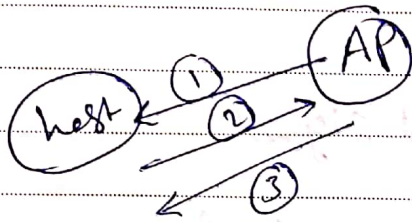
2) host: must Associate with an AP
Scans channels, listening for frames containing
AP name (SSID), MAC Address

- select AP to associate
- may perform authentication will typically run DTCP to get

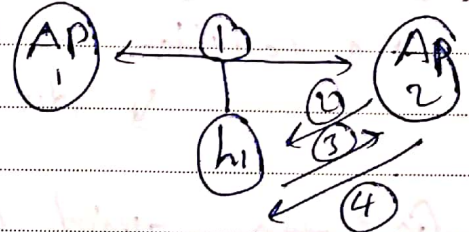
IP AP subnet

Association

① passive Scanning



② Active Scanning



① beacon frame sent from APs

② association Request frame sent from (h1) to (AP)

③ association Response from (AP) to (h1)

① (h1) request broadcast Frame

② Response from (APs)

③ Association from (h1)

④ Association from (AP) Response

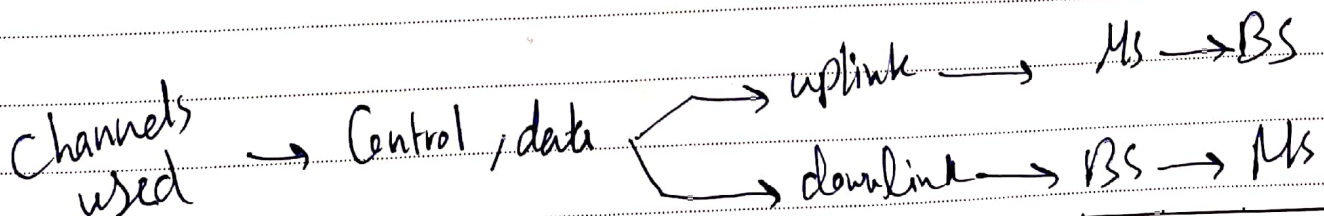
CALL Setup

① Validate information of subscriber (organize the Cell) ^{who} → authentication

② Find the Cell where the receiver is currently located
↳ location management

③ Allocate downlink / uplink Channels (Resource management)

④ Maintain the Cell if Receiver moves while Cell is Active (handoff / admission Control)



Multiple access

avoid Collision \rightarrow 2+ nodes transmitting at time

CSMA - Sense before transmitting

no Collision detection

\rightarrow due to weak received signal

Goal \rightarrow avoid collisions \rightarrow CSMA/CA

Sender

① if Channel idle \rightarrow Distributed inter-frame space
for **DIFS** then
transmit entire frame
no **CD**

② if Channel busy
then Start Random
backoff time timer
Counts down while
Channel idle
transmit when timer expires

if **no Ack** increase random
back off interval

Receiver

if frame received ok
return Ack later

SIFS

\downarrow
short
Inter-frame
spacing

Dealing with hidden terminals (RTS, CTS)

Idea allow sender to reserve channel rather than random access & data → avoid collisions of long data frames

① Sender transmit → small pkts (RTS) request to send to (BS) using CSMA

RTS may collide with each other → they are short ✓

② BS broadcast clear to send (CTS) in response to RTS

③ CTS heard by all nodes

- sender transmit data frame

- other stations defer transmissions

avoid data frame collision using small Reservation pkts

Rate Adaptation

مس ج. ز. Cell 889?

base station, Mobile change transmission rate (physical layer modulation technique) as mobile moves

SNR Varies

$SNR \propto \frac{1}{BER}$
 ↓ ↑
 as node move from base

Power mangment

node-to-AP

sleep \equiv idle

AP knows no to transmit frames to this node
node wakes up before next frame

Frame \rightarrow contains list of mobiles with AP to
mobile frame waiting to be sent

node \rightarrow awake \rightarrow frame sent
otherwise Node \rightarrow sleep

802.16 WiMax

