

wireless mobile phone subscribers now exceeds
wired phone subscribers

2 important (different) Challenges

wireless → Communication over wireless link

mobility → handle mobile user who changes point
of attachment to network

Challenges

- ① Growing number of users
- ② Covered all area
- ③ Mobility
- ④ QoS
- ⑤ Cost

Elements of wireless Network

- ① host → Laptop^①, PDA, run applications, Stationary/Not
wireless doesn't mean mobility
- ②
- ③

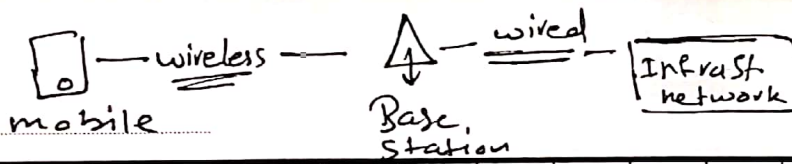
Stationary ← لو حو بجايل حتى لو حو بجايل Region ①
mobile device
لو خرج من ال Region ①
لو خرج من ال Region ②

② Base Station

"handle mobility"

- Collection of data from end user and pass to higher level
- typically Connected to wired network
- reliable in sending pkts between wired network and wireless hosts

eg → Cell tower, 802.11 access point



③ Wireless link

- Connect hosts to base station backbone link
- Multiple access protocol Co-ordinates link access
- Various data rates, transmission distance
- deal with Congestion → R2011

④ Infra structure mode

- Base station connects mobiles into wired network
- hand off → mobile changes base station providing connection into wired network

Ad-hoc mode

Base station is

- No Base station
- nodes can only transmit to other nodes within link coverage

- Nodes organize themselves into network
↳ route among themselves

EX: hotspot

Non-Infrastructure

Wireless network taxonomy

Single hop

host connect to Base station which connect to large internet

Multi hop

host may have to relay through several wireless nodes to connect to large internet

↳ Mesh net

Infra Structure



Access Point

Wireless Network taxonomy

No Infrastructure

↓
Ad-hoc

Single hop

- No Base Station
- No Connection to larger Network

↓
Bluetooth

multi-hop

- No Base Station
- No Connection to larger Network

↓
may have to relay to each other a given wireless node

MANET
VANET

Wireless Link Characteristics

- ① decreased signal strength
radio signal weak as it propagate through matter
- ② interfere with other sources
- ③ Multipath propagation

Measure QoS / Strength

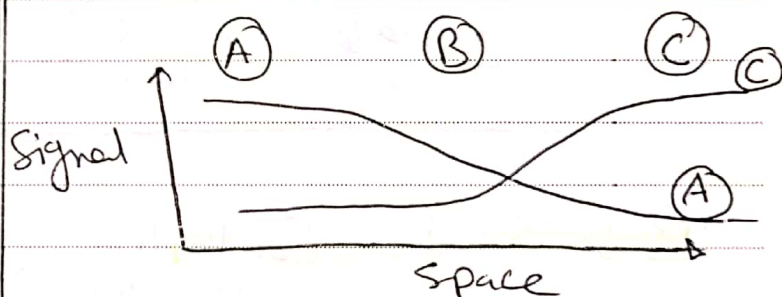
- ① SNR → signal to noise ratio
 - ② Bit error rate
- } reverse Proportional
- ↖ Sc. as 1/x

Larger SNR → easy to extract signal from noise

/ /

SNR $\left\{ \begin{array}{l} \rightarrow \text{Change with mobility} \\ \rightarrow \text{Modulation technique} \rightarrow \text{اینکه} \\ \rightarrow \text{Rate} \end{array} \right.$

(2) Signal attenuation



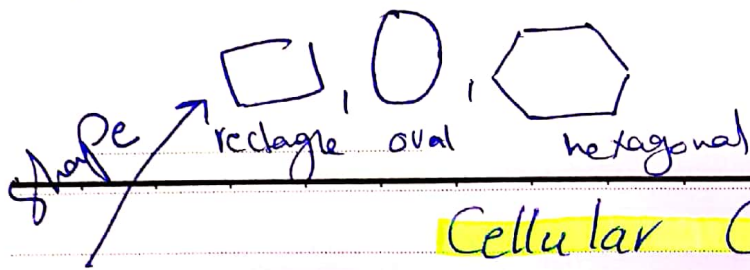
- A, B hear from each other
B, C hear from each other

- A, C Can not hear from each other.
Interleaving at (B)

↓

AIC → unaware
of their interference
with (B)

Interleaving at (B)



Cellular Communication

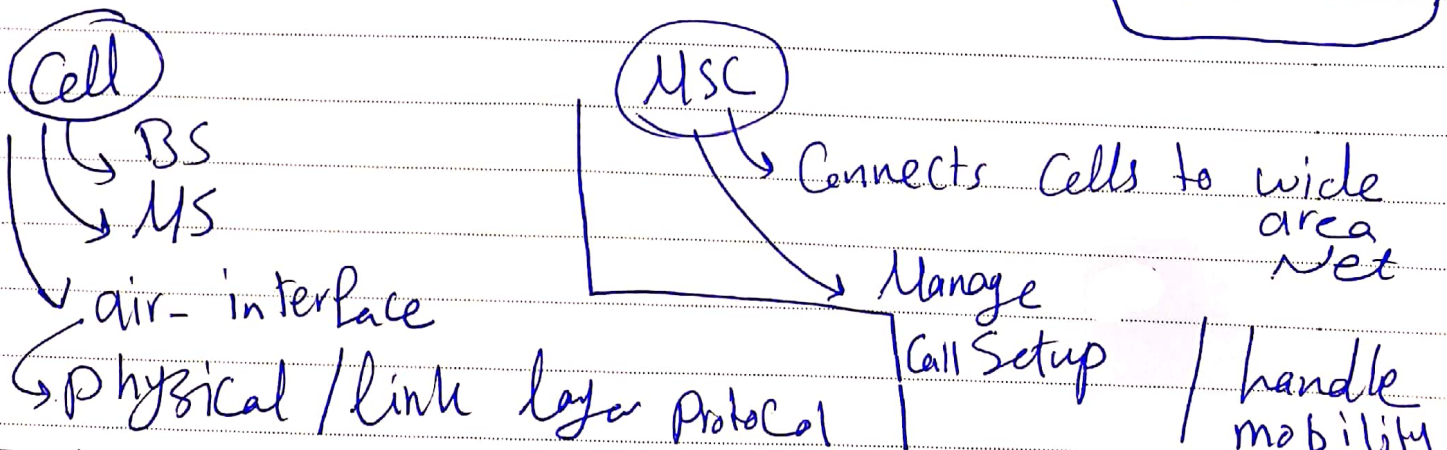
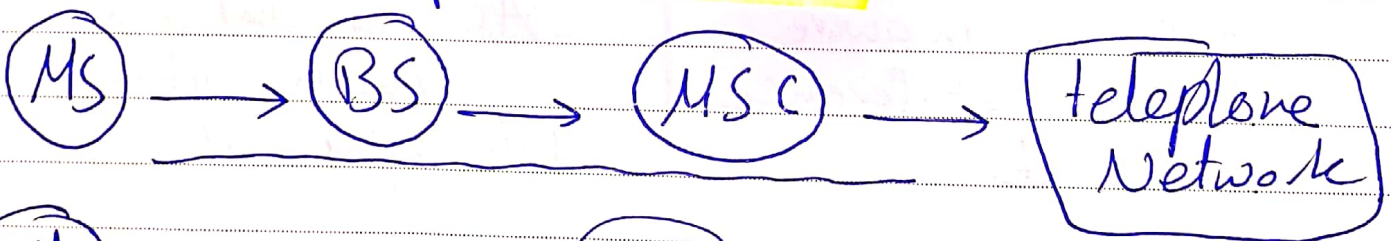
Cell \rightarrow area that can be covered by a transmitting station (Base Station) (BS)

radius of cell = reachable range of signal

Each Cell serve multiple by connecting them to Mobile Subscriber (MS) Single (BS)

Base Station Controller (BSC) Connect all BS \rightarrow wire

Mobile Switching Center (MSC) are connected to MSCs are connected to telephone network



MS → need to be in → Cell → Mobility Supported ✓

BS Connected through wires and Controlled by BSC

MSC → Connected to PSTN (public switched telephone network) and the ATM → Asynchronous transfer mode backbone

MSC Mobile Switching Center "by provider"
routing calls, sms, data

↓	(HLR)	↓	(VLR)
① home location Register		② visitor location register	
initial home location of <u>MS</u> where billing and access info		info. about visiting (MSs)	

③ Authentication Center (AUC)
Authentication info of MS Sim Card

each MS Subscribes to only one MSC