# Ch. 6: Wireless and Mobile Networks

#### Background:

- # wireless (mobile) phone subscribers now exceeds # wired phone subscribers (5-to-1)!
- # wireless Internet-connected devices equals # wireline Internet-connected devices
  - laptops, Internet-enabled phones promise anytime untethered Internet access
- two important (but different) challenges
  - wireless: communication over wireless link
  - mobility: handling the mobile user who changes point of attachment to network









## Characteristics of selected wireless links







#### ad hoc mode

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

# Wireless network taxonomy

	single hop	multiple hops
infrastructure (e.g., APs)	host connects to base station (WiFi, WiMAX, cellular) which connects to larger Internet	host may have to relay through several wireless nodes to connect to larger Internet: <i>mesh net</i>
no infrastructure	no base station, no connection to larger Internet (Bluetooth, ad hoc nets)	no base station, no connection to larger Internet. May have to relay to reach other a given wireless node MANET,VANET

## Code Division Multiple Access (CDMA)

- unique "code" assigned to each user; i.e., code set partitioning
  - all users share same frequency, but each user has own "chipping" sequence (i.e., code) to encode data
  - allows multiple users to "coexist" and transmit simultaneously with minimal interference (if codes are "orthogonal")
- encoded signal = (original data) X (chipping sequence)
- decoding: inner-product of encoded signal and chipping sequence

# 802.11 LAN architecture



- wireless host
  communicates with base
  station
  - base station = access point (AP)
- Basic Service Set (BSS) (aka "cell") in infrastructure mode contains:
  - wireless hosts
  - access point (AP): base station
  - ad hoc mode: hosts only

# 802.11: Channels, association

- 802.11b: 2.4GHz-2.485GHz spectrum divided into 11 channels at different frequencies
  - AP admin chooses frequency for AP
  - interference possible: channel can be same as that chosen by neighboring AP!
- host: must associate with an AP
  - scans channels, listening for beacon frames containing AP's name (SSID) and MAC address
  - selects AP to associate with
  - may perform authentication [Chapter 8]
  - will typically run DHCP to get IP address in AP's subnet

# 802.11: passive/active scanning





#### passive scanning:

- (I) beacon frames sent from APs
- (2) association Request frame sent: H1 to selected AP
- (3) association Response frame sent from selected AP to HI

#### active scanning:

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

# How many MAC address fields in a 802.11 frame?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

# 802.11 frame: addressing



### Select a correct statement

- A. An AP can only have one SSID
- B. An AP and a router might be in one physical device
- C. We cannot have the same SSID for one local network
- D. A and B
- E. A, B and C

## 802.11: mobility within same subnet

- HI remains in same IP subnet: IP address can remain same
- switch: which AP is associated with HI?
  - self-learning (Ch. 5):
    switch will see frame from HI and "remember" which switch port can be used to reach HI





# global wireless roaming

- Stands for EDUcation ROAMing.
- Provides secure internet access for academic roamers.
- User experience "Open your laptop and be online."

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#### EDUROAM architecture

Supplicant



# FORWARDING THE USER'S CREDENTIALS

• User's credentials forwarded via hierarchy of RADIUS



# Next lecture

• Wireless and Mobile Networks Readings Chapter 6