COMPUTER COMMUNICATION NETWORK

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IEEE 802.11: Architecture

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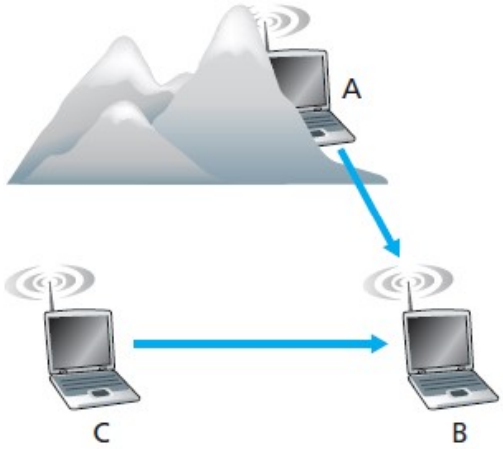
Wireless Link Characteristics

- There are a number of important differences between a wired link and a wireless link
- **Decreasing signal strength**: Electromagnetic radiation attenuates as it passes through matter (through a wall, even in free space) resulting in decreased signal strength as the distance between sender and receiver increases. Also referred as path loss
- **Interference from other sources**: Sources transmitting in the same frequency band will interfere with each other. In addition electromagnetic noise within the environment (e.g., a nearby motor, a microwave) can result in interference

- **Multipath propagation** : Multipath propagation occurs when portions of the electromagnetic wave reflect off objects and the ground, taking paths of different lengths between a sender and receiver. Moving objects between the sender and receiver can cause multipath propagation to change over time
- As signal decreases quickly with distance signal to noise ration (SNR) becomes important point for consideration
- So in wireless scenario probability of occurrence of error (bit error rate / packet error rate) is very high

Hidden Terminal Problem

- Suppose that Station A is transmitting to Station B.
- Suppose also that Station C is transmitting to Station B
- Physical obstructions in the environment may prevent A and C from hearing each other's transmissions
- A's and C's transmissions are interfering at B
- Even they wish A and C can not coordinate to transmit to B
- This is called hidden terminal problem
- This problem make multiple access in a wireless network considerably more complex and need to address in associated protocols



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WiFi variants

- Although many technologies and standards for wireless LANs were developed, one has clearly emerged as the winner: the IEEE 802.11 wireless LAN, also known as WiFi.
- There are several 802.11 standards for wireless LAN technology, including 802.11b, 802.11a, and 802.11g
- A number of dualmode (802.11a/g) and tri-mode (802.11a/b/g) devices are also available

Standard	Frequency Range	Data Rate
802.11b	2.4 GHz	up to 11 Mbps
802.11a	5 GHz	up to 54 Mbps
802.11g	2.4 GHz	up to 54 Mbps
802.11n	2.5 GHz and 5 GHz	up to 450 Mbps
802.11ac	5 GHz	up to 1300 Mbps

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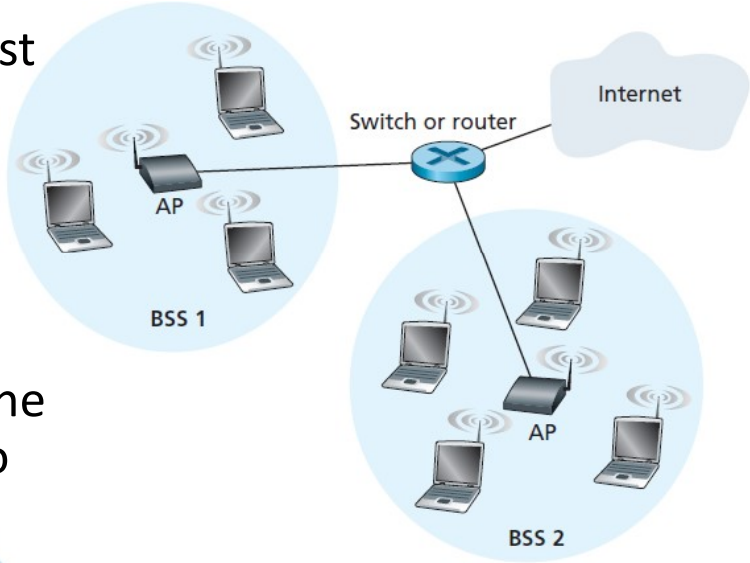
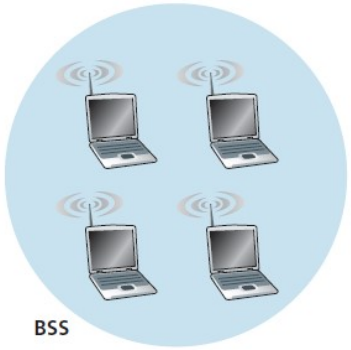
- The three 802.11 standards share many characteristics
  - They all use the same medium access protocol, CSMA/CA
  - Uses the same frame structure for their link-layer frames
  - All three standards have the ability to reduce their transmission rate in order to reach out over greater distances.
  - All three standards allow for both “infrastructure mode” and “ad hoc mode,” as
- A relatively new WiFi standard, 802.11n uses multiple-input multiple-output (MIMO) antennas
- Transmission rates of several hundred megabits per second are possible with 802.11n.

802.11 Architecture

- A basic service set (BSS) contains one or more wireless host and a central base station, known as an access point (AP)
- Each has their own MAC address
- LANs with APs are often referred to as infrastructure wireless LANs
- An Adhoc network with no central control is formed “on the fly,” by devices that have found themselves in proximity to each other
- We’ll focus on infrastructure wireless LANs





AP configuration

- Network administrator assigns a Service Set Identifier (SSID) to the access point
- 802.11 operates in the frequency range of 2.4 GHz to 2.485 GHz. Within it defines 11 partially overlapping sub channels
- Administrator must also assign a channel number to the AP
- At any place a wireless station many receives a sufficiently strong signal from two or more APs
- To gain Internet access, wireless station needs to associate with exactly one of the APs
- Only the associated AP will send data frames to wireless station, and wireless station will send data frames into the Internet only through the associated AP

How to associate with a particular AP?

- AP periodically send beacon frames, each of which includes the AP's SSID and MAC address
- Wireless station, scans the 11 channels, seeking beacon frames from any APs that may be out there
- User of device or the wireless station itself select one of the APs for association
- 802.11 standard does not specify any algorithm for selecting which of the available APs to associate with
- It is possible to selected AP with a strong signal or servicing load of an AP
- It is known as passive scanning

IEEE 802.11: Architecture

- A wireless host can also perform active scanning by broadcasting a probe frame that will be received by all APs within the wireless host's range
- APs respond to the probe request frame with a probe response frame.
- The wireless host can then choose the AP with which to associate from among the responding APs.
- After selecting the AP with which to associate, the wireless host sends an association request frame to the AP, and the AP responds with an association response frame.

IEEE 802.11: Architecture

- In order to create an association with a particular AP, the wireless station may be required to authenticate itself to AP
- Authentication may be based on a station's MAC address or usernames and passwords
- Once associated with an AP, the host will typically send a DHCP discovery message via the AP in order to obtain an IP address on the subnet.

THANK YOU

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