6

Wireless Lans I

# HOmework

Last Name:

First Name:

# Introduction

## OSI Standards

Test Your Understanding

1. **a) At what layers do wireless LANs operate**?

**b) Do wireless LAN standards come from OSI or TCP/IP? Explain**.

## 802.11 versus Wi-Fi

2. a) Distinguish between 802.3 standards and 802.11 standards.

**b) Distinguish between 802.11 and Wi-Fi**.

## Wireless LAN Operation

3. **a) Why do wireless clients need access to the firm’s main wired switched Ethernet network**?

b) How can firms provide WLAN coverage throughout a large building?

# Radio Signal Propagation

4. **a) In 802.3 Ethernet networks, can simple installation rules usually reduce propagation effects to nonissues**?

**b) In 802.11 Wi-Fi networks, can simple installation rules usually reduce propagation effects to nonissues**?

## Frequencies

5. ~~a) What is a transceiver~~?

**b) Is wireless radio transmission usually expressed in terms of wavelength or frequency**?

c) What is a hertz?

**d) Convert 3.4 MHz to a number without a metric prefix. (The use of metric prefixes was discussed in a box in Chapter 1**.)

~~e) At what range of frequencies do most wireless systems operate?~~

## Antennas

6. a) Distinguish between omnidirectional and dish antennas in terms of operation.

**b) Under what circumstances would you use an omnidirectional antenna**?

**c) Under what circumstances would you use a dish antenna**?

**d) What type of antenna normally is used in WLANs? Why**?

## Wireless Propagation Problems

7. **a) If the signal strength from an omnidirectional radio source is 8 mW at 30 meters, how strong will it be at 120 meters, ignoring absorptive attenuation? Show your work**.

**b) Contrast inverse square law attenuation and absorptive attenuation**.

c) How are dead zones created?

**d) What is the most serious propagation problem in WLANs**?

**e) How is it controlled**?

~~f) List some sources of EMI~~.

**g) What two propagation problems become worse as frequency increases**?

# Radio Bands, Bandwidth, and Spread Spectrum Transmission

## Service Bands

8. **a) Distinguish among the frequency spectrum, service bands, and channels**.

b**) In radio, how can you send multiple signals without the signals interfering with one another**?

## Signal and Channel Bandwidth

9. a**) Does a signal usually travel at a single frequency, or does it spread over a range of frequencies**?

b) If the lowest frequency in a channel is 1.22 MHz and the highest frequency is 1.25 MHz, what is the channel bandwidth? (Use proper metric notation.)

**c) If you want to transmit seven times as fast, how much wider must the channel be**?

**d) Why is large channel bandwidth desirable**?

**e) What do we call a system whose channels are wide**?

**f) What other types of system do we call broadband**?

## Licensed and Unlicensed Radio Bands

10. a) Do WLANs today use licensed or unlicensed bands?

**b) What is the advantage of using unlicensed bands**?

**c) What is the downside**?

## The 2.4 GHz and 5 GHz Unlicensed Service Bands

11. **a) In what two unlicensed service bands does 802.11 operate**?

b) Which band dominated use initially?

c) How many 20 MHz non-overlapping channels does the 2.4 GHz band support?

**d) Why is this a problem**?

e**) Why are companies moving rapidly into the 5 GHz band**?

f) How many non-overlapping channels does the 5 GHz band support?

g~~) Why is it important that governments add more bandwidth to the 5 GHz band?~~

**h) If you triple channel bandwidth, what happens to the number of channels in the service band**?

# Normal and Spread Spectrum Transmission

## Spread Spectrum Transmission

12. a) In the 2.4 GHz and 5 GHz service bands, what type of transmission method is required by regulators?

**b) What is the benefit of spread spectrum transmission for business communication**?

**c) Is spread spectrum transmission done for security reasons in commercial WLANs**?

**d) Does spread spectrum transmission increase transmission speed**?

## Implementing Spread Spectrum Transmission

13. a) In normal radio operation, how does channel bandwidth relate to the bandwidth required to transmit a data stream of a given speed?

**b) How does this change in spread spectrum transmission**?

c) What spread spectrum transmission method dominates today?

~~d) Why does it use subcarriers instead of simply spreading the data over the entire channel~~?

# 802.11 WLAN Operation

14. **In Figure 6-13, what is the distribution system**?

## Wireless Access Points

15. **Why must an access point remove an arriving packet from the frame in which the packet arrives and place the packet in a different frame when it sends the packet back out**?

## Basic Service Sets (BSSs)

16. a) What is a BSS? (Do not just spell out the acronym.)

**b) What is an SSID? (Do not just spell out the acronym**.)

c) Does the access point have an SSID?

**d) Why must wireless devices know the access point’s SSID**?

## Extended Service Sets (ESSs), Handoffs, and Roaming

17. a) What is a handoff in 802.11?

~~b) What is the relationship between handoffs and roaming in Wi-Fi?~~

**c) What is an ESS? (Do not just spell out the abbreviation**.)

**d) What characteristics do all access points in an ESS share**?

e) How can access points communicate with each other?

~~f) What is the purpose of the 802.11r standard~~?

## Media Access Control

18. All wireless hosts and the access point that serves them transmit on the same channel. a) What problem does this cause?

**b) How does media access control address this problem**?

**c) Does media access control apply to wireless hosts, access points, or both**?

# Box: Media Access Control (MAC)

~~19. a) What does CS mean? (Do not just spell out the abbreviation.) b) How is carrier sensing used in multiple access? c) Why is CA desirable? d) Does a frame’s receiver transmit an ACK immediately or after a random delay? e) Is CSMA/CA+ACK reliable or unreliable? f) Why was 802.11 made reliable? g) Is CSMA/CA+ACK efficient?~~

~~20. a) Describe RTS/CTS. b) Is CSMA/CA+ACK required or optional? c) Is RTS/CTS required or optional? d) Which is more efficient, RTS/CTS or CSMA/CA+ACK? e) When does it make sense to use RTS/CTS?~~

# 802.11 Transmission Standards

## Characteristics of 802.11g, 802.11a, 802.11n, and 802.11ac

21. ~~a) Among the four standards listed, which are obsolete~~?

b) Which dominates the installed base today?

**c) What is the market position of 802.11ac**?

## Bands and Channel Bandwidth

22. a) Why is wider channel bandwidth good?

**b) What is the downside of wider channel bandwidth**?

**c) What frequency band or bands do 802.11g, 802.11a, 802.11n, and 802.11ac use**?

**d) For each, compare channel bandwidth and the number of possible channels**.

## MIMO

23. a) How does MIMO use spatial streams to increase transmission speed?

**b) What is the main benefit of MIMO**?

**c) What is its other benefit**?

**d) Compare the range of rated speeds possible with 802.11n and 802.11ac**.

## Beamforming and Multiuser MIMO

24. a) What is beamforming?

b) What benefits can it bring?

**c) Distinguish between MIMO and multiuser MIMO**.

## Speed, Throughput, and Distance

25. a) Distinguish between rated speed, aggregate throughput, and individual throughput.

**b) What factors influence individual throughput, given a certain level of aggregate throughput**?

**c) Why does transmission speed drop as a computer moves farther from an access point**?

## Backward Compatibility

26. **a) What is backward compatibility**?

b) Why is it important?

c) Can a wireless client that implements 802.11ac communicate with an 802.11n access point?

**d) If so, what standard will they use to communicate**?

## Standards and Options

27. **a) Why can two products that comply with the same standard perform differently**?

b) What implications does this have for making purchases? (The answer is not in the text.)

# Wireless Mesh Networking

28. a) What is wireless mesh networking?

~~b) What is the current 802.11 standard for mesh networking~~?

**c) What devices forward frames in a mesh network**?

~~d) What three issues must be overcome to make mesh networking acceptable to corporations~~?

# Conclusion

## End-of-Chapter Questions

Thought Questions

6-1. A building is cube-shaped. It uses 16 access points, which are, on average, 10 meters apart from one another. The company wishes to reduce this to 8 meters. About how many 5 GHz access points would the company need for the building?

6-2. The following matters were not addressed specifically in the text. However, if you understand the concepts of Layer 1 and Layer 2 standards, in each case, give your answer and explain your reasoning. a) Is multipath interference a Layer 1 or Layer 2 concern?

b) Is media access control a Layer 1 or Layer 2 concern?

c) Is MIMO a Layer 1 or Layer 2 concern?

d) Are wireless propagation problems Layer 1 or Layer 2 concerns?

e) Is 802.11ac a Layer 1 or Layer 2 standard?

f) Is 802.11r a Layer 1 or Layer 2 standard?

Perspective Questions

6-3. What was the most surprising thing you learned in this chapter?

6-4. What was the most difficult part of this chapter for you?