

Wireless and Mobile Networking, 2022, CRC Press

Table of Contents

1. Wireless and Mobile Networking: From Past to Present

- 1.1 Wireless History
- 1.2 Growth in Wireless and Mobile Networking
- 1.3 Book Outline

2. Wireless Coding and Modulation

- 2.1 Frequency, Wavelength, Amplitude, and Phase
- 2.2 Time and Frequency Domains
- 2.3 Electromagnetic Spectrum
- 2.4 Decibels
- 2.5 Coding Terminology
- 2.6 Modulation
- 2.7 QAM
- 2.8 Channel Capacity
- 2.9 Hamming Distance and Error Correction
- 2.10 Multiple Access Methods
- 2.11 Spread Spectrum
- 2.12 Doppler Shift
- 2.13 Doppler Spread
- 2.14 Coherence Time
- 2.15 Duplexing
- 2.16 Summary

Multiple Choice Questions

Review Exercises

3. Wireless Signal Propagation

- 3.1 Wireless Radio Channel
- 3.2 Antenna
- 3.3 Reflection, Diffraction, Scattering
- 3.4 Channel Model
- 3.5 Path Loss
- 3.6 Receiver Sensitivity
- 3.7 Multipath Propagation
- 3.8 Inter-symbol Interference
- 3.9 Delay Spread
- 3.10 2-ray Propagation Model and d^{-4} Power Law

- 3.11 Fading
- 3.12 Shadowing
- 3.13 Total Path Loss
- 3.14 MIMO
- 3.15 OFDM
- 3.16 OFDMA
- 3.17 Effect of Frequency
- 3.18 Summary

Multiple Choice Questions

References

4. WiFi Basics

- 4.1 WiFi vs IEEE 802.11
- 4.2 IEEE Standards Numbering System
- 4.3 IEEE 802.11 Features
- 4.4 ISM Bands
- 4.5 IEEE 802.11 Channels
- 4.6 Physical Layers
- 4.7 Hidden Node Problem
- 4.8 Collision Avoidance with 4-way Handshake
- 4.9 IEEE 802.11 Medium Access Control (MAC)
- 4.10 IEEE 802.11 Architecture
- 4.11 IEEE 802.11 Frame Format
- 4.12 Use of 802.11 Address Fields
- 4.13 802.11 Power Management
- 4.14 Summary

Multiple Choice Questions

References

5. Mainstream WiFi Standards

- 5.1 802.11 Amendments and WiFi Evolution
- 5.2 Basics of WiFi Data Rates
- 5.3 Data Rate in DSSS-based WiFi: IEEE 802.11-1997 and 802.11b-1999
- 5.4 Data Rate in OFDM-based WiFi
- 5.5 IEEE 802.11a-1999
- 5.6 IEEE 802.11g-2003
- 5.7 IEEE 802.11e-2005 (Enhanced QoS)
- 5.8 IEEE 802.11n-2009
- 5.9 IEEE 802.11ac
- 5.10 802.11ax-2020
- 5.11 The Upcoming Amendment: 802.11be-2024

5.12 Summary

Multiple Choice Questions

Reference

6. Niche WiFi

6.1 802.11af (a.k.a. White-Fi)

6.2 802.11ah (a.k.a. HaLow)

6.3 802.11ad (a.k.a. WiGig)

6.4 802.11ay

6.5 Summary

Multiple Choice Questions

References

7. Cellular Networks

7.1 Beginning of Cellular Networks

7.2 Initial Deployments of Cellular Systems in the US

7.3 Cell Sites

7.4 Macro, Micro, Pico, Femto Cells

7.5 Cell Geometry

7.6 Frequency Reuse and Clustering

7.7 Characterizing Frequency Reuse

7.8 Locating Co-channel Cells

7.9 Spectrum Distribution within Cell Cluster

7.10 Frequency Reuse Notation

7.11 Fractional Frequency Reuse

7.12 Handoff

7.13 Cellular Telephony Generations

7.14 GSM

7.15 GSM Cellular Architecture

7.16 GSM Radio Link

7.17 LTE

7.18 LTE Frame Structure

7.19 LTE Resource Allocation

7.20 Summary

Multiple Choice Questions

References

8. 5G Networks

8.1 Key 5G Targets

- 8.2 New Applications Enabled by 5G
- 8.3 5G Technologies
- 8.4 Non-Orthogonal Multiple Access (NOMA)
- 8.5 Full-duplex Wireless
- 8.6 Massive MIMO and 3D Beamforming
- 8.7 Mobile Edge Computing (MEC)
- 8.8 New Spectrum
- 8.9 Summary

Multiple Choice Questions

References

9. Internet of Things

- 9.1 What are Things?
- 9.2 Why IoT Now?
- 9.3 IoT Applications and Business Opportunities
- 9.4 Wireless Standards for IoT
- 9.5 Summary

Multiple Choice Questions

References

10. Bluetooth

- 10.1 Bluetooth History
- 10.2 Wireless Personal Area Networks
- 10.3 Bluetooth Market
- 10.4 Bluetooth Versions
- 10.5 Bluetooth Classic
- 10.6 Bluetooth Low Energy a.k.a. Bluetooth 4.0
- 10.7 Bluetooth 5
- 10.8 Bluetooth 5.3
- 10.9 Summary

Multiple Choice Questions

References

11. LoRa and LoRaWAN

- 11.1 LoRa
- 11.2 LoRa Frequencies
- 11.3 LoRa Modulation: Chirp Spread Spectrum
- 11.4 LoRa Networking with LoRaWAN
- 11.5 LoRa Device Classes

11.6 Summary

Multiple Choice Questions

References

12. Artificial Intelligence-assisted Wireless Networking

12.1 What is AI?

12.2 Why AI in Wireless Networks?

12.3 Applications of DL in Wireless Networks

12.4 Combating Pitfalls of Deep Learning

12.5 Summary

Multiple Choice Questions

References

13. Wireless Sensing

13.1 Motivation for Wireless Sensing

13.2 Principle of Wireless Sensing

13.3 Types of Sensing Signals

13.4 WiFi Sensing

13.5 Radar Sensing

13.6 Summary

Multiple Choice Questions

References

14. Aerial Wireless Networks

14.1 Non-terrestrial Networks

14.2 Air-to-ground Propagation and Path Loss

14.3 HAPS-based Aerial Networks

14.4 UAV-based Aerial Networks

14.5 Summary

Multiple Choice Questions

References