

Chapter III

Teaching and Learning Wi-Fi Networking Fundamentals Using Limited Resources

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ABSTRACT

Wi-Fi networking has been becoming increasingly popular in recent years, both in terms of applications and as the subject of academic research papers and articles in the IT press. It is important that students grasp the basic concepts of both Wi-Fi networking and wireless propagation measurements. Unfortunately, the underlying concepts of wireless networking often intimidate students with their apparently overwhelming complexity, thereby discouraging the students from learning in-depth this otherwise exciting and rewarding subject. This chapter provides a tutorial on Wi-Fi networking and radio propagation measurements using wireless laptops and access points. Various hands-on learning activities are also discussed.

LEARNING OBJECTIVES

After completing this chapter, you will be able to:

- Describe the architecture of Wi-Fi networks.
- Discuss the evolution of IEEE 802.11 standards.
- Set up Wi-Fi networks for class demonstration.
- Suggest future enhancements to the practical activities described in the chapter.

INTRODUCTION

In recent years, Wi-Fi networks (also called IEEE 802.11b) have been gaining in popularity, both in business and in home networking applications. With the growing proliferation of mobile equipment, this trend is likely to continue in the future. It is therefore important for students of information and telecommunication technologies to cover the fundamentals of wireless networking technologies as part of their curriculum.

Many people find that networking technology in general is somewhat arcane and difficult to understand. Similarly, the apparently overwhelming complexity of the underlying concepts of wireless networking often intimidates students. This perception can easily discourage the students from learning in-depth this otherwise exciting and rewarding subject.

This chapter attempts to overcome these problems by providing a hands-on introduction to Wi-Fi networking. A tutorial is also included to guide learners on how to set up Wi-Fi networks using relatively few computing resources. Although a host of problems are to be expected, given the technical limitations of commercially available hardware, students are encouraged to gain a hands-on learning experience in setting up Wi-Fi networks. The chapter also discusses the effectiveness, measured by student feedback, of Wi-Fi projects.

BACKGROUND AND MOTIVATION

Background

Nowadays business organizations rely heavily on computer networks for their operation. The trend towards mobile communication and computing drives the networking industry further towards wireless technology — particularly Wi-Fi technology. As explained later in this chapter, the term Wi-Fi refers to the IEEE 802.11 standard

for wireless LAN (WLAN). Therefore the terms Wi-Fi, IEEE 802.11, and WLAN are used interchangeably in this chapter.

Kaczman (2002) reports that an estimated 1 to 1.5 million Wi-Fi communication cards and Wi-Fi-enabled laptops were sold every month during 2002. Vaxevanakis et al. (2003) offer similar sales projections in their reports.

Wireless networks, especially the ones employing Wi-Fi technology, are gaining popularity not only in the business domain but also with home users (Vaxevanakis et al., 2003). The reasons for the popularity of wireless networks over the wired ones are highlighted below (Proxim, 1998):

- **Mobility:** Wireless LANs can provide users with real-time information within their organization without the restrictions inherent with physical cable connections.
- **Installation speed and simplicity:** The installation of wireless LANs does not involve the tedious work of pulling cables through walls and ceilings.
- **Installation flexibility:** Wireless LANs allow access from places unreachable by network cables.
- **Cost of ownership:** Overall installation expenses and life-cycle costs of wireless LANs are significantly lower than wired LAN. The discrepancy is even higher in dynamic environments requiring frequent moves and changes.
- **Scalability:** Wireless LANs can be configured relatively easily since no physical arranging of network cables is required.

Although wireless networks may never completely replace wired networks, they will gain in importance as business assets in the future. Howard (2002) reports that the use of wireless networks for mobile Internet access is also becoming big business, as is indicated by the rising number of wireless Internet service providers in the United States. The increasing number of public hotspots

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