Chapter XXIII
Co-Existence of WLAN and WPAN Communication Systems

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ABSTRACT

Recently applications and technologies utilizing the free industrial, scientific, and medical (ISM) band have grown exponentially. Mainly there are three dominant technologies operating at the ISM 2.4 GHz band, IEEE 802.11 b/g, Bluetooth and IEEE 802.15.4 or Zigbee. With the diverse deployment and broad range of applications running over such technologies, it is inevitable that radio channel interference between devices utilizing such technologies exist. In this chapter we focus on co-existence issues between such technologies and on the quantification of the impact of Bluetooth on IEEE 802.11b/g.

INTRODUCTION

The advances achieved recently in the field of data wireless networks facilitated the introduction of wireless local area networks (WLANs) almost everywhere—in schools, hospitals, homes, office buildings, and even military bases. WLANs can be used to replace wired LANs or to extend their infrastructure, providing more mobility and flexibility. Currently, not only laptops and desktops are equipped with WLAN interfaces, but many other devices such as PDAs, home appliances, and cell phones are as well. There are several WLAN standards developed by IEEE workgroups. The most widely used are the IEEE 802.11a, IEEE 802.11 b, and recently IEEE 802.11g. Table 1 summarizes technical aspects of these standards along with

other short-range wireless personal area network (WPAN) technologies such as Bluetooth and IEEE 802.15.4 or Zigbee.

There are many environments where WPAN devices can be found operating within the range of an installed WLAN network. An example of such environments could be a college campus, where students might be using Bluetooth to exchange information in an ad hoc fashion while others are connected to a WLAN network for Web browsing, taking an online exam, downloading files, or conducting office work. Another good example of a WPAN environment is a medical facility. In such an environment, many medical applications can be facilitated with the use of WLAN, Bluetooth, and Zigbee devices. For example, using their mobile devices equipped with a WLAN interface, physicians can electronically issue prescriptions while on rounds, immediately sending the prescription to the patient's choice of pharmacy while automatically checking for known allergies and conflicting medications. Another application is that physicians can electronically order detailed tests for their patients and securely view results as soon as they are available. As for Bluetooth and Zigbee, there are many applications that can apply in a medical facility. For example, Zigbee or Bluetooth wireless sensors can be used to monitor changes in patients' vital signs and alarm medical staff when needed. Moreover, Zigbee sensors in conjunction with WLAN can be used for location-aware services by automatically detecting the presence of a medical staff mobile device and updating it with needed records or updating the location server with the current medical staff location. Given the above examples, and there exist many more such examples, it becomes important to investigate the co-existence of WLAN and WPAN technologies within the same work space.

BACKGROUND

There has been a great interest among both industry and academia for research related to both WLAN and WPAN technologies. This section will briefly outline the characteristics of such technologies and discuss recent work done related to the co-existence of WLAN and WPAN networks.

IEEE 802.11

WLAN technologies as specified in IEEE 802.11 (1999) have been leading internal Internet dis-

Table 1. A comparison between the different WLAN and WPAN standards

Technology	Frequency Allocation	Maximum Distance	Modulation Techniques	Maximum Throughput	Numbers of RF Channels
802.11a	5GHz	Up to 50 meters	COFDM BPSK; QPSK; 16 QAM	Up to 54Mbps	5
802.11b	2.4GHz	Up to 100 meters	QPSK (CCK)	Up to 11 Mbps	11
802.11g	2.4GHz	Up to 100 meters	OFDM 64 + Legacy CCK	Up to 54Mbps	11
Bluetooth	2.4GHz	Up to 30 meters	GFSK	720Kbps	79
Zigbee	2.4 GHZ 868-868.6 MHZ 902-928 MHZ	Up to 30 meters	BPSK; OQPSK	250 Kbps; 40 Kbps	1; 10; 16