Chapter 3.18
Business and Technology Issues in Wireless Networking

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INTRODUCTION

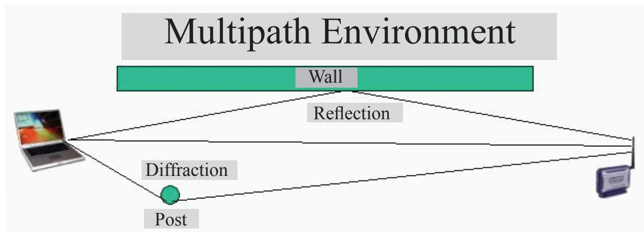
A major development in the enabling technologies for mobile computing and commerce is the evolution of wireless communications standards from the IEEE 802 series on local and metropolitan area networks. The rapid market growth and successful applications of 802.11, WiFi, is likely to be followed by similar commercial profitability of the emerging standards, 802.16e, WiMAX, and 802.20, WiMobile, both for network operators and users. This article describes the capabilities of these three standards and provides a comparative evaluation of features that impact their applicability to mobile computing and commerce. In particular, comparisons include the range, data rate in Mbps and ground speed in Km/h plus the availability of quality of service for voice and multimedia applications.

802.11 WiFi

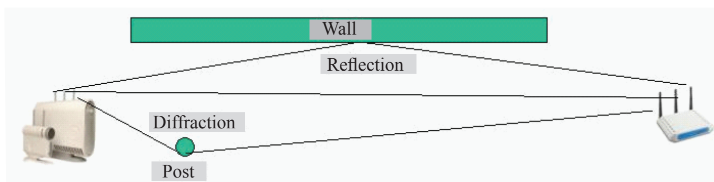
WiFi (IEEE, 1999a, 1999b, 1999c, 2003) was originally designed as a wireless equivalent of the wired local area network standard IEEE802.3, Ethernet. In fact there are many differences between the two technologies, but the packet formats are sufficiently similar that WiFi packets can easily be converted to and from Ethernet packets. Access points can therefore be connected using Ethernet and can communicate with end stations using WiFi.

WiFi can transport both real-time communications such as voice and video plus non-real time communications such as Web browsing, by providing quality of service, QoS, using 802.11e (IEEE, 2005). There are 2 QoS options. One provides four priority levels allowing real-time traffic to be transmitted ahead of non-real-time traffic, but with no guarantee as to the exact delay experienced by the real-time traffic. The other

Figure 1. (a) Receiver recovers a single signal from multiple incoming signals; (b) MIMO receiver recovers multiple signals using multiple antennas



(a)



(b)

allows the user to request a specific amount of delay, for example, 10 msecs., which may then be guaranteed by the access point. This is suited to delay sensitive applications such as telephony and audio/video streaming.

WiFi has a limited range of up to 100 metres, depending on the number of walls and other obstacles that could absorb or reflect the signal. It therefore requires only low powered transmitters, and hence meets the requirements of operating in unlicensed radio spectrum at 2.4 and 5 GHz in North America and other unlicensed bands as available in other countries.

WiFi is deployed in residences, enterprises and public areas such as airports and restaurants, which contain many obstacles such as furniture and walls, so that a direct line of sight between end-station and access point is not always possible, and certainly cannot be guaranteed when end stations are mobile. For this reason the technology is designed so that the receiver can accept multipath signals that have been reflected and/or diffracted between transmitter and receiver as shown in Figure 1(a). WiFi uses two technologies that operate well in this multipath environment: DSSS, Direct Sequence Spread Spectrum, which is used in 802.11b, and OFDM, Orthogonal Frequency Division Multiplexing, which is used in 802.11a and g (Gast, 2002). A key distinguishing factor between these alternatives, which is important to users, is spectral efficiency, that is, the data rate that can be achieved given the limited amount of wireless spectrum available in the unlicensed bands. DSSS as implemented in 802.11b uses 22 MHz wireless channels and achieves 11 Mbps, that is, a spectral efficiency of 11/22 = 0.5. OFDM achieves a higher spectral efficiency and is therefore making more effective use of the available wireless spectrum. 802.11g has 22 MHz channels and delivers 54 Mbps, for a spectral efficiency of 54/22 = 2.5 and 802.11a delivers 54 Mbps in 20 MHz channels, with a spectral efficiency of 54/20

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