

Wireless Networking for Small Businesses

Digital Networks Whitepaper

Wireless networking has become very popular in the small office environment, and for good reasons. The installation of a wireless network saves money compared to the costs of installing a wired network, but the return on investment is most evident in the increased productivity of the employees.

This whitepaper presents a summary of the various wireless networking technologies available today, the benefits of a wireless network for small businesses, and questions and concerns about current wireless technology in the company and in today's business environment. The whitepaper concludes with Digital Networks' wireless local area networking solution and sources for additional information.

Wired and Wireless Local Area Networks

Small businesses can rapidly appreciate and understand the value of setting up a computer network for their company. The ability for employees to share information found in files, databases, and email systems, the ability to share computer hardware resources such as printers, scanners, and servers are all efficient, and cost saving methods for sharing technology resources. These local area networks (LANs) transport company information, files, and applications over copper or fiber optic cable and hence are called wired LANs. A wireless local area network (WLAN) is the transmission of data or information over radio waves, without wires.

Wireless Network Examples

As an example, many real estate businesses will choose an historic building for their office

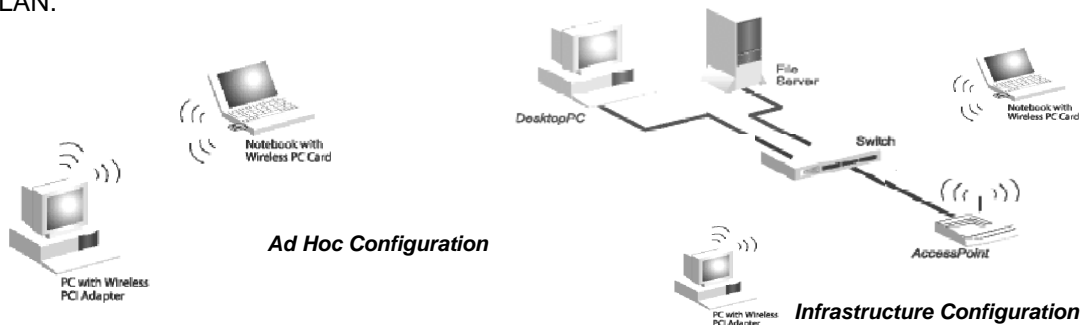
location. When setting up the network, contending with brick or possibly asbestos makes it undesirable to run cables through the walls. Choosing a wireless network easily solves this problem. A WLAN will also provide mobility for the agents to move from desk to conference room with their notebook computer, sharing property information with potential clients. Setting up a WLAN in the agents' home, completes the true benefit of mobility, from the desk to the conference room to whatever room in the home the agent wishes to review the day's activity.

Simplicity

WLAN's are mobile, simple, flexible, scalable and affordable. Location-independent users can access the network anywhere within the WLAN. Users can move from room-to-room and not lose connection with the network. Cable installation is not required; therefore a wireless installation is quick and easy. The only hardware you need to purchase is a wireless radio card and an access point. Typically, 1 access point will support the use of 20 - 50 wireless radio cards in PC's. As more and more wireless PC's are added to the WLAN, simply add another access point. The number of access points is determined by the network area you want to cover, then, plug radio cards into notebooks and/or install wireless adapters into desktops, and start networking. By using an access point in conjunction with radio cards, an instant network is created that integrates seamlessly with Ethernet LANs. A WLAN solution offers fast, reliable wireless connectivity with considerable cost savings over wired LANs.

Wireless LAN Configurations

A WLAN can be configured in two ways: *ad hoc* and *infrastructure*. An ad hoc WLAN consists of a group of computers each equipped with a radio card (PC card) connected via radio signals as an independent WLAN.



An integrated wired and wireless LAN is called an Infrastructure configuration. An Infrastructure WLAN consists of a group of wireless clients (PCs) and an access point that is directly connected to the wired LAN. Each wireless client in this group can talk to any other client in the same group via a radio link, or access other computers or network resources in the wired LAN infrastructure via the access point.

Moreover, moving or expanding the network is as easy as moving or installing additional access points. Sounds simple enough, but the following should be taken into consideration when purchasing WLAN product.

What to Know When Purchasing a Wireless Solution

Wireless Technology

Industry standards govern how wired networks work. Wireless technology also has a set of standards that define how the wireless products work. The following is a brief synopsis of the standards and numbers you will see or hear about when purchasing wireless products.

802.11

The IEEE (The Institute of Electrical and Electronics Engineers, Inc.) ratified this standard in 1997 and it specifies data rates and transmission types. 802.11 defines peak data rates of 2Mbps and transmission in either DSSS (Direct Sequence Spread Spectrum) or FHSS (Frequency Hopping Spread Spectrum), operating in the 2.4GHz frequency band. The standard also helped to maximize interoperability between vendors, which meant more flexibility for consumers to mix and match compliant products of their choice.

802.11b

The 802.11b standard is based on Direct Sequence Spread Spectrum (DSSS) with a

modulation technique called Complementary Code Keying (CCK) to increase speed from 2Mbps to 5.5 and 11 Mbps. It is backward compatible with DSSS 802.11 compliant products. It is not compatible with Frequency Hopping Spread Spectrum (FHSS) based products. As with 802.11, it also operates in the 2.4GHz frequency band.

802.11a

As with 802.11b, 802.11a was also ratified in 1999. Unlike 802.11b, 802.11a products are just now beginning to hit the market. 802.11a does not utilize DSSS or FHSS modulation, but uses a technique called OFDM (Orthogonal Frequency Division Multiplexing). Because of this change, 802.11a is not backward compatible with 802.11b, or, the earlier 802.11 products.

802.11a operates in the higher, less used frequency band of 5GHz. The standard calls for a peak data rate of 54 Mbps, although some vendors are claiming higher 'turbo' rates.

802.11a is not approved for use in Europe due to the European Telecommunications Standards Institute (ETSI) mandatory technical requirements: Dynamic Frequency Selection which permits devices to change channels to avoid interference and Transmission Power Control, which reduces power as a device gets closer to a base station.

Bluetooth

Bluetooth wireless technology has a data rate of up to 1 Mbps. It's designed to allow notebook PC's, Personal Digital Assistant (PDAs), cellular phones, and other devices to exchange data in a close-range (30 feet). Bluetooth products are more appropriate for a personal area network (PAN). Bluetooth operates in the 2.4GHz frequency range however it is not compatible and will not interoperate with other wireless vendor equipment that uses 802.11b or 802.11g standards.

You may hear about other standards: 802.11g and HiperLAN2; however, they are not commercially available at this time.

WLANs Technology Available Today

802.11b WLAN products have become the most widely accepted and implemented to date. 802.11a products are newly available at a higher price and, although the data rate of 54Mbps far exceeds the 11 Mbps of 802.11b, there's a trade-off with the operating range as a result. More 802.11a access points are required for the same coverage area that 802.11b access points can support. The decision to have an 802.11b or an 802.11a WLAN depends on the small businesses' network requirements. If a small business needs support for a large number of users per access point, and applications such as streaming video, voice communications and other bandwidth intensive programs, then 802.11a is a better choice. 802.11b will meet performance requirements very well if the users do not have very high performance requirements.

Security

802.11b is clearly the most popular wireless LAN standard. As part of the 802.11b standard, products must include a means of security called WEP. WEP stands for Wired Equivalent Privacy

and it adds encryption as a way of preventing others from seeing data as it is transmitted over radio waves and from preventing others' access to the network allowing free entry to the Internet. WEP uses either 40 or 128 bit encryption keys that must match between the access point and the wireless clients.

Initially, it was believed to be highly secure, from all but the most sophisticated of hackers. This is no longer true. However, all wireless standards share the same poor security. IEEE is working on an improved standard for WLAN security, but in the meantime, there are many steps that can be taken to enhance the security of a wireless network: Enable WEP and update frequently, configure complex SSID's, set MAC filters, use a firewall, use VPN.

The National Infrastructure Protection Center has published a document entitled, "Best Practices for Wireless Fidelity (802.11b) Network Vulnerabilities". This document is available at: <http://www.nipcc.gov/publications/nipccpub/nipccpub.htm>.

Range and Speed

WLAN products vary in operating range and data rate performance due to product design and environment.

Vendors will provide range and data rates in relationship to an open environment (such as a warehouse), semi-open environment (such as an office area of cubicles), and a closed environment (such as a typical office and home environment with floor-to-ceiling walls).

A data rate of 11 Mbps at an operating range of 150 feet in a semi-open office environment is typical with 802.11b products. Internet connections run at 1.5Mbps or less. Wireless is an ideal fit in a small office environment, where the primary concern is providing users access to the Internet.

Environment is key. As an example, radio waves travel very well through office walls. However, if a large aquarium were placed in between the access point and the client, the signal would not pass through. The water in the aquarium acts as a barrier to the radio waves.

Site surveys prior to installation are recommended for optimum performance.

Cost

802.11b access points range in price from \$100 to \$1000 depending upon features such as maximum number of users, management utilities, security. 802.11b radio cards generally fall in the \$100 range.

802.11a access points range in price from \$400 to over \$1000, also depending upon the same features. 802.11a radio cards range from \$150 to \$250.

Wireless LAN Technology	802.11	802.11b	802.11a	802.11g	802.11h	HiperLAN2	Bluetooth
Frequency	2.4 GHz	2.4 GHz	5 GHz	2.4 GHz	5 GHz	5 GHz	2.4 GHz
Modulation Technique	DHSS; FHSS	DSSS with CCK	OFDM	CCK-OFDM	OFDM	OFDM	FHSS
Data Rate	2Mbps	11Mbps	54Mbps	54Mbps	54Mbps	54 Mbps	1 Mbps
Typical Operating Range	500 feet 2Mbps	150 feet 11Mbps	25 ft 54Mbps				30 ft 1Mbps
Compatible with	802.11b, g	802.11, g	802.11h	802.11 b	802.11a		
Availability	Mid 90's	1999	Q3 2001	Q3 2002	Q3 2002	Q4 2002	Q1 2002

Digital Networks: DNwireless

Digital Networks offers the DNwireless 802.11b compliant wireless solution in its portfolio of networking products.

The DNwireless AP11 Access Point is an 11Mbps Wireless Ethernet Access Point providing easy, cost-effective WLAN connectivity. Included with the AP11 Access Point is a power injector. The power injector provides power to the AP11 Access Point over Category 5 cable. This eliminates the need for a power outlet where the access point is installed. This is a great advantage when the optimal placement of the access point does not coincide with a local AC power source. There's also an easy to use Windows utility that displays all the DNwireless AP11's connected to your LAN. The small size and attractive color make this solution ideal for the small business environment that operates out of the home.



The DNwireless RC11 Radio Card is an 802.11b compatible PCMCIA card, which fully supports high data rates at 11 Mbps, 5.5 Mbps, 2 Mbps and 1 Mbps over an Ethernet connection. It uses Direct Sequence

Spread Spectrum technology for resistance to interference. It's easy to install on any device with a PCMCIA type II slot. It has a built-in patch antenna and a power save mode extending the battery life of mobile devices. The software supports most operating systems. In a noisy environment the transmission rate automatically falls back to a lower data rate and will automatically move forward to the best data speed when available.

DNwireless is ideal for access to databases for mobile computer users, remote access, difficult-to-wire environments, dynamic environments, temporary LANs, small office and home office users who need a quick, easy and cost-effective installation of a wireless local area network.

For more information on Digital Networks and DNwireless, or to purchase our wireless products on-line, please visit our website at: <http://www.digitalnetworks.net/>

Radio Card



Power
Injector



Access Point

DNwireless