The Wireless LANs Page

By Joel B. Wood

This page discusses what a wireless LAN is, what products are out there to implement a wireless LAN, and has a list of many other sites where you can go to find more information on wireless.

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What is a wireless LAN?

In the last few years a new type of local area network has appeared. This new type of LAN, which is the wireless LAN, provides an alternative to the traditional LANs based on twisted pair, coaxial cable, and optical fiber. The wireless LAN serves the same purpose as that of a wired or optical LAN: to convey information among the devices attached to the LAN. But with the lack of physical cabling to tie down the location of a node on a network, the network can be much more flexible -- moving a wireless node is easy. As opposed to the large amount of labor required to add or move the cabling in any other type of network. Also going wireless may be a better choice where the physical makeup of the building makes it difficult or impossible to run wire in the building.

Wireless networks are ideal for portable computers. Using wireless connections allows portable computers to still be portable without sacrificing the advantages of being connected to a network. These machines can be setup virtually anywhere within the building.

Wireless networks can be used in combination with cabled LANs. In that all the machines that will require relative mobility will be connected wirelessly, while the stations that are for the most part permanant can be connected through cable.

Wireless LANs use one of three transmission techniques: spread spectrum, narrowband microwave, and infrared.

Spread Spectrum

Spread spectrum is currently the most widely used transmission technique for wireless LANs. It was initially developed by the military to avoid jamming and eavesdropping of the signals. This is done by spreading the signal over a range of frequencies, that consist of the industrial, scientific, and medical (ISM) bands of the electromagnetic spectrum. The ISM bands include the frequency ranges at 902 MHz to 928 MHZ and at 2.4 GHz to 2.484 GHz, which do not require an FCC license.

The first type of spread spectrum developed is known as **frequency hopping spread spectrum** . This technique broadcasts the signal over a seemingly random series of radio frequencies. A receiver, hopping between frequencies in synchronization with the transmitter, receives the message. The message can only be fully received if the series of frequencies is known. Because only the intended receiver knows the transmitter's hopping sequence, only that receiver can successfully receive all of the data. Most vendores develop their own hopping-sequence algorithms, which all but guarantees that two transmitters will not hop to the same frequency at the same time.

Even though the FCC has made some rules for frequency hopping spread spectrum technologies. The FCC dictates that the transmitters must not spend more than 0.4 seconds on any one channel every 20 seconds in the 902 MHz band and every 30 seconds in the 2.4-GHz band. Also, the transmitters must hop through at least 50 channels in the 902-MHz band and 75 channels in the 2.4-GHz band--a channel consists of a frequency width which is determined by the FCC. The IEEE 802.11 committee has drafted a standard that limits frequency hopping spread spectrum transmitter to the 2.4-GHz band.

The other type of spread spectrum communication is called **direct sequence spread spectrum** , or pseudonoise. This method seems to be the one that most wireless spread-spctrum LANs use. direct sequence transmitter spread their transmissions by adding redundant data bits called "chips" to them. Direct sequence spread spectrum adds at least ten chips to each data bit. Like a frequency hopping receiver, a direct sequence receiver must know a transmitter's spreading code to decipher data. This spreading code is what allows multiple direct sequence transmitters to operate in the same area without interference. Once the receiver has all of the data signal, it uses a correlator to remove the chips and collapse the signal to its original length.

As with frequency hopping spread spectrum, the FCC has also set rules for direct sequence transmitters. Each signal must have ten or more chips. This rule limits the practical raw data throughput of direct sequence transmitters to 2 Mbps in the 902-MHz band and 8Mbps in the 2.4-GHz band. Unfortunately, the number of chips is directly related to a signal's immunity to interference. In an area with lots of radio interference, you'll have to give up throughput to avoid interference. The IEEE 802.11 committee has drafted a standard of 11 chips for direct sequence spread spectrum.

Frequency hopping radios currently use less power than direct sequence radios and generally cost less. While direct sequence radios have a practical raw data rate of 8 Mbps and frequency hopping radios have a practical limit of 2 Mbps. So if high performance is key and interference is not a problem, go with direct sequencing. But if a small, inexpensive portable wireless adapter for a notebook or PDA is needed a the frequency hopping method should be good enough. With either method of spread spectrum the end result is a system that is extremely difficult to detect, does not interfere with other services, and still carries a large bandwidth of data.

Narrowband Microwave

Microwave technology is not really a LAN technology. It's main use is to interconnect LANs between buildings. This requires microwave dishes on both ends of the link. The dishes must be in line-of-sight to transmit and collect the microwave signals. Microwave is used to bypass the telephone company when connecting Lans between buildings.

One major drawback to the use of microwave technology is that the frequency band used requires licensing by the FCC. Once a license is granted for a particular location, that frequency band cannot be licensed to anyone else, for any purpose, within a 17.5 mile radius.

Infrared

Infrared LANs use infrared signals to transmit data. This is the same technology used in products like remote controls for televisions and VCRs. These LANs can be setup using either a point-to-point configuration or a sun-and-moon configuration where the signals are diffused by reflecting them off of some type of surface.

The major advantage of infrared is its ability to carry a high bandwidth, but its major disadvantage is that they can easily be obstructed, since light cannot pass through solid objects.

Wireless LAN Transmission Techniques

	Spread Spectrum	Narrowband Microwave	Infrared
Frequency	902MHz to 928 MHz ; 2.4 GHz to 2.4385 GHz ; 5.725 GHz to 5.825 GHz	18.825 GHz to 19.205 GHz	3 x 10^14 Hz
Maximum coverage	105 to 800 feet, or up to 50,000 square feet	40 to 130 feet, or up to 5000 square feet	30 to 80 feet

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What products are available?

Quick Reference

AirShare AirLAN AIRplex AltAir FreePort InfraLAN LAWN PARCTAB RadioLink RangeLAN RoamAbout WaveLAN

Table of Specifications

Spread Spectrum Technologies

AirLAN
: AirLAN by Solectek is based on radio technology originally developed by NCR Corp. Except for its parallel-port Wireless LAN adapter, Solectek's technology is based on OEM products from AT&T and Digital and has an advertised speed of 2 Mbps.

Altair
: Motorola offers this LAN choice that operates in the 18 GHz range which is licensed to Motorola by the FCC. The Altair system runs at speeds of up to 10 MBps, and is limited by license to five channels for a 17.5-mile radius. Since Motorola controls the licenses they can better manage the interference potential.

AIRplex Cordless Modems
: A new catagory of PCMCIA 28.8 modems have been developed which are similar to conventional modems but require no cord to connect to the telephone line. The idea is to permit you to use your notebook freely without being tied to your desk. They also permit multiple users in an office to easily share an analog telephone line. New wireless technology (AIRplex) is used which permits use of these modems in every room in a large building without mutual interference.

RangeLAN
: The RangeLAN2/PCMClA ($695) operates at distances of up to 500 feet in standard office environments and up to 1000 feet in open spaces. Based on frequency-hopping spread-spectrum technology in the 2.4 GHz to 2.4835 GHz bandwidth, the wireless adapter has a data rate of 1.6 Mbps. The unit's average power output is 100 mW. With the RangeLAN2/PCMClA, as many as 15 independent wireless LANs can operate within the same physical space.

RoamAbout
: The RoamAbout PCMCIA Network Adapter is a PC Network Interface Card (NIC) for wireless LANs. The Network Adapter operates in a PC with a Type II PCMCIA slot that conforms to the PCMCIA release V2.01 specification. An antenna is externally connected via an 18" (0.5 meter) cable. The RoamAbout PCMCIA Network Adapter communicates with the RoamAbout PCMCIA Network Adapter in other portable computers, the WaveLAN NIC in stationary computers, or the RoamAbout Access Point for connectivity to the wired network.

WaveLAN
: A premier spread-spectrum network system manufactured by NCR Corporation. This is a 2Mbps network system that utilizes a proprietary protocol. WaveLAN also uses a robust error-checking protocol that can detect and correct most transmission errors, and a data-encryption option that makes the network highly resistant to electronic eavesdropping.

Wireless LAN Products

Company	Product	Infrared/Radio	Frequency	Advertised Speed	Advertised Distance
AT&T	WaveLAN	No/Yes	902 MHz to 928 MHz	2 Mbps	800 feet
California Microwave	RadioLink	No/Yes	902 MHz to 928 MHz	???	???
Digital	RoamAbout	No/Yes	902 MHz to 928 MHz	2 Mbps	800 feet
IBM	Infrared Wireless LAN Adapter	Yes/No	N/A	1 Mbps	17' X 17' room (integrated PC Card) 30' X 30' room (tethered transceiver)
InfraLAN Technologies	InfraLAN	Yes/No	N/A	10 Mbps	90 feet
Motorola	Altair	No/Yes	18 GHz*	???	???
NCR	WaveLAN	No/Yes	902 MHz to 928 MHz	2 Mbps	800 feet
O'Neill Communications	LAWN	No/Yes	902 MHz to 928 MHz	???	???
Photonics	Wide Area and Point-to-Point products	Yes/No	N/A	1 Mbps	20' X 20' room (integrated PC Card) 25' X 25' room (tethered transceiver)
Proxim, Inc.	RangeLAN	No/Yes	902 MHz to 928 MHz	???	???
Solectek	AirLAN	No/Yes	902 MHz to 928 MHz	2 Mbps	800 feet
Traveling Software and National Semiconductor	AirShare	No/Yes	902 MHz to 928 MHz	No	Portable to desktop
Windata, Inc.	FreePort	No/Yes	2.4 GHz & 5.8 GHz	5.7 Mbps	260 feet
Xerox	PARCTAB	Yes/No	N/A	9.6Kbps, 19.2Kbps, 38.4Kbps	30' X 30' room

*** Frequency use requires a FCC license**

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Standard protocols for wireless networks

IEEE 802.11

802.11 uses a contention mechanism to allow stations to share a wireless channel, based on carrier-sense multiple access (CSMA), like 802.3. 802.11 cannot use all of 802.3 because it is not possible in the wireless environment for a station to listen and transmit on the same channel as would be required for the collision detection (CD) used in 802.3. Because of this a statin on a wireless LAN will not be able to determine that

Other Wireless Related Sites

Hiperlan/Netplan
: Hiperlan is a coming ETSI standard for 20 Mbit/sec wireless LANS at 15,7 GHz. Torben Rune at Netplan was Project Team Leader of PT41, the ETSI project team responsible for defining Hiperlan. Netplan is a danish consultant company in the field of tele and datacommunications. On our Web server you find articles among others about wireless computing. We contribute to the ITU Telecom 95 with a paper on Wireless LANs. The paper is also on our Web server.

Multipoint Networks
: Multipoint Networks designs and manufactures wireless data communications systems for metropolitan area networks.

Shiva

Wireless faq
: Faq from the wireless newsgroup

Wireless LAN Group

Wireless Newsgroup: comp.std.wireless

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