

Local area networks (lans)

Technology



They are Local Area Networks (LANs) that use electromagnetic airwaves as their transmission medium. Instead of the technical issues associated with twisted-pair, Co-axial and fiber-optic wires, the organization must adapt to the differences of radio based communication.

The basic components of an 802. 11 WLAN (wireless LAN) include one or more stations and an AP (access point). A station is usually a laptop with a wireless Network interface card. An AP provides the wireless link between the stations and a wired LAN, or it may only relay packets from one station to another. The 802. 11 standard supports three methods using the physical layer for transmitting data through space. One uses infrared light, and the other two-use spread-spectrum-radio (radio frequency).

Radio: (penetrates indoor walls & surfaces)

Wideband / Spread Spectrum:

1. FHSS (Frequency Hopping)
2. DSSS (Direct Sequence)
3. Infrared (blocked by solid objects)

The FHSS (frequency-hopping spread-spectrum):

Has the advantage of a relatively simple design, but it has an upper bandwidth of only 2 Mbps under FCC rules in the U. S. Because FHSS does not support data rates greater than 2 Mbps it is not used in the IEEE standard, 802. 11b.

The DSSS (direct-sequence spread-spectrum):

This method allows for much higher data rates by dividing the 2.4-GHz band into 14 22 MHz channels. In DSSS, the data is encoded into redundant bit patterns, or "chips." When a chip is transmitted, the total power of the DSSS signal is spread across one of the 22-MHz channels. The chip encoding and spread-spectrum techniques provide data redundancy in DSSS radios. The 1 Mbps DSSS data rate uses BPSK (binary-phase-shift-keying) modulation. The 2-Mbps data uses QPSK (quadrature-phase-shift-keying) modulation. The 802.11b standard also uses QPSK modulation for the 5.5- and 11-Mbps data rates, but it uses a more sophisticated encoding technique, CCK (complementary-code keying), that increases a radio receiver's ability to distinguish encoded bits in the presence of interference. When interference or range becomes too great for 11-Mbps operation, the 802.11b specifications allow the transceiver's data rate to fall back to 5.5, 2, or 1 Mbps. Negatively speaking, DSSS uses more power and is more costly to build.

Infrared:

Infrared technology is limited because transmission must be within line of sight. Infrared (IR) systems use very high frequencies, just below visible light in the electromagnetic spectrum, to carry data. Inexpensive directed systems provide very limited range (3 ft) and typically are used only for personal area networks. Diffuse IR wireless LAN systems do not require line-of-sight, but cells are limited to individual rooms. Most people can relate to this problem because they are familiar with remote control devices for television and videocassette recorders.

How They Operate: 802.11 Standard MAC Layer specifications:

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One level up from the physical layer in the OSI (Open Systems Interconnection) stack

is the MAC (medium-access control). The 802.11b MAC is based on the 802.3

(Wired-Ethernet) MAC but has some important differences. An 802.3 LAN uses a CSMA/CD (carrier-sense-multiple-access/collision-detection) protocol. This protocol requires a station to first sense the LAN to determine whether another station is broadcasting. If a station does not detect other transmissions, it may begin its transmission. When a station transmits, it also listens to detect whether its transmission is being corrupted by another station's transmission. If a collision occurs, the process is repeated. To guarantee that the transmission was successful, the receiving station sends an acknowledgment packet back to the sender. If it does not receive the packet, the sender assumes that the receiver did not successfully receive the sender's packet or that the acknowledgment was lost. Either way, the sender repeats the transmission process until it receives an acknowledgment.

Antenna Considerations:

Carefully designing your antenna and selecting its location can go a long way toward mitigating the effects of multipath distortion. The "antenna-diversity" technique uses two antennas spaced so that a receiver can demodulate the stronger signal and reject the weaker. Depending on your application, you may want to use a directional antenna to increase range. In most cases, an omnidirectional antenna is used to get the best broadest coverage. The

antenna location is also critical. Experimenting with various antenna locations will maximize throughput and range.

Evolution:

In Sept. 1999 - 802. 11b (" Wi-Fi") extension was standardized by IEEE; providing for 11 Mb/sec using DSSS technology in the 2. 4 GHz band. Products are now available using this 802. 11b standard. The IEEE also ratified 802. 11a that will use the 5 Hz band to support data rates from 6 Mb/sec to 54 Mb/sec sharing the same wireless LAN MAC protocol as Wi-Fi.

802. 11 Issues Interoperability:

The IEEE 802. 11B specification enables engineers to build high-speed, wireless

LANs based on a common standard. To ensure that equipment from one vendor

inter-operates with equipment from another, several companies founded WECA

(Wireless Ethernet Compatibility Alliance) to certify 802. 11b compatibility.

Ninety three products have earned the Wi-Fi (Wireless Fidelity) logo, which is WECA's branded name for IEEE 802. 11b Even if your 802. 11 radio is a standalone design, it still has to operate in the presence of other devices, such as Bluetooth and Home RF radios, cordless phones, and microwave ovens, using the 2. 4-GHz band. Microwave ovens use this band because one of the excitation frequencies of water is approximately 2. 4 GHz. The goal is to allow interoperability at the Physical layer. Interoperability at

Physical/MAC layer is an issue, you can't use FHSS card with a DSSS access point but you can use the older 2 Mb/sec DSSS card with the new 802. 11b access point.

Coverage:

Distance is a function of the product design and propagation path. The radius can be less than 30 meters or more than 100 meters depending on this criteria. Throughput was originally 1-2 Mb/sec; but has increased in the new standard 802. 11b to 1, 2, 5. 5, 11 Mb/sec.

Scalability:

The number of clients on each access point depends on number and nature of transmissions (between 15-50 clients).

Roaming:

Microcells used in wireless networks are similar to cellular telephone systems. Users get "handed off" through the wired net as they roam. A group of leading vendors is working to iron out the technical and financial details needed to let mobile wireless LAN users connect to almost any wireless ISP, similar to the way cell phone users can roam and use multiple carriers to complete calls. The Wireless Ethernet Compatibility Alliance (WECA), which includes Cisco, IBM, Intel, 3Com and Microsoft, is looking to create relationships and network standards among WISPs and eventually carriers that will enable roaming for 802. 11b wireless LAN users. These standards will let vendors share subscriber usage and billing data, so no matter how many different ISPs' subscribers are used to make a connection from a plane, train or automobile, they only get one bill from their home

ISP1. Wireless roaming is still an active issue. There are new IAPP products just coming out which is the driving force for " Open Air".

Alternative Wireless Technologies:

Home RF (3COM)

Home RF is a newer standard, developed exclusively for home networking equipment. Wi-Fi and Home RF are different radio-based technologies for wireless home networking. They both use radio signals in the 2.4 GHz frequency band to wirelessly link computers. The wireless network is designed to use different frequencies than those used by your cordless phone. The technology used to divide up shared bandwidth is frequency division multi-plexing (FDM). This technique divides up the total bandwidth into different frequency bands, called channels, using frequency-selective filters. These channels can transmit analog voice, and digital information (including data, audio, and video).

1 http://www.cisco.com/warp/public/cc/pd/witc/ao350ap/prodlit/glsdt_ai.htm