Improvised Internal Wireless Communication in University Library

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Abstract

This paper presents a brief view of the WLAN technology, its characteristic features, the technical structure of WLAN and the benefits. It provides the technical standards for WLAN and the adaptability of WLAN. It presents a model for the application of WLAN technology for the University Library.

Keywords : Wireless Technology, Wireless Networks, WLANs

0. Introduction

A wireless LAN (WLAN) is a flexible data communication system implemented as an extension to, or as an alternative for, a wired LAN within a building or campus. Using electromagnetic waves, WLANs transmit and receive data over the air, minimizing the need for wired connections. WLANs combine data connectivity with user mobility, and, through simplified configuration, enable movable LANs. Nowadays WLANs are becoming more widely recognized as a general-purpose connectivity alternative for a broad range of business customers.

1. Applications for Wireless LANs

Wireless LANs can be an augmenting device for wired LAN networks-often providing the final few meters of connectivity between a backbone network and the mobile user. Some of tge applications of WLAN are

- Hospitals where Doctors and nurses in hospitals can access patient information instantly.
- Companies or Firms where Consulting or accounting audit engagement teams or small workgroups increase productivity with quick network setup.
- Network managers in dynamic environments minimize the overhead of moves, adds, and changes with wireless LANs, thereby reducing the cost of LAN ownership.
- Training sites at corporations and students at universities use wireless connectivity to facilitate access to information, information exchanges, and learning.
- Warehouse workers use wireless LANs to exchange information with central databases and increase their productivity.
- Educational Institutions to have easy access and share information

2. Benefits of WLANs

Wireless LANs offer productivity, service, convenience, and cost advantages over traditional wired networks:

- Mobility-Wireless LAN systems can provide LAN users with access to real-time information anywhere in their organization.
- Installation Speed and Simplicity-Installing a wireless LAN system can be fast and easy and can eliminate the need to pull cable through walls and ceilings.

- Installation Flexibility-Wireless technology allows the network to go where wire cannot go.
- Reduced Cost-of-Ownership-While the initial investment required for wireless LAN hardware can be higher than the cost of wired LAN hardware, overall installation expenses and life-cycle costs can be significantly lower. Long-term cost benefits are greatest in dynamic environments requiring frequent moves, adds, and changes.
- Scalability-Wireless LAN systems can be configured in a variety of topologies to meet the needs of specific applications and installations. Configurations are easily changed and range from peer-to-peer networks suitable for a small number of users to full infrastructure networks of thousands of users that allows roaming over a broad area.

3. Wireless LAN Technology

The important technologies used by WLAN are

- Spread spectrum
- Narrowband Technology
- Frequency-Hopping Spread Spectrum Technology
- Direct-Sequence Spread Spectrum Technology
- Infrared Technology

3.1 Spread Spectrum

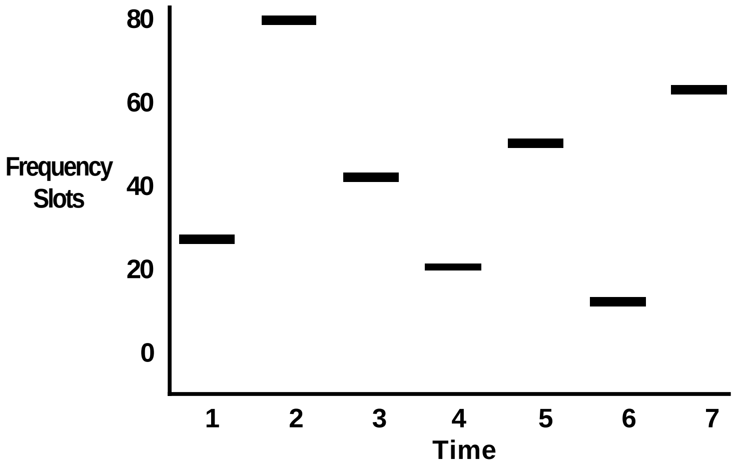
Spread-spectrum technology is a wideband radio frequency technique developed by the military for use in reliable, secure, mission-critical communications systems. Spread-spectrum is designed to trade off bandwidth efficiency for reliability, integrity, and security. If a receiver is not tuned to the right frequency, a spread-spectrum signal looks like background noise. There are two types of spread spectrum radio: frequency hopping and direct sequence.

3.2 Narrowband Technology

A narrowband radio system transmits and receives user information on a specific radio frequency. Narrowband radio keeps the radio signal frequency as narrow as possible just to pass the information. Undesirable crosstalk between communications channels is avoided by carefully coordinating different users on different channel frequencies. A private telephone line is much like a radio frequency. The radio receiver filters out all radio signals except the ones on its designated frequency.

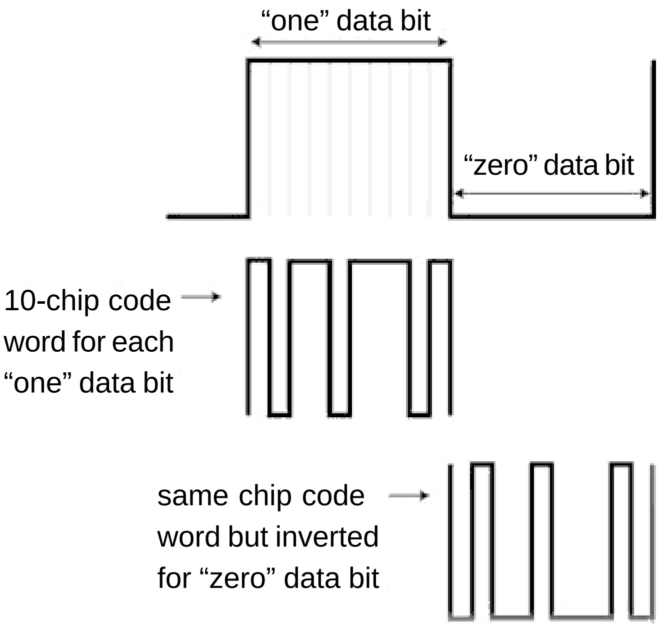
3.3 Frequency-Hopping Spread Spectrum Technology

Frequency-hopping spread-spectrum (FHSS) uses a narrowband carrier that changes frequency in a pattern known to both transmitter and receiver. Properly synchronized, the net effect is to maintain a single logical channel. To an unintended receiver, FHSS appears to be short-duration impulse noise.



3.4 Direct-Sequence Spread Spectrum Technology

Direct-sequence spread-spectrum (DSSS) generates a redundant bit pattern for each bit to be transmitted. This bit pattern is called a chip (or chipping code). The longer the chip, the greater the probability that the original data can be recovered (and, of course, the more bandwidth required). Even if one or more bits in the chip are damaged during transmission, statistical techniques embedded in the radio can recover the original data without the need for retransmission. To an unintended receiver, DSSS appears as low-power wideband noise and is rejected (ignored) by most narrowband receivers.



3.5 Infrared Technology

Infrared (IR) systems use very high frequencies, just below visible light in the electromagnetic spectrum, to carry data. Like light, IR cannot penetrate opaque objects; it is either directed (line-of-sight) or diffuse technology.

4. WLANs and other Wireless Technologies

Wireless LANs use electromagnetic airwaves (radio and infrared) to communicate information from one point to another without relying on any physical connection. The data being transmitted is superimposed on the radio carrier so that it can be accurately extracted at the receiving end. Once data is superimposed (modulated) onto the radio carrier, the radio signal occupies more than a single frequency, since the frequency or bit rate of the modulating information adds to the carrier.

Multiple radio carriers can exist in the same space at the same time without interfering with each other if the radio waves are transmitted on different radio frequencies. To extract data, a radio receiver tunes in (or selects) one radio frequency while rejecting all other radio signals on different frequencies.

In a typical WLAN configuration, a transmitter/receiver (transceiver) device, called an access point, connects to the wired network from a fixed location using standard Ethernet cable. At a minimum, the access point receives, buffers, and transmits data between the WLAN and the wired network infrastructure. A single access point can support a small group of users and can function within a range of less than one hundred to several hundred feet. The access point (or the antenna attached to the access point) is usually mounted high but may be mounted essentially anywhere that is practical as long as the desired radio coverage is obtained.

End users access the WLAN through wireless LAN adapters, which are implemented as PC cards in notebook computers, or use ISA or PCI adapters in desktop computers, or fully integrated devices within hand-held computers. WLAN adapters provide an interface between the client network operating system (NOS) and the airwaves (via an antenna). The nature of the wireless connection is transparent to the NOS.

4.1 Range/Coverage

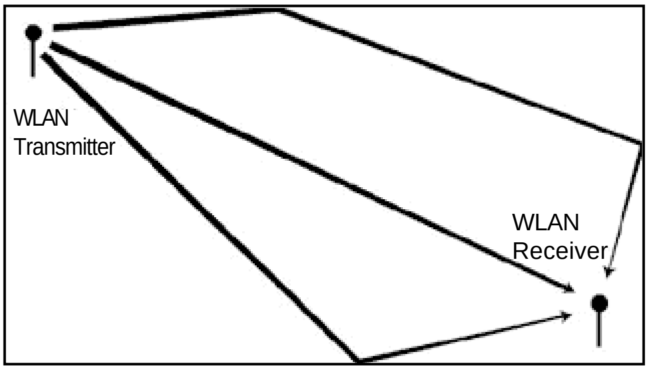
The distance over which RF waves can communicate is a function of product design (including transmitted power and receiver design) and the propagation path, especially in indoor environments. Most wireless LAN systems use RF because radio waves can penetrate many indoor walls and surfaces. The range (or radius of coverage) for typical WLAN systems varies from under 100 feet to more than 500 feet. Coverage can be extended, and true freedom of mobility via roaming, provided through microcells.

4.2 Throughput

As with wired LAN systems, actual throughput in wireless LANs is dependent upon the product and how it is configured. Factors that affect throughput include airwave congestion (number of users), propagation factors such as range and multipath, the type of WLAN system used, as well as the latency and bottlenecks on the wired portions of the WLAN. Typical data rates range from 1 to 11 Mbps.

4.3 Mulitpath Effects

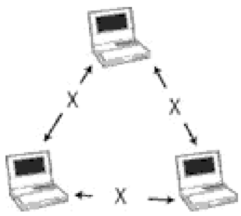
A radio signal can take multiple paths from a transmitter to a receiver, an attribute called multipath. Reflections of the signals can cause them to become stronger or weaker, which can affect data throughput.

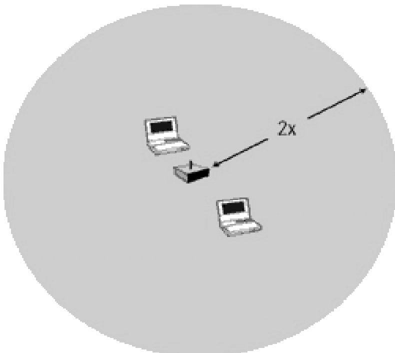


5. WLAN Configurations

5.1 Independent WLANs

The simplest WLAN configuration is an independent (or peer-to-peer) WLAN that connects a set of PCs with wireless adapters. Any time two or more wireless adapters are within range of each other, they can set up an independent network. These on-demand networks typically require no administration or preconfiguration. Access points can extend the range of independent WLANs by acting as a repeater, effectively doubling the distance between wireless PCs.

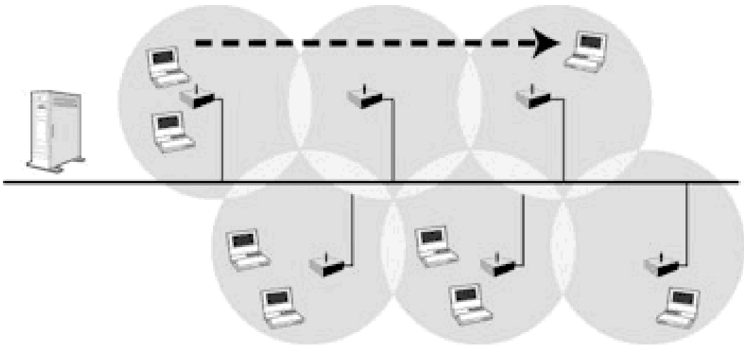




x = distance between any two systems

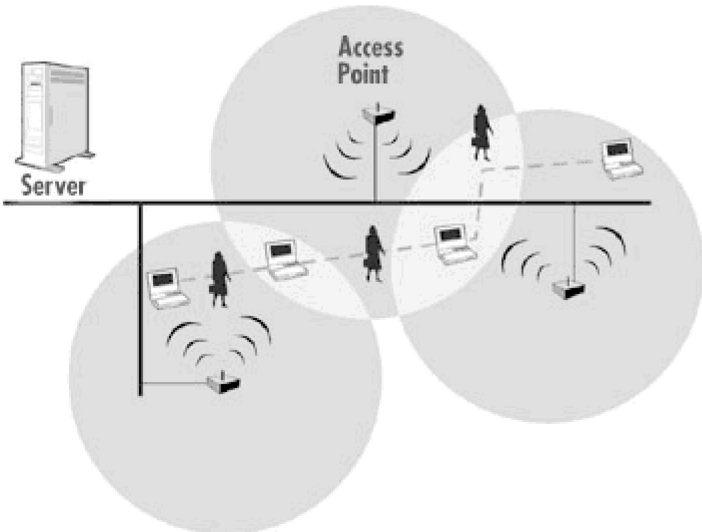
5.2 Infrastructure WLANs

In infrastructure WLANs, multiple access points link the WLAN to the wired network and allow users to efficiently share network resources. The access points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood. Multiple access points can provide wireless coverage for an entire building or campus.



5.3 Microcells and Roaming

Wireless communication is limited by how far signals carry for given power output. WLANs use cells, called microcells, similar to the cellular telephone system to extend the range of wireless connectivity. At any point in time, a mobile PC equipped with a WLAN adapter is associated with a single access point and its microcell, or area of coverage. Individual microcells overlap to allow continuous communication within wired network.



6. Wireless Lan Standards

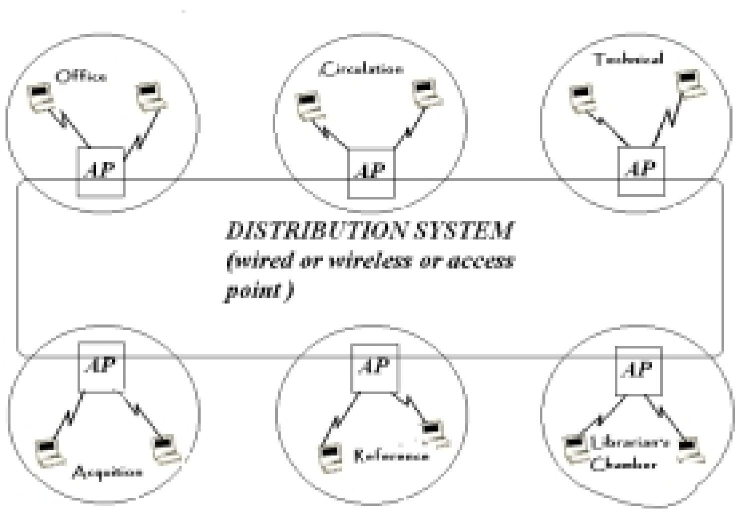
6.1 IEEE 802.11 Layers

The IEEE 802.11 standard places specifications on the parameters of both the physical (PHY) and medium access control (MAC) layers of the network. The PHY layer, which actually handles the transmission of data between nodes, can use either direct sequence spread spectrum, frequency-hopping spread spectrum, or infrared (IR) pulse position modulation. IEEE 802.11 makes provisions for data rates of either 1 Mbps or 2 Mbps, and calls for operation in the 2.4 - 2.4835 GHz frequency band (in the case of spread-spectrum transmission), which is an unlicensed band for industrial, scientific, and medical (ISM) applications, and 300 - 428,000 GHz for IR transmission. Infrared is generally considered to be more secure to eavesdropping

The MAC layer is a set of protocols which is responsible for maintaining order in the use of a shared medium. The 802.11 standard specifies a carrier sense multiple access with collision avoidance (CSMA/CA) protocol. In this protocol, when a node receives a packet to be transmitted, it first listens to ensure no other node is transmitting. If the channel is clear, it then transmits the packet. Otherwise, it chooses a random "backoff factor" which determines the amount of time the node must wait until it is allowed to transmit its packet.

Whenever a packet is to be transmitted, the transmitting node first sends out a short ready-to-send (RTS) packet containing information on the length of the packet. If the receiving node hears the RTS, it responds with a short clear-to-send (CTS) packet. After this exchange, the transmitting node sends its packet. When the packet is received successfully, as determined by a cyclic redundancy check (CRC), the receiving node transmits an acknowledgment (ACK) packet.

7. WLAN in Academic Library environment – a model



8. Conclusions

Wireless data technologies have been proven through more than fifty years of wireless application in both commercial and military systems. While radio interference can cause degradation in throughput, such interference is rare in the workplace. Robust designs of proven WLAN technology and the limited distance over which signals travel result in connections that are far more robust than cellular phone connections and provide data integrity performance equal to or better than wired networking.

9. References

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