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Analysis Study of Wireless Technology and its Communication Standards Using IEEE 802.11

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ABSTRACT:As technology advances in society the need for wired and wireless networking has become essential. Each of these types of networking has their advantages and disadvantages according to security. Wired networking has different hardware requirements and the range and benefits are different. Wireless networking takes into consideration the range, mobility, and the several types of hardware components needed to establish a wireless network. As you read on you will understand different types of configurations of networks and the security measures that need to be taken to ensure a secure network.

KEYWORDS : MIMO, FM, AFM, Zigbee, WI-MAX

1. INTRODUCTION

The term wireless communication was introduced in the 19th century and wireless communication technology has developed over the subsequent years. It is one of the most important mediums of transmission of information from one device to other devices. In this technology, the information can be transmitted through the air without requiring any cable or wires or other electronic conductors, by using electromagnetic waves like IR, RF, satellite, etc[6]. In the present days, the wireless communication technology refers to a variety of wireless communication devices and technologies ranging from smart phones to computers, tabs, laptops, Bluetooth Technology, printers. This article gives an overview of wireless communication and types of wireless communications.

The term wireless refers to the communication or transmission of information over a distance without requiring wires, cables or any other electrical conductors. Wireless communication is one of the important mediums of transmission of data or information to other devices. The Communication is set and the information is transmitted through the air, without requiring any cables, by using electromagnetic waves like radio frequencies, infrared, satellite, etc., in a wireless communication technology network.

It's a fast and rapid technology used for communication in worldwide using IEEE 802.11a, b, g standards, to increase the stability of networks production together. The present days, wireless communication system has become an essential part of various types of wireless communication devices that permits user to communicate even from remote operated areas. There are many devices used for wireless communication like mobiles. Cordless telephones, Zigbee [HYPERLINK "https://www.elprocus.com/what-is-zigbee-technology-architecture-and-its-applications/"](https://www.elprocus.com/what-is-zigbee-technology-architecture-and-its-applications/) [HYPERLINK "https://www.elprocus.com/what-is-zigbee-technology-architecture-and-its-applications/" wirelss](https://www.elprocus.com/what-is-zigbee-technology-architecture-and-its-applications/) [HYPERLINK "https://www.elprocus.com/what-is-zigbee-technology-architecture-and-its-applications/" technology](https://www.elprocus.com/what-is-zigbee-technology-architecture-and-its-applications/), GPS, Wi-Fi, satellite television and wireless computer parts. Current wireless phones include 3 and 4G networks, Bluetooth and Wi-Fi technologies.

IEEE (Institute of Electrical and Electronics Engineers) established the 802.11 group in 1990.

Initial speeds were 1 and 2 Mbps.

IEEE modified the standard in 1999 to include 802.11a and b. 802.11g was added in 2003.

802.11 equipment first available, then a, followed by g.

WIRELESS STANDARDS

Home and business owners looking to buy networking gear face an array of choices. Many products conform to the *802.11a*, *802.11b/g/n*, and/or *802.11ac* wireless standards collectively known as Wi-Fi technologies[2][3].



(Bluetooth and various other wireless (but not Wi-Fi) technologies also exist, each designed for specific networking applications.

This article describes the Wi-Fi standards and related technologies, comparing and contrasting them to help you better understand the evolution of Wi-Fi technology and make educated network planning and equipment buying decisions.

802.11

In 1997, the Institute of Electrical and Electronics Engineers (IEEE) created the first WLAN standard. They called it *802.11* after the name of the group formed to oversee its development. Unfortunately, 802.11 only supported a maximum network bandwidth of 2 Mbps - too slow for most applications. For this reason, ordinary 802.11 wireless products are no longer manufactured.

802.11b

IEEE expanded on the original 802.11 standard in July 1999, creating the *802.11b* specification. 802.11b supports bandwidth up to 11 Mbps, comparable to traditional Ethernet.

802.11b uses the same unregulated radio signaling frequency (2.4 GHz) as the original 802.11 standard. Vendors often prefer using these frequencies to lower their production costs. Being unregulated, 802.11b gear can incur interference from microwave ovens, cordless phones, and other appliances using the same 2.4 GHz range. However, by installing 802.11b gear a reasonable distance from other appliances, interference can easily be avoided.

- Pros of 802.11b - Lowest cost; signal range is good and not easily obstructed
- Cons of 802.11b - Slowest maximum speed; home appliances may interfere on the unregulated frequency band

802.11a

While 802.11b was in development, IEEE created a second extension to the original 802.11 standard called *802.11a*.

Because 802.11b gained in popularity much faster than did 802.11a, some folks believe that 802.11a was created after 802.11b. In fact, 802.11a was created at the same time. Due to its higher cost, 802.11a is usually found on business networks whereas 802.11b better serves the home market.

802.11a supports bandwidth up to 54 Mbps and signals in a regulated frequency spectrum around 5 GHz. This higher frequency compared to 802.11b shortens the range of 802.11a networks. The higher frequency also means 802.11a signals have more difficulty penetrating walls and other obstructions.

Because 802.11a and 802.11b utilize different frequencies, the two technologies are incompatible with each other. Some vendors offer hybrid *802.11a/b* network gear, but these products merely implement the two standards side by side (each connected devices must use one or the other).

- Pros of 802.11a - Fast maximum speed; regulated frequencies prevent signal interference from other devices.
- Cons of 802.11a - Highest cost; shorter range signal that is more easily obstructed.

802.11g

In 2002 and 2003, WLAN products supporting a newer standard called *802.11g* emerged on the market. 802.11g attempts to combine the best of both 802.11a and 802.11b.

802.11g supports bandwidth up to 54 Mbps, and it uses the 2.4 GHz frequency for greater range. 802.11g is backward compatible with 802.11b, meaning that 802.11g access points will work with 802.11b wireless network adapters and vice versa.

- **Pros of 802.11g** - Fast maximum speed; signal range is good and not easily obstructed.
- **Cons of 802.11g** - Costs more than 802.11b; appliances may interfere on the unregulated signal frequency.

802.11n

802.11n (also sometimes known as "Wireless N") was designed to improve on 802.11g in the amount of bandwidth supported by utilizing multiple wireless signals and antennas (called *MIMO* technology) instead of one. Industry standards groups ratified 802.11n in 2009 with specifications providing for up to 300 Mbps of network bandwidth. 802.11n also offers somewhat better range over earlier Wi-Fi standards due to its increased signal intensity, and it is backward-compatible with 802.11b/g gear.

- **Pros of 802.11n** - Fastest maximum speed and best signal range; more resistant to signal interference from outside sources.
- **Cons of 802.11n** - Standard is not yet finalized; costs more than 802.11g; the use of multiple signals may greatly interfere with nearby 802.11b/g based networks.

802.11ac

The newest generation of Wi-Fi signaling in popular use, 802.11ac utilizes dual-band wireless technology, supporting simultaneous connections on both the 2.4 GHz and 5 GHz HYPERLINK "<https://www.lifewire.com/is-5-ghz-wifi-better-than-2-4-ghz-818293>" Wi- HYPERLINK "<https://www.lifewire.com/is-5-ghz-wifi-better-than-2-4-ghz-818293>" Fi bands. 802.11ac offers backward compatibility to 802.11b/g/n and bandwidth rated up to 1300 Mbps on the 5 GHz band plus up to 450 Mbps on 2.4 GHz.

II. TECHNOLOGY AND ITS TYPES**Bluetooth Technology**

Bluetooth technology allows you to connect a variety of different electronic devices wirelessly to a system for the transfer and sharing of data and this is the main function of Bluetooth. Cell phones are connected to hands-free earpieces, wireless keyboard, mouse and mike to laptops with the help of Bluetooth as it transmits information from one device to other device. Bluetooth technology has many functions, and it is used most commonly in wireless communications' market.

**Bluetooth Technology****Features**

- Bluetooth technology uses radio waves to communicate between devices. Most of these radio waves have a range of 15-50 feet.
- According to the official Bluetooth website, Bluetooth uses a low-power signal with a maximum range of 50 feet with sufficient speed to enable transmission of data.
- The pairing process identifies and connects any two devices to each other. It also prevents interference from other non-paired Bluetooth devices in the area.
- It uses maximum power only when it is required, thus preserving battery life.

ZigBee

ZigBee is a wireless communication standard designed to address the unique needs of low-power, low-cost wireless sensor, and control networks. ZigBee can be used almost anywhere, as it is easy to implement and requires little power to operate. Zigbee has been developed looking into the needs of the communication of data with a simple structure like the data from the sensors.



Zigbee Technology

Features

- ZigBee devices are designed for low-power consumption.
- ZigBee is used in Commercial Applications like sensing and monitoring applications.
- ZigBee uses very low power and extremely long device battery life.
- ZigBee gives flexibility to do more with the reliable wireless performance and battery operation.

Wireless Networking

Wireless Networking technologies connect multiple computers, systems and devices together without requiring wires or cables: a wireless local area network or WLAN comes under Wi-Fi.

WiMAX

There are wireless broadband systems that offer fast Web surfing without being getting connected through cable or DSL (Example of wireless broadband is WiMAX). Although WiMAX can potentially deliver data rates of more than 30 Megabits per second, yet the providers offer average 0 data rates of 6 Mbps and often deliver less, making the service significantly slower than the hard-wired broadband. The actual cost of the data available using WiMAX widely varies with the distance from the transmitter. WiMAX is also one of the versions of 4G wireless available in phones as Sprint's 4G technology.

III. TYPES OF WIRELESS COMMUNICATION

The different types of wireless communication mainly include, IR wireless communication, satellite communication, broadcast radio, Microwave radio, Bluetooth, Zigbee etc.

Satellite Communication

Satellite communication is one type of self contained wireless communication technology; it is widely spread all over the world to allow users to stay connected almost anywhere on the earth. When the signal (a beam of modulated microwave) is sent near the satellite then, satellite amplifies the signal and sent it back to the antenna receiver which is located on the surface of the earth. Satellite communication contains two main components like the space segment and the ground segment. The ground segment consists of fixed or mobile transmission, reception and ancillary equipment and the space segment, which mainly is the satellite itself.



Satellite Communication

Infrared Communication

Infrared wireless communication communicates information in a device or systems through IR radiation. IR is electromagnetic energy at a wavelength that is longer than that of red light. It is used for security control, TV remote control and short range communications. In the electromagnetic spectrum, IR radiation lies between microwaves and visible light. So, they can be used as a source of communication

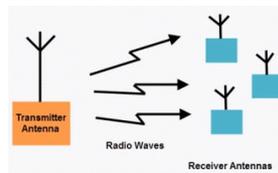


Infrared Communication

For a successful infrared communication, a photo LED transmitter and a photo diode receptor are required. The LED transmitter transmits the IR signal in the form of non visible light, that is captured and saved by the photoreceptor. So the information between the source and the target is transferred in this way. The source and destination can be mobile phones, TVs, security systems, laptops etc supports wireless communication.

Broadcast Radio

The first wireless communication technology is the open radio communication to seek out widespread use, and it still serves a purpose nowadays. Handy multichannel radios permit a user to speak over short distances, whereas citizen's band and maritime radios offer communication services for sailors. Ham radio enthusiasts share data and function emergency communication aids throughout disasters with their powerful broadcasting gear, and can even communicate digital information over the radio frequency spectrum.

**Broadcast Radio**

Mostly an audio broadcasting service, radio broadcasts sound through the air as radio waves. Radio uses a transmitter which is used to transmit the data in the form of radio waves to a receiving antenna (Different Types of Antennas). To broadcast common programming, stations are associated with the radio N/W's. The broadcast happens either in simulcast or syndication or both. Radio broadcasting may be done via cable FM, the net and satellites. A broadcast sends information over long distances at up to two megabits/Sec (AM/FM Radio).

Radio waves are electromagnetic signals, that are transmitted by an antenna. These waves have completely different frequency segments, and you will be ready to obtain an audio signal by changing into a frequency segment.

IV CONCLUSION

Wireless networks are very common in the workplace as well as in the home. Technology has been created to store, transmit and receive data through networks at very high rates of speed. Networks have become essential to completing daily business tasks and most business, those who rely heavily on information technologies, would be crippled without their networks. Advances in networking storage have allowed for organizations to use their networks not only for the sharing of resources but to store large pools of data to be used for data analysis. Companies can now store detailed profile information for customers at a very low cost. In the future, the speed of networks will increase as they have in past years. The cost of networks will continue to decline and using a network will be essential.

This research paper leads you to know the technology with wireless standards some of the devices Bluetooth, zigbee in wireless technology – The technology that propels you into a new dimension in wireless connectivity. It is important to surround yourself with the right kind of people. Bluetooth is a new standard developed by a group of electronics



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manufacturers, that will allow any sort of electronic equipment to make its own connections without wires, cables or any direct action from user. It is a rapid growing technology that makes man easy to transfer his electronic equipments from one place to another. It is a technology that not yet completely developed. Hope this will be achieved very soon.

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