# How Wireless Network Use Radio Waves to Communicate.

Paul Aboagye

***Abstract*—The Wireless Network discusses the use of radio waves for communication, security vulnerabilities, and threats as well as explaining how to identify and prevent threats. It reveals how attackers exploit vulnerabilities and gain access to wireless network.**

## I. Introduction

Wireless network is network set up by using a radio waves to establish communication between computers and other network devices. [6] It enables devices to communicate and access information without the use of wires. Information can be delivered in different forms such as e-mail, web pages, database records, streaming video or voice. Wireless network use either radio waves or infrared light as medium for communication between devices, servers, and database.

This paper is about finding out how radio waves can be used to communicate among wireless network devices, the types of wireless network, security vulnerabilities and threats, types of radio waves communication, and how to prevent security attacks on wireless network.

[5] Radio waves are a type of electromagnetic (EM) radiation with wavelength in the electromagnetic spectrum longer than infrared light. It has frequencies from 300 GHz to low as 3 kHz, and corresponding wavelength from 1 millimeter to 100 kilometers. It is used for fixed and mobile radio communication, broadcasting, radar and other navigation systems, communication satellites, computer networks, and other applications.

## II. Types of WIRELESS NETWORK

### *A. Wireless Local-Area Network (WLAN)*

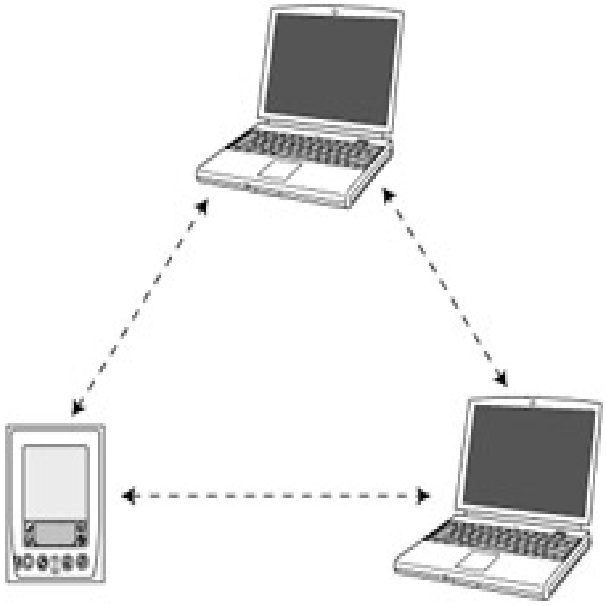
[7]Wireless Local-Area Network are relatively used in homes, offices, and public hotspots. It can provide level of performance that enable higher applications to run smoothly. IEEE 802.11 is the standard for wireless LANs operating in the 2.4 GHz and 5-GHz frequency bands. [7] When it comes to using it at hotspots such as an airports or hotels, people can now gain access to their e-mail and browse the internet for a fee or free.

Install wireless LAN offer mobile access to application from laptops, desktops, and phones.

*W*ireless LAN do experience problems, for example a device using 802.11a adapter may have a problem connecting to another device that is using 802.11b.

Wireless LAN configuration range from simple to very complex. [7] The simplest WLAN is an independent, peer to peer configuration. Peer to peer configuration are sometimes referred as hoc networks which does not required any administration. It very useful when a group of users need to communicate with one another in unstructured way.

[7] An access point provides multiple user access to a single high-speed connection without having to run wires connection to each device on the network.



*B. Wireless Metropolitan-Area Network (WMAN)*

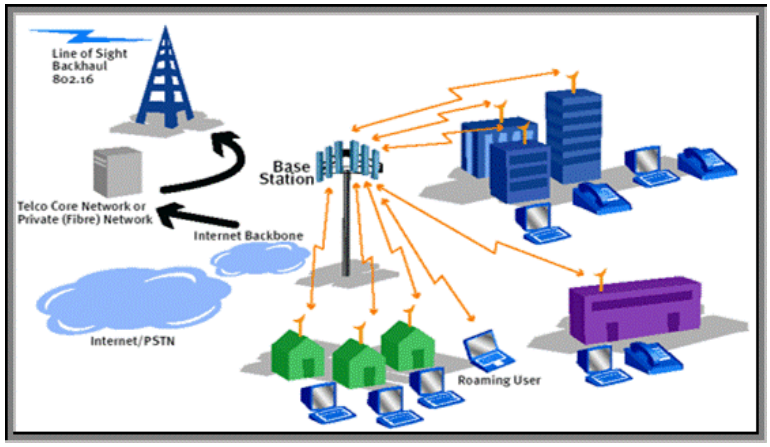
The wireless metropolitan area network provides connection between building and users within a city or campus through several system configuration. The connection using radio waves signal can reach 100 Gbps or more, links over 20 miles distance. [7] The point to point systems uses radio waves signal either semi directional antennae to extend range across metropolitan areas such college campus or cities. Hospitals or Business Offices can use point to point wireless MAN to communicate between the main and remote offices within the city.

[7] A point to multipoint system uses a centralized omnidirectional antenna to provide a single transceiver point. With point to multipoint it is very easy to add a new connection to the network.

[7] The IEEE standard for wireless MAN 802.16 systems. 802.16 offers a standard solution for deploying effective wireless MANs with performance in the megabits-per seconds range.

The packet radio system uses wireless routers to forward data contained within the packet to the destination. *[7]* The Network Interface Card (a hardware component which connects computer to the network) will transmit data to the nearest router. The router then retransmits the data to the next router. The data or packet will reach the destination after hopping from router to router.

,

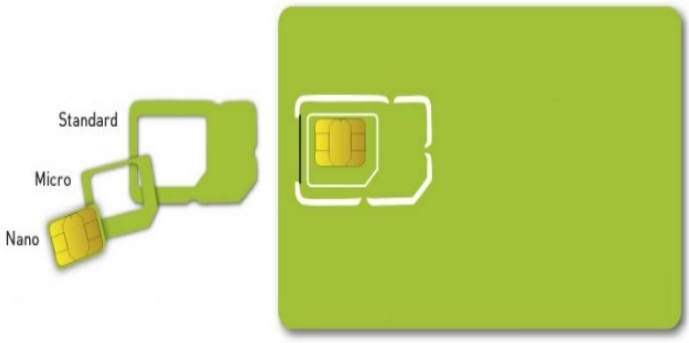



*C. Wireless Wide-Area Network (WWAN)*

[7] Wireless Wide-Area Network sends wireless signals beyond a single building or property. [7] It may use different types of cellular network systems to send signals over a longer distance. WWAN services are delivered to smartphones sold by cellular service providers.

The three wireless WAN technologies are GSM, CDMA, and WiMAX.

GSM (Global System for Mobile Communications) network use Time Division Multiple Access (TDMA) by assigning time slots to multiple conversation streams which alternate them in sequence and switch between each conversation in short intervals. [7] Transmitting information or data on mobile phones during the intervals. Mobile Phones uses identification module card or SIM card to connect to the network.




[7] CDMA (Code Division Multiple Access) allows full access to the entire spectrum of bands, allowing devices to connect at any given time. Mobile that uses CDMA network does not require SIM cards and are tied to carrier providers. GSM and CDMA are global standard for communication.

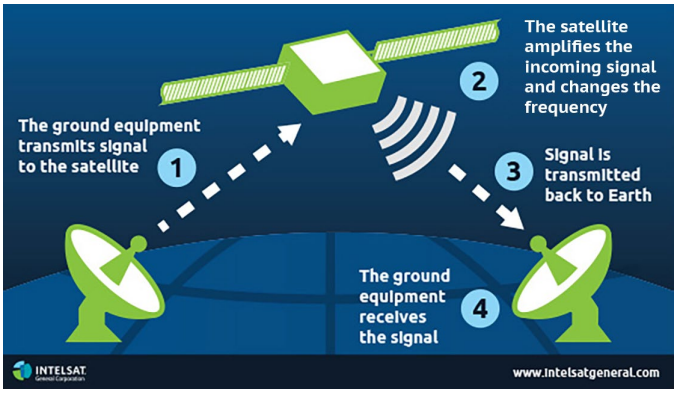
[7] WiMAX (Worldwide Interoperability for Microwave Access) is a telecommunication and mobile used for broadcasting of wireless data using number of transmission methods. IEEE 802.16. Towers enable communication access over miles and broadband service is available in coverage areas.

## III. COMMUNICATION

[5] Wireless Network use radio waves for communication. Computer wireless adapter changes the data into radio signals then transmits the signals using antenna. Wireless router receives the signal and decodes it and the information is send through Ethernet connection to the internet. Different types of signal are used for communication between the devices for wireless transmission of data.

### *A. Satellite Communication*

[3] It consists of space segment and ground segment. Portable satellite phone and modems have powerful broadcast feature due to the increase range. The ground segment consists of fixed or mobile transmission, reception, and ancillary equipment. [3] It establishes communication when a ground equipment transmit signal to the satellite. [3] The satellite then amplifies the incoming signals and changes the frequency which transmits back to earth, and the ground equipment receives the signals.




### *B. Cellular*

The data transmission over cellular network is possible with modern 4G or 5G system capable of speeds reaching wired DSL. Encrypted radio links modulated to allow many devices to communicate across the single frequency.

[7]A mobile device with poor channel quality experience poor quality of service. A strong dedicated control channel for transmitting information to a cellular device from the base station and strong paging channel is used for tracking the cellular device.

[3] The base transceiver station enables cellular device to make direct communication. The base station includes an antenna, controller and number of receivers and traffic channels carry voice or data connection between.

### *C. Microwave Transmission*

[3] It a form of electromagnetic transmission used in wireless communication systems. Wavelength of microwave range from one meter to one millimeter and frequency varies from 300 MHz to 300GHz. [6] It is use for long distance communication and less expensive. During a bad weather, the signal transmission is affected and microwave does not pass through buildings.

## IV. RADIO WAVES

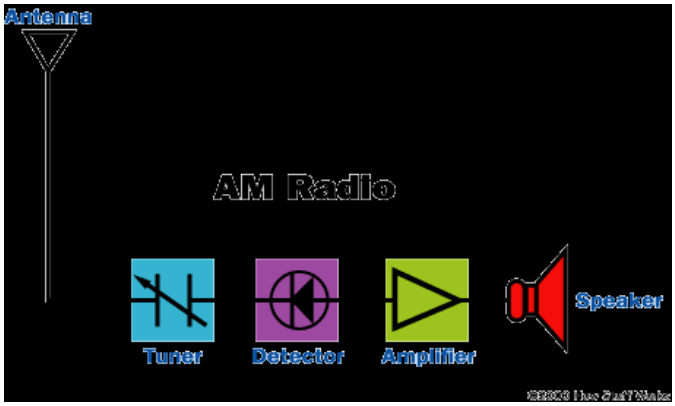
[3] Radio wave is an electromagnetic wave which can propagate through a vacuum, air, liquid or even solid objects. The height of the wave is the amplitude and the number of cycles made in seconds is the frequency. Distance completed by a sine wave is the waves length. The frequency is measured in Hertz (Hz).

[3] In order to receive the transmission such audio or video, the radio wave receive the tune itself to the same frequency as the transmitter. The receiver will then examine the amplitude or the frequency of the received electromagnetic wave in order to get the transmitted data. [3] The electromagnetic spectrum consists of variety of waves such as infrared, x – ray, gamma rays, and radio.

The radio waves have many uses divided into microwaves and electromagnetic waves used for AM and FM, cellular telephones and TV.

### *A. Amplitude Modulation Radio Wave.*

[4] Carry commercial radio signal in the frequency range from 540 to 1600 kHz. The amplitude of the carrier wave is modified in order to transmit the input signal. The method of AM radio wave is encoding and broadcasting radio signals. [4] The signal is broadcast as electromagnetic waves and the receiver pick up the waves, amplifies it and convert them into sound.




### B. *Frequency Modulation Radio Wave*

[4] Carries commercial radio signal between 88 and 108 MHz which produce a wave of constant amplitude but varying frequency. [4] The carrier frequencies of two different radio stations cannot be closer than 0.020 MHz.

## V. SECURITY

### A. *Security Attacks on Wireless Network.*

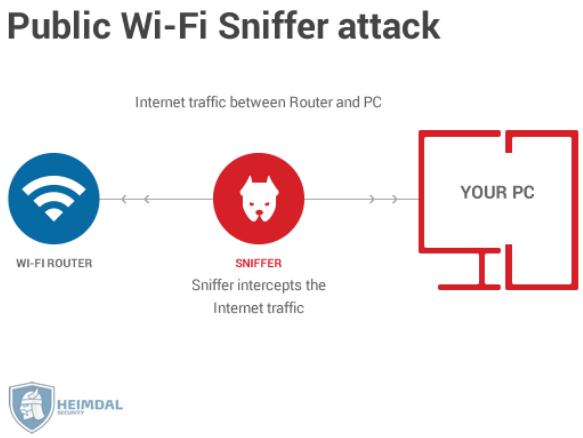
A wireless network can be vulnerable to different kinds of attacks.

I. *Wireless Hijacking*

This type of attack happens when an attacker configures their laptop to broadcast a wireless access point using the SSID as public hotspot. [1] The attacker will intercept messages in the public key exchange and then retransmits them by substituting their own public key for the requested one.

II. WIFI Spoofing

It means copying a network which can look and behaves identically. [2] If the attacker sets up a router with the same name and password as one of your habitual networks, you probably won't give it a second thought when you connect or your computer connects automatically. [2] The attacker can even log on to the legitimate network, send a disconnect command to the computers on it, and then snag the devices that automatically reconnect to the evil twin.




*a) PROTECTION ON WIRELESS NETWORK*

Protecting sensitive information on a wireless network is very important whether it for a business or home use. Encryption scrambles the information send into code so that it is accessible to others and it very effective way to secure a network.

[1] The two main types of encryption are Wi-Fi Protected Access and Wired Equivalent Privacy. [2] One to protect your network is by securing the router which the network is on. Changing the name of the router from default to something that us unique and keeping the router up to date. Software update for the router is effective way to protect against attackers.


[2] Protect against malware and internet attacks by installing a rigorous anti-malware product on computer devices. Virtual Private network allows connection to the network when it use outside the main network.

temperature."

Remember to check spelling. If your native language is not

## REFERENCES

[1] Margaret Rouse, "Hijacking*,".*
[2] CT WiFi, *Types of Wireless Attacks.*
[3] Lumen, "The Electromagnetic Spectrum".
[4] Charlotte Yates, "What Actually is the Difference Between AM and FM Radio," unpublished.
[5] eTutorials, "Understanding Radio Waves,"
[6] Bradley Mitchell, "What is Wireless Computer Networking,"
[7] ComputerNetworkingNotes, Types of wireless Network Explained with Standards.