



Wireless Communication Technologies

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Abstract: *Wireless communication is among technology's biggest contributions to group. Wireless communication involves the transmission of data over a distance while not facilitate of wires, cables or the other sorts of electrical conductors. The transmitted distance will be anyplace between a couple of meters (for example, a television's remote control) and thousands of kilometres (for example, radio communication).*

Keywords: *Handheld, Propagation, Multipath, Signals, Uplink, Downlink, Globe, Transmission, Service, Analysis, Transfer.*

1. Introduction

The term wireless communication was introduced within the nineteenth century and wireless communication technology has developed over the next years. It's one amongst the foremost vital mediums of transmission of knowledge from one device to alternative devices. during this technology, the knowledge are often transmitted through the air while not requiring any cable or wires or alternative electronic conductors, by victimization magnetism waves like IR, RF, satellite, etc. within the gift days, the wireless communication technology refers to a spread of wireless communication devices and technologies starting from sensible phones to computers, tabs, laptops, Bluetooth Technology, printers. This text provides an summary of wireless communication and kinds of wireless communications.

2. Wireless Communication

Wireless communication, or typically merely wireless, is that the transfer of knowledge or power between 2 or a lot of points that don't seem to be connected by associate electrical conductor. The most common wireless technologies use radio waves. With radio waves distances may be short, like many meters for Bluetooth or as way as many kilometers for deep-space radio communications. It encompasses numerous styles of fastened, mobile, and moveable applications, as well as two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Other samples of applications of radio wireless technology embody GPS units, garage door openers, wireless laptop mice, keyboards and headsets, headphones, radio receivers, satellite TV, broadcast tv and conductor telephones. Somewhat less common strategies of achieving wireless communications embody the employment of different magnetic attraction wireless technologies, like lightweight, magnetic, or electrical fields or the employment of sound.

3. The Risk Environment

While wireless networks square measure exposed to several of a similar risks as wired networks, they're at risk of extra risks further. Wireless networks transmit information through radio frequencies, and square measure hospitable intruders unless protected. Intruders have exploited this openness to access systems, destroy or steal information, and launch attacks that holdup network information measure and deny service to licensed users. Another risk is that the felony of the little and moveable devices themselves. Wireless networks and hand-held devices square measure at risk of several of a similar threats as typical wired networks. Intruders World Health Organization gain access to data systems via wireless communications will bypass firewall protection. Once



they need accessed systems, intruders will launch denial of service attacks, steal identities, violate the privacy of legitimate users, insert viruses or malicious code, and disable operations. Sensitive data that's transmitted between 2 wireless devices will be intercepted and disclosed if not protected by sturdy coding. hand-held devices, that square measure simply purloined, will reveal sensitive data..[1]

4. Characteristics of Wireless Channel

The most important characteristics of wireless channel are –

- Path loss
- Fading
- Interference

4.1. Path Loss

Path loss will be outlined because the magnitude relation of the transmitted signal power to the facility of a similar signal reaches the receiver, on a given path. It's a operate of the propagation distance. It is utmost necessary to estimate the trail loss for coming up with and deploying wireless communication networks. Various factors influence the trail loss like the frequency and therefore the nature of the parcel of land. There is a model known as free house propagation model that is that the simplest path loss model wherever signal moves during a direct path between the transmitter and therefore the receiver, with none atmosphere attenuation or multipath parts.

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4.2.Fading

Fading is outlined as variation of a proof with totally different variables. These are the fluctuations that occur in signal strength once reached at the receiver. Fading will be classified in to 2 varieties –

- Fast fading/small scale fading and
- Slow fading/large scale fading

Fast attenuation is that the fast fluctuations occurred within the amplitude, part or delays within the multipath of the received signal, attributable to interference between same transmitted signal that has undergone multiple versions that was reached at the receiver at totally different time intervals.

The time gap between the reception of the primary version of the signal and therefore the last echoed signal is termed delay unfold. The multipath propagation of the transmitted signal, that causes quick attenuation, is attributable to the 3 propagation mechanisms, namely –

- Reflection
- Diffraction
- Scattering

The signal which undergoes multiple paths may sometimes add constructively or sometimes destructively at the receiver which results in a variation in the power level of the signal that was received. This received single envelope follows a Rayleigh distribution so as to see if there was any line-of-sight path between the transmitter and therefore the receiver.



4.3. Interference

Wireless transmissions have to be compelled to counter interference from a good style of sources. Two main forms of interference are –

- Adjacent channel interference and
- Co-channel interference.

In Adjacent channel interference case, signals in close frequencies have parts outside their allotted ranges, and these parts might interfere with on-going transmission within the adjacent frequencies. It will be avoided by fastidiously introducing guard bands between the allotted frequency ranges. Co-channel interference, typically additionally said as slender band interference, is thanks to alternative close systems exploitation constant transmission frequency. Inter-symbol interference is another variety of interference, wherever distortion within the received signal is caused by the temporal spreading and also the sequent overlapping of individual pulses within the signal. Adaptive deed may be a ordinarily used technique for combating inhume image interference. It involves gathering the distributed image energy into its original quantity. Complex digital process algorithms are employed in the deed method.[2]

5. Wireless Technologies:

5.1. Radio

Radio communication was one amongst the primary wireless technology developed and it's still in use. The transportable multi-channel radios enable the user to speak over short distances whereas subject band and maritime radios offer communication services over long distances for truckers and sailors. Radio features a transmitter that transmits the information within the type of radio signals to the receiver antenna.

To broadcast common programming stations square measure related to the radio networks. The broadcast happens either in broadcast or syndication or each the forms. Radio broadcasting could also be done via cable FM, and satellites over long distances at up to 2 megabits/Sec.

5.2. Cellular Network

A cellular network uses encrypted radio links, modulated to permit several users to speak across the one band. As the individual handsets lack vital broadcasting power, the system depends on a network of cellular towers that area unit capable of triangulating the supply of any signal and handing reception duties off to the foremost appropriate antenna. The data transmission over cellular networks is feasible with trendy 4G systems capable of speeds reaching that of wired phone line. Cellular corporations charge their customers by a moment of their voice and by the kilobytes for knowledge.

5.3. Satellite

A satellite is associate object that revolves around another object. For example, earth could be a satellite of The Sun, and moon could be a satellite of earth. A communication satellite could be a microwave repeater station in a very area that's used for telecommunication, radio and TV signals. A communication satellite processes the information coming back from one earth station and it converts the information into another type and send it to the second earth station.

Satellite communications represents the commercialization of space. Every £1 of public funding invested in Satellite Communication technology generates downstream returns of £47.[3]

5.3.1. How a Satellite Works

Two stations on earth need to speak through broadcast however area unit too far to use standard suggests that. The two stations will use a relay station for his or her communication. The signal to the satellite is transmitted by one earth station. Uplink frequency is that the frequency at that ground station is human activity with satellite. The satellite electrical device converts the signal and sends it right down to the second earth station,



and this can be known as Downlink frequency. The second earth station conjointly communicates with the primary one within the same approach.

- ***Following are the advantages of Satellite Communication:***
 - It is employed for mobile and wireless communication applications freelance of location.
 - It covers wide space of the planet thence entire country or region are often lined with only one satellite.
 - It provides wider information measure supported SCPC or MCPC allocation varieties.
 - It is straightforward to put in and manage the bottom station sites.
 - It does not incur much of the costs per VSAT site.
 - It is employed for voice, data, video and any other information transmission. Satellite system are often interfaced with net infrastructure to get net service. It is additionally used for GPS applications in numerous mobile devices for location determination.
 - It is straightforward to get service from one single supplier and uniform service is on the market.
 - It has little weakening margin on the order of regarding 3dB.
- ***Following are the disadvantages of Satellite Communication:***
 - Satellite manufacturing requires more time. Moreover satellite design and development requires higher cost.
 - Satellite once launched, needs to be monitored and controlled on regular periods so it remains within the orbit.
 - Satellite has life which is about 12-15 years. Due to this truth, another launch must be planned before it becomes un-operational.
 - Redundant components are used in the network design. This incur more cost in the installation phase.
 - In the case of LEO/MEO, sizable amount of satellites square measure required to hide radius of earth. Moreover satellite visibility from earth is for terribly short length which needs quick satellite to satellite relinquishing. This makes system very complex.

5.4. Earth Orbits

A satellite once embarked on area has to be placed in bound orbit to supply a selected manner for its revolution, thus on maintain accessibility and serve its purpose whether scientific, military or commercial. Such orbits that area unit assigned to satellites, with reference to earth area unit referred to as Earth Orbits.

The important kinds of Earth Orbits are

- Geo-synchronous Earth Orbit
- Geo-stationary Earth Orbit
- Medium Earth Orbit
- Low Earth Orbit

One more factor affected by the orbit is ground coverage. The coverage is most for GEO satellites at the best altitude. For LEO and MEO satellites, coverage is limited. Hence, several satellites area unit required for covering massive geographical areas leading to high prices. Moreover, the LEO and MEO satellites perpetually move relative to some extent on the layer. However, an advantage of LEO satellites is that smaller and mobile handsets can be used at the earth station for communicating with the satellites since they are relatively closer to earth. One example of an outsized LEO satellite system is that the metal network. A network of sixty six satellites at Associate in nursing altitude of 785 kilometers that cowl the complete globe. The metal satellite network provides satellite phone services for the U.S.A. military worldwide. Mobile services for maritime communications, mining and exploratory requirements, aviation, transportation and construction industries, and personal communications are currently being provided by various satellite systems such as Inmarsat, NSTAR, AMSC, MSAT and MobiSat.



5.5. Wi-Fi

Wi-Fi is an acronym for WLAN, normally seen as IEEE 802.11b. The term comes from WECA. Wifi is synonymous with 802.11b in much the same way as Ethernet is used in place of IEEE 802.3. Products certified as wifi by WECA are interoperable regardless of manufacturer. A user with a wifi product can use any brand of access point with any other brand of client hardware that is built to use wifi.[4]

Wi-Fi is a low-cost wireless communication technology. A Wi-Fi setup consists of a wireless router which serves as a communication hub, linking portable devices with an internet connection. This network facilitates association of the many devices looking on the router configuration. These networks are unit restricted in vary thanks to the low power transmission, permitting the user to attach solely within the shut proximity. This network facilitates association of the many devices looking on the router configuration. These networks square measure restricted in vary thanks to the low power transmission, permitting the user to attach solely within the shut proximity.

5.5.1. Services and Attributes of Wi-Fi

The 802.11 protocol of Wi-Fi defines 5 services:

1. Association: A BSS is able to establish connection with an access point. The access purpose will then more come with alternative access points, so forming associate extended service set.
2. Re-association: Here, a BSS which is already communicating through an access point can get associated with other access point when in movement without disruption in service.
3. Disassociation: A message indicating an already established connection between a BSS and access point to be terminated.
4. Authentication: Avoiding insecure association to any access purpose by applying identification techniques or handclasp strategies.
5. Privacy: The contents of a message sent by a transmitter area unit solely decoded by the individual receiver, therefore reassuring privacy of the network.[7]

- **Advantages**

Convenient

Useful for smart phones, pill devices and alternative moveable devices to attach at any convenient location at intervals premises.

Simplicity

To connect a brand new device with a network, merely activate the Wi-Fi and do the easy configuration settings.

Mobility

Internet can be accessed from anywhere, ie. Bus, train, coffee-shop, super market, etc.

Expandability

It is convenient to feature additional wireless devices with current hardware settings with none value and time.

Efficiency

Wi-Fi enabled devices area unit used at offices for convenient to access their files at any location and it offers additional productivity for the corporate.



Cost Control

In wireless local area network devices may be extra with none value in contrast to cables must be get man power to try to the work.

- ***Disadvantages***

Performance/Speed

Although Gigabit wireless local area network is offered within the market, we tend to cannot get the gigabit speed in the slightest degree locations. Now cable network has 10 Gbps speed.

Connectivity/Reliability

WiFi signal is depends on the interference. Ie. Concrete wall will reduce the signal strength. Also, there's a limit for distance to attach wireless local area network signals.

Security

WiFi router has numerous secret writing strategies to secure our network parole. Need to be done correct configuration before use the wireless local area network.

6. Bluetooth Technology

The main perform of the Bluetooth technology is that allows you to attach a numerous electronic devices wirelessly to a system for the transferring of knowledge. Cell phones are connected to hands free earphones, mouse, and wireless keyboard. By exploitation Bluetooth device the knowledge from one device to a different device. This technology has numerous functions and it's used ordinarily within the wireless communication market.

- ***Following are the advantages of bluetooth:***
 - It creates adhoc connection immediately without any wires. Connection establishment is very quick. User solely have to be compelled to combine the bluetooth PAN association between 2 devices.[5]
 - It has low power consumption.
 - It can pass through walls.
 - It has range better than Infrared communication.
 - It has been managed by Bluetooth SIG and thence product from massive firms square measure offered and there's no issue of ability among totally different bluetooth merchandiser product.
 - It is used for voice and data transfer.
 - It uses FHSS and thence electronic communication is safer.
 - The technology is adopted in many product like head set, in automobile system, printer, web cam, GPS system, keyboard and mouse.
- ***Following are the disadvantages of bluetooth:***
 - One of the large disadvantages of bluetooth is security. This is because of the very fact that it operates on frequency and therefore will penetrate through walls. It is suggested to not use it for important business or personal information transfer.
 - As HomeRF technology operates on same frequency, it's interference from it.
 - The bandwidth is lower compare to WiFi.
 - Battery usage is additional compare to the condition once bluetooth is battery-powered OFF. The new technology called BLE or bluetooth low energy or bluetooth sensible is developed to boost the battery life additional.



7. Conclusion

In conclusion, wireless communications globally are some things that individuals will expect as technology advances. Wireless communications includes a heap of advantages and might create the planet loads additional economical. It will have considerations tho' like each different new advancement that's created in today's world. the problems with security concerning access to a person's personal info or the negative impact that it should appear to own on society square measure some things that square measure holding back the progress that wireless technology might be creating. With additional analysis and experiments conducted, the issues related to wireless communications are often reduced and create it a additional vital a part of the planet. Wireless technology are going to be important within the close to future wherever the necessity for wires connecting individual devices looks to be coming back to Associate in Nursing finish.

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