

A Starter to the Future Communication Through Illumination Transmission Along with the Wireless Transmission

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Abstract:- Nowadays access to Internet is an important task where the access is used for various businesses and house hold works. From small kids to older age people now use smart phones for the purposes of playing, reading, hearing music, paying bills, booking, seeing online shows to dramas in the particular channel, transferring money, video calling, conferencing, etc. Even it is used as the assistant when we are in new place. So Internet with the Smart phones rules the world of communication. The paper discusses how generations of Communication are done and the new current technology of communication with discernible brightness is used in the technology. The basics of the new technology and the benefits are discussed.

In FDMA each user is assigned a individual channels. Each user is allocated a unique key, band or channel. These channels are assigned on demand to users who request service. On the period of the call, no other user can share the same channel. It uses Guard channel for Radio Frequency (RF) filtering between the channels. Its simplicity is the advantage. It is also can be used by simple algorithms and from hardware point of view. It is efficient when the number of stations is small. It uses Narrow Bandwidth of 30 kHz.

INTRODUCTION

Communication, information passing from one person or device to another is done through various technologies. Form the preliminary the generations of communication takes a variety of forms. Many techniques are involved for the communication.

From traditional communication of Newspaper, Radio and now it guide public to communicate through Smart phones. This communication of using Smart phones is much stretched drive. The paper explains the stretched journey of the Smart Phones with their Generations and their workings.

The paper is arranged in the following way. Section 1 Generations and their bandwidth usage, Section 2 discusses on the Wired and Wireless communication, Section 3 explains the Wireless Communication Wi-Fi and the Section 4 explains the Wireless Communication Li-Fi and the Section 5 ends with the conclusion.

1. GENERATIONS AND THEIR BANDWIDTH USAGE

1.1. Generation bandwidth & FDMA

1G can send and receive only analog signal. It started its journey in 1980's ,uses Circuit Switching technique with the 30Khz bandwidth in the frequency of 824 to 894 MHz. Many standards came during the period are Advanced Mobile Phone Systems (AMPS), Nordic Mobile Telephone (NMT) ,Total Access Communication System (TACS). It uses Frequency Division Multiple Access (FDMA) for communication.

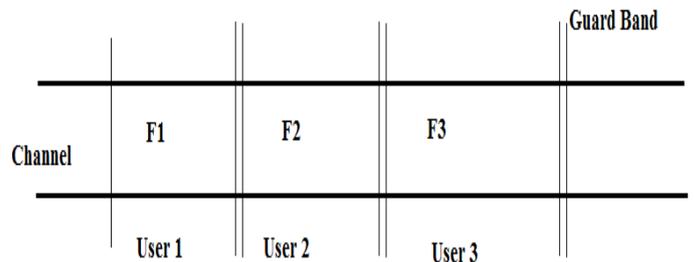
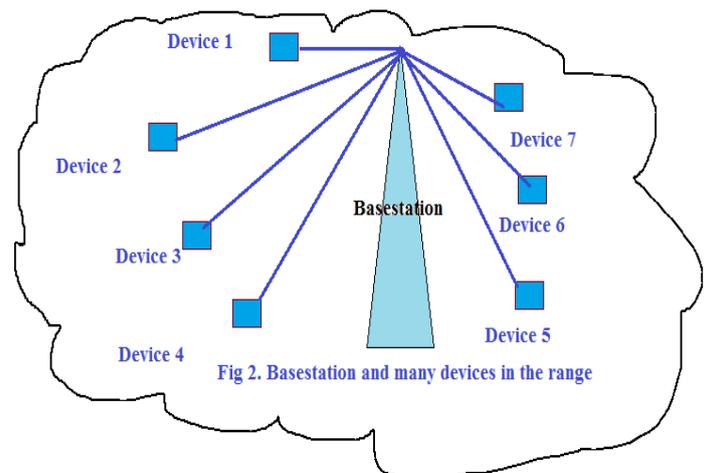


Fig 1. Frequency Division Multiple Access



The Guard band reduces interference so it requires right RF filtering. Since Guard band is a space in the channel it is not used for communication. Maximum bit rate per channel is fixed.

1.2. Generation bandwidth and TDMA

2G came with along with voice plus data can also be transmitted. It was done with the help of Packet Switching in Circuit Switching technique. The data is transmitted in the form of packets and these packets take different paths dynamically. The first data service was short Message Service (SMS), Multimedia Message Service (MMS), and Email in www access. The standards are Global Systems for Mobile Communicaiton GSM. This generation communication added another concept of Security by using encrypting data and voice before transmission. GSM used Time Division Multiple Access (TDMA).

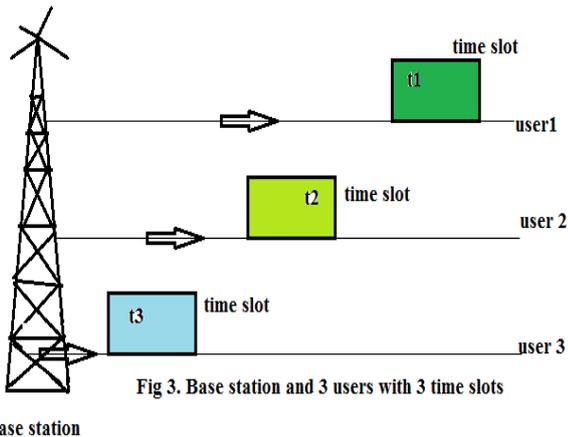


Fig 3. Base station and 3 users with 3 time slots

In TDMA the channel i.e., the ratio spectrum (Signals) is divided into various time slots. In each time slot only one user is allowed to either transmit to receive. It carries data rated of 64 kbps to 120 kbps. It is cost effective technology to convert an analog to digital. Its disadvantage is each user has a predefined time slots, when moving from one cell to another, if all the time slots in this cell use is full, the user might be disconnected.

1.3. Generation bandwidth with CDMA

A standard for Telecommunication came to ensure performance, quality, flexibility and future expansion. It came in 2001. It used both Packet Switching and Circuit Switching. Since it is up gradation of 2G, video calls live streaming video conferencing, mobile television are supported by 3G. It uses Internet Protocol technology for transmission. It speed is increased. It operated in the frequency of 1.8 to 2.5 GHz. It also used all the access technologies like Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA).

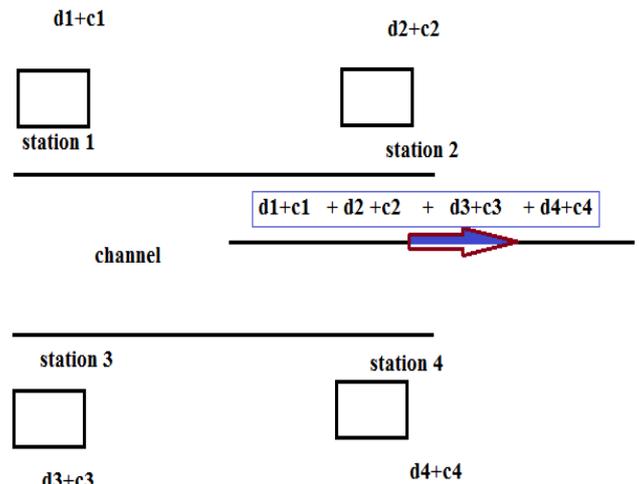


Fig 4. CDMA concept with 4 stations and code transmitted

In CDMA, the multiple access technology of several transmitters can send information simultaneously over a single communication channel. It is using Spread spectrum technology where several users share a band of frequency. One channel carries all transmissions simultaneously. In CDMA each station has a individual code. When transmitting, the station sends data plus the code through the channel. All the stations are sending through the same channel. It is also standardized as wideband code Divison Multiple Access (WCDMA). The increased speed, support of variety of data service is the advantage of 3G but it needs license, agreement and power consumption.

1.4. Generation bandwidth and OFDMA

Its journey started in 2010. It use Packet Switching technique with high speed, range of coverage is smaller. It ensures high quality, data support more clarity such as Mobile TV , digital Videos , Multimedia Newspaper. Its technology is Long term Evolution (LTE) and WiMAX (World Wide Interoperability for Microwave Access). It provides separate data rated for uplink and downlink i.e., 50Mbps and 100 Mbps respectively. It uses Orthogonal Frequency Division Multiple Access(OFDMA) for downlink.

In OFDMA it is same as FDMA but is closely spaced modulated Carries the modulation on either voice or data. Since right angles are used in OFDMA no overlappinf happens and no interference occurs here. OFDMA is the multiplexing technique used in latest wireless and telecommunication standards like Wi-fi 802.11ac,4G and 5G cellular phone technologies, WiMAX , satellite and many others. Its bandwidth is better utilized and offers higher data transmission rate than FDMA.

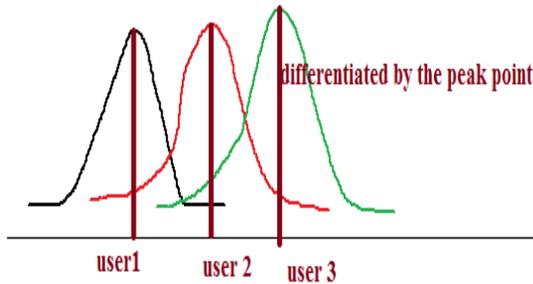


Fig 5. OFDMA with frequencies are closely packed and differentiated by the peak point

1.5. Generation bandwidth

5G starts in 2020 with packet switching technique. It is expected with speed of 1 Gbps with data rate of 10 to 20 Gbps. The 5G is going to use Millimeter Wave, with many modulation techniques like OFDMA, Filter Band Multi Carrier (FBMC), Universal Filter Multi Carrier (UFMC), Orthogonal Frequency Band Multi Carrier (OFBMC), Generalized Frequency Domain Multiplexing (GFDM) and Bi-orthogonal Frequency Division Multiplexing (BFMC). It will be the growth of cloud Computing and Internet of Things.

2. WIRED & WIRELESS COMMUNICATION

When communication of two devices is done by a hardware device like cable, through which data is transferred. Communication in networks can be divided into two categories the first is the wired and the second is the Wireless communication.

In Wired communication the data is passed through a cable of types like copper cable, fiber optic cable and twisted pair cable. The cable carry different types of signals in the form of electricity. The data transfer rate is upto 10Mbps. Ethernet is also a type of Wired communication. Other types of Ethernet are Fast Ethernet and Giga Ethernet with speeds 100 Mbps and 1000 Mbps. The area covered for the communication by wires is said to be the region bounded by that particular area.

The Wireless communication started in 1997 by IEEE. It is a communication in which transfer of data is done by the invisible media i.e., air through the radio waves. Instead of cables (wires), air is used to transfer the data. Air is an open source and it is used by all for communication. Since air is the open source, region is not bounded to particular area.

Wired Network	Wireless Network
Connection is done by cable.	Connection is done by an open source air.
It is bounded to a particular region.	It is not bounded to a particular region.
Inexpensive, have high reliability and high bandwidth with high speed	Expensive, have lower quality and lower bandwidth.
It has more difference in complexity of cable connection.	It need more than one Access Point for Communication.
Additional wiring is needed for additional users.	Many people can be added without any wiring.

Table 1. comparison of Wired and Wireless Network

The various protocols used in Wired Networks are first Ethernet. Its access method is CSMA/CD, one to one

link is made. By using this link, the user must listen to the cable before sending. Data can be send through Coaxial, Optical fiber cables with speed 10 Mbps up to 1000 Mbps. The second protocol is the Fast Ethernet. Its speed is 100 Mbps used for the speed transmission. Its cable type is twisted pair cable. The Third protocol is the Local Talk, the cable type is twisted pair cable, low speed of transmission is 230kbps. The fourth type of protocol is the Token Ring, performance is low speed is 4 Mbps or 16 Mbps. Lot of time is wasted during communication. The fifth type of protocol is Fiber distributed data interface (FDDI). It is used to connect long distances. It uses fiber Optic cable and high speed of data transfer is at 100 Mbps.

The various protocols used in Wireless Networks are Long range, Medium Range and Short Range. In Long range, Long-term evaluation (LTE) uses 100 Mbps and distributing 10Mbps for each user. And the 60 GHz is used to view the video and it requires high bandwidth. Wi fi and WAP belongs to the Medium range protocol. Wi Fi grant hot spot and its speed is lower but it is flexible for the user. WAP provides security for the communication. The short Range includes Bluetooth, Wireless home automation protocol and Ultrawide band. The bandwidth is low and uses low energy consumption.

3. WIRELESS COMMUNICATION WI-FI

Wi Fi stands for Wireless fidelity and it used routers and radio waves for transmitting data. It is invented by NCR Corporation in 1991. Its range is about for data transfer is from 150 Mbps to 2 Gbps. secure transmission is needed to implement. Its coverage area is about 32 meters and it is based on the antenna types. Its main application is used for internet browsing with the help of hot spots.

4. WIRELESS COMMUNICATION LI-FI

Li Fi stands for Light Fidelity, invented by Prof. Harald Haas in 2011 a German Scientist. Its transmission is through visible light. Data transfer speed us about 1 Gbps. It provides more security and covers 10 meters. Normal LED light is used for transmission. Its application is airlines and underwater transmission.

Flickering of light could transfer data and used the concept to invent the Li Fi Technology. This technology provides Internet access form light bulbs. So normal LED lights can be used to operate Internet access. Li-Fi is based around a protocol known as Visible Light Communication (VLC). It essentially involves toggling a light switch thousands of times every second to create a stream of "on" and "off" pulses that can be interpreted as binary bits. It works in a similar fashion to Morse code and currently uses the 400 and 800 THz (terahertz) bands.

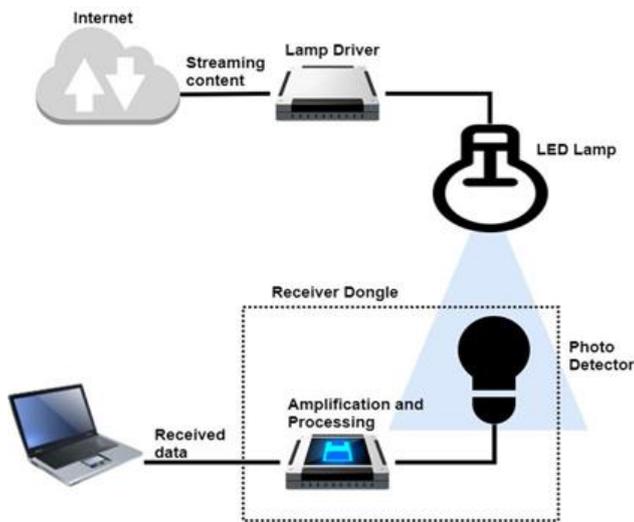


Fig 6. Li Fi Technology

Li-Fi and Wi-Fi technologies are quite related as both broadcast data electromagnetically. Although Wi-Fi make use of radio waves, while Li-Fi lope on visible light waves. Li-Fi is a Visible Light Communications (VLC) system. This resources that it accommodates a photo-detector to receive light signals and a signal processing element to convert the data into 'streamable' content.

An LED light bulb is a semiconductor light source meaning that the constant current of electricity supplied to an LED light bulb can be dipped and dimmed, up and down at extremely high speeds, without being visible to the human eye.

For example, data is fed into an LED light bulb (with signal processing technology), it then sends data (embedded in its beam) at rapid speeds to the photo-detector (photodiode).

The tiny changes in the rapid dimming of LED bulbs are then converted by the 'receiver' into electrical signal. The signal is then converted back into a binary data stream that we would recognize as web, video and audio applications that run on internet-enabled devices.

5. CONCLUSION

From the paper, came to know the long evolution of the discernible brightness for the new technology. Its various techniques for the data speed and its efficiency needed today for the increasing number of users day today. The increasing users must be provided with the data coverage and scalability must be flexible. This can be done by using the hybrid of both the technologies.

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