

LiFi Vs WiFi Vs WiMAX

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Abstract

LiFi as Light based wireless technology instead radio waves used at WiFi and WiMAX visible, LiFi is used visible light spectrum to communicate and instead of modems, used light for millions of years but it has no impact on health issues. It has the ability to transmit data at about 10 Gbps which is much faster than most broadband connections. This paper deals LiFi Technology and Comparison of LiFi/WiFi/WiMAX.

Keywords: LiFi, Comparison, WiFi, WiMAX.

1. Introduction

Herald Haas the father of this technology, a pioneer in the field of optical wireless communications at the University of Edinburgh was the first person to demonstrate this technology. He has been able to show how a light-emitting diode bulb (LED) combined with signal processing technology successfully streamed a video to the computer LiFi is high-speed and would complement existing heterogeneous Radio Frequency (RF) wireless networks, and would provide significant spectrum relief by allowing cellular and Wi-Fi and WiMAX systems to off-load a significant portion of wireless data traffic. , high security for you can't see the light you can't access the data, LiFi used of the visible light portion of the electromagnetic spectrum to transmit information at very high speeds. This is in contrast to established forms of wireless communication such as Wi-Fi which used traditional radio frequency (RF) signals to transmit data, Optical communication or the so-called optical telecommunications, are taking advantage of light to transmit information, And because of the very high speed of light and preserve the environment has become this kind of communication is a very high importance.

The visible light spectrum is 10,000 times bigger than the radio-wave spectrum in

which all of our wireless communications take place. With our Wi-Fi networks getting ever more crowded as more and more connected devices join the fray, internet performance is only going to suffer. A completely different spectrum is one obvious solution, and that's just what Li-Fi promises to provide access to. Li-Fi is also potentially much more energy efficient than Wi-Fi, which requires costly and power-hungry masts to operate. The infrastructure for Li-Fi, meanwhile, is already partially in place, and a connection could eventually be as simple to initiate as turning on a lamp.

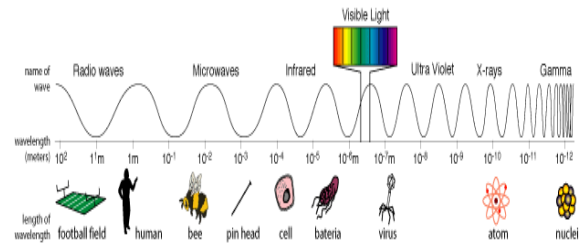


Figure 1: Electromagnetic Spectrum Diagram

2. Technology Details of LiFi, WiFi, and WiMAX

A. LiFi

Li-Fi is high speed and fully networked wireless communication technology .and is a form of visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication, or even a replacement in contexts of data broadcasting. It is so far measured to be about 100 times faster than some Wi-Fi implementations, reaching speeds of 10 gb/s and uses visible light communication or infra-red and

near ultraviolet (instead of radio frequency waves) spectrum, part of optical wireless communications technology, The LiFi system uses standard LED light bulbs which control turn the LED on and off.

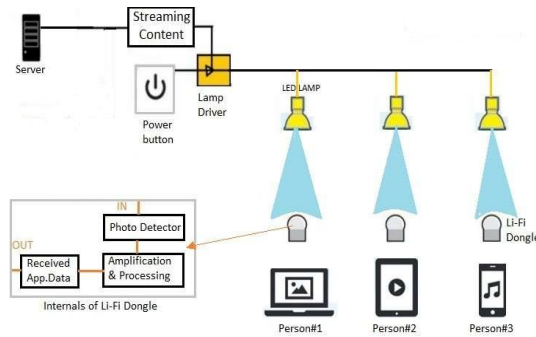


Figure 2: Block Diagram of LiFi system

B. WiFi

The term WiFi (Wireless Fidelity), which means the wireless connection is used to refer to the possibility of connecting to the network (Internet or computer network) wirelessly without wires, easy to use and faster technology to reach ever, Is used WEP Wired key Equivalent Privacy This system provides protection through encryption before transmission over the air, offers WEP key are two types of encryption 64-bit and 128-bit safer and the latter provides encryption at a high level is difficult to penetrate because the hardware level in the form of open communication OSI Model in physical layer and the data link layer ,operates WiFi technology on radio frequencies such as wireless home phones.

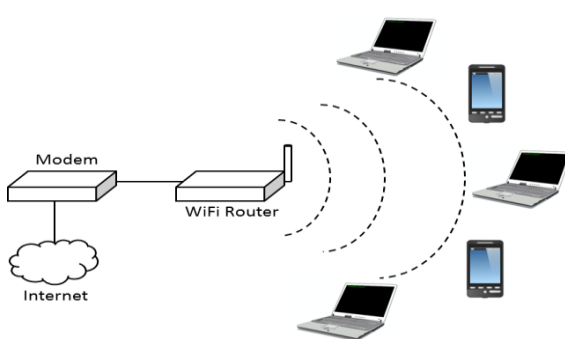


Figure 3: Block Diagram of WiFi System

C. WiMAX

WiMAX is the extension of the WiFi technology in terms of development in the large-space wireless services. The technology of WiMAX wireless regional networks Wireless Metropolitan Area Network (MAN) and aims to replace the digital lines DSL, ISDN, cable and terrestrial lines so that they become wireless, also aims to the supply of sites used for WiFi to the Internet wirelessly, which distinguishes WiMAX high speeds of up to Mb / s 280, and the movement of data, voice and video between computers and mobile phones much faster than digital subscriber line DSL and cable, where a range of up to distances up to 50 km. And it operates in the frequency band between 2-11 GHz and are perfect this technology to Internet service providers who want to expand into sparsely populated areas where cable laying costs rise or digital lines DSL.

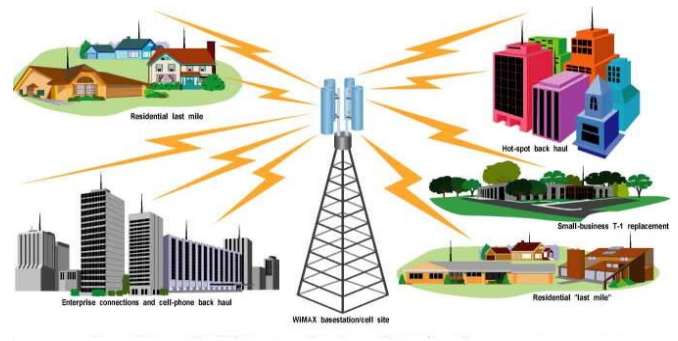


Figure 4: WiMAX System

3. Challenges of LiFi Technology

- It can be blocked easily because it does not penetrate the barriers.
- liFi requires line of sight.

4. Difference between LiFi and WiFi and WiMAX

- A. Depends on Li-Fi and WiMAX and WiFi are quite similar as both transmit data electromagnetically. However, Wi-Fi and WiMAX uses radio waves while Li-Fi uses visible light.

B. Environment Work

Li-Fi can achieve about 1000 times the data density of Wi-Fi and WiMAX because visible light can be well contained in a tight illumination area whereas RF tends to spread out and cause interference, radio waves transmission and propagation in water is extremely difficult but Li-Fi works well in this environment.

C. IEEE Standards

Li-Fi is part of the Visible Light Communications (VLC) IEEE 802.15.7 standard and Wi-Fi IEEE 802.11 standard, WiMAX IEEE 802.16a standard.

D. Operation

Li-Fi transmits data using light with the help of LED bulbs and photo detector, Wi-Fi transmits data using radio waves with the help of Wi-Fi router and WiMAX transmits data using microwave with the help of WiMAX router and microwave antenna.

E. Range

The Li-Fi cannot penetrate walls which makes a much shorter range and it was detectable up to a distance of 10 meter, Wi-Fi can cover 20 /500 meters and WiMAX will coverage a radius of 30 miles (50 km).

F. Network Topology

Li-Fi Using a Point-to-Point topology, Wi-Fi and WiMAX using Point-to-Multi Point topology

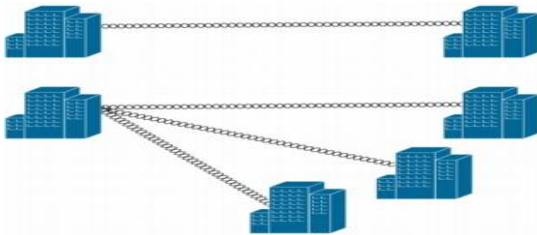


Figure 5: Point-to-Point and Point-to-Multipoint Applications

G. Speed

Light Fidelity (Li-Fi) is high-speed of up to 1 gigabits /sec, Wi-Fi up to 54 megabits/sec and WiMAX up to 10-100 megabits/sec.

H. Frequency Band

Li-Fi uses visible light band, between 400 and 800 THz , Wi-Fi operate on two standard frequencies to send and receive data 2.4 GHz or 5 GHz frequencies and WiMAX 2 to 11 GHz.

I. Security

Li-Fi signals cannot penetrate walls and work if there is direct line of sight between source and receiver, Wi-Fi and WiMAX Penetrate walls and can be accessed from outside the permit region.

J. Cost

Li-Fi is cheaper than Wi-Fi and WiMAX.

K. Spectrum range

Li-Fi is the use of the visible light portion of the electromagnetic spectrum, As shown in Figure 1, Wi-Fi is the use of the Radio range and WiMAX the use of the microwave of the electromagnetic spectrum.

L. Power consumption

The Li-Fi power consumption is low, Wi-Fi power consumption is medium and WiMAX power consumption is high.

M. Development start data

Li-Fi was introduced to the world by Professor Harald Hass at a 2011 TED, The Wi-Fi term was revived in the 1980s and 1990s mainly to distinguish digital devices that communicate without wires and WiMAX was published in 2001.

N. Setup time

Li-Fi and Wi-Fi Setup time is Fast and WiMAX Setup time is low.

O. Interference

Li-Fi is not interfering with radio signals in aircraft cabins, hospitals and nuclear power plants etc ... without causing electromagnetic interference, Wi-Fi and WiMAX is interfering with radio signals.

P. Technology

Li-Fi Technology, Present IrDA compliant devices, Wi-Fi 802.11a/b/g/n/ac/ad standard compliant devices and WiMAX

802.16a/b/c/d/e/f/g/h /j/k/m standard compliant devices.

Q. Applications

LiFi is used in In hospital, in airlines, under sea, nuclear power plants, etc ..., WiFi is used Cafe, Banks, Internet connection, etc... WiMAX is used to connect distant areas.

R. System architecture

LiFi is consists of LED light *bulb*, Photo detector, RF power amplifier circuit(PA),Printed Circuit Board(PCB),Enclosure, optics, WiFi is

consists of Antenna, wifi router , access point,WiFi card and WiMAX consists of Base Station(BS), Subscriber Station(SS) , Mobile Station (MS), ASN Gateway(ASN-GW), Authentication, Authorizations and Accounting Server (AAA).

5. Results and Discussions

The table 1 contains some comparisons which is discussed in LiFi and WiFi, WiMAX.

Table 1: Comparison between LiFi /WiFi /WiMAX

Feature	LiFi	WiFi	WiMAX
depends on	Light Fidelity	radio waves	microwave
Environment work	works in high density environment	Works in low density environment due to interference	Works in low density environment
IEEE Standars	802.15.7	802.11	802.16a
Operation	transmits data using light with the help of LED bulbs	transmits data using radio waves with the help of WiFi router	transmits data using microwave with the help of WiMAX router and microwave antenna
Range	10 meters	20-500 meters	WiMAX will coverage a radius of 30 miles (50 km)
Network Topology	Point-to-Point	Point-to-Multi Point	Point-to-Multi Point
Speed	1-10 Gbps	54 Mbps	10-100 Mbps
Frequency Band	400-800 THz	2.4 or 5 GHz	2 to 11 GHz
security	high	medium	medium

Cost	cheap	expensive	Very expensive
spectrum range	visible light	Radio range	microwave
power consumption	low	medium	high
Development start data	2011	1980	2001
Setup time	Fast	Fast	slow
Interference	There is no	exist	exist
Technoloy	Present IrDA compliant devices	WLAN 802.11a/b/g/n/ac/ad standard compliant devices	WiMAX 802.16a/b/c/d/e/f/g/h /j/k/m standard compliant devices

LiFi a term defined by the IEEE 802.15.7 standardization and WiMAX 802.16a , WiFi 802.11, LiFi system depends on Light Fidelity While each of the system Wimax and Wi-Fi support the Wireless Fidelity, LiFi transmits data using light with the help of LED bulbs and WiMAX transmits data using microwave with the help of WiMAX router and microwave antenna , WiFi transmits data using radio waves with the help of WiFi router, This makes the LiFi system is the least expensive, The LiFi system is the fastest compared to WiMAX and WiFi, no Interference with WiFi system but the WiMax and WiFi with them interference, lifi used Present IrDA compliant devices wifi used 802.11a /b/ g/ n/ ac /ad standard compliant devices WiMAX used 802.16a /b/c/d/e/f/g/h /j/k/m standard compliant devices.

6. Conclusion

With the massive development of wireless communications technology, the lifi technique appeared. And considered Related Very high speed and you the transfer of data through light, In spite of the high-speed preserve the

environment so more than Wifi and WiMAX technologies but there are also what distinguishes each technique of these techniques on the other, by the nature of the use, as shown in the above comparison.

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