

History

- Term first coined in 2011
- Introduced by Prof. Harald Hass during a 2011 TEDGlobal talk in 2011
- Projected the idea of “wireless data from every light” among the world
- Emphasis on idea of communication wirelessly using light to transmit data and position among devices
- Developed by Prof. Harald Hass, Dr. Mostafa Afgani and Dr. Gordon Povey at University of Edinburgh
- Fast and cheap version of wi-fi which based on concepts of visible light communication

Need of Li-Fi

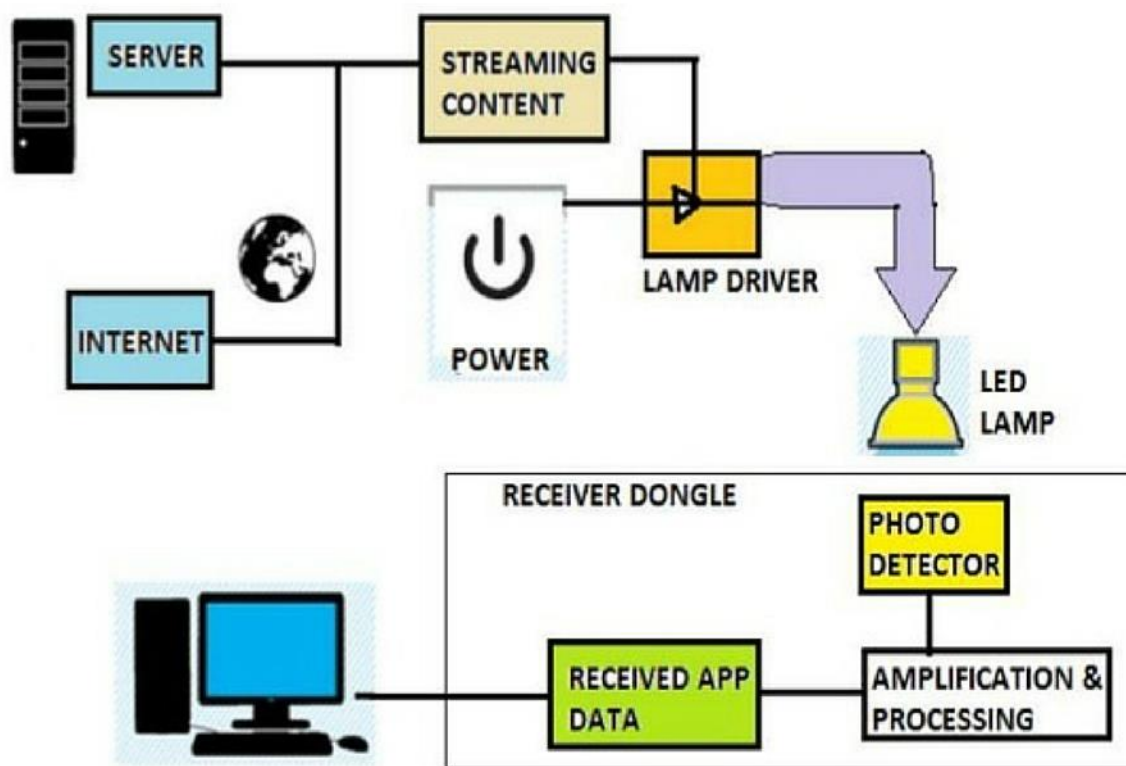
- Due to increasing demand of wireless communication, radio spectrums below 10 GHz are now found to be insufficient.
- So, to overcome this challenge, industry looks towards it by considering options of using radio spectrums above 10 Ghz frequency (mm-wave communication)
- Researchers and thinkers are finding a way in communication wirelessly through means of light.
- They sought to make light as a medium of communication.
- To overcome the limited speed in Wi-Fi
- By making use of Li-Fi, users can have a blazing speed upto 14 Gbps
- Eliminating traditional cable wire communication as LED points, which are main medium of communication in this technique, are available everywhere.

What is Li-Fi?

- Li-Fi stands for Light Fidelity.
- It is a wireless communication technique on which research is still under place.
- Fundamentally, Li-Fi is based on Visible Light Communication (VLC) technology.
- It makes use of light as a medium of communication rather than traditional cable wire communication.

- The communication takes place through light medium. Data transmitted is received at the receiver's side by a photodetector.
- To ensure proper functioning of LED, use of lamp driver is incorporated.
- The signal which is received by photo detector is then sent for amplification and processing.
- Basic working principle of Li-Fi bifurcates into 2 things:
 1. Transceiver
 2. Light as a media transmission

How Li-Fi Works ?



<https://www.cdnsol.com>

- Above diagram shows that it is a duplex communication. It is bidirectional showing that high speed transmission takes place in both links concurrently.
- Li-Fi can achieve rates of upto 14 Gbps if it makes use of red, green, and blue laser diodes. It can achieve rates of upto 100 Gbps if whole visible spectrum is used.
- Li-Fi can be seen as an amalgamation of Wi-Fi and VLC

- But here we need to understand the difference between Wi-Fi and Li-Fi & also between Li-Fi and VLC

Difference between Li-Fi and VLC

- VLC is unidirectional, point to point light communication, with low data speed rates.
- While Li-Fi is bidirectional, point to point light communication, with high data speed rates.

Difference between Li-Fi and Wi-Fi

Criteria	Li-Fi	Wi-Fi
Avg. operation speed	>10 Gbps	150-600 Mbps
Frequency band	1000 times of THz	2.4 GHz
Standard	IEEE 802.15.xx	IEEE 802.11xx
Coverage area	10 meters	20-100 meters
Topology	Point to Point	Point to Multi-point
Communication	Based on VLC	Based on RF comm.
Availability	Anywhere	Limited

Advantages

- Efficiency: As Li-Fi uses visible light technology for transmitting signals and every place like homes, offices, malls and even planes have a light source, and the same source of light can be used for transmitting the signals and data. So Li-Fi technology is very efficient in terms of cost and as well energy.
- Speed: Light waves have the ability to carry more information as compared to radio waves because visible spectrum is approximately 10,000 times larger than the spectrum of radio waves. Therefore, data transmission is faster in Li-Fi. Rate of transmission of signal is 224GB per second. This means high-definition video can be downloaded in seconds.
- Availability: Light bulbs, LEDs and many different sources of light are present everywhere. So where there is a light source, there is internet. This means that high speed data transmission could be available everywhere.

- Security: As light cannot travel through opaque structures like walls and other objects, Li-Fi internet is available to the users within a particular room or area and so cannot be breached from other rooms and buildings.

Disadvantages

- We need a light source for Li-Fi internet. Without availability of light source, internet cannot be used. This can limit the location for the use of Li-Fi.
- Limited range: As light cannot travel through opaque structures, it is a good thing while talking about security but this also means range of internet is limited.
- Light need to be on for transmission of data and would not work with the lights turned off. So it is an issue in terms of use of energy.
- One of the biggest potential drawbacks is the interception of signals in the open. Other sources of light like sun may interrupt the signal
- Limited compatibility: It only works for the devices that have Li-Fi receptors. Most of the devices that we use now are not compatible with Li-Fi and use hardware for Wi-Fi networking.

Applications:

- Hospitals: It is complicated to lay the optical fiber in hospitals. In the operation theatre Li-Fi can be used for modern medical instruments. As Li-Fi does not interfere with the devices using radio frequency, it can be used in many hospital applications.
- Defense and security: Existing technologies pose a great threat to security due to data leakage and hacking. Role of Li-Fi has been identified to be quite huge due to its ability to secure data.
- Aviation: Electronic equipments can create electromagnetic interference with the devices using radio frequency on the flight. With the use of Li-Fi, it is easy for the airline staff to communicate while eliminating data rates, extra wiring, and radio frequency interference.
- Underwater communication: In the present situation, underwater communication is next to impossible because radio waves get absorbed in water very quickly. On the other hand, light travels through water easily and can be used for communication between divers and also for military communication underwater.
- Industries: Can be used in petroleum and chemical plants where other frequencies could be hazardous.

- Smarter power plants: Wi-Fi and other radiations are dangerous for some sensitive areas like power plants. But power plants need high speed data transfer system for monitoring different things. Li-Fi could offer safe connectivity for such sensitive areas.