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Review of Gi-Fi Technology

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Abstract: *With the increasing pace of human lives faster transfer of data has become a necessity, and the present technologies which are commonly used, fail to fulfill this task. For many years mankind was dependent on wires and cables for data transfer, then the invention of optical fibers gave some hope due to its ability of faster transmission but the problem faced installation of cables limited its extensive use. But the invention of Gigabit wireless allows wireless transmission of one billion bits per second. Now the files like videos, audios big mails which have a large amount of data can be transferred from one device to another in a matter of seconds. Gi-fi refers to the faster versions of IEEE 802.11 standards. It is an invention which allows transfer of data at a rate 10 times faster than the one which is currently in use at a relatively cheaper price. The most striking feature of Gifi technology is high security. Its small size makes it portable and deployment is quick. Since it does not make use of cables at all it reduces cost of extra infrastructure.*

Keywords: *Gifi, Bluetooth, Nicta, Wi-fi, Wimax, Wireless network*

I. INTRODUCTION

IN 2008 researchers at the University of Melbourne demonstrated a on a single integrated circuit (chip) that operated at 60 GHz. Gigabit Wireless is the world's first transceiver integrated on a single chip in which a small antenna is used and both transmitter ,receiver are integrated on a single chip. Researchers chose the 57–64 GHz unlicensed frequency band the millimeter-wave range of the spectrum allowed high component on-chip integration as well as the integration of very small high gain arrays. The available 7 GHz spectrum results in very high data rates, up to 5 gigabits per second to users within an indoor environment, usually within a range of 10 meters. Wireless technology consists of a base station; this is the central location that collects all traffic to and from subscribers within a cell. The indoor base station equipment consists of channel groups. The size of the Gi-fi chip is 5×5 millimeter and can be placed in different devices such as mobile phones, computers, etc as shown in figure 1. The most striking feature about this new technology is its cost effectiveness and power consumption, it consumes approximately 2 milli watts of power and the manufacturing cost development of Gi-fi chip costs approximately \$10.

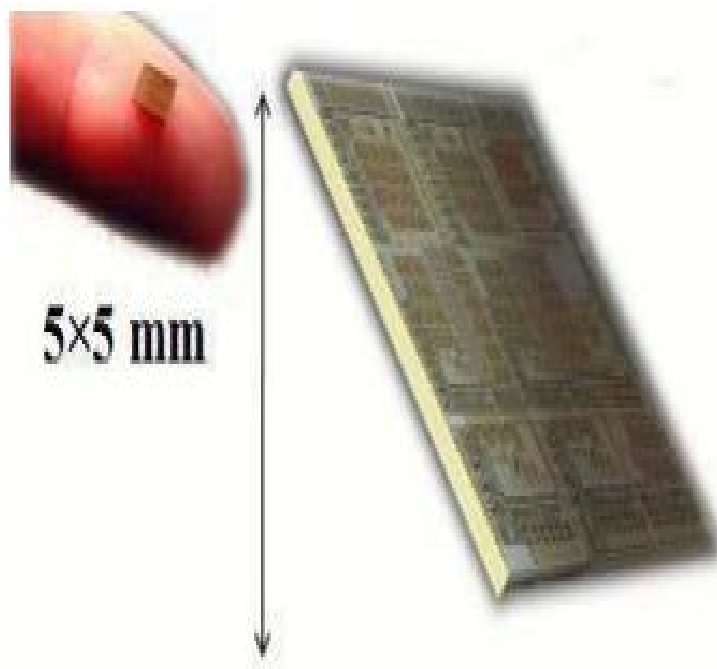


Fig.1.

II. EVOLUTIO OF WIRELESS NETWORK

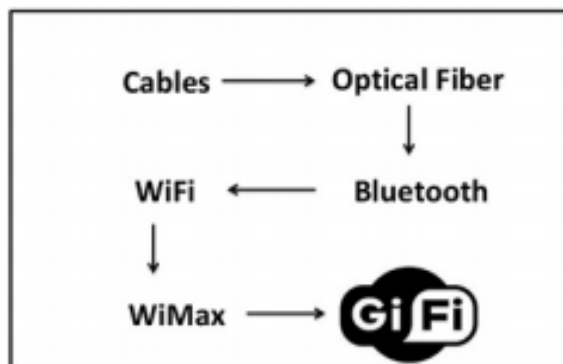


Fig.2.

A. Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz from fixed and mobile devices, and building personal area networks (PANs). Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. A master BR/EDR Bluetooth device can communicate with a maximum of seven devices in a picante, but all the devices don't reach this maximum. The devices can switch roles, by agreement, and the slave can become the master.

B. WI-FI

WI-FI is a technology for wireless local area networking with devices based on the IEEE 802.11 standards. It commonly uses 2.4GHz and 5GHz SHF ISM radio bands. Wi-Fi compatible devices can connect to the Internet via a WLAN and a wireless access point. Such an access point (or hotspot) has a range of about 20 meters. Many devices can use Wi-Fi, e.g. personal computers, video-game consoles, smartphones, digital cameras and tablet computers. These can connect to a network resource such as the internet via a wireless network access point. It usually has a data transfer rate of 11mbps. To connect to a Wi-Fi LAN; a computer has to be equipped with a wireless network interface controller. The combination of computer and interface controller is called a station. For all stations that share a single radio frequency communication channel, transmissions on this channel are received by all stations within range. A carrier wave is used to transmit the data. The data is organized in packets on an Ethernet link, referred to as "Ethernet frames".

C. WiMAX

WiMAX stand for Worldwide Interoperability for Microwave Access. It is a wireless industry coalition dedicated to the advancement of IEEE 802.16 standards for broadband wireless access (BWA) networks. WiMAX supports mobile, nomadic and fixed wireless applications. WiMax is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies (such as Cable Modems, DSL and T1/E1 links) to provide broadband access to customer premises. WiMAX operates similar to WiFi, but at higher speeds over greater distances and for a greater number of users. WiMAX has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure. It can be used to connect 802.11 hot spots to the Internet, provide campus connectivity, and provide a wireless alternative to cable and DSL for last mile broadband access.

III. ARCHITECTURE

The most important component Gifi system is subscriber station which is available to several access points. It supports line of sight operation and has an antenna present at the top to support millimeter wave wireless pan network. This helps in communication among various computer based devices including pda and telephones. It supports standard of IEEE 802.15.3c. The size of the Gi-Fi chip is 5×5 millimeter and can be placed in different devices such as mobile phones.

IV. 802.15.3C TECHNOLOGY

This mm Wave WPAN will operate in the new and clear band including 57-64 GHz unlicensed band. The millimeter-wave WPAN will allow high coexistence with all other microwave systems in the 802.15 family of WPANs. The IEEE 802.15.3C provides more security, it provides link level and service level security, hence it is used by intelligence community for high security communications since many years. To avoid interference it transmits multiple signals simultaneously across the wireless transmission paths within separate frequencies.

V. WORKING PRINCIPLE USED IN GIFI

Gifi technology makes use of Time division duplex for transmission as well as reception. In this the data file is initially converted from IF range to RF60 GHz range by using 2 mixers and this is then fed to power amplifier, which is connected to multi meter wave antenna. Incoming RF signal is converted to IF signal cantered at 5 GHz and then to normal data range; this is done using a heterodyne construction so as to avoid leakage due to direct conversion and hence due to this total data is transferred within seconds.

A. Time Division Duplex

Time-division duplexing (TDD) is a method for emulating full-duplex communication over a half-duplex communication link. The transmitter and receiver both use the same frequency but transmit and receive traffic is switched in time. As uplink traffic increases, more channel capacity can dynamically be allocated to that, and as it shrinks it can be taken away. The primary advantages of this approach as it applies to microwave communication are:

1. It is more spectrum friendly, allowing the use of only a single frequency for operation and dramatically increasing spectrum utilization, especially in license-exempt or narrow-bandwidth frequency bands.
2. It allows for the variable allocation between the transmit and receive directions, making it well suited to applications with asymmetric traffic requirements, such as video surveillance, broadcast and Internet browsing.

B. Operation at 60 GHz

The millimeter wave antenna operates at 60 GHz frequency band which is unlined band. This band helps us achieving higher data rates. It also has many other features such as excellent immunity to co-channel interference, high security, and frequency re-use. Point-to-point wireless systems operating at 60 GHz have been used for many years for satellite-to-satellite communications. This is because of high oxygen absorption at 60 GHz (10-15 dB/Km). As shown in the figure 5.3 the absorption attenuates 60 GHz signals over distance, so that signals cannot travel far beyond their intended recipient. For this reason, 60GHz is an excellent choice for covert communication.

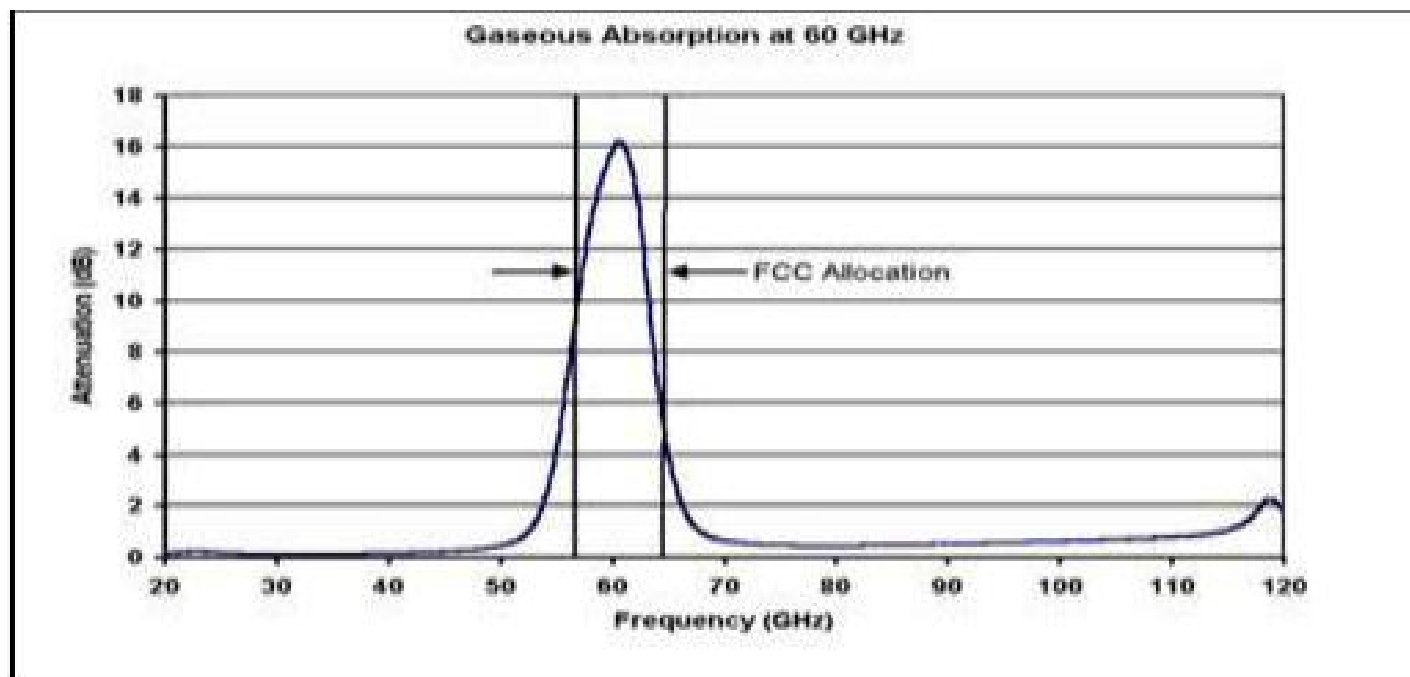


Fig 3. Oxygen attenuation v/s frequency

C. Ultra wide band frequency usage

A technology with high bit rate, high security and faster data transmission. It is a zero carrier technique with low coverage area. So we have low power consumption. These features are Ultra-Wideband is a technology for transmitting information spread over a large bandwidth (>500 MHz) that should, be able to share spectrum with other users. Regulatory settings of FCC are intended to provide an efficient use of scarce radio bandwidth while enabling both high data rate personal-area network (PAN) wireless connectivity and longer-range, low data rate applications as well as radar and imaging system. Gi-Fi is based on an open, international standard. Mass adoption of the standard, and the use of low-cost, mass produced chipsets, will drive costs down.

VI. COMPARISON OF GIFI WITH EXISTING TECHNOLOGIES

TABLE 1.

| Parameters | Bluetooth | Wi-fi | Gi-fi |
|-------------------------|---|--|---|
| Frequency | 2.4Ghz | 2.4GHz | 57-64 GHz |
| Range | 10meters | 100meters | 10meters |
| Data Transfer Rate | 800kbps | 11mbps | 5 Gbps |
| Power consumption | 5mW | 10mW | <2mW |
| Specification Authority | Bluetooth SIG | IEEE ,WECA | NICTA |
| Development Start | 2004 | 1990 | 1998 |
| Primary Devices | Mobiles, laptops, home devices, electronics, etc. | Mobiles,laptops,desktops, Computer servers | Mobiles, laptops, home devices, electronics, etc. |

VII.BENEFITS OF GIFI TECHNOLOGY

A. High Security

Gi-fi technology provides more security as compared to Wi-Fi and Bluetooth. Point-to-point wireless systems operating at 60 GHz have been used for many years by the intelligence community for high security communications and by the military for satellite-to-satellite communication.

B. Low Power Consumption

The most striking feature of Gi-fi technology is that it consumes approximately 2 milli watts of energy for data transfer of gigabits of information. This is fairly low when compared to the existing technologies. Bluetooth and Wi-Fi consume 5mW and 10mwW respectively.

C. High Speed Data Transfer

The speed of data transfer in Gifi technology is 5gbps.This means a whole 4k HD video can be transferred within a matter of seconds. It is 10 times faster than Wi-Fi.

D. Low cost

The current price of wireless integrated transreciever chip is close to 10\$ and is expected to decline further in the coming years. This means that this can be technology can be employed by cell phones and computers and it won't drive up the price.

E. Small in Size

The size of the Gi-Fi chip is 5×5 millimeter and can be placed in different devices such as mobile phones. The chip has a tiny 1mm antenna and uses the 60GHz “millimeterwave”spectrum[6]. It is highly portable in accessing devices such as in internal radio modules, network interface cards, network transmission units, in household appliances.

F. Quick deployment

Once the antenna and equipment are installed and powered, GI-FI is ready for service. In most cases, deployment of GI-FI can be completed in a matter of minutes compared with hours for other solutions.

VIII. APPLICATIONS

Inter vehicle communication is possible due to Gi-fi systems. It helps the vehicles to stay connected and go and it also offers better speed of vehicles in advent of communication system. The data exchange between vehicles is made possible by adhoc networks. Gi-fi technology provides more security as compared to Wifi and Bluetooth. Point-to-point wireless systems operating at 60 GHz have been used for many years by the intelligence community for high security communications and by the military for satellite-to-satellite communication.

As Gi-fi can be used in variety of devices like TV, laptops, mobile phones, etc. one can download and transfer high definition movies and videos in a matter of seconds.

As the data files are transferred to RF 60GHz range by making use of two mixers from an IF (Intermediate Frequency) gifi can be used more productively in wireless pan networks.

Due to its ability to transfer files at higher rates it would prove very effective in day to day office works.

It can be used in broadcasting video transmission system in stadiums and mm wave video signal transmission systems.

IX. CONCLUSION

In this research paper we talk about the evolution of wireless network syetms,how gifi has an upper hand when compared to existing technologies like wifi and bluetooth,the working of gifi network and its achitecture. We also discuss the various fields in which gifi technology can be or is being used. There is still lot to explore about this topic and research is being done. Its ability to transfer files at an extraordinary rate, less power consumption, its mobility and portability makes it lot more desirable than wifi, wimax and bluetooth. Since its range is limited to 10 meters, it can only be used for short range applications, an increase in that factor will help in widening its application in other fields too.

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