

## **HIGH-RATE WIRELESS COMMUNICATION: GI-FI**

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### **ABSTRACT**

*The rapid advancement in the field of science and technologies has hold pressure on Wi-Fi, Bluetooth, broad bands, modems which in turn has also lower their speed of transferring and receiving data, so as to push wireless communication to faster drive a new evaluation of Gi-Fi technology has taken place. Gi-Fi or Gigabits Wireless is the world's first transceiver integrated on a single chip that operates on 60GHz on the CMOS process. It has enormous advantages in comparison with the present technologies, it offers faster information rate in Gbps, less power consumption and low cost for short range transmission. The break in Wi-Fi, Bluetooth, etc. by Gi-Fi will prove to be vital in enabling the digital economy of the future.*

**Keywords:** *Bluetooth, C-MOS, Gi-Fi, Wi-Fi, Wi-Max.*

### **I. INTRODUCTION**

Introduction of technologies like Wi-Fi (IEEE-802.11b) and Wi-Max (IEEE-802.16e) [1] has proved a revolutionary solution to “last mile” problem but the original speed for data exchange has been limited and slow but the man’s continuous quest for even better technology despite the substantial advantages of present technologies led the invention of new, more up-to-date standards for data exchange rate i.e., Gi-Fi, developed by researchers of Melbourne University.

Gi-Fi stands for Gigabits (fidelity), Wireless, Gi-Fi is a wireless transmission system which is ten times faster than other wireless short range technologies and its chip delivers short –range multigigabits data in a local environment. It promises to have speed of 5Gbps (gigabits per seconds) within a confined range of ten metres, which is ten times greater than the current transfer rates of other short ranges technologies. Gigabits wireless uses a single 5mm square chip and a 1mm wide antenna burning less than 2milliwatts power to transmit data wirelessly over specific distances. It has both the transmitter and receiver fabricated on a single chip using the CMOS (complementary metal oxide semiconductor) process. It operates on 60GHz frequency band thereby allowing it to send large files, audio, video data within a fraction of seconds.

The main and important component of a Gi-Fi system is its subscriber station which is available to several access points. It supports standard of IEEE 802.15.3C which uses small antenna at the subscriber support millimetre-wave wireless PAN network [2].In this network, the antenna is mounted on the roof and it supports Line Of Sight (LOS) [3] operation. This millimetre-Wave WPAN will operate in the new and clear band including 57-64GHz unlicensed band defined by FCC 47 CFR 15.255.The millimetre-wave WPAN will allow high coexistence(close physical spacing)with all other microwave system in the 802.15 family of WPANs. It transmits multiple signals simultaneously across the wireless paths within separate frequencies to avoid interferences.

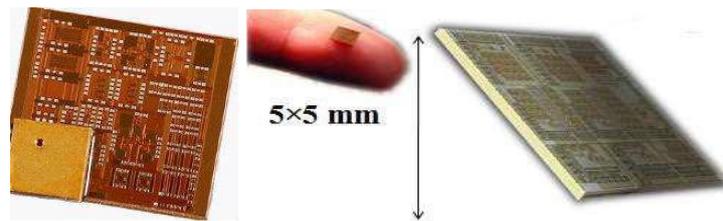


Figure 1: Silicon Chip Used in gi-fi [3].

## II. NETWORK EVOLUTION

Communication technology is divided into two types i.e. wired technology and wireless technology. The evolution of wireless technology has led to Bluetooth, Wi-Fi, GI-Fi technology

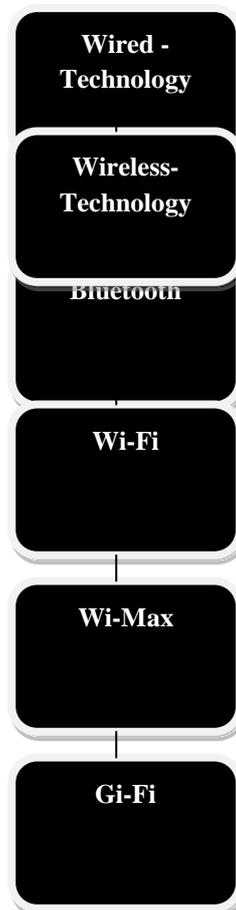


Figure 2: Hierarchy of Networks

Initially, for many years cable ruled the world, but the installation of wires caused a greater difficulty and thus led to wireless access. The foremost of this is Bluetooth which can cover 9-10mts. Wi-Fi followed it having coverage area of 91mts i.e. Wi-Fi style access will be limited to a 4-to-6 mile perhaps 25 square miles or 65 square km of coverage than through the stronger line-of-sight antennas, Wi-Max rooted the communication which enabled a maximum range but further the high cost of infrastructure have not yet made it possible for these technologies to become a total threat to cellular networks, so as to uproot this problem of Wi-Fi a major development in the field of communication has taken place by inventing Gi-Fi.

III. WORKING PRINCIPLE USED IN GI-FI:

NICTA, Australia Information and Computer Technology in collaboration with University of Melbourne have chosen to develop this technology in the 57-64GHz unlicensed frequency band on a single chip that operates on the CMOS (complementary metal –oxide-semiconductor) process the most common semiconductor technology as the millimetre-wave range of the spectrum makes possible high component on-chip integration as well as allowing for the integration of very small high gain arrays. The available 7GHz of 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 .It satisfies the standards of IEEE 802.15.3C .

In this we will use time division duplex (TDD) [4] for both transmission and receiving. Here data files are up converted from IF range to RF60Ghz range by using 2 mixers and we will feed this to a power amplifier, which feeds millimetre wave antenna. The incoming RF signal is first down converted to an IF signal cantered at 5 GHz and then to normal data ranges. Here we will use heterodyne construction for this process to avoid leakages due to direct conversion and due to availability of 7 GHz spectrum the total data will be will be transferred within seconds.

Here we will use millimetre wave antenna which will operate at 60 GHz frequency which is unlined band because of this band we are achieving high data rates energy propagation in the 60 GHz band ,which has unique characteristics that make possible many other benefits such as excellent immunity to co-channel interference high security ,frequency re-use. Point to point wireless system operating at 60 GHz has been used for many years for satellite communications. This is because of high oxygen absorption at 60 GHz, as shown in the figure 5. The absorption at 60 GHz signals over distances, so that signals cannot travel far beyond their intended recipient .For this reason 60 GHz is an excellent choice for convert communication. Ultra Band Frequency (UWB) [5], 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. Hence UWB is a technology for transmitting information and spread it over a large bandwidth so that it should to able to share spectrum with other users.

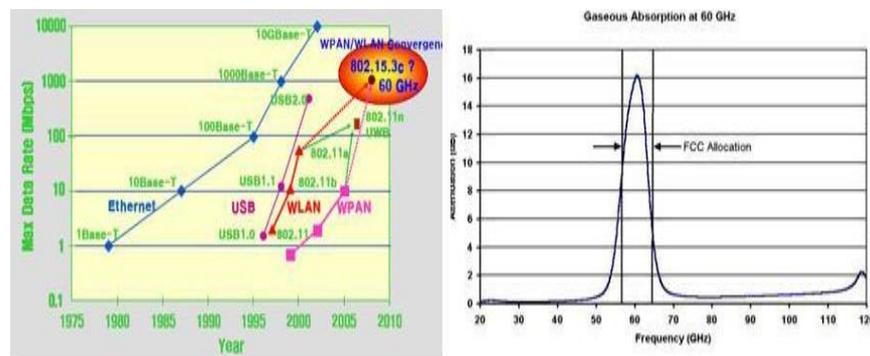


Figure: 3 (From Left To Right) Showing 7ghz Spectrum, Oxygen Attenuation V/S Frequency [6][7].

## IV. ADVANTAGES OF GI-FI

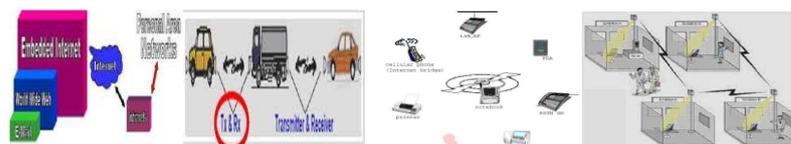
1. High Speed Of Data Transfer – Because of wider availability of continuous 7 GHz spectrum results in high data rates. As the name itself indicates data transfer rate in giga bits per second. Speed of Gi-Fi is 5 gbps. An entire high definition (HD) movie can be transmitted to a cell phone within a second.
2. Less Interference In Data Transfer –It uses 60 GHz millimetre wave spectrum to transmit the data, which makes its cellular network less crowded and the chip provides hundred times faster than the Wi-Fi with less interferences.
3. Low Power Consumption- Power Consumption of present technologies such as Wi-Fi and Bluetooth are 5mw and 10 mw but chip used in Gi-Fi uses tiny one-millimetre antenna and it has less than 2 mili watts of power consumption that in current technologies if compared is very less.
4. Provides High Security- Among the factors that have held back enterprise uptake of wireless LANs outside green field sites have been security fears and lack of performance compared to wire line Ethernet. About 70 per cent of firms have deployed their WLAN in a secure firewall zone but are still using the old WEP protocol, which does not protect the application layer effectively, so better encryption is urgently needed. Secure encryption technology in Gi-Fi ensures privacy and security of content as Gi-Fi technology is based on IEEE 802.15.3C and this standard provides more security since it provides optional security in the link level and service level.
5. Cost Effective - Gi-Fi is based on an open, international standard. Mass adoption of standard, and the use of low cost, mass produced chipsets, will drive costs down dramatically and the resultant integrated wireless trans receiver chip which transfer data at high speed low price \$ 10 only which is very less as compare to present systems as go on development the price will be decreased. Hence it can be said that Gi-Fi is economically feasible.
6. Simplicity-One of the problems with wire connections and cables is complexity for connecting, but in the Gigabit wireless technology simplicity is one of the features. Simple connection improves the consumer experience.
7. Removing Cables-For many years cables ruled the world of communication, but use of cables lead to great loss of information and was cumbersome. Gi-Fi technology removes need for cables to connect consumer electronics devices and the entire device in the range of 10 meters can be connected in order to transmit the data wirelessly.
8. Small-Size: It uses a chip sized 5mm per side.
9. High Level OF frequency Re-Use Enabled- the communication needs of multiple customers within a small geographic region can be satisfy by this technique. This Gi-Fi technology allows wireless streaming of uncompressed high-definition content and operates over a range of 10 meters without interference. It is highly portable and can be constructed in everywhere. Entire transmission system can be built on a cost effective single silicon chip that operates in the unlicensed, 57-64 GHz spectrum band. Gi-Fi technology also enables the future of information management to an easy deployment with the small form factor .It deploys line of sight operation having only shorter coverage area, it has more flexible architecture.

Characteristics	Bluetooth	Wi-Fi	Gi-Fi
Specification Authority	Bluetooth SIG	IEEE, WECA	NICTA
Development Start date	1998	1990	2004
Primary Devices	Mobile phones, PDAs, Consumer Electronics, Office Industrial, automation Devices	Notebooks, Computers, Desktop Computers, Servers	Mobile phones, Home Devices, PDAs, Consumer, Electronics, Office, Industrial, automation Devices
Power Consumption	5mw	10mw	<2mw
Data transfer rate	800Kbps	11Mbps	5Mbps
Range	10m	100m	10m
Frequency	2.4GHz	2.4GHz	57-64GHz
Usage location	Anywhere two Bluetooth devices exist.	Within the range of WLAN infrastructure.	Highly portable.

**Figure 5: Comparison of Gii-Fi And Other Technologies [8]**

**V. APPLICATIONS OF GI-FI**

There are many usage scenarios that can be address by Gi-Fi .Gi-Fi is highly practice oriented technology marked with lots of uses in current world. .Gi-Fi provides a completely new set of optical technologies and technologies offer to fulfil house hold appliances and office appliances.Gi-Fi has also spread its wings broad casting video signal transmission system in sport stadium and inter –vehicle communication system, Media Access Control (MAC) and imaging.



**Figure 6: Various Uses of gi-fi.**

## VI. CONCLUSION

Gi-Fi has practical and viable possibilities which are need to be explored further, it is a up growing and on growing technology giving a stiff vying to developed and developing technologies. The abstraction of Gi-Fi has win over the interest of many making it more attractive. Future use of Gi-Fi are highly noticeable with great benefit and relives Wi-Fi consumption.

## VII. FUTURE SCOPE

As the range is limited to shorter distances only we can expect can expect the broad band with same speed and low power consumption

- Easily Embedded Into device
- Wireless Office and Home Equipment
- Great Reliability and Ability
- Greater Potential
- Wireless HD

A completely integrated single chip transceiver has been fabricated tested and demonstrated in Gi-Fi chip and a transceiver with integrated phased array antenna on 65nm CMOS technology has been sent for fabrication. Gi-Fi technology demonstrates the world's first fully integrated interesting features of this new technology it can be predicted that transceiver on CMOS technology operating at 60 GHz and provides new technique for integrating antennas on CMOS. Demonstrations of Gi-Fi technology can be arranged showing the - huge potential it has to change the way consumers use their in home electronic devices. The Gi-Fi team is looking for partners interested in commercializing its 60GHz chips and with growing consumer adoption of High-Definition (HD) television, low cost chip and other the anticipated worldwide market for this technology is vast. Within next few years, we expect Gi-Fi to be the dominant technology for wireless networking. By providing low-cost, high broadband access, with very high speed large files swapped within seconds it could develop wireless home and office of future.

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