

Evolution of Gi-Fi Technology for the Upcoming Generation

Savita Sangappanavar, Poornima G R, C K Narayanappa

Abstract — Gi-Fi is a wireless transmission system which is ten times faster than Wi-Fi and its chip delivers short-range multigigabit data transfer in an indoor environment. In this paper Gi-Fi technology is defined in detail and also a comparison in performance between Gi-Fi and some of existing technologies are made and it shows that this gigabit wireless technology has an edge over current technologies due to its high speed data transfer rate that is Gbps, low power consumption and low frequency interference. The benefits and features of this new technology are explained and the applications for that are prescribed that can be helpful for use in development of the next generation of devices and places. By providing low-cost, high broadband access, with very high speed large files swapped within seconds. It is expected that Gi-Fi to be the preferred wireless technology used in home and office of future. In this paper future of gigabit wireless technology is traced.

Index Terms — Bluetooth, CMOS, Gi - Fi, gigabit wireless, Wi-Fi, Wireless technology.

I. INTRODUCTION

Wi-Fi (IEEE-802.11b) and Wi-Max (IEEE-802.16e) have captured our attention, as there are no recent developments in the above mentioned technologies which cannot transfer data and video information at a faster rate and led to the introduction of Gi-Fi technology. It gives some advantages over Wi-Fi, a similar wireless technology, that offers faster information rate in Gbps, less power consumption and low cost for short range transmissions. Gi-Fi or Gigabit Wireless is the world's first transceiver integrated on a single chip in which a small antenna used and both transmitter and receiver are integrated on a single chip which is fabricated using the complementary Metal Oxide Semiconductor (CMOS) process, same system that is currently used to print silicon chips [1], [2]. Because of Gi-Fi transfers large videos, files can be send within seconds. Researchers of Melbourne University has come up with a wireless technology which promises high speed short range data transfers with a speed of up to 5Gbps within a radius of 10 meters [1]. The new wireless technology is named as Gi-Fi and operates on the 60GHz frequency band, which is currently mostly unused. The Gi-Fi Chip developed by the Australian researcher's measures 5mm square. The best part about this new technology is its cost effectiveness and power consumption, it consumes only 2 milli watts of power for its operation with antenna (1mm) included and the development of Gi-Fi chip costs approximately \$10 (Rs 380)

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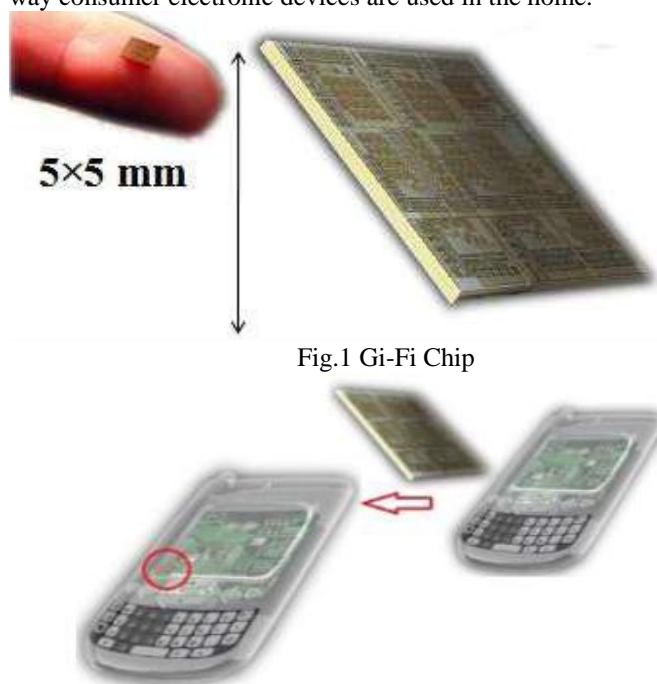
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to manufacture. In theory this technology would transfers GB's of your favorite high definition movies within seconds. So Gi-Fi can be considered as a challenger to Bluetooth [2] rather than Wi-Fi and could find applications ranging from upcoming mobile phones to consumer electronics.

II. EVOLUTION OF Gi-Fi

The process of Gi-Fi would use a chip that transmits at signal would allow a chip to send as much as five gigabits per second. While the spectrum would limit the device to the same 33-foot range as Bluetooth or UWB (Ultra-Wide Band), it could theoretically transfer an HD movie to a cell phone in seconds, the researchers claim [2]. The size of the Gi-Fi chip is 5×5 millimeter and can be placed in different devices such as mobile phones, as it is shown in the fig.1 and fig.2. The NICTA (National ICT Australia Limited) Gi-Fi research team has succeeded in taking complex 60GHz transmission technology and shrinking it to the point where it can be built on a single silicon chip. The NICTA team's expertise in wireless transmission technology means this technology is now at the point where it can have a dramatic impact on the way consumer electronic devices are used in the home.



Gi-Fi chip is the first transceiver in the world that is integrated on a single chip and operates at 60GHz on the CMOS (complementary metal oxide semiconductor) process and delivers short-range multi-gigabit data transfer in an indoor environment. It is a complete wireless system on a single integrated circuit that provides around ten times the bandwidth at one-tenth the cost of existing technologies such as Bluetooth and Wi-Fi. NICTA researchers have chosen to develop this technology in the 57-64GHz unlicensed

frequency band as the millimeter 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 [1,2]. 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 [1].It satisfies the standards of IEEE 802.15.3C.

III. COMPARISON BETWEEN EXISTING TECHNOLOGIES AND Gi-Fi

Gi-Fi wireless technology has been developed and can be an extremely fast replacement for technologies such as Bluetooth and ultra-wideband (UWB). The process of Gi-Fi would use a chip that transmits at an extremely high 60GHz frequency versus the 5GHz used for the fastest forms of Wi-Fi [3]. The sheer density of the signal would allow a chip to send as much as five gigabits per second. While the spectrum would limit the device to the same 33-foot range as Bluetooth or UWB, it could theoretically transfer an HD movie to a cell phone in seconds, the researchers claim. Mixing and signal filtering used in Gi-Fi technology would keep the signal strong versus the longer-ranged but slower and more drop-prone Wi-Fi option of today. The chip in Gi-fi would likely cost about \$10 or less to build. This and a small design would allow cell phones and other small devices to add the technology without significantly drive up the price, according to the company. The change opens the possibility of a successor to UWB and its related technology Wireless USB which matches the same range but roughly the same 480Mbps peak speed of its wired equivalent. In recent years, new wireless local area networks (WLANs) such as Wi-Fi [6] and wireless personal area networks (WPAN) such as Bluetooth [7] have become available. Table I compares different options of these different systems.

Table I. Comparison of Gi-Fi and existing technologies

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	Notebook Computers, Desktop Computers, Servers	Mobile phones, Home Devices, PDAs, Consumer, Electronics Office Industrial automation Devices
Power Consumption	5 mw	10 mw	< 2 mw
Data Transfer Rate	800 Kbps	11 Mbps	5 Gbps
Range	10 Meters	100 Meters	10 Meters
Frequency	2.4 GHz	2.4 GHz	57-64 GHz

Table I. demonstrates the large power consumption associated with Wi-Fi and Bluetooth technologies in compare to Gi-Fi. Wi-Fi requires 10mili watts and Bluetooth requires 5mili watts when Gi-Fi requires less than 2mili watts [6], [7]. Data transfer rate of Wi-Fi is up to 11 Megabit per second and

Bluetooth has 800 kilobits per second while Gi-Fi is able to transmit the data at the rate of 5 Gigabit per second. Wi-Fi and Bluetooth are operating in the frequency of 2.4 Giga Hertz but Gi-Fi uses the 60GHz millimeter wave spectrum to transmit the data, which gives it an advantage over Wi-Fi. Wi-Fi’s part of the spectrum is increasingly crowded, sharing the waves with devices such as cordless phones, which leads to interference and slower speeds. We can conclude that the Gi-Fi is an appropriate technology for short distance data transmission to be used in many devices and places.

IV. Gi-Fi FEATURES

The most important features of the Gi-Fi technology can be summarized as follows:

A. Removing Cables

For many years cables ruled the world. Optical fibers played a dominant role for its higher bit rates and faster transmission. But the installation of cables 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. The standard’s original limitations for data exchange rate and range and high cost of the infrastructures have not yet made it possible for Wi-Fi to become a good replace for the cables Gi-Fi technology Removes need for cables to connect consumer electronics devices and all the devices in the range of 10 meters can be connected in order to transmit the data wirelessly.

B. Low Cost Chip

Gi-Fi’s chip uses only a tiny one-millimeter-wide antenna and less than 2mili watts of power. Low-cost chip allows technology to be readily incorporated into multiple devices. The chip in Gi-fi would likely cost about \$10 or less to build [4,8]. This and a small design would allow cell phones and other small devices to add the technology without significantly drive up the price, according to the company. 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 dramatically, which is very less in compare to present technologies.

C. 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 [9]. Secure encryption technology in Gi-Fi ensures privacy and security of content.

D. 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.

E. High Speed Data Transfer

As the name indicates data transfer rate of Gigabit wireless technology is in Gigabits per second. Speed of Gi-Fi is 5 Gbps; which is 10 times the data transfer of the existing

technologies. Providing higher data transfer rate is the main invention of Gi-Fi. An entire High-Definition (HD) movie could be transmitted to a mobile phone in a few seconds, and the phone could then upload the movie to a home computer or screen at the same speed.

F. No Interference

It uses the 60GHz millimeter wave spectrum to transmit the data, which gives it an advantage over Wi-Fi. Wi-Fi's part of the spectrum is increasingly crowded, sharing the waves with devices such as cordless phones, which leads to interference and slower speeds. But the millimeter wave spectrum (30 to 300 GHz) is almost unoccupied, and the new chip is potentially hundreds of times faster than the average home Wi-Fi unit [10].

G. Low Power Consumption

Power consumption of the present technologies such as Wi-Fi and Bluetooth are 5mili watts and 10mili watts but chip of Gi-Fi uses a tiny one-millimeter-wide antenna and it has less than 2mili watts of power consumption that in compare to the current technologies is very less.

V. APPLICATIONS OF Gi-Fi

A. Gi-Fi Access Devices

Some of the Gi-Fi access devices are shown in fig.3. These access devices include termination units, internal radio modules, network interface cards, printers, PC's, and all household electronic appliances [3].

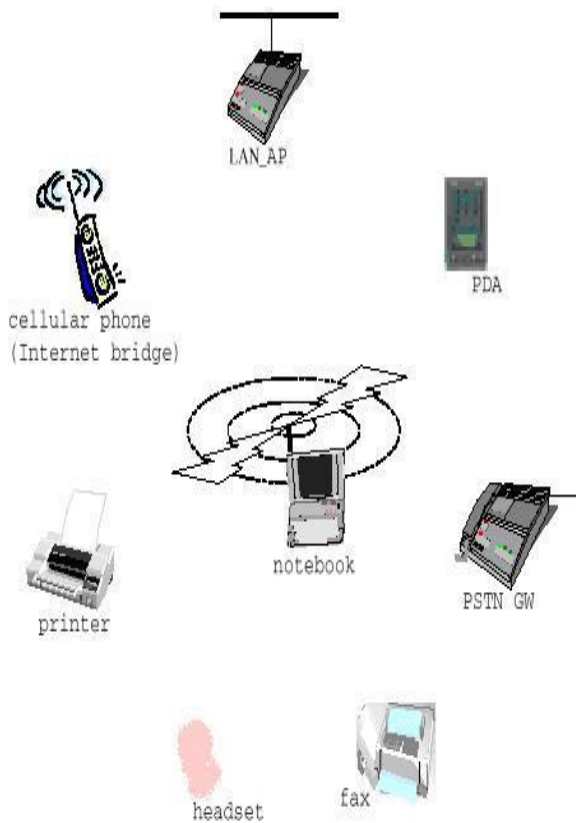


Fig. 3 Gi-Fi Access Devices

B. Broadcasting Video Signal Transmission System in Sports Stadium

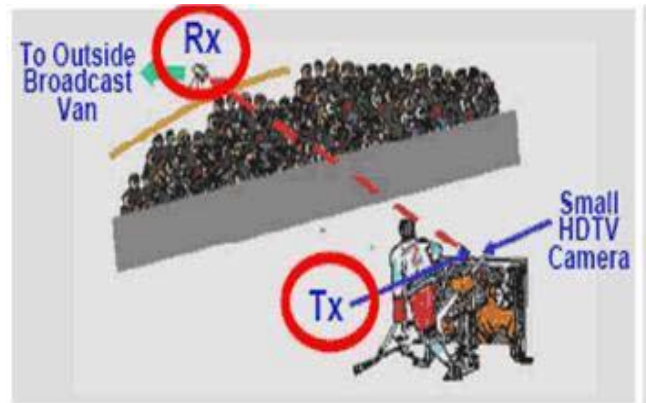


Fig.4 Sports Stadium

Easy and immediate construction of temporal broad band network such as in sports stadium for the advertisement of information distribution can be possible [9].

C. Office Appliances

As Gi-Fi data transfer rate is very high we can transfer data at very high speed in offices as shown in fig. 7 which made work very easy and it also provides high quality of information from the internet.

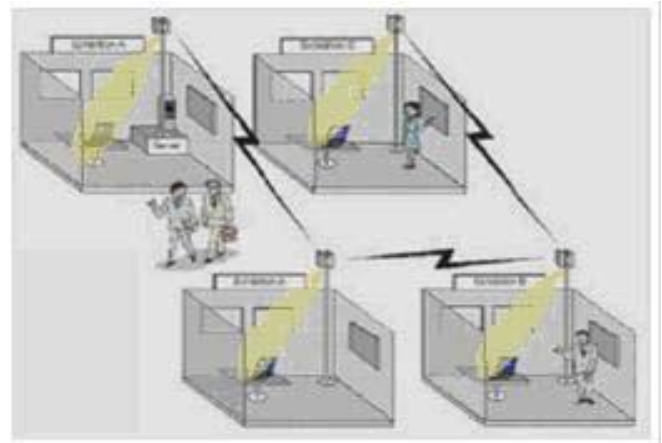


Fig.5 In Office

D. Video Information Transfer



Fig 6.Video transformation

By using present technologies video swapping takes hours of time where as with this technology as shown in fig 6 we can transfer data at a speed of giga bits/sec same as that for the transfer of information from a PC to a mobile and vice-versa.

E. Inter Vehicle Communication System

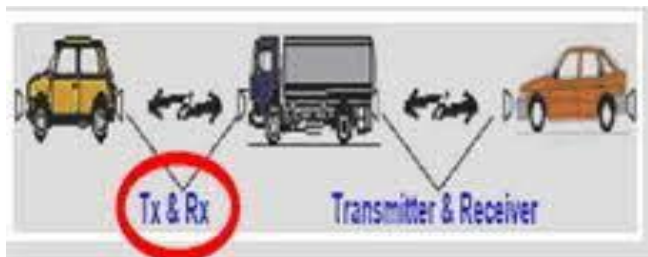


Fig 7. Inter vehicle communication system

The data exchange between vehicles is made possible by ad-hoc networks. These short- distance connections are spontaneously created between the vehicles as the need arises and can organize themselves without the help of any external infrastructure.

VI. FUTURE OF Gi-Fi

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 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 interesting features of this new technology it can be predicted that 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.

VII. CONCLUSION

In this paper Gi-Fi technology is defined that will allow wireless transfer of audio and video data up to 5 gigabits per second, ten times the current maximum wireless transfer rate, at one-tenth of the cost, usually within a range of 10 meters that operates at 60GHz on the CMOS process. This technology removes cables that for many years curled the world and provides high speed data transfer rate. The comparison that is performed between Gi-Fi and existing wireless technologies in this paper shows that these features along with some other benefits such as Low-cost chip, No Frequency Interference, Low Power Consumption and High Security that are explained in detail in this paper, makes it suitable to replace the existing wireless technologies for data transmission between devices that are placed in the short distances from each other. Gi-Fi technology has much number of applications and can be used in many places and devices such as smart phones, wireless pan networks, media access control and mm-Wave video-signals transmission systems.

This chip could also replace HDMI cables and develop wireless home and office of future. Finally some of the future works related to Gi-Fi has given and it is conspicuous that more research should be done in the field of this new wireless technology and its applications.

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