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Evaluation of Gi-Fi Technology for Short-Range, High-Rate Wireless Communication

Dr. B.K. Verma[1], Dr. Shashi Bhushan[2]
Professor, CSE-AI & DS[1], Professor & Director[2]
Panipat Institute of Engineering and Technology, Samalkha, Haryana[1]
Amity school of Engineering and Technology, Patna, Bihar[2]
Email: bkverma.3474@gmail.com[1], shashibhushan6@gmail.com[2]

Abstract: *GiFi is a wireless transmission system which is ten times faster than Wi-Fi and it's chip delivers short-range multi-gigabit data transfer in an indoor environment. In this paper this technology is defined in detail. Also a comparison is perform between Gi-Fi and some of existing technologies and it shows that this gigabit wireless technology has an edge over current technologies due to its high speed data transfer rate that is 5 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 also is traced.*

Keywords: Gi-Fi, Gigabit wireless; Wi-Fi, Wireless technology; Bluetooth.

Introduction

As growing numbers of electronic devices find their way into the average home, they're bringing with them an annoying companion: rats-nests of connector cables. Home entertainment systems require high-speed communication to perform at their peak. This means bundles of unsightly cables, as high definition video needs transmission speeds that are generally only available from fixed connections. In some cases, Short-range wireless technologies have long been seen as a solution, but today's consumer-level home wireless networks cannot deliver these sorts of transmission rates [1-4]. Most of these available technologies cannot deliver the multi-gigabit speeds needed to transmit high-quality video signals; those that can, have been prohibitively expensive. CMOS (complementary metal–oxide–semiconductor) process [5, 6].It 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 [5]. In fact, GiFi is a wireless transmission system which is ten times faster than Wi-Fi and it is expected a revolution networking in offices and homes by implementing high-speed wireless environments. It utilizes a 5mm square chip and a 1mm wide antenna burning less than 2milli watts of power to transmit data wirelessly over short distances, much like Bluetooth [6]. The Nitro chipset in Gi-Fi technology by offering reduced size and power consumption, can be used to send and receive large

amounts of data in a variety of applications, it is able to transfer gigabits of data within seconds and therefore it can be used for huge data file transmission and it is expected that this chipset replaces HDMI (High-Definition Multimedia Interface) cables and could develop wireless home and office of future [6-8]. Gi-Fi technology provides many features such as ease of deployment, small form factor, enabling the future of information management, high speed of data transfer, low power consumption etc. With growing consumer adoption of High-Definition (HD) television, low cost chip and other interesting features and benefits of this new technology it can be predicted that the anticipated worldwide market for this technology is vast.

II. Definition

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. 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 (Ultra-Wide Band), it could theoretically transfer an HD movie to a cell phone in seconds, the researchers claim [7]. 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) GiFi 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.

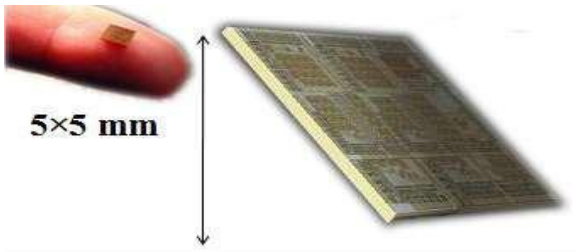

Fig. 1: Gi-Fi chip.

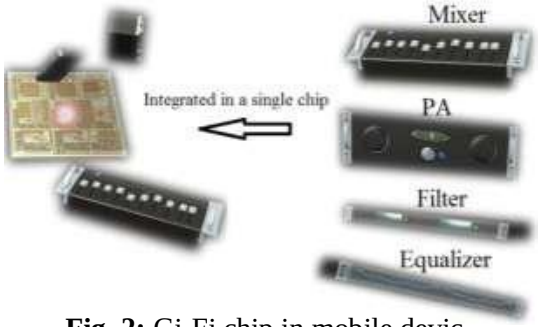

Fig. 2: Gi-Fi chip in mobile devic

The GiFi 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. The integration of the existing technologies is shown in fig. 3. 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 [5,6]. 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 10meters [8].It satisfies the standards of IEEE 802.15.3C.

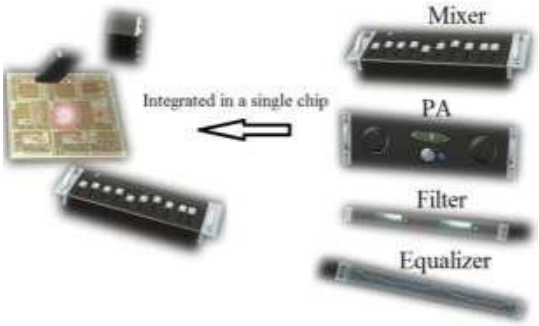

Fig. 3: Gi-Fi chip in mobile device.

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 [7]. 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 [10] and wireless personal area networks (WPAN) such as Bluetooth [11] 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 WiFi 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 [10, 11]. 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.

Benefits of Gi-Fi Wireless Technology

The most important benefits 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 [8, 12]. 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. 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.

In addition to the above mentioned benefits, there are many other benefits related to the Gi-fi technology that can be achieved by the deployment and use of this technology. Enhancements to next generation gaming technology is one of the other benefits of this new technology

Gigabit Features

The new gigabit wireless system provides Multi-gigabit wireless technology that removes the need for cables between consumer electronic devices and is More than 100 times faster than current short-range wireless technologies such as Bluetooth and Wi-Fi. This technology with high level of frequency re-use can satisfy the communication needs of multiple customers within a small geographic region [7, 8, 12]. 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, is easy to deployment with the small form factor. Gi-fi chip has flexible architecture.

A. 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.

B. 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.

C. 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.

D. High Security

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. 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 communications. The combined effects of O2 absorption and narrow beam spread result in high security and low interference [7, 8].

Applications OF GI-FI

The Nitro chipset in Gi-Fi technology by offering reduced size and power consumption, can be used to send and receive large amounts of data in a variety of applications For example, it is intended for use in a wide range of devices including personal computers, tablets, and smart phones. The technology's fast data-

synchronization rates enable the rapid transfer of video, bringing the ―wireless office‖ closer to reality.

In fact Gi-Fi technology has many attractive features that make it suitable for use in many places and devices. There are many applications for Gi-Fi. This technology can be effectively used in wireless pan networks, Inter-vehicle communication systems, Ad-hoc information distribution with Point-to-Point network extension, media access control (MAC), imaging and many other applications [8].

Gi-Fi technology is able to transfer gigabits of data within seconds and therefore it can be used for huge data file transmission and it is expected that this chipset replaces HDMI cables and could develop wireless home and office of future. Gi-Fi technology also can be used in broadcasting video signal transmission system in sports stadiums and mm-Wave video-signals transmission systems. The technology could also be used for beaming full HD video in real-time and could be used by notebooks and other computers to wirelessly connect virtually all the expansion needed for a docking station, including a secondary display and storage.

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 GiFi 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.

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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