International Journal of Research in Advent Technology, Vol.3, No.5, May 2015
E-ISSN: 2321-9637

Evaluation of Gi-Fi Technology for High-Rate Wireless Communication

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Abstract- Wireless technology improvement has become adherent in today's modern life. One of the furthermost improvements made on wireless technology field was inventing a new wireless technology (Gi-Fi). Gi-Fi will helps to push wireless communications to faster drive. As Optical fibers played a primary role for its higher bit rates and more rapidly transmission. But the installation of cables caused a larger complexity and hence led to wireless access. Gi-Fi or Gigabit Wireless is the world's first transceiver integrated on a single chip that operates at 60GHz on the Complementary Metal Oxide Semiconductor (CMOS) process. It will permit wireless transfer of audio and video data up to 5 gigabits per second, low power consumption, typically within a range of 10 meters .This technology delivers low-cost, high broadband access, with very high speed large files exchange within seconds**.** Here we present a low cost, low power and high broadband chip, which will be vital in facilitating the digital economy of the future.

Index Terms- CMOS (Complementary Metal Oxide Semiconductor), Millimeter-Wave, Time-Division Duplex

1. INTRODUCTION

Communication is one of the key parts of science that has always been a crucial point for exchanging information among parties at locations bodily apart. As there is no current developments which transfer data at faster rate, as video information transfer taking lot of time. This leads to introduction of Gi-Fi technology. It delivers faster information rate in Gbps, less power consumption and low cost for short range transmissions. Gigabit Wireless is the world's first transceiver integrated on a single chip that operates at 60GHz on the CMOS (Complementary Metal–Oxide–Semiconductor) process. It will permit 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 [1]. It makes use of 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. With the help of Gi-Fi chips the videos sharing can be possible without any difficulties. The Gi-Fi chip is one of Australia's most productive technologies. The new gigabit wireless system presents Multi-gigabit wireless technology that eliminates the need for cables between consumer electronic devices. This technology with high level of frequency re-use can declare the communication needs of multiple consumers in a small geographic region.

2. WHAT IS GI-FI

Gi-Fi or gigabit wireless is the world's first transceiver integrated on a single chip that operates at 60GHz on the CMOS process. It will allow wireless transfer of audio and video data at up to 5gigabits per second, ten times the current maximum wireless transfer rate, at one- tenth the cost. NICTA researchers have chosen to expand this technology in the 57-64GHz unlicensed frequency band as the millimeter-wave range of the spectrum creates 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 in an indoor environment, typically within a range of 10 meters. It assures the standards of IEEE 802.15.3C.The Gi-Fi chip contains a tiny amplifier; a bandpass filter, which admits only signals of the suitable frequencies; and a switch that isolates the transmitter and receiver so that they do not interfere with each other. The processor employs a 1-mm-wide integrated antenna and would cost about $10 to make. Gi-Fi transmits data at up to 5 Gbits per second over distances up to 10 meters.

Wi-Fi transmits data at up to 54 Mbits per second over distances up to 100 meters. Gi-Fi uses 2.5-GHz-wide channels at frequencies between 57 and 64 GHz and transmits on wavelengths 5 mm wide. Wi-Fi typically uses 20- MHz-wide channels in the spectrum between 2.4 and 2.483 GHz, with wavelengths 12 cm wide [2]. Because Gi-Fi's wavelengths are smaller, the size of the system's components can also be smaller. The technology utilizes high-output power amplifiers that boost the antennas' capability to capture the signal and thereby improve data rates. The researchers also added high-gain transmitters and receivers, which use narrow beams to better focus signals to further improve the data rate and range. However, its smaller antennas capture less energy and thus transmit over a shorter range.

2.1. *Architecture of Gi-Fi*

The core components of a Gi-Fi system is the subscriber station which accessible to several access points. It supports standard of IEEE 802.15.3C supports millimeter-wave wireless pan network used for communication among computer devices close to one person. An 802.15.3C based system frequently uses small antenna at the subscriber station. The antenna is mounted on the roof. It supports line of sight operation.

2.2. *Working Principle used in Gi-Fi*

In this we will use time division duplex for both transmission and receiving. Here data files are up converted from IF range to RF60 GHz range by using 2 mixers and we will supply this to a power amplifier, which feeds millimeter 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.

A. Time Division Duplex

Time-Division Duplex (TDD) is the function of time-division multiplexing to part outward and return signals. It imitates full duplex communication over a half duplex communication link. As uplink traffic increases, more channel capacity can vigorously be allocated to that, and as it shrinks it can be taken away.

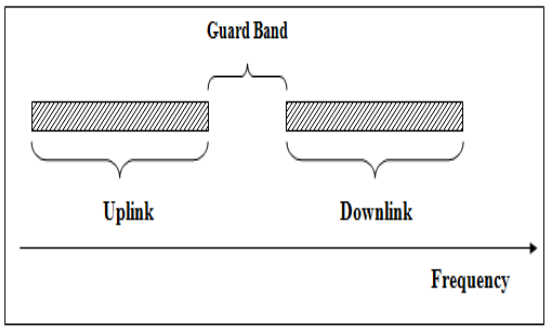

Fig. 1. Time-Division Duplex

Time division duplex (TDD) refers to duplex communication links where uplink is separated from downlink by the allocation of diverse time slots in the same frequency band. It is a transmission method that permits asymmetric flow for uplink and downlink data transmission. Users are allocated time slots for uplink and downlink transmission.

This method is highly profitable in case there is an asymmetry of uplink and downlink data rates. TDD divides a data stream into frames and allocates different time slots to forward and reverse transmissions, thus allowing both types of transmissions to share the similar transmission medium.

B. Operation at 60 GHz

60 GHz transmission technology is a quite new wireless communications conception that intends to use the 7 GHz of bandwidth existing in the 60 GHz unlicensed band. The main advantages of this high-frequency-range technology are that it enables high data rates and short-range communication applications such as data transfer and uncompressed audio and video (A/V) transmissions. Data rates beyond 1 Gbit/s at up to 10 meters are feasible. These high data rates can be achieved because of the continuous spectrum and a less power-restricted bandwidth available in the 60 GHz band. Moreover, high path loss enables a better frequency reuse factor per indoor environment.

3. ANALYSIS

Gi-Fi wireless technology has been developed and can be a tremendously fast substitution for technologies such as Bluetooth and Ultra-Wide Band (UWB). The method of Gi-Fi would employ a chip that transmits at an enormously high 60GHz frequency versus the 5GHz used for the fastest forms of Wi-Fi. Mixing and signal filtering used in Gi-Fi technology would maintain the signal strong versus the longer-ranged except slower and more drop-prone Wi-Fi option of today.

The chip in Gi-Fi would probably cost about $10 or less to build. In modern years, new wireless local area networks (WLANs) such as Wi-Fi and wireless personal area networks (WPAN) such as Bluetooth have become accessible. Table 1 compares different options of these different systems. Table 1 demonstrates the large power consumption associated with Wi-Fi and Bluetooth technologies in contrast to Gi-Fi. Wi-Fi needs 10mili watts and Bluetooth needs 5mili watts when Gi-Fi requiress less than 2mili watts [7, 8]. 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 bestows it a benefit 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 wind up that the Gi- Fi is a suitable technology for short distance data transmission to be used in various devices and places.

TABLE 1 Comparison of Gi-Fi and existing technologies

Characteristics	Wireless Technologies		
	Bluetooth	***Wi-Fi***	***Li-Fi***
Specification Authority	Bluetooth SIG	IEEE, WECA	NICTA
Development Start date	1998	1990	2004
IEEE Standard	IEEE 802.15.1	IEEE 802.11.x	IEEE 802.15.3C
Power Consumption	5mW	10mW	< 2mW
Data Transfer Rate	800 Kbps	11 Mbps	5 Gbps
Network Range	10 m	30 to 100 m	100 m
Operating Frequency	2.4 GHz	2.4 GHz, 5 GHz	57-64 GHz
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

4. ADVANTAGES OF GI-FI

This Gi-Fi technology permits wireless uncompressed high definition content and operates over a range of 10 meters without interference. Gi-Fi chip has flexible architecture. It is highly convenient and can be constructed in all over the place. The complete 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 facilitates the future of information management, is simple to employment with the small form factor. The most significant benefits of the Gi-Fi technology can be recapitulated as follows:

a) Capacity of High Speed Data Transfer: The 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 major invention of Gi-Fi. A complete High-Definition (HD) movie could be transmitted to a mobile handset in a few seconds, and the handset could then upload the movie to a home computer or screen at the similar speed.

b) Large Bandwidth: 60 GHz transmission technology is a quite fresh wireless communications idea that intends to use the 7 GHz of bandwidth existing in the 60 GHz unlicensed band.

c) No Interference: It utilizes the 60GHz millimeter wave spectrum to transmit the data, which offers it an benefit 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 about unoccupied, and the new chip is hundreds of times faster than the average home Wi-Fi technology.

d) Low Power Consumption: Power consumption of the current technologies such as Wi-Fi and Bluetooth are 5mili watts and 10mili watts but chip of Gi-Fi employs a small one-millimeter-wide antenna and it has less than 2mili watts of power consumption that in contrast to the existing technologies is very less.

e) Provides High Security: Gi-Fi technology is based on IEEE 802.15.3C and this standard gives more security as it gives optional security in the link level and service level. Point-to-point wireless systems operating at 60 GHz have been used for several years by the intelligence community for high security communications and by the military for satellite to satellite communications.

5. CONCLUSION

The wireless communication already contributed a gigantic revolt in the telecom sectors from the last three decades. Gi-Fi has given and it is clear that more research should be done in the field of this latest wireless technology and its applications. The Bluetooth which covers 9-10mts range and Wi-Fi followed 91mts. No doubt introduction of Wi-Fi wireless network has showed a inventive solution to bluetooth dilemma the standard original limitations for data exchange rate and range, number of chances, high cost of infrastructure have not so far possible for Wi-Fi to turn into a power network, then towards this dilemma the better technology in spite of the advantages of rate current technologies directed to the introduction of new, more up to date for data exchange that is GI-FI. The comparison is performed between Gi-Fi and existing wireless technologies illustrates that these features along with some other benefits that make it appropriate to replace the existing wireless technologies. It removes cables that for many years ruled over the world and presents high speed data transfer rate. Gi-Fi technology has much number of applications and can be used in various places and devices such as smart phones, wireless pan networks, media access control and mm-Wave video-signals transmission systems.

Acknowledgments

I wish to express my genuine thanks and deep sense of gratitude to respected guide Dr. D M. Bhalerao in Department of Electronics and Telecommunication Engineering of Sinhgad college of Engineering, Vadgaon (BK), Pune 41, for her technical guidance, encouragement and constructive criticism, which inspired me to endeavor harder for excellence.

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