GI-FI

GIGABIT FIDELITY – Technology & Effects on Environment

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ABSTRACT:

For many years, cables ruled the world. Optical fibers played a dominant role because of 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 9-10metres. Wi-Fi followed it having coverage area of 91metres. No doubt, introduction of Wi-Fi (Wireless Fidelity) has brought a revolutionary solution to "last mile" problem. However, the standard's original limitations for data exchange rate and range, number of channels, high cost of the infrastructure have not yet made it possible for Wi-Fi to become a total threat to cellular networks on one hand, and hard-wire networks, on the other. But the man's continuous quest for even better technology despite the substantial advantages of present technologies led to the introduction of new, more up-to-date standards for data exchange rate i.e., Gi-Fi. It will help to push wireless communications to faster drive.

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 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. It utilizes a 5mm square chip and a 1mm wide antenna burning less than 2 mw of power to transmit data wirelessly over short distances, much like Bluetooth.

The development will enable the truly wireless office and home in the future. As the integrated transceiver is extremely small, it can be embedded into devices. The breakthrough will mean the networking of office and home equipment without wires will finally become a reality.

In this paper we present a low cost, low power and high broadband chip, which will be vital in enabling the digital economy of the future.

INTRODUCTION:

Wi-Fi (IEEE-802.11b) and Wi-Max (IEEE-802.16e) have captured our attention. As there are no recent developments which Transfer data at faster rate, video information transfer is taking a lot of time.

This leads to introduction of Gi-Fi technology. It offers some advantages over Wi-Fi, a similar wireless technology, which offers faster information rate (Gb/s), Less power consumption and low cost for short range transmissions.

Gi-Fi is developed on an integrated wireless transceiver chip, in which a small antenna is used and both transmitter-receiver integrated on a single chip, are fabricated using the complementary metal oxide semiconductor (CMOS) process.

WHY Gi-Fi?

The reason for pushing into Gi-Fi technology is because of slow rate high power consumption, low range of frequency operations of earlier technologies i.e., Bluetooth and Wi-Fi. See the comparisons and features of those two technologies.

BLUETOOTH Vs WI-FI:

Characteristic	Bluetooth	Wi-Fi
Frequency	2.4 GHz	2.4 GHz
Range	10 meters	100 meters
Primary application	WPAN: cable replacement	WLAN: Ethernet
Data transfer rate	800 Kbps	11 Mbps
Power consumption	Low	Medium
Primary devices	Mobile phones, PDAs, consumer electronics, office and industrial automation devices	Notebook computers, desktop computers, servers
Primary users	Traveling employees; electronics consumers; office and industrial workers	Corporate campus users
Usage location	Anywhere at least two Bluetooth devices exist — ideal for roaming outside buildings	Within range of WLAN infrastructure, usually inside a building
Development start date	1998	1990
Specifications authority	Bluetooth SIG	IEEE, WECA

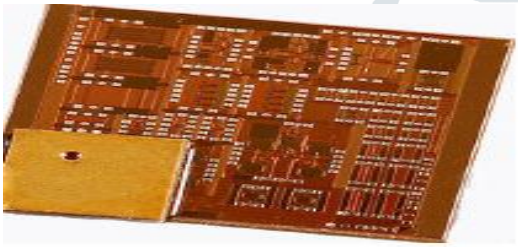
DISADVANTAGES OF BLUETOOTH AND Wi-Fi:

From above table, we can conclude that the bit rate of Bluetooth is 800Kbps and Wi-Fi has 11Mbps. Both are

having very high power consumption .As for GI-FI, it is less than 2 mw to transfer gigabytes of information. Bluetooth and Wi-Fi operate at a lower frequency of 2.4GHz where as GI-FI operates at 60 GHz.

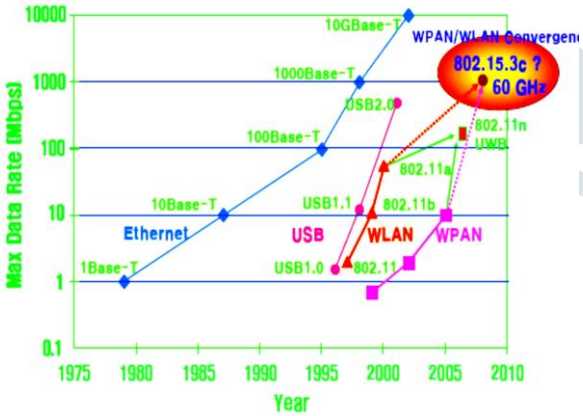
WHAT IS Gi-Fi?

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 **5 gigabits** per second, ten times the current maximum wireless transfer rate, at one-tenth the cost. 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. 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 metres. It satisfies the standards of **IEEE 802.15.3C.**



Gigabit wireless: The Gi-Fi integrated wireless transceiver chip developed at the National ICT Research Centre, Australia. —

FUNDAMENTAL TECHNOLOGIES IN 802.15.3C:



This mm Wave WPAN will operate in the new and clear band including 57-64 GHz unlicensed band defined by FCC 47 CFR 15.255. The millimeter-wave WPAN will allow high coexistence (close physical spacing) with all other microwave systems in the 802.15 family of WPANs.

WORKING OF GI-FI:

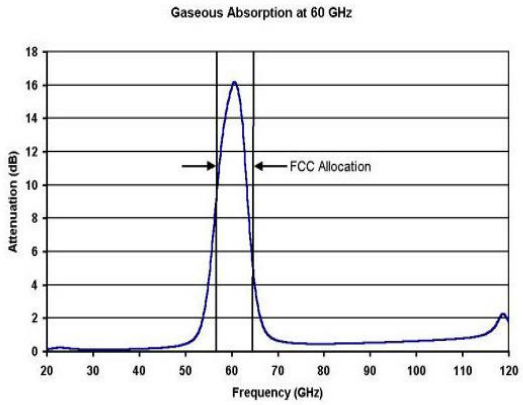
Here we will use time division duplex for both transmission and receiving. Data files are up converted from IF range to RF 60Ghz range by using 2 mixers. The output will fed be into to a power amplifier, which feeds millimeter wave antenna.

The incoming RF signal is first down converted to an IF signal centered at 5 GHz and then to normal data ranges. We use heterodyne construction for this process to avoid leakages due to direct conversion. Due to availability of 7GHz spectrum, the total data will be transferred within seconds.

WHY 60 GHz..?

Here we will use millimeter wave antenna which will operate at 60GHz frequency which is unlicensed band. Because of this band, we are achieving high data rates. Energy propagation in the 60 GHz band has unique characteristics that makes possible many other benefits 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). This 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 communications



Oxygen Attenuation vs. Frequency

ULTRA WIDE BAND FREQUENCY USAGE:

UWB, 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. Ultra-Wideband (UWB) 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 systems

FEATURES OF Gi-Fi:

The Gi-Fi standard has been developed with many objectives in mind. These are summarized below:

1. **High speed of data transfer:**

The main invention of Gi-Fi to provide higher bit rate. As the name itself indicates data transfer rate is in Giga bits

per second. Speed of Gi-Fi is **5 Gbps**., which is 10 times the present data transfer. Because of wider availability of continuous 7 GHz spectrum results in high data rates.

2. Low Power Consumption:

It consumes only 2 mw power for data transfer of gigabits of information. Whereas in present technologies it takes 10 mw power, which is very high.

3. High Security:

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

4. Cost-effective:

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, and the resultant integrated wireless transceiver chip which transfers data at high speed, low power at low price $10 only, which is very less As compare to present systems. As development goes on, the price will be decreased.

5. Small Size:

The chip, just 5 mm per side, has a tiny 1 mm antenna and uses the 60 GHz 'millimetre-wave' spectrum.

6. Quick Deployment:

Compared with the deployment of wired solutions, Gi-Fi requires little or no external plant construction. For example, excavation to support the trenching of cables is not required. Operators that have obtained licenses to use one of the licensed bands, or that plan to use one of the unlicensed bands; do not need to submit further applications to the Government. 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.

7. High Performance:

One particular 60 GHz radio link is quickly reduced to a level that will not interfere with other 60 GHz links operating in the same geographic vicinity. Because of low interference it probably gives high performance.

Other features:

High level of frequency re-use enabled – communication, needs of multiple customers, within a small geographic region can be satisfied.

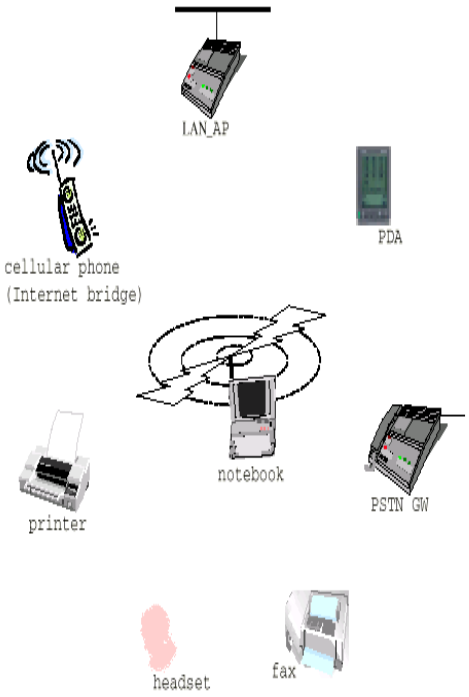
It is also highly portable-we can construct where ever we want.

It deploys line of sight operation having only shorter coverage area. It has more flexible architecture.

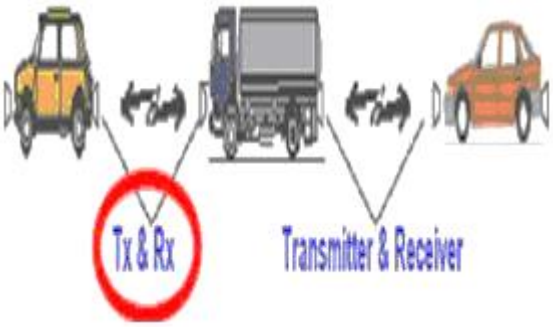
APPLICATIONS:

There are many usage Scenarios that can be addressed by Gi-Fi. The following are some mobility usage applications of Gi-Fi.

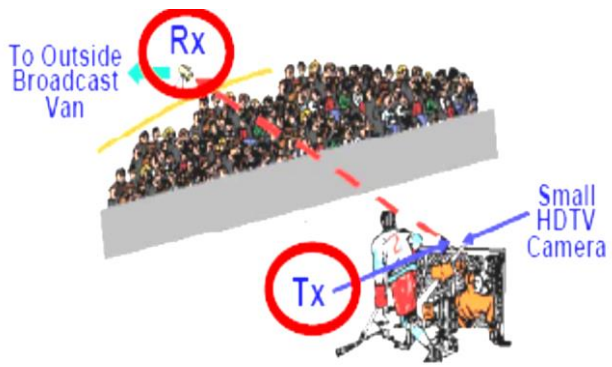
In wireless pan networks:



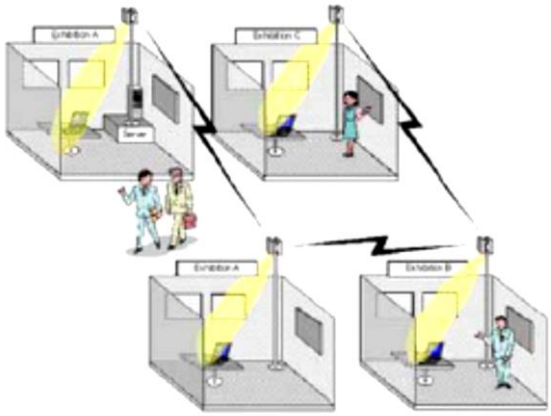
Inter-vehicle communication system:



Broadcasting video signal transmission system in sports stadium:

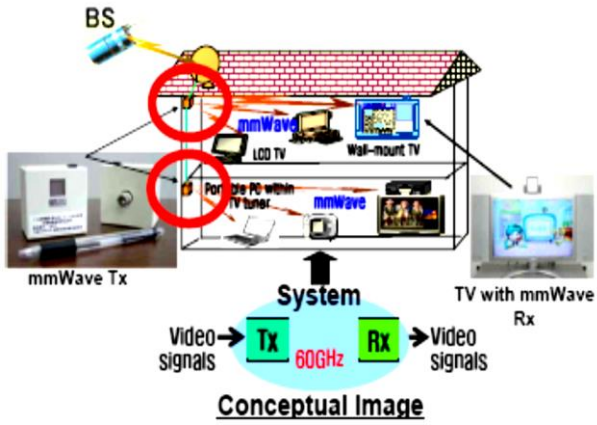


Ad-hoc information distribution with Point-to-Point network extension:

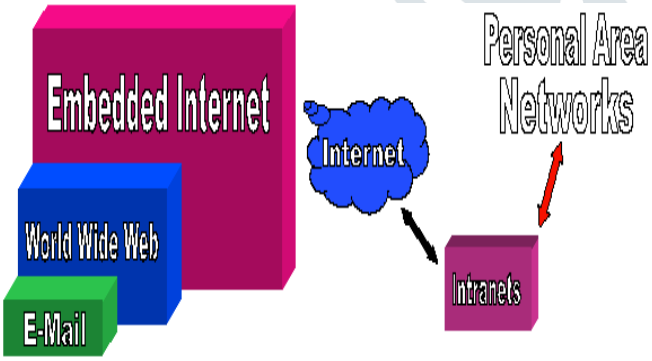


Easy and immediate construction of temporal broadband network such as in exhibition-site for…Advertisement information distribution or Contents downloading service

mm-Wave video-signals transmission system:

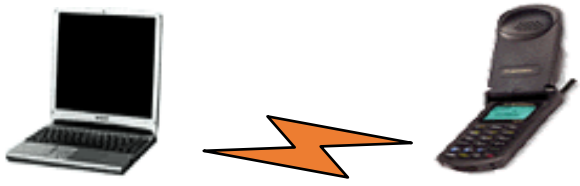


Media access control (MAC) and imaging and others:



Video information transfer:

By using present technologies video swapping takes hours of time, whereas by this we can transfer at a speed of Gbps.



Data transfer rate is same for transfer of information from a PC to a cell or a cell to PC.

Data Distribution at Apartments/condominiums:

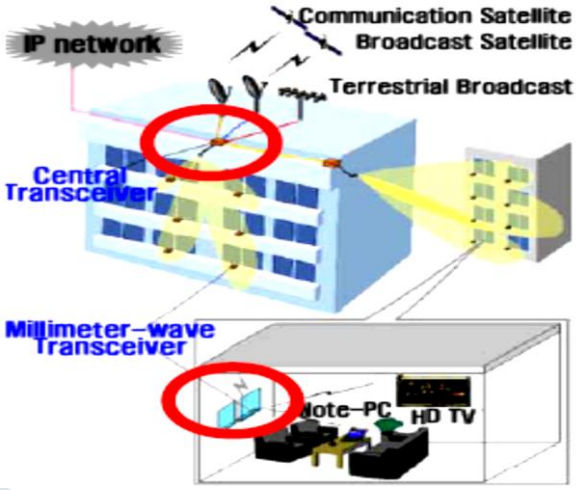


Fig : mm-WAVE PAN for on demand transmission or/ re broadcasting of video information to Ad-hoc terminals.

IN FUTURE:

As the range is limited to shorter distances only, we can expect the broad band with more speed and low power consumption and trying to increase the range of transmission

TECHNOLOGY CONSIDERATIONS:

The Gi-Fi integrated transceiver chip may be launched by ending of this year by NICTA. Due to less cost of chip, so many companies are forward to launch with lower cost. The potential of mw-WPAN for ultra fast data exchange has prompted companies like Intel, LG, Matsushita (Panasonic), NEC, Samsung, Si BEAM, Sony and Toshiba to form Wireless HD, an industry-led effort to define a specification for the next generation consumer electronics products.

CONCLUSION:

Within five years, we expect Gi-Fi to be the dominant technology for wireless networking.

By the time its fully mobile, as well as providing low-cost high broadband access with very high speed, Large files can be swapped within seconds which will develop **wireless home and office of future.**

If the success of Wi-Fi and the imminent wide usage of WiMAX is any indication, Gi-Fi potentially can bring wireless broadband to the enterprise in a new way.

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