Gi-Fi Technology

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***Abstract*--Gi-Fi will helps to push wireless communications to faster drive. 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. No doubt, introduction of Wi-Fi wireless networks has proved a revolutionary solution to "last mile" problem.**

However, the standard's original limitations for data exchange rate and range, number of changes, high cost of the infrastructure have not yet made it possible for Wi-Fi to become a total threat to cellular networks on the 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.

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 2m watts of power to transmit data wirelessly over short distance, much like Bluetooth. The breakthrough will mean the networking of office and home equipment without wires will finally become a reality. In this report we present a low cost, low power and high broadband chip, which will be vital in enabling the digital economy of the future.

Keywords – WI-FI; Wireless; Gi-Fi; Gigabit wireless; Bluetooth

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I. INTRODUCTION

MIND MAP:

The Fig.1 represents a mind map which gives the overview of the paper. The branches refer the main categories and the sub branches represent the categories in the main branch.

Fig 1 : Mind Map

Wi-Fi (ieee-802.11b) and WiMax (ieee-802.16e) have captured our attention. As there is no recent developments which transfer data at faster rate, as video information transfer taking lot of time. This leads to introduction of Gi-Fi technology. It offers some advantages over Wi-Fi, a similar wireless technology. In that it offers faster information rate in Gbps, less power consumption and low cost for short range transmissions. Gi-Fi which is developed on a integrated wireless transceiver chip. In which a small antenna used and both transmitter- receiver integrated on a single chip which is fabricated using the complementary metal oxide semiconductor (CMOS) process. Because of Gi-Fi transfer of large videos, files will be within seconds.

In theory this technology would transfers GB's of our favorite high definition movies in seconds. So Gi-Fi can be considered as a challenger to Bluetooth rather than Wi-Fi and could find applications ranging from new mobile phones to consumer electronics. GiFi allows a full-length high definition movie to be transferred between two devices in seconds to the higher megapixel count on our cameras, the increased bit rate on our music files, the higher resolution of our video files, and so on.

We demand more than ever, but we also want this content to be transferred in the most expedient manner possible. 802.11g and 802.11n are fine and all, but some people want to push the envelope even further. This chip is 5mm per side and it can operate at a frequency of 60GHz while wi fi chip can operate only at 2.4GHz. This have low power conception of 2 watt comes and comes with 1mm antenna.

Fig 3: High speed indoor data transmissiom

The GiFi chip is a good news for personal area networking because there is no internet infrastructure available to cop it with. It can have a span of 10 meters. The usable prototype may be less than a year away. With the help of gifi chips the videos sharing can be possible without any hurdles. The GiFi chip is one of Australia's most lucrative technology. This chip is 5mm per side and it can operate at a frequency of 60GHz while wifi chip can operate only at 2.4GHz.

This have low power conception of 2 watt comes and comes with 1mm antenna.The complete GIFI index is contained in the CRA's Guide To The General Index Of Financial Information (GIFI) For Corporations which you can download or get in a paper or diskette version from your nearest tax services office.You will find links to both the Guide To The General Index Of Financial Information (GIFI) For Corporations and the GIFI.

Fig 2: Use of spectrum in GiFi

The Cost of GiFi chip is only $10. The purpose of the GIFI is to allow the CRA to collect and process financial information more efficiently, for instance, the GIFI lets the CRA validate tax information electronically rather than manually. Short-range wireless technology is a hotly contested area, with research

teams around the world racing to be the first to launch such a product. Professor Skafidas said his team is the first to demonstrate a working transceiver-on-a-chip that uses CMOS (complementary metal-oxide-semiconductor) technology the cheap, ubiquitous technique that prints silicon chips.

This means his team is head and shoulders in front of the competition in terms of price and power demand. His chip uses only a tiny one-millimetre-wide antenna and less than two watts of power, and would cost less than $10 to manufacture. It uses the 60GHz "millimetre wave" spectrum to transmit the data, which gives it an advantage over WiFi (wireless internet).

WiFi'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 millimetre wave spectrum (30 to 300 GHz) is almost unoccupied, and the new chip is potentially hundreds of times faster than the average home WiFi unit. However, WiFi still benefits from being able to provide wireless coverage over a greater distance. Victoria's minister for information and communication technology, Theo Theophanous, said it showed Victoria was at the cutting edge of IT innovation. He praised the 27 members team which worked on the development of the chip.

The high-powered team included 10 PhDs students from the University of Melbourne and collaborated with companies such as computer giant IBM during the research. The world's first transceiver integrated on a single chip that operates at 60GHz on the CMOS (complementary metal–oxide–semiconductor) process, the most common semiconductor technology, was announced today by NICTA, Australia's Information and Communications Technology (ICT) Research Centre of Excellence. The development will enable the truly wireless office and home of the future. As the integrated transceiver developed by NICTA 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. Researchers from NICTA's Gigabit Wireless Project, which is based out of NICTA's Victoria Research Laboratory, are the first in the world to have developed an integrated transceiver, a complete transmitter and receiver, on a single chip at 60GHz on CMOS.

NICTA's research involved a close collaboration with leaders in the global semiconductor industry. The technology was developed using the IBM 130nm RF CMOS process. "Our collaborators IBM, Synopsys, Cadence, Anritsu, Agilent, Ansoft and SUSS MicroTec have been critical to our success and we are grateful to have had their valuable support," Professor Skafidas said. "Our innovative design methodology and access to leading design, test and measurement, and fabrication technology has allowed us to deliver this world-first success." NICTA researchers chose to develop this technology in the 57-64GHz unlicensed frequency band 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 availability of 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," Professor Skafidas said. NICTA Chief Technology Officer, Embedded Systems, Dr Chris Nicol said the availability of a single chip, low cost, very high speed wireless technology will transform the home entertainment industry. "For example, consumers will be able to download a high definition DVD onto their personal digital assistants at a public kiosk in seconds, take it home and play it directly onto their high definition TV." 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 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 metres. The new technology is predicted to revolutionise the way household gadgets talk to each other.

A. History of Gi-Fi

Melbourne University researchers have achieved up to 5Gbps data transfer rates on a wireless chip. This is a lot faster than any current WiFi speeds. Dubbed GiFi, for obvious reasons, it can deliver the connection speed up to ten meters. To fully comprehend how fast GiFi is, one of the researchers said that a full-length high-def movie can be transferred from one device to another in a matter of seconds.

The GiFi chips is only 5mm in size and use current CMOS technology. Cost is only $10. I say, let's begin mass producing it. Professor. Stan Skafidis of " Melbourne University , Australiya " is the inventor of GiFi chip. The GiFi chip uses only a tiny one-millimeter-wide antenna and less than two watts of power, and the GiFi chip would cost less than $10 to manufacture it.

According to the website of Melbourne University , Australia "by using GiFi an entire high-definition movie from a video shop kiosk 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," this statement about the GiFi was given by Nick Miller. GiFi uses the 60GHz "millimetre wave" spectrum to transmit the data from one part to the another part. It provides an advantage over WiFi (wireless internet)". WiFi'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 millimetre wave spectrum (30 to 300 GHz) is almost unoccupied, and the new chip is potentially hundreds of times faster than the average home WiFi unit". The best part about this new technology GiFi is its cost effectiveness and power consumption, it only consumes 2 watts of power for its operation with antenna(1mm) included and the development of Gi-Fi chip costs approximately $10(Rs 380) to manufacture. In theory this technology would transfers GB's of our fav high definition movies in seconds.

So GiFi can be considered as a challenger to Bluetooth rather than Wi-Fi and could find applications ranging from new mobile phones to consumer electronics. GiFi promises some serious game-changing wireless transfer speeds for all types of consumer gadgets. The tiny silicon chip invented by professor " Stan Skafidas " is able to move data through the air as fast as 5 gigabits per second at a distance of just over 30 feet.

The GiFi uses the short-range wireless technology would potentially be a competitor or more than likely a replacement for WiFi, and things like Bluetooth might want to look out as well. The transfer speeds combined with the constantly increased storage capacities of small handheld devices could really take media down some new avenues as well. The Age newspaper uses an example of transferring a high-definition movie from a kiosk at a store to your mobile phone in seconds. Then that same movie can be transferred just as quickly from the phone to our home computer or entertainment system to watch.

The world's first GiFi wireless network chip developed at Australia's peak federal technology incubator has entered its commercialisation phase**.** Nicta chief executive David Skellern confirmed that the research facility had formed a start-up around the new technology.

"It's not up to me to announce it. It's up to the company that has formed, but there is an activity going on to spin out a company from Nicta that will take that technology to market," Dr Skellern said. The GiFi chip could become one of Australia's most lucrative technology.

The Nicta gigabit wireless chip is 100 times faster than current WiFi chips and can be built for a tenth of their cost. The team behind it picked up a gong at the international Innovic's Next Big Thing Award for Innovation Excellence last July. Its development has been part of an international race to develop standards for a super-high-speed gigabit version of the CSIRO's WiFi wireless networking technology, used almost universally in laptops, mobile phones and home wireless network equipment. The fastest current WiFi standard is 802.11n.

"There'll be a kind of bunfight between all the protagonists for all the different approaches and one will end up being a winner. We'll be in there proposing our solutions." The Australian contacted the CSIRO for comment on whether Nicta would need its co-operation to develop the chip or use its patents, but neither of the CSIRO's lead WiFi spokesmen, Tom McGinness and Nigel Poole, were available. A CSIRO spokeswoman said the organisation had not been told Nicta was planning a GiFi start-up. Nicta gigabit wireless project leader Stan Skafidas and some of his 15 staff were likely to join the startup when it began operating. Whether Professor Skafidas would join the new company permanently was yet to be determined, Dr Skellern said.

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B. Need for 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.

Comparison of Bluetooth and 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

C. Demerits of bluetooth and Wi-Fi

1. From the table we can conclude that the bit rate of Bluetooth is 800Kbps and Wi-Fi has 11Mbps.
2. Both are having power consumptions 5mw and 10mw. And lower frequency of operation 2.4GHz.
3. For transferring large amount of videos, audios, data files take hours of time. So to have higher data transfer rate at lower power consumption we move onto Gi-Fi technology

II. 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 meters. It satisfies the standards of IEEE 802.15.3C

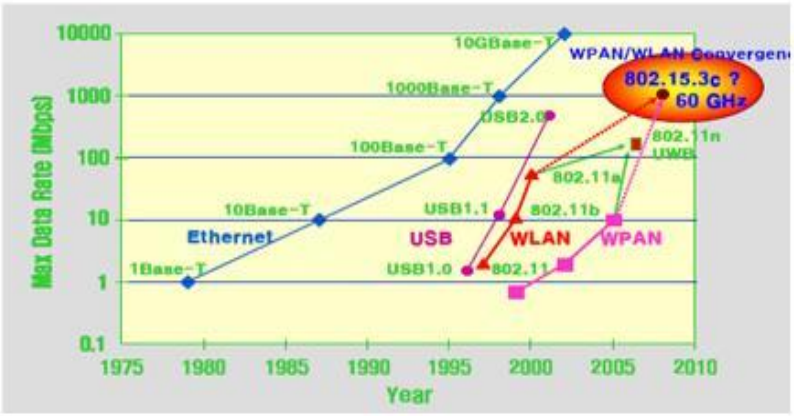


Fig 4: Showing 7 GHZ spectrum

A. *Architecture of Gi-Fi*

The core components of a Gi-Fi system is the subscriber station which available 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 often uses small antenna at the subscriber station. The antenna is mounted on the roof. It supports line of sight operation.

Fundamental technologies in 802.15.3c

This millimeter-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.

Fig 5 : gigabit wireless pan networks

B. *Working in Gi-Fi and its features*

Here we will be use a time division duplex for both transmission and receiving. The data files are up converted from IF range to RF 60Ghz range by using 2 mixers. 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 centered 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. Due to availability of 7 GHz spectrum the total data will be transferred within seconds.

i. Time-Division Duplex

Time-Division Duplex (TDD) is the application of time-division multiplexing to separate outward and return signals. It emulates full duplex communication over a half duplex communication link. Time division duplex has a strong advantage in the case where the asymmetry of the uplink and downlink data speed is variable. As uplink traffic increases, more channel capacity can dynamically be allocated to that, and as it shrinks it can be taken away. Another advantage is that the uplink and downlink radio.

ii. 60 GHZ

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 has unique characteristics that make 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.

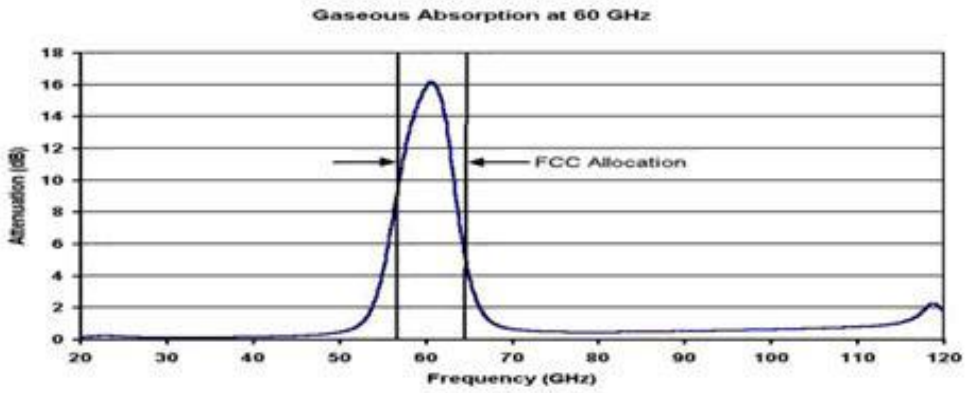


Fig 6: Oxygen Attenuation vs. Frequency

Most important aspect is 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. Their interest in this frequency band stems from a phenomenon of nature: the oxygen molecule (O_2) absorbs electromagnetic energy at 60 GHz like a piece of food in a microwave oven (see Fig 6). This absorption occurs to a much higher degree at 60 GHz than at lower frequencies typically used for wireless communications. This absorption weakens (attenuates) 60 GHz signals over distance, so that signals cannot travel far beyond their intended recipient. For this reason, 60 GHz is an excellent choice for covert satellite-to-satellite communications because the earth's atmosphere acts like a shield preventing earth-based eavesdropping. Because of the rich legacy of applications in this band, a wide variety of components and subassemblies for 60 GHz products are available today.

Another consequence of O_2 absorption is that radiation from 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. This reduction enables higher "frequency reuse" – the ability for more 60 GHz links to operate in the same geographic area than links with longer ranges. As an example, let's compare two different links, one operating near 60 GHz and the other at a frequency that is less affected by O_2 absorption. The second link could be operating at another unlicensed frequency such as 2.4 GHz or 24 GHz.

Consider a typical operating scenario where both links are operating over a distance of one kilometer with the transmitter's power output adjusted such that the signal level at the receiver is 30 decibels (dB) above the background noise. Fig 7 shows how the signal level drops with distance beyond the receiver in the two cases. For the link unaffected by O_2 absorption, it takes 32 kilometers (km) for the transmitted signal to drop down to the background noise level. In other words, that signal would interfere with any other signal at that same frequency for more than 30 kilometers beyond its original recipient. That reduces the number of links at that frequency that can be installed in a fairly large area. Also, this means that the lower-frequency signal could be intercepted up to more than 30 kilometers beyond its intended recipient. In contrast, the transmitted signal at 60 GHz drops down to the noise level in a 2.5 km.

Consequently, more 60 GHz links can be used in the same area without worrying about interference. Also, the 60 GHz links are far more secure given their limited range.

The main invention of Gi-Fi is 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 this high speed data transfer, we can swap large video, audio, data files within seconds. Because of wider availability of continuous 7 GHz spectrum results in high data rates.

iv. *Low Power Consumption*

As the large amount of information transfer it utilizes mili-watts of power only. It consumes only 2mwatt power for data transfer of gigabits of information, where as in present technologies it takes 10mwatt power, which is very high.

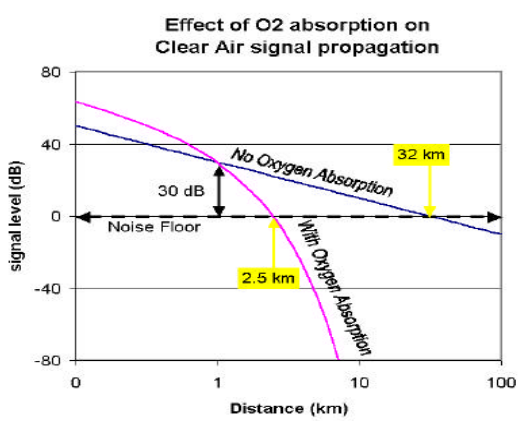


Fig 7 : Radiation Limiting by O_2 Absorption

iii. *High Speed of Data Transfer*

V. High Security

As the IEEE 802.15.3C provides more security, it provides link level and service level secuarity, where these features are optional.

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.

vi. 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 go on development the price will be decreased.

vii. Small Size

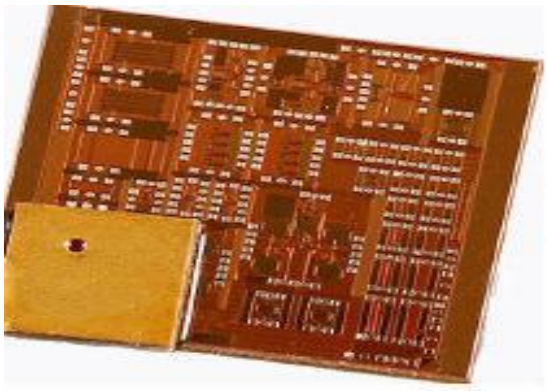


Fig 8: The Gi-Fi integrated wireless transceiver chip developed at the National ICT Research Centre, Australia.

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

viii. Quick Deployment

Compared with the deployment of wired solutions, WiMAX 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.

ix. 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.

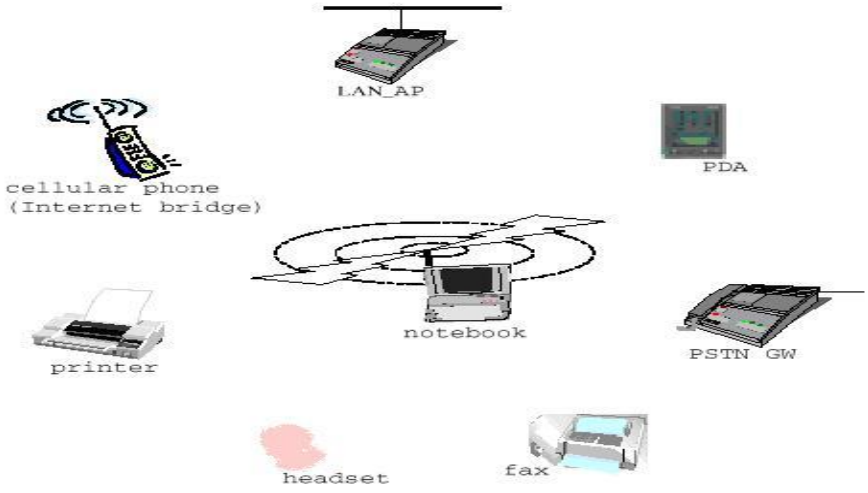


Fig 9: Gi-Fi Access Devices

The fig 9 shows some of the different types of Gi-Fi access devices. This diagram shows that access devices include network termination units, internal radio modules, network interface cards, printers, PC's, all house hold electronic appliances on communication devices.

C. *Ultra Wide Band Frequency Usage*

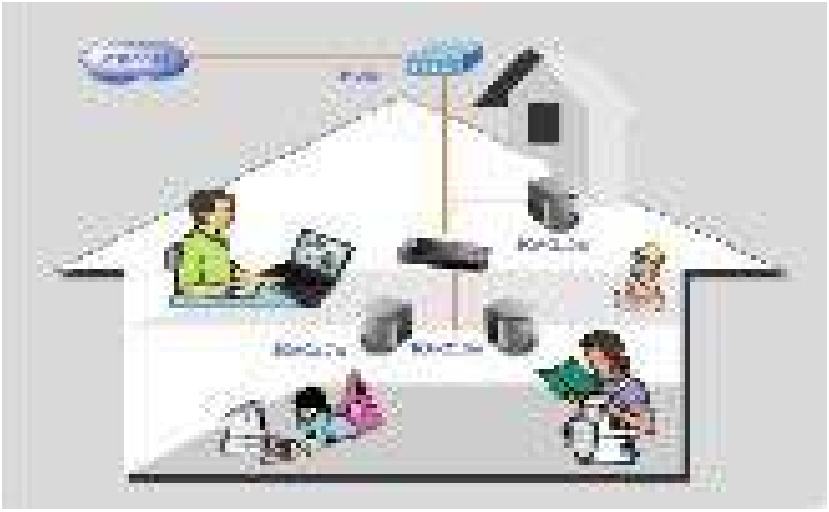
UWB, a technology with high bit rate, high security and faster data transmission. It is a zero carrier technique with low coverage area. So we have low power consumption. These features are Ultra-Wideband (UWB) is a technology for transmitting information spread over a large bandwidth (>500 MHz) that 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.

III. APPLICATIONS

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

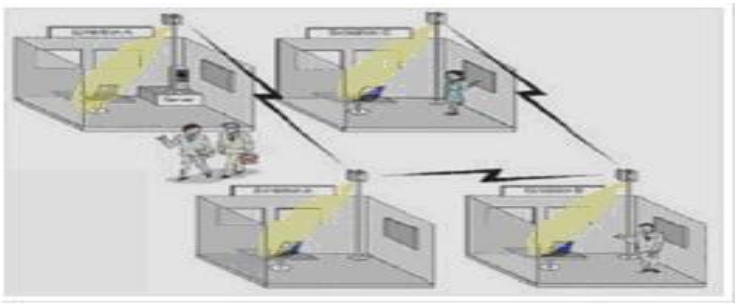
I. House Hold Appliances



Consumers could typically download a high definition movie from a kiosk in a matter of seconds to music player or smart phone and having got home could play it on a home theatre system or store it on a home server for future viewing, again within a few seconds, high speed internet access, streaming content download (video on demand, HDTV, home theater, etc.), real time streaming and wireless data bus for cable replacement. It makes the wireless home and office of the future.

ii.Office Appliances

As it transfers data at high speeds which made work very easy, it also provides high quality of information from internet.



iii. Video information transfer

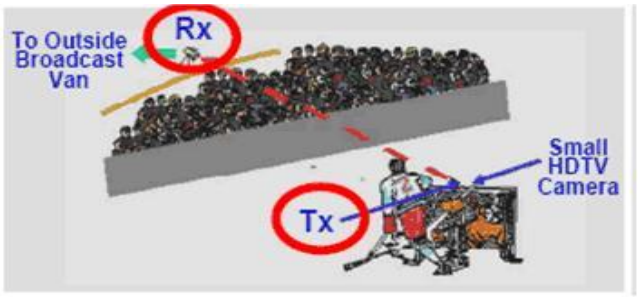
By using present technologies video swapping takes hours of time, whereas by this we can transfer at a speed of Gbps.

Data transfer rate is same for transfer of information from a PC to a cell or a cell to a PC. It can enable wireless monitors, the efficient transfer of data from digital camcorders, wireless printing of digital pictures

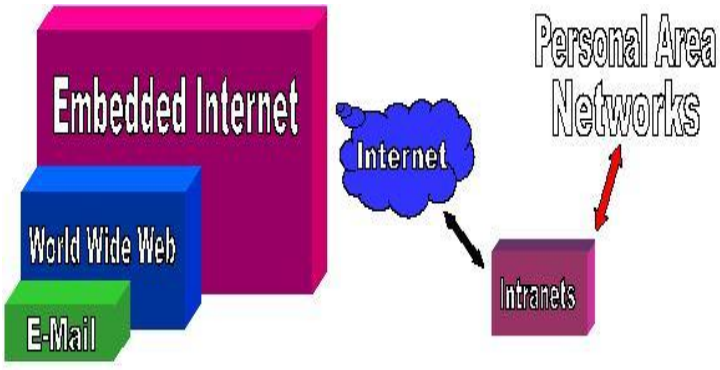
from a camera without the need for an intervening personal computer and the transfer of files among cell phone handsets and other handheld devices like personal digital audio and video players.

iv. Inter-vehicle communication system

v. Broadcasting video signal transmission system in sports stadium



vi. Media access control (MAC) and imaging and others



IV. Future Enhancement

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

A. Technology Considerations

The Gi-Fi integrated transceiver chip is may be launched by starting of next year by NICTA, Australia will be first. 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, SiBEAM, Sony and Toshiba to form Wireless HD, an industry-led effort to define a specification for the next generation consumer electronics products. Specifically, Wireless HD has a stated goal of enabling wireless connectivity for streaming high-definition content between source devices and high-definition displays.

V. CONCLUSION

Within five years, we expect Gi-Fi to be the dominant technology for wireless networking. By that time it will be fully mobile, as well as providing low-cost, high broadband access, with very high speed large files swapped within seconds which will develop wireless home and office of future.

Two important characteristics of CMOS devices that is used in this technology is are high noise immunity and low static power consumption. The same Gi-Fi system is currently used to print silicon chips.

The GiFi Chip developed by the Australian researchers. Gi-Fi allows a full-length high definition movie to be transferred between two devices in seconds.

To the higher megapixel count on our cameras, the increased bit rate on our music files, the higher resolution of our video files, and so on.

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 an entirely new way.

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