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Future of Wireless Communication Network Technologies: Wi-Fi Vs Gi-Fi Vs Super Wi-Fi

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Abstract:

Wireless technology provides us many advantages like portability, flexibility, increased productivity, lower installation cost and many more. Wi-Fi is also a wireless technology which helps in accessing information whenever and wherever required. According to data rates, now a days we already allowed Gigabyte Fidelity (Gi-Fi). There are also some challenges, applications, advantages and limitations of Wi-Fi which we discussed in this paper. In this paper the Wi-Fi technology is introduced initially, and then their advance and modern version like Gi-Fi and Super Wi-Fi characteristics are compared. Next discussing the comparative analysis between Wi-Fi vs Gi-Fi vs Super Wi-Fi.

Keywords: Wireless, Wi-Fi, Li-Fi, Gi-Fi.

1. Introduction

Wireless networking is an essential productivity tool for today`s mobile workforce. With wireless networking, we and our employees can stay connected to our company`s information resources virtually anytime, anywhere [1] Wireless networking is used to meet many needs. Perhaps the most common use is to connect laptop users who travel from location to location. Another common use of wireless networking that connects satellite. These applications may involve point-to-point communication, point-to-multipoint communication, broadcasting, cellular networks and other wireless networks, Wi-Fi and Super Wi-Fi etc. [1] Some NETGEAR

products confirm to the IEEE 802.11g standard for wireless LAN (WLANs). On an 802.11 wireless link, data is encoded using DSSS technology and it transmitted the radio spectrum at 2.5 GHz. Maximum data rate is 54 mbps, when the radio signal is weak or when interference is detected. [2] With a wireless access point, the wireless LAN can operate in the infrastructure mode. This mode lets you connect wirelessly to wireless network devices within a fixed range or area of coverage. The access point has one or more antennas that allow you to interact with wireless nodes. In infrastructure mode, the wireless access point converts airwave data into wired Ethernet data, acting as a bridge between the wired LAN and wireless clients. Connecting multiple access points via a wired Ethernet backbone can further extend the wireless network coverage. As a mobile computing device moves out of the range of one access points it moves into the range of another. As a result, wireless clients can freely roam from one access point domain to another and still maintain seamless network connection. [2]

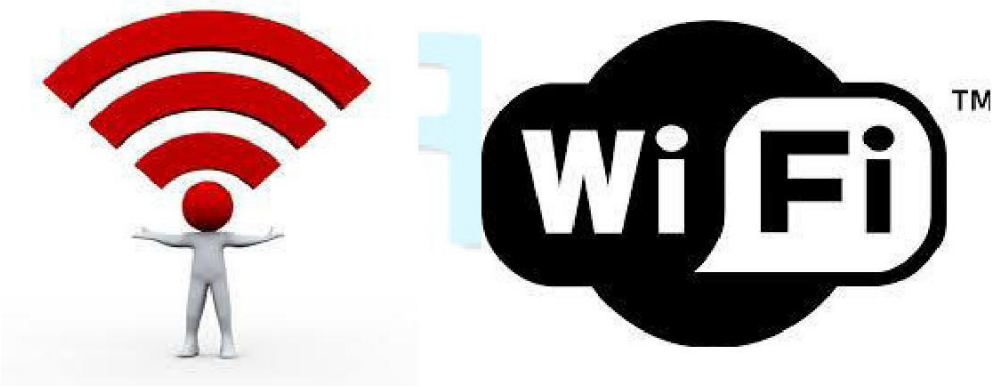
The first Wi-Fi-enabled devices were introduced in 1997. For the first time, we were liberated from a physical Internet connection and free to move about the room, while maintaining connectivity. With this new found freedom came an extraordinary expansion of uses. Over the years, Wi-Fi has become ubiquitous on laptop computers, tablets, televisions, video game consoles, and smart phones.[3]

2. Wi-Fi Technology

Now a days Wi-Fi is the most successful wireless network technology. The number of Wi-Fi enabled devices continues to grow. While a few years ago Wi-Fi was only supported on laptops, there are now Wi-Fi cards on notebooks, cell phones, smart phones, e-readers, portable game consoles, etc. Recent surveys [4] indicate that more than 50% of Internet users in Europe have a wireless network at home (up to 75% in countries such as Spain) and most companies have deployed Wi-Fi networks on their premises. In parallel to this technical evolution, Web 2.0 services combined with the cloud-based services encourage users to remain always connected [5]. Given the ubiquity of Wi-Fi networks, Internet access could be provided everywhere if users

were able to easily and safely share their access point. Some restaurants, bars and hotels provide free Wi-Fi Internet access to attract users [6], and in dense public places such as train stations or airports, commercial Wi-Fi hotspot providers offer paid Internet access services. Unfortunately, openly sharing Internet access through a Wi-Fi access point raises legal [7, 8] and security [9] issues. Indeed, studies [5, 10] reveal that many of these users would likely agree to share their Wi-Fi Internet connectivity on the condition that access by foreign users does not cause security and liability problems.

Wi-Fi is the name of the popular wireless networking technology that uses radio waves to provide wireless high-speed internet and network connection. Wi-Fi is simply a trademarked term meaning IEEE 802.11x. Wi-Fi is a local area wireless technology, which allows an electronic device to exchange data or connect to the internet using 2.4 GHz UHF and 5 GHz SHF radio waves. According to the Wi-Fi Alliance Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards".[12] Moreover, since most modern WLANs are based on these standards, the term "Wi-Fi" is used in general English as a synonym for "WLAN". Only Wi-Fi products that complete Wi-Fi Alliance interoperability certification testing successfully may use the "Wi-Fi CERTIFIED" trademark. [11]



Wi-Fi are the less secure than wired connections (such as Ethernet), as an intruder does not need a physical connection. Web pages that use SSL are secure but unencrypted internet access can

easily be detected by intruders. Due to this reason, Wi-Fi has adopted various encryption technologies. The early encryption WEP, proved easy to break. Higher quality protocols (WPA, WPA2) were added later. An optional feature added in 2007, called Wi-Fi Protected Setup (WPS), had a serious flaw that allowed an attacker to recover the router's password.[12] The Wi-Fi Alliance has since updated its test plan and certification program to ensure all newly certified devices resist attacks. US Federal Communications Commission released the 802.11g wireless fidelity for the ISM band for unlicensed use. [13] In 1991, NCR Corporation with AT&T Corporation invented the precursor to 802.11 intended for use in cashier systems. The first wireless products were under the name WaveLAN.

Conventional Wi-Fi is relatively weak when it comes to working in typical physical settings – bumping up against concrete obstructions and many types of walls. Most population centers have thousands of likely Wi-Fi impediments and almost any installation in a building with more than a few rooms will eventually hit limits. Likewise, many rural areas are difficult to serve using existing technologies due to heavy foliage or topographical challenges. Super Wi-Fi can overcome these limits. Just as your TV signal passes through walls (and many of them), the wireless signal for your Internet connection will as well.[14]

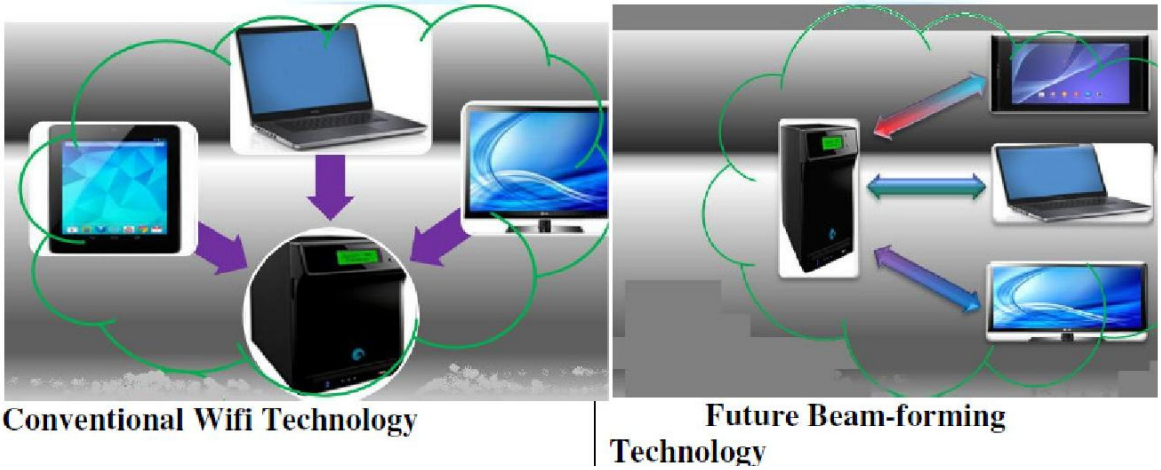


Figure1. 802.11ac Beam-forming technique compared with past conventional Wi-Fi

2.1 Advantages of Wi-Fi

* The main advantages of using Wi-Fi technology is the lack of wires. This is a wireless connection that can merge together multiple devices.

* Wi-Fi network is particularly useful in cases where the wiring is not possible or even unacceptable.

* It allows the cheaper deployment of LAN.

* These devices should be Wi-Fi certified thus the quality of the product is good.

* Another advantage can be pretty easy to create a mesh Wi-Fi. To connect a new device to your network, simply turn on the Wi-Fi and do the simple setting in the software.

2.2 Limitations of Wi-Fi

* Range used in Wi-Fi is limited.

* Fixed channels are used for the communication.

* Due to the wireless nature, the problem of interference is their.

* Data security risks are their in Wi-Fi.

2.3 Future Wi-Fi speeds

Recent survey by global research [15] , in 2017 (20.3Mbps) the Wi-Fi connection speeds generated from dual mode devices will increase 3 times to speeds in 2012(7.7Mbps). Table-1 illustrates the projected Wi-Fi network connection speeds in Kbps by Global region and different countries.

Table-1 - Wi-Fi Network Connection Speeds by Global Regions from 2012- 2017 (in Mbps)

Region/Year	2012	2013	2014	2015	2016	2017	CAGR
North America	11	14	16	18	21	23	15%
Latin America	5	6	7	8	9	11	18%
Western Europe	9	11	12	14	17	18	14%
Central & Eastern Europe	10	12	15	17	20	23	19%
Middle East & Africa	3	3	3	4	4	4	8%
Asia Pacific	6	8	10	13	16	19	26%
Global	8	10	12	14	17	20	21%

Courtesy:- Cisco VNI 2013 Report

Figure-2 and 3 shows the highest growth in Wi-Fi speeds from 2012 to 2017 with a CAGR (Compound Annual Growth Rate) in Percentage and expected Wi-Fi Network Connection Speeds by Global Regions from 2014- 2017 respectively[16].

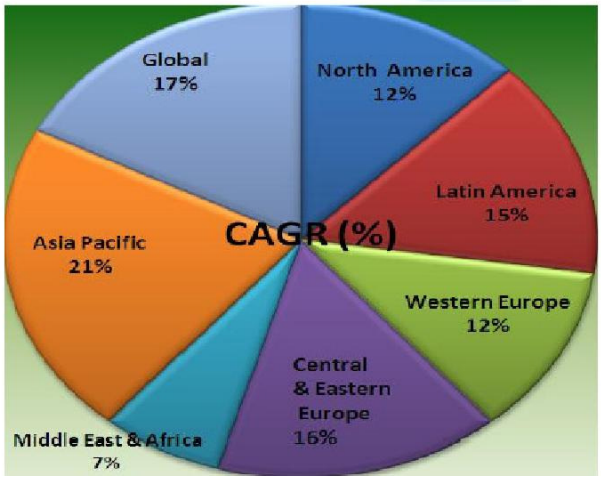


Figure 2. Plot illustrates the highest growth in Wi-Fi speeds from 2012 to 2017 with CAGR in percentage

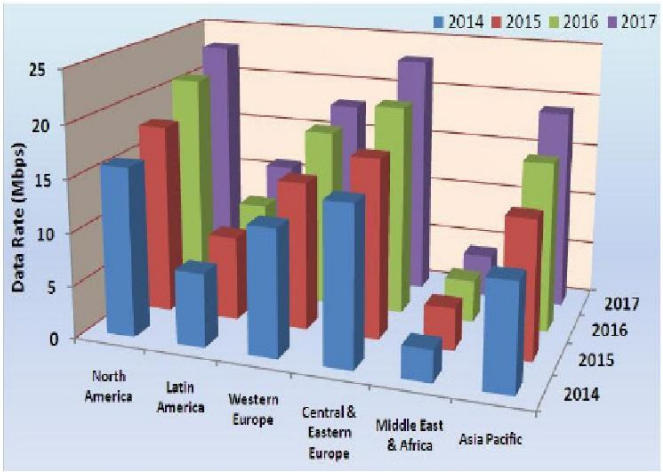


Figure 3. Expected Wi-Fi Network Connection Speeds by Global Regions from 2014-2017

3. Gi-Fi Technology

Gi-Fi or gigabit wireless refers to wireless communication at a data rate of more than one billion bits (gigabit) per second. By 2004 some trade press used the term "Gi-Fi" to refer to faster versions of the IEEE 802.11 standards marketed under the trademark Wi-Fi. [17]In 2008 researchers at the University of Melbourne demonstrated a transceiver integrated on a single integrated circuit (chip) that operated at 60 GHz on the CMOS process. [18] 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. Researchers chose the 57–64 GHz unlicensed frequency band since the millimeter-wave range of the spectrum allowed high component on-chip integration as well as the integration of very small high gain arrays. The available 7 GHz 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.[18] Some press reports called this "Gi-Fi". It was developed by Melbourne University-based laboratories of NICTA (National ICT Australia Limited), Australia's Information and Communications Technology Research Centre of Excellence.[19]

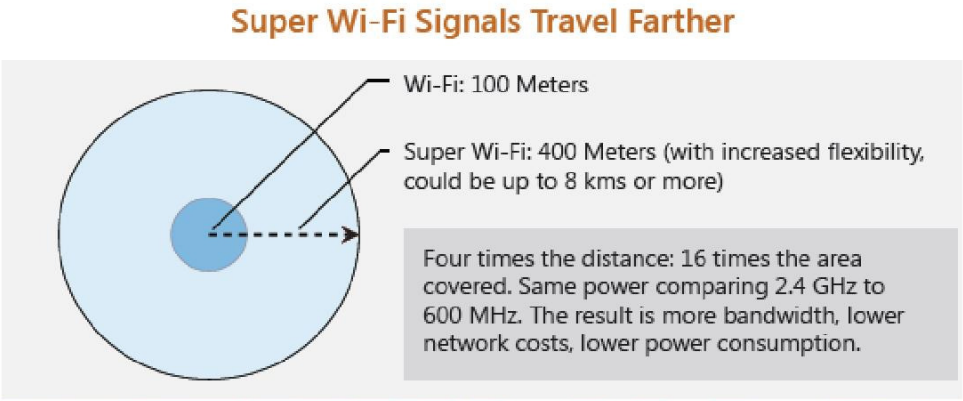
In 2009, the Wireless Gigabit Alliance was formed. It used the term "Wi-Gig" which avoided trademark confusion. [20] It utilize at 5mm square chip and a 1mm wide antenna burning its less than 2milli watts of power to transmit data wirelessly over short distance. It provides many features like ease of development small from factors, enabling the future of information management, high speed of data transfer low power consumption etc.

3.1. Features of Gi-Fi

The Gi-Fi technology allows wireless uncompressed high definition content and operates a range of 10metres, without of interference. It is chip architecture. 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 in development with small form factor.

4. Super Wi-Fi : The Real Future

To achieve today's spectrum demand different wireless access methods are utilized. Now-a-days Wi-Fi has very much congestion and also provided the consumer a economical path to the network. To achieve the goal of affordable access to all consumers Super Wi-Fi is used. Super



Wi-Fi will be provided over radio spectrum to share among different user and internet service providers [14].

4.1. Advantages of Super Wi-Fi:

*Super Wi-Fi (400 meters) signals can travel over long distances than Wi-Fi (100 meters). It can travel 4 times the Wi-Fi as a result more bandwidth, lower network costs and lower power consumption.

* It can penetrate two or three concrete walls but Wi-Fi cannot.

*Greater efficiency due to longer distance coverage, wider range, more bandwidth and lower power consumption.

*Super Wi-Fi devices have the ability to switch from one group of channels to another.
*Advanced and powerful features.

*Self-explanatory and user friendly interface.

4.2. Super Wi-Fi Applications

• Broadband access for K-12 schools, particularly in rural areas where TV white space can be used to connect with nearby fiber optic cables.

• Campus networks by making more spectrum available to meet the users increasing demands for greater bandwidth.

• Smart grid energy efficiency applications by adding to the range of spectrum options available for meeting needs such as remote monitoring and meter reading.

• In home networking for video by providing the additional bandwidth needed for real-time streaming, particularly in densely populated areas.

• Remote sensing by municipalities for applications such as monitoring water quality.

4.3 Security Issue in Super Wi-Fi

Like all wireless technologies, Super Wi-Fi will also have the draw backs of regular Wi-Fi security issues like war driving and encryption. However, there are other problems as the range of Super Wi-Fi means that there is a higher possibility for unauthorized users who previously might not have had access to the network due to Wi-Fi's limited range, to gain access to it. Greater access over a larger area also means that tracking exactly where the user logged into the network could take sometime. Perhaps the biggest unknown at the current moment is that because the technology is so new there have been no set security standards and best practices for setting up a Super Wi-Fi network and getting all those settled could take some time as we have seen with Wi-Fi.

5. Comparisons between Wi-Fi vs Gi-Fi vs Super Wi-Fi

Parameter	Wi-Fi	Gi-Fi	Super Wi-Fi
Speed	54-250 Mbps	5 Gbps	20 Mbps
Range	20-100 Meters	10 Meters	400 Meters
IEEE Standard	802.11b	802.15.3C	802.22
Power Consumption	10MW	< 2 MW	**
Frequency	2.4 GHz	57-64 GHz	2.4 GHz
Development Date	1990	2004	2011
Primary Devices	Notebook, Computers, Desktop, Servers	Mobile, PDAs, Electronic office Industrial automation Device	Notebook, Computers, Desktop, Servers

6. Conclusion

The wireless communication already contributed a huge revolution in the telecom sectors from the last three decades. Wi-Fi gives us the point-to-multiple point internet facility, by which we can create the Wi-Fi hotspot zone anywhere. Super Wi-Fi completely revaluated the business world for the faster internet facility. Now according to the demand of consumers we introduced the Gi-Fi technology for more than 5 Gbps speed. The comparison is performed between Gi-Fi and existing wireless technologies in this paper shows that these features along with some other benefits that make it suitable to replace the existing wireless technologies. It removes cables that for many years ruled over the world and provides high speed data transfer rate. 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. This paper shows that the continuous development of Wi-Fi gives us the Gi-Fi and Super Wi-Fi. But the continuous demand of consumers, we need to improve the technology so that, we can continue our updated technology.

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