# An Analytical Study And Futuristic View Towards Wi-Fi Technologies

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**Abstract:** *Wi-Fi, an acronym for Wireless-Fidelity which is the wireless way to handle networking. The popularity of wireless LANs is a testament primarily to their convenience, cost efficiency, and ease of integration with other networks and network components. The majority of computers sold to consumers today come equipped with all necessary wireless LAN technology. Wireless networking has some serious disadvantages when compared to traditional Ethernet. Businesses considering a transition to a wireless-only network should give these drawbacks serious consideration before moving away from maintaining their traditional wired connections. Wireless Networking is regarded as Networking Future but still there are some unsolved issues which are preventing the wide adaption of Wireless Technologies.*
**Keywords-** *LAN, Ethernet, Networking, Wi-Fi, Wireless Technologies.*

## I. INTRODUCTION

Wi-Fi has emerged as the single most popular wireless network protocol of the 21st century. While other wireless protocols work better in certain situations, Wi-Fi technology powers most home networks, many business local area networks and public hotspot networks.[1]

Some people erroneously label all kinds of wireless networking as "Wi-Fi" when in reality Wi-Fi is just one of many wireless technologies. Different techniques and principles of wireless communication have developed across the world, based on a variety of commercially obsessed requirements. These technologies can generally be classified into four individual categories, based on their explicit application and broadcast range. These view of Network Topologies are recapitulated as shown in figure 1.
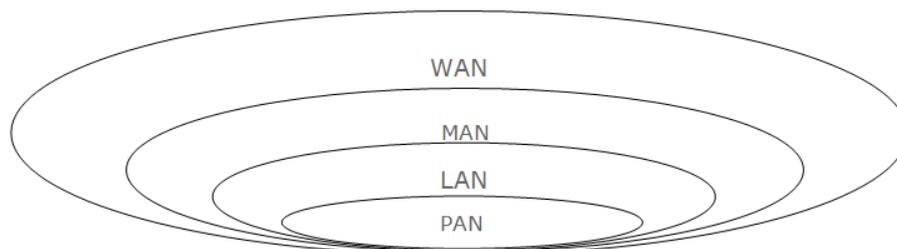


**Figure 1:** View of Network Topologies

**Personal Area Network (PAN)**

A Personal Area Network (PAN) is a computer network used for communication among computer devices (including telephones and personal digital assistants) close to one person. The reach of a PAN is typically a few meters. PAN's can be used for communication among the personal devices themselves (intrapersonal communication), or for connecting to a higher level network and the Internet.

Personal area networks may be wired with computer buses such as USB and FireWire. However, a Wireless Personal Area Network (WPAN) is made possible with network technologies such as Infrared (IrDA) and Bluetooth.
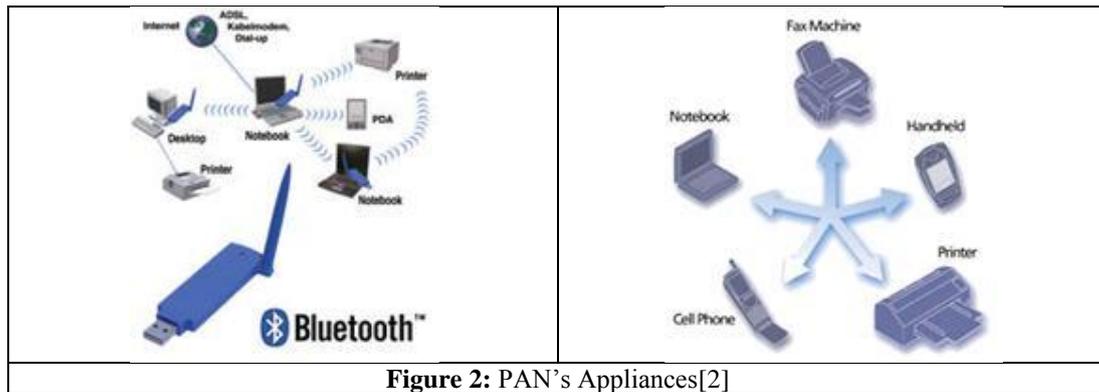
**Figure 2:** PAN's Appliances[2]

***Bluetooth:*** Bluetooth is an engineering specification for wireless personal area networks (PANs), also known as IEEE 802.15.1. Bluetooth afford a way to connect and exchange information between devices such as personal digital assistants (PDAs), cell phones, PCs, laptops, digital cameras, printers, and video game consoles via a secure, globally unlicensed short-range radio frequency.

Bluetooth is a radio standard and communications protocol primarily designed for low power consumption, with a short range (power class dependent: 1 metre, 10 metres, 100 meters) based around low-cost transceiver microchips in each device.

***Infrared (IrDA):*** The Infrared Data Association (IrDA) defines physical specifications communications protocol standards for the short range exchange of data over infrared light, for typical use in Personal Area Networks.

**Local Area Network (LAN)**

A wireless LAN or WLAN is a wireless Local Area Network, which is the linking of two or more computers without using wires. It uses radio communication to accomplish the same functionality that a wired LAN has. WLAN utilizes spread-spectrum technology based on radio waves to enable communication between devices in a limited area, also known as the basic service set. This gives users the mobility to move around within a broad coverage area and still be connected to the network.


**Figure 3:** WLAN based Appliances[2]

*IEEE 802.11:* IEEE 802.11, the Wi-Fi standard, denotes a set of Wireless LAN/WLAN standards developed by working group 11 of the IEEE LAN/MAN Standards Committee (IEEE 802). The 802.11 family currently includes six over-the-air modulation techniques that all use the same protocol

**Metropolitan Area Network (MAN)**

Wireless Metropolitan Area Network (MAN) is the name trademarked by the IEEE 802.16 Working Group on Broadband Wireless Access Standards for its wireless metropolitan area network standard (commercially known as Wi MAX), which defines broadband Internet access from fixed or mobile devices via antennas. Subscriber stations communicate with base-stations that are connected to a core network. This is a good alternative to fixed line networks and it is simple to build and relatively inexpensive.

**Wide Area Network (WAN)**

A Wide Area Network or WAN is a computer network wrapper a wide physical area. Contrast with personal area networks (PAN's), local area networks (LAN's) or metropolitan area networks (MAN's) that are usually limited to a building, room, or campus. The major and most eminent instance of a WAN is the Internet.

WAN's are used to connect local area networks (LAN's) jointly, so that users and computers in one location can communicate with users and computers in other locations. Many WAN's are built for one particular organization and are private. Others, built by Internet service providers, provide connections from an organization's LAN to the Internet.[2]

## II.    AN ACKNOWLEDGMENT OF WI-FI

In the year 1980s, a technology designed for wireless cash registers called Wave LAN was developed and shared with the Institute of Electrical and Electronics Engineers (IEEE) group responsible for networking standards, known as committee 802[3].

- IEEE (Institute of Electrical and Electronics Engineers) established the 802.11 group in 1990.
- Initial speeds were 1 and 2 Mbps.
- IEEE modified the standard in 1999 to include 802.11a and b.
- 802.11g was added in 2003.
- 802.11 equipment first available, then a, followed by g.

## III.    REWARD OF WI-FI

Following are the compensation of Wi-Fi Technology.

- **Convenience:** The wireless nature of such networks allows users to access network resources from nearly any convenient location within their primary networking environment (a home or office). With the increasing saturation of laptop-style computers, this is particularly relevant.
- **Mobility:** With the emergence of public wireless networks, users could be access the internet even outside their normal work environment. Most chain coffee shops, for example, offer their customers a wireless connection to the internet at little or no cost.
- **Productivity:** Users connected to a wireless network can maintain a nearly constant affiliation with their desired network as they move from place to place. For a business, this implies that an employee can potentially be more productive as his or her work can be accomplished from any convenient location.
- **Deployment:** Initial setup of an infrastructure-based wireless network requires little more than a single access point. Wired networks, on the other hand, have the additional cost and complexity of actual physical cables being run to numerous locations (which can even be impossible for hard-to-reach locations within a building).
- **Expandability:** Wireless networks can serve a suddenly-increased number of clients with the existing equipment. In a wired network, additional clients would require additional wiring.
- **Cost:** Wireless networking hardware is at worst a modest increase from wired counterparts. This potentially increased cost is almost always more than outweighed by the savings in cost and labor associated to running physical cables [3].
- **Others**
  i.    Wi-Fi technology allows getting out of home office and working in other rooms.
  ii.   It helps to become more productive at home, like online shopping and banking;
  iii.  Many reliable and bug-free Wi-Fi products on the market
  iv.   Frees network devices from cables, allows for a more dynamic network to be grown.
  v.    Changes the way people live, communicate, work and play.
  vi.   Wi-Fi technology available in hotels, airports, etc., will be more inclined to bring laptop with us when traveling for personal reasons.
  vii.  Wi-Fi is a core technology in GPS Industries Applications.

## IV.    FLAWS OF WI-FI TECHNOLOGY

- **Security**

To combat this consideration, wireless networks may choose to utilize some of the various encryption technologies available. Some of the more commonly utilized encryption methods, however, are known to have weaknesses that a dedicated adversary can compromise. A wired network connection can only be intercepted by someone who has spliced into the wire. But because wireless connections go through the air, all that a person interested in stealing your information needs is a Wi-Fi receiver, software, patience, and a place to work where he can receive your signal. While the Wi-Fi Protected Access security protocol is better than nothing, it can still be cracked by a dedicated hacker.

- **Range**

    The typical range of a common 802.11g network with standard equipment is on the order of tens of meters. While sufficient for a typical home, it will be insufficient in a larger structure. To obtain additional range, repeaters or additional access points will have to be purchased. Costs for these items can add up quickly. A basic Wi-Fi network with one wireless access point reaches at most only a few hundred feet (100m or less) in any direction. Expanding the range of a Wi-Fi network requires installing additional access points configured to communicate with each other, which becomes expensive and difficult to support, especially outdoors. As with other wireless protocols, signal interference (from other wireless devices, or from physical obstructions such as walls) can lower the effective range of Wi-Fi and its overall reliability. [4]

- **Reliability**

    Like any radio frequency transmission, wireless networking signals are subject to a wide variety of interference, as well as complex propagation effects that are beyond the control of the network administrator. Wireless networking uses radios to transmit networking signals. Just as with terrestrial or satellite radio, wireless networks have a limited number of channels and, if every channel is full, connections will slow down or fail to work. The radios that make Wi-Fi work are also prone to interference. Cell phones, microwave ovens, walls, and large pieces of metal like those that make up filing cabinets can all interfere with Wi-Fi signals, giving you unreliable network performance.

- **Speed**

    The speed on most wireless networks (typically 1-54 Mbps) is far slower than even the slowest common wired networks (100Mbps up to several Gbps). However, in specialized environments, the throughput of a wired network might be necessary.

- **Health concerns**

    Some people claim that extensive exposure to wireless radio signals like those from Wi-Fi networks cause headaches, nausea and other physical issues. Many industry experts assure the public that Wi-Fi is safe, but controversy persists as claims one way or the other are difficult to prove[4].Some serious health problems are occurred by the excess use of Wi-Fi, some are give below-
- Contributes to the Development of Insomnia
- Damaging to Childhood Development
- Affects Cell Growth
- Derails Brain Function
- Reduces Brain Activity in Females
- Neutralizes Sperm
- May Impact Fertility
- Provokes Cardiac Stress
- Linked to Cancer?
- Sleep disturbance.
- Lethargy.
- Short term memory loss.

- **Electricity Consumption**

    Wi-Fi Routers consume more electricity as compared to Broadband. The Electricity is consumed to spread Wi-Fi Signals over the Area of 40 Meter.

- **Others**
1. Power consumption is fairly high compared to other standards, making battery life and heat a concern.
2. The 802.11b and 802.11g flavors of Wi-Fi use the 2.4 GHz spectrum, which is crowded with other devices such as Bluetooth, microwave ovens, cordless phones, or video sender devices, among many others.

**Following figures shows the problems of Wi-Fi networks.**



**Figure 4:** Headache problems with Wi-Fi[8]
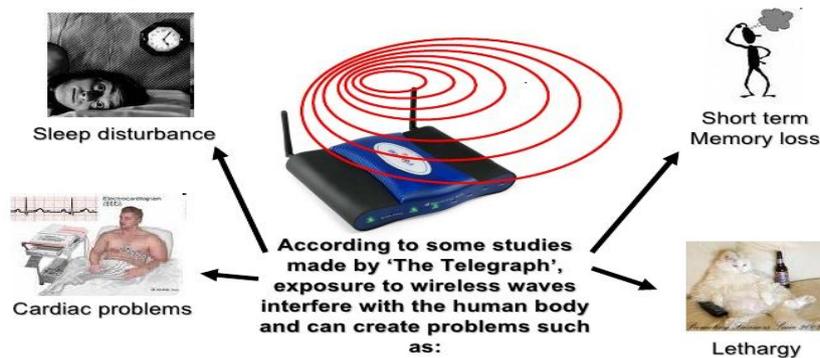


**Figure 5:** Effects on sleeping child[9]



**Figure 6:** Different health problems with Wi-Fi[10]

## V. FUTURE ADVANCEMENT OF WI-FI IN SPEED

The new wireless technologies for enterprise environments in 2014 will change the trends of enterprise employees. The different ways will advance in coming years such as:

- Acceptances of 802.11ad which embody the forthcoming revolutionize in the IEEE 802.11 protocol and amplify the data speed into the Gigabit world.
- By using advance Hot Spot 2.0 and pass point open services.
- Wi-Fi based location analytics will help for different organization to improve the customers and user Wi-Fi experience, to increase business intelligence and to improving the security policy.
- Extension of cloud for small and standard sized enterprises.
- To allow user to log in to the Wi-Fi network by using their social recommendation.
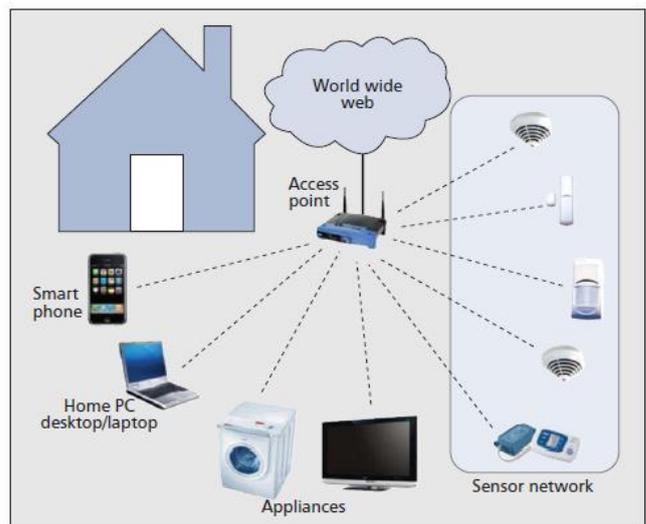- Different home appliances communicates with the Wi-Fi Sensors.[6]



*Figure 7: WI-FI Enabled Appliances used at home [6].*

From worldwide research, in 2017 (20.3Mbps) the Wi-Fi connection speeds generated from dual mode devices will increase 3 times to speeds in 2012(7.7Mbps). The Table-1 shows the projected Wi-Fi network connection speeds in Kbps by Global region and different countries. The Figure-2 and 3 illustrates the highest growth in WiFi 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.

**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

## VI.    SUPER WI-FI : AN FUTURE ASPECT TOWARDS INVESTIGATION

To accomplish today's spectrum demand different wireless access methods are used. Now-a-days Wi-Fi has a good deal congestion and also provided the consumer cost-effective path to the network. To attain the goal of reasonable 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 [7].

The major compensation of super Wi-Fi is:

- It can travel 4 times the Wi-Fi as a result more bandwidth, lower network costs and lower power consumption. Super Wi-Fi (400 meters) signals can travel over long distances than Wi-Fi (100 meters).
- It can go through two or three concrete walls but Wi-Fi cannot.
- Greater effectiveness due to longer distance coverage, wider range, more bandwidth and
- Lesser power utilization.
- Super Wi-Fi devices have the ability to switch from one group of channels to another.
- Sophisticated and powerful features.
- Self-explanatory and user friendly interface.

**We use to define new development alternatives that create wireless access solutions in future, including:**

- WiFi Gigabit Solution (IEEE 802.11 ad standard)
- White Fi solution (IEEE 802.11 af standard)
- Wi-Fi approach for Machine to Machine (M2M) communication (IEEE 802.11 ah standard)
- HetNets solution
- Cognitive-Fi (CogFi)

## VII.    CONCLUSIONS

Super Wi-Fi is an emerging methodology to improve the Wi-Fi speed in forthcoming days. It plays a crucial role for the researchers to develop the Wi-Fi advancement in speed. As Wi-Fi is now shipped in millions of products and deployed in millions of homes, business and hotspots worldwide, the technology has moved beyond the realm of a computer feature. Wi-Fi has fast become a cultural phenomenon. Wireless or not, each technology has its advantages and disadvantages. Wireless technologies often tend to increase convenience and decrease 'safety'. Wired technologies are mostly used whenever reliability is of major importance. When an idea for some kind of new technology arises and the impact on the user can accurately be estimated the question 'Can this technology improve life quality?' should be the go/no go criterion. Knowing the pros and cons in advance should enable someone to answer this question. This go/no go criterion is very different from a regular enumeration because in fact an intelligent weight factor is approved to each of the compensation and annoyance [7].

Recently published research demonstrates that Wi-Fi exposure are not only well within recommended limits, but are only a small fraction (less than 1%) of what is received during typical use of cell phones. For this reason much of the research on possible effects of RF energy has been focused, and will likely continue to focus, on exposures from cell phones rather than the lower exposures associated with RF uses such as Wi-Fi. RF exposures to the public, including school children, from Wi-Fi are far lower than occur with cell phone use and to date there is no plausible evidence that would indicate current public exposures to Wi-Fi are causing adverse effects on health.

Given the experience with other sources of non-ionizing radiation (e.g. power lines) that have been in use much longer than cell phones or Wi-Fi, it is unlikely that all controversies related to potential RF effects will be resolved even after decades of additional research.

## ACKNOWLEDGEMENT

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