

# COMPUTER WIRELESS NETWORKING AND COMMUNICATION

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## ABSTRACT

This paper presents an overview of the wireless networking with emphasis on the most popular standards such as Bluetooth, Wi-Fi, WiMAX and Cellular Networks. A review of what is need to build a generic wireless networks is provided. This literature attempts to discuss the most popular wireless technologies and their protocols. An overview for the advantages that wireless networks have over wired technology is given. This paper also advances some of the major security risks that wireless networks face. Various strategies can be employed to mitigate these risks and safeguard the privacy and security of the networks are given. A review of how wireless network can be used in education and training is then given and it is demonstrated that the education field has benefited from the growth of wireless technologies and the cost effectiveness of this technologies.

**Keywords:** *Overview of computer networks , Wireless networks , Wireless technologies.*

## 1.INTRODUCTION

The inventions of the computer and the subsequent creations of communication networks can be hailed at the most significant accomplishment of 21st century. The invention has transformed the way in which communications and information processing take place.

The network functionalities of computer system has been exploited by the government, business, and individual with immense benefits being reaped by all. The two major types of networks in existence are fixed connections (which makes use of cables) and wireless networks (which use waves to transmit data). The backbone of vast communication network is made up of fixed

connections which mostly utilizes fiber optics as well as Ethernet.

Even so, wireless network have gained increased popularity in the course of the past decades. The hardware costs has significantly decreased making wireless networks affordable to all individuals and organization. In addition, technological advances has increased the capacity and efficiency of wireless networks which have made them favorably compare with wired networks.

## Computer Networks: An Overview

Computer networks are made up of interconnected computing devices which communicates with each other and these networks were categorized by their sizes. The smallest is the Personal Area Networks (PANs) which extend to a few meters and connects adjacent devices together.

Wireless PANs are technologies such as Bluetooth. Local Area Networks (LANs) extends from a few hundred meters to a few kilometers and they were designed to cover buildings which are close together or large facilities. Wireless LANs are implemented facilities such as campuses and busy business locations. Metropolitan Area Networks (MANs) connects different buildings and facilities within a city.

These networks mostly make use of wired connection with fiber optic transmissions providing the fastest speed. The biggest networks are Wide Area Networks (WANs) which connects cities and countries together and they typically make use of fiber-optic cables which operate at speed of up to 40Gbps.

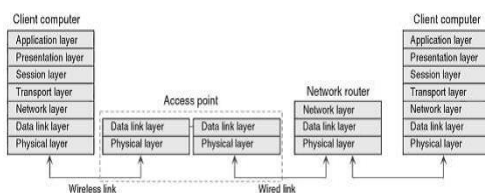
## What is Wireless Networking?

Wireless networking's refers to the "utilization of cross-vendor industry standards, such as IEEE 802.11, where nodes communicates without

needing to be wired". The infrastructure of wireless network makes use of standard protocol that are oriented according to the demand of the network. This makes the capacity as well as the quality of service of wireless networks varies based on the devices.

Wireless networks are typically expected to deal with devices that are made from various manufacture. The networks are therefore be able to support different hardware technologies, architectures, and transport protocols and also controls the flow of traffic within the network. All wireless networks make the use of waves in the form of electromagnetic spectrum. For example, Wireless local-area networks (Wireless LANs) make uses of high frequency electromagnetic waves to transmit data. Modulation and demodulation of radio waves are used to transmit data occurs at the transmitter and receiver respectively.

Wireless networks also uses the Open System Interconnect (OSI) reference model in the transmission of data. The manner in which reference model applies to wireless networks is similar to wired networks with some difference in the data link layer where wireless networks coordinate access by data to a common air medium and also deals with errors which occur due to the inherent nature of the wireless medium. At Physical layer, the data is transmitted in form of radio waves.



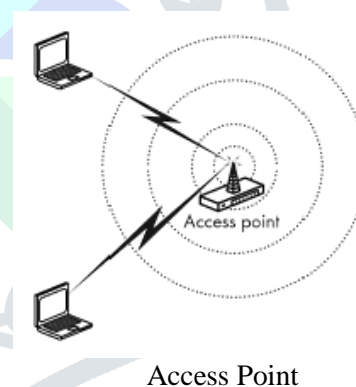
The OSI Protocol Stack and wireless Communication.

## What we need to build a Wireless Networking

Before wireless network can be built, it is important to run a site survey. While this step may ignored when implementing a small wireless network, it is of extreme importance when building large wireless network. This is because wireless networks operate at the same frequency band used by other equipment and avoiding interferences from such equipment is important if

goal of reliable communication is achieved by the wireless network.

There are a number of hardwares and softwares components that are required in implementing wireless network. One hardware device is access point which is the device linking the wireless network to a wired LAN. Wi-Fi Alliance note that the access point is the device that transmits and receives the signals which are used for communicating between the computing devices in the network. Wireless access points have varying capacity and the size is dependent on the speed desired in the network. The device should be placed at a central location at a high vantage point in order to avoid obstacles and ensure that as many users have access the network. There are a number of significant factors that has to consider when acquiring hardware for wireless network. Interoperability of the equipment is important factor if the network is to support all the available protocols. The range which the network is expected to span is also important. Specifications such as the transmission power and the antenna gain should use to calculate range of the equipments.



## Wireless Technologies

- **Bluetooth**

**Bluetooth** is a wireless technology standard for exchanging data over the short distances (using short-wavelength UHF radio waves in ISM band from 2.400 to 2.485 GHz from fixed and mobile devices, and building personal area networks (PANs).

It was originally conceived as wireless alternative of RS-232 data cables. Bluetooth is managing by the Bluetooth Special Interest Group (SIG), which have more than 30,000 member companies in the areas of telecommunications, computing,

networking, and consumer electronics. The IEEE standardized Bluetooth as **IEEE 802.15.1**, but no longer maintains the standards. The Bluetooth SIG oversees development of specification, manages the qualification program, and protects the trademark. A manufacturer must meet Bluetooth SIG standard to market it as a Bluetooth device. A network of patents apply to this technology, which were licensed to individual qualifying devices.

- **Satellite**

Satellite communication is one of the wireless technology, which is widely spread all over the world allowing many users to stay connected virtually anywhere on Earth. These Satellites used in this mode of communication, communicate directly with the orbiting satellites via radio signals. Portable satellite phones and modems have more powerful broadcasting abilities than the cellular devices as they have high ranges, apart from more expensive in terms of cost, than their counterparts. For example, for outfitting a ship through satellite communication, a traditional communication system has linked to a single satellite, which allow multiple users to share same broadcast equipment.

- **Wimax**

There are wireless broadband system that offers fast Web surfing without being getting connected through cable or DSL. Although WiMAX can potentially delivers data rate of more than 30 Megabits per second, the providers offer average 0 data rates of 6 Mbps and often deliver less, making the service significantly slower than the hard-wired broadband. The actual costs of the data using WiMAX widely varies with the distance from the transmitter. WiMAX is one of the versions of 4G wireless available in phones as Sprint's 4G technology.

- **WI-FI**

Wi-Fi is form of low-power wireless communication used by electronic devices such as laptops, systems, smartphones, etc. In Wi-Fi setup, a wireless router serves as a communication hub. The networks are extremely limited in the range due to low power of transmissions allowing users to connect only within close proximity to a router or a signal repeater. Wi-Fi is common in home networking application which provides the

portability without any need of cables. Wi-Fi networks need to secure with passwords for the security purposes in order not to be accessed by the others.



### Cellular Networks

While mobile phones have gained the overwhelming prominence in the past decades, mobile phone networks has introduced as far back as the early 1980s and this technology was able to provide access to wired phone network to mobile user . The area of coverage in the cellular wireless network can ranges from a few hundred meters to a few kilometers in radius. In each cell, there is a base station which was connected to the wired networks and which allows the mobile devices in the range to communicate with each other.



Cellular Transmission Towers

A cellular network or a **mobile network** is a communication network where last link is wireless. The network is distributed over the land areas called cells, and each served by at least one fixed-location transceiver, but more normally three cell sites or base transceiver station. Those base stations provides the cell with the network coverage which can be used for transmission of voice, data, and other types of content. A cell uses different set of frequencies from neighboring cells

to avoid interference and provide the guaranteed service quality within each cell. When joined together those cells provide radio coverage over a wide geographic areas. It enables a large number of portable transceivers (e.g., mobile phones, tablets and laptops equipped with mobile broadband modems, pagers, etc.) to communicate with each other and with fixed transceiver and telephones anywhere in the networks, via base station, even if some of transceivers are moving through more than one cell during the transmission.

### **Advantage of Wireless over Wire Technology**

Wireless networks have a number of significant advantages over wired networks. It is relatively easy to set up the wireless network infrastructure that it is to make a wired one. This is because the physical devices necessary for the wireless network are less than for wired networks. Wireless networks requires an access point and other devices have been properly configured they can operate. Another additional merit of wireless networks is the expansion of an existing network is easy since the connectivity is already available within range of the access point. The ease of deployment of the wireless networks makes them economically attractive for most of the organizations since the capital investment of implementing those networks is not as intimidating that that required for the elaborate wired networks. With the wide success of the wired LAN, the local computing market made a steady shift towards the wireless LANs which offer the same speeds as wired LANs. The mobility of the wireless networks is another attribute that endears them to users. Wireless networks are built with the consideration that most users who wants to access data will be mobile and wired connections may therefore prove to be major inconvenience. With the wireless networks, a person will remain as connected as long as they are in within the range of an Access Point.

- **Demerits**

In spite of all the advantages that wireless networks possesses, there are some major disadvantages which makes it necessary to use the wired networks in some instances. Wireless

networks are more susceptible to interference when compared to wired networks. Wireless networks make use of the radio frequencies and at any given time, there are radio interferences in the atmosphere. The devices which may include the cordless phones and baby monitors operate in the same area that most wireless networks are setups. Interferences therefore occurs when wireless communication devices have to share the frequencies with consumer devices therefore reducing the effectiveness of the network.

### **2. SECURITY ISSUES**

In all forms of communications, security is a vital importance. Securing a network is the challenging task since hardware and software keeps evolving and as old threats are overcome, new ones keeps presenting themselves. Security implementations may therefore not be able to effectively handle the threats being presented in the current years. Wireless networks are prone to a number of security risks and most significant one is the wireless eavesdropping. Due to the wireless nature, it is easy to eavesdrop on them than it is with wired networks.

### **3. USING WIRELESS TECHNOLOGY IN EDUCATION AND TRAINING**

Wireless networkshad a profound impact in the area of schools where the exchange of data was previously unattainable due to the complication associated with the wired networked. The education field had benefited from the growth of the wireless technology and the cost effectiveness of this technology. Before the wireless networks were feasible, the education area suffered from inherent setbacks of wired networks such as lack of mobility, the complexity of deployment and difficulty in expanding the network.

Training sessions may occurs in places that are not equipped with the wired networks. In such settings, implementing wired networks may be impractical and be expensive. Wireless networks can be quickly deployed for the temporary use and then moved when the training is over. For small training sessions which have a small number of people, ad-hoc networks can be useful since they do not require any additional infrastructure to set up. The various individuals in the networks can therefore shares the resources after configuring the devices to communicate in

an ad-hoc manner. This computer networks do not requires the use of an access point but rather allows the wireless devices which are within the range of each other to discover each other and proceed to communicate in a peer to- peer manner.

Educational institutes which make use of the centralized databases for the educational material and information can benefited from the wireless networks since the students are able to access the available resource at different areas in school.

## CONCLUSION

This paper sets out to discuss the wireless networks which are increasingly becoming preferred over wired networks by many users. The paper offering an overview of the networking and then proceeded to define the wireless networking and discussed the various technologies that are used. It is very clear that the wireless network solutions are increasing in popularity as they become more affordable and are adopted by more people. The most popular technologies are such as Bluetooth, Wi-Fi, WiMAX and Cellular networks. It has confirmed that the mobility of wireless networks is their most desirable characteristic. It has been noted that in spite of their merits, there are a few significant issues with the wireless networks which are primarily: quality assurance and security issues.

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