

## Comparative Analysis of Wi-Fi, Bluetooth & Xender Wireless Technology Applications

<sup>1</sup>Omilabu, A.A., <sup>2</sup>Olusanya, O.O. & <sup>3</sup>Adebare, A.A., <sup>4</sup>Ibitowa, F & <sup>5</sup>Longe, O.B. & <sup>6</sup>Ogunjimi, O.A.

<sup>1,2,3</sup>Dept of Computer & Information Science, Tai Solarin University of Education, Ijebu-Ode, Nigeria.

<sup>4</sup>Dept of Computer Science, The Polytechnic, Ibadan, Oyo State, Nigeria

<sup>5&6</sup>Department of Mathematics & Computer Science, Caleb University, Imota, Lagos State, Nigeria

Emails: <sup>1</sup>demmysax@yahoo.co.uk; <sup>2</sup>yinka\_olusanya@yahoo.com; <sup>3</sup>adebaredj06@gmail.com,

<sup>4</sup>ibitowafolashade@yahoo.com, <sup>5</sup>longeolumide@fulbrightmail.org, olaogunjimi@@gmail.com

### ABSTRACT

Wireless technology and application are springing up all over the place, with a large variety of users, ensuring ease access, comfort and mobility. Their essential and indispensable attributes have made them to be part of human lifestyle. Wireless technology shares data and also provides channel of implementation for wireless application rely on radio transmission in the unlicensed ISM (Industrial, Scientific and Medical) band. This paper discusses the characteristics of wireless technologies, wireless application, comparison of the commonly used technologies and application like: Wi-Fi, Bluetooth and Xender application. Currently, wireless technologies and applications are becoming more and more advance, and this needs to be analyzed for optimal usage.

**Key words** - Wireless technology, Radio signal, Wireless application, Wi-Fi, Bluetooth, Xender

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### 1. INTRODUCTION

Wireless communications are typified as a result of their pervasiveness and popularity (Waltenegus & Christian, 2010). The Institute of Electrical and Electronics Engineers (IEEE) in 1999 published the 802.11 wireless LAN Standard, which often referred to as “Wireless Fidelity” (Wi-Fi). In 15 April 2002, IEEE Standard Board approved the 802.15.1 Bluetooth (WPAN Task Group 1, 2003). The standards ensure compatibility, fair access of the medium with the support for high throughput, mobility and energy saving of the hardware devices that use the standards (802.11 and 802.15.1).

Wireless connection is a rapid speed emergent technology that permits the populace admittance to networks and services without physical connection, for provision of flexibility and mobility (Willig, 2003). Perceptibly, wireless networking is reimbursement in respect to cabled devices, dynamic network formation, low cost, and easy deployment. The communication and sharing of the network data fall within resourcefully range of short, medium and long distance. The communication and share point of connections are Smartphones, Personal Digital Assistants (PDAs), Laptops, Wireless-keyboards, mice, telephones Global Positioning Systems (GPSs) unit and the like.

Diverse applications are meant for diverse functions in proportion to their needs, for instance Xender application is applicable to mobile phones (Smartphone), tablets and laptops to send\receive data (files, applications etc.), sharing networks available on four operating systems (Android, iOS, Windows Phone, Tizen). The main goal of Xender application is to get the devices connected using the innovative technology for the purpose of providing the users with excellent and high quality standard experience.

## 2. WIRELESS TECHNOLOGY

Wired technologies in communication have been the custom in the precedent time. Wired technologies make use of cable, which hinder reliable communication over long distance. To prevail over this weakness, wireless technology was introduced and wireless communication technologies entail s cable free and it is dependable. Wireless networks are simple to deploy, and in some cases cost less than wired LANs (Erinaferro, 2005). Wireless technologies are applicable to various applications in a variety of environments such as homes, offices, institutions offices, industrial unit etc. so forth; communicate or transmit the data with wireless technology such as Wi-Fi and Bluetooth.

With an increasing deployment of diverse wireless networks, applications using multiple devices, networks, or user types could be supported on global scale (Varshney, 2000). According to Michelle (2002), the wireless revolution is still underway, and devices based on radio technologies are just started bargaining to remodel market to themselves in the next several years, showing great promise in transforming how people work and communicate with each other. (Michelle, 2002).

### 2.1 Wi-Fi

Wireless fidelity (Wi-Fi) is a wireless technology that facilitates devices to communicate over a high speed short distances wireless signal using star topology. Wi-Fi comprises of IEEE 802.11a, 802.11b, 802.11g and 802.11n standards for Wireless Local Area Networks (WLANs); connecting devices to each other, to internet and to the wired network using star topology. The purpose of the IEEE 802.11 standard is to develop enabled wireless connectivity to devices that require a quick installation and frequency of both 2.4 GHz and 5.2 GHz, such as portable computers, PDAs, or generally mobile devices inside a WLAN (Neeraj, 2013).

The possibility of a Wi-Fi comes through radio signal which always broadcasting from the antennas and receiving by the devices equipped with Wi-Fi adapter cards. According to ([www.tutorialspoint.com](http://www.tutorialspoint.com)), the reception of Wi-Fi network radio signals (shown in the figure 1.0 below), by computer is usually of the range 300 - 500 feet of the antennas, reads by Wi-Fi adapter card, and thus creates an internet connection between the user and the wireless network. Commonly use both at home and in business networks, using various devices such as laptops, smart phones and tablets.



Fig 1.0: Wi-Fi Radio signals

Once a Wi-Fi station is on, scanning job will be performed on the accessible channels to discover the active networks, friendly request will be made by transmitting signal to the active networks to join the Wi-Fi station. There is always a measure to prevent or permit access to the Wi-Fi connection in order to avert security threat, examples of security measure such as Wireless Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA/WPA2). The station can continuously discovering the new networks, join them as long as the security measure to join the connection were met, and can possible disconnect if need be, to join new network of stronger strength. The higher the number of the devices in a particular Wi-Fi connection determines the signal strength of an individual device in the connection.

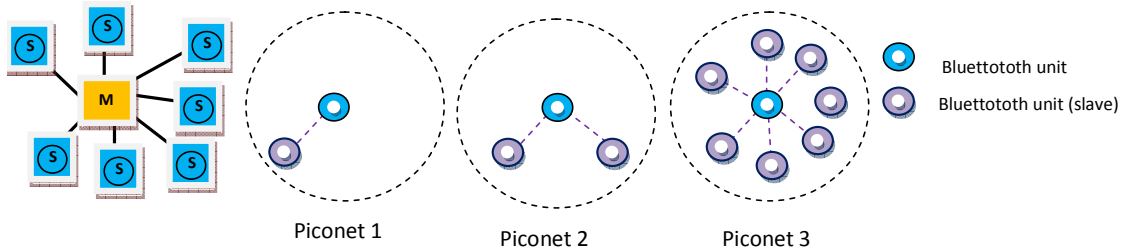
Wi-Fi station construction established on the principle of several components interaction to generate WLAN, it is a half duplex shared media configuration that transmits and receives data on the same radio channel. Each basic component of Wi-Fi station is termed a basic service set (BSS) of mobile or fixed stations. When a station travels out fundamental service setting, it will be impossible to communicate directly with the other members of the BSS. Alternatively, BSS may be part of a broad network, called extended service set (ESS).

In indoor environment, Wi-Fi in some cases subjects to variety of interference, as well as complex propagation effects due to reflection of signals from the various domestic obstacles. Wi-fi speed range from 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 (ipoint-tech.com). Classic range of Wi-Fi connection seems adequate for common home, but for larger structure supplementary range has to be added for proper adequacy, repeaters or additional access points.

## 2.2 Bluetooth

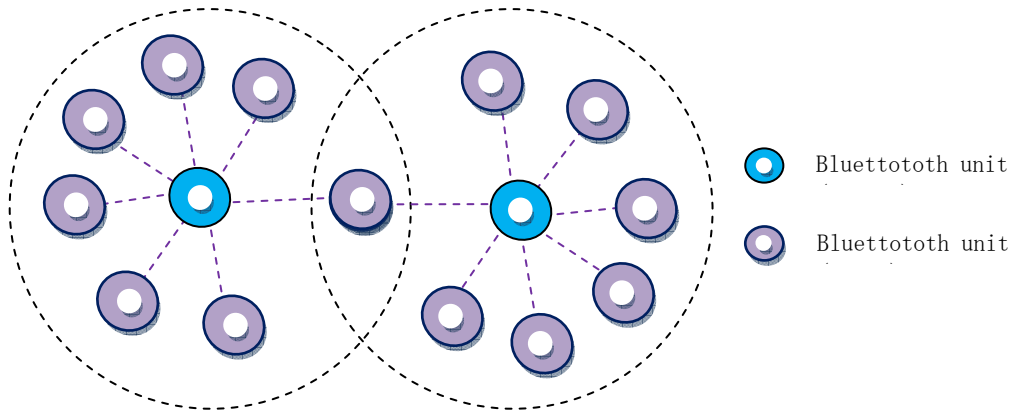
IEEE Std 802.15.1 (2002) referred to Bluetooth as standard for wireless communications using a radio system designed for short-range, cheap communications devices, communications between portable computers, acting as bridges between other networks, serving as nodes of ad hoc networks. Bluetooth wireless technology inventive purpose is to replace the wired connecting system, by creating Wireless Personal Area Network (WPAN) for mobile and fixed devices. Bluetooth is a global wireless communication standard that connects devices together over a certain distance (Kardach 2008). Bluetooth uses technology a radio technology called Frequency-Hopping Spread Spectrum (FHSS), where data to be transmitted is initially divided into packets and each packet is made to transmit on one among the designated 79 Bluetooth channels of 1MHz bandwidth (Simranjit et al.. 2013). Bluetooth is a suitable technology for multiple situations, based on its easy connection, secure inexpensive communication and execution at a fairly high data transmission rate without the needs of line- of - sight communications, (Sainio et al, 2000).

Bluetooth connection always requires authentication process in which user requires validating connection between devices. Creating connection between Bluetooth devices, requires inquiry to discover if there available active Bluetooth device ready for connection, if there is and the ready device have once established pairing process with the questing device, automatically connection will be established between the two devices, but if not, the listening device have to respond with needed information to pair up and in order to establish connection with the questing device. Many mobile devices have built-in Bluetooth connectivity, while others that do not, require the use of a Bluetooth “dongle” (USB adapter) to be able to Bluetooth connection. Bluetooth communication principle features two topologies named the piconet and scatternet. A piconet is a WPAN that make use of master/slave model control for sending and receiving data, where a Bluetooth device serving as a master and one or more Bluetooth devices serving as slaves. In piconet the master device determines the data communication flow, as shown in the *figure 2.0* below. A single master device in piconet can be connected with up to different number (but maximum of seven) of slave devices (point-to-point and point-to-multipoint), while a slave device can only be connected through short range with to a single master (point-to-point).



**Figure 2.0 Piconet**

A scatternet is a type of ad hoc computer network consisting collection of operational Bluetooth piconets overlapping in time and space (Jin-Shyan et al, 2007). Two or more piconets connected to form a scatternet whenever a device in a piconet either master or slave decides to participate as a slave to the master of another piconets and thus serves as bridge between the two piconets.



**Figure 3.0 Scatternet**

Bluetooth technology can be used to collect a few devices to sync and swamp files, through short range with slow data speeds, poor data security, prone to viruses.

### 2.3 Xender

Xender is an Android application that connects two or more devices (such as Smartphone, PDAs, Laptops etc.) for sharing and transferring of files, photos, audios, videos, applications, and any other form of media, accessible at least on four different operating systems (Android, iOS, Windows mobile, Windows, Tizen) (Wikipedia). Xender is an open source file sharing application which helps to connect two or more devices at a time for file sharing (Anas & Aqeel, 2016a). It was firstly released in China, termed Shan Chuan and outside China branded as Flash Transfer, and later known as Xender. Xender wireless application inventive purpose is to connect the world with inventive technology and as well to provide the users an exceptional and high quality standard usability experience in term of data communication. Xender application transfer files and application at tremendously fast rate, variety of sizes and types,

using Wi-Fi, Bluetooth, mobile data or NFC Protocol of the devices involved in the transferring process. Xender application creates a personal network among the communicating devices over Wi-Fi channel; however, the communicating parties must have same file sharing application and must be present within the operating range of Wi-Fi i.e. 25-30 (Anas & Aqeel, 2016b).

Xender uses devices WI-Fi card to communicate with another device Wi-Fi card, by setting up a non interference private radio transmission that does not depend on the speed of the internet with no interference. To transfer files/apps using Xender Android application, the application has to be already available on the system, if not it has to be installed, then launched (using the Xender Icon), an interface with dialogue box appear to indicate whether “to send” or “to receive” files/apps; click on send, an hotspot will be created for the other device to get connected to the (send) device; while the same process is simultaneously taking place on the other device to receive files/apps; in the dialog box to indicate whether “to send” or “to receive” files/apps, “to receive” has to be clicked as dialogue option, then instruction will be given to turn on location (GPS), and the available device will be discovered, clicked upon, once the devices have connected the files/apps can be easily shared and transfer. Xender application in some cases could be affected by compatibility issues or some technical problems. It requires that the devices have the application installed.

### 3. COMPARISON AND ANALYSIS OF WI-FI, BLUETOOTH AND XENDER APPLICATION CHARACTERISTICS

Wireless technologies and application can be compared on the basis of different standards. Table 1.0 gives summary of main differences among the two wireless technologies and an application. For instance, Wi-Fi and Bluetooth are both technology, they based on an IEEE standard while Xender is an application and it based its operations on the technologies. They are of different inventors; Wi-Fi was invented by John O’Sullivan (CSIRO), Bluetooth by Dr. Jaap Haartsen (Ericsson) and Xender by Sahil Blochlo, Lokesh Narwani and Viral Solanki (Anmobi.inc).

#### 3.1 Data rate

Wi-Fi operates in the range of 100m, Bluetooth 1-100m and Xender 25m - 30m range. Wi-Fi data transfer rate is 250Mbps, Bluetooth 3Mbit/s and Xender above 20Mbps.

#### 3.2 Frequency Band

Wi-Fi operates at range of is 2.4 – 5.9 GHz, Bluetooth 2, and Xender ad-hoc Wi-Fi frequency band. Wi-Fi uses DSSS (802.11), complementary code keying (CCK, 802.11b), or OFDM modulation (802.11a/g) with 14 RF channels, Bluetooth uses frequency hopping (FHSS) with 79 channels, whilst Xender adhoc Wi-Fi.

#### 3.3 Security

Wireless technologies use different encryption and authentication methods to securely transfer the data. Wi-Fi uses RC4 stream cipher for encrypting the data, Bluetooth E0 stream cipher while Xender has no encryption. and does not guarantee security of data sent or received. Wi-Fi has different authentication methods; Bluetooth authentication is done using shared secret key while Xender has no-login or other authentication.

#### 3.4 Network Type

Wi-Fi, Bluetooth and Xender are technologies and application of different wireless networks range of applications. Wi-Fi and Xender is of the range of application of Wireless Local Area Network (WLAN); the range of application of Bluetooth is Wireless Personal Area Network (WPAN). The maximum number of nodes belonging to Wi-Fi technology is 2007 for a structured Wi-Fi BSS; Bluetooth is 8 (7 slaves plus one master), while Xender is 5.

**Table 1.0 Comparison between Wi-Fi, Bluetooth and Xender Characteristics**

Standard	Wi-Fi	Bluetooth	Xender
Type	Technology	Technology	Application
Inventor	John O'Sullivan (CSIRO)	Dr. Jaap Haartsen (Ericsson)	Sahil Blochlo, Lokesh Narwani and Viral Solanki (Anmobi.inc)
IEEE specification	802.11a/b/g	802.15.1	-
Versions	802.11.a, 802.11b and so on.	2.0, 2.1, 3.0, & 4.0, EDR	V3.9.0428, V3.9.0428, V3.9.0421, V3.4.0119, V3.3.1219
Frequency band	2.4 – 5.9 GHz	2.4 GHz	Ad-hoc Wi-Fi
Nominal range	100m	1m - 100m	25 - 30m range
Number of Radio Frequency Channels	14	79	Ad-hoc Wi-Fi
Max number of nodes	2007	8 (1 master + 7 slave)	5
Data Transmission rate	54Mbps	3Mbps	Above 20Mbps
Spreading	DSSS, CCK, OFDM	FHSS	Ad-hoc Wi-Fi
Nominal range	100m	1m - 100m	25 - 30m range
Channel bandwidth	1 MHz	22 MHz	Ad-hoc Wi-Fi
Basic cell	BSS	Piconet	Ad-hoc Wi-Fi
Authentication	WPA2 (802.11i)	Shared secret	-
Encryption method	RC4 stream cipher (WEP), AES block cipher	EO stream cipher	-
Data protection	32-bit CRC	16-bit CRC	No absolute guarantee
Network Type	Wireless Local Area Network (WLAN)	Wireless Personal Area Network (WPAN)	Wireless Local Area Network (WLAN)
Device supported	Android, Windows, Mac & IOS	Android, Windows, Mac & IOS	Android, Windows, Mac & IOS
Power/Energy Usage	High	Low	Power efficient entry level

### **3.5 Device Supported and Power Usage**

Wi-Fi, Bluetooth and Xender support various operating systems such as Android, Windows, Mac and IOS. Bluetooth offers very low power consumption compared with Wi-Fi. Wi-Fi is designed for a longer connection and supports devices with a substantial power supply, while Xender offers considerable power efficient entry usage.

## **4. CONCLUSION**

This paper is not prepared to show which the best wireless technology or application is, but rather describes what the differences between Wi-Fi, Bluetooth and Xender are and which technology and or application fulfill(s) the needs of particular user. The comparison is based on data rate, frequency band, security, network type, device supported, power usage etc.

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