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Research Article

COMPARATIVE STUDY ON WIRELESS LOCAL AREA NETWORK STANDARDS

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ABSTRACT
Wireless Local Area Network is a data transmission system considered to provide location independent network access between computing devices by using radio waves rather than a cable infrastructure. In the business venture, wireless LANs are frequently employed as the final link between the existing wired network and a group of client computers, giving these users wireless access to the full resources and services of the corporate network across a building or campus setting. The IEEE 802.11 standard supports radio transmission within the 2.4 GHz band. The 802.11 is a family of specifications developed by the IEEE for WLANs. In this research paper we concern with WLAN standards and their comparative study which will help to WLAN users in selection of better type of WLAN standard.

Key Words: *IEEE, WLAN, Frequency, 802.11, Mac*

INTRODUCTION

WLAN technologies were first available in late 1990, when vendors initiated introducing products that operated within the 900 MHz frequency band. These solutions, which used non-standard, proprietary designs, provided data transfer rates of approximately 1Mbps. It was considerably slower than the 10 Mbps speed provided by most wired LANs at that time.

In 1992, sellers began selling WLAN products that used the 2.4GHz band. Even if these products provided higher data transfer rates than 900 MHz band products they were expensive provided comparatively low data rates, were prone to radio interference and were often designed to use proprietary radio frequency technologies. The Institute of Electrical and Electronic Engineers started the IEEE 802.11 project in 1990 with the objective to develop a MAC and PHY layer specification for wireless connectivity for fixed, portable and moving stations within an area.

MATERIALS AND METHODS

WLAN Standards

The IEEE 802.11 variants are listed in below table.

Table 1: List of IEEE 802.11 Standards

S. No.	IEEE 802.11 Standard	Year of Release	Comments
01	IEEE 802.11a	1999	Speed 54 Mbits and 5 GHz band
02	IEEE 802.11b	1999	Enhancements to 802.11 to support 5.5 and 11 Mbits speed
03	IEEE 802.11c	2001	Bridge operation procedures; included in the IEEE 802.11D standard
04	IEEE 802.11d	2001	International (country-to-country) roaming extensions
05	IEEE 802.11e	2005	Enhancements: QoS, including packet bursting
06	IEEE 802.11F	2003	Inter-Access Point Protocol, Withdrawn February 2006
07	IEEE 802.11g	2003	54 Mbits, 2.4 GHz standard (backwards compatible with b)

08	IEEE 802.11h	2004	Spectrum Managed 802.11a (5 GHz) for European compatibility
09	IEEE 802.11i	2004	Enhanced security
10	IEEE 802.11j	2004	Extensions for Japan
11	IEEE 802.11k	2008	Radio resource measurement enhancements
12	IEEE 802.11n	2009	Higher throughput improvements using Multiple In Multiple Out
13	IEEE 802.11p	2010	WAVE-Wireless Access for the Vehicular Environment

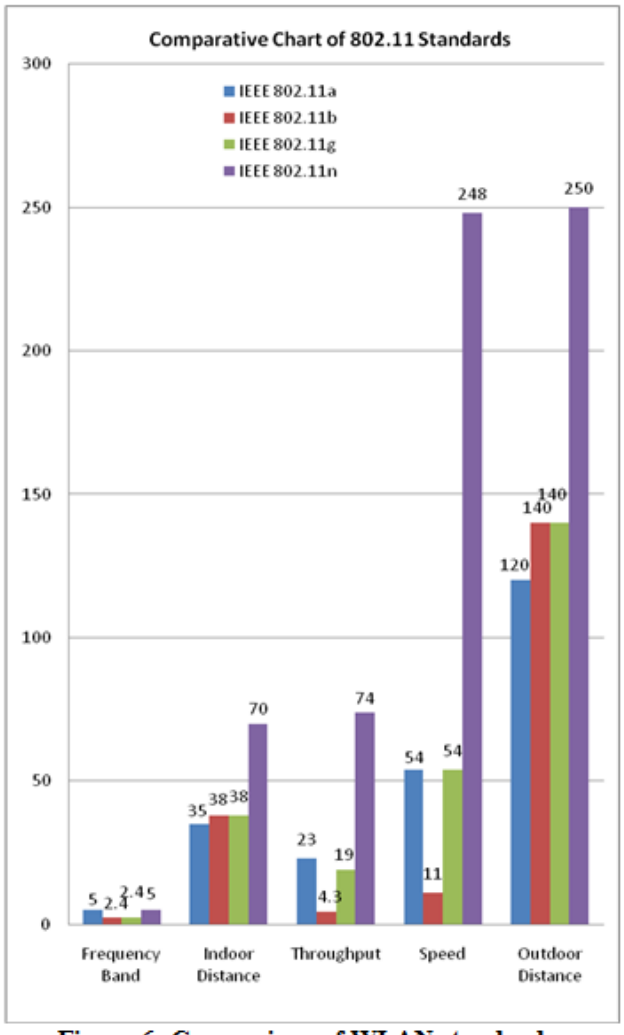

Figure 6: Comparison of WLAN standards

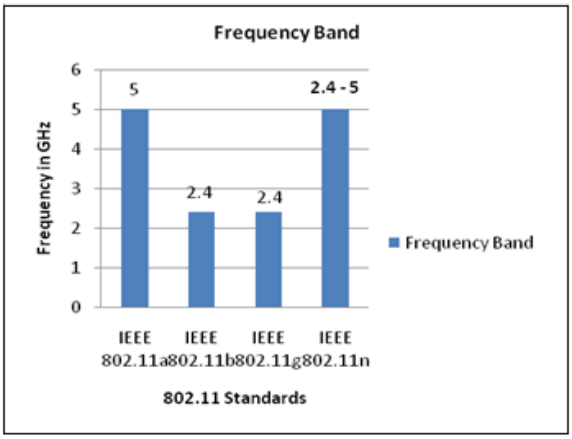

Figure 1: Frequency Band comparison chart of 802.11

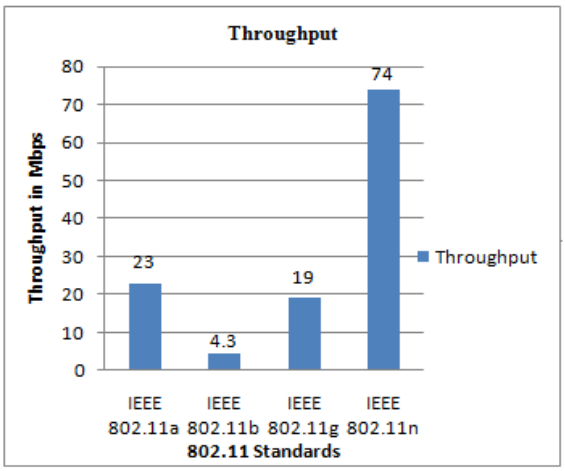

Figure 2: Throughput comparison chart of 802.11 standards

In the present study, only four WLAN standards were preferred, they are IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and IEEE 802.11n because these standards are very much popular among the users. It is noted that all 802.11 standards used Ethernet protocol and Carrier Sense Multiple Access / Collision Avoidance (CSMA/CA) for path sharing.

The details of these standards are given below.

IEEE 802.11a:

The 802.11a WLAN standard was approved around the same time as 802.11b standard, but 802.11a has remained a niche technology while 802.11b became the most widely adopted wireless networking standard in history. It is clearly faster than 802.11b but the speed advantage is compensate by other performance characteristics that create problems in industrial and other environments. Due to its higher cost, it is usually found on business networks whereas 802.11b better serves the domestic market.

It is found that 802.11a supports bandwidth up to 54 Mbps and signals in a regulated around 5 GHz frequency spectrum.

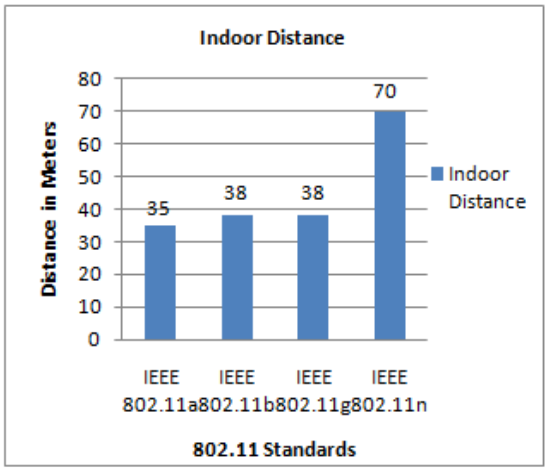

Figure 4: Indoor Distance comparison chart of 802.11 standards

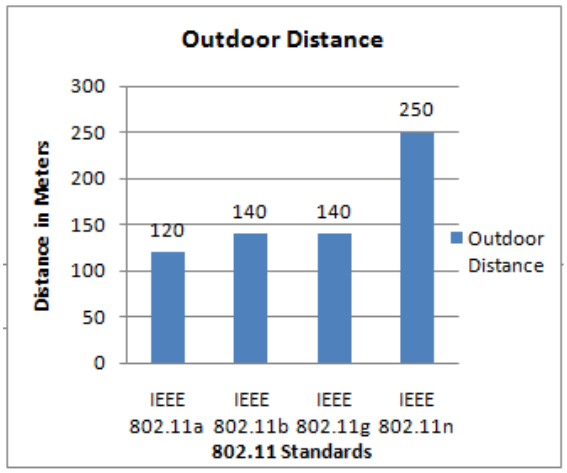

Figure 5: Outdoor distance comparison chart of 802.11 standards

IEEE 802.11b:

IEEE expanded on the original 802.11 standard in July 1999, creating the 802.11b specification. 802.11b supports bandwidth up to 11 Mbps, comparable to traditional Ethernet. The 802.11b standard hits the range, speed and reliability for many industrial, office and personal computing needs. 802.11b is the dominant protocol used in factories and distribution centers and is fully capable of handling applications other than data collection, including voice communication by VoIP. It is uses the same unregulated radio signaling frequency 2.4 GHz as the original 802.11 standard.

IEEE 802.11g:

In 2002 and 2003, WLAN products supporting a newer standard called 802.11g emerged on the market. 802.11g delivers the bandwidth advantages of 802.11a without the range and reliability limitations of 5 GHz technology. As a 2.4 GHz technology, 802.11g provides a migration path for 802.11b users and a bridge to 802.11n systems.

IEEE 802.11n:

It was designed to improve on 802.11g in the amount of bandwidth supported by utilizing

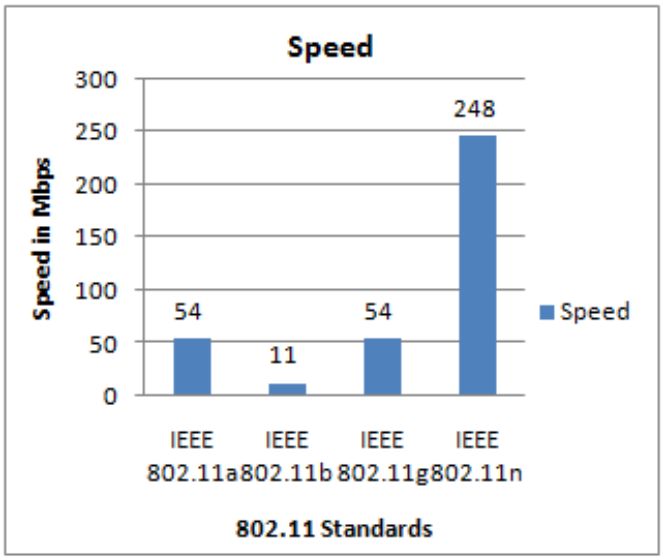

Figure 3: Speed comparison chart of 802.11 standards

multiple wireless signals and antennas instead of one. 802.11n can be implemented as either 2.4 GHz or 5 GHz technology, and will provide backwards compatibility with 802.11b/g and 802.11a systems, respectively.

The signature characteristic of 802.11n technology is its data transmission speed of up to 600 mbps, which is more than 10 times faster than 802.11a or g and about 55 times faster than 802.11b.

Table 2: Comparative study of WLAN standard

Parameters	IEEE 802.11a	IEEE 802.11b	IEEE 802.11g	IEEE 802.11n
Frequency Band	5 GHz	2.4 GHz	2.4 GHz	2.4 - 5 GHz
Throughput	23 Mbits	4.3 Mbits	19 Mbits	74 Mbits
Speed	54 Mbits	11 Mbits	54 Mbits	248 Mbits
Indoor Range	35 Mtrs	38 Mtrs	38 Mtrs	70 Mrs.
Outdoor Range	120 Mrs.	140 Mrs.	140 Mrs.	250 Mrs.

RESULT AND DISCUSSIONS

The IEEE started the IEEE 802.11 project in 1990 with the objective to develop a MAC and PHY layer specification for wireless connectivity for fixed, portable and moving stations within an area. In 1997 IEEE first accepted the IEEE 802.11 international interoperability standard for WLANs. The IEEE 802.11 standard supports radio transmission within the 2.4 GHz band. Table 1 presented the different variants of IEEE 802.11 standards. In this research work only four standards were chosen and they are IEEE 801.11a, IEEE 801.11b, IEEE 801.11g and IEEE 801.11n because these standards are very much popular among the users. The comparative study has done among the standards on the basis of some parameters such as frequency band, throughput, and speed, indoor and outdoor range.

The IEEE 802.11a standard supports only 5 GHz frequency, which is equivalent to IEEE 802.11n standard but IEEE 802.11n standard support the frequency range 2.4 to 5 GHz. IEEE 802.11a standards was not communicated to IEEE 802.11b, and IEEE 802.11g in a same topology and same network due to the frequency miss match.

From the above studied it is found that 802.11n is being most appropriate as the WLAN networking standard, that resolve unwire the network world. The 802.11n standard has two top-level mandates in its assignment to unwire the world; achieve and maintain higher data rates.

CONCLUSION

The four types of WLAN standards; IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and IEEE 802.11n were studied and it was concluded that the IEEE 802.11n WLAN standard is better than other standards in all respect.

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