Wi-Fi and HOTSPOTS:Emerging WLAN Technology in Indian Context

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Abstract

Paper introduces with brief account of advantages of wirefree LAN technology. Discusses technologies of data transmission-infrared and radio waves technologies in WLANs for data transmission. Discusses 802.11a,b & g technologies in brief. It gives an idea of planning with Wi-Fi. Gives an account of common standards of Wi-Fi technology. The cost involvement of Wi-Fi is also given for consideration. The brief discussions on Wi-Fi applications Hot-Spots. Gives Hotspots in India & abroad and its applications in the Library and Information centers. Suggests for easy licensing, fee free and cheaper technology for Library and Information Centres. Includes seven references and six websites.

Keywords : Wireless technology, WLAN, Wi-Fi

0.   Introduction

Wire free LAN creats a data islands over a short radius information. It can connect all personally accessible devices such as MP3, Phonebooks and other Personal Digital Devices (PDA). One can set his own network with other accessories in any location within the building. In an enterprise WLAN provides communication support for on the move competency. It over comes-physical limitations of wire of networks in terms of adaptability to a variation in demand, e.g. number of users in a meeting can vary so making it difficult to guess number of wired ports to put there. Similarly providing networking facility to new recruits (employees) in an enterprise through cable is time consuming. Similarly if an enterprise wish to shift its office it is wastage of huge amount in cable network.

1.   Wireless Data Transmission Techniques

Wireless LANs work on Radio wave and infrared frequencies. The earlier wireless access points that came into the market used infrared, but today most of them use radio frequency. The advantage of this is that radio waves can penetrate through surfaces like walls and doors. Infrared devices on the other hand are based on line of sight and get blocked or reflected on such surfaces. Data transmission over wireless using Radio Frequency is similar to the techniques used in an ordinary radio, AM and FM. There is a constant carrier signal containing the data to be transmitted. The carrier frequency amplitude could be modulated by a signal (Direct Sequence), or its Frequency could be modulated (called Frequency Hopping). After modulation, the carrier signal no longer remains a single frequency, or fixed amplitude, depending upon the modulation technique[1].

Bluetooth technology is one used in many Radio Frequency based Wireless Local Area Networking. Next came 802.11b Wi-Fi(Wireless Fidelity) which has been advancement over Bluetooth. There are many others too. The Wi-Fi has been discussed in this paper.

2.   Technicalities of Wireless Fidelity (WI-FI)

IEEE 802.11 is available in 3 modes-802.11a, 802.11b and 802.11g. Here IEEE stands for Institute of Electrical and Electronics Engineers. The 802.11a works on relatively noise free 5.0 GHz band and

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provide bandwidth of 54Mbps but require license to operate. It is allowed in specific cases only. The most important advantage over 'b's is that 802.11a offers up to 8 networks to co-exist, much more than 3 permitted by 'b' and 'g'. 802.11e is another one to be standardized, and is meant to ensure Quality of Service (QoS) support for LAN applications, which will be critical for delay-sensitive applications such as Voice over Wireless IP[2].

IEEE 802.11b and 802.11g operate in the 2.4 GHz band but providing 11 Mbps and 54 Mbps respectively. Government has freed 'b' bandwidth for internal use. On 12 June, 2003 IEEE has also freed 802.11g platform which delivers 5 times data rate than 'b' at about 54Mbps on same 2.4 GHz. Products available in 'g' bandwidth can support 'b' bandwidth. If one is using 'b' in 'g' access point, it may slow down the network because of longer transmission time taken by 'b' client to communicate. In Wi-Fi total 80 MHz is available in the 2.4 GHz band. Each Wi-Fi network consumes25MHz so not more than three networks can co-exist at a time in this band.

802.11b is often used interchangeably with Wi-Fi.   Institute of Electrical and Electronics Engineers (IEEE) Committee standardized 802.1b. Wireless Fidelity (Wi-Fi). It is an interoperability certification programme promoted by Wi-Fi Alliance, an association of wireless equipment manufacturers. Use of Wi-Fi logo can ensure product compatible with other same certification products[2].

In this section technical aspects of Wi-Fi are given in short and simple way to give understanding of the subject . More details are not required.

IEEE 802.11b defines the physical layer and media access control (MAC) sub layer for communications across a shared, wireless local area network (WLAN). At the physical layer, IEEE 802.11b follows DSSS (Direct Sequence Spread Spectrum) modulation, which works by dividing the stream of information to be transmitted in small pieces, each of which is allocated across to a frequency channel across the spectrum. Media Access Control sub layer of data link network . It uses Collision Sense Multiple Access with Collision Detection (CSMA/CD) to transmit data which happens the MAC layer. This technology allows a transmitting node to detect a collision and retransmit. A data signal at the point of transmission is combined with a chipping code (also called higher data-bit rate) that divides the data according to a spreading ratio. The higher data-rate bit sequence works by converting every binary '1' bit that's transmitted to a sequence of ones and zeros. Every binary '0' transmitted uses the inverse sequence of this '1' bit[2].

802.11a and 802.11g don't use DSSS, and instead they employ Orthogonal Frequency Division Multiplexing(OFDM) that allows them to give higher data rates, although at higher power consumption. OFDM transmits multiple signals simultaneously over a single wireless system. This successful implementation on the OFDM waveform is the first step in Military Software Defined Radio (SDR) Technologies plan to implement the complete IEEE 802.16 family of wireless data applications, also known as WIMax, a higher performing version of WiFi. WiMax-based services will be capable of delivering high quality voice, video and multimedia content over an Internet-based connection. The implementation of OFDM is an important milestone of Military communication Technologies Inc., which is a technology company involved in the development and distribution of proprietary software defined radio (SDR) commercial and military mobile wireless network applications. OFDM-based wireless technology provides for a simpler and much more cost effective alternate to competing wireless technologies [3].

The essential parts of Wi-Fi for wireless LAN are Access Points and Wireless cards.

2.1   Access Points

Access Points(AP) in Wi-Fi can vary greatly in feature depending on their cost, some access points give an option of roaming where wireless clients can transparently switch from one AP to another. Three kinds

of Access Points are currently available. The first (i)Non-bridging are those that don't communicate with other access points and do not perform any bridging functions. Without which, computers on one wireless network will not be able to see computers present on another. The next kind is (ii) bridging which access points that act as bridges, which are also come with different options. These include:

a. Point to point : These are used to connect two LAN segments together. These either use the Master/ Slave configuration, or let you control which bridge unit you connect to using its MAC address.

b. Point to multi-point : Here all bridge units communicate with each other wirelessly.

c. Repeater : In the first two modes, bridging units talk only to each other, and do not connect to wireless clients. Thus, such units are mostly used for connecting two wired networks. However, in the repeater mode, a bridge unit not only supports AP-to-AP bridging, but also wireless client to AP. These are also usually the most expensive[4].

 The third is Mix Media Router. It is cheaper & implemented in software on a machine that are connected to all the networks.

2.2   Wireless Cards

This is an essential component of wi-fi and perform same functions as Ethernet cards. These use PCMCIA to connect and thus can be used in desktop computer. PCI adopters are available to accommodate these cards to a free PCI slot in a PC.

3.   Networking

Networking can be made in two ways by the use of Access Points and Wireless Cards.

a. Ad-hoc : In this method access points are not used and all wireless cards form a peer to peer network.

b. Infrastructure : All wireless cards connect to a central access point that provides them connectivity with each other as well as wired network[4].

4.   Planning in WI-FI

Wire free connectivity in network, is a simple as putting up a wireless access point, practically is not so simple. Many variables are to be considered for successful deployment e.g.

1. The capacity delivered of wireless networks for this standards available must be considered. At present 802.11b & g Wi-Fi are available standards.

2. There should not be any interference in frequencies e.g. cordless also work on 2.4 GHz can interfere. A Bluetooth device in near proximity can interfere.

3. Consider what applications are to run on wireless network.

4. How much bandwidth will be required for each connector?

5. How many connections will be on this network at a given time?

6. Area to be covered by network.

7. Determine kind of data transfer is it heavy data transfer or simple things like browsing only.

8. Determine the applications one plan to run on the Wireless network and how much bandwidth it will load.

9. Determine number of access points required to ensure quality service (QoS). Wi-Fi can provide access to 80 feet radius but quality decreases with distance. The number of users should decrease, with increase of distance to maintain QoS. This will help to decide number of access point required.

10. Distance where to place access point by doing its survey. Minimize black spots where no signals are received and turn adjacent channel should not overlap. For this thing Quality Test should be performed.

11. Ensure constant power supply and in case of failure alternate power supply.

12. Use network management software, if number of access point increases[5].

5.   Concern With WI-FI

1. The 11Mbps speed of 802.11b is as fast as an older coaxial cable based LAN but 1/10 of speed of the current 100 BaseT 100Mbps network.

2. Cordless phones also work on 2.4 GHz are suspectible to interference

3. BT devices setting at close proximity can cause interference

4. Security threat is major issue, as data literally flows through the air, it becomes easier for a hacker to capture it with notebook and a wireless card[6].

6.   Expenditure/Cost Concern of WI-FI

All benefits/advantages are goes off, if money involved is beyond one's capacity. How much money involved for Wi-Fi is stated here. The cost can be divided into three parts:

6.1   Cost of Hardware

An access point range 25-30 thousand PCMCIA card price is Rs. 12000/- a piece. PCI adapter card to fit in PC is Rs. 5000/-

6.2   Cost of Licensing

Several stringent regulations apply here. There are multitude of licenses to be acquired when dealing with wireless network, which include import license, dealer license and end-user license, stock and selling license, etc. Amongst all the end user license are vendor's headache.The end-user site license is granted after verifying the bonafides of the end-user and after the other licensing formalities are completed. It is done after its verification and is only issued on a per site basis. This is an annual license fee and the license fee needs to be paid annually. The license costs Rs. 18,000/- per annum or so.

6.3   Site Clearances

Apart from the above there is also site clearances from several government agencies in the country including the IB, RAW, DoT and Police. Out of all most are handled by WPC upon receipt of the Type Approval application. DoT/BSNL also needs to provide no-objection certificate (NOC) when the bandwidth requirement of the proposed wireless application exceeds 64 Kbps. However this certificate to be procured by the manufacturer[7].

7.   Hot Spots

Hotspot provide wireless connectivity for free or fee on laptops or on PDA (Personal Digital Assistance) to surf the net, check e-mail conduct business etc., using 802.11b or Wireless Fidelity (Wi-Fi). A Hotspot

is any location be it a coffee shop, restaurant, college campus, airport, railway station etc., that offers wireless access.

Hotspot uses FCC approved open standard 802.11b wireless protocol called Wi-Fi. The 2.4 GHz Wi-Fi radio signal can be picked up by any 802.11b compatible wireless network card upto 300 feet from the hotspot transmitter. The wireless signals and transmit it into a speedy internet connection[8].

The Hotspot shares its DSL cable or broadband connection via a device called Access Point (AP). The AP transmit wireless signals to a wireless card in the Wi-Fi enabled device (Laptops or PDA etc). The signal can be transmitted indoors or out within a range of 100 feets to 300 feets radius of the AP at 11Mbps. This speed soon will be raised to 54 or 128 Mbps.

With a hotspot one can have freedom to browse the internet without user's credit card online. One can have account for convenience. It goes high speed wireless internet at cafes, restaurants, airports without wires and boundaries. It works on 11Mbps, many times faster than dial up connections. In just 60 seconds, one can log on to internet.

Wireless Internet Service Providers(WISP) like Convergent Solution, Ittiam, Consilnet, Cisco, Acton, Applied Digital, etc have started deploying wireless connectivity across the country. Wi-Fi Alliance Pvt. Ltd has started certification for "Wi-Fi Zone" to create Global brand to recognize a hotspot such as STD, ISD, PCOs are recognized by its yellow colours in India. Each Wi-Fi zone is to provide minimum 128Kbps connectivity and virtual private network to send and receive data securely[9].

7.1   Hotspots Abroad

Hotspot gives facility to take care business wherever one roam, check e-mail, shopping or researching. In USA it costs $14.95 per month hotspot internet service with anti-virus protection and web accelerator that enable to surf five times faster, etc by service provider Hotspozz: For $5.95 one can avail service for 12Hrs at any Hotspotzz service point[8].

Macdonald joined in Wi-Fi providers across the world. World wide 14712 hotspots have been reported in 2002. Which are likely to be 300000 in 2006. Australia, Hongkong, Japan, Singapore, South Korea and Taiwan are big market and hotspot are likely to raise to 38,000 in 2007 from 1625 in 2002 in these countries[9].

Airports have hotspots, Changi International Airport, Singapore being first. Lufthansa has began offering Wi-Fi in overseas routes in its Boeing. British Airways is soon to follow[8].

Intel, Microsoft, Sasken, Cisco have made their premises Wi-Fi enabled.

7.2   Hotspot in India

India is slowly hotting up. In India luxury star hotels are leaders to opt the technology. Taj Coromandal and Taj Connemmara (Chennai), Taj Residency (Bangalore), Taj Krishna (Hyderabad), etc are few to quote[9].

Café Coffee Day (Bangalore) have the technology. The restaurants have 133 branches in India, 2 in Indore and one is introducing. Indian School of Business (Hyderabad) and Pathway World School (Gurgaon)

have adopted Wi-Fi in their premises. The fee structure and location of some important Hotspots are given as below:

Category	Name of Hotspot centre	Location	Cost (Rs.)
A. Hotels	Oberoi	Mumbai	200/hour
	Park Royal	New Delhi	Not Available
	Quality Inn Aruna	Chennai	Not Available
	GRT Grand Days	Chennai	Not Available
	Taj Connemmara	Chennai	Network cards given for laptops. 200/hour, 3002hours, 600/24hour
	Taj Coromandal	Chennai	-Do-
	Taj Krishna	Hyderabad	-Do-
	Taj Mahal	Mumbai	-Do-
	Taj Residency	Bangalore	-Do-
	Taj Residency Ummed	Ahmedabad	-Do-
B. Coffee Bars	Café' Coffee Day	Bangalore	50/hour
C. Commercial Premises	Reliance Webstores	Across India	Not Available
D. Educational Institutions	Indian School of Business	Hyderabad	Wireless LAN Card 10-12 thousand
	Pathways World School	Gurgaon (Haryana)	Free access anywhere on campus

7.3   Advantages of Hotspots

1. No longer requires a set of Internet cable.
2. It turns waiting and community time into actual time.
3. One can surf web anywhere, anytime not confining to PC desk.
4. No cables for- telephone, electricity or ethernet require.
5. Make use of time and never feel alone.

8.   Other Applicaltions of WI-FI

Wi-Fi application is not restricted to Hotspots only for Wireless Local Area Networking. Many other applications can be made suing Radio Frequency based 802.11b Wi-Fi. This can be applied in machines, tools etc. of an industry. More promising for future applications of OneChip Wi-Fi in digital cameras, MP3 music players, and Wi-Fi VoIP phones. More on that , there will be use in entertainment and messaging applications which are strong among home users.

Big reputed technical, business and other schools where internet facilities are provided to students in labs and even in their hostel rooms, faculties at their quarters provided intenet connectivity for 24 hours a day. To make it available local area networking in the campus with cable is made. With Wireless Local Area Networking Wi-Fi the hassles of cable and its maintenance can be avoided with 10 times greater speed. Though initially it may be costlier in the long run it is cheaper.

In libraries too the technology may be helpful for creating WLANs over many floors and in many rooms without lying costly cables and their costly maintenance.

9.   Library Applications of WI-FI

The use of Wi-Fi in libraries are many, however, broadly these can be divided into two parts:

9.1   For Staff

a. There will be no maintenance for cables
b. All sections can coordinate with other section like acquisition, maintenance, circulation , etc., wire free

9.2   For Readers

a. Users can access library OPAC in any corner of the library, even in stacks while searching for books.
b. Can surf on Web-OPACs during search of documents.
c. Can surf internet in any corner of the library without bothering for occupying particular seats.
    Inspite of many advantages of Wi-Fi applications for WLAN, it has following limitations too:
    a. The initial installations cost is high so medium libraries still to wait for some times.
    b. Licensing procedure is complicated.
    c. Licensing fees are higher.

10.   Suggestions

For Wi-Fi applications for WLAN in libraries, following suggestion can be made:

10.1   Easy licensing for libraries

Since the libraries are meant for research purposes only, the complex licensing for Radio Frequency technology may be made simpler. The No Objection Certificate from many government bodies can be made easy to libraries.

10.2   No fees for libraries

Since the libraries are established and used for research purposes, the licences fees may be reduced to minimum or may be abolished in this case.

10.3   Cheaper technology

At present the technology is costlier as compared to other technologies. Infra-Red technology is very cheap. Bluetooth chips are also quite cheap as compared to Wi-Fi. Not all libraries can afford costly Wi-Fi technology, that too which is being added daily. So, as and when this technology is cheaper, will definitely be adopted by the libraries.

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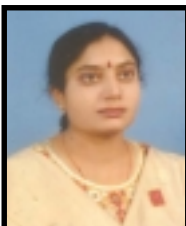
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