“An overview of Technical aspect for Wireless Fidelity (Wi-Fi- Wireless Network Technology)”

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Abstract: Today use of computer technology is in more demand than earlier so there is an increase in the number of computer peripherals and its accessories. The computer wireless network is on the rise today. Basically, wireless networking is the ability to link multiple computer systems in a household together without any wires. It is based on a serial standard of IEEE 802.11. Wi-Fi works with no physical wired connection between sender and receiver by using radio frequency technology. Though Wi-Fi is very advantageous and a powerful technology, it is also having some problems during the transmission of the data for e.g., interference with the household devices like microwave. This paper discusses the security measures to be provided, architecture and design for Wi-Fi technologies.

Keywords: Wireless network, Wi-Fi network, pros and cons of Wi-Fi, IEEE 802.11 standards, applications of Wi-Fi.

1-Introduction

Wi-Fi is an abbreviation of wireless fidelity and as its name suggests eliminates many of the cables that connect computers to various other devices, such as printer/copiers. It makes it possible to connect to the internet from any location and from a laptop, notebook or PC and can be useful in offices where staff have to do a certain amount of travelling either between different company offices or out on the road visiting clients and then needing to update company records and print out documents. If they carry a laptop or notebook it saves reconfiguring the equipment to access the internet at each location.

Many printer/copiers are now supplied capable of using wireless technology, so that they can be connected quickly into the office network. Using a notebook or laptop in combination with a Wi-Fi enabled multi-function printer/copier, therefore, can provide flexible and arguably more efficient working.

Wi-Fi is based on the published IEEE 802.11 standard for short range wireless communication. It is being deployed to provide coverage in the University campuses, hotels, and airports using what are termed as hotspot. A hotspot is the region covered by one or several access points (AP). A wireless access point connects a group of wireless devices to an adjacent wired Local Area Networks (LAN), relaying data between connected wireless devices in addition to a single connected wired device. It is based on the family of standards such as IEEE 802.11a, 802.11b, 802.11g, and 802.11n.

2. IEEE 802.11 STANDARDS (WIRELESS LAN)
IEEE 802.11 is a set of standards for wireless local area network (WLAN) computer communication, developed by the IEEE LAN/MAN Standards Committee (IEEE 802) in the 5 GHz and 2.4 GHz public spectrum bands. Although the terms 802.11 and Wi-Fi are often used interchangeably, the Wi-Fi Alliance uses the term "Wi-Fi" to define a slightly different set of overlapping standards. In some cases, market demand has led the Wi-Fi Alliance to begin certifying products before amendments to the 802.11 standard are complete. The 802.11 family includes over-the-air modulation techniques that use the same basic protocol. The most popular are those defined by the 802.11b and 802.11g protocols, and are amendments to the original standard. 802.11a was the first wireless networking standard, but 802.11b was the first widely accepted one, followed by 802.11g and 802.11n.

IEEE 802.11 (legacy mode): The original version of the standard IEEE 802.11, released in 1997 and clarified in 1999, specified two raw data rates of 1 and 2 megabits per second (Mbit/s) to be transmitted in Industrial Scientific Medical frequency band at 2.4 GHz. Legacy 802.11 was rapidly supplemented (and popularized) by 802.11b.

IEEE 802.11a: The 802.11a standard uses the same core protocol as the original standard, operates in 5 GHz band with a maximum raw data rate of 54 Mbit/s, which yields realistic net achievable throughput in the mid-20 Mbit/s. Since the 2.4 GHz band is heavily used to the point of being crowded, using the relatively un-used 5 GHz band gives 802.11a a significant advantage. However, this high carrier frequency also brings a slight disadvantage: The effective overall range of 802.11a is slightly less than that of 802.11b/g; 802.11a signals cannot penetrate as far as those for 802.11b because they are absorbed more readily by walls and other solid objects in their path.

IEEE 802.11b: 802.11b has a maximum raw data rate of 11 Mbit/s and uses the same media access method defined in the original standard. 802.11b products appeared on the market in early 2000, since 802.11b is a direct extension of the modulation technique defined in the original standard. The dramatic increase in throughput of 802.11b (compared to the original standard) along with simultaneous substantial price reductions led to the rapid acceptance of 802.11b as the definitive wireless LAN technology. 802.11b devices suffer interference from other products operating in the 2.4 GHz band. Devices operating in the 2.4 GHz range include: microwave ovens, Bluetooth devices, baby monitors and cordless telephones.

IEEE 802.11g: This works in the 2.4 GHz band (like 802.11b) but operates at a maximum raw data rate of 54 Mbit/s, or about 19 Mbit/s net throughputs. 802.11g hardware is fully backwards compatible with 802.11b hardware. The then-proposed 802.11g standard was rapidly adopted by consumers starting in January 2003, well before ratification, due to the desire for higher speeds, and reductions in manufacturing costs. By summer 2003, most dual-band 802.11a/b products became dual-band/tri-mode, supporting a and b/g in a single mobile adapter card or access point. Details of making b and g work well together occupied much of the lingering technical process; in an 802.11g network, however, activity by a 802.11b participant will reduce the speed of the overall 802.11g network. Like 802.11b, 802.11g devices suffer interference from other products operating in the 2.4 GHz band. Devices operating in the 2.4 GHz range include: microwave ovens, Bluetooth devices, baby monitors and cordless telephones.

IEEE 802.11n: 802.11n is a proposed amendment which improves upon the previous 802.11 standards by adding multiple-input multiple-output (MIMO) and many other newer features. Though there are already many products on the market based on Draft 2.0 of this proposal, the TGn workgroup is not expected to finalize the amendment until November 2008.

3. 802.11 STANDARDS TABLE

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IEEE 802.11h - Spectrum Managed 802.11a (5 GHz) for European compatibility (2004)
IEEE 802.11i - Enhanced security (2004)
IEEE 802.11-2007 - A new release of the standard that includes amendments a, b, d, e, g, h, i & j. (July 2007)
IEEE 802.11k - Radio resource measurement enhancements (proposed -2007?)
IEEE 802.11l - (reserved and will not be used)
IEEE 802.11m - Maintenance of the standard. Recent edits became 802.11-2007. (Ongoing)
IEEE 802.11n - Higher throughput improvements using MIMO (multiple input, multiple output antennas) (September 2008)
IEEE 802.11o - (reserved and will not be used)
IEEE 802.11p - WAVE - Wireless Access for the Vehicular Environment (such as ambulances and passenger cars) (working - 2009?)
IEEE 802.11q - (reserved and will not be used, can be confused with 802.1Q VLAN trunking)
IEEE 802.11r - Fast roaming Working "Task Group r" - 2007?
IEEE 802.11s - ESS Extended Service Set Mesh Networking (working -2008?)
IEEE 802.11t - Wireless Performance Prediction (WPP) - test methods and metrics Recommendation (working - 2008?)
IEEE 802.11u - Networking with non-802 networks (for example, cellular) (proposal evaluation - ?)
IEEE 802.11v - Wireless network management (early proposal stages - ?)
IEEE 802.11w - Protected Management Frames (early proposal stages - 2008?)
IEEE 802.11x - (reserved and will not be used, can be confused with 802.1x Network Access Control)
IEEE 802.11y - 3650-3700 MHz Operation in the U.S. (March 2008?)
IEEE 802.11z - Extensions to Direct Link Setup (DLS) (Aug. 2007 - Dec. 2011)
IEEE 802.16- (like WiMax)

4- Wi-Fi Architecture

A WLAN comprises two types of equipments namely

- a wireless station and
- an access point

A station, or client, is typically a laptop or notebook or personal computer (PC) or a desktop or even a hand held device with a wireless NIC (Network Interface Card). The AP (Access Points), which acts as a bridge between the wireless and wired networks, typically comprises a radio, a wired network interface such as 802.3, and bridging software. The AP functions as a base station for the wireless network, aggregating multiple wireless stations onto the wired network.
5-Its Features

Wi-Fi has both positive feature and negative feature. And they are as follows:-

- Physical Layer- at this layer the following techniques are involves providing the service of Wi-Fi, DSSS (Direct Sequence Spread Spectrum), FHSS (Frequency hope Spread Spectrum), OFDM (Orthogonal Frequency Division Multiplexing), and IR (Infrared).
- Frequency Band- it use 2.4GHz and 5 GHz
- Data Rate- It use 1Mbps, 2 Mbps, 5.5 Mbps for 802.11b, and 54 Mbps for 802.11a.
- Data and Network Security- RC-4 based stream encryption algorithm for confidentiality, authentication and integrity, limited key management, AES is being considered for 802.11
- Operating Range- it can provide the services up to 50 feet for indoors and 1500 feet for outdoors.
- Positive Aspects- The speed of Ethernet is very high without wire. It provides the connectivity for many different products from many different companies. It decreases the wireless client cards and access point costs.
- Negative Aspects- Its security becomes poor with increase distance and load.
- Network Topology- it use infrastructure (Ad-hoc also possible).
- Access Protocol- it use CSMA/CA.

6-APPLICATIONS OF Wi-Fi

Common applications for Wi-Fi include the Internet, VoIP phone access, and gaming, network connectivity for consumer electronics such as televisions, DVD players, and digital cameras. Some of the important applications of WiFi are describe as follows-

1) Immediate bedside the access to the patient information for doctors and hospital staff.
2) Easy, real-time network access for on-site consultants or auditors improved database access for roving supervisors such as production line managers, warehouse auditors, or construction engineers.
3) Simplified network configuration with minimal MIS involvement for temporary setups such as trade shows or conference rooms.
4) Faster access to customer information for service vendors and retailers, resulting in better service and improved customer satisfaction Location-independent access for network administrators, for easier on-site troubleshooting and support.
5) Real-time access to study group meetings and research links for students.
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7-ADVANTAGES OF Wi-Fi

The important advantages of wireless include mobility and elimination of unsightly cables wireless networks are easy to find. Some of the advantages are describe below-
1) Wi-Fi allows to the LAN to be data transferring without cabling for client devices and reducing the costs of network development deployment and expansion.
2) The wireless LANs behaves as a host where cables cannot be run, such as outdoor areas and historical buildings.
3) The price of chipsets for Wi-Fi continues to drop, making it an economical networking option included in ever more devices.
4) Products designed as “Wi-Fi certified” by the Wi-Fi Alliance are backwards interoperable. Wi-Fi is a global set of standards. Unlike mobile telephones, any standard Wi-Fi devices will work anywhere in the world.
5) New protocols for Quality of service (WMM) make Wi-Fi more suitable for latency-sensitive applications (such as voice and video), and power saving mechanisms (WMM Power Save) improve battery operation.
6) Because of the comfortable and quick installation people often replace bold wired LANs with Wi-Fi. Such connection allows moving your machine around the place without losing the Internet or other network resources.
7) However, building Wi-Fi network is often the cheapest way to achieve the desired connection with the surroundings. The price of a single wireless adapter is decreasing almost every day, so making a large network area by means of Wi-Fi is the most reasonable way.
8) Quick, easy setup: setting up a wireless network may sound like a daunting task, but it's actually a pretty straightforward process. Wi-Fi networks don't require professional installation, and, best of all, there are no holes to drill or wires to run through walls
9) Fast data transfer rates: With transfer speeds up to 54 megabits (Mb) per second (6.75 megabytes), 802.11g is currently the fastest commercially available Wi-Fi protocol on the market.

8-DISADVANTAGES

The most important shortcoming in Wi-Fi is the range. So far we may have difficulties in making a connection with a receiver which is more than 50-75 meters away (inside the buildings). The signal should be stronger to provide larger connectable spaces. Additionally, some of the wireless adapters work on the frequencies that are currently used by many other wireless devices. It can cause a serious interference, so the connection performance can be quite poor.

9-CONCLUSION

“Wi-Fi's ultimate significance, then, may be that it provides a glimpse of what will be possible with future wireless technologies”. It has also changed the way regulators and technologists think about spectrum policy. Inspired by Wi-Fi's success, the vendors have now thrown their weight behind WiMax, a common standard with a consumer-friendly name, which they hope will expand the market and boost all their fortunes. Whatever happens to Wi-Fi in future, it has blazed a trail for other technologies to follow. The WiMAX and LTE will play equally important roles in the future of wireless networks. WiMAX is very important as it represents a whole new dimension of market opportunities. WiMAX is a promising wireless communication technology for wireless MANs. LTE-Advanced provides smooth evolution path for both LTE and HSPA to provide further enhanced end user experience with mobile broadband services. It decreases cost of operation and deployment and opens new business opportunities in local area deployments. The robustness and effectiveness of end-to-end security approaches in WiMAX and LTE will become clear only after deployment. Therefore it is easy to predict that LTE-Advanced and WiMAX are the mainstream technology for mobile broadband evolution.

REFERENCES


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