Notes

Unit 10: Wireless MAN Technologies

CONTENTS

Objectives

After studying this unit, you will be able to:

- Understand IEEE 802.11 and Wi-Fi
- Define IEEE 802.16 and its purpose

Introduction

IEEE 802.11 is a set of physical layer standards for implementing wireless local area network (WLAN) computer communication in the 2.4, 3.6, 5 and 60 GHz frequency bands. They are created and maintained by the IEEE LAN/MANStandards Committee (IEEE 802). The base version of the standard was released in 1997 and has had subsequent amendments. These standards provide the basis for wireless network products using the Wi-Fi brand

10.1 IEEE 802.11 and Wi-Fi

The 802.11 family consist of a series of half-duplex 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, which are amendments to the original standard. 802.11-1997 was the first wireless networking standard, but 802.11a was the first widely accepted one, followed by 802.11b and 802.11g. 802.11n is a new multi-streaming modulation technique. Other standards in the family (c–f, h, j) are service amendments and extensions or corrections to the previous specifications.

802.11b and 802.11g use the 2.4 GHz ISM band, operating in the United States under Part 15 of the US Federal Communications Commission Rules and Regulations. Because of this choice of frequency band, 802.11b and g equipment may occasionally suffer interference from microwave ovens, cordless telephones and Bluetooth devices. 802.11b and 802.11g control their interference and susceptibility to interference by using direct-sequence spread spectrum (DSSS) andorthogonal frequency-division multiplexing (OFDM) signaling methods, respectively. 802.11a uses the 5 GHz U-NII band, which, for much of the world, offers at least 23 non-overlapping channels rather than the 2.4 GHz ISM frequency band, where adjacent channels overlap - see list of WLAN channels. Better or worse performance with higher or lower frequencies (channels) may be realized, depending on the environment.

The segment of the radio frequency spectrum used by 802.11 varies between countries. In the US, 802.11a and 802.11g devices may be operated without a license, as allowed in Part 15 of the FCC Rules and Regulations. Frequencies used by channels one through six of 802.11b and 802.11g fall within the 2.4 GHz amateur radio band. Licensed amateur radio operators may operate 802.11b/g devices under Part 97 of the FCC Rules and Regulations, allowing increased power output but not commercial content or encryption.

10.1.1 Wi-Fi Standards

The 802.11 standard is defined through several specifications of WLANs. It defines an over-the-air interface between a wireless client and a base station or between two wireless clients.

There are several specifications in the 802.11 family:

- ***802.11:*** This pertains to wireless LANs and provides 1- or 2-Mbps transmission in the 2.4-GHz band using either frequency-hopping spread spectrum (FHSS) or direct-sequence spread spectrum (DSSS).
- ***802.11a:*** This is an extension to 802.11 that pertains to wireless LANs and goes as fast as 54 Mbps in the 5-GHz band. 802.11a employs the orthogonal frequency division multiplexing (OFDM) encoding scheme as opposed to either FHSS or DSSS.
- ***802.11b:*** The 802.11 high rate Wi-Fi is an extension to 802.11 that pertains to wireless LANs and yields a connection as fast as 11 Mbps transmission (with a fallback to 5.5, 2, and 1 Mbps depending on strength of signal) in the 2.4-GHz band. The 802.11b specification uses only DSSS. Note that 802.11b was actually an amendment to the original 802.11 standard added in 1999 to permit wireless functionality to be analogous to hard-wired Ethernet connections.
- ***802.11g:*** This pertains to wireless LANs and provides 20+ Mbps in the 2.4-GHz band.

Here is the technical camparsion between the three major Wi-Fi standards.

Freature	**Wi-Fi (802.11b)**	**Wi-Fi (802.11a/g)**
Primary Application	Wireless LAN	Wireless LAN
Frequency Band	2.4 GHz ISM	2.4 GHz ISM (g) 5 GHz U-NII (a)
Channel Bandwidth	25 MHz	20 MHz
Half/Full Duplex	Half	Half
Radio Technology	Direct Sequence Spread Spectrum	OFDM (64-channels)
Bandwidth Efficiency	<=0.44 bps/Hz	<=2.7 bps/Hz
Modulation	QPSK	BPSK, QPSK, 16-, 64-QAM
FEC	None	Convolutional Code
Encryption	Optional- RC4 (AES in 802.11i)	Optional- RC4 (AES in 802.11i)
Mobility	In development	In development
Mesh	Vendor Proprietary	Vendor Proprietary
Access Protocol	CSMA/CA	CSMA/CA

Source: http://www.tutorialspoint.com/wi-fi/wifi_ieee_standards.htm

Notes

IEEE 802.11 wireless LANs use a media access control protocol called Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). While the name is similar to Ethernet.s Carrier Sense Multiple Access with Collision Detection (CSMA/CD), the operating concept is totally different.

Wi-Fi systems are half duplex shared media configurations where all stations transmit and receive on the same radio channel. The fundamental problem this creates in a radio system is that a station cannot hear while it is sending, and hence it impossible to detect a collision. Because of this, the developers of the 802.11 specifications came up with a collision avoidance mechanism called the Distributed Control Function (DCF).

According to DCF, A Wi-Fi station will transmit only if it thinks the channel is clear. All transmissions are acknowledged, so if a station does not receive an acknowledgement, it assumes a collision occurred and retries after a random waiting interval.

The incidence of collisions will increase as the traffic increases or in situations where mobile stations cannot hear each other.

There are plans to incorporate quality of service (QoS) capabilities in Wi-Fi with the adoption of the IEEE 802.11e standard. The 802.11e standard will include two operating modes, either of which can be used to improve service for voice:

1. ***Wi-Fi Multimedia Extensions (WME):*** This uses a protocol called Enhanced Multimedia Distributed Control Access (EDCA), which is Extensions an enhanced version of the Distributed Control Function (DCF) defined in the original 802.11 MAC.

   The enhanced part is that EDCA will define eight levels of access priority to the shared wireless channel. Like the original DCF, the EDCA access is a contention-based protocol that employs a set of waiting intervals and back-off timers designed to avoid collisions. However, with DCF, all stations use the same values and hence have the same priority for transmitting on the channel.

   With EDCA, each of the different access priorities is assigned a different range of waiting intervals and back-off counters. Transmissions with higher access priority are assigned shorter intervals. The standard also includes a packet-bursting mode that allows an access point or a mobile station to reserve the channel and send 3- to 5-packets in sequence.

2. ***Wi-Fi Scheduled Multimedia (WSM):*** True consistent delay services can be provided with the optional Wi-Fi Scheduled Multimedia (WSM). WSM operates like the little used Point Control Function (PCF) defined with the original 802.11 MAC.

   In WSM, the access point periodically broadcasts a control message that forces all stations to treat the channel as busy and not attempt to transmit. During that period, the access point polls each station that is defined for time sensitive service.

   To use the WSM option, devices must first send a traffic profile describing bandwidth, latency, and jitter requirements. If the access point does not have sufficient resources to meet the traffic profile, it will return a busy signal.

   Security has been one of the major deficiencies in Wi-Fi, though better encryption systems are now becoming available. Encryption is optional in Wi-Fi, and three different techniques have been defined. These techniques are given here:

   (a) *Wired Equivalent Privacy (WEP):*

   An RC4-based 40-or 104-bit encryption with a static key.

   (b) *Wi-Fi Protected Access (WPA):*

   This is a new standard from the Wi-Fi Alliance that uses the 40 or 104-bit WEP key, but it changes the key on each packet. That changing key functionality is called the Temporal Key Integrity Protocol (TKIP).

Notes

(c) *IEEE 802.11i/WPA2:*

The IEEE is finalized the 802.11i standard, which is based on a far more robust encryption technique called the Advanced Encryption Standard. The Wi-Fi Alliance designate products that comply with the 802.11i standard as WPA2.

However, implementing 802.11i requires a hardware upgrade.

The picture has become somewhat confused as service providers started using Wi-Fi to deliver services for which it was not originally designed. The two major examples of this are wireless ISPs and city-wide Wi-Fi mesh networks.

(d) *Wireless ISPs (WISPs):*

One business that grew out of Wi-Fi was the Wireless ISP (WISP). This is the idea of selling an Internet access service using wireless LAN technology and a shared Internet connection in a public location designated a hot spot.

From a technical standpoint, access to the service is limited based on the transmission range of the WLAN technology. You have to be in the hot spot (i.e. within 100m of the access point) to use it. From a business standpoint, users either subscribe to a particular carrier.s service for a monthly fee or access the service on a demand basis at a fee per hour. While the monthly fee basis is most cost effective, there are few intercarrier access arrangements so you have to be in a hot spot operated by your carrier in order to access your service.

(e) *City-Wide Mesh Networks:*

To address the limited range, vendors like Mesh Networks and Tropos Networks have developed mesh network capabilities using Wi-Fi's radio technology.

The idea of a radio mesh network is that messages can be relayed through a number of access points to a central network control station. These networks can typically support mobility as connections are handed off from access point to access point as the mobile station moves.

Some municipalities are using Wi-Fi mesh networks to support public safety applications (i.e. terminals in police cruisers) and to provide Internet access to the community (i.e. the city-wide hot spot).

WiFi systems use two primary radio transmission techniques.

802.11b (<=11 Mbps): The 802.11b radio link uses a direct sequence spread spectrum technique called complementary coded keying (CCK). The bit stream is processed with a special coding and then modulated using Quadrature Phase Shift Keying (QPSK).

802.11a and g (<=54 Mbps): The 802.11a and g systems use 64-channel orthogonal frequency division multiplexing (OFDM). In an OFDM modulation system, the available radio band is divided into a number of sub-channels, and some of the bits are sent on each. The transmitter encodes the bit streams on the 64 subcarriers using Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK), or one of two levels of Quadrature Amplitude Modulation (16, or 64-QAM). Some of the transmitted information is redundant, so the receiver does not have to receive all of the sub-carriers to reconstruct the information.

Did u know? The original 802.11 specifications also included an option for frequency hopping spread spectrum (FHSS), but that has largely been abandoned.

10.1.2 Adaptive Modulation

WiFi make use of adaptive modulation and varying levels of forward error correction to optimize transmission rate and error performance.

As a radio signal loses power or encounters interference, the error rate will increase. Adaptive modulation means that the transmitter will automatically shift to a more robust, though less efficient, modulation technique in those adverse conditions.

There are following issues which are assumed to be the cause of the sluggish adoption of Wi-Fi technology:

- ***Security Problems:*** Security concerns have held back Wi-Fi adoption in the corporate world. Hackers and security consultants have demonstrated how easy it can be to crack the current security technology, known as wired equivalent privacy (WEP), used in most Wi-Fi connections. A hacker can break into a Wi-Fi network using readily available materials and software.
- ***Compatibility and Interpretability:*** One of the bigger problems with Wi-Fi is compatibility and interpretability, for example 802.11a products are not compatible with 802.11b products, due to the different operating frequencies, and 802.11a hotspots would not help a 802.11b client. Due to lack of standardization, harmonization and certification, different vendors come out with products that do not work with each other.
- ***Billing Issues:*** Wi-Fi vendors are also looking for ways to solve the problem of back-end integration and billing that has dogged the roll-out of commercial Wi-Fi hotspots. Some of the ideas under consideration for Wi-Fi billing include per day, per hour and unlimited monthly connection fees.

WiFi is a universal wireless networking technology that utilizes radio frequencies to transfer data. WiFi allows for high speed Internet connections without the use of cables or wires.

The term Wi-Fi is a contraction of "wireless fidelity" and commonly used to refer to wireless networking technology. The Wi-Fi Alliance claims rights in its uses as a certification mark for equipment certified to 802.11x standards.

Wi-Fi is a freedom, freedom from wires. It allows you to connect to the Internet from just about anywhere - a coffee shop, a bed in a hotel room or a conference room at work without wires. And the best thing of all, it's super fast - almost 10 times faster than a regular dial-up connection. Wi-Fi networks operate in the unlicensed 2.4 radio bands, with an 11 Mbps (802.11b) or 54 Mbps (802.11a) data rate, respectively.

To access Wi-Fi, you need enabled devices (laptops or PDAs). These devices can send and receive data wirelessly from any location equipped with Wi-Fi access.

What is Next ?

Now the focus in wireless is shifting to the wide area. WiMax, short for Worldwide Interoperability for Microwave Access, is defined in IEEE 802.16 standards is designed to deliver a metro area broadband wireless access (BWA) service, and is being promoted by the WiMax Forum.

Caution WiMAX is similar wireless system to Wi-Fi, but on a much larger scale and at faster speeds. A nomadic version would keep WiMAX-enabled devices connected over large areas, much like today.s cell phones.

Self-Assessment

Fill in the blanks:

1. The term Wi-Fi is a contraction of "wireless fidelity" and commonly used to refer to ....
2. Wi-Fi networks operate in the unlicensed .... bands, with an 11 Mbps or 54 Mbps data rate, respectively.
3. A .... can break into a Wi-Fi network using readily available materials and software.
4. .... modulation means that the transmitter will automatically shift to a more robust, though less efficient, modulation technique in those adverse conditions.
5. The .... radio link uses a direct sequence spread spectrum technique called complementary coded keying (CCK).
6. The 802.11a and g systems use ....
7. The idea of a .... network is that messages can be relayed through a number of access points to a central network control station
8. .... is the idea of selling an Internet access service using wireless LAN technology and a shared Internet connection in a public location designated a hot spot.
9. To use the .... option, devices must first send a traffic profile describing bandwidth, latency, and jitter requirements.

10.2 IEEE 802.16: Broadband Wireless MAN Standard (WiMAX)

Satisfying the growing demand for BWA in underserved markets has been a continuing challenge for service providers, due to the absence of a truly global standard. A standard that would enable companies to build systems that will effectively reach underserved business and residential markets in a manner that supports infrastructure build outs comparable to cable, DSL, and fiber. For years, the wildly successful 802.11x or WiFi wireless LAN technology has been used in BWA applications along with a host of proprietary based solutions. When the WLAN technology was examined closely, it was evident that the overall design and feature set available was not well suited for outdoor BWA applications. It could be done, it is being done, but with limited capacity in terms of bandwidth and subscribers, range and a host of other issues made it clear this approach while a great fit for indoor WLAN was a poor fit for outdoor BWA.

This analysis and review was conducted by the IEEE and it was decided that a new, more complex and fully developed standard would be required to address both the physical layer environment (outdoor versus indoor RF transmissions) and the Quality of Service (QoS) needs demanded by the BWA and last mile access market. The IEEE conducted a multi-year effort to develop this new standard, culminating in final approval of the 802.16a Air- Interface Specification in January 2003. This standard has since received broad industry support from leading equipment makers. Many WiMAX company members are active in both the IEEE 802.16 standards development and the IEEE 802.11 efforts for Wireless LAN, and envision the combination of 802.16a and 802.11 creating a complete wireless solution for delivering high speed Internet access to businesses, homes, and WiFi hot spots. The 802.16a standard delivers carrierclass performance in terms of robustness and QoS and has been designed from the ground up to deliver a suite of services over a scalable, long range, high capacity "last mile" wireless communications for carriers and service providers around the world.

In BWA, applications include residential broadband access – DSL-level service for SOHO and small businesses, T1/E1 level service for enterprise, all supporting not just data but voice and video as well, wireless backhaul for hotspots and cellular tower backhaul service to name a few.

Notes

Caution In reviewing the standard, the technical details and features that differentiate WiMAX certified equipment from WiFi or other technologies can best be illustrated by focusing on the two layers addressed in the standard, the physical (PHY) or RF transmissions and the media access control (MAC) layer design.

10.2.1 WiMAX and the IEEE 802.16a PHY Layer

The first version of the 802.16 standard released addressed Line-of-Sight (LOS) environments at high frequency bands operating in the 10-66 GHz range, whereas the recently adopted amendment, the 802.16a standard, is designed for systems operating in bands between 2 GHz and 11 GHz. The significant difference between these two frequency bands lies in the ability to support Non-Line-of-Sight (NLOS) operation in the lower frequencies, something that is not possible in higher bands. Consequently, the 802.16a amendment to the standard opened up the opportunity for major changes to the PHY layer specifications specifically to address the needs of the 2-11 GHz bands. This is achieved through the introduction of three new PHY-layer specifications (a new Single Carrier PHY, a 256 point FFT OFDM PHY, and a 2048 point FFT OFDMA PHY);major changes to the PHY layer specification as compared to the upper frequency, as well as significant MAC-layer enhancements. Although multiple PHYs are specified as in the 802.11 suite of standards (few recall that infrared and frequency hopping were and are part of the base 802.11 standard), the WiMAX Forum has determined that the first interoperable test plans and eventual certification will support the 256 point FFT OFDM PHY (which is common between 802.16a and ETSI HiperMAN), with the others to be developed as the market requires.

The OFDM signaling format was selected in preference to competing formats such as CDMA due to its ability to support NLOS performance while maintaining a high level of spectral efficiency maximizing the use of available spectrum. In the case of CDMA (prevalent in 2G and 3G standards), the RF bandwidth must be much larger than the data throughput, in order to maintain processing gain adequate to overcome interference. This is clearly impractical for broadband wireless below 11 GHz, since for example, data rates up to 70 Mbps would require RF bandwidths exceeding 200 MHz to deliver comparable processing gains and NLOS performance.

Some of the other PHY layer features of 802.16a that are instrumental in giving this technology the power to deliver robust performance in a broad range of channel environments are; flexible channel widths, adaptive burst profiles, forward error correction with concatenated Reed-Solomon and convolutional encoding, optional AAS (advanced antenna systems) to improve range/capacity, DFS (dynamic frequency selection)-which helps in minimizing interference, and STC (space-time coding) to enhance performance in fading environments through spatial diversity.

10.2.2 IEEE 802.16a MAC Layer

Every wireless network operates fundamentally in a shared medium and as such that requires a mechanism for controlling access by subscriber units to the medium. The 802.16a standard uses a slotted TDMA protocol scheduled by the BTS to allocate capacity to subscribers in a point-to-multipoint network topology. While this on the surface sounds like a one line, technical throwaway statement, it has a huge impact on how the system operates and what services it can deploy. By starting with a TDMA approach with intelligent scheduling, WiMAX systems will be able to deliver not only high speed data with SLAs, but latency sensitive services such as voice and video or database access are also supported.

The standard delivers QoS beyond mere prioritization, a technique that is very limited in effectiveness as traffic load and the number of subscribers increases. The MAC layer in WiMAX certified systems has also been designed to address the harsh physical layer environment where interference, fast fading and other phenomena are prevalent in outdoor operation.

Differentiating the IEEE 802.16a and 802.11 Standards - WiFi versus WiMAX Scalability

At the PHY layer the standard supports flexible RF channel bandwidths and reuse of these channels (frequency reuse) as a way to increase cell capacity as the network grows. The standard also specifies support for automatic transmit power control and channel quality measurements as additional PHY layer tools to support cell planning/deployment and efficient spectrum use. Operators can re-allocate spectrum through sectorization and cell splitting as the number of subscribers grows. Also, support for multiple channel bandwidths enables equipment makers to provide a means to address the unique government spectrum use and allocation regulations faced by operators in diverse international markets. The IEEE 802.16a standard specifies channel sizes ranging form 1.75MHz up to 20MHz with many options in between.

WiFi based products on the other hand require at least 20MHz for each channel (22MHz in the 2.4GHz band for 802.11b), and have specified only the license exempt bands 2.4GHz ISM, 5GHz ISM and 5GHz UNII for operation. In the MAC layer, the CSMA/CA foundation of 802.11, basically a wireless Ethernet protocol, scales about as well as does Ethernet. That is to say - poorly. Just as in an Ethernet LAN, more users results in a geometric reduction of throughput, so does the CSMA/CA MAC for WLANs. In contrast the MAC layer in the 802.16 standard has been designed to scale from one up to 100's of users within one RF channel, a feat the 802.11 MAC was never designed for and is incapable of supporting.

- ***Coverage:*** The BWA standard is designed for optimal performance in all types of propagation environments, including LOS, near LOS and NLOS environments, and delivers reliable robust performance even in cases where extreme link pathologies have been introduced. The robust OFDM waveform supports high spectral efficiency (bits per second per Hertz) over ranges from 2 to 40 kilometers with up to 70 Mbps in a single RF channel. Advanced topologies (mesh networks) and antenna techniques (beam-forming, STC, antenna diversity) can be employed to improve coverage even further. These advanced techniques can also be used to increase spectral efficiency, capacity, reuse, and average and peak throughput per RF channel. In addition, not all OFDM is the same. The OFDM designed for BWA has in it the ability to support longer range transmissions and the multi-path or reflections encountered.

  In contrast, WLANs and 802.11 systems have at their core either a basic CDMA approach or use OFDM with a much different design, and have as a requirement low power consumption limiting the range. OFDM in the WLAN was created with the vision of the systems covering tens and maybe a few hundreds of meters versus 802.16 which is designed for higher power and an OFDM approach that supports deployments in the tens of kilometers.

- ***QoS:*** The 802.16a MAC relies on a Grant/Request protocol for access to the medium and it supports differentiated service levels (e.g., dedicated T1/E1 for business and best effort for residential). The protocol employs TDM data streams on the DL (downlink) and TDMA on the UL (uplink), with the hooks for a centralized scheduler to support delay-sensitive services like voice and video. By assuring collision-free data access to the channel, the 16a MAC improves total system throughput and bandwidth efficiency, in comparison with contention-based access techniques like the CSMA-CA protocol used in WLANs. The 16a MAC also assures bounded delay on the data (CSMA-CA by contrast, offers no guarantees on delay).

Notes The TDM/TDMA access technique also ensures easier support for multicast and broadcast services. With a CSMA/CA approach at its core, WLANs in their current implementation will never be able to deliver the QoS of a BWA, 802.16 system.

Notes

The WiMAX Forum-Interoperability for 802.16 Compliant Systems

Establishment of a standard is critical to mass adoption of a given technology; however by itself a standard is not enough. The 802.11b WLAN standard was ratified in 1999, however it did not reach mass adoption until the introduction of the WiFi Alliance and certified, interoperable equipment was available in 2001. In order to bring interoperability to the Broadband Wireless Access space, the WiMAX Forum is focused on establishing a unique subset of baseline features grouped in what is referred to as "System Profiles" that all compliant equipment must satisfy. These profiles and a suite of test protocols will establish a baseline interoperable protocol, allowing multiple vendors' equipment to interoperate; with the net result being System Integrators and Service Providers will have option to purchase equipment from more than one supplier.

Profiles can address, for example, the regulatory spectrum constraints faced by operators in different geographies. For example, a service provider in Europe2 operating in the 3.5 GHz band, who has been allocated 14 MHz of spectrum, is likely to want equipment that supports 3.5 and/ or 7 MHz channel bandwidths and, depending on regulatory requirements, TDD (time-division duplex) or FDD (frequency-division duplex) operation. Similarly, a WISP (Wireless Internet Service Provider) in the U.S. using license-exempt spectrum in the 5.8GHz UNII band might desire equipment that supports TDD and a 10 MHz bandwidth.

WiMAX is establishing a structured compliance procedure based upon the proven test methodology specified by ISO/IEC 9646.3 The process starts with standardized Test Purposes written in English, which are then translated into Standardized Abstract Test Suites in a language called TTCN.4 In parallel with the Test Purposes, the Test Purposes are also used as input to generate test tables referred to as the PICS (Protocol Implementation Conformance Statement) Proforma is generated. The end result is a complete set of test tools that WiMAX will make available to equipment developers so they can design-in conformance and interoperability during the earliest possible phase of product development. Typically, this activity will commence when the first integrated prototype becomes available.

Self-Assessment

Fill in the blanks:

1. The .... MAC relies on a Grant/Request protocol for access to the medium and it supports differentiated service levels
2. The .... standard is designed for optimal performance in all types of propagation environments, including LOS, near LOS and NLOS environments,
3. The first version of the 802.16 standard released addressed Line-of-Sight (LOS) environments at high frequency bands operating in the .... range
4. Satisfying the growing demand for BWA in underserved markets has been a continuing challenge for service providers, due to the absence of a truly .... standard.

Case Study

Redline Debuts its 802.16-2004 Compliant Broadband Wireless Solution at WCA Symposium

About Redline Communications

Redline Communications is a technology leader in the design and manufacture of standards-based broadband wireless access solutions. Using industry leading OFDM technologies, Redline's award-winning products provide unmatched high capacity and non-line-of-sight capabilities with proven performance, reliability and security. Ideal for a variety of

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Notes

access, backhaul and private network applications, Redline products meet the needs of carriers, service providers and enterprises worldwide. Redline is a principal member of the WiMAX Forum(TM), and was first in the world to market an 802.16 compliant product. Redline has over 10,000 installations in 75 countries across six continents through a global distribution network of 80+ partners

Redline Communications, a leading provider of standards-based broadband wireless equipment, announced today that it is unveiling its WiMAX ready product at the WCA International Symposium and Business Expo (Booth #306) taking place January 12 - 14 at the Fairmont Hotel in San Jose, Calif. On display will be Redline's universal platform, the AN-100U, a fully compliant IEEE 802.16-2004 platform. The AN-100U, which functions as a base station and subscriber station, advances Redline's readiness for WiMAX(TM) interoperability testing and commercial viability.

As a principal member of the WiMAX Forum(TM), Redline plays an active role in the technical development of IEEE 802.16 standards. The company is now actively participating in the development of the 802.16e standard for mobile applications.

"From our earliest days of product development, Redline has been committed to delivering solutions that support the standardization needs of the industry," said Keith Doucet, VP of Marketing and Product Management. "We led the market with our introduction of an 802.16a compliant product, the AN-100, which today is being used worldwide by Tier 1 operators primarily for backhauling wireless access networks. The AN-100 has demonstrated the viability of the standards based technology for backhaul applications, while the AN-100U will serve the access market, representing Redline's foyer into the residential space".

Redline achieved a world first when it introduced the AN-100 802.16a compliant solution to the industry early 2004. This product received the Telecommunication Industry Association's (TIA) SUPERQuest award in the Backbone/Edge Networking Equipment category.

Roger B. Marks, Chairman of IEEE 802.16, says the evolution of 802.16 has been instrumental in accelerating broadband wireless deployment. "Interest in IEEE Standard 802.16 continues to explode around the world, with hundreds of engineers from global industry cooperating on its evolution. As companies introduce new products based upon on that foundation, the synergies created by the standard are set to bring about a rapid evolution of broadband wireless access as an essential communications tool."

Doucet adds, "We are now ready with 802.16-2004 and will once again be counted among the first to move forward on this important initiative that will see true interoperability become a reality for the industry."

"We are pleased that Redline has chosen the WCA International Symposium as its venue of choice to preview its new 802.16-2004 compliant broadband wireless solution," said Andrew Kreig, President of Wireless Communications Association International. "The achievements to date from the broadband wireless community are commendable as they advance their solutions towards WiMAX interoperability. The dedication from companies like Redline will ensure that the promise of WiMAX will soon become a reality."

Questions:

1. Study and analyse the case.
2. Write down the case facts.
3. What do you infer from it?

Source: http://www.businesswire.com/news/home/20050110005400/en/Redline-Debuts-802.16-2004-Compliant-Broadband-Wireless-Solution

Notes

10.6 Summary

IEEE 802.11 is a set of physical layer standards for implementing wireless local area network (WLAN) computer communication in the 2.4, 3.6, 5 and 60 GHz frequency bands.

The 802.11 family consist of a series of half-duplex 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, which are amendments to the original standard. 802.11-1997 was the first wireless networking standard

The 802.11 standard is defined through several specifications of WLANs.

Wi-Fi systems are half duplex shared media configurations where all stations transmit and receive on the same radio channel

One business that grew out of Wi-Fi was the Wireless ISP (WISP). This is the idea of selling an Internet access service using wireless LAN technology and a shared Internet connection in a public location designated a hot spot.

10.7 Keywords

IEEE 802.11: is a set of physical layer standards for implementing wireless local area network (WLAN) computer communication in the 2.4, 3.6, 5 and 60 GHz frequency bands.

802.11a: This is an extension to 802.11 that pertains to wireless LANs and goes as fast as 54 Mbps in the 5-GHz band

802.11b: The 802.11 high rate Wi-Fi is an extension to 802.11 that pertains to wireless LANs and yields a connection as fast as 11 Mbps transmission (with a fallback to 5.5, 2, and 1 Mbps depending on strength of signal) in the 2.4-GHz band.

802.11g: This pertains to wireless LANs and provides 20+ Mbps in the 2.4-GHz band.

Wi-Fi Multimedia Extensions (WME): This uses a protocol called Enhanced Multimedia Distributed Control Access (EDCA), which is Extensions an enhanced version of the Distributed Control Function (DCF) defined in the original 802.11 MAC.

10.8 Review Questions

1. What are the various specifications in the 802.11 family?
2. Do a technical camparsion between the three major wi-fi standards
3. What are the two operating modes that are included in the 802.11e standard?
4. Explain the two primary radio transmission techniquesof the wi Di system.
5. Discuss the issues which are assumed to be the cause of the sluggish adoption of wi-fi technology
6. Distinguish between the ieee 802.16a and 802.11 standards - wifi versus wimax scalability.

Answers: Self-Assessment

1. wireless networking technology
2. 2.4 radio
3. Hacker
4. Adaptive
5. 802.11b

Notes

6. 64-channel orthogonal frequency division multiplexing (ofdm)
7. Radio mesh
8. Wireless ISP (WISP)
9. WSM
10. 802.16a
11. BWA
12. 10-66 GHz
13. global

10.9 Further Readings

Books

802.11 Wireless Networks: The Definitive Guide, Second Edition, Matthew Gast

Introduction to wireless networks, John Ross

Wireless Communications & Networking, Vijay Garg

Wireless Communications: Principles and Practice, Theodore S. Rappaport

Online links

http://www.tutorialspoint.com/wi-fi/wifi_summary.htm

http://www.tra.gov.eg/uploads/technical%20material/Wi-Fi%20report.pdf

http://www.hp.com/rnd/library/pdf/understandingWiFi.pdf

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