

WiMAX Tracker

Manoj Kumar

MDU Rohtak(Haryana)

ABSTRACT

WiMAX stands for Worldwide Interoperability for Microwave Access. Wimax technology is a telecommunication technology which provides wireless transmission. By the help of this technology we can access the internet and other portable devices. It is technology to deliver content over cable and other links at “last mile”.

WiMAX has the ability to support various types of applications, such as web browsing, email, and file transfer. WiMAX operates on the same general principles as WiFi -- it sends data from one computer to another via radio signals. A system which is equipped with WiMAX would receive data from the WiMAX transmitting station, probably using encrypted data keys to prevent unauthorized users from stealing access.

WiMAX also worked like a wifi but difference in between them is fastest WiFi connection can transmit up to 54 megabits per second under optimal conditions. WiMAX should be able to handle up to 70 megabits per second. The biggest difference isn't speed; it's distance. WiMAX outdistances WiFi by miles. WiFi's range is about 100 feet (30 m). WiMAX will blanket a radius of 30 miles (50 km) with wireless access. The increased range is due to the frequencies used and the power of the transmitter. Of course, at that distance, terrain, weather and large buildings will act to reduce the maximum range in some circumstances, but the potential is there to cover huge tracts of land.

WiMax coverage is measured in square kilometers, while that of WiFi is measured in square meters. WiMax specifications also provides much better facilities than WiFi, providing higher bandwidth and high data security by the use of enhanced encryption schemes. WiMax can also provide service in both Line Of Sight (LOS) and Non-Line Of Sight (NLOS)

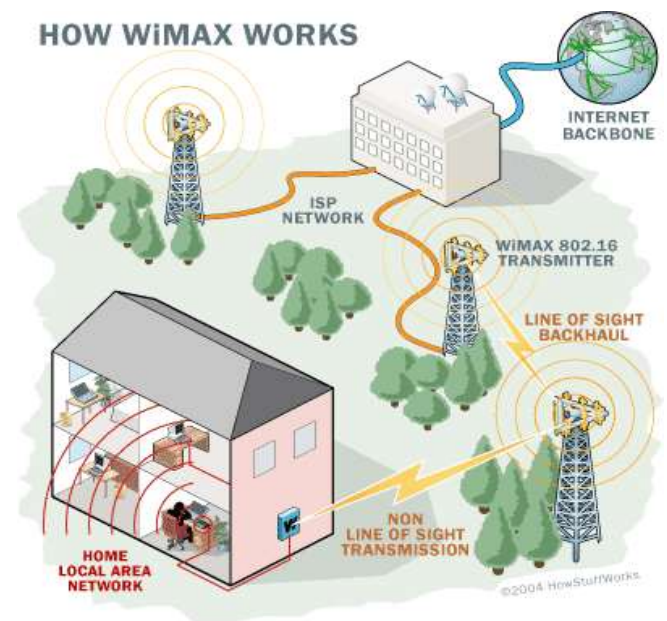
locations, but the range will vary accordingly. WiMax antennas can "share" a cell tower without compromising the function of cellular arrays already in place.

Worldwide Interoperability for Microwave Access (WiMAX) is currently one of the hottest technologies in wireless. WiMAX is a standard-based wireless technology that provides high throughput broadband connections over long distance. WiMAX can be used for a number of applications, including "last mile" broadband connections, hotspots and high-speed connectivity for business customers. It provides wireless metropolitan area network (MAN) connectivity at speeds up to 70 Mbps and the WiMAX base station on the average can cover between 5 to 10 km.

Wimax Infrastructure:-

A WiMAX Base Station: Base station consists of indoor electronics and a WiMAX tower. Typically, a base station can cover up to 10 km radius (Theoretically, a base station can cover up to 50 kilo meter radius or 30 miles, however practical considerations limit it to about 10 km or 6 miles). Any wireless node within the coverage area would be able to access the Internet.

A WiMAX receiver - The receiver and antenna could be a stand-alone box or a PC card that sits in your laptop or computer. Access to WiMAX base station is similar to accessing a Wireless Access Point in a WiFi network, but the coverage is more

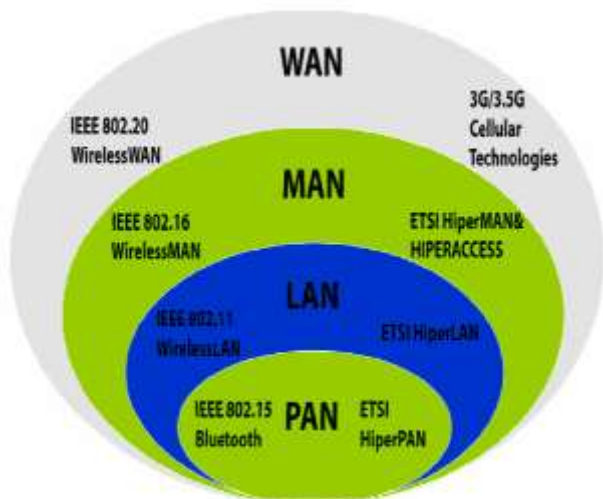


Several topology and backhauling options are to be supported on the WiMAX base stations: wireline backhauling (typically over Ethernet), microwave Point-to-Point connection, as well as WiMAX backhaul. With the latter option, the base station has the capability to backhaul itself. This can be achieved by reserving part of the bandwidth normally used for the end-user traffic and using it for backhauling

purposes. At Figure 5. we can see topologies of urban and rural areas in WiMAX deployment.

WiMAX technology can provide a cost-effective broadband access solution in areas beyond the reach of DSL and cable. The ongoing evolution of IEEE 802.16 will expand the standard to address mobile applications thus enabling broadband access directly to WiMAX-enabled portable devices ranging from smartphones and PDAs to notebook and laptop computers. Figure 1.1. below from the WiMAX Forum summarizes the 802.16 standards.

Standards Associated With Wimax:-



Completion Date	802.16 Dec 2001	802.16a/ 802.16REVd 802.16a: Jan 2003 802.16Revd: Q3 2004	802.16e 2005
Spectrum	10 to 66 GHz	< 11 GHz	< 6 GHz
Channel Conditions	Line-of-Sight only	Non-Line-of-Sight	Non-Line-of-Sight
Bit Rate	32 to 134 Mbps	75 Mbps max 20-MHz channelization	15 Mbps max 5-MHz channelization
Modulation	QPSK 16QAM 64QAM	OFDM 256 subcarrier QPSK 16QAM 64QAM	Same as 802.16a
Mobility	Fixed	Fixed	Pedestrian mobility Regional roaming
Channel Bandwidths	20, 25 and 28 MHz	Selectable between 1.25 and 20 MHz	Same as 802.16a with uplink subchannels
Typical Cell Radius	1 to 3 miles	3 to 5 miles (30 miles max based on tower height, antenna gain, and power transmit)	1 to 3 miles

IEEE 802.16 : The IEEE 802.16 Working Group on Broadband Wireless

Access Standards, which was established by IEEE Standards Board in 1999, aims to prepare formal specifications for the global deployment of broadband Wireless Metropolitan Area Networks. The Workgroup is a unit of the IEEE 802 LAN/MAN

Standards Committee. A related future technology Mobile Broadband Wireless Access (MBWA) is under development in IEEE 802.20. Although the 802.16 family of standards is officially called Wireless MAN, it has been dubbed “WiMAX” (from "Worldwide Interoperability for Microwave Access") by an industry group called the Imax Forum. The mission of the Forum is to promote and certify

compatibility and interoperability of broadband wireless products

WHY WiMAX?

WiMAX stands for wireless interoperability for microwave access. WiMAX is expected to do more for Metropolitan Area Networks (MANs) and what Wi-Fi has done for local area networks (LANs)? WiMAX is not projected to replace Wi-Fi, but to complement it by connecting Wi-Fi networks to each other or the Internet through high-speed wireless links. You can therefore use WiMAX technology to extend the power and range of Wi-Fi and cellular networks. However, in developing countries, WiMAX may become the only wireless technology because Wi-Fi and cellular have not penetrated areas that can be reached with WiMAX technology

Range:-

The wide range of the WiMAX technology depends on the height of the antennas, if they are installed at the suitable position from where there is no barrier between the transmitter and receiver, and then we can get better range and service from it. Even

though the frequency for operation of WiMAX is not definite, the most likely band

at 3.5GHz is higher in frequency than the 3G bands at around 2.1 GHz. Range will, as a result, be lower, perhaps somewhere between 50% and 75% of the range of 3G. WiMAX can therefore support 30 to 50 kilometres distance with Line-of-Sight (LOS) links. As far as Non-line-of-sight (NLOS) links in concerned WiMAX can support the broad range from 3 to 10 kilometres using advanced modulation algorithm that can overcome many interfering objects that Wi-Fi systems cannot pass through.

Quality of Service (QoS)

Excellent Quality Of service management donates from variety of WiMAX features. Just as on a Wi-Fi network, WiMAX users share a data pipe and QoS can degrade as more users are added to the network. Using the QoS features of WiMAX service providers can guarantee certain users specific bandwidth amounts by limiting the bandwidth consumption of other users. Grant request mechanism for accessing to network is the first aspect of Quality of

Service. The WiMAX functioning of disagreement allocates only a fixed amount of time to be given to these grant requests. Disagreement refers to the act of competing for access to the network. Because of the limited amount of time available, bandwidth cannot be consumed by contention requests. When a disagreement request comes into the network, the system compares the request with a service level agreement for the user making the request, and they are granted, or denied, access accordingly.

Link by link modulation schemes is another benefit of WiMAX Quality of Service. In other words, the base station can use different modulation schemes for different links. The modulation scheme used is related directly to the distance of the link. Rather than all users' links being downgraded by the user farthest away, link by link modulation enables closer users to use higher data-rate modulation schemes

Technology: WiMAX Design

The design of the WiMAX is ideal for challenges related with earlier versions of

wired and wireless access networks. At the same time the backhaul connects the WiMAX system to the network, it is not an integrated part of WiMAX system.

Normally a WiMAX network consists of two parts, a WiMAX Base Station (BS) and a WiMAX receiver also referred as Customer Premise Equipment (CPE).

Backhaul

Backhaul is actually a connection system from the Access Point (AP) back to the provider and to the connection from the provider to the network. A backhaul can set out any technology and media provided; it connects the system to the backbone. In most of the WiMAX deployments circumstances, it is also possible to connect several base stations with one another by use of high speed backhaul microwave links. This would also allow for roaming by a WiMAX subscriber from one base station coverage area to another, similar to roaming enabled by cellular phone.

Receiver

A WiMAX receiver, which is also referred as Customer Premise Equipment (CPE), may have a separate antenna or could be a stand-alone box or a PCMCIA card that inserted in a laptop or a desktop computer. Access to a WiMAX base station is similar to accessing a wireless access point (AP) in a Wi-Fi network, but the coverage is more.

So far one of the biggest restrictions to the widespread acceptance of WiMAX has been the cost of CPE. This is not only the cost of CPE itself, but also that of installation. In the past, Broadband Wireless Access (BWA) have been predominantly Line Of Sight (LOS), requiring highly skilled labour and a truck role to install and provide a service to customer. The concept of a self-installed CPE has been difficult for BWA from the beginning, but with the advent of WiMAX, this issue seems to be getting resolved. Base Station (BS)

A WiMAX base station comprises of internal devices and a WiMAX tower. A base station can normally covers the area of about 50 kilometres or 30 miles radius, but

some other and environmental issues bound the limits of WiMAX range to 10 km or

6 miles. Any wireless user within the coverage area would be able to access the WiMAX services (Fig: 2). The WiMAX base stations would use the media access control layer defines in the standard and would allocate uplink and downlink bandwidth to subscribers according to their requirements on real time basis.

Antennas For Fixed WiMAX

Applications:-

Directional antennas enhance the fade margin by adding together extra gain. This increases the link accessibility comparisons between directional and Omnidirectional antennas. Delay spread is further reduced by directional antennas at both the Base Station and Customer Premise Equipment (CPE). The antenna pattern restrains any multi-path signals that appear in the side lobes and back lobes. The efficiency of these methods has been verified and demonstrated in booming deployments, in which the service operates under considerable NLOS fading. Adaptive Modulation WiMAX system supports adaptive modulation to regulate the Signal Modulation Scheme (SMC)

depending on the Signal to Noise Ratio (SNR) state of the radio link. When the radio link is soaring in quality, the peak modulation scheme is used, offering the system additional capacity. During a signal fade, the WiMAX system can move to a lower modulation scheme to keep the connection quality and link permanence. This element allows the system to overcome time-selective fading. The key element of adaptive modulation is that it enhances the range that a higher modulation scheme can be used over, because the system can bend to the actual fading circumstances, as opposed to having a fixed scheme that is planned for the worst case situations.

Enhancements In Wimax

OFDM stands for Orthogonal Frequency Division Multiplexing; it's a technology that provides the operator to beat the challenges of Non-Line-of-Sight (NLOS) transmission in the more efficient manner. OFDM waveform put forward the advantage of functioning with the larger delay spread of the NLOS background. With the excellent quality of OFDM functionality, time and use of a cyclic prefix

and its also removes the Inter Symbol Interference (ISI) complications of adaptive equalization. Multiple narrowband orthogonal carriers composed because of OFDM waveform, localizing selective fading to a subset of carriers that are comparatively simple to equalize. A comparison between an OFDM signal and a single carrier signal, with the information being sent in parallel for OFDM and in series for single carrier.

The facility to remove delay spread, Inter Symbol Interference (ISI) and multi-path In a proficient manner allows for higher data rate throughput. It is simpler to equalize the individual OFDM carriers than it is to equalize the broader single carrier signal. For these entire reasons modern international standard such as those set by IEEE 802.16, have created OFDM as the ideal technology.

Future of Wimax:

WiMax technology is considered to be a next generation technology because this technology is aimed at replacing most of the present wireless technologies like wifi, Bluetooth, microwave and mobile phone

technologies. This technology would give rise to a broad consumer market for wireless digital devices. This wireless connection does not only provide compatibility with exiting devices but in the near future it would help in further inventions. The world would witness many inventions which are now even hard to imagine. WiMax is a technology which considered as the first step toward 4G. Today WiMax is operating as second generation and third generation technology but in near future it would be substantial 4G technology.

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Manoj Kumar, received bachelor degree in 2013 from MDU Rohtak(Haryana) and currently pursuing Master degree in Computer science from same .Working to publish paper in the area of latest mobile communication technology on different forums.