

## CHAPTER -2

### INTRODUCTION OF WiMAX

#### 2.1 Introduction

The term of “WiMAX” about the future evolution of mobile networks and services. From the simple voice and text messaging services of today, and efficient move towards richer multimedia and broadband services is the WiMAX. The new technology promises high speed of broadband service, Wireless rather than wired access and Broad Coverage. WiMAX interoperability and 802.16 standards have come a long way in their development and attempting to understand all of the applications and capabilities of WiMAX can be a daunting task for anyone without a core understanding of the technologies. At the base level, communications officials need to know why adaptive modulation, OFDM, OFDMA along with a scheduled protocol, serves to make WiMAX networks efficient, effective, and usable today and well into the future. This article is intended to provide a high-level overview of WiMAX technology; discuss the components necessary for ensuring an effective WiMAX solution; and explore the future applications for WiMAX.

WiMAX is a scheduled protocol, meaning that the base stations, which are centralized control units for the network, manage and control the WiMAX network. Access points, or subscriber stations, cannot communicate with the network until they are recognized by the base station. The base station allocates the times and frequencies the subscriber station can communicate with the base station. Because of this, WiMAX-based networks cannot be overloaded, as is common with other contention-based protocol.

#### 2.2 Definition of WiMAX

Worldwide Interoperability for Microwave Access, abbreviated as **WiMAX**, is a wireless digital telecommunications system or technology that is aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access. It is based on the IEEE 802.16 standard, which is also called **WMAN (Wireless Metropolitan Area Network)**. The name "WiMAX" was created by the **WiMAX** Forum, which was formed in June 2001 to promote conformance and interoperability of the standard. The forum describes **WiMAX** as "a standards-based technology enabling the delivery of last mile Broadband Wireless Access (BWA) as an alternative to cable and DSL (Digital Subscriber Line).

- WiMAX is a highly scalable, long-range system.
- WiMAX provide high-speed data bandwidth up 70Mbps and telecommunications service.
- WiMAX device using with directional antennas, speeds of 10Mbit/s at 10km distance is possible.
- Wimax devices with omni-directional antennas 10Mbit/s over 2 km is possible.
- WiMAX can provide broadband wireless access (BWA) up to 30 miles(50km) for mobile stations.
- WiMAX operates on both licensed and non-licensed frequencies.
- Useful in areas where where cable,DSL Broadband and even dial-up might not exist.

### 2.3 Definition of WiMAX Terms

- **802.16a**

- Uses the licensed frequencies from 2 to 11 GHz

- Support Mesh network

- **802.16b**

- Increase Spectrum to 5 and 6 GHz

- Provides QoS (for real time voice and video service)

- **802.16c**

- Represents a 10 to 66GHz

- **802.16d**

- Improvement and fixes for 802.16a

- **802.16e**

- Address on Mobile

- Enable high speed signal handoffs necessary for communications with users moving at vehicular speeds

## 2.4 History of WiMAX

The 802.16 project started in 1998. The aim was to make broadband wireless access more widely and cheaply available through a standard for wireless metropolitan area networks. The first version of the standard, 802.16, was published in April 2002 and addressed fixed line of sight connections for the 'first mile/last mile' link. The IEEE 802.16e standard is an amendment to the 802.16 – 2004 base specification and targets the mobile market by adding portability and the ability for mobile clients.

### ► History of WiMAX Forum

- June 2001 – WiMAX Forum was established
- June 2004 – 802.16-2004 Standard

256 OFDM PHY modes of the 802.16-2004 standards, which was ratified by the IEEE.

### ► July 2005 – Fixed WiMAX Certification

- Cetecom began testing WiMAX Forum member companies' products to certify that they meet WiMAX Forum conformance and interoperability standards.

### ► End of 2005 – Mobile WiMAX Standard

- Mobile WiMAX standard is planned to be ratified.

### ► 2006 – WiMAX Forum Certified Products

- FDD as well as TDD
- Licensed as well as unlicensed spectrum
- Licensed needed to guarantee wide area service
- No single global spectrum assigned, possibilities:

-5.8 GHz

-3.5 GHz

-2.5 GHz, (IMT-2000 more likely in this band)

-2.3 GHz

Commercial trials in the fourth quarter. That network could be commercially deployed by the first quarter of 2006.

## 2.5 Characteristics of WiMAX:

**WiMAX** (Worldwide Interoperability for Microwave Access) is a "last mile," broadband, wireless access mechanism which can potentially replace DSL and Cable Modem. Defined by the IEEE 802.16 standards.

### Synonyms

- 802.16
- IEEE 802.16
- Wireless MAN.

WiMAX, the Worldwide Interoperability for Microwave Access, is a telecommunications technology that provides wireless data in a variety of ways. A telecommunications technology providing wireless data, voice and video over long distances.

Also known as the IEEE 802.16 group of standards defines a packet-based wireless technology that provides high-throughput broadband connections.

Popular name of the IEEE 802.16 wireless metropolitan-area network standard that is being developed. WiMAX technology is expected to enable multimedia applications with wireless connection and, with a range of up to 30 miles, enable networks to have a wireless last-mile solution.

WiMAX is the new wireless broadband with a range of up to 80km, with a bandwidth of up to 75Mbps. It is the successor to Wi-Fi.

Technology that uses fixed, local radio cells to provide high-speed Internet access via the air interface.

Commonly referred to as WiMAX or less commonly as WirelessMAN™ or the Air Interface Standard, IEEE 802.16 is a specification for fixed broadband.

A wireless broadband standard that does not require line of sight, also known as 802.16. WiMAX is an Intel-backed wireless standard that has far greater bandwidth and range capability than any of the standards in the 802.11x family. The IEEE designation is 802.16, and it has a range of 31 miles with bandwidth capabilities up to 70Mbps.

The emerging next generation technology for wireless access. Currently in test mode, its wide-spread commercial applications are generally believed.

A grid of digital signal emitted over a large area to provide wireless access to all locations, effectively providing a 'blanket' of broadband. WiMAX is a wireless broadband transmission system known as IEEE 802.16e. Unlike WiFi which has a maximum range of about 100 feet, WiMAX may reach Wi-MAX is a type of a long range and mobile wireless network.

## 2.6 Principle of WiMAX Working :

WiMAX is a connection-oriented technology and affects only affects only the Physical Layer and MAC portion in the Data Link layer of the OSI Model. Therefore the 802.16 Specification mainly describes the scheduling of communication between towers and WiMAX devices.

WiMAX supporting two types of connection types.

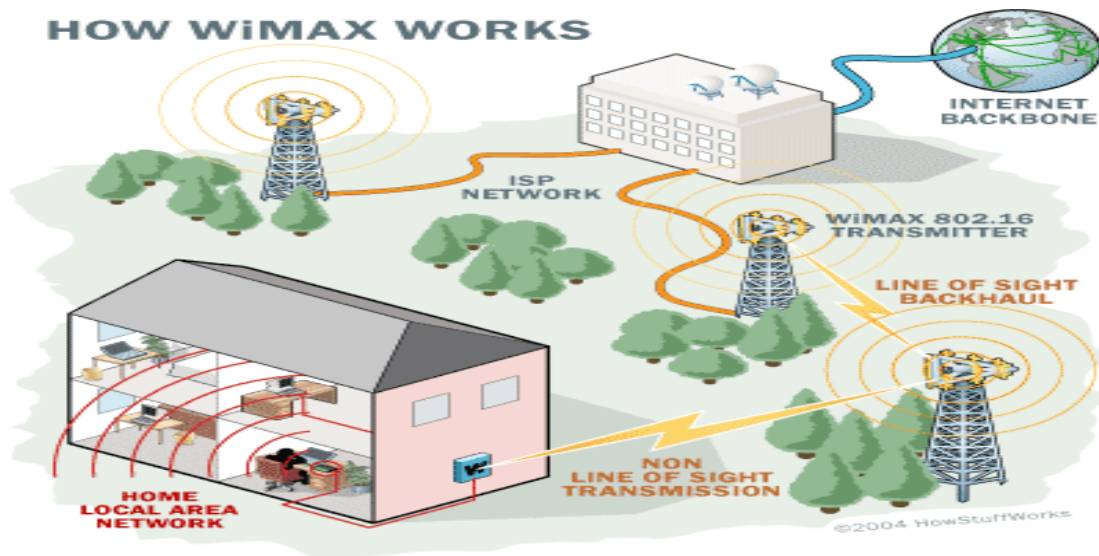
### Frequency Division Duplexing (FDD)

One frequency is sent from the base tower to another station tower and from the station tower to the base tower.

### Time Division Duplexing (TDD)

The Base tower transmits at one frequency to a station tower and receiver data from the station tower at another frequency.

Ultimately, WiMAX can be envisioned as a mesh network where each node (tower/access points) can communicate with each other in order to extend the range of WiMAX and ,therefore, allows robust communication as there are multiple routes a signal can take.



*Fig :2.6 How does WiMAX Work*

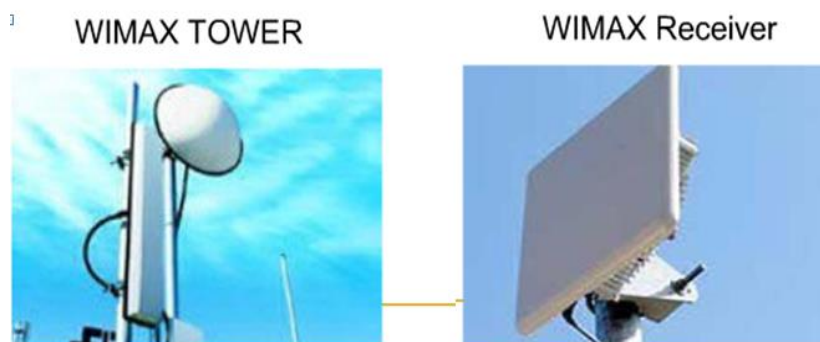
**WiMAX actually can provide two forms of wireless service:**

There is the **non-line-of-sight**, WiFi sort of service, where a small antenna on your computer connects to the tower. In this mode, WiMAX uses a **lower frequency range** -- 2 GHz to 11 GHz (similar to WiFi). Lower-wavelength transmissions are not as easily disrupted by physical obstructions -- they are better able to diffract, or bend, around obstacles.

There is **line-of-sight** service, where a fixed dish antenna points straight at the WiMAX tower from a rooftop or pole. The line-of-sight connection is stronger and more stable, so it's able to send a lot of data with fewer errors. Line-of-sight transmissions use **higher frequencies**, with ranges reaching a possible 66 GHz. At higher frequencies, there is less interference and lots more bandwidth.

## 2.7 WiMAX Wireless Network

In practical terms, WiMAX would operate similar to Wi-Fi but at higher speeds, over greater distances and for a greater number of users. WiMAX could potentially erase the suburban and rural blackout areas that currently have no broadband Internet access because phone and cable companies have not yet run the necessary wires to those remote locations.



*Fig: 2.7 WiMAX Wireless Network*

**A WiMAX system consists of two parts:**

A **WiMAX tower**, similar in concept to a cell-phone tower - A single WiMAX tower can provide coverage to a very large area -- as big as 3,000 square miles (~8,000 square km).

A **WiMAX receiver** - The receiver and antenna could be a small box or PCMCIA card, or they could be built into a laptop the way WiFi access is today.

A WiMAX tower station can connect directly to the Internet using a high-bandwidth, wired connection (for example, a T3 line). It can also connect to another WiMAX tower using a line-of-sight, microwave link. This connection to a second tower (often referred to as a **backhaul**), along with the ability of a single tower to cover up to 3,000 square miles, is what allows WiMAX to provide coverage to remote rural areas.

WiFi-style access will be limited to a 4-to-6 mile radius (perhaps 25 square miles or 65 square km of coverage, which is similar in range to a cell-phone zone). Through the stronger line-of-sight antennas, the WiMAX transmitting station would send data to WiMAX-enabled computers or routers set up within the transmitter's 30-mile radius (2,800 square miles or 9,300 square km of coverage). This is what allows WiMAX to achieve its maximum range.

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 labor and a truck role to install and provide a service to customer.