CHEPTER-6

Service Provide in WiMAX

6.1 Service development of WiMAX

The WiMAX standard to maintain has been developed with many objectives in mind. These are Summarized below:

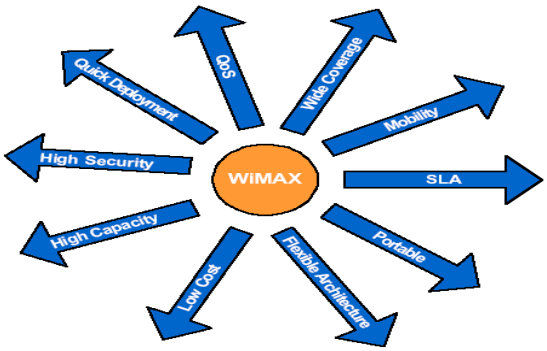

Fig: 6.1 WiMAX Technology

Flexible Architecture: WiMAX supports several system architectures, including Point-to-Point, Point-to-Multipoint, and ubiquitous coverage. The WiMAX MAC (Media Access Control) supports Point-to-Multipoint and ubiquitous service by scheduling a time slot for each Subscriber Station (SS). If there is only one SS in the network, the WiMAX Base Station (BS) will communicate with the SS on a Point-to-Point basis. A BS in a Point-to-Point configuration may use a narrower beam antenna to cover longer distances.

High Security: WiMAX supports AES (Advanced Encryption Standard) and 3DES (Triple DES, where DES is the Data Encryption Standard). By encrypting the links between the BS and the SS, WiMAX provides subscribers with privacy (against eavesdropping) and security across the broadband wireless interface. Security also provides operators with strong protection against theft of service. WiMAX also has built-in VLAN support, which provides protection for data that is being transmitted by different users on the same BS.

WiMAX QoS: WiMAX can be dynamically optimized for the mix of traffic that is being carried. Four types of service are supported:

Service	Describe
Unsolicited Grant Service(UGS)	UGS is designed to support real-time data streams consisting of fixed-size data packets issued periodic intervals, such as T1/E1 and Voice over IP.
Real-time Polling Service(rtPS)	rtPS is designed to support real-time data streams consisting of variable-sized data packets that are issued at periodic intervals, such as MPEG video.
Non-Real-time Polling Service(nrtPS)	nrtPS is designed to support delay-tolerant data streams consisting of variable-sized data packets for which a minimum data rate is required such as MPEG video.
Best Effort (BE)	BE service is designed to support data streams for which no minimum service level is required and which can be handled on a space-available basis.

Table: 6.1 WiMAX Service

Quick Deployment: Compared with the deployment of wired solutions, WiMAX requires little or no external plant construction. Operators that have obtained licenses to use one of the licensed bands, or that plan to use one of the unlicensed bands, do not need to submit further applications to the Government. Once the antenna and equipment are installed and powered, WiMAX is ready for service. In most cases, deployment of WiMAX can be completed in a matter of hours, compared with months for other solutions.

Multi-Level Service: The manner in which QoS is delivered is generally based on the Service Level Agreement (SLA) between the service provider and the end-user. Further, one service provider can offer different SLAs to different subscribers, or even to different users on the same SS.

Interoperability: WiMAX is based on international, vendor-neutral standards, which make it easier for end-users to transport and use their SS at different locations, or with different service providers. Interoperability protects the early investment of an operator since it can select equipment from different equipment vendors, and it will continue to drive the costs of equipment down as a result of mass adoption.

Portability: As with current cellular systems, once the WiMAX SS is powered up, it identifies itself, determines the characteristics of the link with the BS, as long as the SS is registered in the system database, and then negotiates its transmission characteristics accordingly.

Mobility: The IEEE 802.16e amendment has added key features in support of mobility. Improvements have been made to the OFDM and OFDMA physical layers to support devices and services in a mobile environment. These improvements, which include Scaleable OFDMA, MIMO, and support for idle/sleep mode and hand-off, will allow full mobility at speeds up to 160 km/hr. The WiMAX Forum-supported standard has inherited OFDM's superior NLOS (Non-Line Of Sight) performance and multipath-resistant operation, making it highly suitable for the mobile environment.

Cost-effective: WiMAX is based on an open, international standard. Mass adoption of the standard, and the use of low-cost, mass-produced chipsets, will drive costs down dramatically, and the resultant competitive pricing will provide considerable cost savings for service providers and end-users.

Wider Coverage: WiMAX dynamically supports multiple modulation levels, including BPSK, QPSK, 16-QAM, and 64-QAM. When equipped with a high-power amplifier and operating with a low-level modulation (BPSK or QPSK, for example), WiMAX systems are able to cover a large geographic area when the path between the BS and the SS is unobstructed.

Non-Line-of-Sight Operation: NLOS usually refers to a radio path with its first Fresnel zone completely blocked. WiMAX is based on OFDM technology, which has the inherent capability of handling NLOS environments. This capability helps WiMAX products deliver broad bandwidth in a NLOS environment, which other wireless product cannot do.

High Capacity: Using higher modulation (64-QAM) and channel bandwidth (currently 7 MHz, with planned evolution towards the full bandwidth specified in the associated IEEE and ETSI standards), WiMAX systems can provide significant bandwidth to end-users.

6.2 WiMAX VoIP

A fixed wireless solution not only offers competitive internet access, it can do the same for telephone service thus further bypassing the telephone company's copper wire network. Voice over Internet Protocol (VoIP) offers a wider range of voice services at reduced cost to subscribers and service providers alike. The diagram below illustrates a typical solution where a WiMAX service provider can obtain wholesale VoIP services (no need for the WiMAX service provider to install and operate a VoIP softswitch) at about $5/number/month and resell to enterprise customers at $50.

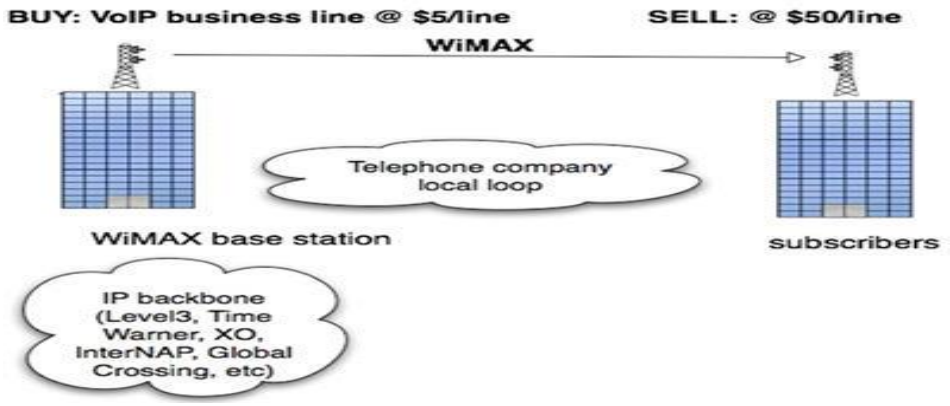

Fig: 6.2 Figure : VoIP is the "killer app" for WiMAX

In residential markets, VoIP is a "must offer" service. Without the additional revenue per user (think ARPU where "A" is for average), WiMAX does not offer a compelling reason to switch from other forms of residential broadband. When bundled with broadband internet access and IPTV, a WiMAX triple play becomes very attractive to residential subscribers. Given the QoS, security and reliability mechanisms built into WiMAX, sub-scribers will find WiMAX VoIP as good or better than voice services from the telephone company.

6.3 WiMAX Service Provided in Access:

- **WiMAX Broadband Wireless Access**

- **Cable/DSL Broadband Access**

Currently, there are cable and DSL broadband access services in the marketplace. But, their practical limitations in features and deployment have prevented them from reaching many potential broadband Internet customers. The wired broadband connection provided by cable and DSL is an all-consuming and expensive process. A large number of areas throughout the world currently are not able to access broadband connectivity. Traditionally, DSL can only reach about 18,000 feet (three miles) from the central office switch, and this limitation means that many urban and suburban locations may not be served by DSL connectivity. The limitation of cable is that many older cable networks have not been equipped to offer a return channel, and converting and deploying these networks to support high-speed broadband can be expensive.

6.3.1 WiMAX can be used for Broadband Wireless Access (BWA):

Typical areas of application of WiMAX are as given below:

Residential and SOHO High Speed Internet Access. The main contenders for residential and SOHO market are the DSL, and Cable Internet technologies. These technologies have already established a market presence, and have proven track record in meeting the demands of the residential and SOHO customers. WiMAX provides an alternative to existing access methods, where it is not feasible to use DSL or Cable Internet. Typical application will be in remote areas where it is not economically feasible to have a DSL or Cable Internet. WiMAX is also expected to be more reliable due to wireless nature of communication between the customer premises and the base station. This is particularly useful in developing countries where the reliability and quality of land-line communications infrastructure is often poor.

Small and Medium Business. The WiMAX WBA is well suited to provide the reliability and speed for meeting the requirements of small and medium size businesses in low density environments. One disadvantage of WiMAX is the spectral limitation, in other words limitation of wireless bandwidth. For use in high density areas, it is possible that the bandwidth may not be sufficient to cater to the needs of a large clientele, driving the costs high.

WiFi Hot Spot Backhaul: Another area where WiMAX connectivity is for WiFi hot spots connectivity. As of now, there have been several WiFi hotspots and a WiMAX backhaul provides full wireless solution to these wireless networks.

6.3.2 DSL (Digital Subscriber Loop)

DSL (Eng. Digital Subscriber Loop) - a digital subscriber loop, the family of broadband access to the Internet technology. The standard data reception speed fluctuates between128 Kbps up to 24,000 Kbps, depending on the applied DSL technology and its level. For ADSL technology, the speed of dispatching data is lower than its speed of data reception, but symmetrical to SDLS. Joseph W.Lechleitter, inventor of DSL modem and employer of Bellcore, demonstrated the construction projects of such devices in the 80s.
The local terminal of the Public Switched Telephone Network was primarily designed for voice communication and signaling - for the oldest, basic POTS services; the notion of data communication was unknown at that time. Due to economical reasons, the telephone system sends the audio signal nominally between the frequencies of 300 and 3,400 Hz, which are consistent with the range required for human voice so that it can be clearly understood. Services using Dial-up modems are limited by POTS channel capacity.

Within the local telephone exchanges, the speech is discretized to 64 kbit/s of the data stream in the form of an 8-bit signal using sampling frequency 8,000 Hz, because according to Nyquist`s theory, each signal over 4,000 Hz is not let through a telephone net. The local terminal connecting the telephone exchange to majority of the subscribers, is capable of sending frequencies higher than POTS`s limit of 3.4 kHz. The limit cannot be higher than that depending on the quality and distance of the terminal. DSL technology uses the higher, unused band of the terminal by creating 4312.5 Hz, broad channels starting at - 10 and 100 kHz - depending on the configuration of the system. The channel allocation is continued upon higher and higher frequencies (up to 1.1 MHz for ADSL) until the new channels are recognized as unfit for usage. Each channel is extended so that it is can be used on more than one route, as in case of POTS connections. In the given group individual channels are joined into a couple of cycles, each in different direction.

All of the DSL technologies use highly complex algorithms for converting the digital signal, overcoming the inseparable limitations of wires` strands. Recently costs of a similar installation would have been incredibly high but thanks to VLSI technology, costs of installation of DSL in the already existing local terminals, with DSLAM multiplexer on one end and a DSL modem on the

other, requires a smaller amount of expenditures that could arise at the same route and distance, when installing a new optic fiber.

DSL technology is used in majority of apartments and minor offices, the proper filters enable simultaneous operation of voice services and of DSL. DSL modem can use the same subscriber`s line that the communication devices based on POTS technology use, turning faxes and analogue modems on. At the same time, only one DSL modem can use the subscriber`s line. The standard method of making DSL available to many computers in the same premises is using a router, which connects the DSL modem and local Ethernet or Wi-Fi net.