ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 6, June 2016

A Review Paper on WiMAX Technology

Anuragsingh Rajpoot[1], Namarata Gadani[2], Aakash Patel[3], Poonam Pansinia[4]

Abstract*—WiMAX is Worldwide Interoperability for Microwave Access technology used for long distance wireless communication with higher data rates. It can be used as an alternative broadband. This paper covers basic information about WiMAX, WiMAX features, its network architecture, Portable WiMAX, QoS of WiMAX and its parameters

***Index Terms*— Broadband, IEEE standard 802.16, P2MP, Portable WiMAX, QoS, Wireless MAN**

I. INTRODUCTION

WiMAX (Worldwide-Interoperability-for-Microwave-Acces s) belongs to wireless communications standards. It is defined as IEEE standard 802.16. The standard was approved in April, 2002. It is officially called "Air Interface for Fixed Broadband Wireless Access Systems". It is also called as Wireless MAN (Metropolitan Area Network) or a Wireless local loop [1]. It can be used as an alternative broadband rather than using cable and DSL.

II. IEEE 802.16

The IEEE developed the 802.16 in its first version to address line of sight (LOS) access at spectrum ranges from 10 GHz to 66 GHz. The technology has evolved through several updates to the standard such as 802.16a, 802.16c, the Fixed WiMAX 802.16d (802.16-2004) specification, the mobile 802.16e set and the 802.16m standard [4]. It provides data rate up to 1 Gbps for fixed station considering the updates [2].

WiMAX is a *connection-oriented* wide area network. It can potentially provide broadband access to remote places. It can use point-to-multipoint (P2MP) architecture. Its purpose is to deliver broadband seamless quality multimedia services to the end users. A WiMAX base-station can cover of almost of 3,000 square miles[3].

III. WIMAX FEATURES [3]

- Uses wireless link with microwave or millimetre waves.
- Uses licensed spectrum
- Provides public network service to fee-paying customers
- Uses point-to-multipoint (P2MP) architecture
- Uses Simple stationary rooftop or tower-mounted antennas
- Provides broadband

IV. WIMAX NETWORK ARCHITECTURE

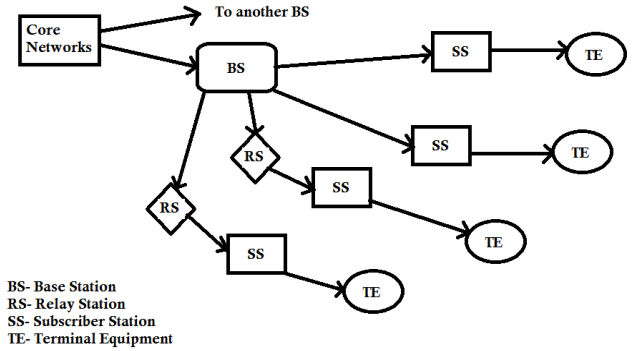

Fig. 1. WiMAX network architecture

WiMAX architecture consists of two types of fixed stations:

• Subscriber Stations (SS) serves a building (business or residence)

• Base station (BS) connects to public network and provides SS with first-mile access to public networks.

The communication path between SS and BS has two directions:

• Uplink (from SS to BS)

• Downlink (from BS to SS)

V. WIMAX LAYER ARCHITECTURE [3]

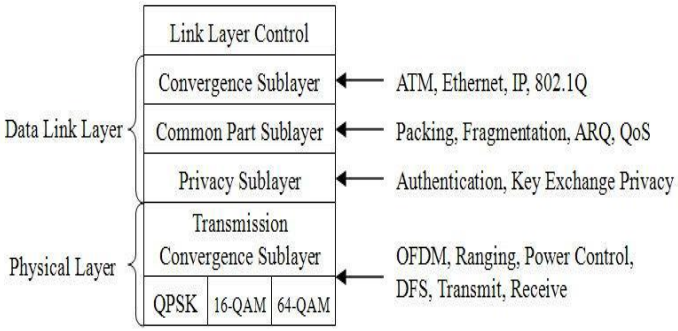

Fig. 2. Architecture of WiMAX layer

Physical layer functions are,

- Encoding /decoding of signals
- Preamble generation/removal
- Bit transmission/reception.

In the Data link layer, medium access control functions are:

• On transmission, assemble data into a frame with address and error detection fields
• On reception, disassemble frame, and perform address recognition and error detection
• Govern access to the wireless transmission medium
For the convergence layer, functions are,

- Encapsulate PDU framing of upper layers into native 802.16 MAC/PHY frames
- Map upper layer's addresses into 802.16 addresses
- Translate upper layer QoS parameters into native 802.16 MAC format
- Adapt time dependencies of upper layer traffic into equivalent MAC service.

VI. PORTABLE WiMAX

802.16e provides enhancements to 802.16-2004 to support subscriber stations moving at vehicular speeds Š standard specifies a system for a combined fixed and mobile broadband wireless access [6].
802.16e can offer full-mobility for WiMAX and thus it can be considered as a real competitor for 3G for example in IPtraffic (VoIP / IPTV). Š 802.16e supports seamless handoff which provides switching between base stations in vehicular speeds. Š Mobile WiMAX uses Scalable OFDMA multiplexing which maximizes the spectral efficiency.
It attracted a significant number of Forum members towards an opportunity to substantively challenge existing 3G technology purveyors. While clearly based on the same OFDM base technology adopted in 802.16-2004, the 802.16e version is designed to deliver service across many more sub-channels than the OFDM 256-FFT. It is notable that both standards support single carrier, OFDM 256-FFT and at least OFDMA 1K-FFT. The 802.16e standard adds OFDMA 2K-FFT, 512-FFT and 128-FFT capability. Sub-channelization facilitates access at varying distance by providing operators the capability to dynamically reduce the number of channels while increasing the gain of signal to each channel in order to reach customers farther away. The reverse is also possible. For example, when a user gets closer to a cell site, the number of channels will increase and the modulation can also change to increase bandwidth. At longer ranges, modulations like QPSK (which offer robust links but lower bandwidth) can give way at shorter ranges to 64 QAM (which are more sensitive links, but offer much higher bandwidth) for example. Each subscriber is linked to a number of sub-channels that obviate multi-path interference. The upshot is that cells should be much less sensitive to overload and cell size shrinkage during the load than before. Ideally, customers at any range should receive solid QOS without drops that 3G technology may experience [4].

VII. QoS SERVICE CLASSES IN WiMAX [5]

The IEEE 802.16d WiMAX standard offers four categories for the prioritization of traffic:
(1) Unsolicited Grant Service (UGS).
(2) Real-Time Polling Service (rtPS).
(3) Non-Real Time Polling Service (nrtPS).
(4) Best Effort (BE).
Each of these service classes is intended for specific application(s).

7.1 Unsolicited Grant Service (UGS)

It supports real-time constant bit-rate (CBR) data flows. Fixed size data packets are accepted by the BS at periodic intervals, with firm guarantees for bandwidth and access delay. UGS is suitable for applications that require a constant bandwidth and limited delay variation, such as Skype VoIP without silence suppression.

7.2 Real-Time Polling Service (rtPS)

Also supports real-time applications, but with variable bit-rate (VBR) and less stringent delay/jitter requirements (e.g., video conferencing, video streaming, VoIP with silence suppression).The BS provides transmission opportunities to each SS periodically via a basic polling mechanism.

7.3 Non-Real-Time Polling Service (nrtPS)

It is intended for use by non-real-time applications requiring better than best effort service in terms of bandwidth, but that are not delay sensitive. Examples include file transfer or database applications.

7.4 Best Effort (BE)

Service is for best effort applications with elastic traffic, such as email, Web browsing, and telnet. No guarantees in terms of bandwidth, delay, or request access are offered by the BS. This service has the lowest priority.

Service Class	Description	Applications
Unsolicited Grant service(UGS)	For constant Bit rate and delay dependent applications	VOIP
Real Time Polling Service (rtPS)	For variable rate and delay dependent applications	Streaming audio , video
Extended Real time Service (ertPS)	For variable rate and delay dependent applications	VOIP and Silence Suppression
Non real time polling service (nrtPS)	Variable and non real time applications	FTP
Best Effort (BE)	Best effort	Email , Web Traffic

Table. 1. QoS Service Classes in WiMAX

VIII. QoS PARAMETERS FOR WiMAX NETWORKS [5]

The QoS (Quality of Service) is majorly provided by the network itself and may be described by various objective parameters called as QoS parameters which affect the performance of WiMAX network. QoS more narrowly refers to meeting certain requirements typically, throughput, packet error rate, delay, and jitter associated with a given application or a service class.

8.1 Delay
Delay or latency could be defined as the time taken by the packets to reach from source to destination. The main sources of delay can be categorized into: propagation delay, source processing delay, network delay and destination processing delay.

8.2 Packet Delay variance (Jitter)
Jitter could be termed as the variation in delay or packet delay variation. The value of jitter is calculated from the end to end delay. Measuring jitter is critical element to determining the performance of network and the QoS the network offers. It is the variation in the time between packets arriving. Jitter is commonly used as an indicator of consistency and stability of a network.

8.3 Packet Delivery Ratio (PDR)
Packet delivery ratio signifies the total number of packets successfully delivered to the destination.

8.4 Packet Loss Ratio (PLR)
Packet loss affects the perceived quality of the application. Several causes of packet loss or corruption would be bit errors in an erroneous wireless network or insufficient buffers due to network congestion when the channel becomes overloaded. Some of the packets are lost due to network congestion or due to noise. Packet loss ratio should be minimum, so as to keep the successful delivery of high QoS. According to ITU (International Telecommunication Union) standards, the value of packet loss should be kept at minimum level.

8.5 Throughput (Th)
Throughput is measure of number of packets successfully delivered in a network. It is measured in terms of packets/second. The value of throughput should be high or else it affects every service class defined in WiMAX.

IX. REFERENCES

[1] Computer networks 4th ed andrew s. tanenbaum prentice hall

[2]https://en.wikipedia.org/wiki/WiMAX#cite_note-Carl_Weinschenk-1

[3] IEEE 802.16: WiMAX Overview, WiMAX Architecture Mojtaba Seyedzadegan and Mohamed OthmanInternational Journal of Computer Theory and Engineering, Vol. 5, No. 5, October 2013

[4] WIMAX TECHNOLOGY AND ITS APPLICATIONS Gyan Prakash, Sadhana Pal /International Journal of Engineering Research and Applications (IJERA) ISS : 2248-9622 www.ijera.com Vol. 1, Issue 2, pp.327-336

[5] QoS for WiMAX Networks: A Review Paper Abozar Ahmed Mukhtar Ahmed and Dr. Amin Babiker A\ Nabi Mustafa, International Journal of Engineering, Applied and Management Sciences Paradigms, Vol. 20, Issue 01 Publishing Month: December 2014, An Indexed and Referred Journal ISSN (Online): 2320-6608, www.ijeam.com

[6] http://www.cs.tut.fi/kurssit/TLT-6556/Slides/3-802.16e.pdf

ABOUT AUTHORS

Aakash Patel studied Electronics and Communication Engineering from July-2012 to June-2016 at LDRP INSTITUTE OF RESEARCH AND TECHNOLOGY, Gandhinagar -382015

Anuragsingh Rajpoot studied Electronics and Communication Engineering from July-2012 to June-2016 at L D College of Engineering, Ahmedabad-380015

Namrata Gadani studied Electronics and Communication Engineering from July-2012 to June-2016 at L D COLLEGE OF ENGINEERING, Ahmedabad-380015

Poonam Pansinia studied Computer Engineering from July-2012 to June-2016 at LDRP INSTITUTE OF RESEARCH AND TECHNOLOGY, Gandhinagar -382015