

A Survey Paper on WiMAX Technology

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Abstract— WiMAX stands for Worldwide Interoperability for Microwave Access and can be utilized for longer distance wireless communication escorted easily delivering high data rates to large geographical areas. WiMAX aims to give a metropolitan Access Network, which will give large coverage and bandwidth. This paper provides basic information about WiMAX in terms of what it is its features, and Architecture of the network, Portable WiMAX, QoS (Quality of Service) of WiMAX, Parameters as well as Security.

Keywords—WiMAX, Portable WiMAX, QoS, WirelessMAN, Security

I. INTRODUCTION TO WiMAX

WiMAX is one of the hottest broadband wireless communication technologies that offer communication of wireless data through different communication methods, alike as portable or completely mobile internet access through point to multi point's connections. WiMAX technology is actually depends on the quality that assembling the chance to distribute the last mile wideband access as a replace with the regular cable and DSL lines. It is also known as "Air Interface for Fixed Broadband Wireless Access System" and can offer two types of wireless service: Line-of-Sight Service (LoS) and Non-Line-of-Sight Service (NloS)[1].

II. IEEE 802.16

In the year of 1999, the Institute of Electrical and Electronics Engineers (IEEE) working group is set up, which examines the broadband radio access technology standards. The objective of this group is to install a worldwide broadband radio access standard. The air interface standard and associated standards settles through this committee. At the starting of the year of 2003, this committee issues the 802.16a standard that defines the 2GHz to 11 GHz NLOS fixed access system. 1st October 2004, this group issues the 802.16d fixed access standard and in the year of 2005, this group proceed the 802.16e standard [2].

III. WiMAX FEATURES

WiMAX is an appreciable innovation in radio communication technology, that offering wideband access to

mobile users. WiMAX technology has salient features that are given below:

- WiMAX provide adaptive modulation and coding
- WiMAX encourage multipath
- WiMAX support for TDD and FDD
- WiMAX support advanced antenna techniques
- Provide broadband
- WiMAX strong encryption
- Robust security
- Support for mobility
- IP-based architecture
- Quality of service support[3]

IV. ARCHITECTURE OF WiMAX NETWORK

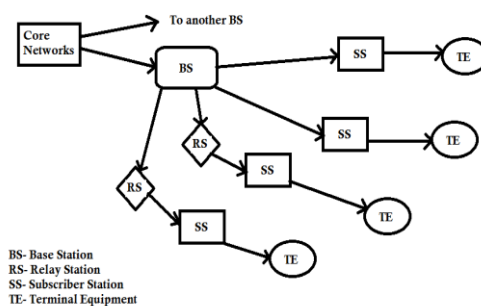


Figure 1. Architecture of WiMAX network

WiMAX system contains two kinds of stations:

- **Subscribe Stations (SS):** The Subscribe Station is a stationary WiMAX effective radio system that communication with a BS while it may also link to a

transmission terminal in multi-hop transmission network operations.

- Base Station (BS): The Base Station is the junction that orderly links wireless follower devices to operate the network. The Base Station continues communication with follower to the operation network.

The SS and BS have two methods for transmission:

- Uplink (from Subscribe Station to Base Station)
- Downlink (from Base Station to Subscribe Station)

V. Layer Architecture of WiMAX

The functions of the physical layer are signal encoding or decoding, preamble generation or removal, and bit transmission or reception.

In the Data connect layer, the functions of MAC are:

- On communication, collect data with address and error detection fields into a frame
- On receiving, disassemble frame, and work address identification and error detection
- Govern access to the wireless communication medium

For the convergence layer, functions are:

Encapsulate PDU framing of upper layers into local 802.16 MAC/PHY forms, map higher layer's addresses into 802.16 addresses, convert higher layer QoS specifications into local 802.16 MAC form and adjust time dependence of higher layer traffic into similar medium access control service.

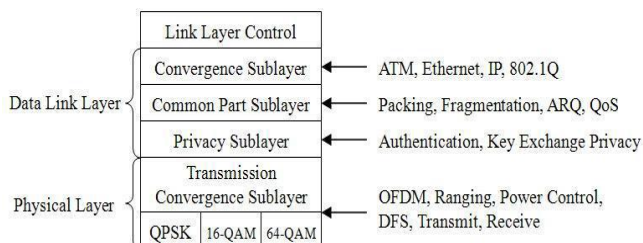


Figure 2. Layer Architecture of WiMAX

Physical Layer

The functions of physical layer are:

- Encoding and decoding of signal
- Preamble generation or removal
- Bit transmission or reception
- Map upper layer's address into 802.16 addresses
- Convert higher layer QoS specifications into local 802.16 MAC form
- Adjust time dependencies of higher layer traffic into similar MAC services

The physical layer supports:

- Orthogonal Frequency Division Multiplexing (OFDM)

- Time Division Duplex (TDD)
- Frequency Division Duplex (FDD)
- Quadrature Phase Shift Keying (QPSK)[4][5]

VI. Portable WiMAX

802.16e provides improvements to 802.16-2004 to support subscribe stations moving at vehicular speed and quality to a system for a combined fixed and mobile broadband wireless access.

802.16e can provide full-mobility for WiMAX and hence it can be considered as a real competitor for 3G.

It attracted a significant number of forum members towards an opportunity to substantively challenges existing 3G technology purveyors. While clearly based on the same OFDM base technology adopted in 802.1-2004, the 802.16e version is designed to deliver service across many more sub-channels than OFDM 256-FFT. It is notable that both standards support single carrier, OFDM 256-FFT and least OFDMA 1K-FFT [6].

VII. QUALITY OF SERVICES CLASSES IN WiMAX

There are five different types of QoS for WiMAX that are given below:

- a. Unsolicited Grant Service (UGS).
- b. Real-Time Polling Service (rtPS).
- c. Non Real-Time Polling Service (nrtPS).
- d. Best Effort (BE).
- e. Extended Real-Time Variable Rate Service (ERT-VR).

a) Unsolicited Grant Service (UGS)

UGS is supports real-time data streams which generate data packet and are accepted by the BS at periodically, which are fixed-sized. The grants assign are basically of two kinds i.e. grant period and grant size. Thus, it is sufficient for sending data packets like as VOIP without silence suppression.

b) Real Time Polling Service (rtPS)

The rtPS is support real-time data streams as UGS but with variable bit-rate and less stringent delay/jitter requirements like as MPEG (Moving Pictures Experts Group) that provide variable-size data packets on a periodic basis.

c) Non-Real-Time Polling Service (nrtPS)

The nrtPS is support non-real-time data streams that containing of variable size data packets and minimum data rate is required like as FTP or HTTP and grant to the voice users on regularly. This service basically supports those applications to make requests even through network congestion is in progress.

d) Best Effort (BE)

Best Effort service support data streams that don't require minimum service level and which give efficient service to the best effort during the network congestion. This service has the lowest priority.

e) Extended Real-Time Variable Rate (ERT-VR) Service

Extended Real Time Polling Service is offered in the series to take out the drawbacks of both UGS and rtPS. It is also called as extended real-time polling service (ErtPS) [7].

Table 1. Quality Of Services In WiMAX

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

VIII. QoS PARAMETERS FOR WiMAX NETWORKS

The Quality of Service is foremost given by the network itself and may be defined through several guidelines known as Quality of Service guidelines which affect the operation of WiMAX network. Quality of Service more narrowly mention to meeting certain necessity typically, the throughput, average delay, jitter and packet loss related with specified applications.

a. Throughput

Throughput is determined as the entire unit of packets effectively distributed in a network. This is determined in terms of packet/seconds. The value of throughput should be else it affects every service class explained in WiMAX.

b. Delay

Delay could be explained as the total time taken by the packets to transverse from beginning to end. The most important beginning of delay can be further classified into many forms and these forms are classified as propagation delay, source processing delay, processing delay, network delay and end processing delay.

c. Jitter

Delay change is the change in the delay developed through the elements along the transmission path. The jitter value is calculated from the end to end delay. Jitter is often used measurement of dependability and security of a network. Calculating jitter is a critical element to deciding the performance of the network and the Quality of Service that network provides.

d. Packet Loss Ratio

The packet loss ratio influences the recognized standard of the request. Some sources of packets are lost or misconduct would be fault in wrong wireless system because of network traffic or due to noise when the channels turn overburden.

e. Packet Delivery Ratio

Packet delivery ratio indicates that the entire unit of packets that are successfully sent to the station [8].

IX. SECURITY IN WiMAX NETWORK

Security architecture for WiMAX network should support the given conditions.

A. Privacy: To protect the data network while transferring from beginning to end.

B. Data Integrity: Make sure that user data is protected from interfere.

C. Authentication: To ensure that the given users or devices should be able to confirm the authenticity of the net.

D. Authorization: To confirm that a particular services are authorized to a certain users.

E. Access control: Make sure that the offered services are authorization to authorized users only [3].

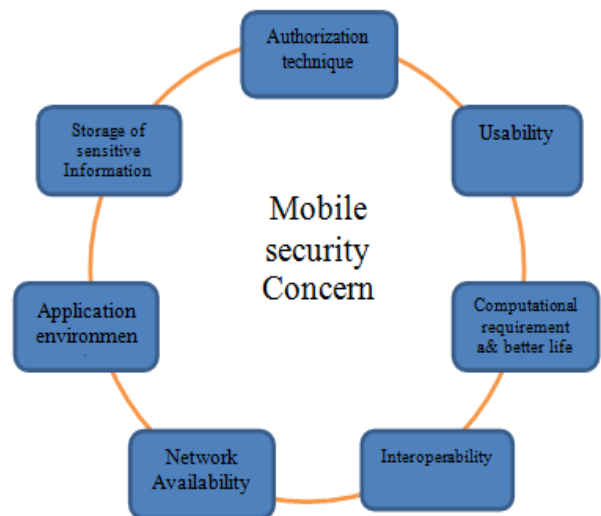


Figure 3. Security in WiMAX Network

X. WiMAX BENEFITS

- Sure wide market acceptance of developed and components
- Cheaper manufacturing price
- Reduced risk
- Fast supply of low price elements.
- Liberty to attention on evolution of web work factor dependable escorted by middle capabilities, during noticing that apparatus will interoperate with third party products
- Engineering development efficiencies.
- Low investment risk
- Capability to tailor the network to particular requests through combining and equivalent equipment from dissimilar seller
- Low follower charge
- More selection of stations allow price production testing
- Lower service rates over time [6]

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