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DESIGN AND SIMULATION OF MOBILE WIMAX NETWORK USING OPNET MODELER

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Master's Thesis

Supervisor

Asst. Prof. Dr. Ayça Kurnaz TÜRKBEN

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The thesis titled DESIGN AND SIMULATION OF MOBILE WIMAX NETWORK USING OPNET MODELER prepared by AHMED KADHIM RESEN and submitted on 16/12/2022 has been **accepted unanimously** for the degree of Master of Science in Electrical and Computer Engineering

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Ahmed Kadhim RESEN

Signature

DEDICATION

I want to recommend and give the acknowledgements to persons who help me to accomplish this journey, father, mother, sisters, brothers, and nearest friends.

PREFACE

I want to preface people were support me along this journey in additional to that, Asst. Prof. Dr. Ayça Kurnaz TÜRKBEN for her help.

ABSTRACT

DESIGN AND SIMULATION OF MOBILE WIMAX NETWORK USING OPNET MODELER

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Transmission weakness signals, low bitrate, low distance with heavy and light services on Orthogonal Frequency Division Multiplexing (OFDM) based lowest throughput and the least response could being a big problem should to solve it, additionally depend on the Quality of Service (QoS) that can classify to heavy and light on this network topology to avoid packet data loss with additional IP network based distributed load on overall entire network and nodes, the design of this network can be divided in three common WiMAX Network each on between them work with different number of Base Station connected indirect by a Ethernet Server than consists of Cloud IP and Router were are contribute to solve different type of services when compared to WiMAX heavy delay 25 sec and light delay 28 sec, the heavy throughput 3500 bitrate and light throughput 6400 bitrate, Traffic Sent on heavy and light for packets, 4045 and 5800 is requires for this type of comparison according to the overall system design can be implement by using OPNET Modeler.

The utilize of mobile WiMAX network for huge bitrates is able by the utilize of reliability and scalability for the suggested system additionally, based on the open system interconnected layers there are multiple Quality of Service are applied in this proposed work to enhance the

WiMAX network by insert the oriented routers, which generates high services for the end users.

Keywords: Heavy Service, Light Service, OPNET Modeler, Quality of Service, WiMAX Mobility.

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ABBREVIATIONS

WIMAX	:	Worldwide Interoperability for Microwave Access.
QoS	:	Quality of Service.
OFDMA	:	Orthogonal Frequency Division Multiplexing Access.
FTP	:	File Transfer Protocol.
ES	:	Email Service.
PPPOE	:	Point to Point Protocol Over Ethernet.
MWN	:	Mobile WiMAX Network.
IP	:	Internet Protocol.
LOS	:	Line Of Sight.
IEEE	:	Institute of Electrical and Electronics Engineers.
MAN	:	Metropolitan Area Network.
DSL	:	Digital Subscriber Line.
SOFDMA	:	Scalable Orthogonal Frequency Division Multiplexing Access.
MTG	:	Mobile Technology Group.
MAC	:	Media Access Control.
MAP	:	MAPPING.
MIMO	:	Multiple Input and Multiple Output
ISO	:	International Standard Organization.

NWG	:	Network Working Group.
AES-CCM	:	Advanced Encryption Standard- Cipher Chaining Message.
SAM	:	Subscriber Identity/Identification Module.
HMAC	:	Hash-based Message Authentication Code.
USIM	:	Universal Subscriber Identity Module.
CMAC	:	Cipher-based Message Authentication Code.
VoIP	:	Voice over Internet Protocol.
EAP	:	Extensible Authentication Protocol.
CDMA	:	Code Division Multiple Access.
HARQ	:	Hybrid Automatic Repeat Request.
3G	:	Third Generation.
UL	:	Up-Link.
DL	:	Down-Link.
MPLS	:	Multi-Protocol Label Switching.
ISI	:	Inter-symbol Interference.
CQICH	:	Channel Quality Indicator Channel.
UFDM	:	Universal Factory Data Model.
CP	:	Cerebral Palsy.
PUSC	:	Partially Used Sub Channelization.
ASN	:	Access Service Network.

CSN	:	Connectivity Service Network.
NSP	:	Network Service Provider.
DOCSIS	:	Data Over Cable Service Interface Specification.
ASP	:	Application Service Provider.
TCP/IP	:	Transmission Control Protocol / Internet Protocol.
MSS	:	Mobile Subscriber Station.
ADSL	:	Asymmetric Digital Subscriber Line.
SIM	:	Subscriber Identity Module.
AMC	:	Adaptive Modulation and Coding.
KP	:	Kinetic Potential.
IFFT	:	Inverse Fast Fourier Transform.
NLOS	:	Non-Line-Of-Sight.
RF	:	Radio Frequency.
BSS	:	Basic Service Set.
Wi-Fi	:	Wireless Fidelity.
TCP/IP	:	Transmission Control Protocol/Internet Protocol.
IEFT	:	Internet Engineering Task Force.

1. INTRODUCTION

In general, Worldwide Inter-operability for Microwave Access which referred to the WiMAX term which means for rules gathering for IEEE-802.16 gives twice sorts for broad-banding accesses, fixing despite flexible access on broadcast correspondences scene. WiMAX running in twice the bandwidth, reached within 10-GHz and 66-GHz additional to that, the un-licensed for 2-GHz, 11-GHz channels of action in Line-of-Sight (LOS) notwithstanding the Non-Line-of-Sight (NLOS) of every gathering [1]. At first, Wireless interoperability for microwave access was assigned through a response for last miles broadband access, avoiding critical system appraisals overseeing approaches of connections and digital subscriber line. Starting there ahead, Mobile WiMAX qualifies of four generation essentials of information adaptable associations testing demanded of endorsers where gives upper bit per rates to IP networking were accomplishing of proposed mind-blowing Quality of Service as presented in Figure 1.1 [2].

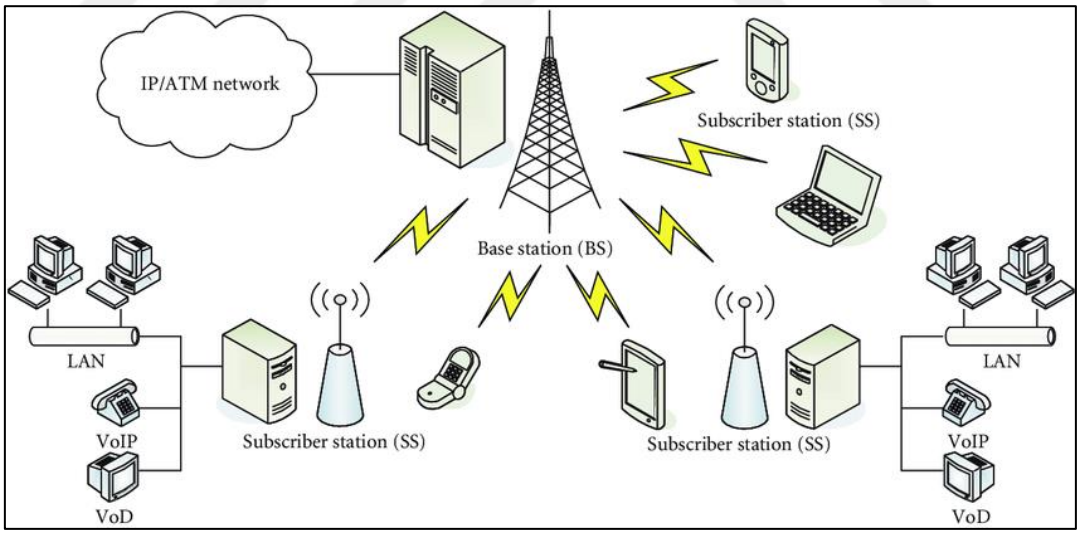

Figure 1.1: IEEE 802.16 Protocol Example-based Entire Network [2].

This development for Worldwide interoperability for microwave access considered such the air ethernet standards while is promptly validated it-self for showing the basic occupation of the fix additional to that, versatile broadbands of remote Metropolitan Area Network (MAN),

also when an improvement advancement such an orthogonally frequencies division multiplex can apply while incites sent go against of dissipating these efficiencies for multipath also reducing itself. the upper bites per rate also an attestation for Quality of Service giving via IEEE802.16 standard has financially coordinated is attainable of blended media apps support like videos on demanding, accounts correspondence, accounts game, like mobile television broadcasting [3].

Flexible Wireless interoperability for microwave access expresses as the explanations of broad banding distant which helps association for every broadband's association, versatile, fixing, on the run of the mill radios accessing width-running broadbands development, designing for versatile associations. Orthogonal Frequency Division Multiplexing Access (OFDMA) of refreshed shows for multiple-way conditions, where scalability orthogonally frequencies division multiplex it acquainted as IEEE 802.16e Modification with sponsorship versatile repeat bandwidths start via 1.25 up to 200-MHz as present in Figure 1.2 [4].

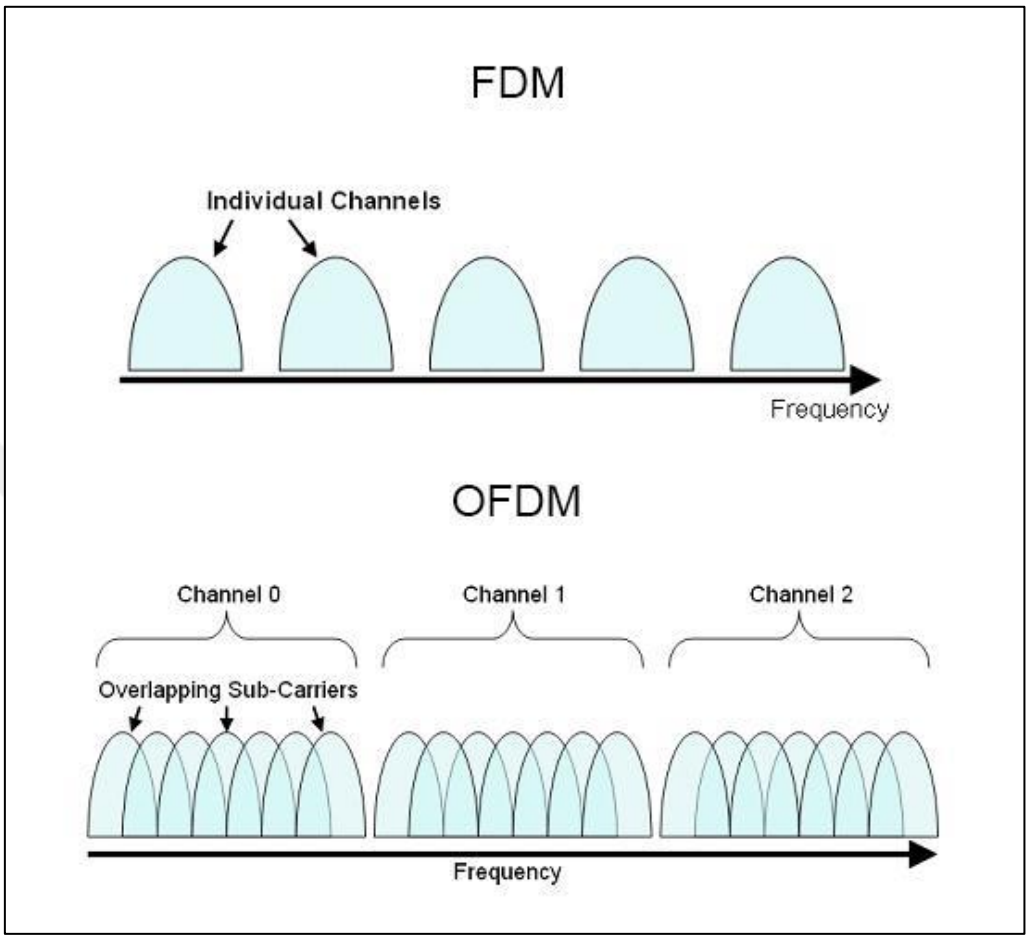

Figure 1.2: OFDM Overlapping Sub-Carriers [4].

On distant correspondence structures, numerous components sway the components of the got signal, specifically way hardship type, the scope between base stations interfering and a sought-after client, log-typical shadowing, Rayleigh obscuring of a short period of time despite fuss. For additional creating breaking point of the system, an apex data rate other than incorporation constancy should be changed, furthermore, the imparted signal from or to a specific director is changed [5].

1.1 MOTIVATION

Utilizing WiMAX throughout the network could reduce overall error and throughput. In addition, base stations were proposed to bring and improve the network's efficiency when connected via 1000BaseT cable to end users. During transmission, there was a significant

increase in the number of interested parties in the mobile WiMAX network. Currently, WiMAX equipment requires a proper administration, such as video conferencing, voice over internet protocol, and file transfer protocol, and other administrations may demand a greater transmission capacity, such as Wi-Fi. Considering the cost, utilization facilities with a high cost of establishment may be of greater appeal. The concept can be extended to mobile WiMAX networks across great distances. For high coverage areas, theoretical research based on earlier studies was applied in accordance with IEEE 802.16. Due to the criteria of the WiMAX network being identified in 2001 by the main committee that proposed by International Standard Organization (ISO) was known via IEEE 802.16, the accessibility was applicable for mobile mobile phones. [6].

1.2 PROBLEM DEFINITIONS

While the development of WiMAX networks is predicated on Quality of Service (QoS), the main requirements for the data rates increments and the delay were regarded as the most important factors to be taken into account in a calculation, particularly when dealing with the base stations for the higher data rate network. Lowest bitrate transmission with the supplied local area network, especially when multiple frequencies are applied to the network as a whole, and a high degree of vulnerability when distance is applied to access points. With the lowest transceiver throughput not applicable with the type of cable in addition, Variety responds with the use of standard and a large number of customers in this case; for this reason, our proposed solutions will investigate these conflicts, which is the compatibility issue with the other multi-criteria for mobile WiMAX networks.

1.3 CONTRIBUTION OF THESIS

The main contribution of the proposed WiMAX Network is handled and prepared toward the mobility-based entire network with these aspects as follows:

i Propose and model the mobile WiMAX network with the highest bit rates and utilize the heavy and light services to bit rates increment to helpful highest speed depending on these services.

ii Study the suggested model by considering to the difference between WiMAX designs with the transmitting distances based on their developed parameters with decrease in the overall packet data and bits and over nodes to avoid this type of weakness is to use Mobile WiMAX Networks and apply it for each one of base stations it can be split into base station 1,2,3 respectively.

iii The WiMAX Network is applied and designed to give high efficiency for the WiMAX Topology and add Cloud IP Component to arrange and distribute the load on the WiMAX Network which can be applied to give and increase the overall load, throughput for both heavy and light services and decrease the WiMAX Delay, this research can lead to multiple solutions for the mobile network such as the ternary relation between students, university, an administrator with the services assist, nowadays the heavy and light became more important due to its facilities toward services usage additionally reliability, scalability, responses, when applied for WiMAX network, could reduce the delay on nodes and increase the file exchange information.

1.4 MOBILE WIMAX NETWORK (MWN)

WiMAX technology is based on the Institute of Electrical and Electronics Engineers (IEEE) 802.16-2004 radio interface standard. It quickly established itself as a key technology for fixed broadband wireless communications. The first certified laboratory was created in the CETECOM Laboratory More than 150 WiMAX trials are underway in Malaga, Spain. Europe, Asia, Africa, and America. Stable WiMAX, based on the IEEE 802.16-2004 radio interface standard, has become a cost-effective fixed wireless alternative to cable and Digital Subscriber Line (DSL) services. In December 2005, The IEEE approved the 802.16e amendment to the 802.16 standards. This amendment adds to Standard features and functions needed to support the motion. WiMAX, the association now defines computer performance profiles and IEEE-based certifications. 802.16 amendment regarding the Mobile Over the Air interface and the WiMAX forum Defining the network architecture required for mobile applications WiMAX two chain Version one of the system profiles will be completed in early

2016 many people from several WiMAX Forum organizations with long-standing experience in wireless technologies.as described in Figure 1.3 [7].

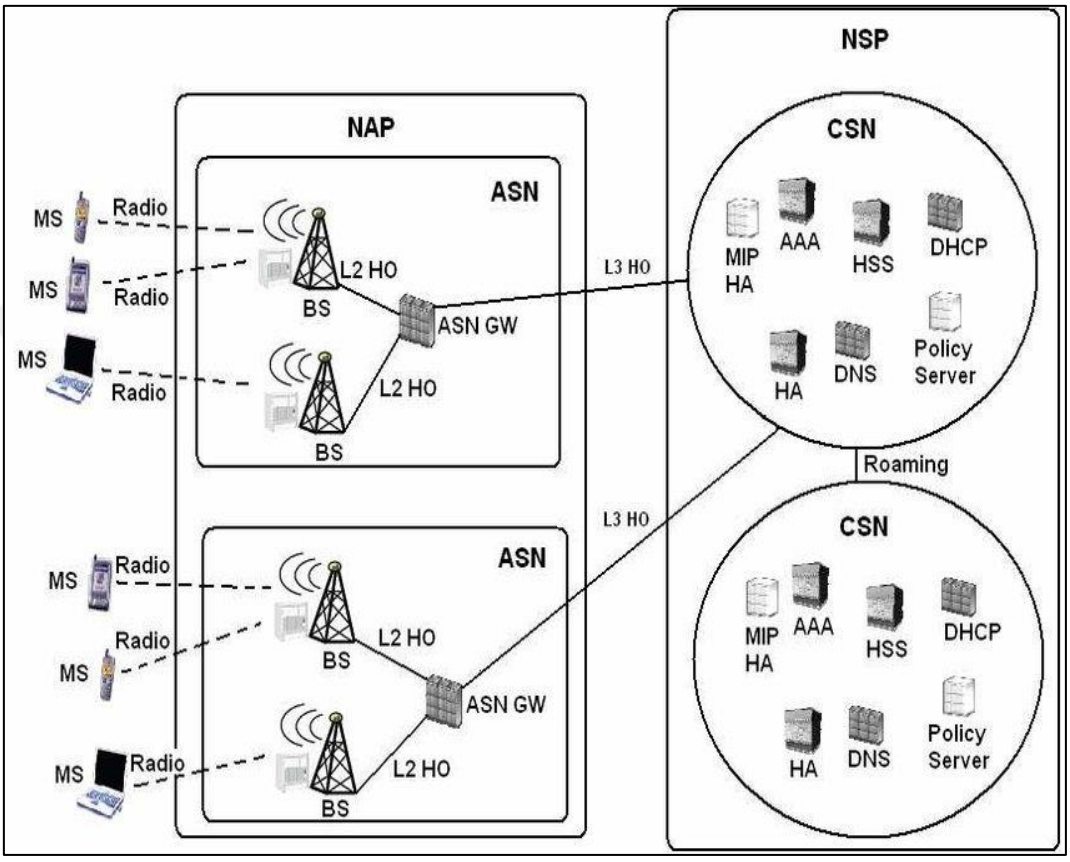

Figure 1.3: Network Access Point Based Wireless Station [7].

Mobile WiMAX is a wireless broadband solution that simplifies the integration of mobile and portable devices. Fixed bandwidth using public broadband radio Flexible network technology and architecture The WiMAX Air mobile interface uses the following, Orthogonal Frequency Division Multiplexing Access (OFDMA). Performance in the invisible medium is scalable OFDMA known via SOFDMA. The IEEE 802.16 amendment introduced support for scalable channel bandwidth utilization Mobile Technology Group (MTG). WiMAX Forum from 1.25 to 20 MHz while enhancing the mandatory and comprehensive specifications of the WiMAX mobile system, other aspects of the IEEE standard are required to create a Mobile WiMAX compatible wireless interface approved by the WiMAX connection. Mobile WiMAX System profiles allow us to organize our mobile settings based on typical key actions. It is designed to

provide the basic functions of end terminals and base stations, an interpolation of some elements of the original station specification is provided as an appendix. This provides more flexibility for deployment based on specific deployment scenarios with other structures optimized for capacity or coverage that may be required. WiMAX Mobile Release-1 profiles include 5, 7, 8.75, and 10 MHz channels. 2.3 GHz, 2.5 GHz, 3.3 bandwidths for global spectrum allocation license GHz and 3.5 GHz frequency range that described as both IEEE 802.16e and 802.16-2004 for broadband wireless high data throughput enables efficient data multiplexing and low data latency. Attributes essential to enable broadband data services including data, streaming video and VoIP with high quality of service (QoS) as in Figure 1.4 [8].

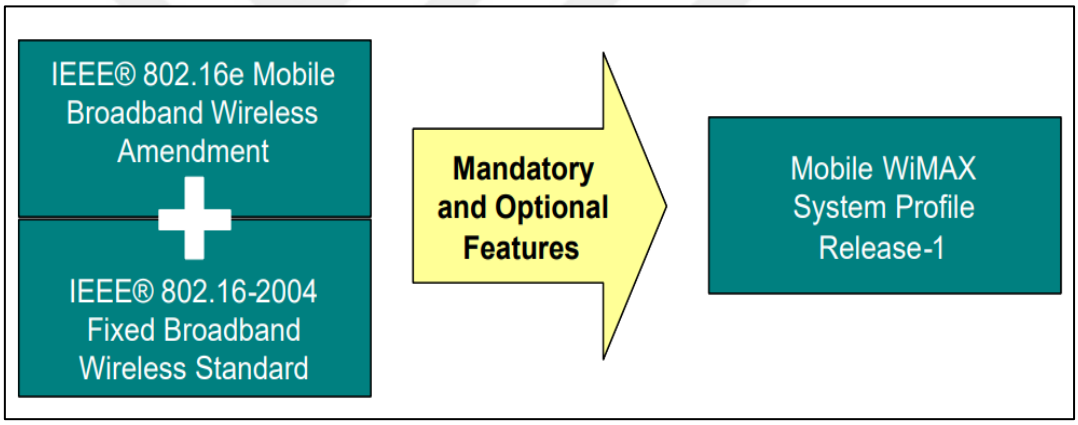

Figure 1.4: System Profile for Mobile WiMAX Network [8].

The WiMAX components consist of the Network Working Group (NWG). Network specifications of WiMAX cellular systems are more than defined in [9]. This is the IEEE 802.16 standard that deals with radio interface specifications. More supports the completion of the combined efforts of the IEEE 802.16 and WiMAX communities. System solutions for WiMAX mobile networks. Mobile WiMAX systems offer scalability of both wireless technologies and networks. This architecture offers more flexibility and network deployment capabilities Offer services. The most popular features supported by Mobile WiMAX:

i High data transmissions: Multiple Input and Multiple Output (MIMO) antenna technology combined with flexibility Internal channel design, advanced coding, and

modulation Mobile WiMAX technology with a maximum download data transfer rate of up to 63 Mbit/s per segment The maximum upload data rate is up to 28 Mbps per segment on a 10 MHz channel.

ii Quality of Service: basic IEEE 802.16 Media Access Control (MAC) Architecture based QoS. Different services define service flows that can be mapped to code points. Which enables Internet Protocol (IP) based QoS using Multi-Protocol Label Switching (MPLS) flow labels. In addition, subchannel and MAPPING that known as MAP-based signaling schemes provide flexible mechanisms for Optimal planning of space, frequency, and time resources through the air interface Legal basis as mentioned in Figure 1.5 [10].

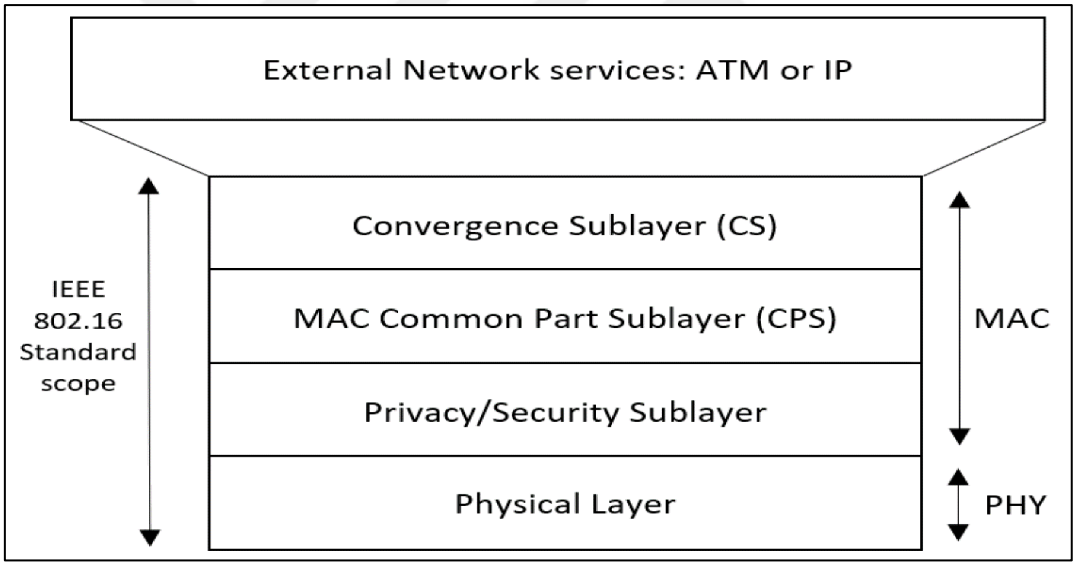

Figure 1.5: External Network Services Classifications [10].

iii Scalability: spectrum resources despite the growth of the global economy global deployment of wireless broadband continues to be uneven. Therefore, WiMAX technology is designed for various extensions. Channel 1.25 ~ 20 MHz according to global requirements in the long run, according to the Mobile communications enable various economies to realize the many benefits of WiMAX Technologies for specific geographic needs, such as providing low-cost internet access in rural areas and expanding mobile broadband access. Metro and suburban areas.

iv Securities: WiMAX mobile security is excellent. Extensible Authentication Protocol (EAP) -based authentication, encryption based on Advanced Encryption Standard-Cipher Chaining Message (AES-CCM) authentication. Check message protection schemes based on Cipher-based Message Authentication Code (CMAC) and Hash-based Message Authentication Code (HMAC). The technique is underground Subscriber Identity Module (SIM) card, Universal Subscriber Identity Module (USIM) card, and smart card, there is an EAP-based digital certificate and username/password scheme method for the type of loan described in Figure 1.6 [11].

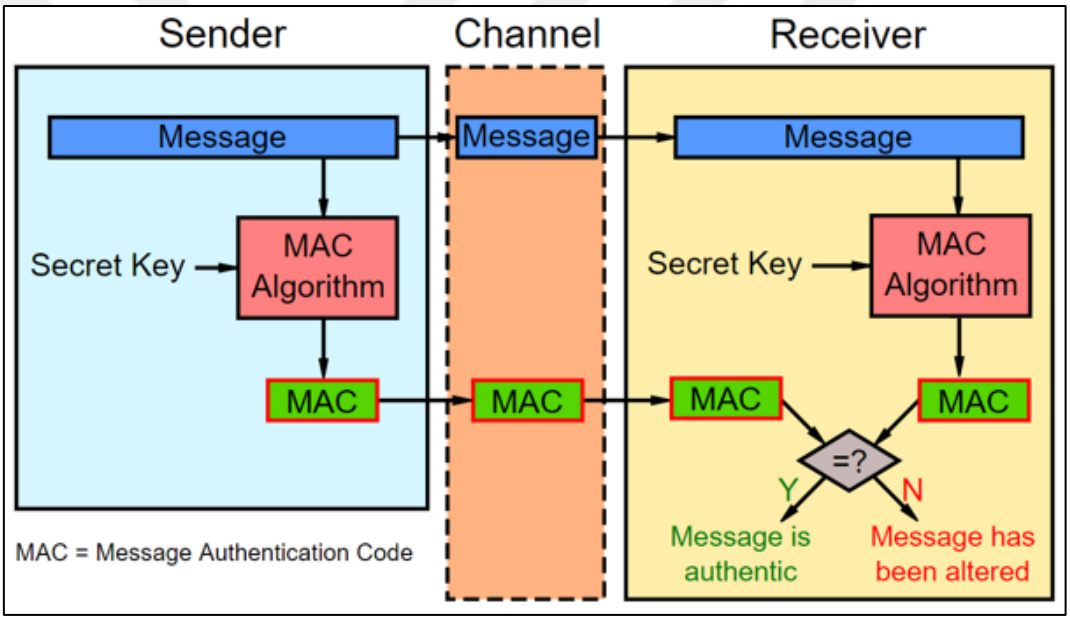

Figure 1.6: External Network Services Classifications [11].

v Mobilities: WiMAX Mobile supports an optimized transmission schedule with low latency. More than 50 milliseconds for real-time applications such as Voice over Internet Protocol (VoIP) to run without VoIP Degradation Ensure security with a flexible key management program Continue translating The WiMAX mobile business is growing, and equipment vendors are starting to use it. Aggressive equipment WiMAX / 802.16e-2005 participation Trading of WiMAX mobile devices, Mobile WiMAX. Provides a detailed explanation of WiMAX mobile technology. Based on the specifications and certification details of the planned WiMAX association

Predictive analysis of mobile WiMAX performance in a mobile environment. Everyone Readers interested in additional information are referred to the full bibliography. One of the features of WiMAX is discussed in the article. This work describes the development of Code Division Multiple Access (CDMA) based Third Generation (3G) systems and products. WiMAX Mobile Vs A comparative qualitative and quantitative analysis of 3G mobile technology as in Figure 1.7 [12].

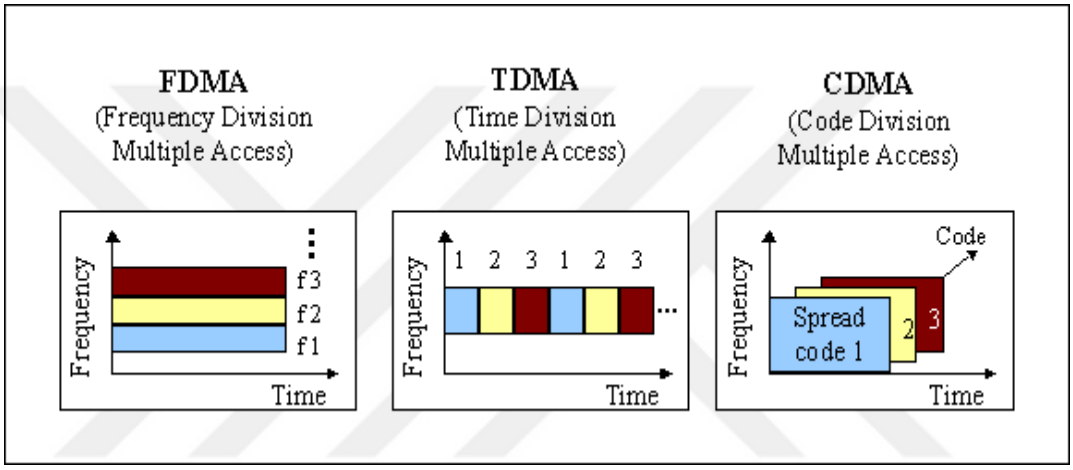

Figure 1.7: Division Multiple Access Comparison [12].

1.5 MWN ADVANTAGES

There are many advantages of the MWN model and these advantages that described with many applications related to the properties and related features of such systems. is supported to take advantage of higher peak rates and increased throughput. With spatial multiplexing, multiple streams are transmitted over multiple antennas.

i Coverages: the WiMAX station can provide service and coverage to hundreds of users at the same time and transmit and receive data with extremely high speed and complete network security.

ii Highest Speeds: high-speed connection and high-speed voice are required in densely populated areas.

iii Multipurposed: WiMAX technology performs multiple tasks at the same time, such as providing high-speed Internet, providing telephone services, data transmission, video transmission, and voice use.

iv Infrastructures: WiMAX infrastructure is very simple and flexible, ensuring maximum network reliability and physical access for end users.

v Network not cost: WiMAX provides a low-cost alternative network to Internet services provided by Asymmetric Digital Subscriber Line (ADSL), modem, or Local Area Network (LAN) based on the IEEE 802.16-2004 Air Interface Standard is rapidly proving itself as a technology that will play a key role in fixed broadband wireless metropolitan area networks as in Figure 1.8 [13].

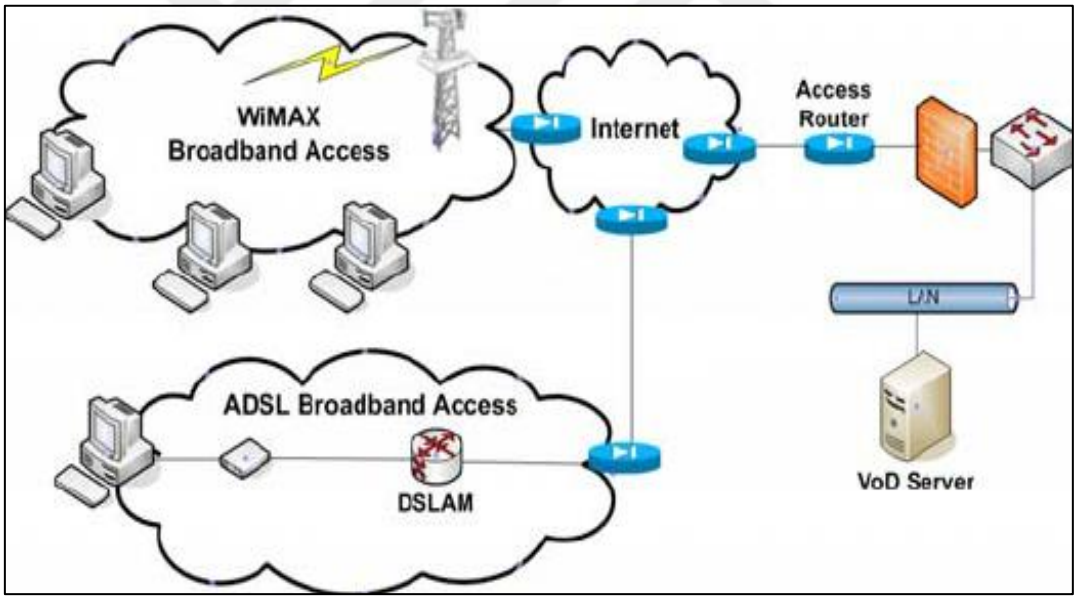

Figure 1.8: ADSL Broadband Access Routing [13].

vi Advancing Properties: WiMAX technology offers useful advanced features. WiMAX offers separate voice and data channels for entertainment, and semantic connectivity makes your network more secure than ever, offering faster connections, bandwidth, and freedom of movement [14].

1.6 MEDIA ACCESS CONTROL SCHEDULING FOR MWN

MAC WiMAX Mobile programming service is designed for efficient delivery. Broadband data services, including time-varying voice, data, and video broadband wireless channel The MAC Scheduling Service has the following functions with the Broadband data transmission services as follows:

Fast Data Scheduling: MAC scheduling should efficiently allocate available data. Resources that respond to time-varying data traffic and channel conditions. Using a scheduler for each base station to quickly respond to traffic packet data terms vary by service. A flow scheduler with fully defined QoS parameters at the MAC level precisely defines the way packets are transmitted over the air interface. With the Channel Quality Indicator Channel (CQICH) provides fast feedback on channel information to enable channel planning. Choose the right encoding and modulation for each task. It is acceptable in combination with Hybrid Automatic Repeat Request (HARQ), the modulation/coding scheme ensures stable transmission in time-varying channels. Scheduling for download and upload: Scheduling services are provided for Down-Link (DL) and Up-Link (UL) traffic. The MAC scheduler must provide accurate feedback to the UL to efficiently allocate resources and ensure the desired QoS in the UL. Real-time information about traffic status and QoS requirements. Multiple uplink bandwidth requests, such as limited bandwidth requests Channels, returns, and reconfigurations are designed to meet upload bandwidth requirements. The UL service flow defines a feedback mechanism for each uplink to provide predictable UL scheduling behavior. Also, there is no interference between cells using orthogonal UL subchannels. UL can schedule resources more efficiently and implement QoS better Advanced Coding and Modulation all enable the Mobile WiMAX technology to support peak DL data rates up to 63 Mbps per sector and peak UL data rates up to 28 Mbps per sector in a 10 MHz channel as in Figure 1.9 [15].

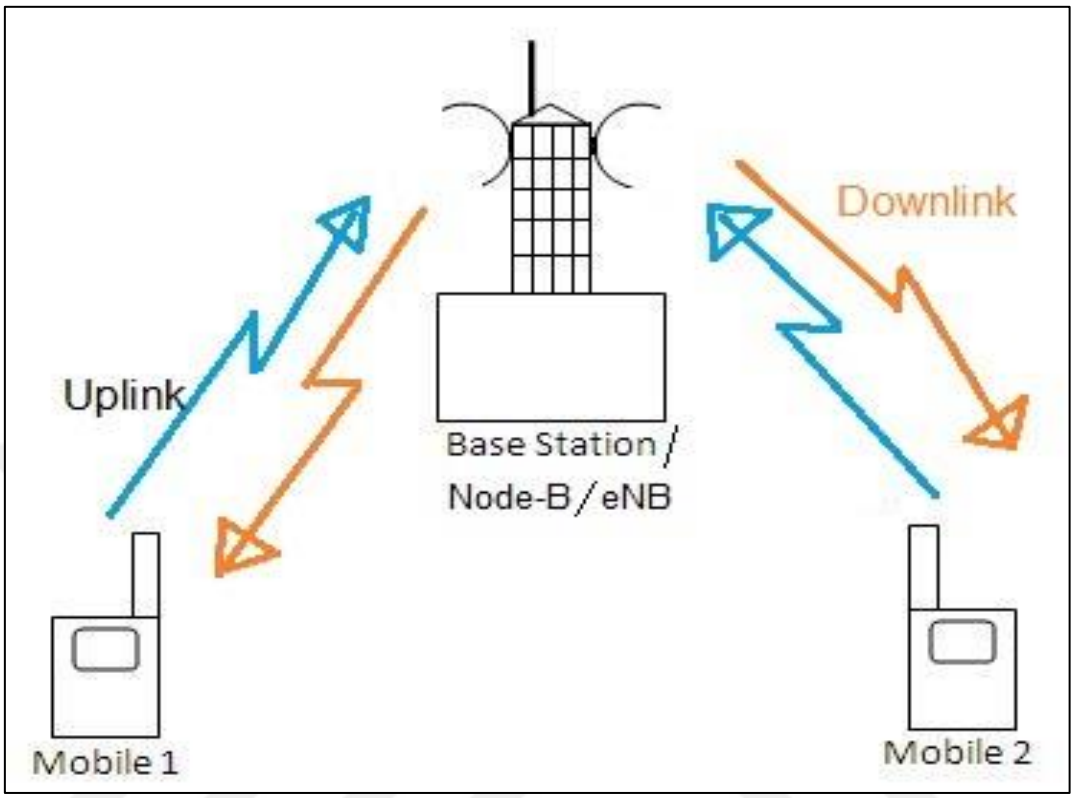

Figure 1.9: UL and DL Transmission Concept Example [15].

Dynamic resource allocation: MAC supports resource allocation with periodicity. Allocation by frame in both DL and UL. Resource allocation means: It is delivered as a MAP message at the beginning of each frame. Hence the sauce Allocations can be changed on a frame-by-frame basis in response to traffic and channels. Condition, in addition, the number of resources in each distribution can be different: One cell for the whole frame. This allows you to quickly and comprehensively allocate resources.

High QoS for data traffic. QoS depends on MAC scheduling and manages data traffic on each channel. Each connection set is associated with a data service QoS parameters that measure aspects of its behavior. with the possibility of dynamically allocating resources to DL and UL, the scheduler can ensure High QoS for DL and UL traffic. Especially for uplink plans - Upstream resources are allocated more efficiently, performance is predictable toward better QoS is supported that present in Figure 1.10 [16].

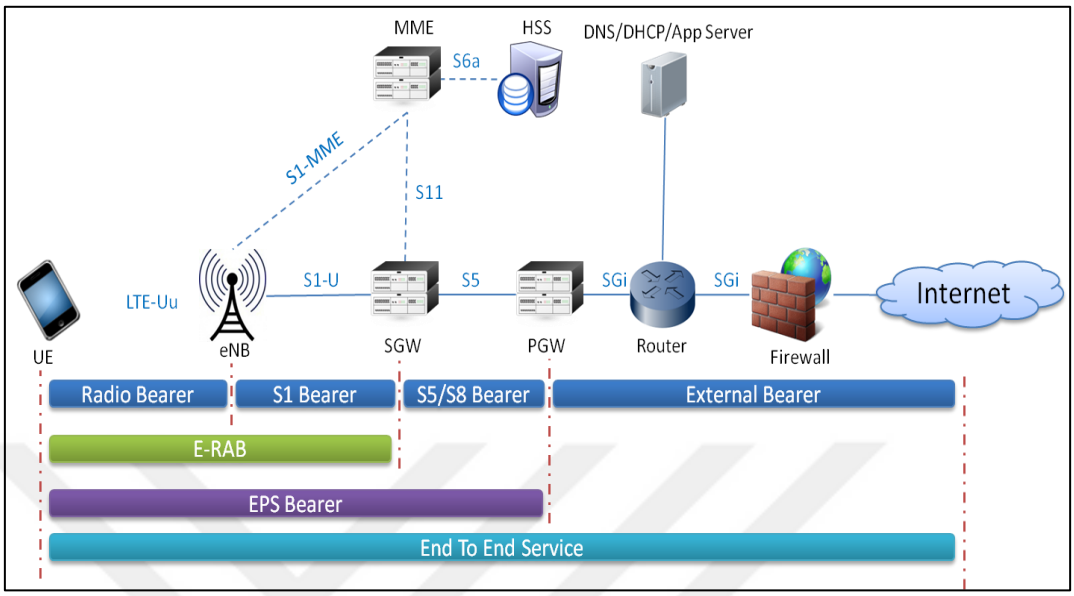

Figure 1.10: UL and DL Transmission Concept Example [16].

Selective frequency programming that the programmer can work in different modes. Subchannel For subchannels with different frequencies, such as Partially Used Sub Channelization (PUSC) switching with the subcarriers of the subchannels is pseudo-randomly distributed. Bandwidth, internal channel quality, etc. the frequency diversity scheme: QoS support through detailed and flexible scheduling of time-frequency resources. Adjacent switching subchannels such as Adaptive Modulation and Coding (AMC) switching is a strange dilemma. The additional frequency table can be divided into the following: Drive mobile users to more powerful internal channels. selected frequency CQI scheduling can increase system throughput with increased overhead in the university library. The contiguous permutation groups a block of contiguous sub-carriers to form a subchannel. The contiguous permutations include DL AMC and UL AMC and have the same structure. A bin consists of 9 contiguous sub-carriers in a symbol, with 8 assigned for data and one assigned for a pilot. In general, diversity sub-carrier permutations perform well in mobile applications while contiguous sub-carrier permutations are well suited for fixed, portable, or low mobility environments as shown in Figure 1.11 [17].

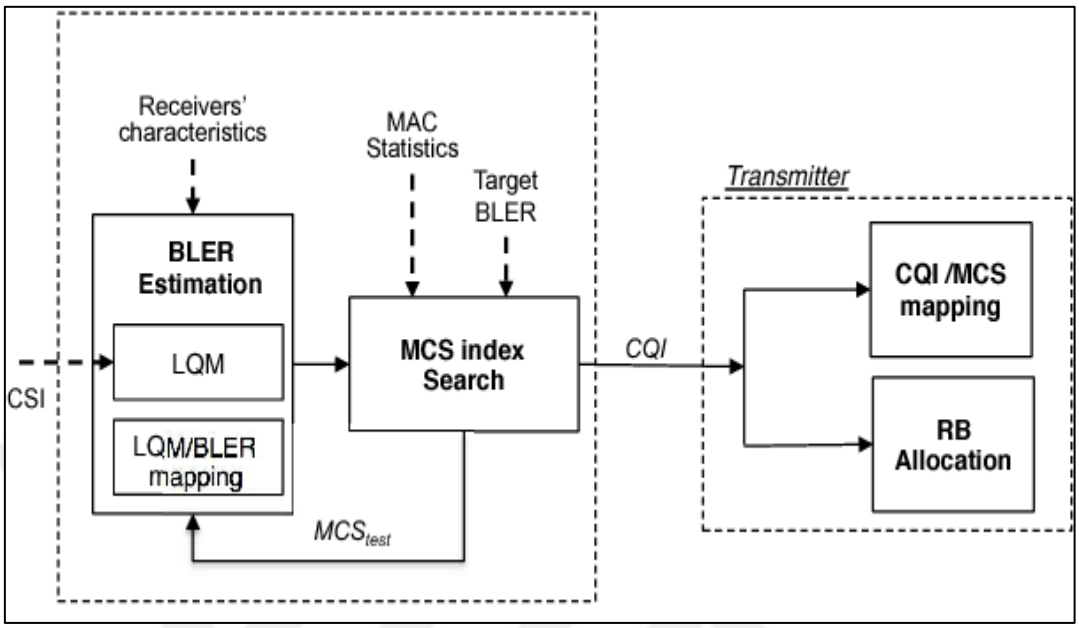

Figure 1.11: AMC Diagram with Transceiver [17].

1.7 MWN APPLICATIONS

WiMAX networks allow service providers to create a new idea of broadband services. WiMAX applications are more efficient than today. This base serves a wide range of customers and adds mobility capabilities to these services. Applications of WiMAX technology are a means for service providers to provide data, video, voice, mobile, and Internet access. WiMAX technology has many advantages, including enabling VoIP calls, mobile devices, video production, and high-speed data transmission, while providing easy cost savings and service efficiency [18].

WiMAX technology brings new elements to a modern mobile society. The primary applications served by WiMAX technology are business, consumer communications, and backhaul. WiMAX technology improves communication and allows you to quickly respond to situations, using the capabilities of video, data, and voice transmission. WiMAX technology helps customers use temporary communication services to support events and conditions and accelerate networks. WiMAX technology programs provide temporary access to the media, visitors, and employees. Since the company's equipment for these events is in the tower, it is

easily accessible. The main strengths of WiMAX technology applications are high bandwidth, high quality of service, security, deployment, and cost, including full duplex over DSL and cables [19].

1.8 OFDM OVERVIEW

OFDM (Orthogonal Frequency Division Multiplexing) is a multiplexing method. Divide the bandwidth into several frequency bands. In OFDM, the input data stream is divided into several parallel sub streams. Reduction of data rate (because of increased code length) and any modulated underflow and below are the individual orthogonal media. Improved long recording time OFDM power is slowly expanding. Also, insert a Cerebral Palsy (CP) for Inter-symbol Interference (ISI) if the CP exists. The duration is greater than the channel delay. CP usually repeats the last case of the data part of the associated data block. to die It is like the fact that the channel rotates and creates a more complex area. Everything The disadvantage of the Kinetic Potential (KP) is that the load is overflowing, and the ability to process CP -wide band is slightly reduced but the effect CP, as rotation is one carrier filtered by a cassette that increases the effect System. OFDM takes up more space because it has a very sharp, almost brick spectrum. Available reserved channel bandwidth for data transmission: Performance degradation due to cyclic prefixes that are present in Figure 1.12 [20].

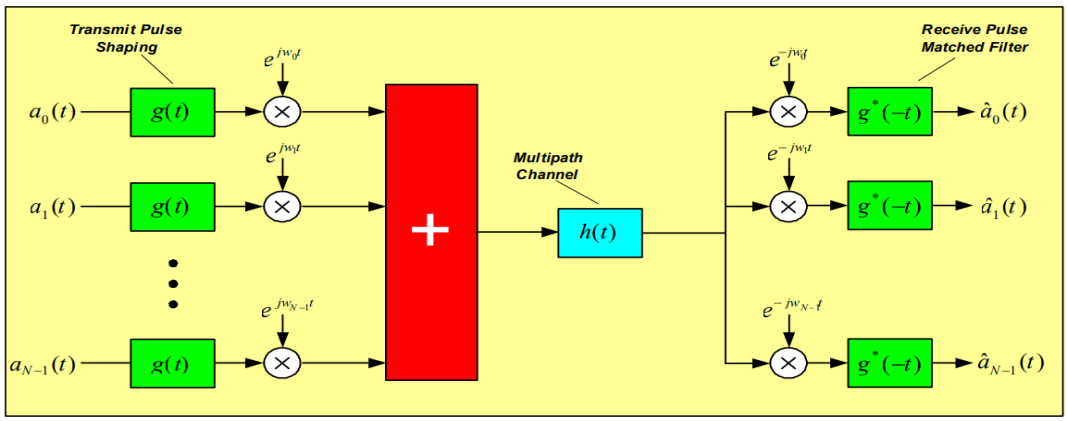

Figure 1.12: OFDM Architecture [20].

It uses frequency diversity of multipath channels through OFDM and coding. Interprets internal media information before transmission. Modulation can be activated by an Inverse

Fast Fourier Transform (IFFT) rapid turn. Low complexity allows many underground people (by 2048). In OFDM Systematic resources in the field of time through the symbols of the Universal Factory Data Model (UFDM) and the frequency range through the internal media. Sources of time and frequency: This is organized under dedicated to users. Orthogonal frequency Some segments (OFDMA) are multiple for multiple access systems. A data stream is activated by serving multiple users in the downlink. Multiple access is created through additional channels and subchannels as mentioned in Figure 1.13 [20].

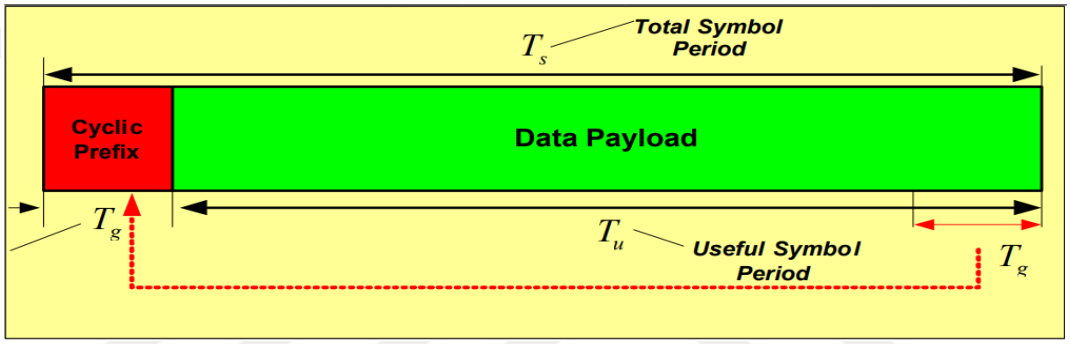

Figure 1.13: Prefix of Cyclic Insertion [20].

1.9 THESIS ORGANIZATION

In the first chapter, which incorporates the entire organization regarding the related issues with the mobile WiMAX network model, the MWN and their statements were explained in this section. Afterward, especially at this point, MWN modeling was given about the mobile WiMAX equipment. At last, the MWN usage advantages and OFDM architecture were handled in the remainders for this current section.

In the second chapter, most authors and authors were inserted for our literature survey, which was suggested and noted, the huge feature and multiple highlights between each review. The written audit was noted to our subject as propositionally, and the analysts on numerous inserted to it.

The third chapter, it experiments with the mobile WiMAX network connection applied with OPNET Modeler software that highlights cloud IP components and planning for our proposed

system. Additionally, the main pieces of the proposed system were dealt with in this partition. Moreover, the difference in hypotheticals perspective is made with different remunerations method is shown in this chapter.

The fourth chapter describes the proposed structure results via ponder different methodologies of base station insertion and closed via different services on video conferencing. These described results could be established in the throughput and delay. Moreover, this chapter handled the latest connections regarding our proposed system compared with previous work proposed by many researchers to accomplish the basis and efficiencies of our proposed structures.

In the fifth chapter, discuss the issues regarding the conclusion and future work ideas.

2. LITERATURE SURVEY

In [21] researchers discussed the investigation of WiMAX. The base station is equipped with common topologies that are used to serve the network. The performance of heavy services is combined with the OFDM. the higher delay presented in the case of throughput, additionally, the data rates had experimented for the model on 10 base stations with 100 base-T for data rates tested with a small coverage area. The obtained results were indicated for the lowest transmission up to 100 Mbps, the model showed effectiveness versus different distances. While, for data rate increment to 1000 Mbps, the WiMAX method depending on distances was shown the better entire performance when compared with other methods. The bit rates accomplished with respect to the suggested model that needed to be enhanced further.

In [22] authors proposed the illustration of a WiMAX network model that has the capability for 1000 base-T regard cabling usage via OPNET Modeler 14.5 software. The data rate accomplished was 1000 Mbps and the transmission distances reached to 5 km. The base station is equipped with common topologies that are utilized to serve the network. The performance of light services is combined with the mobile WiMAX network. the lower load presented in the case of throughput. Furthermore, the proposed effectiveness was done with 3 bases stations-based WiMAX model designed and given as throughput results were around 1500 Mbps while considered as the minimum threshold. This model needs to be improved by the values raise of throughput and the coverage area distances.

In [23] authors proposed the consideration of the WiMAX model that has a possibility for 1000 base-T with a new common base station insertion via OPNET Modeler 14.5 software. The bit rate achieved was 1000 Mbps and the distances reached to 15 km. The base stations were equipped with common structures that were used to reserve the entire network. The performance of heavy services are merged within the mobile WiMAX network for the model. the highest load is presented in the case of throughput. Furthermore, the proposed effectiveness was completed within 4 base stations-based WiMAX model modeled and given throughput results were around 2000 Mbps while considered as the minimum threshold. This model needs to be enhance via the values raising for throughput and the distances area.

In [24] researchers proposed the illustration of WiMAX model network that has the capability for 1000 base-T with a common backbone area network inserted via OPNET Modeler 14.5 software. The bit rate accomplished was 2000 Mbps and the coverages reached to 20 km. The base stations were connected within main structures that were utilized to serve the overall network. The performance of QoS services is merged with the fixed WiMAX network for the entire model. the highest load presented in the cases of throughput. Furthermore, the proposed effectiveness was completed within 5 base stations-based WiMAX model modeled and given as throughput results were around 3000 Mbps while considered as the minimum threshold. This model needs to be enhanced via the values raising for throughput and the distances area.

In [25] authors suggested the WiMAX model with 4 bridges as a consideration that has a possibility for 1000 base-T with the backbone area network added by OPNET Modeler 14.5 software. The data rate achieved was 3000 Mbps and the coverage areas reached 25 km. The base stations were combined with the head structures that were used to reserve the entire network. The performance of quality of services is merged with the mobile WiMAX network for the completed model. the higher load is described in the multi-cases for throughputs. Furthermore, the proposed effectiveness was done with 6 base stations depending on the WiMAX model and gave as QoS results were around 4000 Mbps when illustrated as the minimum boundaries of the threshold. This model requires to be more enhanced by the coefficients raise to QoS and the coverage area.

In [26] authors proposed the WiMAX network within 5 bridges as considered that have the capability for 1 Gbps with the BAN inserted via OPNET Modeler 14.5 version. The bit rate accomplished was 4000 Mbps and the coverage areas arrived at 30 km. The base stations were merged with the main structures that were utilized to reserve the entire network. The performance of quality of services is combined within the mobile WiMAX network for the main model. the highest loader is presented in the multi-cases for throughputs. Furthermore, the proposed effectiveness was done with 7 base stations depending on the WiMAX model and gave as QoS results were around 6000 Mbps when suggested as the minimum requirements of the threshold. This system requires to be more enhancement via the factors raised for quality-of-service.

In [27] authors suggested the WiMAX network with 6 bridges as a consideration that has a possibility for 1.2 Gbps with the MAN network by OPNET Modeler 14.5 version. The data rate achieved was 5000 Mbps and the coverage areas arrived at 35 km. The main subscriber stations were combined within the main structures that were used to reserve the completed network. The performance of QoS is equipped with the mobile WiMAX network for the main network. the high load on the model was described in the multi-cases for throughputs. Moreover, the proposed method was created within 8 base stations based on a WiMAX network and gave quality results around of 7000 Mbps while proposed as the minimum boundaries of the threshold. This model required to be more improvement by the coefficients raising for QoS and the coverage area.

In [28] researchers proposed the WiMAX model within 7 bridges as considered that have the capability for 1.4 Gbps with the MAN network via OPNET Modeler 14.5 version. The bit rate accomplished was 6000 Mbps and the coverage areas reached 40 km. The main subscriber stations were merged with the main structures that were utilized for reserved the completed network. The performance of QoS is equipment within the mobile WiMAX networks for the main networks. the highest loader in the model was presented in the multi-cases for throughputs. Moreover, the proposed technique was done with 9 base stations depending on the WiMAX network and gave quality results were about of 8000 Mbps when suggested as the minimum limit of thresholds. This system model is required to become more improve via the coefficients raised for QoS and the coverage areas.

3. METHODOLOGY

3.1 INTRODUCTION

This chapter will consider the detailed regard the proposed WiMAX network in the entire network could reduce the overall error and throughput Additionally, the base stations were proposed to bring and enhance the efficiency of the network when connected via 1000BaseT cable with end users that implemented by using the more dedicated OPNET Modeler software. The proposed model consists of two scenarios that rely upon heavy and light services which are discussed in detailed with highlighted all the information that were set. The OPNET Modeler used as the simulator for the studies could be clarified on detailed, and the estimation of parameters discussed for analyzing the model performance could be highlighted in this part.

3.2 WIMAX ARCHITECTURE

The WiMAX is a far-off Metropolitan communication spread out within standard for IEEE802.16 including IEEE 802.16e the further foster this rule 802.16 within the improvement for news plans of these systems especial this adaptability. Worldwide Interoperability for Microwave Access has twice standard expressed every physical also media access control layer such observes as in Figure 3.1 [29]:

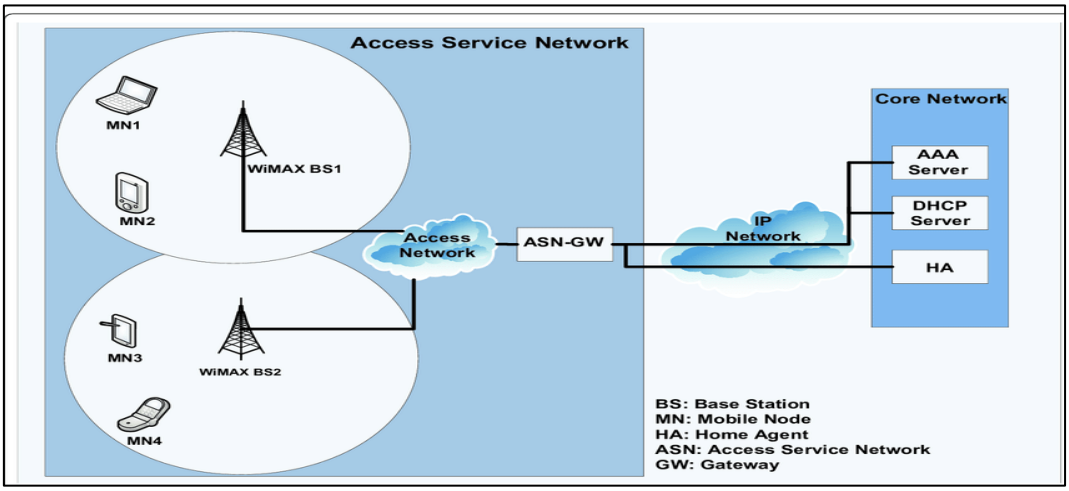

Figure 3.1: WiMAX Architecture [29].

The physical layer used scale orthogonal frequency division multiple access within delegated repeat extent for two GHz and eleven GHz of NLOS and repeat bandwidth for ten GHz and sixty-six GHz of LOS. In any case, most implemented Worldwide Interoperability for Microwave Access communications could be founded on this extent for 3.5GHz in additionally moving redirect information transmission on this compass 2 MHz and 20 MHz [30].

3.3 MOBILE WIMAX NETWORK

Minimized WiMAX headway presents adaptability for the hugest things, Radio Frequency (RF) access information and affiliation plan, subsequently to give a critical lessened of adaptability goes with due network plan decisions and association makes a difference. The most basic parts remained mindful of by Mobile WiMAX are as follows:

Highs data rates: The presence of Multiple Input and Multiple Output (MIMO) radio wires shows close to introducing day Coding, versatile subchannel constructions, also Modulator, thoroughly supported this progression for Mobile WiMAX to sponsorship most significant downloading information periods around 630 Mega Bites per second for all areas and pinnacles maximum weight information periods for around 280 Mega Bites per second in a 10 MHz channel. Quality of service could be considered such the focal support for media access control plan for this IEEE802.16. is makes sense of services running while gives planning for diffuser programming step stream step were empowered start for finish IP Show spread out the quality of service that described in Figure 3.2 [31].

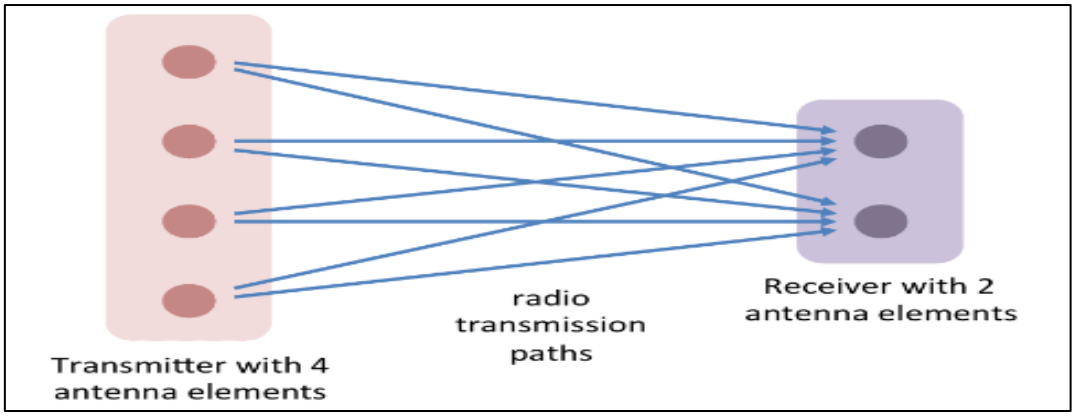

Figure 3.2: Transceiver with 4 Antenna Elements by Radio Transmission Paths [31].

Adaptability: these assets for the reach of remote broadbands overall are now incredibly uncommon with their parts even with a continually globalized spending plan, accordingly headway of Versatile WiMAX is viewed as prepared to actuate in different channelization in the compass 1.25 to 20 MHz to satisfy the different by and large necessities like forwarding endeavors to arrive at range synchronization, and additionally allows coordinated economies for understanding the advantages of various improvement of Mobiles WiMAX for their central focuses geographic requirements like giving sensible web access at field regions against developing breaking point open of mobiles broadband at metro and away zones that shown in Figure 3.3 [32].

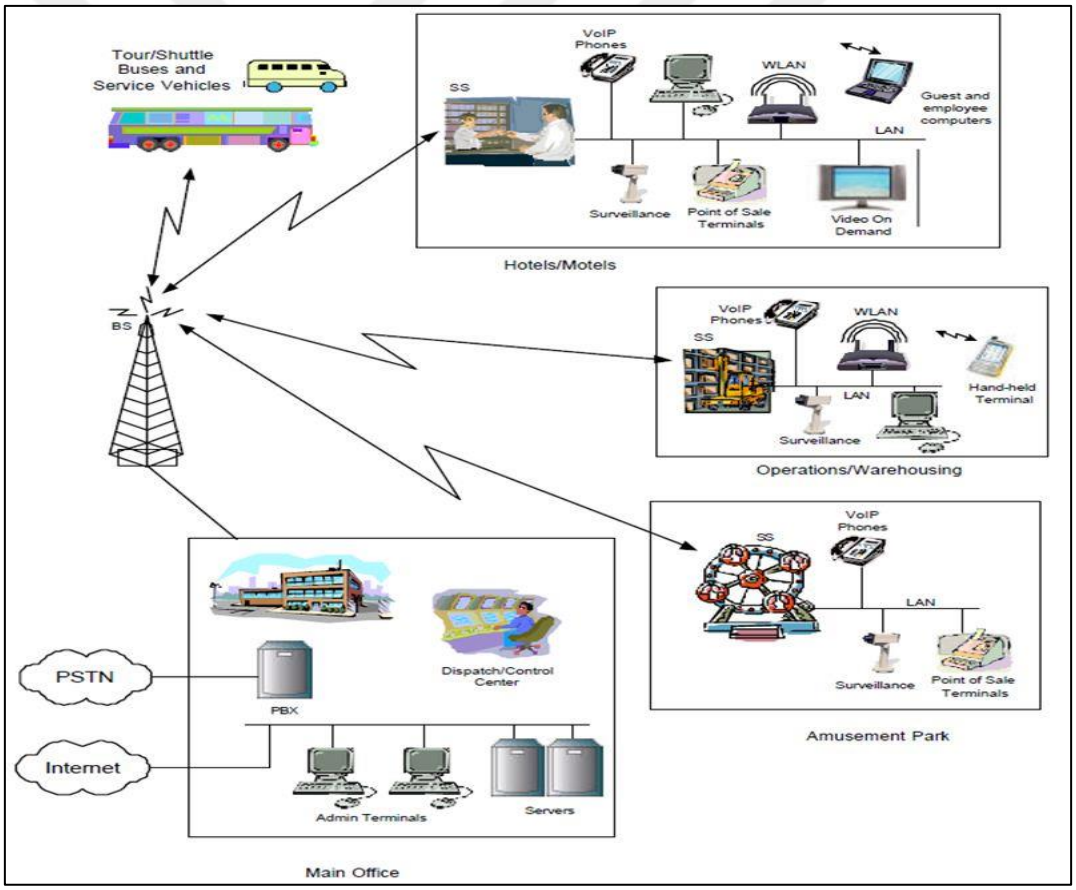

Figure 3.3: WiMAX Base Station Services [32].

Security: The security parts of Mobiles WiMAX had been equipped most unquestionable highlights in brands within messages look at code, sponsorships updated task structures inside subtlety's not more than 500 msec for confirming reals time introductions like Voice over IP

execution without association rot. Adaptable key overseeing outlines guarantee that security will stay aware of through handover. The delayed consequences of WiMAX rules be verifiably passage fixed band wandering work environments. The guidelines were changed for looking out for all adaptability applications. As necessary, Mobiles WiMAX sponsorships immovable progression for wandering other than fixed plans. The going with highlights can be tended to by WiMAX with the highest information rates offering; sponsorships fixed, meandering and adaptable applications consequently congregating the two mobiles and Fixed affiliations; have flexibles orchestrating models; other than moderate with fundamental for sending. In addition, the supporting of components ceaselessly includes multipoint connection, and supporting IP-focused setup; have streamlining tasks that assists all with conveying capacity applications like VoIP. At this point, a power-saving machine that broadens a battery lifetime off limited contraptions as presented in Figure 3.4 [33].

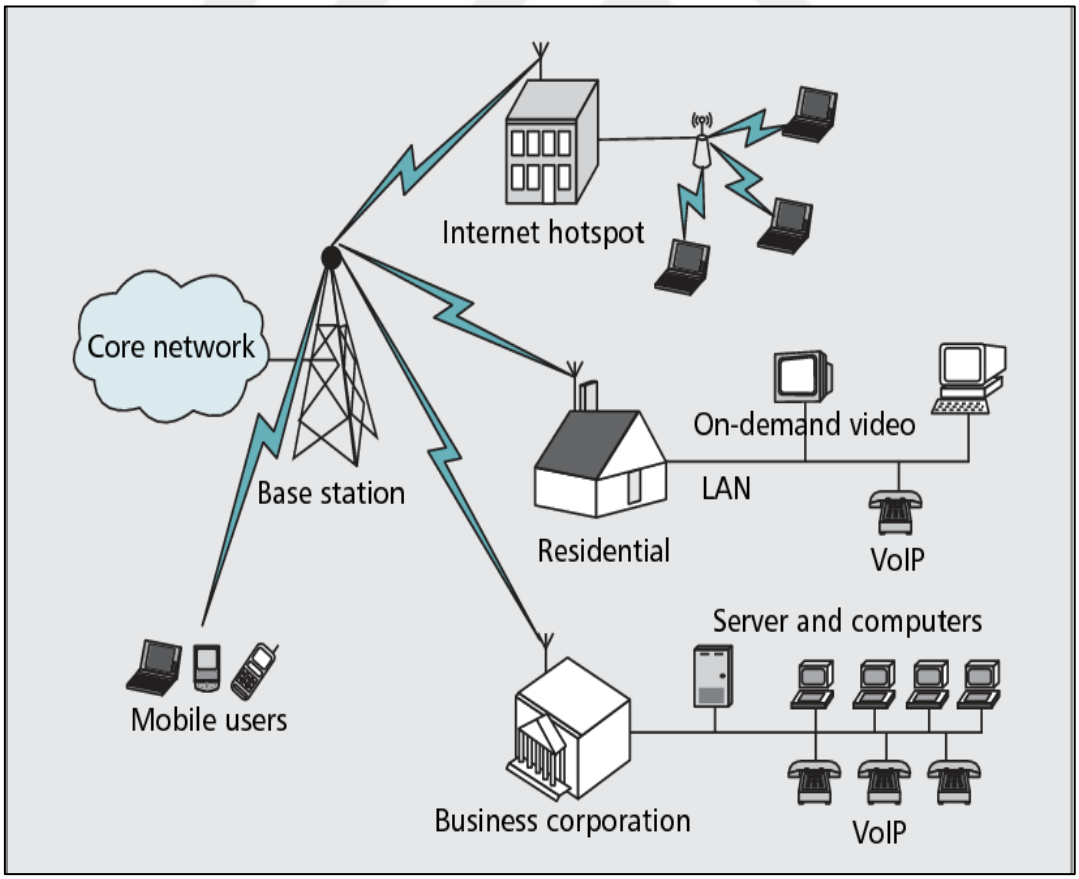

Figure 3.4: WiMAX Scenarios Conversations [33].

3.4 WIMAX SIMULATION SETUP

WiMAX parameters for both Base Station and Subscriber Station were dependent on the currently given parameters in table 3.1:

Table 3.1: Wireless interoperability for microwave access parameters.

WiMAX		
	Base Station	Subscriber Station
Tx Power	20 Watt	0.5 Watt
Antenna Gain	15dB	15dB
Path Loss	FS	FS
Bandwidth	20 MHz	20 MHz

The crucial advancement for WiMAX is coordinated at Subscriber Station (SS), Base Station (BS), an Access Service Network (ASN) entrance, and ASN highlights. The base station can be either vectorizing or Omnidirectional, fixed, and adaptable. This base station could survey nature for this channelization made in qualities of this getting signal. the nature of channelization reaction show helps the advantage for offering the base station inside qualities reaction in the down-link channelization. This algorithm for the action of the base station might being considering of the channel qualities of down-link also up-link for this client possibly to conclude this rule also code structures while fostering the throughput. the amusement conditions the fair Omnidirectional base station shall be limited. Partner stations could be share stations within servers' executions and also subscriber stations within Wi-Fi switch practices despite subscriber stations within work-stations functions. Within whatever relation for SS-base stations, MAC work environments configuration can be created, OFDMA authentic frameworks, change and an assortment coding might be worked with [34]. The restrictions of the genuine layer are composed. In situation one, each of the affiliations

organizes with an equivalent setting and game plan for making the show assessment direct yet broad. Notwithstanding, in objective applications, we could have different settings and plans for each affiliation and focus highlight support the reasonability of the design. While mirroring a relation in giving and considering different circumstances as various and over the top as conceivable would make it sensible and more concentrated to study and research. In these conditions, the way to deal with acting for quality-of-service class is seen via separating this outcome was concluded quality of service class was utilized within this situation when everything this trafficable is managed in great efforts premise. while zeroing in on where all these quality-of-service class act, endless spreads were facilitated, by utilizing each QoS class independently and with others, including each under the sunset and wireless conditions [35]. The WiMAX network topology structure design is shown in Figure 3.5.

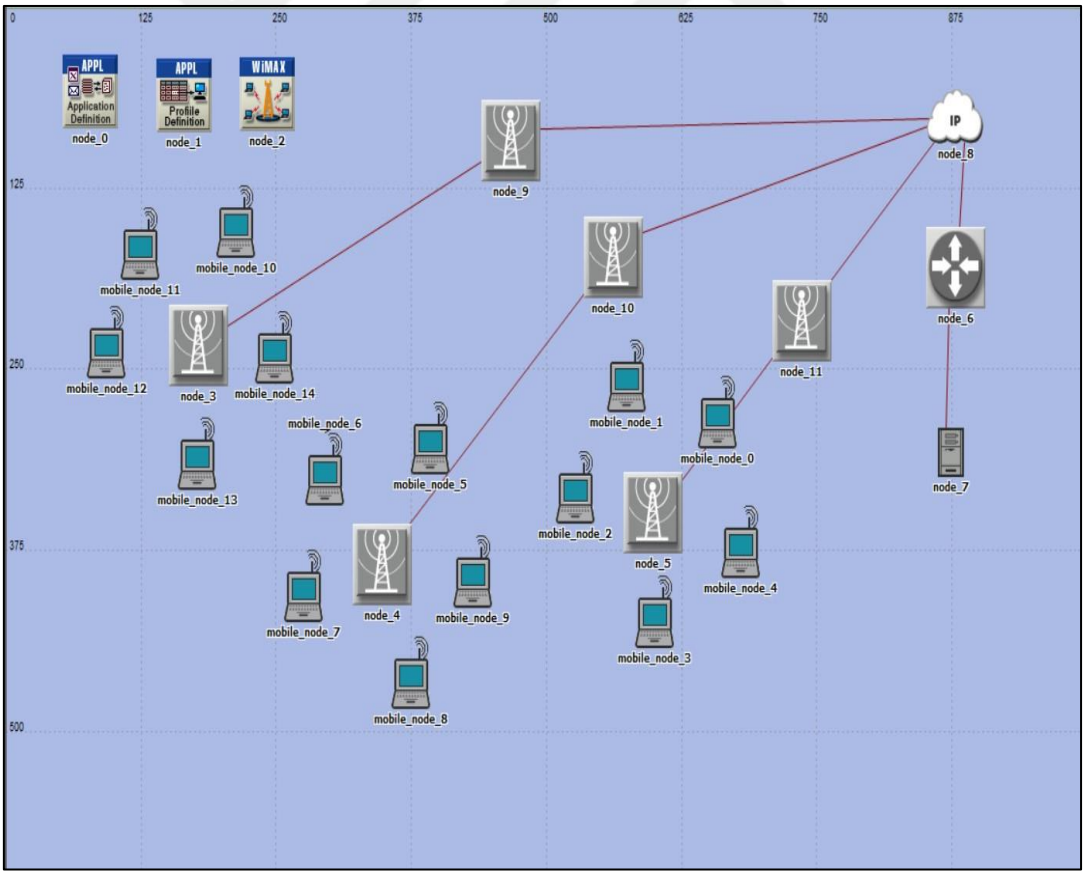

Figure 3.5: Overall WiMAX Networks.

The configurations of setup for each profile, the services would be more interesting due to the quality-of-service checks with quality factor for each application, as seen in Figure 3.6, 3.7, and 3.8, the base stations would be inserted to coverage around 5 km to be 10 km for each path trajectory, based on BAN, there is a high distance with transmission enhancement based on the main wired server, the router cs-2000 is considered as oriented with cloud IP components with one base station on the middle, the performance would be better in the high coverage area with highest QoS and lowest delay, based on the frequencies of the main base stations, the mobile subscriber stations were connected via Basic Service Set (BSS) identifier with the same frequencies between uplinks and downlinks, the mobile stations were served by multi-services like video conferencing, VoIP,…etc. the main applications with mobility services as the configurations.

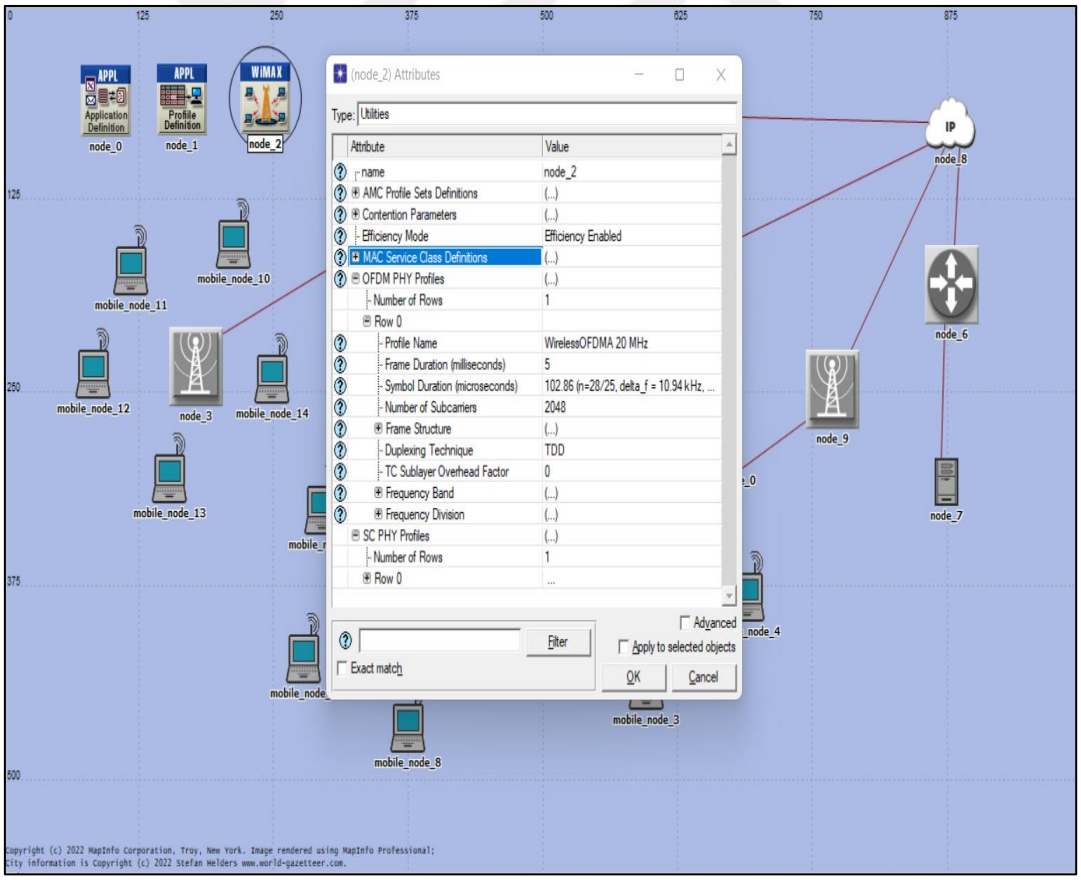

Figure 3.6: WiMAX Mobility Parameters.

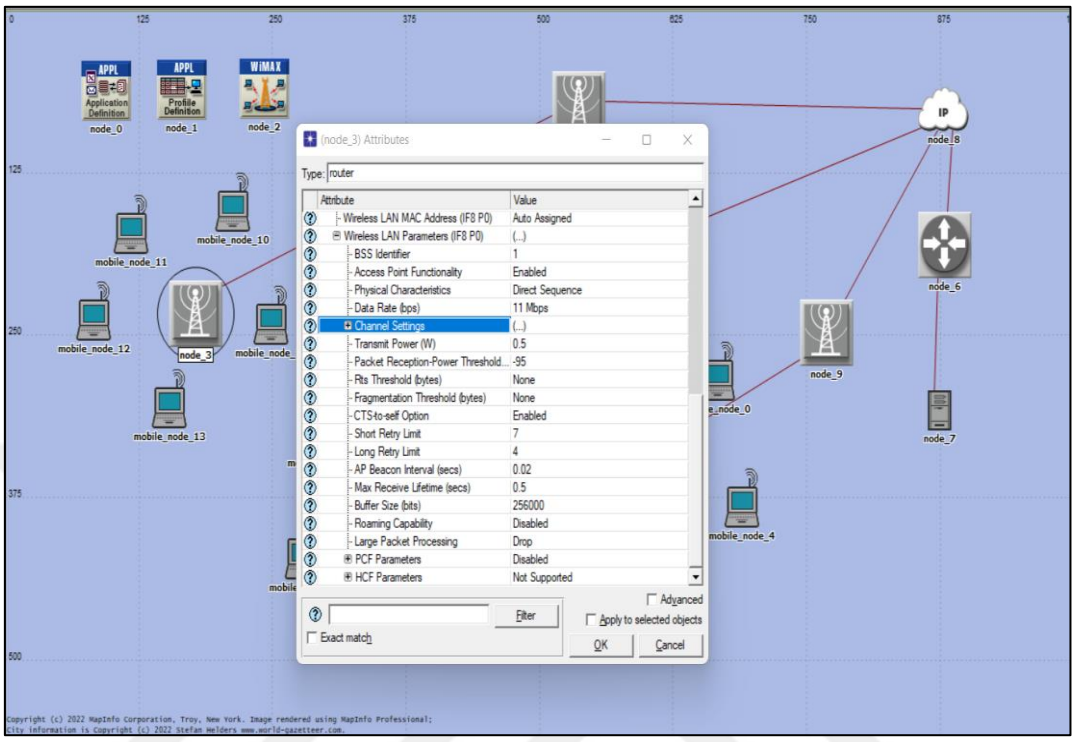

Figure 3.7: WiMAX BSS Parameters.

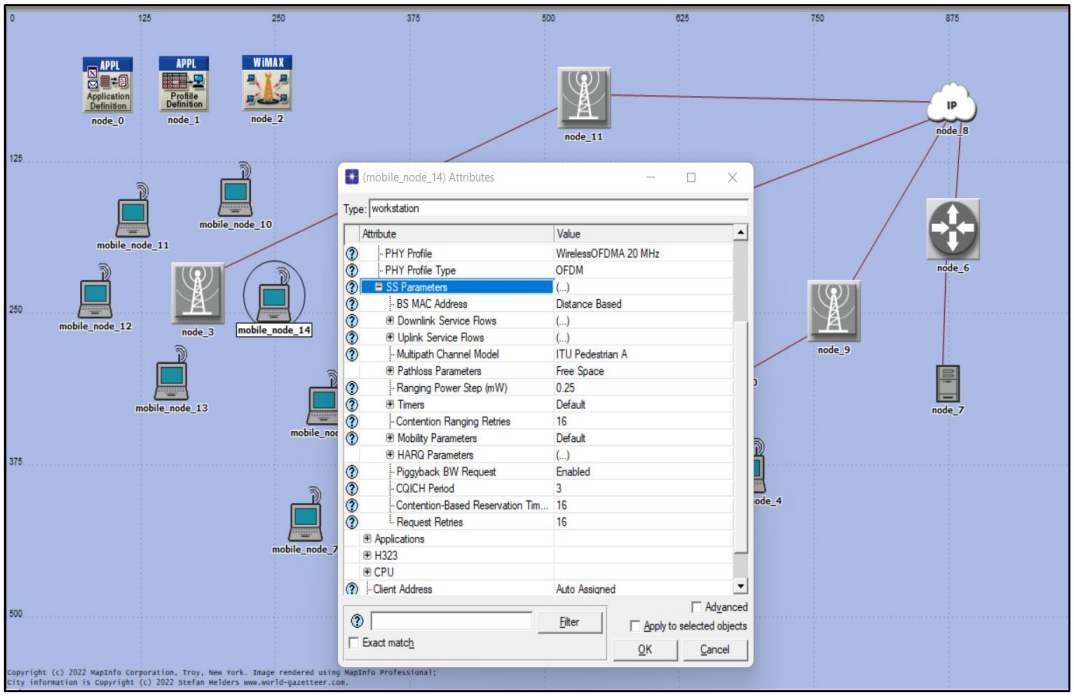

Figure 3.8: WiMAX SS Parameters.

When the wireless OFDMA technique had been inserted, the usage of the frequency around 20 MHz that sets for physical profile with media access control address for base station based on distance, by taking the free space technique for bits transmission, the pathloss parameters had been estimated via a large ranging for power around at 0.25 (milli-W) based on multi-cases for the study performance checks, the new base station has been added as assistant for the entire network, additionally, the MSS had been considered as a solution for this type of mobility, the cable type has been replaced with 1 Gbps for each station connection, based on the main server, this type of connection could be enhanced QoS depend on the cable quality type and services on applications whether be VoIP or broadcasting conferencing in addition to that, besides these reasons, the transmitted power could be more interest due to the medium transferring that occur during gains, the addition of the TP can be more effectible due to the gains parameters could make a variety for other gains, the subscriber stations can be done by the higher number of frequencies as shown in the Figure 3.9, 3.10, 3.11, 3.12 and 3.13.

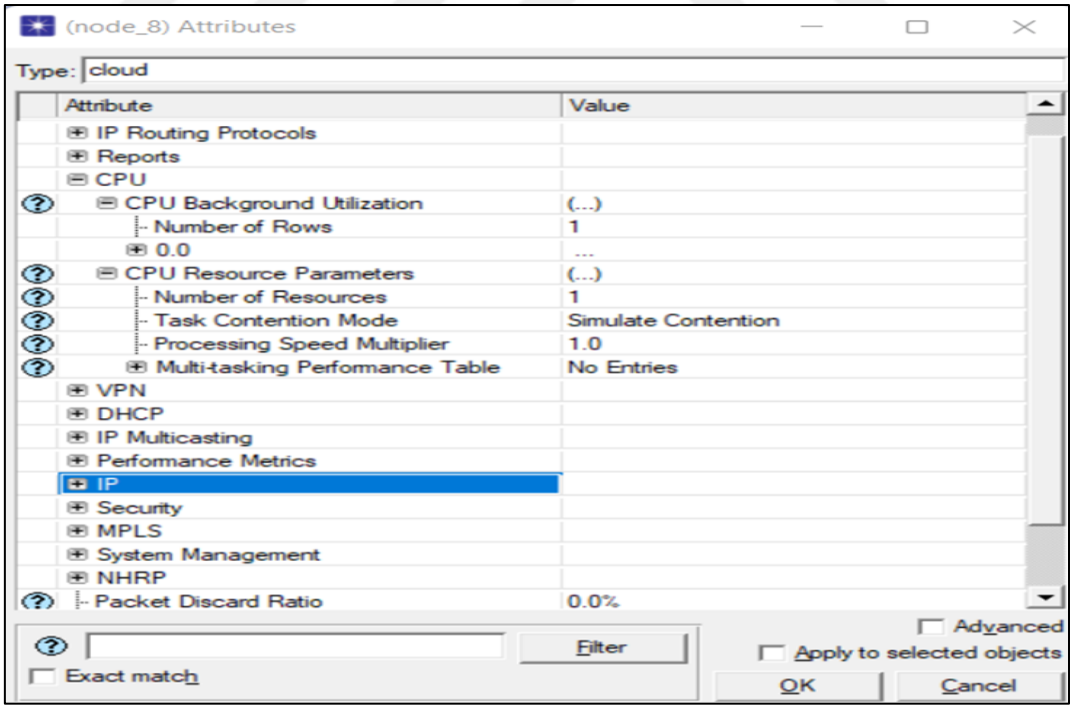

Figure 3.9: CPU Settings For Network Topology.

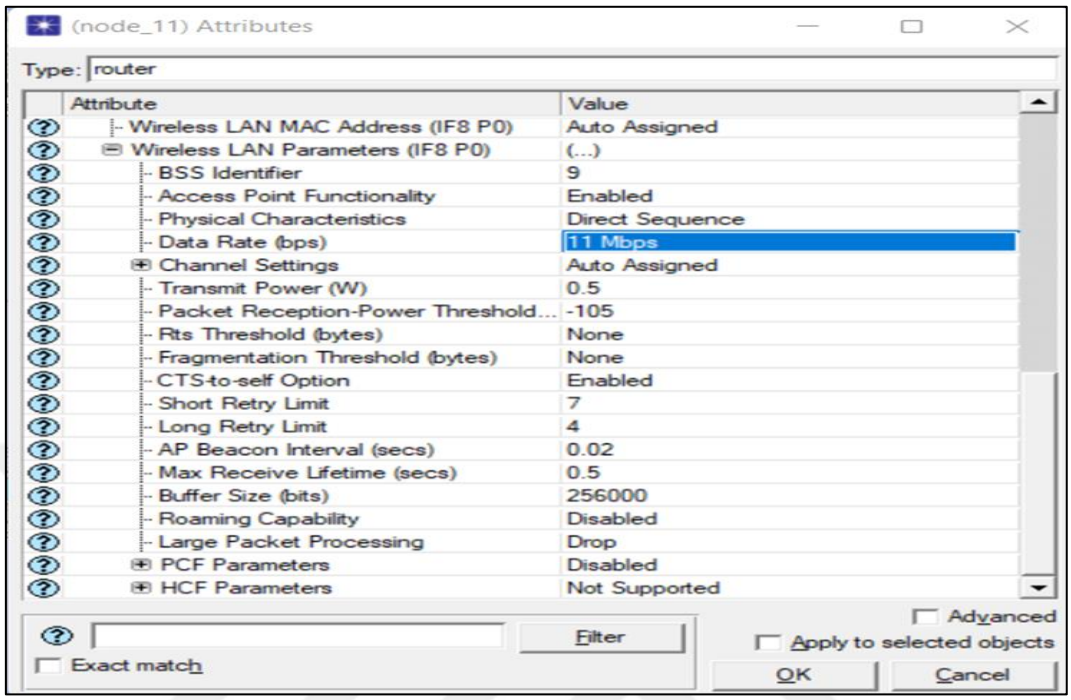

Figure 3.10: WLAN Parameters for Base Station.

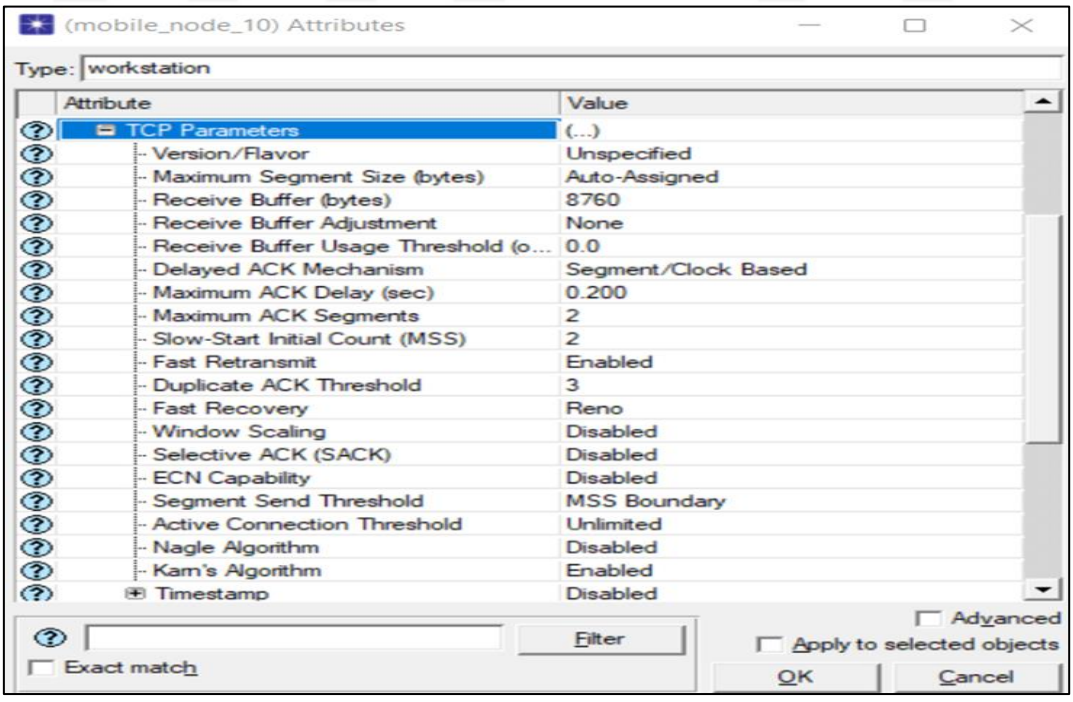

Figure 3.11: TCP Parameters for Base Station Node 1.

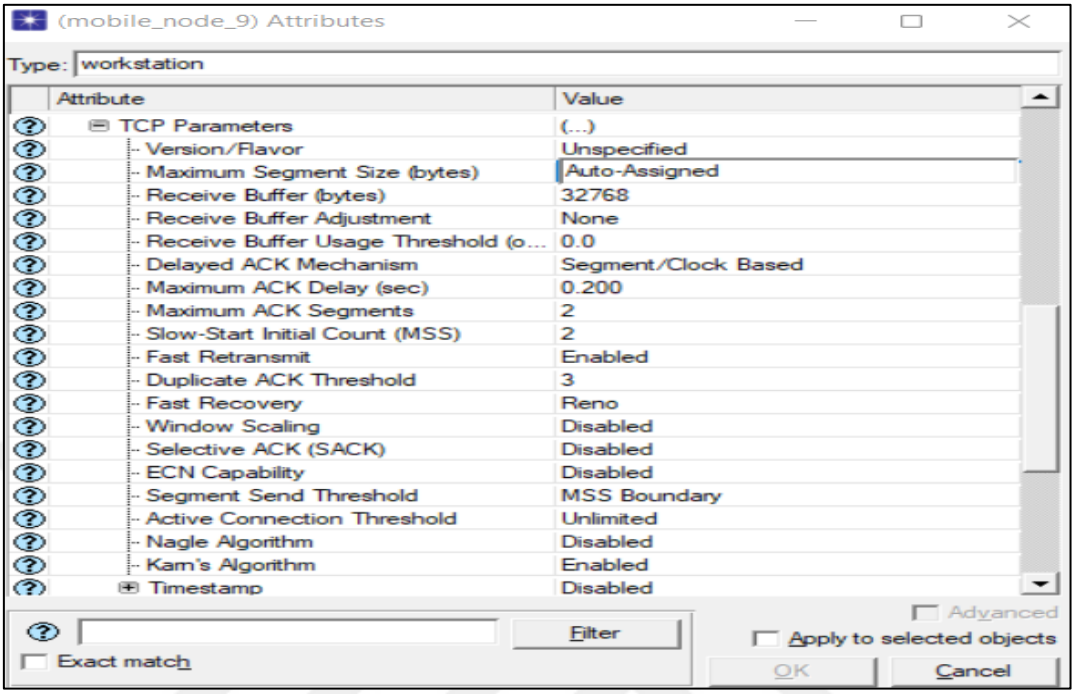

Figure 3.12: TCP Parameters for Base Station Node 2.

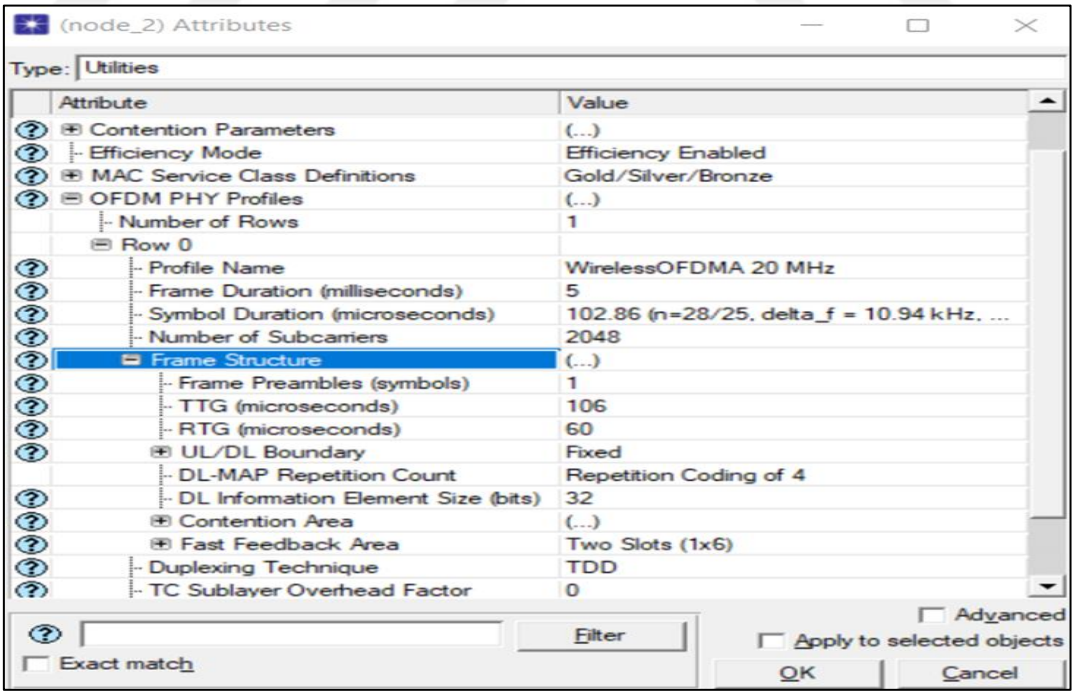

Figure 3.13: Frame Structure for Overall Base Stations.

3.5 MAC LAYER DESCRIPTION

802.16 land is designed to provide standard bandwidth. Services include sound, data, and information. MAC status checked Data Over Cable Service Interface Specification (DOCSIS) standards and support for high-speed data traffic with high demand. Simultaneous support for playback of video and delayed audio traffic Those channel resources allocated to the MAC scheduling may vary. It offers a very wide dynamic range from slow motion to full frame. Bandwidth for a specific user terminal at a specific time. All from the source Map information is provided in the MAP message at the beginning of each frame. The scheduler can effectively change the resource allocation for a frame as follows: This corresponds to the intense nature of the movement. With quick air connection, asymmetric lowering/lifting, subtle flares, and a flexible resource allocation mechanism, mobile WiMAX can meet QoS requirements for the wide range of services and programs for data transfer. At the MAC layer, Mobile WiMAX QoS is provided by the service flow. The one-way flow of packets with specified QoS parameters. Before providing any data services, the base station and the user terminal first establishes a unidirectional logical connection between MAC peers. Outgoing MACs connect packets through the MAC interface. Set the relative QoS for the service flow sent over the link. It determines the sequence and time of the exchange in the flow of services and radio interfaces. Connection-oriented QoS can provide fine-tuned sky management. Connection air interfaces are usually narrow, so QoS is link oriented seamless QoS management can be done efficiently. Service flow parameters may include Dynamically controlled MAC messages for dynamic service deployment QoS algorithms based on request flow are used for DL and UL that Improved bi-directional QoS WiMAX Mobile supports various data transmission services. Applications with different QoS requirements as present in Figure 3.14 [36].

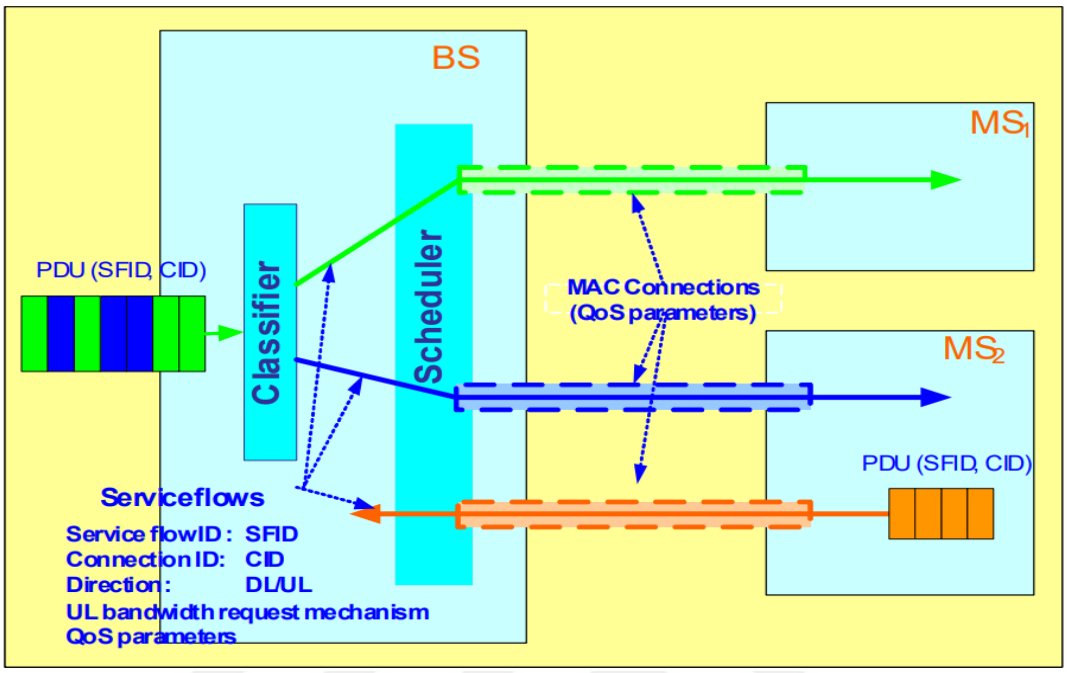

Figure 3.14: Mobile WiMAX Quality of Service Supports [36].

Some joint policies have managed the development of WiMAX -moving networks. Including structures and logical unit guarantees IP management methods and procedures, connection, and connection control ASN Protocol that uses access policy to use permanent architectural policy and National Adaptation Plan (NAPs) accept only Network Service Provider (NSP) provided by the cost that includes many NSPs and support ASN or select an existing NSP on one In addition, with access to ASN topology, which supports accumulated operating services If we need online processing activities, Overt description, and infrastructure description Signs between other network groups Between ASN, ASN and Connectivity Service Network (CSN), between the CSN), especially Microsoft, ASN and CSN interact among many providers. Development support Intelligent technical hypotheses are used for roads among other models. inserting other providers for different purposes. When such a race with current order protocol and actions is a combination of companies for real network companies Network specifications and defined documents CSN limited packages of one operator used in ASN Operations for Operators to provide simple online access services Consider or call almost. The WiMAX architecture enables the use of IP and Ethernet services on standard mobile phones [36].

3.6 WIMAX END-TO-END ARCHITECTURE

IEEE defined only the physical and medium access control (MAC) layers. This approach has worked well for technologies such as Ethernet and Wi-Fi. It also creates other organizations such as the Internet Engineering Task Force (IETF).

A standard for advanced protocols such as Transmission Control Protocol/Internet Protocol (TCP/IP), VoIP, and IP security. on the phone in the wireless world standards. Different interfaces and protocols not only require wireless compatibility but also Roaming for multi-operator access, the interaction between operators Payments over the web, and between companies. Internet service providers and operators were aware of this problem.

Additional working groups were created to develop standard network definitions. Open the web interface model. Two of them - WiMAX forums Network that focused on creating advanced networks and technical features of standard systems, mobile, portable, and mobile WiMAX and their violations IEEE 802.16 is determined by the standard and supported by the service group for Written and defined priority requirements to help the workgroup network. WiMAX Mobile Network Setup is based on All-Internet Protocol, all pocket technologies without reading a scheme.

It offers fewer benefits. The total cost of ownership over the lifecycle of WiMAX network deployment. for use All IP means you can use a common network core without saving both. Above introduced in closed circuit and core networks. Another advantage All-IP uses the network for the full performance curve. Target processors and computing devices are often referred to as Moore's Law.

Computer Advances in the processing are much faster than advances in communication devices. Because general purpose hardware is not limited to communication devices Mainly long and heavy cycles. The result is a network Continued adoption and adoption through improved capital and operational efficiency The Internet community uses third-party developments. This leads to a reduction. Cost, high scalability, and rapid deployment like all network functions Mostly software services.

Successful implementation of a business system requires the Radio interface specification 802.16 (physical/media access control) or higher is supported. The most important of them Support for core network operations is required as part of the overall end-to-end network operation. According to the architecture of the WiMAX system. Before going into details of Architecture Let's first outline some of the principles that govern the WiMAX architecture enhancement. The architecture is based on a local closed switch architecture.

The procedures used are based on the IEEE 802.16 standard and its amendments. IETF and Ethernet standard. The architecture allows and supports differentiation of access architectures. In the Topology, IP connection service for an element of a communication network that system does not comply with the IEEE 802.16 wireless specification.

Architecture provides flexibility and flexibility for extensive acceptance. Activation as a small fugitive with wireless lid and final capacity WiMAX -networks City, suburbs and national radio stations pass through the city and suburbs Authorization and or frequency, Mild, soft or online topics, and options, Tolerate regular stability, nomads, small users, and cellphone models, Services and programs with It's a final structure for Supporting Sound, multimedia service and other mandatory control services for Emergency, Application Service Provider (ASP) approximately connect the mobile phone, that ported for to be displayed by translating the IP over Heritage Service, for example, message using internet protocol Network with access WiMAX and Providing multilateral IPs and distributing services via WiMAX.

Communications and routes are other major forces of the final network with Architecture taking many active scenes. To be especially Free call with wireless networks as support Current wire lines such as DSL and standard interface ethics, Global wandering to avoid support and information on the WiMAX network phone calls who have been introduced by standard use For accounting and investor, coordination over the total account and consent Various authentication user settings such as user and password, to identify certificates, (SIM), Universal Subscriber Identity Module (USIM) and WiMAX Network certificates identified by WiMAX Forum is a logical image of a network structure.

These companies identify the operating system and the operating system. It was developed between the functional units of the architecture with the following objectives Provides internal support for features required for network deployment Use models and scenarios (static - mobile - portable - simple mobile - for all mobile subscribers). 17 MS, ASN, and A well-defined reference point for linking CSNs and logical objects with the main regulatory guidelines R1-R5. All amenities, MS, ASN CSN means a group of operating companies. Each of these features includes It can be deployed on a single physical device or distributed across multiple physical devices.

Grouping and separation of functions by the physical device of function objects Choice of implementation. Producers can use any physical object. Before performing functions individually or together Activation performs functional and operational needs. The purpose of NSP is to allow several active options for a particular operation. object, but achieves interaction between different implementations of functional objects. Compatibility is based on the communication protocol and data page definitions. processing to achieve a common final function between functional objects, for example, security or mobility management. So functional objects on both sides A reference point represents a reference plane and a set of endpoints on the reference plane that is described in Figure 3.15 [37].

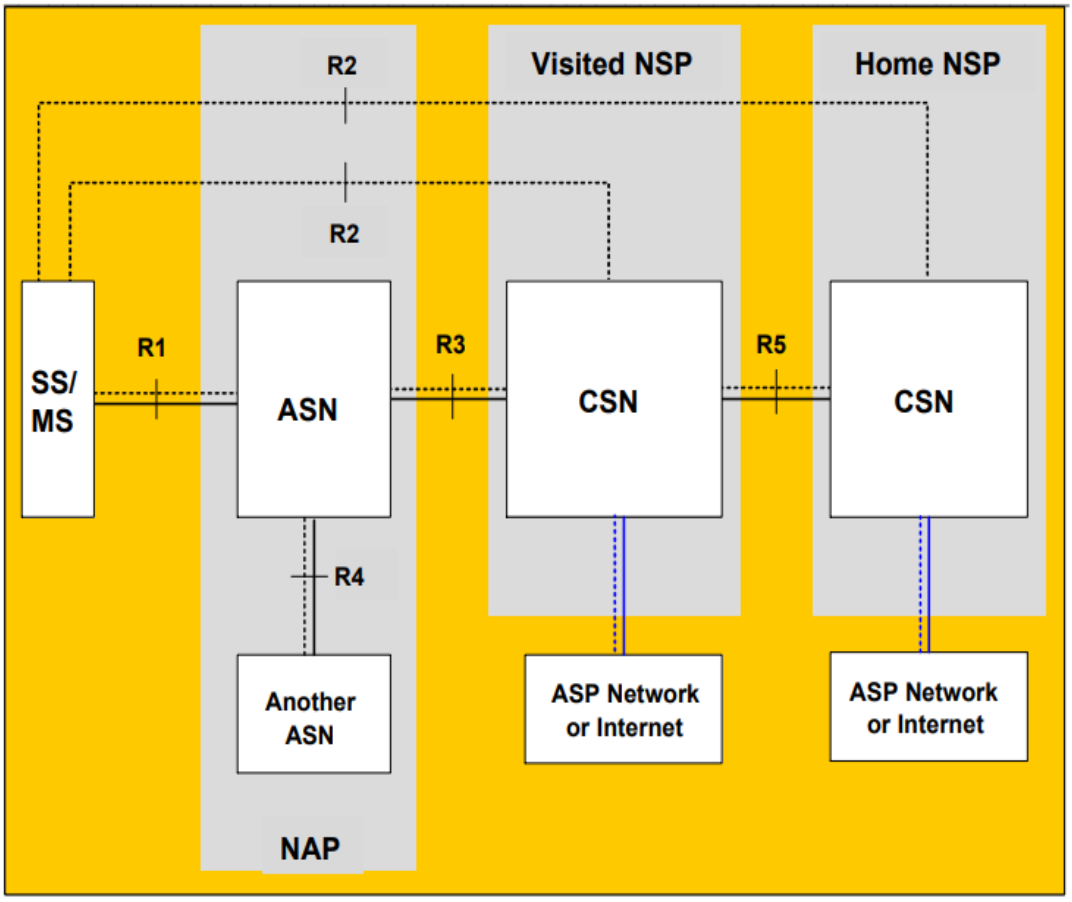

Figure 3.15: WiMAX Network Internal Model [37].

ASN provides an easy way to define and describe logical boundaries that Connect the relevant functional objects and the relevant message flow Access to services. ASN refers to the limitations of the following operating system: WiMAX Customer, WiMAX Connection Service functions, and synchronization of functions with other providers Comparison of practical and logical objects as noted in the NRM, ASNs can be implemented in a variety of ways. Forum WiMAX, for managing your online profile in different ways.

Enable flexible and diversity-friendly suppliers. Nomination requirements Connectivity Service Network (CSN) is defined as a set of network functions with IP communication service for WiMAX subscribers. CSNs can be formed from networks. Things like routers, servers, user databases, and running gateways CSN devices can be used as part of a WiMAX

with Network Service Provider (NSP) or part of an installed WiMAX NSP. Figure 3.16 shows a basic view of several objects in action between ASN and CSN groups [38].

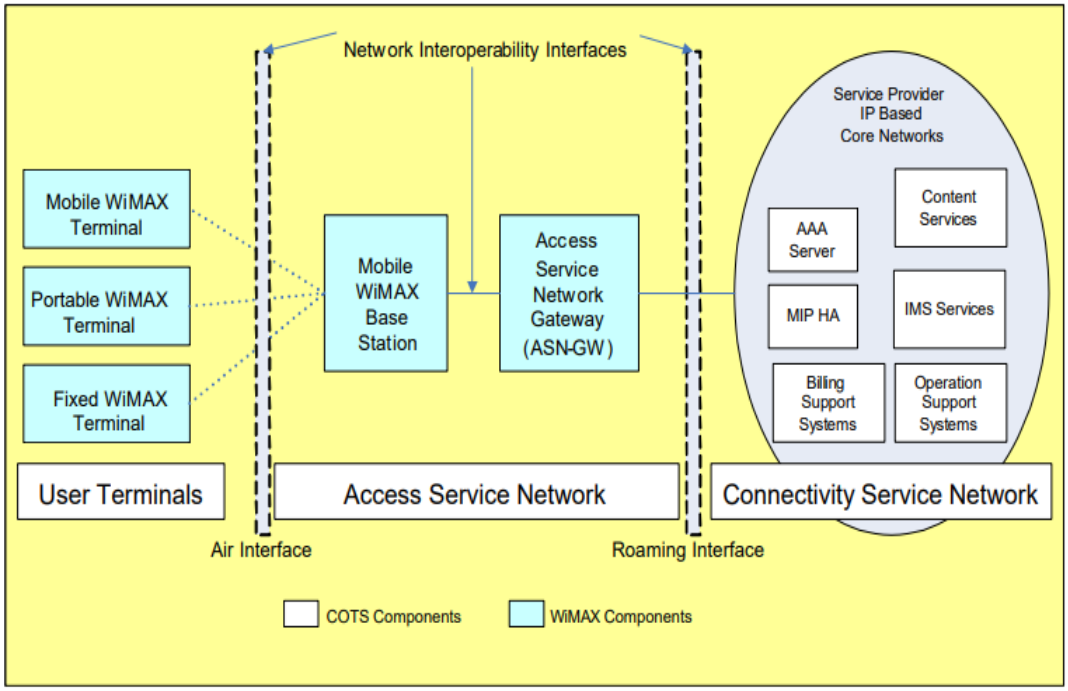

Figure 3.16: WiMAX Network Internet Protocol Architecture [38].

The network functions of a WiMAX-based system are based on different principles. The principle of network architecture is mentioned below. Some joint policies have managed the development of WiMAX moving networks. Including structures and such a logical unit guarantee. IP management methods and procedures, connection, and connection control ASN Protocol that uses access policy to use permanent architectural policy and access policy Suppliers accept only provided by many NSPs. And support ASN or select an existing NSP on one in addition, with access to ASN -topology supports accumulated operating services If we need online processing activities, Overt description, and infrastructure description Signs between other network groups.

Between ASN, and CSN, CSN, especially Microsoft, ASN and CSN interact among many providers. Development support Intelligent technical hypotheses are used for roads among other models. Add other providers for different purposes. When such a race with current order

protocol and actions is a combination of companies for real network companies Network specifications and defined documents CSN limited packages of one operator used in ASN Operations for Operators to provide simple online access services Consider or call almost.

The WiMAX architecture also supports IP and Ethernet services in fixed mobile phones Flexible IP compatible networks and interoperability supported by WiMAX Provide a low-cost WiMAX implementation for network operators online, even with a hybrid deployment of distributed and centralized ASNs chain The WiMAX network has the following key features with the latest WiMAX network architecture is based on security rules.

Operators and ASNs apply to topology types and are used sequentially Use of new and online models and implementation scenarios. Specifically, Support is available for Complex tests on intermediate devices between MS and Microsoft WiMAX network, security framework IEEE 802.16, Internal certification, and a certification mechanism addressed to the operator were introduced. permanent data authentication and attachment Personal information and parts are not repeated with keys. length, mechanism of virtual individual protection of the network, and a standard security mechanism for managing IP addresses. The WiMAX network architecture fully supports the following:

The mobility. These include technical transmission of vertical or technology, for example DSL - when connected to Multimode, Support for Internet Protocol version four or Internet Protocol version five traffic management. In this setting and application, the tuning issue with many Ips Uses wandering between NSP at the same time Free Hando-support recommendations at the speed of the vehicle-satisfactory disorder of services. Excess transmission supports include its support: dynamic and stable home the full Address, we change in the network representative on service entire network with Road is an official format and the full IP based the Dynamic distribution of home agent based on the form of load balance. Another important aspect of the WiMAX network structure is supported: operating system between different manufacturers in ASN. ASN, and CSN and clearly identified reference points for interconnection of the logical entities. The figure depicts the key normative reference points R1-R5.

In the case of ASN, these contacts are as follows: Package equipment in ASN and different components of ASN (maybe other suppliers) and CSN, with partial or destruction of activity or activity.

The IEEE 802.16 standard defines several aggregation platforms with WiMAX Network architecture systems that support different types of cisco materials: Ethernet CS, IPv4 CS, and IPv6 CS. The WiMAX network architecture has provisions to support QoS mechanisms.

Nowadays, the simultaneous use of different IP services allows you to use flexible support. Support architecture: different sizes QoS - each Username and password, access Tracking, Sliding Management, and Implementation of Policy Various QOS phones based on their transactions, including any user implementation and a group of users, as well as a place, time of the day and more.

Factors that are widely used Built on standard IETF mechanisms for policy definition and management Implementation of flexible specifications of WiMAX networks between operators allows for expand various approaches. Maybe Access Service Network (ASN), specifically an ASN profile that includes both Distributed/reduced and centralized architecture. Also, WiMAX the forum provides a framework for interaction between ASNs as in Figure 3.17 [39].

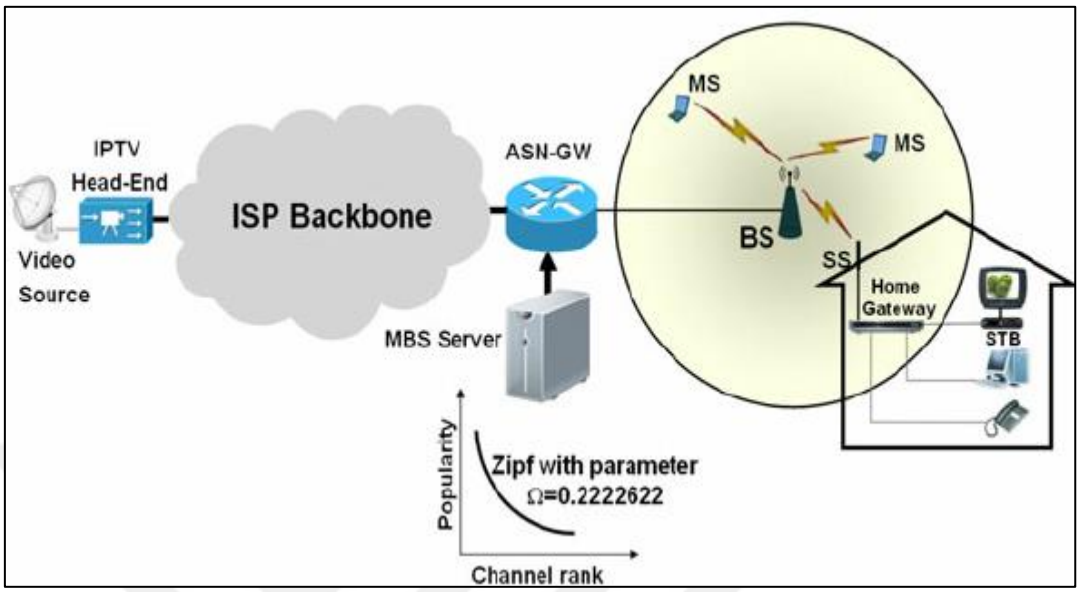

Figure 3.17: ISP Backbone Based ASN [39].

Interoperability between different providers is guaranteed. Architectural development and strict adherence to protocol specifications. In the meantime, an online working group has been launched. The second plan will be released in the second quarter of 2016 in the next feature set (informally known as version 1.5). it is Release the previous features are scheduled for release in 4Q-06. when the Working Group of Service Providers in the WiMAX Forum establishes the following requirements: Operator priorities for future versions will be determined by the network working group Working Group has divided the scope of its work on WiMAX features into 3 releases. Each release has 3 stages. Stage 1 is on requirements that are set by the Service Provider Working Group. The second and third stages correspond to architecture development and detailed protocol specifications [39-54].

4. SIMULATION MODEL RESULTS

The multiplication results for WiMAX voice-pack start to finish delay for the PCM voice and light video information transmission there is no relationship until second 110 where the connection network spread out, and the correspondence framework appear at the consistent state at the second 250 with most cutoff concede 115 milli-second, as displayed in Figure 4.1.

The expansion postponed outcomes of the WiMAX voice-bunches consummations to closes defer section the PCM voice and huge video information transmission there is no relationship until second 110 where the alliance network spread out and the outcomes are seen in Figure 4.1:

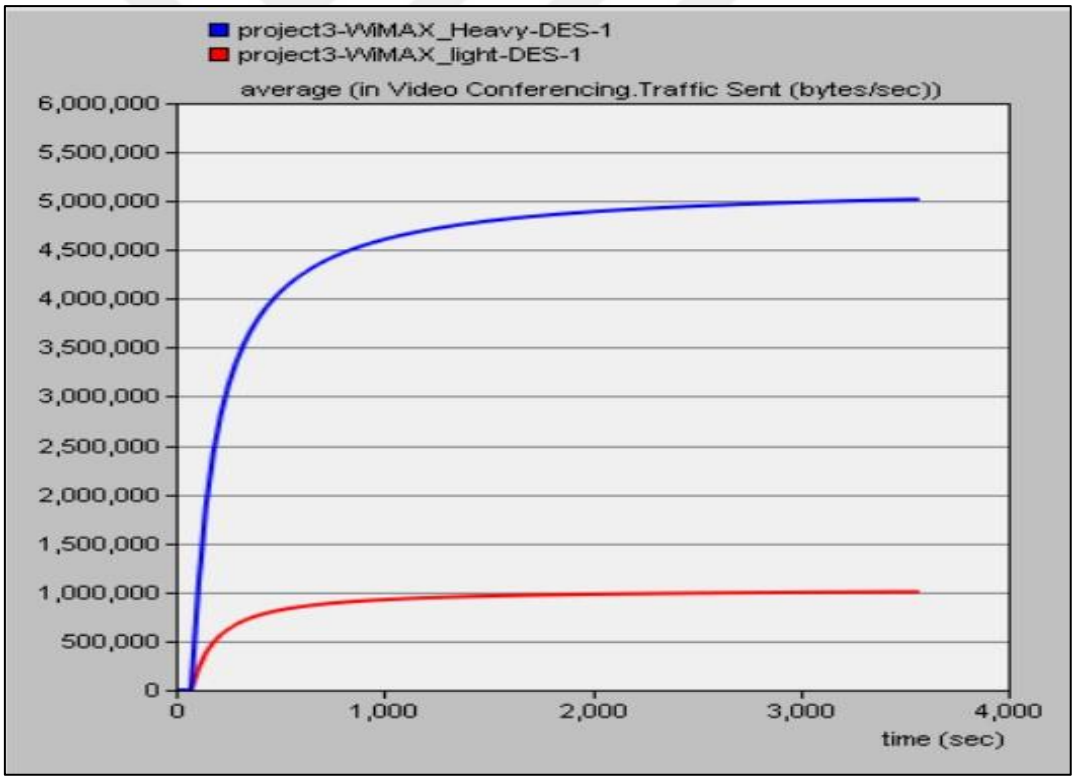

Figure 4.1: WiMAX Heavy and Light for Video Conferencing Traffic Sent Bytes/sec.

As a comparison between services, heavy and light services have been proposed as a solution for the WiMAX networks, additionally, the settling time occurs for both services were 2750

sec for a variety between traffic transmission rate that made 5500000 for heavy and 1000000 for light when experimented on video conferencing based on bytes/sec.

As mentioned in Figure 4.2 and 4.3, the comparative don between heavy and light services, based on WiMAX facilitate by describing the variety between the curves, the blue curve describe the heavy services while giving 145 packets rate for 3775 sec and settling at 2500 sec when the red curve present light service that applied for packet rate which gave 59 packets rate and settle at the same time due to the majority of the light services and based on QoS when applied for WiMAX equipment and the received traffic, the light services is superior to the utilization, during executing these curves on simulation, the red curve limit at 20 packet for the first 10 second while the blue curve for heavy services gave the same first 10 second in a time but gave around 9 packet rates on video conferencing.

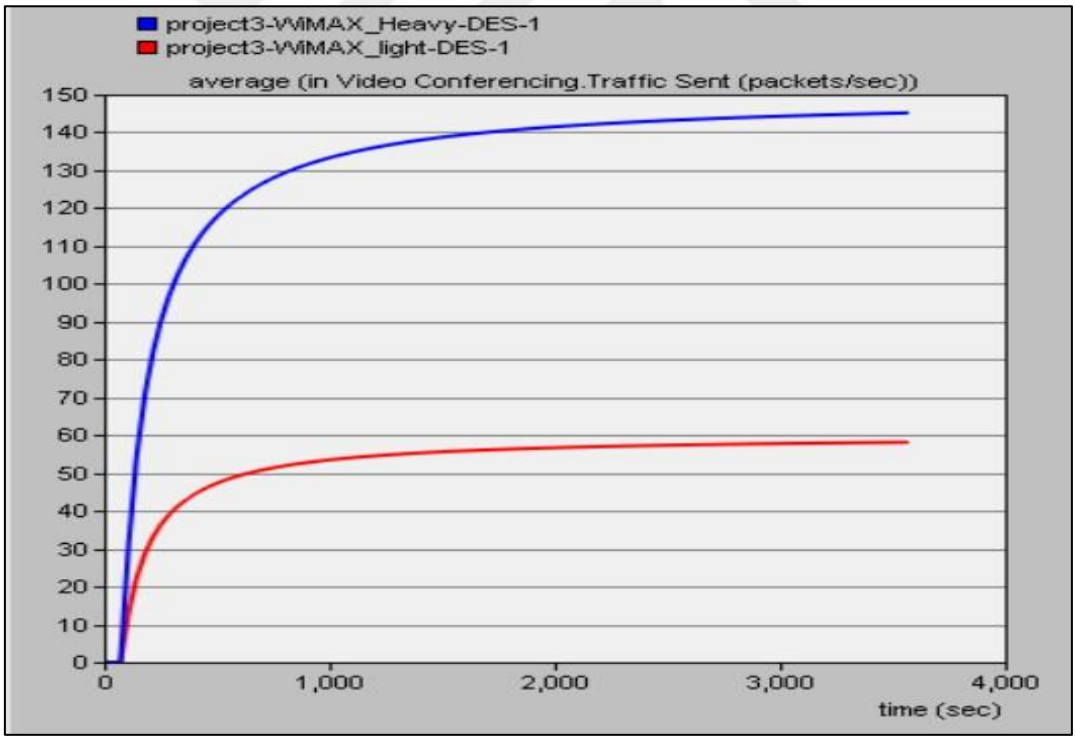

Figure 4.2: WiMAX Heavy and Light for Video Conferencing Traffic Sent Packets/sec.

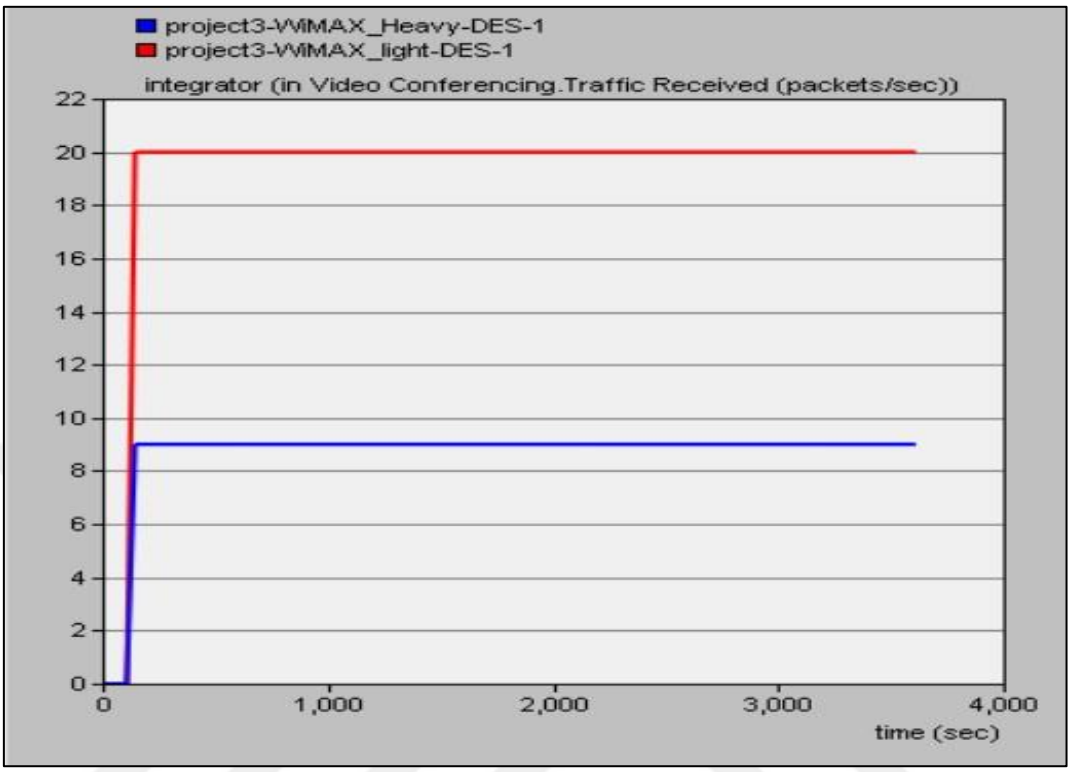

Figure 4.3: WiMAX Heavy and Light for Video Conferencing Traffic Received Packets/sec.

According to Figure 4.4, which presents the comparison between heavy and light services, based on the received traffic, there is a big change between services and as mentioned below, the light services is superior and close to the better line of traffic, which red curve present the light services with the better response in 10 sec via 349000 for bytes per second while the blue curve present the heavy with 325000 bytes per second in the similar time respond.

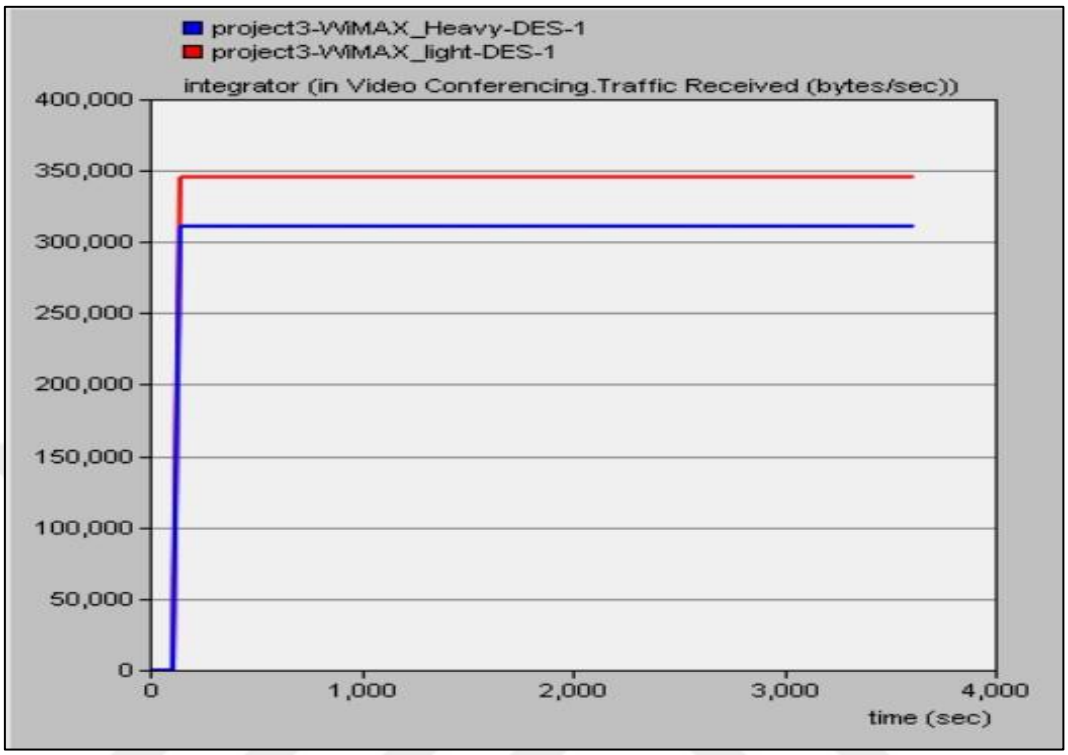

Figure 4.4: WiMAX Heavy and Light for Video Conferencing Traffic Received Bytes/sec.

In Figure 4.5, the WiMAX delay has been presented for the heavy and light services, as appears in the mentioned Figure, the curves for heavy and light services were closed to each other, the WiMAX delay for light services gave 1.2 sec when the blue curve had gave 1.15 for heavy services, this depend on the WiMAX structure with the parameters estimated for each value starting via transmission medium and the entire ethernet cable which allocated for a maximum range between 1000 Base-T and 1 Gbps, these coefficients had made a variety between cases based on our proposed system, by taking the time into account, the settling time for light that around at 1000 sec and this number can be expressed as the first time for settling for both services.

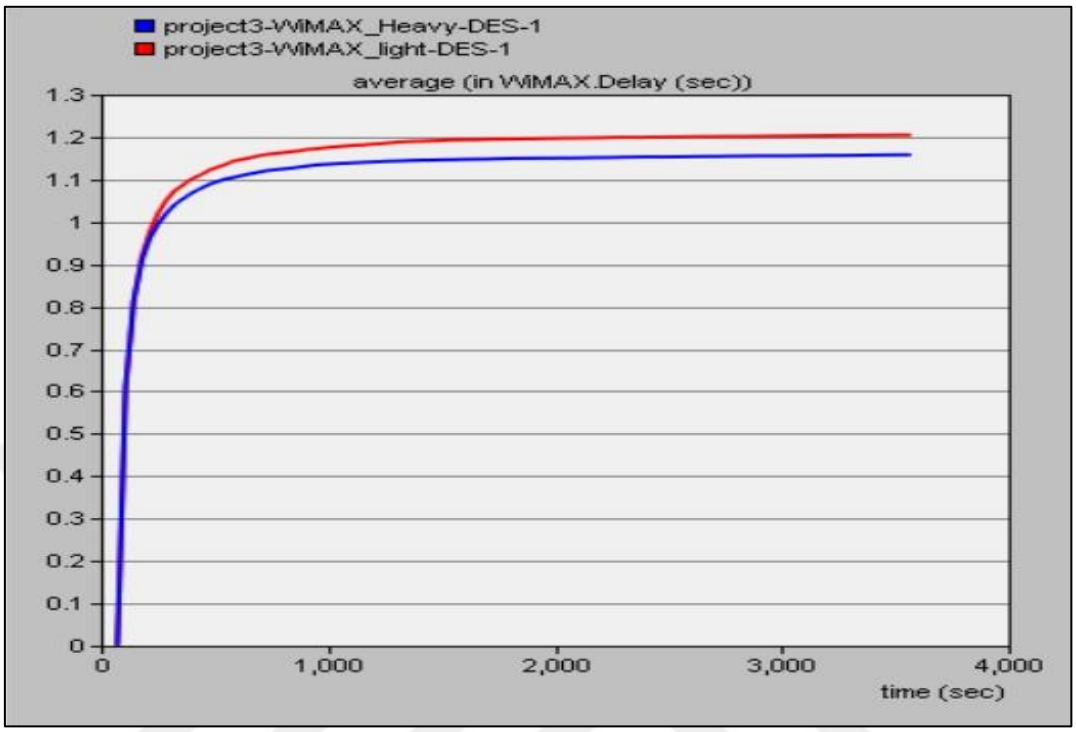

Figure 4.5: WiMAX Heavy and Light for WiMAX Delay (sec).

As mentioned above for both services, the variety had been measured between throughputs, delay, and load for these factors could be made a big variation and due to this reason, many other services can be applied to solve this current curves between services, as mentioned in the Figures 4.6, and 4.7, can be made 7500000 for heavy service, and 3900000 for light service based on bitrate and 640 for heavy and 350 for light as presented above, according to these varieties in table 4.1, which describe a comparison between the last research on the topic and our current study as a comparative study.

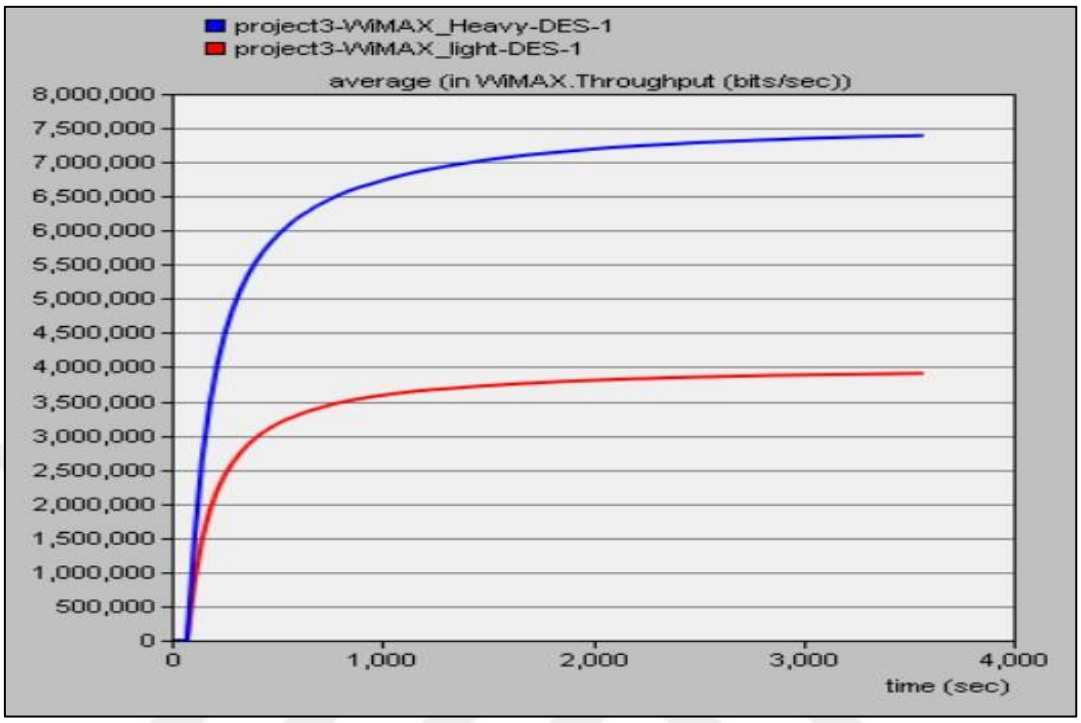

Figure 4.6: WiMAX Heavy and Light for WiMAX Throughput Bits/sec.

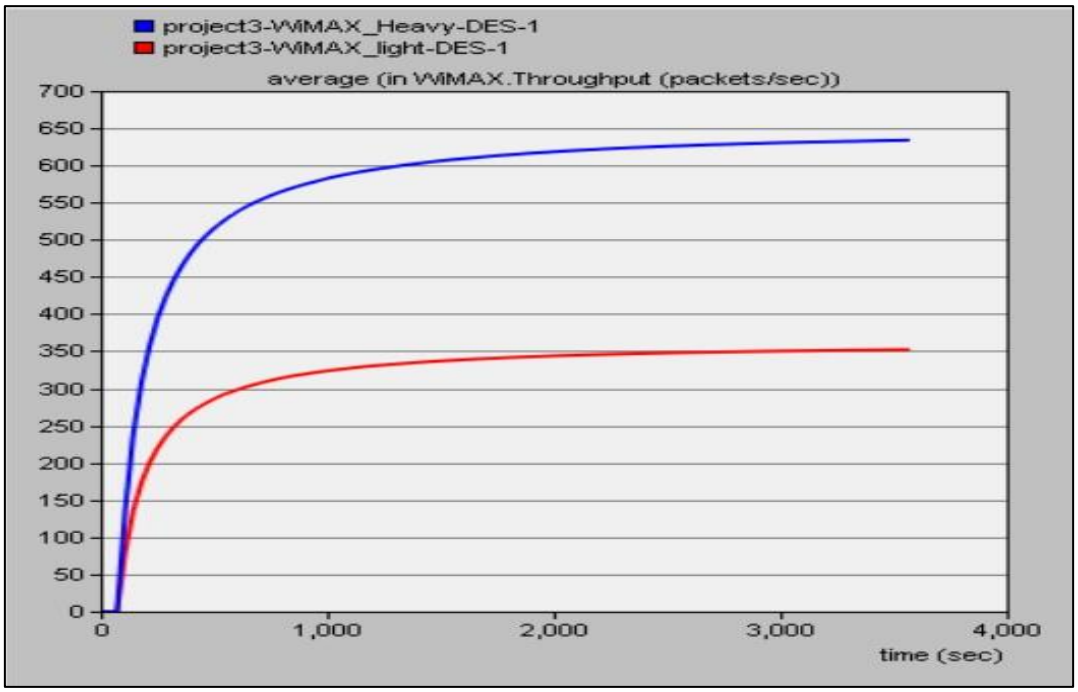

Figure 4.7: WiMAX Heavy and Light for WiMAX Throughput packets/sec.

In Table 4.1, the comparison between heavy and light based on the previous researcher and our proposed work, based on the WiMAX structure with the important estimation of parameters such as the transmission power for the area of coverages and the number of the mobile subscriber stations when compared to the previous studies, our comparative study based on the BSS identifier between the uplink and downlink this made the throughput appeared in the best performance when using a new type of cables such PPPOE-DS1 that able to transceiver around 1 Gbps.

Table 4.1: WiMAX heavy and light between our work and previous work.

Parameters	**Ref. [1]**	**Proposed**
Packet End to End Delay (Light Video)	115 (sec)	28 (sec)
Packet End to End Delay (Heavy Video)	110 (sec)	25 (sec)
Traffic Sent (Light Video) with Packet	4600 (packets)	5800 (packet)
Traffic Sent (Heavy Video) with Packet	3700 (packets)	4045 (packets)
Cable Type	100Base-T	1Gbps
WiMAX Throughput Packet with Light WiMAX Throughput Packet with Heavy	2700Bitrate 1180Bitrate	6400Bitrate 3500Bitrate

5. CONCLUSION

5.1 CONCLUSIONS

In this piece of work, the Mobile WiMAX Network Components that had been actualized with the WiMAX Network Model and for demonstrated that the use with proposed Cloud IP Component superior to other due to the enhanced throughput for light packets around 6400-bit rates and gained 3700-bit rates in comparison to the study that came before it was discussed. The WiMAX Network Model had been actualized with the Mobile WiMAX Network Components. The proposed Mobile WiMAX Network had been put into use, and parameter assessment of throughput, load, delay, and WiMAX connection depended on WiMAX heavy and light services according to the enhanced value regard 28 seconds and gave towards 87 delays over second that gained from our proposed technique. These results were determined by analyzing the data. Experiments have been done in order to improve the proposed Mobile WiMAX Network Components as well as the Cloud IP Component. The goals of these experiments have been stated previously.

5.2 FUTURE WORK

In future work, we would recommend the following:

i Increasing the numbers of frequencies to accomplish high density for data rates, estimated parameters, such as throughput and the transmitted power that provide for this suggested model, must be a thing in a consideration.

ii Experiments within various equipment techniques for seen that could renew the transmitting distances for a large coverage area.

iii Other applications could be introduced to enhance the mobile WiMAX network such as a printer, remote login, VoIP, and FTP with quality checks for each one of the services with their responses.

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