International Journal of Engineering Sciences Paradigms and Researches (IJESPR)
(Vol. 33, Issue 01) and (Publishing Month: August 2016)
(An Indexed, Referred and Impact Factor Journal)
ISSN: 2319-6564
www.ijesonline.com

Performance Analysis of WiMax Networks

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Publishing Date: August 17, 2016

Abstract

Wimax standard is one of the promising technologies that provide broadband wireless access for the metropolitan area network (MAN). Multiple performance evaluation techniques exist for performance analysis of this network. Simulation is widely used in both academia and Industry. Different Simulation tools are available including general public, private and standalone simulators nevertheless, due to the numerous number, complex framework and enormous cost of these Simulators. This paper study IEEE 802. 16 standard and survey some previous research subjected to WIMAX network and looking for the appropriate seems to be employed by analysts.

Keywords: *WiMAX, Simulator, IEEE 802.16, MAN, MAC, QoS.*

1. Introduction

The IEEE 802.16 standard [1], widely known as worldwide interoperability for Microwave Access (wimax). The standard models out two specifications, the physical (PHY and media access control (MAC) tiers. It has several advantages, including ease and cost of deployment, firstmile last-mile access, and quality-of-service (QoS support for multimedia applications at the MAC layer Because multi-media applications must support various sorts of traffic simultaneously, each of which has different QoS requirements from the network, such as band width, delay, jitter, and bundle loss, providing QoS to these traffic classes symbolizes an issue [1],[2] [3]. For that reason the right resource allocation approach is highly needed to provide network-level QoS The performance analysis of reference management algorithms plays a crucial role in the look of a WiMAX system.

2. Specifications

2.1 IEEE 802.16 Standard

When a user wants a network service of broadband access, he considers using digital subscriber line (DSL) and Cable-modem to connect with the network. Some broadband access Technologies like LMDS or MMDS have been proposed early in the past, there was no uniform technical standard for LMDS and MMDS then, and the air interfaces. Provided by different manufacturers were incompatible, which limited the development of the whole communication industry severely. IEEE802.16 is established to support air interface between WIMAX tower and user terminal.

2.2 IEEE 802.16-2001

It's a wireless network specification applicable for Wireless Metropolitan Area Network (WMAN), IEEE 802.16-2001 is only suitable for Clear areas because the microwave signals in the frequency range of 10–66 GHz have poor penetrability, and the signals are easily affected by rain attenuation.

There for communication between the base station (BS) and the subscribe station (SS) is line of sight (LOS).

2.3 IEEE 802.16a

IEEE 802.16 standard he extension of IEEE 802.16-2001, It operates in the frequency range of 2–11GHz, The signal coverage reaches up to 50km (with radius of 10km),

IEEE 802.16a can operate in the NLOS (Non-Line-of-Sight). The support of mesh topology is added to IEEE 802.16a.

2.4 IEEE 802.16-2004 (IEEE 802.16d)

(IEEE 802.16d) or IEEE (802.16-2004) standard is defines details specifically to the physical layer and the media access control (MAC) layer of the 2-66GHZ frequency range.

2.5 IEEE 802.16-2005 (IEEE 802.16e)

IEEE802.16e or IEEE 802.16-2005 IEEE802.16e standard firstly emphasized the application of fixed network. However, resulting from the progress of wireless communication technology and demand of user market, only the mobility features can guarantee a broader market prospect of wireless broadband access service. IEEE802.16e supports the high-speed information transmission in moving, in addition to supporting mobile communication.

2.6 IEEE 802.16f

Improve the coverage area by using the mesh networking. Mesh networking has the ability to bypass obstacles and only a small amount of meshing can largely improve the coverage area of base station.

2.7 IEEE 802.16 g

This technology support mobility at higher layer and across backhaul. It's not yet fixed whether OFDM or OFDMA will be the transmission technique.

The standards are compared with each other as shown in table 1:

Table 1: 802.16 standards

Release	802.16	802.16A	802.16E
Spectrum	10-66 GHZ	2-11GHZ	2-6 GHZ
Channel Bandwidth	20.25 AND 28 MHZ	1.5 TO 20 MHZ	1.5 TO 20 MHZ with UL Sub Channels
Modulation	QPSK ,16 QAM, 64 QAM	OFDM 256 SUB Carriers QPSK, 16QAM,64QAM	OFDM 256 Sub Carriers
Bit Rate	32-134MBPS (28MHZ)	75MBPS(20 MHZ	1.5 MPS(5 MHZ)
Channel Conditions	Line of Sight	Non-Line- of Sight	Non-Line- of Sight
Typical Cell Radians	2-5KM	7-10 KM, MAX 50 KM	2.5KM

Application	Fixed	Fixed And Portable	Mobility

3. WiMax Architecture

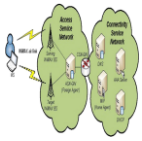

Figure 1: WIMAX Architecture

3.1 Previous Study

At this paper techniques exist for the performance analysis of WiMAX sites. These techniques consist of experiment, computer simulation, and mathematical analysis [4, 5]. An experiment is conducting trials with real test beds, and is the most suitable for monitoring the status of a system for a specific network configuration. Even though the technique provides the most accurate performance examination, building test beds is costly, reconfiguring and giving out them is complex, and they are really relatively inflexible [6]. Furthermore, it can be difficult to reproduce some network phenomena, such as wireless interference, routine attenuation, noise, and removal.

At this paper mathematical analysis works on the simple mathematical model. This method provides a theoretical history for a given technology, but only provide a limited insight into the technology. It has a lower cost and less effort than the other two techniques. Yet, math models often become intractable [7]. Finally, Pc simulation provides a practical process where the system is `imitated' over time [8, 9]. This kind of technique produces replicable results [5 Thus, ruse has become a powerful technique applied by research workers in conducting performance critiques of emerging technologies [4, 5]. Recently, almost all of the research conducted on IEEE 802. 16 sites has depended on ruse for the performance critiques [3,10,11] The importance of network ruse is thoroughly described in [12] With this newspaper, a survey on existing IEEE 802. Sixteen network Simulators in WiMAX networking is presented. The strive of the survey is to reduce the burden of searching for an appropriate simulator to be employed by researchers.

3.2 Survey of WiMax Simulators

A large range of network simulators have been developed in order to evaluate the performance of the various aspects constituting 802. of sixteen networks. These simulators are classified into three types[13]: domain, private domain and standalone. The ns-2 [14] is one of the public domain name simulators utilized in academia and industry [15, 16, 17, 18]. It deploys a rich set of Internet protocols which include both wired and wi-fi marketing networks [17]. Up to now, ns-2 has lacked a certain 802. 16 module [16]. Thus, modules should be added to ns-2 [19] in order to serve the meant objective. Herein, several segments for ns-2 and ns-3 available in the open public domain and the stand alone simulators are discussed and analysed based on the resource management algorithm used to put into practice the simulator and traffic types used. The private domain such as OPNET [30]and Qualnet [20] are excluded in this evaluation due to the unavailability to the public with their source codes A lot of researchers have developed ns-2 modules for 802. sixteen based networks [15, 18, 21, 22]. The Network 802.16 and Distributed Devices Laboratory (NDSL[15] proposed for first for ns-2 called MAC 802. The module focuses on MAC protocol development by supporting different service moves and the WRR scheduler as well as a simple CAC scheme that follows FIFO to declare an incoming connection Even so, it does not consider several implementation details because of its high ease thus the module is not standard compliant [18]. Although the module has its own good features, its further improvement has stopped [22]. Then, the Nationwide Institute of Standards and Technology (NIST) [21] proposed another ns-2 component, called the NIST component that supports the predetermined RR scheduler for the UP allocation of group width to the listed MSs. However, it is lacking in the implementation of a MAC QoS [16, 23, 24] Several themes have been proposed to extend the NIST component

[21]. A joint effort among teams at Rensselaer Polytechnic Institute (RPI), Washington University in E. Louis (WUSTL), the WiMAX Forum and the NIST, have proposed a WiMAX forum module[6].

This kind of module also supplies a standard RR scheduler for the UP bandwidth allocation to registered MSs according to bandwidth requested and comes with support to QoS organizing services, i. e., UGS, rtPS and BE services But nrtPS and ertPS are not included. Telecommunications Bretagne proposed a new ns-2 WiMAX [16] module.

It facilitates three scheduling service classes, such as UGS, rtPS, and END UP BEING as well as various scheduling algorithms that include RR, WRR, Temporary Removing Scheduler (TRS)+RR Maximum Transmission to Interference Ratio (mSIR), and TRS+mSIR. The Laptop Networks Laboratory (CNL) of KAIST University proposed another WiMAX[17,23] component which supports all the five of the 802. 16's QoS booking services. Nevertheless , it truly does not support any arranging and CAC algorithm. Therefore, the CNL module has been produced less attention by the developers who aim to modify the module with news and plug-ins, due to their high non-modularity [22]. The NIST module and its existing extensions shortage an implementation of an ns-2 module that works with both WiMAX compliant flexibility and QoS support. Subsequent, the University Siena proposed a new ns-2 Tool [24] that is based on the favorite module described in [2] that implements all five Quality of service classes, but no booking algorithm is implemented After, several researchers also recommended other ns-2 modules for 802. 16 based. The module from KAIST [25] in their earlier papers [26, 7] considered only the best effort service with a simple RR scheduling algorithm among the various scheduling services. The authors extended basically to four different classes of service, an UP arranging algorithm for band size allocation, and simple CAC are also supported in [28] The Eurocom Institute and ENSI recommended an 802. 16 component [29] for an ns-2 simulator standard [1] and ns 2.29 variation.

It supports a narrative QoS architecture that comprises of a CAC and a hierarchical booking formula. Although the authors offered it as a new component with integrated QoS buildings, it is not different from the NIST rendering. The Research and Technology Platforms together with the Telecommunication Laboratory proposed another component called WiMAX ns-2 Extension (WINSE) [22] that implements 802. 16 extensions for the ns-2 network simulator..

4. Conclusions

With this paper, we presented a survey on simulators in WiMAX networks. The study considers only the community and standalone simulators. In public simulators, several quests are discussed by showcasing strengths and weaknesses of every module. While in the standalone, several simulators are also discussed. The conventional paper provided an improved understanding of the WiMAX simulators and reduced time for looking an appropriate simulator to provide in academia.

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