Proposed A Method Of Implementation For Wimax Network Over Metro-Ethernet Backhaul To Decrease The Amount Of End-To-End Delay And Network’S Load

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Abstract: WiMAX offers unwired broadband access with high capacity of data transmission for dispersed areas. WiMAX network with high bandwidth and suitable speed of transfer can be considered as a solution for public access. This technology with production in considerable volumes from fixed to portable versions shows notable progress in wireless connectivity. Capability of Quality of Service (QoS) support provides user satisfaction in real-time and interactive services over WiMax networks. This network allows the interconnection of MetroEthernet networks with connection up to 10Gbps. The study herein presented deals with a proposal of an end-to-end Quality of Service (QoS) suitable not only for voice and video traffics but also for data traffic. The purpose of this study is to investigate WiMAX network performance over a Metro-Ethernet backhaul. Until the elaboration of this work, as far as we know, there is not a theoretical and practical study of the characteristics of real-time traffic in WiMAX interconnecting Metro-Ethernet networks.

Keywords: capacity, Metro-Ethernet networks, transmission, QoS

Introduction

In the modern wireless communication systems designing products with high flexibility and benefit is considered to have low cost implementation and consuming power and optimal speed and transfer rate [2, 5]. Originally suited for local area networks, Ethernet services are topologically divided into two groups, linear Ethernet (point to point) and Ethernet network (point to multi point). Those services can also be categorized based on provided bandwidth to be in the form of individual services or common services among several users. Although WiMAX does not create a new market, it should allow financial costs reduction and increase wireless communication usability. WiMAX sufficiently surpasses IEEE 802.11 limitations, such as bandwidth provision with the use of strong cryptography for data transmission. With this scenario and the increasing demand for bandwidth to send and receive data, video, voice and television signal, an infrastructure with end-to-end Quality of Service (QoS) mapping is being proposed. Moreover QoS is provided in such networks by the means of VLAN technology to guarantee the bandwidth and delay requirements for heterogeneous services. This paper is organized as follows. Section 2 is allocated to the concepts and operation of WiMAX network and Metro-Ethernet history. The suggested idea for the representation of Metro-Ethernet to implement QoS in WiMAX networks, evaluating the operation of the suggested idea and the simulation of that network is presented in section 3. Conclusion is presented in section 4.

WiMAX and Metro-Ethernet

need to communicate with information world and also remove the limitation of time and place has been the concern of computer science experts and especially internet engineers for a long time. 802.16 standards for metropolitan network is the last solution to answer these requirements. WiMAX technology provides wireless access to the broadband for the common and business users [1, 2]. 802.16 standard is consisted of central stations named bus station(BS) and subscriber station(SS) that receives network service from BSs.

Protocol access layer in 802.16 standards

The explanation of the task of each of them is presented below:
1- Convergence sublayer: The highest sublayer with the task of recording the received traffic from the user which is located in the upper layer of MAC
2- Common part sublayer: The main part of MAC operation happens in this sublayer.
3- Security maintenance sublayer: This sublayer’s task is to identify, modify the code’s key, code and decode the received and sent messages.
the access layer uses the common media in two different ways to transfer data, which are point to multi point (PMP) and mesh. Mesh method is more general than PMP. Mesh method like AD-hoc networks, data traffic exists among subscriber stations
Standardization of the basis of QoS in WiMAX network considers some details about the current’s type of supported services. As wireless environments are full of environmental noise, power weakening barriers, suitable wires should be used to connect access points (AP) and external network. A reliable basis such as Metro-Ethernet should be used to connect APs or BS. To guarantee the quality of service in WiMAX wireless network, there is a need to define and enforce the mechanisms of forming the traffic, timing, queuing and prioritizing the data traffic. The packets hierarchical timing model for the UL state in WiMAX network is introduced in two ways: soft QoS and hard QoS. nrtPS traffic and rtPS traffic are considered as a part of soft service quality group because the bandwidth between maximum and minimum is the amount of bandwidth for each required connection. UGS traffic is considered as a part of hard QoS because the maximum bandwidth which is accessible for each connection is required. With timing BE traffic by BS, the model can distribute bandwidth between BE and other traffic exploitation classes and guarantee fairness in supported in QoS [2, 4].

**Metro-Ethernet**

Metro Ethernet network is a metropolitan area network (MAN) that is based on Ethernet standards. It is commonly used to connect subscribers to a larger service network or the Internet. Businesses can also use metropolitan-area Ethernet to connect their own offices to each other. Ethernet is a developed, beneficial and well-known technology and its media are accessible in most of communication and data devices. The media compatible with this standard are accessible for 10, 100, 1000 Mbps speeds and the standard related to the speed of 10Gbps has approved. Suitable qualification of Metro-Ethernet network such as transferring through available station and providing quality of service has encouraged developers to use this network as the basis of wireless network in Metropolitan dimension. Most of these networks have extended in Metropolitan in past years with high expenses and limited flexibility. The idea of developing a low expense and simple Ethernet from a local network to a metro network that makes it possible to use the available networks in the Metropolitan as the basis of Ethernet transfers, has created interests to make networks called Metro-Ethernet. Also, the basis of providing quality of service is created in these networks.

**WiMAX network with Metro-Ethernet**

MEF association has introduced some of the new Metro-Ethernet services based on the network architecture. Customer’s equipment are joined to their Metro-Ethernet network by Ethernet port. The task of this connection to network which is called UNI is to define physical limitation of service provider’s tasks and customer’s tasks. Inside metro network, the connection between UNIs is provided by Ethernet virtual connection. Switch processor can be arranged and formed in a way that separate some nodes from the stations and treat them like several independent LAN: “a collection of virtual LANs that their connected stations reflect organizational structure not geographical structure.” 802.1P header consists three bits for prioritization which allows packets to be categorized in different traffic classes [5].

**Simulation**

In the simulated scenario, three subnets with different number of nodes were used within WiMAX network with Metro-Ethernet backhaul. The connection between subnets is done by third layer switches, VLAN and 802.1P and 802.1Q standards are used to prioritize the traffic. In order to provide high security, speed and QoS guarantee in WiMAX network, the connection of service providers and the relationship between APs with Metro-Ethernet basis is considered in this study. The transferred packets use UDP, RTP and IP protocols. In this scenario, assume each node has the same PHY mode that is OFDMA 20MHZ.

**End-to-End Delay**

Delay is measured as the average of total time that lasts until one packet after production in source is delivered to final receiver in destination. Delay parameter is achieved by the following combination. The propagation delay: it is the limited speed of signal propagates. The speed of transfer and propagation packets is higher in Metro-Ethernet networks because of their wired basis. As in satellite and wireless state, this delay is maximum so in the simulated scenario of WiMAX network, propagation delay among APs is extremely decreased due to using a Metro-Ethernet basis. The delay between two mobile nodes in two different cells requires the evaluation of the three following steps:

- The delay between source nodes to source AP.
- The delay between APs.
- The delay between AP in destination to destination node.

Figure 1 shows all the three delays for the sending of packets between two packets in the network.
Increasing the number of mobile packets (users) in each cell not only decrease each station’s share from channel’s useful capacity and Metro-Ethernet but also decrease the network’s useful capacity because of the increase in overhead queuing and timing operation. Also the number of users in each cell affects the amount of AP’s load in each cell. The amount of each AP’s load is extremely changing due to wireless nature of WiMAX network and mobile nature of stations. Each AP’s load in WiMAX depends on parameters such as AP’s sending rate, the type of station’s practical programs, the amount of delay, jitter, bandwidth and rate of packets loss. In order to compute each station’s useful share from bandwidth, the following parameters should be considered:

- In each cell, at most several stations are connected to that cell’s AP and receive service.
- How much is the frequency of traffic production in each practical program (average).
- Whether the sum of station’s produced traffic is more than network’s useful capacity.
- The type of operations (profile) that available users in a cell use.

In scenario of WiMAX network, mobile nodes in each cell or even in each subnet are considered changeable in order to examine different factors and their changes. Figure 2 shows Evaluating network’s load in wimax.

**Conclusion**

In this paper, we proposed a method of implementation for WiMAX network over Metro-Ethernet backhaul to decrease the amount of end-to-end delay and network’s load in such system. To model the packet transfer between two BSs, we used Markov chain. Our simulations show noticeable advantages for the integration of the MLS switch, IEEE 802.1P which is proposed in this paper.
References


