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Study of IEEE802.16e standards to improve QoS throughput and delay analysis of PMP MAC Scheduling algorithms

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Abstract: WiMAX has two modes of operation: Point to Multi Point (PMP) mode and Mesh mode. PMP mode consists of one BS and multiple SS.The Wi-MAX is IEEE 802.16 Wireless network standard which recently used for Broadband Wireless communication. Now days to satisfy the highest demand of broadband wireless access by using various resource of bandwidth is a biggest challenge for Researchers, in this time WiMAX (Worldwide Interoperability for Microwave Access) emerged as a better solution to fulfil that demand. To provide authentic services for voice, data and videos WiMAX define the various QoS parameters at Media Access Control (MAC) layer. WiMAX structure is based on IEEE 802.16 OSI standard and defines the PMP (Point to Multipoint) and Mesh modes for transmission of information. In this study, cross-layer scheduling algorithm for Wimax networks has been proposed.

Keywords: - *Cross-Layer, IEEE 802.16, QoS, Scheduling, Wimax,NS2.*

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I. INTRODUCTION:

PROPOSED CROSS-LAYER SCHEDULING ALGORITHM

The main focus of the cross layer design is to provide best possible end-to-end performance for the applications. The objective is to maximize the total throughput when satisfying the QoS requirements of different service classes. The proposed scheduling algorithm modifies cross-layer algorithm which incorporates SNR value and the minimum required throughput of the SS in its formulation. The SS with highest priority is selected to transmit in the frame. The priority of the SS is calculated based on the traffic class it belongs to.

How We are Implementing

1. Installation of Open source operating System i.e Linux
2. Installation of NS2
3. 3.Creation of Wimax IEEE 802.16 environment
4. 4.Implementation of CROSS-LAYER SCHEDULING ALGORITHM

Implementation of CROSS-LAYER SCHEDULING ALGORITHM includes:

- Introduction of wimax
- Define higher priority queue
- Schedule the Bandwidth request opportunities which should be scheduled in next frame
- Periodically check the deadline for the service flow
- Do check the bandwidth minimum availability
- Resources should be periodically distributed among the service flow according to the deadline

Performance Evaluation depends on three parameter:

Throughput:

To calculate throughput the size of each packet was added. The total time was calculated by the difference between the time that the first packet started and the time that the last packet reached the destination.

Packet Loss : Packet loss is the sum of all the packets which do not reach the destination over the sum of packets which leaves the destination

Average Delay : The time taken by the packets to start from the source and reach the destination and traverse back to source is the delay produced by packet.

WiMAX is based on IEEE 802.16 standard, that also known as Wireless MAN. IEEE 802.16 group was formed in 1998 to develop a standard for wireless broadband access. Initially, group's focus was to develop a LOS Point to Multipoint (PMP) wireless system in frequency ranges from 10 GHz to 66 GHz. First standard of IEEE 802.16 completed in December 2001. That was based on single carrier Physical (PHY) layer with burst Time Division Multiplexed (TDM) MAC layer. As shown in figure1 WiMAX network consists of Base Station (BS) and Sub-scriber Station (SS), usually, BS connected with the backbone network through wired connection however, in some cases it might be in the form of wireless connection. Whereas, SS receive services from BS according to user requirements. WiMAX operates in two type of networking

modes: Point to Multipoint (PMP) and Mesh Mode. In PMP mode, each SS in the network has a direct communication link with BS and SS's are not allowed to communicate directly with each other. Whereas, in case of Mesh mode, SS's might have direct communication with BS as well as can communicate with each other directly. Purpose behind this was to serve SS's that are in the depth coverage areas by using multihop links through intermediate SS's. WiMAX standard specifies two scheduling modes. In Centralized Scheduling BS acts as a central entity that perform all operations related to resource allocation and traffic scheduling. Whereas, in Distributed Scheduling, all SS's and BS's in the network participate in the process for scheduling and resource allocation. As all nodes compete with each other for network resources by using an election algorithm. Usually different traffic types and different nodes have different priorities in network for proper scheduling of network resources.IEEE 802.16 WiMAX standard specifies five different QoS service classes for differentiation between traffic classes to ensure the efficiency. Specified QoS classes are Unsolicited Grant Service (UGS), real time Polling Service (rtPS), extended real time Polling Service (ertPS), non-real time Polling Service (nrtPS) and Best Effort (BE).

Physical Layer of WiMAX has support for several multiplexing techniques like Frequency Division Duplexing (FDD) and Time Division Duplexing (TDD) with wide bandwidth capacity of 1.25 MHz to 20 MHz for each channel. Also it has some wide frequency range 2 GHz to 11 GHz for NLOS and 10 GHz to 66 GHz for LOS on which it can operate. However due to equipment availability only few frequency bands are in use e.g., 2.4, 2.5, 3.5, 5 and 5.8 GHz.

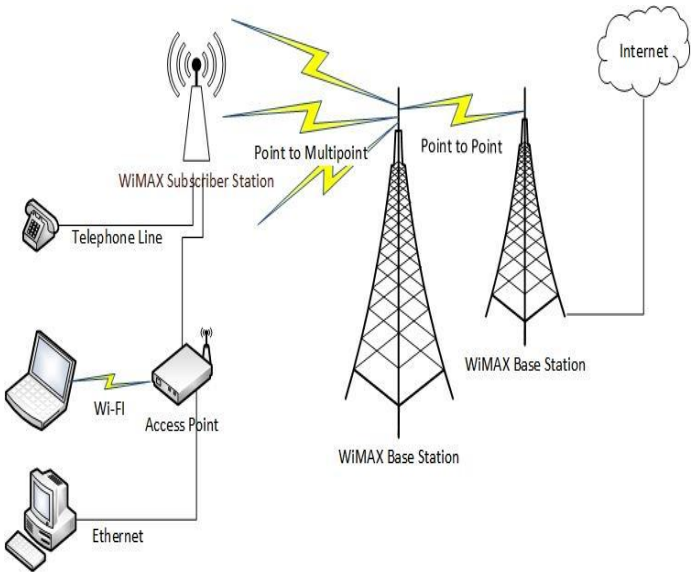

Figure. 1. Overview of WiMAX

II. LITERATURE SURVEY

Borin and Fonseca[1] proposed a standard compliant scheduling solution for uplink traffic in IEEE 802.16 networks but wireless channel characteristics are not considered in this solution.

Many other scheduling mechanisms have been proposed by Y.Caoand, V.Li[2] and H.Fattah and C.Leung[3] but none of them is able to support the QoS requirements of the five types of service flow defined by the IEEE 802.16e standard.

To provide guaranteed latency requirements to real time applications, the scheduling mechanism proposed by Q.Ho, M.Ashour and T.Le-ngoc[4] uses a history of packet delays to classify packets in four classes and the scheduler gives a higher priority to packets destined to users whose instant channel conditions are better.

A.Lera,S.pizzi[5] proposed a scheme in which packets can be blocked when the user channel conditions are not satisfactory.

In Qingwen Liu[6] the authors proposed a two stage cross-layer QoS support framework with a scheduling algorithm. That scheduler provided the latency guarantee, and a mechanism to avoid starvation, but failed to provide the maximum rate guarantee.

Revankar[7] (2010), the authors explain the MAC scheduling architecture for IEEE 802.16 wireless networks in both uplink and downlink direction to broadcast the frame. Further they used WFQ as uplink as well as downlink scheduling algorithm for improving delay and throughput. There is no separate scheduling policy for Unsolicited Grant Services (UGS). Even though there are vast number of works based on scheduling in single hop networks, these algorithms cannot be applied for multihop relay scenarios.

M.Vijayalakshmi[8] explain the WiMAX MAC layer is designed to support different types of applications and services having different Quality of service (QoS) requirements. In addition of providing higher throughput and less delay. A sc heduling algorithm should also take into account the WiMAX Qos classes and service requirements at MAC layer. Proper scheduling algorithm will enhance the date rate of all the QoS classes of IEEE 802.16e standard.

Angana Chakraborty[9] explain The system requirement of next-generation mobile WiMAX is supposed to be based on IEEE 802.16 m which is still in letter ballot stage specifically considering Indian environment. This paper presents an optimized architecture and scenario based on the recently standardized IEEE 802.16 m framework, integrating both mobility management and QoS in Indian scenario. Moreover, we analyse the QoS issues like

throughput, uplink and downlink packet drop. OPNET-based simulation platform has been introduced for the verification of analytical model and results.

III. SYSTEM DEVELOPMENT METHODOLOGY

3.1 Implementation Objectives:

This architecture is designed to achieve the following objective:

1. Packets are scheduled in uplink direction as per their priority UGS packets having highest priority and after that rtPS and nrtPS packets.
2. The packets are sent one after another in the downlink direction in SS based on the priority of the packets.

The UGS packets are sent first as per FIFO and same type of rtPS and nrtPS packets are sent as per FIFO.

3.2 Implementation Steps of WiMAX:

The drawback of any wireless communication structure is that coverage ranging area data rates are imperfect. To overcome this limitation in WiMAX communication structure the coverage ranging area is increase by changing the bandwidth. The following steps are involved in ns2 for implementing WiMAX point-to-multipoint communication.

Step 1: We have used the ns-2 version 2.34 for implementing WiMAX point-to-multipoint communication.

Step 2: The files have been made changes are mac-802.16.cc, mac-802_16.h and ll.c, packet.h

Step 3: Add the given listed parameters in Table 1 & 2 in the files mac-802.16.cc, mac-802_16.h

Step 4: For this implementation purpose we have used Linux (Fedora 12 version)

Step 5: After execution of the wimax1.tcl file, the trace file is created wimax1.tr it includes the information about packets sending & receiving time, packets drop & transfer from BS to SS.

Step 6: For displaying the graph we have used the Microsoft Excel 2007. Even though we can use the xghraph, gnu plot command in ns-2 & MatLab for graph plotting purpose.

IV. CONCLUSION

In this paper for the purpose of better bandwidth use for IEEE 802.16 wireless network the channel condition is taken as a feed back by the crucial scheduling strategy. In this work, the static IEEE 802.16 network is considered for study. A WiMax Simulation platform which is based on NS2 has been implemented. Thus the proposed algorithm can be validated. In order to very that the proposed scheduling algorithm is capable of enhancing the performance of WiMax network, the simulation results can be used. The simulation results shows the performance improvement in proposed scheme. The proposed algorithm not only meets all the QoS requirements of the service classes but also provides higher throughput, low delay and packet loss rate, while promising fairness to all the other service classes.

REFERENCES

[1] J.F.Borin, N.LS.Da Fonseca, “Uplink scheduler and admission control for the IEEE 802.16 standard,” Globecom 2009.

[2] Y.Caoand, V.Li, “Scheduling algorithms in broadband wireless networks”, proceedings of IEEE, vol. 89,no.1, pp.76-87, 2001

[3] H.Fattah and C.Leung, “An overview of scheduling algorithms in wireless multimedia networks,” IEEE wireless communication, vol.9, pp.76-83, October 2002.

[4] Q.Ho, M.Ashour, and T.Le-ngoc, “Delay sensitive and channel aware scheduling in next generation wireless networks”, Canadian conference on electrical and computer engineering, pp. 1801-1804, May 2008.

[5] A.Lera, A.Molinaro, S.Pizzi, and R.Calabria, “Channel aware scheduling for QoS and fairness provisioning in IEEE 802.16/ Wimax broadband wireless access systems,” IEEE Network, vol.21,pp. 34-41, September 2007.

[6] Qingwen Liu, Dept. of Electr. & Computer. Eng., Univ. of Minnesota, Minneapolis, MN, Xin Wang ; Giannakis, G.B. “Cross-layer scheduling algorithm with qos support in wireless networks”, IEEE Transactions on Vehicular Technology, Volume 55, Issue 3, pp.839 – 847, May 2006.

[7] Revankar, P.S., A.S. Kapse and W.Z. Gandhare, 2010. Overview of MAC scheduling algorithm for IEEE 802.16 wireless networks. Int. J. Computer. Applic.DOI:10.5120/689-968

[8] M.Vijayalakshmi,Swaroop R. Puranik,Linganagouda Kulkarni, A Cross Layer Scheduling Algorithm in IEEE 802.16e WiMAX Standard to Support RTPS TrafficClass,2014.

[9] Angana Chakraborty, Sajal Saha, Indrajit Banerjee, Arna b Gupta in Optimized WiMAX Network Development in India: Specification and Implementation,2015.

[10] Rehman, Mustafa Shakir International Journal of Computing and Digital Systems @ 2014: Scientific Publishing Centre, University of Bahrain

[11] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[12] IEEE 802.16, IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems, IEEE Std. 802.16, Oct. 2004.

[13] IEEE 802.16 Working Group on Broadband Wireless Access. http://wirelessman.org

[14] Guosong Chu, Deng Wang, and Shunliang Mei. "A QoS architecture for the MAC Protocol of IEEE 802.16 BWA System." IEEE International Conference on Communications Circuits and System and West Sino Expositions, vol.1, pp.435–439, China, 2002.

[15] Parekh, A. K. and Gallager, "A generalized processor sharing approach to flow control in integrated services networks: the singlenode case." IEEE/ACM Trans. Netw. 1, 3 (Jun. 1993), 344-357.

[16] Xiaoliang (David) Wei. Amini "TCP-Linux in ns-2", tutorial available at http://netlab.caltech.edu/projects/ns2tcplinux/.

[17] The ns2 network simulator: available at http://www.isi.edu/nsnam/ns/.ns2.html

[18] Frank Chee-Da Tsai, Jenhui Cheny, Chiang-Wei Chang, Wei-Jen Lien, Chih-Hsin Hung, and Jui-Hsiang Sum, "The Design and Implementation of WiMAX Module for ns-2 Simulator" , Conference on mobile multimedia communication, September 2007, Vol 46, pp 1024-1039.

[19] 1R. Nandhini and 2N. DevarajanAmerican Journal of Applied Sciences 11 (1): 8-16, 2014 ISSN: 1546-9239 ©2014 Science Publication doi:10.3844/ajassp.2014.8.16 Published Online 11 (1) 2014 (http://www.thescipub.com/ajas.toc) http://www.lifesciencesite.com

[20] IEEE Std 802.16-2004 (Revision of IEEE Std 802.16-2001), "IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems," 2004

[21] Hassan Yaghoobi. 802.16 Broadband wireless access: the next big thing in wireless. Intel Developer Forum, Sep2003

[22] G. Andrews, A. Ghosh, R. Muhamed, *Fundamentals of WiMAX: Understanding Broadband Wireless Networking* (Prentice Hall, New Jersey, 2007)

[23] A .Yarali, S. Rahman, WiMAX broadband wireless access technology: services, architecture and deployment models. in *Canadian Conference on Electrical and Computer Engineering* (*CCECE*) (2008), pp.77–82

[24] A.K. Mukhopadhyay et al., QoS and mobility management issues on next generation mobile WiMAX networks. in *Broadband Wireless Access Networks for 4G*: *Theory, Application, and Experimentation, Hershey, PA*: *Information Science Reference*, ed. by R. Santos, V. Licea, A. Edwards-Block. pp. 298–323 doi:10.4018/978-1-4666-4888-3.ch016

[25] G.S.V. Radha, K. Rao, G. Radhamani, *WiMAX : a Wireless Technology Revolution* (Aurbach Publication)

[26] Aldmour, LTE and WiMAX: comparison and future perspective. Commun. Netw. **5**, 360–368 (2013)

[27] R.K. Singh, WiMAX networks: service and their quality metrics. Int. J. Emerg. Technol. Adv. Eng. **2**(6), 329–333 (2012). ISSN 2250-2459

[28] K. Etemad, Overview of mobile WiMAX technology and evolution. IEEE Commun. Mag. **46(**10), 31–40 (2008)

[29] S. Ahmadi, An overview of next-generation mobile WiMAX technology. IEEE Commun. Mag. **47**, 84–98 (2009)

[30] J. Chen, C.-C. Wang, F.C.-D. Tsai, C.-W. Chang, S.-S. Liu, J. Guo, W.-J. Lien, J.-H. Sum, C.-H. Hung, The Design and Implementation of WiMAX Module for ns-2 Simulator. WNS2 (Pisa, Italy, 2006)

[31] IEEE 802.16e/D12-2005, IEEE Standard for local and metropolitan area networks – part 16: air interface for fixed and mobile broadband wireless access systems - amendant for physical and medium access control layers for combined fixed and mobile operation in licensed bands and corrigendum 1 (October 2005)

[32] Kim, S., Yeom, I.: Performance Analysis of Best Effort Traffic in IEEE 802.16 Networks

[33] Cable Television Labs Inc., Data Over Cable Service Interface Speci-fications – Radio Frequency Interface Specification, SP-RFIv2.0

[34] Shrivastav, N.: A network simulator model of the DOCSIS protocol and a solution to the bandwidth-hog problem in the cable networks. Master Dissertation, North Carolina State University, EUA (2003)