KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Electronics & Communication Engineering

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COURSE NAME: Project and Thesis

Report On: Prediction of Heavily Loaded ONU for Auction based DBA Algorithm in EPON-WiMAX

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Chapter-1
Introduction

1.1 Introduction:

Due to significant increase in internet traffic, several new service based on multimedia applications are growing and broadband access is demanded highly.
New service patterns have been propelled from text and voice-based services to the user generated interactive multimedia services.Voiceover IP (VoIP), Video conferencing, Video on Demand (VoD), online gaming and High Definition Television (HDTV) broadcasting services are growing dramatically in regular basis and results in increasing bandwidth requirements.In response to this amazing development, the underlying telecommunication networks have evolved to support new emerging applications with tremendous growth in bandwidth and capacity.Ethernet Passive Optical Network (EPON) is regarded as a promising solution for the next generation fiber-based access technique as it provides high-speed, cost-efficiency , scalablility.
On the other hand, wireless access technique is also gradually upgrading its bandwidth, mobile ability, and quality of service (QoS) support. The new-generation wireless technique Worldwide Interoperability for Microwave Access (WiMAX) has now been standardized and deployed. The advantages of bandwidth benefit and mobility feature make the integrated EPON and WiMAX architecture as one of the best candidate solutions for next-generation broadband access networks. Wireless technology can go everywhere, but with limited capacity. On the other hand, optical fiber although limited to fixed paths, has almost unlimited capacity. This integrated architecture supports larger access network coverage and enables to provide both wire and wireless access services simultaneously.

1.2 Motivation:

The requirement of data transmission is increasing dramatically in recent days. Consequently, different methods and technologies are growing to carry out the bandwidth requirement. Optical network usually provides that facilities of faster data transmission rate with less attenuation and less electromagnetic interference. Several methods is applicable to provide faster data transmission rate. Dynamic Bandwidth allocation is mostly used method to provide the faster data rate and improve system efficiency. For a fixed amount service provider, bandwidth wastage is a problem. That makes the system inefficient. To improve the bandwidth allocation and reduce bandwidth wastage this proposed method will be a better way.

1.3 Problem Statement:

The integration of wireless and optical access networks capitalizes on the advantage of large bandwidth availability of optical networks as well as on the mobility provided by wireless networks. Among the broadband access technologies the Worldwide Interoperability for Microwave Access (WiMAX) and optical Ethernet Passive Optical Network (EPON) technologies have been successfully deployed and can be easily integrated since the majority of WiMAX Base Stations comes with an ethernet port that can be plugged into Optical Network Unit (ONU). WiMAX is a

broadband wireless access network that provides Quality of Service(QoS), wide coverage, low cost infrastructure and high speed access while EPON is an optical access network with no active elements which provides large amount of bandwidth to the users. These two technologies have several similarities. They can work in point to multipoint infrastructures. Both EPON and WiMAX employ a request/grant mechanism for bandwidth allocation.

The allocation of bandwidth for service providing in mostly case is dynamic.But the dynamic bandwidth allocation is time consuming, which affects the delay time and throughput. A combinational process of dynamic and static bandwidth allocation is used but the probability of heavily loaded ONU is not determined. At the same time, how much data is required for each ONU that is not determined also.These determination helps to reduce Bandwidth wastage which also increase the throughput.

1.4 Objectives:

The objectives of this proposed scheme is :

- To learn about the conceptual knowledge about optical network communication.
- Design an efficient bandwidth allocation scheme.
- To find the possible best way to allocate bandwidth so that the system performance got increased and BW wastage decrease.
- Reduce the packet loss probability of a highly loaded ONU in a transmission cycle.
- Evaluate the performance of network throughput, data transmission delay.

Chapter -2
Literature Review

2.1 Introduction:

Ethernet Passive Optical Network (EPON) and Worldwide Interoperability for Microwave Access (WiMAX) are two promising broadband access technologies for next generation wired and wireless access network. The integrated architecture of complementary EPON and WiMAX technologies combine the benefits of optical fiber capacity and wireless network mobility. Several works have been done to achieve better system performance on the basis of this integrated architecture. Bandwidth allocation method helps to allocate BW effectively thus system can eliminate bandwidth wastage and improves performance . To achieve these purposes various methods and models have been proposed.

2.2 Related Work:

There are several process to allocate bandwidth in any optical network. Bandwidth can be allocate dynamically and statically. Dynamic Bandwidth allocation is mostly followed. Bandwidth allocation schemes can be divided into the centralized, the decentralized and the hierarchical.

To improve the performance and system efficiency, various method can be applicable. A hybrid bandwidth allocation method can be a way to improve the throughput and delay performance. Mohammad et al. [1] proposed a hybrid strategy for bandwidth allocation that worked on auction process. The dynamic Bandwidth allocation is used to determine the number of user demand. Auction cycle is used repeatedly in each 5 cycles to avoid any unwanted changes. This saves time and avoid mistakes in every cycle . After that the rest of the process become static. That repeats periodically.

The service quality and data transmission rate can be improved by checking the ONU priority ratio and scheduling the buffer ratio into two steps. Jhong et al [2] proposed a hybrid dynamic bandwidth allocation method and a queue-based scheduling scheme and upstream transmission scheduling to manage call admission control make users can efficiently satisfy the demand for bandwidth request and enhance the efficiency of the system. Designing has been done in two steps based on configuration priority and in each steps the priority is checked with the buffer level defined for each priority.

Another efficient method to improve service quality is proposed by Mariana et al [3] . They proposed about a scheduler named DBQUS Scheduler which keeps track of the amount of bandwidth that was not supplied to each connection (deficitMinimum) due to bandwidth limitation. This deficit occurs when the bandwidth given to a connection is below the minimum required. In this method, the deficit is compensated by providing additional bandwidth as soon as possible so that the minimum bandwidth requirement is supported. Such compensation is provided to

the connections according to a decreasing order of priority. This proposed scheduler used three queues according to their priority level. In run of each queue, the bandwidth priority got improved and thus system performance.

A hierarchical scheduling algorithm and Dynamic bandwidth allocation method is proposed by Hwang et al [4]. This paper shows that WiMAX technology provides better quality of services than EPON technology. WiMAX protocol supports five types of QoS : UGS (Unsolicited Grant Service), rtPS (real time Polling Service), ertPS (extended real-time Polling Service), nrtPS (non-real time Polling Service), and BE (Best Effort service). Two steps scheduling scheme has designed to configure priority. Firstly, the UGS has configured highest priority to transmit. Secondly,the rtPS has configured more high priority than ertPS, and based on this priority to assign the data packet into the Priority Queue 1 (PQ1). Moreover, the nrtPS also has more high priority than BE, and assigns the data packet into Priority Queue 2 (PQ2). Next,ONU buffer situation is referred to decide the priority ratio of UGS, PQ1 and PQ2. If the buffer of ONU is filled less than 40%, then configures the priority ratio 4:2:1 for UGS, PQ1, and PQ2. And if the buffer of ONU is filled between 40% and 80%, then configures the priority ratio 2:1:0 for UGS, PQ1, and PQ2. Finally, if the buffer of ONU is filled more than 80%, then configures the priority ratio 1:0:0 for UGS, PQ1 and PQ2, respectively. Furthermore, the data packets in UGS queue has transmitted into the EF queue of ONU, the data packets in PQ1 queue has transmitted into the AF queue of ONU, and the data packets in PQ2 queue has transmitted into the BE queue of ONU, respectively. In this mode, this scheme guarantees that UGS has more opportunities to be transmitted in the hybrid architecture.

2.3 Summary:

This part discussed some contribution and method for improving overall performance in a system for EPON-WiMAX integarted technology. As the bandwidth requirement is increasing day by day , we need effective methods to achieve desired performances. In section 2.2 some methods are discussed in this regards.

Chapter-3:
Proposed Method & Working Plan.

3.1 Introduction:

It is an EPON based Bandwidth Allocation algorithm that utilize the auction process. In this strategy, OLT is answerable for auction process, which can react in a successful way to bandwidth demands from ONUs compared with their needs and the last time they are stand-by to get their requested bandwidth. The auction cycle repeats itself in every five cycles to perform mathematical iteration to allocate bandwidth. Bandwidth allocation method is followed in hybrid manner that is named semi dynamic process. Differentiating heavily loaded ONU is important. That leads to a new way for bandwidth allocation which further reduce the amount of extra ONU and extra Bandwidth wastage will be eliminated and provide better system outcome.

3.2 Proposed Method:

In the proposed scheme, highly loaded ONU is being differentiated that will help to allocate bandwidth for each ONU in a prioritized manner.

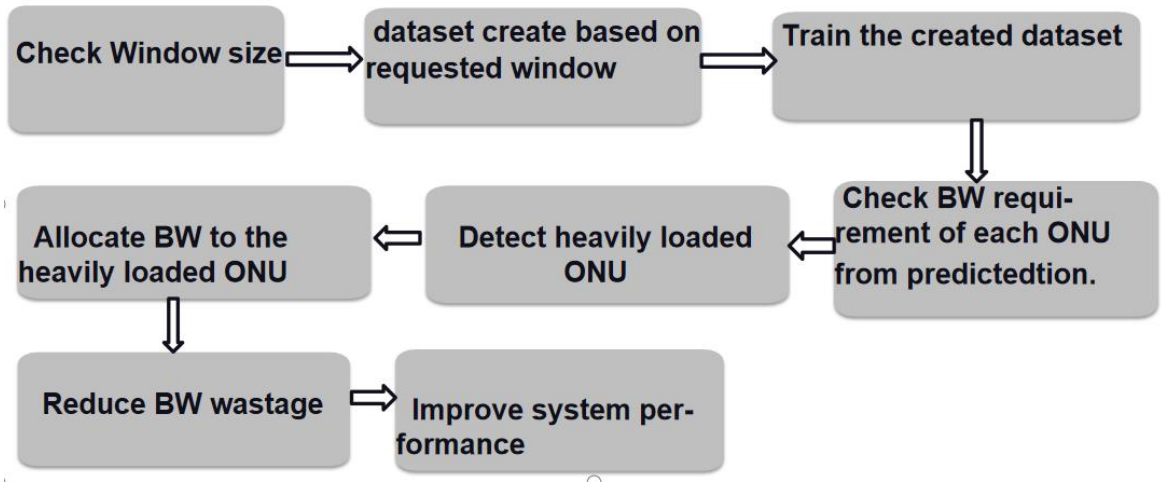

Fig-1: Block representation of the proposed scheme

In beginning, Maximum window required for each ONU will be determined. Then, Requested window for each ONU will be compared with maximum window. Based on the required window a dataset will have generated. The obtained dataset will be trained and differentiate the heavily loaded . This process will be followed again and again in cyclic manner, the ONU will again checked and prioritize heavily loaded ONU in every case. Those heavily loaded ONU will be provided bandwidth first . Such a prioritized manner bandwidth will be allocated. Bandwidth allocation will be done based on the predicted heavily loaded ONUs. It will help to reduce the Bandwidth Wastage . As the Bandwidth requirement will be reduced , the system will take less time to operate, that will improves delay time. In same manner, data transmission rate increase will lead to improved throughput.

3.3 Working plan:

A hybrid bandwidth allocation mechanism is proposed where the highly loaded ONU will be predicted at first. Based on the prediction the bandwidth allocation will be occurred. That will reduce the bandwidth wastage and make the allocation possible faster. Consequently, overall system efficiency will be improved. This overall work will be possible by following the required steps.

Study: Studying algorithm and methods of proposed scheme.

Research: This step is required for finding the proper way to enhance system performance and to obtain expected outcome.

Flowchart Design: Flowchart helps to design the overall working procedural steps. It's also important to know where the further modification can be helpful or not for the system improvement.

Analysis: For performing mathematical operation and simulation and coding based task and analysis the overall computational output if it meets the requirement or further work can be possible or not.

3.4 Summary:

Overall working procedure and steps to be followed in the proposed scheme are discussed. In section 3.2, the block diagram represents the necessary steps to reach our expected outcome and a working plan of the overall research procedure are discussed in 3.3

Chapter-4:
Conclusion

4.1 Conclusion:

An auction based hybrid DBA algorithm in EPON-WiMAX is proposed which basically predicts heavily loaded ONU and prioritized these heavily loaded ONU based on the prediction which will reduce the extra amount of bandwidth wastage. As only the required amount of bandwidth will be provided, the system will carry less time to operate. Thus, the time delay and packet delay loss will be reduced. This will also make faster the data transmission and network throughput will increase. All mathematical iteration will be simulated on software and based on the output, result will be analyzed.

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