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Evaluation of Ethernet Passive Optical Network Using Opnet Modeler

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Abstract— Optical communication is also named as optical telecommunication, is communication at a distance using light to carry information. It can be performed optically or by using electronic devices. Recently, passive optical networks (PONs) seem to be ready for commercial distribution in access networks due to the maturity of a number of enabling technologies, long distance and decreased maintenance. Among PON technologies, the Ethernet PON (EPON) presently being normalized by the IEEE 802.3ah.Ethernet in the first miles (EFM) duty force is most interesting because of its high speed, less cost, familiarity, interoperability and low overhead. OPNET stands for Optimum Network Performance.Opnet is a network simulation tool .Opnet Modeler, is a research oriented package. The optical network performance can be measured on parameters delay,jitter,bandwidth, speed, cost, failure rate etc. Various algorithms and techniques have been proposed to improve all these parameters.

Keywords— - Dynamic- bandwidth allocation algorithm, MAC-protocol, Ethernet PON. Grant scheduling, Grant sizing.

I. INTRODUCTION

Telecommunications today is may be the fastest growing field of study. It is continuously offering new challenges and lucky chance to telecommunications network planners. Passive optical network is a very attractive solution to the bottleneck problem in the access networks. Passive optical network consist of OLT and many ONU's consisting only the passive peripherals like splitter all the way down from OLT to ONU. For the downstream direction it is like a point-to-multipoint network a passive splitter action as a 1:N splitter. Downstream direction is like relay system in which information is broadcasted to all ONU the ONU saves the information relating to it and discards everything else. But for the upstream way the network is multipoint -point network. Thus every ONU's shares the single medium to interface with the OLT. According to the MAC recently for upstream route it uses one wavelength (e.g. 1310) and another one for the downstream route (e.g. 1550). TDM is used in the upstream direction to separate the transmission of many ONU's to avoid collision. A particular time slot is assigning to the ONU only in which it can transmit its data frames. That is why the bandwidth assignment is very important issue in PON. For a network to be profitable it have a very fine bandwidth asignment algorithm. Further the bandwidth can be assigning by two means static or dynamic. In the static bandwidth asignment fixed slots are asign to the ONU's only in which they can sends data packets. But in the static bandwidth assignment schemes there is so much wastage of the bandwidth. But in the dynamic bandwidth assignmentation scheme the bandwidth assign to the ONU in not constant it can be changed relating to the bandwidth requirement of the ONU.

PON standardization activities have been continuing for the past fifteen years within the ITU-T and IEEE standards frames EPON and 10G-EPON are the latest authorized IEEE standards and GPON is the latest authorized ITU-T standard. EPON and GPON both deadlock heavily from G.983, the BPON standard for their simple concepts (PON operation, ODN -framework, wavelength –plan or application). Also, they were designed to good accommodate variable-length IP- frames at Gigabit line rates. There are, significant dissimilarity in the way used by each. In order to goal flexible sharing of bandwidth among all the users and high bandwidth utilization, a dynamic bandwidth assignment (DBA) scheme that can adapt to the recent traffic demand is required. Two major standards for PONs have mixed,Ethernet PON (EPON) and gigabit PON (GPON) [6]. Due to meaningful differences in bet-ween the EPON and GPON standards (different control message formats, guard times,etc.)

A. Bandwidth Allocation

The use of TDMA in the upstream direction needs the OLT to schedule each ONT's transmission to prevent from collisions. Fundamentally, each ONT accepts a grant telling it when to begin and end transmission [8]. In GPON, grants are anticipated per T-CONT; in EPON, per LLID. In the case of GPON, permits are carried in the downstream frame- headers. A map field with in the header specifies the particular T-CONT, start and end {Alloc-ID+Start+End} for each grants upstream window (timeslot). In EPON, grant messages are sands as per LLID, as separate MAC-Control client-frames (GATEs) between constant Ethernet- frames. Each

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frames specifies the {LLID+Start+Length}.

II. LITERATURE REVIEW

Span of Research Work

A number of research papers and journals presented during the above interval 2006-2015 have been considered. The various facet of the problem were examined.

Sulaiman Khalifa Yakhlef, et al. [2015] states that Dynamic bandwidth assignment in passive optical networks presents a key issue for providing efficient and equitable utilization of the PON upstream bandwidth while supports the QoS required of different traffic classes. In this paper the author compare the difficult characteristic of DBA, such as bandwidth utilization, delay, and jitter at distincts traffic loads, within two important standards for PONs, Ethernet PON and gigabit PON. They illustrate these distinction between EPON and GPON. Industries standard for Passive Optical Network (PON) technology have enabled the initially deployment of Fibers to the Premise (FTTP) services[1]

Vipan Kumar al. [2015] Proposed that the Bandwidth allocation is very difficult issue in the passive optical networks. An efficient bandwidth assignment algorithm can significantly good the network performance by confirmation the network presented to all the ONU's in the network. In this paper they proposed a effective PDF based DBA algorithm which uses the almost last polling table for the atpresent allotment of the bandwidth based on the ONU's dynamically. This scheme early allots bandwidth.the ONU's requesting bandwidth less than minimum guaranteed bandwidth and ONU's requiring bandwidth more than minimum assurance whose PDF in the last polling table is more than threshold value. It assigns more bandwidth of lightly loaded ONU's to the heavily loaded ONU's[2]

PreetiDrall et al. [2014] When the data is communicate or transfering via(upon) the network, a reliable end packet release and bandwidth optimization is one of the basic requirement of both user and network but there are many causes which result in packet loss and bandwidth wastage over the network. In this paper, the proposed work gives the solution for the same problem. In the proposed approach firstly calculate the bandwidth requirement of the user then by rearrangement and bandwidth allocation schemes optimized the communication in PON[3]

Pei Wei et al. [2013] An adept dynamic bandwidth allocation (DBA) algorithm for multiclass service called MSDBA is design for next-generation time division multiplexing (TDM) inactive optical networks includes network coding (NC-PON). In MSDBA, a DBA cycle is break into two subcycles with contrasting coding plannings for differentiated classes of services, and the conversation time of the first subcycle flap with the bandwidth allotment calculation time at the optical line terminal. however, according to the quality-of-service (QoS), precondition of services, different scheduling and bandwidth allotment schemes are used to coded or uncoded services in the corresponding subcycle[4]

N. Moradpoor et al. [2008] Ethernet Passive Optical Network (EPON) has been deliberate for access networks for quite some time to provide high-speed, high-capacity services. As a original type of network, EPON represents many challenges so one main motive of this paper is to gives a test-bed based upon IEEE 802.3ah standards using OPNET Modeler to start smooth implementation of the wide range of bandwidth allocation algorithms[5]

Michael P. Mcgarry et al. [2008] The Author compile and classified the research work organized for Ethernet passive optical networks. They examine PON architectures and dynamic bandwidth allocation algorithm. Their classifications provide meaningful and accurate introduction of the starting effert on EPONs. The classification of DBA are:- grant-sizing, grant -scheduling, and optical-network unit queue scheduling.They further examine the topics of QoS supports, as well as fair bandwidth allotments. The presentation allow these advancing EPON research to quickly understood what already was investigated and what requires further future investigation. [6]

Kye-Hyun Ahn et al. [2004] In this paper, the Author projected a new dynamic bandwidth allocation (DBA) algorithm for multichannel services upon Ethernet PONs (passive optical networks). This algorithm is mixture of a low-level scheduling in the optical network unit (ONU) and a high-level planner in the optical-line-terminal(OLT). The ordered DBA algorithm can gives expansibility and effective resource allocation in an Ethernet PON device in which the packet scheduler is departs from the queues. In the proposed DBA algorithm, the OLT assigns bandwidth to the ONUs in proportional to the weight associated with their class , queue length, while the ONU either allocates its bandwidth to queues with a static priority order. [7]

Michael P. McGarry et al. [2006] The inference of the main parts of Dynamic-Bandwidth-Allocation (DBA) design in the

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Ethernet Passive Optical Networks (EPONs), such as grant-scheduling-framework, grant-sizing, and grant-scheduling have to data been examined in isolation. In contrast, manage a inclusive throughput-delay comparison observation of the three main DBA parts; whereby, for each of the DBA components consideration a range of common mechanisms. Their differentiate study assumes a number of novel mixtures of mechanisms for the all different DBA algorithm, such as- the double- phase-polling (DPP) planning frame-work combined with shortage with more spreading grant sizing, and Shortest Propagation Delay first (SPD) scheduling[8]

III. SURVEY CONCLUSION

TABLE I

SR. NO	AUTHOR'S NAME AND YEAR	TECHNIQUES	FINDINGS
1.	Sulaiman Khalifa Yakhlef ,2015	BANDWIDTH ALLOCATION	Dynamic bandwidth allocation (DBA) is a process that allows quick adoption of user's bandwidth allocation based on current traffic requirements. DBA is handled by OLT, which allocates bandwidth volume to ONUs. This technique works only in upstream direction and or in downstream direction traffic is broadcasted.
2.	Vipan Kumar ,2015	PDF-polling bandwidth allocation algorithm	Under medium traffic load the proposed algorithm can significantly enhance the network performance in terms of packet delay, queue length, and Bandwidth utilization as compared with a suitable efficient DBA algorithm proposed.this algorithm will improve the Qos and support the different type traffic loads.
3.	PreetiDrall ,2014	Restorationtechniques, conventional bandwidth assignment techniques, optimization techniques.	The optimization of optical network is necessary. The optical network performance can be measured on parameters delay,jitter,bandwidth, speed, cost, failure rate etc. Various algorithms and techniques have been proposed to improve all these parameters.
4.	Pei Wei ,2013	passive optical networks; time division multiplexing;	An systematic DBA algorithm for multiclass services called MSDBA in next-generation TDM PONs with NC is proposed, and different coding procedures and bandwidth allocation schemes are applied to differentiated classes of services in MSDBA. Compared with the IPACT and APS algorithms redistribute in NC-PON, the proposed MSDBA demonstrates better queuing-delay, scheduling-delay, and end-to-end delay accomplishment and improved QoS support for differentiated classes of services.

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5.	N. Moradpoor ,2008	TDM access, bandwidth allocation techniques	Implemented a sample EPON scenario depends upon the features which are already provided by OPNET as well as the IEEE 802.3ah standard definitions.
6.	Michael P. Mcgarry ,2008	Error recovery, dynamic grant-sizing techniques	The author outlined the standard physical PON architecture, as well as two alternative architectures, broadcast PON and two-stage PON. They also examined and provided a meaningful taxonomy for dynamic bandwidth allocation.
7.	Kye-Hyun Ahn ,2004	MAC protocol, Ethernet PON.	the hierarchical proportionalpreferential dynamic bandwidth allocation algorithms, involving multiple services in an Ethernet PON. The use of a hierarchical scheme can solve the scalability issues by eliminating the need for separate GATE and REPORT messages to be sent to every queue via an Ethernet PON system. The use of this scheme also solves the switchover overhead issues due to the fact that all of the queues in one ONU are served consecutively, with no guard times between their transmissions.
8.	Michael P. McGarry ,2006	Grant scheduling, Grant sizing, Packet delay	The grant scheduling framework has a remarkable impact on average packet delay. By enhanced interleaved polling, granting cycle lengths are abbreviated given a particular set of grant sizes thereby reducing queueing delays. Decreased cycle lengths also grow channel exercise. Therefore, the grant scheduling framework has a significant impact on channel usage as well.

IV. CONCLUSIONS

Various papers have been studied for Ethernet Passive Optical Network. Bandwidth Allocation technique works only in upstream direction, in downstream direction transfering is broadcasted. conventional bandwidth assignment techniques can be measured on parameters delay, jitter, bandwidth, speed, cost, failure rate etc. The grant scheduling framework has a significant force on average packet delay. By enhanced interleaved polling, granting cycle lengths are shortened given a particular set of grant sizes thereby decreasing queueing delays. Decreased cycle lengths also increase channel utilization.

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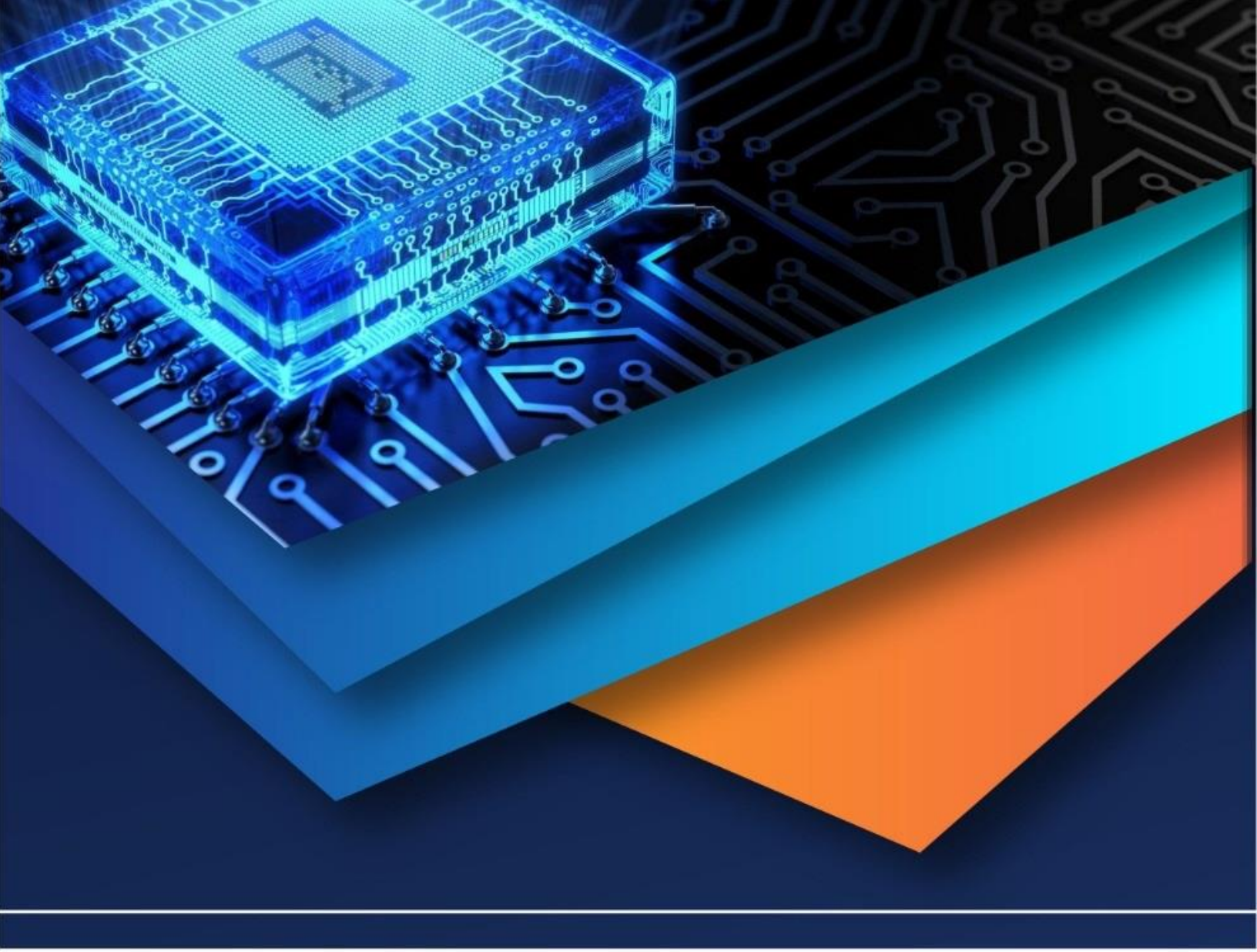

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